

Run-Time Library (RTL) :
Reference guide.

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Reference guide for RTL units.
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About this guide

This document describes all constants, types, variables, functions and procedures as they are declared in the units that come standard with the Free Pascal Run-Time library (RTL).

Throughout this document, we will refer to functions, types and variables with typewriter font. Functions and procedures have their own subsections, and for each function or procedure we have the following topics:

Declaration The exact declaration of the function.

Description What does the procedure exactly do ?

Errors What errors can occur.

See Also Cross references to other related functions/commands.

0.1 Overview

The Run-Time Library is the basis of all Free Pascal programs. It contains the basic units that most programs will use, and are made available on all platforms supported by Free Pascal (well, more or less).

There are units for compatibility with the Turbo Pascal Run-Time library, and there are units for compatibility with Delphi.

On top of these two sets, there are also a series of units to handle keyboard/mouse and text screens in a cross-platform way.

Other units include platform specific units that implement the specifics of a platform, these are usually needed to support the Turbo Pascal or Delphi units.

Units that fall outside the above outline do not belong in the RTL, but should be included in the packages, or in the FCL.

Chapter 1

Reference for unit 'BaseUnix'

1.1 Used units

Table 1.1: Used units by unit 'BaseUnix'

Name	Page
System	1229
unixtype	1713

1.2 Overview

The BaseUnix unit was implemented by Marco Van de Voort. It contains basic unix functionality. It supersedes the Linux unit of version 1.0.X of the compiler, but does not implement all functionality of the linux unit.

People that have code which heavily uses the old Linux unit, must fetch this unit from the sources or older distributions and manually compile it. In 2.0.x and 2.2.x releases this unit was included as `oldlinux`, but starting with 2.4.0 this unit has been removed \ from the release distribution.

For porting FPC to new unix-like platforms, it should be sufficient to implement the functionality in this unit for the new platform.

1.3 Constants, types and variables

1.3.1 Constants

`ARG_MAX = UnixType . ARG_MAX`

Maximum number of arguments to a program.

`BITSINWORD = 8 * (cuLong)`

Number of bits in a word.

`ESysE2BIG = 7`

System error: Argument list too long

ESysEACCES = 13

System error: Permission denied

ESysEADDRINUSE = 98

System error: Address already in use

ESysEADDRNOTAVAIL = 99

System error: Cannot assign requested address

ESysEADV = 68

System error: Advertise error

ESysEAFNOSUPPORT = 97

System error: Address family not supported by protocol

ESysEAGAIN = 11

System error: Try again

ESysEALREADY = 114

System error: Operation already in progress

ESysEBADE = 52

System error: Invalid exchange

ESysEBADF = 9

System error: Bad file number

ESysEBADFD = 77

System error: File descriptor in bad state

ESysEBADMSG = 74

System error: Not a data message

ESysEBADR = 53

System error: Invalid request descriptor

ESysEBADRQC = 56

System error: Invalid request code

ESysEBADSLT = 57

System error: Invalid slot

ESysEBFONT = 59

System error: Bad font file format

ESysEBUSY = 16

System error: Device or resource busy

ESysECANCELED = 125

ESysECHILD = 10

System error: No child processes

ESysECHRNG = 44

System error: Channel number out of range

ESysECOMM = 70

System error: Communication error on send

ESysECONNABORTED = 103

System error: Software caused connection abort

ESysECONNREFUSED = 111

System error: Connection refused

ESysECONNRESET = 104

System error: Connection reset by peer

ESysEDEADLK = 35

System error: Resource deadlock would occur

ESysEDEADLOCK = ESysEDEADLK

System error: File locking deadlock error

ESysEDESTADDRREQ = 89

System error: Destination address required

ESysEDOM = 33

System error: Math argument out of domain of func

ESysEDOTDOT = 73

System error: RFS specific error

ESysEDQUOT = 122

System error: Quota exceeded

ESysEEEXIST = 17

System error: File exists

ESysEFAULT = 14

System error: Bad address

ESysEFBIG = 27

System error: File too large

ESysEHOSTDOWN = 112

System error: Host is down

ESysEHOSTUNREACH = 113

System error: No route to host

ESysEIDRM = 43

System error: Identifier removed

ESysEILSEQ = 84

System error: Illegal byte sequence

ESysEINPROGRESS = 115

System error: Operation now in progress

ESysEINTR = 4

System error: Interrupted system call

ESysEINVAL = 22

System error: Invalid argument

ESysEIO = 5

System error: I/O error

ESysEISCONN = 106

System error: Transport endpoint is already connected

ESysEISDIR = 21

System error: Is a directory

ESysEISNAM = 120

System error: Is a named type file

ESysEKEYEXPIRED = 127

ESysEKEYREJECTED = 129

ESysEKEYREVOKED = 128

ESysEL2HLT = 51

System error: Level 2 halted

ESysEL2NSYNC = 45

System error: Level 2 not synchronized

ESysEL3HLT = 46

System error: Level 3 halted

ESysEL3RST = 47

System error: Level 3 reset

ESysELIBACC = 79

System error: Can not access a needed shared library

ESysELIBBAD = 80

System error: Accessing a corrupted shared library

ESysELIBEXEC = 83

System error: Cannot exec a shared library directly

ESysELIBMAX = 82

System error: Attempting to link in too many shared libraries

ESysELIBSCN = 81

System error: .lib section in a.out corrupted

ESysELNRNG = 48

System error: Link number out of range

ESysELOOP = 40

System error: Too many symbolic links encountered

ESysEMEDIUMTYPE = 124

ESysEMFILE = 24

System error: Too many open files

ESysEMLINK = 31

System error: Too many links

ESysEMGSIZE = 90

System error: Message too long

ESysMULTIHOP = 72

System error: Multihop attempted

ESysENAMETOOLONG = 36

System error: File name too long

ESysENAVAIL = 119

System error: No XENIX semaphores available

ESysENETDOWN = 100

System error: Network is down

ESysENETRESET = 102

System error: Network dropped connection because of reset

ESysENETUNREACH = 101

System error: Network is unreachable

ESysENFILE = 23

System error: File table overflow

ESysENOANO = 55

System error: No anode

ESysENOBUFS = 105

System error: No buffer space available

ESysENOCSI = 50

System error: No CSI structure available

ESysENODATA = 61

System error: No data available

ESysENODEV = 19

System error: No such device

ESysENOENT = 2

System error: No such file or directory

ESysENOEXEC = 8

System error: Exec format error

ESysENOKEY = 126

ESysENOLCK = 37

System error: No record locks available

ESysENOLINK = 67

System error: Link has been severed

ESysENOMEDIUM = 123

ESysENOMEM = 12

System error: Out of memory

ESysENOMSG = 42

System error: No message of desired type

ESysENONET = 64

System error: Machine is not on the network

ESysENOPKG = 65

System error: Package not installed

ESysENOPROTOOPT = 92

System error: Protocol not available

ESysENOSPC = 28

System error: No space left on device

ESysENOSR = 63

System error: Out of streams resources

ESysENOSTR = 60

System error: Device not a stream

ESysENOSYS = 38

System error: Function not implemented

ESysENOTBLK = 15

System error: Block device required

ESysENOTCONN = 107

System error: Transport endpoint is not connected

ESysENOTDIR = 20

System error: Not a directory

ESysENOTEMPTY = 39

System error: Directory not empty

ESysENOTNAM = 118

System error: Not a XENIX named type file

ESysENOTRECOVERABLE = 131

ESysENOTSOCK = 88

System error: Socket operation on non-socket

ESysENOTTY = 25

System error: Not a typewriter

ESysENOTUNIQ = 76

System error: Name not unique on network

ESysENXIO = 6

System error: No such device or address

ESysEOPNOTSUPP = 95

System error: Operation not supported on transport endpoint

ESysEOVERFLOW = 75

System error: Value too large for defined data type

ESysEOWNERDEAD = 130

ESysEPERM = 1

System error: Operation not permitted.

ESysEPFNOSUPPORT = 96

System error: Protocol family not supported

ESysEPIPE = 32

System error: Broken pipe

ESysEPROTO = 71

System error: Protocol error

ESysEPROTONOSUPPORT = 93

System error: Protocol not supported

ESysEPROTOTYPE = 91

System error: Protocol wrong type for socket

ESysERANGE = 34

System error: Math result not representable

ESysEREMCHG = 78

System error: Remote address changed

ESysEREMOTE = 66

System error: Object is remote

ESysEREMOTEIO = 121

System error: Remote I/O error

ESysERESTART = 85

System error: Interrupted system call should be restarted

ESysERFKILL = 132

ESysEROFS = 30

System error: Read-only file system

ESysESHUTDOWN = 108

System error: Cannot send after transport endpoint shutdown

ESysESOCKTNOSUPPORT = 94

System error: Socket type not supported

ESysESPIPE = 29

System error: Illegal seek

ESysESRCH = 3

System error: No such process

ESysESRMNT = 69

System error: Srmount error

ESysESTALE = 116

System error: Stale NFS file handle

ESysESTRPIPE = 86

System error: Streams pipe error

ESysETIME = 62

System error: Timer expired

ESysETIMEDOUT = 110

System error: Connection timed out

ESysETOOMANYREFS = 109

System error: Too many references: cannot splice

ESysETXTBSY = 26

System error: Text (code segment) file busy

ESysEUCLEAN = 117

System error: Structure needs cleaning

ESysEUNATCH = 49

System error: Protocol driver not attached

ESysEUSERS = 87

System error: Too many users

ESysEWOULDLOCK = ESysEAGAIN

System error: Operation would block

ESysEXDEV = 18

System error: Cross-device link

ESysEXFULL = 54

System error: Exchange full

FD_MAXFDSET = 1024

Maximum elements in a TFDSet ([137](#)) array.

FPE_FLTDIV = 3

Value signalling floating point divide by zero in case of SIGFPE signal

FPE_FLTINV = 7

Value signalling floating point invalid operation in case of SIGFPE signal

FPE_FLTOVF = 4

Value signalling floating point overflow in case of SIGFPE signal

FPE_FLTRES = 6

Value signalling floating point inexact result in case of SIGFPE signal

FPE_FLTSUB = 8

Value signalling floating point subscript out of range in case of SIGFPE signal

FPE_FLTUND = 5

Value signalling floating point underflow in case of SIGFPE signal

FPE_INTDIV = 1

Value signalling integer divide in case of SIGFPE signal

FPE_INTOVF = 2

Value signalling integer overflow in case of SIGFPE signal

F_GetFd = 1

fpFCntl ([151](#)) command: Get close-on-exec flag

F_GetFl = 3

fpFCntl ([151](#)) command: Get filedescriptor flags

F_GetLk = 5

fpFCntl ([151](#)) command: Get lock

F_GetOwn = 9

fpFCntl ([151](#)) command: get owner of filedescriptor events

F_OK = 0

fpAccess (143) call test: file exists.

F_SetFd = 2

fpFcntl (151) command: Set close-on-exec flag

F_SetFl = 4

fpFcntl (151) command: Set filedescriptor flags

F_SetLk = 6

fpFcntl (151) command: Set lock

F_SetLkW = 7

fpFcntl (151) command: Test lock

F_SetOwn = 8

fpFcntl (151) command: Set owner of filedescriptor events

ln2bitmask = 1 shl ln2bitsinword - 1

Last bit in word.

ln2bitsinword = 5

Power of 2 number of bits in word.

MAP_ANON = MAP_ANONYMOUS

Anonymous memory mapping (data private to application)

MAP_ANONYMOUS = \$20

FpMMap (165) map type: Don't use a file

MAP_FAILED = (-1)

Memory mapping failed error code

MAP_FIXED = \$10

FpMMap (165) map type: Interpret addr exactly

MAP_PRIVATE = \$2

FpMMap (165) map type: Changes are private

MAP_SHARED = \$1

FpMMap (165) map type: Share changes

MAP_TYPE = \$f

FpMMap (165) map type: Bitmask for type of mapping

NAME_MAX = UnixType . NAME_MAX

Maximum filename length.

O_APPEND = \$400

fpOpen (169) file open mode: Append to file

O_CREAT = \$40

fpOpen (169) file open mode: Create if file does not yet exist.

O_DIRECT = \$4000

fpOpen (169) file open mode: Minimize caching effects

O_DIRECTORY = \$10000

fpOpen (169) file open mode: File must be directory.

O_EXCL = \$80

fpOpen (169) file open mode: Open exclusively

O_NDELAY = O_NONBLOCK

fpOpen (169) file open mode: Alias for O_NonBlock (115)

O_NOCTTY = \$100

fpOpen (169) file open mode: No TTY control.

O_NOFOLLOW = \$20000

fpOpen (169) file open mode: Fail if file is symbolic link.

O_NONBLOCK = \$800

fpOpen (169) file open mode: Open in non-blocking mode

O_RDONLY = 0

fpOpen (169) file open mode: Read only

O_RDWR = 2

fpOpen (169) file open mode: Read/Write

O_SYNC = \$1000

fpOpen (169) file open mode: Write to disc at once

O_TRUNC = \$200

fpOpen (169) file open mode: Truncate file to length 0

O_WRONLY = 1

fpOpen (169) file open mode: Write only

PATH_MAX = UnixType . PATH_MAX

Maximum pathname length.

POLLERR = \$0008

Error condition on output file descriptor

POLLHUP = \$0010

Hang up

POLLIN = \$0001

Data is available for reading

POLLNVAL = \$0020

Invalid request, file descriptor not open.

POLLOUT = \$0004

Writing data will not block the write call

POLLPRI = \$0002

Urgent data is available for reading.

POLLRDBAND = \$0080

Priority data ready for reading.

POLLRDNORM = \$0040

Same as POLLIN.

POLLWRBAND = \$0200

Priority data my be written.

POLLWRNORM = \$0100

Equivalent to POLLOUT.

PRIO_PGRP = UnixType . PRIO_PGRP

Easy access alias for unixtype.PRIO_PGRP ([1713](#))

PRIO_PROCESS = UnixType . PRIO_PROCESS

Easy access alias for unixtype.PRIO_PROCESS ([1713](#))

PRIO_USER = UnixType . PRIO_USER

Easy access alias for unixtype.PRIO_USER ([1713](#))

PROT_EXEC = \$4

FpMMap ([165](#)) memory access: page can be executed

PROT_NONE = \$0

FpMMap ([165](#)) memory access: page can not be accessed

PROT_READ = \$1

FpMMap ([165](#)) memory access: page can be read

PROT_WRITE = \$2

FpMMap ([165](#)) memory access: page can be written

RLIMIT_AS = 9

RLimit request address space limit

RLIMIT_CORE = 4

RLimit request max core file size

RLIMIT_CPU = 0

RLimit request CPU time in ms

RLIMIT_DATA = 2

RLimit request max data size

RLIMIT_FSIZE = 1

Rlimit request maximum filesize

RLIMIT_LOCKS = 10

Rlimit request maximum file locks held

RLIMIT_MEMLOCK = 8

Rlimit request max locked-in-memory address space

RLIMIT_NOFILE = 7

Rlimit request max number of open files

RLIMIT_NPROC = 6

Rlimit request max number of processes

RLIMIT_RSS = 5

Rlimit request max resident set size

RLIMIT_STACK = 3

Rlimit request max stack size

R_OK = 4

fpAccess (143) call test: read allowed

SA_INTERRUPT = \$20000000

Sigaction options: ?

SA_NOCLDSTOP = 1

Sigaction options: Do not receive notification when child processes stop

SA_NOCLDWAIT = 2

Sigaction options: ?

SA_NODEFER = \$40000000

Sigaction options: Do not mask signal in its own signal handler

SA_NOMASK = SA_NODEFER

Sigaction options: Do not prevent the signal from being received when it is handled.

SA_ONESHOT = SA_RESETHAND

Sigaction options: Restore the signal action to the default state.

SA_ONSTACK = \$08000000

SA_ONSTACK is used in the fpSigaction (181) to indicate the signal handler must be called on an alternate signal stack provided by sigaltstack(2). If an alternate stack is not available, the default stack will be used.

SA_RESETHAND = \$80000000

Sigaction options: Restore signal action to default state when signal handler exits.

SA_RESTART = \$10000000

Sigaction options: Provide behaviour compatible with BSD signal semantics

SA_RESTORER = \$04000000

Signal restorer handler

SA_SIGINFO = 4

Sigaction options: The signal handler takes 3 arguments, not one.

SEEK_CUR = 1

fpLSeek (163) option: Set position relative to current position.

SEEK_END = 2

fpLSeek (163) option: Set position relative to end of file.

SEEK_SET = 0

fpLSeek (163) option: Set absolute position.

SIGABRT = 6

Signal: ABRT (Abort)

SIGALRM = 14

Signal: ALRM (Alarm clock)

SIGBUS = 7

Signal: BUS (bus error)

SIGCHLD = 17

Signal: CHLD (child status changed)

SIGCONT = 18

Signal: CONT (Continue)

SIGFPE = 8

Signal: FPE (Floating point error)

SIGHUP = 1

Signal: HUP (Hangup)

SIGILL = 4

Signal: ILL (Illegal instruction)

SIGINT = 2

Signal: INT (Interrupt)

SIGIO = 29

Signal: IO (I/O operation possible)

SIGIOT = 6

Signal: IOT (IOT trap)

SIGKILL = 9

Signal: KILL (unblockable)

SIGPIPE = 13

Signal: PIPE (Broken pipe)

SIGPOLL = SIGIO

Signal: POLL (Pollable event)

SIGPROF = 27

Signal: PROF (Profiling alarm)

SIGPWR = 30

Signal: PWR (power failure restart)

SIGQUIT = 3

Signal: QUIT

SIGSEGV = 11

Signal: SEGV (Segmentation violation)

SIGSTKFLT = 16

Signal: STKFLT (Stack Fault)

SIGSTOP = 19

Signal: STOP (Stop, unblockable)

SIGTERM = 15

Signal: TERM (Terminate)

SIGTRAP = 5

Signal: TRAP (Trace trap)

SIGTSTP = 20

Signal: TSTP (keyboard stop)

SIGTTIN = 21

Signal: TTIN (Terminal input, background)

SIGTTOU = 22

Signal: TTOU (Terminal output, background)

SIGUNUSED = 31

Signal: Unused

SIGURG = 23

Signal: URG (Socket urgent condition)

SIGUSR1 = 10

Signal: USR1 (User-defined signal 1)

SIGUSR2 = 12

Signal: USR2 (User-defined signal 2)

SIGVTALRM = 26

Signal: VTALRM (Virtual alarm clock)

SIGWINCH = 28

Signal: WINCH (Window/Terminal size change)

SIGXCPU = 24

Signal: XCPU (CPU limit exceeded)

SIGXFSZ = 25

Signal: XFSZ (File size limit exceeded)

SIG_BLOCK = 0

Sigprocmask flags: Add signals to the set of blocked signals.

SIG_DFL = 0

Signal handler: Default signal handler

SIG_ERR = -1

Signal handler: error

SIG_IGN = 1

Signal handler: Ignore signal

SIG_MAXSIG = UnixType . SIG_MAXSIG

Maximum system signal number.

SIG_SETMASK = 2

Sigprocmask flags: Set of blocked signals is given.

SIG_UNBLOCK = 1

Sigprocmask flags: Remove signals from the set set of blocked signals.

SI_PAD_SIZE = 128 div (longint) - 3

Signal information pad size.

SYS_NMLN = UnixType . SYS_NMLN

Max system name length.

S_IFBLK = 24576

File (#rtl.baseunix.stat ([137](#)) record) mode: Block device

S_IFCHR = 8192

File (#rtl.baseunix.stat (137) record) mode: Character device

S_IFDIR = 16384

File (#rtl.baseunix.stat (137) record) mode: Directory

S_IFIFO = 4096

File (#rtl.baseunix.stat (137) record) mode: FIFO

S_IFLNK = 40960

File (#rtl.baseunix.stat (137) record) mode: Link

S_IFMT = 61440

File (#rtl.baseunix.stat (137) record) mode: File type bit mask

S_IFREG = 32768

File (#rtl.baseunix.stat (137) record) mode: Regular file

S_IFSOCK = 49152

File (#rtl.baseunix.stat (137) record) mode: Socket

S_IRGRP = %0000100000

Mode flag: Read by group.

S_IROTH = %0000000100

Mode flag: Read by others.

S_IRUSR = %0100000000

Mode flag: Read by owner.

S_IRWXG = S_IRGRP or S_IWGRP or S_IXGRP

Mode flag: Read, write, execute by groups.

S_IRWXO = S_IROTH or S_IWOTH or S_IXOTH

Mode flag: Read, write, execute by others.

S_IRWXU = S_IRUSR or S_IWUSR or S_IXUSR

Mode flag: Read, write, execute by user.

S_IWGRP = %0000010000

Mode flag: Write by group.

S_IWOTH = %0000000010

Mode flag: Write by others.

S_IWUSR = %0010000000

Mode flag: Write by owner.

S_IXGRP = %0000001000

Mode flag: Execute by group.

S_IXOTH = %0000000001

Mode flag: Execute by others.

S_IXUSR = %0001000000

Mode flag: Execute by owner.

UTSNAME_DOMAIN_LENGTH = UTSNAME_LENGTH

Max length of utsname ([142](#)) domain name.

UTSNAME_LENGTH = SYS_NMLN

Max length of utsname ([142](#)) system name, release, version, machine.

UTSNAME_NODENAME_LENGTH = UTSNAME_LENGTH

Max length of utsname ([142](#)) node name.

WNOHANG = 1

#rtl.baseunix.fpWaitpid ([194](#)) option: Do not wait for processes to terminate.

wordsinfdset = FD_MAXFDSET div BITSINWORD

Number of words in a TFDSet ([137](#)) array

wordsinsigset = SIG_MAXSIG div BITSINWORD

Number of words in a signal set.

WUNTRACED = 2

#rtl.baseunix.fpWaitpid ([194](#)) option: Also report children which were stopped but not yet reported

W_OK = 2

fpAccess (143) call test: write allowed

X_OK = 1

fpAccess (143) call test: execute allowed

_STAT_VER = _STAT_VER_LINUX

Stat version number

_STAT_VER_KERNEL = 1

Current version of stat record

_STAT_VER_LINUX = 3

Version of linux stat record

_STAT_VER_LINUX_OLD = 1

Old kernel definition of stat

_STAT_VER_SVR4 = 2

SVR 4 definition of stat

1.3.2 Types

Blkcnt64_t = cuint64

64-bit block count

Blkcnt_t = cuint

Block count type.

Blksize_t = cuint

Block size type.

cbool = UnixType.cbool

Boolean type

cchar = UnixType.cchar

Alias for #rtl.UnixType.cchar (1715)

`cdouble = UnixType.cdouble`

Double precision real format.

`cfloat = UnixType.cfloat`

Floating-point real format

`cint = UnixType.cint`

C type: integer (natural size)

`cint16 = UnixType.cint16`

C type: 16 bits sized, signed integer.

`cint32 = UnixType.cint32`

C type: 32 bits sized, signed integer.

`cint64 = UnixType.cint64`

C type: 64 bits sized, signed integer.

`cint8 = UnixType.cint8`

C type: 8 bits sized, signed integer.

`clock_t = UnixType.clock_t`

Clock ticks type

`clong = UnixType.clong`

C type: long signed integer (double sized)

`clonglong = UnixType.clonglong`

C type: 64-bit (double long) signed integer.

`coff_t = UnixType.TOff`

Character offset type

`cschar = UnixType.cschar`

Signed character type

`cshort = UnixType.cshort`

C type: short signed integer (half sized)

`csigned` = `UnixType.cssigned`

`csigned` is an alias for `cint` ([126](#)).

`csint` = `UnixType.csint`

Signed integer

`csize_t` = `UnixType.size_t`

Character size type

`cslong` = `UnixType.cslong`

The size is CPU dependent.

`cslonglong` = `UnixType.cslonglong`

`cslonglong` is an alias for `clonglong` ([126](#)).

`csshort` = `UnixType.csshort`

Short signed integer type

`cuchar` = `UnixType.cuchar`

Alias for `#rtl.UnixType.cuchar` ([1716](#))

`cuint` = `UnixType.cuint`

C type: unsigned integer (natural size)

`cuint16` = `UnixType.cuint16`

C type: 16 bits sized, unsigned integer.

`cuint32` = `UnixType.cuint32`

C type: 32 bits sized, unsigned integer.

`cuint64` = `UnixType.cuint64`

C type: 64 bits sized, unsigned integer.

`cuint8` = `UnixType.cuint8`

C type: 8 bits sized, unsigned integer.

`culong` = `UnixType.culong`

C type: long unsigned integer (double sized)

```
culonglong = UnixType.culonglong
```

C type: 64-bit (double long) unsigned integer.

```
cunsigned = UnixType.cunsigned
```

Alias for #rtl.unixtype.cunsigned ([1717](#))

```
cushort = UnixType.cushort
```

C type: short unsigned integer (half sized)

```
dev_t = UnixType.dev_t
```

Device descriptor type.

```
Dir = record
  dd_fd : Integer;
  dd_loc : LongInt;
  dd_size : Integer;
  dd_buf : pDirentr;
  dd_nextoff : Cardinal;
  dd_max : Integer;
  dd_lock : pointer;
end
```

Record used in fpOpenDir ([170](#)) and fpReadDir ([174](#)) calls

```
Direntr = record
  d_fileno : ino64_t;
  d_off : off_t;
  d_reclen : cushort;
  d_type : uchar;
  d_name : Array[0..(255+1)-1] of Char;
end
```

Record used in the fpReadDir ([174](#)) function to return files in a directory.

```
FLock = record
  l_type : cshort;
  l_whence : cshort;
  l_start : kernel_off_t;
  l_len : kernel_off_t;
  l_pid : pid_t;
end
```

Lock description type for fpFCntl ([151](#)) lock call.

```
FLock64 = record
    l_type : cshort;
    l_whence : cshort;
    l_start : kernel_loff_t;
    l_len : kernel_loff_t;
    l_pid : pid_t;
end
```

FLock64 is the record used in the FpFcntl (151) file locking call. It is the same as the FLock (128) type, only contains 64-bit offsets.

```
gid_t = UnixType.gid_t
```

Group ID type.

```
ino_t = UnixType.ino_t
```

Inode type.

```
iovec = record
    iov_base : pointer;
    iov_len : size_t;
end
```

iovec is used in fpready (176) for IO to multiple buffers to describe a buffer location.

```
kernel_gid_t = cuint
```

kernel_gid_t may differ from the libc type used to describe group IDs.

```
kernel_loff_t = clonglong
```

Long kernel offset type

```
kernel_mode_t = cuint
```

kernel_mode_t may differ from the libc type used to describe file modes.

```
kernel_off_t = clong
```

Kernel offset type

```
kernel_uid_t = cuint
```

kernel_uid_t may differ from the libc type used to describe user IDs.

```
mode_t = UnixType.mode_t
```

Inode mode type.

nlink_t = UnixType.nlink_t

Number of links type.

off_t = UnixType.off_t

Offset type.

PBlkCnt = ^Blkcnt_t

pointer to TBlkCnt ([137](#)) type.

PBlkSize = ^Blksize_t

Pointer to TBlkSize ([137](#)) type.

pcbool = UnixType.pcbool

Pointer to boolean type cbool ([125](#))

pcchar = UnixType.pcchar

Alias for #rtl.UnixType.pcchar ([1718](#))

pcdouble = UnixType.pcdouble

Pointer to cdouble ([126](#)) type.

pcffloat = UnixType.pcffloat

Pointer to cfloat ([126](#)) type.

pclist = UnixType.pclist

Pointer to cInt ([126](#)) type.

pclist16 = UnixType.pclist16

Pointer to 16-bit signed integer type

pclist32 = UnixType.pclist32

Pointer to signed 32-bit integer type

pclist64 = UnixType.pclist64

Pointer to signed 64-bit integer type

pclist8 = UnixType.pclist8

Pointer to 8-bits signed integer type

```
pClock = UnixType.pClock
```

Pointer to TClock (137) type.

```
pclong = UnixTypepclong
```

Pointer to cLong (126) type.

```
pclonglong = UnixTypepclonglong
```

Pointer to longlong type.

```
pcschar = UnixTypepcschar
```

Pointer to character type cschar (126).

```
pcshort = UnixTypepcshort
```

Pointer to cShort (126) type.

```
pcsigned = UnixTypepcsigned
```

Pointer to signed integer type csigned (127).

```
pcsint = UnixTypepcsint
```

Pointer to signed integer type csint (127)

```
pcsize_t = UnixTypepsize_t
```

Pointer to cszie_t

```
pcslong = UnixTypepcslong
```

Pointer of the signed long cslong (127)

```
pcslonglong = UnixTypepcslonglong
```

Pointer to Signed longlong type cslonglong (127)

```
pcsshort = UnixTypepcsshort
```

Pointer to short signed integer type csshort (127)

```
pcuchar = UnixTypepcuchar
```

Alias for #rtl.UnixType.pcuchar (1720)

```
pcuint = UnixTypepcuint
```

Pointer to cUIInt (127) type.

pcuint16 = UnixType.pcuint16

Pointer to 16-bit unsigned integer type

pcuint32 = UnixType.pcuint32

Pointer to unsigned 32-bit integer type

pcuint64 = UnixType.pcuint64

Pointer to unsigned 64-bit integer type

pcuint8 = UnixType.pcuint8

Pointer to 8-bits unsigned integer type

pculong = UnixType.pculong

Pointer to cuLong (127) type.

pculonglong = UnixType.pculonglong

Unsigned longlong type

pcunsigned = UnixType.pcunsigned

Alias for #rtl.unixtype.pcunsigned (1720)

pcushort = UnixType.pcushort

Pointer to cuShort (128) type.

pDev = UnixType.pDev

Pointer to TDev (137) type.

pDir = ^Dir

Pointer to TDir (137) record

pDirentr = ^Direntr

Pointer to TDirentr (137) record.

pFDSet = ^TFDSet

Pointer to TFDSet (137) type.

pFilDes = ^TFilDes

Pointer to TFilDes (137) type.

```
pfpstate = ^tfpstate
```

Pointer to tfpstate (138) record.

```
pGid = UnixType.pGid
```

Pointer to TGid (138) type.

```
pGrpArr = ^TGrpArr
```

Pointer to TGrpArr (138) array.

```
pid_t = UnixType.pid_t
```

Process ID type.

```
pIno = UnixType.pIno
```

Pointer to TIno (138) type.

```
piovec = ^tiovec
```

pointer to a iovec (129) record

```
pMode = UnixType.pMode
```

Pointer to TMode (139) type.

```
pnLink = UnixType.pnLink
```

Pointer to TnLink (139) type.

```
pOff = UnixType.pOff
```

Pointer to TOff (139) type.

```
pollfd = record  
  fd : cint;  
  events : cshort;  
  revents : cshort;  
end
```

pollfd is used in the fpPoll (172) call to describe the various actions.

```
pPid = UnixType.pPid
```

Pointer to TPid (139) type.

```
ppollfd = ^pollfd
```

Pointer to tpollfd.

PRLimit = ^TRLimit

Pointer to TRLimit (139) record

psigactionrec = ^sigactionrec

Pointer to SigActionRec (136) record type.

PSigContext = ^TSigContext

Pointer to #rtl.baseunix.TSigContext (140) record type.

psiginfo = ^tsiginfo

Pointer to #rtl.baseunix.TSigInfo (140) record type.

psigset = ^tsigset

Pointer to SigSet (136) type.

pSize = UnixType.pSize

Pointer to TSize (141) type.

pSize_t = UnixType.pSize_t

Pointer to Size_t

pSocklen = UnixType.pSocklen

Pointer to TSockLen (141) type.

psSize = UnixType.psSize

Pointer to TsSize (141) type

PStat = ^Stat

Pointer to TStat (141) type.

pstatfs = UnixType.PStatFs

This is an alias for the type defined in the #rtl.unixtype (1713) unit.

pthread_cond_t = UnixType(pthread_cond_t

Thread conditional variable type.

pthread_mutex_t = UnixType(pthread_mutex_t

Thread mutex type.

```
pthread_t = UnixType(pthread_t
```

Posix thread type.

```
pTime = UnixType.pTime
```

Pointer to TTime (141) type.

```
ptimespec = UnixType.ptimespec
```

Pointer to timespec (138) type.

```
ptimeval = UnixType.ptimeval
```

Pointer to timeval (138) type.

```
ptimezone = ^timezone
```

Pointer to TimeZone (138) record.

```
ptime_t = UnixType.ptime_t
```

Pointer to time_t (138) type.

```
PTms = ^tms
```

Pointer to TTms (141) type.

```
Pucontext = ^Tucontext
```

Pointer to TUContext (142) type.

```
pUid = UnixType.pUid
```

Pointer to TUid (142) type.

```
pUTimBuf = ^UTimBuf
```

Pointer to TUTimBuf (142) type.

```
PUtsName = ^TUtsName
```

Pointer to TUtsName (142) type.

```
rlim_t = culong
```

rlim_t is used as the type for the various fields in the TRLimit (139) record.

```
sigactionhandler = sigactionhandler_t
```

When installing a signal handler, the actual signal handler must be of type `SigActionHandler`.

```
sigactionhandler_t = procedure(signal: LongInt; info: psiginfo;  
                               context: PSigContext)
```

Standard signal action handler prototype

```
sigactionrec = record  
  sa_handler : sigactionhandler_t;  
  sa_flags : culong;  
  sa_restorer : sigrestorerhandler_t;  
  sa_mask : sigset_t;  
end
```

Record used in `fpSigAction` (181) call.

```
signalhandler = signalhandler_t
```

Simple signal handler prototype

```
signalhandler_t = procedure(signal: LongInt)
```

Standard signal handler prototype

```
sigrestorerhandler = sigrestorerhandler_t
```

Alias for `sigrestorerhandler_t` (136) type.

```
sigrestorerhandler_t = procedure
```

Standard signal action restorer prototype

```
sigset = sigset_t
```

Signal set type

```
sigset_t = Array[0..wordsinsigset-1] of culong
```

Signal set type

```
size_t = UnixType.size_t
```

Size specification type.

```
socklen_t = UnixType.socklen_t
```

Socket address length type.

```
ssize_t = UnixType ssize_t
```

Small size type.

```
Stat = packed record
end
```

Record describing an inode (file) in the FPFstat (154) call.

```
TBlkCnt = Blkcnt_t
```

Alias for Blkcnt_t (125) type.

```
TBlkSize = Blksize_t
```

Alias for blksize_t (125) type.

```
TClock = UnixType.TClock
```

Alias for clock_t (126) type.

```
TDev = UnixType.TDev
```

Alias for dev_t (128) type.

```
TDir = Dir
```

Alias for Dir (128) type.

```
TDirent = Dirent
```

Alias for Dirent (128) type.

```
TFDSet = Array[0..(FD_MAXFDSETdivBITSINWORD)-1] of culong
```

File descriptor set for fpSelect (177) call.

```
TFilDes = Array[0..1] of cint
```

Array of file descriptors as used in fpPipe (171) call.

```
tfpreg = record
  significand : Array[0..3] of Word;
  exponent : Word;
end
```

Record describing floating point register in signal handler.

```
tfpstate = record
  cw : Cardinal;
  sw : Cardinal;
  tag : Cardinal;
  ipoff : Cardinal;
  cssel : Cardinal;
  dataoff : Cardinal;
  dataset : Cardinal;
  st : Array[0..7] of tfpreg;
  status : Cardinal;
end
```

Record describing floating point unit in signal handler.

```
TGid = UnixType.TGid
```

Alias for gid_t ([129](#)) type.

```
TGrpArr = Array[0..0] of TGid
```

Array of gid_t ([129](#)) IDs

```
timespec = UnixType.timespec
```

Short time specification type.

```
timeval = UnixType.timeval
```

Time specification type.

```
timezone = record
  tz_minuteswest : cint;
  tz_dsttime : cint;
end
```

Record describing a timezone

```
time_t = UnixType.time_t
```

Time span type

```
TIo = UnixType.TIo
```

Alias for ino_t ([129](#)) type.

```
TIOCtlRequest = UnixType.TIOCtlRequest
```

Easy access alias for unixtype.TIOCtlRequest ([1725](#))

```
tiovec = iovec
```

Alias for the iovec (129) record type.

```
TMode = UnixType.TMode
```

Alias for mode_t (129) type.

```
tms = record
  tms_utime : clock_t;
  tms_stime : clock_t;
  tms_cutime : clock_t;
  tms_cstime : clock_t;
end
```

Record containing timings for fpTimes (191) call.

```
TnLink = UnixType.TnLink
```

Alias for nlink_t (130) type.

```
TOff = UnixType.TOff
```

Alias for off_t (130) type.

```
TPid = UnixType.TPid
```

Alias for pid_t (133) type.

```
tpollfd = pollfd
```

Alias for pollfd type

```
TRLimit = record
  rlim_cur : rlim_t;
  rlim_max : rlim_t;
end
```

TRLimit is the structure used by the kernel to return resource limit information in.

```
tsigactionhandler = sigactionhandler_t
```

Alias for sigactionhandler_t (136) type.

```
tsigaltstack = record
  ss_sp : pointer;
  ss_flags : LongInt;
  ss_size : LongInt;
end
```

Provide the location of an alternate signal handler stack.

```
TSigContext = record
  gs : Word;
  __gsh : Word;
  fs : Word;
  __fsh : Word;
  es : Word;
  __esh : Word;
  ds : Word;
  __dsh : Word;
  edi : Cardinal;
  esi : Cardinal;
  ebp : Cardinal;
  esp : Cardinal;
  ebx : Cardinal;
  edx : Cardinal;
  ecx : Cardinal;
  eax : Cardinal;
  trapno : Cardinal;
  err : Cardinal;
  eip : Cardinal;
  cs : Word;
  __csh : Word;
  eflags : Cardinal;
  esp_at_signal : Cardinal;
  ss : Word;
  __ssh : Word;
  fpstate : pfpstate;
  oldmask : Cardinal;
  cr2 : Cardinal;
end
```

This type is CPU dependent. Cross-platform code should not use the contents of this record.

```
tsiginfo = record
  si_signo : LongInt;
  si_errno : LongInt;
  si_code : LongInt;
  _sifields : record
  end;
end
```

This type describes the signal that occurred.

```
tsignalhandler = signalhandler_t
```

Alias for signalhandler_t ([136](#)) type.

```
tsigrestorerhandler = sigrestorerhandler_t
```

Alias for sigrestorerhandler_t ([136](#)) type.

tsigset = sigset_t

Alias for SigSet (136) type.

TSize = UnixType.TSize

Alias for size_t (136) type

TSocklen = UnixType.TSocklen

Alias for socklen_t (136) type.

TsSize = UnixType.TsSize

Alias for ssize_t (137) type

TStat = Stat

Alias for Stat (137) type.

tstatfs = UnixType.TStatFs

Record describing a file system in the baseunix.fpstatfs (1229) call.

TTIME = UnixType.TTime

Alias for TTime (141) type.

Ttimespec = UnixType.Ttimespec

Alias for TimeSpec (138) type.

TTimeVal = UnixType.TTimeVal

Alias for timeval (138) type.

TTIMEZone = timezone

Alias for TimeZone (138) record.

TTms = tms

Alias for Tms (139) record type.

```
TUcontext = record
  uc_flags : Cardinal;
  uc_link : Pucontext;
  uc_stack : tsigaltstack;
  uc_mcontext : TSigContext;
  uc_sigmask : tsigset;
end
```

This structure is used to describe the user context in a program or thread. It is not used in this unit, but is provided for completeness.

```
TUid = UnixType.TUid
```

Alias for uid_t ([142](#)) type.

```
TUtimBuf = UTimBuf
```

Alias for UtimBuf ([142](#)) type.

```
TUtsName = UtsName
```

Alias for UtsName ([142](#)) type.

```
uid_t = UnixType.uid_t
```

User ID type

```
UTimBuf = record
  actime : time_t;
  modtime : time_t;
end
```

Record used in fpUtime ([192](#)) to set file access and modificaton times.

```
UtsName = record
  Sysname : Array[0..UTSNAME_LENGTH-1] of Char;
  Nodename : Array[0..UTSNAME_NODENAME_LENGTH-1] of Char;
  Release : Array[0..UTSNAME_LENGTH-1] of Char;
  Version : Array[0..UTSNAME_LENGTH-1] of Char;
  Machine : Array[0..UTSNAME_LENGTH-1] of Char;
  Domain : Array[0..UTSNAME_DOMAIN_LENGTH-1] of Charplatform;
end
```

The elements of this record are null-terminated C style strings, you cannot access them directly. Note that the Domain field is a GNU extension, and may not be available on all platforms.

1.4 Procedures and functions

1.4.1 CreateShellArgV

Synopsis: Create a null-terminated array of strings from a command-line string

Declaration: function CreateShellArgV(const prog: string) : PPChar
function CreateShellArgV(const prog: Ansistring) : PPChar

Visibility: default

Description: CreateShellArgV creates a command-line string for executing a shell command using 'sh -c'.
The result is a null-terminated array of null-terminated strings suitable for use in fpExecv ([149](#)) and friends.

Errors: If no more memory is available, a heap error may occur.

See also: fpExecv ([149](#)), FreeShellArgV ([195](#))

1.4.2 FpAccess

Synopsis: Check file access

Declaration: function FpAccess (pathname: PChar; aMode: cint) : cint
 function FpAccess (pathname: AnsiString; aMode: cint) : cint

Visibility: default

Description: FpAccess tests user's access rights on the specified file. Mode is a mask existing of one or more of the following:

R_OKUser has read rights.

W_OKUser has write rights.

X_OKUser has execute rights.

F_OKFile exists.

The test is done with the real user ID, instead of the effective user ID. If the user has the requested rights, zero is returned. If access is denied, or an error occurred, a nonzero value is returned.

Errors: Extended error information can be retrieved using fpGetErrno ([156](#)).

sys_eaccessThe requested access is denied, either to the file or one of the directories in its path.

sys EINVALMode was incorrect.

sys ENOENTA directory component in Path doesn't exist or is a dangling symbolic link.

sys ENOTDIRA directory component in Path is not a directory.

sys ENOMEMInsufficient kernel memory.

sys ELOOPPath has a circular symbolic link.

See also: FpChown ([146](#)), FpChmod ([144](#))

Listing: ./bunixex/ex26.pp

Program Example26;

{ Program to demonstrate the Access function. }

Uses BaseUnix;

```
begin
  if fpAccess ('/etc/passwd', W_OK)=0 then
    begin
      Writeln ('Better check your system.');
      Writeln ('I can write to the /etc/passwd file !');
      end;
  end.
```

1.4.3 FpAlarm

Synopsis: Schedule an alarm signal to be delivered

Declaration: function FpAlarm(seconds: cuint) : cuint

Visibility: default

Description: FpAlarm schedules an alarm signal to be delivered to your process in Seconds seconds. When Seconds seconds have elapsed, the system will send a SIGALRM signal to the current process. If Seconds is zero, then no new alarm will be set. Whatever the value of Seconds, any previous alarm is cancelled.

The function returns the number of seconds till the previously scheduled alarm was due to be delivered, or zero if there was none. A negative value indicates an error.

See also: fpSigAction (181), fpPause (171)

Listing: ./bunixex/ex59.pp

Program Example59 ;

{ *Program to demonstrate the Alarm function.* }

Uses BaseUnix;

Procedure AlarmHandler(Sig : cint);**cdecl**;

begin

Writeln ('Got to alarm handler');

end;

begin

Writeln('Setting alarm handler');

 fpSignal(SIGALRM, SignalHandler(@AlarmHandler));

Writeln ('Scheduling Alarm in 10 seconds');

 fpAlarm(10);

Writeln ('Pausing');

 fpPause;

Writeln ('Pause returned');

end.

1.4.4 FpChdir

Synopsis: Change current working directory.

Declaration: function FpChdir(path: PChar) : cint
function FpChdir(path: AnsiString) : cint

Visibility: default

Description: fpChDir sets the current working directory to Path.

It returns zero if the call was successful, -1 on error.

Note: There exist a portable alterative to fpChDir: system.chdir. Please use fpChDir only if you are writing Unix specific code. System.chdir will work on all operating systems.

Errors: Extended error information can be retrieved using fpGetErrno (156).

See also: fpGetCwd (155)

1.4.5 FpChmod

Synopsis: Change file permission bits

Declaration: function FpChmod(path: PChar;Mode: TMode) : cint
function FpChmod(path: AnsiString;Mode: TMode) : cint

Visibility: default

Description: fpChmod sets the Mode bits of the file in Path to Mode. Mode can be specified by 'or'-ing the following values:

S_ISUIDSet user ID on execution.
S_ISGIDSet Group ID on execution.
S_ISVTXSet sticky bit.
S_IRUSRRead by owner.
S_IWUSRWrite by owner.
S_IXUSRExecute by owner.
S_IRGRPRead by group.
S_IWGRPWrite by group.
S_IXGRPExecute by group.
S_IROTHRead by others.
S_IWOTHWrite by others.
S_IXOTHExecute by others.
S_IRWXORead, write, execute by others.
S_IRWXGRead, write, execute by groups.
S_IRWXURead, write, execute by user.

If the function is successful, zero is returned. A nonzero return value indicates an error.

Errors: The following error codes are returned:

sys_epermThe effective UID doesn't match the ownership of the file, and is not zero. Owner or group were not specified correctly.
sys_eaccessOne of the directories in Path has no search (=execute) permission.
sys_enoentA directory entry in Path does not exist or is a symbolic link pointing to a non-existent directory.
sys_enomemInsufficient kernel memory.
sys_eroofsThe file is on a read-only filesystem.
sys_eloopPath has a reference to a circular symbolic link, i.e. a symbolic link, whose expansion points to itself.

See also: fpChown (146), fpAccess (143)

Listing: ./bunixex/ex23.pp

Program Example23 ;

{ Program to demonstrate the Chmod function . }

Uses BaseUnix , Unix ;

Var F : Text;

begin

```

{ Create a file }
Assign (f, 'testex21');
Rewrite (F);
Writeln (f, '#!/bin/sh');
Writeln (f, 'echo Some text for this file');
Close (F);
fpChmod ('testex21', &777);
{ File is now executable }
fpexecl ('./testex21', []);
end.

```

1.4.6 FpChown

Synopsis: Change owner of file

Declaration: function FpChown(path: PChar;owner: TUId;group: TGid) : cint
 function FpChown(path: AnsiString;owner: TUId;group: TGid) : cint

Visibility: default

Description: fpChown sets the User ID and Group ID of the file in Path to Owner,Group.

The function returns zero if the call was succesfull, a nonzero return value indicates an error.

Errors: The following error codes are returned:

- sys_eperm**The effective UID doesn't match the ownership of the file, and is not zero. Owner or group were not specified correctly.
- sys_eaccess**One of the directories in Path has no search (=execute) permission.
- sys_enoent**A directory entry in Path does not exist or is a symbolic link pointing to a non-existent directory.
- sys_enomem**Insufficient kernel memory.
- sys_eroofs**The file is on a read-only filesystem.
- sys_eloop**Path has a reference to a circular symbolic link, i.e. a symbolic link, whose expansion points to itself.

See also: fpChmod (144), fpAccess (143)

Listing: ./bunixex/ex24.pp

```

Program Example24;

{ Program to demonstrate the Chown function. }

Uses BaseUnix;

Var UID : TUId;
      GID : TGid;
      F : Text;

begin

  Writeln ('This will only work if you are root.');
  Write ('Enter a UID : '); readIn(UID);
  Write ('Enter a GID : '); readIn(GID);
  Assign (f, 'test.txt');


```

```

Rewrite (f);
WriteLn (f, 'The owner of this file should become : ');
WriteLn (f, 'UID : ', UID);
WriteLn (f, 'GID : ', GID);
Close (F);
if fpChown ('test.txt', UID, GID) <> 0 then
    if fpgeterrno=ESysEPERM then
        WriteLn ('You are not root !')
    else
        WriteLn ('Chmod failed with exit code : ', fpgeterrno)
    else
        WriteLn ('Changed owner successfully !');
end.

```

1.4.7 FpClose

Synopsis: Close file descriptor

Declaration: function FpClose(fd: cint) : cint

Visibility: default

Description: FpClose closes a file with file descriptor Fd. The function returns zero if the file was closed successfully, a nonzero return value indicates an error.

For an example, see FpOpen (169).

Errors: Extended error information can be retrieved using fpGetErrno (156).

See also: FpOpen (169), FpRead (173), FpWrite (194), FpFTruncate (155), FpLSeek (163)

1.4.8 FpClosedir

Synopsis: Close directory file descriptor

Declaration: function FpClosedir(var dirp: Dir) : cint

Visibility: default

Description: FpCloseDir closes the directory pointed to by dirp. It returns zero if the directory was closed successfully, -1 otherwise.

For an example, see fpOpenDir (170).

Errors: Extended error information can be retrieved using fpGetErrno (156).

See also: FpOpenDir (170), FpReadDir (174)

1.4.9 FpDup

Synopsis: Duplicate a file handle

Declaration: function FpDup(fildes: cint) : cint
 function FpDup(var oldfile: text; var newfile: text) : cint
 function FpDup(var oldfile: File; var newfile: File) : cint

Visibility: default

Description: FpDup returns a file descriptor that is a duplicate of the file descriptor `fildes`.

The second and third forms make `NewFile` an exact copy of `OldFile`, after having flushed the buffer of `OldFile` in case it is a Text file or untyped file. Due to the buffering mechanism of Pascal, these calls do not have the same functionality as the `dup` call in C. The internal Pascal buffers are not the same after this call, but when the buffers are flushed (e.g. after output), the output is sent to the same file. Doing an `Iseek` will, however, work as in C, i.e. doing a `Iseek` will change the fileposition in both files.

The function returns a negative value in case of an error, a positive value is a file handle, and indicates success.

Errors: A negative value can be one of the following error codes:

`sys_ebadf``OldFile` hasn't been assigned.

`sys_emfile`Maximum number of open files for the process is reached.

See also: `fpDup2` (148)

Listing: ./bunixex/ex31.pp

```
program Example31;

{ Program to demonstrate the Dup function. }

uses baseunix;

var f : text;

begin
  if fpdup (output,f)<>0 then
    writeln ('Dup Failed !');
    writeln ('This is written to stdout.');
    writeln (f,'This is written to the dup file , and flushed');flush(f);
    writeln
end.
```

1.4.10 FpDup2

Synopsis: Duplicate one filehandle to another

Declaration: function `FpDup2(fildes: cint; fildes2: cint) : cint`
 function `FpDup2(var oldfile: text; var newfile: text) : cint`
 function `FpDup2(var oldfile: File; var newfile: File) : cint`

Visibility: default

Description: Makes `fildes2` or `NewFile` an exact copy of `fildes` or `OldFile`, after having flushed the buffer of `OldFile` in the case of text or untyped files.

After a call to `fdup2`, the 2 file descriptors point to the same physical device (a file, socket, or a terminal).

`NewFile` can be an assigned file. If `newfile` or `fildes` was open, it is closed first. Due to the buffering mechanism of Pascal, this has not the same functionality as the `dup2` call in C. The internal Pascal buffers are not the same after this call, but when the buffers are flushed (e.g. after output), the output is sent to the same file. Doing an `Iseek` will, however, work as in C, i.e. doing a `Iseek` will change the fileposition in both files.

The function returns the new file descriptor number, on error -1 is returned, and the error can be retrieved with fpgeterrno ([156](#))

Errors: In case of error, the following error codes can be reported:

sys_ebadf OldFile (or fildes) hasn't been assigned.
sys_emfile Maximum number of open files for the process is reached.

See also: fpDup ([147](#))

Listing: ./bunixex/ex32.pp

```
program Example31;

{ Program to demonstrate the FpDup2 function. }

uses BaseUnix;

var f : text;
    i : longint;

begin
  Assign (f, 'text.txt');
  Rewrite (F);
  For i:=1 to 10 do writeln (F, 'Line : ',i);
  if fpdup2 (output,f)=-1 then
    writeln ('Dup2 Failed !');
  writeln ('This is written to stdout.');
  writeln (f,'This is written to the dup file , and flushed');
  flush(f);
  writeln;
  { Remove file . Comment this if you want to check flushing.}
  fpUnlink ('text.txt');
end.
```

1.4.11 FpExecv

Synopsis: Execute process

Declaration: function FpExecv(path: PChar;argv: PPChar) : cint
function FpExecv(path: AnsiString;argv: PPChar) : cint

Visibility: default

Description: Replaces the currently running program with the program, specified in path. It gives the program the options in argv. This is a pointer to an array of pointers to null-terminated strings. The last pointer in this array should be nil. The current environment is passed to the program. On success, execv does not return.

Errors: On error, -1 is returned. Extended error information can be retrieved with fpGetErrNo ([156](#))

sys_eacces File is not a regular file, or has no execute permission. A component of the path has no search permission.
sys_eperm The file system is mounted \textit{noexec}.
sys_e2big Argument list too big.
sys_enoexec The magic number in the file is incorrect.

sys_enoentThe file does not exist.

sys_enomemNot enough memory for kernel.

sys_enotdirA component of the path is not a directory.

sys_eloopThe path contains a circular reference (via symlinks).

See also: fpExecve (150), fpFork (153)

Listing: ./bunixex/ex8.pp

Program Example8;

{ Program to demonstrate the Execv function. }

Uses Unix, strings;

Const Arg0 : PChar = '/bin/ls';
Arg1 : Pchar = '-l';

Var PP : PPchar;

```
begin
  GetMem (PP,3*SizeOf (Pchar));
  PP[0]:=Arg0;
  PP[1]:=Arg1;
  PP[3]:=Nil;
  { Execute '/bin/ls -l', with current environment }
  fpExecv ('/bin/ls',pp);
end.
```

1.4.12 FpExecve

Synopsis: Execute process using environment

Declaration: function FpExecve(path: PChar; argv: PPChar; envp: PPChar) : cint
function FpExecve(path: AnsiString; argv: PPChar; envp: PPChar) : cint

Visibility: default

Description: Replaces the currently running program with the program, specified in path. It gives the program the options in argv, and the environment in envp. They are pointers to an array of pointers to null-terminated strings. The last pointer in this array should be nil. On success, execve does not return.

Errors: Extended error information can be retrieved with fpGetErrno (156), and includes the following:

sys_eaccesFile is not a regular file, or has no execute permission. A component of the path has no search permission.

sys_epermThe file system is mounted \textit{noexec}.

sys_e2bigArgument list too big.

sys_enoexecThe magic number in the file is incorrect.

sys_enoentThe file does not exist.

sys_enomemNot enough memory for kernel.

sys_enotdirA component of the path is not a directory.

sys_eloopThe path contains a circular reference (via symlinks).

See also: fpExecv (149), fpFork (153)

Listing: ./bunixex/ex7.pp

```
Program Example7;

{ Program to demonstrate the Execve function. }

Uses BaseUnix, strings;

Const Arg0 : PChar = '/bin/ls';
      Arg1 : Pchar = '-l';

Var PP : PPchar;

begin
  GetMem (PP,3*SizeOf (Pchar));
  PP[0]:=Arg0;
  PP[1]:=Arg1;
  PP[3]:=Nil;
  { Execute '/bin/ls -l', with current environment }
  { Env is defined in system.inc }
  fpExecVe ('/bin/ls',pp,envp);
end.
```

1.4.13 FpExit

Synopsis: Exit the current process

Declaration: procedure FpExit (Status: cint)

Visibility: default

Description: FpExit exits the currently running process, and report Status as the exit status.

Remark: If this call is executed, the normal unit finalization code will not be executed. This may lead to unexpected errors and stray files on your system. It is therefore recommended to use the Halt call instead.

Errors: None.

See also: FpFork (153), FpExecve (150)

1.4.14 FpFcntl

Synopsis: File control operations.

Declaration: function FpFcntl(fildes: cint;cmd: cint) : cint
 function FpFcntl(fildes: cint;cmd: cint;arg: cint) : cint
 function FpFcntl(fildes: cint;cmd: cint;var arg: FLock) : cint

Visibility: default

Description: Read/set a file's attributes. `Fildes` a valid file descriptor. `Cmd` specifies what to do, and is one of the following:

F_GetFdRead the close_on_exec flag. If the low-order bit is 0, then the file will remain open across execve calls.

F_GetFlRead the descriptor's flags.

F_GetOwnGet the Process ID of the owner of a socket.

F_SetFdSet the close_on_exec flag of `fildes`. (only the least significant bit is used).

F_GetLkReturn the `flock` record that prevents this process from obtaining the lock, or set the `l_type` field of the lock if there is no obstruction. `Arg` is the flock record.

F_SetLkSet the lock or clear it (depending on `l_type` in the `flock` structure). if the lock is held by another process, an error occurs.

F_GetLkwSame as for **F_Setlk**, but wait until the lock is released.

F_SetOwnSet the Process or process group that owns a socket.

The function returns 0 if successful, -1 otherwise.

Errors: On error, -1 is returned. Use `fpGetErrno` (156) for extended error information.

sys_ebadf`Fd` has a bad file descriptor.

sys_eagain or **sys_eaccess**For \textbf{F_SetLk}, if the lock is held by another process.

1.4.15 fpfdfillset

Synopsis: Set all filedescriptors in the set.

Declaration: `function fpfdfillset(var nset: TFDSet) : cint`

Visibility: default

Description: `fpfdfillset` sets all filedescriptors in `nset`.

See also: `FpSelect` (177), `FpFD_ZERO` (153), `FpFD_IsSet` (153), `FpFD_Clr` (152), `FpFD_Set` (153)

1.4.16 fpFD_CLR

Synopsis: Clears a filedescriptor in a set

Declaration: `function fpFD_CLR(fdno: cint; var nset: TFDSet) : cint`

Visibility: default

Description: `FpFD_Clr` clears file descriptor `fdno` in filedescriptor set `nset`.

For an example, see `FpSelect` (177).

Errors: None.

See also: `FpSelect` (177), `FpFD_ZERO` (153), `FpFD_Set` (153), `FpFD_IsSet` (153)

1.4.17 fpFD_ISSET

Synopsis: Check whether a filedescriptor is set

Declaration: function fpFD_ISSET(fdno: cint;const nset: TFDSet) : cint

Visibility: default

Description: FpFD_Set Checks whether file descriptor fdNo in filedescriptor set fds is set. It returns zero if the descriptor is not set, 1 if it is set. If the number of the filedescriptor is wrong, -1 is returned.

For an example, see FpSelect ([177](#)).

Errors: If an invalid file descriptor number is passed, -1 is returned.

See also: FpSelect ([177](#)), FpFD_ZERO ([153](#)), FpFD_Clr ([152](#)), FpFD_Set ([153](#))

1.4.18 fpFD_SET

Synopsis: Set a filedescriptor in a set

Declaration: function fpFD_SET(fdno: cint;var nset: TFDSet) : cint

Visibility: default

Description: FpFD_Set sets file descriptor fdno in filedescriptor set nset.

For an example, see FpSelect ([177](#)).

Errors: None.

See also: FpSelect ([177](#)), FpFD_ZERO ([153](#)), FpFD_Clr ([152](#)), FpFD_IsSet ([153](#))

1.4.19 fpFD_ZERO

Synopsis: Clear all file descriptors in set

Declaration: function fpFD_ZERO(out nset: TFDSet) : cint

Visibility: default

Description: FpFD_Zero clears all the filedescriptors in the file descriptor set nset.

For an example, see FpSelect ([177](#)).

Errors: None.

See also: FpSelect ([177](#)), FpFD_Clr ([152](#)), FpFD_Set ([153](#)), FpFD_IsSet ([153](#))

1.4.20 FpFork

Synopsis: Create child process

Declaration: function FpFork : TPid

Visibility: default

Description: FpFork creates a child process which is a copy of the parent process. FpFork returns the process ID in the parent process, and zero in the child's process. (you can get the parent's PID with fpGetPPid ([159](#))).

Errors: On error, -1 is returned to the parent, and no child is created.

sys_eagainNot enough memory to create child process.

See also: fpExecve (150), #rtl.linux.Clone (740)

1.4.21 FPFStat

Synopsis: Retrieve file information about a file descriptor.

Declaration: function FpFStat(fd: cint; var sb: Stat) : cint
 function FPFStat(var F: Text; var Info: Stat) : Boolean
 function FPFStat(var F: File; var Info: Stat) : Boolean

Visibility: default

Description: FpFStat gets information about the file specified in one of the following:

Fda valid file descriptor.

Fan opened text file or untyped file.

and stores it in **Info**, which is of type stat (137). The function returns zero if the call was succesfull, a nonzero return value indicates failure.

Errors: Extended error information can be retrieved using fpGetErrno (156).

sys_enoentPath does not exist.

See also: FpStat (186), FpLStat (163)

Listing: ./bunixex/ex28.pp

```
program example28;

{ Program to demonstrate the FStat function. }

uses BaseUnix;

var f : text;
    i : byte;
    info : stat;

begin
  { Make a file }
  assign (f, 'test.fil');
  rewrite (f);
  for i:=1 to 10 do writeln (f, 'Testline # ',i);
  close (f);
  { Do the call on made file. }
  if fpstat ('test.fil',info)<>0 then
    begin
      writeln('Fstat failed. Errno : ',fpgeterrno);
      halt (1);
    end;
  writeln;
  writeln ('Result of fstat on file ''test.fil''.');
  writeln ('Inode     : ',info.st_ino);
  writeln ('Mode      : ',info.st_mode);
```

```

writeln ('nlink' : ',info.st_nlink);
writeln ('uid' : ',info.st_uid);
writeln ('gid' : ',info.st_gid);
writeln ('rdev' : ',info.st_rdev);
writeln ('Size' : ',info.st_size);
writeln ('Blksize' : ',info.st_blksize);
writeln ('Blocks' : ',info.st_blocks);
writeln ('atime' : ',info.st_atime);
writeln ('mtime' : ',info.st_mtime);
writeln ('ctime' : ',info.st_ctime);
{ Remove file }
erase (f);
end.

```

1.4.22 FpFtruncate

Synopsis: Truncate file on certain size.

Declaration: function FpFtruncate(fd: cint; flength: TOff) : cint

Visibility: default

Description: FpFTruncate sets the length of a file in `fd` on `flength` bytes, where `flength` must be less than or equal to the current length of the file in `fd`.

The function returns zero if the call was successful, a nonzero return value indicates that an error occurred.

Errors: Extended error information can be retrieved using fpGetErrno (156).

See also: FpOpen (169), FpClose (147), FpRead (173), FpWrite (194), FpLSeek (163)

1.4.23 FpGetcwd

Synopsis: Retrieve the current working directory.

Declaration: function FpGetcwd(path: PChar;siz: TSize) : PChar
function FpGetcwd : AnsiString

Visibility: default

Description: fpgetCWD returns the current working directory of the running process. It is returned in `Path`, which points to a memory location of at least `siz` bytes.

If the function is succesful, a pointer to `Path` is returned, or a string with the result. On error `Nil` or an empty string are returned.

Errors: On error `Nil` or an empty string are returned.

See also: FpGetPID (158), FpGetUID (160)

1.4.24 FpGetegid

Synopsis: Return effective group ID

Declaration: function FpGetegid : TGid

Visibility: default

Description: FpGetegid returns the effective group ID of the currently running process.

Errors: None.

See also: FpGetGid (157), FpGetUid (160), FpGetEUid (157), FpGetPid (158), FpGetPPid (159), fpSetUID (180), FpSetGid (179)

Listing: ./bunixex/ex18.pp

Program Example18;

```
{ Program to demonstrate the GetGid and GetEGid functions. }
```

Uses BaseUnix;

```
begin
  writeln ('Group Id = ',fpgetgid , ' Effective group Id = ',fpgetegid );
end.
```

1.4.25 FpGetEnv

Synopsis: Return value of environment variable.

Declaration: function FpGetEnv(name: PChar) : PChar
function FpGetEnv(name: string) : PChar

Visibility: default

Description: FPGetEnv returns the value of the environment variable in Name. If the variable is not defined, nil is returned. The value of the environment variable may be the empty string. A PChar is returned to accomodate for strings longer than 255 bytes, TERMCAP and LS_COLORS, for instance.

Errors: None.

Listing: ./bunixex/ex41.pp

Program Example41;

```
{ Program to demonstrate the GetEnv function. }
```

Uses BaseUnix;

```
begin
  Writeln ('Path is : ',fpGetenv( 'PATH' ));
end.
```

1.4.26 fpgeterrno

Synopsis: Retrieve extended error information.

Declaration: function fpgeterrno : LongInt

Visibility: default

Description: fpgeterrno returns extended information on the latest error. It is set by all functions that communicate with the kernel or C library.

Errors: None.

See also: fpseterrno (179)

1.4.27 FpGeteuid

Synopsis: Return effective user ID

Declaration: function FpGeteuid : TUid

Visibility: default

Description: FpGeteuid returns the effective user ID of the currently running process.

Errors: None.

See also: FpGetUid (160), FpGetGid (157), FpGetEGid (155), FpGetPid (158), FpGetPPid (159), fpSetUID (180), FpSetGid (179)

Listing: ./bunisex/ex17.pp

Program Example17;

{ Program to demonstrate the GetUid and GetEUid functions. }

Uses BaseUnix;

begin
 writeln ('User Id = ',fpgetuid , ' Effective user Id = ',fpgeteuid);
end.

1.4.28 FpGetgid

Synopsis: Return real group ID

Declaration: function FpGetgid : TGid

Visibility: default

Description: FpGetgid returns the real group ID of the currently running process.

Errors: None.

See also: FpGetEGid (155), FpGetUid (160), FpGetEUId (157), FpGetPid (158), FpGetPPid (159), fpSetUID (180), FpSetGid (179)

Listing: ./bunisex/ex18.pp

Program Example18;

{ Program to demonstrate the GetGid and GetEGid functions. }

Uses BaseUnix;

begin
 writeln ('Group Id = ',fpgetgid , ' Effective group Id = ',fpgetegid);
end.

1.4.29 FpGetgroups

Synopsis: Get the list of supplementary groups.

Declaration: function FpGetgroups(gidsetsize: cint;var grouplist: TGrpArr) : cint

Visibility: default

Description: FpGetgroups returns up to gidsetsize groups in GroupList

If the function is successful, then number of groups that were stored is returned. On error, -1 is returned.

Errors: On error, -1 is returned. Extended error information can be retrieved with fpGetErrNo (156)

See also: FpGetpgrp (158), FpGetGID (157), FpGetEGID (155)

1.4.30 FpGetpgrp

Synopsis: Get process group ID

Declaration: function FpGetpgrp : TPid

Visibility: default

Description: FpGetpgrp returns the process group ID of the current process.

Errors: None.

See also: fpGetPID (158), fpGetPPID (159), FpGetGID (157), FpGetUID (160)

1.4.31 FpGetpid

Synopsis: Return current process ID

Declaration: function FpGetpid : TPid

Visibility: default

Description: FpGetpid returns the process ID of the currently running process.

Note: There exist a portable alterative to fpGetpid: system.GetProcessID. Please use fpGetpid only if you are writing Unix specific code. System.GetProcessID will work on all operating systems.

Errors: None.

See also: FpGetPPid (159)

Listing: ./bunixex/ex16.pp

Program Example16;

{ Program to demonstrate the GetPid , GetPPid function . }

Uses BaseUnix;

begin

WriteIn ('Process Id = ',fpgetpid , ' Parent process Id = ',fpgetppid);

end.

1.4.32 FpGetppid

Synopsis: Return parent process ID

Declaration: function FpGetppid : TPid

Visibility: default

Description: FpGetppid returns the Process ID of the parent process.

Errors: None.

See also: FpGetPid (158)

Listing: ./bunixex/ex16.pp

Program Example16;

{ Program to demonstrate the GetPid, GetPPid function. }

Uses BaseUnix;

begin

WriteLn ('Process Id = ',fpgetpid,' Parent process Id = ',fpgetppid);

end.

1.4.33 fpGetPriority

Synopsis: Return process priority

Declaration: function fpGetPriority(Which: cint;Who: cint) : cint

Visibility: default

Description: GetPriority returns the priority with which a process is running. Which process(es) is determined by the Which and Who variables. Which can be one of the pre-defined Prio_Process, Prio_PGrp, Prio_User, in which case Who is the process ID, Process group ID or User ID, respectively.

For an example, see FpNice (168).

Errors: Error information is returned solely by the FpGetErrno (156) function: a priority can be a positive or negative value.

sys_esrchNo process found using which and who.

sys_eINVALWhich was not one of Prio_Process, Prio_Grp or Prio_User.

See also: FpSetPriority (179), FpNice (168)

1.4.34 FpGetRLimit

Synopsis: Get process resource limits

Declaration: function FpGetRLimit(resource: cint;rlim: PRLimit) : cint

Visibility: default

Description: FpGetRLimit gets the resource limits for the current process: `resource` determines the resource of which the kernel should return the limits (one of the many `RLIMIT_*` constants). `rlim` should point to a TRLimit (139) record and on success will contain the resource limits.

The function returns zero if the resource limits were correctly returned.

Errors: On error, -1 is returned and fpgeterrno (156) can be used to retrieve the error code.

See also: FpSetRLimit (180)

1.4.35 FpGetsid

Synopsis: Get current session ID

Declaration: function FpGetsid(pid: TPid) : TPid

Visibility: default

Description: FpGetsid returns the session ID of the process `pid`. The return value is the session ID of the process. (it equals the PID of the session leader). The process `pid` must be in the same session as the current process.

Errors: On error, -1 is returned, and extended error information can be obtained with fpGetErrno.

See also: FpGetpgrp (158), FpGetpid (158), FpGetPpid (159)

1.4.36 FpGetuid

Synopsis: Return current user ID

Declaration: function FpGetuid : TUid

Visibility: default

Description: FpGetuid returns the real user ID of the currently running process.

Errors: None.

See also: FpGetGid (157), FpGetEUid (157), FpGetEGid (155), FpGetPid (158), FpGetPPid (159), fpSetUID (180)

Listing: ./bunixex/ex17.pp

Program Example17;

{ Program to demonstrate the GetUid and GetEUid functions . }

Uses BaseUnix;

begin
 writeln ('User Id = ',fpgetuid , ' Effective user Id = ',fpgeteuid);
end.

1.4.37 FpIOCtl

Synopsis: General kernel IOCTL call.

Declaration: function FpIOCtl(Handle: cint;Ndx: TIOCtlRequest;Data: Pointer) : cint

Visibility: default

Description: This is a general interface to the Unix/ linux ioctl call. It performs various operations on the filedescriptor Handle. Ndx describes the operation to perform. Data points to data needed for the Ndx function. The structure of this data is function-dependent, so we don't elaborate on this here. For more information on this, see various manual pages under linux.

Errors: Extended error information can be retrieved using fpGetErrno ([156](#)).

Listing: ./bunixex/ex54.pp

Program Example54 ;

```

uses BaseUnix , Termio ;

{ Program to demonstrate the IOCTL function . }

var
    tios : Termios;

begin
    {$ifdef FreeBSD}
        fpIOCtl(1,TIOCGETA,@tios); // these constants are very OS dependant.
                                    // see the tcgetattr example for a better way
    {$endif}
    WriteLn('Input Flags   : $',hexstr(tios.c_iflag,8));
    WriteLn('Output Flags  : $',hexstr(tios.c_oflag,8));
    WriteLn('Line Flags     : $',hexstr(tios.c_lflag,8));
    WriteLn('Control Flags : $',hexstr(tios.c_cflag,8));
end.

```

1.4.38 FpKill

Synopsis: Send a signal to a process

Declaration: function FpKill(pid: TPid;sig: cint) : cint

Visibility: default

Description: fpKill sends a signal Sig to a process or process group. If Pid>0 then the signal is sent to Pid, if it equals -1, then the signal is sent to all processes except process 1. If Pid<-1 then the signal is sent to process group -Pid.

The return value is zero, except in case three, where the return value is the number of processes to which the signal was sent.

Errors: Extended error information can be retrieved using fpGetErrno ([156](#)):

sys_einvalAn invalid signal is sent.

sys_esrchThe Pid or process group don't exist.

sys_epermThe effective userid of the current process doesn't math the one of process Pid.

See also: FpSigAction ([181](#)), FpSignal ([183](#))

1.4.39 FpLink

Synopsis: Create a hard link to a file

Declaration: function FpLink(existing: PChar; newone: PChar) : cint
 function FpLink(existing: AnsiString; newone: AnsiString) : cint

Visibility: default

Description: fpLink makes NewOne point to the same file als Existing. The two files then have the same inode number. This is known as a 'hard' link. The function returns zero if the call was succesfull, and returns a non-zero value if the call failed.

Errors: The following error codes are returned:

sys_exdev Existing and NewOne are not on the same filesystem.
sys_eperm The filesystem containing Existing and NewOne doesn't support linking files.
sys_eaccess Write access for the directory containing NewOne is disallowed, or one of the directories in Existing or NewOne has no search (=execute) permission.
sys_enoent A directory entry in Existing or NewOne does not exist or is a symbolic link pointing to a non-existent directory.
sys_enotdir A directory entry in Existing or NewOne is nor a directory.
sys_enomem Insufficient kernel memory.
sys_eroofs The files are on a read-only filesystem.
sys_eexist NewOne already exists.
sys_emlink Existing has reached maximal link count.
sys_eloop existing or NewOne has a reference to a circular symbolic link, i.e. a symbolic link, whose expansion points to itself.
sys_enospc The device containing NewOne has no room for another entry.
sys_eperm Existing points to . or .. of a directory.

See also: fpSymLink (187), fpUnLink (192)

Listing: ./bunixex/ex21.pp

```
Program Example21;

{ Program to demonstrate the Link and UnLink functions. }

Uses BaseUnix;

Var F : Text;
      S : String;
begin
  Assign (F, 'test.txt');
  Rewrite (F);
  Writeln (F, 'This is written to test.txt');
  Close(f);
  { new.txt and test.txt are now the same file }
  if fpLink ('test.txt', 'new.txt')<>0 then
    writeln ('Error when linking !');
  { Removing test.txt still leaves new.txt }
  If fpUnlink ('test.txt')<>0 then
    Writeln ('Error when unlinking !');
  Assign (f, 'new.txt');
```

```

Reset (F);
While not EOF(f) do
  begin
    ReadIn(F,S);
    WriteIn ('> ',s);
    end;
  Close (f);
  { Remove new.txt also }
  If not FPUnlink ('new.txt')<>0 then
    WriteIn ('Error when unlinking !');
end.

```

1.4.40 FpLseek

Synopsis: Set file pointer position.

Declaration: function FpLseek(fd: cint;offset: TOff;whence: cint) : TOff

Visibility: default

Description: FpLSeek sets the current fileposition of file fd to Offset, starting from Whence, which can be one of the following:

Seek_SetOffset is the absolute position in the file.

Seek_CurOffset is relative to the current position.

Seek_endOffset is relative to the end of the file.

The function returns the new fileposition, or -1 if an error occurred.

For an example, see FpOpen (169).

Errors: Extended error information can be retrieved using fpGetErrno (156).

See also: FpOpen (169), FpWrite (194), FpClose (147), FpRead (173), FpFTruncate (155)

1.4.41 fpLstat

Synopsis: Return information about symbolic link. Do not follow the link

Declaration: function fpLstat(path: PChar;Info: PStat) : cint
 function fpLstat(path: Ansistring;Info: PStat) : cint
 function fpLstat(path: PChar;var Info: Stat) : cint
 function fpLstat(Filename: ansistring;var Info: Stat) : cint

Visibility: default

Description: FpLstat gets information about the link specified in Path (or FileName, and stores it in Info, which points to a record of type TStat. Contrary to FpFstat (154), it stores information about the link, not about the file the link points to. The function returns zero if the call was successful, a nonzero return value indicates failure. failed.

Errors: Extended error information is returned by the FpGetErrno (156) function.

sys_enoent Path does not exist.

See also: FpFStat (154), #rtl.unix.StatFS (1710)

Listing: ./unixex/ex29.pp

```

program example29;

{ Program to demonstrate the LStat function. }

uses BaseUnix, Unix;

var f : text;
    i : byte;
    info : stat;

begin
    { Make a file }
    assign (f, 'test.fil');
    rewrite (f);
    for i:=1 to 10 do writeln (f, 'Testline # ',i);
    close (f);
    { Do the call on made file. }
    if fpstat ('test.fil',info)<>0 then
        begin
            writeln ('Fstat failed. Errno : ',fpgeterrno);
            halt (1);
            end;
    writeln;
    writeln ('Result of stat on file ''test.fil''.');
    writeln ('Inode : ',info.st_ino);
    writeln ('Mode : ',info.st_mode);
    writeln ('nlink : ',info.st_nlink);
    writeln ('uid : ',info.st_uid);
    writeln ('gid : ',info.st_gid);
    writeln ('rdev : ',info.st_rdev);
    writeln ('Size : ',info.st_size);
    writeln ('Blksize : ',info.st_blksize);
    writeln ('Blocks : ',info.st_blocks);
    writeln ('atime : ',info.st_atime);
    writeln ('mtime : ',info.st_mtime);
    writeln ('ctime : ',info.st_ctime);

    If fpSymLink ('test.fil','test.lnk')<>0 then
        writeln ('Link failed ! Errno : ',fpgeterrno);

    if fplstat ('test.lnk',@info)<>0 then
        begin
            writeln ('LStat failed. Errno : ',fpgeterrno);
            halt (1);
            end;
    writeln;
    writeln ('Result of fstat on file ''test.lnk''.');
    writeln ('Inode : ',info.st_ino);
    writeln ('Mode : ',info.st_mode);
    writeln ('nlink : ',info.st_nlink);
    writeln ('uid : ',info.st_uid);
    writeln ('gid : ',info.st_gid);
    writeln ('rdev : ',info.st_rdev);
    writeln ('Size : ',info.st_size);
    writeln ('Blksize : ',info.st_blksize);
    writeln ('Blocks : ',info.st_blocks);
    writeln ('atime : ',info.st_atime);

```

```

writeln ('mtime    : ',info.st_mtime);
writeln ('ctime    : ',info.st_ctime);
{ Remove file and link }
erase (f);
funlink ('test.lnk');
end.

```

1.4.42 FpMkdir

Synopsis: Create a new directory

Declaration: function FpMkdir(path: PChar;Mode: TMode) : cint
 function FpMkdir(path: AnsiString;Mode: TMode) : cint

Visibility: default

Description: FpMkdir creates a new directory Path, and sets the new directory's mode to Mode. Path can be an absolute path or a relative path. Note that only the last element of the directory will be created, higher level directories must already exist, and must be writeable by the current user.

On success, 0 is returned. If the function fails, -1 is returned.

Note: There exist a portable alternative to fpMkdir: system.mkdir. Please use fpMkdir only if you are writing Unix specific code. System.mkdir will work on all operating systems.

Errors: Extended error information can be retrieved using fpGetErrno ([156](#)).

See also: fpGetCWD ([155](#)), fpChDir ([144](#))

1.4.43 FpMkfifo

Synopsis: Create FIFO (named pipe) in file system

Declaration: function FpMkfifo(path: PChar;Mode: TMode) : cint
 function FpMkfifo(path: AnsiString;Mode: TMode) : cint

Visibility: default

Description: fpMkfifo creates named a named pipe in the filesystem, with name Path and mode Mode.

The function returns zero if the command was successful, and nonzero if it failed.

Errors: The error codes include:

sys_emfile Too many file descriptors for this process.

sys_enfile The system file table is full.

1.4.44 Fpmmap

Synopsis: Create memory map of a file

Declaration: function Fpmmap(start: pointer;len: size_t;prot: cint;flags: cint;
 fd: cint;offst: off_t) : pointer

Visibility: default

Description: Fpmmap maps or unmaps files or devices into memory. The different arguments determine what and how the file is mapped:

adrAddress where to mmap the device. This address is a hint, and may not be followed.

lenSize (in bytes) of area to be mapped.

protProtection of mapped memory. This is a OR-ed combination of the following constants:

PROT_EXECThe memory can be executed.

PROT_READThe memory can be read.

PROT_WRITEThe memory can be written.

PROT_NONEThe memory can not be accessed.

flagsContains some options for the mmap call. It is an OR-ed combination of the following constants:

MAP_FIXEDDo not map at another address than the given address. If the address cannot be used, MMap will fail.

MAP_SHAREDShare this map with other processes that map this object.

MAP_PRIVATECreate a private map with copy-on-write semantics.

MAP_ANONYMOUSfd does not have to be a file descriptor.

One of the options MAP_SHARED and MAP_PRIVATE must be present, but not both at the same time.

fdFile descriptor from which to map.

offOffset to be used in file descriptor fd.

The function returns a pointer to the mapped memory, or a -1 in case of an error.

Errors: On error, -1 is returned and extended error information is returned by the FpGetErrno ([156](#)) function.

Sys_EBADFfd is not a valid file descriptor and MAP_ANONYMOUS was not specified.

Sys_EACCESMAP_PRIVATE was specified, but fd is not open for reading. Or MAP_SHARED was asked and PROT_WRITE is set, fd is not open for writing

Sys_EINVALOne of the record fields Start, length or offset is invalid.

Sys_ETIMEMAP_DENYWRITE was set but the object specified by fd is open for writing.

Sys_EAGAINfd is locked, or too much memory is locked.

Sys_ENOMEMNot enough memory for this operation.

See also: FpMUnMap ([167](#))

Listing: ./unixex/ex66.pp

Program Example66;

```
{ Program to demonstrate the MMap function. }
```

Uses BaseUnix, Unix;

```
Var S      : String;
      fd    : cint;
      Len   : longint;
//      args : tmmapargs;
      P      : PChar;

begin
  S:='This is the string';
  Len:=Length(S);
  fd:=fpOpen('testfile.txt',O_wrOnly or o_creat);
  If fd=-1 then
```

```

Halt(1);
If fpWrite(fd,S[1],Len)=-1 then
    Halt(2);
fpClose(fd);
fd:=fpOpen('testfile.txt',O_rdOnly);
if fd=-1 then
    Halt(3);
P:=Pchar(fpmmmap(nil,len+1,PROT_READ or PROT_WRITE,MAP_PRIVATE,fd,0));

If longint(P)=-1 then
    Halt(4);
Writeln('Read in memory : ',P);
fpclose(fd);
if fpMUnMap(P,Len)<>0 Then
    Halt(fpgeterrno);
end.

```

1.4.45 Fpmunmap

Synopsis: Unmap previously mapped memory block

Declaration: function Fpmunmap(start: pointer; len: size_t) : cint

Visibility: default

Description: FpMUnMap unmaps the memory block of size Len, pointed to by Adr, which was previously allocated with FpMMap (165).

The function returns True if successful, False otherwise.

For an example, see FpMMap (165).

Errors: In case of error the function returns a nonzero value, extended error information is returned by the FpGetErrno (156) function. See FpMMap (165) for possible error values.

See also: FpMMap (165)

1.4.46 FpNanoSleep

Synopsis: Suspend process for a short time

Declaration: function FpNanoSleep(req: ptimespec; rem: ptimespec) : cint

Visibility: default

Description: FpNanoSleep suspends the process till a time period as specified in req has passed. Then the function returns. If the call was interrupted (e.g. by some signal) then the function may return earlier, and rem will contain the remaining time till the end of the intended period. In this case the return value will be -1, and ErrNo will be set to EINTR

If the function returns without error, the return value is zero.

Errors: If an error occurred or the call was interrupted, -1 is returned. Extended error information can be retrieved using fpGetErrno (156).

See also: FpPause (171), FpAlarm (143)

Listing: ./bunixex/ex72.pp

```

program example72;

{ Program to demonstrate the NanoSleep function. }

uses BaseUnix;

Var
  Req,Rem : TimeSpec;
  Res : Longint;

begin
  With Req do
    begin
      tv_sec:=10;
      tv_nsec:=100;
    end;
  Write( 'NanoSleep returned : ' );
  Flush(Output);
  Res:=(fpNanoSleep(@Req,@rem));
  Writeln(res);
  If (res<>0) then
    With rem do
      begin
        Writeln('Remaining seconds      : ',tv_sec);
        Writeln('Remaining nanoseconds : ',tv_nsec);
      end;
end.

```

1.4.47 fpNice

Synopsis: Set process priority

Declaration: function fpNice(N: cint) : cint

Visibility: default

Description: Nice adds -N to the priority of the running process. The lower the priority numerically, the less the process is favored. Only the superuser can specify a negative N, i.e. increase the rate at which the process is run.

If the function is successful, zero is returned. On error, a nonzero value is returned.

Errors: Extended error information is returned by the FpGetErrno ([156](#)) function.

sys_epermA non-superuser tried to specify a negative N, i.e. do a priority increase.

See also: FpGetPriority ([159](#)), FpSetPriority ([179](#))

Listing: ./unixex/ex15.pp

Program Example15;

{ Program to demonstrate the Nice and Get/SetPriority functions. }

Uses BaseUnix, Unix;

begin

```

writeln ('Setting priority to 5');
fpsetpriority (prio_process,fpgetpid,5);
writeln ('New priority = ',fpgetpriority (prio_process,fpgetpid));
writeln ('Doing nice 10');
fpnice (10);
writeln ('New Priority = ',fpgetpriority (prio_process,fpgetpid));
end.

```

1.4.48 FpOpen

Synopsis: Open file and return file descriptor

Declaration:

```

function FpOpen(path: PChar;flags: cint;Mode: TMode) : cint
function FpOpen(path: PChar;flags: cint) : cint
function FpOpen(path: AnsiString;flags: cint) : cint
function FpOpen(path: AnsiString;flags: cint;Mode: TMode) : cint
function FpOpen(path: string;flags: cint) : cint
function FpOpen(path: string;flags: cint;Mode: TMode) : cint

```

Visibility: default

Description: FpOpen opens a file in Path with flags flags and mode Mode One of the following:

O_RdOnlyFile is opened Read-only

O_WrOnlyFile is opened Write-only

O_RdWrFile is opened Read-Write

The flags may be OR-ed with one of the following constants:

O_CreatFile is created if it doesn't exist.

O_ExclIf the file is opened with **O_Creat** and it already exists, the call wil fail.

O_NoCttyIf the file is a terminal device, it will NOT become the process' controlling terminal.

O_TruncIf the file exists, it will be truncated.

O_Appendthe file is opened in append mode. *Before each write*, the file pointer is positioned at the end of the file.

O_NonBlockThe file is opened in non-blocking mode. No operation on the file descriptor will cause the calling process to wait till.

O_NDelayIdem as **O_NonBlock**

O_SyncThe file is opened for synchronous IO. Any write operation on the file will not return untill the data is physically written to disk.

O_NoFollowif the file is a symbolic link, the open fails. (linux 2.1.126 and higher only)

O_Directoryif the file is not a directory, the open fails. (linux 2.1.126 and higher only)

Path can be of type PChar or String. The optional mode argument specifies the permissions to set when opening the file. This is modified by the umask setting. The real permissions are Mode and not umask. The return value of the function is the filedescriptor, or a negative value if there was an error.

Errors: Extended error information can be retrieved using fpGetErrno ([156](#)).

See also: FpClose ([147](#)), FpRead ([173](#)), FpWrite ([194](#)), FpFTruncate ([155](#)), FpLSeek ([163](#))

Listing: ./bunixex/ex19.pp

```

Program Example19;

{ Program to demonstrate the fdOpen, fdwrite and fdClose functions. }

Uses BaseUnix;

Const Line : String[80] = 'This is easy writing !';

Var FD : Cint;

begin
  FD:=fpOpen ('Test.dat',O_WrOnly or O_Creat);
  if FD>0 then
    begin
      if length(Line)<>fpwrite (FD,Line[1],Length(Line)) then
        Writeln ('Error when writing to file !');
      fpClose(FD);
    end;
  end;
end.

```

1.4.49 FpOpendir

Synopsis: Open a directory for reading

Declaration: function FpOpendir(dirname: PChar) : pDir
 function FpOpendir(dirname: AnsiString) : pDir
 function FpOpendir(dirname: shortString) : pDir

Visibility: default

Description: FpOpendir opens the directory DirName, and returns a pdir pointer to a Dir (128) record, which can be used to read the directory structure. If the directory cannot be opened, nil is returned.

Errors: Extended error information can be retrieved using fpGetErrno (156).

See also: FpCloseDir (147), FpReadDir (174)

Listing: ./bunixex/ex35.pp

```

Program Example35;

{ Program to demonstrate the
    OpenDir, ReadDir, SeekDir and TellDir functions. }

Uses BaseUnix;

Var TheDir : PDir;
     ADirent : PDirent;
     Entry : Longint;

begin
  TheDir:=fpOpenDir ('./.');
  Repeat
//    Entry:=fpTellDir(TheDir);
    ADirent:=fpReadDir (TheDir^);
    If ADirent<>Nil then

```

```

With ADirent^ do
  begin
    Writeln ( 'Entry No : ', Entry );
    Writeln ( 'Inode : ', d_fileno );
    //      Writeln ('Offset : ', d_off);
    Writeln ( 'Reclen : ', d_reclen );
    Writeln ( 'Name : ', pchar(@d_name[0]));
    end;
  Until ADirent=Nil;
Repeat
  Write ( 'Entry No. you would like to see again (-1 to stop): ' );
  ReadLn ( Entry );
  If Entry<>-1 then
    begin
    //      fpSeekDir (TheDir, Entry);           // not implemented for various platforms
    ADirent:=fpReadDir ( TheDir^ );
    If ADirent<>Nil then
      With ADirent^ do
        begin
          Writeln ( 'Entry No : ', Entry );
          Writeln ( 'Inode : ', d_fileno );
          //      Writeln ('Offset : ', off);
          Writeln ( 'Reclen : ', d_reclen );
          Writeln ( 'Name : ', pchar(@d_name[0]));
        end;
      end;
    Until Entry=-1;
    fpCloseDir ( TheDir^ );
  end.

```

1.4.50 FpPause

Synopsis: Wait for a signal to arrive

Declaration: function FpPause : cint

Visibility: default

Description: FpPause puts the process to sleep and waits until the application receives a signal. If a signal handler is installed for the received signal, the handler will be called and after that pause will return control to the process.

For an example, see fpAlarm (143).

1.4.51 FpPipe

Synopsis: Create a set of pipe file handlers

Declaration: function FpPipe(var fildes: TFilDes) : cint

Visibility: default

Description: FpPipe creates a pipe, i.e. two file objects, one for input, one for output. The filehandles are returned in the array fildes. The input handle is in the 0-th element of the array, the output handle is in the 1-st element.

The function returns zero if everything went successfully, a nonzero return value indicates an error.

Errors: In case the function fails, the following return values are possible:

sys_emfile Too many file descriptors for this process.

sys_enfile The system file table is full.

See also: #rtl.unix.POpen (1706), fpMkFifo (165)

Listing: ./bunixex/ex36.pp

Program Example36;

{ Program to demonstrate the AssignPipe function. }

Uses BaseUnix, Unix;

Var pipi, pipo : Text;
s : String;

```
begin
  Writeln ('Assigning Pipes.');
  If assignpipe(pipi, pipo)<>0 then
    Writeln('Error assigning pipes !',fpgeterrno);
  Writeln ('Writing to pipe, and flushing .');
  Writeln (pipo, 'This is a textstring');close(pipo);
  Writeln ('Reading from pipe .');
  While not eof(pipi) do
    begin
      Readln (pipi,s);
      Writeln ('Read from pipe : ',s);
    end;
  close (pipi);
  writeln ('Closed pipes .');
  writeln
end.
```

1.4.52 FpPoll

Synopsis: Poll a file descriptor for events.

Declaration: function FpPoll(fds: ppollfd; nfds: cuint; timeout: clong) : cint

Visibility: default

Description: fpPoll waits for events on file descriptors. fds points to an array of tpollfd records, each of these records describes a file descriptor on which to wait for events. The number of file descriptors is given by nfds. >timeout specifies the maximum time (in milliseconds) to wait for events.

On timeout, the result value is 0. If an event occurred on some descriptors, then the return value is the number of descriptors on which an event (or error) occurred. The revents field of the tpollfd records will contain the events for the file descriptor it described.

See also: tpollfd (139)

1.4.53 FppRead

Synopsis: Positional read: read from file descriptor at a certain position.

Declaration: function FpPRead(fd: cint;buf: PChar;nbytes: TSize;offset: TOff)
 : TsSize
 function FppRead(fd: cint;var buf;nbytes: TSize;offset: TOff) : TsSize

Visibility: default

Description: FpPRead reads nbytes bytes from file descriptor fd into buffer buf starting at offset offset. Offset is measured from the start of the file. This function can only be used on files, not on pipes or sockets (i.e. any seekable file descriptor).

The function returns the number of bytes actually read, or -1 on error.

Errors: On error, -1 is returned.

See also: FpReadV (176), FpPWrite (173)

1.4.54 FppWrite

Synopsis: Positional write: write to file descriptor at a certain position.

Declaration: function FpPWrite(fd: cint;buf: PChar;nbytes: TSize;offset: TOff)
 : TsSize
 function FppWrite(fd: cint;const buf;nbytes: TSize;offset: TOff)
 : TsSize

Visibility: default

Description: FpPWrite writes nbytes bytes from buffer buf into file descriptor fd starting at offset offset. Offset is measured from the start of the file. This function can only be used on files, not on pipes or sockets (i.e. any seekable file descriptor).

The function returns the number of bytes actually written, or -1 on error.

Errors: On error, -1 is returned.

See also: FpPRead (172), FpWriteV (195)

1.4.55 FpRead

Synopsis: Read data from file descriptor

Declaration: function FpRead(fd: cint;buf: PChar;nbytes: TSize) : TsSize
 function FpRead(fd: cint;var buf;nbytes: TSize) : TsSize

Visibility: default

Description: FpRead reads at most nbytes bytes from the file descriptor fd, and stores them in buf.

The function returns the number of bytes actually read, or -1 if an error occurred. No checking on the length of buf is done.

Errors: Extended error information can be retrieved using fpGetErrno (156).

See also: FpOpen (169), FpClose (147), FpWrite (194), FpFTruncate (155), FpLSeek (163)

Listing: ./bunixex/ex20.pp

```

Program Example20;

{ Program to demonstrate the fdRead and fdTruncate functions. }

Uses BaseUnix;

Const Data : string[10] = '1234567890';

Var FD : cint;
    I : longint;

begin
    FD:=fpOpen( 'test.dat',o_wronly or o_creat,&666);
    if FD>0 then
        begin
            { Fill file with data }
            for I:=1 to 10 do
                if fpWrite (FD,Data[1],10)<>10 then
                    begin
                        writeln ('Error when writing !');
                        halt(1);
                    end;
            fpClose(FD);
            FD:=fpOpen('test.dat',o_rdonly );
            { Read data again }
            If FD>0 then
                begin
                    For I:=1 to 5 do
                        if fpRead (FD,Data[1],10)<>10 then
                            begin
                                Writeln ('Error when Reading !');
                                Halt(2);
                            end;
                fpClose(FD);
                { Truncating file at 60 bytes }
                { For truncating, file must be open or write }
                FD:=fpOpen('test.dat',o_wronly ,&666);
                if FD>0 then
                    begin
                        if fpfTruncate(FD,60)<>0 then
                            Writeln('Error when truncating !');
                            fpClose (FD);
                        end;
                    end;
                end;
            end;
        end.

```

1.4.56 FpReaddir

Synopsis: Read entry from directory

Declaration: function FpReaddir(var dirp: Dir) : pDirentr

Visibility: default

Description: FpReadDir reads the next entry in the directory pointed to by dirp. It returns a pdirentr pointer to a dirent ([128](#)) record describing the entry. If the next entry can't be read, Nil is returned.

For an example, see FpOpenDir (170).

Errors: Extended error information can be retrieved using fpGetErrno (156).

See also: FpCloseDir (147), FpOpenDir (170)

1.4.57 fpReadLink

Synopsis: Read destination of symbolic link

Declaration: function fpReadLink(name: PChar; linkname: PChar; maxlen: size_t) : cint
function fpReadLink(Name: ansistring) : ansistring

Visibility: default

Description: FpReadLink returns the file the symbolic link name is pointing to. The first form of this function accepts a buffer linkname of length maxlen where the filename will be stored. It returns the actual number of characters stored in the buffer.

The second form of the function returns simply the name of the file.

Errors: On error, the first form of the function returns -1; the second one returns an empty string. Extended error information is returned by the FpGetErrno (156) function.

SYS_ENOTDIR part of the path in Name is not a directory.

SYS_EINVAL maxlen is not positive, or the file is not a symbolic link.

SYS_ENAMETOOLONG A pathname, or a component of a pathname, was too long.

SYS_ENOENT the link name does not exist.

SYS_EACCES No permission to search a directory in the path

SYS_ELOOP Too many symbolic links were encountered in translating the pathname.

SYS_EIO An I/O error occurred while reading from the file system.

SYS_EFAULT The buffer is not part of the process's memory space.

SYS_ENOMEM Not enough kernel memory was available.

See also: FpSymLink (187)

Listing: ./unixex/ex62.pp

Program Example62;

{ Program to demonstrate the ReadLink function. }

Uses BaseUnix, Unix;

Var F : Text;
S : String;

begin

```
Assign (F, 'test.txt');
Rewrite (F);
WriteLn (F, 'This is written to test.txt');
Close(f);
{ new.txt and test.txt are now the same file }
if fpSymLink ('test.txt', 'new.txt')<>0 then
  writeln ('Error when symlinking !');
S:=fpReadLink ('new.txt');
```

```

If S= '' then
  Writeln ('Error reading link !')
Else
  Writeln ('Link points to : ',S);
{ Now remove links }
If fpUnlink ('new.txt')<>0 then
  Writeln ('Error when unlinking !');
If fpUnlink ('test.txt')<>0 then
  Writeln ('Error when unlinking !');
end.

```

1.4.58 FpReadV

Synopsis: Vector read: Read into multiple buffers

Declaration: function FpReadV(fd: cint; const iov: piovec; iovcnt: cint) : TsSize

Visibility: default

Description: FpReadV reads data from file descriptor fd and writes it into iovcnt buffers described by the tiovec ([139](#)) buffers pointed to by iov. It works like fpRead ([173](#)) only on multiple buffers.

Errors: On error, -1 is returned.

See also: FpWriteV ([195](#)), FpPWrite ([173](#)), FpPRead ([172](#))

1.4.59 FpRename

Synopsis: Rename file

Declaration: function FpRename(old: PChar; newpath: PChar) : cint
 function FpRename(old: AnsiString; newpath: AnsiString) : cint

Visibility: default

Description: FpRename renames the file Old to NewPath. NewPath can be in a different directory than Old, but it cannot be on another partition (device). Any existing file on the new location will be replaced.

If the operation fails, then the Old file will be preserved.

The function returns zero on succes, a nonzero value indicates failure.

Note: There exist a portable alterative to fpRename: system.rename. Please use fpRename only if you are writing Unix specific code. System.rename will work on all operating systems.

Errors: Extended error information can be retrieved using fpGetErrno ([156](#)).

- sys_eisdir**NewPath exists and is a directory, but Old is not a directory.
- sys_exdev**NewPath and Old are on different devices.
- sys_enotempty** or **sys_eexist**NewPath is an existing, non-empty directory.
- sys_ebusy**Old or NewPath is a directory and is in use by another process.
- sys_einval**NewPath is part of Old.
- sys_emlink**OldPath or NewPath already have tha maximum amount of links pointing to them.
- sys_enotdir**part of Old or NewPath is not directory.
- sys_efault**For the pchar case: One of the pointers points to an invalid address.
- sys_eaccess**access is denied when attempting to move the file.

sys_enametoolong Either Old or NewPath is too long.
sys_enoenta directory component in Old or NewPath didn't exist.
sys_enomem not enough kernel memory.
sys_eroofs NewPath or Old is on a read-only file system.
sys_eloop too many symbolic links were encountered trying to expand Old or NewPath
sys_enospc the filesystem has no room for the new directory entry.

See also: FpUnLink (192)

1.4.60 FpRmdir

Synopsis: Remove a directory.

Declaration: function FpRmdir(path: PChar) : cint
 function FpRmdir(path: AnsiString) : cint

Visibility: default

Description: FpRmdir removes the directory Path from the system. The directory must be empty for this call to succeed, and the user must have the necessary permissions in the parent directory. Only the last component of the directory is removed, i.e. higher-lying directories are not removed.

On success, zero is returned. A nonzero return value indicates failure.

Note: There exist a portable alterative to fpRmDir: system.rmdir. Please use fpRmDir only if you are writing Unix specific code. System.rmdir will work on all operating systems.

Errors: Extended error information can be retrieved using fpGetErrno (156).

1.4.61 fpSelect

Synopsis: Wait for events on file descriptors

Declaration: function FPSelect(N: cint; readfds: pFDSet; writefds: pFDSet;
 exceptfds: pFDSet; TimeOut: ptmeval) : cint
 function fpSelect(N: cint; readfds: pFDSet; writefds: pFDSet;
 exceptfds: pFDSet; TimeOut: cint) : cint
 function fpSelect(var T: Text; TimeOut: ptmeval) : cint
 function fpSelect(var T: Text; TimeOut: time_t) : cint

Visibility: default

Description: FpSelect checks one of the file descriptors in the FDSets to see if the following I/O operation on the file descriptors will block.

readfds, writefds and exceptfds are pointers to arrays of 256 bits. If you want a file descriptor to be checked, you set the corresponding element in the array to 1. The other elements in the array must be set to zero. Three arrays are passed : The entries in readfds are checked to see if the following read operation will block. The entries in writefds are checked to see if the following write operation will block, while entries in exceptfds are checked to see if an exception occurred on them.

You can use the functions fpFD_ZERO (153), fpFD_Clr (152), fpFD_Set (153) or fpFD_IsSet (153) to manipulate the individual elements of a set.

The pointers can be Nil.

N is the value of the largest file descriptor in one of the sets, + 1. In other words, it is the position of the last bit which is set in the array of bits.

TimeOut can be used to set a time limit. If TimeOut can be two types :

- 1.TimeOut is of type ptimeval and contains a zero time, the call returns immediately. If TimeOut is Nil, the kernel will wait forever, or until a status changed.
- 2.TimeOut is of type cint. If it is -1, this has the same effect as a Timeout of type PTime which is Nil. Otherwise, TimeOut contains a time in milliseconds.

When the TimeOut is reached, or one of the file descriptors has changed, the Select call returns. On return, it will have modified the entries in the array which have actually changed, and it returns the number of entries that have been changed. If the timeout was reached, and no descriptor changed, zero is returned; The arrays of indexes are undefined after that. On error, -1 is returned.

The variant with the text file will execute the FpSelect call on the file descriptor associated with the text file T

Errors: On error, the function returns -1. Extended error information can be retrieved using fpGetErrno ([156](#)).

SYS_EBADFAn invalid descriptor was specified in one of the sets.

SYS_EINTR non blocked signal was caught.

SYS EINVALN is negative or too big.

SYS_ENOMEMSelect was unable to allocate memory for its internal tables.

See also: fpFD_ZERO ([153](#)), fpFD_Clr ([152](#)), fpFD_Set ([153](#)), fpFD_IsSet ([153](#))

Listing: ./bunixex/ex33.pp

```

Program Example33;

{ Program to demonstrate the Select function. }

Uses BaseUnix;

Var FDS : Tfdset;

begin
  fpfd_zero(FDS);
  fpfd_set(0,FDS);
  Writeln ('Press the <ENTER> to continue the program.');
  { Wait until File descriptor 0 (=Input) changes }
  fpSelect (1,@FDS,nil,nil,nil);
  { Get rid of <ENTER> in buffer }
  readIn;
  Writeln ('Press <ENTER> key in less than 2 seconds ...');
  FpfD_zero(FDS);
  FpFd_set (0,FDS);
  if fpSelect (1,@FDS,nil,nil,2000)>0 then
    Writeln ('Thank you !')
    { FD_ISSET(0,FDS) would be true here. }
  else
    Writeln ('Too late !');
end.
```

1.4.62 fpseterrno

Synopsis: Set extended error information.

Declaration: procedure fpseterrno(err: LongInt)

Visibility: default

Description: fpseterrno sets the extended information on the latest error. It is called by all functions that communicate with the kernel or C library.

Unless a direct kernel call is performed, there should never be any need to call this function.

See also: fpgeterrno (156)

1.4.63 FpSetgid

Synopsis: Set the current group ID

Declaration: function FpSetgid(gid: TGid) : cint

Visibility: default

Description: fpSetUID sets the group ID of the current process. This call will only work if it is executed as root, or the program is setgid root.

On success, zero is returned, on error -1 is returned.

Errors: Extended error information can be retrieved with fpGetErrNo (156).

See also: FpSetUid (180), FpGetGid (157), FpGetUid (160), FpGetEUid (157), FpGetEGid (155), FpGetPid (158), FpGetPPid (159)

1.4.64 fpSetPriority

Synopsis: Set process priority

Declaration: function fpSetPriority(Which: cint;Who: cint;What: cint) : cint

Visibility: default

Description: fpSetPriority sets the priority with which a process is running. Which process(es) is determined by the Which and Who variables. Which can be one of the pre-defined constants:

Prio_ProcessWho is interpreted as process ID

Prio_PGrpWho is interpreted as process group ID

Prio_UserWho is interpreted as user ID

Prio is a value in the range -20 to 20.

For an example, see FpNice (168).

The function returns zero on success, -1 on failure

Errors: Extended error information is returned by the FpGetErrno (156) function.

sys_esrchNo process found using which and who.

sys_einvalWhich was not one of Prio_Process, Prio_Grp or Prio_User.

sys_epermA process was found, but neither its effective or real user ID match the effective user ID of the caller.

sys_eaccesA non-superuser tried to a priority increase.

See also: FpGetPriority (159), FpNice (168)

1.4.65 FpSetRLimit

Synopsis: Set process resource limits

Declaration: function FpSetRLimit(Resource: cint; rlim: PRLimit) : cint

Visibility: default

Description: FpGetRLimit sets the resource limits for the current process: `resource` determines the resource of which the kernel should set the limits (one of the many `RLIMIT_*` constants). `rlim` should point to a TRLimit (139) record which contains the new limits for the resource indicated in `resource`.

The function returns zero if the resource limits were successfully set.

Errors: On error, -1 is returned and fpgeterrno (156) can be used to retrieve the error code.

See also: FpGetRLimit (159)

1.4.66 FpSetsid

Synopsis: Create a new session.

Declaration: function FpSetsid : TPid

Visibility: default

Description: FpSetsid creates a new session (process group). It returns the new process group id (as returned by FpGetpgrp (158)). This call will fail if the current process is already the process group leader.

Errors: On error, -1 is returned. Extended error information can be retrieved with fpGetErrNo (156)

1.4.67 fpsettimeofday

Synopsis: Set kernel time

Declaration: function fpsettimeofday(tp: ptimeval; tzp: ptimezone) : cint

Visibility: default

Description: FpSetTimeOfDay sets the kernel time to the number of seconds since 00:00, January 1 1970, GMT specified in the `tp` record. This time NOT corrected any way, not taking into account time-zones, daylight savings time and so on.

It is simply a wrapper to the kernel system call.

See also: #rtl.unix.FPGetTimeOfDay (1701)

1.4.68 FpSetuid

Synopsis: Set the current user ID

Declaration: function FpSetuid(uid: TUId) : cint

Visibility: default

Description: fpSetUID sets the user ID of the current process. This call will only work if it is executed as root, or the program is setuid root.

On success, zero is returned, on error -1 is returned.

Errors: Extended error information can be retrieved with fpGetErrNo (156).

See also: FpGetGid (157), FpGetUid (160), FpGetEUid (157), FpGetEGid (155), FpGetPid (158), FpGetPPid (159), FpSetGid (179)

1.4.69 FPSigaction

Synopsis: Install signal handler

Declaration: function FPSigaction(sig: cint;act: psigactionrec;oact: psigactionrec)
 : cint

Visibility: default

Description: FPSigaction changes the action to take upon receipt of a signal. **Act** and **Oact** are pointers to a SigActionRec (136) record. **Sig** specifies the signal, and can be any signal except **SIGKILL** or **SIGSTOP**.

If **Act** is non-nil, then the new action for signal **Sig** is taken from it. If **Oact** is non-nil, the old action is stored there. **Sa_Handler** may be **SIG_DFL** for the default action or **SIG_IGN** to ignore the signal. **Sa_Mask** Specifies which signals should be ignored during the execution of the signal handler. **Sa_Flags** Specifies a series of flags which modify the behaviour of the signal handler. You can 'or' none or more of the following :

SA_NOCLDSTOPIf **sig** is **SIGCHLD** do not receive notification when child processes stop.

SA_ONESHOT or **SA_RESETHAND**Restore the signal action to the default state once the signal handler has been called.

SA_RESTARTFor compatibility with BSD signals.

SA_NOMASK or **SA_NODEFER**Do not prevent the signal from being received from within its own signal handler.

Errors: Extended error information can be retrieved using fpGetErrno (156).

sys_einval invalid signal was specified, or it was **SIGKILL** or **SIGSTOP**.

sys_efault**Act**,**OldAct** point outside this process address space

sys_eintrSystem call was interrupted.

See also: FpSigProcMask (184), FpSigPending (184), FpSigSuspend (185), FpKill (161)

Listing: ./bunixex/ex57.pp

Program example57;

{ Program to demonstrate the SigAction function.}

{
do a kill -USR1 pid from another terminal to see what happens.
replace pid with the real pid of this program.
You can get this pid by running 'ps'.
}

uses BaseUnix;

Var

oa,na : PSigActionRec;

Procedure DoSig(sig : cint);**cdecl**;

begin

writeln('Receiving signal: ',sig);

end;

```

begin
  new(na);
  new(oa);
  na^.sa_Handler:=SigActionHandler(@DoSig);
  fillchar(na^.Sa_Mask,sizeof(na^.sa_mask),#0);
  na^.Sa_Flags:=0;
  {$ifdef Linux}                      // Linux specific
    na^.Sa_Restorer:=Nil;
  {$endif}
  if fpSigAction(SigUsr1,na,oa)<>0 then
    begin
      writeln('Error: ',fpgeterrno,'.');
      halt(1);
    end;
  writeln('Send USR1 signal or press <ENTER> to exit');
  readln;
end.

```

1.4.70 FpSigAddSet

Synopsis: Set a signal in a signal set.

Declaration: function FpSigAddSet(var nset: tsigset; signo: cint) : cint

Visibility: default

Description: FpSigAddSet adds signal Signo to the signal set nset. The function returns 0 on success.

Errors: If an invalid signal number is given, -1 is returned.

See also: FpSigEmptySet (182), FpSigFillSet (183), FpSigDelSet (182), FpSigIsMember (183)

1.4.71 FpSigDelSet

Synopsis: Remove a signal from a signal set.

Declaration: function FpSigDelSet(var nset: tsigset; signo: cint) : cint

Visibility: default

Description: FpSigDelSet removes signal Signo to the signal set nset. The function returns 0 on success.

Errors: If an invalid signal number is given, -1 is returned.

See also: FpSigEmptySet (182), FpSigFillSet (183), FpSigAddSet (182), FpSigIsMember (183)

1.4.72 FpsigEmptySet

Synopsis: Clear all signals from signal set.

Declaration: function FpsigEmptySet(var nset: tsigset) : cint

Visibility: default

Description: FpsigEmptySet clears all signals from the signal set nset.

Errors: None. This function always returns zero.

See also: FpSigFillSet (183), FpSigAddSet (182), FpSigDelSet (182), FpSigIsMember (183)

1.4.73 FpSigFillSet

Synopsis: Set all signals in signal set.

Declaration: function FpSigFillSet(var nset: tsigset) : cint

Visibility: default

Description: FpSigFillSet sets all signals in the signal set nset.

Errors: None. This function always returns zero.

See also: FpSigEmptySet (182), FpSigAddSet (182), FpSigDelSet (182), FpSigIsMember (183)

1.4.74 FpSigIsMember

Synopsis: Check whether a signal appears in a signal set.

Declaration: function FpSigIsMember(const nset: tsigset; signo: cint) : cint

Visibility: default

Description: FpSigIsMember checks whether Signo appears in the set nset. If it is a member, then 1 is returned. If not, zero is returned.

Errors: If an invalid signal number is given, -1 is returned.

See also: FpSigEmptySet (182), FpSigFillSet (183), FpSigAddSet (182), FpSigDelSet (182)

1.4.75 FpSignal

Synopsis: Install signal handler (deprecated)

Declaration: function FpSignal(signum: LongInt; Handler: signalhandler)
 : signalhandler

Visibility: default

Description: FpSignal installs a new signal handler (specified by Handler) for signal SigNum.

This call has a subset of the functionality provided by the FpSigAction (181) call. The return value for FpSignal is the old signal handler, or nil on error.

Errors: Extended error information can be retrieved using fpGetErrno (156).

SIG_ERRAn error occurred.

See also: FpSigAction (181), FpKill (161)

Listing: ./bunixex/ex58.pp

Program example58;

{ Program to demonstrate the Signal function. }

{
do a kill -USR1 pid from another terminal to see what happens.
replace pid with the real pid of this program.
You can get this pid by running 'ps'.
}

```

uses BaseUnix;

Procedure DoSig(sig : cint);cdecl;
begin
  writeln('Receiving signal: ', sig);
end;

begin
  if fpSignal(SigUsr1, SignalHandler(@DoSig))=signalhandler(SIG_ERR) then
    begin
      writeln('Error: ', fpGetErrno, '.');
      halt(1);
    end;
  writeln('Send USR1 signal or press <ENTER> to exit');
  readln;
end.

```

1.4.76 FpSigPending

Synopsis: Return set of currently pending signals

Declaration: function FpSigPending(var nset: tsigset) : cint

Visibility: default

Description: fpSigpending allows the examination of pending signals (which have been raised while blocked.)
The signal mask of pending signals is returned.

Errors: None

See also: fpSigAction (181), fpSigProcMask (184), fpSigSuspend (185), fpSignal (183), fpKill (161)

1.4.77 FpSigProcMask

Synopsis: Set list of blocked signals

Declaration: function FpSigProcMask(how: cint;nset: psigset;oset: psigset) : cint
function FpSigProcMask(how: cint;constref nset: tsigset;
var oset: tsigset) : cint

Visibility: default

Description: Changes the list of currently blocked signals. The behaviour of the call depends on How :

SIG_BLOCKThe set of blocked signals is the union of the current set and the nset argument.

SIG_UNBLOCKThe signals in nset are removed from the set of currently blocked signals.

SIG_SETMASKThe list of blocked signals is set so nset.

If oset is non-nil, then the old set is stored in it.

Errors: Errno is used to report errors.

sys_efaulto set or nset point to an adress outside the range of the process.

sys_eintrSystem call was interrupted.

See also: fpSigAction (181), fpSigPending (184), fpSigSuspend (185), fpKill (161)

1.4.78 FpSigSuspend

Synopsis: Set signal mask and suspend process till signal is received

Declaration: function FpSigSuspend(const sigmask: tsigset) : cint

Visibility: default

Description: fpSigSuspend temporarily replaces the signal mask for the process with the one given in SigMask, and then suspends the process until a signal is received.

Errors: None

See also: fpSigAction (181), fpSigProcMask (184), fpSigPending (184), fpSignal (183), fpKill (161)

1.4.79 FpSigTimedWait

Synopsis: Wait for signal, with timeout

Declaration: function FpSigTimedWait(const sigset: tsigset; info: psiginfo; timeout: ptimespec) : cint

Visibility: default

Description: FpSigTimedWait will suspend the current thread and wait for one of the signals in sigset to be delivered. information on the delivered signal is placed in the location provided by info (or in info itself, if the Var variant of the call is used). If the signal is not delivered within the time limit set in timeout, then the call will return -1, and fpGetErrno will return EAGAIN.

On success, the signal number is returned.

Errors: On error, -1 is returned, and extended error information can be obtained with fpGetErrno.

See also: FpSigSuspend (185)

1.4.80 FpSleep

Synopsis: Suspend process for several seconds

Declaration: function FpSleep(seconds: cuint) : cuint

Visibility: default

Description: FpSleep suspends the process till a time period as specified in seconds has passed, then the function returns. If the call was interrupted (e.g. by some signal) then the function may return earlier, and the return value is the remaining time till the end of the intended period.

If the function returns without error, the return value is zero.

See also: fpPause (171), fpAlarm (143), fpNanoSleep (167)

Listing: ./bunisex/ex73.pp

program example73;

{ Program to demonstrate the FpSleep function. }

uses BaseUnix;

Var

```

Res : Longint;

begin
  Write( 'Sleep returned : ' );
  Flush(Output);
  Res:=(fpSleep(10));
  Writeln(res);
  If (res<>0) then
    Writeln( 'Remaining seconds      : ',res );
end.

```

1.4.81 FpStat

Synopsis: Retrieve file information about a file descriptor.

Declaration: function FpStat(path: PChar;var buf: Stat) : cint
 function FpStat(path: AnsiString;var buf: Stat) : cint
 function FpStat(path: string;var buf: Stat) : cint

Visibility: default

Description: FpFStat gets information about the file specified in Path, and stores it in Info, which is of type stat (137). The function returns zero if the call was succesfull, a nonzero return value indicates failure.

Errors: Extended error information can be retrieved using fpGetErrno (156).

sys_enoentPath does not exist.

See also: FpStat (186), FpLStat (163)

Listing: ./bunixex/ex28.pp

```

program example28;

{ Program to demonstrate the FStat function. }

uses BaseUnix;

var f : text;
    i : byte;
    info : stat;

begin
  { Make a file }
  assign (f,'test.fil');
  rewrite (f);
  for i:=1 to 10 do writeln (f,'Testline # ',i);
  close (f);
  { Do the call on made file. }
  if fpstat ('test.fil',info)<>0 then
    begin
      writeln('Fstat failed. Errno : ',fpgeterrno);
      halt (1);
    end;
  writeln;
  writeln ('Result of fstat on file ''test.fil''.');

```

```

writeln ( 'Inode' : ',info.st_ino);
writeln ( 'Mode' : ',info.st_mode);
writeln ( 'nlink' : ',info.st_nlink);
writeln ( 'uid' : ',info.st_uid);
writeln ( 'gid' : ',info.st_gid);
writeln ( 'rdev' : ',info.st_rdev);
writeln ( 'Size' : ',info.st_size);
writeln ( 'Blksize' : ',info.st_blksize);
writeln ( 'Blocks' : ',info.st_blocks);
writeln ( 'atime' : ',info.st_atime);
writeln ( 'mtime' : ',info.st_mtime);
writeln ( 'ctime' : ',info.st_ctime);
{ Remove file }
erase ( f );
end.

```

1.4.82 fpSymlink

Synopsis: Create a symbolic link

Declaration: function fpSymlink(oldname: PChar; newname: PChar) : cint

Visibility: default

Description: SymLink makes NewName point to the file in OldName, which doesn't necessarily exist. The two files DO NOT have the same inode number. This is known as a 'soft' link.

The permissions of the link are irrelevant, as they are not used when following the link. Ownership of the file is only checked in case of removal or renaming of the link.

The function returns zero if the call was successful, a nonzero value if the call failed.

Errors: Extended error information is returned by the FpGetErrno ([156](#)) function.

sys_eperm The filesystem containing oldpath and newpath does not support linking files.

sys_eaccess Write access for the directory containing Newpath is disallowed, or one of the directories in OldPath or NewPath has no search (=execute) permission.

sys_enoent A directory entry in OldPath or NewPath does not exist or is a symbolic link pointing to a non-existent directory.

sys_enotdir A directory entry in OldPath or NewPath is nor a directory.

sys_enomem Insufficient kernel memory.

sys_erofs The files are on a read-only filesystem.

sys_eexist NewPath already exists.

sys_eloop OldPath or NewPath has a reference to a circular symbolic link, i.e. a symbolic link, whose expansion points to itself.

sys_enospc The device containing NewPath has no room for another entry.

See also: FpLink ([162](#)), FpUnLink ([192](#)), FpReadLink ([175](#))

Listing: ./unixex/ex22.pp

Program Example22;

{ Program to demonstrate the SymLink and UnLink functions. }

```

Uses baseunix , Unix ;

Var F : Text;
      S : String;

begin
  Assign (F, 'test.txt');
  Rewrite (F);
  Writeln (F, 'This is written to test.txt');
  Close(f);
  { new.txt and test.txt are now the same file }
  if fpSymLink ('test.txt', 'new.txt')<>0 then
    writeln ('Error when symlinking !');
  { Removing test.txt still leaves new.txt
    Pointing now to a non-existent file ! }
  If fpUnlink ('test.txt')<>0 then
    writeln ('Error when unlinking !');
  Assign (f, 'new.txt');
  { This should fail, since the symbolic link
    points to a non-existent file ! }
  {$i-}
  Reset (F);
  {$i+}
  If IOResult=0 then
    writeln ('This shouldn''t happen');
  { Now remove new.txt also }
  If fpUnlink ('new.txt')<>0 then
    writeln ('Error when unlinking !');
end.

```

1.4.83 fpS_ISBLK

Synopsis: Is file a block device

Declaration: function fpS_ISBLK(m: TMode) : Boolean

Visibility: default

Description: FpS_ISBLK checks the file mode m to see whether the file is a block device file. If so it returns True.

See also: FpFStat (154), FpS_ISLNK (189), FpS_ISREG (190), FpS_ISDIR (189), FpS_ISCHR (188), FpS_IS FIFO (189), FpS_ISSOCK (190)

1.4.84 fpS_ISCHR

Synopsis: Is file a character device

Declaration: function fpS_ISCHR(m: TMode) : Boolean

Visibility: default

Description: FpS_ISCHR checks the file mode m to see whether the file is a character device file. If so it returns True.

See also: FpFStat (154), FpS_ISLNK (189), FpS_ISREG (190), FpS_ISDIR (189), FpS_ISBLK (188), FpS_IS FIFO (189), FpS_ISSOCK (190)

1.4.85 fpS_ISDIR

Synopsis: Is file a directory

Declaration: function fpS_ISDIR(m: TMode) : Boolean

Visibility: default

Description: fpS_ISDIR checks the file mode m to see whether the file is a directory. If so, it returns True

See also: FpFStat (154), FpS_ISLNK (189), FpS_ISREG (190), FpS_ISCHR (188), FpS_ISBLK (188), fpS_ISFIFO (189), FpS_ISSOCK (190)

1.4.86 fpS_ISFIFO

Synopsis: Is file a FIFO

Declaration: function fpS_ISFIFO(m: TMode) : Boolean

Visibility: default

Description: FpS_ISFIFO checks the file mode m to see whether the file is a fifo (a named pipe). If so it returns True.

See also: FpFStat (154), FpS_ISLNK (189), FpS_ISREG (190), FpS_ISCHR (188), FpS_ISBLK (188), FpS_ISDIR (189), FpS_ISSOCK (190)

1.4.87 fpS_ISLNK

Synopsis: Is file a symbolic link

Declaration: function fpS_ISLNK(m: TMode) : Boolean

Visibility: default

Description: FpS_ISLNK checks the file mode m to see whether the file is a symbolic link. If so it returns True

See also: FpFStat (154), FpS_ISFIFO (189), FpS_ISREG (190), FpS_ISCHR (188), FpS_ISBLK (188), FpS_ISDIR (189), FpS_ISSOCK (190)

Listing: ./bunixex/ex53.pp

```
Program Example53;

{ Program to demonstrate the S_ISLNK function. }

Uses BaseUnix, Unix;

Var Info : Stat;

begin
  if fpLStat (paramstr(1),@info)=0 then
    begin
      if fpS_ISLNK(info.st_mode) then
        Writeln ('File is a link');
      if fpS_ISREG(info.st_mode) then
        Writeln ('File is a regular file');
      if fpS_ISDIR(info.st_mode) then
        Writeln ('File is a directory');
```

```

if fpS_ISCHR(info.st_mode) then
  WriteLn ('File is a character device file');
if fpS_ISBLK(info.st_mode) then
  WriteLn ('File is a block device file');
if fpS_ISFIFO(info.st_mode) then
  WriteLn ('File is a named pipe (FIFO)');
if fpS_ISSOCK(info.st_mode) then
  WriteLn ('File is a socket');
end;
end.

```

1.4.88 fpS_ISREG

Synopsis: Is file a regular file

Declaration: function fpS_ISREG(m: TMode) : Boolean

Visibility: default

Description: FpS_ISREG checks the file mode m to see whether the file is a regular file. If so it returns True

See also: FpFStat (154), FpS_ISFIFO (189), FpS_ISLNK (189), FpS_ISCHR (188), FpS_ISBLK (188), FpS_ISDIR (189), FPS_ISSOCK (190)

1.4.89 fpS_ISSOCK

Synopsis: Is file a unix socket

Declaration: function fpS_ISSOCK(m: TMode) : Boolean

Visibility: default

Description: FpS_ISSOCK checks the file mode m to see whether the file is a socket. If so it returns True.

See also: FpFStat (154), FpS_ISFIFO (189), FpS_ISLNK (189), FpS_ISCHR (188), FpS_ISBLK (188), FpS_ISDIR (189), FpS_ISREG (190)

1.4.90 fptime

Synopsis: Return the current unix time

Declaration: function FpTime(var tloc: TTime) : TTime
function fptime : time_t

Visibility: default

Description: FpTime returns the number of seconds since 00:00:00 GMT, january 1, 1970. it is adjusted to the local time zone, but not to DST. The result is also stored in tloc, if it is specified.

Errors: On error, -1 is returned. Extended error information can be retrieved using fpGetErrno (156).

Listing: ./bunisex/ex1.pp

```
Program Example1;  
  { Program to demonstrate the fptime function. }  
  
Uses baseunix;  
  
begin  
  Write ('Secs past the start of the Epoch (00:00 1/1/1980) : ');  
  Writeln (fptime);  
end.
```

1.4.91 FpTimes

Synopsis: Return execution times for the current process

Declaration: function FpTimes(var buffer: tms) : TClock

Visibility: default

Description: fpTimes stores the execution time of the current process and child processes in buffer.

The return value (on linux) is the number of clock ticks since boot time. On error, -1 is returned, and extended error information can be retrieved with fpGetErrno ([156](#)).

See also: fpUTime ([192](#))

1.4.92 FpUmask

Synopsis: Set file creation mask.

Declaration: function FpUmask(cmask: TMode) : TMode

Visibility: default

Description: fpUmask changes the file creation mask for the current user to cmask. The current mask is returned.

See also: fpChmod ([144](#))

Listing: ./buninx/ex27.pp

```
Program Example27;  
  { Program to demonstrate the Umask function. }  
  
Uses BaseUnix;  
  
begin  
  Writeln ('Old Umask was : ',fpUmask(&111));  
  WRiteLn ('New Umask is : ',&111);  
end.
```

1.4.93 FpUname

Synopsis: Return system name.

Declaration: function FpUname(var name: UtsName) : cint

Visibility: default

Description: Uname gets the name and configuration of the current linux kernel, and returns it in the name record.

On success, 0 is returned, on error, -1 is returned.

Errors: Extended error information can be retrieved using fpGetErrno ([156](#)).

See also: FpUTime ([192](#))

1.4.94 FpUnlink

Synopsis: Unlink (i.e. remove) a file.

Declaration: function FpUnlink(path: PChar) : cint
function FpUnlink(path: AnsiString) : cint

Visibility: default

Description: FpUnlink decreases the link count on file Path. Path can be of type AnsiString or PChar.
If the link count is zero, the file is removed from the disk.

The function returns zero if the call was successful, a nonzero value indicates failure.

Note: There exist a portable alternative to erase files: system.erase. Please use fpUnlink only if you are writing Unix specific code. System.erase will work on all operating systems.

For an example, see FpLink ([162](#)).

Errors: Extended error information can be retrieved using fpGetErrno ([156](#)).

sys_eaccess You have no write access right in the directory containing Path, or you have no search permission in one of the directory components of Path.

sys_eperm The directory containing pathname has the sticky-bit set and the process's effective uid is neither the uid of the file to be deleted nor that of the directory containing it.

sys_enoent A component of the path doesn't exist.

sys_enotdir A directory component of the path is not a directory.

sys_eisdir Path refers to a directory.

sys_enomem Insufficient kernel memory.

sys_eroofs Path is on a read-only filesystem.

See also: FpLink ([162](#)), FpSymLink ([187](#))

1.4.95 FpUtime

Synopsis: Set access and modification times of a file (touch).

Declaration: function FpUtime(path: PChar; times: pUtimBuf) : cint
function FpUtime(path: AnsiString; times: pUtimBuf) : cint

Visibility: default

Description: FpUtime sets the access and modification times of the file specified in Path. the times record contains 2 fields, actime, and modtime, both of type time_t (commonly a longint). They should be filled with an epoch-like time, specifying, respectively, the last access time, and the last modification time. For some filesystem (most notably, FAT), these times are the same.

The function returns zero on success, a nonzero return value indicates failure.

Errors: Extended error information can be retrieved using fpGetErrno ([156](#)).

sys_eaccess One of the directories in Path has no search (=execute) permission.

sys_enoent A directory entry in Path does not exist or is a symbolic link pointing to a non-existent directory.

Other errors may occur, but aren't documented.

See also: FpTime ([190](#)), FpChown ([146](#)), FpAccess ([143](#))

Listing: ./bunixex/ex25.pp

Program Example25 ;

```
{ Program to demonstrate the UTime function. }

Uses Dos,BaseUnix,Unix,UnixUtil;

Var utim : utimbuf;
      dow,msec,year,month,day,hour,minute,second : Word;

begin
  { Set access and modification time of executable source }
  GetTime (hour,minute,second,msec);
  GetDate (year,month,day,dow);
  utim.actime:=LocalToEpoch(year,month,day,hour,minute,second);
  utim.modtime:=utim.actime;
  if Fputime('ex25.pp',@utim)<>0 then
    writeln ('Call to UTime failed !')
  else
    begin
      Write ('Set access and modification times to : ');
      Write (Hour:2,':',minute:2,':',second,' ',');
      writeln (Day:2,'/',month:2,'/',year:4);
    end;
end.
```

1.4.96 FpWait

Synopsis: Wait for a child to exit.

Declaration: function FpWait(var stat_loc: cint) : TPid

Visibility: default

Description: fpWait suspends the current process and waits for any child to exit or stop due to a signal. It reports the exit status of the exited child in stat_loc.

The return value of the function is the process ID of the child that exited, or -1 on error.

Errors: Extended error information can be retrieved using fpgetErrno ([156](#)).

See also: fpFork ([153](#)), fpExecve ([150](#)), fpWaitPid ([194](#))

1.4.97 FpWaitPid

Synopsis: Wait for a process to terminate

Declaration: function FpWaitpid(pid: TPid;stat_loc: pcint;options: cint) : TPid
function FpWaitPid(pid: TPid;var Status: cint;Options: cint) : TPid

Visibility: default

Description: fpWaitPid waits for a child process with process ID Pid to exit. The value of Pid can be one of the following:

Pid < -1Causes fpWaitPid to wait for any child process whose process group ID equals the absolute value of pid.

Pid = -1Causes fpWaitPid to wait for any child process.

Pid = 0Causes fpWaitPid to wait for any child process whose process group ID equals the one of the calling process.

Pid > 0Causes fpWaitPid to wait for the child whose process ID equals the value of Pid.

The Options parameter can be used to specify further how fpWaitPid behaves:

WNOHANGCauses fpWaitpid to return immediately if no child has exited.

WUNTRACEDCauses fpWaitPid to return also for children which are stopped, but whose status has not yet been reported.

_WCLONECauses fpWaitPid also to wait for threads created by the #rtl.linux.Clone ([740](#)) call.

The exit status of the process that caused fpWaitPID is reported in stat_loc or Status.

Upon return, it returns the process id of the process that exited, 0 if no process exited, or -1 in case of failure.

For an example, see fpFork ([153](#)).

Errors: Extended error information can be retrieved using fpGetErrno ([156](#)).

See also: fpFork ([153](#)), fpExecve ([150](#)), fpWait ([193](#))

1.4.98 FpWrite

Synopsis: Write data to file descriptor

Declaration: function FpWrite(fd: cint;buf: PChar;nbytes: TSize) : TsSize
function FpWrite(fd: cint;const buf:nbytes: TSize) : TsSize

Visibility: default

Description: FpWrite writes at most nbytes bytes from buf to file descriptor fd.

The function returns the number of bytes actually written, or -1 if an error occurred.

Errors: Extended error information can be retrieved using fpGetErrno ([156](#)).

See also: FpOpen ([169](#)), FpClose ([147](#)), FpRead ([173](#)), FpFTruncate ([155](#)), FpLSeek ([163](#))

1.4.99 FpWriteV

Synopsis: Vector write: Write from multiple buffers to a file descriptor

Declaration: function FpWriteV(fd: cint; const iov: piovec; iovcnt: cint) : TsSize

Visibility: default

Description: FpWriteV writes data to file descriptor fd. The data is taken from iovcnt buffers described by the iovec (139) buffers pointed to by iov. It works like fpWrite (194) only from multiple buffers.

Errors: On error, -1 is returned.

See also: FpReadV (176), FpPWrite (173), FpPRead (172)

1.4.100 FreeShellArgV

Synopsis: Free the result of a CreateShellArgV (142) function

Declaration: procedure FreeShellArgV(p: PPChar)

Visibility: default

Description: FreeShellArgV frees the memory pointed to by p, which was allocated by a call to CreateShellArgV (142).

Errors: None.

See also: CreateShellArgV (142)

1.4.101 wexitStatus

Synopsis: Extract the exit status from the fpWaitPID (194) result.

Declaration: function wexitStatus(Status: cint) : cint

Visibility: default

Description: WEXITSTATUS can be used to extract the exit status from Status, the result of the FpWaitPID (194) call.

See also: FpWaitPID (194), WTERMSIG (196), WSTOPSIG (196), WIFEXITED (195), WIFSIGNALLED (196)

1.4.102 wifexited

Synopsis: Check whether the process exited normally

Declaration: function wifexited(Status: cint) : Boolean

Visibility: default

Description: WIFEXITED checks Status and returns True if the status indicates that the process terminated normally, i.e. was not stopped by a signal.

See also: FpWaitPID (194), WTERMSIG (196), WSTOPSIG (196), WIFSIGNALLED (196), WEXITSTATUS (195)

1.4.103 wifsignaled

Synopsis: Check whether the process was exited by a signal.

Declaration: function wifsignaled(Status: cint) : Boolean

Visibility: default

Description: WIFSIGNALED returns True if Status indicates that the process exited because it received a signal.

See also: FpWaitPID (194), WTERMSIG (196), WSTOPSIG (196), WIFEXITED (195), WEXITSTATUS (195)

1.4.104 wstopsig

Synopsis: Return the exit code from the process.

Declaration: function wstopsig(Status: cint) : cint

Visibility: default

Description: WSTOPSIG is an alias for WEXITSTATUS (195).

See also: FpWaitPID (194), WTERMSIG (196), WIFEXITED (195), WIFSIGNALED (196), WEXITSTATUS (195)

1.4.105 wtermsig

Synopsis: Return the signal that caused a process to exit.

Declaration: function wtermsig(Status: cint) : cint

Visibility: default

Description: WTERMSIG extracts from Status the signal number which caused the process to exit.

See also: FpWaitPID (194), WSTOPSIG (196), WIFEXITED (195), WIFSIGNALED (196), WEXITSTATUS (195)

Chapter 2

Reference for unit 'Classes'

2.1 Used units

Table 2.1: Used units by unit 'Classes'

Name	Page
rtlconsts	??
System	1229
sysutils	1449
types	1620
typinfo	1639

2.2 Overview

This documentation describes the FPC **classes** unit. The **Classes** unit contains basic classes for the Free Component Library (FCL):

- a **TList** ([327](#)) class for maintaining lists of pointers,
- **TStringList** ([379](#)) for lists of strings,
- **TCollection** ([280](#)) to manage collections of objects
- **TStream** ([365](#)) classes to support streaming.

Furthermore it introduces methods for object persistence, and classes that understand an owner-owned relationship, with automatic memory management.

2.3 Constants, types and variables

2.3.1 Constants

```
BaseGUIDObserved = '{663C603C-3F3C-4CC5-823C-AC8079F979E5}'
```

BaseGUIDObserver = '{BC7376EA-199C-4C2A-8684-F4805F0691CA}'

BITSHIFT = 5

Used to calculate the size of a bits array

dupAccept = Types . dupAccept

Duplicate values can be added to the list.

dupError = Types . dupError

If an attempt is made to add a duplicate value to the list, an EStringListError (231) exception is raised.

dupIgnore = Types . dupIgnore

Duplicate values will not be added to the list, but no error will be triggered.

FilerSignature : Array[1..4] of Char = 'TPF0'

Constant that is found at the start of a binary stream containing a streamed component.

fmCreate = \$FF00

TFileStream.Create (1) creates a new file if needed.

fmOpenRead = 0

TFileStream.Create (1) opens a file with read-only access.

fmOpenReadWrite = 2

TFileStream.Create (1) opens a file with read-write access.

fmOpenWrite = 1

TFileStream.Create (1) opens a file with write-only access.

GUIDObserved : TGuid = BaseGUIDObserved

GUIDObserver : TGuid = BaseGUIDObserver

MASK = 31

Bitmask with all bits on.

MaxBitFlags = \$7FFFFFFE0

Maximum number of bits in TBits collection.

```
MaxBitRec = MaxBitFlags div ((cardinal) * 8)
```

Maximum number of bit records in TBits.

```
MaxListSize = Maxint div 16
```

This constant sets the maximum number of elements in a TList ([327](#)).

```
scAlt = $8000
```

Indicates ALT key in a keyboard shortcut.

```
scCtrl = $4000
```

indicates CTRL key in a keyboard shortcut.

```
scNone = 0
```

Indicates no special key is presed in a keyboard shortcut.

```
scShift = $2000
```

Indicates Shift key in a keyboard shortcut.

```
SGUIDObserved = BaseGUIDObserved
```

```
SGUIDObserver = BaseGUIDObserver
```

```
soFromBeginning = 0
```

Seek ([1](#)) starts relative to the stream origin.

```
soFromCurrent = 1
```

Seek ([1](#)) starts relative to the current position in the stream.

```
soFromEnd = 2
```

Seek ([1](#)) starts relative to the stream end.

```
toEOF = (0)
```

Value returned by TParser.Token ([1](#)) when the end of the input stream was reached.

```
toFloat = (4)
```

Value returned by TParser.Token ([1](#)) when a floating point value was found in the input stream.

```
toInteger = (3)
```

Value returned by `TParser.Token` (1) when an integer was found in the input stream.

```
toString = (2)
```

Value returned by `TParser.Token` (1) when a string was found in the input stream.

```
toSymbol = (1)
```

Value returned by `TParser.Token` (1) when a symbol was found in the input stream.

```
toWString = (5)
```

Value returned by `TParser.Token` (1) when a widestring was found in the input stream.

2.3.2 Types

```
HMODULE = PtrInt
```

FPC doesn't support modules yet, so this is a dummy type.

```
HRSRC = TFPResourceHandle deprecated
```

This type is provided for Delphi compatibility, it is used for resource streams.

```
PPointerList = ^TPointerList
```

Pointer to an array of pointers.

```
PStringItem = ^TStringItem
```

Pointer to a `TStringItem` (211) record.

```
PStringItemList = ^TStringItemList
```

Pointer to a `TStringItemList` (211).

```
TActiveXRegType = (axrComponentOnly, axrIncludeDescendants)
```

Table 2.2: Enumeration values for type `TActiveXRegType`

Value	Explanation
axrComponentOnly	
axrIncludeDescendants	

This type is provided for compatibility only, and is currently not used in Free Pascal.

```
TAlignment = (taLeftJustify, taRightJustify, taCenter)
```

Table 2.3: Enumeration values for type TAlignment

Value	Explanation
taCenter	Text is displayed centered.
taLeftJustify	Text is displayed aligned to the left
taRightJustify	Text is displayed aligned to the right.

The TAlignment type is used to specify the alignment of the text in controls that display a text.

```
TAnccestorNotFoundEvent = procedure(Reader: TReader;
                                     const ComponentName: string;
                                     ComponentClass: TPersistentClass;
                                     var Component: TComponent) of object
```

This event occurs when an ancestor component cannot be found.

```
TBasicActionClass = Class of TBasicAction
```

TBasicAction ([255](#)) class reference.

```
TBasicActionLinkClass = Class of TBasicActionLink
```

TBasicActionLink ([259](#)) class reference.

```
TBiDiMode = (bdLeftToRight, bdRightToLeft, bdRightToLeftNoAlign,
              bdRightToLeftReadingOnly)
```

Table 2.4: Enumeration values for type TBiDiMode

Value	Explanation
bdLeftToRight	Texts read from left to right.
bdRightToLeft	Texts read from right to left.
bdRightToLeftNoAlign	Texts read from right to left, but not right-aligned
bdRightToLeftReadingOnly	Texts read from right to left

TBiDiMode describes bi-directional support for displaying texts.

```
TBitArray = Array[0..MaxBitRec-1] of Cardinal
```

Array to store bits.

```
TCollectionItemClass = Class of TCollectionItem
```

TCollectionItemClass is used by the TCollection.ItemClass ([1](#)) property of TCollection ([280](#)) to identify the descendent class of TCollectionItem ([287](#)) which should be created and managed.

```
TCollectionNotification = (cnAdded, cnExtracting, cnDeleting)
```

Table 2.5: Enumeration values for type TCollectionNotification

Value	Explanation
cnAdded	An item is added to the collection.
cnDeleting	An item is deleted from the collection.
cnExtracting	An item is extracted from the collection.

TCollectionNotification is used in the TCollection ([280](#)) class to send notifications about changes to the collection.

```
TCollectionSortCompare = function(Item1: TCollectionItem;
                                    Item2: TCollectionItem) : Integer
```

TCollectionSortCompare is the prototype for a callback used in the TCollection.Sort ([1](#)) method. The procedure should compare Item1 and Item2 and return an integer:

Result < 0 if Item1 comes before Item2

Result = 0 if Item1 is at the same level as Item2

Result > 0 if Item1 comes after Item2

```
TComponentClass = Class of TComponent
```

The TComponentClass type is used when constructing TComponent ([289](#)) descendent instances and when registering components.

```
TComponentName = String
```

Names of components are of type TComponentName. By specifying a different type, the Object inspector can handle this property differently than a standard string property.

```
TComponentState= Set of (csLoading, csReading, csWriting, csDestroying,
                           csDesigning, csAncestor, csUpdating, csFixups,
                           csFreeNotification, csInline, csDesignInstance)
```

Table 2.6: Enumeration values for type

Value	Explanation
csAncestor	The component is being streamed as part of a frame (?)
csDesigning	The component is being designed in an IDE.
csDesignInstance	??
csDestroying	The component is being destroyed.
csFixups	The component's references to other components are being fixed.
csFreeNotification	Indicates whether the component has freenotifications
csInline	Component is part of a frame (?).
csLoading	The component is being loaded from the stream.
csReading	Properties are being read from the stream.
csUpdating	The component is being updated.
csWriting	Properties are being written to the stream.

Indicates the state of the component during the streaming process.

```
TComponentStyle = Set of (csInheritable, csCheckPropAvail, csSubComponent,
                           csTransient)
```

Table 2.7: Enumeration values for type

Value	Explanation
csCheckPropAvail	??
csInheritable	The component can be on inherited forms.
csSubComponent	Subcomponent - streamed as part of the owning component
csTransient	Transient component

Describes the style of the component.

```
TCreateComponentEvent = procedure(Reader: TReader;
                                    ComponentClass: TComponentClass;
                                    var Component: TComponent) of object
```

Event handler type, occurs when a component instance must be created when a component is read from a stream.

```
TDataModuleClass = Class of TDataModule
```

TDataModuleClass defines the class pointer for TDataModule ([303](#)).

```
TDuplicates = Types.TDuplicates
```

Type to describe what to do with duplicate values in a TStringlist ([379](#)).

```
TExceptionClass = Class of Exception
```

TExceptionClass is the class pointer for the Exception ([1611](#)) class, defined in the SysUtils ([1449](#)) unit.

```
TFilerFlag = (ffInherited, ffChildPos, ffInline)
```

Table 2.8: Enumeration values for type TFilerFlag

Value	Explanation
ffChildPos	The position of the child on it's parent is included.
ffInherited	Stored object is an inherited object.
ffInline	Used for frames.

The TFiler class uses this enumeration type to decide whether the streamed object was streamed as part of an inherited form or not.

```
TFilerFlags = Set of TFilerFlag
```

Set of TFilerFlag (203)

```
TFindAncestorEvent = procedure(Writer: TWriter;Component: TComponent;
                               const Name: string;
                               var Ancestor: TComponent;
                               var RootAncestor: TComponent) of object
```

Event that occurs w

```
TFindComponentClassEvent = procedure(Reader: TReader;
                                      const ClassName: string;
                                      var ComponentClass: TComponentClass)
                                         of object
```

Event handler type, occurs when a component class pointer must be found when reading a component from a stream.

```
TFindGlobalComponent = function(const Name: string) : TComponent
```

TFindGlobalComponent is a callback used to find a component in a global scope. It is used when the streaming system needs to find a component which is not part of the component which is currently being streamed. It should return the component with name Name, or Nil if none is found.

The variable FindGlobalComponent (216) is a callback of type TFindGlobalComponent. It can be set by the IDE when an unknown reference is found, to offer the designer to redirect the link to a new component.

```
TFindMethodEvent = procedure(Reader: TReader;const MethodName: string;
                            var Address: Pointer;var Error: Boolean)
                               of object
```

If a TReader (350) instance needs to locate a method and it doesn't find it in the streamed form, then the OnFindMethod (1) event handler will be called, if one is installed. This event can be assigned in order to use different locating methods. If a method is found, then its address should be returned in Address. The Error should be set to True if the reader should raise an exception after the event was handled. If it is set to False no exception will be raised, even if no method was found. On entry, Error will be set to True.

```
TFPObservedOperation = (ooChange,ooFree,ooAddItem,ooDeleteItem,ooCustom)
```

Table 2.9: Enumeration values for type TFPObservedOperation

Value	Explanation
ooAddItem	
ooChange	
ooCustom	
ooDeleteItem	
ooFree	

```
TGetChildProc = procedure(Child: TComponent) of object
```

Callback used when obtaining child components.

```
TGetStrProc = procedure(const S: string) of object
```

This event is used as a callback to retrieve string values. It is used, among other things, to pass along string properties in property editors.

```
THandle = System.THandle
```

This type is used as the handle for THandleStream ([318](#)) stream descendants

```
THelpContext = -MaxLongint..MaxLongint
```

Range type to specify help contexts.

```
THelpEvent = function(Command: Word;Data: LongInt;var CallHelp: Boolean)
                  : Boolean of object
```

This event is used for display of online help.

```
THelpType = (htKeyword, htContext)
```

Table 2.10: Enumeration values for type THelpType

Value	Explanation
htContext	Help type: Context ID help.
htKeyword	Help type: Keyword help

Enumeration type specifying the kind of help requested.

```
TIdentMapEntry = record
  Value : Integer;
  Name : string;
end
```

TIdentMapEntry is used internally by the IdentToInt ([219](#)) and IntToIdent ([219](#)) calls to store the mapping between the identifiers and the integers they represent.

```
TIdentToInt = function(const Ident: string;var Int: LongInt) : Boolean
```

TIdentToInt is a callback used to look up identifiers (Ident) and return an integer value corresponding to this identifier (Int). The callback should return True if a value corresponding to integer Ident was found, False if not.

A callback of type TIdentToInt should be specified when an integer is registered using the RegisterIntegerConsts ([225](#)) call.

```
TInitComponentHandler = function(Instance: TComponent;
                                 RootAncestor: TClass) : Boolean
```

`TInitComponentHandler` is a callback type. It is used in the `InitInheritedComponent` (219) call to initialize a component. Callbacks of this type are registered with the `RegisterInitComponentHandler` (224) call.

```
TIntToIdent = function(Int: LongInt; var Ident: string) : Boolean
```

`TIdentToInt` is a callback used to look up integers (`Ident`) and return an identifier (`Ident`) that can be used to represent this integer value in an IDE. The callback should return `True` if a value corresponding to integer `Ident` was found, `False` if not.

A callback of type `TIntToIdent` should be specified when an integer is registered using the `RegisterIntegerConsts` (225) call.

```
TLeftRight = taLeftJustify..taRightJustify
```

`TLeftRight` is a subrange type based on the `TAlignment` (201) enumerated type. It contains only the left and right alignment constants.

```
TListAssignOp = (laCopy, laAnd, laOr, laXor, laSrcUnique, laDestUnique)
```

Table 2.11: Enumeration values for type `TListAssignOp`

Value	Explanation
laAnd	Remove all elements not first second list
laCopy	Clear list and copy all strings from second list.
laDestUnique	Keep all elements that exists only in list2
laOr	Add all elements from second (and optional third) list, eliminate duplicates
laSrcUnique	Just keep all elements that exist only in source list
laXor	Remove elements in second lists, Add all elements from second list not in first list

This type determines what operation `TList.Assign` (1) or `TFPList.assign` (1) performs.

```
TListCallback = Types.TListCallback
```

`TListCallback` is the method callback prototype for the function that is passed to the `TFPList.ForEachCall` (1) call. The `data` argument will be filled with all the pointers in the list (one per call) and the `arg` argument is the `Arg` argument passed to the `ForEachCall` call.

```
TListNotification = (lnAdded, lnExtracted, lnDeleted)
```

Table 2.12: Enumeration values for type `TListNotification`

Value	Explanation
lnAdded	List change notification: Element added to the list.
lnDeleted	List change notification: Element deleted from the list.
lnExtracted	List change notification: Element extracted from the list.

Kind of list notification event.

```
TListSortCompare = function(Item1: Pointer; Item2: Pointer) : Integer
```

Callback type for the list sort algorithm.

```
TListStaticCallback = Types.TListStaticCallback
```

`TListCallback` is the procedurald callback prototype for the function that is passed to the `TFPList.ForEachCall` (1) call. The `data` argument will be filled with all the pointers in the list (one per call) and the `arg` argument is the `Arg` argument passed to the `ForEachCall` call.

```
TNotifyEvent = procedure(Sender: TObject) of object
```

Most event handlers are implemented as a property of type `TNotifyEvent`. When this is set to a certain method of a class, when the event occurs, the method will be called, and the class that generated the event will pass itself along as the `Sender` argument.

```
TObjectTextEncoding = (oteDFM, oteLFM)
```

Table 2.13: Enumeration values for type `TObjectTextEncoding`

Value	Explanation
oteDFM	Characters are in DFM (Delphi) format: widechar encoded.
oteLFM	Characters are in LFM format: UTF-8 encoded.

`TObjectTextEncoding` is an enumerated type which denotes the encoding of non ascii characters in an object stream file. It is needed for correct encoding when reading string values in the text stream.

```
TOperation = (opInsert, opRemove)
```

Table 2.14: Enumeration values for type `TOperation`

Value	Explanation
opInsert	A new component is being inserted in the child component list.
opRemove	A component is being removed from the child component list.

Operation of which a component is notified.

```
TPersistentClass = Class of TPersistent
```

`TPersistentClass` is the class reference type for the `TPersistent` (347) class.

```
TPoint = Types.TPoint
```

This record describes a coordinate. It is used to handle the `Top` (1) and `Left` (1) properties of `TComponent` (289).

X represents the X-Coordinate of the point described by the record. Y represents the Y-Coordinate of the point described by the record.

```
TPointerList = Array[0..MaxListSize-1] of Pointer
```

Type for an Array of pointers.

```
TPropertyNotFoundEvent = procedure(Reader: TReader;
                                    Instance: TPersistent;
                                    var PropName: string; IsPath: Boolean;
                                    var Handled: Boolean;
                                    var Skip: Boolean) of object
```

TPropertyNotFoundEvent is the prototype for the TReader.OnPropertyNotFound ([1](#)) event. Reader is the sender of the event, Instance is the instance that is being streamed. PropInfo is a pointer to the RTTI information for the property being read. Handled should be set to True if the handler redirected the unknown property successfully, and Skip should be set to True if the value should be skipped. IsPath determines whether the property refers to a sub-property.

```
TReadComponentsProc = procedure(Component: TComponent) of object
```

Callback type when reading a component from a stream

```
TReaderError = procedure(Reader: TReader; const Message: string;
                           var Handled: Boolean) of object
```

Event handler type, called when an error occurs during the streaming.

```
TReaderProc = procedure(Reader: TReader) of object
```

The TReaderProc reader procedure is a callback procedure which will be used by a TPersistent ([347](#)) descendent to read user properties from a stream during the streaming process. The Reader argument is the writer object which can be used read properties from the stream.

```
TReadWriteStringPropertyEvent = procedure(Sender: TObject;
                                             const Instance: TPersistent;
                                             PropInfo: PPropInfo;
                                             var Content: string) of object
```

TReadWriteStringPropertyEvent is the prototype for the TReader.OnReadStringProperty ([1](#)) event handler. Reader is the sender of the event, Instance is the instance that is being streamed. PropInfo is a pointer to the RTTI information for the property being read. Content is the string as it was read from the stream.

```
TRect = Types.TRect
```

TRect describes a rectangle in space with its upper-left (in (Top,Left>)) and lower-right (in (Bottom,Right)) corners.

```
TReferenceNameEvent = procedure(Reader: TReader; var Name: string)
                           of object
```

Occurs when a named object needs to be looked up.

```
TSeekOrigin = (soBeginning, soCurrent, soEnd)
```

Table 2.15: Enumeration values for type TSeekOrigin

Value	Explanation
soBeginning	Offset is interpreted relative to the start of the stream.
soCurrent	Offset is interpreted relative to the current position in the stream.
soEnd	Offset is interpreted relative to the end of the stream.

Specifies the origin of the TStream.Seek ([1](#)) method.

```
TSetMethodPropertyEvent = procedure(Reader: TReader;
                                     Instance: TPersistent;
                                     PropInfo: PPropInfo;
                                     const TheMethodName: string;
                                     var Handled: Boolean) of object
```

TSetMethodPropertyEvent is the prototype for the TReader.OnSetMethodProperty ([1](#)) event. Reader is the sender of the event, Instance is the instance that is being streamed. PropInfo is a pointer to the RTTI information for the property being read, and TheMethodName is the name of the method that the property should be set to. Handled should be set to True if the handler set the property successfully.

```
TSetNameEvent = procedure(Reader: TReader; Component: TComponent;
                           var Name: string) of object
```

Occurs when the reader needs to set a component's name.

```
TShiftState = Set of TShiftStateEnum
```

This type is used when describing a shortcut key or when describing what special keys are pressed on a keyboard when a key event is generated.

The set contains the special keys that can be used in combination with a 'normal' key.

```
TShiftStateEnum = (ssShift, ssAlt, ssCtrl, ssLeft, ssRight, ssMiddle,
                   ssDouble, ssMeta, ssSuper, ssHyper, ssAltGr, ssCaps, ssNum,
                   ssScroll, ssTriple, ssQuad, ssExtral, ssExtra2)
```

Table 2.16: Enumeration values for type TShiftStateEnum

Value	Explanation
ssAlt	Alt key pressed
ssAltGr	Alt-GR key pressed.
ssCaps	Caps lock key pressed
ssCtrl	Ctrl key pressed
ssDouble	Double mouse click.
ssExtra1	Extra key 1
ssExtra2	Extra key 2
ssHyper	Hyper key pressed.
ssLeft	Left mouse button pressed.
ssMeta	Meta key pressed.
ssMiddle	Middle mouse button pressed.
ssNum	Num lock key pressed
ssQuad	Quadruple mouse click
ssRight	Right mouse button pressed.
ssScroll	Scroll lock key pressed
ssShift	Shift key pressed
ssSuper	Super key pressed.
ssTriple	Triple mouse click

Keyboard/Mouse shift state enumerator

```
TShortCut = (Word) .. (Word)
```

Enumeration type to identify shortcut key combinations.

```
TSmallPoint = record
  x : SmallInt;
  y : SmallInt;
end
```

Same as TPoint (207), only the X and Y ranges are limited to 2-byte integers instead of 4-byte integers.

```
TStreamOwnership = (soReference, soOwned)
```

Table 2.17: Enumeration values for type TStreamOwnership

Value	Explanation
soOwned	Stream is owned: it will be freed when the adapter is freed.
soReference	Stream is referenced only, it is not freed by the adapter

The ownership of a streamadapter determines what happens with the stream on which a TStreamAdapter (374) acts, when the adapter is freed.

```
TStreamProc = procedure(Stream: TStream) of object
```

Procedure type used in streaming.

```
TStringItem = record
  FString : string;
  FObject : TObject;
end
```

The `TStringItem` is used to store the string and object items in a `TStringList` (379) string list instance. It should never be used directly.

```
TStringItemList = Array[0..MaxListSize] of TStringItem
```

This declaration is provided for Delphi compatibility, it is not used in Free Pascal.

```
TStringListSortCompare = function(List: TStringList; Index1: Integer;
                                    Index2: Integer) : Integer
```

Callback type used in stringlist compares.

```
TSynchronizeProcVar = procedure
```

Synchronize callback type

```
TThreadMethod = procedure of object
```

Procedure variable used when synchronizing threads.

```
TThreadPriority = (tpIdle, tpLowest, tpLower, tpNormal, tpHigher, tpHighest,
                   tpTimeCritical)
```

Table 2.18: Enumeration values for type `TThreadPriority`

Value	Explanation
tpHigher	Thread runs at high priority
tpHighest	Thread runs at highest possible priority.
tpIdle	Thread only runs when other processes are idle.
tpLower	Thread runs at a lower priority.
tpLowest	Thread runs at the lowest priority.
tpNormal	Thread runs at normal process priority.
tpTimeCritical	Thread runs at realtime priority.

Enumeration specifying the priority at which a thread runs.

```
TValueType = (vaNull, vaList, vaInt8, vaInt16, vaInt32, vaExtended, vaString,
              vaIdent, vaFalse, vaTrue, vaBinary, vaSet, vaLString, vaNil,
              vaCollection, vaSingle, vaCurrency, vaDate, vaWString, vaInt64,
              vaUTF8String, vaUString, vaQWord)
```

Table 2.19: Enumeration values for type TValueType

Value	Explanation
vaBinary	Binary data follows.
vaCollection	Collection follows
vaCurrency	Currency value follows
vaDate	Date value follows
vaExtended	Extended value.
vaFalse	Boolean False value.
vaIdent	Identifier.
vaInt16	Integer value, 16 bits long.
vaInt32	Integer value, 32 bits long.
vaInt64	Integer value, 64 bits long.
vaInt8	Integer value, 8 bits long.
vaList	Identifies the start of a list of values
vaLString	Ansistring data follows.
vaNil	Nil pointer.
vaNull	Empty value. Ends a list.
vaQWord	QWord (64-bit word) value
vaSet	Set data follows.
vaSingle	Single type follows.
vaString	String value.
vaTrue	Boolean True value.
vaUString	UnicodeString value
vaUTF8String	UTF8 encoded unicode string.
vaWString	Widestring value follows.

Enumerated type used to identify the kind of streamed property

```
TWriteMethodPropertyEvent = procedure(Writer: TWriter;
                                      Instance: TPersistent;
                                      PropInfo: PPropInfo;
                                      const MethodValue: TMethod;
                                      const DefMethodValue: TMethod;
                                      var Handled: Boolean) of object
```

TWriteMethodPropertyEvent is the prototype for the TWriter.OnWriteMethodProperty ([1](#)) event. Writer is the sender of the event, Instance is the instance that is being streamed. PropInfo is a pointer to the RTTI information for the property being written, and MethodValue is the value of the method that the property was set to. DefMethodCodeValue is set to the default value of the property (Nil or the parent value). Handled should be set to True if the handler set the property successfully.

```
TWriterProc = procedure(Writer: TWriter) of object
```

The TWriterProc writer procedure is a callback procedure which will be used by a TPersistent ([347](#)) descendent to write user properties from a stream during the streaming process. The Writer argument is the writer object which can be used write properties to the stream.

2.3.3 Variables

```
AddDataModule : procedure(DataModule: TDataModule) of object
```

AddDataModule can be set by an IDE or a streaming mechanism to receive notification when a new instance of a TDataModule ([303](#)) descendent is created.

ApplicationHandleException : procedure (Sender: TObject) of object

ApplicationHandleException can be set by an application object to handle any exceptions that may occur when a TDataModule ([303](#)) is created.

ApplicationShowException : procedure (E: Exception) of object

Unused.

CreateVCLComObjectProc : procedure (Component: TComponent) = Nil

CreateVCLComObjectProc is called by TComponent if it needs to create a IVCLComObject interface for itself (when the ComObject property is read). It passes itself as the Component parameter.

GlobalNameSpace : IReadWriteSync

An interface protecting the global namespace. Used when reading/writing to the global namespace list during streaming of forms.

MainThreadID : TThreadID

ID of main thread. Unused at this point.

RegisterComponentsProc : procedure (const Page: string; ComponentClasses: Array of TComponentClass)

RegisterComponentsProc can be set by an IDE to be notified when new components are being registered. Application programmers should never have to set RegisterComponentsProc

RegisterNoIconProc : procedure (ComponentClasses: Array of TComponentClass)

RegisterNoIconProc can be set by an IDE to be notified when new components are being registered, and which do not need an Icon in the component palette. Application programmers should never have to set RegisterComponentsProc

RemoveDataModule : procedure (DataModule: TDataModule) of object

RemoveDataModule can be set by an IDE or a streaming mechanism to receive notification when an instance of a TDataModule ([303](#)) descendent is freed.

WakeMainThread : TNotifyEvent = Nil

WakeMainThread is called by the TThread.synchronize ([1](#)) call. It should alert the main program thread that a thread is waiting for synchronization. The call is executed by the thread, and should therefore NOT synchronize the thread, but should somehow signal the main thread that a thread is waiting for synchronization. For example, by sending a message.

2.4 Procedures and functions

2.4.1 ActivateClassGroup

Synopsis: Activates a class group

Declaration: function ActivateClassGroup(AClass: TPersistentClass) : TPersistentClass

Visibility: default

Description: ActivateClassGroup activates the group of classes to which AClass belongs. The function returns the class that was last used to activate the class group.

The class registration and streaming mechanism allows to organize the classes in groups. This allows an IDE to form groups of classes, which can be enabled or disabled. It is not needed at Run-Time.

Errors: If AClass does not belong to a class group, an exception is raised.

See also: StartClassGroup (226), GroupDescendentsWith (218), ClassGroupOf (215)

2.4.2 BeginGlobalLoading

Synopsis: Not yet implemented

Declaration: procedure BeginGlobalLoading

Visibility: default

Description: Not yet implemented

2.4.3 BinToHex

Synopsis: Convert a binary buffer to a hexadecimal string

Declaration: procedure BinToHex(BinValue: PChar; HexValue: PChar; BinBufSize: Integer)

Visibility: default

Description: BinToHex converts the byte values in BinValue to a string consisting of 2-character hexadeciml strings in HexValue. BufSize specifies the length of BinValue, which means that HexValue must have size 2*BufSize.

For example a buffer containing the byte values 255 and 0 will be converted to FF00.

Errors: No length checking is done, so if an invalid size is specified, an exception may follow.

See also: HexToBin (218)

2.4.4 Bounds

Synopsis: Returns a TRect structure with the bounding rect of the given location and size.

Declaration: function Bounds(ALeft: Integer; ATop: Integer; AWidth: Integer; AHeight: Integer) : TRect

Visibility: default

Description: Bounds returns a TRect (208) record with the given origin (ALeft, ATop) and dimensions (AWidth, AHeight) filled in. The bottom-right corner is calculated by adding AWidth to ALeft and AHeight to ATop. As a result, a rectangle with width/height set to 0 is exactly 1 pixel.

See also: Rect (223)

2.4.5 CheckSynchronize

Synopsis: Check whether there are any synchronize calls in the synchronize queue.

Declaration: function CheckSynchronize(timeout: LongInt) : Boolean

Visibility: default

Description: CheckSynchronize should be called regularly by the main application thread to handle any TThread.synchronize ([1](#)) calls that may be waiting for execution by the main thread.

See also: TThread.synchronize ([1](#))

2.4.6 ClassGroupOf

Synopsis: Returns the class group to which an instance or class belongs

Declaration: function ClassGroupOf(AClass: TPersistentClass) : TPersistentClass
function ClassGroupOf(Instance: TPersistent) : TPersistentClass

Visibility: default

Description: ClassGroupOf returns the class group to which AClass or Instance belongs.

Errors: The result is Nil if no matching class group is found.

See also: StartClassGroup ([226](#)), ActivateClassGroup ([214](#)), GroupDescendentsWith ([218](#))

2.4.7 CollectionsEqual

Synopsis: Returns True if two collections are equal.

Declaration: function CollectionsEqual(C1: TCollection; C2: TCollection) : Boolean
function CollectionsEqual(C1: TCollection; C2: TCollection;
Owner1: TComponent; Owner2: TComponent)
: Boolean

Visibility: default

Description: CollectionsEqual is not yet implemented. It simply returns False

2.4.8 EndGlobalLoading

Synopsis: Not yet implemented.

Declaration: procedure EndGlobalLoading

Visibility: default

Description: Not yet implemented.

2.4.9 ExtractStrings

Synopsis: Split a string in different words.

Declaration: function ExtractStrings(Separators: TSysCharSet;WhiteSpace: TSysCharSet;
Content: PChar;Strings: TStrings) : Integer

Visibility: default

Description: ExtractStrings splits Content (a null-terminated string) into words, and adds the words to the Strings stringlist. The words are separated by Separators and any characters in whitespace are stripped from the strings. The space and CR/LF characters are always considered whitespace.

Errors: No length checking is performed on Content. If no null-termination character is present, an access violation may occur. Likewise, if Strings is not valid, an access violation may occur.

2.4.10 FindClass

Synopsis: Returns the class pointer of a class with given name.

Declaration: function FindClass(const AClassName: string) : TPersistentClass

Visibility: default

Description: FindClass searches for the class named ClassName in the list of registered classes and returns a class pointer to the definition. If no class with the given name could be found, an exception is raised. The GetClass (217) function does not raise an exception when it does not find the class, but returns a Nil pointer instead.

See also: RegisterClass (223), GetClass (217)

2.4.11 FindGlobalComponent

Synopsis: Callback used when a component must be found.

Declaration: function FindGlobalComponent(const Name: string) : TComponent

Visibility: default

Description: FindGlobalComponent is a callback of type TFindGlobalComponent (204). It can be set by the IDE when an unknown reference is found, to offer the user to redirect the link to a new component. It is a callback used to find a component in a global scope. It is used when the streaming system needs to find a component which is not part of the component which is currently being streamed. It should return the component with name Name, or Nil if none is found.

See also: TFindGlobalComponent (204)

2.4.12 FindIdentToInt

Synopsis: Return the string to integer converter for an integer type

Declaration: function FindIdentToInt(AIntegerType: Pointer) : TIdentToInt

Visibility: default

Description: FindIdentToInt returns the handler that handles the conversion of a string representation to an integer that can be used in component streaming, when IdentToInt (219) is called.

Errors: Nil is returned if no handler is registered for the given type.

2.4.13 FindIntToIdent

Synopsis: Return the integer to string converter for an integer type

Declaration: function FindIntToIdent(AIntegerType: Pointer) : TIntToIdent

Visibility: default

Description: FindIntToIdent returns the handler that handles the conversion of an integer to a string representation that can be used in component streaming, when IntToIdent ([219](#)) is called.

Errors: Nil is returned if no handler is registered for the given type.

See also: IntToIdent ([219](#)), TIntToIdent ([206](#)), FindIdentToInt ([216](#))

2.4.14 FindNestedComponent

Synopsis: Finds the component with name path starting at the indicated root component.

Declaration: function FindNestedComponent(Root: TComponent; APath: string; CStyle: Boolean) : TComponent

Visibility: default

Description: FindNestedComponent will descend through the list of owned components (starting at Root) and will return the component whose name path matches NamePath. As a path separator the characters . (dot), - (dash) and > (greater than) can be used

See also: GlobalFixupReferences ([218](#))

2.4.15 GetClass

Synopsis: Returns the class pointer of a class with given name.

Declaration: function GetClass(const AClassName: string) : TPersistentClass

Visibility: default

Description: GetClass searches for the class named ClassName in the list of registered classes and returns a class pointer to the definition. If no class with the given name could be found, Nil is returned.

The FindClass ([216](#)) function will raise an exception if it does not find the class.

See also: RegisterClass ([223](#)), GetClass ([217](#))

2.4.16 GetFixupInstanceNames

Synopsis: Returns the names of elements that need to be resolved for the root component, whose reference contains ReferenceRootName

Declaration: procedure GetFixupInstanceNames(Root: TComponent; const ReferenceRootName: string; Names: TStrings)

Visibility: default

Description: GetFixupInstanceNames examines the list of unresolved references and returns the names of classes that contain unresolved references to the Root component in the list Names. The list is not cleared prior to filling it.

See also: GetFixupReferenceNames ([218](#)), GlobalFixupReferences ([218](#))

2.4.17 GetFixupReferenceNames

Synopsis: Returns the names of elements that need to be resolved for the `Root` component.

Declaration: `procedure GetFixupReferenceNames (Root: TComponent; Names: TStrings)`

Visibility: default

Description: `GetFixupReferenceNames` examines the list of unresolved references and returns the names of properties that must be resolved for the component `Root` in the list `Names`. The list is not cleared prior to filling it.

See also: [GetFixupInstanceNames \(217\)](#), [GlobalFixupReferences \(218\)](#)

2.4.18 GlobalFixupReferences

Synopsis: Called to resolve unresolved references after forms are loaded.

Declaration: `procedure GlobalFixupReferences`

Visibility: default

Description: `GlobalFixupReferences` runs over the list of unresolved references and tries to resolve them. This routine should under normal circumstances not be called in an application programmer's code. It is called automatically by the streaming system after a component has been instantiated and its properties read from a stream. It will attempt to resolve references to other global components.

See also: [GetFixupReferenceNames \(218\)](#), [GetFixupInstanceNames \(217\)](#)

2.4.19 GroupDescendentsWith

Synopsis: Add class to the group of another class.

Declaration: `procedure GroupDescendentsWith (AClass: TPersistentClass;
AClassGroup: TPersistentClass)`

Visibility: default

Description: `GroupDescendentsWith` adds `AClass` to the group that `AClassGroup` belongs to. If `AClassGroup` belongs to more than 1 group, then it is added to the group which contains the nearest ancestor.

The class registration and streaming mechanism allows to organize the classes in groups. This allows an IDE to form groups of classes, which can be enabled or disabled. It is not needed at Run-Time.

See also: [StartClassGroup \(226\)](#), [ActivateClassGroup \(214\)](#), [ClassGroupOf \(215\)](#)

2.4.20 HexToBin

Synopsis: Convert a hexadecimal string to a binary buffer

Declaration: `function HexToBin (HexValue: PChar; BinValue: PChar; BinBufSize: Integer)
: Integer`

Visibility: default

Description: `HexToBin` scans the hexadecimal string representation in `HexValue` and transforms every 2 character hexadecimal number to a byte and stores it in `BinValue`. The buffer size is the size of the binary buffer. Scanning will stop if the size of the binary buffer is reached or when an invalid character is encountered. The return value is the number of stored bytes.

Errors: No length checking is done, so if an invalid size is specified, an exception may follow.

See also: [BinToHex \(214\)](#)

2.4.21 IdentToInt

Synopsis: Looks up an integer value in a integer-to-identifier map list.

Declaration: `function IdentToInt(const Ident: string; var Int: LongInt;
const Map: Array of TIdentMapEntry) : Boolean`

Visibility: default

Description: `IdentToInt` searches `Map` for an entry whose `Name` field matches `Ident` and returns the corresponding integer value in `Int`. If a match was found, the function returns `True`, otherwise, `False` is returned.

See also: [TIdentToInt \(205\)](#), [TIntToIdent \(206\)](#), [IntToIdent \(219\)](#), [TIdentMapEntry \(205\)](#)

2.4.22 InitComponentRes

Synopsis: Provided for Delphi compatibility only

Declaration: `function InitComponentRes(const ResName: string; Instance: TComponent)
: Boolean`

Visibility: default

Description: This function is provided for Delphi compatibility. It always returns `false`.

See also: [ReadComponentRes \(222\)](#)

2.4.23 InitInheritedComponent

Synopsis: Initializes a component descending from `RootAncestor`

Declaration: `function InitInheritedComponent(Instance: TComponent;
RootAncestor: TClass) : Boolean`

Visibility: default

Description: `InitInheritedComponent` should be called from a constructor to read properties of the component `Instance` from the streaming system. The `RootAncestor` class is the root class from which `Instance` is a descendent. This must be one of `TDataModule`, `TCustomForm` or `TFrame`.

The function returns `True` if the properties were successfully read from a stream or `False` if some error occurred.

See also: [ReadComponentRes \(222\)](#), [ReadComponentResEx \(222\)](#), [ReadComponentResFile \(222\)](#)

2.4.24 IntToIdent

Synopsis: Looks up an identifier for an integer value in a identifier-to-integer map list.

Declaration: `function IntToIdent(Int: LongInt; var Ident: string;
const Map: Array of TIdentMapEntry) : Boolean`

Visibility: default

Description: `IdentToInt` searches `Map` for an entry whose `Value` field matches `Int` and returns the corresponding identifier in `Ident`. If a match was found, the function returns `True`, otherwise, `False` is returned.

See also: [TIdentToInt \(205\)](#), [TintToIdent \(206\)](#), [IdentToInt \(219\)](#), [TIdentMapEntry \(205\)](#)

2.4.25 InvalidPoint

Synopsis: Check whether a point is invalid.

Declaration: `function InvalidPoint(X: Integer; Y: Integer) : Boolean`
`function InvalidPoint(const At: TPoint) : Boolean`
`function InvalidPoint(const At: TSmallPoint) : Boolean`

Visibility: default

Description: `InvalidPoint` returns `True` if the `X` and `Y` coordinates (of the `TPoint` or `TSmallPoint` records, if one of these versions is used) are -1.

See also: [TPoint \(207\)](#), [TSmallPoint \(210\)](#), [PointsEqual \(222\)](#)

2.4.26 LineStart

Synopsis: Finds the start of a line in `Buffer` before `BufPos`.

Declaration: `function LineStart(Buffer: PChar; BufPos: PChar) : PChar`

Visibility: default

Description: `LineStart` reversely scans `Buffer` starting at `BufPos` for a linefeed character. It returns a pointer at the linefeed character.

2.4.27 NotifyGlobalLoading

Synopsis: Not yet implemented.

Declaration: `procedure NotifyGlobalLoading`

Visibility: default

Description: Not yet implemented.

2.4.28 ObjectBinaryToText

Synopsis: Converts an object stream from a binary to a text format.

Declaration: `procedure ObjectBinaryToText(Input: TStream; Output: TStream;`
`Encoding: TObjectTextEncoding)`
`procedure ObjectBinaryToText(Input: TStream; Output: TStream)`

Visibility: default

Description: `ObjectBinaryToText` reads an object stream in binary format from `Input` and writes the object stream in text format to `Output`. No components are instantiated during the process, this is a pure conversion routine.

See also: [ObjectTextToBinary \(221\)](#)

2.4.29 ObjectResourceToText

Synopsis: Converts an object stream from a (windows) resource to a text format.

Declaration: procedure ObjectResourceToText (Input: TStream; Output: TStream)

Visibility: default

Description: ObjectResourceToText reads the resource header from the Input stream and then passes the streams to ObjectBinaryToText (220)

See also: ObjectBinaryToText (220), ObjectTextToResource (221)

2.4.30 ObjectTextToBinary

Synopsis: Converts an object stream from a text to a binary format.

Declaration: procedure ObjectTextToBinary (Input: TStream; Output: TStream)

Visibility: default

Description: Converts an object stream from a text to a binary format.

2.4.31 ObjectTextToResource

Synopsis: Converts an object stream from a text to a (windows) resource format.

Declaration: procedure ObjectTextToResource (Input: TStream; Output: TStream)

Visibility: default

Description: ObjectTextToResource reads an object stream in text format from Input and writes a resource stream to Output.

Note that for the current implementation of this method in Free Pascal, the output stream should support positioning. (e.g. it should not be a pipe)

See also: ObjectBinaryToText (220), ObjectResourceToText (221)

2.4.32 Point

Synopsis: Returns a TPoint record with the given coordinates.

Declaration: function Point (AX: Integer;AY: Integer) : TPoint

Visibility: default

Description: Point returns a TPoint (207) record with the given coordinates AX and AY filled in.

See also: TPoint (207), SmallPoint (226), Rect (223), Bounds (214)

2.4.33 PointsEqual

Synopsis: Check whether two TPoint variables are equal.

Declaration: function PointsEqual(const P1: TPoint; const P2: TPoint) : Boolean
function PointsEqual(const P1: TSmallPoint; const P2: TSmallPoint)
: Boolean

Visibility: default

Description: PointsEqual compares the P1 and P2 points (of type TPoint (207) or TSmallPoint (210)) and returns True if the X and Y coordinates of the points are equal, or False otherwise.

See also: TPoint (207), TSmallPoint (210), InvalidPoint (220)

2.4.34 ReadComponentRes

Synopsis: Read component properties from a resource in the current module

Declaration: function ReadComponentRes(const ResName: string; Instance: TComponent)
: TComponent

Visibility: default

Description: This function is provided for Delphi compatibility. It always returns Nil.

2.4.35 ReadComponentResEx

Synopsis: Read component properties from a resource in the specified module

Declaration: function ReadComponentResEx(HInstance: THHandle; const ResName: string)
: TComponent

Visibility: default

Description: This function is provided for Delphi compatibility. It always returns Nil.

2.4.36 ReadComponentResFile

Synopsis: Read component properties from a specified resource file

Declaration: function ReadComponentResFile(const FileName: string;
Instance: TComponent) : TComponent

Visibility: default

Description: ReadComponentResFile starts reading properties for Instance from the file FileName. It creates a filestream from FileName and then calls the TStream.ReadComponentRes (1) method to read the state of the component from the stream.

See also: TStream.ReadComponentRes (1), WriteComponentResFile (228)

2.4.37 Rect

Synopsis: Returns a TRect record with the given coordinates.

Declaration: function Rect (ALeft: Integer;ATop: Integer;ARight: Integer;
ABottom: Integer) : TRect

Visibility: default

Description: Rect returns a TRect (208) record with the given top-left (ALeft,ATop) and bottom-right (ABottom,ARight) corners filled in.

No checking is done to see whether the coordinates are valid.

See also: TRect (208), Point (221), SmallPoint (226), Bounds (214)

2.4.38 RedirectFixupReferences

Synopsis: Redirects references under the root object from OldRootName to NewRootName

Declaration: procedure RedirectFixupReferences (Root: TComponent;
const OldRootName: string;
const NewRootName: string)

Visibility: default

Description: RedirectFixupReferences examines the list of unresolved references and replaces references to a root object named OldRootName with references to root object NewRootName.

An application programmer should never need to call RedirectFixupReferences. This function can be used by an IDE to support redirection of broken component links.

See also: RemoveFixupReferences (226)

2.4.39 RegisterClass

Synopsis: Registers a class with the streaming system.

Declaration: procedure RegisterClass (AClass: TPersistentClass)

Visibility: default

Description: RegisterClass registers the class AClass in the streaming system. After the class has been registered, it can be read from a stream when a reference to this class is encountered.

See also: RegisterClasses (224), RegisterClassAlias (223), RegisterComponents (224), UnregisterClass (227)

2.4.40 RegisterClassAlias

Synopsis: Registers a class alias with the streaming system.

Declaration: procedure RegisterClassAlias (AClass: TPersistentClass;
const Alias: string)

Visibility: default

Description: RegisterClassAlias registers a class alias in the streaming system. If a reference to a class Alias is encountered in a stream, then an instance of the class AClass will be created instead by the streaming code.

See also: RegisterClass (223), RegisterClasses (224), RegisterComponents (224), UnregisterClass (227)

2.4.41 RegisterClasses

Synopsis: Registers multiple classes with the streaming system.

Declaration: procedure RegisterClasses(AClasses: Array of TPersistentClass)

Visibility: default

Description: RegisterClasses registers the specified classes AClass in the streaming system. After the classes have been registered, they can be read from a stream when a reference to this class is encountered.

See also: RegisterClass (223), RegisterClassAlias (223), RegisterComponents (224), UnregisterClass (227)

2.4.42 RegisterComponents

Synopsis: Registers components for the component palette.

Declaration: procedure RegisterComponents(const Page: string;
ComponentClasses: Array of TComponentClass)

Visibility: default

Description: RegisterComponents registers the component on the appropriate component page. The component pages can be used by an IDE to display the known components so an application programmer may pick and use the components in his programs.

Registercomponents inserts the component class in the correct component page. If the RegisterComponentsProc procedure is set, this is called as well. Note that this behaviour is different from Delphi's behaviour where an exception will be raised if the procedural variable is not set.

See also: RegisterClass (223), RegisterNoIcon (225)

2.4.43 RegisterFindGlobalComponentProc

Synopsis: Register a component searching handler

Declaration: procedure RegisterFindGlobalComponentProc
(AFindGlobalComponent: TFindGlobalComponent)

Visibility: default

Description: RegisterFindGlobalComponentProc registers a global component search callback AFindGlobalComponent. When FindGlobalComponent (216) is called, then this callback will be used to search for the component.

Errors: None.

See also: FindGlobalComponent (216), UnRegisterFindGlobalComponentProc (227)

2.4.44 RegisterInitComponentHandler

Synopsis: Register a component initialization handler

Declaration: procedure RegisterInitComponentHandler(ComponentClass: TComponentClass;
Handler: TInitComponentHandler)

Visibility: default

Description: `RegisterInitComponentHandler` registers a component initialization handler `Handler` for the component `ComponentClass`. This handler will be used to initialize descendants of `ComponentClass` in the `InitInheritedComponent` (219) call.

See also: `InitInheritedComponent` (219), `TInitComponentHandler` (206)

2.4.45 RegisterIntegerConsts

Synopsis: Registers some integer-to-identifier mappings.

Declaration: `procedure RegisterIntegerConsts(IntegerType: Pointer;`
`IdentToIntFn: TIdentToInt;`
`IntToIdentFn: TIntToIdent)`

Visibility: default

Description: `RegisterIntegerConsts` registers a pair of callbacks to be used when an integer of type `IntegerType` must be mapped to an identifier (using `IntToIdentFn`) or when an identifier must be mapped to an integer (using `IdentToIntFn`).

Component programmers can use `RegisterIntegerConsts` to associate a series of identifier strings with integer values for a property. A necessary condition is that the property should have a separate type declared using the type `integer` syntax. If a type of integer is defined in this way, an IDE can show symbolic names for the values of these properties.

The `IntegerType` should be a pointer to the type information of the integer type. The `IntToIdentFn` and `IdentToIntFn` are two callbacks that will be used when converting between the identifier and integer value and vice versa. The functions `IdentToInt` (219) and `IntToIdent` (219) can be used to implement these callback functions.

See also: `TIdentToInt` (205), `TIntToIdent` (206), `IdentToInt` (219), `IntToIdent` (219)

2.4.46 RegisterNoIcon

Synopsis: Registers components that have no icon on the component palette.

Declaration: `procedure RegisterNoIcon(ComponentClasses: Array of TComponentClass)`

Visibility: default

Description: `RegisterNoIcon` performs the same function as `RegisterComponents` (224) except that it calls `RegisterNoIconProc` (213) instead of `RegisterComponentsProc` (213)

See also: `RegisterNoIconProc` (213), `RegisterComponents` (224)

2.4.47 RegisterNonActiveX

Synopsis: Register non-activex component.

Declaration: `procedure RegisterNonActiveX(ComponentClasses: Array of TComponentClass;`
`AxRegType: TActiveXRegType)`

Visibility: default

Description: Not yet implemented in Free Pascal

2.4.48 RemoveFixupReferences

Synopsis: Removes references to rootname from the fixup list.

Declaration: procedure RemoveFixupReferences (Root: TComponent; const RootName: string)

Visibility: default

Description: RemoveFixupReferences examines the list of unresolved references and removes references to a root object pointing at Root or a root component named RootName.

An application programmer should never need to call RemoveFixupReferences. This function can be used by an IDE to support removal of broken component links.

See also: RedirectFixupReferences ([223](#))

2.4.49 RemoveFixups

Synopsis: Removes Instance from the fixup list.

Declaration: procedure RemoveFixups (Instance: TPersistent)

Visibility: default

Description: RemoveFixups removes all entries for component Instance from the list of unresolved references.a

See also: RedirectFixupReferences ([223](#)), RemoveFixupReferences ([226](#))

2.4.50 SmallPoint

Synopsis: Returns a TSmallPoint record with the given coordinates.

Declaration: function SmallPoint (AX: SmallInt;AY: SmallInt) : TSmallPoint

Visibility: default

Description: SmallPoint returns a TSmallPoint ([210](#)) record with the given coordinates AX and AY filled in.

See also: TSmallPoint ([210](#)), Point ([221](#)), Rect ([223](#)), Bounds ([214](#))

2.4.51 StartClassGroup

Synopsis: Start new class group.

Declaration: procedure StartClassGroup (AClass: TPersistentClass)

Visibility: default

Description: StartClassGroup starts a new class group and adds AClass to it.

The class registration and streaming mechanism allows to organize the classes in groups. This allows an IDE to form groups of classes, which can be enabled or disabled. It is not needed at Run-Time.

See also: GroupDescendentsWith ([218](#)), ActivateClassGroup ([214](#)), ClassGroupOf ([215](#))

2.4.52 UnRegisterClass

Synopsis: Unregisters a class from the streaming system.

Declaration: procedure UnRegisterClass(AClass: TPersistentClass)

Visibility: default

Description: UnregisterClass removes the class AClass from the class definitions in the streaming system.

See also: UnRegisterClasses (227), UnRegisterModuleClasses (227), RegisterClass (223)

2.4.53 UnRegisterClasses

Synopsis: Unregisters multiple classes from the streaming system.

Declaration: procedure UnRegisterClasses(AClasses: Array of TPersistentClass)

Visibility: default

Description: UnregisterClasses removes the classes in AClasses from the class definitions in the streaming system.

2.4.54 UnregisterFindGlobalComponentProc

Synopsis: Remove a previously registered component searching handler.

Declaration: procedure UnregisterFindGlobalComponentProc

(AFindGlobalComponent: TFindGlobalComponent)

Visibility: default

Description: UnRegisterFindGlobalComponentProc unregisters the previously registered global component search callback AFindGlobalComponent. After this call, when FindGlobalComponent (216) is called, then this callback will be no longer be used to search for the component.

Errors: None.

See also: FindGlobalComponent (216), RegisterFindGlobalComponentProc (224)

2.4.55 UnRegisterModuleClasses

Synopsis: Unregisters classes registered by module.

Declaration: procedure UnRegisterModuleClasses(Module: HMODULE)

Visibility: default

Description: UnRegisterModuleClasses unregisters all classes which reside in the module Module. For each registered class, the definition pointer is checked to see whether it resides in the module, and if it does, the definition is removed.

See also: UnRegisterClass (227), UnRegisterClasses (227), RegisterClasses (224)

2.4.56 WriteComponentResFile

Synopsis: Write component properties to a specified resource file

Declaration: procedure WriteComponentResFile(const FileName: string;
Instance: TComponent)

Visibility: default

Description: WriteComponentResFile starts writing properties of Instance to the file FileName. It creates a filestream from FileName and then calls TStream.WriteComponentRes (1) method to write the state of the component to the stream.

See also: TStream.WriteComponentRes (1), ReadComponentResFile (222)

2.5 EBitsError

2.5.1 Description

When an index of a bit in a TBits (273) is out of the valid range (0 to Count - 1) then a EBitsError exception is raised.

2.6 EClassNotFound

2.6.1 Description

When the streaming system needs to create a component, it looks for the class pointer (VMT) in the list of registered classes by its name. If this name is not found, then an EClassNotFound is raised.

See also: EFilerError (229)

2.7 EComponentError

2.7.1 Description

When an error occurs during the registration of a component, or when naming a component, then a EComponentError is raised. Possible causes are:

1. A name with an illegal character was assigned to a component.
2. A component with the same name and owner already exists.
3. The component registration system isn't set up properly.

See also: TComponent (289), TComponent.Name (1)

2.8 EFCREATError

2.8.1 Description

When the operating system reports an error during creation of a new file in the Filestream Constructor (1), a EFCREATError is raised.

See also: EStreamError (231), EFOpenError (229)

2.9 EFilerError

2.9.1 Description

This class serves as an ancestor class for exceptions that are raised when an error occurs during component streaming. A `EFilerError` exception is raised when a class is registered twice.

See also: `EStreamError` (231), `EReadError` (230)

2.10 EFOpenError

2.10.1 Description

When the operating system reports an error during the opening of a file in the Filestream Constructor (1), a `EFOpenError` is raised.

See also: `EStreamError` (231), `EFCreateError` (228)

2.11 EInvalidImage

2.11.1 Description

This exception is not used by Free Pascal but is provided for Delphi compatibility.

2.12 EInvalidOperation

2.12.1 Description

This exception is not used in Free Pascal, it is defined for Delphi compatibility purposes only.

2.13 EListError

2.13.1 Description

If an error occurs in one of the `TList` (327) or `TStrings` (384) methods, then a `EListError` exception is raised. This can occur in one of the following cases:

1. There is not enough memory to expand the list.
2. The list tried to grow beyond its maximal capacity.
3. An attempt was made to reduce the capacity of the list below the current element count.
4. An attempt was made to set the list count to a negative value.
5. A non-existent element of the list was referenced. (i.e. the list index was out of bounds)
6. An attempt was made to move an item to a position outside the list's bounds.

See also: `TList` (327), `TStrings` (384)

2.14 EMethodNotFound

2.14.1 Description

This exception is no longer used in the streaming system. This error is replaced by a EReadError (230).

See also: EFilerError (229), EReadError (230)

2.15 EOObserver

2.16 EOutOfResources

2.16.1 Description

This exception is not used in Free Pascal, it is defined for Delphi compatibility purposes only.

2.17 EParserError

2.17.1 Description

When an error occurs during the parsing of a stream, an `EParserError` is raised. Usually this indicates that an invalid token was found on the input stream, or the token read from the stream wasn't the expected token.

See also: TParser (340)

2.18 EReadError

2.18.1 Description

If an error occurs when reading from a stream, a `EReadError` exception is raised. Possible causes for this are:

1. Not enough data is available when reading from a stream
2. The stream containing a component's data contains invalid data. this will occur only when reading a component from a stream.

See also: EFilerError (229), EWriteError (232)

2.19 EResNotFound

2.19.1 Description

This exception is not used by Free Pascal but is provided for Delphi compatibility.

2.20 EStreamError

2.20.1 Description

An `EStreamError` is raised when an error occurs during reading from or writing to a stream:
Possible causes are

1. Not enough data is available in the stream.
2. Trying to seek beyond the beginning or end of the stream.
3. Trying to set the capacity of a memory stream and no memory is available.
4. Trying to write to a read-only stream, such as a resource stream.
5. Trying to read from a write-only stream.

See also: `EFCreateError` (228)

2.21 EStringListError

2.21.1 Description

When an error occurs in one of the methods of `TStrings` (384) then an `EStringListError` is raised. This can have one of the following causes:

1. There is not enough memory to expand the list.
2. The list tried to grow beyond its maximal capacity.
3. A non-existent element of the list was referenced. (i.e. the list index was out of bounds)
4. An attempt was made to add a duplicate entry to a `TStringList` (379) when `TStringList.AllowDuplicates` (1) is `False`.

See also: `TStrings` (384), `TStringList` (379)

2.22 EThread

2.22.1 Description

Thread error exception.

2.23 EThreadDestroyCalled

2.23.1 Description

Exception raised when a thread is destroyed illegally.

2.24 EWriteError

2.24.1 Description

If an error occurs when writing to a stream, a `EWriteError` exception is raised. Possible causes for this are:

1. The stream doesn't allow writing.
2. An error occurred when writing a property to a stream.

See also: `EFilerError` (229), `EReadError` (230)

2.25 IDesignerNotify

2.25.1 Description

`IDesignerNotify` is an interface that can be used to communicate changes to a designer mechanism. It offers functionality for detecting changes, and notifications when the component is destroyed.

2.25.2 Method overview

Page	Property	Description
232	Modified	Notify that the component is modified.
232	Notification	Notification of owner changes

2.25.3 IDesignerNotify.Modified

Synopsis: Notify that the component is modified.

Declaration: `procedure Modified`

Visibility: default

Description: `Modified` can be used to notify a designer of changes, indicating that components should be streamed.

2.25.4 IDesignerNotify.Notification

Synopsis: Notification of owner changes

Declaration: `procedure Notification(AnObject: TPersistent; Operation: TOperation)`

Visibility: default

Description: `Notification` is the interface counterpart of `TComponent.Notification` (1) which is used to communicate adds to the components.

See also: `TComponent.Notification` (1)

2.26 IFPObserved

2.26.1 Method overview

Page	Property	Description
233	FPOAttachObserver	
233	FPODetachObserver	
233	FPONotifyObservers	

2.26.2 IFPObserved.FPOAttachObserver

Declaration: procedure FPOAttachObserver (AObservable: TObject)

Visibility: default

2.26.3 IFPObserved.FPODetachObserver

Declaration: procedure FPODetachObserver (AObservable: TObject)

Visibility: default

2.26.4 IFPObserved.FPONotifyObservers

Declaration: procedure FPONotifyObservers (ASender: TObject;
 AOperation: TFPObservedOperation;
 Data: Pointer)

Visibility: default

2.27 IFPObserver

2.27.1 Method overview

Page	Property	Description
233	FPOObservedChanged	

2.27.2 IFPObserver.FPOObservedChanged

Declaration: procedure FPOObservedChanged (ASender: TObject;
 Operation: TFPObservedOperation;
 Data: Pointer)

Visibility: default

2.28 IInterfaceComponentReference

2.28.1 Description

IInterfaceComponentReference is an interface to return the component that implements a given interface. It is implemented by TComponent ([289](#)).

See also: TComponent ([289](#))

2.28.2 Method overview

Page	Property	Description
234	GetComponent	Return component instance

2.28.3 IInterfaceComponentReference.GetComponent

Synopsis: Return component instance

Declaration: function GetComponent : TComponent

Visibility: default

Description: GetComponent returns the component instance.

Errors: None.

See also: TComponent ([289](#))

2.29 IInterfaceList

2.29.1 Description

IInterfaceList is an interface for maintaining a list of interfaces, strongly resembling the standard TList ([327](#)) class. It offers the same list of public methods as TList, with the exception that it uses interfaces instead of pointers.

All interfaces in the list should descend from IUnknown.

More detailed descriptions of how the various methods behave can be found in the TList reference.

See also: TList ([327](#))

2.29.2 Method overview

Page	Property	Description
237	Add	Add an interface to the list
236	Clear	Clear the list
236	Delete	Remove an interface from the list
237	Exchange	Exchange 2 interfaces in the list
237	First	Return the first non-empty interface in the list.
235	Get	Retrieve an interface pointer from the list.
235	GetCapacity	Return the capacity of the list.
235	GetCount	Return the current number of elements in the list.
237	IndexOf	Return the index of an interface.
237	Insert	Insert an interface in the list.
238	Last	Returns the last non-nil interface in the list.
238	Lock	Lock the list
235	Put	Write an item to the list
238	Remove	Remove an interface from the list
236	SetCapacity	Set the capacity of the list
236	SetCount	Set the number of items in the list
238	Unlock	Unlock the list.

2.29.3 Property overview

Page	Property	Access	Description
238	Capacity	rw	Capacity of the list
239	Count	rw	Current number of elements in the list.
239	Items	rw	Provides Index-based, sequential, access to the interfaces in the list.

2.29.4 IInterfaceList.Get

Synopsis: Retrieve an interface pointer from the list.

Declaration: function Get(i: Integer) : IUnknown

Visibility: default

Description: Get returns the interface pointer at position *i* in the list. It serves as the Read method for the Items ([1](#)) property.

See also: IInterfaceList.Items ([1](#)), TList.Items ([1](#))

2.29.5 IInterfaceList.GetCapacity

Synopsis: Return the capacity of the list.

Declaration: function GetCapacity : Integer

Visibility: default

Description: GetCapacity returns the current capacity of the list. It serves as the Read method for the Capacity ([1](#)) property.

See also: IInterfaceList.Capacity ([1](#)), TList.Capacity ([1](#))

2.29.6 IInterfaceList.GetCount

Synopsis: Return the current number of elements in the list.

Declaration: function GetCount : Integer

Visibility: default

Description: It serves as the Read method for the Count ([1](#)) property.

See also: IInterfaceList.Count ([1](#)), TList.Count ([1](#))

2.29.7 IInterfaceList.Put

Synopsis: Write an item to the list

Declaration: procedure Put(i: Integer; item: IUnknown)

Visibility: default

Description: Put writes the interface Item at position *I* in the list. It servers as the Write method for the Items ([1](#)) property.

See also: IInterfaceList.Items ([1](#)), TList.Items ([1](#))

2.29.8 IIInterfaceList.SetCapacity

Synopsis: Set the capacity of the list

Declaration: procedure SetCapacity (NewCapacity: Integer)

Visibility: default

Description: SetCapacity sets the capacity of the list to NewCapacity. It serves as the Write method for the Capacity ([1](#)) property.

See also: IIInterfaceList.Capacity ([1](#)), TList.Capacity ([1](#))

2.29.9 IIInterfaceList.SetCount

Synopsis: Set the number of items in the list

Declaration: procedure SetCount (NewCount: Integer)

Visibility: default

Description: SetCount sets the count of the list to NewCount. It serves as the Write method for the Capacity ([1](#))

See also: IIInterfaceList.Count ([1](#)), TList.Count ([1](#))

2.29.10 IIInterfaceList.Clear

Synopsis: Clear the list

Declaration: procedure Clear

Visibility: default

Description: Clear removes all interfaces from the list. All interfaces in the list will be cleared (i.e. their reference count will decrease with 1)

See also: TList.Clear ([1](#))

2.29.11 IIInterfaceList.Delete

Synopsis: Remove an interface from the list

Declaration: procedure Delete (index: Integer)

Visibility: default

Description: Delete removes the interface at position Index from the list. It does this by explicitly clearing the interface and then removing the slot.

See also: TList.Clear ([1](#)), IIInterfaceList.Add ([1](#)), IIInterfaceList.Delete ([1](#)), IIInterfaceList.Insert ([1](#))

2.29.12 IIInterfaceList.Exchange

Synopsis: Exchange 2 interfaces in the list

Declaration: procedure Exchange(index1: Integer; index2: Integer)

Visibility: default

Description: Exchange exchanges 2 interfaces in the list at locations index1 and Index2.

See also: TList.Exchange ([1](#)), IIInterfaceList.Add ([1](#)), IIInterfaceList.Delete ([1](#)), IIInterfaceList.Insert ([1](#))

2.29.13 IIInterfaceList.First

Synopsis: Return the first non-empty interface in the list.

Declaration: function First : IUnknown

Visibility: default

Description: First returns the first non-empty interface in the list.

See also: TList.First ([1](#)), IIInterfaceList.IndexOf ([1](#)), IIInterfaceList.Last ([1](#))

2.29.14 IIInterfaceList.IndexOf

Synopsis: Return the index of an interface.

Declaration: function IndexOf(item: IUnknown) : Integer

Visibility: default

Description: IndexOf returns the location in the list of the interface Item. If there is no such interface in the list, then -1 is returned.

See also: TList.IndexOf ([1](#)), IIInterfaceList.First ([1](#)), IIInterfaceList.Last ([1](#))

2.29.15 IIInterfaceList.Add

Synopsis: Add an interface to the list

Declaration: function Add(item: IUnknown) : Integer

Visibility: default

Description: Add adds the interface Item to the list, and returns the position at which it has been added.

See also: TList.Add ([1](#)), IIInterfaceList.Insert ([1](#)), IIInterfaceList.Delete ([1](#))

2.29.16 IIInterfaceList.Insert

Synopsis: Insert an interface in the list.

Declaration: procedure Insert(i: Integer; item: IUnknown)

Visibility: default

Description: Insert inserts the interface Item in the list, at position I, shifting all items one position.

See also: TList.Insert ([1](#)), IIInterfaceList.Add ([1](#)), IIInterfaceList.Delete ([1](#))

2.29.17 IIInterfaceList.Last

Synopsis: Returns the last non-nil interface in the list.

Declaration: function Last : IUnknown

Visibility: default

Description: Last returns the last non-empty interface in the list.

See also: TList.Last ([1](#)), IIInterfaceList.First ([1](#)), IIInterfaceList.IndexOf ([1](#))

2.29.18 IIInterfaceList.Remove

Synopsis: Remove an interface from the list

Declaration: function Remove(item: IUnknown) : Integer

Visibility: default

Description: Remove searches for the first occurrence of Item in the list and deletes it.

See also: TList.Remove ([1](#)), IIInterfaceList.Delete ([1](#)), IIInterfaceList.IndexOf ([1](#))

2.29.19 IIInterfaceList.Lock

Synopsis: Lock the list

Declaration: procedure Lock

Visibility: default

Description: Lock locks the list. After a call to lock, the object list can only be accessed by the current thread, untill UnLock ([1](#)) is called.

See also: TList.Lock ([1](#)), IIInterfaceList.Unlock ([1](#))

2.29.20 IIInterfaceList.Unlock

Synopsis: Unlock the list.

Declaration: procedure Unlock

Visibility: default

Description: Unlock unlocks a locked list. After a call to UnLock, other threads are again able to access the list.

See also: TList.UnLock ([1](#)), IIInterfaceList.Lock ([1](#))

2.29.21 IIInterfaceList.Capacity

Synopsis: Capacity of the list

Declaration: Property Capacity : Integer

Visibility: default

Access: Read,Write

Description: Capacity is the maximum number of elements the list can hold without needing to reallocate memory for the list. It can be set to improve speed when adding a lot of items to the list.

See also: [TList.Capacity \(1\)](#), [IInterfaceList.Count \(1\)](#)

2.29.22 IInterfaceList.Count

Synopsis: Current number of elements in the list.

Declaration: Property Count : Integer

Visibility: default

Access: Read,Write

Description: Count is the current number of elements in the list. Setting it to a larger number will allocate empty slots. Setting it to a smaller number will clear any interfaces that fall outside the new border.

See also: [IInterfaceList.Capacity \(1\)](#), [TList.Count \(1\)](#)

2.29.23 IInterfaceList.Items

Synopsis: Provides Index-based, sequential, access to the interfaces in the list.

Declaration: Property Items [index: Integer] : IUnknown; default

Visibility: default

Access: Read,Write

Description: Items is the default property of the interface list and provides index-based array access to the interfaces in the list. Allowed values for Index include 0 to Count-1

See also: [IInterfaceList.Count \(1\)](#), [TList.Items \(1\)](#)

2.30 IStreamPersist

2.30.1 Description

IStreamPersist defines an interface for object persistence streaming to a stream. Any class implementing this interface is expected to be able to save or load its state from or to a stream.

See also: [TPersistent \(347\)](#), [TComponent \(289\)](#), [TStream \(365\)](#)

2.30.2 Method overview

Page	Property	Description
240	LoadFromStream	Load persistent data from stream.
240	SaveToStream	Save persistent data to stream.

2.30.3 IStreamPersist.LoadFromStream

Synopsis: Load persistent data from stream.

Declaration: procedure LoadFromStream(Stream: TStream)

Visibility: default

Description: LoadFromStream is the method called when the object should load it's state from the stream stream. It should be able to read the data which was written using the SaveToStream method.

See also: TPersistent (347), TComponent (289), TStream (365), IStreamPersist.SaveToStream (1)

2.30.4 IStreamPersist.SaveToStream

Synopsis: Save persistent data to stream.

Declaration: procedure SaveToStream(Stream: TStream)

Visibility: default

Description: SaveFromStream is the method called when the object should load it's state from the stream stream. The data written by this method should be readable by the LoadFromStream method.

See also: TPersistent (347), TComponent (289), TStream (365), IStreamPersist.LoadFromStream (1)

2.31 IStringsAdapter

2.31.1 Description

Is not yet supported in Free Pascal.

See also: TString (384)

2.31.2 Method overview

Page	Property	Description
240	ReferenceStrings	Add a reference to the indicated strings.
240	ReleaseStrings	Release the reference to the strings.

2.31.3 IStringsAdapter.ReferenceStrings

Synopsis: Add a reference to the indicated strings.

Declaration: procedure ReferenceStrings(S: TString)

Visibility: default

2.31.4 IStringsAdapter.ReleaseStrings

Synopsis: Release the reference to the strings.

Declaration: procedure ReleaseStrings

Visibility: default

2.32 IVCLComObject

2.32.1 Description

`IVCLComObject` is used by `TComponent` to implement the `IUnknown` interface used by COM automation servers. Partially, it is the translation to pascal of the `IDispatch` interface definition by Microsoft. If `TComponent` needs to return an `IUnknown` interface, it creates a `IVCLComObject` interface instead.

See also: `TComponent.VCLComObject` (1)

2.32.2 Method overview

Page	Property	Description
242	<code>FreeOnRelease</code>	Is called by <code>TComponent.FreeOnRelease</code>
242	<code>GetIDsOfNames</code>	The <code>IDispatch:GetIDsOfNames</code> call for automation servers.
241	<code>GetTypeInfo</code>	The <code>IDispatch:.GetTypeInfo</code> call for automation servers
241	<code>GetTypeInfoCount</code>	The <code>IDispatch:GetTypeInfoCount</code> call for automation servers
242	<code>Invoke</code>	The <code>IDispatch:Invoke</code> call for automation servers.
242	<code>SafeCallException</code>	This method can be invoked if an exception occurs during <code>Invoke</code>

2.32.3 IVCLComObject.GetTypeInfoCount

Synopsis: The `IDispatch:GetTypeInfoCount` call for automation servers

Declaration: `function GetTypeInfoCount (out Count: Integer) : HRESULT`

Visibility: default

Description: `GetTypeInfoCount` must return in `Count` either 0 or 1 to indicate that it provides type information (1) or not (0).

Errors: On error, a nonzero (different from `S_OK`) return value must be returned.

See also: `IVCLComObject.GetTypeInfo` (1)

2.32.4 IVCLComObject.GetTypeInfo

Synopsis: The `IDispatch:GetTypeInfo` call for automation servers

Declaration: `function GetTypeInfo(Index: Integer; LocaleID: Integer; out TypeInfo) : HRESULT`

Visibility: default

Description: `GetTypeInfo` must return the `Index`-th entry in the type information of the component in `TypeInfo`. The `LocaleID` argument can be used to indicate the locale of the caller, as different type information can be returned depending on the locale.

Errors: On error, a nonzero (different from `S_OK`) return value must be returned.

See also: `IVCLComObject.GetTypeInfoCount` (1)

2.32.5 IVCLComObject.GetIDsOfNames

Synopsis: The `IDispatch:GetIDsOfNames` call for automation servers.

Declaration: `function GetIDsOfNames(const IID: TGuid; Names: Pointer;
NameCount: Integer; LocaleID: Integer;
DispIDs: Pointer) : HRESULT`

Visibility: default

Description: `GetIDsOfNames` must return in `DispIDs` the dispatch IDs for the `NameCount` names of the methods listed in `Names`. The `LocaleID` indicates the locale of the caller.

Errors: On error, a nonzero (different from `S_OK`) return value must be returned.

See also: `IVCLComObject.Invoke` ([1](#))

2.32.6 IVCLComObject.Invoke

Synopsis: The `IDispatch:Invoke` call for automation servers.

Declaration: `function Invoke(DispID: Integer; const IID: TGuid; LocaleID: Integer;
Flags: Word; var Params; VarResult: Pointer;
ExcepInfo: Pointer; ArgErr: Pointer) : HRESULT`

Visibility: default

Description: `Invoke` must invoke the method designated by `DispID`. `IID` can be ignored. `LocaleID` is used by the caller to indicate the locale it is using. The `Flags` argument describes the context in which `Invoke` is called: a method, or property getter/setter. The `Params` argument contains the parameters to the call. The result should be in `VarResult`. On error, `ExcepInfo` and `ArgError` should be filled.

The function should return 0 (`S_OK`) if all went well.

See also: `IVCLComObject.GetIDsOfNames` ([1](#))

2.32.7 IVCLComObject.SafeCallException

Synopsis: This method can be invoked if an exception occurs during `Invoke`

Declaration: `function SafeCallException(ExceptObject: TObject; ExceptAddr: Pointer)
: HRESULT`

Visibility: default

Description: `SafeCallException` is called to handle an exception during invocation of the `Invoke` method. The `TObject` implementation of this method returns `E_UNEXPECTED`.

See also: `IVCLComObject.Invoke` ([1](#))

2.32.8 IVCLComObject.FreeOnRelease

Synopsis: Is called by `TComponent.FreeOnRelease`

Declaration: `procedure FreeOnRelease`

Visibility: default

Description: `FreeOnRelease` is called by `TComponent.FreeOnRelease` (1) for the `IVCLComObject` interface implemented by `TComponent`.

See also: `TComponent.FreeOnRelease` (1)

2.33 TABstractObjectReader

2.33.1 Description

The Free Pascal streaming mechanism, while compatible with Delphi's mechanism, differs from it in the sense that the streaming mechanism uses a driver class when streaming components. The `TAbstractObjectReader` class is the base driver class for reading property values from streams. It consists entirely of abstract methods, which must be implemented by descendent classes.

Different streaming mechanisms can be implemented by making a descendent from `TAbstractObjectReader`. The `TBinaryObjectReader` (261) class is such a descendent class, which streams data in binary (Delphi compatible) format.

All methods described in this class, must be implemented by descendent classes.

See also: `TBinaryObjectReader` (261)

2.33.2 Method overview

Page	Property	Description
244	BeginComponent	Marks the reading of a new component.
245	BeginProperty	Marks the reading of a property value.
244	BeginRootComponent	Starts the reading of the root component.
243	NextValue	Returns the type of the next value in the stream.
245	Read	Read raw data from stream
245	ReadBinary	Read binary data from the stream.
246	ReadCurrency	Read a currency value from the stream.
246	ReadDate	Read a date value from the stream.
245	ReadFloat	Read a float value from the stream.
246	ReadIdent	Read an identifier from the stream.
247	ReadInt16	Read a 16-bit integer from the stream.
248	ReadInt32	Read a 32-bit integer from the stream.
248	ReadInt64	Read a 64-bit integer from the stream.
247	ReadInt8	Read an 8-bit integer from the stream.
248	ReadSet	Reads a set from the stream.
246	ReadSingle	Read a single (real-type) value from the stream.
249	ReadStr	Read a shortstring from the stream
249	ReadString	Read a string of type <code>StringType</code> from the stream.
249	ReadUnicodeString	Read a unicode string value
244	ReadValue	Reads the type of the next value.
249	ReadWideString	Read a widestring value from the stream.
250	SkipComponent	Skip till the end of the component.
250	SkipValue	Skip the current value.

2.33.3 TABstractObjectReader.NextValue

Synopsis: Returns the type of the next value in the stream.

Declaration: function `NextValue` : `TValueType`; Virtual; Abstract

Visibility: public

Description: This function should return the type of the next value in the stream, but should not read the actual value, i.e. the stream position should not be altered by this method. This is used to 'peek' in the stream what value is next.

See also: TAbstractObjectReader.ReadValue ([1](#))

2.33.4 TAbstractObjectReader.ReadValue

Synopsis: Reads the type of the next value.

Declaration: function ReadValue : TValueType; Virtual; Abstract

Visibility: public

Description: This function returns the type of the next value in the stream and reads it. i.e. after the call to this method, the stream is positioned to read the value of the type returned by this function.

See also: TAbstractObjectReader.ReadValue ([1](#))

2.33.5 TAbstractObjectReader.BeginRootComponent

Synopsis: Starts the reading of the root component.

Declaration: procedure BeginRootComponent; Virtual; Abstract

Visibility: public

Description: This function can be used to initialize the driver class for reading a component. It is called once at the beginning of the read process, and is immediately followed by a call to BeginComponent ([1](#)).

See also: TAbstractObjectReader.BeginComponent ([1](#))

2.33.6 TAbstractObjectReader.BeginComponent

Synopsis: Marks the reading of a new component.

Declaration: procedure BeginComponent (var Flags: TFilerFlags; var AChildPos: Integer;
var CompClassName: string; var CompName: string)
; Virtual; Abstract

Visibility: public

Description: This method is called when the streaming process wants to start reading a new component.

Descendent classes should override this method to read the start of a component new component definition and return the needed arguments. Flags should be filled with any flags that were found at the component definition, as well as AChildPos. The CompClassName should be filled with the class name of the streamed component, and the CompName argument should be filled with the name of the component.

AChildPos is used to change the ordering in which components appear below their parent component when streaming descendent forms.

See also: TAbstractObjectReader.BeginRootComponent ([1](#)), TAbstractObjectReader.BeginProperty ([1](#))

2.33.7 TAbstractObjectReader.BeginProperty

Synopsis: Marks the reading of a property value.

Declaration: function BeginProperty : string; Virtual; Abstract

Visibility: public

Description: BeginProperty is called by the streaming system when it wants to read a new property. The return value of the function is the name of the property which can be read from the stream.

See also: TAbstractObjectReader.BeginComponent ([1](#))

2.33.8 TAbstractObjectReader.Read

Synopsis: Read raw data from stream

Declaration: procedure Read(var Buf; Count: LongInt); Virtual; Abstract

Visibility: public

Description: Read is introduced for Delphi compatibility to read raw data from the component stream. This should not be used in production code as it will totally mess up the streaming.

See also: TBinaryObjectReader.Read ([1](#)), TReader.Read ([1](#))

2.33.9 TAbstractObjectReader.ReadBinary

Synopsis: Read binary data from the stream.

Declaration: procedure ReadBinary(const DestData: TMemoryStream); Virtual; Abstract

Visibility: public

Description: ReadBinary is called when binary data should be read from the stream (i.e. after ReadValue ([1](#)) returned a valuetype of vaBinary). The data should be stored in the DestData memory stream by descendent classes.

See also: TAbstractObjectReader.ReadFloat ([1](#)), TAbstractObjectReader.ReadDate ([1](#)), TAbstractObjectReader.ReadSingle ([1](#)), TAbstractObjectReader.ReadIdent ([1](#)), TAbstractObjectReader.ReadInt8 ([1](#)), TAbstractObjectReader.ReadInt16 ([1](#)), TAbstractObjectReader.ReadInt32 ([1](#)), TAbstractObjectReader.ReadInt64 ([1](#)), TabstractObjectReader.ReadSet ([1](#)), TabstractObjectReader.ReadStr ([1](#)), TabstractObjectReader.ReadString ([1](#))

2.33.10 TAbstractObjectReader.ReadFloat

Synopsis: Read a float value from the stream.

Declaration: function ReadFloat : Extended; Virtual; Abstract

Visibility: public

Description: ReadFloat is called by the streaming system when it wants to read a float from the stream (i.e. after ReadValue ([1](#)) returned a valuetype of vaExtended). The return value should be the value of the float.

See also: TAbstractObjectReader.ReadFloat ([1](#)), TAbstractObjectReader.ReadDate ([1](#)), TAbstractObjectReader.ReadSingle ([1](#)), TAbstractObjectReader.ReadIdent ([1](#)), TAbstractObjectReader.ReadInt8 ([1](#)), TAbstractObjectReader.ReadInt16 ([1](#)), TAbstractObjectReader.ReadInt32 ([1](#)), TAbstractObjectReader.ReadInt64 ([1](#)), TabstractObjectReader.ReadSet ([1](#)), TabstractObjectReader.ReadStr ([1](#)), TabstractObjectReader.ReadString ([1](#))

2.33.11 TAbstractObjectReader.ReadSingle

Synopsis: Read a single (real-type) value from the stream.

Declaration: function ReadSingle : Single; Virtual; Abstract

Visibility: public

Description: ReadSingle is called by the streaming system when it wants to read a single-type float from the stream (i.e. after ReadValue (1) returned a valuetype of vaSingle). The return value should be the value of the float.

See also: TAbstractObjectReader.ReadFloat (1), TAbstractObjectReader.ReadDate (1), TAbstractObjectReader.ReadSingle (1), TAbstractObjectReader.ReadIdent (1), TAbstractObjectReader.ReadInt8 (1), TAbstractObjectReader.ReadInt16 (1), TAbstractObjectReader.ReadInt32 (1), TAbstractObjectReader.ReadInt64 (1), TabstractObjectReader.ReadSet (1), TabstractObjectReader.ReadStr (1), TabstractObjectReader.ReadString (1)

2.33.12 TAbstractObjectReader.ReadDate

Synopsis: Read a date value from the stream.

Declaration: function ReadDate : TDateTime; Virtual; Abstract

Visibility: public

Description: ReadDate is called by the streaming system when it wants to read a date/time value from the stream (i.e. after ReadValue (1) returned a valuetype of vaDate). The return value should be the date/time value. (This value can be stored as a float, since TDateTime is nothing but a float.)

See also: TAbstractObjectReader.ReadFloat (1), TAbstractObjectReader.ReadSingle (1), TAbstractObjectReader.ReadIdent (1), TAbstractObjectReader.ReadInt8 (1), TAbstractObjectReader.ReadInt16 (1), TAbstractObjectReader.ReadInt32 (1), TAbstractObjectReader.ReadInt64 (1), TabstractObjectReader.ReadSet (1), TabstractObjectReader.ReadStr (1), TabstractObjectReader.ReadString (1)

2.33.13 TAbstractObjectReader.ReadCurrency

Synopsis: Read a currency value from the stream.

Declaration: function ReadCurrency : Currency; Virtual; Abstract

Visibility: public

Description: ReadCurrency is called when a currency-typed value should be read from the stream. This abstract method should be overridden by descendent classes, and should return the currency value read from the stream.

See also: TAbstractObjectWriter.WriteCurrency (1)

2.33.14 TAbstractObjectReader.ReadIdent

Synopsis: Read an identifier from the stream.

Declaration: function ReadIdent (ValueType: TValueType) : string; Virtual; Abstract

Visibility: public

Description: ReadIdent is called by the streaming system if it expects to read an identifier of type ValueType from the stream after a call to ReadValue (1) returned vaIdent. The identifier should be returned as a string. Note that in some cases the identifier does not actually have to be in the stream. The following table indicates which identifiers must actually be read:

Table 2.20:

ValueType	Expected value
valIdent	Read from stream.
vaNil	'Nil'. This does not have to be read from the stream.
vaFalse	'False'. This does not have to be read from the stream.
vaTrue	'True'. This does not have to be read from the stream.
vaNull	'Null'. This does not have to be read from the stream.

See also: TAbstractObjectReader.ReadFloat (1), TAbstractObjectReader.ReadDate (1), TAbstractObjectReader.ReadSingle (1), TAbstractObjectReader.ReadInt8 (1), TAbstractObjectReader.ReadInt16 (1), TAbstractObjectReader.ReadInt32 (1), TAbstractObjectReader.ReadInt64 (1), TabstractObjectReader.ReadSet (1), TabstractObjectReader.ReadStr (1), TabstractObjectReader.ReadString (1)

2.33.15 TAbstractObjectReader.ReadInt8

Synopsis: Read an 8-bit integer from the stream.

Declaration: function ReadInt8 : ShortInt; Virtual; Abstract

Visibility: public

Description: ReadInt8 is called by the streaming process if it expects to read an integer value with a size of 8 bits (1 byte) from the stream (i.e. after ReadValue (1) returned a valuetype of vaInt8). The return value is the value if the integer. Note that the size of the value in the stream does not actually have to be 1 byte.

See also: TAbstractObjectReader.ReadFloat (1), TAbstractObjectReader.ReadDate (1), TAbstractObjectReader.ReadSingle (1), TAbstractObjectReader.ReadIdent (1), TAbstractObjectReader.ReadInt16 (1), TAbstractObjectReader.ReadInt32 (1), TAbstractObjectReader.ReadInt64 (1), TabstractObjectReader.ReadSet (1), TabstractObjectReader.ReadStr (1), TabstractObjectReader.ReadString (1)

2.33.16 TAbstractObjectReader.ReadInt16

Synopsis: Read a 16-bit integer from the stream.

Declaration: function ReadInt16 : SmallInt; Virtual; Abstract

Visibility: public

Description: ReadInt16 is called by the streaming process if it expects to read an integer value with a size of 16 bits (2 bytes) from the stream (i.e. after ReadValue (1) returned a valuetype of vaInt16). The return value is the value if the integer. Note that the size of the value in the stream does not actually have to be 2 bytes.

See also: TAbstractObjectReader.ReadFloat (1), TAbstractObjectReader.ReadDate (1), TAbstractObjectReader.ReadSingle (1), TAbstractObjectReader.ReadIdent (1), TAbstractObjectReader.ReadInt8 (1), TAbstractObjectReader.ReadInt32 (1), TAbstractObjectReader.ReadInt64 (1), TabstractObjectReader.ReadSet (1), TabstractObjectReader.ReadStr (1), TabstractObjectReader.ReadString (1)

2.33.17 TAbstractObjectReader.ReadInt32

Synopsis: Read a 32-bit integer from the stream.

Declaration: function ReadInt32 : LongInt; Virtual; Abstract

Visibility: public

Description: ReadInt32 is called by the streaming process if it expects to read an integer value with a size of 32 bits (4 bytes) from the stream (i.e. after ReadValue (1) returned a valuetype of vaInt32). The return value is the value of the integer. Note that the size of the value in the stream does not actually have to be 4 bytes.

See also: TAbstractObjectReader.ReadFloat (1), TAbstractObjectReader.ReadDate (1), TAbstractObjectReader.ReadSingle (1), TAbstractObjectReader.ReadIdent (1), TAbstractObjectReader.ReadInt8 (1), TAbstractObjectReader.ReadInt16 (1), TAbstractObjectReader.ReadInt32 (1), TAbstractObjectReader.ReadInt64 (1), TAbstractObjectReader.ReadSet (1), TAbstractObjectReader.ReadStr (1), TAbstractObjectReader.ReadString (1)

2.33.18 TAbstractObjectReader.ReadInt64

Synopsis: Read a 64-bit integer from the stream.

Declaration: function ReadInt64 : Int64; Virtual; Abstract

Visibility: public

Description: ReadInt64 is called by the streaming process if it expects to read an int64 value with a size of 64 bits (8 bytes) from the stream (i.e. after ReadValue (1) returned a valuetype of vaInt64). The return value is the value of the integer. Note that the size of the value in the stream does not actually have to be 8 bytes.

See also: TAbstractObjectReader.ReadFloat (1), TAbstractObjectReader.ReadDate (1), TAbstractObjectReader.ReadSingle (1), TAbstractObjectReader.ReadIdent (1), TAbstractObjectReader.ReadInt8 (1), TAbstractObjectReader.ReadInt16 (1), TAbstractObjectReader.ReadInt32 (1), TAbstractObjectReader.ReadInt64 (1), TAbstractObjectReader.ReadSet (1), TAbstractObjectReader.ReadStr (1), TAbstractObjectReader.ReadString (1)

2.33.19 TAbstractObjectReader.ReadSet

Synopsis: Reads a set from the stream.

Declaration: function ReadSet (EnumType: Pointer) : Integer; Virtual; Abstract

Visibility: public

Description: This method is called by the streaming system if it expects to read a set from the stream (i.e. after ReadValue (1) returned a valuetype of vaSet). The return value is the contents of the set, encoded in a bitmask the following way:

For each (enumerated) value in the set, the bit corresponding to the ordinal value of the enumerated value should be set. i.e. as `1 shl ord(value)`.

See also: TAbstractObjectReader.ReadFloat (1), TAbstractObjectReader.ReadDate (1), TAbstractObjectReader.ReadSingle (1), TAbstractObjectReader.ReadIdent (1), TAbstractObjectReader.ReadInt8 (1), TAbstractObjectReader.ReadInt16 (1), TAbstractObjectReader.ReadInt32 (1), TAbstractObjectReader.ReadInt64 (1), TAbstractObjectReader.ReadStr (1), TAbstractObjectReader.ReadString (1)

2.33.20 TAbstractObjectReader.ReadStr

Synopsis: Read a shortstring from the stream

Declaration: function ReadStr : string; Virtual; Abstract

Visibility: public

Description: ReadStr is called by the streaming system if it expects to read a string from the stream (i.e. after ReadValue (1) returned a valuetype of vaLString,vaWString or vaString). The return value is the string.

See also: TAbstractObjectReader.ReadFloat (1), TAbstractObjectReader.ReadDate (1), TAbstractObjectReader.ReadSingle (1), TAbstractObjectReader.ReadIdent (1), TAbstractObjectReader.ReadInt8 (1), TAbstractObjectReader.ReadInt16 (1), TAbstractObjectReader.ReadInt32 (1), TAbstractObjectReader.ReadInt64 (1), TabstractObjectReader.ReadSet (1), TabstractObjectReader.ReadString (1)

2.33.21 TAbstractObjectReader.ReadString

Synopsis: Read a string of type StringType from the stream.

Declaration: function ReadString(StringType: TValueType) : string; Virtual
; Abstract

Visibility: public

Description: ReadStr is called by the streaming system if it expects to read a string from the stream (i.e. after ReadValue (1) returned a valuetype of vaLString,vaWString or vaString). The return value is the string.

See also: TAbstractObjectReader.ReadFloat (1), TAbstractObjectReader.ReadDate (1), TAbstractObjectReader.ReadSingle (1), TAbstractObjectReader.ReadIdent (1), TAbstractObjectReader.ReadInt8 (1), TAbstractObjectReader.ReadInt16 (1), TAbstractObjectReader.ReadInt32 (1), TAbstractObjectReader.ReadInt64 (1), TabstractObjectReader.ReadSet (1), TabstractObjectReader.ReadStr (1)

2.33.22 TAbstractObjectReader.ReadWideString

Synopsis: Read a widestring value from the stream.

Declaration: function ReadWideString : WideString; Virtual; Abstract

Visibility: public

Description: ReadWideString is called when a widestring-typed value should be read from the stream. This abstract method should be overridden by descendent classes.

See also: TAbstractObjectWriter.WriteString (1)

2.33.23 TAbstractObjectReader.ReadUnicodeString

Synopsis: Read a unicode string value

Declaration: function ReadUnicodeString : UnicodeString; Virtual; Abstract

Visibility: public

Description: ReadUnicodeString should read a UnicodeString value from the stream. (indicated by the vaUString value type).

Descendent classes should override this method to actually read a UnicodeString value.

See also: TBinaryObjectWriter.WriteUnicodeString ([1](#)), TAbstractObjectReader.ReadWideString ([1](#))

2.33.24 TAbstractObjectReader.SkipComponent

Synopsis: Skip till the end of the component.

Declaration: procedure SkipComponent (SkipComponentInfos: Boolean); Virtual
; Abstract

Visibility: public

Description: This method is used to skip the entire declaration of a component in the stream. Each descendent of TAbstractObjectReader should implement this in a way which is optimal for the implemented stream format.

See also: TAbstractObjectReader.BeginComponent ([1](#)), TAbstractObjectReader.SkipValue ([1](#))

2.33.25 TAbstractObjectReader.SkipValue

Synopsis: Skip the current value.

Declaration: procedure SkipValue; Virtual; Abstract

Visibility: public

Description: SkipValue should be used when skipping a value in the stream; The method should determine the type of the value which should be skipped by itself, if this is necessary.

See also: TAbstractObjectReader.SkipComponent ([1](#))

2.34 TAbstractObjectWriter

2.34.1 Description

Abstract driver class for writing component data.

2.34.2 Method overview

Page	Property	Description
251	BeginCollection	Start writing a collection.
251	BeginComponent	Start writing a component
251	BeginList	Start writing a list.
252	BeginProperty	Start writing a property
252	EndList	Mark the end of a list.
252	EndProperty	Marks the end of writing of a property.
252	Write	Write raw data to stream
252	WriteBinary	Writes binary data to the stream.
253	WriteBoolean	Writes a boolean value to the stream.
253	WriteCurrency	Write a currency value to the stream
253	WriteDate	Writes a date type to the stream.
253	WriteFloat	Writes a float value to the stream.
254	WriteIdent	Writes an identifier to the stream.
254	WriteInteger	Writes an integer value to the stream
254	WriteMethodName	Writes a methodname to the stream.
255	WriteSet	Writes a set value to the stream.
253	WriteSingle	Writes a single-type real value to the stream.
255	WriteString	Writes a string value to the stream.
254	WriteUInt64	Write an unsigned 64-bit integer
255	WriteUnicodeString	Write a unicode string to the stream.
254	WriteVariant	Write a variant to the stream
255	WriteWideString	Write a widestring value to the stream

2.34.3 TAbstractObjectWriter.BeginCollection

Synopsis: Start writing a collection.

Declaration: procedure BeginCollection; Virtual; Abstract

Visibility: public

Description: Start writing a collection.

2.34.4 TAbstractObjectWriter.BeginComponent

Synopsis: Start writing a component

Declaration: procedure BeginComponent (Component: TComponent; Flags: TFilerFlags;
ChildPos: Integer); Virtual; Abstract

Visibility: public

Description: Start writing a component

2.34.5 TAbstractObjectWriter.BeginList

Synopsis: Start writing a list.

Declaration: procedure BeginList; Virtual; Abstract

Visibility: public

Description: Start writing a list.

2.34.6 TAbstractObjectWriter.EndList

Synopsis: Mark the end of a list.

Declaration: procedure EndList; Virtual; Abstract

Visibility: public

Description: Mark the end of a list.

2.34.7 TAbstractObjectWriter.BeginProperty

Synopsis: Start writing a property

Declaration: procedure BeginProperty(const PropName: string); Virtual; Abstract

Visibility: public

Description: Start writing a property

2.34.8 TAbstractObjectWriter.EndProperty

Synopsis: Marks the end of writing of a property.

Declaration: procedure EndProperty; Virtual; Abstract

Visibility: public

Description: Marks the end of writing of a property.

2.34.9 TAbstractObjectWriter.Write

Synopsis: Write raw data to stream

Declaration: procedure Write(const Buffer;Count: LongInt); Virtual; Abstract

Visibility: public

Description: Write is introduced for Delphi compatibility to write raw data to the component stream. This should not be used in new production code as it will totally mess up the streaming.

See also: TBinaryObjectWriter.Write ([1](#)), TWriter.Write ([1](#))

2.34.10 TAbstractObjectWriter.WriteBinary

Synopsis: Writes binary data to the stream.

Declaration: procedure WriteBinary(const Buffer;Count: LongInt); Virtual; Abstract

Visibility: public

Description: Writes binary data to the stream.

2.34.11 TAbstractObjectWriter.WriteBoolean

Synopsis: Writes a boolean value to the stream.

Declaration: procedure WriteBoolean(Value: Boolean); Virtual; Abstract

Visibility: public

Description: Writes a boolean value to the stream.

2.34.12 TAbstractObjectWriter.WriteFloat

Synopsis: Writes a float value to the stream.

Declaration: procedure WriteFloat(const Value: Extended); Virtual; Abstract

Visibility: public

Description: Writes a float value to the stream.

2.34.13 TAbstractObjectWriter.WriteSingle

Synopsis: Writes a single-type real value to the stream.

Declaration: procedure WriteSingle(const Value: Single); Virtual; Abstract

Visibility: public

Description: Writes a single-type real value to the stream.

2.34.14 TAbstractObjectWriter.WriteDate

Synopsis: Writes a date type to the stream.

Declaration: procedure WriteDate(const Value: TDateTime); Virtual; Abstract

Visibility: public

Description: Writes a date type to the stream.

2.34.15 TAbstractObjectWriter.WriteCurrency

Synopsis: Write a currency value to the stream

Declaration: procedure WriteCurrency(const Value: Currency); Virtual; Abstract

Visibility: public

Description: WriteCurrency is called when a currency-typed value should be written to the stream. This abstract method should be overridden by descendent classes.

See also: TAbstractObjectReader.ReadCurrency (1)

2.34.16 TAbstractObjectWriter.Writeln

Synopsis: Writes an identifier to the stream.

Declaration: procedure Writeln(const Ident: string); Virtual; Abstract

Visibility: public

Description: Writes an identifier to the stream.

2.34.17 TAbstractObjectWriter.WriteLine

Synopsis: Writes an integer value to the stream

Declaration: procedure WriteLine(Value: Int64); Virtual; Abstract

Visibility: public

Description: Writes an integer value to the stream

2.34.18 TAbstractObjectWriter.WriteUInt64

Synopsis: Write an unsigned 64-bit integer

Declaration: procedure WriteUInt64(Value: QWord); Virtual; Abstract

Visibility: public

Description: WriteUInt64 must be overridden by descendent classes to write a 64-bit unsigned Value (value type vaQWord) to the stream.

Errors: None.

See also: TBinaryObjectWriter.WriteLine ([1](#))

2.34.19 TAbstractObjectWriter.WriteVariant

Synopsis: Write a variant to the stream

Declaration: procedure WriteVariant(const Value: Variant); Virtual; Abstract

Visibility: public

Description: WriteVariant must be overridden by descendent classes to write a simple variant type to the stream. WriteVariant does not write arrays types or complex types.

See also: TBinaryObjectWriter.WriteLine ([1](#))

2.34.20 TAbstractObjectWriter.WriteMethodName

Synopsis: Writes a methodname to the stream.

Declaration: procedure WriteMethodName(const Name: string); Virtual; Abstract

Visibility: public

Description: Writes a methodname to the stream.

2.34.21 TAbstractObjectWriter.WriteSet

Synopsis: Writes a set value to the stream.

Declaration: procedure WriteSet (Value: LongInt; SetType: Pointer); Virtual; Abstract

Visibility: public

Description: Writes a set value to the stream.

2.34.22 TAbstractObjectWriter.WriteString

Synopsis: Writes a string value to the stream.

Declaration: procedure WriteString (const Value: string); Virtual; Abstract

Visibility: public

Description: Writes a string value to the stream.

2.34.23 TAbstractObjectWriter.WriteLineString

Synopsis: Write a widestring value to the stream

Declaration: procedure WriteWideString (const Value: WideString); Virtual; Abstract

Visibility: public

Description: WriteCurrency is called when a currency-typed value should be written to the stream. This abstract method should be overridden by descendent classes.

See also: TAbstractObjectReader.ReadWideString ([1](#))

2.34.24 TAbstractObjectWriter.WriteUnicodeString

Synopsis: Write a unicode string to the stream.

Declaration: procedure WriteUnicodeString (const Value: UnicodeString); Virtual
; Abstract

Visibility: public

Description: WriteUnicodeString must be overridden by descendent classes to write a unicodestring (valuetype vaUString) value to the stream.

See also: TBinaryObjectWriter.WriteUnicodeString ([1](#))

2.35 TBasicAction

2.35.1 Description

TBasicAction implements a basic action class from which all actions are derived. It introduces all basic methods of an action, and implements functionality to maintain a list of clients, i.e. components that are connected with this action.

Do not create instances of TBasicAction. Instead, create a descendent class and create an instance of this class instead.

See also: TBasicActionLink ([259](#)), TComponent ([289](#))

2.35.2 Method overview

Page	Property	Description
256	Create	Creates a new instance of a TBasicAction (255) class.
256	Destroy	Destroys the action.
257	Execute	Triggers the OnExecute (1) event
257	ExecuteTarget	Executes the action on the Target object
256	HandlesTarget	Determines whether Target can be handled by this action
258	RegisterChanges	Registers a new client with the action.
258	UnRegisterChanges	Unregisters a client from the list of clients
258	Update	Triggers the OnUpdate (1) event
257	UpdateTarget	Notify client controls when the action updates itself.

2.35.3 Property overview

Page	Property	Access	Description
258	ActionComponent	rw	Returns the component that initiated the action.
259	OnExecute	rw	Event triggered when the action executes.
259	OnUpdate	rw	Event triggered when the application is idle.

2.35.4 TBasicAction.Create

Synopsis: Creates a new instance of a TBasicAction (255) class.

Declaration: constructor Create (AOwner: TComponent); Override

Visibility: public

Description: Create calls the inherited constructor, and then initializes the list of clients controls (or action lists).

Under normal circumstances it should not be necessary to create a TBasicAction descendent manually, actions are created in an IDE.

See also: Destroy (1), AssignClient (1)

2.35.5 TBasicAction.Destroy

Synopsis: Destroys the action.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroy cleans up the list of client controls and then calls the inherited destructor.

An application programmer should not call Destroy directly; Instead Free should be called, if it needs to be called at all. Normally the controlling class (e.g. a TActionList) will destroy the action.

2.35.6 TBasicAction.HandlesTarget

Synopsis: Determines whether Target can be handled by this action

Declaration: function HandlesTarget (Target: TObject) : Boolean; Virtual

Visibility: public

Description: HandlesTarget returns True if Target is a valid client for this action and if so, if it is in a suitable state to execute the action. An application programmer should never need to call HandlesTarget directly, it will be called by the action itself when needed.

In TBasicAction this method is empty; descendent classes should override this method to implement appropriate checks.

See also: UpdateTarget (1), ExecuteTarget (1)

2.35.7 TBasicAction.UpdateTarget

Synopsis: Notify client controls when the action updates itself.

Declaration: procedure UpdateTarget (Target: TObject); Virtual

Visibility: public

Description: UpdateTarget should update the client control specified by Target when the action updates itself. In TBasicAction, the implementation of UpdateTarget is empty. Descendent classes should override and implement UpdateTarget to actually update the Target object.

An application programmer should never need to call HandlesTarget directly, it will be called by the action itself when needed.

See also: HandlesTarget (1), ExecuteTarget (1)

2.35.8 TBasicAction.ExecuteTarget

Synopsis: Executes the action on the Target object

Declaration: procedure ExecuteTarget (Target: TObject); Virtual

Visibility: public

Description: ExecuteTarget performs the action on the Target object. In TBasicAction this method does nothing. Descendent classes should implement the action to be performed. For instance an action to post data in a dataset could call the Post method of the dataset.

An application programmer should never call ExecuteTarget directly.

See also: HandlesTarget (1), UpdateTarget (1), Execute (1)

2.35.9 TBasicAction.Execute

Synopsis: Triggers the OnExecute (1) event

Declaration: function Execute : Boolean; Dynamic

Visibility: public

Description: Execute triggers the OnExecute event, if one is assigned. It returns True if the event handler was called, False otherwise.

2.35.10 **TBasicAction.RegisterChanges**

Synopsis: Registers a new client with the action.

Declaration: procedure RegisterChanges (Value: TBasicActionLink)

Visibility: public

Description: RegisterChanges adds Value to the list of clients.

See also: UnregisterChanges ([1](#))

2.35.11 **TBasicAction.UnRegisterChanges**

Synopsis: Unregisters a client from the list of clients

Declaration: procedure UnRegisterChanges (Value: TBasicActionLink)

Visibility: public

Description: UnregisterChanges removes Value from the list of clients. This is called for instance when the action is destroyed, or when the client is assigned a new action.

See also: UnregisterChanges ([1](#)), Destroy ([1](#))

2.35.12 **TBasicAction.Update**

Synopsis: Triggers the OnUpdate ([1](#)) event

Declaration: function Update : Boolean; Virtual

Visibility: public

Description: Update triggers the OnUpdate event, if one is assigned. It returns True if the event was triggered, or False if no event was assigned.

Application programmers should never run Update directly. The Update method is called automatically by the action mechanism; Normally this is in the Idle time of an application. An application programmer should assign the OnUpdate ([1](#)) event, and perform any checks in that handler.

See also: OnUpdate ([1](#)), Execute ([1](#)), UpdateTarget ([1](#))

2.35.13 **TBasicAction.ActionComponent**

Synopsis: Returns the component that initiated the action.

Declaration: Property ActionComponent : TComponent

Visibility: public

Access: Read,Write

Description: ActionComponent is set to the component that caused the action to execute, e.g. a toolbutton or a menu item. The property is set just before the action executes, and is reset to nil after the action was executed.

See also: Execute ([1](#)), OnExecute ([1](#))

2.35.14 TBasicAction.OnExecute

Synopsis: Event triggered when the action executes.

Declaration: Property OnExecute : TNotifyEvent

Visibility: public

Access: Read,Write

Description: OnExecute is the event triggered when the action is activated (executed). The event is triggered e.g. when the user clicks e.g. on a menu item or a button associated to the action. The application programmer should provide a OnExecute event handler to execute whatever code is necessary when the button is pressed or the menu item is chosen.

Note that assigning an OnExecute handler will result in the Execute (1) method returning a True value. Predefined actions (such as dataset actions) will check the result of Execute and will not perform their normal task if the OnExecute handler was called.

See also: Execute (1), OnUpdate (1)

2.35.15 TBasicAction.OnUpdate

Synopsis: Event triggered when the application is idle.

Declaration: Property OnUpdate : TNotifyEvent

Visibility: public

Access: Read,Write

Description: OnUpdate is the event triggered when the application is idle, and the action is being updated. The OnUpdate event can be used to set the state of the action, for instance disable it if the action cannot be executed at this point in time.

See also: Update (1), OnExecute (1)

2.36 TBasicActionLink

2.36.1 Description

TBasicActionLink links an Action to its clients. With each client for an action, a TBasicActionLink class is instantiated to handle the communication between the action and the client. It passes events between the action and its clients, and thus presents the action with a uniform interface to the clients.

An application programmer should never use a TBasicActionLink instance directly; They are created automatically when an action is associated with a component. Component programmers should create specialized descendants of TBasicActionLink which communicate changes in the action to the component.

See also: TBasicAction (255)

2.36.2 Method overview

Page	Property	Description
260	Create	Creates a new instance of the TBasicActionLink class
260	Destroy	Destroys the TBasicActionLink instance.
260	Execute	Calls the action's Execute method.
261	Update	Calls the action's Update method

2.36.3 Property overview

Page	Property	Access	Description
261	Action	rw	The action to which the link was assigned.
261	OnChange	rw	Event handler triggered when the action's properties change

2.36.4 TBasicActionLink.Create

Synopsis: Creates a new instance of the TBasicActionLink class

Declaration: constructor Create(AClient: TObject); Virtual

Visibility: public

Description: Create creates a new instance of a TBasicActionLink and assigns AClient as the client of the link.

Application programmers should never instantiate TBasicActionLink classes directly. An instance is created automatically when an action is assigned to a control (client).

Component programmers can override the create constructor to initialize further properties.

See also: Destroy (1)

2.36.5 TBasicActionLink.Destroy

Synopsis: Destroys the TBasicActionLink instance.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroy unregisters the TBasicActionLink with the action, and then calls the inherited destructor.

Application programmers should never call Destroy directly. If a link should be destroyed at all, the Free method should be called instead.

See also: Create (1)

2.36.6 TBasicActionLink.Execute

Synopsis: Calls the action's Execute method.

Declaration: function Execute(AComponent: TComponent) : Boolean; Virtual

Visibility: public

Description: Execute sets the ActionComponent (1) property of the associated Action (1) to AComponent and then calls the Action's execute (1) method. After the action has executed, the ActionComponent property is cleared again.

The return value of the function is the return value of the Action's execute method.

Application programmers should never call Execute directly. This method will be called automatically when the associated control is activated. (e.g. a button is clicked on)

Component programmers should call Execute whenever the action should be activated.

See also: Action (1), TBasicAction.ActionComponent (1), TBasicAction.Execute (1), TBasicAction.onExecute (1)

2.36.7 TBasicActionLink.Update

Synopsis: Calls the action's Update method

Declaration: function Update : Boolean; Virtual

Visibility: public

Description: Update calls the associated Action's Update (1) methoda.

Component programmers can override the Update method to provide additional processing when the Update method occurs.

2.36.8 TBasicActionLink.Action

Synopsis: The action to which the link was assigned.

Declaration: Property Action : TBasicAction

Visibility: public

Access: Read,Write

Description: Action represents the Action (255) which was assigned to the client. Setting this property will unregister the client at the old action (if one existed) and registers the client at the new action.

See also: TBasicAction (255)

2.36.9 TBasicActionLink.OnChange

Synopsis: Event handler triggered when the action's properties change

Declaration: Property OnChange : TNotifyEvent

Visibility: public

Access: Read,Write

Description: OnChange is the event triggered when the action's properties change.

Application programmers should never need to assign this event. Component programmers can assign this event to have a client control reflect any changes in an Action's properties.

See also: Change (1), TBasicAction.Change (1)

2.37 TBinaryObjectReader

2.37.1 Description

The TBinaryObjectReader class reads component data stored in binary form in a file. For this, it overrides or implements all abstract methods from TAbstractObjectReader (243). No new functionality is added by this class, it is a driver class for the streaming system.

It should never be necessary to create an instance of this class directly. Instead, the TStream.WriteComponent (1) call should be used.

See also: TAbstractObjectReader (243), TBinaryObjectWriter (268)

2.37.2 Method overview

Page	Property	Description
263	BeginComponent	Start reading a component.
263	BeginProperty	Start reading a property.
263	BeginRootComponent	Start reading the root component.
262	Create	Creates a new binary data reader instance.
262	Destroy	Destroys the binary data reader.
263	NextValue	Return the type of the next value.
264	Read	Read raw data from stream
264	ReadBinary	Start reading a binary value.
265	ReadCurrency	Read a currency value from the stream.
264	ReadDate	Read a date.
264	ReadFloat	Read a float value
265	ReadIdent	Read an identifier
265	ReadInt16	Read a 16-bits integer.
266	ReadInt32	Read a 32-bits integer.
266	ReadInt64	Read a 64-bits integer.
265	ReadInt8	Read an 8-bits integer.
266	ReadSet	Read a set
264	ReadSingle	Read a single-size float value
266	ReadStr	Read a short string
266	ReadString	Read a string
267	ReadUnicodeString	Read a unicode string value
263	ReadValue	Read the next value in the stream
267	ReadWideString	Read a widestring value from the stream.
267	SkipComponent	Skip a component's data
267	SkipValue	Skip a value's data

2.37.3 TBinaryObjectReader.Create

Synopsis: Creates a new binary data reader instance.

Declaration: constructor Create(Stream: TStream; BufSize: Integer)

Visibility: public

Description: Create instantiates a new binary component data reader. The Stream argument is the stream from which data will be read. The BufSize argument is the size of the internal buffer that will be used by the reader. This can be used to optimize the reading process.

See also: TAbstractObjectReader (243)

2.37.4 TBinaryObjectReader.Destroy

Synopsis: Destroys the binary data reader.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroy frees the buffer allocated when the instance was created. It also positions the stream on the last used position in the stream (the buffering may cause the reader to read more bytes than were actually used.)

See also: TBinaryObjectReader.Create (1)

2.37.5 TBinaryObjectReader.NextValue

Synopsis: Return the type of the next value.

Declaration: function NextValue : TValueType; Override

Visibility: public

Description: `NextValue` returns the type of the next value in a binary stream, but does not read the value.

This method is simply the implementation for a binary stream of the abstract method introduced in [TAbstractObjectReader](#) (243).

2.37.6 TBinaryObjectReader.ReadValue

Synopsis: Read the next value in the stream

Declaration: function ReadValue : TValueType; Override

Visibility: public

Description: `NextValue` reads the next value in a binary stream and returns the type of the read value.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader (243).

2.37.7 TBinaryObjectReader.BeginRootComponent

Synopsis: Start reading the root component.

Declaration: procedure BeginRootComponent(); **Override**

Visibility: public

Description: BeginRootComponent starts reading the root component in a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader (243).

2.37.8 TBinaryObjectReader.BeginComponent

Synopsis: Start reading a component.

Declaration: procedure BeginComponent (var Flags: TFilerFlags; var AChildPos: Integer;
 var CompClassName: string; var CompName: string)
 ; Override

Visibility: public

Description: This method is simply the implementation for a binary stream of the abstract method introduced in [TAbstractObjectReader](#) (243)

2.37.9 TBinaryObjectReader.BeginProperty

Synopsis: Start reading a property.

Declaration: function BeginProperty : string; Override

Visibility: public

Description: This method is simply the implementation for a binary stream of the abstract method introduced in [TAbstractObjectReader](#) (243)

2.37.10 **TBinaryObjectReader.Read**

Synopsis: Read raw data from stream

Declaration: procedure Read(var Buf; Count: LongInt); Override

Visibility: public

Description: Read is introduced for Delphi compatibility to read raw data from the component stream. This should not be used in production code as it will totally mess up the streaming.

See also: TAbstractObjectReader.Read ([1](#)), TReader.Read ([1](#))

2.37.11 **TBinaryObjectReader.ReadBinary**

Synopsis: Start reading a binary value.

Declaration: procedure ReadBinary(const DestData: TMemoryStream); Override

Visibility: public

Description: ReadBinary reads a binary value from a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader ([243](#))

2.37.12 **TBinaryObjectReader.ReadFloat**

Synopsis: Read a float value

Declaration: function ReadFloat : Extended; Override

Visibility: public

Description: ReadFloat reads a float value from a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader ([243](#))

2.37.13 **TBinaryObjectReader.ReadSingle**

Synopsis: Read a single-size float value

Declaration: function ReadSingle : Single; Override

Visibility: public

Description: ReadSingle reads a single-sized float value from a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader ([243](#))

2.37.14 **TBinaryObjectReader.ReadDate**

Synopsis: Read a date.

Declaration: function ReadDate : TDateTime; Override

Visibility: public

Description: ReadDate reads a date value from a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader (243)

2.37.15 **TBinaryObjectReader.ReadCurrency**

Synopsis: Read a currency value from the stream.

Declaration: function ReadCurrency : Currency; Override

Visibility: public

Description: var>ReadCurrency reads a currency-typed value from a binary stream. It is the implementation of the method introduced in TAbstractObjectReader (243).

See also: TAbstractObjectReader.ReadCurrency (1), TBinaryObjectWriter.WriteCurrency (1)

2.37.16 **TBinaryObjectReader.ReadIdent**

Synopsis: Read an identifier

Declaration: function ReadIdent (ValueType: TValueType) : string; Override

Visibility: public

Description: ReadIdent reads an identifier from a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader (243)

2.37.17 **TBinaryObjectReader.ReadInt8**

Synopsis: Read an 8-bits integer.

Declaration: function ReadInt8 : ShortInt; Override

Visibility: public

Description: Read8Int reads an 8-bits signed integer from a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader (243)

2.37.18 **TBinaryObjectReader.ReadInt16**

Synopsis: Read a 16-bits integer.

Declaration: function ReadInt16 : SmallInt; Override

Visibility: public

Description: Read16Int reads a 16-bits signed integer from a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader (243)

2.37.19 **TBinaryObjectReader.ReadInt32**

Synopsis: Read a 32-bits integer.

Declaration: function ReadInt32 : LongInt; Override

Visibility: public

Description: Read32Int reads a 32-bits signed integer from a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader ([243](#))

2.37.20 **TBinaryObjectReader.ReadInt64**

Synopsis: Read a 64-bits integer.

Declaration: function ReadInt64 : Int64; Override

Visibility: public

Description: Read64Int reads a 64-bits signed integer from a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader ([243](#))

2.37.21 **TBinaryObjectReader.ReadSet**

Synopsis: Read a set

Declaration: function ReadSet (EnumType: Pointer) : Integer; Override

Visibility: public

Description: ReadSet reads a set from a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader ([243](#))

2.37.22 **TBinaryObjectReader.ReadStr**

Synopsis: Read a short string

Declaration: function ReadStr : string; Override

Visibility: public

Description: ReadStr reads a short string from a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in TAbstractObjectReader ([243](#))

2.37.23 **TBinaryObjectReader.ReadString**

Synopsis: Read a string

Declaration: function ReadString (StringType: TValueType) : string; Override

Visibility: public

Description: ReadStr reads a string of type `StringType` from a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in `TAbstractObjectReader` ([243](#))

2.37.24 `TBinaryObjectReader.ReadWideString`

Synopsis: Read a widestring value from the stream.

Declaration: `function ReadWideString : WideString; Override`

Visibility: public

Description: `var>ReadWideString` reads a widestring-typed value from a binary stream. It is the implementation of the method introduced in `TAbstractObjectReader` ([243](#)).

See also: `TAbstractObjectReader.ReadWideString` ([1](#)), `TBinaryObjectWriter.WriteWideString` ([1](#))

2.37.25 `TBinaryObjectReader.ReadUnicodeString`

Synopsis: Read a unicode string value

Declaration: `function ReadUnicodeString : UnicodeString; Override`

Visibility: public

Description: `ReadUnicodeString` is overridden by `TBinaryObjectReader` to read a `UnicodeString` value from the binary stream.

See also: `TAbstractObjectReader.ReadUnicodeString` ([1](#))

2.37.26 `TBinaryObjectReader.SkipComponent`

Synopsis: Skip a component's data

Declaration: `procedure SkipComponent(SkipComponentInfos: Boolean); Override`

Visibility: public

Description: `SkipComponent` skips the data of a component in a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in `TAbstractObjectReader` ([243](#)).

2.37.27 `TBinaryObjectReader.SkipValue`

Synopsis: Skip a value's data

Declaration: `procedure SkipValue; Override`

Visibility: public

Description: `SkipComponent` skips the data of the next value in a binary stream.

This method is simply the implementation for a binary stream of the abstract method introduced in `TAbstractObjectReader` ([243](#))

2.38 TBinaryObjectWriter

2.38.1 Description

Driver class which stores component data in binary form.

2.38.2 Method overview

Page	Property	Description
269	BeginCollection	Start writing a collection.
269	BeginComponent	Start writing a component
269	BeginList	Start writing a list.
269	BeginProperty	Start writing a property
268	Create	Creates a new instance of a binary object writer.
268	Destroy	Destroys an instance of the binary object writer.
269	EndList	Mark the end of a list.
269	EndProperty	Marks the end of writing of a property.
270	Write	Write raw data to stream
270	WriteBinary	Writes binary data to the stream.
270	WriteBoolean	Writes a boolean value to the stream.
271	WriteCurrency	Write a currency-valued type to a stream
270	WriteDate	Writes a date type to the stream.
270	WriteFloat	Writes a float value to the stream.
271	WriteIdent	Writes an identifier to the stream.
271	WriteInteger	Writes an integer value to the stream.
271	WriteMethodName	Writes a methodname to the stream.
271	WriteSet	Writes a set value to the stream.
270	WriteSingle	Writes a single-type real value to the stream.
272	WriteStr	
272	WriteString	Writes a string value to the stream.
271	WriteUInt64	Write an unsigned 64-bit integer
272	WriteUnicodeString	Write a unicode string to the stream.
272	WriteVariant	Write a variant to the stream
272	WriteWideString	Write a widestring-valued type to a stream

2.38.3 TBinaryObjectWriter.Create

Synopsis: Creates a new instance of a binary object writer.

Declaration: constructor Create(Stream: TStream; BufSize: Integer)

Visibility: public

Description: Creates a new instance of a binary object writer.

2.38.4 TBinaryObjectWriter.Destroy

Synopsis: Destroys an instance of the binary object writer.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroys an instance of the binary object writer.

2.38.5 `TBinaryObjectWriter.BeginCollection`

Synopsis: Start writing a collection.

Declaration: procedure BeginCollection; Override

Visibility: public

2.38.6 `TBinaryObjectWriter.BeginComponent`

Synopsis: Start writing a component

Declaration: procedure BeginComponent (Component: TComponent; Flags: TFilerFlags;
ChildPos: Integer); Override

Visibility: public

2.38.7 `TBinaryObjectWriter.BeginList`

Synopsis: Start writing a list.

Declaration: procedure BeginList; Override

Visibility: public

2.38.8 `TBinaryObjectWriter.EndList`

Synopsis: Mark the end of a list.

Declaration: procedure EndList; Override

Visibility: public

2.38.9 `TBinaryObjectWriter.BeginProperty`

Synopsis: Start writing a property

Declaration: procedure BeginProperty (const PropName: string); Override

Visibility: public

2.38.10 `TBinaryObjectWriter.EndProperty`

Synopsis: Marks the end of writing a property.

Declaration: procedure EndProperty; Override

Visibility: public

2.38.11 TBinaryObjectWriter.Write

Synopsis: Write raw data to stream

Declaration: procedure Write(const Buffer;Count: LongInt); Override

Visibility: public

Description: Write is introduced for Delphi compatibility to write raw data to the component stream. This should not be used in new production code as it will totally mess up the streaming.

See also: TAbstractObjectWriter.Write ([1](#)), TWriter.Write ([1](#))

2.38.12 TBinaryObjectWriter.WriteBinary

Synopsis: Writes binary data to the stream.

Declaration: procedure WriteBinary(const Buffer;Count: LongInt); Override

Visibility: public

2.38.13 TBinaryObjectWriter.WriteBoolean

Synopsis: Writes a boolean value to the stream.

Declaration: procedure WriteBoolean(Value: Boolean); Override

Visibility: public

2.38.14 TBinaryObjectWriter.WriteFloat

Synopsis: Writes a float value to the stream.

Declaration: procedure WriteFloat(const Value: Extended); Override

Visibility: public

2.38.15 TBinaryObjectWriter.WriteSingle

Synopsis: Writes a single-type real value to the stream.

Declaration: procedure WriteSingle(const Value: Single); Override

Visibility: public

2.38.16 TBinaryObjectWriter.WriteDate

Synopsis: Writes a date type to the stream.

Declaration: procedure WriteDate(const Value: TDateTime); Override

Visibility: public

2.38.17 `TBinaryObjectWriter`.`WriteCurrency`

Synopsis: Write a currency-valued type to a stream

Declaration: `procedure WriteCurrency(const Value: Currency); Override`

Visibility: public

Description: `WriteCurrency` writes a currency-typed value to a binary stream. It is the implementation of the method introduced in `TAbstractObjectWriter` (250).

See also: `TAbstractObjectWriter`.`WriteCurrency` (1)

2.38.18 `TBinaryObjectWriter`.`WriteIdent`

Synopsis: Writes an identifier to the stream.

Declaration: `procedure WriteIdent(const Ident: string); Override`

Visibility: public

2.38.19 `TBinaryObjectWriter`.`WriteInteger`

Synopsis: Writes an integer value to the stream.

Declaration: `procedure WriteInteger(Value: Int64); Override`

Visibility: public

2.38.20 `TBinaryObjectWriter`.`WriteUInt64`

Synopsis: Write an unsigned 64-bit integer

Declaration: `procedure WriteUInt64(Value: QWord); Override`

Visibility: public

Description: `WriteUInt64` is overridden by `TBinaryObjectWriter` to write an unsigned 64-bit integer (QWord) to the stream. It tries to use the smallest possible storage for the value that is passed. (largest valuetype will be vaQWord).

See also: `TAbstractObjectWriter`.`WriteUInt64` (1)

2.38.21 `TBinaryObjectWriter`.`WriteMethodName`

Synopsis: Writes a methodname to the stream.

Declaration: `procedure WriteMethodName(const Name: string); Override`

Visibility: public

2.38.22 `TBinaryObjectWriter`.`WriteSet`

Synopsis: Writes a set value to the stream.

Declaration: `procedure WriteSet(Value: LongInt; SetType: Pointer); Override`

Visibility: public

2.38.23 **TBinaryObjectWriter.WriteString**

Declaration: procedure WriteStr(const Value: string)

Visibility: public

2.38.24 **TBinaryObjectWriter.WriteString**

Synopsis: Writes a string value to the stream.

Declaration: procedure WriteString(const Value: string); Override

Visibility: public

2.38.25 **TBinaryObjectWriter.WriteWideString**

Synopsis: Write a widestring-valued type to a stream

Declaration: procedure WriteWideString(const Value: WideString); Override

Visibility: public

Description: WriteWideString writes a widestring-typed value to a binary stream. It is the implementation of the method introduced in TAbstractObjectWriter (250).

See also: TAbstractObjectWriter.WriteWideString (1)

2.38.26 **TBinaryObjectWriter.WriteUnicodeString**

Synopsis: Write a unicode string to the stream.

Declaration: procedure WriteUnicodeString(const Value: UnicodeString); Override

Visibility: public

Description: WriteUnicodeString is overridden by TBinaryObjectWriter to write a unicodestring (valuetype vaUString) value to the stream. It simply writes the character length and then all widecharacters.

See also: TAbstractObjectWriter.WriteUnicodeString (1)

2.38.27 **TBinaryObjectWriter.WriteVariant**

Synopsis: Write a variant to the stream

Declaration: procedure WriteVariant(const VarValue: Variant); Override

Visibility: public

Description: WriteVariant is overridden by TBinaryObjectWriter to write a simple variant type to the stream. WriteVariant does not write arrays types or complex types. Only null, integer (ordinal) float and string types are written.

Errors: If a non-supported type is written, then an EWriteError exception is.

2.39 TBits

2.39.1 Description

TBits can be used to store collections of bits in an indexed array. This is especially useful for storing collections of booleans: Normally the size of a boolean is the size of the smallest enumerated type, i.e. 1 byte. Since a bit can take 2 values it can be used to store a boolean as well. Since TBits can store 8 bits in a byte, it takes 8 times less space to store an array of booleans in a TBits class than it would take to store them in a conventional array.

TBits introduces methods to store and retrieve bit values, apply masks, and search for bits.

2.39.2 Method overview

Page	Property	Description
275	AndBits	Performs an and operation on the bits.
274	Clear	Clears a particular bit.
275	Clearall	Clears all bits in the array.
273	Create	Creates a new bits collection.
274	Destroy	Destroys a bit collection
277	Equals	Determines whether the bits of 2 arrays are equal.
277	FindFirstBit	Find first bit with a particular value
278	FindNextBit	Searches the next bit with a particular value.
278	FindPrevBit	Searches the previous bit with a particular value.
276	Get	Retrieve the value of a particular bit
274	GetFSize	Returns the number of records used to store the bits.
276	Grow	Expands the bits array to the requested size.
276	NotBits	Performs a not operation on the bits.
278	OpenBit	Returns the position of the first bit that is set to False.
275	OrBits	Performs an or operation on the bits.
277	SetIndex	Sets the start position for FindNextBit (1) and FindPrevBit (1)
274	SetOn	Turn a particular bit on.
275	XorBits	Performs a xor operation on the bits.

2.39.3 Property overview

Page	Property	Access	Description
279	Bits	rw	Access to all bits in the array.
279	Size	rw	Current size of the array of bits.

2.39.4 TBits.Create

Synopsis: Creates a new bits collection.

Declaration: constructor Create(TheSize: LongInt); Virtual

Visibility: public

Description: Create creates a new bit collection with initial size TheSize. The size of the collection can be changed later on.

All bits are initially set to zero.

See also: Destroy ([1](#))

2.39.5 TBits.Destroy

Synopsis: Destroys a bit collection

Declaration: `destructor Destroy; Override`

Visibility: public

Description: `Destroy` destroys a previously created bit collection and releases all memory used to store the bit collection.

`Destroy` should never be called directly, `Free` should be used instead.

Errors: None.

See also: Create ([1](#))

2.39.6 TBits.GetFSize

Synopsis: Returns the number of records used to store the bits.

Declaration: `function GetFSize : LongInt`

Visibility: public

Description: `GetFSize` returns the number of records used to store the current number of bits.

Errors: None.

See also: Size ([1](#))

2.39.7 TBits.SetOn

Synopsis: Turn a particular bit on.

Declaration: `procedure SetOn(Bit: LongInt)`

Visibility: public

Description: `SetOn` turns on the bit at position `bit`, i.e. sets it to 1. If `bit` is at a position bigger than the current size, the collection is expanded to the required size using `Grow` ([1](#)).

Errors: If `bit` is larger than the maximum allowed bits array size or is negative, an `EBitsError` ([228](#)) exception is raised.

See also: Bits ([1](#)), Clear ([1](#))

2.39.8 TBits.Clear

Synopsis: Clears a particular bit.

Declaration: `procedure Clear(Bit: LongInt)`

Visibility: public

Description: `Clear` clears the bit at position `bit`. If the array If `bit` is at a position bigger than the current size, the collection is expanded to the required size using `Grow` ([1](#)).

Errors: If `bit` is larger than the maximum allowed bits array size or is negative, an `EBitsError` ([228](#)) exception is raised.

See also: Bits ([1](#)), seton ([1](#))

2.39.9 TBits.Clearall

Synopsis: Clears all bits in the array.

Declaration: procedure Clearall

Visibility: public

Description: ClearAll clears all bits in the array, i.e. sets them to zero. ClearAll works faster than clearing all individual bits, since it uses the packed nature of the bits.

Errors: None.

See also: Bits ([1](#)), clear ([1](#))

2.39.10 TBits.AndBits

Synopsis: Performs an and operation on the bits.

Declaration: procedure AndBits(BitSet: TBits)

Visibility: public

Description: andbits performs an and operation on the bits in the array with the bits of array BitSet. If BitSet contains less bits than the current array, then all bits which have no counterpart in BitSet are cleared.

Errors: None.

See also: ClearAll ([1](#)), OrBits ([1](#)), XOrBits ([1](#)), NotBits ([1](#))

2.39.11 TBits.OrBits

Synopsis: Performs an or operation on the bits.

Declaration: procedure OrBits(BitSet: TBits)

Visibility: public

Description: andbits performs an or operation on the bits in the array with the bits of array BitSet.

If BitSet contains less bits than the current array, then all bits which have no counterpart in BitSet are left untouched.

If the current array contains less bits than BitSet then it is grown to the size of BitSet before the or operation is performed.

Errors: None.

See also: ClearAll ([1](#)), andBits ([1](#)), XOrBits ([1](#)), NotBits ([1](#))

2.39.12 TBits.XorBits

Synopsis: Performs a xor operation on the bits.

Declaration: procedure XorBits(BitSet: TBits)

Visibility: public

Description: `XorBits` performs a `xor` operation on the bits in the array with the bits of array `BitSet`.

If `BitSet` contains less bits than the current array, then all bits which have no counterpart in `BitSet` are left untouched.

If the current array contains less bits than `BitSet` then it is grown to the size of `BitSet` before the `xor` operation is performed.

Errors: None.

See also: [ClearAll \(1\)](#), [andBits \(1\)](#), [OrBits \(1\)](#), [NotBits \(1\)](#)

2.39.13 TBits.NotBits

Synopsis: Performs a `not` operation on the bits.

Declaration: `procedure NotBits(BitSet: TBits)`

Visibility: public

Description: `NotBits` performs a `not` operation on the bits in the array with the bits of array `Bitset`.

If `BitSet` contains less bits than the current array, then all bits which have no counterpart in `BitSet` are left untouched.

Errors: None.

See also: [ClearAll \(1\)](#), [andBits \(1\)](#), [OrBits \(1\)](#), [XOrBits \(1\)](#)

2.39.14 TBits.Get

Synopsis: Retrieve the value of a particular bit

Declaration: `function Get(Bit: LongInt) : Boolean`

Visibility: public

Description: `Get` returns `True` if the bit at position `bit` is set, or `False` if it is not set.

Errors: If `bit` is not a valid bit index then an `EBitsError` (228) exception is raised.

See also: [Bits \(1\)](#), [FindFirstBit \(1\)](#), [seton \(1\)](#)

2.39.15 TBits.Grow

Synopsis: Expands the bits array to the requested size.

Declaration: `procedure Grow(NBit: LongInt)`

Visibility: public

Description: `Grow` expands the bit array so it can at least contain `nbit` bits. If `nbit` is less than the current size, nothing happens.

Errors: If there is not enough memory to complete the operation, then an `EBitsError` (228) is raised.

See also: [Size \(1\)](#)

2.39.16 TBits.Equals

Synopsis: Determines whether the bits of 2 arrays are equal.

Declaration: function Equals(Obj: TObject) : Boolean; Override; Overload
 function Equals(BitSet: TBits) : Boolean; Overload

Visibility: public

Description: equals returns True if all the bits in BitSet are the same as the ones in the current BitSet; if not, False is returned.

If the sizes of the two BitSets are different, the arrays are still reported equal when all the bits in the larger set, which are not present in the smaller set, are zero.

Errors: None.

See also: ClearAll (1), andBits (1), OrBits (1), XOrBits (1)

2.39.17 TBits.SetIndex

Synopsis: Sets the start position for FindNextBit (1) and FindPrevBit (1)

Declaration: procedure SetIndex(Index: LongInt)

Visibility: public

Description: SetIndex sets the search start position forFindNextBit (1) and FindPrevBit (1) to Index. This means that these calls will start searching from position Index.

This mechanism provides an alternative to FindFirstBit (1) which can also be used to position for the FindNextBit and FindPrevBit calls.

Errors: None.

See also: FindNextBit (1), FindPrevBit (1), FindFirstBit (1), OpenBit (1)

2.39.18 TBits.FindFirstBit

Synopsis: Find first bit with a particular value

Declaration: function FindFirstBit(State: Boolean) : LongInt

Visibility: public

Description: FindFirstBit searches for the first bit with value State. It returns the position of this bit, or -1 if no such bit was found.

The search starts at position 0 in the array. If the first search returned a positive result, the found position is saved, and the FindNextBit (1) and FindPrevBit (1) will use this position to resume the search. To start a search from a certain position, the start position can be set with the SetIndex (1) instead.

Errors: None.

See also: FindNextBit (1), FindPrevBit (1), OpenBit (1), SetIndex (1)

2.39.19 **TBits.FindNextBit**

Synopsis: Searches the next bit with a particular value.

Declaration: function FindNextBit : LongInt

Visibility: public

Description: FindNextBit resumes a previously started search. It searches for the next bit with the value specified in the FindFirstBit (1). The search is done towards the end of the array and starts at the position last reported by one of the Find calls or at the position set with SetIndex (1).

If another bit with the same value is found, its position is returned. If no more bits with the same value are present in the array, -1 is returned.

Errors: None.

See also: FindFirstBit (1), FindPrevBit (1), OpenBit (1), SetIndex (1)

2.39.20 **TBits.FindPrevBit**

Synopsis: Searches the previous bit with a particular value.

Declaration: function FindPrevBit : LongInt

Visibility: public

Description: FindPrevBit resumes a previously started search. It searches for the previous bit with the value specified in the FindFirstBit (1). The search is done towards the beginning of the array and starts at the position last reported by one of the Find calls or at the position set with SetIndex (1).

If another bit with the same value is found, its position is returned. If no more bits with the same value are present in the array, -1 is returned.

Errors: None.

See also: FindFirstBit (1), FindNextBit (1), OpenBit (1), SetIndex (1)

2.39.21 **TBits.OpenBit**

Synopsis: Returns the position of the first bit that is set to False.

Declaration: function OpenBit : LongInt

Visibility: public

Description: OpenBit returns the position of the first bit whose value is 0 (False), or -1 if no open bit was found. This call is equivalent to FindFirstBit(False), except that it doesn't set the position for the next searches.

Errors: None.

See also: FindNextBit (1), FindPrevBit (1), FindFirstBit (1), SetIndex (1)

2.39.22 TBits.Bits

Synopsis: Access to all bits in the array.

Declaration: Property Bits[Bit: LongInt]: Boolean; default

Visibility: public

Access: Read,Write

Description: Bits allows indexed access to all of the bits in the array. It gives True if the bit is 1, False otherwise; Assigning to this property will set, respectively clear the bit.

Errors: If an index is specified which is out of the allowed range then an EBitsError (228) exception is raised.

See also: Size (1)

2.39.23 TBits.Size

Synopsis: Current size of the array of bits.

Declaration: Property Size : LongInt

Visibility: public

Access: Read,Write

Description: Size is the current size of the bit array. Setting this property will adjust the size; this is equivalent to calling Grow(Value-1)

Errors: If an invalid size (negative or too large) is specified, a EBitsError (228) exception is raised.

See also: Bits (1)

2.40 TBytesStream

2.40.1 Method overview

Page	Property	Description
279	Create	

2.40.2 Property overview

Page	Property	Access	Description
280	Bytes	r	

2.40.3 TBytesStream.Create

Declaration: constructor Create(const ABytes: TBytes); Overload

Visibility: public

2.40.4 TBytesStream.Bytes

Declaration: Property Bytes : TBytes

Visibility: public

Access: Read

2.41 TCollection

2.41.1 Description

TCollection implements functionality to manage a collection of named objects. Each of these objects needs to be a descendent of the TCollectionItem (287) class. Exactly which type of object is managed can be seen from the TCollection.ItemClass (1) property.

Normally, no TCollection is created directly. Instead, a descendants of TCollection and TCollectionItem (287) are created as a pair.

See also: TCollectionItem (287)

2.41.2 Method overview

Page	Property	Description
281	Add	Creates and adds a new item to the collection.
281	Assign	Assigns one collection to another.
282	BeginUpdate	Start an update batch.
282	Clear	Removes all items from the collection.
280	Create	Creates a new collection.
283	Delete	Delete an item from the collection.
281	Destroy	Destroys the collection and frees all the objects it manages.
282	EndUpdate	Ends an update batch.
284	Exchange	Exchange 2 items in the collection
284	FindItemID	Searches for an Item in the collection, based on its TCollectionItem.ID (1) property.
283	GetEnumerator	Create an IEnumator instance
283	GetNamePath	Overrides TPersistent.GetNamePath (1) to return a proper pathname.
283	Insert	Insert an item in the collection.
281	Owner	Owner of the collection.
284	Sort	Sort the items in the collection

2.41.3 Property overview

Page	Property	Access	Description
284	Count	r	Number of items in the collection.
285	ItemClass	r	Class pointer for each item in the collection.
285	Items	rw	Indexed array of items in the collection.

2.41.4 TCollection.Create

Synopsis: Creates a new collection.

Declaration: constructor Create (AItemClass: TCollectionItemClass)

Visibility: public

Description: Create instantiates a new instance of the TCollection class which will manage objects of class AItemClass. It creates the list used to hold all objects, and stores the AItemClass for the adding of new objects to the collection.

See also: TCollection.ItemClass (1), TCollection.Destroy (1)

2.41.5 TCollection.Destroy

Synopsis: Destroys the collection and frees all the objects it manages.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroy first clears the collection, and then frees all memory allocated to this instance.

Don't call Destroy directly, call Free instead.

See also: TCollection.Create (1)

2.41.6 TCollection.Owner

Synopsis: Owner of the collection.

Declaration: function Owner : TPersistent

Visibility: public

Description: Owner returns a reference to the owner of the collection. This property is required by the object inspector to be able to show the collection.

2.41.7 TCollection.Add

Synopsis: Creates and adds a new item to the collection.

Declaration: function Add : TCollectionItem

Visibility: public

Description: Add instantiates a new item of class TCollection.ItemClass (1) and adds it to the list. The newly created object is returned.

See also: TCollection.ItemClass (1), TCollection.Clear (1)

2.41.8 TCollection.Assign

Synopsis: Assigns one collection to another.

Declaration: procedure Assign(Source: TPersistent); Override

Visibility: public

Description: Assign assigns the contents of one collection to another. It does this by clearing the items list, and adding as much elements as there are in the Source collection; it assigns to each created element the contents of its counterpart in the Source element.

Two collections cannot be assigned to each other if instances of the ItemClass classes cannot be assigned to each other.

Errors: If the objects in the collections cannot be assigned to one another, then an `EConvertError` is raised.

See also: `TPersistent.Assign` (1), `TCollectionItem` (287)

2.41.9 `TCollection.BeginUpdate`

Synopsis: Start an update batch.

Declaration: `procedure BeginUpdate; Virtual`

Visibility: public

Description: `BeginUpdate` is called at the beginning of a batch update. It raises the update count with 1.

Call `BeginUpdate` at the beginning of a series of operations that will change the state of the collection. This will avoid the call to `TCollection.Update` (1) for each operation. At the end of the operations, a corresponding call to `EndUpdate` must be made. It is best to do this in the context of a `Try ... finally` block:

```
With MyCollection Do
  try
    BeginUpdate;
    // Some Lengthy operations
  finally
    EndUpdate;
  end;
```

This insures that the number of calls to `BeginUpdate` always matches the number of calls to `TCollection.EndUpdate` (1), even in case of an exception.

See also: `TCollection.EndUpdate` (1), `TCollection.Changed` (1), `TCollection.Update` (1)

2.41.10 `TCollection.Clear`

Synopsis: Removes all items from the collection.

Declaration: `procedure Clear`

Visibility: public

Description: `Clear` will clear the collection, i.e. each item in the collection is destroyed and removed from memory. After a call to `Clear`, `Count` is zero.

See also: `TCollection.Add` (1), `TCollectionItem.Destroy` (1), `TCollection.Destroy` (1)

2.41.11 `TCollection.EndUpdate`

Synopsis: Ends an update batch.

Declaration: `procedure EndUpdate; Virtual`

Visibility: public

Description: `EndUpdate` signals the end of a series of operations that change the state of the collection, possibly triggering an update event. It does this by decreasing the update count with 1 and calling `TCollection.Changed` (1) it should always be used in conjunction with `TCollection.BeginUpdate` (1), preferably in the `Finally` section of a `Try ... Finally` block.

See also: `TCollection.BeginUpdate` (1), `TCollection.Changed` (1), `TCollection.Update` (1)

2.41.12 TCollection.Delete

Synopsis: Delete an item from the collection.

Declaration: procedure Delete(Index: Integer)

Visibility: public

Description: Delete deletes the item at (zero based) position Index from the collection. This will result in a cnDeleted notification.

Errors: If an invalid index is specified, an EListError exception is raised.

See also: TCollection.Items (1), TCollection.Insert (1), TCollection.Clear (1)

2.41.13 TCollection.GetEnumerator

Synopsis: Create an IEnumator instance

Declaration: function GetEnumerator : TCollectionEnumerator

Visibility: public

Description: GetEnumerator is the implementation of the IEnumerable (1432) interface for TCollection. It creates a TCollectionEnumerator (285) instance and returns its IEnumator (1432) interface.

See also: TCollectionEnumerator (285), IEnumator (1432), IEnumerable (1432)

2.41.14 TCollection.GetNamePath

Synopsis: Overrides TPersistent.GetNamePath (1) to return a proper pathname.

Declaration: function GetNamePath : string; Override

Visibility: public

Description: GetNamePath returns the name path for this collection. If the following conditions are satisfied:

1. There is an owner object.
2. The owner object returns a non-empty name path.
3. The TCollection.Propname (1) property is not empty

collection has an owner and the owning object has a name, then the function returns the owner name, followed by the propname. If one of the conditions is not satisfied, then the classname is returned.

See also: TCollection.GetOwner (1), TCollection.Propname (1)

2.41.15 TCollection.Insert

Synopsis: Insert an item in the collection.

Declaration: function Insert(Index: Integer) : TCollectionItem

Visibility: public

Description: Insert creates a new item instance and inserts it in the collection at position Index, and returns the new instance.

In contrast, TCollection.Add (1) adds a new item at the end.

Errors: None.

See also: TCollection.Add (1), TCollection.Delete (1), TCollection.Items (1)

2.41.16 TCollection.FindItemID

Synopsis: Searches for an Item in the collection, based on its TCollectionItem.ID (1) property.

Declaration: function FindItemID (ID: Integer) : TCollectionItem

Visibility: public

Description: FindItemID searches through the collection for the item that has a value of ID for its TCollectionItem.ID (1) property, and returns the found item. If no such item is found in the collection, Nil is returned.

The routine performs a linear search, so this can be slow on very large collections.

See also: TCollection.Items (1), TCollectionItem.ID (1)

2.41.17 TCollection.Exchange

Synopsis: Exchange 2 items in the collection

Declaration: procedure Exchange (const Index1: Integer; const index2: Integer)

Visibility: public

Description: Exchange exchanges the items at indexes Index1 and Index2 in the collection.

Errors: If one of the two indexes is invalid (less than zero or larger than the number of items) an EListError exception is raised.

See also: Items (1), TCollectionItem.Index (1)

2.41.18 TCollection.Sort

Synopsis: Sort the items in the collection

Declaration: procedure Sort (const Compare: TCollectionSortCompare)

Visibility: public

Description: Sort sorts the items in the collection, and uses the Compare procedure to compare 2 items in the collection. It is more efficient do use this method than to perform the sort manually, because the list items are manipulated directly.

For more information on how the Compare function should behave, see the TCollectionSortCompare (202) type.

See also: TCollectionSortCompare (202)

2.41.19 TCollection.Count

Synopsis: Number of items in the collection.

Declaration: Property Count : Integer

Visibility: public

Access: Read

Description: Count contains the number of items in the collection.

Remark: The items in the collection are identified by their TCollectionItem.Index (1) property, which is a zero-based index, meaning that it can take values between 0 and Count - 1, borders included.

See also: TCollectionItem.Index (1), TCollection.Items (1)

2.41.20 TCollection.ItemClass

Synopsis: Class pointer for each item in the collection.

Declaration: Property ItemClass : TCollectionItemClass

Visibility: public

Access: Read

Description: ItemClass is the class pointer with which each new item in the collection is created. It is the value that was passed to the collection's constructor when it was created, and does not change during the lifetime of the collection.

See also: TCollectionItem (287), TCollection.Items (1)

2.41.21 TCollection.Items

Synopsis: Indexed array of items in the collection.

Declaration: Property Items[Index: Integer] : TCollectionItem

Visibility: public

Access: Read,Write

Description: Items provides indexed access to the items in the collection. Since the array is zero-based, Index should be an integer between 0 and Count-1.

It is possible to set or retrieve an element in the array. When setting an element of the array, the object that is assigned should be compatible with the class of the objects in the collection, as given by the TCollection.ItemClass (1) property.

Adding an element to the array can be done with the TCollection.Add (1) method. The array can be cleared with the TCollection.Clear (1) method. Removing an element of the array should be done by freeing that element.

See also: TCollection.Count (1), TCollection.ItemClass (1), TCollection.Clear (1), TCollection.Add (1)

2.42 TCollectionEnumerator

2.42.1 Description

TCollectionEnumerator implements the #rtl.system.IEnumerator (1432) interface for the TCollection (280) class, so the TCollection class can be used in a `for ... in` loop. It is returned by the TCollection.GetEnumerator (1) method of TCollection.

See also: TCollection (280), TCollection.GetEnumerator (1), #rtl.system.IEnumerator (1432)

2.42.2 Method overview

Page	Property	Description
286	Create	Initialize a new instance of TCollectionEnumerator
286	GetCurrent	Return the current pointer in the list
286	MoveNext	Move the position of the enumerator to the next position in the collection.

2.42.3 Property overview

Page	Property	Access	Description
286	Current	r	Current pointer in the list

2.42.4 TCollectionEnumerator.Create

Synopsis: Initialize a new instance of TCollectionEnumerator

Declaration: constructor Create (ACollection: TCollection)

Visibility: public

Description: Create initializes a new instance of TCollectionEnumerator and keeps a reference to the collection ACollection that will be enumerated.

See also: TCollection ([280](#))

2.42.5 TCollectionEnumerator.GetCurrent

Synopsis: Return the current pointer in the list

Declaration: function GetCurrent : TCollectionItem

Visibility: public

Description: GetCurrent returns the current TCollectionItem ([287](#)) instance in the enumerator.

Errors: No checking is done on the validity of the current position.

See also: MoveNext ([1](#)), TCollectionItem ([287](#))

2.42.6 TCollectionEnumerator.MoveNext

Synopsis: Move the position of the enumerator to the next position in the collection.

Declaration: function MoveNext : Boolean

Visibility: public

Description: MoveNext puts the pointer on the next item in the collection, and returns True if this succeeded, or False if the pointer is past the last element in the list.

Errors: Note that if False is returned, calling GetCurrent will result in an exception.

See also: GetCurrent ([1](#))

2.42.7 TCollectionEnumerator.Current

Synopsis: Current pointer in the list

Declaration: Property Current : TCollectionItem

Visibility: public

Access: Read

Description: Current redefines GetCurrent ([1](#)) as a property.

See also: GetCurrent ([1](#))

2.43 TCollectionItem

2.43.1 Description

TCollectionItem and TCollection (280) form a pair of base classes that manage a collection of named objects. The TCollectionItem is the named object that is managed, it represents one item in the collection. An item in the collection is represented by three properties: TCollectionItem.DisplayName (1), TCollection.Index (1) and TCollectionItem.ID (1).

A TCollectionItem object is never created directly. To manage a set of named items, it is necessary to make a descendent of TCollectionItem to which needed properties and methods are added. This descendant can then be managed with a TCollection (280) class. The managing collection will create and destroy its items by itself, it should therefore never be necessary to create TCollectionItem descendants manually.

See also: TCollection (280)

2.43.2 Method overview

Page	Property	Description
287	Create	Creates a new instance of this collection item.
287	Destroy	Destroys this collection item.
288	GetNamePath	Returns the namepath of this collection item.

2.43.3 Property overview

Page	Property	Access	Description
288	Collection	rw	Pointer to the collection managing this item.
289	DisplayName	rw	Name of the item, displayed in the object inspector.
288	ID	r	Initial index of this item.
289	Index	rw	Index of the item in its managing collection TCollection.Items (1) property.

2.43.4 TCollectionItem.Create

Synopsis: Creates a new instance of this collection item.

Declaration: constructor Create(ACollection: TCollection); Virtual

Visibility: public

Description: Create instantiates a new item in a TCollection (280). It is called by the TCollection.Add (1) function and should under normal circumstances never be called directly. called

See also: TCollectionItem.Destroy (1)

2.43.5 TCollectionItem.Destroy

Synopsis: Destroys this collection item.

Declaration: destructor Destroy; Override

Visibility: public

Description: `Destroy` removes the item from the managing collection and Destroys the item instance.

This is the only way to remove items from a collection;

See also: `TCollectionItem.Create` (1)

2.43.6 **TCollectionItem.GetNamePath**

Synopsis: Returns the namepath of this collection item.

Declaration: `function GetNamePath : string; Override`

Visibility: public

Description: `GetNamePath` overrides the `TPersistent.GetNamePath` (1) method to return the name of the managing collection and appends its `TCollectionItem.Index` (1) property.

See also: `TCollectionItem.Collection` (1), `TPersistent.GetNamePath` (1), `TCollectionItem.Index` (1)

2.43.7 **TCollectionItem.Collection**

Synopsis: Pointer to the collection managing this item.

Declaration: `Property Collection : TCollection`

Visibility: public

Access: Read,Write

Description: `Collection` points to the collection managing this item. This property can be set to point to a new collection. If this is done, the old collection will be notified that the item should no longer be managed, and the new collection is notified that it should manage this item as well.

See also: `TCollection` (280)

2.43.8 **TCollectionItem.ID**

Synopsis: Initial index of this item.

Declaration: `Property ID : Integer`

Visibility: public

Access: Read

Description: `ID` is the initial value of `TCollectionItem.Index` (1); it doesn't change after the index changes. It can be used to uniquely identify the item. The `ID` property doesn't change as items are added and removed from the collection.

While the `TCollectionItem.Index` (1) property forms a continuous series, `ID` does not. If items are removed from the collection, their `ID` is not used again, leaving gaps. Only when the collection is initially created, the `ID` and `Index` properties will be equal.

See also: `TCollection.Items` (1), `TCollectionItem.Index` (1)

2.43.9 TCollectionItem.Index

Synopsis: Index of the item in its managing collection TCollection.Items (1) property.

Declaration: Property Index : Integer

Visibility: public

Access: Read,Write

Description: Index is the current index of the item in its managing collection's TCollection.Items (1) property.

This property may change as items are added and removed from the collection.

The index of an item is zero-based, i.e. the first item has index zero. The last item has index Count-1 where Count is the number of items in the collection.

The Index property of the items in a collection form a continuous series ranging from 0 to Count-1. The TCollectionItem.ID (1) property does not form a continuous series, but can also be used to identify an item.

See also: TCollectionItem.ID (1), TCollection.Items (1)

2.43.10 TCollectionItem.DisplayName

Synopsis: Name of the item, displayed in the object inspector.

Declaration: Property DisplayName : string

Visibility: public

Access: Read,Write

Description: DisplayName contains the name of this item as shown in the object inspector. For TCollectionItem this returns always the class name of the managing collection, followed by the index of the item.

TCollectionItem does not implement any functionality to store the DisplayName property. The property can be set, but this will have no effect other than that the managing collection is notified of a change. The actual displayname will remain unchanged. To store the DisplayName property, TCollectionItem descendants should override the TCollectionItem.SetDisplayName (1) and TCollectionItem.GetDisplayName (1) to add storage functionality.

See also: TCollectionItem.Index (1), TCollectionItem.ID (1), TCollectionItem.GetDisplayName (1), TCollectionItem.SetDisplayName (1)

2.44 TComponent

2.44.1 Description

TComponent is the base class for any set of classes that needs owner-owned functionality, and which needs support for property streaming. All classes that should be handled by an IDE (Integrated Development Environment) must descend from TComponent, as it includes all support for streaming all its published properties.

Components can 'own' other components. TComponent introduces methods for enumerating the child components. It also allows to name the owned components with a unique name. Furthermore, functionality for sending notifications when a component is removed from the list or removed from memory altogether is also introduced in TComponent

TComponent introduces a form of automatic memory management: When a component is destroyed, all its child components will be destroyed first.

2.44.2 Interfaces overview

Page	Property	Description
233	IInterfaceComponentReference	Interface for checking component references
1434	IUnknown	Basic interface for all COM-based interfaces

2.44.3 Method overview

Page	Property	Description
291	BeforeDestruction	Overrides standard BeforeDestruction.
291	Create	Creates a new instance of the component.
291	Destroy	Destroys the instance of the component.
292	DestroyComponents	Destroy child components.
292	Destroying	Called when the component is being destroyed
292	ExecuteAction	Standard action execution method.
292	FindComponent	Finds and returns the named component in the owned components.
293	FreeNotification	Ask the component to notify called when it is being destroyed.
293	FreeOnRelease	Part of the IVCLComObject interface.
293	GetEnumerator	Create an IEnumator instance
293	GetNamePath	Returns the name path of this component.
294	GetParentComponent	Returns the parent component.
294	HasParent	Does the component have a parent ?
294	InsertComponent	Insert the given component in the list of owned components.
295	IsImplementorOf	Checks if the current component is the implementor of the interface
296	ReferenceInterface	Interface implementation of Notification
294	RemoveComponent	Remove the given component from the list of owned components.
293	RemoveFreeNotification	Remove a component from the Free Notification list.
295	SafeCallException	Part of the IVCLComObject Interface.
295	SetSubComponent	Sets the csSubComponent style.
295	UpdateAction	Updates the state of an action.
290	WriteState	Writes the component to a stream.

2.44.4 Property overview

Page	Property	Access	Description
296	ComObject	r	Interface reference implemented by the component
296	ComponentCount	r	Count of owned components
297	ComponentIndex	rw	Index of component in its owner's list.
296	Components	r	Indexed list (zero-based) of all owned components.
297	ComponentState	r	Current component's state.
297	ComponentStyle	r	Current component's style.
298	DesignInfo	rw	Information for IDE designer.
298	Name	rws	Name of the component.
298	Owner	r	Owner of this component.
299	Tag	rw	Tag value of the component.
298	VCLComObject	rw	Not implemented.

2.44.5 TComponent.WriteState

Synopsis: Writes the component to a stream.

Declaration: procedure WriteState(Writer: TWriter); Virtual

Visibility: public

Description: WriteState writes the component's current state to a stream through the writer (410) object writer. Values for all published properties of the component can be written to the stream. Normally there is no need to call WriteState directly. The streaming system calls WriteState itself.

The TComponent (289) implementation of WriteState simply calls TWriter.WriteData (1). Descendent classes can, however, override WriteStateto provide additional processing of stream data.

See also: ReadState (1), TStream.WriteComponent (1), TWriter.WriteData (1)

2.44.6 TComponent.Create

Synopsis: Creates a new instance of the component.

Declaration: constructor Create(AOwner: TComponent); Virtual

Visibility: public

Description: Create creates a new instance of a TComponent class. If AOwner is not Nil, the new component attempts to insert itself in the list of owned components of the owner.

See also: Insert (1), Owner (1)

2.44.7 TComponent.Destroy

Synopsis: Destroys the instance of the component.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroy sends a opRemove notification to all components in the free-notification list. After that, all owned components are destroyed by calling DestroyComponents (1) (and hence removed from the list of owned components). When this is done, the component removes itself from its owner's child component list. After that, the parent's destroy method is called.

See also: Notification (1), Owner (1), DestroyComponents (1), Components (1)

2.44.8 TComponent.BeforeDestruction

Synopsis: Overrides standard BeforeDestruction.

Declaration: procedure BeforeDestruction; Override

Visibility: public

Description: BeforeDestruction is overridden by TComponent to set the csDestroying flag in TComponent.ComponentState (1)

See also: TComponent.ComponentState (1)

2.44.9 TComponent.DestroyComponents

Synopsis: Destroy child components.

Declaration: procedure DestroyComponents

Visibility: public

Description: DestroyComponents calls the destructor of all owned components, till no more components are left in the Components (1) array.

Calling the destructor of an owned component has as the effect that the component will remove itself from the list of owned components, if nothing has disrupted the sequence of destructors.

Errors: If an overridden 'destroy' method does not call it's inherited destructor or raises an exception, it's TComponent.Destroy (1) destructor will not be called, which may result in an endless loop.

See also: Destroy (1), Components (1)

2.44.10 TComponent.Destroying

Synopsis: Called when the component is being destroyed

Declaration: procedure Destroying

Visibility: public

Description: Destroying sets the csDestroying flag in the component's state (1) property, and does the same for all owned components.

It is not necessary to call Destroying directly, the destructor Destroy (1) does this automatically.

See also: State (1), Destroy (1)

2.44.11 TComponent.ExecuteAction

Synopsis: Standard action execution method.

Declaration: function ExecuteAction(Action: TBasicAction) : Boolean; Dynamic

Visibility: public

Description: ExecuteAction checks whether Action handles the current component, and if yes, calls the ExecuteAction method, passing itself as a parameter. The function returns True if the action handles the current component.

See also: TBasicAction (255), TBasicAction.ExecuteAction (1), TBasicAction.HandlesTarget (1), TComponent.UpdateAction (1)

2.44.12 TComponent.FindComponent

Synopsis: Finds and returns the named component in the owned components.

Declaration: function FindComponent(const AName: string) : TComponent

Visibility: public

Description: FindComponent searches the component with name AName in the list of owned components. If AName is empty, then Nil is returned.

See also: Components (1), Name (1)

2.44.13 TComponent.FreeNotification

Synopsis: Ask the component to notify called when it is being destroyed.

Declaration: procedure FreeNotification(AComponent : TComponent)

Visibility: public

Description: FreeNotification inserts AComponent in the freenotification list. When the component is destroyed, the Notification (1) method is called for all components in the freenotification list.

See also: Components (1), Notification (1), TComponent.RemoveFreeNotification (1)

2.44.14 TComponent.RemoveFreeNotification

Synopsis: Remove a component from the Free Notification list.

Declaration: procedure RemoveFreeNotification(AComponent : TComponent)

Visibility: public

Description: RemoveFreeNotification removes AComponent from the freenotification list.

See also: TComponent.FreeNotification (1)

2.44.15 TComponent.FreeOnRelease

Synopsis: Part of the IVCLComObject interface.

Declaration: procedure FreeOnRelease

Visibility: public

Description: Provided for Delphi compatibility, but is not yet implemtenedd.

2.44.16 TComponent.GetEnumerator

Synopsis: Create an IEnumator instance

Declaration: function GetEnumerator : TComponentEnumerator

Visibility: public

Description: GetEnumerator is the implementation of the IEnumerable (1432) interface for TComponent. It creates a TComponentEnumerator (299) instance and returns its IEnumator (1432) interface. The enumerator enumerates all child components of the component instance.

See also: TComponentEnumerator (299), IEnumator (1432), IEnumerable (1432)

2.44.17 TComponent.GetNamePath

Synopsis: Returns the name path of this component.

Declaration: function GetNamePath : string; Override

Visibility: public

Description: GetNamePath returns the name of the component as it will be shown in the object inspector. TComponent overrides GetNamePath so it returns the Name (1) property of the component.

See also: Name (1), TPersistent.GetNamePath (1)

2.44.18 TComponent.GetParentComponent

Synopsis: Returns the parent component.

Declaration: function GetParentComponent : TComponent; Dynamic

Visibility: public

Description: GetParentComponent can be implemented to return the parent component of this component.

The implementation of this method in TComponent always returns Nil. Descendent classes must override this method to return the visual parent of the component.

See also: HasParent (1), Owner (1)

2.44.19 TComponent.HasParent

Synopsis: Does the component have a parent ?

Declaration: function HasParent : Boolean; Dynamic

Visibility: public

Description: HasParent can be implemented to return whether the parent of the component exists. The implementation of this method in TComponent always returns False, and should be overridden by descendent classes to return True when a parent is available. If HasParent returns True, then GetParentComponent (1) will return the parent component.

See also: HasParent (1), Owner (1)

2.44.20 TComponent.InsertComponent

Synopsis: Insert the given component in the list of owned components.

Declaration: procedure InsertComponent (AComponent : TComponent)

Visibility: public

Description: InsertComponent attempts to insert AComponent in the list with owned components. It first calls ValidateComponent (289) to see whether the component can be inserted. It then checks whether there are no name conflicts by calling ValidateRename (1). If neither of these checks have raised an exception the component is inserted, and notified of the insert.

See also: RemoveComponent (1), Insert (1), ValidateContainer (1), ValidateRename (1), Notification (1)

2.44.21 TComponent.RemoveComponent

Synopsis: Remove the given component from the list of owned components.

Declaration: procedure RemoveComponent (AComponent : TComponent)

Visibility: public

Description: RemoveComponent will send an opRemove notification to AComponent and will then proceed to remove AComponent from the list of owned components.

See also: InsertComponent (1), Remove (1), ValidateRename (1), Notification (1)

2.44.22 TComponent.SafeCallException

Synopsis: Part of the IVCLComObject Interface.

Declaration: function SafeCallException(ExceptObject: TObject; ExceptAddr: Pointer) : HRESULT; Override

Visibility: public

Description: Provided for Delphi compatibility, but not implemented.

2.44.23 TComponent.SetSubComponent

Synopsis: Sets the csSubComponent style.

Declaration: procedure SetSubComponent(ASubComponent: Boolean)

Visibility: public

Description: SetSubComponent includes csSubComponent in the ComponentStyle (1) property if ASubComponent is True, and excludes it again if ASubComponent is False.

See also: TComponent.ComponentStyle (1)

2.44.24 TComponent.UpdateAction

Synopsis: Updates the state of an action.

Declaration: function UpdateAction(Action: TBasicAction) : Boolean; Dynamic

Visibility: public

Description: UpdateAction checks whether Action handles the current component, and if yes, calls the UpdateTarget method, passing itself as a parameter. The function returns True if the action handles the current component.

See also: TBasicAction (255), TBasicAction.UpdateTarget (1), TBasicAction.HandlesTarget (1), TBasicAction.ExecuteAction (1)

2.44.25 TComponent.IsImplementorOf

Synopsis: Checks if the current component is the implementor of the interface

Declaration: function IsImplementorOf(const Intf: IInterface) : Boolean

Visibility: public

Description: IsImplementorOf returns True if the current component implements the given interface. The interface should descend from IInterfaceComponentReference (233) and the GetComponent method should return the current instance.

See also: IInterfaceComponentReference (233)

2.44.26 TComponent.ReferenceInterface

Synopsis: Interface implementation of Notification

Declaration: procedure ReferenceInterface(const intf: IInterface; op: TOperation)

Visibility: public

Description: ReferenceInterface can be used to notify an interface of a component operation: it is the equivalent of the TComponent.Notification ([1](#)) method of TComponent for interfaces. If the interface implements IIInterfaceComponentReference ([233](#)), then the component that implements the interface is notified of the given operation Op.

Errors: None.

See also: TComponent.Notification ([1](#)), IIInterfaceComponentReference ([233](#))

2.44.27 TComponent.ComObject

Synopsis: Interface reference implemented by the component

Declaration: Property ComObject : IUnknown

Visibility: public

Access: Read

Description: ComObject returns the COM interface represented by the component. If the component does not represent a COM interface, reading this property will raise an EComponentError ([228](#)).

See also: EComponentError ([228](#))

2.44.28 TComponent.Components

Synopsis: Indexed list (zero-based) of all owned components.

Declaration: Property Components[Index: Integer]: TComponent

Visibility: public

Access: Read

Description: Components provides indexed access to the list of owned components. Index can range from 0 to ComponentCount-1 ([1](#)).

See also: ComponentCount ([1](#)), Owner ([1](#))

2.44.29 TComponent.ComponentCount

Synopsis: Count of owned components

Declaration: Property ComponentCount : Integer

Visibility: public

Access: Read

Description: ComponentCount returns the number of components that the current component owns. It can be used to determine the valid index range in the Component ([1](#)) array.

See also: Components ([1](#)), Owner ([1](#))

2.44.30 TComponent.ComponentIndex

Synopsis: Index of component in it's owner's list.

Declaration: Property ComponentIndex : Integer

Visibility: public

Access: Read,Write

Description: ComponentIndex is the index of the current component in its owner's list of components. If the component has no owner, the value of this property is -1.

See also: Components (1), ComponentCount (1), Owner (1)

2.44.31 TComponent.ComponentState

Synopsis: Current component's state.

Declaration: Property ComponentState : TComponentState

Visibility: public

Access: Read

Description: ComponentState indicates the current state of the component. It is a set of flags which indicate the various stages in the lifetime of a component. The following values can occur in this set:

Table 2.21: Component states

Flag	Meaning
csLoading	The component is being loaded from stream
csReading	Component properties are being read from stream.
csWriting	Component properties are weing written to stream.
csDestroying	The component or one of it's owners is being destroyed.
csAncestor	The component is being streamed as part of a frame
csUpdating	The component is being updated
csFixups	References to other components are being resolved
csFreeNotification	The component has freenotifications.
csInline	The component is being loaded as part of a frame
csDesignInstance	? not used.

The component state is set by various actions such as reading it from stream, destroying it etc.

See also: SetAncestor (1), SetDesigning (1), SetInline (1), SetDesignInstance (1), Updating (1), Updated (1), Loaded (1)

2.44.32 TComponent.ComponentStyle

Synopsis: Current component's style.

Declaration: Property ComponentStyle : TComponentStyle

Visibility: public

Access: Read

Description: Current component's style.

2.44.33 TComponent.DesignInfo

Synopsis: Information for IDE designer.

Declaration: Property DesignInfo : LongInt

Visibility: public

Access: Read,Write

Description: DesignInformation can be used by an IDE to store design information in the component. It should not be used by an application programmer.

See also: Tag (1)

2.44.34 TComponent.Owner

Synopsis: Owner of this component.

Declaration: Property Owner : TComponent

Visibility: public

Access: Read

Description: Owner returns the owner of this component. The owner cannot be set except by explicitly inserting the component in another component's owned components list using that component's InsertComponent (1) method, or by removing the component from it's owner's owned component list using the RemoveComponent (1) method.

See also: Components (1), InsertComponent (1), RemoveComponent (1)

2.44.35 TComponent.VCLComObject

Synopsis: Not implemented.

Declaration: Property VCLComObject : Pointer

Visibility: public

Access: Read,Write

Description: VCLComObject is not yet implemented in Free Pascal.

2.44.36 TComponent.Name

Synopsis: Name of the component.

Declaration: Property Name : TComponentName

Visibility: published

Access: Read,Write

Description: Name is the name of the component. This name should be a valid identifier, i.e. must start with a letter or underscore, and can contain only letters, numbers and the underscore character. When attempting to set the name of a component, the name will be checked for validity. Furthermore, when a component is owned by another component, the name must be either empty or must be unique among the child component names.

By "letters", 7-bit letters are meant.

Errors: Attempting to set the name to an invalid value will result in an exception being raised.

See also: ValidateRename (1), Owner (1)

2.44.37 TComponent.Tag

Synopsis: Tag value of the component.

Declaration: Property Tag : PtrInt

Visibility: published

Access: Read,Write

Description: Tag can be used to store an integer value in the component. This value is streamed together with all other published properties. It can be used for instance to quickly identify a component in an event handler.

See also: Name (1)

2.45 TComponentEnumerator

2.45.1 Description

TComponentEnumerator implements the #rtl.system.IEnumerator (1432) interface for the TComponent (289) class, so the TComponent class can be used in a `for ... in` loop over the TComponent.Components (1) child components of the component. It is returned by the TComponent.GetEnumerator (1) method of TComponent.

See also: TComponent (289), TComponent.GetEnumerator (1), #rtl.system.IEnumerator (1432)

2.45.2 Method overview

Page	Property	Description
299	Create	Initialize a new instance of TComponentEnumerator
300	GetCurrent	Return the current pointer in the list
300	MoveNext	Move the position of the enumerator to the next position in the children of the component.

2.45.3 Property overview

Page	Property	Access	Description
300	Current	r	Current pointer in the list

2.45.4 TComponentEnumerator.Create

Synopsis: Initialize a new instance of TComponentEnumerator

Declaration: constructor Create (AComponent: TComponent)

Visibility: public

Description: Create initializes a new instance of TComponentEnumerator and keeps a reference to the component AComponent that will be enumerated.

See also: TComponent (289)

2.45.5 TComponentEnumerator.GetCurrent

Synopsis: Return the current pointer in the list

Declaration: function GetCurrent : TComponent

Visibility: public

Description: GetCurrent returns the current TComponent (289) child component instance in the enumerator.

Errors: No checking is done on the validity of the current position.

See also: MoveNext (1), TComponent.Components (1)

2.45.6 TComponentEnumerator.MoveNext

Synopsis: Move the position of the enumerator to the next position in the children of the component.

Declaration: function MoveNext : Boolean

Visibility: public

Description: MoveNext puts the pointer on the next child in the components child components, and returns True if this succeeded, or False if the pointer is past the last child in the list.

Errors: Note that if False is returned, calling GetCurrent will result in an exception.

See also: GetCurrent (1)

2.45.7 TComponentEnumerator.Current

Synopsis: Current pointer in the list

Declaration: Property Current : TComponent

Visibility: public

Access: Read

Description: Current redefines GetCurrent (1) as a property.

See also: GetCurrent (1)

2.46 TCustomMemoryStream

2.46.1 Description

TCustomMemoryStream is the parent class for streams that stored their data in memory. It introduces all needed functions to handle reading from and navigating through the memory, and introduces a Memory (1) property which points to the memory area where the stream data is kept.

The only thing which TCustomMemoryStream does not do is obtain memory to store data when writing data or the writing of data. This functionality is implemented in descendent streams such as TMemoryStream (336). The reason for this approach is that this way it is possible to create e.g. read-only descendants of TCustomMemoryStream that point to a fixed part in memory which can be read from, but not written to.

Remark: Since TCustomMemoryStream is an abstract class, do not create instances of TMemoryStream directly. Instead, create instances of descendants such as TMemoryStream (336).

See also: TMemoryStream (336), TStream (365)

2.46.2 Method overview

Page	Property	Description
301	Read	Reads Count bytes from the stream into buffer.
302	SaveToFile	Writes the contents of the stream to a file.
301	SaveToStream	Writes the contents of the memory stream to another stream.
301	Seek	Sets a new position in the stream.

2.46.3 Property overview

Page	Property	Access	Description
302	Memory	r	Pointer to the data kept in the memory stream.

2.46.4 TCustomMemoryStream.Read

Synopsis: Reads Count bytes from the stream into buffer.

Declaration: function Read(var Buffer;Count: LongInt) : LongInt; Override

Visibility: public

Description: Read reads Count bytes from the stream into the memory pointed to by buffer. It returns the number of bytes actually read.

This method overrides the TStream.Read (1) method of TStream (365). It will read as much bytes as are still available in the memory area pointer to by Memory (1). After the bytes are read, the internal stream position is updated.

See also: TCustomMemoryStream.Memory (1), TStream.Read (1)

2.46.5 TCustomMemoryStream.Seek

Synopsis: Sets a new position in the stream.

Declaration: function Seek(const Offset: Int64;Origin: TSeekOrigin) : Int64
; Override

Visibility: public

Description: Seek overrides the abstract TStream.Seek (1) method. It simply updates the internal stream position, and returns the new position.

Errors: No checking is done whether the new position is still a valid position, i.e. whether the position is still within the range 0..Size. Attempting a seek outside the valid memory range of the stream may result in an exception at the next read or write operation.

See also: TStream.Position (1), TStream.Size (1), TCustomMemoryStream.Memory (1)

2.46.6 TCustomMemoryStream.SaveToStream

Synopsis: Writes the contents of the memory stream to another stream.

Declaration: procedure SaveToStream(Stream: TStream)

Visibility: public

Description: SaveToStream writes the contents of the memory stream to Stream. The content of Stream is not cleared first. The current position of the memory stream is not changed by this action.

Remark: This method will work much faster than the use of the TStream.CopyFrom (1) method:

```
Seek(0, soFromBeginning);
Stream.CopyFrom(Self, Size);
```

because the CopyFrom method copies the contents in blocks, while SaveToStream writes the contents of the memory as one big block.

Errors: If an error occurs when writing to Stream an EStreamError (231) exception will be raised.

See also: TCustomMemoryStream.SaveToFile (1), TStream.CopyFrom (1)

2.46.7 TCustomMemoryStream.SaveToFile

Synopsis: Writes the contents of the stream to a file.

Declaration: procedure SaveToFile(const FileName: string)

Visibility: public

Description: SaveToFile writes the contents of the stream to a file with name FileName. It simply creates a filestream and writes the contents of the memorystream to this file stream using TCustomMemoryStream.SaveToStream (1).

Remark: This method will work much faster than the use of the TStream.CopyFrom (1) method:

```
Stream:=TFileStream.Create(fmCreate,FileName);
Seek(0, soFromBeginning);
Stream.CopyFrom(Self,Size);
```

because the CopyFrom method copies the contents in blocks, while SaveToFile writes the contents of the memory as one big block.

Errors: If an error occurs when creating or writing to the file, an EStreamError (231) exception may occur.

See also: TCustomMemoryStream.SaveToStream (1), TFileStream (308), TStream.CopyFrom (1)

2.46.8 TCustomMemoryStream.Memory

Synopsis: Pointer to the data kept in the memory stream.

Declaration: Property Memory : Pointer

Visibility: public

Access: Read

Description: Memory points to the memory area where stream keeps it's data. The property is read-only, so the pointer cannot be set this way.

Remark: Do not write to the memory pointed to by Memory, since the memory content may be read-only, and thus writing to it may cause errors.

See also: TStream.Size (1)

2.47 TDataModule

2.47.1 Description

TDataModule is a container for non-visual objects which can be used in an IDE to group non-visual objects which can be used by various other containers (forms) in a project. Notably, data access components are typically stored on a datamodule. Web components and services can also be implemented as descendants of datamodules.

TDataModule introduces some events which make it easier to program, and provides the needed streaming capabilities for persistent storage.

An IDE will typically allow to create a descendent of TDataModule which contains non-visual components in its published property list.

See also: [TDataModule.OnCreate \(1\)](#)

2.47.2 Method overview

Page	Property	Description
304	AfterConstruction	Overrides standard TObject (1438) behaviour.
304	BeforeDestruction	
303	Create	Create a new instance of a TDataModule.
304	CreateNew	
304	Destroy	Destroys the TDataModule instance.

2.47.3 Property overview

Page	Property	Access	Description
305	DesignOffset	rw	Position property needed for manipulation in an IDE.
305	DesignSize	rw	Size property needed for manipulation in an IDE.
306	OldCreateOrder	rw	Determines when OnCreate and OnDestroy are triggered.
305	OnCreate	rw	Event handler, called when the datamodule is created.
305	OnDestroy	rw	Event handler, called when the datamodule is destroyed.

2.47.4 TDataModule.Create

Synopsis: Create a new instance of a TDataModule.

Declaration: constructor Create(AOwner: TComponent); Override

Visibility: public

Description: Create creates a new instance of the TDatamodule and calls TDatamodule.CreateNew ([1](#)).

After that it reads the published properties from a stream using InitInheritedComponent ([219](#)) if a descendent class is instantiated. If the OldCreateOrder ([1](#)) property is True, the TDataModule.OnCreate ([1](#)) event is called.

Errors: An exception can be raised during the streaming operation.

See also: [TDataModule.CreateNew \(1\)](#)

2.47.5 TDataModule.CreateNew

Synopsis:

Declaration: constructor CreateNew(AOwner: TComponent);
constructor CreateNew(AOwner: TComponent; CreateMode: Integer); Virtual

Visibility: public

Description: CreateNew creates a new instance of the class, but bypasses the streaming mechanism. The CreateMode parameter (by default zero) is not used in TDataModule. If the AddDataModule (213) handler is set, then it is called, with the newly created instance as an argument.

See also: TDataModule.Create (1), AddDataModule (213), TDataModule.OnCreate (1)

2.47.6 TDataModule.Destroy

Synopsis: Destroys the TDataModule instance.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroy destroys the TDataModule instance. If the OldCreateOrder (1) property is True the OnDestroy (1) event handler is called prior to destroying the data module.

Before calling the inherited destroy, the RemoveDataModule (213) handler is called if it is set, and Self is passed as a parameter.

Errors: An event can be raised during the OnDestroy event handler.

See also: TDataModule.OnDestroy (1), RemoveDataModule (213)

2.47.7 TDataModule.AfterConstruction

Synopsis: Overrides standard TObject (1438) behaviour.

Declaration: procedure AfterConstruction; Override

Visibility: public

Description: AfterConstruction calls the OnCreate (1) handler if the OldCreateOrder (1) property is False.

See also: TDataModule.OldCreateOrder (1), TDataModule.OnCreate (1)

2.47.8 TDataModule.BeforeDestruction

Synopsis:

Declaration: procedure BeforeDestruction; Override

Visibility: public

Description: BeforeDestruction calls the OnDestroy (1) handler if the OldCreateOrder (1) property is False.

See also: TDataModule.OldCreateOrder (1), TDataModule.OnDestroy (1)

2.47.9 **TDataModule.DesignOffset**

Synopsis: Position property needed for manipulation in an IDE.

Declaration: Property DesignOffset : TPoint

Visibility: public

Access: Read,Write

Description: DesignOffset is the position of the datamodule when displayed in an IDE. It is streamed to the form file, and should not be used at run-time.

See also: TDataModule.DesignSize (1)

2.47.10 **TDataModule.DesignSize**

Synopsis: Size property needed for manipulation in an IDE.

Declaration: Property DesignSize : TPoint

Visibility: public

Access: Read,Write

Description: DesignSize is the size of the datamodule when displayed in an IDE. It is streamed to the form file, and should not be used at run-time.

See also: TDataModule.DesignOffset (1)

2.47.11 **TDataModule.OnCreate**

Synopsis: Event handler, called when the datamodule is created.

Declaration: Property OnCreate : TNotifyEvent

Visibility: published

Access: Read,Write

Description: The OnCreate event is triggered when the datamodule is created and streamed. The exact moment of triggering is dependent on the value of the OldCreateOrder (1) property.

See also: TDataModule.Create (1), TDataModule.CreateNew (1), TDataModule.OldCreateOrder (1)

2.47.12 **TDataModule.OnDestroy**

Synopsis: Event handler, called when the datamodule is destroyed.

Declaration: Property OnDestroy : TNotifyEvent

Visibility: published

Access: Read,Write

Description: The OnDestroy event is triggered when the datamodule is destroyed. The exact moment of triggering is dependent on the value of the OldCreateOrder (1) property.

See also: TDataModule.Destroy (1), TDataModule.OnCreate (1), TDataModule.Create (1), TDataModule.CreateNew (1), TDataModule.OldCreateOrder (1)

2.47.13 TDataModule.OldCreateOrder

Synopsis: Determines when OnCreate and OnDestroy are triggered.

Declaration: Property OldCreateOrder : Boolean

Visibility: published

Access: Read,Write

Description: OldCreateOrder determines when exactly the OnCreate (1) and OnDestroy (1) event handlers are called.

If set to True, then the OnCreate event handler is called after the data module was streamed. If it is set to False, then the handler is called prior to the streaming process.

If set to True, then the OnDestroy event handler is called before the data module is removed from the streaming system. If it is set to False, then the handler is called after the data module was removed from the streaming process.

See also: TDataModule.OnDestroy (1), TDataModule.OnCreate (1), TDataModule.Destroy (1), TDataModule.Create (1), TDataModule.CreateNew (1), TDataModule.OldCreateOrder (1)

2.48 TFiler

2.48.1 Description

Class responsible for streaming of components.

2.48.2 Method overview

Page	Property	Description
307	DefineBinaryProperty	
306	DefineProperty	

2.48.3 Property overview

Page	Property	Access	Description
307	Ancestor	rw	Ancestor component from which an inherited component is streamed.
308	IgnoreChildren	rw	Determines whether children will be streamed as well.
307	LookupRoot	r	Component used to look up ancestor components.
307	Root	rw	The root component is the initial component which is being streamed.

2.48.4 TFiler.DefineProperty

Synopsis:

Declaration: procedure DefineProperty(const Name: string; ReadData: TReaderProc;
WriteData: TWriterProc; HasData: Boolean);
Virtual; Abstract

Visibility: public

Description:

2.48.5 TFiler.DefineBinaryProperty

Synopsis:

Declaration: procedure DefineBinaryProperty(const Name: string; ReadData: TStreamProc;
WriteData: TStreamProc; HasData: Boolean)
; Virtual; Abstract

Visibility: public

Description:

2.48.6 TFiler.Root

Synopsis: The root component is the initial component which is being streamed.

Declaration: Property Root : TComponent

Visibility: public

Access: Read,Write

Description: The streaming process will stream a component and all the components which it owns. The Root component is the component which is initially streamed.

See also: [LookupRoot \(1\)](#)

2.48.7 TFiler.LookupRoot

Synopsis: Component used to look up ancestor components.

Declaration: Property LookupRoot : TComponent

Visibility: public

Access: Read

Description: When comparing inherited component's values against parent values, the values are compared with the component in LookupRoot. Initially, it is set to Root (1).

See also: [Root \(1\)](#)

2.48.8 TFiler.Ancestor

Synopsis: Ancestor component from which an inherited component is streamed.

Declaration: Property Ancestor : TPersistent

Visibility: public

Access: Read,Write

Description: When streaming a component, this is the parent component. Only properties that differ from the parent's property value will be streamed.

See also: [Root \(1\)](#), [LookupRoot \(1\)](#)

2.48.9 TFiler.IgnoreChildren

Synopsis: Determines whether children will be streamed as well.

Declaration: Property IgnoreChildren : Boolean

Visibility: public

Access: Read,Write

Description: By default, all children (i.e. owned objects) will also be streamed when streaming a component.
This property can be used to prevent owned objects from being streamed.

2.49 TFileStream

2.49.1 Description

TFileStream is a TStream (365) descendent that stores or reads its data from a named file in the filesystem of the operating system.

To this end, it overrides some of the methods in TStream and implements them for the case of files on disk, and it adds the FileName (1) property to the list of public properties.

See also: TFileStream.Create (1), TStream (365)

2.49.2 Method overview

Page	Property	Description
308	Create	Creates a file stream.
309	Destroy	Destroys the file stream.

2.49.3 Property overview

Page	Property	Access	Description
309	FileName	r	The filename of the stream.

2.49.4 TFileStream.Create

Synopsis: Creates a file stream.

Declaration: constructor Create(const AFileName: string;Mode: Word)
constructor Create(const AFileName: string;Mode: Word;Rights: Cardinal)

Visibility: public

Description: Create creates a new instance of a TFileStream class. It opens the file AFileName with mode Mode, which can have one of the following values:

Table 2.22:

fmCreate	TFileStream.Create (1) creates a new file if needed.
fmOpenRead	TFileStream.Create (1) opens a file with read-only access.
fmOpenWrite	TFileStream.Create (1) opens a file with write-only access.
fmOpenReadWrite	TFileStream.Create (1) opens a file with read-write access.

After the file has been opened in the requested mode and a handle has been obtained from the operating system, the inherited constructor is called.

Errors: If the file could not be opened in the requested mode, an EFOpenError (229) exception is raised.

See also: [TStream \(365\)](#), [TFileStream.FileName \(1\)](#), [THandleStream.Create \(1\)](#)

2.49.5 **TFileStream.Destroy**

Synopsis: Destroys the file stream.

Declaration: `destructor Destroy; Override`

Visibility: public

Description: `Destroy` closes the file (causing possible buffered data to be written to disk) and then calls the inherited destructor.

Do not call `destroy` directly, instead call the `Free` method. `Destroy` does not check whether `Self` is nil, while `Free` does.

See also: [TFileStream.Create \(1\)](#)

2.49.6 **TFileStream.FileName**

Synopsis: The filename of the stream.

Declaration: `Property FileName : string`

Visibility: public

Access: Read

Description: `FileName` is the name of the file that the stream reads from or writes to. It is the name as passed in the constructor of the stream; it cannot be changed. To write to another file, the stream must be freed and created again with the new filename.

See also: [TFileStream.Create \(1\)](#)

2.50 **TFPList**

2.50.1 **Description**

`TFPList` is a class that can be used to manage collections of pointers. It introduces methods and properties to store the pointers, search in the list of pointers, sort them. It manages its memory by itself, no intervention for that is needed. Contrary to `TList (327)`, `TFPList` has no notification mechanism. If no notification mechanism is used, it is better to use `TFPList` instead of `TList`, as the performance of `TFPList` is much higher.

To manage collections of strings, it is better to use a `TStrings (384)` descendent such as `TStringList (379)`. To manage general objects, a `TCollection (280)` class exists, from which a descendent can be made to manage collections of various kinds.

See also: [TStrings \(384\)](#), [TCollection \(280\)](#)

2.50.2 Method overview

Page	Property	Description
311	Add	Adds a new pointer to the list.
310	AddList	Add all pointers from another list
314	Assign	Assign performs the given operation on the list.
311	Clear	Clears the pointer list.
311	Delete	Removes a pointer from the list.
310	Destroy	Destroys the list and releases the memory used to store the list elements.
311	Error	Raises an EListError (229) exception.
312	Exchange	Exchanges two pointers in the list.
312	Expand	Increases the capacity of the list if needed.
312	Extract	Remove the first occurrence of a pointer from the list.
312	First	Returns the first non-nil pointer in the list.
315	ForEachCall	Call a procedure or method for each pointer in the list.
313	GetEnumerator	Create an IEnumator instance
313	IndexOf	Returns the index of a given pointer.
313	IndexOfItem	
313	Insert	Inserts a new pointer in the list at a given position.
313	Last	Returns the last non-nil pointer in the list.
314	Move	Moves a pointer from one position in the list to another.
314	Pack	Removes Nil pointers from the list and frees unused memory.
314	Remove	Removes a value from the list.
315	Sort	Sorts the pointers in the list.

2.50.3 Property overview

Page	Property	Access	Description
315	Capacity	rw	Current capacity (i.e. number of pointers that can be stored) of the list.
316	Count	rw	Current number of pointers in the list.
316	Items	rw	Provides access to the pointers in the list.
316	List	r	Memory array where pointers are stored.

2.50.4 TFPLList.Destroy

Synopsis: Destroys the list and releases the memory used to store the list elements.

Declaration: `destructor Destroy; Override`

Visibility: public

Description: `Destroy` destroys the list and releases the memory used to store the list elements. The elements themselves are in no way touched, i.e. any memory they point to must be explicitly released before calling the destructor.

2.50.5 TFPLList.AddList

Synopsis: Add all pointers from another list

Declaration: `procedure AddList (AList: TFPLList)`

Visibility: public

Description: AddList adds all pointers from AList to the list. If a pointer is already present, it is added a second time.

See also: TFPLList.Assign ([1](#)), TList.AddList ([1](#))

2.50.6 TFPLList.Add

Synopsis: Adds a new pointer to the list.

Declaration: function Add(Item: Pointer) : Integer

Visibility: public

Description: Add adds a new pointer to the list after the last pointer (i.e. at position Count, thus increasing the item count with 1. If the list is at full capacity, the capacity of the list is expanded, using the Grow ([1](#)) method.

To insert a pointer at a certain position in the list, use the Insert ([1](#)) method instead.

See also: Delete ([1](#)), Grow ([1](#)), Insert ([1](#))

2.50.7 TFPLList.Clear

Synopsis: Clears the pointer list.

Declaration: procedure Clear

Visibility: public

Description: Clear removes all pointers from the list, and sets the capacity to 0, thus freeing any memory allocated to maintain the list.

See also: Destroy ([1](#))

2.50.8 TFPLList.Delete

Synopsis: Removes a pointer from the list.

Declaration: procedure Delete(Index: Integer)

Visibility: public

Description: Delete removes the pointer at position Index from the list, shifting all following pointers one position up (or to the left).

The memory the pointer is pointing to is *not* deallocated.

2.50.9 TFPLList.Error

Synopsis: Raises an EListError ([229](#)) exception.

Declaration: class procedure Error(const Msg: string; Data: PtrInt)

Visibility: public

Description: Error raises an EListError ([229](#)) exception, with a message formatted with Msg and Data.

2.50.10 **TFPList.Exchange**

Synopsis: Exchanges two pointers in the list.

Declaration: procedure Exchange (Index1: Integer; Index2: Integer)

Visibility: public

Description: Exchange exchanges the pointers at positions Index1 and Index2. Both pointers must be within the current range of the list, or an EListError ([229](#)) exception will be raised.

2.50.11 **TFPList.Expand**

Synopsis: Increases the capacity of the list if needed.

Declaration: function Expand : TFPList

Visibility: public

Description: Expand increases the capacity of the list if the current element count matches the current list capacity.

The capacity is increased according to the following algorithm:

- 1.If the capacity is less than 3, the capacity is increased with 4.
- 2.If the capacity is larger than 3 and less than 8, the capacity is increased with 8.
- 3.If the capacity is larger than 8, the capacity is increased with 16.

The return value is Self.

See also: Capacity ([1](#))

2.50.12 **TFPList.Extract**

Synopsis: Remove the first occurrence of a pointer from the list.

Declaration: function Extract (Item: Pointer) : Pointer

Visibility: public

Description: Extract searches for the first occurrence of Item in the list and deletes it from the list. If Item was found, its value is returned. If Item was not found, Nil is returned.

See also: TFPList.Delete ([1](#))

2.50.13 **TFPList.First**

Synopsis: Returns the first non-nil pointer in the list.

Declaration: function First : Pointer

Visibility: public

Description: First returns the value of the first non-nil pointer in the list.

If there are no pointers in the list or all pointers equal Nil, then Nil is returned.

See also: Last ([1](#))

2.50.14 **TFPList.GetEnumerator**

Synopsis: Create an `IEnumerator` instance

Declaration: `function GetEnumerator : TFPLis`

Visibility: public

Description: `GetEnumerator` is the implementation of the `IEnumerable` (1432) interface for `TFPList`. It creates a `TFPLis` instance and returns its `IEnumerator` (1432) interface.

See also: `TFPLis` (316), `IEnumerator` (1432), `IEnumerable` (1432)

2.50.15 **TFPList.IndexOf**

Synopsis: Returns the index of a given pointer.

Declaration: `function IndexOf(Item: Pointer) : Integer`

Visibility: public

Description: `IndexOf` searches for the pointer `Item` in the list of pointers, and returns the index of the pointer, if found.

If no pointer with the value `Item` was found, -1 is returned.

2.50.16 **TFPList.IndexOfItem**

Declaration: `function IndexOfItem(Item: Pointer; Direction: TDirec`

Visibility: public

2.50.17 **TFPList.Insert**

Synopsis: Inserts a new pointer in the list at a given position.

Declaration: `procedure Insert(Index: Integer; Item: Pointer)`

Visibility: public

Description: `Insert` inserts pointer `Item` at position `Index` in the list. All pointers starting from `Index` are shifted to the right.

If `Index` is not a valid position, then a `EListError` (229) exception is raised.

See also: `Add` (1), `Delete` (1)

2.50.18 **TFPList.Last**

Synopsis: Returns the last non-nil pointer in the list.

Declaration: `function Last : Pointer`

Visibility: public

Description: `Last` returns the value of the last non-nil pointer in the list.

If there are no pointers in the list or all pointers equal `Nil`, then `Nil` is returned.

See also: `First` (1)

2.50.19 **TFPList.Move**

Synopsis: Moves a pointer from one position in the list to another.

Declaration: procedure Move (CurIndex: Integer; NewIndex: Integer)

Visibility: public

Description: Move moves the pointer at position CurIndex to position NewIndex. This is done by storing the value at position CurIndex, deleting the pointer at position CurIndex, and reinserting the value at position NewIndex

If CurIndex or Newindex are not inside the valid range of indices, an EListError (229) exception is raised.

See also: Exchange (1)

2.50.20 **TFPList.Assign**

Synopsis: Assign performs the given operation on the list.

Declaration: procedure Assign (ListA: TFPList; AOperator: TListAssignOp; ListB: TFPList)

Visibility: public

Description: Assign can be used to merge or assign lists It is an extended version of the usual TPersistent.Assign mechanism. The arguments ListA and ListB are used as sources of pointers to add or remove elements from the current list, depending on the operation AOperation. The available operations are documented in the TListAssignOp (206) type.

See also: TFPList.Add (1), TFPList.Clear (1)

2.50.21 **TFPList.Remove**

Synopsis: Removes a value from the list.

Declaration: function Remove (Item: Pointer) : Integer

Visibility: public

Description: Remove searches Item in the list, and, if it finds it, deletes the item from the list. Only the first occurrence of Item is removed.

See also: Delete (1), IndexOf (1), Insert (1)

2.50.22 **TFPList.Pack**

Synopsis: Removes Nil pointers from the list and frees unused memory.

Declaration: procedure Pack

Visibility: public

Description: Pack removes all nil pointers from the list. The capacity of the list is then set to the number of pointers in the list. This method can be used to free unused memory if the list has grown to very large sizes and has a lot of unneeded nil pointers in it.

See also: TFPList.Clear (1)

2.50.23 **TFPList.Sort**

Synopsis: Sorts the pointers in the list.

Declaration: procedure Sort (Compare: TListSortCompare)

Visibility: public

Description: Sort> sorts the pointers in the list. Two pointers are compared by passing them to the Compare function. The result of this function determines how the pointers will be sorted:

- If the result of this function is negative, the first pointer is assumed to be 'less' than the second and will be moved before the second in the list.
- If the function result is positive, the first pointer is assumed to be 'greater than' the second and will be moved after the second in the list.
- if the function result is zero, the pointers are assumed to be 'equal' and no moving will take place.

The sort is done using a quicksort algorithm.

2.50.24 **TFPList.ForEachCall**

Synopsis: Call a procedure or method for each pointer in the list.

Declaration: procedure ForEachCall(proc2call: TListCallback; arg: pointer)
procedure ForEachCall(proc2call: TListStaticCallback; arg: pointer)

Visibility: public

Description: ForEachCall iterates over all pointers in the list and calls proc2call, passing it the pointer and the additional arg data pointer. Proc2Call can be a method or a static procedure.

Errors: None.

See also: TListStaticCallback (207), TListCallback (206)

2.50.25 **TFPList.Capacity**

Synopsis: Current capacity (i.e. number of pointers that can be stored) of the list.

Declaration: Property Capacity : Integer

Visibility: public

Access: Read,Write

Description: Capacity contains the number of pointers the list can store before it starts to grow.

If a new pointer is added to the list using add (1) or insert (1), and there is not enough memory to store the new pointer, then the list will try to allocate more memory to store the new pointer. Since this is a time consuming operation, it is important that this operation be performed as little as possible. If it is known how many pointers there will be before filling the list, it is a good idea to set the capacity first before filling. This ensures that the list doesn't need to grow, and will speed up filling the list.

See also: SetCapacity (1), Count (1)

2.50.26 TFPLIST.Count

Synopsis: Current number of pointers in the list.

Declaration: Property Count : Integer

Visibility: public

Access: Read,Write

Description: Count is the current number of (possibly Nil) pointers in the list. Since the list is zero-based, the index of the largest pointer is Count-1.

2.50.27 TFPLIST.Items

Synopsis: Provides access to the pointers in the list.

Declaration: Property Items [Index: Integer] : Pointer; default

Visibility: public

Access: Read,Write

Description: Items is used to access the pointers in the list. It is the default property of the TFPLIST class, so it can be omitted.

The list is zero-based, so Index must be in the range 0 to Count-1.

2.50.28 TFPLIST.List

Synopsis: Memory array where pointers are stored.

Declaration: Property List : PPointerList

Visibility: public

Access: Read

Description: List points to the memory space where the pointers are stored. This can be used to quickly copy the list of pointers to another location.

2.51 TFPLISTEnumerator

2.51.1 Description

TFPLISTEnumerator implements the #rtl.system.IEnumerator ([1432](#)) interface for the TFPLIST ([309](#)) class, so the TFPLIST class can be used in a `for ... in` loop. It is returned by the TFPLIST.GetEnumerator ([1](#)) method of TFPLIST.

See also: TFPLIST ([309](#)), TFPLIST.GetEnumerator ([1](#)), #rtl.system.IEnumerator ([1432](#))

2.51.2 Method overview

Page	Property	Description
317	Create	Initialize a new instance of TFPLISTEnumerator
317	GetCurrent	Return the current pointer in the list
317	MoveNext	Move the position of the enumerator to the next position in the list.

2.51.3 Property overview

Page	Property	Access	Description
317	Current	r	Current pointer in the list

2.51.4 TFPLListEnumerator.Create

Synopsis: Initialize a new instance of TFPLListEnumerator

Declaration: constructor Create (AList: TFPLList)

Visibility: public

Description: Create initializes a new instance of TFPLListEnumerator and keeps a reference to the list AList that will be enumerated.

See also: TFPLList (309)

2.51.5 TFPLListEnumerator.GetCurrent

Synopsis: Return the current pointer in the list

Declaration: function GetCurrent : Pointer

Visibility: public

Description: GetCurrent returns the current pointer in the enumerator.

Errors: No checking is done on the validity of the current position.

See also: MoveNext (1)

2.51.6 TFPLListEnumerator.MoveNext

Synopsis: Move the position of the enumerator to the next position in the list.

Declaration: function MoveNext : Boolean

Visibility: public

Description: MoveNext puts the pointer on the next item in the list, and returns True if this succeeded, or False if the pointer is past the last element in the list.

Errors: Note that if False is returned, calling GetCurrent will result in an exception.

See also: GetCurrent (1)

2.51.7 TFPLListEnumerator.Current

Synopsis: Current pointer in the list

Declaration: Property Current : Pointer

Visibility: public

Access: Read

Description: Current redefines GetCurrent (1) as a property.

See also: GetCurrent (1)

2.52 THandleStream

2.52.1 Description

THandleStream is an abstract descendent of the TStream ([365](#)) class that provides methods for a stream to handle all reading and writing to and from a handle, provided by the underlying OS. To this end, it overrides the Read ([1](#)) and Write ([1](#)) methods of TStream.

Remark:

- THandleStream does not obtain a handle from the OS by itself, it just handles reading and writing to such a handle by wrapping the system calls for reading and writing; Descendent classes should obtain a handle from the OS by themselves and pass it on in the inherited constructor.
- Contrary to Delphi, no seek is implemented for THandleStream, since pipes and sockets do not support this. The seek is implemented in descendent methods that support it.

See also: TStream ([365](#)), TFileStream ([308](#))

2.52.2 Method overview

Page	Property	Description
318	Create	Create a handlestream from an OS Handle.
318	Read	Overrides standard read method.
319	Seek	Overrides the Seek method.
319	Write	Overrides standard write method.

2.52.3 Property overview

Page	Property	Access	Description
319	Handle	r	The OS handle of the stream.

2.52.4 THandleStream.Create

Synopsis: Create a handlestream from an OS Handle.

Declaration: constructor Create(AHandle: THandle)

Visibility: public

Description: Create creates a new instance of a THandleStream class. It stores AHandle in an internal variable and then calls the inherited constructor.

See also: TStream ([365](#))

2.52.5 THandleStream.Read

Synopsis: Overrides standard read method.

Declaration: function Read(var Buffer; Count: LongInt) : LongInt; Override

Visibility: public

Description: Read overrides the Read ([1](#)) method of TStream. It uses the Handle ([1](#)) property to read the Count bytes into Buffer

If no error occurs while reading, the number of bytes actually read will be returned.

Errors: If the operating system reports an error while reading from the handle, -1 is returned.

See also: TStream.Read ([1](#)), THandleStream.Write ([1](#)), THandleStream.Handle ([1](#))

2.52.6 THandleStream.Write

Synopsis: Overrides standard write method.

Declaration: function Write(const Buffer;Count: LongInt) : LongInt; Override

Visibility: public

Description: Write overrides the Write ([1](#)) method of TStream. It uses the Handle ([1](#)) property to write the Count bytes from Buffer.

If no error occurs while writing, the number of bytes actually written will be returned.

Errors: If the operating system reports an error while writing to the handle, 0 is returned.

See also: TStream.Read ([1](#)), THandleStream.Write ([1](#)), THandleStream.Handle ([1](#))

2.52.7 THandleStream.Seek

Synopsis: Overrides the Seek method.

Declaration: function Seek(const Offset: Int64;Origin: TSeekOrigin) : Int64
; Override

Visibility: public

Description: seek uses the FileSeek ([1525](#)) method to position the stream on the desired position. Note that handle stream descendants (notably pipes) can override the method to prevent the seek.

2.52.8 THandleStream.Handle

Synopsis: The OS handle of the stream.

Declaration: Property Handle : THandle

Visibility: public

Access: Read

Description: Handle represents the Operating system handle to which reading and writing is done. The handle can be read only, i.e. it cannot be set after the THandlestream instance was created. It should be passed to the constructor THandleStream.Create ([1](#))

See also: THandleStream ([318](#)), THandleStream.Create ([1](#))

2.53 TInterfacedPersistent

2.53.1 Description

TInterfacedPersistent is a direct descendent of TPersistent (347) which implements the #rtl.system.IInterface (1257) interface. In particular, it implements the QueryInterface as a public method.

See also: IInterface (1257)

2.53.2 Interfaces overview

Page	Property	Description
1257	IInterface	Basic interface for all COM based interfaces

2.53.3 Method overview

Page	Property	Description
320	AfterConstruction	Overrides the standard AfterConstruction method.
320	QueryInterface	Implementation of IInterface.QueryInterface

2.53.4 TInterfacedPersistent.QueryInterface

Synopsis: Implementation of IInterface.QueryInterface

Declaration: function QueryInterface(const IID: TGuid;out Obj) : HRESULT; Virtual

Visibility: public

Description: QueryInterface simply calls GetInterface using the specified IID, and returns the correct values.

See also: TObject.GetInterface (1446)

2.53.5 TInterfacedPersistent.AfterConstruction

Synopsis: Overrides the standard AfterConstruction method.

Declaration: procedure AfterConstruction; Override

Visibility: public

Description: AfterConstruction is overridden to do some extra interface housekeeping: a reference to the IInterface interface of the owning class is obtained (if it exists).

2.54 TInterfaceList

2.54.1 Description

TInterfaceList is a standard implementation of the IInterfaceList (234) interface. It uses a TThreadList (407) instance to store the list of interfaces.

See also: IInterfaceList (234), TList (327)

2.54.2 Interfaces overview

Page	Property	Description
324	IInterfaceList	Interface for maintaining a list of interfaces.

2.54.3 Method overview

Page	Property	Description
323	Add	Add an interface to the list
322	Clear	Removes all interfaces from the list.
321	Create	Create a new instance of TInterfaceList
322	Delete	Delete an interface from the list.
321	Destroy	Destroys the list of interfaces
322	Exchange	Exchange 2 interfaces in the list
325	Expand	Expands the list
322	First	Returns the first non- <code>Nil</code> element in the list.
323	GetEnumerator	Create an <code>IEnumerator</code> instance
323	IndexOf	Returns the index of an interface.
323	Insert	Insert an interface to the list
324	Last	Returns the last non- <code>Nil</code> element in the list.
324	Lock	Lock the list
324	Remove	Remove an interface from the list
324	Unlock	UnLocks a locked list

2.54.4 Property overview

Page	Property	Access	Description
325	Capacity	rw	The current capacity of the list.
325	Count	rw	The current number of elements in the list.
325	Items	rw	Array-based access to the list's items.

2.54.5 TInterfaceList.Create

Synopsis: Create a new instance of TInterfaceList

Declaration: constructor Create

Visibility: public

Description: Create creates a new instance of the TInterfaceList class. It sets up the internal structures needed to store the list of interfaces.

See also: Destroy ([1](#))

2.54.6 TInterfaceList.Destroy

Synopsis: Destroys the list of interfaces

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroy first calls Clear ([1](#)) and then frees the TInterfaceList instance from memory.

Note that the Clear method decreases the reference count of all interfaces.

See also: Create ([1](#)), Clear ([1](#))

2.54.7 **TInterfaceList.Clear**

Synopsis: Removes all interfaces from the list.

Declaration: procedure Clear

Visibility: public

Description: Clear is the implementation of the IInterfaceList.Clear ([1](#)) method. It removes all interfaces from the list. It does this by setting each element in the list to Nil, in this way the reference count of each interface in the list is decreased.

See also: IInterfaceList.Clear ([1](#)), Add ([1](#)), Destroy ([1](#)), TList.Clear ([1](#)), TFPLList.Clear ([1](#))

2.54.8 **TInterfaceList.Delete**

Synopsis: Delete an interface from the list.

Declaration: procedure Delete(index: Integer)

Visibility: public

Description: Delete is the implementation of the IInterfaceList.Delete ([1](#)) method. It clears the slot first and then removes the element from the list.

See also: IInterfaceList.Delete ([1](#)), TInterfaceList.Remove ([1](#)), TInterfaceList.Add ([1](#)), TList.Delete ([1](#)), TFPLList.Delete ([1](#))

2.54.9 **TInterfaceList.Exchange**

Synopsis: Exchange 2 interfaces in the list

Declaration: procedure Exchange(index1: Integer; index2: Integer)

Visibility: public

Description: Exchange is the implementation of the IInterfaceList.Exchange ([1](#)) method. It exchanges the position of 2 interfaces in the list.

See also: IInterfaceList.Exchange ([1](#)), TInterfaceList.Delete ([1](#)), TInterfaceList.Add ([1](#)), TList.Exchange ([1](#)), TFPLList.Exchange ([1](#))

2.54.10 **TInterfaceList.First**

Synopsis: Returns the first non-Nil element in the list.

Declaration: function First : IUnknown

Visibility: public

Description: First is the implementation of the IInterfaceList.First ([1](#)) method. It returns the first non-Nil element from the list.

See also: IInterfaceList.First ([1](#)), TList.First ([1](#))

2.54.11 TInterfaceList.GetEnumerator

Synopsis: Create an `IEnumerator` instance

Declaration: `function GetEnumerator : TInterfaceListEnumerator`

Visibility: public

Description: `GetEnumerator` is the implementation of the `IEnumerable` (1432) interface for `TInterfaceList`.

It creates a `TInterfaceListEnumerator` (326) instance and returns its `IEnumerator` (1432) interface.

The enumerator enumerates all interfaces in the list.

See also: `TInterfaceListEnumerator` (326), `IEnumerator` (1432), `IEnumerable` (1432)

2.54.12 TInterfaceList.IndexOf

Synopsis: Returns the index of an interface.

Declaration: `function IndexOf(item: IUnknown) : Integer`

Visibility: public

Description: `IndexOf` is the implementation of the `IInterfaceList.IndexOf` (1) method. It returns the zero-based index in the list of the indicated interface, or -1 if the index is not in the list.

See also: `IInterfaceList.IndexOf` (1), `TList.IndexOf` (1)

2.54.13 TInterfaceList.Add

Synopsis: Add an interface to the list

Declaration: `function Add(item: IUnknown) : Integer`

Visibility: public

Description: `Add` is the implementation of the `IInterfaceList.Add` (1) method. It adds an interface to the list, and returns the location of the new element in the list. This operation will increment the reference count of the interface.

See also: `IInterfaceList.Add` (1), `TInterfaceList.Delete` (1), `TInterfaceList.Insert` (1), `TList.Add` (1), `TFPList.Add` (1)

2.54.14 TInterfaceList.Insert

Synopsis: Insert an interface to the list

Declaration: `procedure Insert(i: Integer; item: IUnknown)`

Visibility: public

Description: `Insert` is the implementation of the `IInterfaceList.Insert` (1) method. It inserts an interface in the list at the indicated position. This operation will increment the reference count of the interface.

See also: `IInterfaceList.Insert` (1), `TInterfaceList.Delete` (1), `TInterfaceList.Add` (1), `TList.Insert` (1), `TFPList.Insert` (1)

2.54.15 TInterfaceList.Last

Synopsis: Returns the last non-Nil element in the list.

Declaration: function Last : IUnknown

Visibility: public

Description: `Last` is the implementation of the `IInterfaceList.Last` (1) method. It returns the last non-Nil element from the list.

See also: `IInterfaceList.Last` (1), `TInterfaceList.First` (1), `TList.Last` (1), `TFPList.Last` (1)

2.54.16 TInterfaceList.Remove

Synopsis: Remove an interface from the list

Declaration: function Remove(item: IUnknown) : Integer

Visibility: public

Description: `Remove` is the implementation of the `IInterfaceList.Remove` (1) method. It removes the first occurrence of the interface from the list.

See also: `IInterfaceList.Remove` (1), `TInterfaceList.Delete` (1), `TInterfaceList.IndexOf` (1), `TList.Remove` (1), `TFPList.Remove` (1)

2.54.17 TInterfaceList.Lock

Synopsis: Lock the list

Declaration: procedure Lock

Visibility: public

Description: `Lock` locks the list. It is the implementation of the `IInterfaceList.Lock` (1) method. It limits access to the list to the current thread.

See also: `IInterfaceList.Lock` (1), `TInterfaceList.UnLock` (1), `TThreadList.LockList` (1)

2.54.18 TInterfaceList.Unlock

Synopsis: UnLocks a locked list

Declaration: procedure Unlock

Visibility: public

Description: `UnLock` unlocks the list. It is the implementation of the `IInterfaceList.UnLock` (1) method. After a call to unlock, the current thread releases the list for manipulation by other threads.

See also: `IInterfaceList.UnLock` (1), `TInterfaceList.Lock` (1), `TThreadList.UnLockList` (1)

2.54.19 TInterfaceList.Expand

Synopsis: Expands the list

Declaration: function Expand : TInterfaceList

Visibility: public

Description: Expand calls the expand method from the internally used list. It returns itself.

See also: TList.Expand ([1](#))

2.54.20 TInterfaceList.Capacity

Synopsis: The current capacity of the list.

Declaration: Property Capacity : Integer

Visibility: public

Access: Read,Write

Description: Capacity is the number of elements that the list can contain without needing to allocate more memory.

See also: IInterfaceList.Capacity ([1](#)), TInterfaceList.Count ([1](#)), TList.Capacity ([1](#)), TFPLList.Capacity ([1](#))

2.54.21 TInterfaceList.Count

Synopsis: The current number of elements in the list.

Declaration: Property Count : Integer

Visibility: public

Access: Read,Write

Description: Count is the number of elements in the list. This can include Nil elements. Note that the elements are zero-based, and thus are indexed from 0 to Count - 1.

See also: IInterfaceList.Count ([1](#)), TInterfaceList.Items ([1](#)), TInterfaceList.Capacity ([1](#)), TList.Count ([1](#)), TFPLList.Count ([1](#))

2.54.22 TInterfaceList.Items

Synopsis: Array-based access to the list's items.

Declaration: Property Items [Index: Integer] : IUnknown; default

Visibility: public

Access: Read,Write

Description: Items provides indexed access to the elements in the list. Note that the elements are zero-based, and thus are indexed from 0 to Count - 1. The items are read-write. It is not possible to add elements to the list by accessing an element with index larger or equal to Count ([1](#)).

See also: IInterfaceList.Items ([1](#)), TInterfaceList.Count ([1](#)), TList.Items ([1](#)), TFPLList.Items ([1](#))

2.55 TInterfaceListEnumerator

2.55.1 Description

`TInterfaceListEnumerator` implements the #rtl.system.IEnumerator (1432) interface for the `TInterfaceList` (320) class, so the `TInterfaceList` class can be used in a `for ... in` loop over the `TInterfaceList.Components` (1) child components of the component. It is returned by the `TInterfaceList.GetEnumerator` (1) method of `TInterfaceList`.

See also: `TInterfaceList` (320), `TInterfaceList.GetEnumerator` (1), #rtl.system.IEnumerator (1432)

2.55.2 Method overview

Page	Property	Description
326	Create	Initialize a new instance of <code>TInterfaceListEnumerator</code>
326	GetCurrent	Return the current pointer in the list
327	MoveNext	Move the position of the enumerator to the next position in the children of the component.

2.55.3 Property overview

Page	Property	Access	Description
327	Current	r	Current pointer in the list

2.55.4 TInterfaceListEnumerator.Create

Synopsis: Initialize a new instance of `TInterfaceListEnumerator`

Declaration: constructor Create (AList: `TInterfaceList`)

Visibility: public

Description: `Create` initializes a new instance of `TInterfaceListEnumerator` and keeps a reference to the component `AComponent` that will be enumerated.

See also: `TInterfaceList` (320)

2.55.5 TInterfaceListEnumerator.GetCurrent

Synopsis: Return the current pointer in the list

Declaration: function GetCurrent : `IUnknown`

Visibility: public

Description: `GetCurrent` returns the current interface in the `TInterfaceList` (320) list.

Errors: No checking is done on the validity of the current position.

See also: `MoveNext` (1), `TInterfaceList.Components` (1)

2.55.6 **TInterfaceListEnumerator.MoveNext**

Synopsis: Move the position of the enumerator to the next position in the children of the component.

Declaration: function MoveNext : Boolean

Visibility: public

Description: MoveNext puts the pointer on the next interface in the list, and returns True if this succeeded, or False if the pointer is past the last interface in the list.

Errors: Note that if False is returned, calling GetCurrent will result in an exception.

See also: GetCurrent (1)

2.55.7 **TInterfaceListEnumerator.Current**

Synopsis: Current pointer in the list

Declaration: Property Current : IUnknown

Visibility: public

Access: Read

Description: Current redefines GetCurrent (1) as a property.

See also: GetCurrent (1)

2.56 **TList**

2.56.1 **Description**

TList is a class that can be used to manage collections of pointers. It introduces methods and properties to store the pointers, search in the list of pointers, sort them. It manages its memory by itself, no intervention for that is needed. It has an event notification mechanism which allows to notify of list changes. This slows down some of TList mechanisms, and if no notification is used, TFPLList (309) may be used instead.

To manage collections of strings, it is better to use a TString (384) descendent such as TStringList (379). To manage general objects, a TCollection (280) class exists, from which a descendent can be made to manage collections of various kinds.

See also: TString (384), TCollection (280)

2.56.2 **Interfaces overview**

Page	Property	Description
233	IFPObserved	

2.56.3 Method overview

Page	Property	Description
329	Add	Adds a new pointer to the list.
329	AddList	Add all pointers from another list
333	Assign	Copy the contents of other lists.
330	Clear	Clears the pointer list.
328	Create	Class to manage collections of pointers.
330	Delete	Removes a pointer from the list.
328	Destroy	Destroys the list and releases the memory used to store the list elements.
330	Error	Raises an EListError (229) exception.
330	Exchange	Exchanges two pointers in the list.
330	Expand	Increases the capacity of the list if needed.
331	Extract	Remove the first occurrence of a pointer from the list.
331	First	Returns the first non-nil pointer in the list.
329	FPOAttachObserver	
329	FPODetachObserver	
329	FPONotifyObservers	
331	GetEnumerator	Create an IEnumarator instance
332	IndexOf	Returns the index of a given pointer.
332	Insert	Inserts a new pointer in the list at a given position.
332	Last	Returns the last non-nil pointer in the list.
332	Move	Moves a pointer from one position in the list to another.
333	Pack	Removes Nil pointers from the list and frees unused memory.
333	Remove	Removes a value from the list.
333	Sort	Sorts the pointers in the list.

2.56.4 Property overview

Page	Property	Access	Description
334	Capacity	rw	Current capacity (i.e. number of pointers that can be stored) of the list.
334	Count	rw	Current number of pointers in the list.
334	Items	rw	Provides access to the pointers in the list.
335	List	r	Memory array where pointers are stored.

2.56.5 TList.Create

Synopsis: Class to manage collections of pointers.

Declaration: constructor Create

Visibility: public

Description: TList.Create creates a new instance of TList. It clears the list and prepares it for use.

See also: TList (327), TList.Destroy (1)

2.56.6 TList.Destroy

Synopsis: Destroys the list and releases the memory used to store the list elements.

Declaration: destructor Destroy; Override

Visibility: public

Description: `Destroy` destroys the list and releases the memory used to store the list elements. The elements themselves are in no way touched, i.e. any memory they point to must be explicitly released before calling the destructor.

2.56.7 **TList.FPOAttachObserver**

Declaration: `procedure FPOAttachObserver(AObserver: TObject)`

Visibility: public

2.56.8 **TList.FPODetachObserver**

Declaration: `procedure FPODetachObserver(AObserver: TObject)`

Visibility: public

2.56.9 **TList.FPONotifyObservers**

Declaration: `procedure FPONotifyObservers(ASender: TObject;`
 `AOperation: TFPOObservedOperation;`
 `Data: Pointer)`

Visibility: public

2.56.10 **TList.AddList**

Synopsis: Add all pointers from another list

Declaration: `procedure AddList(AList: TList)`

Visibility: public

Description: `AddList` adds all pointers from `AList` to the list. If a pointer is already present, it is added a second time.

See also: `TList.Assign` (1), `TFPLList.AddList` (1)

2.56.11 **TList.Add**

Synopsis: Adds a new pointer to the list.

Declaration: `function Add(Item: Pointer) : Integer`

Visibility: public

Description: `Add` adds a new pointer to the list after the last pointer (i.e. at position `Count`, thus increasing the item count with 1. If the list is at full capacity, the capacity of the list is expanded, using the `Grow` (1) method.

To insert a pointer at a certain position in the list, use the `Insert` (1) method instead.

See also: `Delete` (1), `Grow` (1), `Insert` (1)

2.56.12 **TList.Clear**

Synopsis: Clears the pointer list.

Declaration: procedure Clear; Virtual

Visibility: public

Description: Clear removes all pointers from the list, and sets the capacity to 0, thus freeing any memory allocated to maintain the list.

See also: Destroy (1)

2.56.13 **TList.Delete**

Synopsis: Removes a pointer from the list.

Declaration: procedure Delete(Index: Integer)

Visibility: public

Description: Delete removes the pointer at position Index from the list, shifting all following pointers one position up (or to the left).

The memory the pointer is pointing to is *not* deallocated.

2.56.14 **TList.Error**

Synopsis: Raises an EListError (229) exception.

Declaration: class procedure Error(const Msg: string; Data: PtrInt); Virtual

Visibility: public

Description: Error raises an EListError (229) exception, with a message formatted with Msg and Data.

2.56.15 **TList.Exchange**

Synopsis: Exchanges two pointers in the list.

Declaration: procedure Exchange(Index1: Integer; Index2: Integer)

Visibility: public

Description: Exchange exchanges the pointers at positions Index1 and Index2. Both pointers must be within the current range of the list, or an EListError (229) exception will be raised.

2.56.16 **TList.Expand**

Synopsis: Increases the capacity of the list if needed.

Declaration: function Expand : TList

Visibility: public

Description: Expand increases the capacity of the list if the current element count matches the current list capacity.

The capacity is increased according to the following algorithm:

- 1.If the capacity is less than 3, the capacity is increased with 4.
- 2.If the capacity is larger than 3 and less than 8, the capacity is increased with 8.
- 3.If the capacity is larger than 8, the capacity is increased with 16.

The return value is `Self`.

See also: [Capacity \(1\)](#)

2.56.17 TList.Extract

Synopsis: Remove the first occurrence of a pointer from the list.

Declaration: `function Extract(item: Pointer) : Pointer`

Visibility: `public`

Description: `Extract` searched for an occurrence of `item`, and if a match is found, the match is deleted from the list. If no match is found, nothing is deleted. If `Item` was found, the result is `Item`. If `Item` was not found, the result is `Nil`. A `InExtracted` notification event is triggered if an element is extracted from the list.

See also: [TList.Delete \(1\)](#), [TList.IndexOf \(1\)](#), [TList.Remove \(1\)](#)

2.56.18 TList.First

Synopsis: Returns the first non-nil pointer in the list.

Declaration: `function First : Pointer`

Visibility: `public`

Description: `First` returns the value of the first non-nil pointer in the list.

If there are no pointers in the list or all pointers equal `Nil`, then `Nil` is returned.

See also: [Last \(1\)](#)

2.56.19 TList.GetEnumerator

Synopsis: Create an `IEnumerator` instance

Declaration: `function GetEnumerator : TListEnumerator`

Visibility: `public`

Description: `GetEnumerator` is the implementation of the `IEnumerable (1432)` interface for `TList`. It creates a `TListEnumerator (335)` instance and returns its `IEnumerator (1432)` interface.

See also: [TListEnumerator \(335\)](#), [IEnumerator \(1432\)](#), [IEnumerable \(1432\)](#)

2.56.20 TList.IndexOf

Synopsis: Returns the index of a given pointer.

Declaration: function IndexOf(Item: Pointer) : Integer

Visibility: public

Description: IndexOf searches for the pointer Item in the list of pointers, and returns the index of the pointer, if found.

If no pointer with the value Item was found, -1 is returned.

2.56.21 TList.Insert

Synopsis: Inserts a new pointer in the list at a given position.

Declaration: procedure Insert(Index: Integer; Item: Pointer)

Visibility: public

Description: Insert inserts pointer Item at position Index in the list. All pointers starting from Index are shifted to the right.

If Index is not a valid position, then a EListError (229) exception is raised.

See also: Add (1), Delete (1)

2.56.22 TList.Last

Synopsis: Returns the last non-nil pointer in the list.

Declaration: function Last : Pointer

Visibility: public

Description: Last returns the value of the last non-nil pointer in the list.

If there are no pointers in the list or all pointers equal Nil, then Nil is returned.

See also: First (1)

2.56.23 TList.Move

Synopsis: Moves a pointer from one position in the list to another.

Declaration: procedure Move(CurIndex: Integer; NewIndex: Integer)

Visibility: public

Description: Move moves the pointer at position CurIndex to position NewIndex. This is done by storing the value at position CurIndex, deleting the pointer at position CurIndex, and reinserting the value at position NewIndex

If CurIndex or Newindex are not inside the valid range of indices, an EListError (229) exception is raised.

See also: Exchange (1)

2.56.24 TList.Assign

Synopsis: Copy the contents of other lists.

Declaration: procedure Assign(ListA: TList; AOperator: TListAssignOp; ListB: TList)

Visibility: public

Description: Assign can be used to merge or assign lists. It is an extended version of the usual TPersistent.Assign mechanism. The arguments ListA and ListB are used as sources of pointers to add or remove elements from the current list, depending on the operation AOperation. The available operations are documented in the TListAssignOp (206) type.

See also: TList.Clear (1)

2.56.25 TList.Remove

Synopsis: Removes a value from the list.

Declaration: function Remove(Item: Pointer) : Integer

Visibility: public

Description: Remove searches Item in the list, and, if it finds it, deletes the item from the list. Only the first occurrence of Item is removed.

See also: Delete (1), IndexOf (1), Insert (1)

2.56.26 TList.Pack

Synopsis: Removes Nil pointers from the list and frees unused memory.

Declaration: procedure Pack

Visibility: public

Description: Pack removes all nil pointers from the list. The capacity of the list is then set to the number of pointers in the list. This method can be used to free unused memory if the list has grown to very large sizes and has a lot of unneeded nil pointers in it.

See also: TList.Clear (1)

2.56.27 TList.Sort

Synopsis: Sorts the pointers in the list.

Declaration: procedure Sort(Compare: TListSortCompare)

Visibility: public

Description: Sort> sorts the pointers in the list. Two pointers are compared by passing them to the Compare function. The result of this function determines how the pointers will be sorted:

- If the result of this function is negative, the first pointer is assumed to be 'less' than the second and will be moved before the second in the list.
- If the function result is positive, the first pointer is assumed to be 'greater than' the second and will be moved after the second in the list.

- if the function result is zero, the pointers are assumed to be 'equal' and no moving will take place.

The sort is done using a quicksort algorithm.

2.56.28 TList.Capacity

Synopsis: Current capacity (i.e. number of pointers that can be stored) of the list.

Declaration: Property Capacity : Integer

Visibility: public

Access: Read,Write

Description: Capacity contains the number of pointers the list can store before it starts to grow.

If a new pointer is added to the list using add (1) or insert (1), and there is not enough memory to store the new pointer, then the list will try to allocate more memory to store the new pointer. Since this is a time consuming operation, it is important that this operation be performed as little as possible. If it is known how many pointers there will be before filling the list, it is a good idea to set the capacity first before filling. This ensures that the list doesn't need to grow, and will speed up filling the list.

See also: SetCapacity (1), Count (1)

2.56.29 TList.Count

Synopsis: Current number of pointers in the list.

Declaration: Property Count : Integer

Visibility: public

Access: Read,Write

Description: Count is the current number of (possibly Nil) pointers in the list. Since the list is zero-based, the index of the largest pointer is Count - 1.

2.56.30 TList.Items

Synopsis: Provides access to the pointers in the list.

Declaration: Property Items [Index: Integer] : Pointer; default

Visibility: public

Access: Read,Write

Description: Items is used to access the pointers in the list. It is the default property of the TList class, so it can be omitted.

The list is zero-based, so Index must be in the range 0 to Count - 1.

2.56.31 TList.List

Synopsis: Memory array where pointers are stored.

Declaration: Property List : PPointerList

Visibility: public

Access: Read

Description: List points to the memory space where the pointers are stored. This can be used to quickly copy the list of pointers to another location.

2.57 TListEnumerator

2.57.1 Description

TListEnumerator implements the #rtl.system.IEnumerator ([1432](#)) interface for the TList ([327](#)) class, so the TList class can be used in a `for ... in` loop. It is returned by the TList.GetEnumerator ([1](#)) method of TList.

See also: TList ([327](#)), TList.GetEnumerator ([1](#)), #rtl.system.IEnumerator ([1432](#))

2.57.2 Method overview

Page	Property	Description
335	Create	Initialize a new instance of TListEnumerator
335	GetCurrent	Return the current pointer in the list
336	MoveNext	Move the position of the enumerator to the next position in the list.

2.57.3 Property overview

Page	Property	Access	Description
336	Current	r	Current pointer in the list

2.57.4 TListEnumerator.Create

Synopsis: Initialize a new instance of TListEnumerator

Declaration: constructor Create (AList: TList)

Visibility: public

Description: Create initializes a new instance of TListEnumerator and keeps a reference to the list AList that will be enumerated.

See also: TList ([327](#))

2.57.5 TListEnumerator.GetCurrent

Synopsis: Return the current pointer in the list

Declaration: function GetCurrent : Pointer

Visibility: public

Description: `GetCurrent` returns the current pointer in the enumerator.

Errors: No checking is done on the validity of the current position.

See also: `MoveNext` (1)

2.57.6 **TListEnumerator.MoveNext**

Synopsis: Move the position of the enumerator to the next position in the list.

Declaration: `function MoveNext : Boolean`

Visibility: public

Description: `MoveNext` puts the pointer on the next item in the list, and returns `True` if this succeeded, or `False` if the pointer is past the last element in the list.

Errors: Note that if `False` is returned, calling `GetCurrent` will result in an exception.

See also: `GetCurrent` (1)

2.57.7 **TListEnumerator.Current**

Synopsis: Current pointer in the list

Declaration: `Property Current : Pointer`

Visibility: public

Access: Read

Description: `Current` redefines `GetCurrent` (1) as a property.

See also: `GetCurrent` (1)

2.58 **TMemoryStream**

2.58.1 **Description**

`TMemoryStream` is a `TStream` (365) descendent that stores it's data in memory. It descends directly from `TCustomMemoryStream` (300) and implements the necessary to allocate and de-allocate memory directly from the heap. It implements the `Write` (1) method which is missing in `TCustomMemoryStream`.

`TMemoryStream` also introduces methods to load the contents of another stream or a file into the memory stream.

It is not necessary to do any memory management manually, as the stream will allocate or de-allocate memory as needed. When the stream is freed, all allocated memory will be freed as well.

See also: `TCustomMemoryStream` (300), `TStream` (365)

2.58.2 Method overview

Page	Property	Description
337	Clear	Zeroes the position, capacity and size of the stream.
337	Destroy	Frees any allocated memory and destroys the memory stream.
338	LoadFromFile	Loads the contents of a file into memory.
337	LoadFromStream	Loads the contents of a stream into memory.
338	SetSize	Sets the size for the memory stream.
338	Write	Writes data to the stream's memory.

2.58.3 TMemoryStream.Destroy

Synopsis: Frees any allocated memory and destroys the memory stream.

Declaration: `destructor Destroy; Override`

Visibility: public

Description: `Destroy` clears the memory stream, thus in effect freeing any memory allocated for it, and then frees the memory stream.

2.58.4 TMemoryStream.Clear

Synopsis: Zeroes the position, capacity and size of the stream.

Declaration: `procedure Clear`

Visibility: public

Description: `Clear` sets the position and size to 0, and sets the capacity of the stream to 0, thus freeing all memory allocated for the stream.

See also: [TStream.Size](#) ([1](#)), [TStream.Position](#) ([1](#)), [TCustomMemoryStream.Memory](#) ([1](#))

2.58.5 TMemoryStream.LoadFromStream

Synopsis: Loads the contents of a stream into memory.

Declaration: `procedure LoadFromStream(Stream: TStream)`

Visibility: public

Description: `LoadFromStream` loads the contents of `Stream` into the memorybuffer of the stream. Any previous contents of the memory stream are overwritten. Memory is allocated as needed.

Remark: The `LoadFromStream` uses the `Size` ([1](#)) property of `Stream` to determine how much memory must be allocated. Some streams do not allow the stream size to be determined, so care must be taken when using this method.

This method will work much faster than the use of the `TStream.CopyFrom` ([1](#)) method:

```
Seek(0, soFromBeginning);
CopyFrom(Stream, Stream.Size);
```

because the `CopyFrom` method copies the contents in blocks, while `LoadFromStream` reads the contents of the stream as one big block.

Errors: If an error occurs when reading from the stream, an `EStreamError` ([231](#)) may occur.

See also: [TStream.CopyFrom](#) ([1](#)), [TMemoryStream.LoadFromFile](#) ([1](#))

2.58.6 TMemoryStream.LoadFromFile

Synopsis: Loads the contents of a file into memory.

Declaration: procedure LoadFromFile(const FileName: string)

Visibility: public

Description: LoadFromFile loads the contents of the file with name FileName into the memory stream. The current contents of the memory stream is replaced by the contents of the file. Memory is allocated as needed.

The LoadFromFile method simply creates a filestream and then calls the TMemoryStream.LoadFromStream (1) method.

See also: TMemoryStream.LoadFromStream (1)

2.58.7 TMemoryStream.SetSize

Synopsis: Sets the size for the memory stream.

Declaration: procedure SetSize(NewSize: PtrInt); Override

Visibility: public

Description: SetSize sets the size of the memory stream to NewSize. This will set the capacity of the stream to NewSize and correct the current position in the stream when needed.

See also: TStream.Position (1), TStream.Size (1)

2.58.8 TMemoryStream.Write

Synopsis: Writes data to the stream's memory.

Declaration: function Write(const Buffer; Count: LongInt) : LongInt; Override

Visibility: public

Description: Write writes Count bytes from Buffer to the stream's memory, starting at the current position in the stream. If more memory is needed than currently allocated, more memory will be allocated. Any contents in the memory stream at the current position will be overwritten. The function returns the number of bytes actually written (which should under normal circumstances always equal Count).

This method overrides the TStream.Write (1) method.

Errors: If no more memory could be allocated, then an exception will be raised.

See also: TCustomMemoryStream.Read (1)

2.59 TOwnedCollection

2.59.1 Description

TOwnedCollection automatically maintains owner information, so it can be displayed in an IDE. Collections that should be displayed in an IDE should descend from TOwnedCollection or must implement a GetOwner function.

See also: TCollection (280)

2.59.2 Method overview

Page	Property	Description
339	Create	Create a new TOwnerCollection instance.

2.59.3 TOwnerCollection.Create

Synopsis: Create a new TOwnerCollection instance.

Declaration: constructor Create (AOwner: TPersistent; AItemClass: TCollectionItemClass)

Visibility: public

Description: Create creates a new instance of TOwnerCollection and stores the AOwner references. It will set the value returned in the TCollection.Owner ([1](#)) property of the collection. The ItemClass class reference is passed on to the inherited constructor, and will be used to create new instances in the Insert ([1](#)) and Add ([1](#)) methods.

See also: TCollection.Create ([1](#)), TCollection.Owner ([1](#))

2.60 TOwnerStream

2.60.1 Description

TOwnerStream can be used when creating stream chains such as when using encryption and compression streams. It keeps a reference to the source stream and will automatically free the source stream when ready (if the SourceOwner ([1](#)) property is set to True).

See also: TStream ([365](#)), TOwnerStream.Source ([1](#)), TOwnerStream.SourceOwner ([1](#))

2.60.2 Method overview

Page	Property	Description
339	Create	Create a new instance of TOwnerStream.
340	Destroy	Destroys the TOwnerStream instance and the source stream.

2.60.3 Property overview

Page	Property	Access	Description
340	Source	r	Reference to the source stream.
340	SourceOwner	rw	Indicates whether the ownerstream owns it's source

2.60.4 TOwnerStream.Create

Synopsis: Create a new instance of TOwnerStream.

Declaration: constructor Create (ASource: TStream)

Visibility: public

Description: Create instantiates a new instance of TOwnerStream and stores the reference to AStream. If SourceOwner is True, the source stream will also be freed when the instance is destroyed.

See also: TOwnerStream.Destroy ([1](#)), TOwnerStream.Source ([1](#)), TOwnerStream.SourceOwner ([1](#))

2.60.5 TOwnerStream.Destroy

Synopsis: Destroys the TOwnerStream instance and the source stream.

Declaration: `destructor Destroy; Override`

Visibility: public

Description: `Destroy` frees the source stream if the `SourceOwner` property is True.

See also: [TOwnerStream.Create](#) (1), [TOwnerStream.Source](#) (1), [TOwnerStream.SourceOwner](#) (1)

2.60.6 TOwnerStream.Source

Synopsis: Reference to the source stream.

Declaration: `Property Source : TStream`

Visibility: public

Access: Read

Description: `Source` is the source stream. It should be used by descendent streams to access the source stream to read from or write to.

Do not free the `Source` reference directly if `SourceOwner` is True. In that case the owner stream instance will free the source stream itself.

See also: [TOwnerStream.Create](#) (1)

2.60.7 TOwnerStream.SourceOwner

Synopsis: Indicates whether the ownerstream owns it's source

Declaration: `Property SourceOwner : Boolean`

Visibility: public

Access: Read,Write

Description: `SourceOwner` indicates whether the TOwnerStream owns it's `Source` stream or not. If this property is True then the `Source` stream is freed when the TOwnerStream instance is freed.

See also: [TOwnerStream.Source](#) (1), [TOwnerStream.Destroy](#) (1)

2.61 TParser

2.61.1 Description

This class breaks a stream of text data in tokens. Its primary use is to help reading the contents of a form file (usually a file with dfm, xfm or lfm extension), and for this reason it isn't suitable to be used as a general parser.

The parser is always positioned on a certain token, whose type is stored in the `Token` (1) property. Various methods are provided to obtain the token value in the desired format.

To advance to the next token, invoke `NextToken` (1) method.

See also: [TParser.Token](#) (1), [TParser.NextToken](#) (1)

2.61.2 Method overview

Page	Property	Description
342	CheckToken	Checks whether the token if of the given type.
342	CheckTokenSymbol	Checks whether the token equals the given symbol
341	Create	Creates a new parser instance.
341	Destroy	Destroys the parser instance.
342	Error	Raises an EParserError (230) exception with the given message
342	ErrorFmt	Raises an EParserError (230) exception and formats the message.
342	ErrorStr	Raises an EParserError (230) exception with the given message
343	HexToBinary	Writes hexadecimal data to a stream.
343	NextToken	Reads the next token and returns its type.
343	SourcePos	Returns the current position in the stream.
344	TokenComponentIdent	Returns the path of a subcomponent starting from the current token.
344	TokenFloat	Returns the current token as a float.
344	TokenInt	Returns the current token as an integer.
345	TokenString	Returns the current token as a string.
345	TokenSymbolIs	Returns True if the token equals the given symbol.
345	TokenWideString	Returns the current token as a widestring

2.61.3 Property overview

Page	Property	Access	Description
346	FloatType	r	The type of a float token.
346	SourceLine	r	Current source line number.
346	Token	r	The type of the current token.

2.61.4 TParser.Create

Synopsis: Creates a new parser instance.

Declaration: constructor Create(Stream: TStream)

Visibility: public

Description: Create creates a new TParser instance, using Stream as the stream to read data from, and reads the first token from the stream.

Errors: If an error occurs while parsing the first token, an EParserError ([230](#)) exception is raised.

See also: TParser.NextToken ([1](#)), TParser.Token ([1](#))

2.61.5 TParser.Destroy

Synopsis: Destroys the parser instance.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroys the parser instance.

Errors: None.

2.61.6 TParser.CheckToken

Synopsis: Checks whether the token if of the given type.

Declaration: procedure CheckToken (T: Char)

Visibility: public

Description: Checks whether the token if of the given type.

Errors: If current token isn't of type T, an EParserError (230) exception is raised.

See also: TParser.Token (1)

2.61.7 TParser.CheckTokenSymbol

Synopsis: Checks whether the token equals the given symbol

Declaration: procedure CheckTokenSymbol (const S: string)

Visibility: public

Description: CheckTokenSymbol performs a case-insensitive comparison of current token value with S.

Current token must be of type toSymbol (200), otherwise an EParserError (230) exception is raised.

Errors: If the comparison fails, or current token isn't a symbol, an EParserError (230) exception is raised.

See also: TParser.TokenSymbolIs (1), toSymbol (200)

2.61.8 TParser.Error

Synopsis: Raises an EParserError (230) exception with the given message

Declaration: procedure Error (const Ident: string)

Visibility: public

Description: Raises an EParserError (230) exception with the given message

2.61.9 TParser.ErrorFmt

Synopsis: Raises an EParserError (230) exception and formats the message.

Declaration: procedure ErrorFmt (const Ident: string; const Args: Array of const)

Visibility: public

Description: Raises an EParserError (230) exception and formats the message.

2.61.10 TParser.ErrorStr

Synopsis: Raises an EParserError (230) exception with the given message

Declaration: procedure ErrorStr (const Message: string)

Visibility: public

Description: Raises an EParserError (230) exception with the given message

2.61.11 TParser.HexToBinary

Synopsis: Writes hexadecimal data to a stream.

Declaration: procedure HexToBinary (Stream: TStream)

Visibility: public

Description: HexToBinary reads a sequence of hexadecimal characters from the input stream and converts them to a sequence of bytes which is written to Stream. Each byte is represented by two contiguous hexadecimal characters.

Whitespace is allowed between hexadecimal characters if it doesn't appear between two characters that form the same byte.

HexToBinary stops when the first non-hexadecimal and non-whitespace character is found, or the end of the input stream is reached.

Remark: This method begins reading after the current token: that is, current token, even if it's a valid hexadecimal value, isn't included.

Errors: If a single hexadecimal character is found, an EParserError (230) exception is raised.

2.61.12 TParser.NextToken

Synopsis: Reads the next token and returns its type.

Declaration: function NextToken : Char

Visibility: public

Description: NextToken parses the next token in the stream and returns its type. The type of the token can also be retrieved later reading Token (1) property.

If the end of the stream is reached, toEOF (199) is returned.

For details about token types, see TParser.Token (1)

Errors: If an error occurs while parsing the token, an EParserError (230) exception is raised.

See also: TParser.Token (1)

2.61.13 TParser.SourcePos

Synopsis: Returns the current position in the stream.

Declaration: function SourcePos : LongInt

Visibility: public

Description: This is not the character position relative to the current source line, but the byte offset from the beginning of the stream.

Errors: None.

See also: TParser.SourceLine (1)

2.61.14 TParser.TokenComponentIdent

Synopsis: Returns the path of a subcomponent starting from the current token.

Declaration: function TokenComponentIdent : string

Visibility: public

Description: If current token is toSymbol (200), TokenComponentIdent tries to find subcomponent names separated by a dot (.). The returned string is the longest subcomponent path found. If there are no subcomponents, current symbol is returned.

Remark: After this method has been called, subsequent calls to TokenString (1) or TokenWideString (1) return the same value returned by TokenComponentIdent.

Example

If source stream contains a.b.c and TParser is positioned on the first token (a), this method returns a.b.c.

Errors: If Token (1) isn't toSymbol (200), or no valid symbol is found after a dot, an EParserError (230) exception is raised.

See also: TParser.NextToken (1), TParser.Token (1), TParser.TokenString (1), TParser.TokenWideString (1), toSymbol (200)

2.61.15 TParser.TokenFloat

Synopsis: Returns the current token as a float.

Declaration: function TokenFloat : Extended

Visibility: public

Description: If current token type is toFloat (199), this method returns the token value as a float.

To specify a negative number, no space must exist between unary minus and number.

Floating point numbers can be postfixed with a character that specifies the floating point type. See FloatType (1) for further information.

Remark: In the input stream the decimal separator, if present, must be a dot (.).

Errors: If Token (1) isn't toFloat (199), an EParserError (230) exception is raised.

See also: TParser.FloatType (1), TParser.NextToken (1), TParser.Token (1), toFloat (199)

2.61.16 TParser.TokenInt

Synopsis: Returns the current token as an integer.

Declaration: function TokenInt : Int64

Visibility: public

Description: If current token type is toInteger (200), this method returns the token value as an integer.

In the input stream an integer can be an hexadecimal (prefixed by '\$' character) or decimal number. Decimal numbers can be prefixed by an unary minus: if this is the case, no space must exist between minus and number.

Errors: If Token (1) isn't toInteger (200), an EConvertError (1) exception is raised.

See also: TParser.NextToken (1), TParser.Token (1), toInteger (200)

2.61.17 TParser.TokenString

Synopsis: Returns the current token as a string.

Declaration: function TokenString : string

Visibility: public

Description: If current token type is [toString \(200\)](#) or [toWString \(200\)](#), this method returns the contents of the string. That is, enclosing quotes are removed, embedded quotes are unescaped and control strings are converted to the appropriate sequence of characters.

If current token type isn't a string, a string containing the token representation in the input stream is returned, without any conversion: hexadecimal integers are returned with the leading \$, and floating point suffixes like s, c or d are kept. For tokens whose type isn't a special type, return value of `TokenString` equals `Token (1)`.

Remark: If `Token (1)` is [toWString \(200\)](#), `TokenWideString (1)` should be used instead.

Errors: None.

See also: `TParser.NextToken (1)`, `TParser.TokenWideString (1)`, `TParser.Token (1)`, [toString \(200\)](#), [toWString \(200\)](#)

2.61.18 TParser.TokenWideString

Synopsis: Returns the current token as a widestring

Declaration: function TokenWideString : WideString

Visibility: public

Description: If current token type is [toWString \(200\)](#), this method returns the contents of the string. That is, enclosing quotes are removed, embedded quotes are unescaped and control strings are converted to the appropriate sequence of characters.

If current token isn't a widestring, `TokenWideString` behaviour is the same as `TokenString (1)`.

Errors: None.

See also: `TParser.NextToken (1)`, `TokenString (1)`, `TParser.Token (1)`, [toWString \(200\)](#)

2.61.19 TParser.TokenSymbols

Synopsis: Returns `True` if the token equals the given symbol.

Declaration: function TokenSymbolIs(const S: string) : Boolean

Visibility: public

Description: `TokenSymbolIs` performs a case-insensitive comparison of current token value with `S`.

If current token isn't of type [toSymbol \(200\)](#), or comparison fails, `False` is returned.

Errors: None.

See also: `TParser.CheckTokenSymbol (1)`, `TParser.Token (1)`

2.61.20 TParser.FloatType

Synopsis: The type of a float token.

Declaration: Property FloatType : Char

Visibility: public

Access: Read

Description: Floating point numbers can be postfixed with a character specifying the type of floating point value.

When specified, this property holds the character postfixed to the number.

It can be one of the following values:

Table 2.23:

s or S	Value is a single.
c or C	Value is a currency.
d or D	Value is a date.

If Token (1) isn't toFloat (199) or one of the above characters wasn't specified, FloatType is the null character (zero).

See also: TParser.NextToken (1), TParser.Token (1), TParser.TokenFloat (1), toFloat (199)

2.61.21 TParser.SourceLine

Synopsis: Current source line number.

Declaration: Property SourceLine : Integer

Visibility: public

Access: Read

Description: Current source line number.

See also: TParser.SourcePos (1)

2.61.22 TParser.Token

Synopsis: The type of the current token.

Declaration: Property Token : Char

Visibility: public

Access: Read

Description: This property holds the type of the current token. When Token isn't one of the special token types (whose value can be retrieved with specific methods) it is the character representing the current token.

Special token types:

Table 2.24:

toEOF (199)	Value returned by TParser.Token (1) when the end of the input stream was reached.
toSymbol (200)	Value returned by TParser.Token (1) when a symbol was found in the input stream.
toString (200)	Value returned by TParser.Token (1) when a string was found in the input stream.
toInteger (200)	Value returned by TParser.Token (1) when an integer was found in the input stream.
toFloat (199)	Value returned by TParser.Token (1) when a floating point value was found in the input stream.
toWString (200)	Value returned by TParser.Token (1) when a widestring was found in the input stream.

To advance to the next token, use NextToken (1) method.

See also: [TParser.CheckToken \(1\)](#), [TParser.NextToken \(1\)](#), [TParser.TokenComponentIdent \(1\)](#), [TParser.TokenFloat \(1\)](#), [TParser.TokenInt \(1\)](#), [TParser.TokenString \(1\)](#), [TParser.TokenWideString \(1\)](#)

2.62 TPersistent

2.62.1 Description

TPersistent is the basic class for the streaming system. Since it is compiled in the { \$M+ } state, the compiler generates RTTI (Run-Time Type Information) for it and all classes that descend from it. This information can be used to stream all properties of classes.

It also introduces functionality to assign the contents of 2 classes to each other.

See also: [TComponent \(289\)](#)

2.62.2 Interfaces overview

Page	Property	Description
233	IFPObserved	

2.62.3 Method overview

Page	Property	Description
348	Assign	Assign the contents of one class to another.
347	Destroy	Destroys the TPersistent instance.
348	GetNamePath	Returns a string that can be used to identify the class instance.

2.62.4 TPersistent.Destroy

Synopsis: Destroys the TPersistent instance.

Declaration: `destructor Destroy; Override`

Visibility: public

Description: `Destroy` disposes of the persistent object. This method should never be called directly. Instead the `Free` method should be used.

2.62.5 TPersistent.Assign

Synopsis: Assign the contents of one class to another.

Declaration: procedure Assign(Source: TPersistent); Virtual

Visibility: public

Description: Assign copies the contents of Source to Self, if the classes of the destination and source classes are compatible.

The TPersistent implementation of Assign does nothing but calling the AssignTo (1) method of source. This means that if the destination class does not know how to assign the contents of the source class, the source class instance is asked to assign itself to the destination class. This means that it is necessary to implement only one of the two methods so that two classes can be assigned to one another.

Remark: In general, a statement of the form

```
Destination:=Source;
```

(where Destination and Source are classes) does not achieve the same as a statement of the form

```
Destination.Assign(Source);
```

After the former statement, both Source and Destination will point to the same object. The latter statement will copy the *contents* of the Source class to the Destination class.

See also: AssignTo (1)

2.62.6 TPersistent.GetNamePath

Synopsis: Returns a string that can be used to identify the class instance.

Declaration: function GetNamePath : string; Virtual

Visibility: public

Description: GetNamePath returns a string that can be used to identify the class instance. This can be used to display a name for this instance in a Object designer.

GetNamePath constructs a name by recursively prepending the Classname of the Owner instance to the Classname of this instance, separated by a dot.

See also: TPersistent.GetOwner (1)

2.63 TProxyStream

2.63.1 Description

TProxyStream is a proxy class for the #rtl.types.IStream (1635) interface. It implements all stream methods by relaying them to the IStream interface.

See also: #rtl.types.IStream (1635), TStreamAdapter (374)

2.63.2 Method overview

Page	Property	Description
349	Check	Check errors
349	Create	Create a new instance of the TProxyStream class.
349	Read	
349	Seek	
349	Write	

2.63.3 TProxyStream.Create

Synopsis: Create a new instance of the TProxyStream class.

Declaration: constructor Create(const Stream: IStream)

Visibility: public

Description: Create initializes a new instance of the TProxyStream class. It saves var stream for use in the other methods.

See also: #rtl.types.IStream ([1635](#))

2.63.4 TProxyStream.Read

Declaration: function Read(var Buffer; Count: LongInt) : LongInt; Override

Visibility: public

2.63.5 TProxyStream.Write

Declaration: function Write(const Buffer; Count: LongInt) : LongInt; Override

Visibility: public

2.63.6 TProxyStream.Seek

Declaration: function Seek(const Offset: Int64; Origin: TSeekOrigin) : Int64
; Override

Visibility: public

2.63.7 TProxyStream.Check

Synopsis: Check errors

Declaration: procedure Check(err: LongInt); Virtual

Visibility: public

Description: Check will check the result of the IStream interface. This method must be overridden by descendant classes to return interface-specific errors.

See also: #rtl.types.IStream ([1635](#))

2.64 TReader

2.64.1 Description

The `TReader` class is a reader class that implements generic component streaming capabilities, independent of the format of the data in the stream. It uses a driver class `TAbstractObjectReader` (243) to do the actual reading of data. The interface of the `TReader` class should be identical to the interface in Delphi.

Note that the `TReader` design is such that it can read a single component from a stream. It will read all children of this component, but it is not designed to read multiple components in succession from one stream.

It should never be necessary to create an instance of this class directly. Instead, the `TStream.ReadComponent` (1) call should be used.

See also: `TFiler` (306), `TWriter` (410), `TAbstractObjectReader` (243)

2.64.2 Method overview

Page	Property	Description
352	BeginReferences	Initializes the component referencing mechanism.
353	CheckValue	Raises an exception if the next value in the stream is not of type Value
359	CopyValue	Copy a value to a writer.
352	Create	Creates a new reader class
353	DefineBinaryProperty	Reads a user-defined binary property from the stream.
353	DefineProperty	Reads a user-defined property from the stream.
352	Destroy	Destroys a reader class.
353	EndOfList	Returns true if the stream contains an end-of-list marker.
353	EndReferences	Finalizes the component referencing mechanism.
354	FixupReferences	Tries to resolve all unresolved component references.
354	NextValue	Returns the type of the next value.
354	Read	Read raw data from stream
354	ReadBoolean	Reads a boolean from the stream.
354	ReadChar	Reads a character from the stream.
355	ReadCollection	Reads a collection from the stream.
355	ReadComponent	Starts reading a component from the stream.
355	ReadComponents	Starts reading child components from the stream.
356	ReadCurrency	Read a currency value from the stream.
356	ReadDate	Reads a date from the stream
356	ReadFloat	Reads a float from the stream.
356	ReadIdent	Reads an identifier from the stream.
357	ReadInt64	Reads a 64-bit integer from the stream.
357	ReadInteger	Reads an integer from the stream
357	ReadListBegin	Checks for the beginning of a list.
357	ReadListEnd	Checks for the end of a list.
358	ReadRootComponent	Starts reading a root component.
357	ReadSet	Read a set value from the stream
356	ReadSingle	Reads a single-type real from the stream.
358	ReadString	Reads a string from the stream.
355	ReadUnicodeChar	Read unicode character
358	ReadUnicodeString	Read a UnicodeString value from the stream
359	ReadValue	Reads the next value type from the stream.
358	ReadVariant	Read a variant from the stream
355	ReadWideChar	Read widechar from the stream
358	ReadWideString	Read a WideString value from the stream.

2.64.3 Property overview

Page	Property	Access	Description
359	Driver	r	The driver in use for streaming the data.
361	OnAncestorNotFound	rw	Handler called when the ancestor component cannot be found.
361	OnCreateComponent	rw	Handler called when a component needs to be created.
360	OnError	rw	Handler called when an error occurs.
361	OnFindComponentClass	rw	Handler called when a component class reference needs to be found.
360	OnFindMethod	rw	Handler to find or change a method address.
360	OnPropertyNotFound	rw	Handler for treating missing properties.
362	OnReadStringProperty	rw	Handler for translating strings when read from the stream.
361	OnReferenceName	rw	Handler called when another component is referenced.
360	OnSetMethodProperty	rw	Handler for setting method properties.
361	OnSetName	rw	Handler called when setting a component name.
359	Owner	rw	Owner of the component being read
359	Parent	rw	Parent of the component being read.

2.64.4 TReader.Create

Synopsis: Creates a new reader class

Declaration: constructor Create(Stream: TStream; BufSize: Integer)

Visibility: public

Description: Creates a new reader class

2.64.5 TReader.Destroy

Synopsis: Destroys a reader class.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroys a reader class.

2.64.6 TReader.BeginReferences

Synopsis: Initializes the component referencing mechanism.

Declaration: procedure BeginReferences

Visibility: public

Description: When streaming components, the streaming mechanism keeps a list of existing components that can be referenced to. This method initializes up that system.

2.64.7 TReader.CheckValue

Synopsis: Raises an exception if the next value in the stream is not of type Value

Declaration: procedure CheckValue (Value: TValueType)

Visibility: public

Description: Raises an exception if the next value in the stream is not of type Value

2.64.8 TReader.DefineProperty

Synopsis: Reads a user-defined property from the stream.

Declaration: procedure DefineProperty (const Name: string; AReadData: TReaderProc;
WriteData: TWriterProc; HasData: Boolean)
; Override

Visibility: public

Description: Reads a user-defined property from the stream.

2.64.9 TReader.DefineBinaryProperty

Synopsis: Reads a user-defined binary property from the stream.

Declaration: procedure DefineBinaryProperty (const Name: string;
AReadData: TStreamProc;
WriteData: TStreamProc; HasData: Boolean)
; Override

Visibility: public

Description: Reads a user-defined binary property from the stream.

2.64.10 TReader.EndOfList

Synopsis: Returns true if the stream contains an end-of-list marker.

Declaration: function EndOfList : Boolean

Visibility: public

Description: Returns true if the stream contains an end-of-list marker.

2.64.11 TReader.EndReferences

Synopsis: Finalizes the component referencing mechanism.

Declaration: procedure EndReferences

Visibility: public

Description: When streaming components, the streaming mechanism keeps a list of existing components that can be referenced to. This method cleans up that system.

2.64.12 TReader.FixupReferences

Synopsis: Tries to resolve all unresolved component references.

Declaration: procedure FixupReferences

Visibility: public

Description: Tries to resolve all unresolved component references.

2.64.13 TReader.NextValue

Synopsis: Returns the type of the next value.

Declaration: function NextValue : TValueType

Visibility: public

Description: Returns the type of the next value.

2.64.14 TReader.Read

Synopsis: Read raw data from stream

Declaration: procedure Read(var Buf; Count: LongInt); Virtual

Visibility: public

Description: Read is introduced for Delphi compatibility to read raw data from the component stream. This should not be used in new production code as it will totally mess up the streaming.

See also: TAbstractObjectReader.Read ([1](#)), TBinaryObjectReader.Read ([1](#))

2.64.15 TReader.ReadBoolean

Synopsis: Reads a boolean from the stream.

Declaration: function ReadBoolean : Boolean

Visibility: public

Description: Reads a boolean from the stream.

2.64.16 TReader.ReadChar

Synopsis: Reads a character from the stream.

Declaration: function ReadChar : Char

Visibility: public

Description: Reads a character from the stream.

2.64.17 TReader.ReadWideChar

Synopsis: Read widechar from the stream

Declaration: function ReadWideChar : WideChar

Visibility: public

Description: TReader.ReadWideChar reads a widechar from the stream. This actually reads a widestring and returns the first character.

See also: TReader.ReadWideString (1), TWriter.WriteWideChar (1)

2.64.18 TReader.ReadUnicodeChar

Synopsis: Read unicode character

Declaration: function ReadUnicodeChar : UnicodeChar

Visibility: public

Description: ReadUnicodeChar reads a single unicode character from the stream. It does this by reading a UnicodeString string from the stream and returning the first character.

Errors: If the string has a length different from 1, an EReadError exception will occur.

See also: TReader.ReadUnicodeString (1)

2.64.19 TReader.ReadCollection

Synopsis: Reads a collection from the stream.

Declaration: procedure ReadCollection(Collection: TCollection)

Visibility: public

Description: Reads a collection from the stream.

2.64.20 TReader.ReadComponent

Synopsis: Starts reading a component from the stream.

Declaration: function ReadComponent(Component: TComponent) : TComponent

Visibility: public

Description: Starts reading a component from the stream.

2.64.21 TReader.ReadComponents

Synopsis: Starts reading child components from the stream.

Declaration: procedure ReadComponents(AOwner: TComponent; AParent: TComponent;
Proc: TReadComponentsProc)

Visibility: public

Description: Starts reading child components from the stream.

2.64.22 TReader.ReadFloat

Synopsis: Reads a float from the stream.

Declaration: function ReadFloat : Extended

Visibility: public

Description: Reads a float from the stream.

2.64.23 TReader.ReadSingle

Synopsis: Reads a single-type real from the stream.

Declaration: function ReadSingle : Single

Visibility: public

Description: Reads a single-type real from the stream.

2.64.24 TReader.ReadDate

Synopsis: Reads a date from the stream

Declaration: function ReadDate : TDateTime

Visibility: public

Description: Reads a date from the stream

2.64.25 TReader.ReadCurrency

Synopsis: Read a currency value from the stream.

Declaration: function ReadCurrency : Currency

Visibility: public

Description: ReadCurrency reads a currency typed value from the stream and returns the result. This method does nothing except call the driver method of the driver being used.

See also: TWriter.WriteCurrency ([1](#))

2.64.26 TReader.ReadIdent

Synopsis: Reads an identifier from the stream.

Declaration: function ReadIdent : string

Visibility: public

Description: Reads an identifier from the stream.

2.64.27 TReader.ReadInteger

Synopsis: Reads an integer from the stream

Declaration: function ReadInteger : LongInt

Visibility: public

Description: Reads an integer from the stream

2.64.28 TReader.ReadInt64

Synopsis: Reads a 64-bit integer from the stream.

Declaration: function ReadInt64 : Int64

Visibility: public

Description: Reads a 64-bit integer from the stream.

2.64.29 TReader.ReadSet

Synopsis: Read a set value from the stream

Declaration: function ReadSet(EnumType: Pointer) : Integer

Visibility: public

Description: ReadSet reads a set of elements with type `EnumType` and returns them as an integer where each element is encoded in a bit of the integer. Thus, at most an enumerated type with 32 elements can be read with this function.

Errors: No checking is performed on the validity of `EnumType`. It is assumed to be a valid `PTypeInfo` pointer.

See also: `TWriter.WriteSet` (1)

2.64.30 TReader.ReadListBegin

Synopsis: Checks for the beginning of a list.

Declaration: procedure ReadListBegin

Visibility: public

Description: Checks for the beginning of a list.

2.64.31 TReader.ReadListEnd

Synopsis: Checks for the end of a list.

Declaration: procedure ReadListEnd

Visibility: public

Description: Checks for the end of a list.

2.64.32 TReader.ReadRootComponent

Synopsis: Starts reading a root component.

Declaration: function ReadRootComponent (ARoot : TComponent) : TComponent

Visibility: public

Description: Starts reading a root component.

2.64.33 TReader.ReadVariant

Synopsis: Read a variant from the stream

Declaration: function ReadVariant : Variant

Visibility: public

Description: ReadVariant reads the next value from the stream and returns it as a variant. No variant array can be read from the stream, only single values.

Errors: If no variant manager is installed, the function will raise an EReadError exception. If the next value is not a simple value, again an EReadError exception is raised. exception is

See also: [TBinaryObjectWriter.WriteVariant \(1\)](#)

2.64.34 TReader.ReadString

Synopsis: Reads a string from the stream.

Declaration: function ReadString : string

Visibility: public

Description: Reads a string from the stream.

2.64.35 TReader.ReadWideString

Synopsis: Read a WideString value from the stream.

Declaration: function ReadWideString : WideString

Visibility: public

Description: ReadWideString reads a WideString typed value from the stream and returns the result. This method does nothing except call the driver method of the driver being used.

See also: [TWriter.WriteString \(1\)](#)

2.64.36 TReader.ReadUnicodeString

Synopsis: Read a UnicodeString value from the stream

Declaration: function ReadUnicodeString : UnicodeString

Visibility: public

Description: ReadUnicodeString reads a UnicodeString string from the stream. The stream can contain a string from any type, it will be converted to UnicodeString.

See also: [TAbstractObjectReader.ReadUnicodeString \(1\)](#), [TWriter.WriteString \(1\)](#)

2.64.37 TReader.ReadValue

Synopsis: Reads the next value type from the stream.

Declaration: function ReadValue : TValueType

Visibility: public

Description: Reads the next value type from the stream.

2.64.38 TReader.CopyValue

Synopsis: Copy a value to a writer.

Declaration: procedure CopyValue(Writer: TWriter)

Visibility: public

Description: CopyValue reads the next value from the reader stream, and writes it to the passed Writer.

2.64.39 TReader.Driver

Synopsis: The driver in use for streaming the data.

Declaration: Property Driver : TAbstractObjectReader

Visibility: public

Access: Read

Description: The driver in use for streaming the data.

2.64.40 TReader.Owner

Synopsis: Owner of the component being read

Declaration: Property Owner : TComponent

Visibility: public

Access: Read,Write

Description: Owner of the component being read

2.64.41 TReader.Parent

Synopsis: Parent of the component being read.

Declaration: Property Parent : TComponent

Visibility: public

Access: Read,Write

Description: Parent of the component being read.

2.64.42 TReader.OnError

Synopsis: Handler called when an error occurs.

Declaration: Property OnError : TReaderError

Visibility: public

Access: Read,Write

Description: Handler called when an error occurs.

2.64.43 TReader.OnPropertyNotFound

Synopsis: Handler for treating missing properties.

Declaration: Property OnPropertyNotFound : TPropertyNotFoundEvent

Visibility: public

Access: Read,Write

Description: OnPropertyNotFound can be used to take appropriate action when a property is read from a stream and no such property is found in the RTTI information of the Instance that is being read from the stream. It can be set at runtime, or at designtime by an IDE.

For more information about the meaning of the various arguments to the event handler, see TPropertyNotFoundEvent ([208](#)).

See also: TPropertyNotFoundEvent ([208](#)), TReader.OnSetMethodProperty ([1](#)), TReader.OnReadStringProperty ([1](#))

2.64.44 TReader.OnFindMethod

Synopsis: Handler to find or change a method address.

Declaration: Property OnFindMethod : TFindMethodEvent

Visibility: public

Access: Read,Write

Description: Handler to find or change a method address.

2.64.45 TReader.OnSetMethodProperty

Synopsis: Handler for setting method properties.

Declaration: Property OnSetMethodProperty : TSetMethodPropertyEvent

Visibility: public

Access: Read,Write

Description: OnSetMethodProperty can be set to handle the setting of method properties. This handler can be used by an IDE to prevent methods from actually being assigned when an object is being streamed in the designer.

See also: TReader.OnReadStringProperty ([1](#)), TReader.OnPropertyNotFound ([1](#))

2.64.46 TReader.OnSetName

Synopsis: Handler called when setting a component name.

Declaration: Property OnSetName : TSetNameEvent

Visibility: public

Access: Read,Write

Description: Handler called when setting a component name.

2.64.47 TReader.OnReferenceName

Synopsis: Handler called when another component is referenced.

Declaration: Property OnReferenceName : TReferenceNameEvent

Visibility: public

Access: Read,Write

Description: Handler called when another component is referenced.

2.64.48 TReader.OnAncestorNotFound

Synopsis: Handler called when the ancestor component cannot be found.

Declaration: Property OnAncestorNotFound : TAnccestorNotFoundEvent

Visibility: public

Access: Read,Write

Description: Handler called when the ancestor component cannot be found.

2.64.49 TReader.OnCreateComponent

Synopsis: Handler called when a component needs to be created.

Declaration: Property OnCreateComponent : TCreateComponentEvent

Visibility: public

Access: Read,Write

Description: Handler called when a component needs to be created.

2.64.50 TReader.OnFindComponentClass

Synopsis: Handler called when a component class reference needs to be found.

Declaration: Property OnFindComponentClass : TFindComponentClassEvent

Visibility: public

Access: Read,Write

Description: Handler called when a component class reference needs to be found.

2.64.51 TReader.OnReadStringProperty

Synopsis: Handler for translating strings when read from the stream.

Declaration: Property OnReadStringProperty : TReadWriteStringPropertyEvent

Visibility: public

Access: Read,Write

Description: OnReadStringProperty is called whenever a string property is read from the stream. It can be used e.g. by a translation mechanism to translate the strings on the fly, when a form is loaded. See TReadWriteStringPropertyEvent (208) for a description of the various parameters.

See also: TReader.OnPropertyNotFound (1), TReader.OnSetMethodProperty (1), TReadWriteStringPropertyEvent (208)

2.65 TRecall

2.65.1 Description

TRecall is a helper class used to copy published properties of a class (the reference object) in another class (the storage object). The reference object and storage object must be assignable to each other.

The TRecall can be used to store the state of a persistent class, and restore it at a later time.

When a TRecall object is created, it gets passed a reference instance and a storage instance. It immediately stores the properties of the reference object in the storage object.

The Store (1) method can be called throughout the lifetime of the reference object to update the stored properties.

When the TRecall instance is destroyed then the properties are copied from the storage object to the reference object. The storage object is freed automatically.

If the properties should not be copied back from the storage to the reference object, the Forget (1) can be called.

See also: TRecall.Create (1), TRecall.Destroy (1), TRecall.Forget (1), TRecall.Store (1), TPersistent.Assign (1)

2.65.2 Method overview

Page	Property	Description
363	Create	Creates a new instance of TRecall.
363	Destroy	Copies the stored properties to the reference object and destroys the TRecall instance.
363	Forget	Clear the reference property.
363	Store	Assigns the reference instance to the storage instance.

2.65.3 Property overview

Page	Property	Access	Description
364	Reference	r	The reference object.

2.65.4 TRecall.Create

Synopsis: Creates a new instance of TRecall.

Declaration: constructor Create (AStorage: TPersistent; AReference: TPersistent)

Visibility: public

Description: Create creates a new instance of TRecall and initializes the Reference and Storage instances. It calls Store (1) to assign the reference object properties to the storage instance.

See also: TRecall.Store (1), TRecall.Destroy (1)

2.65.5 TRecall.Destroy

Synopsis: Copies the stored properties to the reference object and destroys the TRecall instance.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroy assigns the storage instance to the reference instance, if the latter is still valid. After this, it frees the storage and calls the inherited destroy.

Errors: Destroy does not check whether the reference (1) instance is still valid. If the reference pointer was invalidated, call TRecall.Forget (1) to clear the reference instance.

See also: TRecall.Store (1), TRecall.Forget (1)

2.65.6 TRecall.Store

Synopsis: Assigns the reference instance to the storage instance.

Declaration: procedure Store

Visibility: public

Description: Store assigns the reference instance to the storage instance. This will only work if the two classes can be assigned to each other.

This method can be used to refresh the storage.

Errors: Store does not check whether the reference (1) instance is still valid. If the reference pointer was invalidated, call TRecall.Forget (1) to clear the reference instance.

2.65.7 TRecall.Forget

Synopsis: Clear the reference property.

Declaration: procedure Forget

Visibility: public

Description: Forget sets the Reference (1) property to Nil. When the TRecall instance is destroyed, the reference instance will not be restored.

Note that after a call to Forget, a call to Store (1) has no effect.

Errors: None.

See also: TRecall.Reference (1), TRecall.Store (1), TRecall.Destroy (1)

2.65.8 TRecall.Reference

Synopsis: The reference object.

Declaration: Property Reference : TPersistent

Visibility: public

Access: Read

Description: Reference is the instance of the reference object. Do not free the reference directly. Call Forget ([1](#)) to clear the reference and then free the reference object.

See also: TRecall.Forget ([1](#))

2.66 TResourceStream

2.66.1 Description

Stream that reads its data from a resource object.

2.66.2 Method overview

Page	Property	Description
364	Create	Creates a new instance of a resource stream.
364	CreateFromID	Creates a new instance of a resource stream with a resource
365	Destroy	Destroys the instance of the resource stream.

2.66.3 TResourceStream.Create

Synopsis: Creates a new instance of a resource stream.

Declaration: constructor Create(Instance: TFPResourceHMODULE; const ResName: string; ResType: PChar)

Visibility: public

Description: Creates a new instance of a resource stream.

2.66.4 TResourceStream.CreateFromID

Synopsis: Creates a new instance of a resource stream with a resource

Declaration: constructor CreateFromID(Instance: TFPResourceHMODULE; ResID: Integer; ResType: PChar)

Visibility: public

Description: The resource is loaded from the loaded module (identified by the handle Instance), identifier ResID and type ResType.

2.66.5 TResourceStream.Destroy

Synopsis: Destroys the instance of the resource stream.

Declaration: `destructor Destroy; Override`

Visibility: public

Description: Destroys the instance of the resource stream.

2.67 TStream

2.67.1 Description

TStream is the base class for all streaming classes. It defines methods for reading (1), writing (1) from and to streams, as well as functions to determine the size of the stream as well as the current position of the stream.

Descendent classes such as TMemoryStream (336) or TFileStream (308) then override these methods to write streams to memory or file.

See also: TMemoryStream (336), TFileStream (308), TStringStream (401)

2.67.2 Method overview

Page	Property	Description
368	CopyFrom	Copy data from one stream to another
370	FixupResourceHeader	Not implemented in FPC
366	Read	Reads data from the stream to a buffer and returns the number of bytes read.
372	ReadAnsiString	Read an ansistring from the stream and return its value.
367	ReadBuffer	Reads data from the stream to a buffer
371	ReadByte	Read a byte from the stream and return its value.
368	ReadComponent	Reads component data from a stream
369	ReadComponentRes	Reads component data and resource header from a stream
371	ReadDWord	Read a DWord from the stream and return its value.
372	ReadQWord	Read a QWord value from the stream and return its value
371	ReadResHeader	Read a resource header from the stream.
371	ReadWord	Read a word from the stream and return its value.
366	Seek	Sets the current position in the stream
366	Write	Writes data from a buffer to the stream and returns the number of bytes written.
373	WriteAnsiString	Write an ansistring to the stream.
368	WriteBuffer	Writes data from a buffer to the stream
372	WriteByte	Write a byte to the stream.
369	WriteComponent	Write component data to the stream
369	WriteComponentRes	Write resource header and component data to a stream
369	WriteDescendent	Write component data to a stream, relative to an ancestor
370	WriteDescendentRes	Write resource header and component data to a stream, relative to an ancestor
373	WriteDWord	Write a DWord to the stream.
373	WriteQWord	Write a QWord value to the stream
370	WriteResourceHeader	Write resource header to the stream
373	WriteWord	Write a word to the stream.

2.67.3 Property overview

Page	Property	Access	Description
374	Position	rw	The current position in the stream.
374	Size	rw	The current size of the stream.

2.67.4 TStream.Read

Synopsis: Reads data from the stream to a buffer and returns the number of bytes read.

Declaration: function Read(var Buffer; Count: LongInt) : LongInt; Virtual

Visibility: public

Description: Read attempts to read Count from the stream to Buffer and returns the number of bytes actually read.

This method should be used when the number of bytes is not determined. If a specific number of bytes is expected, use TStream.ReadBuffer ([1](#)) instead.

As implemented in TStream, Read does nothing but raises an EStreamError ([231](#)) exception to indicate that reading is not supported. Descendent classes that allow reading must override this method to do the actual reading.

Errors: In case a descendent class does not allow reading from the stream, an exception is raised.

See also: TStream.Write ([1](#)), TStream.ReadBuffer ([1](#))

2.67.5 TStream.Write

Synopsis: Writes data from a buffer to the stream and returns the number of bytes written.

Declaration: function Write(const Buffer; Count: LongInt) : LongInt; Virtual

Visibility: public

Description: Write attempts to write Count bytes from Buffer to the stream. It returns the actual number of bytes written to the stream.

This method should be used when the number of bytes that should be written is not determined. If a specific number of bytes should be written, use TStream.WriteBuffer ([1](#)) instead.

As implemented in TStream, Write does nothing but raises EStreamError ([231](#)) exception to indicate that writing is not supported. Descendent classes that allow writing must override this method to do the actual writing.

Errors: In case a descendent class does not allow writing to the stream, an exception is raised.

See also: TStream.Read ([1](#)), TStream.WriteBuffer ([1](#))

2.67.6 TStream.Seek

Synopsis: Sets the current position in the stream

Declaration: function Seek(Offset: LongInt; Origin: Word) : LongInt; Virtual
 ; Overload
 function Seek(const Offset: Int64; Origin: TSeekOrigin) : Int64; Virtual
 ; Overload

Visibility: public

Description: Seek sets the position of the stream to `Offset` bytes from `Origin`. There is a 32-bit variant of this function and a 64-bit variant. The difference can be made by choosing the correct `Offset` parameter: the integer-typed parameter selects the 32-bit variant, the parameter of type `TSeekOrigin` (209) selects the 64-bit variant of the function.

The `Origin` parameter for the 32-bit version can have one of the following values:

Table 2.25:

Constant	Meaning
<code>soFromBeginning</code>	Set the position relative to the start of the stream.
<code>soFromCurrent</code>	Set the position relative to the current position in the stream.
<code>soFromEnd</code>	Set the position relative to the end of the stream.

These values are defined in the `SysUtils` (1449) unit.

The `Origin` parameter for the 64-bit version has one of the following values:

Table 2.26:

Value	Meaning
<code>soBeginning</code>	Offset is interpreted relative to the start of the stream.
<code>soCurrent</code>	Offset is interpreted relative to the current position in the stream.
<code>soEnd</code>	Offset is interpreted relative to the end of the stream.

`Offset` should be negative when the origin is `soFromEnd` (`soEnd`). It should be positive for `soFromBeginning` and can have both signs for `soFromCurrent`.

This is an abstract method, which must be overridden by descendent classes. They may choose not to implement this method for all values of `Origin` and `Offset`.

Remark: Internally, all calls are re-routed to the 64-bit version of the call. When creating a descendent of `TStream`, the 64-bit version of the call should be overridden.

Errors: An exception may be raised if this method is called with an invalid pair of `Offset`,`Origin` values.
e.g. a negative `offset` for `soFromBeginning` (or `soBeginning`).

See also: `TStream.Position` (1)

2.67.7 TStream.ReadBuffer

Synopsis: Reads data from the stream to a buffer

Declaration: `procedure ReadBuffer(var Buffer; Count: LongInt)`

Visibility: public

Description: `ReadBuffer` reads `Count` bytes of the stream into `Buffer`. If the stream does not contain `Count` bytes, then an exception is raised.

`ReadBuffer` should be used to read in a fixed number of bytes, such as when reading structures or the content of variables. If the number of bytes is not determined, use `TStream.Read` (1) instead. `ReadBuffer` uses `Read` internally to do the actual reading.

Errors: If the stream does not allow to read `Count` bytes, then an exception is raised.

See also: `TStream.Read` (1), `TStream.WriteBuffer` (1)

2.67.8 TStream.WriteBuffer

Synopsis: Writes data from a buffer to the stream

Declaration: procedure WriteBuffer(const Buffer; Count: LongInt)

Visibility: public

Description: WriteBuffer writes Count bytes to the stream from Buffer. If the stream does not allow Count bytes to be written, then an exception is raised.

WriteBuffer should be used to write a fixed number of bytes, such as when writing structures or the content of variables. If the number of bytes is not determined, use TStream.Write ([1](#)) instead. WriteBuffer uses Write internally to do the actual writing.

Errors: If the stream does not allow to write Count bytes, then an exception is raised.

See also: TStream.Write ([1](#)), TStream.ReadBuffer ([1](#))

2.67.9 TStream.CopyFrom

Synopsis: Copy data from one stream to another

Declaration: function CopyFrom(Source: TStream; Count: Int64) : Int64

Visibility: public

Description: CopyFrom reads Count bytes from Source and writes them to the current stream. This updates the current position in the stream. After the action is completed, the number of bytes copied is returned. If Count is zero, then the whole contents of the Source stream is copied. It is positioned on the first byte of data, and Size bytes are copied. Note that this cannot be used with streams that do not allow seeking or do not allow determining the size of the stream.

This can be used to quickly copy data from one stream to another or to copy the whole contents of the stream.

See also: TStream.Read ([1](#)), TStream.Write ([1](#))

2.67.10 TStream.ReadComponent

Synopsis: Reads component data from a stream

Declaration: function ReadComponent(Instance: TComponent) : TComponent

Visibility: public

Description: ReadComponent reads a component state from the stream and transfers this state to Instance. If Instance is nil, then it is created first based on the type stored in the stream. ReadComponent returns the component as it is read from the stream.

ReadComponent simply creates a TReader ([350](#)) object and calls its ReadRootComponent ([1](#)) method.

Errors: If an error occurs during the reading of the component, an EFilerError ([229](#)) exception is raised.

See also: TStream.WriteComponent ([1](#)), TStream.ReadComponentRes ([1](#)), TReader.ReadRootComponent ([1](#))

2.67.11 **TStream.ReadComponentRes**

Synopsis: Reads component data and resource header from a stream

Declaration: function ReadComponentRes(Instance: TComponent) : TComponent

Visibility: public

Description: ReadComponentRes reads a resource header from the stream, and then calls ReadComponent ([1](#)) to read the component state from the stream into Instance.

This method is usually called by the global streaming method when instantiating forms and datamodules as created by an IDE. It should be used mainly on Windows, to store components in Windows resources.

Errors: If an error occurs during the reading of the component, an EFilerError ([229](#)) exception is raised.

See also: [TStream.ReadComponent \(1\)](#), [TStream.WriteComponentRes \(1\)](#)

2.67.12 **TStream.WriteComponent**

Synopsis: Write component data to the stream

Declaration: procedure WriteComponent(Instance: TComponent)

Visibility: public

Description: WriteComponent writes the published properties of Instance to the stream, so they can later be read with [TStream.ReadComponent \(1\)](#). This method is intended to be used by an IDE, to preserve the state of a form or datamodule as designed in the IDE.

WriteComponent simply calls [WriteDescendent \(1\)](#) with Nil ancestor.

See also: [TStream.ReadComponent \(1\)](#), [TStream.WriteComponentRes \(1\)](#)

2.67.13 **TStream.WriteComponentRes**

Synopsis: Write resource header and component data to a stream

Declaration: procedure WriteComponentRes(const ResName: string; Instance: TComponent)

Visibility: public

Description: WriteComponentRes writes a ResName resource header to the stream and then calls [WriteComponent \(1\)](#) to write the published properties of Instance to the stream.

This method is intened for use by an IDE that can use it to store forms or datamodules as designed in a Windows resource stream.

See also: [TStream.WriteComponent \(1\)](#), [TStream.ReadComponentRes \(1\)](#)

2.67.14 **TStream.WriteDescendent**

Synopsis: Write component data to a stream, relative to an ancestor

Declaration: procedure WriteDescendent(Instance: TComponent; Ancestor: TComponent)

Visibility: public

Description: WriteDescendent writes the state of Instance to the stream where it differs from Ancestor, i.e. only the changed properties are written to the stream.

WriteDescendent creates a TWriter (410) object and calls its WriteDescendent (1) object. The writer is passed a binary driver object (268) by default.

2.67.15 TStream.WriteDescendentRes

Synopsis: Write resource header and component data to a stream, relative to an ancestor

Declaration: procedure WriteDescendentRes(const ResName: string; Instance: TComponent; Ancestor: TComponent)

Visibility: public

Description: WriteDescendentRes writes a ResName resource header, and then calls WriteDescendent (1) to write the state of Instance to the stream where it differs from Ancestor, i.e. only the changed properties are written to the stream.

This method is intened for use by an IDE that can use it to store forms or datamodules as designed in a Windows resource stream.

2.67.16 TStream.WriteResourceHeader

Synopsis: Write resource header to the stream

Declaration: procedure WriteResourceHeader(const ResName: string; var FixupInfo: Integer)

Visibility: public

Description: WriteResourceHeader writes a resource-file header for a resource called ResName. It returns in FixupInfo the argument that should be passed on to TStream.FixupResourceHeader (1).

WriteResourceHeader should not be used directly. It is called by the TStream.WriteComponentRes (1) and TStream.WriteDescendentRes (1) methods.

See also: TStream.FixupResourceHeader (1), TStream.WriteComponentRes (1), TStream.WriteDescendentRes (1)

2.67.17 TStream.FixupResourceHeader

Synopsis: Not implemented in FPC

Declaration: procedure FixupResourceHeader(FixupInfo: Integer)

Visibility: public

Description: FixupResourceHeader is used to write the size of the resource after a component was written to stream. The size is determined from the current position, and it is written at position FixupInfo. After that the current position is restored.

FixupResourceHeader should never be called directly; it is handled by the streaming system.

See also: TStream.WriteResourceHeader (1), TStream.WriteComponentRes (1), TStream.WriteDescendentRes (1)

2.67.18 TStream.ReadResHeader

Synopsis: Read a resource header from the stream.

Declaration: procedure ReadResHeader

Visibility: public

Description: ReadResourceHeader reads a reasource file header from the stream. It positions the stream just beyond the header.

ReadResourceHeader should not be called directly, it is called by the streaming system when needed.

Errors: If the resource header is invalid an EInvalidImage (229) exception is raised.

See also: TStream.ReadComponentRes (1), EInvalidImage (229)

2.67.19 TStream.ReadByte

Synopsis: Read a byte from the stream and return its value.

Declaration: function ReadByte : Byte

Visibility: public

Description: ReadByte reads one byte from the stream and returns its value.

Errors: If the byte cannot be read, a EStreamError (231) exception will be raised. This is a utility function which symply calls the Read (1) function.

See also: TStream.Read (1), TStream.WriteByte (1), TStream.ReadWord (1), TStream.ReadDWord (1), TStream.ReadAnsiString (1)

2.67.20 TStream.ReadWord

Synopsis: Read a word from the stream and return its value.

Declaration: function ReadWord : Word

Visibility: public

Description: ReadWord reads one Word (i.e. 2 bytes) from the stream and returns its value. This is a utility function which symply calls the Read (1) function.

Errors: If the word cannot be read, a EStreamError (231) exception will be raised.

See also: TStream.Read (1), TStream.WriteByte (1), TStream.ReadWord (1), TStream.ReadDWord (1), TStream.ReadAnsiString (1)

2.67.21 TStream.ReadDWord

Synopsis: Read a DWord from the stream and return its value.

Declaration: function ReadDWord : Cardinal

Visibility: public

Description: ReadDWord reads one DWord (i.e. 4 bytes) from the stream and returns its value. This is a utility function which simply calls the Read (1) function.

Errors: If the DWord cannot be read, a EStreamError (231) exception will be raised.

See also: TStream.Read (1), TStream.WriteDWord (1), TStream.ReadByte (1), TStream.ReadWord (1), TStream.ReadAnsiString (1)

2.67.22 TStream.ReadQWord

Synopsis: Read a QWord value from the stream and return its value

Declaration: function ReadQWord : QWord

Visibility: public

Description: ReadQWord reads a QWord value (8 bytes) from the stream and returns it's value.

Errors: If not enough bytes are available on the stream, an EStreamError (231) exception will be raised.

See also: TStream.Read (1), TStream.WriteByte (1), TStream.ReadWord (1), TStream.ReadDWord (1), TStream.ReadAnsiString (1)

2.67.23 TStream.ReadAnsiString

Synopsis: Read an ansistring from the stream and return its value.

Declaration: function ReadAnsiString : string

Visibility: public

Description: ReadAnsiString reads an ansistring from the stream and returns its value. This is a utility function which simply calls the read function several times. The Ansistring should be stored as 4 bytes (a DWord) representing the length of the string, and then the string value itself. The WriteAnsiString (1) function writes an ansistring in such a format.

Errors: If the AnsiString cannot be read, a EStreamError (231) exception will be raised.

See also: TStream.Read (1), TStream.WriteAnsiString (1), TStream.ReadByte (1), TStream.ReadWord (1), TStream.ReadDWord (1)

2.67.24 TStream.WriteByte

Synopsis: Write a byte to the stream.

Declaration: procedure WriteByte(b: Byte)

Visibility: public

Description: WriteByte writes the byte B to the stream. This is a utility function which simply calls the Write (1) function. The byte can be read from the stream using the ReadByte (1) function.

Errors: If an error occurs when attempting to write, an EStreamError (231) exception will be raised.

See also: TStream.Write (1), TStream.ReadByte (1), TStream.WriteWord (1), TStream.WriteDWord (1), TStream.WriteAnsiString (1)

2.67.25 TStream.WriteWord

Synopsis: Write a word to the stream.

Declaration: procedure WriteWord(w: Word)

Visibility: public

Description: WriteWord writes the word W (i.e. 2 bytes) to the stream. This is a utility function which simply calls the Write ([1](#)) function. The word can be read from the stream using the ReadWord ([1](#)) function.

Errors: If an error occurs when attempting to write, an EStreamError ([231](#)) exception will be raised.

See also: TStream.Write ([1](#)), TStream.ReadWord ([1](#)), TStream.WriteByte ([1](#)), TStream.WriteDWord ([1](#)), TStream.WriteString ([1](#))

2.67.26 TStream.WriteDWord

Synopsis: Write a DWord to the stream.

Declaration: procedure WriteDWord(d: Cardinal)

Visibility: public

Description: WriteDWord writes the DWord D (i.e. 4 bytes) to the stream. This is a utility function which simply calls the Write ([1](#)) function. The DWord can be read from the stream using the ReadDWord ([1](#)) function.

Errors: If an error occurs when attempting to write, an EStreamError ([231](#)) exception will be raised.

See also: TStream.Write ([1](#)), TStream.ReadDWord ([1](#)), TStream.WriteByte ([1](#)), TStream.WriteWord ([1](#)), TStream.WriteString ([1](#))

2.67.27 TStream.WriteQWord

Synopsis: Write a QWord value to the stream

Declaration: procedure WriteQWord(q: QWord)

Visibility: public

Description: WriteQWord writes the word W (i.e. 8 bytes) to the stream. This is a utility function which simply calls the Write ([1](#)) function. The word can be read from the stream using the ReadQWord ([1](#)) function.

Errors: If an error occurs when attempting to write, an EStreamError ([231](#)) exception will be raised.

See also: TStream.Write ([1](#)), TStream.ReadByte ([1](#)), TStream.WriteWord ([1](#)), TStream.WriteDWord ([1](#)), TStream.WriteString ([1](#))

2.67.28 TStream.WriteString

Synopsis: Write an ansistring to the stream.

Declaration: procedure WriteAnsiString(const S: string)

Visibility: public

Description: WriteAnsiString writes the AnsiString S (i.e. 4 bytes) to the stream. This is a utility function which simply calls the Write ([1](#)) function. The ansistring is written as a 4 byte length specifier, followed by the ansistring's content. The ansistring can be read from the stream using the ReadAnsiString ([1](#)) function.

Errors: If an error occurs when attempting to write, an EStreamError ([231](#)) exception will be raised.

See also: TStream.Write ([1](#)), TStream.ReadAnsiString ([1](#)), TStream.WriteByte ([1](#)), TStream.WriteWord ([1](#)), TStream.WriteDWord ([1](#))

2.67.29 TStream.Position

Synopsis: The current position in the stream.

Declaration: Property Position : Int64

Visibility: public

Access: Read,Write

Description: Position can be read to determine the current position in the stream. It can be written to to set the (absolute) position in the stream. The position is zero-based, so to set the position at the beginning of the stream, the position must be set to zero.

Remark: Not all TStream descendants support setting the position in the stream, so this should be used with care.

Errors: Some descendants may raise an EStreamError ([231](#)) exception if they do not support setting the stream position.

See also: TStream.Size ([1](#)), TStream.Seek ([1](#))

2.67.30 TStream.Size

Synopsis: The current size of the stream.

Declaration: Property Size : Int64

Visibility: public

Access: Read,Write

Description: Size can be read to determine the stream size or to set the stream size.

Remark: Not all descendants of TStream support getting or setting the stream size; they may raise an exception if the Size property is read or set.

See also: TStream.Position ([1](#)), TStream.Seek ([1](#))

2.68 TStreamAdapter

2.68.1 Description

Implements IStream for TStream ([365](#)) descendants

2.68.2 Interfaces overview

Page	Property	Description
1635	IStream	COM stream abstraction

2.68.3 Method overview

Page	Property	Description
378	Clone	Clone the stream
377	Commit	Commit data to the stream
377	CopyTo	Copy data to destination stream
375	Create	Create a new instance of TStreamAdapter
375	Destroy	Free the TStreamAdapter instance
377	LockRegion	Lock a region of the stream
376	Read	Read from the stream.
377	Revert	Revert operations on the stream
376	Seek	Set the stream position
376	SetSize	Set the stream size
378	Stat	Return statistical data about the stream
378	UnlockRegion	Unlock a region of the stream
376	Write	Write to the stream

2.68.4 Property overview

Page	Property	Access	Description
378	Stream	r	Stream on which adaptor works
379	StreamOwnership	rw	Determines what happens with the stream when the adaptor is freed

2.68.5 TStreamAdapter.Create

Synopsis: Create a new instance of TStreamAdapter

Declaration: constructor Create (Stream: TStream; Ownership: TStreamOwnership)

Visibility: public

Description: Create creates a new instance of TStreamAdaptor. It initializes TStreamAdapter.Stream ([1](#)) with Stream and initializes StreamOwnerShip ([1](#)) with Ownership.

TStreamAdapter is an abstract class: descendants must be created that implement the actual functionality.

See also: StreamOwnerShip ([1](#)), TStreamAdapter.Stream ([1](#))

2.68.6 TStreamAdapter.Destroy

Synopsis: Free the TStreamAdapter instance

Declaration: destructor Destroy; Override

Visibility: public

Description: Explicitly free the TStreamAdapter instance. Normally, this is done automatically if a reference to the IStream interface is freed.

2.68.7 TStreamAdapter.Read

Synopsis: Read from the stream.

Declaration: function Read(pv: Pointer; cb: DWORD; pcbRead: PDWord) : HRESULT; Virtual

Visibility: public

Description: Read implements #rtl.types.ISequentialStream.Read ([1635](#)) by reading from the stream specified at creation.

Errors: This function must be overridden and will raise a runerror 217 when called directly.

See also: #rtl.types.ISequentialStream.Read ([1635](#))

2.68.8 TStreamAdapter.Write

Synopsis: Write to the stream

Declaration: function Write(pv: Pointer; cb: DWORD; pcbWritten: PDWord) : HRESULT
; Virtual

Visibility: public

Description: Write implements #rtl.types.ISequentialStream.Write ([1635](#)) by writing to the stream specified at creation.

Errors: This function must be overridden and will raise a runerror 217 when called directly.

See also: #rtl.types.ISequentialStream.Write ([1635](#))

2.68.9 TStreamAdapter.Seek

Synopsis: Set the stream position

Declaration: function Seek(dlibMove: Largeint; dwOrigin: LongInt;
out libNewPosition: Largeint) : HRESULT; Virtual

Visibility: public

Description: Seek implements #rtl.types.IStream.Seek ([1636](#)) by setting the position of the stream specified at creation.

Errors: This function must be overridden and will raise a runerror 217 when called directly.

See also: #rtl.types.IStream.Seek ([1636](#))

2.68.10 TStreamAdapter.SetSize

Synopsis: Set the stream size

Declaration: function SetSize(libNewSize: Largeint) : HRESULT; Virtual

Visibility: public

Description: SetSize implements #rtl.types.IStream.Setsize ([1636](#)) by setting the size of the stream specified at creation.

Errors: This function must be overridden and will raise a runerror 217 when called directly.

See also: #rtl.types.IStream.Setsize ([1636](#))

2.68.11 TStreamAdapter.CopyTo

Synopsis: Copy data to destination stream

Declaration: function CopyTo(stm: IStream; cb: Largeint; out cbRead: Largeint;
out cbWritten: Largeint) : HRESULT; Virtual

Visibility: public

Description: CopyTo implements #rtl.types.IStream.CopyTo ([1636](#)).

Errors: This function must be overridden and will raise a runerror 217 when called directly.

2.68.12 TStreamAdapter.Commit

Synopsis: Commit data to the stream

Declaration: function Commit(grfCommitFlags: LongInt) : HRESULT; Virtual

Visibility: public

Description: Commit implements #rtl.types.IStream.Commit ([1637](#)).

Errors: This function must be overridden and will raise a runerror 217 when called directly.

See also: #rtl.types.IStream.Commit ([1637](#))

2.68.13 TStreamAdapter.Revert

Synopsis: Revert operations on the stream

Declaration: function Revert : HRESULT; Virtual

Visibility: public

Description: Revert implements #rtl.types.IStream.Revert ([1637](#)).

Errors: This function must be overridden and will raise a runerror 217 when called directly.

See also: #rtl.types.IStream.Revert ([1637](#))

2.68.14 TStreamAdapter.LockRegion

Synopsis: Lock a region of the stream

Declaration: function LockRegion(libOffset: Largeint; cb: Largeint;
dwLockType: LongInt) : HRESULT; Virtual

Visibility: public

Description: LockRegion implements #rtl.types.IStream.LockRegion ([1637](#)).

Errors: This function must be overridden and will raise a runerror 217 when called directly.

See also: #rtl.types.IStream.LockRegion ([1637](#))

2.68.15 TStreamAdapter.UnlockRegion

Synopsis: Unlock a region of the stream

Declaration: function UnlockRegion(libOffset: Largeint; cb: Largeint;
dwLockType: LongInt) : HRESULT; Virtual

Visibility: public

Description: UnLockRegion implements #rtl.types.IStream.UnLockRegion ([1637](#)).

Errors: This function must be overridden and will raise a runerror 217 when called directly.

See also: #rtl.types.IStream.UnLockRegion ([1637](#))

2.68.16 TStreamAdapter.Stat

Synopsis: Return statistical data about the stream

Declaration: function Stat(out statstg: TStatStg; grfStatFlag: LongInt) : HRESULT
; Virtual

Visibility: public

Description: Stat implements #rtl.types.IStream.Stat ([1638](#)).

Errors: This function must be overridden and will raise a runerror 217 when called directly.

See also: #rtl.types.IStream.Stat ([1638](#))

2.68.17 TStreamAdapter.Clone

Synopsis: Clone the stream

Declaration: function Clone(out stm: IStream) : HRESULT; Virtual

Visibility: public

Description: Clone implements #rtl.types.IStream.Clone ([1638](#)).

Errors: This function must be overridden and will raise a runerror 217 when called directly.

See also: #rtl.types.IStream.Clone ([1638](#))

2.68.18 TStreamAdapter.Stream

Synopsis: Stream on which adaptor works

Declaration: Property Stream : TStream

Visibility: public

Access: Read

Description: This is the stream on which the adaptor works. It was specified at creation.

2.68.19 TStreamAdapter.StreamOwnership

Synopsis: Determines what happens with the stream when the adaptor is freed

Declaration: Property StreamOwnership : TStreamOwnership

Visibility: public

Access: Read,Write

Description: StreamOwnership determines what happens when the adaptor

2.69 TStringList

2.69.1 Description

TStringList is a descendent class of [TStrings](#) ([384](#)) that implements all of the abstract methods introduced there. It also introduces some additional methods:

- Sort the list, or keep the list sorted at all times
- Special handling of duplicates in sorted lists
- Notification of changes in the list

See also: [TStrings](#) ([384](#)), [TStrings.Duplicates](#) ([1](#)), [TStrings.Sorted](#) ([1](#))

2.69.2 Method overview

Page	Property	Description
380	Add	Implements the TStrings.Add (1) function.
380	Clear	Implements the TStrings.Clear (1) function.
382	CustomSort	Sort the stringlist using a custom sort algorithm
380	Delete	Implements the TStrings.Delete (1) function.
380	Destroy	Destroys the stringlist.
381	Exchange	Implements the TStrings.Exchange (1) function.
381	Find	Locates the index for a given string in sorted lists.
381	IndexOf	Overrides the TStrings.IndexOf (1) property.
381	Insert	Overrides the TStrings.Insert (1) method.
382	Sort	Sorts the strings in the list.

2.69.3 Property overview

Page	Property	Access	Description
383	CaseSensitive	rw	
382	Duplicates	rw	Describes the behaviour of a sorted list with respect to duplicate strings.
383	OnChange	rw	Event triggered after the list was modified.
383	OnChanging	rw	Event triggered when the list is about to be modified.
384	OwnsObjects	rw	Determines whether the stringlist owns its objects or not.
382	Sorted	rw	Determines whether the list is sorted or not.

2.69.4 TStringList.Destroy

Synopsis: Destroys the stringlist.

Declaration: `destructor Destroy; Override`

Visibility: public

Description: `Destroy` clears the stringlist, release all memory allocated for the storage of the strings, and then calls the inherited destroy method.

Remark: Any objects associated to strings in the list will *not* be destroyed; it is the responsibility of the caller to destroy all objects associated with strings in the list.

2.69.5 TStringList.Add

Synopsis: Implements the `TStrings.Add` (1) function.

Declaration: `function Add(const S: string) : Integer; Override`

Visibility: public

Description: `Add` will add `S` to the list. If the list is sorted and the string `S` is already present in the list and `TStringList.Duplicates` (1) is `dupError` then an `EStringListError` (231) exception is raised. If `Duplicates` is set to `dupIgnore` then the return value is undefined.

If the list is sorted, new strings will not necessarily be added to the end of the list, rather they will be inserted at their alphabetical position.

Errors: If the list is sorted and the string `S` is already present in the list and `TStringList.Duplicates` (1) is `dupError` then an `EStringListError` (231) exception is raised.

See also: `TStringList.Insert` (1), `TStringList.Duplicates` (1)

2.69.6 TStringList.Clear

Synopsis: Implements the `TStrings.Clear` (1) function.

Declaration: `procedure Clear; Override`

Visibility: public

Description: Implements the `TStrings.Clear` (1) function.

2.69.7 TStringList.Delete

Synopsis: Implements the `TStrings.Delete` (1) function.

Declaration: `procedure Delete(Index: Integer); Override`

Visibility: public

Description: Implements the `TStrings.Delete` (1) function.

2.69.8 TStringList.Exchange

Synopsis: Implements the `TStrings.Exchange` (1) function.

Declaration: `procedure Exchange(Index1: Integer; Index2: Integer); Override`

Visibility: public

Description: `Exchange` will exchange two items in the list as described in `TStrings.Exchange` (1).

Remark: `Exchange` will not check whether the list is sorted or not; if `Exchange` is called on a sorted list and the strings are not identical, the sort order of the list will be destroyed.

See also: `TStringList.Sorted` (1), `TStrings.Exchange` (1)

2.69.9 TStringList.Find

Synopsis: Locates the index for a given string in sorted lists.

Declaration: `function Find(const S: string; out Index: Integer) : Boolean; Virtual`

Visibility: public

Description: `Find` returns `True` if the string `S` is present in the list. Upon exit, the `Index` parameter will contain the position of the string in the list. If the string is not found, the function will return `False` and `Index` will contain the position where the string will be inserted if it is added to the list.

Remark:

1. Use this method only on sorted lists. For unsorted lists, use `TStringList.IndexOf` (1) instead.
2. `Find` uses a binary search method to locate the string

2.69.10 TStringList.IndexOf

Synopsis: Overrides the `TStrings.IndexOf` (1) property.

Declaration: `function IndexOf(const S: string) : Integer; Override`

Visibility: public

Description: `IndexOf` overrides the ancestor method `TStrings.indexOf` (1). It tries to optimize the search by executing a binary search if the list is sorted. The function returns the position of `S` if it is found in the list, or -1 if the string is not found in the list.

See also: `TStrings.IndexOf` (1), `TStringList.Find` (1)

2.69.11 TStringList.Insert

Synopsis: Overrides the `TStrings.Insert` (1) method.

Declaration: `procedure Insert(Index: Integer; const S: string); Override`

Visibility: public

Description: `Insert` will insert the string `S` at position `Index` in the list. If the list is sorted, an `EStringListError` (231) exception will be raised instead. `Index` is a zero-based position.

Errors: If `Index` contains an invalid value (less than zero or larger than `Count`, or the list is sorted, an `EStringListError` (231) exception will be raised.

See also: `TStringList.Add` (1), `TStrings.Insert` (1), `TStringList.InsertObject` (1)

2.69.12 TStringList.Sort

Synopsis: Sorts the strings in the list.

Declaration: procedure Sort; Virtual

Visibility: public

Description: Sort will sort the strings in the list using the quicksort algorithm. If the list has its TStringList.Sorted

(1) property set to True then nothing will be done.

See also: TStringList.Sorted (1)

2.69.13 TStringList.CustomSort

Synopsis: Sort the stringlist using a custom sort algorithm

Declaration: procedure CustomSort (CompareFn: TStringListSortCompare); Virtual

Visibility: public

Description: CustomSort sorts the stringlist with a custom comparison function. The function should compare 2 elements in the list, and return a negative number if the first item is before the second. It should return 0 if the elements are equal, and a positive result indicates that the second elements should be before the first.

See also: TStringList.Sorted (1), TStringList.Sort (1)

2.69.14 TStringList.Duplicates

Synopsis: Describes the behaviour of a sorted list with respect to duplicate strings.

Declaration: Property Duplicates : TDuplicates

Visibility: public

Access: Read,Write

Description: Duplicates describes what to do in case a duplicate value is added to the list:

Table 2.27:

dupIgnore	Duplicate values will not be added to the list, but no error will be triggered.
dupError	If an attempt is made to add a duplicate value to the list, an EStringListError (231) exception is raised.
dupAccept	Duplicate values can be added to the list.

If the stringlist is not sorted, the Duplicates setting is ignored.

2.69.15 TStringList.Sorted

Synopsis: Determines whether the list is sorted or not.

Declaration: Property Sorted : Boolean

Visibility: public

Access: Read,Write

Description: Sorted can be set to True in order to cause the list of strings to be sorted. Further additions to the list will be inserted at the correct position so the list remains sorted at all times. Setting the property to False has no immediate effect, but will allow strings to be inserted at any position.

Remark:

1. When Sorted is True, TStringList.Insert (1) cannot be used. For sorted lists, TStringList.Add (1) should be used instead.
2. If Sorted is True, the TStringList.Duplicates (1) setting has effect. This setting is ignored when Sorted is False.

See also: TStringList.Sort (1), TStringList.Duplicates (1), TStringList.Add (1), TStringList.Insert (1)

2.69.16 **TStringList.CaseSensitive**

Synopsis:

Declaration: Property CaseSensitive : Boolean

Visibility: public

Access: Read,Write

Description: Indicates whether locating strings happens in a case sensitive manner.

2.69.17 **TStringList.OnChange**

Synopsis: Event triggered after the list was modified.

Declaration: Property OnChange : TNotifyEvent

Visibility: public

Access: Read,Write

Description: OnChange can be assigned to respond to changes that have occurred in the list. The handler is called whenever strings are added, moved, modified or deleted from the list.

The Onchange event is triggered after the modification took place. When the modification is about to happen, an TStringList.OnChanging (1) event occurs.

See also: TStringList.OnChanging (1)

2.69.18 **TStringList.OnChanging**

Synopsis: Event triggered when the list is about to be modified.

Declaration: Property OnChanging : TNotifyEvent

Visibility: public

Access: Read,Write

Description: OnChanging can be assigned to respond to changes that will occur in the list. The handler is called whenever strings will be added, moved, modified or deleted from the list.

The Onchanging event is triggered before the modification will take place. When the modification has happened, an TStringList.OnChange (1) event occurs.

See also: TStringList.OnChange (1)

2.69.19 TStringList.OwnsObjects

Synopsis: Determines whether the stringlist owns it's objects or not.

Declaration: Property OwnsObjects : Boolean

Visibility: public

Access: Read,Write

Description: OwnsObjects can be set to true to let the stringlist instance own the objects in the list: if an element is removed from the list, the associated object (if there is any) will be freed as well. The same is true if the list is cleared or destroyed.

See also: [TStrings.Objects \(1\)](#)

2.70 TStrings

2.70.1 Description

TStrings implements an abstract class to manage an array of strings. It introduces methods to set and retrieve strings in the array, searching for a particular string, concatenating the strings and so on. It also allows an arbitrary object to be associated with each string.

It also introduces methods to manage a series of name=value settings, as found in many configuration files.

An instance of TStrings is never created directly, instead a descendent class such as TStringList ([379](#)) should be created. This is because TStrings is an abstract class which does not implement all methods; TStrings also doesn't store any strings, this is the functionality introduced in descendants such as TStringList ([379](#)).

See also: [TStringList \(379\)](#)

2.70.2 Method overview

Page	Property	Description
386	Add	Add a string to the list
386	AddObject	Add a string and associated object to the list.
387	AddStrings	Add contents of another stringlist to this list.
386	Append	Add a string to the list.
387	Assign	Assign the contents of another stringlist to this one.
387	BeginUpdate	Mark the beginning of an update batch.
388	Clear	Removes all strings and associated objects from the list.
388	Delete	Delete a string from the list.
386	Destroy	Frees all strings and objects, and removes the list from memory.
388	EndUpdate	Mark the end of an update batch.
388	Equals	Compares the contents of two stringlists.
389	Exchange	Exchanges two strings in the list.
394	ExtractName	Extract the name part of a string
389	GetEnumerator	Create an <code>IEnumerator</code> instance
393	GetNameValue	Return both name and value of a name,value pair based on it's index.
389	GetText	Returns the contents as a PChar
390	IndexOf	Find a string in the list and return its position.
390	IndexOfName	Finds the index of a name in the name-value pairs.
390	IndexOfObject	Finds an object in the list and returns its index.
391	Insert	Insert a string in the list.
391	InsertObject	Insert a string and associated object in the list.
391	LoadFromFile	Load the contents of a file as a series of strings.
392	LoadFromStream	Load the contents of a stream as a series of strings.
392	Move	Move a string from one place in the list to another.
393	SaveToFile	Save the contents of the list to a file.
393	SaveToStream	Save the contents of the string to a stream.
393	SetText	Set the contents of the list from a PChar.

2.70.3 Property overview

Page	Property	Access	Description
396	Capacity	rw	Capacity of the list, i.e. number of strings that the list can currently hold before it tries to expand.
396	CommaText	rw	Contents of the list as a comma-separated string.
397	Count	r	Number of strings in the list.
395	DelimitedText	rw	Get or set all strings in the list in a delimited form.
394	Delimiter	rw	Delimiter character used in DelimitedText (395).
398	Names	r	Name parts of the name-value pairs in the list.
396	NameValueSeparator	rw	Value of the character used to separate name,value pairs
398	Objects	rw	Indexed access to the objects associated with the strings in the list.
395	QuoteChar	rw	Quote character used in DelimitedText (395).
395	StrictDelimiter	rw	Should only the delimiter character be considered a delimiter
399	Strings	rw	Indexed access to the strings in the list.
400	StringsAdapter	rw	Not implemented in Free Pascal.
399	Text	rw	Contents of the list as one big string.
394	TextLineBreakStyle	rw	Determines which line breaks to use in the Text (399) property
396	ValueFromIndex	rw	Return the value part of a string based on it's index.
398	Values	rw	Value parts of the name-value pairs in the list.

2.70.4 TStrings.Destroy

Synopsis: Frees all strings and objects, and removes the list from memory.

Declaration: `destructor Destroy; Override`

Visibility: public

Description: `Destroy` is the destructor of `TStrings` it does nothing except calling the inherited destructor.

2.70.5 TStrings.Add

Synopsis: Add a string to the list

Declaration: `function Add(const S: string) : Integer; Virtual`

Visibility: public

Description: `Add` adds `S` at the end of the list and returns the index of `S` in the list (which should equal `Tstrings.Count` ([1](#)))

See also: `TStrings.Items` ([1](#)), `TStrings.AddObject` ([1](#)), `TStrings.Insert` ([1](#)), `TStrings.Delete` ([1](#)), `TStrings.Strings` ([1](#)), `TStrings.Count` ([1](#))

2.70.6 TStrings.AddObject

Synopsis: Add a string and associated object to the list.

Declaration: `function AddObject(const S: string; AObject: TObject) : Integer; Virtual`

Visibility: public

Description: `AddObject` adds `S` to the list of strings, and associates `AObject` with it. It returns the index of `S`.

Remark: An object added to the list is not automatically destroyed by the list of the list is destroyed or the string it is associated with is deleted. It is the responsibility of the application to destroy any objects associated with strings.

See also: `TStrings.Add` ([1](#)), `Tstrings.Items` ([1](#)), `TStrings.Objects` ([1](#)), `Tstrings.InsertObject` ([1](#))

2.70.7 TStrings.Append

Synopsis: Add a string to the list.

Declaration: `procedure Append(const S: string)`

Visibility: public

Description: `Append` does the same as `TStrings.Add` ([1](#)), only it does not return the index of the inserted string.

See also: `TStrings.Add` ([1](#))

2.70.8 TStrings.AddStrings

Synopsis: Add contents of another stringlist to this list.

Declaration: procedure AddStrings(TheStrings: TStrings); Virtual; Overload
procedure AddStrings(const TheStrings: Array of); Virtual; Overload

Visibility: public

Description: AddStrings adds the contents of TheStrings to the stringlist. Any associated objects are added as well.

See also: TStrings.Add ([1](#)), TStrings.Assign ([1](#))

2.70.9 TStrings.Assign

Synopsis: Assign the contents of another stringlist to this one.

Declaration: procedure Assign(Source: TPersistent); Override

Visibility: public

Description: Assign replaces the contents of the stringlist with the contents of Source if Source is also of type TStrings. Any associated objects are copied as well.

See also: TStrings.Add ([1](#)), TStrings.AddStrings ([1](#)), TPersistent.Assign ([1](#))

2.70.10 TStrings.BeginUpdate

Synopsis: Mark the beginning of an update batch.

Declaration: procedure BeginUpdate

Visibility: public

Description: BeginUpdate increases the update count by one. It is advisable to call BeginUpdate before lengthy operations on the stringlist. At the end of these operation, TStrings.EndUpdate ([1](#)) should be called to mark the end of the operation. Descendent classes may use this information to perform optimizations. e.g. updating the screen only once after many strings were added to the list.

All TStrings methods that modify the string list call BeginUpdate before the actual operation, and call endUpdate when the operation is finished. Descendent classes should also call these methods when modifying the string list.

Remark: Always put the corresponding call to TStrings.EndUpdate ([1](#)) in the context of a Finally block, to ensure that the update count is always decreased at the end of the operation, even if an exception occurred:

```
With MyStrings do
  try
    BeginUpdate;
    // Some lengthy operation.
  Finally
    EndUpdate
  end;
```

See also: TStrings.EndUpdate ([1](#))

2.70.11 TStrings.Clear

Synopsis: Removes all strings and associated objects from the list.

Declaration: procedure Clear; Virtual; Abstract

Visibility: public

Description: Clear will remove all strings and their associated objects from the list. After a call to clear, TStrings.Count ([1](#)) is zero.

Since it is an abstract method, TStrings itself does not implement Clear. Descendent classes such as TStringList ([379](#)) implement this method.

See also: TStrings.Items ([1](#)), TStrings.Delete ([1](#)), TStrings.Count ([1](#))

2.70.12 TStrings.Delete

Synopsis: Delete a string from the list.

Declaration: procedure Delete(Index: Integer); Virtual; Abstract

Visibility: public

Description: Delete deletes the string at position Index from the list. The associated object is also removed from the list, but not destroyed. Index is zero-based, and should be in the range 0 to Count-1.

Since it is an abstract method, TStrings itself does not implement Delete. Descendent classes such as TStringList ([379](#)) implement this method.

Errors: If Index is not in the allowed range, an EStringListError ([231](#)) is raised.

See also: TStrings.Insert ([1](#)), TStrings.Items ([1](#)), TStrings.Clear ([1](#))

2.70.13 TStrings.EndUpdate

Synopsis: Mark the end of an update batch.

Declaration: procedure EndUpdate

Visibility: public

Description: EndUpdate should be called at the end of a lengthy operation on the stringlist, but only if there was a call to BeginUpdate before the operation was started. It is best to put the call to EndUpdate in the context of a Finally block, so it will be called even if an exception occurs.

For more information, see TStrings.BeginUpdate ([1](#)).

See also: TStrings.BeginUpdate ([1](#))

2.70.14 TStrings.Equals

Synopsis: Compares the contents of two stringlists.

Declaration: function Equals(Obj: TObject) : Boolean; Override; Overload
function Equals(TheStrings: TStrings) : Boolean; Overload

Visibility: public

Description: Equals compares the contents of the stringlist with the contents of TheStrings. If the contents match, i.e. the stringlist contain an equal amount of strings, and all strings match, then True is returned. If the number of strings in the lists is unequal, or they contain one or more different strings, False is returned.

Remark:

- 1.The strings are compared case-insensitively.
- 2.The associated objects are not compared

See also: [Tstrings.Items](#) ([1](#)), [TStrings.Count](#) ([1](#)), [TStrings.Assign](#) ([1](#))

2.70.15 TStrings.Exchange

Synopsis: Exchanges two strings in the list.

Declaration: procedure Exchange (Index1: Integer; Index2: Integer); Virtual

Visibility: public

Description: Exchange exchanges the strings at positions Index1 and Index2. The associated objects are also exchanged.

Both indexes must be in the range of valid indexes, i.e. must have a value between 0 and Count-1.

Errors: If either Index1 or Index2 is not in the range of valid indexes, an EStringListError ([231](#)) exception is raised.

See also: [TStrings.Move](#) ([1](#)), [TStrings.Strings](#) ([1](#)), [TStrings.Count](#) ([1](#))

2.70.16 TStrings.GetEnumerator

Synopsis: Create an IEnumator instance

Declaration: function GetEnumerator : TStringsEnumerator

Visibility: public

Description: GetEnumerator is the implementation of the IEnumerable ([1432](#)) interface for TStrings. It creates a TStringsEnumerator ([400](#)) instance and returns it's IEnumator ([1432](#)) interface.

See also: [TStringsEnumerator](#) ([400](#)), [IEnumator](#) ([1432](#)), [IEnumerable](#) ([1432](#))

2.70.17 TStrings.GetText

Synopsis: Returns the contents as a PChar

Declaration: function GetText : PChar; Virtual

Visibility: public

Description: GetText allocates a memory buffer and copies the contents of the stringlist to this buffer as a series of strings, separated by an end-of-line marker. The buffer is zero terminated.

Remark: The caller is responsible for freeing the returned memory buffer.

2.70.18 **TStrings.IndexOf**

Synopsis: Find a string in the list and return its position.

Declaration: function IndexOf(const S: string) : Integer; Virtual

Visibility: public

Description: IndexOf searches the list for S. The search is case-insensitive. If a matching entry is found, its position is returned. If no matching string is found, -1 is returned.

Remark:

1. Only the first occurrence of the string is returned.
2. The returned position is zero-based, i.e. 0 indicates the first string in the list.

See also: TStrings.IndexOfObject ([1](#)), TStrings.IndexOfName ([1](#)), TStrings.Strings ([1](#))

2.70.19 **TStrings.IndexOfName**

Synopsis: Finds the index of a name in the name-value pairs.

Declaration: function IndexOfName(const Name: string) : Integer; Virtual

Visibility: public

Description: IndexOfName searches in the list of strings for a name-value pair with name part Name. If such a pair is found, it returns the index of the pair in the stringlist. If no such pair is found, the function returns -1. The search is done case-insensitive.

Remark:

1. Only the first occurrence of a matching name-value pair is returned.
2. The returned position is zero-based, i.e. 0 indicates the first string in the list.

See also: TStrings.IndexOf ([1](#)), TStrings.IndexOfObject ([1](#)), TStrings.Strings ([1](#))

2.70.20 **TStrings.IndexOfObject**

Synopsis: Finds an object in the list and returns its index.

Declaration: function IndexOfObject(AObject: TObject) : Integer; Virtual

Visibility: public

Description: IndexOfObject searches through the list of strings till it finds a string associated with AObject, and returns the index of this string. If no such string is found, -1 is returned.

Remark:

1. Only the first occurrence of a string with associated object AObject is returned; if more strings in the list can be associated with AObject, they will not be found by this routine.
2. The returned position is zero-based, i.e. 0 indicates the first string in the list.

2.70.21 **TStrings.Insert**

Synopsis: Insert a string in the list.

Declaration: procedure Insert(Index: Integer; const S: string); Virtual; Abstract

Visibility: public

Description: Insert inserts the string S at position Index in the list. Index is a zero-based position, and can have values from 0 to Count. If Index equals Count then the string is appended to the list.

Remark:

- 1.All methods that add strings to the list use Insert to add a string to the list.
- 2.If the string has an associated object, use TStrings.InsertObject ([1](#)) instead.

Errors: If Index is less than zero or larger than Count then an EStringListError ([231](#)) exception is raised.

See also: TStrings.Add ([1](#)), TStrings.InsertObject ([1](#)), TStrings.Append ([1](#)), TStrings.Delete ([1](#))

2.70.22 **TStrings.InsertObject**

Synopsis: Insert a string and associated object in the list.

Declaration: procedure InsertObject(Index: Integer; const S: string; AObject: TObject)

Visibility: public

Description: InsertObject inserts the string S and its associated object AObject at position Index in the list. Index is a zero-based position, and can have values from 0 to Count. If Index equals Count then the string is appended to the list.

Errors: If Index is less than zero or larger than Count then an EStringListError ([231](#)) exception is raised.

See also: TStrings.Insert ([1](#)), TStrings.AddObject ([1](#)), TStrings.Append ([1](#)), TStrings.Delete ([1](#))

2.70.23 **TStrings.LoadFromFile**

Synopsis: Load the contents of a file as a series of strings.

Declaration: procedure LoadFromFile(const FileName: string); Virtual

Visibility: public

Description: LoadFromFile loads the contents of a file into the stringlist. Each line in the file (as marked by the end-of-line marker of the particular OS the application runs on) becomes one string in the stringlist. This action replaces the contents of the stringlist, it does not append the strings to the current content.

LoadFromFile simply creates a file stream ([308](#)) with the given filename, and then executes TStrings.LoadfromStream ([1](#)); after that the file stream object is destroyed again.

See also: TStrings.LoadFromStream ([1](#)), TStrings.SaveToFile ([1](#)), Tstrings.SaveToStream ([1](#))

2.70.24 TStrings.LoadFromStream

Synopsis: Load the contents of a stream as a series of strings.

Declaration: procedure LoadFromStream(Stream: TStream); Virtual

Visibility: public

Description: LoadFromStream loads the contents of Stream into the stringlist. Each line in the stream (as marked by the end-of-line marker of the particular OS the application runs on) becomes one string in the stringlist. This action replaces the contents of the stringlist, it does not append the strings to the current content.

See also: TStrings.LoadFromFile (1), TStrings.SaveToFile (1), Tstrings.SaveToStream (1)

2.70.25 TStrings.Move

Synopsis: Move a string from one place in the list to another.

Declaration: procedure Move(CurIndex: Integer; NewIndex: Integer); Virtual

Visibility: public

Description: Move moves the string at position CurIndex so it has position NewIndex after the move operation. The object associated to the string is also moved. CurIndex and NewIndex should be in the range of 0 to Count-1.

Remark: NewIndex is *not* the position in the stringlist before the move operation starts. The move operation

1. removes the string from position CurIndex
2. inserts the string at position NewIndex

This may not lead to the desired result if NewIndex is bigger than CurIndex. Consider the following example:

```
With MyStrings do
begin
  Clear;
  Add('String 0');
  Add('String 1');
  Add('String 2');
  Add('String 3');
  Add('String 4');
  Move(1, 3);
end;
```

After the Move operation has completed, 'String 1' will be between 'String 3' and 'String 4'.

Errors: If either CurIndex or NewIndex is outside the allowed range, an EStringListError (231) is raised.

See also: TStrings.Exchange (1)

2.70.26 **TStrings.SaveToFile**

Synopsis: Save the contents of the list to a file.

Declaration: procedure SaveToFile(const FileName: string); Virtual

Visibility: public

Description: SaveToFile saves the contents of the stringlist to the file with name FileName. It writes the strings to the file, separated by end-of-line markers, so each line in the file will contain 1 string from the stringlist.

SaveToFile creates a file stream (308) with name FileName, calls TStrings.SaveToStream (1) and then destroys the file stream object.

Errors: An EStreamError (231) exception can be raised if the file FileName cannot be opened, or if it cannot be written to.

See also: TStrings.SaveToStream (1), Tstrings.LoadFromStream (1), TStrings.LoadFromFile (1)

2.70.27 **TStrings.SaveToStream**

Synopsis: Save the contents of the string to a stream.

Declaration: procedure SaveToStream(Stream: TStream); Virtual

Visibility: public

Description: SaveToStream saves the contents of the stringlist to Stream. It writes the strings to the stream, separated by end-of-line markers, so each 'line' in the stream will contain 1 string from the stringlist.

Errors: An EStreamError (231) exception can be raised if the stream cannot be written to.

See also: TStrings.SaveToFile (1), Tstrings.LoadFromStream (1), TStrings.LoadFromFile (1)

2.70.28 **TStrings.SetText**

Synopsis: Set the contents of the list from a PChar.

Declaration: procedure SetText(TheText: PChar); Virtual

Visibility: public

Description: SetText parses the contents of TheText and fills the stringlist based on the contents. It regards TheText as a series of strings, separated by end-of-line markers. Each of these strings is added to the stringlist.

See also: TStrings.Text (1)

2.70.29 **TStrings.GetNameValue**

Synopsis: Return both name and value of a name,value pair based on it's index.

Declaration: procedure GetNameValue(Index: Integer; out AName: string;
out AValue: string)

Visibility: public

Description: Return both name and value of a name,value pair based on it's index.

2.70.30 TStrings.ExtractName

Synopsis: Extract the name part of a string

Declaration: function ExtractName(const S: string) : string

Visibility: public

Description: ExtractName returns the name part (the part before the NameValueSeparator (1) character) of the string. If the character is not present, an empty string is returned. The resulting string is not trimmed, it can end or start with spaces.

See also: NameValueSeparator (1)

2.70.31 TStrings.TextLineStyle

Synopsis: Determines which line breaks to use in the Text (399) property

Declaration: Property TextLineStyle : TTextLineStyle

Visibility: public

Access: Read,Write

Description: TextLineStyle determines which linebreak style is used when constructing the Text property: the same rules are used as in the writing to text files:

tlbsLFLines are separated with a linefeed character #10.

tlbsCRLFLines are separated with a carriage-return/linefeed character pair: #13#10.

tlbsCRLines are separated with a carriage-return character #13.

It has no effect when setting the text property.

See also: Text (399)

2.70.32 TStrings.Delimiter

Synopsis: Delimiter character used in DelimitedText (395).

Declaration: Property Delimiter : Char

Visibility: public

Access: Read,Write

Description: Delimiter is the delimiter character used to separate the different strings in the stringlist when they are read or set through the DelimitedText (1) property.

See also: TStrings.DelimitedText (1)

2.70.33 TStrings.DelimitedText

Synopsis: Get or set all strings in the list in a delimited form.

Declaration: Property DelimitedText : string

Visibility: public

Access: Read,Write

Description: DelimitedText returns all strings, properly quoted with QuoteChar (1) and separated by the Delimiter (1) character.

Strings are quoted if they contain a space or any character with ASCII value less than 32.

The CommaText (1) property is a special case of delimited text where the delimiter character is a comma and the quote character is a double quote.

If StrictDelimiter (1) is set to True, then no quoting is done (The QuoteChar property is disregarded completely): the returned text will contain the items in the stringlist, separated by the Delimiter character. When writing the DelimitedText property, the text will be split at all occurrences of the Delimiter character; however, when reading, the QuoteChar property will be taken into account.

See also: TStrings.Delimiter (1), TStrings.Text (1), TStrings.QuoteChar (1), TStrings.CommaText (1)

2.70.34 TStrings.StrictDelimiter

Synopsis: Should only the delimiter character be considered a delimiter

Declaration: Property StrictDelimiter : Boolean

Visibility: public

Access: Read,Write

Description: StrictDelimiter can be used to indicate that only the delimiter character should be considered a delimiter when setting DelimitedText (1): under normal circumstances, quotes and spaces are considered specially (see the TStrings.CommaText (1) property for more information).

When StrictDelimiter is set to True then only the Delimiter (1) character is considered when splitting the text in items: no quoting whatsoever is performed when writing the DelimitedText property. However, when reading the DelimitedText property, quoted strings are taken into account (so a quoted string can contain a delimiter that is treated as text instead of a delimiter).

See also: DelimitedText (1), CommaText (1), Delimiter (1)

2.70.35 TStrings.QuoteChar

Synopsis: Quote character used in DelimitedText (395).

Declaration: Property QuoteChar : Char

Visibility: public

Access: Read,Write

Description: QuoteChar is the character used by the DelimitedText (1) property to quote strings that have a space or non-printing character in it.

2.70.36 **TStrings.NameValueSeparator**

Synopsis: Value of the character used to separate name,value pairs

Declaration: Property NameValueSeparator : Char

Visibility: public

Access: Read,Write

Description: NameValueSeparator is the character used to separate name,value pair. By default, this is the equal sign (=), resulting in Name=Value pairs.

It can be set to a colon for Name : Value pairs.

2.70.37 **TStrings.ValueFromIndex**

Synopsis: Return the value part of a string based on it's index.

Declaration: Property ValueFromIndex[Index: Integer]: string

Visibility: public

Access: Read,Write

Description: ValueFromIndex returns the value part of a string based on the string index. The value part are all characters in the string after the NameValueSeparator ([1](#)) character, or all characters if the NameValueSeparator character is not present.

2.70.38 **TStrings.Capacity**

Synopsis: Capacity of the list, i.e. number of strings that the list can currently hold before it tries to expand.

Declaration: Property Capacity : Integer

Visibility: public

Access: Read,Write

Description: Capacity is the number of strings that the list can hold before it tries to allocate more memory.

TStrings returns TStrings.Count ([1](#)) when read. Trying to set the capacity has no effect. Descendent classes such as TStringlist ([379](#)) can override this property such that it actually sets the new capacity.

See also: TStringList ([379](#)), TStrings.Count ([1](#))

2.70.39 **TStrings.CommaText**

Synopsis: Contents of the list as a comma-separated string.

Declaration: Property CommaText : string

Visibility: public

Access: Read,Write

Description: CommaText represents the stringlist as a single string, consisting of a comma-separated concatenation of the strings in the list. If one of the strings contains spaces, comma's or quotes it will be enclosed by double quotes. Any double quotes in a string will be doubled. For instance the following strings:

```
Comma,string
Quote"string
Space string
NormalString
```

is converted to

```
"Comma,string", "Quote""String", "Space string", NormalString
```

Conversely, when setting the CommaText property, the text will be parsed according to the rules outlined above, and the strings will be set accordingly. Note that spaces will in this context be regarded as string separators, unless the string as a whole is contained in double quotes. Spaces that occur next to a delimiter will be ignored. The following string:

```
"Comma,string" , "Quote""String", Space string,, NormalString
```

Will be converted to

```
Comma, String
Quote"String
Space
String
```

```
NormalString
```

This is a special case of the `TStrings.DelimitedText` (1) property where the quote character is always the double quote, and the delimiter is always the colon.

See also: `TStrings.Text` (1), `TStrings.SetText` (1)

2.70.40 TStrings.Count

Synopsis: Number of strings in the list.

Declaration: Property Count : Integer

Visibility: public

Access: Read

Description: Count is the current number of strings in the list. `TStrings` does not implement this property; descendent classes should override the property read handler to return the correct value.

Strings in the list are always uniquely identified by their `Index`; the index of a string is zero-based, i.e. it's supported range is 0 to `Count`-1. trying to access a string with an index larger than or equal to `Count` will result in an error. Code that iterates over the list in a stringlist should always take into account the zero-based character of the list index.

See also: `TStrings.Strings` (1), `TStrings.Objects` (1), `TStrings.Capacity` (1)

2.70.41 TStrings.Names

Synopsis: Name parts of the name-value pairs in the list.

Declaration: Property Names [Index: Integer]: string

Visibility: public

Access: Read

Description: Names provides indexed access to the names of the name-value pairs in the list. It returns the name part of the Index-th string in the list.

Remark: The index is not an index based on the number of name-value pairs in the list. It is the name part of the name-value pair a string Index in the list. If the string at position Index is not a name-value pair (i.e. does not contain the equal sign (=)), then an empty name is returned.

See also: TStrings.Values ([1](#)), TStrings.IndexOfName ([1](#))

2.70.42 TStrings.Objects

Synopsis: Indexed access to the objects associated with the strings in the list.

Declaration: Property Objects [Index: Integer]: TObject

Visibility: public

Access: Read,Write

Description: Objects provides indexed access to the objects associated to the strings in the list. Index is a zero-based index and must be in the range of 0 to Count-1.

Setting the objects property will not free the previously associated object, if there was one. The caller is responsible for freeing the object that was previously associated to the string.

TStrings does not implement any storage for objects. Reading the Objects property will always return Nil. Setting the property will have no effect. It is the responsibility of the descendent classes to provide storage for the associated objects.

Errors: If an Index outside the valid range is specified, an EStringListError ([231](#)) exception will be raised.

See also: TStrings.Strings ([1](#)), TStrings.IndexToObject ([1](#)), TStrings.Names ([1](#)), TStrings.Values ([1](#))

2.70.43 TStrings.Values

Synopsis: Value parts of the name-value pairs in the list.

Declaration: Property Values [Name: string]: string

Visibility: public

Access: Read,Write

Description: Values represents the value parts of the name-value pairs in the list.

When reading this property, if there is a name-value pair in the list of strings that has name part Name, then the corresponding value is returned. If there is no such pair, an empty string is returned.

When writing this value, first it is checked whether there exists a name-value pair in the list with name Name. If such a pair is found, its value part is overwritten with the specified value. If no such pair is found, a new name-value pair is added with the specified Name and value.

Remark:

- 1.Names are compared case-insensitively.
- 2.Any character, including whitespace, up till the first equal (=) sign in a string is considered part of the name.

See also: [TStrings.Names \(1\)](#), [TStrings.Strings \(1\)](#), [TStrings.Objects \(1\)](#)

2.70.44 TStrings.Strings

Synopsis: Indexed access to the strings in the list.

Declaration: Property Strings[Index: Integer]: string; default

Visibility: public

Access: Read,Write

Description: `Strings` is the default property of `TStrings`. It provides indexed read-write access to the list of strings. Reading it will return the string at position `Index` in the list. Writing it will set the string at position `Index`.

`Index` is the position of the string in the list. It is zero-based, i.e. valued values range from 0 (the first string in the list) till `Count-1` (the last string in the list). When browsing through the strings in the list, this fact must be taken into account.

To access the objects associated with the strings in the list, use the `TStrings.Objects (1)` property. The name parts of name-value pairs can be accessed with the `TStrings.Names (1)` property, and the values can be set or read through the `TStrings.Values (1)` property.

Searching through the list can be done using the `TStrings.IndexOf (1)` method.

Errors: If `Index` is outside the allowed range, an `EStringListError (231)` exception is raised.

See also: [TStrings.Count \(1\)](#), [TStrings.Objects \(1\)](#), [TStrings.Names \(1\)](#), [TStrings.Values \(1\)](#), [TStrings.IndexOf \(1\)](#)

2.70.45 TStrings.Text

Synopsis: Contents of the list as one big string.

Declaration: Property Text : string

Visibility: public

Access: Read,Write

Description: `Text` returns, when read, the contents of the stringlist as one big string consisting of all strings in the list, separated by an end-of-line marker. When this property is set, the string will be cut into smaller strings, based on the positions of end-of-line markers in the string. Any previous content of the stringlist will be lost.

Remark: If any of the strings in the list contains an end-of-line marker, then the resulting string will appear to contain more strings than actually present in the list. To avoid this ambiguity, use the `TStrings.CommaText (1)` property instead.

See also: [TStrings.Strings \(1\)](#), [TStrings.Count \(1\)](#), [TStrings.CommaText \(1\)](#)

2.70.46 **TStrings.StringsAdapter**

Synopsis: Not implemented in Free Pascal.

Declaration: Property StringsAdapter : IStringsAdapter

Visibility: public

Access: Read,Write

Description: Not implemented in Free Pascal.

2.71 **TStringsEnumerator**

2.71.1 **Description**

`TStringsEnumerator` implements the #rtl.system.IEnumerator ([1432](#)) interface for the `TStrings` ([384](#)) class, so the `TStrings` class can be used in a `for ... in` loop. It is returned by the `TStrings.GetEnumerator` ([1](#)) method of `TStrings`.

See also: `TStrings` ([384](#)), `TStrings.GetEnumerator` ([1](#)), #rtl.system.IEnumerator ([1432](#))

2.71.2 **Method overview**

Page	Property	Description
400	Create	Initialize a new instance of <code>TStringsEnumerator</code>
400	GetCurrent	Return the current pointer in the list
401	MoveNext	Move the position of the enumerator to the next position in the list.

2.71.3 **Property overview**

Page	Property	Access	Description
401	Current	r	Current pointer in the list

2.71.4 **TStringsEnumerator.Create**

Synopsis: Initialize a new instance of `TStringsEnumerator`

Declaration: constructor Create (AStrings: `TStrings`)

Visibility: public

Description: `Create` initializes a new instance of `TStringsEnumerator` and keeps a reference to the stringlist `AStrings` that will be enumerated.

See also: `TStrings` ([384](#))

2.71.5 **TStringsEnumerator.GetCurrent**

Synopsis: Return the current pointer in the list

Declaration: function GetCurrent : string

Visibility: public

Description: GetCurrent returns the current string item in the enumerator.

Errors: No checking is done on the validity of the current position.

See also: MoveNext (1), TStringItem (211)

2.71.6 TStringsEnumerator.MoveNext

Synopsis: Move the position of the enumerator to the next position in the list.

Declaration: function MoveNext : Boolean

Visibility: public

Description: MoveNext puts the pointer on the next item in the stringlist, and returns True if this succeeded, or False if the pointer is past the last element in the list.

Errors: Note that if False is returned, calling GetCurrent will result in an exception.

See also: GetCurrent (1)

2.71.7 TStringsEnumerator.Current

Synopsis: Current pointer in the list

Declaration: Property Current : string

Visibility: public

Access: Read

Description: Current redefines GetCurrent (1) as a property.

See also: GetCurrent (1)

2.72 TStringStream

2.72.1 Description

TStringStream stores its data in an ansistring. The contents of this string is available as the DataString (1) property. It also introduces some methods to read or write parts of the stringstream's data as a string.

The main purpose of a TStringStream is to be able to treat a string as a stream from which can be read.

See also: TStream (365), TStringStream.DataString (1), TStringStream.ReadString (1), TStringStream.WriteString (1)

2.72.2 Method overview

Page	Property	Description
402	Create	Creates a new stringstream and sets its initial content.
402	Read	Reads from the stream.
402	ReadString	Reads a string of length Count
402	Seek	Sets the position in the stream.
403	Write	Write overries the TStream.Write (1) method.
403	WriteString	WriteString writes a string to the stream.

2.72.3 Property overview

Page	Property	Access	Description
403	DataString	r	Contains the contents of the stream in string form

2.72.4 TStringStream.Create

Synopsis: Creates a new stringstream and sets its initial content.

Declaration: constructor Create(const AString: string)

Visibility: public

Description: Create creates a new TStringStream instance and sets its initial content to AString. The position is still 0 but the size of the stream will equal the length of the string.

See also: TStringStream.DataString (1)

2.72.5 TStringStream.Read

Synopsis: Reads from the stream.

Declaration: function Read(var Buffer; Count: LongInt) : LongInt; Override

Visibility: public

Description: Read overrides the Read (1) from TStream (365). It tries to read Count bytes into Buffer. It returns the number of bytes actually read. The position of the stream is advanced with the number of bytes actually read; When the reading has reached the end of the DataString (1), then the reading stops, i.e. it is not possible to read beyond the end of the datastring.

See also: TStream.Read (1), TStringStream.Write (1), TStringStream.DataString (1)

2.72.6 TStringStream.ReadString

Synopsis: Reads a string of length Count

Declaration: function ReadString(Count: LongInt) : string

Visibility: public

Description: ReadString reads Count bytes from the stream and returns the read bytes as a string. If less than Count bytes were available, the string has as many characters as bytes could be read.

The ReadString method is a wrapper around the Read (1) method. It does not do the same string as the TStream.ReadAnsiString (1) method, which first reads a length integer to determine the length of the string to be read.

See also: TStringStream.Read (1), TStream.ReadAnsiString (1)

2.72.7 TStringStream.Seek

Synopsis: Sets the position in the stream.

Declaration: function Seek(Offset: LongInt; Origin: Word) : LongInt; Override

Visibility: public

Description: Seek implements the abstract Seek (1) method.

2.72.8 **TStringStream.Write**

Synopsis: Write overries the TStream.Write ([1](#)) method.

Declaration: function Write(const Buffer;Count: LongInt) : LongInt; Override

Visibility: public

Description: Write overries the TStream.Write ([1](#)) method.

2.72.9 **TStringStream.WriteString**

Synopsis: WriteString writes a string to the stream.

Declaration: procedure WriteString(const AString: string)

Visibility: public

Description: WriteString writes a string to the stream.

2.72.10 **TStringStream.DataString**

Synopsis: Contains the contents of the stream in string form

Declaration: Property DataString : string

Visibility: public

Access: Read

Description: Contains the contents of the stream in string form

2.73 **TTextObjectWriter**

2.73.1 **Description**

Not yet implemented.

2.74 **TThread**

2.74.1 **Description**

The TThread class encapsulates the native thread support of the operating system. To create a thread, declare a descendent of the TThread object and override the Execute ([1](#)) method. In this method, the thread's code should be executed. To run a thread, create an instance of the tthread descendent, and call it's execute method.

See also: EThread ([231](#)), TThread.Execute ([1](#))

2.74.2 Method overview

Page	Property	Description
404	AfterConstruction	Code to be executed after construction but before execute.
404	Create	Creates a new thread.
404	Destroy	Destroys the thread object.
405	Resume	Resumes the thread's execution.
405	Start	Starts a thread thread that was created in a suspended state.
405	Suspend	Suspends the thread's execution.
405	Terminate	Signals the thread it should terminate.
405	WaitFor	Waits for the thread to terminate and returns the exit status.

2.74.3 Property overview

Page	Property	Access	Description
407	FatalException	r	Exception that occurred during thread execution
406	FreeOnTerminate	rw	Indicates whether the thread should free itself when it stops executing.
406	Handle	r	Returns the thread handle.
407	OnTerminate	rw	Event called when the thread terminates.
406	Priority	rw	Returns the thread priority.
406	Suspended	rw	Indicates whether the thread is suspended.
406	ThreadID	r	Returns the thread ID.

2.74.4 TThread.Create

Synopsis: Creates a new thread.

Declaration: constructor Create(CreateSuspended: Boolean; const StackSize: SizeUInt)

Visibility: public

Description: Creates a new thread.

2.74.5 TThread.Destroy

Synopsis: Destroys the thread object.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroys the thread object.

2.74.6 TThread.AfterConstruction

Synopsis: Code to be executed after construction but before execute.

Declaration: procedure AfterConstruction; Override

Visibility: public

Description: AfterConstruction is overridden in TThread but currently does not do anything useful.

2.74.7 TThread.Start

Synopsis: Starts a thread thread that was created in a suspended state.

Declaration: procedure Start

Visibility: public

Description: The effect of this method is currently the same as calling `TThread.Resume` after creating a thread in a suspended state. This method was added for Delphi-compatibility, where it was introduced after `TThread.Suspend` and `TThread.Resume` were deprecated.

See also: `TThread.Create` (1)

2.74.8 TThread.Resume

Synopsis: Resumes the thread's execution.

Declaration: procedure Resume

Visibility: public

Description: Resumes the thread's execution.

See also: `TThread.Start` (1), `TThread.Suspend` (1)

2.74.9 TThread.Suspend

Synopsis: Suspends the thread's execution.

Declaration: procedure Suspend

Visibility: public

Description: On non-Windows platforms, a thread can only suspend itself. Other threads can wake up a suspended thread by calling `TThread.Resume`.

See also: `TThread.Resume` (1)

2.74.10 TThread.Terminate

Synopsis: Signals the thread it should terminate.

Declaration: procedure Terminate

Visibility: public

Description: Signals the thread it should terminate.

2.74.11 TThread.WaitFor

Synopsis: Waits for the thread to terminate and returns the exit status.

Declaration: function WaitFor : Integer

Visibility: public

Description: Waits for the thread to terminate and returns the exit status.

2.74.12 TThread.FreeOnTerminate

Synopsis: Indicates whether the thread should free itself when it stops executing.

Declaration: Property FreeOnTerminate : Boolean

Visibility: public

Access: Read,Write

Description: Indicates whether the thread should free itself when it stops executing.

2.74.13 TThread.Handle

Synopsis: Returns the thread handle.

Declaration: Property Handle : TThreadID

Visibility: public

Access: Read

Description: Returns the thread handle.

2.74.14 TThread.Priority

Synopsis: Returns the thread priority.

Declaration: Property Priority : TThreadPriority

Visibility: public

Access: Read,Write

Description: Returns the thread priority.

2.74.15 TThread.Suspended

Synopsis: Indicates whether the thread is suspended.

Declaration: Property Suspended : Boolean

Visibility: public

Access: Read,Write

Description: Indicates whether the thread is suspended.

2.74.16 TThread.ThreadID

Synopsis: Returns the thread ID.

Declaration: Property ThreadID : TThreadID

Visibility: public

Access: Read

Description: Returns the thread ID.

2.74.17 TThread.OnTerminate

Synopsis: Event called when the thread terminates.

Declaration: Property OnTerminate : TNotifyEvent

Visibility: public

Access: Read,Write

Description: Event called when the thread terminates.

2.74.18 TThread.FatalException

Synopsis: Exception that occurred during thread execution

Declaration: Property FatalException : TObject

Visibility: public

Access: Read

Description: FatalException contains the exception that occurred during the thread's execution.

2.75 TThreadList

2.75.1 Description

TThreadList is a thread-safe Tlist ([327](#)) implementation. Unlike TList, it can be accessed read-write by multiple threads: the list implementation will take care of locking the list when adding or removing items from the list.

See also: [TList](#) ([327](#))

2.75.2 Method overview

Page	Property	Description
408	Add	Adds an element to the list.
408	Clear	Removes all elements from the list.
408	Create	Creates a new thread-safe list.
408	Destroy	Destroys the list instance.
409	LockList	Locks the list for exclusive access.
409	Remove	Removes an item from the list.
409	UnlockList	Unlocks the list after it was locked.

2.75.3 Property overview

Page	Property	Access	Description
409	Duplicates	rw	Describes what to do with duplicates

2.75.4 TThreadList.Create

Synopsis: Creates a new thread-safe list.

Declaration: constructor Create

Visibility: public

Description: Create instantiates a new TThreadList instance. It initializes a critical section and an internal list object.

See also: TThreadList.Destroy ([1](#))

2.75.5 TThreadList.Destroy

Synopsis: Destroys the list instance.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroy finalizes the critical section, clears the internal list object and calls the inherited destructor.

See also: TThreadList.Create ([1](#))

2.75.6 TThreadList.Add

Synopsis: Adds an element to the list.

Declaration: procedure Add(Item: Pointer)

Visibility: public

Description: Add attempts to lock the list and adds the pointer Item to the list. After the pointer was added, the list is unlocked again.

See also: LockList ([1](#)), Clear ([1](#)), Remove ([1](#)), UnlockList ([1](#))

2.75.7 TThreadList.Clear

Synopsis: Removes all emements from the list.

Declaration: procedure Clear

Visibility: public

Description: Clear attempts to lock the list and then clears the list; all items are removed from the list. After the list is cleared, it is again unlocked.

See also: LockList ([1](#)), Add ([1](#)), Remove ([1](#)), UnlockList ([1](#))

2.75.8 TThreadList.LockList

Synopsis: Locks the list for exclusive access.

Declaration: function LockList : TList

Visibility: public

Description: LockList locks the list for exclusive access. Locklist uses an internal critical section, so all rules for multiple locking of critical sections apply to locklist/unlocklist as well.

See also: Clear (1), Add (1), Remove (1), UnlockList (1)

2.75.9 TThreadList.Remove

Synopsis: Removes an item from the list.

Declaration: procedure Remove (Item: Pointer)

Visibility: public

Description: Remove attempts to lock the list and then removes Item from the list. After the item is removed, the list is again unlocked.

See also: LockList (1), Add (1), Clear (1), UnlockList (1)

2.75.10 TThreadList.UnlockList

Synopsis: Unlocks the list after it was locked.

Declaration: procedure UnlockList

Visibility: public

Description: UnLockList unlocks the list when it was locked for exclusive access. UnLocklist and LockList use an internal critical section, so all rules for multiple locking/unlocking of critical sections apply.

See also: Clear (1), Add (1), Remove (1), lockList (1)

2.75.11 TThreadList.Duplicates

Synopsis: Describes what to do with duplicates

Declaration: Property Duplicates : TDuplicates

Visibility: public

Access: Read,Write

Description: Duplicates describes what the threadlist should do when a duplicate pointer is added to the list. It is identical in behaviour to the Duplicates (1) property of TStringList (379).

See also: TDuplicates (203)

2.76 TWriter

2.76.1 Description

The `TWriter` class is a writer class that implements generic component streaming capabilities, independent of the format of the data in the stream. It uses a driver class `TAbstractObjectWriter` (250) to do the actual reading of data. The interface of the `TWriter` class should be identical to the interface in Delphi.

Note that the `TWriter` design is such that it will write a single component to a stream. It will write all children of this component, but it is not designed to write multiple components in succession to one stream.

It should never be necessary to create an instance of this class directly. Instead, the `TStream.WriteComponent` (1) call should be used.

See also: `TFiler` (306), `TWriter` (410), `TAbstractObjectReader` (243)

2.76.2 Method overview

Page	Property	Description
411	Create	Creates a new Writer with a stream and bufsize.
411	DefineBinaryProperty	Callback used when defining and streaming custom properties.
411	DefineProperty	Callback used when defining and streaming custom properties.
411	Destroy	Destroys the writer instance.
412	Write	Write raw data to stream
412	WriteBoolean	Write boolean value to the stream.
412	WriteChar	Write a character to the stream.
412	WriteCollection	Write a collection to the stream.
412	WriteComponent	Stream a component to the stream.
414	WriteCurrency	Write a currency value to the stream
413	WriteDate	Write a date to the stream.
413	WriteDescendent	Write a descendent component to the stream.
413	WriteFloat	Write a float to the stream.
414	WriteIdent	Write an identifier to the stream.
414	WriteInteger	Write an integer to the stream.
414	WriteListBegin	Write a start-of-list marker to the stream.
415	WriteListEnd	Write an end-of-list marker to the stream.
415	WriteRootComponent	Write a root component to the stream.
414	WriteSet	Write a set value to the stream
413	WriteSingle	Write a single-type real to the stream.
415	WriteString	Write a string to the stream.
415	WriteUnicodeString	Write a unicode string to the stream.
416	WriteVariant	Write a variant to the stream
413	WriteWideChar	Write widechar to stream
415	WriteWideString	Write a widestring value to the stream

2.76.3 Property overview

Page	Property	Access	Description
417	Driver	r	Driver used when writing to the stream.
416	OnFindAncestor	rw	Event occurring when an ancestor component must be found.
416	OnWriteMethodProperty	rw	Handler from writing method properties.
417	OnWriteStringProperty	rw	Event handler for translating strings written to stream.
417	PropertyPath	r	Path to the property that is currently being written
416	RootAncestor	rw	Ancestor of root component.

2.76.4 TWriter.Create

Synopsis: Creates a new Writer with a stream and bufsize.

Declaration: constructor Create(ADriver: TAbstractObjectWriter)
constructor Create(Stream: TStream; BufSize: Integer)

Visibility: public

Description: Creates a new Writer with a stream and bufsize.

2.76.5 TWriter.Destroy

Synopsis: Destroys the writer instance.

Declaration: destructor Destroy; Override

Visibility: public

Description: Destroys the writer instance.

2.76.6 TWriter.DefineProperty

Synopsis: Callback used when defining and streaming custom properties.

Declaration: procedure DefineProperty(const Name: string; ReadData: TReaderProc;
AWriteData: TWriterProc; HasData: Boolean)
; Override

Visibility: public

Description: Callback used when defining and streaming custom properties.

2.76.7 TWriter.DefineBinaryProperty

Synopsis: Callback used when defining and streaming custom properties.

Declaration: procedure DefineBinaryProperty(const Name: string; ReadData: TStreamProc;
AWriteData: TStreamProc; HasData: Boolean)
; Override

Visibility: public

Description: Callback used when defining and streaming custom properties.

2.76.8 TWriter.Write

Synopsis: Write raw data to stream

Declaration: procedure Write(const Buffer; Count: LongInt); Virtual

Visibility: public

Description: Write is introduced for Delphi compatibility to write raw data to the component stream. This should not be used in new production code as it will totally mess up the streaming.

See also: TBinaryObjectWriter.Write ([1](#)), TAbstractObjectWriter.Write ([1](#))

2.76.9 TWriter.WriteBoolean

Synopsis: Write boolean value to the stream.

Declaration: procedure WriteBoolean(Value: Boolean)

Visibility: public

Description: Write boolean value to the stream.

2.76.10 TWriter.WriteCollection

Synopsis: Write a collection to the stream.

Declaration: procedure WriteCollection(Value: TCollection)

Visibility: public

Description: Write a collection to the stream.

2.76.11 TWriter.WriteComponent

Synopsis: Stream a component to the stream.

Declaration: procedure WriteComponent(Component: TComponent)

Visibility: public

Description: Stream a component to the stream.

2.76.12 TWriter.WriteChar

Synopsis: Write a character to the stream.

Declaration: procedure WriteChar(Value: Char)

Visibility: public

Description: Write a character to the stream.

2.76.13 TWriter.WriteWideChar

Synopsis: Write widechar to stream

Declaration: procedure WriteWideChar (Value: WideChar)

Visibility: public

Description: WriteWideChar writes a widechar to the stream. This actually writes a widestring of length 1.

See also: TReader.ReadWideChar ([1](#)), TWriter.WriteString ([1](#))

2.76.14 TWriter.WriteDescendent

Synopsis: Write a descendent component to the stream.

Declaration: procedure WriteDescendent (ARoot: TComponent; AAncestor: TComponent)

Visibility: public

Description: Write a descendent component to the stream.

2.76.15 TWriter.WriteFloat

Synopsis: Write a float to the stream.

Declaration: procedure WriteFloat (const Value: Extended)

Visibility: public

Description: Write a float to the stream.

2.76.16 TWriter.WriteSingle

Synopsis: Write a single-type real to the stream.

Declaration: procedure WriteSingle (const Value: Single)

Visibility: public

Description: Write a single-type real to the stream.

2.76.17 TWriter.WriteDate

Synopsis: Write a date to the stream.

Declaration: procedure WriteDate (const Value: TDateTime)

Visibility: public

Description: Write a date to the stream.

2.76.18 TWriter.WriteCurrency

Synopsis: Write a currency value to the stream

Declaration: procedure WriteCurrency (const Value: Currency)

Visibility: public

Description: WriteCurrency writes a currency typed value to the stream. This method does nothing except call the driver method of the driver being used.

See also: TReader.ReadCurrency ([1](#))

2.76.19 TWriter.WritIdent

Synopsis: Write an identifier to the stream.

Declaration: procedure WritIdent (const Ident: string)

Visibility: public

Description: Write an identifier to the stream.

2.76.20 TWriter.WriteLineger

Synopsis: Write an integer to the stream.

Declaration: procedure WriteInteger (Value: LongInt); Overload
procedure WriteInteger (Value: Int64); Overload

Visibility: public

Description: Write an integer to the stream.

2.76.21 TWriter.WriteSet

Synopsis: Write a set value to the stream

Declaration: procedure WriteSet (Value: LongInt; SetType: Pointer)

Visibility: public

Description: WriteSet writes a set Value consisting of elements with type EnumType. The set must be encoded as an integer where each element is encoded in a bit of the integer. Thus, at most an enumerated type with 32 elements can be written with this method.

Errors: No checking is performed on the validity of EnumType. It is assumed to be a valid PTypeInfo pointer.

See also: TReader.ReadSet ([1](#))

2.76.22 TWriter.WriteLineListBegin

Synopsis: Write a start-of-list marker to the stream.

Declaration: procedure WriteLineListBegin

Visibility: public

Description: Write a start-of-list marker to the stream.

2.76.23 TWriter.WriteLineEnd

Synopsis: Write an end-of-list marker to the stream.

Declaration: procedure WriteLineEnd

Visibility: public

Description: Write an end-of-list marker to the stream.

2.76.24 TWriter.WriteRootComponent

Synopsis: Write a root component to the stream.

Declaration: procedure WriteRootComponent (ARoot: TComponent)

Visibility: public

Description: Write a root component to the stream.

2.76.25 TWriter.WriteString

Synopsis: Write a string to the stream.

Declaration: procedure WriteString (const Value: string)

Visibility: public

Description: Write a string to the stream.

2.76.26 TWriter.WriteString

Synopsis: Write a widestring value to the stream

Declaration: procedure WriteWideString (const Value: WideString)

Visibility: public

Description: WriteWideString writes a currency typed value to the stream. This method does nothing except call the driver method of the driver being used.

See also: TReader.ReadWideString ([1](#))

2.76.27 TWriter.UnicodeString

Synopsis: Write a unicode string to the stream.

Declaration: procedure WriteUnicodeString (const Value: UnicodeString)

Visibility: public

Description: WriteUnicodeString writes Value, a UnicodeString string to the stream. It simply passes the string on to the WriteUnicodeString method of the writer driver class.

See also: TBinaryObjectWriter.WriteUnicodeString ([1](#)), TReader.ReadUnicodeString ([1](#))

2.76.28 TWriter.WriteVariant

Synopsis: Write a variant to the stream

Declaration: procedure WriteVariant (const VarValue: Variant)

Visibility: public

Description: WriteVariant writes Value, a simple variant, o the stream. It simply passes the string on to the WriteVariant method of the writer driver class.

See also: [TBinaryObjectWriter.WriteVariant \(1\)](#), [TReader.ReadVariant \(1\)](#)

2.76.29 TWriter.RootAncestor

Synopsis: Ancestor of root component.

Declaration: Property RootAncestor : TComponent

Visibility: public

Access: Read,Write

Description: Ancestor of root component.

2.76.30 TWriter.OnFindAncestor

Synopsis: Event occurring when an ancestor component must be found.

Declaration: Property OnFindAncestor : TFindAncestorEvent

Visibility: public

Access: Read,Write

Description: Event occurring when an ancestor component must be found.

2.76.31 TWriter.OnWriteMethodProperty

Synopsis: Handler from writing method properties.

Declaration: Property OnWriteMethodProperty : TWriteMethodPropertyEvent

Visibility: public

Access: Read,Write

Description: OnWriteMethodProperty can be set by an IDE or some streaming mechanism which handles dummy values for method properties; It can be used to write a real value to the stream which will be interpreted correctly when the stream is read. See [TWriteMethodPropertyEvent \(212\)](#) for a description of the arguments.

See also: [TWriteMethodPropertyEvent \(212\)](#), [TReader.OnSetMethodProperty \(1\)](#)

2.76.32 TWriter.OnWriteStringProperty

Synopsis: Event handler for translating strings written to stream.

Declaration: Property OnWriteStringProperty : TReadWriteStringPropertyEvent

Visibility: public

Access: Read,Write

Description: OnWriteStringProperty is called whenever a string property is written to the stream. It can be used e.g. by a translation mechanism to translate the strings on the fly, when a form is written. See TReadWriteStringPropertyEvent (208) for a description of the various parameters.

See also: TReader.OnPropertyNotFound (1), TReader.OnSetMethodProperty (1), TReadWriteStringPropertyEvent (208)

2.76.33 TWriter.Driver

Synopsis: Driver used when writing to the stream.

Declaration: Property Driver : TAbstractObjectWriter

Visibility: public

Access: Read

Description: Driver used when writing to the stream.

2.76.34 TWriter.PropertyPath

Synopsis: Path to the property that is currently being written

Declaration: Property PropertyPath : string

Visibility: public

Access: Read

Description: PropertyPath is set to the property name of the class currently being written to stream. This is only done when TPersistent (347) descendent class properties are written.

Chapter 3

Reference for unit 'clocale'

3.1 Overview

The `clocale` offers no API by itself: it just initializes the internationalization settings of the `sysutils` ([1449](#)) unit with the values provided by the C library found on most Unix or Linux systems that are POSIX compliant.

The `clocale` should simply be included in the `uses` clause of the program, preferably as one of the first units, and the initialization section of the unit will do all the work.

Note that including this unit, links your program to the C library of the system.

It makes no sense to use this unit on a non-posix system: Windows, OS/2 or DOS - therefore it should always be between an `ifdef` statement:

```
program myprogram;

uses
{$ifdef unix}clocale{$endif},
classes, sysutils;
```

Chapter 4

Reference for unit 'cmem'

4.1 Overview

The `cmem` memory manager sets the system units memory manager to a C-based memory manager: all memory management calls are shunted through to the C memory manager, using `Malloc` (420), `Free` (419) and `ReAlloc` (420). For this reason, the `cmem` unit should be the first unit of the uses clause of the program.

The unit also offers the C memory calls directly as external declarations from the C library, but it is recommended to use the normal FPC routines for this.

Obviously, including this unit links your program to the C library.

4.2 Constants, types and variables

4.2.1 Constants

`LibName = 'c'`

`LibName` is the name of the library that is actually used. On most systems, this is simply "libc.so".

4.3 Procedures and functions

4.3.1 CAlloc

Synopsis: Allocate memory based on item size and count

Declaration: `function CAlloc(unitSize: ptruint;UnitCount: ptruint) : pointer`

Visibility: default

Description: `CAlloc` allocates memory to hold `UnitCount` units of size `UnitSize` each. The memory is one block of memory. It returns a pointer to the newly allocated memory block.

See also: `Malloc` (420), `Free` (419), `Realloc` (420)

4.3.2 Free

Synopsis: Free a previously allocated block

Declaration: procedure Free (P: pointer)

Visibility: default

Description: Free returns the memory block pointed to by P to the system. After Free was called, the pointer P is no longer valid.

See also: Malloc (420), ReAlloc (420)

4.3.3 Malloc

Synopsis: Malloc external declaration.

Declaration: function Malloc(Size: ptruint) : Pointer

Visibility: default

Description: Malloc is the external declaration of the C library's malloc call. It accepts a size parameter, and returns a pointer to a memory block of the requested size or Nil if no more memory could be allocated.

See also: Free (419), ReAlloc (420)

4.3.4 ReAlloc

Synopsis: Reallocates a memory block

Declaration: function ReAlloc(P: Pointer; Size: ptruint) : pointer

Visibility: default

Description: ReAlloc re-allocates a block of memory pointed to by p. The new block will have size Size, and as much data as was available or as much data as fits is copied from the old to the new location.

See also: Malloc (420), Free (419)

Chapter 5

Reference for unit 'Crt'

5.1 Overview

This chapter describes the CRT unit for Free Pascal, both under dos linux and Windows. The unit was first written for dos by Florian klaempfl. The unit was ported to linux by Mark May and enhanced by Michael Van Canneyt and Peter Vreman. It works on the linux console, and in xterm and rxvt windows under X-Windows. The functionality for both is the same, except that under linux the use of an early implementation (versions 0.9.1 and earlier of the compiler) the crt unit automatically cleared the screen at program startup.

There are some caveats when using the CRT unit:

- Programs using the CRT unit will *not* be usable when input/output is being redirected on the command-line.
- For similar reasons they are not usable as CGI-scripts for use with a webserver.
- The use of the CRT unit and the graph unit may not always be supported.
- The CRT unit is not thread safe.
- On linux or other unix OSes , executing other programs that expect special terminal behaviour (using one of the special functions in the linux unit) will not work. The terminal is set in RAW mode, which will destroy most terminal emulation settings.

5.2 Constants, types and variables

5.2.1 Constants

Black = 0

Black color attribute

Blink = 128

Blink attribute

Blue = 1

Blue color attribute

Brown = 6

Brown color attribute

BW40 = 0

40 columns black and white screen mode.

BW80 = 2

80 columns black and white screen mode.

C40 = CO40

40 columns color screen mode.

C80 = CO80

80 columns color screen mode.

CO40 = 1

40 columns color screen mode.

CO80 = 3

80 columns color screen mode.

ConsoleMaxX = 1024

ConsoleMaxY = 1024

Cyan = 3

Cyan color attribute

DarkGray = 8

Dark gray color attribute

Flushing = False

Font8x8 = 256

Internal ROM font mode

Green = 2

Green color attribute

LightBlue = 9

Light Blue color attribute

LightCyan = 11

Light cyan color attribute

LightGray = 7

Light gray color attribute

LightGreen = 10

Light green color attribute

LightMagenta = 13

Light magenta color attribute

LightRed = 12

Light red color attribute

Magenta = 5

Magenta color attribute

Mono = 7

Monochrome screen mode (hercules screens)

Red = 4

Red color attribute

ScreenHeight : LongInt = 25

Current screen height.

ScreenWidth : LongInt = 80

Current screen width

White = 15

White color attribute

Yellow = 14

Yellow color attribute

5.2.2 Types

```
PConsoleBuf = ^TConsoleBuf
```

```
TCharAttr = packed record
  ch : Char;
  attr : Byte;
end
```

```
TConsoleBuf = Array[0..ConsoleMaxX*ConsoleMaxY-1] of TCharAttr
```

```
tcrtcoord = 1..255
```

`tcrtcoord` is a subrange type for denoting CRT coordinates. It supports coordinates ranging from 1 to 255. Using this type together with range-checking turned on can be used to debug CRT code.

5.2.3 Variables

```
CheckBreak : Boolean
```

Check for CTRL-Break keystroke. Not used.

```
CheckEOF : Boolean
```

Check for EOF on standard input. Not used.

```
CheckSnow : Boolean
```

Check snow on CGA screens. Not used.

```
ConsoleBuf : PConsoleBuf
```

```
DirectVideo : Boolean
```

The `DirectVideo` variable controls the writing to the screen. If it is `True`, the cursor is set via direct port access. If `False`, then the BIOS is used. This is defined under DOS only.

```
LastMode : Word = 3
```

The `Lastmode` variable tells you which mode was last selected for the screen. It is defined on DOS only.

```
TextAttr : Byte = $07
```

The `TextAttr` variable controls the attributes with which characters are written to screen.

```
WindMax : Word = $184f
```

The upper byte of `WindMax` contains the Y coordinate while the lower byte contains the X coordinate. The use of this variable is deprecated, use `WindMaxX` and `WindMaxY` instead.

`WindMaxX` : DWord

X coordinate of lower right corner of the defined window

`WindMaxY` : DWord

Y coordinate of lower right corner of the defined window

`WindMin` : Word = \$0

The upper byte of `WindMin` contains the Y coordinate while the lower byte contains the X coordinate. The use of this variable is deprecated, use `WindMinX` and `WindMinY` instead.

`WindMinX` : DWord

X coordinate of upper left corner of the defined window

`WindMinY` : DWord

Y coordinate of upper left corner of the defined window

5.3 Procedures and functions

5.3.1 AssignCrt

Synopsis: Assign file to CRT.

Declaration: procedure `AssignCrt`(var F: Text)

Visibility: default

Description: `AssignCrt` Assigns a file F to the console. Everything written to the file F goes to the console instead. If the console contains a window, everything is written to the window instead.

Errors: None.

See also: Window (436)

Listing: ./crtex/ex1.pp

```
Program Example1;
uses Crt;

{ Program to demonstrate the AssignCrt function. }

var
  F : Text;
begin
  AssignCrt(F);
  Rewrite(F); { Don't forget to open for output! }
  WriteLn(F,'This is written to the Assigned File');
  Close(F);
end.
```

5.3.2 ClrEol

Synopsis: Clear from cursor position till end of line.

Declaration: procedure ClrEol

Visibility: default

Description: ClrEol clears the current line, starting from the cursor position, to the end of the window. The cursor doesn't move

Errors: None.

See also: DelLine (428), InsLine (430), ClrScr (426)

Listing: ./crtex/ex9.pp

```
Program Example9;
uses Crt;

{ Program to demonstrate the ClrEol function. }
var
  I,J : integer;

begin
  For I:=1 to 15 do
    For J:=1 to 80 do
      begin
        gotoxy(j,i);
        Write(j mod 10);
      end;
  Window(5,5,75,12);
  Write('This line will be cleared from',
        ' here till the right of the window');
  GotoXY(27,WhereY);
  ReadKey;
  ClrEol;
  WriteLn;
end.
```

5.3.3 ClrScr

Synopsis: Clear current window.

Declaration: procedure ClrScr

Visibility: default

Description: ClrScr clears the current window (using the current colors), and sets the cursor in the top left corner of the current window.

Errors: None.

See also: Window (436)

Listing: ./crtex/ex8.pp

```
Program Example8;
uses Crt;

{ Program to demonstrate the ClrScr function. }

begin
  WriteLn('Press any key to clear the screen');
  ReadKey;
  ClrScr;
  WriteLn('Have fun with the cleared screen');
end.
```

5.3.4 cursorbig

Synopsis: Show big cursor

Declaration: procedure cursorbig

Visibility: default

Description: CursorBig makes the cursor a big rectangle. Not implemented on unixes.

Errors: None.

See also: CursorOn (427), CursorOff (427)

5.3.5 cursoroff

Synopsis: Hide cursor

Declaration: procedure cursoroff

Visibility: default

Description: CursorOff switches the cursor off (i.e. the cursor is no longer visible). Not implemented on unixes.

Errors: None.

See also: CursorOn (427), CursorBig (427)

5.3.6 cursoron

Synopsis: Display cursor

Declaration: procedure cursoron

Visibility: default

Description: CursorOn switches the cursor on. Not implemented on unixes.

Errors: None.

See also: CursorBig (427), CursorOff (427)

5.3.7 Delay

Synopsis: Delay program execution.

Declaration: procedure Delay (MS: Word)

Visibility: default

Description: Delay waits a specified number of milliseconds. The number of specified seconds is an approximation, and may be off a lot, if system load is high.

Errors: None

See also: Sound (433), NoSound (432)

Listing: ./crtex/ex15.pp

```
Program Example15;
uses Crt;

{ Program to demonstrate the Delay function. }
var
  i : longint;
begin
  WriteLn('Counting Down');
  for i:=10 downto 1 do
    begin
      WriteLn(i);
      Delay(1000); {Wait one second}
    end;
  WriteLn('BOOM!!!');
end.
```

5.3.8 DelLine

Synopsis: Delete line at cursor position.

Declaration: procedure DelLine

Visibility: default

Description: DelLine removes the current line. Lines following the current line are scrolled 1 line up, and an empty line is inserted at the bottom of the current window. The cursor doesn't move.

Errors: None.

See also: ClrEol (426), InsLine (430), ClrScr (426)

Listing: ./crtex/ex11.pp

```
Program Example10;
uses Crt;

{ Program to demonstrate the InsLine function. }

begin
  ClrScr;
  WriteLn;
  WriteLn('Line 1');
```

```

WriteLn('Line 2');
WriteLn('Line 2');
WriteLn('Line 3');
WriteLn;
WriteLn('Oops, Line 2 is listed twice,
           ' let's delete the line at the cursor position');
GotoXY(1,3);
ReadKey;
Delete;
GotoXY(1,10);
end.

```

5.3.9 GotoXY

Synopsis: Set cursor position on screen.

Declaration: procedure GotoXY(X: tcrtcoord; Y: tcrtcoord)

Visibility: default

Description: GotoXY positions the cursor at (X, Y), X in horizontal, Y in vertical direction relative to the origin of the current window. The origin is located at (1, 1), the upper-left corner of the window.

Errors: None.

See also: WhereX (435), WhereY (435), Window (436)

Listing: ./crtex/ex6.pp

```

Program Example6;
uses Crt;

{ Program to demonstrate the GotoXY function. }

begin
  ClrScr;
  GotoXY(10,10);
  Write('10,10');
  GotoXY(70,20);
  Write('70,20');
  GotoXY(1,22);
end.

```

5.3.10 HighVideo

Synopsis: Switch to highlighted text mode

Declaration: procedure HighVideo

Visibility: default

Description: HighVideo switches the output to highlighted text. (It sets the high intensity bit of the video attribute)

Errors: None.

See also: TextColor (434), TextBackground (433), LowVideo (431), NormVideo (431)

Listing: ./crtex/ex14.pp

```
Program Example14;
uses Crt;

{ Program to demonstrate the LowVideo, HighVideo, NormVideo functions. }

begin
  LowVideo;
  WriteLn('This is written with LowVideo');
  HighVideo;
  WriteLn('This is written with HighVideo');
  NormVideo;
  WriteLn('This is written with NormVideo');
end.
```

5.3.11 InsLine

Synopsis: Insert an empty line at cursor position

Declaration: procedure InsLine

Visibility: default

Description: InsLine inserts an empty line at the current cursor position. Lines following the current line are scrolled 1 line down, causing the last line to disappear from the window. The cursor doesn't move.

Errors: None.

See also: ClrEol (426), DelLine (428), ClrScr (426)

Listing: ./crtex/ex10.pp

```
Program Example10;
uses Crt;

{ Program to demonstrate the InsLine function. }

begin
  ClrScr;
  WriteLn;
  WriteLn('Line 1');
  WriteLn('Line 3');
  WriteLn;
  WriteLn('Oops, forgot Line 2, let ''s insert at the cursor postion');
  GotoXY(1,3);
  ReadKey;
  InsLine;
  Write('Line 2');
  GotoXY(1,10);
end.
```

5.3.12 KeyPressed

Synopsis: Check if there is a keypress in the keybuffer

Declaration: function KeyPressed : Boolean

Visibility: default

Description: Keypressed scans the keyboard buffer and sees if a key has been pressed. If this is the case, True is returned. If not, False is returned. The Shift, Alt, Ctrl keys are not reported. The key is not removed from the buffer, and can hence still be read after the KeyPressed function has been called.

Errors: None.

See also: ReadKey ([432](#))

Listing: ./crtex/ex2.pp

```
Program Example2;
uses Crt;

{ Program to demonstrate the KeyPressed function. }

begin
  WriteLn('Waiting until a key is pressed');
  repeat
    until KeyPressed;
  { The key is not Read,
    so it should also be outputted at the commandline}
end.
```

5.3.13 LowVideo

Synopsis: Switch to low intensity colors.

Declaration: procedure LowVideo

Visibility: default

Description: LowVideo switches the output to non-highlighted text. (It clears the high intensity bit of the video attribute)

For an example, see HighVideo ([429](#))

Errors: None.

See also: TextColor ([434](#)), TextBackground ([433](#)), HighVideo ([429](#)), NormVideo ([431](#))

5.3.14 NormVideo

Synopsis: Return to normal (startup) modus

Declaration: procedure NormVideo

Visibility: default

Description: NormVideo switches the output to the defaults, read at startup. (The defaults are read from the cursor position at startup)

For an example, see HighVideo ([429](#))

Errors: None.

See also: TextColor ([434](#)), TextBackground ([433](#)), LowVideo ([431](#)), HighVideo ([429](#))

5.3.15 NoSound

Synopsis: Stop system speaker

Declaration: procedure NoSound

Visibility: default

Description: NoSound stops the speaker sound. This call is not supported on all operating systems.

Errors: None.

See also: Sound (433)

Listing: ./crtex/ex16.pp

```
Program Example16;
uses Crt;

{ Program to demonstrate the Sound and NoSound function. }

var
  i : longint;
begin
  WriteLn('You will hear some tones from your speaker');
  while (i<15000) do
    begin
      inc(i,500);
      Sound(i);
      Delay(100);
    end;
  WriteLn('Quiet now!');
  NoSound; {Stop noise}
end.
```

5.3.16 ReadKey

Synopsis: Read key from keybuffer

Declaration: function ReadKey : Char

Visibility: default

Description: ReadKey reads 1 key from the keyboard buffer, and returns this. If an extended or function key has been pressed, then the zero ASCII code is returned. You can then read the scan code of the key with a second ReadKey call.

Key mappings under Linux can cause the wrong key to be reported by ReadKey, so caution is needed when using ReadKey.

Errors: None.

See also: KeyPressed (430)

Listing: ./crtex/ex3.pp

```
Program Example3;
uses Crt;

{ Program to demonstrate the ReadKey function. }
```

```

var
  ch : char;
begin
  writeln( 'Press Left/Right , Esc=Quit' );
  repeat
    ch:=ReadKey;
    case ch of
      #0 : begin
        ch:=ReadKey; {Read ScanCode}
        case ch of
          #75 : WriteLn( 'Left' );
          #77 : WriteLn( 'Right' );
        end;
      end;
      #27 : WriteLn( 'ESC' );
    end;
  until ch=#27 {Esc}
end.

```

5.3.17 Sound

Synopsis: Sound system speaker

Declaration: procedure Sound(Hz: Word)

Visibility: default

Description: Sound sounds the speaker at a frequency of hz. Under Windows, a system sound is played and the frequency parameter is ignored. On other operating systems, this routine may not be implemented.

Errors: None.

See also: NoSound ([432](#))

5.3.18 TextBackground

Synopsis: Set text background

Declaration: procedure TextBackground(Color: Byte)

Visibility: default

Description: TextBackground sets the background color to CL. CL can be one of the predefined color constants.

Errors: None.

See also: TextColor ([434](#)), HighVideo ([429](#)), LowVideo ([431](#)), NormVideo ([431](#))

Listing: ./crtex/ex13.pp

```

Program Example13;
uses Crt;

{ Program to demonstrate the TextBackground function. }

begin

```

```

TextColor(White);
WriteLn('This is written in with the default background color');
TextColorBackground(Green);
WriteLn('This is written in with a Green background');
TextColorBackground(Brown);
WriteLn('This is written in with a Brown background');
TextColorBackground(Black);
WriteLn('Back with a black background');
end.

```

5.3.19 TextColor

Synopsis: Set text color

Declaration: procedure TextColor(Color: Byte)

Visibility: default

Description: TextColor sets the foreground color to CL. CL can be one of the predefined color constants.

Errors: None.

See also: TextBackground (433), HighVideo (429), LowVideo (431), NormVideo (431)

Listing: ./crtex/ex12.pp

```

Program Example12;
uses Crt;

{ Program to demonstrate the TextColor function. }

begin
  WriteLn('This is written in the default color');
  TextColor(Red);
  WriteLn('This is written in Red');
  TextColor(White);
  WriteLn('This is written in White');
  TextColor(LightBlue);
  WriteLn('This is written in Light Blue');
end.

```

5.3.20 TextMode

Synopsis: Set screen mode.

Declaration: procedure TextMode(Mode: Word)

Visibility: default

Description: TextMode sets the textmode of the screen (i.e. the number of lines and columns of the screen).

The lower byte is use to set the VGA text mode.

This procedure is only implemented on dos.

Errors: None.

See also: Window (436)

5.3.21 WhereX

Synopsis: Return X (horizontal) cursor position

Declaration: function WhereX : tcrtcoord

Visibility: default

Description: WhereX returns the current X-coordinate of the cursor, relative to the current window. The origin is (1, 1), in the upper-left corner of the window.

Errors: None.

See also: GotoXY (429), WhereY (435), Window (436)

Listing: ./crtex/ex7.pp

```
Program Example7;
uses Crt;

{ Program to demonstrate the WhereX and WhereY functions. }

begin
  Writeln('Cursor position: X= ',WhereX, ' Y= ',WhereY);
end.
```

5.3.22 WhereY

Synopsis: Return Y (vertical) cursor position

Declaration: function WhereY : tcrtcoord

Visibility: default

Description: WhereY returns the current Y-coordinate of the cursor, relative to the current window. The origin is (1, 1), in the upper-left corner of the window.

Errors: None.

See also: GotoXY (429), WhereX (435), Window (436)

Listing: ./crtex/ex7.pp

```
Program Example7;
uses Crt;

{ Program to demonstrate the WhereX and WhereY functions. }

begin
  Writeln('Cursor position: X= ',WhereX, ' Y= ',WhereY);
end.
```

5.3.23 Window

Synopsis: Create new window on screen.

Declaration: procedure Window(X1: Byte; Y1: Byte; X2: Byte; Y2: Byte)

Visibility: default

Description: Window creates a window on the screen, to which output will be sent. (X1, Y1) are the coordinates of the upper left corner of the window, (X2, Y2) are the coordinates of the bottom right corner of the window. These coordinates are relative to the entire screen, with the top left corner equal to (1, 1). Further coordinate operations, except for the next Window call, are relative to the window's top left corner.

Errors: None.

See also: GotoXY (429), WhereX (435), WhereY (435), ClrScr (426)

Listing: ./crtex/ex5.pp

```
Program Example5;
uses Crt;

{ Program to demonstrate the Window function. }

begin
  ClrScr;
  WriteLn('Creating a window from 30,10 to 50,20');
  Window(30,10,50,20);
  WriteLn('We are now writing in this small window we just created, we '+
          'can''t get outside it when writing long lines like this one');
  Write('Press any key to clear the window');
  ReadKey;
  ClrScr;
  Write('The window is cleared, press any key to restore to fullscreen');
  ReadKey;
{ Full Screen is 80x25}
  Window(1,1,80,25);
  Clrscr;
  Writeln('Back in Full Screen');
end.
```

Chapter 6

Reference for unit 'cthreads'

6.1 Overview

The CThreads unit initializes the system unit's thread management routines with an implementation based on the POSIX thread managing routines in the C library. This assures that C libraries that are thread-aware still work if they are linked to by a FPC program.

It doesn't offer any API by itself: the initialization section of the unit just initializes the ThreadManager record in the System (1229) unit. This is done using the SetCThreadManager (437) call

The **cthreads** unit simply needs to be included in the uses clause of the program, preferably the very first unit, and the initialization section of the unit will do all the work.

Note that including this unit links your program to the C library of the system.

It makes no sense to use this unit on a non-posix system: Windows, OS/2 or DOS, therefor it should always between an ifdef statement:

```
program myprogram;

uses
  {$ifndef unix}cthreads{$endif},
  classes, sysutils;
```

The Lazarus IDE inserts this conditional automatically for each new started program.

6.2 Procedures and functions

6.2.1 SetCThreadManager

Synopsis: Sets the thread manager to the C thread manager

Declaration: procedure SetCThreadManager

Visibility: default

Description: SetCThreadManager actually sets the thread manager to the C thread manager. It can be called to re-set the thread manager if the thread manager was set to some other thread manager during the life-time of the program.

Chapter 7

Reference for unit 'ctypes'

7.1 Used units

Table 7.1: Used units by unit 'ctypes'

Name	Page
System	1229
unixtype	1713

7.2 Overview

The `ctypes` unit contains the definitions of commonly found C types. It can be used when interfaces to C libraries need to be defined. The types here are correct on all platforms, 32 or 64 bit.

The main advantage of using this file is to make sure that all C header import units use the same definitions for basic C types.

The `h2pas` program can include the `ctypes` unit automatically in the units it generates. The `-C` command-line switch can be used for this.

7.3 Constants, types and variables

7.3.1 Types

`cbool = UnixType.cbool`

C boolean (longbool)

`cchar = UnixType.cchar`

C character type (No signedness specification, 8 bit integer)

`cdouble = UnixType.cdouble`

Double precision floating point type (double)

`cfloat = UnixType.cfloat`

Single precision floating point type (single)

`cint = UnixType.cint`

C integer (commonly 32 bit)

`cint16 = UnixType.cint16`

16-bit signed integer.

`cint32 = UnixType.cint32`

32-bit signed integer (commonly: int)

`cint64 = UnixType.cint64`

64-bit integer

`cint8 = UnixType.cint8`

8-bit signed integer

`clong = UnixType.clong`

long integer (32/64 bit, depending on CPU register size)

`clongdouble = packed Array[0..15] of Byte`

Long precision floating point type (extended/double, depending on CPU)

`clonglong = UnixType.clonglong`

Long (64-bit) integer

`coff_t = UnixType.TOff`

Generic type to indicate offset

`cschar = UnixType.cschar`

C signed character type (8 bit signed integer)

`cshort = UnixType.cshort`

Short integer (16 bit)

`csigned = UnixType.cssigned`

Signed integer (commonly 32 bit)

csint = UnixType.csint

Signed integer (commonly 32 bit)

csize_t = UnixType.size_t

Generic type to contain a size of all kinds of structures

cslong = UnixType.cslong

Signed long integer (32/64 bit, depending on CPU register size)

cslonglong = UnixType.cslonglong

Signed long (64-bit) integer

csshort = UnixType.csshort

Short signed integer (16 bit)

cuchar = UnixType.cuchar

C unsigned character type (8 bit unsigned integer).

cuint = UnixType.cuint

Unsigned integer (commonly 32 bit)

cuint16 = UnixType.cuint16

16-bit unsigned integer.

cuint32 = UnixType.cuint32

32-bit unsigned integer

cuint64 = UnixType.cuint64

Unsigned 64-bit integer

cuint8 = UnixType.cuint8

8-bit unsigned integer

culong = UnixType.culong

Unsigned long integer (32/64 bit, depending on CPU register size)

culonglong = UnixType.culonglong

Unsigned long (64-bit) integer

cunsigned = UnixType.cunsigned

Unsigned integer (commonly 32 bit)

cushort = UnixType.cushort

Short unsigned integer (16 bit)

pcbool = UnixType.pcbool

Pointer to cbool (438) type.

pcchar = UnixType.pcchar

Pointer to cchar (438) type.

pcdouble = UnixType.pcdouble

Pointer to cdouble (438) type.

pcffloat = UnixType.pcffloat

Pointer to cffloat (439) type.

pcint = UnixType.pcint

Pointer to cint (439) type.

pcint16 = UnixType.pcint16

Pointer to cint16 (439) type.

pcint32 = UnixType.pcint32

Pointer to cint32 (439) type.

pcint64 = UnixType.pcint64

Pointer to cint64 (439) type.

pcint8 = UnixType.pcint8

Pointer to cint8 (439) type.

pclong = UnixType.pclong

Pointer to clong (439) type.

Pclongdouble = ^clongdouble

Pointer to clongdouble (439) type.

```
pclonglong = UnixTypepclonglong
```

Pointer to clonglong ([439](#)) type.

```
pcschar = UnixTypepcschar
```

Pointer to cschar ([439](#)) type.

```
pcshort = UnixTypepcshort
```

Pointer to cshort ([439](#)) type.

```
pcsigned = UnixTypepcsigned
```

Pointer to csigned ([439](#)) type.

```
pcrint = UnixTypepcrint
```

Pointer to csint ([440](#)) type.

```
pcsize_t = UnixTypepsize_t
```

Pointer to generic size type

```
pcslong = UnixTypepcslong
```

Pointer to cslong ([440](#)) type.

```
pcslonglong = UnixTypepcslonglong
```

Pointer to cslonglong ([440](#)) type.

```
pcsshort = UnixTypepcsshort
```

Pointer to csshort ([440](#)) type.

```
pcuchar = UnixTypepcuchar
```

Pointer to uchar ([440](#)) type.

```
pcuint = UnixTypepcuint
```

Pointer to uint ([440](#)) type.

```
pcuint16 = UnixTypepcuint16
```

Pointer to uint16 ([440](#)) type.

```
pcuint32 = UnixTypepcuint32
```

Pointer to uint32 ([440](#)) type.

```
pcuint64 = UnixType.pcuint64
```

Pointer to cuint64 (440) type.

```
pcuint8 = UnixType.pcuint8
```

Pointer to cuint8 (440) type.

```
pculong = UnixType.pculong
```

Pointer to culong (440) type.

```
pculonglong = UnixType.pculonglong
```

Pointer to culonglong (440) type.

```
pcunsigned = UnixType.pcunsigned
```

Pointer to cunsigned (441) type.

```
pcushort = UnixType.pcushort
```

Pointer to cushort (441) type.

7.4 Procedures and functions

7.4.1 operator *(clongdouble, Double): Double

Synopsis: Implement multiplication of clongdouble and double.

Declaration: operator operator *(clongdouble, Double): Double(const c: clongdouble;
const e: Double)
: Double

Visibility: default

Description: This operator allows to multiply a double typed value with a clongdouble typed value. the result is a double typed value.

7.4.2 operator *(Double, clongdouble): Double

Synopsis: Implement multiplication of double and clongdouble.

Declaration: operator operator *(Double, clongdouble): Double(const e: Double;
const c: clongdouble)
: Double

Visibility: default

Description: This operator allows to multiply a clongdouble typed value with a double typed value. The result is a double typed value.

7.4.3 operator +(clongdouble, Double): Double

Synopsis:

Declaration: operator operator +(clongdouble, Double): Double(const c: clongdouble;
const e: Double)
: Double

Visibility: default

Description: This operator allows to add `clongdouble` and `double` typed values. The result is a `double` typed value.

7.4.4 operator +(Double, clongdouble): Double

Synopsis: Implement addition of `clongdouble` and `double`.

Declaration: operator operator +(Double, clongdouble): Double(const e: Double;
const c: clongdouble)
: Double

Visibility: default

Description: This operator allows to add double and clongdouble typed values. The result is a double typed value.

7.4.5 operator -(clongdouble, Double): Double

Synopsis: Implement subtraction of double and clongdouble.

Declaration: operator operator -(clongdouble, Double): Double(const c: clongdouble;
const e: Double)
: Double

Visibility: default

Description: This operator allows to subtract a double typed value from a clongdouble typed value. The result is a double typed value.

7.4.6 operator -(Double, clongdouble): Double

Synopsis: Implement subtraction of `clongdouble` and `double`.

Declaration: operator operator -(Double, clongdouble): Double(const e: Double;
const c: clongdouble)
: Double

Visibility: default

Description: This operator allows to subtract a `clongdouble` typed value from a `double` typed value. The result is a `double` typed value.

7.4.7 operator /(clongdouble, Double): Double

Synopsis: Implement division of double and clongdouble.

Declaration: operator operator /(clongdouble, Double): Double(const c: clongdouble;
const e: Double)
: Double

Visibility: default

Description: This operator allows to divide a clongdouble typed value by a double typed value. the result is a double typed value.

7.4.8 operator /(Double, clongdouble): Double

Synopsis: Implement division of clongdouble and double.

Declaration: operator operator /(Double, clongdouble): Double(const e: Double;
const c: clongdouble)
: Double

Visibility: default

Description: This operator allows to divide a double typed value by a clongdouble typed value. the result is a double typed value.

7.4.9 operator :=(clongdouble): Double

Synopsis: Implement assignment of a clongdouble to a double type.

Declaration: operator operator :=(clongdouble): Double(const v: clongdouble) : Double

Visibility: default

Description: This operator allows to assign a clongdouble to a Double type.

7.4.10 operator :=(Double): clongdouble

Synopsis: Implement assignment of a double to a clongdouble type.

Declaration: operator operator :=(Double): clongdouble(const v: Double) : clongdouble

Visibility: default

Description: This operator allows to assign a double to a clongdouble type.

7.4.11 operator <(clongdouble, Double): Boolean

Synopsis: Implement less than comparison between double and clongdouble.

Declaration: operator operator <(clongdouble, Double): Boolean(const c: clongdouble;
const e: Double)
: Boolean

Visibility: default

Description: This operator compares the values of a clongdouble typed value and a double typed value, and returns True if the clongdouble value is less than the double value.

7.4.12 operator <(Double, clongdouble): Boolean

Synopsis: Implement less than comparison between `clongdouble` and `double`.

Declaration: `operator operator <(Double, clongdouble): Boolean(const e: Double;
const c: clongdouble)
: Boolean`

Visibility: default

Description: This operator compares the values of a `double` typed value and a `clongdouble` typed value, and returns `True` if the `double` value is less than the `clongdouble` value.

7.4.13 operator <=(clongdouble, Double): Boolean

Synopsis: Implement greater than or equal comparison between `double` and `clongdouble`.

Declaration: `operator operator <=(clongdouble, Double): Boolean(const c: clongdouble;
const e: Double)
: Boolean`

Visibility: default

Description: This operator compares the values of a `clongdouble` typed value and a `double` typed value, and returns `True` if the `clongdouble` value is less than or equal to the `double` value.

7.4.14 operator <=(Double, clongdouble): Boolean

Synopsis: Implement less than or equal comparison between `clongdouble` and `double`.

Declaration: `operator operator <=(Double, clongdouble): Boolean(const e: Double;
const c: clongdouble)
: Boolean`

Visibility: default

Description: This operator compares the values of a `double` typed value and a `clongdouble` typed value, and returns `True` if the `double` value is less than or equal to the `clongdouble` value.

7.4.15 operator =(clongdouble, Double): Boolean

Synopsis: Implement equality of `clongdouble` and `double`.

Declaration: `operator operator =(clongdouble, Double): Boolean(const c: clongdouble;
const e: Double)
: Boolean`

Visibility: default

Description: This operator compares the values of a `double` typed value and a `clongdouble` typed value, and returns `True` if the values are equal (only double precision is used).

7.4.16 operator =(Double, clongdouble): Boolean

Synopsis: Implement equality of double and clongdouble.

Visibility: default

Description: This operator compares the values of a `clongdouble` typed value and a `double` typed value, and returns `True` if the values are equal (only double precision is used).

7.4.17 operator >(clongdouble, Double): Boolean

Synopsis: Implement greater than comparison between double and clongdouble.

Declaration: operator operator >(clongdouble, Double): Boolean(const c: clongdouble;
const e: Double)
: Boolean

Visibility: default

Description: This operator compares the values of a `clongdouble` typed value and a `double` typed value, and returns `True` if the `clongdouble` value is greater than the `double` value.

7.4.18 operator >(Double, clongdouble): Boolean

Synopsis: Implement greater than comparison between `clongdouble` and `double`.

Visibility: default

Description: This operator compares the values of a double typed value and a clongdouble typed value, and returns True if the double value is greater than the clongdouble value.

7.4.19 operator >=(clongdouble, Double): Boolean

Synopsis: Implement greater than or equal comparison between double and clongdouble.

Declaration: operator operator >=(clongdouble, Double): Boolean(const c: clongdouble;
const e: Double)
: Boolean

Visibility: default

Description: This operator compares the values of a `clongdouble` typed value and a `double` typed value, and returns `True` if the `clongdouble` value is greater than or equal to the `double` value.

7.4.20 operator >=(Double, clongdouble): Boolean

Synopsis: Implement greater than or equal comparison between `clongdouble` and `double`.

Declaration: `operator operator >=(Double, clongdouble): Boolean(const e: Double;
const c: clongdouble)
: Boolean`

Visibility: default

Description: This operator compares the values of a `double` typed value and a `clongdouble` typed value, and returns `True` if the `double` value is greater than or equal to the `clongdouble` value.

Chapter 8

Reference for unit 'cwstring'

8.1 Overview

The `cwstring` unit offers no API by itself: it just initializes the widestring manager record of the system ([1229](#)) unit with an implementation that uses collation and conversion routines which are provided by the C library found on most Unix or Linux systems that are POSIX compliant.

The `cwstring` should simply be included in the `uses` clause of the program, preferably as one of the first units, and the initialization section of the unit will do all the work.

Note that including this unit links your program to the C library of the system.

It makes no sense to use this unit on a non-POSIX system like Windows, OS/2 or DOS. Therefor it should always be enclosed with an `ifdef` statement:

```
program myprogram;

uses
  {$ifndef unix}cwstring,{$endif}
  classes, sysutils;
```

8.2 Procedures and functions

8.2.1 SetCWidestringManager

Synopsis: Set the Widestring manager of the system unit to the C version

Declaration: procedure SetCWidestringManager

Visibility: default

Description: `SetCWidestringManager` actually sets the widestring manager record of the system unit. It is called automatically by the initialization section of the unit.

Chapter 9

Reference for unit 'dateutils'

9.1 Used units

Table 9.1: Used units by unit 'dateutils'

Name	Page
math	763
System	1229
sysutils	1449

9.2 Overview

DateUtils contains a large number of date/time manipulation routines, all based on the `TDateTime` type. There are routines for date/time math, for comparing dates and times, for composing dates and decomposing dates in their constituent parts.

9.3 Constants, types and variables

9.3.1 Constants

`ApproxDaysPerMonth : Double = 30.4375`

Average number of days in a month, measured over a year. Used in `MonthsBetween` ([497](#)).

`ApproxDaysPerYear : Double = 365.25`

Average number of days in a year, measured over 4 years. Used in `YearsBetween` ([538](#)).

`DayFriday = 5`

ISO day number for Friday

`DayMonday = 1`

ISO day number for Monday

DaySaturday = 6

ISO day number for Saturday

DaysPerWeek = 7

Number of days in a week.

DaysPerYear : Array[Boolean] of Word = (365, 366)

Array with number of days in a year. The boolean index indicates whether it is a leap year or not.

DaySunday = 7

ISO day number for Sunday

DayThursday = 4

ISO day number for Thursday

DayTuesday = 2

ISO day number for Tuesday

DayWednesday = 3

ISO day number for Wednesday

MonthsPerYear = 12

Number of months in a year

OneHour = 1 / HoursPerDay

One hour as a fraction of a day (suitable for TDateTime)

OneMillisecond = 1 / MSecsPerDay

One millisecond as a fraction of a day (suitable for TDateTime)

OneMinute = 1 / MinsPerDay

One minute as a fraction of a day (suitable for TDateTime)

OneSecond = 1 / SecsPerDay

One second as a fraction of a day (suitable for TDateTime)

RecodeLeaveFieldAsIs = (Word)

Bitmask deciding what to do with each TDateTime field in recode routines

`WeeksPerFortnight = 2`

Number of weeks in fortnight

`YearsPerCentury = 100`

Number of years in a century

`YearsPerDecade = 10`

Number of years in a decade

`YearsPerMillennium = 1000`

Number of years in a millenium

9.4 Procedures and functions

9.4.1 CompareDate

Synopsis: Compare 2 dates, disregarding the time of day

Declaration: `function CompareDate(const A: TDateTime; const B: TDateTime): TValueRelationship`

Visibility: default

Description: CompareDate compares the date parts of two timestamps A and B and returns the following results:

- < 0 if the day part of A is earlier than the day part of B.
- 0 if A and B are the on same day (times may differ) .
- > 0 if the day part of A is later than the day part of B.

See also: CompareTime (454), CompareDateTime (453), SameDate (507), SameTime (508), SameDateTime (508)

Listing: ./datutex/ex99.pp

Program Example99;

{ This program demonstrates the CompareDate function }

Uses SysUtils, DateUtils;

Const

`Fmt = 'dddd dd mmmm yyyy';`

Procedure Test(D1,D2 : TDateTime);

Var

`Cmp : Integer;`

```

begin
  Write(FormatDateTime(Fmt,D1), ' is '');
  Cmp:=CompareDate(D1,D2);
  If Cmp<0 then
    write('earlier than ')
  else if Cmp>0 then
    Write('later than ')
  else
    Write('equal to ');
  WriteLn(FormatDateTime(Fmt,D2));
end;

Var
  D,N : TDateTime;

Begin
  D:=Today;
  N:=Now;
  Test(D,D);
  Test(N,N);
  Test(D+1,D);
  Test(D-1,D);
  Test(D+OneSecond,D);
  Test(D-OneSecond,D);
  Test(N+OneSecond,N);
  Test(N-OneSecond,N);
End.

```

9.4.2 CompareDateTime

Synopsis: Compare 2 dates, taking into account the time of day

Declaration: function CompareDateTime(const A: TDateTime; const B: TDateTime) : TValueRelationship

Visibility: default

Description: CompareDateTime compares two timestamps A and B and returns the following results:

- < **0**if A is earlier in date/time than B.
- 0**if A and B are the same date/time .
- > **0**if A is later in date/time than B.

See also: CompareTime (454), CompareDate (452), SameDate (507), SameTime (508), SameDateTime (508)

Listing: ./datutex/ex98.pp

Program Example98 ;

{ This program demonstrates the CompareDateTime function }

Uses SysUtils, DateUtils;

Const

```
Fmt = 'dddd dd mmmm yyyy hh:nn:ss.zzz';
```

```

Procedure Test(D1,D2 : TDateTime);

Var
  Cmp : Integer;

begin
  Write(FormatDateTime(Fmt,D1), ' is ');
  Cmp:=CompareDateTime(D1,D2);
  If Cmp<0 then
    write('earlier than ')
  else if Cmp>0 then
    Write('later than ')
  else
    Write('equal to ');
  WriteIn(FormatDateTime(Fmt,D2));
end;

Var
  D,N : TDateTime;

Begin
  D:=Today;
  N:=Now;
  Test(D,D);
  Test(N,N);
  Test(D+1,D);
  Test(D-1,D);
  Test(D+OneSecond,D);
  Test(D-OneSecond,D);
  Test(N+OneSecond,N);
  Test(N-OneSecond,N);
End.

```

9.4.3 CompareTime

Synopsis: Compares two times of the day, disregarding the date part.

Declaration: function CompareTime(const A: TDateTime; const B: TDateTime)
 : TValueRelationship

Visibility: default

Description: CompareTime compares the time parts of two timestamps A and B and returns the following results:

- < 0 if the time part of A is earlier than the time part of B.
- 0 if A and B have the same time part (dates may differ).
- > 0 if the time part of A is later than the time part of B.

See also: [CompareDateTime](#) (453), [CompareDate](#) (452), [SameDate](#) (507), [SameTime](#) (508), [SameDateTime](#) (508)

Listing: ./datutex/ex100.pp

```

Program Example100;

{ This program demonstrates the CompareTime function }

Uses SysUtils, DateUtils;

Const
  Fmt = 'dddd dd mmmm yyyy hh:nn:ss.zzz';

Procedure Test(D1,D2 : TDateTime);

Var
  Cmp : Integer;

begin
  Write(FormatDateTime(Fmt,D1), ' has ');
  Cmp:=CompareDateTime(D1,D2);
  If Cmp<0 then
    write('earlier time than ')
  else if Cmp>0 then
    Write('later time than ')
  else
    Write('equal time with ');
  Writeln(FormatDateTime(Fmt,D2));
end;

Var
  D,N : TDateTime;

Begin
  D:=Today;
  N:=Now;
  Test(D,D);
  Test(N,N);
  Test(N+1,N);
  Test(N-1,N);
  Test(N+OneSecond,N);
  Test(N-OneSecond,N);
End.

```

9.4.4 DateOf

Synopsis: Extract the date part from a DateTime indication.

Declaration: function DateOf(const AValue: TDateTime) : TDateTime

Visibility: default

Description: DateOf extracts the date part from AValue and returns the result.

Since the TDateTime is actually a double with the date part encoded in the integer part, this operation corresponds to a call to Trunc.

See also: TimeOf (518), YearOf (537), MonthOf (497), DayOf (457), HourOf (472), MinuteOf (493), SecondOf (510), MilliSecondOf (488)

Listing: ./datutex/ex1.pp

```
Program Example1;

{ This program demonstrates the DateOf function }

Uses SysUtils, DateUtils;

Begin
  WriteLn( 'Date is : ', DateTimeToStr(DateOf(Now)) );
End.
```

9.4.5 DateTimeToDosDateTime

Synopsis: Convert TDateTime format to DOS date/time format

Declaration: function DateTimeToDosDateTime(const AValue: TDateTime) : LongInt

Visibility: default

Description: DateTimeToDosDateTime takes Value, a TDateTime formatted timestamp, and recodes it to a MS-DOS encoded date/time value. This is a longint with the date/time encoded in the bits as:

- 0-4**Seconds divided by 2
- 5-10**Minutes
- 11-15**Hours
- 16-20**Day
- 21-24**Month
- 25-31**Years since 1980

See also: DosDateTimeToDate (465)

9.4.6 DateTimeToJulianDate

Synopsis: Converts a TDateTime value to a Julian date representation

Declaration: function DateTimeToJulianDate(const AValue: TDateTime) : Double

Visibility: default

Description: DateTimeToJulianDate converts the AValue date/time indication to a julian (as opposed to Gregorian) date.

See also: JulianDateToDate (487), TryJulianDateToDate (523), DateTimeToModifiedJulianDate (457), TryModifiedJulianDateToDate (523)

9.4.7 DateTimeToMac

Synopsis: Convert a TDateTime timestamp to a Mac timestamp

Declaration: function DateTimeToMac(const AValue: TDateTime) : Int64

Visibility: default

Description: DateTimeToMac converts the TDateTime value AValue to a valid Mac timestamp indication and returns the result.

Errors: None.

See also: UnixTimeStampToMac (525), MacToDate (488), MacTimeStampToUnix (488)

9.4.8 DateTimeToModifiedJulianDate

Synopsis: Convert a TDateTime value to a modified Julian date representation

Declaration: function DateTimeToModifiedJulianDate(const AValue: TDateTime) : Double

Visibility: default

Description: Not yet implemented.

Errors: Currently, trying to use this function will raise an exception.

See also: DateTimeToJulianDate (456), JulianDateToDate (487), TryJulianDateToDate (523), TryModifiedJulianDateToDate (523)

9.4.9 DateTimeToUnix

Synopsis: Convert a TDateTime value to Unix epoch time

Declaration: function DateTimeToUnix(const AValue: TDateTime) : Int64

Visibility: default

Description: DateTimeToUnix converts a TDateTime value to a epoch time (i.e. the number of seconds elapsed since 1/1/1970).

See also: UnixToDate (525)

9.4.10 DayOf

Synopsis: Extract the day (of month) part from a DateTime value

Declaration: function DayOf(const AValue: TDateTime) : Word

Visibility: default

Description: DayOf returns the day of the month part of the AValue date/time indication. It is a number between 1 and 31.

For an example, see YearOf (537)

See also: YearOf (537), WeekOf (525), MonthOf (497), HourOf (472), MinuteOf (493), SecondOf (510), MillisecondOf (488)

9.4.11 DayOfTheMonth

Synopsis: Extract the day (of month) part of a DateTime value

Declaration: function DayOfTheMonth(const AValue: TDateTime) : Word

Visibility: default

Description: DayOfTheMonth returns the number of days that have passed since the start of the month till the moment indicated by AValue. This is a one-based number, i.e. the first day of the month will return 1.

For an example, see the WeekOfTheMonth (525) function.

See also: DayOfTheYear (458), WeekOfTheMonth (525), HourOfTheMonth (473), MinuteOfTheMonth (494), SecondOfTheMonth (511), MilliSecondOfTheMonth (490)

9.4.12 DayOfTheWeek

Synopsis: Extracts the day of the week from a DateTime value

Declaration: function DayOfTheWeek (const AValue: TDateTime) : Word

Visibility: default

Description: DayOfTheWeek returns the number of days that have passed since the start of the week till the moment indicated by AValue. This is a one-based number, i.e. the first day of the week will return 1.

See also: DayOfTheYear (458), DayOfTheMonth (457), HourOfTheWeek (473), MinuteOfTheWeek (494), SecondOfTheWeek (511), MilliSecondOfTheWeek (490)

Listing: ./datutex/ex42.pp

Program Example42;

{ This program demonstrates the WeekOfTheMonth function }

Uses SysUtils, DateUtils;

Var

N : TDateTime;

Begin

N:=Now;

WriteLn('Day of the Week : ', DayOfTheWeek(N));
 WriteLn('Hour of the Week : ', HourOfTheWeek(N));
 WriteLn('Minute of the Week : ', MinuteOfTheWeek(N));
 WriteLn('Second of the Week : ', SecondOfTheWeek(N));
 WriteLn('Millisecond of the Week : ',
 MilliSecondOfTheWeek(N));

End.

9.4.13 DayOfTheYear

Synopsis: Extracts the day of the year from a TDateTime value

Declaration: function DayOfTheYear (const AValue: TDateTime) : Word

Visibility: default

Description: DayOfTheYear returns the number of days that have passed since the start of the year till the moment indicated by AValue. This is a one-based number, i.e. January 1 will return 1.

For an example, see the WeekOfTheYear (526) function.

See also: WeekOfTheYear (526), HourOfTheYear (474), MinuteOfTheYear (494), SecondOfTheYear (512), MilliSecondOfTheYear (491)

9.4.14 DaysBetween

Synopsis: Number of whole days between two DateTime values.

Declaration: function DaysBetween(const ANow: TDateTime; const ATThen: TDateTime) : Integer

Visibility: default

Description: DaysBetween returns the number of whole days between ANow and ATThen. This means the fractional part of a day (hours, minutes, etc.) is dropped.

See also: YearsBetween (538), MonthsBetween (497), WeeksBetween (527), HoursBetween (474), MinutesBetween (495), SecondsBetween (512), MilliSecondsBetween (491)

Listing: ./datutex/ex58.pp

Program Example58;

{ This program demonstrates the DaysBetween function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, ATThen : TDateTime);

begin

 Write('Number of days between ');\n Write(DateTimeToStr(ATThen), ' and ', DateTimeToStr(ANow));\n WriteLn(' : ', DaysBetween(ANow, ATThen));

end;

Var

 D1,D2 : TDateTime;

Begin

 D1:=Now;\n D2:=Today-23/24;\n Test(D1,D2);\n D2:=Today-1;\n Test(D1,D2);\n D2:=Today-25/24;\n Test(D1,D2);\n D2:=Today-26/24;\n Test(D1,D2);\n D2:=Today-5.4;\n Test(D1,D2);\n D2:=Today-2.5;\n Test(D1,D2);

End.

9.4.15 DaysInAMonth

Synopsis: Number of days in a month of a certain year.

Declaration: function DaysInAMonth(const AYear: Word; const AMonth: Word) : Word

Visibility: default

Description: DaysInAMonth returns the number of days in the month AMonth in the yearAYear. The return value takes leap years into account.

See also: WeeksInAYear ([528](#)), WeeksInYear ([528](#)), DaysInYear ([461](#)), DaysInAYear ([460](#)), DaysInMonth ([461](#))

Listing: ./datutex/ex17.pp

Program Example17;

```
{ This program demonstrates the DaysInAMonth function }
```

Uses SysUtils, DateUtils;

Var

```
Y,M : Word;
```

Begin

```
For Y:=1992 to 2010 do
```

```
For M:=1 to 12 do
```

```
  WriteLn(LongMonthNames[m], ' ', Y, ' has ', DaysInAMonth(Y,M), ' days.');
```

End.

9.4.16 DaysInAYear

Synopsis: Number of days in a particular year.

Declaration: function DaysInAYear(const AYear: Word) : Word

Visibility: default

Description: DaysInAYear returns the number of weeks in the year AYear. The return value is either 365 or 366.

See also: WeeksInAYear ([528](#)), WeeksInYear ([528](#)), DaysInYear ([461](#)), DaysInMonth ([461](#)), DaysInAMonth ([459](#))

Listing: ./datutex/ex15.pp

Program Example15;

```
{ This program demonstrates the DaysInAYear function }
```

Uses SysUtils, DateUtils;

Var

```
Y : Word;
```

Begin

```
For Y:=1992 to 2010 do
```

```
  WriteLn(Y, ' has ', DaysInAYear(Y), ' days.');
```

End.

9.4.17 DaysInMonth

Synopsis: Return the number of days in the month in which a date occurs.

Declaration: function DaysInMonth(const AValue: TDateTime) : Word

Visibility: default

Description: DaysInMonth returns the number of days in the month in which AValue falls. The return value takes leap years into account.

See also: WeeksInAYear (528), WeeksInYear (528), DaysInYear (461), DaysInAYear (460), DaysInAMonth (459)

Listing: ./datutex/ex16.pp

Program Example16;

{ This program demonstrates the DaysInMonth function }

Uses SysUtils, DateUtils;

Var

Y,M : Word;

Begin

For Y:=1992 to 2010 do

For M:=1 to 12 do

WriteLn(LongMonthNames[m], ' ', Y, ' has ', DaysInMonth(EncodeDate(Y,M,1)), ' days.');

End.

9.4.18 DaysInYear

Synopsis: Return the number of days in the year in which a date occurs.

Declaration: function DaysInYear(const AValue: TDateTime) : Word

Visibility: default

Description: DaysInYear returns the number of days in the year part of AValue. The return value is either 365 or 366.

See also: WeeksInAYear (528), WeeksInYear (528), DaysInAYear (460), DaysInMonth (461), DaysInAMonth (459)

Listing: ./datutex/ex14.pp

Program Example14;

{ This program demonstrates the DaysInYear function }

Uses SysUtils, DateUtils;

Var

Y : Word;

Begin

For Y:=1992 to 2010 do

WriteLn(Y, ' has ', DaysInYear(EncodeDate(Y,1,1)), ' days.');

End.

9.4.19 DaySpan

Synopsis: Calculate the approximate number of days between two DateTime values.

Declaration: function DaySpan(const ANow: TDateTime; const AThen: TDateTime) : Double

Visibility: default

Description: DaySpan returns the number of Days between ANow and AThen, including any fractional parts of a Day.

See also: YearSpan (539), MonthSpan (498), WeekSpan (529), HourSpan (475), MinuteSpan (496), SecondSpan (513), MillisecondSpan (492), DaysBetween (459)

Listing: ./datutex/ex66.pp

Program Example66;

{ This program demonstrates the DaySpan function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, AThen : TDateTime);

begin

 Write('Number of days between ');\n Write(DateTimeToStr(AThen), ' and ', DateTimeToStr(ANow));\n WriteLn(' : ', DaySpan(ANow, AThen));

end;

Var

 D1,D2 : TDateTime;

Begin

 D1:=Now;\n D2:=Today-23/24;\n Test(D1,D2);\n D2:=Today-1;\n Test(D1,D2);\n D2:=Today-25/24;\n Test(D1,D2);\n D2:=Today-26/24;\n Test(D1,D2);\n D2:=Today-5.4;\n Test(D1,D2);\n D2:=Today-2.5;\n Test(D1,D2);

End.

9.4.20 DecodeDateDay

Synopsis: Decode a DateTime value in year and year of day.

Declaration: procedure DecodeDateDay(const AValue: TDateTime; out AYear: Word;
 out ADayOfYear: Word)

Visibility: default

Description: DecodeDateDay decomposes the date indication in AValue and returns the various components in AYear, ADayOfYear.

See also: EncodeDateTime (466), EncodeDateMonthWeek (466), EncodeDateWeek (467), EncodeDateDay (466), DecodeDateTime (464), DecodeDateWeek (464), DecodeDateMonthWeek (463)

Listing: ./datutex/ex83.pp

Program Example83;

{ This program demonstrates the DecodeDateDay function }

Uses SysUtils, DateUtils;

Var

Y,DoY : Word;
TS : TDateTime;

Begin

DecodeDateDay(Now,Y,DoY);
TS:=EncodeDateDay(Y,DoY);
Writeln('Today is : ',DateToStr(TS));

End.

9.4.21 DecodeDateMonthWeek

Synopsis: Decode a DateTime value in a month, week of month and day of week

Declaration: procedure DecodeDateMonthWeek(const AValue: TDateTime; out AYear: Word;
out AMonth: Word; out AWeekOfMonth: Word;
out ADayOfWeek: Word);

Visibility: default

Description: DecodeDateMonthWeek decomposes the date indication in AValue and returns the various components in AYear, AMonth, AWeekOfMonth and ADayOfWeek.

See also: EncodeDateTime (466), EncodeDateMonthWeek (466), EncodeDateWeek (467), EncodeDateDay (466), DecodeDateTime (464), DecodeDateWeek (464), DecodeDateDay (462)

Listing: ./datutex/ex85.pp

Program Example85;

{ This program demonstrates the DecodeDateMonthWeek function }

Uses SysUtils, DateUtils;

Var

Y,M,Wom,Dow : Word;
TS : TDateTime;

Begin

DecodeDateMonthWeek(Now,Y,M,WoM,DoW);
TS:=EncodeDateMonthWeek(Y,M,WoM,Dow);
Writeln('Today is : ',DateToStr(TS));

End.

9.4.22 DecodeDateTime

Synopsis: Decode a datetime value in a date and time value

Declaration: procedure DecodeDateTime(const AValue: TDateTime; out AYear: Word;
out AMonth: Word; out ADay: Word; out AHour: Word;
out AMinute: Word; out ASecond: Word;
out AMilliSecond: Word)

Visibility: default

Description: DecodeDateTime decomposes the date/time indication in AValue and returns the various components in AYear, AMonth, ADay, AHour, AMinute, ASecond, AMilliSecond

See also: EncodeDateTime (466), EncodeDateMonthWeek (466), EncodeDateWeek (467), EncodeDateDay (466), DecodeDateWeek (464), DecodeDateDay (462), DecodeDateMonthWeek (463)

Listing: ./datutex/ex79.pp

Program Example79;

{ This program demonstrates the DecodeDateTime function }

Uses SysUtils, DateUtils;

Var

Y,Mo,D,H,Mi,S,MS : Word;
TS : TDateTime;

Begin

DecodeDateTime(Now, Y, Mo, D, H, Mi, S, MS);
TS:=EncodeDateTime(Y, Mo, D, H, Mi, S, MS);
WriteLn('Now is : ', DateTimeToStr(TS));

End.

9.4.23 DecodeDateWeek

Synopsis: Decode a DateTime value in a week of year and day of week.

Declaration: procedure DecodeDateWeek(const AValue: TDateTime; out AYear: Word;
out AWeekOfYear: Word; out ADayOfWeek: Word)

Visibility: default

Description: DecodeDateWeek decomposes the date indication in AValue and returns the various components in AYear, AWeekOfYear, ADayOfWeek.

See also: EncodeDateTime (466), EncodeDateMonthWeek (466), EncodeDateWeek (467), EncodeDateDay (466), DecodeDateTime (464), DecodeDateDay (462), DecodeDateMonthWeek (463)

Listing: ./datutex/ex81.pp

Program Example81;

{ This program demonstrates the DecodeDateWeek function }

Uses SysUtils, DateUtils;

```

Var
  Y,W,Dow : Word;
  TS : TDateTime;

Begin
  DecodeDateWeek(Now,Y,W,Dow);
  TS:=EncodeDateWeek(Y,W,Dow);
  WriteLn( 'Today is : ',DateToStr(TS));
End.

```

9.4.24 DecodeDayOfWeekInMonth

Synopsis: Decode a DateTime value in year, month, day of week parts

Declaration: procedure DecodeDayOfWeekInMonth (const AValue: TDateTime;
 out AYear: Word; out AMonth: Word;
 out ANthDayOfWeek: Word;
 out ADayOfWeek: Word)

Visibility: default

Description: DecodeDayOfWeekInMonth decodes the date AValue in a AYear, AMonth, ADayOfWeek and ANthDayOfWeek. (This is the N-th time that this weekday occurs in the month, e.g. the third saturday of the month.)

See also: NthDayOfWeek ([499](#)), EncodeDateMonthWeek ([466](#)), #rtl.sysutils.DayOfWeek ([1503](#)), EncodeDayOfWeekInMonth ([467](#)), TryEncodeDayOfWeekInMonth ([522](#))

Listing: ./datutex/ex105.pp

Program Example105;

{ This program demonstrates the DecodeDayOfWeekInMonth function }

Uses SysUtils, DateUtils;

```

Var
  Y,M,NDoW,DoW : Word;
  D : TDateTime;
Begin
  DecodeDayOfWeekInMonth(Date,Y,M,NDoW,DoW);
  D:=EncodeDayOfWeekInMonth(Y,M,NDoW,DoW);
  Write(DateToStr(D), ' is the ',NDoW,'-th ');
  WriteLn(formatDateTime('dddd',D), ' of the month.');
End.

```

9.4.25 DosDateTimeToDateDateTime

Synopsis: Convert DOS date/time format to TDateTime format

Declaration: function DosDateTimeToDateDateTime(AValue: LongInt) : TDateTime

Visibility: default

Description: DosDateTimeToDateDateTime takes a DOS encoded date/time AValue and recodes it as a TDateTime value.

The bit encoding of the DOS date/time is explained in the DateTimeToDosDateTime ([456](#)) function.

See also: [DateTimeToDosDateTime](#) (456)

9.4.26 EncodeDateDay

Synopsis: Encodes a year and day of year to a DateTime value

Declaration: function EncodeDateDay(const AYear: Word; const ADayOfYear: Word) : TDateTime

Visibility: default

Description: EncodeDateDay encodes the values AYear and ADayOfYear to a date value and returns this value.

For an example, see [DecodeDateDay](#) (462).

Errors: If any of the arguments is not valid, then an EConvertError exception is raised.

See also: [EncodeDateMonthWeek](#) (466), [DecodeDateDay](#) (462), [EncodeDateTime](#) (466), [EncodeDateWeek](#) (467), [TryEncodeDateTime](#) (521), [TryEncodeDateMonthWeek](#) (520), [TryEncodeDateWeek](#) (521)

9.4.27 EncodeDateMonthWeek

Synopsis: Encodes a year, month, week of month and day of week to a DateTime value

Declaration: function EncodeDateMonthWeek(const AYear: Word; const AMonth: Word; const AWeekOfMonth: Word; const ADayOfWeek: Word) : TDateTime

Visibility: default

Description: EncodeDateMonthWeek encodes the values AYearAMonth, WeekOfMonth,ADayOfWeek, to a date value and returns this value.

For an example, see [DecodeDateMonthWeek](#) (463).

Errors: If any of the arguments is not valid, then an EConvertError exception is raised.

See also: [DecodeDateMonthWeek](#) (463), [EncodeDateTime](#) (466), [EncodeDateWeek](#) (467), [EncodeDateDay](#) (466), [TryEncodeDateTime](#) (521), [TryEncodeDateWeek](#) (521), [TryEncodeDateMonthWeek](#) (520), [TryEncodeDateDay](#) (519), [NthDayOfWeek](#) (499)

9.4.28 EncodeDateTime

Synopsis: Encodes a DateTime value from all its parts

Declaration: function EncodeDateTime(const AYear: Word; const AMonth: Word; const ADay: Word; const AHour: Word; const AMinute: Word; const ASecond: Word; const AMilliSecond: Word) : TDateTime

Visibility: default

Description: EncodeDateTime encodes the values AYearAMonth, ADay,AHour, AMinute,ASecond and AMilliSecond to a date/time valueand returns this value.

For an example, see [DecodeDateTime](#) (464).

Errors: If any of the arguments is not valid, then an EConvertError exception is raised.

See also: [DecodeDateTime](#) (464), [EncodeDateMonthWeek](#) (466), [EncodeDateWeek](#) (467), [EncodeDateDay](#) (466), [TryEncodeDateTime](#) (521), [TryEncodeDateWeek](#) (521), [TryEncodeDateDay](#) (519), [TryEncodeDateMonthWeek](#) (520)

9.4.29 EncodeDateWeek

Synopsis: Encode a `TDatetime` value from a year, week and day of week triplet

Declaration: `function EncodeDateWeek(const AYear: Word; const AWeekOfYear: Word;
const ADayOfWeek: Word) : TDatetime`
`function EncodeDateWeek(const AYear: Word; const AWeekOfYear: Word)
: TDatetime`

Visibility: default

Description: `EncodeDateWeek` encodes the values `AYear`, `AWeekOfYear` and `ADayOfWeek` to a date value and returns this value.

For an example, see [DecodeDateWeek](#) (464).

Errors: If any of the arguments is not valid, then an `EConvertError` exception is raised.

See also: [EncodeDateMonthWeek](#) (466), [DecodeDateWeek](#) (464), [EncodeDateTime](#) (466), [EncodeDateDay](#) (466), [TryEncodeDateTime](#) (521), [TryEncodeDateWeek](#) (521), [TryEncodeDateMonthWeek](#) (520)

9.4.30 EncodeDayOfWeekInMonth

Synopsis: Encodes a year, month, week, day of week specification to a `TDatetime` value

Declaration: `function EncodeDayOfWeekInMonth(const AYear: Word; const AMonth: Word;
const ANthDayOfWeek: Word;
const ADayOfWeek: Word) : TDatetime`

Visibility: default

Description: `EncodeDayOfWeekInMonth` encodes `AYear`, `AMonth`, `ADayOfWeek` and `ANthDayOfWeek` to a valid date stamp and returns the result.

`ANthDayOfWeek` is the N-th time that this weekday occurs in the month, e.g. the third saturday of the month.

For an example, see [DecodeDayOfWeekInMonth](#) (465).

Errors: If any of the values is not in range, then an `EConvertError` exception will be raised.

See also: [NthDayOfWeek](#) (499), [EncodeDateMonthWeek](#) (466), [#rtl.sysutils.DayOfWeek](#) (1503), [DecodeDayOfWeekInMonth](#) (465), [TryEncodeDayOfWeekInMonth](#) (522)

9.4.31 EncodeTimeInterval

Synopsis: Encode an interval as a `TDatetime` value.

Declaration: `function EncodeTimeInterval(Hour: Word; Minute: Word; Second: Word;
Millisecond: Word) : TDatetime`

Visibility: default

Description: `EncodeTimeInterval` encodes a time interval expressed in Hour, Min, Sec, MSec as a `TDatetime` value and returns the value in Time.

Errors: If Min, Sec, MSec do not contain a valid time indication, then an EConvertError exception is raised.

See also: TryEncodeTimeInterval (??)

9.4.32 EndOfDay

Synopsis: Calculates a DateTime value representing the end of a specified day

Declaration: function EndOfDay (const AYear: Word; const AMonth: Word;
 const ADay: Word) : TDateTime; Overload
function EndOfDay (const AYear: Word; const ADayOfYear: Word) : TDateTime
 ; Overload

Visibility: default

Description: EndOfDay returns a TDateTime value with the date/time indication of the last moment (23:59:59.999) of the day given by AYear, AMonth, ADay.

The day may also be indicated with a AYear, ADayOfYear pair.

See also: StartOfTheDay (516), StartOfDay (514), StartOfTheWeek (517), StartOfAWeek (515), StartOfAMonth (514), StartOfTheMonth (517), EndOfTheWeek (471), EndOfAWeek (469), EndOfTheYear (472), EndOfAYear (470), EndOfTheMonth (471), EndOfAMonth (468), EndOfTheDay (470)

Listing: ./datutex/ex39.pp

```
Program Example39;

{ This program demonstrates the EndOfDay function }

Uses SysUtils, DateUtils;

Const
  Fmt = '"End of the day : "dd mmmm yyyy hh:nn:ss';

Var
  Y,M,D : Word;

Begin
  Y:=YearOf(Today);
  M:=MonthOf(Today);
  D:=DayOf(Today);
  Writeln(FormatDateTime(Fmt, EndOfDay(Y,M,D)));
  DecodeDateDay(Today,Y,D);
  Writeln(FormatDateTime(Fmt, EndOfDay(Y,D)));
End.
```

9.4.33 EndOfMonth

Synopsis: Calculate a datetime value representing the last day of the indicated month

Declaration: function EndOfMonth (const AYear: Word; const AMonth: Word) : TDateTime

Visibility: default

Description: EndOfMonth e returns a TDateTime value with the date of the last day of the month indicated by the AYear, AMonth pair.

See also: StartOfTheMonth (517), StartOfAMonth (514), EndOfTheMonth (471), EndOfTheYear (472), EndOfAYear (470), StartOfAWeek (515), StartOfTheWeek (517)

Listing: ./datutex/ex31.pp

Program Example31;

{ This program demonstrates the EndOfAMonth function }

Uses SysUtils, DateUtils;

Const

Fmt = '"Last day of this month : "dd mmmm yyyy';

Var

Y,M : Word;

Begin

Y:=YearOf(Today);

M:=MonthOf(Today);

WriteLn(FormatDateTime(Fmt, EndOfAMonth(Y,M)));

End.

9.4.34 EndOfAWeek

Synopsis: Return the last moment of day of the week, given a year and a week in the year.

Declaration: function EndOfAWeek(const AYear: Word; const AWeekOfYear: Word;
const ADayOfWeek: Word) : TDateTime
function EndOfAWeek(const AYear: Word; const AWeekOfYear: Word)
: TDateTime

Visibility: default

Description: EndOfAWeek returns a TDateTime value with the date of the last moment (23:59:59:999) on the indicated day of the week indicated by the AYear, AWeek, ADayOfWeek values.

The default value for ADayOfWeek is 7.

See also: StartOfTheWeek (517), EndOfTheWeek (471), EndOfAWeek (469), StartOfAMonth (514), EndOfTheYear (472), EndOfAYear (470), EndOfTheMonth (471), EndOfAMonth (468)

Listing: ./datutex/ex35.pp

Program Example35;

{ This program demonstrates the EndOfAWeek function }

Uses SysUtils, DateUtils;

Const

Fmt = '"Last day of this week : "dd mmmm yyyy hh:nn:ss';

Fmt2 = '"Last-1 day of this week : "dd mmmm yyyy hh:nn:ss';

Var

Y,W : Word;

Begin

Y:=YearOf(Today);

```

W:=WeekOf(Today);
WriteLn(FormatDateTime(Fmt,EndOfAWeek(Y,W)));
WriteLn(FormatDateTime(Fmt2,EndOfAWeek(Y,W,6)));
End.
```

9.4.35 EndOfDay

Synopsis: Calculate a DateTime value representing the last day of a year

Declaration: function EndOfDay(AYear: Word) : TDateTime

Visibility: default

Description: StartOfDay returns a TDateTime value with the date of the last day of the year AYear (December 31).

See also: StartOfTheYear (518), EndOfTheYear (472), EndOfDay (470), EndOfTheMonth (471), EndOfAMonth (468), StartOfAWeek (515), StartOfTheWeek (517)

Listing: ./datutex/ex27.pp

Program Example27;

```
{ This program demonstrates the EndOfDay function }
```

Uses SysUtils, DateUtils;

Const

```
Fmt = '"Last day of this year : "dd mmmm yyyy';
```

Begin

```
  WriteLn(FormatDateTime(Fmt,EndOfDay(YearOf(Today))));
```

End.

9.4.36 EndOfDay

Synopsis: Calculate a datetime value that represents the end of a given day.

Declaration: function EndOfDay(AValue: TDateTime) : TDateTime

Visibility: default

Description: EndOfDay extracts the date part of AValue and returns a TDateTime value with the date/time indication of the last moment (23:59:59.999) of this day.

See also: StartOfDay (516), StartOfDay (514), StartOfTheWeek (517), StartOfAWeek (515), StartOfAMonth (514), StartOfTheMonth (517), EndOfTheWeek (471), EndOfAWeek (469), EndOfTheYear (472), EndOfDay (470), EndOfTheMonth (471), EndOfAMonth (468), EndOfDay (468)

Listing: ./datutex/ex37.pp

Program Example37;

```
{ This program demonstrates the EndOfDay function }
```

Uses SysUtils, DateUtils;

```

Const
  Fmt = '"End of the day : "dd mmmm yyyy hh:nn:ss';

Begin
  WriteLn(FormatDateTime(Fmt, EndOfDay(Today)));
End.

```

9.4.37 EndOfTheMonth

Synopsis: Calculate a DateTime value representing the last day of the month, given a day in that month.

Declaration: function EndOfTheMonth(const AValue: TDateTime) : TDateTime

Visibility: default

Description: EndOfTheMonth extracts the year and month parts of AValue and returns a TDateTime value with the date of the first day of that year and month as the EndOfAMonth ([468](#)) function.

See also: StartOfAMonth ([514](#)), StartOfTheMonth ([517](#)), EndOfAMonth ([468](#)), EndOfTheYear ([472](#)), EndOfAYear ([470](#)), StartOfAWeek ([515](#)), StartOfTheWeek ([517](#))

Listing: ./datutex/ex29.pp

```

Program Example29;

{ This program demonstrates the EndOfTheMonth function }

Uses SysUtils, DateUtils;

Const
  Fmt = '"last day of this month : "dd mmmm yyyy';

Begin
  WriteLn(FormatDateTime(Fmt, EndOfTheMonth(Today)));
End.

```

9.4.38 EndOfTheWeek

Synopsis: Calculate a DateTime value which represents the end of a week, given a date in that week.

Declaration: function EndOfTheWeek(const AValue: TDateTime) : TDateTime

Visibility: default

Description: EndOfTheWeek extracts the year and week parts of AValue and returns a TDateTime value with the date of the last day of that week as the EndOfAWeek ([469](#)) function.

See also: StartOfAWeek ([515](#)), StartOfTheWeek ([517](#)), EndOfAWeek ([469](#)), StartOfAMonth ([514](#)), EndOfTheYear ([472](#)), EndOfAYear ([470](#)), EndOfTheMonth ([471](#)), EndOfAMonth ([468](#))

Listing: ./datutex/ex33.pp

```
Program Example33;

{ This program demonstrates the EndOfTheWeek function }

Uses SysUtils, DateUtils;

Const
  Fmt = '"last day of this week : "dd mmmm yyyy';

Begin
  WriteLn(FormatDateTime(Fmt, EndOfTheWeek(Today)));
End.
```

9.4.39 EndOfTheYear

Synopsis: Calculate a DateTime value representing the last day of a year, given a date in that year.

Declaration: function EndOfTheYear(const AValue: TDateTime) : TDateTime

Visibility: default

Description: EndOfTheYear extracts the year part of AValue and returns a TDateTime value with the date of the last day of that year (December 31), as the EndOfAYear (470) function.

See also: StartOfAYear (516), StartOfTheYear (518), EndOfTheMonth (471), EndOfAMonth (468), StartOfAWeek (515), StartOfTheWeek (517), EndOfAYear (470)

Listing: ./datutex/ex25.pp

```
Program Example25;

{ This program demonstrates the EndOfTheYear function }

Uses SysUtils, DateUtils;

Const
  Fmt = '"Last day of this year : "dd mmmm yyyy';

Begin
  WriteLn(FormatDateTime(Fmt, EndOfTheYear(Today)));
End.
```

9.4.40 HourOf

Synopsis: Extract the hour part from a DateTime value.

Declaration: function HourOf(const AValue: TDateTime) : Word

Visibility: default

Description: HourOf returns the hour of the day part of the AValue date/time indication. It is a number between 0 and 23.

For an example, see YearOf (537)

See also: YearOf (537), WeekOf (525), MonthOf (497), DayOf (457), MinuteOf (493), SecondOf (510), MillisecondOf (488)

9.4.41 HourOfDay

Synopsis: Calculate the hour of a given DateTime value

Declaration: function HourOfDay(const AValue: TDateTime) : Word

Visibility: default

Description: HourOfDay returns the number of hours that have passed since the start of the day till the moment indicated by AValue. This is a zero-based number, i.e. 00:59:59 will return 0.

See also: HourOfDayTheYear (474), HourOfDayTheMonth (473), HourOfDayTheWeek (473), MinuteOfDay (493), SecondOfDay (510), MillisecondOfDay (489)

Listing: ./datutex/ex43.pp

Program Example43;

{ This program demonstrates the HourOfDay function }

Uses SysUtils, DateUtils;

Var

N : TDateTime;

Begin

```
N:=Now;
WriteLn('Hour of the Day      : ',HourOfDay(N));
WriteLn('Minute of the Day     : ',MinuteOfDay(N));
WriteLn('Second of the Day      : ',SecondOfDay(N));
WriteLn('Millisecond of the Day : ',
      MillisecondOfDay(N));
```

End.

9.4.42 HourOfTheMonth

Synopsis: Calculate the number of hours passed since the start of the month.

Declaration: function HourOfTheMonth(const AValue: TDateTime) : Word

Visibility: default

Description: HourOfTheMonth returns the number of hours that have passed since the start of the month till the moment indicated by AValue. This is a zero-based number, i.e. 00:59:59 on the first day of the month will return 0.

For an example, see the WeekOfTheMonth (525) function.

See also: WeekOfTheMonth (525), DayOfTheMonth (457), MinuteOfDay (494), SecondOfDay (511), MillisecondOfDay (490)

9.4.43 HourOfTheWeek

Synopsis: Calculate the number of hours elapsed since the start of the week.

Declaration: function HourOfTheWeek(const AValue: TDateTime) : Word

Visibility: default

Description: HourOfTheWeek returns the number of hours that have passed since the start of the Week till the moment indicated by AValue. This is a zero-based number, i.e. 00:59:59 on the first day of the week will return 0.

For an example, see the DayOfTheWeek (458) function.

See also: HourOfTheYear (474), HourOfTheMonth (473), HourOfTheDay (473), DayOfTheWeek (458), MinuteOfTheWeek (494), SecondOfTheWeek (511), MilliSecondOfTheWeek (490)

9.4.44 HourOfTheYear

Synopsis: Calculate the number of hours passed since the start of the year.

Declaration: function HourOfTheYear (const AValue: TDateTime) : Word

Visibility: default

Description: HourOfTheYear returns the number of hours that have passed since the start of the year (January 1, 00:00:00) till the moment indicated by AValue. This is a zero-based number, i.e. January 1 00:59:59 will return 0.

For an example, see the WeekOfTheYear (526) function.

See also: WeekOfTheYear (526), DayOfTheYear (458), MinuteOfTheYear (494), SecondOfTheYear (512), MilliSecondOfTheYear (491)

9.4.45 HoursBetween

Synopsis: Calculate the number of whole hours between two DateTime values.

Declaration: function HoursBetween (const ANow: TDateTime; const ATThen: TDateTime) : Int64

Visibility: default

Description: HoursBetween returns the number of whole hours between ANow and ATThen. This means the fractional part of an hour (minutes,seconds etc.) is dropped.

See also: YearsBetween (538), MonthsBetween (497), WeeksBetween (527), DaysBetween (459), MinutesBetween (495), SecondsBetween (512), MilliSecondsBetween (491)

Listing: ./datutex/ex59.pp

Program Example59;

{ This program demonstrates the HoursBetween function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, ATThen : TDateTime);

begin

 Write('Number of hours between ');\n Write(DateTimeToStr(ATThen), ' and ', DateTimeToStr(ANow));\n WriteLn(' : ', HoursBetween(ANow, ATThen));

end;

Var

 D1, D2 : TDateTime;

```
Begin
  D1:=Now;
  D2:=D1-(59*OneMinute);
  Test(D1,D2);
  D2:=D1-(61*OneMinute);
  Test(D1,D2);
  D2:=D1-(122*OneMinute);
  Test(D1,D2);
  D2:=D1-(306*OneMinute);
  Test(D1,D2);
  D2:=D1-(5.4*OneHour);
  Test(D1,D2);
  D2:=D1-(2.5*OneHour);
  Test(D1,D2);
End.
```

9.4.46 HourSpan

Synopsis: Calculate the approximate number of hours between two DateTime values.

Declaration: function HourSpan(const ANow: TDateTime; const AThen: TDateTime) : Double

Visibility: default

Description: HourSpan returns the number of Hours between ANow and AThen, including any fractional parts of a Hour.

See also: YearSpan (539), MonthSpan (498), WeekSpan (529), DaySpan (462), MinuteSpan (496), SecondSpan (513), MillisecondSpan (492), HoursBetween (474)

Listing: ./datutex/ex67.pp

Program Example67;

{ This program demonstrates the HourSpan function }

Uses SysUtils, DateUtils;

Procedure Test(ANow,AThen : TDateTime);

begin

 Write('Number of hours between ');
 Write(DateTimeToStr(AThen), ' and ', DateTimeToStr(ANow));
 WriteLn(' : ', HourSpan(ANow,AThen));

end;

Var

 D1,D2 : TDateTime;

Begin

 D1:=Now;
 D2:=D1-(59*OneMinute);
 Test(D1,D2);
 D2:=D1-(61*OneMinute);
 Test(D1,D2);
 D2:=D1-(122*OneMinute);

```

Test(D1,D2);
D2:=D1-(306*OneMinute );
Test(D1,D2);
D2:=D1-(5.4*OneHour );
Test(D1,D2);
D2:=D1-(2.5*OneHour );
Test(D1,D2);
End.

```

9.4.47 IncDay

Synopsis: Increase a DateTime value with a number of days.

Declaration: function IncDay(const AValue: TDateTime; const ANumberOfDays: Integer)
 : TDateTime
 function IncDay(const AValue: TDateTime) : TDateTime

Visibility: default

Description: IncDay adds ANumberOfDays days to AValue and returns the resulting date/time. ANumberOfDays can be positive or negative.

See also: IncYear ([479](#)), #rtl.sysutils.IncMonth ([1553](#)), IncWeek ([478](#)), IncHour ([476](#)), IncMinute ([477](#)), IncSecond ([478](#)), IncMillisecond ([477](#))

Listing: ./datutex/ex74.pp

Program Example74;

```
{ This program demonstrates the IncDay function }
```

```
Uses SysUtils, DateUtils;
```

Begin

```
  WriteLn('One Day from today is ', DateToStr(IncDay(Today, 1)));
  WriteLn('One Day ago from today is ', DateToStr(IncDay(Today, -1)));
End.
```

9.4.48 IncHour

Synopsis: Increase a DateTime value with a number of hours.

Declaration: function IncHour(const AValue: TDateTime; const ANumberOfHours: Int64)
 : TDateTime
 function IncHour(const AValue: TDateTime) : TDateTime

Visibility: default

Description: IncHour adds ANumberOfHours hours to AValue and returns the resulting date/time. ANumberOfHours can be positive or negative.

See also: IncYear ([479](#)), #rtl.sysutils.IncMonth ([1553](#)), IncWeek ([478](#)), IncDay ([476](#)), IncMinute ([477](#)), IncSecond ([478](#)), IncMillisecond ([477](#))

Listing: ./datutex/ex75.pp

```
Program Example75
;

{ This program demonstrates the IncHour function }

Uses SysUtils, DateUtils;

Begin
  WriteLn( 'One Hour from now is ', DateTimeToStr(IncHour(Now, 1)) );
  WriteLn( 'One Hour ago from now is ', DateTimeToStr(IncHour(Now, -1)) );
End.
```

9.4.49 IncMilliSecond

Synopsis: Increase a DateTime value with a number of milliseconds.

Declaration: `function IncMilliSecond(const AValue: TDateTime;
 const ANumberOfMilliSeconds: Int64) : TDateTime`
`function IncMilliSecond(const AValue: TDateTime) : TDateTime`

Visibility: default

Description: `IncMilliSecond` adds `ANumberOfMilliSeconds` milliseconds to `AValue` and returns the resulting date/time. `ANumberOfMilliSeconds` can be positive or negative.

See also: [IncYear \(479\)](#), [#rtl.sysutils.IncMonth \(1553\)](#), [IncWeek \(478\)](#), [IncDay \(476\)](#), [IncHour \(476\)](#), [IncSecond \(478\)](#), [IncMillisecond \(477\)](#)

Listing: ./datutex/ex78.pp

```
Program Example78;
;

{ This program demonstrates the IncMillisecond function }

Uses SysUtils, DateUtils;

Begin
  WriteLn( 'One Millisecond from now is ', TimeToStr(IncMillisecond(Now, 1)) );
  WriteLn( 'One Millisecond ago from now is ', TimeToStr(IncMillisecond(Now, -1)) );
End.
```

9.4.50 IncMinute

Synopsis: Increase a DateTime value with a number of minutes.

Declaration: `function IncMinute(const AValue: TDateTime;
 const ANumberOfMinutes: Int64) : TDateTime`
`function IncMinute(const AValue: TDateTime) : TDateTime`

Visibility: default

Description: `IncMinute` adds `ANumberOfMinutes` minutes to `AValue` and returns the resulting date/time. `ANumberOfMinutes` can be positive or negative.

See also: [IncYear \(479\)](#), [#rtl.sysutils.IncMonth \(1553\)](#), [IncWeek \(478\)](#), [IncDay \(476\)](#), [IncHour \(476\)](#), [IncSecond \(478\)](#), [IncMillisecond \(477\)](#)

Listing: ./datutex/ex76.pp

```
Program Example76;

{ This program demonstrates the IncMinute function }

Uses SysUtils, DateUtils;

Begin
  WriteLn( 'One Minute from now is ', TimeToStr(IncMinute(Time, 1)));
  WriteLn( 'One Minute ago from now is ', TimeToStr(IncMinute(Time, -1)));
End.
```

9.4.51 IncSecond

Synopsis: Increase a DateTime value with a number of seconds.

Declaration: `function IncSecond(const AValue: TDateTime; const ANumberOfSeconds: Int64) : TDateTime`
`function IncSecond(const AValue: TDateTime) : TDateTime`

Visibility: default

Description: `IncSecond` adds `ANumberOfSeconds` seconds to `AValue` and returns the resulting date/time. `ANumberOfSeconds` can be positive or negative.

See also: [IncYear \(479\)](#), [#rtl.sysutils.IncMonth \(1553\)](#), [IncWeek \(478\)](#), [IncDay \(476\)](#), [IncHour \(476\)](#), [IncSecond \(478\)](#), [IncMillisecond \(477\)](#)

Listing: ./datutex/ex77.pp

```
Program Example77;

{ This program demonstrates the IncSecond function }

Uses SysUtils, DateUtils;

Begin
  WriteLn( 'One Second from now is ', TimeToStr(IncSecond(Time, 1)));
  WriteLn( 'One Second ago from now is ', TimeToStr(IncSecond(Time, -1)));
End.
```

9.4.52 IncWeek

Synopsis: Increase a DateTime value with a number of weeks.

Declaration: `function IncWeek(const AValue: TDateTime; const ANumberOfWeeks: Integer) : TDateTime`
`function IncWeek(const AValue: TDateTime) : TDateTime`

Visibility: default

Description: `IncWeek` adds `ANumberOfWeeks` weeks to `AValue` and returns the resulting date/time. `ANumberOfWeeks` can be positive or negative.

See also: [IncYear \(479\)](#), [#rtl.sysutils.IncMonth \(1553\)](#), [IncDay \(476\)](#), [IncHour \(476\)](#), [IncMinute \(477\)](#), [IncSecond \(478\)](#), [IncMillisecond \(477\)](#)

Listing: ./datutex/ex73.pp

```

Program Example73;

{ This program demonstrates the IncWeek function }

Uses SysUtils, DateUtils;

Begin
  WriteLn( 'One Week from today is ', DateToStr(IncWeek(Today, 1)));
  WriteLn( 'One Week ago from today is ', DateToStr(IncWeek(Today, -1)));
End.

```

9.4.53 IncYear

Synopsis: Increase a DateTime value with a number of years.

Declaration: function IncYear(const AValue: TDateTime; const ANumberOfYears: Integer)
 : TDateTime
 function IncYear(const AValue: TDateTime) : TDateTime

Visibility: default

Description: IncYear adds ANumberOfYears years to AValue and returns the resulting date/time. ANumberOfYears can be positive or negative.

See also: #rtl.sysutils.IncMonth (1553), IncWeek (478), IncDay (476), IncHour (476), IncMinute (477), IncSecond (478), IncMillisecond (477)

Listing: ./datutex/ex71.pp

```

Program Example71;

{ This program demonstrates the IncYear function }

Uses SysUtils, DateUtils;

Begin
  WriteLn( 'One year from today is ', DateToStr(IncYear(Today, 1)));
  WriteLn( 'One year ago from today is ', DateToStr(IncYear(Today, -1)));
End.

```

9.4.54 InvalidDateDayError

Synopsis: Raise an EConvertError exception when a day is not a valid day of a year.

Declaration: procedure InvalidDateDayError(const AYear: Word; const ADayOfYear: Word)

Visibility: default

Description: InvalidDateDayError raises an EConvertError (1605) exception and formats the error message with an appropriate description made up from the parts AYear and ADayOfYear.

Normally this function should not be needed, the conversion routines call it when they have received invalid arguments.

See also: InvalidDateWeekError (480), InvalidDateTimeError (480), InvalidDateMonthWeekError (480), InvalidDayOfWeekInMonthError (481)

9.4.55 InvalidDateMonthWeekError

Synopsis: Raise an EConvertError exception when a Year,Month,WeekOfMonth,DayofWeek is invalid.

Declaration: procedure InvalidDateMonthWeekError (const AYear: Word;
const AMonth: Word;
const AWeekOfMonth: Word;
const ADayOfWeek: Word)

Visibility: default

Description: InvalidDateMonthWeekError raises an EConvertError ([1605](#)) exception and formats the error message with an appropriate description made up from the parts AYear, AMonth, AWeekOfMonth and ADayOfWeek.

Normally this function should not be needed, the conversion routines call it when they have received invalid arguments.

See also: [InvalidDateWeekError \(480\)](#), [InvalidDateTimeError \(480\)](#), [InvalidDateDayError \(479\)](#), [InvalidDay-OfWeekInMonthError \(481\)](#)

9.4.56 InvalidDateTimeError

Synopsis: Raise an EConvertError about an invalid date-time specification.

Declaration: procedure InvalidDateTimeError (const AYear: Word; const AMonth: Word;
const ADay: Word; const AHour: Word;
const AMinute: Word; const ASecond: Word;
const AMilliSecond: Word;
const ABaseDate: TDateTime)
procedure InvalidDateTimeError (const AYear: Word; const AMonth: Word;
const ADay: Word; const AHour: Word;
const AMinute: Word; const ASecond: Word;
const AMilliSecond: Word)

Visibility: default

Description: InvalidDateTimeError raises an EConvertError ([1605](#)) exception and formats the error message with an appropriate description made up from the parts AYear, AMonth, ADay, AHour, AMinute, ASecond and AMilliSecond.

Normally this function should not be needed, the conversion routines call it when they have received invalid arguments.

See also: [InvalidDateWeekError \(480\)](#), [InvalidDateDayError \(479\)](#), [InvalidDateMonthWeekError \(480\)](#), [InvalidDay-OfWeekInMonthError \(481\)](#)

9.4.57 InvalidDateWeekError

Synopsis: Raise an EConvertError with an invalid Year, WeekOfyear and DayOfWeek specification

Declaration: procedure InvalidDateWeekError (const AYear: Word;
const AWeekOfYear: Word;
const ADayOfWeek: Word)

Visibility: default

Description: `InvalidDateWeekError` raises an `EConvertError` (1605) exception and formats the error message with an appropriate description made up from the parts `AYear`, `AWeek`, `ADayOfWeek`. Normally this function should not be needed, the conversion routines call it when they have received invalid arguments.

See also: `InvalidDateTimeError` (480), `InvalidDateDayError` (479), `InvalidDateMonthWeekError` (480), `InvalidDayOfWeekInMonthError` (481)

9.4.58 InvalidDayOfWeekInMonthError

Synopsis: Raise an `EConvertError` exception when a `Year`,`Month`,`NthDayofWeek`,`DayofWeek` is invalid.

Declaration: `procedure InvalidDayOfWeekInMonthError(const AYear: Word;
const AMonth: Word;
const ANthDayOfWeek: Word;
const ADayOfWeek: Word)`

Visibility: default

Description: `InvalidDayOfWeekInMonthError` raises an `EConvertError` (1605) exception and formats the error message with an appropriate description made up from the parts `AYear`, `AMonth`, `ANthDayOfWeek` and `ADayOfWeek`.

Normally this function should not be needed, the conversion routines call it when they have received invalid arguments.

See also: `InvalidDateWeekError` (480), `InvalidDateTimeError` (480), `InvalidDateDayError` (479), `InvalidDateMonthWeekError` (480)

9.4.59 IsInLeapYear

Synopsis: Determine whether a date is in a leap year.

Declaration: `function IsInLeapYear(const AValue: TDateTime) : Boolean`

Visibility: default

Description: `IsInLeapYear` returns `True` if the year part of `AValue` is leap year, or `False` if not.

See also: `YearOf` (537), `IsPM` (482), `IsToday` (483), `IsSameDay` (482)

Listing: ./datutex/ex3.pp

```
Program Example3;
{ This program demonstrates the IsInLeapYear function }
Uses SysUtils, DateUtils;
Begin
  Writeln('Current year is leap year: ', IsInLeapYear(Date));
End.
```

9.4.60 IsPM

Synopsis: Determine whether a time is PM or AM.

Declaration: function IsPM(const AValue: TDateTime) : Boolean

Visibility: default

Description: IsPM returns True if the time part of AValue is later than 12:00 (PM, or afternoon).

See also: YearOf (537), IsInLeapYear (481), IsToday (483), IsSameDay (482)

Listing: ./datutex/ex4.pp

Program Example4;

```
{ This program demonstrates the IsPM function }
```

```
Uses SysUtils, DateUtils;
```

```
Begin
```

```
  WriteLn('Current time is PM : ', IsPM(Now));
```

```
End.
```

9.4.61 IsSameDay

Synopsis: Check if two date/time indications are the same day.

Declaration: function IsSameDay(const AValue: TDateTime; const ABasis: TDateTime) : Boolean

Visibility: default

Description: IsSameDay checks whether AValue and ABasis have the same date part, and returns True if they do, False if not.

See also: Today (519), Yesterday (540), Tomorrow (519), IsToday (483)

Listing: ./datutex/ex21.pp

Program Example21;

```
{ This program demonstrates the IsSameDay function }
```

```
Uses SysUtils, DateUtils;
```

```
Var
```

```
  I : Integer;
  D : TDateTime;
```

```
Begin
```

```
  For I:=1 to 3 do
```

```
    begin
```

```
      D:=Today+Random(3)-1;
```

```
      Write(FormatDateTime('dd mmmm yyyy "is today : "',D));
```

```
      WriteLn(IsSameDay(D, Today));
```

```
    end;
```

```
End.
```

9.4.62 IsSameMonth

Synopsis: Check if 2 dates are in the same month.

Declaration: function IsSameMonth(const AValue: TDateTime; const ABasis: TDateTime) : Boolean

Visibility: default

Description: IsSameMonth will return True if the two dates AValue and ABasis occur in the same year and month. (i.e. if their month and year parts match). Otherwise, False is returned.

See also: IsSameDay (482), IsToday (483), SameDate (507)

9.4.63 IsToday

Synopsis: Check whether a given date is today.

Declaration: function IsToday(const AValue: TDateTime) : Boolean

Visibility: default

Description: IsToday returns True if AValue is today's date, and False otherwise.

See also: Today (519), Yesterday (540), Tomorrow (519), IsSameDay (482)

Listing: ./datutex/ex20.pp

Program Example20;

{ This program demonstrates the IsToday function }

Uses SysUtils, DateUtils;

Begin

```
  WriteLn( 'Today      : ', IsToday(Today));
  WriteLn( 'Tomorrow   : ', IsToday(Tomorrow));
  WriteLn( 'Yesterday  : ', IsToday(Yesterday));

```

End.

9.4.64 IsValidDate

Synopsis: Check whether a set of values is a valid date indication.

Declaration: function IsValidDate(const AYear: Word; const AMonth: Word; const ADay: Word) : Boolean

Visibility: default

Description: IsValidDate returns True when the values AYear, AMonth, ADay form a valid date indication. If one of the values is not valid (e.g. the day is invalid or does not exist in that particular month), False is returned.

AYear must be in the range 1..9999 to be valid.

See also: IsValidTime (487), IsValidDateTime (485), IsValidDateDay (484), IsValidDateWeek (486), IsValidDateMonthWeek (484)

Listing: ./datutex/ex5.pp

```

Program Example5;

{ This program demonstrates the IsValidDate function }

Uses SysUtils, DateUtils;

Var
  Y,M,D : Word;

Begin
  For Y:=2000 to 2004 do
    For M:=1 to 12 do
      For D:=1 to 31 do
        If Not IsValidDate(Y,M,D) then
          Writeln(D, ' is not a valid day in ',Y,'/',M);
End.

```

9.4.65 IsValidDateDay

Synopsis: Check whether a given year/day of year combination is a valid date.

Visibility: default

Description: IsValidDateDay returns True if AYear and ADayOfYear form a valid date indication, or False otherwise.

AYear must be in the range 1..9999 to be valid.

The `ADayOfYear` value is checked to see whether it falls within the valid range of dates for `AYear`.

See also: [IsValidDate \(483\)](#), [IsValidTime \(487\)](#), [IsValidDateTime \(485\)](#), [IsValidDateWeek \(486\)](#), [IsValidDate-MonthWeek \(484\)](#)

Listing: ./datutex/ex9.pp

Program Example9 ;

{ This program demonstrates the IsValidDateDay function }

Uses SysUtils , DateUtils ;

Var
Y : Word;

```

Begin
  For Y:=1996 to 2004 do
    if IsValidDateDay(Y,366) then
      WriteIn(Y,' is a leap year');
End.

```

9.4.66 IsValidDateMonthWeek

Synopsis: Check whether a given year/month/week/day of the week combination is a valid day.

Declaration: function IsValidDateMonthWeek(const AYear: Word; const AMonth: Word;
const AWeekOfMonth: Word;
const ADayOfWeek: Word) : Boolean

Visibility: default

Description: IsValidDateMonthWeek returns True if AYear, AMonth, AWeekOfMonth and ADayOfWeek form a valid date indication, or False otherwise.

AYear must be in the range 1..9999 to be valid.

The AWeekOfMonth, ADayOfWeek values are checked to see whether the combination falls within the valid range of weeks for the AYear, AMonth combination.

See also: IsValidDate (483), IsValidTime (487), IsValidDateTime (485), IsValidDateDay (484), IsValidDateWeek (486)

Listing: ./datutex/ex11.pp

Program Example11;

```
{ This program demonstrates the IsValidDateMonthWeek function }

Uses SysUtils, DateUtils;

Var
  Y,W,D : Word;
  B : Boolean;

Begin
  For Y:=2000 to 2004 do
    begin
      B:=True;
      For W:=4 to 6 do
        For D:=1 to 7 do
          If B then
            begin
              B:=IsValidDateMonthWeek(Y,12,W,D);
              If Not B then
                if (D=1) then
                  WriteLn('December ',Y,' has exactly ',W,' weeks.');
                else
                  WriteLn('December ',Y,' has ',W,' weeks and ',D-1,', days.');
              end;
            end;
      end;
  End.
```

9.4.67 IsValidDateTime

Synopsis: Check whether a set of values is a valid date and time indication.

Declaration: function IsValidDateTime(const AYear: Word; const AMonth: Word;
const ADay: Word; const AHour: Word;
const AMinute: Word; const ASecond: Word;
const AMilliSecond: Word) : Boolean

Visibility: default

Description: IsValidTime returns True when the values AYear, AMonth, ADay, AHour, AMinute, ASecond and AMilliSecond form a valid date and time indication. If one of the values is not valid (e.g. the seconds are larger than 60), False is returned.

AYear must be in the range 1..9999 to be valid.

See also: [IsValidDate \(483\)](#), [IsValidTime \(487\)](#), [IsValidDateDay \(484\)](#), [IsValidDateWeek \(486\)](#), [IsValidDate-MonthWeek \(484\)](#)

Listing: ./datutex/ex7.pp

Program Example7 ;

{ This program demonstrates the IsValidDateTime function }

Uses SysUtils , DateUtils ;

Var

```
Y,Mo,D : Word;  
H,M,S,MS : Word;  
I : Integer;
```

Begin

For I := 1 to 10 do

begin

Y:=2000+Random(5)

Mo:=Random(15)

```
D:=Random(40);
```

```
H:=Random(32);
```

M:=Random(90);

```
S:=Random(90);
```

```
MS:=Random(1500);
```

If Not IsValidDateTime(Y,Mo,D,H,M,S,MS) then

WriteLn(Y, '—',Mo,'—',D,' ',H,':',M,':',S,'.',MS,' is not a valid date/time.');

end;

End .

9.4.68 IsValidDateWeek

Synopsis: Check whether a given year/week/day of the week combination is a valid day.

Declaration: function IsValidDateWeek(const AYear: Word; const AWeekOfYear: Word;
const ADayOfWeek: Word) : Boolean

Visibility: default

Description: IsValidDateWeek returns True if AYear, AWeekOfYear and ADayOfWeek form a valid date indication, or False otherwise.

AYear must be in the range 1..9999 to be valid.

The `ADayOfWeek`,`ADayOfWeek` values are checked to see whether the combination falls within the valid range of weeks for `AYear`.

See also: [IsValidDate \(483\)](#), [IsValidTime \(487\)](#), [IsValidDateTime \(485\)](#), [IsValidDateDay \(484\)](#), [IsValidDateMonthWeek \(484\)](#)

Listing: ./datutex/ex10.pp

```

Program Example10;

{ This program demonstrates the IsValidDateWeek function }

Uses SysUtils, DateUtils;

Var
  Y,W,D : Word;
  B : Boolean;

Begin
  For Y:=2000 to 2004 do
    begin
      B:=True;
      For W:=51 to 54 do
        For D:=1 to 7 do
          If B then
            begin
              B:=IsValidDateWeek(Y,W,D);
              If Not B then
                if (D=1) then
                  Writeln(Y, ' has exactly ',W,' weeks.')
                else
                  Writeln(Y, ' has ',W,' weeks and ',D-1,' days.');
            end;
        end;
    End;
End.

```

9.4.69 IsValidTime

Synopsis: Check whether a set of values is a valid time indication.

Declaration: `function IsValidTime(const AHour: Word; const AMinute: Word;
const ASecond: Word; const AMilliSecond: Word)
: Boolean`

Visibility: default

Description: Check whether a set of values is a valid time indication.

9.4.70 JulianDateToDateTime

Synopsis: Convert a Julian date representation to a TDateTime value.

Declaration: `function JulianDateToDateTime(const AValue: Double) : TDateTime`

Visibility: default

Description: JulianDateToDateTime converts the Julian AValue date/time indication to a regular TDateTime date/time indication.

See also: [DateTimeToJulianDate \(456\)](#), [TryJulianDateToDateTime \(523\)](#), [DateTimeToModifiedJulianDate \(457\)](#), [TryModifiedJulianDateToDateTime \(523\)](#)

9.4.71 LocalTimeToUniversal

Declaration: function LocalTimeToUniversal(LT: TDatetime) : TDatetime
function LocalTimeToUniversal(LT: TDatetime; TZOffset: Integer)
: TDatetime

Visibility: default

9.4.72 MacTimeStampToUnix

Synopsis: Convert a Mac timestamp to a Unix timestamp

Declaration: function MacTimeStampToUnix(const AValue: Int64) : Int64

Visibility: default

Description: MacTimeStampToUnix converts the Mac timestamp indication in AValue to a unix timestamp indication (epoch time)

Errors: None.

See also: UnixTimeStampToMac (525), DateTimeToMac (456), MacToDate (488)

9.4.73 MacToDate

Synopsis: Convert a Mac timestamp to a TDatetime timestamp

Declaration: function MacToDate (const AValue: Int64) : TDatetime

Visibility: default

Description: MacToDate converts the Mac timestamp indication in AValue to a valid TDatetime indication.

Errors: None.

See also: UnixTimeStampToMac (525), DateTimeToMac (456), MacTimeStampToUnix (488)

9.4.74 MillisecondOf

Synopsis: Extract the millisecond part from a Date/Time value.

Declaration: function MillisecondOf (const AValue: TDatetime) : Word

Visibility: default

Description: MillisecondOf returns the second of the minute part of the AValue date/time indication. It is a number between 0 and 999.

For an example, see YearOf (537)

See also: YearOf (537), WeekOf (525), MonthOf (497), DayOf (457), HourOf (472), MinuteOf (493), MillisecondOf (488)

9.4.75 MillisecondOfTheDay

Synopsis: Calculate the number of milliseconds elapsed since the start of the day

Declaration: function MillisecondOfTheDay(const AValue: TDateTime) : LongWord

Visibility: default

Description: MillisecondOfTheDay returns the number of milliseconds that have passed since the start of the Day (00:00:00.000) till the moment indicated by AValue. This is a zero-based number, i.e. 00:00:00.000 will return 0.

For an example, see the HourOfTheDay ([473](#)) function.

See also: MillisecondOfTheYear ([491](#)), MillisecondOfTheMonth ([490](#)), MillisecondOfTheWeek ([490](#)), MillisecondOfTheHour ([489](#)), MillisecondOfTheMinute ([489](#)), MillisecondOfTheSecond ([490](#)), HourOfTheDay ([473](#)), MinuteOfTheDay ([493](#)), SecondOfTheDay ([510](#))

9.4.76 MillisecondOfTheHour

Synopsis: Calculate the number of milliseconds elapsed since the start of the hour

Declaration: function MillisecondOfTheHour(const AValue: TDateTime) : LongWord

Visibility: default

Description: MillisecondOfTheHour returns the number of milliseconds that have passed since the start of the Hour (HH:00:00.000) till the moment indicated by AValue. This is a zero-based number, i.e. HH:00:00.000 will return 0.

For an example, see the MinuteOfTheHour ([493](#)) function.

See also: MillisecondOfTheYear ([491](#)), MillisecondOfTheMonth ([490](#)), MillisecondOfTheWeek ([490](#)), MillisecondOfTheDay ([489](#)), MillisecondOfTheMinute ([489](#)), MillisecondOfTheSecond ([490](#)), MinuteOfTheHour ([493](#)), SecondOfTheHour ([510](#))

9.4.77 MillisecondOfTheMinute

Synopsis: Calculate the number of milliseconds elapsed since the start of the minute

Declaration: function MillisecondOfTheMinute(const AValue: TDateTime) : LongWord

Visibility: default

Description: MillisecondOfTheMinute returns the number of milliseconds that have passed since the start of the Minute (HH:MM:00.000) till the moment indicated by AValue. This is a zero-based number, i.e. HH:MM:00.000 will return 0.

For an example, see the SecondOfTheMinute ([510](#)) function.

See also: MillisecondOfTheYear ([491](#)), MillisecondOfTheMonth ([490](#)), MillisecondOfTheWeek ([490](#)), MillisecondOfTheDay ([489](#)), MillisecondOfTheHour ([489](#)), MillisecondOfTheMinute ([489](#)), MillisecondOfTheSecond ([490](#)), SecondOfTheMinute ([510](#))

9.4.78 MillisecondOfTheMonth

Synopsis: Calculate number of milliseconds elapsed since the start of the month.

Declaration: function MillisecondOfTheMonth(const AValue: TDateTime) : LongWord

Visibility: default

Description: MillisecondOfTheMonth returns the number of milliseconds that have passed since the start of the month (00:00:00.000) till the moment indicated by AValue. This is a zero-based number, i.e. 00:00:00.000 on the first of the month will return 0.

For an example, see the WeekOfTheMonth ([525](#)) function.

See also: WeekOfTheMonth ([525](#)), DayOfTheMonth ([457](#)), HourOfTheMonth ([473](#)), MinuteOfTheMonth ([494](#)), SecondOfTheMonth ([511](#)), MillisecondOfTheMonth ([490](#))

9.4.79 MillisecondOfTheSecond

Synopsis: Calculate the number of milliseconds elapsed since the start of the second

Declaration: function MillisecondOfTheSecond(const AValue: TDateTime) : Word

Visibility: default

Description: MillisecondOfTheSecond returns the number of milliseconds that have passed since the start of the second (HH:MM:SS.000) till the moment indicated by AValue. This is a zero-based number, i.e. HH:MM:SS.000 will return 0.

See also: MillisecondOfTheYear ([491](#)), MillisecondOfTheMonth ([490](#)), MillisecondOfTheWeek ([490](#)), MillisecondOfTheDay ([489](#)), MillisecondOfTheHour ([489](#)), MillisecondOfTheMinute ([489](#)), SecondOfTheMinute ([510](#))

Listing: ./datutex/ex46.pp

Program Example46;

{ This program demonstrates the MillisecondOfTheSecond function }

Uses SysUtils, DateUtils;

Var

N : TDateTime;

Begin

N:=Now;

WriteLn('Millisecond of the Second : ',
MillisecondOfTheSecond(N));

End.

9.4.80 MillisecondOfTheWeek

Synopsis: Calculate the number of milliseconds elapsed since the start of the week

Declaration: function MillisecondOfTheWeek(const AValue: TDateTime) : LongWord

Visibility: default

Description: MillisecondOfTheWeek returns the number of milliseconds that have passed since the start of the Week (00:00:00.000) till the moment indicated by AValue. This is a zero-based number, i.e. 00:00:00.000 on the first of the Week will return 0.

For an example, see the DayOfTheWeek (458) function.

See also: MillisecondOfTheYear (491), MillisecondOfTheMonth (490), MillisecondOfTheDay (489), MillisecondOfTheHour (489), MillisecondOfTheMinute (489), MillisecondOfTheSecond (490), DayOfTheWeek (458), HourOfTheWeek (473), MinuteOfTheWeek (494), SecondOfTheWeek (511)

9.4.81 MillisecondOfTheYear

Synopsis: Calculate the number of milliseconds elapsed since the start of the year.

Declaration: function MillisecondOfTheYear(const AValue: TDateTime) : Int64

Visibility: default

Description: MillisecondOfTheYear returns the number of milliseconds that have passed since the start of the year (January 1, 00:00:00.000) till the moment indicated by AValue. This is a zero-based number, i.e. January 1 00:00:00.000 will return 0.

For an example, see the WeekOfTheYear (526) function.

See also: WeekOfTheYear (526), DayOfTheYear (458), HourOfTheYear (474), MinuteOfTheYear (494), SecondOfTheYear (512), MillisecondOfTheYear (491)

9.4.82 MillisecondsBetween

Synopsis: Calculate the number of whole milliseconds between two DateTime values.

Declaration: function MillisecondsBetween(const ANow: TDateTime;
const ATThen: TDateTime) : Int64

Visibility: default

Description: MillisecondsBetween returns the number of whole milliseconds between ANow and ATThen. This means a fractional part of a millisecond is dropped.

See also: YearsBetween (538), MonthsBetween (497), WeeksBetween (527), DaysBetween (459), HoursBetween (474), MinutesBetween (495), SecondsBetween (512)

Listing: ./datutex/ex62.pp

Program Example62;

```
{ This program demonstrates the MillisecondsBetween function }
```

Uses SysUtils, DateUtils;

Procedure Test(ANow, ATThen : TDateTime);

begin

```
  Write('Number of milliseconds between ');
  Write(TimeToStr(ATThen), ' and ', TimeToStr(ANow));
  WriteLn(' : ', MillisecondsBetween(ANow, ATThen));
end;
```

Var

```

D1,D2 : TDateTime;

Begin
  D1:=Now;
  D2:=D1-(0.9*OneMillisecond);
  Test(D1,D2);
  D2:=D1-(1.0*OneMillisecond);
  Test(D1,D2);
  D2:=D1-(1.1*OneMillisecond);
  Test(D1,D2);
  D2:=D1-(2.5*OneMillisecond);
  Test(D1,D2);
End.

```

9.4.83 MillisecondSpan

Synopsis: Calculate the approximate number of milliseconds between two DateTime values.

Declaration: function MillisecondSpan(const ANow: TDateTime; const AThen: TDateTime) : Double

Visibility: default

Description: MillisecondSpan returns the number of milliseconds between ANow and AThen. Since millisecond is the smallest fraction of a TDateTime indication, the returned number will always be an integer value.

See also: YearSpan (539), MonthSpan (498), WeekSpan (529), DaySpan (462), HourSpan (475), MinuteSpan (496), SecondSpan (513), MillisecondsBetween (491)

Listing: ./datutex/ex70.pp

Program Example70;

{ This program demonstrates the MillisecondSpan function }

Uses SysUtils, DateUtils;

Procedure Test(ANow,AThen : TDateTime);

begin

```

  Write('Number of milliseconds between ');
  Write(TimeToStr(AThen), ' and ', TimeToStr(ANow));
  WriteLn(' : ', MillisecondSpan(ANow,AThen));
end;

```

Var

D1,D2 : TDateTime;

Begin

```

  D1:=Now;
  D2:=D1-(0.9*OneMillisecond);
  Test(D1,D2);
  D2:=D1-(1.0*OneMillisecond);
  Test(D1,D2);
  D2:=D1-(1.1*OneMillisecond);
  Test(D1,D2);

```

```
D2:=D1-(2.5*OneMillisecond);
Test(D1,D2);
End.
```

9.4.84 MinuteOf

Synopsis: Extract the minute part from a DateTime value.

Declaration: function MinuteOf(const AValue: TDateTime) : Word

Visibility: default

Description: MinuteOf returns the minute of the hour part of the AValue date/time indication. It is a number between 0 and 59.

For an example, see YearOf ([537](#))

See also: YearOf ([537](#)), WeekOf ([525](#)), MonthOf ([497](#)), DayOf ([457](#)), HourOf ([472](#)), SecondOf ([510](#)), MillisecondOf ([488](#))

9.4.85 MinuteOfTheDay

Synopsis: Calculate the number of minutes elapsed since the start of the day

Declaration: function MinuteOfTheDay(const AValue: TDateTime) : Word

Visibility: default

Description: MinuteOfTheDay returns the number of minutes that have passed since the start of the Day (00:00:00) till the moment indicated by AValue. This is a zero-based number, i.e. 00:00:59 will return 0.

For an example, see the HourOfTheDay ([473](#)) function.

See also: MinuteOfTheYear ([494](#)), MinuteOfTheMonth ([494](#)), MinuteOfTheWeek ([494](#)), MinuteOfTheHour ([493](#)), HourOfTheDay ([473](#)), SecondOfTheDay ([510](#)), MillisecondOfTheDay ([489](#))

9.4.86 MinuteOfTheHour

Synopsis: Calculate the number of minutes elapsed since the start of the hour

Declaration: function MinuteOfTheHour(const AValue: TDateTime) : Word

Visibility: default

Description: MinuteOfTheHour returns the number of minutes that have passed since the start of the Hour (HH:00:00) till the moment indicated by AValue. This is a zero-based number, i.e. HH:00:59 will return 0.

See also: MinuteOfTheYear ([494](#)), MinuteOfTheMonth ([494](#)), MinuteOfTheWeek ([494](#)), MinuteOfTheDay ([493](#)), SecondOfTheHour ([510](#)), MillisecondOfTheHour ([489](#))

Listing: ./datutex/ex44.pp

```

Program Example44;

{ This program demonstrates the MinuteOfTheHour function }

Uses SysUtils, DateUtils;

Var
  N : TDateTime;

Begin
  N:=Now;
  WriteLn( 'Minute of the Hour      : ', MinuteOfTheHour(N));
  WriteLn( 'Second of the Hour     : ', SecondOfTheHour(N));
  WriteLn( 'Millisecond of the Hour : ',
            MillisecondOfTheHour(N));
End.

```

9.4.87 MinuteOfTheMonth

Synopsis: Calculate number of minutes elapsed since the start of the month.

Declaration: `function MinuteOfTheMonth(const AValue: TDateTime) : Word`

Visibility: default

Description: `MinuteOfTheMonth` returns the number of minutes that have passed since the start of the Month (00:00:00) till the moment indicated by `AValue`. This is a zero-based number, i.e. 00:00:59 on the first day of the month will return 0.

For an example, see the `WeekOfTheMonth` ([525](#)) function.

See also: `WeekOfTheMonth` ([525](#)), `DayOfTheMonth` ([457](#)), `HourOfTheMonth` ([473](#)), `MinuteOfTheMonth` ([494](#)), `SecondOfTheMonth` ([511](#)), `MillisecondOfTheMonth` ([490](#))

9.4.88 MinuteOfTheWeek

Synopsis: Calculate the number of minutes elapsed since the start of the week

Declaration: `function MinuteOfTheWeek(const AValue: TDateTime) : Word`

Visibility: default

Description: `MinuteOfTheWeek` returns the number of minutes that have passed since the start of the week (00:00:00) till the moment indicated by `AValue`. This is a zero-based number, i.e. 00:00:59 on the first day of the week will return 0.

For an example, see the `DayOfTheWeek` ([458](#)) function.

See also: `MinuteOfTheYear` ([494](#)), `MinuteOfTheMonth` ([494](#)), `MinuteOfTheDay` ([493](#)), `MinuteOfTheHour` ([493](#)), `DayOfTheWeek` ([458](#)), `HourOfTheWeek` ([473](#)), `SecondOfTheWeek` ([511](#)), `MillisecondOfTheWeek` ([490](#))

9.4.89 MinuteOfTheYear

Synopsis: Calculate the number of minutes elapsed since the start of the year

Declaration: `function MinuteOfTheYear(const AValue: TDateTime) : LongWord`

Visibility: default

Description: MinuteOfTheYear returns the number of minutes that have passed since the start of the year (January 1, 00:00:00) till the moment indicated by AValue. This is a zero-based number, i.e. January 1 00:00:59 will return 0.

For an example, see the WeekOfTheYear (526) function.

See also: WeekOfTheYear (526), DayOfTheYear (458), HourOfTheYear (474), MinuteOfTheYear (494), SecondOfTheYear (512), MilliSecondOfTheYear (491)

9.4.90 MinutesBetween

Synopsis: Calculate the number of whole minutes between two DateTime values.

Declaration: function MinutesBetween(const ANow: TDateTime; const ATen: TDateTime) : Int64

Visibility: default

Description: MinutesBetween returns the number of whole minutes between ANow and ATen. This means the fractional part of a minute (seconds, milliseconds etc.) is dropped.

See also: YearsBetween (538), MonthsBetween (497), WeeksBetween (527), DaysBetween (459), HoursBetween (474), SecondsBetween (512), MilliSecondsBetween (491)

Listing: ./datutex/ex60.pp

Program Example60;

{ This program demonstrates the MinutesBetween function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, ATen : TDateTime);

begin

```
  Write('Number of minutes between ');
  Write(TimeToStr(ATen), ' and ', TimeToStr(ANow));
  WriteLn(' : ', MinutesBetween(ANow, ATen));
end;
```

Var

D1, D2 : TDateTime;

Begin

```
  D1:=Now;
  D2:=D1-(59*OneSecond);
  Test(D1, D2);
  D2:=D1-(61*OneSecond);
  Test(D1, D2);
  D2:=D1-(122*OneSecond);
  Test(D1, D2);
  D2:=D1-(306*OneSecond);
  Test(D1, D2);
  D2:=D1-(5.4*OneMinute);
  Test(D1, D2);
  D2:=D1-(2.5*OneMinute);
  Test(D1, D2);
End.
```

9.4.91 MinuteSpan

Synopsis: Calculate the approximate number of minutes between two DateTime values.

Declaration: function MinuteSpan(const ANow: TDateTime; const ATThen: TDateTime) : Double

Visibility: default

Description: MinuteSpan returns the number of minutes between ANow and ATThen, including any fractional parts of a minute.

See also: YearSpan (539), MonthSpan (498), WeekSpan (529), DaySpan (462), HourSpan (475), SecondSpan (513), MilliSecondSpan (492), MinutesBetween (495)

Listing: ./datutex/ex68.pp

Program Example68;

{ This program demonstrates the MinuteSpan function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, ATThen : TDateTime);

begin

 Write('Number of minutes between ');
 Write(TimeToStr(ATThen), ' and ', TimeToStr(ANow));
 WriteLn(' : ', MinuteSpan(ANow, ATThen));

end;

Var

 D1,D2 : TDateTime;

Begin

 D1:=Now;
 D2:=D1-(59*OneSecond);
 Test(D1,D2);
 D2:=D1-(61*OneSecond);
 Test(D1,D2);
 D2:=D1-(122*OneSecond);
 Test(D1,D2);
 D2:=D1-(306*OneSecond);
 Test(D1,D2);
 D2:=D1-(5.4*OneMinute);
 Test(D1,D2);
 D2:=D1-(2.5*OneMinute);
 Test(D1,D2);

End.

9.4.92 ModifiedJulianDateToDateTime

Synopsis: Convert a modified Julian date representation to a TDateTime value.

Declaration: function ModifiedJulianDateToDateTime(const AValue: Double) : TDateTime

Visibility: default

Description: Not yet implemented.

Errors: Currently, trying to use this function will raise an exception.

See also: [DateTimeToJulianDate \(456\)](#), [JulianDateToDateTime \(487\)](#), [TryJulianDateToDateTime \(523\)](#), [DateTimeToModifiedJulianDate \(457\)](#), [TryModifiedJulianDateToDateTime \(523\)](#)

9.4.93 MonthOf

Synopsis: Extract the month from a given date.

Declaration: `function MonthOf(const AValue: TDateTime) : Word`

Visibility: default

Description: `MonthOf` returns the month part of the `AValue` date/time indication. It is a number between 1 and 12.

For an example, see [YearOf \(537\)](#)

See also: [YearOf \(537\)](#), [DayOf \(457\)](#), [WeekOf \(525\)](#), [HourOf \(472\)](#), [MinuteOf \(493\)](#), [SecondOf \(510\)](#), [MillisecondOf \(488\)](#)

9.4.94 MonthOfTheYear

Synopsis: Extract the month of a `DateTime` indication.

Declaration: `function MonthOfTheYear(const AValue: TDateTime) : Word`

Visibility: default

Description: `MonthOfTheYear` extracts the month part of `Avalue` and returns it. It is an alias for `MonthOf (497)`, and is provided for completeness only, corresponding to the other `PartOfTheYear` functions.

For an example, see the [WeekOfTheYear \(526\)](#) function.

See also: [MonthOf \(497\)](#), [WeekOfTheYear \(526\)](#), [DayOfTheYear \(458\)](#), [HourOfTheYear \(474\)](#), [MinuteOfTheYear \(494\)](#), [SecondOfTheYear \(512\)](#), [MillisecondOfTheYear \(491\)](#)

9.4.95 MonthsBetween

Synopsis: Calculate the number of whole months between two `DateTime` values

Declaration: `function MonthsBetween(const ANow: TDateTime; const ATThen: TDateTime) : Integer`

Visibility: default

Description: `MonthsBetween` returns the number of whole months between `ANow` and `AThen`. This number is an approximation, based on an average number of days of 30.4375 per month (average over 4 years). This means the fractional part of a month is dropped.

See also: [YearsBetween \(538\)](#), [WeeksBetween \(527\)](#), [DaysBetween \(459\)](#), [HoursBetween \(474\)](#), [MinutesBetween \(495\)](#), [SecondsBetween \(512\)](#), [MilliSecondsBetween \(491\)](#)

Listing: `./datutex/ex56.pp`

```

Program Example56;

{ This program demonstrates the MonthsBetween function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, AThen : TDateTime);

begin
  Write('Number of months between ');
  Write(DateToStr(AThen), ' and ', DateToStr(ANow));
  WriteLn(' : ', MonthsBetween(ANow, AThen));
end;

Var
  D1,D2 : TDateTime;

Begin
  D1:=Today;
  D2:=Today-364;
  Test(D1,D2);
  D2:=Today-365;
  Test(D1,D2);
  D2:=Today-366;
  Test(D1,D2);
  D2:=Today-390;
  Test(D1,D2);
  D2:=Today-368;
  Test(D1,D2);
  D2:=Today-1000;
  Test(D1,D2);
End.

```

9.4.96 MonthSpan

Synopsis: Calculate the approximate number of months between two DateTime values.

Declaration: function MonthSpan(const ANow: TDateTime; const ATThen: TDateTime)
 : Double

Visibility: default

Description: MonthSpan returns the number of month between ANow and ATThen, including any fractional parts of a month. This number is an approximation, based on an average number of days of 30.4375 per month (average over 4 years).

See also: YearSpan (539), WeekSpan (529), DaySpan (462), HourSpan (475), MinuteSpan (496), SecondSpan (513), MillisecondSpan (492), MonthsBetween (497)

Listing: ./datutex/ex64.pp

Program Example64;

{ This program demonstrates the MonthSpan function }

Uses SysUtils, DateUtils;

```

Procedure Test(ANow,AThen : TDateTime);

begin
  Write('Number of months between ');
  Write(DateToStr(AThen), ' and ', DateToStr(ANow));
  Writeln(' : ', MonthSpan(ANow,AThen));
end;

Var
  D1,D2 : TDateTime;

Begin
  D1:=Today;
  D2:=Today-364;
  Test(D1,D2);
  D2:=Today-365;
  Test(D1,D2);
  D2:=Today-366;
  Test(D1,D2);
  D2:=Today-390;
  Test(D1,D2);
  D2:=Today-368;
  Test(D1,D2);
  D2:=Today-1000;
  Test(D1,D2);
End.

```

9.4.97 NthDayOfWeek

Synopsis: Calculate which occurrence of weekday in the month a given day represents

Declaration: function NthDayOfWeek(const AValue: TDateTime) : Word

Visibility: default

Description: NthDayOfWeek returns the occurrence of the weekday of AValue in the month. This is the N-th time that this weekday occurs in the month (e.g. the third saturday of the month).

See also: EncodeDateMonthWeek ([466](#)), #rtl.sysutils.DayOfWeek ([1503](#)), DecodeDayOfWeekInMonth ([465](#)), EncodeDayOfWeekInMonth ([467](#)), TryEncodeDayOfWeekInMonth ([522](#))

Listing: ./datutex/ex104.pp

Program Example104;

{ This program demonstrates the NthDayOfWeek function }

Uses SysUtils, DateUtils;

Begin

 Write('Today is the ',NthDayOfWeek(Today), '-th ');
 Writeln(formatDateTime('ddd', Today), ' of the month.');

End.

9.4.98 PreviousDayOfWeek

Synopsis: Given a day of the week, return the previous day of the week.

Declaration: function PreviousDayOfWeek (DayOfWeek: Word) : Word

Visibility: default

Description: PreviousDayOfWeek returns the previous day of the week. If the current day is the first day of the week (1) then the last day will be returned (7).

Remark: Note that the days of the week are in ISO notation, i.e. 1-based.

See also: Yesterday ([540](#))

Listing: ./datutex/ex22.pp

```
Program Example22;
{ This program demonstrates the PreviousDayOfWeek function }
Uses SysUtils, DateUtils;

Var
  D : Word;

Begin
  For D:=1 to 7 do
    WriteLn('Previous day of ',D,' is : ',PreviousDayOfWeek(D));
End.
```

9.4.99 RecodeDate

Synopsis: Replace date part of a TDateTime value with another date.

Declaration: function RecodeDate(const AValue: TDateTime; const AYear: Word;
const AMonth: Word; const ADay: Word) : TDateTime

Visibility: default

Description: RecodeDate replaces the date part of the timestamp AValue with the date specified in AYear, AMonth, ADay. All other parts (the time part) of the date/time stamp are left untouched.

Errors: If one of the AYear, AMonth, ADay values is not within a valid range then an EConvertError exception is raised.

See also: RecodeYear ([506](#)), RecodeMonth ([504](#)), RecodeDay ([502](#)), RecodeHour ([502](#)), RecodeMinute ([503](#)), RecodeSecond ([505](#)), RecodeDate ([500](#)), RecodeTime ([505](#)), RecodeDateTime ([501](#))

Listing: ./datutex/ex94.pp

```
Program Example94;
{ This program demonstrates the RecodeDate function }
Uses SysUtils, DateUtils;

Const
  Fmt = 'dddd dd mmmm yyyy hh:nn:ss';
```

```

Var
  S : AnsiString;

Begin
  S:=FormatDateTime(Fmt, RecodeDate(Now,2001,1,1));
  WriteIn('This moment on the first of the millenium : ',S);
End.

```

9.4.100 RecodeDateTime

Synopsis: Replace selected parts of a TDateTime value with other values

Declaration: function RecodeDateTime(const AValue: TDateTime; const AYear: Word;
 const AMonth: Word; const ADay: Word;
 const AHour: Word; const AMinute: Word;
 const ASecond: Word; const AMilliSecond: Word)
 : TDateTime

Visibility: default

Description: RecodeDateTime replaces selected parts of the timestamp AValue with the date/time values specified in AYear, AMonth, ADay, AHour, AMinute, ASecond and AMilliSecond. If any of these values equals the pre-defined constant RecodeLeaveFieldAsIs (452), then the corresponding part of the date/time stamp is left untouched.

Errors: If one of the values AYear, AMonth, ADay, AHour, AMinute, ASecondAMilliSecond is not within a valid range (RecodeLeaveFieldAsIs excepted) then an EConvertError exception is raised.

See also: RecodeYear (506), RecodeMonth (504), RecodeDay (502), RecodeHour (502), RecodeMinute (503), RecodeSecond (505), RecodeMilliSecond (503), RecodeDate (500), RecodeTime (505), TryRecodeDateTime (524)

Listing: ./datutex/ex96.pp

```

Program Example96;

{ This program demonstrates the RecodeDateTime function }

Uses SysUtils, DateUtils;

Const
  Fmt = 'dddd dd mmmm yyyy hh:nn:ss';

Var
  S : AnsiString;
  D : TDateTime;

Begin
  D:=Now;
  D:=RecodeDateTime(D,2000,2,RecodeLeaveFieldAsIs,0,0,0,0);
  S:=FormatDateTime(Fmt,D);
  WriteIn('This moment in februari 2000 : ',S);
End.

```

9.4.101 RecodeDay

Synopsis: Replace day part of a TDateTime value with another day.

Declaration: function RecodeDay(const AValue: TDateTime; const ADay: Word) : TDateTime

Visibility: default

Description: RecodeDay replaces the Day part of the timestamp AValue with ADay. All other parts of the date/time stamp are left untouched.

Errors: If the ADay value is not within a valid range (1 till the number of days in the month) then an EConvertError exception is raised.

See also: RecodeYear ([506](#)), RecodeMonth ([504](#)), RecodeHour ([502](#)), RecodeMinute ([503](#)), RecodeSecond ([505](#)), RecodeMillisecond ([503](#)), RecodeDate ([500](#)), RecodeTime ([505](#)), RecodeDateTime ([501](#))

Listing: ./datutex/ex89.pp

Program Example89;

```
{ This program demonstrates the RecodeDay function }
```

```
Uses SysUtils, DateUtils;
```

```
Const
```

```
Fmt = 'dddd dd mmmm yyyy hh:nn:ss';
```

```
Var
```

```
S : AnsiString;
```

```
Begin
```

```
S:=FormatDateTime(Fmt, RecodeDay(Now, 1));
  WriteLn('This moment on the first of the month : ', S);
```

```
End.
```

9.4.102 RecodeHour

Synopsis: Replace hours part of a TDateTime value with another hour.

Declaration: function RecodeHour(const AValue: TDateTime; const AHour: Word)
 : TDateTime

Visibility: default

Description: RecodeHour replaces the Hour part of the timestamp AValue with AHour. All other parts of the date/time stamp are left untouched.

Errors: If the AHour value is not within a valid range (0..23) then an EConvertError exception is raised.

See also: RecodeYear ([506](#)), RecodeMonth ([504](#)), RecodeDay ([502](#)), RecodeMinute ([503](#)), RecodeSecond ([505](#)), RecodeMillisecond ([503](#)), RecodeDate ([500](#)), RecodeTime ([505](#)), RecodeDateTime ([501](#))

Listing: ./datutex/ex90.pp

Program Example90;

```
{ This program demonstrates the RecodeHour function }
```

```

Uses SysUtils, DateUtils;

Const
  Fmt = 'dddd dd mmmm yyyy hh:nn:ss';

Var
  S : AnsiString;

Begin
  S:=FormatDateTime(Fmt, RecodeHour(Now,0));
  Writeln('Today, in the first hour : ',S);
End.

```

9.4.103 RecodeMillisecond

Synopsis: Replace milliseconds part of a TDateTime value with another millisecond.

Declaration: function RecodeMillisecond(const AValue: TDateTime;
const AMilliSecond: Word) : TDateTime

Visibility: default

Description: RecodeMillisecond replaces the millisecond part of the timestamp AValue with AMilliSecond.
All other parts of the date/time stamp are left untouched.

Errors: If the AMilliSecond value is not within a valid range (0..999) then an EConvertError exception is raised.

See also: RecodeYear ([506](#)), RecodeMonth ([504](#)), RecodeDay ([502](#)), RecodeHour ([502](#)), RecodeMinute ([503](#)),
RecodeSecond ([505](#)), RecodeDate ([500](#)), RecodeTime ([505](#)), RecodeDateTime ([501](#))

Listing: ./datutex/ex93.pp

```

Program Example93;

{ This program demonstrates the RecodeMillisecond function }

Uses SysUtils, DateUtils;

Const
  Fmt = 'dddd dd mmmm yyyy hh:nn:ss.zzz';

Var
  S : AnsiString;

Begin
  S:=FormatDateTime(Fmt, RecodeMillisecond(Now,0));
  Writeln('This moment, milliseconds stripped : ',S);
End.

```

9.4.104 RecodeMinute

Synopsis: Replace minutse part of a TDateTime value with another minute.

Declaration: function RecodeMinute(const AValue: TDateTime; const AMinute: Word)
: TDateTime

Visibility: default

Description: RecodeMinute replaces the Minute part of the timestamp AValue with AMinute. All other parts of the date/time stamp are left untouched.

Errors: If the AMinute value is not within a valid range (0..59) then an EConvertError exception is raised.

See also: RecodeYear ([506](#)), RecodeMonth ([504](#)), RecodeDay ([502](#)), RecodeHour ([502](#)), RecodeSecond ([505](#)), RecodeMillisecond ([503](#)), RecodeDate ([500](#)), RecodeTime ([505](#)), RecodeDateTime ([501](#))

Listing: ./datutex/ex91.pp

Program Example91;

```
{ This program demonstrates the RecodeMinute function }
```

Uses SysUtils, DateUtils;

Const

```
Fmt = 'dddd dd mmmm yyyy hh:nn:ss';
```

Var

```
S : AnsiString;
```

Begin

```
S:=FormatDateTime(Fmt, RecodeMinute(Now, 0));
```

```
WriteLn('This moment in the first minute of the hour: ', S);
```

End.

9.4.105 RecodeMonth

Synopsis: Replace month part of a TDateTime value with another month.

Declaration: function RecodeMonth(const AValue: TDateTime; const AMonth: Word)
 : TDateTime

Visibility: default

Description: RecodeMonth replaces the Month part of the timestamp AValue with AMonth. All other parts of the date/time stamp are left untouched.

Errors: If the AMonth value is not within a valid range (1..12) then an EConvertError exception is raised.

See also: RecodeYear ([506](#)), RecodeDay ([502](#)), RecodeHour ([502](#)), RecodeMinute ([503](#)), RecodeSecond ([505](#)), RecodeMillisecond ([503](#)), RecodeDate ([500](#)), RecodeTime ([505](#)), RecodeDateTime ([501](#))

Listing: ./datutex/ex88.pp

Program Example88;

```
{ This program demonstrates the RecodeMonth function }
```

Uses SysUtils, DateUtils;

Const

```
Fmt = 'dddd dd mmmm yyyy hh:nn:ss';
```

```

Var
  S : AnsiString;

Begin
  S:=FormatDateTime(Fmt, RecodeMonth(Now, 5));
  WriteLn('This moment in May : ',S);
End.

```

9.4.106 RecodeSecond

Synopsis: Replace seconds part of a TDateTime value with another second.

Declaration: function RecodeSecond(const AValue: TDateTime; const ASecond: Word) : TDateTime

Visibility: default

Description: RecodeSecond replaces the Second part of the timestamp AValue with ASecond. All other parts of the date/time stamp are left untouched.

Errors: If the ASecond value is not within a valid range (0..59) then an EConvertError exception is raised.

See also: RecodeYear (506), RecodeMonth (504), RecodeDay (502), RecodeHour (502), RecodeMinute (503), RecodeMilliSecond (503), RecodeDate (500), RecodeTime (505), RecodeDateTime (501)

Listing: ./datutex/ex92.pp

```

Program Example92;

{ This program demonstrates the RecodeSecond function }

Uses SysUtils, DateUtils;

Const
  Fmt = 'dddd dd mmmm yyyy hh:nn:ss';

Var
  S : AnsiString;

Begin
  S:=FormatDateTime(Fmt, RecodeSecond(Now, 0));
  WriteLn('This moment, seconds stripped : ',S);
End.

```

9.4.107 RecodeTime

Synopsis: Replace time part of a TDateTime value with another time.

Declaration: function RecodeTime(const AValue: TDateTime; const AHour: Word; const AMinute: Word; const ASecond: Word; const AMilliSecond: Word) : TDateTime

Visibility: default

Description: RecodeTime replaces the time part of the timestamp AValue with the date specified in AHour, AMinute, ASecond and AMilliSecond. All other parts (the date part) of the date/time stamp are left untouched.

Errors: If one of the values AHour, AMinute, ASecondAMilliSecond is not within a valid range then an EConvertError exception is raised.

See also: RecodeYear ([506](#)), RecodeMonth ([504](#)), RecodeDay ([502](#)), RecodeHour ([502](#)), RecodeMinute ([503](#)), RecodeSecond ([505](#)), RecodeMilliSecond ([503](#)), RecodeDate ([500](#)), RecodeDateTime ([501](#))

Listing: ./datutex/ex95.pp

```
Program Example95;

{ This program demonstrates the RecodeTime function }

Uses SysUtils, DateUtils;

Const
  Fmt = 'dddd dd mmmm yyyy hh:nn:ss';

Var
  S : AnsiString;

Begin
  S:=FormatDateTime(Fmt, RecodeTime(Now, 8, 0, 0, 0));
  WriteLn('Today, 8 AM : ', S);
End.
```

9.4.108 RecodeYear

Synopsis: Replace year part of a TDateTime value with another year.

Declaration: function RecodeYear(const AValue: TDateTime; const AYear: Word)
 : TDateTime

Visibility: default

Description: RecodeYear replaces the year part of the timestamp AValue with AYear. All other parts of the date/time stamp are left untouched.

Errors: If the AYear value is not within a valid range (1..9999) then an EConvertError exception is raised.

See also: RecodeMonth ([504](#)), RecodeDay ([502](#)), RecodeHour ([502](#)), RecodeMinute ([503](#)), RecodeSecond ([505](#)), RecodeMilliSecond ([503](#)), RecodeDate ([500](#)), RecodeTime ([505](#)), RecodeDateTime ([501](#))

Listing: ./datutex/ex87.pp

```
Program Example87;

{ This program demonstrates the RecodeYear function }

Uses SysUtils, DateUtils;

Const
  Fmt = 'dddd dd mmmm yyyy hh:nn:ss';
```

```

Var
  S : AnsiString;

Begin
  S:=FormatDateTime(Fmt, RecodeYear(Now, 1999));
  WriteLn('This moment in 1999 : ',S);
End.

```

9.4.109 SameDate

Synopsis: Check whether two TDateTime values have the same date part.

Declaration: function SameDate(const A: TDateTime; const B: TDateTime) : Boolean

Visibility: default

Description: SameDate compares the date parts of two timestamps A and B and returns True if they are equal, False if they are not.

The function simply checks whether CompareDate (452) returns zero.

See also: CompareDateTime (453), CompareDate (452), CompareTime (454), SameDateTime (508), SameTime (508)

Listing: ./datutex/ex102.pp

```

Program Example102;

{ This program demonstrates the SameDate function }

Uses SysUtils, DateUtils;

Const
  Fmt = 'dddd dd mmmm yyyy hh:nn:ss.zzz';

Procedure Test(D1,D2 : TDateTime);

begin
  Write(FormatDateTime(Fmt,D1), ' is the same date as ');
  WriteLn(FormatDateTime(Fmt,D2), ' : ',SameDate(D1,D2));
end;

Var
  D,N : TDateTime;

Begin
  D:=Today;
  N:=Now;
  Test(D,D);
  Test(N,N);
  Test(N+1,N);
  Test(N-1,N);
  Test(N+OneSecond,N);
  Test(N-OneSecond,N);
End.

```

9.4.110 SameDateTime

Synopsis: Check whether two TDateTime values have the same date and time parts.

Declaration: function SameDateTime(const A: TDateTime; const B: TDateTime) : Boolean

Visibility: default

Description: SameDateTime compares the date/time parts of two timestamps A and B and returns True if they are equal, False if they are not.

The function simply checks whether CompareDateTime ([453](#)) returns zero.

See also: CompareDateTime ([453](#)), CompareDate ([452](#)), CompareTime ([454](#)), SameDate ([507](#)), SameTime ([508](#))

Listing: ./datutex/ex101.pp

```
Program Example101;

{ This program demonstrates the SameDateTime function }

Uses SysUtils, DateUtils;

Const
  Fmt = 'dddd dd mmmm yyyy hh:nn:ss.zzz';

Procedure Test(D1,D2 : TDateTime);

begin
  Write(FormatDateTime(Fmt,D1), ' is the same datetime as ');
  WriteLn(FormatDateTime(Fmt,D2), ': ',SameDateTime(D1,D2));
end;

Var
  D,N : TDateTime;

Begin
  D:=Today;
  N:=Now;
  Test(D,D);
  Test(N,N);
  Test(N+1,N);
  Test(N-1,N);
  Test(N+OneSecond,N);
  Test(N-OneSecond,N);
End.
```

9.4.111 SameTime

Synopsis: Check whether two TDateTime values have the same time part.

Declaration: function SameTime(const A: TDateTime; const B: TDateTime) : Boolean

Visibility: default

Description: SameTime compares the time parts of two timestamps A and B and returns True if they are equal, False if they are not.

The function simply checks whether CompareTime ([454](#)) returns zero.

See also: CompareDateTime (453), CompareDate (452), CompareTime (454), SameDateTime (508), SameDate (507)

Listing: ./datutex/ex103.pp

```

Program Example102;

{ This program demonstrates the SameTime function }

Uses SysUtils, DateUtils;

Const
  Fmt = 'dddd dd mmmm yyyy hh:nn:ss.zzz';

Procedure Test(D1,D2 : TDateTime);

begin
  Write(FormatDateTime(Fmt,D1), ' is the same time as ');
  Writeln(FormatDateTime(Fmt,D2), ': ',SameTime(D1,D2));
end;

Var
  D,N : TDateTime;

Begin
  D:=Today;
  N:=Now;
  Test(D,D);
  Test(N,N);
  Test(N+1,N);
  Test(N-1,N);
  Test(N+OneSecond,N);
  Test(N-OneSecond,N);
End.

```

9.4.112 ScanDateTime

Synopsis: Scans a string for a DateTime pattern and returns the date/time

Declaration: function ScanDateTime(const Pattern: string; const s: string;
 const fmt: TFormatSettings; startpos: Integer)
 : TDateTime; Overload
 function ScanDateTime(const Pattern: string; const s: string;
 startpos: Integer) : TDateTime; Overload

Visibility: default

Description: ScanDateTime scans string S for the date/time pattern Pattern, starting at position StartPos (default 1). Optionally, the format settings fmt can be specified.

In effect, this function does the opposite of what FormatDateTime (1543) does. The Pattern variable must contain a valid date/time pattern: note that not all possible formatdatetime patterns can be recognized, e.g., hn cannot be detected properly.

Errors: In case of an error, a EConvertError (1605) exception is raised.

See also: FormatDateTime (1543)

9.4.113 SecondOf

Synopsis: Extract the second part from a DateTime value.

Declaration: function SecondOf(const AValue: TDateTime) : Word

Visibility: default

Description: SecondOf returns the second of the minute part of the AValue date/time indication. It is a number between 0 and 59.

For an example, see YearOf ([537](#))

See also: YearOf ([537](#)), WeekOf ([525](#)), MonthOf ([497](#)), DayOf ([457](#)), HourOf ([472](#)), MinuteOf ([493](#)), MillisecondOf ([488](#))

9.4.114 SecondOfDay

Synopsis: Calculate the number of seconds elapsed since the start of the day

Declaration: function SecondOfDay(const AValue: TDateTime) : LongWord

Visibility: default

Description: SecondOfDay returns the number of seconds that have passed since the start of the Day (00:00:00) till the moment indicated by AValue. This is a zero-based number, i.e. 00:00:00.999 return 0.

For an example, see the HourOfDay ([473](#)) function.

See also: SecondOfTheYear ([512](#)), SecondOfTheMonth ([511](#)), SecondOfTheWeek ([511](#)), SecondOfTheHour ([510](#)), SecondOfTheMinute ([510](#)), HourOfDay ([473](#)), MinuteOfDay ([493](#)), MillisecondOfDay ([489](#))

9.4.115 SecondOfTheHour

Synopsis: Calculate the number of seconds elapsed since the start of the hour

Declaration: function SecondOfTheHour(const AValue: TDateTime) : Word

Visibility: default

Description: SecondOfTheHour returns the number of seconds that have passed since the start of the Hour (HH:00:00) till the moment indicated by AValue. This is a zero-based number, i.e. HH:00:00.999 return 0.

For an example, see the MinuteOfTheHour ([493](#)) function.

See also: SecondOfTheYear ([512](#)), SecondOfTheMonth ([511](#)), SecondOfTheWeek ([511](#)), SecondOfTheDay ([510](#)), SecondOfTheMinute ([510](#)), MinuteOfTheHour ([493](#)), MillisecondOfTheHour ([489](#))

9.4.116 SecondOfTheMinute

Synopsis: Calculate the number of seconds elapsed since the start of the minute

Declaration: function SecondOfTheMinute(const AValue: TDateTime) : Word

Visibility: default

Description: SecondOfTheMinute returns the number of seconds that have passed since the start of the minute (HH:MM:00) till the moment indicated by AValue. This is a zero-based number, i.e. HH:MM:00.999 return 0.

See also: SecondOfTheYear (512), SecondOfTheMonth (511), SecondOfTheWeek (511), SecondOfTheDay (510), SecondOfTheHour (510), MilliSecondOfTheMinute (489)

Listing: ./datutex/ex45.pp

Program Example45;

```
{ This program demonstrates the SecondOfTheMinute function }
```

Uses SysUtils, DateUtils;

Var

```
N : TDateTime;
```

Begin

```
N:=Now;
Writeln('Second of the Minute      : ',SecondOfTheMinute(N));
Writeln('Millisecond of the Minute : ',
      MilliSecondOfTheMinute(N));
```

End.

9.4.117 SecondOfTheMonth

Synopsis: Calculate number of seconds elapsed since the start of the month.

Declaration: function SecondOfTheMonth(const AValue: TDateTime) : LongWord

Visibility: default

Description: SecondOfTheMonth returns the number of seconds that have passed since the start of the month (00:00:00) till the moment indicated by AValue. This is a zero-based number, i.e. 00:00:00.999 on the first day of the month will return 0.

For an example, see the WeekOfTheMonth (525) function.

See also: WeekOfTheMonth (525), DayOfTheMonth (457), HourOfTheMonth (473), MinuteOfTheMonth (494), MilliSecondOfTheMonth (490)

9.4.118 SecondOfTheWeek

Synopsis: Calculate the number of seconds elapsed since the start of the week

Declaration: function SecondOfTheWeek(const AValue: TDateTime) : LongWord

Visibility: default

Description: SecondOfTheWeek returns the number of seconds that have passed since the start of the week (00:00:00) till the moment indicated by AValue. This is a zero-based number, i.e. 00:00:00.999 on the first day of the week will return 0.

For an example, see the DayOfTheWeek (458) function.

See also: SecondOfTheYear (512), SecondOfTheMonth (511), SecondOfTheDay (510), SecondOfTheHour (510), SecondOfTheMinute (510), DayOfTheWeek (458), HourOfTheWeek (473), MinuteOfTheWeek (494), MilliSecondOfTheWeek (490)

9.4.119 SecondOfTheYear

Synopsis: Calculate the number of seconds elapsed since the start of the year.

Declaration: function SecondOfTheYear(const AValue: TDateTime) : LongWord

Visibility: default

Description: SecondOfTheYear returns the number of seconds that have passed since the start of the year (January 1, 00:00:00) till the moment indicated by AValue. This is a zero-based number, i.e. January 1 00:00:00.999 will return 0.

For an example, see the WeekOfTheYear ([526](#)) function.

See also: WeekOfTheYear ([526](#)), DayOfTheYear ([458](#)), HourOfTheYear ([474](#)), MinuteOfTheYear ([494](#)), SecondOfTheYear ([512](#)), MilliSecondOfTheYear ([491](#))

9.4.120 SecondsBetween

Synopsis: Calculate the number of whole seconds between two DateTime values.

Declaration: function SecondsBetween(const ANow: TDateTime; const AThen: TDateTime) : Int64

Visibility: default

Description: SecondsBetween returns the number of whole seconds between ANow and AThen. This means the fractional part of a second (milliseconds etc.) is dropped.

See also: YearsBetween ([538](#)), MonthsBetween ([497](#)), WeeksBetween ([527](#)), DaysBetween ([459](#)), HoursBetween ([474](#)), MinutesBetween ([495](#)), MilliSecondsBetween ([491](#))

Listing: ./datutex/ex61.pp

Program Example61;

{ This program demonstrates the SecondsBetween function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, AThen : TDateTime);

begin

```
Write('Number of seconds between ');
Write(TimeToStr(AThen), ' and ', TimeToStr(ANow));
WriteLn(' : ', SecondsBetween(ANow, AThen));
end;
```

Var

D1,D2 : TDateTime;

Begin

```
D1:=Now;
D2:=D1-(999*OneMillisecond);
Test(D1,D2);
D2:=D1-(1001*OneMillisecond);
Test(D1,D2);
D2:=D1-(2001*OneMillisecond);
Test(D1,D2);
D2:=D1-(5001*OneMillisecond);
```

```

Test(D1,D2);
D2:=D1-(5.4*OneSecond);
Test(D1,D2);
D2:=D1-(2.5*OneSecond);
Test(D1,D2);
End.

```

9.4.121 SecondSpan

Synopsis: Calculate the approximate number of seconds between two DateTime values.

Declaration: function SecondSpan (const ANow: TDateTime; const ATThen: TDateTime)
 : Double

Visibility: default

Description: SecondSpan returns the number of seconds between ANow and ATThen, including any fractional parts of a second.

See also: YearSpan (539), MonthSpan (498), WeekSpan (529), DaySpan (462), HourSpan (475), MinuteSpan (496), MilliSecondSpan (492), SecondsBetween (512)

Listing: ./datutex/ex69.pp

Program Example69;

{ This program demonstrates the SecondSpan function }

Uses SysUtils, DateUtils;

Procedure Test(ANow,AThen : TDateTime);

begin

```

Write('Number of seconds between ');
Write(TimeToStr(AThen), ' and ', TimeToStr(ANow));
WriteLn(' : ', SecondSpan(ANow,AThen));
end;

```

Var

D1,D2 : TDateTime;

Begin

```

D1:=Now;
D2:=D1-(999*OneMillisecond);
Test(D1,D2);
D2:=D1-(1001*OneMillisecond);
Test(D1,D2);
D2:=D1-(2001*OneMillisecond);
Test(D1,D2);
D2:=D1-(5001*OneMillisecond);
Test(D1,D2);
D2:=D1-(5.4*OneSecond);
Test(D1,D2);
D2:=D1-(2.5*OneSecond);
Test(D1,D2);
End.

```

9.4.122 StartOfDay

Synopsis: Return the start of a day as a DateTime value, given a day indication

Declaration: function StartOfDay(const AYear: Word; const AMonth: Word;
const ADay: Word) : TDateTime; Overload
function StartOfDay(const AYear: Word; const ADAYofYear: Word)
: TDateTime; Overload

Visibility: default

Description: StartOfDay returns a TDateTime value with the date/time indication of the start (0:0:0.000) of the day given by AYear, AMonth, ADay.

The day may also be indicated with a AYear, ADAYofYear pair.

See also: StartOfDay (516), StartOfTheWeek (517), StartOfAWeek (515), StartOfAMonth (514), StartOfTheMonth (517), EndOfTheWeek (471), EndOfAWeek (469), EndOfTheYear (472), EndOfAYear (470), EndOfTheMonth (471), EndOfAMonth (468), EndOfTheDay (470), EndOfDay (468)

Listing: ./datutex/ex38.pp

Program Example38;

```
{ This program demonstrates the StartOfDay function }
```

Uses SysUtils, DateUtils;

Const

```
Fmt = '"Start of the day : "dd mmmm yyyy hh:nn:ss';
```

Var

```
Y,M,D : Word;
```

Begin

```
Y:=YearOf(Today);  
M:=MonthOf(Today);  
D:=DayOf(Today);  
WriteLn(FormatDateTime(Fmt, StartOfDay(Y,M,D)));  
DecodeDateDay(Today,Y,D);  
WriteLn(FormatDateTime(Fmt, StartOfDay(Y,D)));
```

End.

9.4.123 StartOfMonth

Synopsis: Return first date of month, given a year/month pair.

Declaration: function StartOfMonth(const AYear: Word; const AMonth: Word) : TDateTime

Visibility: default

Description: StartOfMonth returns a TDateTime value with the date of the first day of the month indicated by the AYear, AMonth pair.

See also: StartOfTheMonth (517), EndOfTheMonth (471), EndOfAMonth (468), EndOfTheYear (472), EndOfAYear (470), StartOfAWeek (515), StartOfTheWeek (517)

Listing: ./datutex/ex30.pp

```
Program Example30;

{ This program demonstrates the StartOfAMonth function }

Uses SysUtils, DateUtils;

Const
  Fmt = '"First day of this month : "dd mmmm yyyy';
Var
  Y,M : Word;

Begin
  Y:=YearOf(Today);
  M:=MonthOf(Today);
  WriteLn(FormatDateTime(Fmt, StartOfAMonth(Y,M)));
End.
```

9.4.124 StartOfAWeek

Synopsis: Return a day of the week, given a year, week and day in the week.

Declaration: `function StartOfAWeek(const AYear: Word; const AWeekOfYear: Word;
 const ADayOfWeek: Word) : TDateTime`
`function StartOfAWeek(const AYear: Word; const AWeekOfYear: Word)
 : TDateTime`

Visibility: default

Description: StartOfAWeek returns a TDateTime value with the date of the indicated day of the week indicated by the AYear, AWeek, ADayOfWeek values.

The default value for ADayOfWeek is 1.

See also: StartOfTheWeek (517), EndOfTheWeek (471), EndOfAWeek (469), StartOfAMonth (514), EndOfTheYear (472), EndOfAYear (470), EndOfTheMonth (471), EndOfAMonth (468)

Listing: ./datutex/ex34.pp

```
Program Example34;

{ This program demonstrates the StartOfAWeek function }

Uses SysUtils, DateUtils;

Const
  Fmt = '"First day of this week : "dd mmmm yyyy hh:nn:ss';
  Fmt2 = '"Second day of this week : "dd mmmm yyyy hh:nn:ss';

Var
  Y,W : Word;

Begin
  Y:=YearOf(Today);
  W:=WeekOf(Today);
  WriteLn(FormatDateTime(Fmt, StartOfAWeek(Y,W)));
  WriteLn(FormatDateTime(Fmt2, StartOfAWeek(Y,W,2)));
End.
```

9.4.125 StartOfDay

Synopsis: Return the first day of a given year.

Declaration: function StartOfDay(const AYear: Word) : TDateTime

Visibility: default

Description: StartOfDay returns a TDateTime value with the date of the first day of the year AYear (January 1).

See also: StartOfTheYear (518), EndOfTheYear (472), EndOfAYear (470), EndOfTheMonth (471), EndOfAMonth (468), StartOfAWeek (515), StartOfTheWeek (517)

Listing: ./datutex/ex26.pp

Program Example26;

{ This program demonstrates the StartOfDay function }

Uses SysUtils, DateUtils;

Const

Fmt = '"First day of this year : "dd mmmm yyyy';

Begin

 WriteLn(FormatDateTime(Fmt, StartOfDay(YearOf(Today))));

End.

9.4.126 StartOfDay

Synopsis: Calculate the start of the day as a DateTime value, given a moment in the day.

Declaration: function StartOfDay(const AValue: TDateTime) : TDateTime

Visibility: default

Description: StartOfDay extracts the date part of AValue and returns a TDateTime value with the date/time indication of the start (0:0:0.000) of this day.

See also: StartOfDay (514), StartOfTheWeek (517), StartOfAWeek (515), StartOfAMonth (514), StartOfTheMonth (517), EndOfTheWeek (471), EndOfAWeek (469), EndOfTheYear (472), EndOfAYear (470), EndOfTheMonth (471), EndOfAMonth (468), EndOfDay (470), EndOfDay (468)

Listing: ./datutex/ex36.pp

Program Example36;

{ This program demonstrates the StartOfDay function }

Uses SysUtils, DateUtils;

Const

Fmt = '"Start of the day : "dd mmmm yyyy hh:nn:ss';

Begin

 WriteLn(FormatDateTime(Fmt, StartOfDay(Today)));

End.

9.4.127 StartOfTheMonth

Synopsis: Calculate the first day of the month, given a date in that month.

Declaration: function StartOfTheMonth(const AValue: TDateTime) : TDateTime

Visibility: default

Description: StartOfTheMonth extracts the year and month parts of AValue and returns a TDateTime value with the date of the first day of that year and month as the StartOfAMonth (514) function.

See also: StartOfAMonth (514), EndOfTheYear (472), EndOfAYear (470), EndOfTheMonth (471), EndOfAMonth (468), StartOfAWeek (515), StartOfTheWeek (517)

Listing: ./datutex/ex28.pp

Program Example28;

{ This program demonstrates the StartOfTheMonth function }

Uses SysUtils, DateUtils;

Const

Fmt = '"First day of this month : "dd mmmm yyyy';

Begin

 WriteLn(FormatDateTime(Fmt, StartOfTheMonth(Today)));

End.

9.4.128 StartOfTheWeek

Synopsis: Return the first day of the week, given a date.

Declaration: function StartOfTheWeek(const AValue: TDateTime) : TDateTime

Visibility: default

Description: StartOfTheWeek extracts the year and week parts of AValue and returns a TDateTime value with the date of the first day of that week as the StartOfAWeek (515) function.

See also: StartOfAWeek (515), EndOfTheWeek (471), EndOfAWeek (469), StartOfAMonth (514), EndOfTheYear (472), EndOfAYear (470), EndOfTheMonth (471), EndOfAMonth (468)

Listing: ./datutex/ex32.pp

Program Example32;

{ This program demonstrates the StartOfTheWeek function }

Uses SysUtils, DateUtils;

Const

Fmt = '"First day of this week : "dd mmmm yyyy';

Begin

 WriteLn(FormatDateTime(Fmt, StartOfTheWeek(Today)));

End.

9.4.129 StartOfTheYear

Synopsis: Return the first day of the year, given a date in this year.

Declaration: function StartOfTheYear(const AValue: TDateTime) : TDateTime

Visibility: default

Description: StartOfTheYear extracts the year part of AValue and returns a TDateTime value with the date of the first day of that year (January 1), as the StartOfAYear (516) function.

See also: StartOfAYear (516), EndOfTheYear (472), EndOfAYear (470)

Listing: ./datutex/ex24.pp

Program Example24;

```
{ This program demonstrates the StartOfTheYear function }
```

```
Uses SysUtils, DateUtils;
```

```
Const
```

```
Fmt = '"First day of this year : "dd mmmm yyyy';
```

```
Begin
```

```
  WriteLn(FormatDateTime(Fmt, StartOfTheYear(Today)));
```

```
End.
```

9.4.130 TimeOf

Synopsis: Extract the time part from a DateTime indication.

Declaration: function TimeOf(const AValue: TDateTime) : TDateTime

Visibility: default

Description: TimeOf extracts the time part from AValue and returns the result.

Since the TDateTime is actually a double with the time part encoded in the fractional part, this operation corresponds to a call to Frac.

See also: DateOf (455), YearOf (537), MonthOf (497), DayOf (457), HourOf (472), MinuteOf (493), SecondOf (510), MillisecondOf (488)

Listing: ./datutex/ex2.pp

Program Example2;

```
{ This program demonstrates the TimeOf function }
```

```
Uses SysUtils, DateUtils;
```

```
Begin
```

```
  WriteLn('Time is : ', TimeToStr(TimeOf(Now)));
```

```
End.
```

9.4.131 Today

Synopsis: Return the current date

Declaration: function Today : TDateTime

Visibility: default

Description: Today is an alias for the Date (1499) function in the sysutils (1449) unit.

For an example, see Yesterday (540)

See also: Date (1499), Yesterday (540), Tomorrow (519)

9.4.132 Tomorrow

Synopsis: Return the next day

Declaration: function Tomorrow : TDateTime

Visibility: default

Description: Tomorrow returns tomorrow's date. Tomorrow is determined from the system clock, i.e. it is Today (519) +1.

See also: Today (519), Yesterday (540)

Listing: ./datutex/ex19.pp

Program Example19;

{ This program demonstrates the Tomorrow function }

Uses SysUtils, DateUtils;

Begin

```
  WriteLn(FormatDateTime('Today is " dd mmmm yyyy ', Today));
  WriteLn(FormatDateTime('Tomorrow will be" dd mmmm yyyy ', Tomorrow));
End.
```

9.4.133 TryEncodeDateDay

Synopsis: Encode a year and day of year to a TDateTime value

Declaration: function TryEncodeDateDay(const AYear: Word; const ADayOfYear: Word;
 out AValue: TDateTime) : Boolean

Visibility: default

Description: TryEncodeDateDay encodes the values AYear and ADayOfYear to a date value and returns this value in AValue.

If the encoding was successful, True is returned. False is returned if any of the arguments is not valid.

See also: EncodeDateDay (466), EncodeDateTime (466), EncodeDateMonthWeek (466), EncodeDateWeek (467), TryEncodeDateTime (521), TryEncodeDateMonthWeek (520), TryEncodeDateWeek (521)

Listing: ./datutex/ex84.pp

```
Program Example84;

{ This program demonstrates the TryEncodeDateDay function }

Uses SysUtils, DateUtils;

Var
  Y,DoY : Word;
  TS : TDateTime;

Begin
  DecodeDateDay(Now,Y,DoY);
  If TryEncodeDateDay(Y,DoY,TS) then
    WriteLn( 'Today is : ',DateToStr(TS))
  else
    WriteLn( 'Wrong year/day of year indication' );
End.
```

9.4.134 TryEncodeDateMonthWeek

Synopsis: Encode a year, month, week of month and day of week to a TDateTime value

Declaration: function TryEncodeDateMonthWeek(const AYear: Word; const AMonth: Word;
const AWeekOfMonth: Word;
const ADayOfWeek: Word;
out AValue: TDateTime) : Boolean

Visibility: default

Description: TryEncodeDateMonthWeek encodes the values AYearAMonth, WeekOfMonth,ADayOfWeek, to a date value and returns this value in AValue.

If the encoding was succesful, True is returned, False if any of the arguments is not valid.

See also: DecodeDateMonthWeek (463), EncodeDateTime (466), EncodeDateWeek (467), EncodeDateDay (466), EncodeDateMonthWeek (466), TryEncodeDateTime (521), TryEncodeDateWeek (521), TryEncodeDateDay (519), NthDayOfWeek (499)

Listing: ./datutex/ex86.pp

```
Program Example86;

{ This program demonstrates the TryEncodeDateMonthWeek function }

Uses SysUtils, DateUtils;

Var
  Y,M,WoM,Dow : Word;
  TS : TDateTime;

Begin
  DecodeDateMonthWeek(Now,Y,M,WoM,Dow);
  If TryEncodeDateMonthWeek(Y,M,WoM,Dow,TS) then
    WriteLn( 'Today is : ',DateToStr(TS))
  else
    WriteLn( 'Invalid year/month/week/dow indication' );
End.
```

9.4.135 TryEncodeDateTime

Synopsis: Encode a Year, Month, Day, Hour, minute, seconds, milliseconds tuple to a TDateTime value

Declaration: function TryEncodeDateTime(const AYear: Word; const AMonth: Word;
const ADay: Word; const AHour: Word;
const AMinute: Word; const ASecond: Word;
const AMilliSecond: Word;
out AValue: TDateTime) : Boolean

Visibility: default

Description: EncodeDateTime encodes the values AYearAMonth, ADay,AHour, AMinute,ASecond and AMilliSecond to a date/time valueand returns this value in AValue.

If the date was encoded succesfully, True is returned, False is returned if one of the arguments is not valid.

See also: EncodeDateTime ([466](#)), EncodeDateMonthWeek ([466](#)), EncodeDateWeek ([467](#)), EncodeDateDay ([466](#)), TryEncodeDateDay ([519](#)), TryEncodeDateWeek ([521](#)), TryEncodeDateMonthWeek ([520](#))

Listing: ./datutex/ex80.pp

```
Program Example79;

{ This program demonstrates the TryEncodeDateTime function }

Uses SysUtils, DateUtils;

Var
  Y,Mo,D,H,Mi,S,MS : Word;
  TS : TDateTime;

Begin
  DecodeDateTime(Now, Y, Mo, D, H, Mi, S, MS);
  If TryEncodeDateTime(Y, Mo, D, H, Mi, S, MS, TS) then
    Writeln('Now is : ', DateTimeToStr(TS))
  else
    Writeln('Wrong date/time indication');
End.
```

9.4.136 TryEncodeDateWeek

Synopsis: Encode a year, week and day of week triplet to a TDateTime value

Declaration: function TryEncodeDateWeek(const AYear: Word; const AWeekOfYear: Word;
out AValue: TDateTime; const ADayOfWeek: Word)
: Boolean
function TryEncodeDateWeek(const AYear: Word; const AWeekOfYear: Word;
out AValue: TDateTime) : Boolean

Visibility: default

Description: TryEncodeDateWeek encodes the values AYear, AWeekOfYear and ADayOfWeek to a date value and returns this value in AValue.

If the encoding was succesful, True is returned. False is returned if any of the arguments is not valid.

See also: [EncodeDateMonthWeek](#) (466), [EncodeDateWeek](#) (467), [EncodeDateTime](#) (466), [EncodeDateDay](#) (466), [TryEncodeDateTime](#) (521), [TryEncodeDateMonthWeek](#) (520), [TryEncodeDateDay](#) (519)

Listing: ./datutex/ex82.pp

```

Program Example82;

{ This program demonstrates the TryEncodeDateWeek function }

Uses SysUtils, DateUtils;

Var
  Y,W,Dow : Word;
  TS : TDateTime;

Begin
  DecodeDateWeek(Now,Y,W,Dow);
  If TryEncodeDateWeek(Y,W,TS,Dow) then
    WriteLn( 'Today is : ',DateToStr(TS))
  else
    WriteLn( 'Invalid date/week indication' );
End.
```

9.4.137 TryEncodeDayOfWeekInMonth

Synopsis: Encode a year, month, week, day of week triplet to a TDateTime value

Declaration: function TryEncodeDayOfWeekInMonth(const AYear: Word; const AMonth: Word;
const ANthDayOfWeek: Word;
const ADayOfWeek: Word;
out AValue: TDateTime) : Boolean

Visibility: default

Description: EncodeDayOfWeekInMonth encodes AYear, AMonth, ADayOfWeek and ANthDayOfWeek to a valid date stamp and returns the result in AValue.

ANthDayOfWeek is the N-th time that this weekday occurs in the month, e.g. the third saturday of the month.

The function returns True if the encoding was successful, False if any of the values is not in range.

See also: [NthDayOfWeek](#) (499), [EncodeDateMonthWeek](#) (466), [#rtl.sysutils.DayOfWeek](#) (1503), [DecodeDayOfWeekInMonth](#) (465), [EncodeDayOfWeekInMonth](#) (467)

Listing: ./datutex/ex106.pp

```

Program Example105;

{ This program demonstrates the DecodeDayOfWeekInMonth function }

Uses SysUtils, DateUtils;

Var
  Y,M,NDoW,DoW : Word;
  D : TDateTime;

Begin
  DecodeDayOfWeekInMonth(Date,Y,M,NDoW,DoW);
```

```

If TryEncodeDayOfWeekInMonth(Y,M,NDow,DoW,D) then
  begin
    Write(DateToStr(D), ' is the ',NDow,'-th ');
    Writeln(formatDateTime('ddd',D), ' of the month.');
  end
else
  Writeln('Invalid year/month/NthDayOfweek combination');
End.

```

9.4.138 TryEncodeTimeInterval

Synopsis: Try to encode an interval as a TDateTime value.

Declaration: function TryEncodeTimeInterval(Hour: Word; Min: Word; Sec: Word;
MSec: Word; out Time: TDateTime) : Boolean

Visibility: default

Description: TryEncodeTimeInterval encodes a time interval expressed in Hour, Min, Sec, MSec as a TDateTime value and returns the value in Time. It returns True if Min, Sec, MSec contain valid time values (i.e. less than 60, 60 resp. MSec). The number of hours may be larger than 24.

See also: EncodeTimeInterval (??)

9.4.139 TryJulianDateToDateTime

Synopsis: Convert a Julian date representation to a TDateTime value.

Declaration: function TryJulianDateToDateTime(const AValue: Double;
out ADateTime: TDateTime) : Boolean

Visibility: default

Description: Try to convert a Julian date to a regular TDateTime date/time representation.

See also: DateTimeToJulianDate (456), JulianDateToDateTime (487), DateTimeToModifiedJulianDate (457), TryModifiedJulianDateToDateTime (523)

9.4.140 TryModifiedJulianDateToDateTime

Synopsis: Convert a modified Julian date representation to a TDateTime value.

Declaration: function TryModifiedJulianDateToDateTime(const AValue: Double;
out ADateTime: TDateTime)
: Boolean

Visibility: default

Description: Not yet implemented.

Errors: Currently, trying to use this function will raise an exception.

See also: DateTimeToJulianDate (456), JulianDateToDateTime (487), TryJulianDateToDateTime (523), DateTimeToModifiedJulianDate (457), ModifiedJulianDateToDateTime (496)

9.4.141 TryRecodeDateTime

Synopsis: Replace selected parts of a TDateTime value with other values

Declaration: function TryRecodeDateTime(const AValue: TDateTime; const AYear: Word;
const AMonth: Word; const ADay: Word;
const AHour: Word; const AMinute: Word;
const ASecond: Word; const AMilliSecond: Word;
out AResult: TDateTime) : Boolean

Visibility: default

Description: TryRecodeDateTime replaces selected parts of the timestamp AValue with the date/time values specified in AYear, AMonth, ADay, AHour, AMinute, ASecond and AMilliSecond. If any of these values equals the pre-defined constant RecodeLeaveFieldAsIs (452), then the corresponding part of the date/time stamp is left untouched.

The resulting date/time is returned in AValue.

The function returns True if the encoding was successful. It returns False if one of the values AYear, AMonth, ADay, AHour, AMinute, ASecondAMilliSecond is not within a valid range.

See also: RecodeYear (506), RecodeMonth (504), RecodeDay (502), RecodeHour (502), RecodeMinute (503), RecodeSecond (505), RecodeMilliSecond (503), RecodeDate (500), RecodeTime (505), RecodeDateTime (501)

Listing: ./datutex/ex97.pp

```
Program Example97;

{ This program demonstrates the TryRecodeDateTime function }

Uses SysUtils, DateUtils;

Const
  Fmt = 'dddd dd mmmm yyyy hh:nn:ss';

Var
  S : AnsiString;
  D : TDateTime;

Begin
  If TryRecodeDateTime(Now,2000,2,RecodeLeaveFieldAsIs,0,0,0,0,D) then
    begin
      S:=FormatDateTimeFmt,D);
      Writeln('This moment in februari 2000 : ',S);
    end
  else
    Writeln('This moment did/does not exist in februari 2000');
End.
```

9.4.142 UniversalTimeToLocal

Declaration: function UniversalTimeToLocal(UT: TDateTime) : TDateTime
function UniversalTimeToLocal(UT: TDateTime; TZOffset: Integer)
: TDateTime

Visibility: default

9.4.143 UnixTimeStampToMac

Synopsis: Convert Unix Timestamp to a Mac Timestamp

Declaration: function UnixTimeStampToMac(const AValue: Int64) : Int64

Visibility: default

Description: UnixTimeStampToMac converts the unix epoch time in AValue to a valid Mac timestamp indication and returns the result.

Errors: None.

See also: [DateTimeToMac \(456\)](#), [MacToDateTIme \(488\)](#), [MacTimeStampToUnix \(488\)](#)

9.4.144 UnixToDateTIme

Synopsis: Convert Unix epoch time to a TDateTime value

Declaration: function UnixToDateTIme(const AValue: Int64) : TDateTime

Visibility: default

Description: UnixToDateTIme converts epoch time (seconds elapsed since 1/1/1970) to a TDateTime value.

See also: [DateTimeToUnix \(457\)](#)

9.4.145 WeekOf

Synopsis: Extract week (of the year) from a given date.

Declaration: function WeekOf(const AValue: TDateTime) : Word

Visibility: default

Description: WeekOf returns the week-of-the-year part of the AValue date/time indication. It is a number between 1 and 53.

For an example, see [YearOf \(537\)](#)

See also: [YearOf \(537\)](#), [DayOf \(457\)](#), [MonthOf \(497\)](#), [HourOf \(472\)](#), [MinuteOf \(493\)](#), [SecondOf \(510\)](#), [MilisecoundOf \(488\)](#)

9.4.146 WeekOfTheMonth

Synopsis: Extract the week of the month (and optionally month and year) from a DateTime value

```
Declaration: function WeekOfTheMonth(const AValue: TDateTime) : Word; Overload
              function WeekOfTheMonth(const AValue: TDateTime; out AYear: Word;
                                      out AMonth: Word) : Word; Overload
```

Visibility: default

Description: WeekOfTheMonth extracts the week of the month from Avalue and returns it, and optionally returns the year and month as well (in AYear, AMonth respectively).

Remark: Note that weeks are numbered from 1 using the ISO 8601 standard, and the day of the week as well. This means that the year and month may not be the same as the year part of the date, since the week may start in the previous year as the first week of the year is the week with at least 4 days in it.

See also: WeekOfTheYear ([526](#)), DayOfTheMonth ([457](#)), HourOfTheMonth ([473](#)), MinuteOfTheMonth ([494](#)), SecondOfTheMonth ([511](#)), MillisecondOfTheMonth ([490](#))

Listing: ./datutex/ex41.pp

Program Example41;

{ This program demonstrates the WeekOfTheMonth function }

Uses SysUtils, DateUtils;

Var

N : TDateTime;

Begin

N:=Now;

```
Writeln('Week of the Month      : ', WeekOfTheMonth(N));
Writeln('Day of the Month        : ', DayOfTheMonth(N));
Writeln('Hour of the Month       : ', HourOfTheMonth(N));
Writeln('Minute of the Month     : ', MinuteOfTheMonth(N));
Writeln('Second of the Month      : ', SecondOfTheMonth(N));
Writeln('Millisecond of the Month : ', MillisecondOfTheMonth(N));
```

End.

9.4.147 WeekOfTheYear

Synopsis: Extract the week of the year (and optionally year) of a DateTime indication.

Declaration: function WeekOfTheYear(const AValue: TDateTime) : Word; Overload
 function WeekOfTheYear(const AValue: TDateTime; out AYear: Word) : Word
 ; Overload

Visibility: default

Description: WeekOfTheYear extracts the week of the year from AValue and returns it, and optionally returns the year as well. It returns the same value as WeekOf ([525](#)).

Remark: Note that weeks are numbered from 1 using the ISO 8601 standard, and the day of the week as well. This means that the year may not be the same as the year part of the date, since the week may start in the previous year as the first week of the year is the week with at least 4 days in it.

See also: WeekOf ([525](#)), MonthOfTheYear ([497](#)), DayOfTheYear ([458](#)), HourOfTheYear ([474](#)), MinuteOfTheYear ([494](#)), SecondOfTheYear ([512](#)), MillisecondOfTheYear ([491](#))

Listing: ./datutex/ex40.pp

Program Example40;

{ This program demonstrates the WeekOfTheYear function }

Uses SysUtils, DateUtils;

Var

N : TDateTime;

Begin

N:=Now;

```

WriteLn('Month of the year      : ',MonthOfTheYear(N));
WriteLn('Week of the year       : ',WeekOfTheYear(N));
WriteLn('Day of the year        : ',DayOfTheYear(N));
WriteLn('Hour of the year       : ',HourOfTheYear(N));
WriteLn('Minute of the year     : ',MinuteOfTheYear(N));
WriteLn('Second of the year      : ',SecondOfTheYear(N));
WriteLn('Millisecond of the year: ',MillisecondOfTheYear(N));
End.

```

9.4.148 WeeksBetween

Synopsis: Calculate the number of whole weeks between two DateTime values

Declaration: function WeeksBetween(const ANow: TDateTime; const ATThen: TDateTime)
 : Integer

Visibility: default

Description: WeeksBetween returns the number of whole weeks between ANow and ATThen. This means the fractional part of a Week is dropped.

See also: YearsBetween (538), MonthsBetween (497), DaysBetween (459), HoursBetween (474), MinutesBetween (495), SecondsBetween (512), MilliSecondsBetween (491)

Listing: ./datutex/ex57.pp

Program Example57;

{ This program demonstrates the WeeksBetween function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, ATThen : TDateTime);

begin

```

Write('Number of weeks between ');
Write(DateToStr(ATThen), ' and ',DateToStr(ANow));
WriteLn(' : ',WeeksBetween(ANow,ATThen));

```

end;

Var

 D1,D2 : TDateTime;

Begin

```

D1:=Today;
D2:=Today-7;
Test(D1,D2);
D2:=Today-8;
Test(D1,D2);
D2:=Today-14;
Test(D1,D2);
D2:=Today-35;
Test(D1,D2);
D2:=Today-36;
Test(D1,D2);
D2:=Today-17;

```

```
Test(D1,D2);
End.
```

9.4.149 WeeksInAYear

Synopsis: Return the number of weeks in a given year

Declaration: function WeeksInAYear(const AYear: Word) : Word

Visibility: default

Description: WeeksInAYear returns the number of weeks in the year AYear. The return value is either 52 or 53.

Remark: The first week of the year is determined according to the ISO 8601 standard: It is the first week that has at least 4 days in it, i.e. it includes a thursday.

See also: WeeksInYear ([528](#)), DaysInYear ([461](#)), DaysInAYear ([460](#)), DaysInMonth ([461](#)), DaysInAMonth ([459](#))

Listing: ./datutex/ex13.pp

Program Example13;

```
{ This program demonstrates the WeeksInAYear function }
```

Uses SysUtils, DateUtils;

Var

```
Y : Word;
```

Begin

```
For Y:=1992 to 2010 do
```

```
  WriteLn(Y, ' has ', WeeksInAYear(Y), ' weeks.');
```

End.

9.4.150 WeeksInYear

Synopsis: return the number of weeks in the year, given a date

Declaration: function WeeksInYear(const AValue: TDateTime) : Word

Visibility: default

Description: WeeksInYear returns the number of weeks in the year part of AValue. The return value is either 52 or 53.

Remark: The first week of the year is determined according to the ISO 8601 standard: It is the first week that has at least 4 days in it, i.e. it includes a thursday.

See also: WeeksInAYear ([528](#)), DaysInYear ([461](#)), DaysInAYear ([460](#)), DaysInMonth ([461](#)), DaysInAMonth ([459](#))

Listing: ./datutex/ex12.pp

Program Example12;

{ This program demonstrates the WeeksInYear function }

Uses SysUtils, DateUtils;

Var

Y : Word;

Begin

For Y:=1992 to 2010 do

 WriteLn(Y, ' has ', WeeksInYear(EncodeDate(Y, 2, 1)), ' weeks.');

End.

9.4.151 WeekSpan

Synopsis: Calculate the approximate number of weeks between two DateTime values.

Declaration: function WeekSpan(const ANow: TDateTime; const ATThen: TDateTime) : Double

Visibility: default

Description: WeekSpan returns the number of weeks between ANow and ATThen, including any fractional parts of a week.

See also: YearSpan (539), MonthSpan (498), DaySpan (462), HourSpan (475), MinuteSpan (496), SecondSpan (513), MillisecondSpan (492), WeeksBetween (527)

Listing: ./datutex/ex65.pp

Program Example57;

{ This program demonstrates the WeekSpan function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, ATThen : TDateTime);

begin

 Write('Number of weeks between '');

 Write(DateToStr(ATThen), ' and ', DateToStr(ANow));

 WriteLn(' : ', WeekSpan(ANow, ATThen));

end;

Var

D1,D2 : TDateTime;

Begin

 D1:=Today;

 D2:=Today-7;

 Test(D1,D2);

 D2:=Today-8;

 Test(D1,D2);

 D2:=Today-14;

 Test(D1,D2);

 D2:=Today-35;

 Test(D1,D2);

```

D2:=Today-36;
Test(D1,D2);
D2:=Today-17;
Test(D1,D2);
End.

```

9.4.152 WithinPastDays

Synopsis: Check whether two datetimes are only a number of days apart

Declaration: function WithinPastDays(const ANow: TDateTime; const AThen: TDateTime;
const ADays: Integer) : Boolean

Visibility: default

Description: WithinPastDays compares the timestamps ANow and AThen and returns True if the difference between them is at most ADays days apart, or False if they are further apart.

Remark: Since this function uses the DaysBetween (459) function to calculate the difference in days, this means that fractional days do not count, and the fractional part is simply dropped, so for two dates actually 2 and a half days apart, the result will also be True

See also: WithinPastYears (536), WithinPastMonths (533), WithinPastWeeks (535), WithinPastHours (531), WithinPastMinutes (533), WithinPastSeconds (534), WithinPastMilliSeconds (532)

Listing: ./datutex/ex50.pp

Program Example50;

```
{ This program demonstrates the WithinPastDays function }
```

Uses SysUtils, DateUtils;

Procedure Test(ANow, AThen : TDateTime; ADays : Integer);

begin

```
Write(DateTimeToStr(AThen), ' and ', DateTimeToStr(ANow));
Write(' are within ', ADays, ' days: ');
WriteIn(WithinPastDays(ANow, AThen, ADays));
end;
```

Var

```
D1,D2 : TDateTime;
```

Begin

```
D1:=Now;
D2:=Today-23/24;
Test(D1,D2,1);
D2:=Today-1;
Test(D1,D2,1);
D2:=Today-25/24;
Test(D1,D2,1);
D2:=Today-26/24;
Test(D1,D2,5);
D2:=Today-5.4;
Test(D1,D2,5);
D2:=Today-2.5;
Test(D1,D2,1);
```

```

Test(D1,D2,2);
Test(D1,D2,3);
End.

```

9.4.153 WithinPastHours

Synopsis: Check whether two datetimes are only a number of hours apart

Declaration: function WithinPastHours(const ANow: TDateTime; const AThen: TDateTime;
 const AHours: Int64) : Boolean

Visibility: default

Description: WithinPastHours compares the timestamps ANow and AThen and returns True if the difference between them is at most AHours hours apart, or False if they are further apart.

Remark: Since this function uses the HoursBetween (474) function to calculate the difference in Hours, this means that fractional hours do not count, and the fractional part is simply dropped, so for two dates actually 2 and a half hours apart, the result will also be True

See also: WithinPastYears (536), WithinPastMonths (533), WithinPastWeeks (535), WithinPastDays (530), WithinPastMinutes (533), WithinPastSeconds (534), WithinPastMilliSeconds (532)

Listing: ./datutex/ex51.pp

Program Example51;

```
{ This program demonstrates the WithinPastHours function }
```

Uses SysUtils, DateUtils;

Procedure Test(ANow,AThen : TDateTime; AHours : Integer);

begin

```
  Write(DateTimeToStr(AThen), ' and ', DateTimeToStr(ANow));
  Write(' are within ', AHours, ' hours : ');
  WriteLn(WithinPastHours(ANow,AThen,AHours));

```

end;

Var

```
  D1,D2 : TDateTime;
```

Begin

```

D1:=Now;
D2:=D1-(59*OneMinute);
Test(D1,D2,1);
D2:=D1-(61*OneMinute);
Test(D1,D2,1);
D2:=D1-(122*OneMinute);
Test(D1,D2,1);
D2:=D1-(306*OneMinute);
Test(D1,D2,5);
D2:=D1-(5.4*OneHour);
Test(D1,D2,5);
D2:=D1-(2.5*OneHour);
Test(D1,D2,1);
Test(D1,D2,2);
Test(D1,D2,3);

```

End.

9.4.154 WithinPastMilliSeconds

Synopsis: Check whether two datetimes are only a number of milliseconds apart

Declaration: function WithinPastMilliSeconds (const ANow: TDateTime;
 const AThen: TDateTime;
 const AMilliSeconds: Int64) : Boolean

Visibility: default

Description: WithinPastMilliSeconds compares the timestamps ANow and AThen and returns True if the difference between them is at most AMilliSeconds milliseconds apart, or False if they are further apart.

Remark: Since this function uses the MilliSecondsBetween (491) function to calculate the difference in milliseconds, this means that fractional milliseconds do not count, and the fractional part is simply dropped, so for two dates actually 2 and a half milliseconds apart, the result will also be True

See also: WithinPastYears (536), WithinPastMonths (533), WithinPastWeeks (535), WithinPastDays (530), WithinPastHours (531), WithinPastMinutes (533), WithinPastSeconds (534)

Listing: ./datutex/ex54.pp

Program Example54;

```
{ This program demonstrates the WithinPastMilliSeconds function }
```

```
Uses SysUtils, DateUtils;
```

```
Procedure Test(ANow, AThen : TDateTime; AMilliSeconds : Integer);
```

```
begin
```

```
  Write(TimeToStr(AThen), ' and ', TimeToStr(ANow));  
  Write(' are within ', AMilliSeconds, ' milliseconds: ');  
  WriteLn(WithinPastMilliSeconds(ANow, AThen, AMilliSeconds));
```

```
end;
```

```
Var
```

```
  D1, D2 : TDateTime;
```

```
Begin
```

```
  D1:=Now;  
  D2:=D1-(0.9*OneMillisecond);  
  Test(D1,D2,1);  
  D2:=D1-(1.0*OneMillisecond);  
  Test(D1,D2,1);  
  D2:=D1-(1.1*OneMillisecond);  
  Test(D1,D2,1);  
  D2:=D1-(2.5*OneMillisecond);  
  Test(D1,D2,1);  
  Test(D1,D2,2);  
  Test(D1,D2,3);
```

```
End.
```

9.4.155 WithinPastMinutes

Synopsis: Check whether two datetimes are only a number of minutes apart

Declaration: function WithinPastMinutes(const ANow: TDateTime; const AThen: TDateTime; const AMinutes: Int64) : Boolean

Visibility: default

Description: WithinPastMinutes compares the timestamps ANow and AThen and returns True if the difference between them is at most AMinutes minutes apart, or False if they are further apart.

Remark: Since this function uses the MinutesBetween (495) function to calculate the difference in Minutes, this means that fractional minutes do not count, and the fractional part is simply dropped, so for two dates actually 2 and a half minutes apart, the result will also be True

See also: WithinPastYears (536), WithinPastMonths (533), WithinPastWeeks (535), WithinPastDays (530), WithinPastHours (531), WithinPastSeconds (534), WithinPastMilliSeconds (532)

Listing: ./datutex/ex52.pp

Program Example52;

{ This program demonstrates the WithinPastMinutes function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, AThen : TDateTime; AMinutes : Integer);

begin

```
Write(DateTimeToStr(AThen), ' and ', DateTimeToStr(ANow));
Write(' are within ', AMinutes, ' Minutes: ');
WriteIn(WithinPastMinutes(ANow, AThen, AMinutes));
```

end;

Var

D1,D2 : TDateTime;

Begin

```
D1:=Now;
D2:=D1-(59*OneSecond);
Test(D1,D2,1);
D2:=D1-(61*OneSecond);
Test(D1,D2,1);
D2:=D1-(122*OneSecond);
Test(D1,D2,1);
D2:=D1-(306*OneSecond);
Test(D1,D2,5);
D2:=D1-(5.4*OneMinute);
Test(D1,D2,5);
D2:=D1-(2.5*OneMinute);
Test(D1,D2,1);
Test(D1,D2,2);
Test(D1,D2,3);
```

End.

9.4.156 WithinPastMonths

Synopsis: Check whether two datetimes are only a number of months apart

Declaration: function WithinPastMonths (const ANow: TDateTime; const AThen: TDateTime;
const AMonths: Integer) : Boolean

Visibility: default

Description: WithinPastMonths compares the timestamps ANow and AThen and returns True if the difference between them is at most AMonths months apart, or False if they are further apart.

Remark: Since this function uses the MonthsBetween (497) function to calculate the difference in Months, this means that fractional months do not count, and the fractional part is simply dropped, so for two dates actually 2 and a half months apart, the result will also be True

See also: WithinPastYears (536), WithinPastWeeks (535), WithinPastDays (530), WithinPastHours (531), WithinPastMinutes (533), WithinPastSeconds (534), WithinPastMilliSeconds (532)

Listing: ./datutex/ex48.pp

Program Example48;

{ This program demonstrates the WithinPastMonths function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, AThen : TDateTime; AMonths : Integer);

begin

Write(**DateToStr**(AThen), ' and ', **DateToStr**(ANow));

Write(' are within ', AMonths, ' months: ');

WriteIn(WithinPastMonths(ANow, AThen, AMonths));

end;

Var

 D1, D2 : TDateTime;

Begin

 D1 := Today;

 D2 := Today - 364;

 Test(D1, D2, 12);

 D2 := Today - 365;

 Test(D1, D2, 12);

 D2 := Today - 366;

 Test(D1, D2, 12);

 D2 := Today - 390;

 Test(D1, D2, 12);

 D2 := Today - 368;

 Test(D1, D2, 11);

 D2 := Today - 1000;

 Test(D1, D2, 31);

 Test(D1, D2, 32);

 Test(D1, D2, 33);

End.

9.4.157 WithinPastSeconds

Synopsis: Check whether two datetimes are only a number of seconds apart

Declaration: function WithinPastSeconds (const ANow: TDateTime; const AThen: TDateTime;
const ASeconds: Int64) : Boolean

Visibility: default

Description: WithinPastSeconds compares the timestamps ANow and AThen and returns True if the difference between them is at most ASeconds seconds apart, or False if they are further apart.

Remark: Since this function uses the SecondsBetween (512) function to calculate the difference in seconds, this means that fractional seconds do not count, and the fractional part is simply dropped, so for two dates actually 2 and a half seconds apart, the result will also be True

See also: WithinPastYears (536), WithinPastMonths (533), WithinPastWeeks (535), WithinPastDays (530), WithinPastHours (531), WithinPastMinutes (533), WithinPastMilliSeconds (532)

Listing: ./datutex/ex53.pp

Program Example53;

```
{ This program demonstrates the WithinPastSeconds function }
```

```
Uses SysUtils, DateUtils;
```

```
Procedure Test(ANow, AThen : TDateTime; ASeconds : Integer);
```

```
begin
```

```
  Write(DateTimeToStr(AThen), ' and ', DateTimeToStr(ANow));
  Write(' are within ', ASeconds, ' seconds: ');
  WriteIn(WithinPastSeconds(ANow, AThen, ASeconds));

```

```
end;
```

```
Var
```

```
  D1, D2 : TDateTime;
```

```
Begin
```

```
  D1:=Now;
  D2:=D1-(999*OneMillisecond);
  Test(D1, D2, 1);
  D2:=D1-(1001*OneMillisecond);
  Test(D1, D2, 1);
  D2:=D1-(2001*OneMillisecond);
  Test(D1, D2, 1);
  D2:=D1-(5001*OneMillisecond);
  Test(D1, D2, 5);
  D2:=D1-(5.4*OneSecond);
  Test(D1, D2, 5);
  D2:=D1-(2.5*OneSecond);
  Test(D1, D2, 1);
  Test(D1, D2, 2);
  Test(D1, D2, 3);

```

```
End.
```

9.4.158 WithinPastWeeks

Synopsis: Check whether two datetimes are only a number of weeks apart

Declaration: function WithinPastWeeks(const ANow: TDateTime; const AThen: TDateTime;
const AWeeks: Integer) : Boolean

Visibility: default

Description: `WithinPastWeeks` compares the timestamps `ANow` and `AThen` and returns `True` if the difference between them is at most `AWeeks` weeks apart, or `False` if they are further apart.

Remark: Since this function uses the WeeksBetween (527) function to calculate the difference in Weeks, this means that fractional Weeks do not count, and the fractional part is simply dropped, so for two dates actually 2 and a half weeks apart, the result will also be True

See also: [WithinPastYears](#) ([536](#)), [WithinPastMonths](#) ([533](#)), [WithinPastDays](#) ([530](#)), [WithinPastHours](#) ([531](#)), [WithinPastMinutes](#) ([533](#)), [WithinPastSeconds](#) ([534](#)), [WithinPastMilliSeconds](#) ([532](#))

Listing: ./datutex/ex49.pp

Program Example49 ;

{ This program demonstrates the WithinPastWeeks function }

Uses SysUtils , DateUtils ;

Procedure Test(ANow,AThen : TDateTime; AWeeks : Integer);

```
begin
  Write (DateToStr(AThen) , ' and ' , DateToStr(ANow));
  Write (' are within ', AWeeks, ' weeks : ');
  WriteIn (WithinPastWeeks (ANow, AThen, AWeeks));
end;
```

Var

D1,D2 : TDateTime;

Begin

```
D1:=Today;  
D2:=Today-7;  
Test(D1,D2,1)  
D2:=Today-8;  
Test(D1,D2,1)  
D2:=Today-14;  
Test(D1,D2,1)  
D2:=Today-35;  
Test(D1,D2,5)  
D2:=Today-36;  
Test(D1,D2,5)  
D2:=Today-17;  
Test(D1,D2,1)  
Test(D1,D2,2)  
Test(D1,D2,3)
```

End .

9.4.159 WithinPastYears

Synopsis: Check whether two datetimes are only a number of years apart

```
Declaration: function WithinPastYears(const ANow: TDateTime; const AThen: TDateTime;  
const AYears: Integer) : Boolean
```

Visibility: default

Description: WithinPastYears compares the timestamps ANow and AThen and returns True if the difference between them is at most AYears years apart, or False if they are further apart.

Remark: Since this function uses the YearsBetween (538) function to calculate the difference in years, this means that fractional years do not count, and the fractional part is simply dropped, so for two dates actually 2 and a half years apart, the result will also be True

See also: WithinPastMonths (533), WithinPastWeeks (535), WithinPastDays (530), WithinPastHours (531), WithinPastMinutes (533), WithinPastSeconds (534), WithinPastMilliSeconds (532)

Listing: ./datutex/ex47.pp

Program Example47;

{ This program demonstrates the WithinPastYears function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, AThen : TDateTime; AYears : Integer);

begin

Write(**DateToStr**(AThen), ' and ', **DateToStr**(ANow));

Write(' are within ', AYears, ' years: '');

WriteIn(WithinPastYears(ANow, AThen, AYears));

end;

Var

 D1, D2 : TDateTime;

Begin

 D1 := Today;

 D2 := Today - 364;

 Test(D1, D2, 1);

 D2 := Today - 365;

 Test(D1, D2, 1);

 D2 := Today - 366;

 Test(D1, D2, 1);

 D2 := Today - 390;

 Test(D1, D2, 1);

 D2 := Today - 368;

 Test(D1, D2, 1);

 D2 := Today - 1000;

 Test(D1, D2, 1);

 Test(D1, D2, 2);

 Test(D1, D2, 3);

End.

9.4.160 YearOf

Synopsis: Extract the year from a given date.

Declaration: function YearOf(const AValue: TDateTime) : Word

Visibility: default

Description: YearOf returns the year part of the AValue date/time indication. It is a number between 1 and 9999.

See also: MonthOf (497), DayOf (457), WeekOf (525), HourOf (472), MinuteOf (493), SecondOf (510), MilliSecondOf (488)

Listing: ./datutex/ex23.pp

Program Example23 ;

{ This program demonstrates the YearOf function }

Uses SysUtils , DateUtils ;

Var

D : TDateTime;

Begin

```
D:=Now;  
Writeln('Year      : ',YearOf(D));  
Writeln('Month     : ',MonthOf(D));  
Writeln('Day       : ',DayOf(D));  
Writeln('Week      : ',WeekOf(D));  
Writeln('Hour      : ',HourOf(D));  
Writeln('Minute    : ',MinuteOf(D));  
Writeln('Second    : ',SecondOf(D));  
Writeln('Millisecond : ',MillisecondOf(D));
```

End .

9.4.161 YearsBetween

Synopsis: Calculate the number of whole years between two DateTime values

```
Declaration: function YearsBetween(const ANow: TDateTime; const AThen: TDateTime)
                      : Integer
```

Visibility: default

Description: `YearsBetween` returns the number of whole years between `ANow` and `AThen`. This number is an approximation, based on an average number of days of 365.25 per year (average over 4 years). This means the fractional part of a year is dropped.

See also: [MonthsBetween](#) (497), [WeeksBetween](#) (527), [DaysBetween](#) (459), [HoursBetween](#) (474), [MinutesBetween](#) (495), [SecondsBetween](#) (512), [MilliSecondsBetween](#) (491), [YearSpan](#) (539)

Listing: ./datutex/ex55.pp

Program Example55 ;

{ This program demonstrates the YearsBetween function }

Uses SysUtils, DateUtils;

```
Procedure Test(ANow, AThen : TDateTime);  
  
begin  
  Write('Number of years between ');  
  Write(DateToStr(AThen), ' and ', DateToStr(ANow))  
  Writeln(' : ', YearsBetween(ANow, AThen));  
end.
```

Var

D1 D2 : TDateTime;

```
Begin
  D1:=Today;
  D2:=Today-364;
  Test(D1,D2);
  D2:=Today-365;
  Test(D1,D2);
  D2:=Today-366;
  Test(D1,D2);
  D2:=Today-390;
  Test(D1,D2);
  D2:=Today-368;
  Test(D1,D2);
  D2:=Today-1000;
  Test(D1,D2);
End.
```

9.4.162 YearSpan

Synopsis: Calculate the approximate number of years between two DateTime values.

Declaration: function YearSpan(const ANow: TDateTime; const ATThen: TDateTime) : Double

Visibility: default

Description: YearSpan returns the number of years between ANow and ATThen, including any fractional parts of a year. This number is an approximation, based on an average number of days of 365.25 per year (average over 4 years).

See also: MonthSpan (498), WeekSpan (529), DaySpan (462), HourSpan (475), MinuteSpan (496), SecondSpan (513), MillisecondSpan (492), YearsBetween (538)

Listing: ./datutex/ex63.pp

Program Example63;

{ This program demonstrates the YearSpan function }

Uses SysUtils, DateUtils;

Procedure Test(ANow, ATThen : TDateTime);

begin

```
  Write('Number of years between ');
  Write(DateToStr(ATThen), ' and ', DateToStr(ANow));
  WriteLn(' : ', YearSpan(ANow, ATThen));
end;
```

Var

```
  D1,D2 : TDateTime;
```

Begin

```
  D1:=Today;
  D2:=Today-364;
  Test(D1,D2);
  D2:=Today-365;
  Test(D1,D2);
  D2:=Today-366;
```

```
Test(D1,D2);
D2:=Today-390;
Test(D1,D2);
D2:=Today-368;
Test(D1,D2);
D2:=Today-1000;
Test(D1,D2);
End.
```

9.4.163 Yesterday

Synopsis: Return the previous day.

Declaration: function Yesterday : TDateTime

Visibility: default

Description: Yesterday returns yesterday's date. Yesterday is determined from the system clock, i.e. it is Today (519) -1.

See also: Today (519), Tomorrow (519)

Listing: ./datutex/ex18.pp

Program Example18;

```
{ This program demonstrates the Yesterday function }
```

```
Uses SysUtils, DateUtils;
```

```
Begin
```

```
  Writeln(FormatDateTime('Today is " dd mmmm yyyy ', Today));
  Writeln(FormatDateTime('Yesterday was " dd mmmm yyyy ', Yesterday));
```

```
End.
```

Chapter 10

Reference for unit 'Dos'

10.1 Used units

Table 10.1: Used units by unit 'Dos'

Name	Page
BaseUnix	102
System	1229

10.2 Overview

The DOS unit gives access to some operating system calls related to files, the file system, date and time. Except for the PalmOS target, this unit is available to all supported platforms.

The unit was first written for dos by Florian Klaempfl. It was ported to linux by Mark May and enhanced by Michael Van Canneyt. The Amiga version was ported by Nils Sjoholm.

Under non-DOS systems, some of the functionality is lost, as it is either impossible or meaningless to implement it. Other than that, the functionality is the same for all operating systems.

Because the DOS unit is a Turbo Pascal compatibility unit, it is no longer actively developed: the interface is frozen and it is maintained only for the purpose of porting Turbo Pascal programs. For new development, it is recommended to use the sysutils ([1449](#)) unit instead.

10.3 System information

Functions for retrieving and setting general system information such as date and time.

Table 10.2:

Name	Description
DosVersion (102)	Get OS version
GetCBreak (556)	Get setting of control-break handling flag
GetDate (557)	Get system date
GetIntVec (559)	Get interrupt vector status
GetTime (561)	Get system time
GetVerify (561)	Get verify flag
Intr (562)	Execute an interrupt
Keep (562)	Keep process in memory and exit
MSDos (562)	Execute MS-dos function call
PackTime (563)	Pack time for file time
SetCBreak (563)	Set control-break handling flag
SetDate (564)	Set system date
SetIntVec (565)	Set interrupt vectors
SetTime (565)	Set system time
SetVerify (565)	Set verify flag
SwapVectors (566)	Swap interrupt vectors
UnPackTime (566)	Unpack file time

10.4 Process handling

Functions to handle process information and starting new processes.

Table 10.3:

Name	Description
DosExitCode (102)	Exit code of last executed program
EnvCount (552)	Return number of environment variables
EnvStr (552)	Return environment string pair
Exec (553)	Execute program
GetEnv (557)	Return specified environment string

10.5 Directory and disk handling

Routines to handle disk information.

Table 10.4:

Name	Description
AddDisk (548)	Add disk to list of disks (UNIX only)
DiskFree (549)	Return size of free disk space
DiskSize (549)	Return total disk size

10.6 File handling

Routines to handle files on disk.

Table 10.5:

Name	Description
FExpand (553)	Expand filename to full path
FindClose (553)	Close finfirst/findnext session
FindFirst (554)	Start find of file
FindNext (555)	Find next file
FSearch (555)	Search for file in a path
FSplit (556)	Split filename in parts
GetFAttr (558)	Return file attributes
GetFTime (559)	Return file time
GetLongName (560)	Convert short filename to long filename (DOS only)
GetShortName (560)	Convert long filename to short filename (DOS only)
SetFAttr (564)	Set file attributes
SetFTime (565)	Set file time

10.7 File open mode constants.

These constants are used in the Mode field of the TextRec record. Gives information on the file-mode of the text I/O. For their definitions consult the following table:

Table 10.6: Possible mode constants

Constant	Description	Value
fmclosed	File is closed	\$D7B0
fminput	File is read only	\$D7B1
fmoutput	File is write only	\$D7B2
fminout	File is read and write	\$D7B3

10.8 File attributes

The File Attribute constants are used in FindFirst ([554](#)), FindNext ([555](#)) to determine what type of special file to search for in addition to normal files. These flags are also used in the SetFAttr ([564](#)) and GetFAttr ([558](#)) routines to set and retrieve attributes of files. For their definitions consult fileattributes ([543](#)).

Table 10.7: Possible file attributes

Constant	Description	Value
readonly	Read-Only file attribute	\$01
hidden	Hidden file attribute	\$02
sysfile	System file attribute	\$04
volumeid	Volumd ID file attribute	\$08
directory	Directory file attribute	\$10
archive	Archive file attribute	\$20
anyfile	Match any file attribute	\$3F

10.9 Constants, types and variables

10.9.1 Constants

anyfile = \$3F

Match any file attribute

archive = \$20

Archive file attribute

directory = \$10

Directory file attribute

fauxiliary = \$0010

CPU auxiliary flag. Not used.

fcarry = \$0001

CPU carry flag. Not used.

FileNameLen = 255

Maximum length of a filename

filerecnamelength = 255

Maximum length of FileName part in FileRec ([546](#))

fmclosed = \$D7B0

File is closed

fminout = \$D7B3

File is read and write

`fminput = $D7B1`

File is read only

`fmoutput = $D7B2`

File is write only

`foverflow = $0800`

CPU overflow flag. Not used.

`fparity = $0004`

CPU parity flag. Not used.

`fsign = $0080`

CPU sign flag. Not used.

`fzero = $0040`

CPU zero flag. Not used.

`hidden = $02`

Hidden file attribute

`readonly = $01`

Read-Only file attribute

`sysfile = $04`

System file attribute

`TextRecBufSize = 256`

Size of default buffer in TextRec ([548](#))

`TextRecNameLength = 256`

Maximum length of filename in TextRec ([548](#))

`volumeid = $08`

Volumd ID file attribute

10.9.2 Types

ComStr = string

Command-line string type

```
DateTime = packed record
  Year : Word;
  Month : Word;
  Day : Word;
  Hour : Word;
  Min : Word;
  Sec : Word;
end
```

The DateTime type is used in PackTime ([563](#)) and UnPackTime ([566](#)) for setting/reading file times with GetFTime ([559](#)) and SetFTime ([565](#)).

DirStr = string

Full directory string type.

ExtStr = string

Filename extension string type.

```
FileRec = packed record
  Handle : THandle;
  Mode : LongInt;
  RecSize : SizeInt;
  _private : Array[1..3*SizeOf(SizeInt)+5*SizeOf(pointer)] of Byte;
  UserData : Array[1..32] of Byte;
  name : Array[0..filerecnamelength] of Char;
end
```

FileRec is used for internal representation of typed and untyped files.

NameStr = string

Fill filename string type.

PathStr = string

Full File path string type.

```
Registers = packed record
end
```

This structure is only defined on a i386 compatible 32-bit platform, and is not used anywhere: it is defined for Turbo Pascal backwards compatibility only.

```

SearchRec = packed record
  SearchPos : TOff;
  SearchNum : LongInt;
  DirPtr : Pointer;
  SearchType : Byte;
  SearchAttr : Byte;
  Mode : Word;
  Fill : Array[1..1] of Byte;
  Attr : Byte;
  Time : LongInt;
  Size : LongInt;
  Reserved : Word;
  Name : string;
  SearchSpec : string;
  NamePos : Word;
end

```

`SearchRec` is filled by the [FindFirst \(554\)](#) call and can be used in subsequent [FindNext \(555\)](#) calls to search for files. The structure of this record depends on the platform. Only the following fields are present on all platforms:

Attr File attributes.

Time File modification time.

Size File size

Name File name (name part only, no path)

Mode File access mode (linux only)

```
TextBuf = Array[0..TextRecBufSize-1] of Char
```

Type for default buffer in `TextRec` ([548](#))

```

TextRec = packed record
  Handle : THandle;
  Mode : LongInt;
  bufsize : SizeInt;
  _private : SizeInt;
  bufpos : SizeInt;
  bufend : SizeInt;
  bufptr : ^TextBuf;
  openfunc : pointer;
  inoutfunc : pointer;
  flushfunc : pointer;
  closefunc : pointer;
  UserData : Array[1..32] of Byte;
  name : Array[0..textrecnamelength-1] of Char;
  LineEnd : TLineEndStr;
  buffer : TextBuf;
end

```

`TextRec` describes the internal working of a `Text` file.

Remark that this is not binary compatible with the Turbo Pascal definition of `TextRec`, since the sizes of the different fields are different.

```
TLineEndStr = string
```

`TLineEndStr` is used in the `TextRec` (548) record to indicate the end-of-line sequence for a text file.

10.9.3 Variables

```
DosError : Integer
```

The `DosError` variable is used by the procedures in the dos unit to report errors. It can have the following values :

Table 10.8: Dos error codes

Value	Meaning
2	File not found.
3	Path not found.
5	Access denied.
6	Invalid handle.
8	Not enough memory.
10	Invalid environment.
11	Invalid format.
18	No more files.

Other values are possible, but are not documented.

10.10 Procedures and functions

10.10.1 AddDisk

Synopsis: Add disk definition to list if drives (Unix only)

Declaration: function `AddDisk(const path: string) : Byte`

Visibility: default

Description: `AddDisk` adds a filename `S` to the internal list of disks. It is implemented for systems which do not use DOS type drive letters. This list is used to determine which disks to use in the `DiskFree` (549) and `DiskSize` (549) calls. The `DiskFree` (549) and `DiskSize` (549) functions need a file on the specified drive, since this is required for the `statfs` system call. The names are added sequentially. The dos initialization code presets the first three disks to:

- ' .' for the current drive,
- ' /fd0/ .' for the first floppy-drive (linux only).
- ' /fd1/ .' for the second floppy-drive (linux only).
- ' /' for the first hard disk.

The first call to AddDisk will therefore add a name for the second harddisk, The second call for the third drive, and so on until 23 drives have been added (corresponding to drives 'D:' to 'Z:')

Errors: None

See also: DiskFree ([549](#)), DiskSize ([549](#))

10.10.2 DiskFree

Synopsis: Get free size on Disk.

Declaration: function DiskFree(drive: Byte) : Int64

Visibility: default

Description: DiskFree returns the number of free bytes on a disk. The parameter Drive indicates which disk should be checked. This parameter is 1 for floppy a:, 2 for floppy b:, etc. A value of 0 returns the free space on the current drive.

Remark: For Unices: The diskfree and disksize functions need a file on the specified drive, since this is required for the statfs system call. These filenames are set in the initialization of the dos unit, and have been preset to :

- '.' for the current drive,
- '/fd0/. for the first floppy-drive (linux only).
- '/fd1/. for the second floppy-drive (linux only).
- '/' for the first hard disk.

There is room for 1-26 drives. You can add a drive with the AddDisk ([548](#)) procedure. These settings can be coded in dos.pp, in the initialization part.

Errors: -1 when a failure occurs, or an invalid drive number is given.

See also: DiskSize ([549](#)), AddDisk ([548](#))

Listing: ./dosex/ex6.pp

```
Program Example6;
uses Dos;

{ Program to demonstrate the DiskSize and DiskFree function. }

begin
  WriteLn('This partition size has ',DiskSize(0), ' bytes');
  WriteLn('Currently ',DiskFree(0), ' bytes are free');
end.
```

10.10.3 DiskSize

Synopsis: Get total size of disk.

Declaration: function DiskSize(drive: Byte) : Int64

Visibility: default

Description: DiskSize returns the total size (in bytes) of a disk. The parameter Drive indicates which disk should be checked. This parameter is 1 for floppy a:, 2 for floppy b:, etc. A value of 0 returns the size of the current drive.

Remark: For unix only: The diskfree and disksize functions need a file on the specified drive, since this is required for the statfs system call. These filenames are set in the initialization of the dos unit, and have been preset to :

- ' . ' for the current drive,
- ' /fd0/. ' for the first floppy-drive (linux only).
- ' /fd1/. ' for the second floppy-drive (linux only).
- ' // ' for the first hard disk.

There is room for 1-26 drives. You can add a drive with the AddDisk (548) procedure. These settings can be coded in dos.pp, in the initialization part.

For an example, see DiskFree (549).

Errors: -1 when a failure occurs, or an invalid drive number is given.

See also: DiskFree (549), AddDisk (548)

10.10.4 DosExitCode

Synopsis: Exit code of last executed program.

Declaration: function DosExitCode : Word

Visibility: default

Description: DosExitCode contains (in the low byte) the exit-code of a program executed with the Exec call.

Errors: None.

See also: Exec (553)

Listing: ./dosex/ex5.pp

```
Program Example5;
uses Dos;

{ Program to demonstrate the Exec and DosExitCode function. }

begin
{$IFDEF Unix}
  WriteLn('Executing /bin/ls -la');
  Exec('/bin/ls', '-la');
{$ELSE}
  WriteLn('Executing Dir');
  Exec(GetEnv('COMSPEC'), '/C dir');
{$ENDIF}
  WriteLn('Program returned with ExitCode ', Lo(DosExitCode));
end.
```

10.10.5 DosVersion

Synopsis: Current OS version

Declaration: function DosVersion : Word

Visibility: default

Description: DosVersion returns the operating system or kernel version. The low byte contains the major version number, while the high byte contains the minor version number.

Remark: On systems where versions consists of more then two numbers, only the first two numbers will be returned. For example Linux version 2.1.76 will give you DosVersion 2.1. Some operating systems, such as FreeBSD, do not have system calls to return the kernel version, in that case a value of 0 will be returned.

Errors: None.

Listing: ./dosex/ex1.pp

```
Program Example1;
uses Dos;

{ Program to demonstrate the DosVersion function. }

var
  OS      : string[32];
  Version : word;
begin
{$IFDEF LINUX}
  OS:='Linux';
{$ENDIF}
{$ifdef FreeBSD}
  OS:='FreeBSD';
{$endif}
{$ifdef NetBSD}
  OS:='NetBSD';
{$endif}
{$ifdef Solaris}
  OS:='Solaris';
{$endif}
{$ifdef QNX}
  OS:='QNX';
{$endif}

{$IFDEF DOS}
  OS:='Dos';
{$ENDIF}
  Version:=DosVersion;
  WriteLn('Current ',OS,' version is ',Lo(Version),'.',Hi(Version));
end.
```

10.10.6 DTToUnixDate

Synopsis: Convert a DateTime to unix timestamp

Declaration: function DTToUnixDate(DT: DateTime) : LongInt

Visibility: default

Description: DTToUnixDate converts the DateTime value in DT to a unix timestamp. It is an internal function, implemented on Unix platforms, and should not be used.

Errors: None.

See also: UnixDateToDT ([566](#)), PackTime ([563](#)), UnpackTime ([566](#)), GetTime ([561](#)), SetTime ([565](#))

10.10.7 EnvCount

Synopsis: Return the number of environment variables

Declaration: function EnvCount : LongInt

Visibility: default

Description: EnvCount returns the number of environment variables.

Errors: None.

See also: EnvStr ([552](#)), GetEnv ([557](#))

10.10.8 EnvStr

Synopsis: Return environment variable by index

Declaration: function EnvStr(Index: LongInt) : string

Visibility: default

Description: EnvStr returns the Index-th Name=Value pair from the list of environment variables. The index of the first pair is zero.

Errors: The length is limited to 255 characters.

See also: EnvCount ([552](#)), GetEnv ([557](#))

Listing: ./dosex/ex13.pp

```

Program Example13;
uses Dos;

{ Program to demonstrate the EnvCount and EnvStr function. }

var
  i : Longint;
begin
  WriteLn('Current Environment is:');
  for i:=1 to EnvCount do
    WriteLn(EnvStr(i));
end.

```

10.10.9 Exec

Synopsis: Execute another program, and wait for it to finish.

Declaration: procedure Exec(const path: PathStr; const comline: ComStr)

Visibility: default

Description: Exec executes the program in Path, with the options given by ComLine. The program name should *not* appear again in ComLine, it is specified in Path. Comline contains only the parameters that are passed to the program.

After the program has terminated, the procedure returns. The Exit value of the program can be consulted with the DosExitCode function.

For an example, see DosExitCode (102)

Errors: Errors are reported in DosError.

See also: DosExitCode (102)

10.10.10 FExpand

Synopsis: Expand a relative path to an absolute path

Declaration: function FExpand(const path: PathStr) : PathStr

Visibility: default

Description: FExpand takes its argument and expands it to a complete filename, i.e. a filename starting from the root directory of the current drive, prepended with the drive-letter or volume name (when supported).

Remark: On case sensitive file systems (such as unix and linux), the resulting name is left as it is, otherwise it is converted to uppercase.

Errors: FSplit (556)

Listing: ./dosex/ex11.pp

```
Program Example11;
uses Dos;

{ Program to demonstrate the FExpand function. }

begin
  WriteLn('Expanded Name of this program is ',FExpand(ParamStr(0)));
end.
```

10.10.11 FindClose

Synopsis: Dispose resources allocated by a FindFirst (554)/FindNext (555) sequence.

Declaration: procedure FindClose(var f: SearchRec)

Visibility: default

Description: FindClose frees any resources associated with the search record F.

This call is needed to free any internal resources allocated by the FindFirst ([554](#)) or FindNext ([555](#)) calls.

The unix implementation of the dos unit therefore keeps a table of open directories, and when the table is full, closes one of the directories, and reopens another. This system is adequate but slow if you use a lot of searchrecs.

So, to speed up the findfirst/findnext system, the FindClose call was implemented. When you don't need a searchrec any more, you can tell this to the dos unit by issuing a FindClose call. The directory which is kept open for this searchrec is then closed, and the table slot freed.

Remark: It is recommended to use the linux call Glob when looking for files on linux.

Errors: Errors are reported in DosError.

See also: FindFirst ([554](#)), FindNext ([555](#))

10.10.12 FindFirst

Synopsis: Start search for one or more files.

Declaration: procedure FindFirst(const path: PathStr; attr: Word; var f: SearchRec)

Visibility: default

Description: FindFirst searches the file specified in Path. Normal files, as well as all special files which have the attributes specified in Attr will be returned.

It returns a SearchRec record for further searching in F. Path can contain the wildcard characters ? (matches any single character) and * (matches 0 or more arbitrary characters). In this case FindFirst will return the first file which matches the specified criteria. If DosError is different from zero, no file(s) matching the criteria was(were) found.

Remark: On os/2, you cannot issue two different FindFirst calls. That is, you must close any previous search operation with FindClose ([553](#)) before starting a new one. Failure to do so will end in a Run-Time Error 6 (Invalid file handle)

Errors: Errors are reported in DosError.

See also: FindNext ([555](#)), FindClose ([553](#))

Listing: ./dosex/ex7.pp

```

Program Example7;
uses Dos;

{ Program to demonstrate the FindFirst and FindNext function. }

var
  Dir : SearchRec;
begin
  FindFirst( '.*' ,archive ,Dir );
  WriteLn( 'FileName '+Space(32) , 'FileSize ':9 );
  while ( DosError=0 ) do
  begin
    WriteLn( Dir .Name+Space(40-Length( Dir .Name)) , Dir .Size :9 );
    FindNext(Dir );
  end;
  FindClose(Dir );
end.

```

10.10.13 FindNext

Synopsis: Find next matching file after FindFirst ([554](#))

Declaration: procedure FindNext (var f: SearchRec)

Visibility: default

Description: FindNext takes as an argument a SearchRec from a previous FindNext call, or a FindFirst call, and tries to find another file which matches the criteria, specified in the FindFirst call. If DosError is different from zero, no more files matching the criteria were found.

For an example, see FindFirst ([554](#)).

Errors: DosError is used to report errors.

See also: FindFirst ([554](#)), FindClose ([553](#))

10.10.14 FSearch

Synopsis: Search a file in searchpath

Declaration: function FSearch(path: PathStr; dirlist: string) : PathStr

Visibility: default

Description: FSearch searches the file Path in all directories listed in DirList. The full name of the found file is returned. DirList must be a list of directories, separated by semi-colons. When no file is found, an empty string is returned.

Remark: On unix systems, DirList can also be separated by colons, as is customary on those environments.

Errors: None.

See also: FExpand ([553](#))

Listing: ./dosex/ex10.pp

```

program Example10;

uses Dos;

{ Program to demonstrate the FSearch function. }

var s:pathstr;

begin
  s:=FSearch(ParamStr(1),GetEnv( 'PATH' ));
  if s=' ' then
    WriteLn(ParamStr(1), ' not Found in PATH')
  else
    WriteLn(ParamStr(1), ' Found in PATH at ',s);
end.

```

10.10.15 FSplit

Synopsis: Split a full-path filename in parts.

Declaration: procedure FSPLIT(path: PathStr; var dir: DirStr; var name: NameStr;
var ext: ExtStr);

Visibility: default

Description: FSPLIT splits a full file name into 3 parts : A Path, a Name and an extension (in ext.) The extension is taken to be all letters after the *last* dot (.). For dos, however, an exception is made when LFNSupport=False, then the extension is defined as all characters after the *first* dot.

Errors: None.

See also: FSearch ([555](#))

Listing: ./dosex/ex12.pp

```
program Example12;

uses Dos;

{ Program to demonstrate the FSPLIT function. }

var dir:dirstr;
    name:namestr;
    ext:extstr;

begin
  FSPLIT(ParamStr(1),dir,name,ext);
  WriteLn('Splitted ',ParamStr(1), ' in :');
  WriteLn('Path      : ',dir);
  WriteLn('Name      : ',name);
  WriteLn('Extension: ',ext);
end.
```

10.10.16 GetCBreak

Synopsis: Get control-Break flag

Declaration: procedure GetCBreak(var breakvalue: Boolean)

Visibility: default

Description: GetCBreak gets the status of CTRL-Break checking under dos and Amiga. When BreakValue is false, then dos only checks for the CTRL-Break key-press when I/O is performed. When it is set to True, then a check is done at every system call.

Remark: Under non-dos and non-Amiga operating systems, BreakValue always returns True.

Errors: None

See also: SetCBreak ([563](#))

10.10.17 GetDate

Synopsis: Get the current date

Declaration: procedure GetDate(var year: Word; var month: Word; var mday: Word; var wday: Word);

Visibility: default

Description: GetDate returns the system's date. Year is a number in the range 1980..2099.mday is the day of the month, wday is the day of the week, starting with Sunday as day 0.

Errors: None.

See also: GetTime (561), SetDate (564)

Listing: ./dosex/ex2.pp

```
Program Example2;
uses Dos;

{ Program to demonstrate the GetDate function. }

const
  DayStr:array[0..6] of string[3]=( 'Sun' , 'Mon' , 'Tue' , 'Wed' , 'Thu' , 'Fri' , 'Sat' );
  MonthStr:array[1..12] of string[3]=( 'Jan' , 'Feb' , 'Mar' , 'Apr' , 'May' , 'Jun' ,
                                      'Jul' , 'Aug' , 'Sep' , 'Oct' , 'Nov' , 'Dec' );
var
  Year,Month,Day,WDay : word;
begin
  GetDate(Year,Month,Day,WDay);
  WriteLn('Current date');
  WriteLn(DayStr[WDay],',',Day,',',MonthStr[Month],',',Year,'.');
end.
```

10.10.18 GetEnv

Synopsis: Get environment variable by name.

Declaration: function GetEnv(envvar: string) : string

Visibility: default

Description: Getenv returns the value of the environment variable EnvVar. When there is no environment variable EnvVar defined, an empty string is returned.

Remark: Under some operating systems (such as unix), case is important when looking for EnvVar.

Errors: None.

See also: EnvCount (552), EnvStr (552)

Listing: ./dosex/ex14.pp

```
Program Example14;
uses Dos;

{ Program to demonstrate the GetEnv function. }

begin
```

```
  WriteLn( ' Current PATH is ',GetEnv( 'PATH' ) );
end.
```

10.10.19 GetFAttr

Synopsis: Get file attributes

Declaration: procedure GetFAttr(var f; var attr: Word)

Visibility: default

Description: GetFAttr returns the file attributes of the file-variable f. f can be a untyped or typed file, or of type Text. f must have been assigned, but not opened. The attributes can be examined with the following constants :

- ReadOnly
- Hidden
- SysFile
- VolumeId
- Directory
- Archive

Under linux, supported attributes are:

- Directory
- ReadOnly if the current process doesn't have access to the file.
- Hidden for files whose name starts with a dot ('.').

Errors: Errors are reported in DosError

See also: SetFAttr ([564](#))

Listing: ./dosex/ex8.pp

```
Program Example8;
uses Dos;

{ Program to demonstrate the GetFAttr function. }

var
  Attr : Word;
  f     : File;
begin
  Assign(f,ParamStr(1));
  GetFAttr(f, Attr);
  WriteLn('File ',ParamStr(1), ' has attribute ', Attr);
  if (Attr and archive)<>0 then WriteLn(' - Archive');
  if (Attr and directory)<>0 then WriteLn(' - Directory');
  if (Attr and readonly)<>0 then WriteLn(' - Read-Only');
  if (Attr and sysfile)<>0 then WriteLn(' - System');
  if (Attr and hidden)<>0 then WriteLn(' - Hidden');
end.
```

10.10.20 GetFTime

Synopsis: Get file last modification time.

Declaration: procedure GetFTime(var f; var time: LongInt)

Visibility: default

Description: GetFTime returns the modification time of a file. This time is encoded and must be decoded with UnPackTime. F must be a file type, which has been assigned, and opened.

Errors: Errors are reported in DosError

See also: SetFTime (565), PackTime (563), UnPackTime (566)

Listing: ./dosex/ex9.pp

```

Program Example9;
uses Dos;

{ Program to demonstrate the GetFTime function. }

Function L0(w:word):string;
var
  s : string;
begin
  Str(w,s);
  if w<10 then
    L0:='0'+s
  else
    L0:=s;
end;

var
  f      : File;
  Time   : Longint;
  DT     : DateTime;
begin
  if ParamCount>0 then
    Assign(f,ParamStr(1))
  else
    Assign(f, 'ex9.pp' );
  Reset(f);
  GetFTime(f, Time);
  Close(f);
  UnPackTime(Time,DT);
  Write ('File ',ParamStr(1), ' is last modified on ');
  Writeln (L0(DT.Month), '-', L0(DT.Day), '-', DT.Year,
           ' at ', L0(DT.Hour), ':', L0(DT.Min));
end.

```

10.10.21 GetIntVec

Synopsis: Get interrupt vector

Declaration: procedure GetIntVec(intno: Byte; var vector: pointer)

Visibility: default

Description: GetIntVec returns the address of interrupt vector IntNo.

Remark: This call does nothing, it is present for compatibility only. Modern systems do not allow low level access to the hardware.

Errors: None.

See also: SetIntVec ([565](#))

10.10.22 GetLongName

Synopsis: Get the long filename of a DOS 8.3 filename.

Declaration: function GetLongName(var p: string) : Boolean

Visibility: default

Description: This function is only implemented in the GO32V2 and Win32 versions of Free Pascal.

GetLongName changes the filename p to a long filename if the API call to do this is successful.
The resulting string is the long file name corresponding to the short filename p.

The function returns True if the API call was successful, False otherwise.

This function should only be necessary when using the DOS extender under Windows 95 and higher.

Errors: If the API call was not succesfull, False is returned.

See also: GetShortName ([560](#))

10.10.23 GetMsCount

Synopsis: Number of milliseconds since a starting point.

Declaration: function GetMsCount : Int64

Visibility: default

Description: GetMSCount returns a number of milliseconds elapsed since a certain moment in time. This moment in time is implementation dependent. This function is used for timing purposes: Subtracting the results of 2 subsequent calls to this function returns the number of milliseconds elapsed between the two calls.

This call is not very reliable, it is recommended to use some system specific calls for timings.

See also: GetTime ([561](#))

10.10.24 GetShortName

Synopsis: Get the short (8.3) filename of a long filename.

Declaration: function GetShortName(var p: string) : Boolean

Visibility: default

Description: This function is only implemented in the GO32V2 and Win32 versions of Free Pascal.

GetShortName changes the filename p to a short filename if the API call to do this is successful.
The resulting string is the short file name corresponding to the long filename p.

The function returns True if the API call was successful, False otherwise.

This function should only be necessary when using the DOS extender under Windows 95 and higher.

Errors: If the API call was not successful, `False` is returned.

See also: [GetLongName \(560\)](#)

10.10.25 GetTime

Synopsis: Return the current time

Declaration: `procedure GetTime(var hour: Word; var minute: Word; var second: Word;
var sec100: Word)`

Visibility: default

Description: `GetTime` returns the system's time. `Hour` is a on a 24-hour time scale. `sec100` is in hundredth of a second.

Remark: Certain operating systems (such as Amiga), always set the `sec100` field to zero.

Errors: None.

See also: [GetDate \(557\)](#), [SetTime \(565\)](#)

Listing: `./dosex/ex3.pp`

```
Program Example3;
uses Dos;

{ Program to demonstrate the GetTime function. }

Function L0(w:word):string;
var
  s : string;
begin
  Str(w,s);
  if w<10 then
    L0 := '0'+s
  else
    L0:=s;
end;

var
  Hour,Min,Sec,HSec : word;
begin
  GetTime(Hour,Min,Sec,HSec);
  WriteLn('Current time');
  WriteLn(L0(Hour),':',L0(Min),':',L0(Sec));
end.
```

10.10.26 GetVerify

Synopsis: Get verify flag

Declaration: `procedure GetVerify(var verify: Boolean)`

Visibility: default

Description: `GetVerify` returns the status of the verify flag under dos. When `Verify` is `True`, then dos checks data which are written to disk, by reading them after writing. If `Verify` is `False`, then data written to disk are not verified.

Remark: Under non-dos systems (excluding os/2 applications running under vanilla DOS), `Verify` is always `True`.

Errors: None.

See also: `SetVerify` ([565](#))

10.10.27 Intr

Synopsis: Execute interrupt

Declaration: `procedure Intr(intno: Byte; var regs: Registers)`

Visibility: default

Description: `Intr` executes a software interrupt number `IntNo` (must be between 0 and 255), with processor registers set to `Regs`. After the interrupt call returned, the processor registers are saved in `Regs`.

Remark: Under non-dos operating systems, this call does nothing.

Errors: None.

See also: `MSDos` ([562](#))

10.10.28 Keep

Synopsis: Terminate and stay resident.

Declaration: `procedure Keep(exitcode: Word)`

Visibility: default

Description: `Keep` terminates the program, but stays in memory. This is used for TSR (Terminate Stay Resident) programs which catch some interrupt. `ExitCode` is the same parameter as the `Halt` function takes.

Remark: This call does nothing, it is present for compatibility only.

Errors: None.

10.10.29 MSDos

Synopsis: Execute MS-DOS system call

Declaration: `procedure MSDos(var regs: Registers)`

Visibility: default

Description: `MSDos` executes an operating system call. This is the same as doing a `Intr` call with the interrupt number for an os call.

Remark: Under non-dos operating systems, this call does nothing. On DOS systems, this calls interrupt \$21.

Errors: None.

See also: `Intr` ([562](#))

10.10.30 PackTime

Synopsis: Pack DateTime value to a packed-time format.

Declaration: procedure PackTime(var t: DateTime; var p: LongInt)

Visibility: default

Description: UnPackTime converts the date and time specified in T to a packed-time format which can be fed to SetFTime.

Errors: None.

See also: SetFTime (565), FindFirst (554), FindNext (555), UnPackTime (566)

Listing: ./dosex/ex4.pp

```

Program Example4;
uses Dos;

{ Program to demonstrate the PackTime and UnPackTime functions. }

var
  DT    : DateTime;
  Time : longint;
begin
  with DT do
  begin
    Year:=2008;
    Month:=11;
    Day:=11;
    Hour:=11;
    Min:=11;
    Sec:=11;
  end;
  PackTime(DT, Time);
  WriteLn( 'Packed Time : ', Time );
  UnPackTime( Time, DT );
  WriteLn( 'Unpacked Again:' );
  with DT do
  begin
    WriteLn( 'Year    ', Year );
    WriteLn( 'Month   ', Month );
    WriteLn( 'Day     ', Day );
    WriteLn( 'Hour    ', Hour );
    WriteLn( 'Min     ', Min );
    WriteLn( 'Sec     ', Sec );
  end;
end.

```

10.10.31 SetCBreak

Synopsis: Set Control-Break flag status

Declaration: procedure SetCBreak(breakvalue: Boolean)

Visibility: default

Description: SetCBreak sets the status of CTRL-Break checking. When BreakValue is false, then dos only checks for the CTRL-Break key-press when I/O is performed. When it is set to True, then a check is done at every system call.

Remark: Under non-dos and non-Amiga operating systems, this call does nothing.

Errors: None.

See also: GetCBreak ([556](#))

10.10.32 SetDate

Synopsis: Set system date

Declaration: procedure SetDate(year: Word; month: Word; day: Word)

Visibility: default

Description: SetDate sets the system's internal date. Year is a number between 1980 and 2099.

Remark: On a unix machine, there must be root privileges, otherwise this routine will do nothing. On other unix systems, this call currently does nothing.

Errors: None.

See also: GetDate ([557](#)), SetTime ([565](#))

10.10.33 SetFAttr

Synopsis: Set file attributes

Declaration: procedure SetFAttr(var f; attr: Word)

Visibility: default

Description: SetFAttr sets the file attributes of the file-variable F. F can be a untyped or typed file, or of type Text. F must have been assigned, but not opened. The attributes can be a sum of the following constants:

- ReadOnly
- Hidden
- SysFile
- VolumeId
- Directory
- Archive

Remark: Under unix like systems (such as linux and BeOS) the call exists, but is not implemented, i.e. it does nothing.

Errors: Errors are reported in DosError.

See also: GetFAttr ([558](#))

10.10.34 SetFTime

Synopsis: Set file modification time.

Declaration: procedure SetFTime(var f;time: LongInt)

Visibility: default

Description: SetFTime sets the modification time of a file, this time is encoded and must be encoded with PackTime. F must be a file type, which has been assigned, and opened.

Remark: Under unix like systems (such as linux and BeOS) the call exists, but is not implemented, i.e. it does nothing.

Errors: Errors are reported in DosError

See also: GetFTime ([559](#)), PackTime ([563](#)), UnPackTime ([566](#))

10.10.35 SetIntVec

Synopsis: Set interrupt vector

Declaration: procedure SetIntVec(intno: Byte;vector: pointer)

Visibility: default

Description: SetIntVec sets interrupt vector IntNo to Vector. Vector should point to an interrupt procedure.

Remark: This call does nothing, it is present for compatibility only.

Errors: None.

See also: GetIntVec ([559](#))

10.10.36 SetTime

Synopsis: Set system time

Declaration: procedure SetTime(hour: Word;minute: Word;second: Word;sec100: Word)

Visibility: default

Description: SetTime sets the system's internal clock. The Hour parameter is on a 24-hour time scale.

Remark: On a linux machine, there must be root privileges, otherwise this routine will do nothing. On other unix systems, this call currently does nothing.

Errors: None.

See also: GetTime ([561](#)), SetDate ([564](#))

10.10.37 SetVerify

Synopsis: Set verify flag

Declaration: procedure SetVerify(verify: Boolean)

Visibility: default

Description: SetVerify sets the status of the verify flag under dos. When Verify is True, then dos checks data which are written to disk, by reading them after writing. If Verify is False, then data written to disk are not verified.

Remark: Under non-dos operating systems (excluding os/2 applications running under vanilla dos), Verify is always True.

Errors: None.

See also: SetVerify ([565](#))

10.10.38 SwapVectors

Synopsis: Swap interrupt vectors

Declaration: procedure SwapVectors

Visibility: default

Description: SwapVectors swaps the contents of the internal table of interrupt vectors with the current contents of the interrupt vectors. This is called typically in before and after an Exec call.

Remark: Under certain operating systems, this routine may be implemented as an empty stub.

Errors: None.

See also: Exec ([553](#)), SetIntVec ([565](#))

10.10.39 UnixDateToDt

Synopsis: Convert a unix timestamp to a DateTime record

Declaration: procedure UnixDateToDt (SecsPast: LongInt; var Dt: DateTime)

Visibility: default

Description: DTToUnixDate converts the unix timestamp value in SecsPast to a DateTime representation in DT. It is an internal function, implemented on Unix platforms, and should not be used.

Errors: None.

See also: DTToUnixDate ([551](#)), PackTime ([563](#)), UnpackTime ([566](#)), GetTime ([561](#)), SetTime ([565](#))

10.10.40 UnpackTime

Synopsis: Unpack packed file time to a DateTime value

Declaration: procedure UnpackTime (p: LongInt; var t: DateTime)

Visibility: default

Description: UnPackTime converts the file-modification time in p to a DateTime record. The file-modification time can be returned by GetFTime, FindFirst or FindNext calls.

For an example, see PackTime ([563](#)).

Errors: None.

See also: GetFTime ([559](#)), FindFirst ([554](#)), FindNext ([555](#)), PackTime ([563](#))

10.10.41 weekday

Synopsis: Return the day of the week

Declaration: function weekday(y: LongInt;m: LongInt;d: LongInt) : LongInt

Visibility: default

Description: WeekDay returns the day of the week on which the day Y/M/D falls. Sunday is represented by 0, Saturday is 6.

Errors: On error, -1 is returned.

See also: PackTime ([563](#)), UnpackTime ([566](#)), GetTime ([561](#)), SetTime ([565](#))

Chapter 11

Reference for unit 'dxe_load'

11.1 Overview

The dxe_load unit was implemented by Pierre Mueller for dos, it allows to load a DXE file (an object file with 1 entry point) into memory and return a pointer to the entry point.

It exists only for dos.

11.2 Procedures and functions

11.2.1 dxe_load

Synopsis: Load DXE file in memory

Declaration: function dxe_load(filename: string) : pointer

Visibility: default

Description: dxe_load loads the contents of the file `filename` into memory. It performs the necessary relocations in the object code, and returns then a pointer to the entry point of the code.

For an example, see the emu387 ([572](#)) unit in the RTL.

Errors: If an error occurs during the load or relocations, `Nil` is returned.

Chapter 12

Reference for unit 'dynlibs'

12.1 Overview

The **Dynlibs** unit provides support for dynamically loading shared libraries. It is available only on those platforms that support shared libraries. The functionality available here may only be a part of the functionality available on each separate platform, in the interest of portability.

On unix platforms, using this unit will cause the program to be linked to the C library, as most shared libraries are implemented in C and the dynamical linker too.

12.2 Constants, types and variables

12.2.1 Constants

```
NilHandle = (0)
```

Correctly typed Nil handle - returned on error by LoadLibrary ([571](#))

```
SharedSuffix = 'so'
```

`SharedSuffix` contains the extension of a shared library (dynamically loadable library) on the current platform. It does not contain the . (dot) character. This can be used to determine the name of a shared library in a platform independent way.

12.2.2 Types

```
HModule = TLibHandle
```

Alias for `TLibHandle` ([569](#)) type.

```
TLibHandle = PtrInt
```

`TLibHandle` should be considered an opaque type. It is defined differently on various platforms. The definition shown here depends on the platform for which the documentation was generated.

12.3 Procedures and functions

12.3.1 FreeLibrary

Synopsis: For compatibility with Delphi/Windows: Unload a library

Declaration: `function FreeLibrary(Lib: TLibHandle) : Boolean`

Visibility: default

Description: `FreeLibrary` provides the same functionality as `UnloadLibrary` ([571](#)), and is provided for compatibility with Delphi.

See also: `UnloadLibrary` ([571](#))

12.3.2 GetLoadErrorStr

Declaration: `function GetLoadErrorStr : string`

Visibility: default

12.3.3 GetProcAddress

Synopsis: For compatibility with Delphi/Windows: Get the address of a procedure

Declaration: `function GetProcAddress(Lib: TLibHandle; const ProcName: AnsiString) : Pointer`

Visibility: default

Description: `GetProcAddress` provides the same functionality as `GetProcedureAddress` ([570](#)), and is provided for compatibility with Delphi.

See also: `GetProcedureAddress` ([570](#))

12.3.4 GetProcedureAddress

Synopsis: Get the address of a procedure or symbol in a dynamic library.

Declaration: `function GetProcedureAddress(Lib: TLibHandle; const ProcName: AnsiString) : Pointer`

Visibility: default

Description: `GetProcedureAddress` returns a pointer to the location in memory of the symbol `ProcName` in the dynamically loaded library specified by its handle `lib`. If the symbol cannot be found or the handle is invalid, `Nil` is returned.

On Windows, only an exported procedure or function can be searched this way. On Unix platforms the location of any exported symbol can be retrieved this way.

Errors: If the symbol cannot be found, `Nil` is returned.

See also: `LoadLibrary` ([571](#)), `UnLoadLibrary` ([571](#))

12.3.5 LoadLibrary

Synopsis: Load a dynamic library and return a handle to it.

Declaration: function LoadLibrary(const Name: AnsiString) : TLibHandle

Visibility: default

Description: LoadLibrary loads a dynamic library in file Name and returns a handle to it. If the library cannot be loaded, NilHandle ([569](#)) is returned.

No assumptions should be made about the location of the loaded library if a relative pathname is specified. The behaviour is dependent on the platform. Therefore it is best to specify an absolute pathname if possible.

Errors: On error, NilHandle ([569](#)) is returned.

See also: UnloadLibrary ([571](#)), GetProcAddress ([570](#))

12.3.6 SafeLoadLibrary

Synopsis: Saves the control word and loads a library

Declaration: function SafeLoadLibrary(const Name: AnsiString) : TLibHandle

Visibility: default

Description: SafeLoadLibrary saves the FPU control word, and calls LoadLibrary ([571](#)) with library name Name. After that function has returned, the FPU control word is saved again. (only on Intel i386 CPUS).

See also: LoadLibrary ([571](#))

12.3.7 UnloadLibrary

Synopsis: Unload a previously loaded library

Declaration: function UnloadLibrary(Lib: TLibHandle) : Boolean

Visibility: default

Description: UnloadLibrary unloads a previously loaded library (specified by the handle lib). The call returns True if succesful, False otherwisa.

Errors: On error, False is returned.

See also: LoadLibrary ([571](#)), GetProcAddress ([570](#))

Chapter 13

Reference for unit 'emu387'

13.1 Overview

The emu387 unit was written by Pierre Mueller for dos. It sets up the coprocessor emulation for FPC under dos. It is not necessary to use this unit on other OS platforms because they either simply do not run on a machine without coprocessor, or they provide the coprocessor emulation themselves. It shouldn't be necessary to use the function in this unit, it should be enough to place this unit in the uses clause of your program to enable the coprocessor emulation under dos. The unit initialization code will try and load the coprocessor emulation code and initialize it.

13.2 Procedures and functions

13.2.1 npxsetup

Synopsis: Set up coprocessor emulation.

Declaration: procedure npxsetup(prog_name: string)

Visibility: default

Description: npxsetup checks whether a coprocessor is found. If not, it loads the file `wmemu387.dxe` into memory and initializes the code in it.

If the environment variable `387` is set to `N`, then the emulation will be loaded, even if there is a coprocessor present. If the variable doesn't exist, or is set to any other value, the unit will try to detect the presence of a coprocessor unit.

The function searches the file `wmemu387.dxe` in the following way:

- 1.If the environment variable `EMU387` is set, then it is assumed to point at the `wmemu387.dxe` file.
- 2.if the environment variable `EMU387` does not exist, then the function will take the path part of `prog_name` and look in that directory for the file `wmemu387.dxe`.

It should never be necessary to call this function, because the initialization code of the unit contains a call to the function with as an argument `paramstr(0)`. This means that you should deliver the file `wmemu387.dxe` together with your program.

Errors: If there is an error, an error message is printed to standard error, and the program is halted, since any floating-point code is bound to fail anyhow.

Chapter 14

Reference for unit 'exeinfo'

14.1 Overview

The `exeinfo` unit implements some cross-platform routines to examine the contents of an executable: information about sections, mapping addresses to loaded modules etc.

It is mainly used by the `lineinfo` (739) and `Infodwrf` (762) unit to examine the binary for debug info.

14.2 Constants, types and variables

14.2.1 Types

```
TExeFile = record
  f : File;
  size : Int64;
  isopen : Boolean;
  nsects : LongInt;
  sechdrofs : ptruint;
  secstrofs : ptruint;
  processaddress : ptruint;
  FunctionRelative : Boolean;
  ImgOffset : ptruint;
  filename : string;
  buf : Array[0..4095] of Byte;
  bufsize : LongInt;
  bufcnt : LongInt;
end
```

`TExeFile` is a record used in the various calls of this unit. It contains a file descriptor, and various fields that describe the executable.

The structure of `TExeFile` is opaque, that is, one shouldn't rely on the exactness of this structure, it may change any time in the future.

14.3 Procedures and functions

14.3.1 CloseExeFile

Synopsis: Close a previously opened file.

Declaration: `function CloseExeFile(var e: TExeFile) : Boolean`

Visibility: default

Description: `CloseExeFile` closes an executable file image previously opened with `OpenExeFile` (574), and represented by `e`.

The function returns `True` if the file was closed successfully, or `False` if something went wrong.

Errors: In case of an error, `False` is returned.

See also: `OpenExeFile` (574)

14.3.2 FindExeSection

Synopsis: Find a section in the binary image.

Declaration: `function FindExeSection(var e: TExeFile; const secname: string;
var secofs: LongInt; var seclen: LongInt)
: Boolean`

Visibility: default

Description: `FindExeSection` examines the binary that was opened with `OpenExeFile` (574) (represented by `e`) and searches for the section named `secname`. If found, the section offset is returned in `secofs` and the section length (in bytes) is returned in `seclen`.

The function returns `True` if the section was found, `False` if not.

See also: `OpenExeFile` (574)

14.3.3 GetModuleByAddr

Synopsis: Return the module name by address

Declaration: `procedure GetModuleByAddr(addr: pointer; var baseaddr: pointer;
var filename: string)`

Visibility: default

Description: `GetModuleByAddr` returns the name of the module that contains address `addr`. If successful, it returns `True` and returns the filename in `FileName` and the base address at which it is loaded in `BaseAddr`.

14.3.4 OpenExeFile

Synopsis: Open an executable file

Declaration: `function OpenExeFile(var e: TExeFile; const fn: string) : Boolean`

Visibility: default

Description: OpenExeFile opens the executable file `fn` and initializes the structure `e` for subsequent calls to routines in the `exeinfo` unit.

The function returns `True` if the file was opened successfully, `false` otherwise.

See also: [FindExeSection \(574\)](#), [CloseExeFile \(574\)](#), [ReadDebugLink \(575\)](#)

14.3.5 ReadDebugLink

Synopsis: Read the location of a debug info filename

Declaration: `function ReadDebugLink(var e: TExeFile; var dbgfn: string) : Boolean`

Visibility: default

Description: `ReadDebugLink` examines the `.gnu_debuglink` section to see if the debug information is stored in an external file. If so, then the name of the file with the debug information is returned in the `dbgfn` parameter.

The function returns `false` if there is no external debug information file, or if the file with debug information does not exist. It is searched next to the binary file or in the current directory.

See also: [OpenExeFile \(574\)](#), [CloseExeFile \(574\)](#)

Chapter 15

Reference for unit 'getopts'

15.1 Overview

This document describes the GETOPTS unit for Free Pascal. It was written for linux by Michael Van Canneyt. It now also works for all supported platforms.

The getopts unit provides a mechanism to handle command-line options in a structured way, much like the GNU getopt mechanism. It allows you to define the valid options for your program, and the unit will then parse the command-line options for you, and inform you of any errors.

15.2 Constants, types and variables

15.2.1 Constants

EndOfOptions = #255

Returned by getopt ([578](#)),getlongopts ([578](#)) to indicate that there are no more options.

No_Argument = 0

Specifies that a long option does not take an argument.

Optional_Argument = 2

Specifies that a long option optionally takes an argument.

OptSpecifier : Set of Char = ['-']

Character indicating an option on the command-line.

Required_Argument = 1

Specifies that a long option needs an argument.

15.2.2 Types

```
Orderings = (require_order, permute, return_in_order)
```

Table 15.1: Enumeration values for type Orderings

Value	Explanation
permute	Change command-line options.
require_order	Don't touch the ordering of the command-line options
return_in_order	Return options in the correct order.

Command-line ordering options.

```
POption = ^TOption
```

Pointer to TOption ([577](#)) record.

```
TOption = record
  Name : string;
  Has_arg : Integer;
  Flag : PChar;
  Value : Char;
end
```

The TOption type is used to communicate the long options to GetLongOpts ([578](#)). The Name field is the name of the option. Has_arg specifies if the option wants an argument, Flag is a pointer to a char, which is set to Value, if it is non-nil.

15.2.3 Variables

```
OptArg : string
```

Set to the argument of an option, if the option needs one.

```
OptErr : Boolean
```

Indicates whether getopt () prints error messages.

```
OptInd : LongInt
```

when all options have been processed, optind is the index of the first non-option parameter. This is a read-only variable. Note that it can become equal to paramcount+1.

```
OptOpt : Char
```

In case of an error, contains the character causing the error.

15.3 Procedures and functions

15.3.1 GetLongOpts

Synopsis: Return next long option.

Declaration: function GetLongOpts(ShortOpts: string; LongOpts: POption;
var LongInd: LongInt) : Char

Visibility: default

Description: Returns the next option found on the command-line, taking into account long options as well. If no more options are found, returns EndOfOptions. If the option requires an argument, it is returned in the OptArg variable.

ShortOptions is a string containing all possible one-letter options. (see Getopt ([578](#)) for its description and use) LongOpts is a pointer to the first element of an array of Option records, the last of which needs a name of zero length.

The function tries to match the names even partially (i.e. -app will match e.g. the append option), but will report an error in case of ambiguity. If the option needs an argument, set Has_arg to Required_argument, if the option optionally has an argument, set Has_arg to Optional_argument. If the option needs no argument, set Has_arg to zero.

Required arguments can be specified in two ways :

- 1.Pasted to the option : -option=value
- 2.As a separate argument : -option value

Optional arguments can only be specified through the first method.

Errors: see Getopt ([578](#)).

See also: Getopt ([578](#))

15.3.2 GetOpt

Synopsis: Get next short option.

Declaration: function GetOpt(ShortOpts: string) : Char

Visibility: default

Description: Returns the next option found on the command-line. If no more options are found, returns EndOfOptions. If the option requires an argument, it is returned in the OptArg variable.

ShortOptions is a string containing all possible one-letter options. If a letter is followed by a colon (:), then that option needs an argument. If a letter is followed by 2 colons, the option has an optional argument. If the first character of shortoptions is a '+' then options following a non-option are regarded as non-options (standard Unix behavior). If it is a '-', then all non-options are treated as arguments of a option with character #0. This is useful for applications that require their options in the exact order as they appear on the command-line. If the first character of shortoptions is none of the above, options and non-options are permuted, so all non-options are behind all options. This allows options and non-options to be in random order on the command line.

Errors: Errors are reported through giving back a '?' character. OptOpt then gives the character which caused the error. If OptErr is True then getopt prints an error-message to stdout.

See also: GetLongOpts ([578](#))

Listing: ./optex/optex.pp

```

program testopt;

{ Program to demonstrate the getopt function. }

{
  Valid calls to this program are
  optex --verbose --add me --delete you
  optex --append --create child
  optex -ab -c me -d you
  and so on
}
uses getopt;

var c : char;
      optionindex : Longint;
      theopts : array[1..7] of TOption;

begin
  with theopts[1] do
  begin
    name:='add';
    has_arg:=1;
    flag:=nil;
    value:=#0;
  end;
  with theopts[2] do
  begin
    name:='append';
    has_arg:=0;
    flag:=nil;
    value:=#0;
  end;
  with theopts[3] do
  begin
    name:='delete';
    has_arg:=1;
    flag:=nil;
    value:=#0;
  end;
  with theopts[4] do
  begin
    name:='verbose';
    has_arg:=0;
    flag:=nil;
    value:=#0;
  end;
  with theopts[5] do
  begin
    name:='create';
    has_arg:=1;
    flag:=nil;
    value:='c'
  end;
  with theopts[6] do
  begin
    name:='file';
    has_arg:=1;
  
```

```

    flag:=nil;
    value:=#0;
end;
with theopts[7] do
begin
  name:='';
  has_arg:=0;
  flag:=nil;
end;
c:=#0;
repeat
  c:=getlongopts('abc:d:012',@theopts[1],optionindex);
  case c of
    '1','2','3','4','5','6','7','8','9':
      begin
        writeln ('Got optind : ',c)
      end;
    #0 : begin
      write ('Long option : ',theopts[optionindex].name);
      if theopts[optionindex].has_arg>0 then
        writeln (' With value : ',optarg)
      else
        writeln
      end;
    'a' : writeln ('Option a.');
    'b' : writeln ('Option b.');
    'c' : writeln ('Option c : ', optarg);
    'd' : writeln ('Option d : ', optarg);
    '?',':' : writeln ('Error with opt : ',optopt);
  end; { case }
until c=endofoptions;
if optind<=paramcount then
begin
  write ('Non options : ');
  while optind<=paramcount do
    begin
      write (paramstr(optind), ' ');
      inc(optind)
    end;
  writeln
end
end.

```

Chapter 16

Reference for unit 'go32'

16.1 Overview

This document describes the GO32 unit for the Free Pascal compiler under dos. It was donated by Thomas Schatzl (tom_at_work@geocities.com), for which my thanks. This unit was first written for dos by Florian Klaempfl.

Only the GO32V2 DPMI mode is discussed by me here due to the fact that new applications shouldn't be created with the older GO32V1 model. The go32v2 version is much more advanced and better. Additionally a lot of functions only work in DPMI mode anyway. I hope the following explanations and introductions aren't too confusing at all. If you notice an error or bug send it to the FPC mailing list or directly to me. So let's get started and happy and error free coding I wish you.... Thomas Schatzl, 25. August 1998

16.2 Real mode callbacks

The callback mechanism can be thought of as the converse of calling a real mode procedure (i.e. interrupt), which allows your program to pass information to a real mode program, or obtain services from it in a manner that's transparent to the real mode program. In order to make a real mode callback available, you must first get the real mode callback address of your procedure and the selector and offset of a register data structure. This real mode callback address (this is a segment:offset address) can be passed to a real mode program via a software interrupt, a dos memory block or any other convenient mechanism. When the real mode program calls the callback (via a far call), the DPMI host saves the registers contents in the supplied register data structure, switches into protected mode, and enters the callback routine with the following settings:

- interrupts disabled
- %CS : %EIP = 48 bit pointer specified in the original call to `get_rm_callback` ([602](#))
- %DS : %ESI = 48 bit pointer to to real mode SS : SP
- %ES : %EDI = 48 bit pointer of real mode register data structure.
- %SS : %ESP = locked protected mode stack
- All other registers undefined

The callback procedure can then extract its parameters from the real mode register data structure and/or copy parameters from the real mode stack to the protected mode stack. Recall that the segment

register fields of the real mode register data structure contain segment or paragraph addresses that are not valid in protected mode. Far pointers passed in the real mode register data structure must be translated to virtual addresses before they can be used with a protected mode program. The callback procedure exits by executing an IRET with the address of the real mode register data structure in %ES : %EDI, passing information back to the real mode caller by modifying the contents of the real mode register data structure and/or manipulating the contents of the real mode stack. The callback procedure is responsible for setting the proper address for resumption of real mode execution into the real mode register data structure; typically, this is accomplished by extracting the return address from the real mode stack and placing it into the %CS : %EIP fields of the real mode register data structure. After the IRET, the DPMI host switches the CPU back into real mode, loads ALL registers with the contents of the real mode register data structure, and finally returns control to the real mode program. All variables and code touched by the callback procedure MUST be locked to prevent page faults.

See also: [get_rm_callback \(602\)](#), [free_rm_callback \(598\)](#), [lock_code \(611\)](#), [lock_data \(611\)](#)

16.3 Executing software interrupts

Simply execute a realintr() call with the desired interrupt number and the supplied register data structure. But some of these interrupts require you to supply them a pointer to a buffer where they can store data to or obtain data from in memory. These interrupts are real mode functions and so they only can access the first Mb of linear address space, not FPC's data segment. For this reason FPC supplies a pre-initialized dos memory location within the GO32 unit. This buffer is internally used for dos functions too and so its contents may change when calling other procedures. Its size can be obtained with tb_size (620) and its linear address via transfer_buffer (620). Another way is to allocate a completely new dos memory area via the global_dos_alloc (608) function for your use and supply its real mode address.

See also: [tb_size \(620\)](#), [transfer_buffer \(620\)](#), [global_dos_alloc \(608\)](#), [global_dos_free \(609\)](#), [realintr \(613\)](#)

Listing: ./go32ex/softint.pp

```
uses
    go32;

var
    r : trealregs;

begin
    r.ah := $30;
    r.al := $01;
    realintr($21, r);
    Writeln('DOS v', r.al, '.', r.ah, ' detected');
end.
```

Listing: ./go32ex/rmpmint.pp

```
uses
    crt,
    go32;

var
    r : trealregs;
    axreg : Word;

    oldint21h : tseginfo;
```

```

        newint21h : tseginfo;
procedure int21h_handler; assembler;
asm
    cmpw $0x3001, %ax
    jne .LCallOld
    movw $0x3112, %ax
    iret

.LCallOld:
    ljmp %cs:oldint21h
end;

procedure resume;
begin
    Writeln;
    Write('-- press any key to resume --'); readkey;
    gotoxy(1, wherey); clreol;
end;

begin
    clrscr;
    Writeln('Executing real mode interrupt');
    resume;
    r.ah := $30; r.al := $01; realintr($21, r);
    Writeln('DOS v', r.al, '.', r.ah, ' detected');
    resume;
    Writeln('Executing protected mode interrupt without our own',
             ' handler');
    Writeln;
    asm
        movb $0x30, %ah
        movb $0x01, %al
        int $0x21
        movw %ax, axreg
    end;
    Writeln('DOS v', r.al, '.', r.ah, ' detected');
    resume;
    Writeln('As you can see the DPMI hosts default protected mode',
             ' handler');
    Writeln('simply redirects it to the real mode handler');
    resume;
    Writeln('Now exchanging the protected mode interrupt with our ',
             'own handler');
    resume;

newint21h.offset := @int21h_handler;
newint21h.segment := get_cs;
get_pm_interrupt($21, oldint21h);
set_pm_interrupt($21, newint21h);

Writeln('Executing real mode interrupt again');
resume;
r.ah := $30; r.al := $01; realintr($21, r);
Writeln('DOS v', r.al, '.', r.ah, ' detected');
Writeln;
Writeln('See, it didn''t change in any way.');
resume;
Writeln('Now calling protected mode interrupt');
```

```

resume;
asm
    movb $0x30, %ah
    movb $0x01, %al
    int $0x21
    movw %ax, axreg
end;
Writeln('DOS v', lo(axreg), '.', hi(axreg), ' detected');
Writeln;
Writeln('Now you can see that there ''s a distinction between ',
      'the two ways of calling interrupts ...');
set_pm_interrupt($21, oldint21h);
end.

```

16.4 Software interrupts

Ordinarily, a handler installed with `set_pm_interrupt` (617) only services software interrupts that are executed in protected mode; real mode software interrupts can be redirected by `set_rm_interrupt` (618).

See also: `set_rm_interrupt` (618), `get_rm_interrupt` (605), `set_pm_interrupt` (617), `get_pm_interrupt` (602), `lock_data` (611), `lock_code` (611), `enable` (597), `disable` (595), `outportb` (612)

16.5 Hardware interrupts

Hardware interrupts are generated by hardware devices when something unusual happens; this could be a keypress or a mouse move or any other action. This is done to minimize CPU time, else the CPU would have to check all installed hardware for data in a big loop (this method is called 'polling') and this would take much time. A standard IBM-PC has two interrupt controllers, that are responsible for these hardware interrupts: both allow up to 8 different interrupt sources (IRQs, interrupt requests). The second controller is connected to the first through IRQ 2 for compatibility reasons, e.g. if controller 1 gets an IRQ 2, he hands the IRQ over to controller 2. Because of this up to 15 different hardware interrupt sources can be handled. IRQ 0 through IRQ 7 are mapped to interrupts 8h to Fh and the second controller (IRQ 8 to 15) is mapped to interrupt 70h to 77h. All of the code and data touched by these handlers MUST be locked (via the various locking functions) to avoid page faults at interrupt time. Because hardware interrupts are called (as in real mode) with interrupts disabled, the handler has to enable them before it returns to normal program execution. Additionally a hardware interrupt must send an EOI (end of interrupt) command to the responsible controller; this is accomplished by sending the value 20h to port 20h (for the first controller) or A0h (for the second controller). The following example shows how to redirect the keyboard interrupt.

Listing: ./go32ex/keyclick.pp

```

{$ASMMODE ATT}
{$MODE FPC}

uses
    crt,
    go32;

const
    kbdint = $9;

```

```

var
    oldint9_handler : tseginfo;
    newint9_handler : tseginfo;

    clickproc : pointer;
    backupDS : Word; external name '___v2prt0_ds_alias';

procedure int9_handler; assembler;
asm
    cli
    pushl %ds
    pushl %es
    pushl %fs
    pushl %gs
    pushal
    movw %cs:backupDS, %ax
    movw %ax, %ds
    movw %ax, %es
    movw dosmemselector, %ax
    movw %ax, %fs
    call *clickproc
    popal
    popl %gs
    popl %fs
    popl %es
    popl %ds
    ljmp %cs:oldint9_handler
end;
procedure int9_dummy; begin end;

procedure clicker;
begin
    sound(500); delay(10); nosound;
end;
procedure clicker_dummy; begin end;

procedure install_click;
begin
    clickproc := @clicker;
    lock_data(clickproc, sizeof(clickproc));
    lock_data(dosmemselector, sizeof(dosmemselector));

    lock_code(@clicker,
              longint(@clicker_dummy) - longint(@clicker));
    lock_code(@int9_handler,
              longint(@int9_dummy)-longint(@int9_handler));
    newint9_handler.offset := @int9_handler;
    newint9_handler.segment := get_cs;
    get_pm_interrupt(kbdint, oldint9_handler);
    set_pm_interrupt(kbdint, newint9_handler);
end;

procedure remove_click;
begin
    set_pm_interrupt(kbdint, oldint9_handler);
    unlock_data(dosmemselector, sizeof(dosmemselector));
    unlock_data(clickproc, sizeof(clickproc));

```

```

        unlock_code(@clicker,
            longint(@clicker_dummy)-longint(@clicker));
        unlock_code(@int9_handler,
            longint(@int9_dummy)-longint(@int9_handler));
end;

var
    ch : char;

begin
    install_click;
    Writeln('Enter any message. Press return when finished');
    while (ch <> #13) do begin
        ch := readkey; write(ch);
    end;
    remove_click;
end.

```

16.6 Disabling interrupts

The GO32 unit provides the two procedures disable() and enable() to disable and enable all interrupts.

16.7 Creating your own interrupt handlers

Interrupt redirection with FPC pascal is done via the set_pm_interrupt() for protected mode interrupts or via the set_rm_interrupt() for real mode interrupts.

16.8 Protected mode interrupts vs. Real mode interrupts

As mentioned before, there's a distinction between real mode interrupts and protected mode interrupts; the latter are protected mode programs, while the former must be real mode programs. To call a protected mode interrupt handler, an assembly 'int' call must be issued, while the other is called via the realintr() or intr() function. Consequently, a real mode interrupt then must either reside in dos memory (<1MB) or the application must allocate a real mode callback address via the get_rm_callback() function.

16.9 Handling interrupts with DPMI

The interrupt functions are real-mode procedures; they normally can't be called in protected mode without the risk of an protection fault. So the DPMI host creates an interrupt descriptor table for the application. Initially all software interrupts (except for int 31h, 2Fh and 21h function 4Ch) or external hardware interrupts are simply directed to a handler that reflects the interrupt in real-mode, i.e. the DPMI host's default handlers switch the CPU to real-mode, issue the interrupt and switch back to protected mode. The contents of general registers and flags are passed to the real mode handler and the modified registers and flags are returned to the protected mode handler. Segment registers and stack pointer are not passed between modes.

16.10 Interrupt redirection

Interrupts are program interruption requests, which in one or another way get to the processor; there's a distinction between software and hardware interrupts. The former are explicitly called by an 'int' instruction and are a bit comparable to normal functions. Hardware interrupts come from external devices like the keyboard or mouse. Functions that handle hardware interrupts are called handlers.

16.11 Processor access

These are some functions to access various segment registers (%cs, %ds, %ss) which makes your work a bit easier.

See also: [get_cs \(598\)](#), [get_ds \(599\)](#), [get_ss \(607\)](#)

16.12 I/O port access

The I/O port access is done via the various [inportb \(609\)](#), [outportb \(612\)](#) functions which are available. Additionally Free Pascal supports the Turbo Pascal PORT[]-arrays but it is by no means recommended to use them, because they're only for compatibility purposes.

See also: [outportb \(612\)](#), [inportb \(609\)](#)

16.13 dos memory access

Dos memory is accessed by the predefined `dosmemselector` selector; the GO32 unit additionally provides some functions to help you with standard tasks, like copying memory from heap to dos memory and the likes. Because of this it is strongly recommended to use them, but you are still free to use the provided standard memory accessing functions which use 48 bit pointers. The third, but only thought for compatibility purposes, is using the `mem[]`-arrays. These arrays map the whole 1 Mb dos space. They shouldn't be used within new programs. To convert a segment:offset real mode address to a protected mode linear address you have to multiply the segment by 16 and add its offset. This linear address can be used in combination with the DOSMEMSELECTOR variable.

See also: [dosmemget \(589\)](#), [dosmemput \(589\)](#), [dosmemmove \(589\)](#), [dosmemfillchar \(588\)](#), [dosmemfillword \(589\)](#), [seg_move \(616\)](#), [seg_fillchar \(615\)](#), [seg_fillword \(616\)](#)

16.14 FPC specialities

The %ds and %es selector MUST always contain the same value or some system routines may crash when called. The %fs selector is preloaded with the DOSMEMSELECTOR variable at startup, and it MUST be restored after use, because again FPC relies on this for some functions. Luckily we asm programmers can still use the %gs selector for our own purposes, but for how long ?

See also: [get_cs \(598\)](#), [get_ds \(599\)](#), [get_ss \(607\)](#), [allocate_ldt_descriptors \(592\)](#), [free_ldt_descriptor \(597\)](#), [segment_to_descriptor \(614\)](#), [get_next_selector_increment_value \(601\)](#), [get_segment_base_address \(606\)](#), [set_segment_base_address \(619\)](#), [set_segment_limit \(619\)](#), [create_code_segment_alias_descriptor \(595\)](#)

16.15 Selectors and descriptors

Selectors are a bit like real mode segments; they describe (as the name implies) a memory area in protected mode. A descriptor contains information about segment length, its base address and the attributes of it (i.e. type, access rights, ...). These descriptors are stored internally in a so-called descriptor table, which is basically an array of such descriptors. Selectors are roughly an index into this table. Because these 'segments' can be up to 4 GB in size, 32 bits aren't sufficient anymore to describe a single memory location like in real mode. 48 bits are now needed to do this, a 32 bit address and a 16 bit sized selector. The GO32 unit provides the tseginfo record to store such a pointer. But due to the fact that most of the time data is stored and accessed in the %ds selector, FPC assumes that all pointers point to a memory location of this selector. So a single pointer is still only 32 bits in size. This value represents the offset from the data segment base address to this memory location.

16.16 What is DPMI

The dos Protected Mode Interface helps you with various aspects of protected mode programming. These are roughly divided into descriptor handling, access to dos memory, management of interrupts and exceptions, calls to real mode functions and other stuff. Additionally it automatically provides swapping to disk for memory intensive applications. A DPMI host (either a Windows dos box or CWSDPMI.EXE) provides these functions for your programs.

16.17 Constants, types and variables

16.17.1 Constants

`auxcarryflag = $010`

Check for auxiliary carry flag in trealregs ([591](#))

`carryflag = $001`

Check for carry flag in trealregs ([591](#))

`directionflag = $400`

Check for direction flag in trealregs ([591](#))

`dosmemfillchar : procedure(seg: Word;ofs: Word;count: LongInt;c: Char) = @dpmi_dosmemfillchar`

Sets a region of dos memory to a specific byte value.

Parameters:

seg real mode segment.

ofs real mode offset.

count number of bytes to set.

c value to set memory to.

Notes: No range check is performed.

```
dosmemfillword : procedure(seg: Word;ofs: Word;count: LongInt;w: Word) = @dpmi_dosmemfillword
```

Sets a region of dos memory to a specific word value.

Parameters:

seg real mode segment.

ofs real mode offset.

count number of words to set.

w value to set memory to.

Notes: No range check is performed.

```
dosmemget : procedure(seg: Word;ofs: Word;var data;count: LongInt) = @dpmi_dosmemget
```

Copies data from the dos memory onto the heap.

Parameters:

seg source real mode segment.

ofs source real mode offset.

data destination.

count number of bytes to copy.

Notes: No range checking is performed.

For an example, see [global_dos_alloc \(608\)](#).

```
dosmemmove : procedure(sseg: Word;sofs: Word;dseg: Word;dofs: Word;count: LongInt) = @dpmi_dosmemmove
```

Copies count bytes of data between two dos real mode memory locations.

Parameters:

sseg source real mode segment.

sofs source real mode offset.

dseg destination real mode segment.

dofs destination real mode offset.

count number of bytes to copy.

Notes: No range check is performed in any way.

```
dosmemput : procedure(seg: Word;ofs: Word;var data;count: LongInt) = @dpmi_dosmemput
```

Copies heap data to dos real mode memory.

Parameters:

seg destination real mode segment.

ofs destination real mode offset.

data source.

count number of bytes to copy.

Notes: No range checking is performed.

For an example, see [global_dos_alloc \(608\)](#).

interruptflag = \$200

Check for interrupt flag in trealregs ([591](#))

overflowflag = \$800

Check for overflow flag in trealregs ([591](#))

parityflag = \$004

Check for parity flag in trealregs ([591](#))

rm_dpmi = 4

[get_run_mode \(606\)](#) return value: DPMI (e.g. dos box or 386Max)

rm_raw = 1

[get_run_mode \(606\)](#) return value: raw (without HIMEM)

rm_unknown = 0

[get_run_mode \(606\)](#) return value: Unknown runmode

rm_vcpi = 3

[get_run_mode \(606\)](#) return value: VCPI (with HIMEM and EMM386)

rm_xms = 2

[get_run_mode \(606\)](#) return value: XMS (with HIMEM, without EMM386)

signflag = \$080

Check for sign flag in trealregs ([591](#))

trapflag = \$100

Check for trap flag in trealregs ([591](#))

zeroflag = \$040

Check for zero flag in trealregs ([591](#))

16.17.2 Types

```
registers = trealregs
```

Alias for trealregs ([591](#))

```
tmeminfo = record
    available_memory : LongInt;
    available_pages : LongInt;
    available_lockable_pages : LongInt;
    linear_space : LongInt;
    unlocked_pages : LongInt;
    available_physical_pages : LongInt;
    total_physical_pages : LongInt;
    free_linear_space : LongInt;
    max_pages_in_paging_file : LongInt;
    reserved0 : LongInt;
    reserved1 : LongInt;
    reserved2 : LongInt;
end
```

`tmeminfo` Holds information about the memory allocation, etc.

NOTE: The value of a field is -1 (0xffffffff) if the value is unknown, it's only guaranteed, that `available_memory` contains a valid value. The size of the pages can be determined by the `get_page_size()` function.

```
trealregs = record
end
```

The `trealregs` type contains the data structure to pass register values to a interrupt handler or real mode callback.

```
tseginfo = record
    offset : pointer;
    segment : Word;
end
```

This record is used to store a full 48-bit pointer. This may be either a protected mode selector:offset address or in real mode a segment:offset address, depending on application.

See also: Selectors and descriptors, dos memory access, Interrupt redirection

16.17.3 Variables

```
dosmemselector : Word
```

Selector to the dos memory. The whole dos memory is automatically mapped to this single descriptor at startup. This selector is the recommended way to access dos memory.

```
int31error : Word
```

This variable holds the result of a DPMI interrupt call. Any nonzero value must be treated as a critical failure.

16.18 Procedures and functions

16.18.1 allocate_ldt_descriptors

Synopsis: Allocate a number of descriptors

Declaration: function allocate_ldt_descriptors(count: Word) : Word

Visibility: default

Description: Allocates a number of new descriptors.

Parameters:

count:\ specifies the number of requested unique descriptors.

Return value: The base selector.

Remark: Notes: The descriptors allocated must be initialized by the application with other function calls. This function returns descriptors with a limit and size value set to zero. If more than one descriptor was requested, the function returns a base selector referencing the first of a contiguous array of descriptors. The selector values for subsequent descriptors in the array can be calculated by adding the value returned by the get_next_selector_increment_value (601) function.

Errors: Check the int31error (591) variable.

See also: free_ldt_descriptor (597), get_next_selector_increment_value (601), segment_to_descriptor (614), create_code_segment_alias_descriptor (595), set_segment_limit (619), set_segment_base_address (619)

Listing: ./go32ex/seldes.pp

```

{$mode delphi}
uses
  crt,
  go32;

const
  maxx = 80;
  maxy = 25;
  bytespercell = 2;
  screensize = maxx * maxy * bytespercell;

  linB8000 = $B800 * 16;

type
  string80 = string[80];

var
  text_save : array[0..screensize-1] of byte;
  text_oldx, text_oldy : Word;

  text_sel : Word;

procedure status(s : string80);
begin
  gotoxy(1, 1); clreol; write(s); readkey;
end;

procedure selinfo(sel : Word);

```

```

begin
  gotoxy(1, 24);
  clreol; writeln('Descriptor base address : $',
    hexstr(get_segment_base_address(sel), 8));
  clreol; write('Descriptor limit : ', get_segment_limit(sel));
end;

function makechar(ch : char; color : byte) : Word;
begin
  result := byte(ch) or (color shl 8);
end;

begin
  seg_move(dosmemselector, linB8000, get_ds, longint(@text_save),
    screensize);
  text_olidx := wherex; text_oldy := wherey;
  seg_fillword(dosmemselector, linB8000, screensize div 2,
    makechar(' ', Black or (Black shl 4)));
  status('Creating selector ''text_sel'' to a part of ' +
    'text screen memory');
  text_sel := allocate_ldt_descriptors(1);
  set_segment_base_address(text_sel,
    linB8000 + bytespercell * maxx * 1);
  set_segment_limit(text_sel, screensize - 1 - bytespercell *
    maxx * 3);
  selinfo(text_sel);

  status('and clearing entire memory selected by ''text_sel''' +
    ' descriptor');
  seg_fillword(text_sel, 0, (get_segment_limit(text_sel)+1) div 2,
    makechar(' ', LightBlue shl 4));

  status('Notice that only the memory described by the' +
    ' descriptor changed, nothing else');

  status('Now reducing it ''s limit and base and setting it ''s ' +
    'described memory');
  set_segment_base_address(text_sel,
    get_segment_base_address(text_sel) + bytespercell * maxx);
  set_segment_limit(text_sel,
    get_segment_limit(text_sel) - bytespercell * maxx * 2);
  selinfo(text_sel);
  status('Notice that the base addr increased by one line but ' +
    'the limit decreased by 2 lines');
  status('This should give you the hint that the limit is ' +
    'relative to the base');
  seg_fillword(text_sel, 0, (get_segment_limit(text_sel)+1) div 2,
    makechar(#176, LightMagenta or Brown shl 4));

  status('Now let ''s get crazy and copy 10 lines of data from ' +
    'the previously saved screen');
  seg_move(get_ds, longint(@text_save), text_sel,
    maxx * bytespercell * 2, maxx * bytespercell * 10);

  status('At last freeing the descriptor and restoring the old ' +
    'screen contents..');
  status('I hope this little program may give you some hints on '+
    'working with descriptors');

```

```

    free_ldt_descriptor(text_sel);
    seg_move(get_ds, longint(@text_save), dosmemselector,
              linB8000, screensize);
    gotoxy(text_oldx, text_oldy);
end.
```

16.18.2 allocate_memory_block

Synopsis: Allocate a block of linear memory

Declaration: function allocate_memory_block(size: LongInt) : LongInt

Visibility: default

Description: Allocates a block of linear memory.

Parameters:

size: Size of requested linear memory block in bytes.

Returned values: blockhandle - the memory handle to this memory block. Linear address of the requested memory.

Remark: *warning* According to my DPMI docs this function is not implemented correctly. Normally you should also get a blockhandle to this block after successful operation. This handle can then be used to free the memory block afterwards or use this handle for other purposes. Since the function isn't implemented correctly, and doesn't return a blockhandle, the block can't be deallocated and is hence unusable ! This function doesn't allocate any descriptors for this block, it's the applications responsibility to allocate and initialize for accessing this memory.

Errors: Check the int31error ([591](#)) variable.

See also: [free_memory_block](#) ([598](#))

16.18.3 copyfromdos

Synopsis: Copy data from DOS to to heap

Declaration: procedure copyfromdos(var addr; len: LongInt)

Visibility: default

Description: Copies data from the pre-allocated dos memory transfer buffer to the heap.

Parameters:

addr data to copy to.

len number of bytes to copy to heap.

Notes: Can only be used in conjunction with the dos memory transfer buffer.

Errors: Check the int31error ([591](#)) variable.

See also: [tb_size](#) ([620](#)), [transfer_buffer](#) ([620](#)), [copytodos](#) ([595](#))

16.18.4 copytodos

Synopsis: Copy data from heap to DOS memory

Declaration: procedure copytodos(var addr; len: LongInt)

Visibility: default

Description: Copies data from heap to the pre-allocated dos memory buffer.

Parameters:

addrdata to copy from.

lennumber of bytes to copy to dos memory buffer.

Notes: This function fails if you try to copy more bytes than the transfer buffer is in size. It can only be used in conjunction with the transfer buffer.

Errors: Check the int31error ([591](#)) variable.

See also: tb_size ([620](#)), transfer_buffer ([620](#)), copyfromdos ([594](#))

16.18.5 create_code_segment_alias_descriptor

Synopsis: Create new descriptor from existing descriptor

Declaration: function create_code_segment_alias_descriptor(seg: Word) : Word

Visibility: default

Description: Creates a new descriptor that has the same base and limit as the specified descriptor.

Parameters:

segDescriptor.

Return values: The data selector (alias).

Notes: In effect, the function returns a copy of the descriptor. The descriptor alias returned by this function will not track changes to the original descriptor. In other words, if an alias is created with this function, and the base or limit of the original segment is then changed, the two descriptors will no longer map the same memory.

Errors: Check the int31error ([591](#)) variable.

See also: allocate_ldt_descriptors ([592](#)), set_segment_limit ([619](#)), set_segment_base_address ([619](#))

16.18.6 disable

Synopsis: Disable hardware interrupts

Declaration: procedure disable

Visibility: default

Description: Disables all hardware interrupts by execution a CLI instruction.

Errors: None.

See also: enable ([597](#))

16.18.7 dpmi_dosmemfillchar

Synopsis: Fill DOS memory with a character

Declaration: procedure dpmi_dosmemfillchar(seg: Word;ofs: Word;count: LongInt;
c: Char)

Visibility: default

Description: dpmi_dosmemfillchar fills the DOS memory reagion indicated by seg,ofs with count characters c.

See also: dpmi_dosmemput ([597](#)), dpmi_dosmemget ([596](#)), dpmi_dosmemmove ([596](#)), dpmi_dosmemfillword ([596](#))

16.18.8 dpmi_dosmemfillword

Synopsis: Fill DOS memory with a word value

Declaration: procedure dpmi_dosmemfillword(seg: Word;ofs: Word;count: LongInt;
w: Word)

Visibility: default

Description: dpmi_dosmemfillword fills the DOS memory reagion indicated by seg,ofs with count words W.

See also: dpmi_dosmemput ([597](#)), dpmi_dosmemget ([596](#)), dpmi_dosmemfillchar ([596](#)), dpmi_dosmemmove ([596](#))

16.18.9 dpmi_dosmemget

Synopsis: Move data from DOS memory to DPMI memory

Declaration: procedure dpmi_dosmemget(seg: Word;ofs: Word;var data;count: LongInt)

Visibility: default

Description: dpmi_dosmemput moves count bytes of data from the DOS memory location indicated by seg and ofs to DPMI memory indicated by data.

See also: dpmi_dosmemput ([597](#)), dpmi_dosmemmove ([596](#)), dpmi_dosmemfillchar ([596](#)), dpmi_dosmemfillword ([596](#))

16.18.10 dpmi_dosmemmove

Synopsis: Move DOS memory

Declaration: procedure dpmi_dosmemmove(sseg: Word;sofs: Word;dseg: Word;dofs: Word;
count: LongInt)

Visibility: default

Description: dpmi_dosmemmove moves count bytes from DOS memory sseg,sofs to dseg,dofs.

See also: dpmi_dosmemput ([597](#)), dpmi_dosmemget ([596](#)), dpmi_dosmemfillchar ([596](#)), dpmi_dosmemfillword ([596](#))

16.18.11 dpmi_dosmemput

Synopsis: Move data from DPMI memory to DOS memory.

Declaration: procedure dpmi_dosmemput(seg: Word; ofs: Word; var data; count: LongInt)

Visibility: default

Description: dpmi_dosmemput moves count bytes of data from data to the DOS memory location indicated by seg and ofs.

See also: dpmi_dosmemget (596), dpmi_dosmemmove (596), dpmi_dosmemfillchar (596), dpmi_dosmemfillword (596)

16.18.12 enable

Synopsis: Enable hardware interrupts

Declaration: procedure enable

Visibility: default

Description: Enables all hardware interrupts by executing a STI instruction.

Errors: None.

See also: disable (595)

16.18.13 free_ldt_descriptor

Synopsis: Free a descriptor

Declaration: function free_ldt_descriptor(d: Word) : Boolean

Visibility: default

Description: Frees a previously allocated descriptor.

Parameters:

desThe descriptor to be freed.

Return value: True if successful, False otherwise. Notes: After this call this selector is invalid and must not be used for any memory operations anymore. Each descriptor allocated with allocate_ldt_descriptors (592) must be freed individually with this function, even if it was previously allocated as a part of a contiguous array of descriptors.

For an example, see allocate_ldt_descriptors (592).

Errors: Check the int31error (591) variable.

See also: allocate_ldt_descriptors (592), get_next_selector_increment_value (601)

16.18.14 free_memory_block

Synopsis: Free allocated memory block

Declaration: function free_memory_block(blockhandle: LongInt) : Boolean

Visibility: default

Description: Frees a previously allocated memory block.

Parameters:

blockhandlethe handle to the memory area to free.

Return value: True if successful, false otherwise. Notes: Frees memory that was previously allocated with allocate_memory_block (594). This function doesn't free any descriptors mapped to this block, it's the application's responsibility.

Errors: Check int31error (591) variable.

See also: allocate_memory_block (594)

16.18.15 free_rm_callback

Synopsis: Release real mode callback.

Declaration: function free_rm_callback(var intaddr: tseginfo) : Boolean

Visibility: default

Description: Releases a real mode callback address that was previously allocated with the get_rm_callback (602) function.

Parameters:

intaddrreal mode address buffer returned by get_rm_callback (602).

Return values: True if successful, False if not

For an example, see get_rm_callback (602).

Errors: Check the int31error (591) variable.

See also: set_rm_interrupt (618), get_rm_callback (602)

16.18.16 get_cs

Synopsis: Get CS selector

Declaration: function get_cs : Word

Visibility: default

Description: Returns the cs selector.

Return value: The content of the cs segment register.

For an example, see set_pm_interrupt (617).

Errors: None.

See also: get_ds (599), get_ss (607)

16.18.17 get_descriptor_access_right

Synopsis: Get descriptor's access rights

Declaration: function get_descriptor_access_right(d: Word) : LongInt

Visibility: default

Description: Gets the access rights of a descriptor.

Parameters:

dselector to descriptor.

Return value: Access rights bit field.

Errors: Check the int31error ([591](#)) variable.

See also: set_descriptor_access_right ([617](#))

16.18.18 get_ds

Synopsis: Get DS Selector

Declaration: function get_ds : Word

Visibility: default

Description: Returns the ds selector.

Return values: The content of the ds segment register.

Errors: None.

See also: get_cs ([598](#)), get_ss ([607](#))

16.18.19 get_exception_handler

Synopsis: Return current exception handler

Declaration: function get_exception_handler(e: Byte; var intaddr: tseginfo) : Boolean

Visibility: default

Description: get_exception_handler returns the exception handler for exception E in intaddr. It returns True if the call was successful, False if not.

See also: set_exception_handler ([617](#)), get_pm_exception_handler ([602](#))

16.18.20 get_linear_addr

Synopsis: Convert physical to linear address

Declaration: function get_linear_addr(phys_addr: LongInt; size: LongInt) : LongInt

Visibility: default

Description: Converts a physical address into a linear address.

Parameters:

phys_addrphysical address of device.

sizeSize of region to map in bytes.

Return value: Linear address that can be used to access the physical memory. Notes: It's the applications responsibility to allocate and set up a descriptor for access to the memory. This function shouldn't be used to map real mode addresses.

Errors: Check the int31error ([591](#)) variable.

See also: allocate_ldt_descriptors ([592](#)), set_segment_limit ([619](#)), set_segment_base_address ([619](#))

16.18.21 get_meminfo

Synopsis: Return information on the available memory

Declaration: function get_meminfo(var meminfo: tmeminfo) : Boolean

Visibility: default

Description: Returns information about the amount of available physical memory, linear address space, and disk space for page swapping.

Parameters:

meminfobuffer to fill memory information into.

Return values: Due to an implementation bug this function always returns False, but it always succeeds.

Remark: Notes: Only the first field of the returned structure is guaranteed to contain a valid value. Any fields that are not supported by the DPMI host will be set by the host to -1 (0xFFFFFFFFH) to indicate that the information is not available. The size of the pages used by the DPMI host can be obtained with the get_page_size ([601](#)) function.

Errors: Check the int31error ([591](#)) variable.

See also: get_page_size ([601](#))

Listing: ./go32ex/meminfo.pp

```

uses
    go32;

var
    meminfo : tmeminfo;

begin
    get_meminfo(meminfo);
    if (int31error <> 0) then begin
        Writeln('Error getting DPMI memory information... Halting');
        Writeln('DPMI error number : ', int31error);
    end else begin
        with meminfo do begin
            Writeln('Largest available free block : ',
                    available_memory div 1024, ' kbytes');
            if (available_pages <> -1) then
                Writeln('Maximum available unlocked pages : ',
                    available_pages);
            if (available_lockable_pages <> -1) then

```

```

        WriteIn( 'Maximum lockable available pages : ',
                  available_lockable_pages);
    if (linear_space <> -1) then
        WriteIn( 'Linear address space size : ',
                  linear_space*get_page_size div 1024, ' kbytes');
    if (unlocked_pages <> -1) then
        WriteIn( 'Total number of unlocked pages : ',
                  unlocked_pages);
    if (available_physical_pages <> -1) then
        WriteIn( 'Total number of free pages : ',
                  available_physical_pages);
    if (total_physical_pages <> -1) then
        WriteIn( 'Total number of physical pages : ',
                  total_physical_pages);
    if (free_linear_space <> -1) then
        WriteIn( 'Free linear address space : ',
                  free_linear_space*get_page_size div 1024,
                  ' kbytes');
    if (max_pages_in_paging_file <> -1) then
        WriteIn( 'Maximum size of paging file : ',
                  max_pages_in_paging_file*get_page_size div 1024,
                  ' kbytes');
    end;
end;

```

16.18.22 get_next_selector_increment_value

Synopsis: Return selector increment value

Declaration: function get_next_selector_increment_value : Word

Visibility: default

Description: Returns the selector increment value when allocating multiple subsequent descriptors via allocate_ldt_descriptors ([592](#)).

Return value: Selector increment value.

Remark: Notes: Because allocate_ldt_descriptors ([592](#)) only returns the selector for the first descriptor and so the value returned by this function can be used to calculate the selectors for subsequent descriptors in the array.

Errors: Check the int31error ([591](#)) variable.

See also: allocate_ldt_descriptors ([592](#)), free_ldt_descriptor ([597](#))

16.18.23 get_page_size

Synopsis: Return the page size

Declaration: function get_page_size : LongInt

Visibility: default

Description: Returns the size of a single memory page.

Return value: Size of a single page in bytes.

Remark: The returned size is typically 4096 bytes.

For an example, see [get_meminfo \(600\)](#).

Errors: Check the int31error ([591](#)) variable.

See also: [get_meminfo \(600\)](#)

16.18.24 get_pm_exception_handler

Synopsis: Get protected mode exception handler

Declaration: function get_pm_exception_handler(e: Byte; var intaddr: tseginfo) : Boolean

Visibility: default

Description: `get_pm_exception_handler` returns the protected mode exception handler for exception E in `intaddr`. It returns True if the call was successful, False if not.

See also: [get_exception_handler \(599\)](#), [set_pm_exception_handler \(617\)](#)

16.18.25 get_pm_interrupt

Synopsis: Return protected mode interrupt handler

Declaration: function get_pm_interrupt(vector: Byte; var intaddr: tseginfo) : Boolean

Visibility: default

Description: Returns the address of a current protected mode interrupt handler.

Parameters:

vector interrupt handler number you want the address to.

intaddr buffer to store address.

Return values: True if successful, False if not.

Remark: The returned address is a protected mode selector:offset address.

For an example, see [set_pm_interrupt \(617\)](#).

Errors: Check the int31error ([591](#)) variable.

See also: [set_pm_interrupt \(617\)](#), [set_rm_interrupt \(618\)](#), [get_rm_interrupt \(605\)](#)

16.18.26 get_rm_callback

Synopsis: Return real mode callback

Declaration: function get_rm_callback(pm_func: pointer; const reg: trealregs; var rmcb: tseginfo) : Boolean

Visibility: default

Description: Returns a unique real mode segment : offset address, known as a "real mode callback," that will transfer control from real mode to a protected mode procedure.

Parameters:

pm_funcpointer to the protected mode callback function.

regssupplied registers structure.

rmcbbuffer to real mode address of callback function.

Return values: True if successful, otherwise False.

Remark: Callback addresses obtained with this function can be passed by a protected mode program for example to an interrupt handler, device driver, or TSR, so that the real mode program can call procedures within the protected mode program or notify the protected mode program of an event. The contents of the supplied regs structure is not valid after function call, but only at the time of the actual callback.

Errors: Check the int31error (591) variable.

See also: free_rm_callback (598)

Listing: ./go32ex/callback.pp

```

{$ASMMODE ATT}
{$MODE FPC}

uses
    crt,
    go32;

const
    mouseint = $33;

var
    mouse_regs     : trealregs; external name '___v2prt0_rmcbs_regs';
    mouse_seginfo : tseginfo;

var
    mouse_numbuttons : longint;

    mouse_action : word;
    mouse_x, mouse_y : Word;
    mouse_b : Word;

    userproc_installed : Longbool;
    userproc_length : Longint;
    userproc_proc : pointer;

procedure callback_handler; assembler;
asm
    pushw %ds
    pushl %eax
    movw %es, %ax
    movw %ax, %ds

    cmpl $1, USERPROC_INSTALLED
    jne .LNoCallback
    pushal
    movw DOSmemSELECTOR, %ax
    movw %ax, %fs
    call *USERPROC_PROC
    popal
.LNoCallback:

```

```

popl %eax
popw %ds

pushl %eax
movl (%esi), %eax
movl %eax, %es:42(%edi)
addw $4, %es:46(%edi)
popl %eax
iret
end;
procedure mouse_dummy; begin end;

procedure textuserproc;
begin
    mouse_b := mouse_regs.bx;
    mouse_x := (mouse_regs.cx shr 3) + 1;
    mouse_y := (mouse_regs.dx shr 3) + 1;
end;

procedure install_mouse(userproc : pointer; userprocrlen : longint);
var r : trealregs;
begin
    r.eax := $0; realintr(mouseint, r);
    if (r.eax <> $FFFF) then begin
        Writeln('No Microsoft compatible mouse found');
        Writeln('A Microsoft compatible mouse driver is necessary ',
               'to run this example');
        halt;
    end;
    if (r.bx = $ffff) then mouse_numbbuttons := 2
    else mouse_numbbuttons := r.bx;
    Writeln(mouse_numbbuttons, ' button Microsoft compatible mouse ',
            'found.');
    if (userproc <> nil) then begin
        userproc_proc := userproc;
        userproc_installed := true;
        userproc_length := userprocrlen;
        lock_code(userproc_proc, userproc_length);
    end else begin
        userproc_proc := nil;
        userproc_length := 0;
        userproc_installed := false;
    end;
    lock_data(mouse_x, sizeof(mouse_x));
    lock_data(mouse_y, sizeof(mouse_y));
    lock_data(mouse_b, sizeof(mouse_b));
    lock_data(mouse_action, sizeof(mouse_action));

    lock_data(userproc_installed, sizeof(userproc_installed));
    lock_data(userproc_proc, sizeof(userproc_proc));

    lock_data(mouse_regs, sizeof(mouse_regs));
    lock_data(mouse_seginfo, sizeof(mouse_seginfo));
    lock_code(@callback_handler,
              longint(@mouse_dummy)-longint(@callback_handler));
    get_rm_callback(@callback_handler, mouse_regs, mouse_seginfo);
    r.eax := $0c; r.ecx := $7f;

```

```

r.edx := longint(mouse_seginfo.offset);
r.es := mouse_seginfo.segment;
realintr(mouseint, r);
r.eax := $01;
realintr(mouseint, r);
end;

procedure remove_mouse;
var
  r : trealregs;
begin
  r.eax := $02; realintr(mouseint, r);
  r.eax := $0c; r.ecx := 0; r.edx := 0; r.es := 0;
  realintr(mouseint, r);
  free_rm_callback(mouse_seginfo);
  if (userproc_installed) then begin
    unlock_code(userproc_proc, userproc_length);
    userproc_proc := nil;
    userproc_length := 0;
    userproc_installed := false;
  end;
  unlock_data(mouse_x, sizeof(mouse_x));
  unlock_data(mouse_y, sizeof(mouse_y));
  unlock_data(mouse_b, sizeof(mouse_b));
  unlock_data(mouse_action, sizeof(mouse_action));

  unlock_data(userproc_proc, sizeof(userproc_proc));
  unlock_data(userproc_installed, sizeof(userproc_installed));

  unlock_data(mouse_regs, sizeof(mouse_regs));
  unlock_data(mouse_seginfo, sizeof(mouse_seginfo));
  unlock_code(@callback_handler,
             longint(@mouse_dummy)-longint(@callback_handler));
  fillchar(mouse_seginfo, sizeof(mouse_seginfo), 0);
end;

begin
  install_mouse(@textuserproc, 400);
  Writeln('Press any key to exit ...');
  while (not keypressed) do begin
    gotoxy(1, wherey);
    write('MouseX : ', mouse_x:2, ' MouseY : ', mouse_y:2,
          ' Buttons : ', mouse_b:2);
  end;
  remove_mouse;
end.

```

16.18.27 get_rm_interrupt

Synopsis: Get real mode interrupt vector

Declaration: function get_rm_interrupt(vector: Byte; var intaddr: tsseginfo) : Boolean

Visibility: default

Description: Returns the contents of the current machine's real mode interrupt vector for the specified interrupt.

Parameters:

vector interrupt vector number.

intaddr buffer to store real mode segment:offset address.

Return values: True if successful, False otherwise.

Remark: The returned address is a real mode segment address, which isn't valid in protected mode.

Errors: Check the int31error (591) variable.

See also: set_rm_interrupt (618), set_pm_interrupt (617), get_pm_interrupt (602)

16.18.28 get_run_mode

Synopsis: Return current run mode

Declaration: function get_run_mode : Word

Visibility: default

Description: Returns the current mode your application runs with.

Return values: One of the constants used by this function.

Errors: None.

See also: get_run_mode (606)

Listing: ./go32ex/getrunmd.pp

```
uses
    go32;

begin
    case (get_run_mode) of
        rm_unknown :
            Writeln( 'Unknown environment found' );
        rm_raw :
            Writeln( 'You are currently running in raw mode',
                     '(without HIMEM)' );
        rm_xms :
            Writeln( 'You are currently using HIMEM.SYS only' );
        rm_vcpi :
            Writeln( 'VCPI server detected. You''re using HIMEM and',
                     'EMM386' );
        rm_dpmi :
            Writeln( 'DPMI detected. You''re using a DPMI host like',
                     'a windows DOS box or CWSDPMI' );
    end;
end.
```

16.18.29 get_segment_base_address

Synopsis: Return base address from descriptor table

Declaration: function get_segment_base_address(d: Word) : LongInt

Visibility: default

Description: Returns the 32-bit linear base address from the descriptor table for the specified segment.

Parameters:

dselector of the descriptor you want the base address of.

Return values: Linear base address of specified descriptor.

For an example, see `allocate_ldt_descriptors` ([592](#)).

Errors: Check the `int31error` ([591](#)) variable.

See also: `allocate_ldt_descriptors` ([592](#)), `set_segment_base_address` ([619](#)), `allocate_ldt_descriptors` ([592](#)), `set_segment_limit` ([619](#)), `get_segment_limit` ([607](#))

16.18.30 get_segment_limit

Synopsis: Return segment limite from descriptor

Declaration: `function get_segment_limit(d: Word) : LongInt`

Visibility: default

Description: Returns a descriptors segment limit.

Parameters:

dselector.

Return value: Limit of the descriptor in bytes.

Errors: Returns zero if descriptor is invalid.

See also: `allocate_ldt_descriptors` ([592](#)), `set_segment_limit` ([619](#)), `set_segment_base_address` ([619](#)), `get_segment_base_address` ([606](#))

16.18.31 get_ss

Synopsis: Return SS selector

Declaration: `function get_ss : Word`

Visibility: default

Description: Returns the ss selector.

Return values: The content of the ss segment register.

Errors: None.

See also: `get_ds` ([599](#)), `get_cs` ([598](#))

16.18.32 global_dos_alloc

Synopsis: Allocate DOS real mode memory

Declaration: function global_dos_alloc(bytes: LongInt) : LongInt

Visibility: default

Description: Allocates a block of dos real mode memory.

Parameters:

bytes size of requested real mode memory.

Return values: The low word of the returned value contains the selector to the allocated dos memory block, the high word the corresponding real mode segment value. The offset value is always zero. This function allocates memory from dos memory pool, i.e. memory below the 1 MB boundary that is controlled by dos. Such memory blocks are typically used to exchange data with real mode programs, TSRs, or device drivers. The function returns both the real mode segment base address of the block and one descriptor that can be used by protected mode applications to access the block. This function should only be used for temporary buffers to get real mode information (e.g. interrupts that need a data structure in ES:(E)DI), because every single block needs an unique selector. The returned selector should only be freed by a global_dos_free ([609](#)) call.

Errors: Check the int31error ([591](#)) variable.

See also: global_dos_free ([609](#))

Listing: ./go32ex/buffer.pp

```

uses
    go32;

procedure dosalloc(var selector : word;
                    var segment : word; size : longint);
var
    res : longint;
begin
    res := global_dos_alloc(size);
    selector := word(res);
    segment := word(res shr 16);
end;

procedure dosfree(selector : word);
begin
    global_dos_free(selector);
end;

type
    VBEInfoBuf = packed record
        Signature : array[0..3] of char;
        Version : Word;
        reserved : array[0..505] of byte;
    end;

var
    selector,
    segment : Word;
    r : trealregs;

```

```

infobuf : VBEInfoBuf;

begin
    fillchar(r, sizeof(r), 0);
    fillchar(infobuf, sizeof(VBEInfoBuf), 0);
    dosalloc(selector, segment, sizeof(VBEInfoBuf));
    if (int31error <> 0) then begin
        Writeln('Error while allocating real mode memory, halting');
        halt;
    end;
    infobuf.Signature := 'VBE2';
    dosmemput(segment, 0, infobuf, sizeof(infobuf));
    r.ax := $4f00; r.es := segment;
    realintr($10, r);
    dosmemget(segment, 0, infobuf, sizeof(infobuf));
    dosfree(selector);
    if (r.ax <> $4f) then begin
        Writeln('VBE BIOS extension not available, function call',
            'failed');
        halt;
    end;
    if (infobuf.signature[0] = 'V') and
        (infobuf.signature[1] = 'E') and
        (infobuf.signature[2] = 'S') and
        (infobuf.signature[3] = 'A') then begin
        Writeln('VBE version ', hi(infobuf.version), '.',
            lo(infobuf.version), ' detected');
    end;
end.

```

16.18.33 global_dos_free

Synopsis: Free DOS memory block

Declaration: function global_dos_free(selector: Word) : Boolean

Visibility: default

Description: Frees a previously allocated dos memory block.

Parameters:

selector: selector to the dos memory block.

Return value: True if successful, False otherwise.

Remark: The descriptor allocated for the memory block is automatically freed and hence invalid for further use. This function should only be used for memory allocated by global_dos_alloc (608).

For an example, see global_dos_alloc (608).

Errors: Check the int31error (591) variable.

See also: global_dos_alloc (608)

16.18.34 inportb

Synopsis: Read byte from I/O port

Declaration: function inportb(port: Word) : Byte

Visibility: default

Description: Reads 1 byte from the selected I/O port.

Parameters:

portthe I/O port number which is read.

Return values: Current I/O port value.

Errors: None.

See also: outportb (612), inportw (610), inportl (610)

16.18.35 inportl

Synopsis: Read longint from I/O port

Declaration: function inportl(port: Word) : LongInt

Visibility: default

Description: Reads 1 longint from the selected I/O port.

Parameters:

portthe I/O port number which is read.

Return values: Current I/O port value.

Errors: None.

See also: outportb (612), inportb (609), inportw (610)

16.18.36 inportw

Synopsis: Read word from I/O port

Declaration: function inportw(port: Word) : Word

Visibility: default

Description: Reads 1 word from the selected I/O port.

Parameters:

portthe I/O port number which is read.

Return values: Current I/O port value.

Errors: None.

See also: outportw (613), inportb (609), inportl (610)

16.18.37 lock_code

Synopsis: Lock code memory range

Declaration: function lock_code(functionaddr: pointer; size: LongInt) : Boolean

Visibility: default

Description: Locks a memory range which is in the code segment selector.

Parameters:

functionaddr address of the function to be locked.

size size in bytes to be locked.

Return values: True if successful, False otherwise.

For an example, see [get_rm_callback \(602\)](#).

Errors: Check the int31error ([591](#)) variable.

See also: [lock_linear_region \(611\)](#), [lock_data \(611\)](#), [unlock_linear_region \(621\)](#), [unlock_data \(621\)](#), [unlock_code \(621\)](#)

16.18.38 lock_data

Synopsis: Lock data memory range

Declaration: function lock_data(var data; size: LongInt) : Boolean

Visibility: default

Description: Locks a memory range which resides in the data segment selector.

Parameters:

data address of data to be locked.

size length of data to be locked.

Return values: True if successful, False otherwise.

For an example, see [get_rm_callback \(602\)](#).

Errors: Check the int31error ([591](#)) variable.

See also: [lock_linear_region \(611\)](#), [lock_code \(611\)](#), [unlock_linear_region \(621\)](#), [unlock_data \(621\)](#), [unlock_code \(621\)](#)

16.18.39 lock_linear_region

Synopsis: Lock linear memory region

Declaration: function lock_linear_region(linearaddr: LongInt; size: LongInt) : Boolean

Visibility: default

Description: Locks a memory region to prevent swapping of it.

Parameters:

linearaddr the linear address of the memory are to be locked.

sizesize in bytes to be locked.

Return value: True if successful, False otherwise.

Errors: Check the int31error ([591](#)) variable.

See also: lock_data ([611](#)), lock_code ([611](#)), unlock_linear_region ([621](#)), unlock_data ([621](#)), unlock_code ([621](#))

16.18.40 map_device_in_memory_block

Synopsis: Map a device into program's memory space

Declaration: function map_device_in_memory_block(handle: LongInt; offset: LongInt;
pagecount: LongInt; device: LongInt)
: Boolean

Visibility: default

Description: `map_device_in_memory_block` allows to map a device in memory. This function is a direct call of the extender. For more information about it's arguments, see the extender documentation.

16.18.41 outportb

Synopsis: Write byte to I/O port

Declaration: procedure outportb(port: Word; data: Byte)

Visibility: default

Description: Sends 1 byte of data to the specified I/O port.

Parameters:

portthe I/O port number to send data to.

datavalue sent to I/O port.

Return values: None.

Errors: None.

See also: `inportb` ([609](#)), `outportl` ([613](#)), `outportw` ([613](#))

Listing: ./go32ex/outport.pp

```
uses
    crt,
    go32;

begin
    outportb($61, $ff);
    delay(50);
    outportb($61, $0);
end.
```

16.18.42 outportl

Synopsis: Write longint to I/O port

Declaration: procedure outportl(port: Word; data: LongInt)

Visibility: default

Description: Sends 1 longint of data to the specified I/O port.

Parameters:

portthe I/O port number to send data to.

datavalue sent to I/O port.

Return values: None.

For an example, see [outportb \(612\)](#).

Errors: None.

See also: [inportl \(610\)](#), [outportw \(613\)](#), [outportb \(612\)](#)

16.18.43 outportw

Synopsis: Write word to I/O port

Declaration: procedure outportw(port: Word; data: Word)

Visibility: default

Description: Sends 1 word of data to the specified I/O port.

Parameters:

portthe I/O port number to send data to.

datavalue sent to I/O port.

Return values: None.

For an example, see [outportb \(612\)](#).

Errors: None.

See also: [inportw \(610\)](#), [outportl \(613\)](#), [outportb \(612\)](#)

16.18.44 realintr

Synopsis: Simulate interrupt

Declaration: function realintr(intnr: Word; var regs: trealregs) : Boolean

Visibility: default

Description: Simulates an interrupt in real mode.

Parameters:

intnrinterrupt number to issue in real mode.

regsregisters data structure.

Return values: The supplied registers data structure contains the values that were returned by the real mode interrupt. True if successful, False if not.

Remark: The function transfers control to the address specified by the real mode interrupt vector of intnr. The real mode handler must return by executing an IRET.

Errors: Check the int31error (591) variable.

Listing: ./go32ex flags.pp

```

uses
    go32;

var
    r : trealregs;

begin
    r.ax := $5300;
    r.bx := 0;
    realintr($15, r);
    if ((r.flags and carryflag)=0) then begin
        Writeln('APM v', (r.ah and $f), '.', 
            (r.al shr 4), (r.al and $f), ' detected');
    end else
        Writeln('APM not present');
end.
```

16.18.45 request_linear_region

Synopsis: Request linear address region.

Declaration: function request_linear_region(linearaddr: LongInt; size: LongInt;
var blockhandle: LongInt) : Boolean

Visibility: default

Description: request_linear_region requests a linear range of addresses of size Size, starting at linearaddr.
If successful, True is returned, and a handle to the address region is returned in blockhandle.

Errors: On error, False is returned.

16.18.46 segment_to_descriptor

Synopsis: Map segment address to descriptor

Declaration: function segment_to_descriptor(seg: Word) : Word

Visibility: default

Description: Maps a real mode segment (paragraph) address onto an descriptor that can be used by a protected mode program to access the same memory.

Parameters:

segthe real mode segment you want the descriptor to.

Return values: Descriptor to real mode segment address.

Remark: The returned descriptors limit will be set to 64 kB. Multiple calls to this function with the same segment address will return the same selector. Descriptors created by this function can never be modified or freed. Programs which need to examine various real mode addresses using the same selector should use the function allocate_ldt_descriptors (592) and change the base address as necessary.

For an example, see seg_fillchar (615).

Errors: Check the int31error (591) variable.

See also: allocate_ldt_descriptors (592), free_ldt_descriptor (597), set_segment_base_address (619)

16.18.47 seg_fillchar

Synopsis: Fill segment with byte value

Declaration: procedure seg_fillchar(seg: Word; ofs: LongInt; count: LongInt; c: Char)

Visibility: default

Description: Sets a memory area to a specific value.

Parameters:

segselector to memory area.

ofsoffset to memory.

countnumber of bytes to set.

cbyte data which is set.

Return values: None.

Notes: No range check is done in any way.

Errors: None.

See also: seg_move (616), seg_fillword (616), dosmemfillchar (588), dosmemfillword (589), dosmemget (589), dosmemput (589), dosmemmove (589)

Listing: ./go32ex/vgasel.pp

```

uses
    go32;

var
    vgasel : Word;
    r : trealregs;

begin
    r.eax := $13; realintr($10, r);
    vgasel := segment_to_descriptor($A000);
    seg_fillchar(vgasel, 0, 64000, #15);
    readIn;
    r.eax := $3; realintr($10, r);
end.

```

16.18.48 seg_fillword

Synopsis: Fill segment with word value

Declaration: procedure seg_fillword(seg: Word; ofs: LongInt; count: LongInt; w: Word)

Visibility: default

Description: Sets a memory area to a specific value.

Parameters:

segselector to memory area.

ofsoffset to memory.

countnumber of words to set.

wword data which is set.

Return values: None.

Notes: No range check is done in any way.

For an example, see allocate_ldt_descriptors ([592](#)).

Errors: None.

See also: seg_move ([616](#)), seg_fillchar ([615](#)), dosmemfillchar ([588](#)), dosmemfillword ([589](#)), dosmemget ([589](#)), dosmemput ([589](#)), dosmemmove ([589](#))

16.18.49 seg_move

Synopsis: Move data between 2 locations

Declaration: procedure seg_move (sseg: Word; source: LongInt; dseg: Word; dest: LongInt;
count: LongInt)

Visibility: default

Description: Copies data between two memory locations.

Parameters:

ssegsource selector.

sourcesource offset.

dsegdestination selector.

destdestination offset.

countsize in bytes to copy.

Return values: None.

Remark: Overlapping is only checked if the source selector is equal to the destination selector. No range check is done.

For an example, see allocate_ldt_descriptors ([592](#)).

Errors: None.

See also: seg_fillchar ([615](#)), seg_fillword ([616](#)), dosmemfillchar ([588](#)), dosmemfillword ([589](#)), dosmemget ([589](#)), dosmemput ([589](#)), dosmemmove ([589](#))

16.18.50 set_descriptor_access_right

Synopsis: Set access rights to memory descriptor

Declaration: function set_descriptor_access_right(d: Word; w: Word) : LongInt

Visibility: default

Description: set_descriptor_access_right sets the access rights for descriptor d to w

16.18.51 set_exception_handler

Synopsis: Set exception handler

Declaration: function set_exception_handler(e: Byte; const intaddr: tseginfo) : Boolean

Visibility: default

Description: set_exception_handler sets the exception handler for exception E to intaddr. It returns True if the call was successful, False if not.

See also: get_exception_handler (599), set_pm_exception_handler (617)

16.18.52 set_pm_exception_handler

Synopsis: Set protected mode exception handler

Declaration: function set_pm_exception_handler(e: Byte; const intaddr: tseginfo) : Boolean

Visibility: default

Description: set_pm_exception_handler sets the protected mode exception handler for exception E to intaddr. It returns True if the call was successful, False if not.

See also: set_exception_handler (617), get_pm_exception_handler (602)

16.18.53 set_pm_interrupt

Synopsis: Set protected mode interrupt handler

Declaration: function set_pm_interrupt(vector: Byte; const intaddr: tseginfo) : Boolean

Visibility: default

Description: Sets the address of the protected mode handler for an interrupt.

Parameters:

vector number of protected mode interrupt to set.

intaddr selector:offset address to the interrupt vector.

Return values: True if successful, False otherwise.

Remark: The address supplied must be a valid selector:offset protected mode address.

Errors: Check the int31error (591) variable.

See also: [get_pm_interrupt \(602\)](#), [set_rm_interrupt \(618\)](#), [get_rm_interrupt \(605\)](#)

Listing: ./go32ex/intpm.pp

```

uses
    crt,
    go32;

const
    int1c = $1c;

var
    oldint1c : tseginfo;
    newint1c : tseginfo;

    int1c_counter : Longint;

    int1c_ds : Word; external name '___v2prt0_ds_alias';

procedure int1c_handler; assembler;
asm
    cli
    pushw %ds
    pushw %ax
    movw %cs:int1c_ds, %ax
    movw %ax, %ds
    incl int1c_counter
    popw %ax
    popw %ds
    sti
    iret
end;

var i : Longint;

begin
    newint1c.offset := @int1c_handler;
    newint1c.segment := get_cs;
    get_pm_interrupt(int1c, oldint1c);
    WriteLn('-- Press any key to exit --');
    set_pm_interrupt(int1c, newint1c);
    while (not keypressed) do begin
        gotoxy(1, wherey);
        write('Number of interrupts occurred : ', int1c_counter);
    end;
    set_pm_interrupt(int1c, oldint1c);
end.

```

16.18.54 set_rm_interrupt

Synopsis: Set real mode interrupt handler

Declaration: function set_rm_interrupt(vector: Byte; const intaddr: tseginfo)
 : Boolean

Visibility: default

Description: Sets a real mode interrupt handler.

Parameters:

vectorthe interrupt vector number to set.

intaddraddress of new interrupt vector.

Return values: True if successful, otherwise False.

Remark: The address supplied MUST be a real mode segment address, not a selector:offset address. So the interrupt handler must either reside in dos memory (below 1 Mb boundary) or the application must allocate a real mode callback address with get_rm_callback (602).

Errors: Check the int31error (591) variable.

See also: get_rm_interrupt (605), set_pm_interrupt (617), get_pm_interrupt (602), get_rm_callback (602)

16.18.55 set_segment_base_address

Synopsis: Set descriptor's base address

Declaration: function set_segment_base_address(d: Word;s: LongInt) : Boolean

Visibility: default

Description: Sets the 32-bit linear base address of a descriptor.

Parameters:

dselector.

snew base address of the descriptor.

Errors: Check the int31error (591) variable.

See also: allocate_ldt_descriptors (592), get_segment_base_address (606), allocate_ldt_descriptors (592), set_segment_limit (619), get_segment_base_address (606), get_segment_limit (607)

16.18.56 set_segment_limit

Synopsis: Set descriptor limit

Declaration: function set_segment_limit(d: Word;s: LongInt) : Boolean

Visibility: default

Description: Sets the limit of a descriptor.

Parameters:

dselector.

snew limit of the descriptor.

Return values: Returns True if successful, else False.

Remark: The new limit specified must be the byte length of the segment - 1. Segment limits bigger than or equal to 1MB must be page aligned, they must have the lower 12 bits set.

For an example, see allocate_ldt_descriptors (592).

Errors: Check the int31error (591) variable.

See also: allocate_ldt_descriptors (592), set_segment_base_address (619), get_segment_limit (607), set_segment_limit (619)

16.18.57 tb_offset

Synopsis: Return DOS transfer buffer offset

Declaration: function tb_offset : LongInt

Visibility: default

Description: tb_offset returns the DOS transfer buffer segment.

See also: transfer_buffer ([620](#)), tb_segment ([620](#)), tb_size ([620](#))

16.18.58 tb_segment

Synopsis: Return DOS transfer buffer segment

Declaration: function tb_segment : LongInt

Visibility: default

Description: tb_segment returns the DOS transfer buffer segment.

See also: transfer_buffer ([620](#)), tb_offset ([620](#)), tb_size ([620](#))

16.18.59 tb_size

Synopsis: Return DOS transfer memory buffer size

Declaration: function tb_size : LongInt

Visibility: default

Description: Returns the size of the pre-allocated dos memory buffer.

Return values: The size of the pre-allocated dos memory buffer. This block always seems to be 16k in size, but don't rely on this.

Errors: None.

See also: transfer_buffer ([620](#)), copyfromdos ([594](#)), copytodos ([595](#))

16.18.60 transfer_buffer

Synopsis: Return offset of DOS transfer buffer

Declaration: function transfer_buffer : LongInt

Visibility: default

Description: transfer_buffer returns the offset of the transfer buffer.

Errors: None.

See also: tb_size ([620](#))

16.18.61 unlock_code

Synopsis: Unlock code segment

Declaration: function unlock_code(functionaddr: pointer; size: LongInt) : Boolean

Visibility: default

Description: Unlocks a memory range which resides in the code segment selector.

Parameters:

functionaddr address of function to be unlocked.

sizesize bytes to be unlocked.

Return value: True if successful, False otherwise.

For an example, see `get_rm_callback` (602).

Errors: Check the `int31error` ([591](#)) variable.

See also: [unlock_linear_region](#) (621), [unlock_data](#) (621), [lock_linear_region](#) (611), [lock_data](#) (611), [lock_code](#) (611)

16.18.62 unlock data

Synopsis: Unlock data segment

Declaration: function unlock_data(var data; size: LongInt) : Boolean

Visibility: default

Description: Unlocks a memory range which resides in the data segment selector.

Parameters:

data address of memory to be unlocked.

`sizesize` bytes to be unlocked.

Return values: True if successful. False otherwise.

For an example, see `get_rm_callback` (602).

Errors: Check the int31error (591) variable.

See also: [unlock_linear_region](#) (621), [unlock_code](#) (621), [lock_linear_region](#) (611), [lock_data](#) (611), [lock_code](#) (611)

16.18.63 unlock linear region

Synopsis: Unlock linear memory region

Visibility: default

Description: Unlocks a previously locked linear region range to allow it to be swapped out again if needed.

Parameters:

linearaddr linear address of the memory to be unlocked.

sizesize bytes to be unlocked.

Return values: True if successful, False otherwise.

Errors: Check the int31error ([591](#)) variable.

See also: unlock_data ([621](#)), unlock_code ([621](#)), lock_linear_region ([611](#)), lock_data ([611](#)), lock_code ([611](#))

Chapter 17

Reference for unit 'gpm'

17.1 Used units

Table 17.1: Used units by unit 'gpm'

Name	Page
BaseUnix	102
System	1229

17.2 Overview

The GPM unit implements an interface to libgpm, the console program for mouse handling. This unit was created by Peter Vreman, and is only available on linux.

When this unit is used, your program is linked to the C libraries, so you must take care of the C library version. Also, it will only work with version 1.17 or higher of the libgpm library.

17.3 Constants, types and variables

17.3.1 Constants

GPM_BOT = 2

Bottom of area.

GPM_B_LEFT = 4

Left mouse button identifier.

GPM_B_MIDDLE = 2

Middle mouse button identifier.

GPM_B_RIGHT = 1

Right mouse button identifier.

GPM_DOUBLE = 32

Mouse double click event.

GPM_DOWN = 4

Mouse button down event.

GPM_DRAG = 2

Mouse drag event.

GPM_ENTER = 512

Enter area event.

GPM_HARD = 256

?

GPM_LEAVE = 1024

Leave area event.

GPM_LFT = 4

Left side of area.

GPM_MAGIC = \$47706D4C

Constant identifying GPM in gpm_Open ([102](#)).

GPM_MFLAG = 128

Motion flag.

GPM_MOVE = 1

Mouse move event.

GPM_NODE_CTL = GPM_NODE_DEV

Control socket

GPM_NODE_DEV = '/dev/gpmctl'

Device socket filename

GPM_NODE_DIR = _PATH_VARRUN

Where to write socket.

```
GPM_NODE_DIR_MODE = 0775
```

Mode of socket.

```
GPM_NODE_FIFO = '/dev/gpmdata'
```

FIFO name

```
GPM_NODE_PID = '/var/run/gpm.pid'
```

Name of PID file.

```
GPM_RGT = 8
```

Right side of area.

```
GPM_SINGLE = 16
```

Mouse single click event.

```
GPM_TOP = 1
```

Top of area.

```
GPM_TRIPLE = 64
```

Mouse triple click event.

```
GPM_UP = 8
```

Mouse button up event.

```
_PATH_DEV = '/dev/'
```

Location of /dev directory.

```
_PATH_VARRUN = '/var/run/'
```

Location of run PID files directory.

17.3.2 Types

```
Pgpmconnect = Pgpm_connect
```

Pointer to TGpmConnect ([626](#)) record.

```
Pgpmevent = Pgpm_event
```

Pointer to TGpmEvent ([626](#)) record

```
Pgpmroi = Pgpm_roi
```

Pointer to TGpmRoi ([626](#)) record.

```
Pgpm_connect = ^TGpm_connect
```

Pointer to TGpm_Connect ([627](#)) record.

```
Pgpm_event = ^Tgpm_event
```

Pointer to TGpm_Event ([627](#)) record

```
Pgpm_roi = ^Tgpm_roi
```

Pointer to Tgpm_roi ([627](#)) record.

```
Tgpmconnect = Tgpm_connect
```

Alias for TGpm_Connect ([627](#)) record.

```
TGpmEtype = LongInt
```

Type for event type.

```
Tgpmevent = Tgpm_event
```

Alias for TGPM_Event ([627](#)) record

```
TGpmHandler = function(var event: Tgpmevent; clientdata: pointer)
                  : LongInt
```

Mouse event handler callback.

```
TGpmMargin = LongInt
```

Type to hold area margin.

```
Tgpmroi = Tgpm_roi
```

Alias for TGpm_roi ([627](#))Record

```
Tgpm_connect = record
  eventMask : Word;
  defaultMask : Word;
  minMod : Word;
  maxMod : Word;
  pid : LongInt;
  vc : LongInt;
end
```

GPM server connection information.

```
Tgpm_event = record
  buttons : Byte;
  modifiers : Byte;
  vc : Word;
  dx : Word;
  dy : Word;
  x : Word;
  y : Word;
  EventType : TGpmEtype;
  clicks : LongInt;
  margin : TGpmMargin;
  wdx : Word;
  wdy : Word;
end
```

`Tgpm_event` describes the events that are reported by GPM.

```
Tgpm_roi = record
  xmin : Integer;
  xmax : Integer;
  ymin : Integer;
  ymax : Integer;
  minmod : Word;
  maxmod : Word;
  eventmask : Word;
  owned : Word;
  handler : TGpmHandler;
  clientdata : pointer;
  prev : Pgpm_roi;
  next : Pgpm_roi;
end
```

Record used to define regions of interest.

17.3.3 Variables

`gpm_current_roi` : `Pgpm_roi`

Internal gpm library variable. Do not use.

`gpm_handler` : `TGpmHandler`

Internal gpm library variable. Do not use.

`gpm_roi` : `Pgpm_roi`

Internal gpm library variable. Do not use.

`gpm_roi_data` : `pointer`

Internal gpm library variable. Do not use.

```
gpm_roi_handler : TGpmHandler
```

Internal gpm library variable. Do not use.

17.4 Procedures and functions

17.4.1 Gpm_AnyDouble

Synopsis: Check whether event has double click event.

Declaration: function Gpm_AnyDouble(EventType: LongInt) : Boolean

Visibility: default

Description: Gpm_AnyDouble returns True if EventType contains the GPM_DOUBLE flag, False otherwise.

Errors: None.

See also: Gpm_StrictSingle (633), Gpm_AnySingle (628), Gpm_StrictDouble (633), Gpm_StrictTriple (633), Gpm_AnyTriple (628)

17.4.2 Gpm_AnySingle

Synopsis: Check whether event has a single click event.

Declaration: function Gpm_AnySingle(EventType: LongInt) : Boolean

Visibility: default

Description: Gpm_AnySingle returns True if EventType contains the GPM_SINGLE flag, False otherwise.

Errors: None.

See also: Gpm_StrictSingle (633), Gpm_AnyDouble (628), Gpm_StrictDouble (633), Gpm_StrictTriple (633), Gpm_AnyTriple (628)

17.4.3 Gpm_AnyTriple

Synopsis: Check whether event has a triple click event.

Declaration: function Gpm_AnyTriple(EventType: LongInt) : Boolean

Visibility: default

Description: Gpm_AnySingle returns True if EventType contains the GPM_TRIPLE flag, False otherwise.

Errors: None.

See also: Gpm_StrictSingle (633), Gpm_AnyDouble (628), Gpm_StrictDouble (633), Gpm_StrictTriple (633), Gpm_AnySingle (628)

17.4.4 gpm_close

Synopsis: Close connection to GPM server.

Declaration: function gpm_close : LongInt

Visibility: default

Description: Gpm_Close closes the current connection, and pops the connection stack; this means that the previous connection becomes active again.

The function returns -1 if the current connection is not the last one, and it returns 0 if the current connection is the last one.

for an example, see Gpm_GetEvent ([629](#)).

Errors: None.

See also: Gpm_Open ([631](#))

17.4.5 gpm_fitvalues

Synopsis: Change coordinates to fit physical screen.

Declaration: function gpm_fitvalues(var x: LongInt; var y: LongInt) : LongInt

Visibility: default

Description: Gpm_FitValues changes x and y so they fit in the visible screen. The actual mouse pointer is not affected by this function.

Errors: None.

See also: Gpm_FitValuesM ([629](#))

17.4.6 gpm_fitvaluesM

Synopsis: Change coordinates to fit margin.

Declaration: function gpm_fitvaluesM(var x: LongInt; var y: LongInt; margin: LongInt) : LongInt

Visibility: default

Description: Gpm_FitValuesM changes x and y so they fit in the margin indicated by margin. If margin is -1, then the values are fitted to the screen. The actual mouse pointer is not affected by this function.

Errors: None.

See also: Gpm_FitValues ([629](#))

17.4.7 gpm_getevent

Synopsis: Get event from event queue.

Declaration: function gpm_getevent(var event: Tgpm_event) : LongInt

Visibility: default

Description: Gpm_GetEvent Reads an event from the file descriptor gpm_fd. This file is only for internal use and should never be called by a client application.

It returns 1 on success, and -1 on failure.

Errors: On error, -1 is returned.

See also: Gpm_GetSnapshot (631)

Listing: ./gpmex/gpmex.pp

```

program gpmex;

{
  Example program to demonstrate the use of the gpm unit.
}

uses gpm;

var
  connect : TGPMConnect;
  event : tgpmevent;

begin
  connect.EventMask:=GPM_MOVE or GPM_DRAG or GPM_DOWN or GPM_UP;
  connect.DefaultMask:=0;
  connect.MinMod:=0;
  connect.MaxMod:=0;
  if Gpm_Open(connect,0)=-1 then
    begin
      Writeln( 'No mouse handler present.' );
      Halt(1);
    end;
  Writeln( 'Click right button to end.' );
Repeat
  gpm_getevent(Event);
  With Event do
    begin
      Write( 'Pos = ( ',X,', ',Y,' ) Buttons : ( ' );
      if (buttons and Gpm_b_left)<>0 then
        write('left ');
      if (buttons and Gpm_b_right)<>0 then
        write('right ');
      if (buttons and Gpm_b_middle)<>0 then
        Write('middle ');
      Write(') Event : ');
      Case EventType and $F of
        GPM_MOVE: write('Move');
        GPM_DRAG: write('Drag');
        GPM_DOWN: write('Down');
        GPM_UP: write('Up');
      end;
      Writeln;
    end;
  Until (Event.Buttons and gpm_b_right)<>0;
  gpm_close;
end.

```

17.4.8 gpm_getsnapshot

Synopsis: Return servers' current image of mouse state.

Declaration: function gpm_getsnapshot(eptr: Pgpmevent) : LongInt
function gpm_getsnapshot(var eptr: Tgpmevent) : LongInt

Visibility: default

Description: Gpm_GetSnapshot returns the picture that the server has of the current situation in Event. This call will not read the current situation from the mouse file descriptor, but returns a buffered version.

The function returns the number of mouse buttons, or -1 if this information is not available.

Errors: None.

See also: Gpm_GetEvent ([629](#))

17.4.9 gpm_lowerroi

Synopsis: Lower a region of interest in the stack.

Declaration: function gpm_lowerroi(which: Pgpm_roi; after: Pgpm_roi) : Pgpm_roi

Visibility: default

Description: Gpm_LowerRoi lowers the region of interest which after after. If after is Nil, the region of interest is moved to the bottom of the stack.

The return value is the new top of the region-of-interest stack.

Errors: None.

See also: Gpm_RaiseRoi ([632](#)), Gpm_PopRoi ([632](#)), Gpm_PushRoi ([632](#))

17.4.10 gpm_open

Synopsis: Open connection to GPM server.

Declaration: function gpm_open(var conn: Tgpm_connect; flag: LongInt) : LongInt

Visibility: default

Description: Gpm_Open opens a new connection to the mouse server. The connection is described by the fields of the conn record of type TGPMConnect ([626](#)).

If Flag is 0, then the application only receives events that come from its own terminal device. If it is negative it will receive all events. If the value is positive then it is considered a console number to which to connect.

The return value is -1 on error, or the file descriptor used to communicate with the client. Under an X-Term the return value is -2.

for an example, see Gpm_GetEvent ([629](#)).

Errors: On Error, the return value is -1.

See also: Gpm_Open ([631](#))

17.4.11 gpm_poproi

Synopsis: Pop region of interest from the stack.

Declaration: function gpm_poproi(which: Pgpm_roi) : Pgpm_roi

Visibility: default

Description: Gpm_PopRoi pops the topmost region of interest from the stack. It returns the next element on the stack, or Nil if the current element was the last one.

Errors: None.

See also: Gpm_RaiseRoi (632), Gpm_LowerRoi (631), Gpm_PushRoi (632)

17.4.12 gpm_pushroi

Synopsis: Push region of interest on the stack.

Declaration: function gpm_pushroi(x1: LongInt; y1: LongInt; x2: LongInt; y2: LongInt;
mask: LongInt; fun: TGpmHandler; xtradata: pointer)
: Pgpm_roi

Visibility: default

Description: Gpm_PushRoi puts a new *region of interest* on the stack. The region of interest is defined by a rectangle described by the corners (X1, Y1) and (X2, Y2).

The mask describes which events the handler {fun} will handle; ExtraData will be put in the xtradata field of the {TGPM_Roi} record passed to the fun handler.

Errors: None.

See also: Gpm_RaiseRoi (632), Gpm_PopRoi (632), Gpm_LowerRoi (631)

17.4.13 gpm_raiseroi

Synopsis: Raise region of interest in the stack.

Declaration: function gpm_raiseroi(which: Pgpm_roi; before: Pgpm_roi) : Pgpm_roi

Visibility: default

Description: Gpm_RaiseRoi raises the *region of interest* which till it is on top of region before. If before is nil then the region is put on top of the stack. The returned value is the top of the stack.

Errors: None.

See also: Gpm_PushRoi (632), Gpm_PopRoi (632), Gpm_LowerRoi (631)

17.4.14 gpm_repeat

Synopsis: Check for presence of mouse event.

Declaration: function gpm_repeat(millisec: LongInt) : LongInt

Visibility: default

Description: Gpm_Repeat returns 1 if no mouse event arrives in the next millisec milliseconds, it returns 0 otherwise.

Errors: None.

See also: [Gpm_GetEvent \(629\)](#)

17.4.15 Gpm_StrictDouble

Synopsis: Check whether event contains only a double-click event.

Declaration: `function Gpm_StrictDouble(EventType: LongInt) : Boolean`

Visibility: default

Description: `Gpm_StrictDouble` returns true if `EventType` contains only a doubleclick event, False otherwise.

Errors: None.

See also: [Gpm_StrictSingle \(633\)](#), [Gpm_AnyTriple \(628\)](#), [Gpm_AnyDouble \(628\)](#), [Gpm_StrictTriple \(633\)](#), [Gpm_AnySingle \(628\)](#)

17.4.16 Gpm_StrictSingle

Synopsis: Check whether event contains only a single-click event.

Declaration: `function Gpm_StrictSingle(EventType: LongInt) : Boolean`

Visibility: default

Description: `Gpm_StrictSingle` returns True if `EventType` contains only a singleclick event, False otherwise.

Errors: None.

See also: [Gpm_AnyTriple \(628\)](#), [Gpm_StrictDouble \(633\)](#), [Gpm_AnyDouble \(628\)](#), [Gpm_StrictTriple \(633\)](#), [Gpm_AnySingle \(628\)](#)

17.4.17 Gpm_StrictTriple

Synopsis: Check whether event contains only a triple-click event.

Declaration: `function Gpm_StrictTriple(EventType: LongInt) : Boolean`

Visibility: default

Description: `Gpm_StrictTriple` returns true if `EventType` contains only a triple click event, False otherwise.

Errors: None.

See also: [Gpm_AnyTriple \(628\)](#), [Gpm_StrictDouble \(633\)](#), [Gpm_AnyDouble \(628\)](#), [Gpm_StrictSingle \(633\)](#), [Gpm_AnySingle \(628\)](#)

Chapter 18

Reference for unit 'Graph'

18.1 Overview

This document describes the GRAPH unit for Free Pascal, for all platforms. The unit was first written for dos by Florian Klaempfl, but was later completely rewritten by Carl-Eric Codere to be completely portable. The unit is provided for compatibility only: It is recommended to use more modern graphical systems. The graph unit will allow to recompile old programs. They will work to some extent, but if the application has heavy graphical needs, it's recommended to use another set of graphical routines, suited to the platform the program should work on.

18.2 Categorized functions: Text and font handling

Functions to set texts on the screen.

Table 18.1:

Name	Description
GetTextSettings (674)	Get current text settings
InstallUserFont (677)	Install a new font
OutText (679)	Write text at current cursor position
OutTextXY (666)	Write text at coordinates X,Y
RegisterBGIFont (680)	Register a new font
SetTextJustify (683)	Set text justification
SetTextStyle (684)	Set text style
SetUserCharSize (684)	Set text size
TextHeight (685)	Calculate height of text
TextWidth (685)	Calculate width of text

18.3 Categorized functions: Filled drawings

Functions for drawing filled regions.

Table 18.2:

Name	Description
Bar3D (668)	Draw a filled 3D-style bar
Bar (667)	Draw a filled rectangle
FloodFill (670)	Fill starting from coordinate
FillEllipse (669)	Draw a filled ellipse
FillPoly (669)	Draw a filled polygone
GetFillPattern (671)	Get current fill pattern
GetFillSettings (672)	Get current fill settings
SetFillPattern (681)	Set current fill pattern
SetFillStyle (682)	Set current fill settings

18.4 Categorized functions: Drawing primitives

Functions for simple drawing.

Table 18.3:

Name	Description
Arc (667)	Draw an arc
Circle (665)	Draw a complete circle
DrawPoly (669)	Draw a polygone with N points
Ellipse (669)	Draw an ellipse
GetArcCoords (670)	Get arc coordinates
GetLineSettings (672)	Get current line drawing settings
Line (666)	Draw line between 2 points
LineRel (677)	Draw line relative to current position
LineTo (678)	Draw line from current position to absolute position
MoveRel (678)	Move cursor relative to current position
MoveTo (678)	Move cursor to absolute position
PieSlice (679)	Draw a pie slice
PutPixel (666)	Draw 1 pixel
Rectangle (679)	Draw a non-filled rectangle
Sector (680)	Draw a sector
SetLineStyle (682)	Set current line drawing style

18.5 Categorized functions: Color management

All functions related to color management.

Table 18.4:

Name	Description
GetBkColor (665)	Get current background color
GetColor (670)	Get current foreground color
GetDefaultPalette (671)	Get default palette entries
GetMaxColor (672)	Get maximum valid color
GetPaletteSize (674)	Get size of palette for current mode
GetPixel (665)	Get color of selected pixel
GetPalette (674)	Get palette entry
SetAllPalette (666)	Set all colors in palette
SetBkColor (667)	Set background color
SetColor (681)	Set foreground color
SetPalette (683)	Set palette entry
SetRGBPalette (667)	Set palette entry with RGB values

18.6 Categorized functions: Screen management

General drawing screen management functions.

Table 18.5:

Name	Description
ClearViewPort (665)	Clear the current viewport
GetImage (665)	Copy image from screen to memory
GetMaxX (673)	Get maximum X coordinate
GetMaxY (673)	Get maximum Y coordinate
GetX (675)	Get current X position
GetY (675)	Get current Y position
ImageSize (665)	Get size of selected image
GetViewSettings (675)	Get current viewport settings
PutImage (666)	Copy image from memory to screen
SetActivePage (666)	Set active video page
SetAspectRatio (681)	Set aspect ratio for drawing routines
SetViewPort (685)	Set current viewport
SetVisualPage (667)	Set visual page
SetWriteMode (685)	Set write mode for screen operations

18.7 Categorized functions: Initialization

Initialization of the graphics screen.

Table 18.6:

Name	Description
ClearDevice (668)	Empty the graphics screen
CloseGraph (668)	Finish drawing session, return to text mode
DetectGraph (668)	Detect graphical modes
GetAspectRatio (670)	Get aspect ratio of screen
GetModeRange (674)	Get range of valid modes for current driver
GraphDefaults (1)	Set defaults
GetDriverName (671)	Return name of graphical driver
GetGraphMode (672)	Return current or last used graphics mode
GetMaxMode (673)	Get maximum mode for current driver
GetModeName (673)	Get name of current mode
GraphErrorMsg (1)	String representation of graphical error
GraphResult (1)	Result of last drawing operation
InitGraph (676)	Initialize graphics drivers
InstallUserDriver (677)	Install a new driver
RegisterBGIDriver (680)	Register a new driver
RestoreCRTMode (680)	Go back to text mode
SetGraphMode (682)	Set graphical mode

18.8 Target specific issues: Linux

There are several issues on Linux that need to be taken care of:

The Linux version of the Graph unit uses the `libvga` library. This library works on the console, not under X.

If you get an error similar to

```
/usr/bin/ld: cannot find -lvga
```

This can mean one of two things: either `libvga` and its development package is not installed properly, or the directory where it is installed is not in the linker path.

To remedy the former, you should install both the `libvga` package and `libvga-devel` package (or compile and install from scratch).

To remedy the latter, you should add the path to the compiler command-line using the `-F1` option.

Programs using `libvga` need root privileges to run. You can make them setuid root with the following command:

```
chown root.root myprogram
chmod u+s myprogram
```

The `libvga` library will give up the root privileges after it is initialized.

there is an experimental version of the Graphics library available that uses GGI to do all the drawing, but it is not well tested. It's called `ggigraph` and is distributed in source form only.

Do not use the CRT unit together with the Graph unit: the console may end up in an unusable state. Instead, the `ncurses` unit may function fine.

18.9 Target specific issues: DOS

VESA modes (i.e., anything but 320x200x256 and 640x480x16) do not work under most installations of Windows NT, Windows 2000 and Windows XP. They also do not work for some people under Windows 98 and Windows ME, depending on their graphics drivers. However, the graph unit cannot detect this, because no errors are returned from the system. In such cases, the screen simply turns black, or will show garbage.

Nothing can be done about this, the reason is missing or buggy support in the graphics drivers of the operating system.

18.10 A word about mode selection

The graph unit was implemented for compatibility with the old Turbo Pascal graph unit. For this reason, the mode constants as they were defined in the Turbo Pascal graph unit are retained.

However, since

1. Video cards have evolved very much
2. Free Pascal runs on multiple platforms

it was decided to implement new mode and graphic driver constants, which are more independent of the specific platform the program runs on.

In this section we give a short explanation of the new mode system. the following drivers were defined:

```
D1bit = 11;
D2bit = 12;
D4bit = 13;
D6bit = 14; { 64 colors Half-brite mode - Amiga }
D8bit = 15;
D12bit = 16; { 4096 color modes HAM mode - Amiga }
D15bit = 17;
D16bit = 18;
D24bit = 19; { not yet supported }
D32bit = 20; { not yet supported }
D64bit = 21; { not yet supported }

lowNewDriver = 11;
highNewDriver = 21;
```

Each of these drivers specifies a desired color-depth.

The following modes have been defined:

```
detectMode = 30000;
m320x200 = 30001;
m320x256 = 30002; { amiga resolution (PAL) }
m320x400 = 30003; { amiga/atari resolution }
m512x384 = 30004; { mac resolution }
m640x200 = 30005; { vga resolution }
m640x256 = 30006; { amiga resolution (PAL) }
m640x350 = 30007; { vga resolution }
```

```

m640x400 = 30008;
m640x480 = 30009;
m800x600 = 30010;
m832x624 = 30011; { mac resolution }
m1024x768 = 30012;
m1280x1024 = 30013;
m1600x1200 = 30014;
m2048x1536 = 30015;

lowNewMode = 30001;
highNewMode = 30015;

```

These modes start at 30000 because Borland specified that the mode number should be ascending with increasing X resolution, and the new constants shouldn't interfere with the old ones.

The above constants can be used to set a certain color depth and resolution, as demonstrated in the below example.

If other modes than the ones above are supported by the graphics card, you will not be able to select them with this mechanism.

For this reason, there is also a 'dynamic' mode number, which is assigned at run-time. This number increases with increasing X resolution. It can be queried with the `getmoderange` call. This call will return the range of modes which are valid for a certain graphics driver. The numbers are guaranteed to be consecutive, and can be used to search for a certain resolution, as in the second example below.

Thus, the `getmoderange` function can be used to detect all available modes and drivers, as in the third example below:

Listing: ./graphex/inigraph1.pp

```

Program inigraph1;

{ Program to demonstrate static graphics mode selection }

uses graph;

const
  TheLine = 'We are now in 640 x 480 x 256 colors!' +
            '(press <Return> to continue)';

var
  gd, gm, lo, hi, error, tw, th: integer;
  found: boolean;

begin
  { We want an 8 bit mode }
  gd := D8bit;
  gm := m640x480;
  initgraph(gd,gm, '');
  { Make sure you always check graphresult! }
  error := graphResult;
  if (error <> grOk) Then
    begin
      writeln('640x480x256 is not supported!');
      halt(1)
    end;
  { We are now in 640x480x256 }

```

```

setColor(cyan);
rectangle(0,0,getmaxx,getmaxy);
{ Write a nice message in the center of the screen }
setTextStyle(defaultFont,horizDir,1);
tw:=TextWidth(TheLine);
th:=TextHeight(TheLine);
outTextXY((getMaxX - TW) div 2,
          (getMaxY - TH) div 2,TheLine);
{ Wait for return }
readIn;
{ Back to text mode }
closegraph;
end.
```

Listing: ./graphex/inigraph2.pp

```

Program inigraph2;

{ Program to demonstrate dynamic graphics mode selection }

uses graph;

const
  TheLine = 'We are now in 640 x 480 x 256 colors!'+
             '(press <Return> to continue)';

var
  th, tw, gd, gm, lo, hi, error: integer;
  found: boolean;

begin
  { We want an 8 bit mode }
  gd := D8bit;
  { Get all available resolutions for this bitdepth }
  getmoderange(gd,lo,hi);
  { If the highest available mode number is -1,
    no resolutions are supported for this bitdepth }
  if hi = -1 then
    begin
      writeln('no 8 bit modes supported!');
      halt
    end;
  found := false;
  { Search all resolutions for 640x480 }
  for gm := lo to hi do
    begin
      initgraph(gd,gm,'');
      { Make sure you always check graphresult! }
      error := graphResult;
      if (error = grOk) and
        (getmaxx = 639) and (getmaxy = 479) then
        begin
          found := true;
          break;
        end;
    end;
  if not found then
    CloseGraph();
  begin
```

```
writeln('640x480x256 is not supported!');
halt(1)
end;
{ We are now in 640x480x256 }
setColor(cyan);
rectangle(0,0,getmaxx,getmaxy);
{ Write a nice message in the center of the screen }
setTextStyle(defaultFont,horizDir,1);
TW:=TextWidth(TheLine);
TH:=TextHeight(TheLine);
outTextXY((getMaxX - TW) div 2,
          (getMaxY - TH) div 2,TheLine);
{ Wait for return }
readIn;
{ Back to text mode }
closegraph;
end.
```

Listing: ./graphex/modrange.pp

```
Program GetModeRange_Example;

{ This program demonstrates how to find all available graph modes }

uses graph;

const
  { Currently, only 4, 8, 15 and 16 bit modes are supported
    but this may change in the future }
  gdnames: array[D4bit..D16bit] of string[6] =
    ('4 bit','6 bit','8 bit','12 bit','15 bit','16 bit');

procedure WriteRes(const depth : integer);
var
  tw, th : integer;
  v, text : String;
begin
  text := 'Current resolution is ' + str(getmaxx+1, v);
  text := text + v + 'x' + str(getmaxy+1, v);
  text := text + v + 'x' + gdnames[depth];
  setTextStyle(defaultFont,horizDir,1);
  TW:=TextWidth(text);
  TH:=TextHeight(text);
  outTextXY((getMaxX - TW) div 2,
            (getMaxY - TH) div 2,text);
end;

var
  t: text;
  line : string;
  gd, c, low, high, res: integer;
begin
  assign(t, 'modes.txt');
  rewrite(t);
  close(t);
  for gd := D4bit to D16bit do
    begin
      { Get the available mode numbers for this driver }
```

```

getModeRange(gd,low,high);
append(t);
writeln(t,' low modenr = ',low,', high modenr = ',high);
close(t);
{ If high is -1,
  no resolutions are supported for this bitdepth }
if high = -1 then
  begin
    append(t);
    writeln(t,' No modes supported! ');
    writeln(t);
    close(t);
  end
else
  { Enter all supported resolutions for this bitdepth
    and write their characteristics to the file }
  for c := low to high do
    begin
      append(t);
      writeln(t,' testing mode nr ',c);
      close(t);
      initgraph(gd,c,'');
      res := graphresult;
      append(t);
      { An error occurred when entering the mode? }
      if res <> grok then
        writeln(t,grapherrormsg(res))
      else
        begin
          write(t,'maxx: ',getmaxx,', maxy: ',getmaxy);
          writeln(t,', maxcolor: ',getmaxcolor);
          closegraph;
        end;
      writeln(t);
      WriteRes(gd);
      close(t);
    end;
  append(t);
  writeln(t);
  close(t);
end;
writeln('All supported modes are listed in modes.txt files');
end.

```

18.11 Requirements

The unit Graph exports functions and procedures for graphical output. It requires at least a VGA-compatible Card or a VGA-Card with software-driver (min. **512Kb** video memory).

18.12 Constants, types and variables

18.12.1 Constants

AndPut = 3

Draw operation: use AND

AnsiToASCIITransTable : TCharsetTransTable = (#\$00, #\$01, #\$02, #\$03, #\$04, #\$05, #\$/

Default ansi transliteration table.

BkSlashFill = 5

Fill style: Diagonal (backslash) lines

black = 0

Color code: black.

blue = 1

Color code: blue

BoldFont = 10

Font number: Bold font.

BottomText = 0

Vertical text alignment: Align text to bottom

brown = 6

Color code: brown

CenterLn = 2

Line style: centered line

CenterText = 1

Horizontal text alignment: Center text

CGA = 1

Graphic driver for CGA cards

CGAC0 = 0

CGA Graphic driver mode C0

CGAC1 = 1

CGA Graphic driver mode C1

CGAC2 = 2

CGA Graphic driver mode C2

CGAC3 = 3

CGA Graphic driver mode C3

CGAH1 = 4

CGA Graphic driver Hi-res mode

ClipOff = False

Viewport clipping off

ClipOn = True

Viewport clipping on

CloseDotFill = 11

Fill style: Closely spaced dotted lines

CopyPut = 0

Draw operation: use Copy

CurrentDriver = -128

Currently used driver

cyan = 3

Color code: Cyan

D12bit = 16

Mode: Depth 12 bit

D15bit = 17

Mode: Depth 15 bit

D16bit = 18

Mode: Depth 16 bit

D1bit = 11

Mode: Depth 1 bit

D24bit = 19

Mode: Depth 24 bit

D2bit = 12

Mode: Depth 2 bit

D32bit = 20

Mode: Depth 32 bit

D4bit = 13

Mode: Depth 4 bit

D64bit = 21

Mode: Depth 64 bit

D6bit = 14

Mode: Depth 6 bit

D8bit = 15

Mode: Depth 8 bit

darkgray = 8

Color code: Dark gray

DashedLn = 3

Line style: dashed line

Default = 0

Default mode

DefaultFont = 0

Font number: Normal font

Detect = 0

Mode: Detect mode.

detectMode = 30000

Mode: Autodetect optimal mode

DottedLn = 1

Line style: Dotted line

DrawTextBackground : Boolean = False

Should the background of texts be drawn or should it be left untouched ?

EGA = 3

Graphic driver for EGA cards

EGA64 = 4

Graphic driver for EGA 64 cards

EGA64Hi = 1

EGA64 graphic driver high resolution mode

EGA64Lo = 0

EGA64 graphic driver low resolution mode

EGABlack = 0

Color code: EGA Black

EGABlue = 1

Color code: EGA blue

EGABrown = 20

Color code: EGA brown

EGACyan = 3

Color code: EGA cyan

EGADarkgray = 56

Color code: EGA dark gray

EGAGreen = 2

Color code: EGA green

EGAHi = 1

EGA graphic driver high resolution mode

EGALightblue = 57

Color code: EGA Light blue

EGALightcyan = 59

Color code: EGA Light cyan

EGALightgray = 7

Color code: EGA Light gray

EGALightgreen = 58

Color code: EGA Light green

EGALightmagenta = 61

Color code: EGA light magenta

EGALightred = 60

Color code: EGA light red

EGALo = 0

EGA graphic driver low resolution mode

EGAMagenta = 5

Color code: EGA magenta

EGAMono = 5

Graphic driver for EGA monochrome cards

EGAMonoHi = 3

EGAMono graphic driver high resolution mode

EGARed = 4

Color code: EGA red

EGAWhite = 63

Color code: EGA white

EGAYellow = 62

Color code: EGA yellow

EmptyFill = 0

Fill style: Do not fill

EuroFont = 9

Font number: ?

fillpatternTable : Array[0..12] of FillPatternType = ((\\$00, \\$00, \\$00, \\$00, \\$00, \\$00,

Table with standard fill patterns

G1024x768x16 = 30

Mode: Resolution 1024x768, 16 colors

G1024x768x16M = 25

Mode: Resolution 1024x768, 16M colors

G1024x768x16M32 = 36

Mode: Resolution 1024x758, 16M 32-bit colors

G1024x768x256 = 12

Mode: Resolution 1024x768, 256 colors

G1024x768x32K = 23

Mode: Resolution 1024x768, 32K colors

G1024x768x64K = 24

Mode: Resolution 1024x768, 64K colors

G1152x864x16 = 38

Mode: Resolution 1152x864, 16 colors

G1152x864x16M = 42

Mode: Resolution 1152x864, 16M colors

G1152x864x16M32 = 43

Mode: Resolution 1152x864, 16M 32-bitcolors

G1152x864x256 = 39

Mode: Resolution 1152x864, 256 colors

G1152x864x32K = 40

Mode: Resolution 1152x864, 32K colors

G1152x864x64K = 41

Mode: Resolution 1152x864, 64K colors

G1280x1024x16 = 31

Mode: Resolution 1280x1024, 16 colors

G1280x1024x16M = 28

Mode: Resolution 1280x1024, 16M colors

G1280x1024x16M32 = 37

Mode: Resolution 1280x1024, 16M 32-bit colors

G1280x1024x256 = 13

Mode: Resolution 1280x1024, 256 colors

G1280x1024x32K = 26

Mode: Resolution 1280x1024, 32K colors

G1280x1024x64K = 27

Mode: Resolution 1280x1024, 64K colors

G1600x1200x16 = 44

Mode: Resolution 1600x1200, 16 colors

G1600x1200x16M = 48

Mode: Resolution 1600x1200, 16M colors

G1600x1200x16M32 = 49

Mode: Resolution 1600x1200, 16M 32-bit colors

G1600x1200x256 = 45

Mode: Resolution 1600x1200, 256 colors

G1600x1200x32K = 46

Mode: Resolution 1600x1200, 32K colors

G1600x1200x64K = 47

Mode: Resolution 1600x1200, 64K colors

G320x200x16 = 1

Mode: Resolution 320x200, 16 colors

G320x200x16M = 16

Mode: Resolution 320x200, 16M colors

G320x200x16M32 = 33

Mode: Resolution 320x200, 16M 32-bit colors

G320x200x256 = 5

Mode: Resolution 320x200, 256 colors

G320x200x32K = 14

Mode: Resolution 320x200, 32K colors

G320x200x64K = 15

Mode: Resolution 320x200, 64K colors

G320x240x256 = 6

Mode: Resolution 320x240, 256 colors

G320x400x256 = 7

Mode: Resolution 320x400, 256 colors

G360x480x256 = 8

Mode: Resolution 360x480, 256 colors

G640x200x16 = 2

Mode: Resolution x, colors

G640x350x16 = 3

Mode: Resolution x, colors

G640x480x16 = 4

Mode: Resolution x, colors

G640x480x16M = 19

Mode: Resolution 640x480, 16M colors

G640x480x16M32 = 34

Mode: Resolution 640x480, 16M 32-bit colors

G640x480x2 = 9

Mode: Resolution 640x480, 2 colors

G640x480x256 = 10

Mode: Resolution 640x480, 256 colors

G640x480x32K = 17

Mode: Resolution 640x480, 32K colors

G640x480x64K = 18

Mode: Resolution 640x480, 64K colors

G720x348x2 = 32

Mode: Resolution 720x348, 2 colors

G800x600x16 = 29

Mode: Resolution 800x600, 16 colors

G800x600x16M = 22

Mode: Resolution 800x600, 16M colors

G800x600x16M32 = 35

Mode: Resolution 800x600, 16M 32-bit colors

G800x600x256 = 11

Mode: Resolution 800x600, 256 colors

G800x600x32K = 20

Mode: Resolution 800x600, 32K colors

G800x600x64K = 21

Mode: Resolution 800x600, 64K colors

GothicFont = 4

Font number: Gothic font

GraphStringTransTable : PCharsetTransTable = Nil

Table used when transliterating strings.

green = 2

Color code: green

grError = -11

Error: Unknown error.

grFileNotFoundException = -3

Error: File for driver not found.

grFontNotFound = -8

Error: font description file not found.

grInvalidDriver = -4

Error: Invalid driver specified

grInvalidFont = -13

Error: Invalid font description

grInvalidFontNum = -14

Error: Invalid font number

grInvalidMode = -10

Error: Invalid mode specified.

grInvalidVersion = -18

Error: Invalid version.

grIOerror = -12

Error: Unspecified Input/Output error.

grNoFloodMem = -7

Error: Could not allocate memory for flood operation.

grNoFontMem = -9

Error: Not enough memory to load font.

grNoInitGraph = -1

Error: Graphical system not initialized

grNoLoadMem = -5

Error: Memory error.

grNoScanMem = -6

Error: Could not allocate memory for scan

grNotDetected = -2

Error: Graphics device not detected.

grOk = 0

Graphical operation went OK.

HatchFill = 7

Fill style: Hatch lines

HercMono = 7

Mode: Hercules, mono color

HercMonoHi = 0

Mode: Hercules card, monochrome, high resolution

highNewDriver = 21

Mode: highest number for new driver

highNewMode = 30015

Mode: Highest possible value of the new modes.

HorizDir = 0

Text write direction: Horizontal

InterleaveFill = 9

Fill style: Interleaving lines

LCOMFont = 8

Font number: ?

LeftText = 0

Horizontal text alignment: Align text left

lightblue = 9

Color code: Light blue

lightcyan = 11

Color code: Light cyan

lightgray = 7

Color code: Light gray

lightgreen = 10

Color code: Light green

lightmagenta = 13

Color code: Light magenta

lightred = 12

Color code: Light red

LineFill = 2

Fill style: Fill using horizontal lines

lowNewDriver = 11

Mode: lowest number for new driver

lowNewMode = 30001

Mode: Lowest possible value of the new modes.

LowRes = 6

Mode: Low resolution.

LtBkSlashFill = 6

Fill style: Light diagonal (backslash) lines

LtSlashFill = 3

Fill style: Light diagonal (slash) lines

m1024x768 = 30012

Mode: Resolution 1024x768

m1280x1024 = 30013

Mode: Resolution 1280x1024

m1600x1200 = 30014

Mode: Resolution 1600x1200

m2048x1536 = 30015

Mode: Resolution 2048x1536

m320x200 = 30001

Mode: Resolution 320x200

m320x256 = 30002

Mode: Resolution 320x256

m320x400 = 30003

Mode: Resolution 320x400

m512x384 = 30004

Mode: Resolution 512x384

m640x200 = 30005

Mode: Resolution 640x200

m640x256 = 30006

Mode: Resolution 640x256

m640x350 = 30007

Mode: Resolution 640x350

m640x400 = 30008

Mode: Resolution 640x400

m640x480 = 30009

Mode: Resolution 640x480

m800x600 = 30010

Mode: Resolution 800x600

m832x624 = 30011

Mode: Resolution 832x624

magenta = 5

Color code: Magenta

MaxColors = 255

Max amount of colors in a palette

maxsmallint = (smallint)

Maximum value for smallint type

MCGA = 2

Graphic driver for MCGA cards

MCGAC0 = 0

MCGA Graphic driver mode C0

MCGAC1 = 1

MCGA Graphic driver mode C1

MCGAC2 = 2

MCGA Graphic driver mode C2

MCGAC3 = 3

MCGA Graphic driver mode C3

MCGAHi = 5

MCGA Graphic driver high resolution mode

MCGAMed = 4

MCGA Graphic driver medium resolution mode

NormalPut = 0

Draw operation: Use Normal (copy) operation

NormWidth = 1

Line width: Normal width

NotPut = 4

Draw operation: use NOT

OrPut = 2

Draw operation: use OR

red = 4

Color code: Red

resolutions : Array[lowNewMode..highNewMode] of TResolutionRec = ((x: 320; y: 200),

Array with actual resolutions of the new modes

RightText = 2

Horizontal text alignment: Align text right

SansSerifFont = 3

Font number: Sans Serif font

ScriptFont = 5

Font number: Script font

SimpleFont = 6

Font number: Simple font

SlashFill = 4

Fill style: Diagonal (slash) lines

SmallFont = 2

Font number: Small font

SolidFill = 1

Fill style: Solid fill.

SolidLn = 0

Line style: Solid line

ThickWidth = 3

Line width: double width

TopOff = False

Top off

TopOn = True

Top on

TopText = 2

Vertical text alignment: Align text to top

TriplexFont = 1

Font number: Triplex font

TSCRFont = 7

Font number: Terminal font

UserBitLn = 4

Line style: User defined

UserCharSize = 0

User character size

UserFill = 12

Fill style: User-defined fill.

VertDir = 1

Text write direction: Vertical

VESA = 10

Mode: VESA graphics adaptor.

VGA = 9

Mode: VGA graphics adaptor.

VGAHi = 2

Mode: VGA high resolution (640x480)

VGALo = 0

Mode: VGA low resolution (640x200)

VGAMed = 1

Mode: VGA medium resolution (640x350)

white = 15

Color code: White

WideDotFill = 10

Fill style: Widely spaced dotted lines

XHatchFill = 8

Fill style: Heavy hatch lines

XORPut = 1

Draw operation: use XOR

yellow = 14

Color code: Yellow

18.12.2 Types

```
ArcCoordsType = record
  x : SmallInt;
  y : SmallInt;
  xstart : SmallInt;
  ystart : SmallInt;
  xend : SmallInt;
  yend : SmallInt;
end
```

Describe the last arc which was drawn on screen

```
CircleProc = procedure(X: SmallInt;Y: SmallInt;Radius: Word)
```

Standard circle drawing routine prototype.

```
clrviewproc = procedure
```

Standard clearviewport routine prototype

```
defpixelproc = procedure(X: SmallInt;Y: SmallInt)
```

This is the standard putpixel routine used by all function drawing routines, it will use the viewport settings, as well as clip, and use the current foreground color to plot the desired pixel.

```
ellipseproc = procedure(X: SmallInt;Y: SmallInt;XRadius: Word;
                        YRadius: Word;stAngle: Word;EndAngle: Word;
                        fp: patternlineproc)
```

Standard ellipse drawing routine prototype.

```
FillPatternType = Array[1..8] of Byte
```

Bit pattern used when drawing lines. Set bits are drawn.

```
FillSettingsType = record
  pattern : Word;
  color : Word;
end
```

Record describing fill mode

```
GetBkColorProc = function : Word
```

GetBkColorProc is the procedure prototype for the GetBkColor ([665](#)) method handler in TMod-eInfo ([664](#)). The function should return the color code of the background color.

```
getimageproc = procedure(X1: SmallInt;Y1: SmallInt;X2: SmallInt;
                         Y2: SmallInt;var Bitmap)
```

Standard GetImage ([665](#)) procedure prototype.

```
getpixelproc = function(X: SmallInt;Y: SmallInt) : Word
```

Standard pixel fetching routine prototype

```
getrgbpaletteproc = procedure(ColorNum: SmallInt;var RedValue: SmallInt;
                               var GreenValue: SmallInt;
                               var BlueValue: SmallInt)
```

This routine prototype is a hook for GetRGBPalette ([665](#))

```
getscanlineproc = procedure(X1: SmallInt;X2: SmallInt;Y: SmallInt;
                            var data)
```

This routine is used for FloodFill (670) It returns an entire screen scan line with a word for each pixel in the scanline. Also handy for GetImage.

```
graphfreememprc = procedure(var P: Pointer;size: Word)
```

Procedure prototype, used when heap memory is freed by the graph routines.

```
graphgetmemprc = procedure(var P: pointer;size: Word)
```

Procedure prototype, used when heap memory is needed by the graph routines.

```
graph_float = single
```

The platform's preferred floating point size for fast graph operations

```
hlineproc = procedure(x: SmallInt;x2: SmallInt;y: SmallInt)
```

Standard procedure prototype to draw a single horizontal line

```
imagesizeproc = function(X1: SmallInt;Y1: SmallInt;X2: SmallInt;
                         Y2: SmallInt) : LongInt
```

Standard ImageSize (665) calculation procedure prototype.

```
initmodeproc = procedure
```

Standard routine prototype to initialize a mode.

```
lineproc = procedure(X1: SmallInt;Y1: SmallInt;X2: SmallInt;
                      Y2: SmallInt)
```

Standard line drawing routine prototype.

```
LineSettingsType = record
  linestyle : Word;
  pattern : Word;
  thickness : Word;
end
```

Record describing current line drawing mode

```
OutTextXYProc = procedure(x: SmallInt;y: SmallInt;
                           const TextString: string)
```

This routine prototype is a hook for OutTextXY (666)

```
PaletteType = record
  Size : LongInt;
  Colors : Array[0..MaxColors] of RGBRec;
end
```

Record describing palette.

```
patternlineproc = procedure(x1: SmallInt;x2: SmallInt;y: SmallInt)
```

Standard procedure prototype to draw a patterned line

```
PCharsetTransTable = ^TCharsetTransTable
```

Pointer to TCharsetTransTable ([663](#)) array.

```
PModeInfo = ^TModeInfo
```

Pointer to TModeInfo ([664](#)) record

```
PointType = record
  x : SmallInt;
  y : SmallInt;
end
```

Record describing a point in a 2 dimensional plane

```
putimageproc = procedure(X: SmallInt;Y: SmallInt;var Bitmap;
                        BitBlt: Word)
```

Standard PutImage ([666](#)) procedure prototype.

```
putpixelproc = procedure(X: SmallInt;Y: SmallInt;Color: Word)
```

Standard pixel drawing routine prototype

```
restoretateproc = procedure
```

Standard routine prototype to restore the graphical state at a closegraph call.

```
RGBRec = packed record
  Red : SmallInt;
  Green : SmallInt;
  Blue : SmallInt;
end
```

Record describing palette RGB color

```
savestateproc = procedure
```

Standard routine prototype to save the graphical state before a mode is set.

```
setactivepageproc = procedure(page: Word)
```

Standard SetActivePage ([666](#)) procedure prototype.

```
SetAllPaletteProc = procedure(const Palette: PaletteType)
```

This routine prototype is a hook for SetAllPalette ([666](#))

```
SetBkColorProc = procedure(ColorNum: Word)
```

SetBkColorProc is the procedure prototype for the SetBkColor ([667](#)) method handler in TModeInfo ([664](#)). The procedure gets passed the color code for the color to set as background color.

```
setrgbpaletteproc = procedure(ColorNum: SmallInt; RedValue: SmallInt;  
                               GreenValue: SmallInt; BlueValue: SmallInt)
```

This routine prototype is a hook for SetRGBPalette ([667](#))

```
setvisualpageproc = procedure(page: Word)
```

Standard SetVisualPage ([667](#)) procedure prototype.

```
TCharsetTransTable = Array[Char] of Char
```

Character transliteration table, with entries for 256 characters

```
TextSettingsType = record  
  font : Word;  
  direction : Word;  
  charsize : Word;  
  horiz : Word;  
  vert : Word;  
end
```

Record describing how texts are drawn.

```
TModeInfo = record  
  DriverNumber : SmallInt;  
  ModeNumber : SmallInt;  
  internModeNumber : SmallInt;  
  MaxColor : LongInt;  
  PaletteSize : LongInt;  
  XAspect : Word;  
  YAspect : Word;  
  MaxX : Word;  
  MaxY : Word;  
  DirectColor : Boolean;  
  Hardwarepages : Byte;  
  ModeName : string;  
  DirectPutPixel : defpixelproc;  
  GetPixel : getpixelproc;  
  PutPixel : putpixelproc;  
  SetRGBPalette : setrgbpaletteproc;  
  GetRGBPalette : getrgbpaletteproc;  
  SetAllPalette : SetAllPaletteProc;
```

```
SetVisualPage : setvisualpageproc;
SetActivePage : setactivepageproc;
ClearViewPort : clrviewproc;
PutImage : putimageproc;
GetImage : getimageproc;
ImageSize : imagesizeproc;
GetScanLine : getscanlineproc;
Line : lineproc;
InternalEllipse : ellipseproc;
PatternLine : patternlineproc;
HLine : hlineproc;
VLine : vlineproc;
Circle : CircleProc;
InitMode : initmodeproc;
OutTextXY : OutTextXYProc;
SetBKColor : SetBkColorProc;
GetBKColor : GetBkColorProc;
next : PModeInfo;
end
```

Record describing a graphical mode.

```
TNewModeInfo = record
  modeInfo : Array[lowNewDriver..highNewDriver] of PModeInfo;
  loHiModeNr : Array[lowNewDriver..highNewDriver] of ;
end
```

Mode information for new modes.a

```
TResolutionRec = record
  x : LongInt;
  y : LongInt;
end
```

Record describing resolution

```
ViewPortType = record
  x1 : SmallInt;
  y1 : SmallInt;
  x2 : SmallInt;
  y2 : SmallInt;
  Clip : Boolean;
end
```

Record describing a viewport

```
vlineproc = procedure(x: SmallInt; y: SmallInt; y2: SmallInt)
```

Standard procedure prototype to draw a single vertical line

18.12.3 Variables

`Circle : CircleProc`

`Circle` draws a complete circle with center at (X, Y) , radius `radius`.

`ClearViewPort : clrviewproc`

`Clears` the current viewport. The current background color is used as filling color. The pointer is set at $(0, 0)$.

`DirectPutPixel : defpixelproc`

`Hook` to directly draw a pixel on the screen.

`GetBkColor : GetBkColorProc`

`GetBkColor` returns the current background color (the palette entry).

`GetImage : getimageproc`

`GetImage` Places a copy of the screen area $(X1, Y1)$ to $X2, Y2$ in BitMap

`GetPixel : getpixelproc`

`GetPixel` returns the color of the point at (X, Y)

`GetRGBPalette : getrgbpaletteproc`

`Hook` to set a RGB palette entries.

`GetScanLine : getscanlineproc`

`Hook` to get a scan line from the screen.

`GraphFreeMemPtr : graphfreememprc`

`Hook` to free heap memory.

`GraphGetMemPtr : graphgetmemprc`

`Hook` to get heap memory

`HLine : hlineproc`

`Hook` to draw a solid horizontal line

`ImageSize : imagesizeproc`

`ImageSize` returns the number of bytes needed to store the image in the rectangle defined by $(X1, Y1)$ and $(X2, Y2)$.

InternalEllipse : ellipseproc

Hook to draw an ellipse

Line : lineproc

Line draws a line starting from (X₁, Y₁) to (X₂, Y₂), in the current line style and color. The current position is put to (X₂, Y₂)

OutTextXY : OutTextXYProc

OutText puts TextString on the screen, at position (X, Y), using the current font and text settings. The current position is moved to the end of the text.

PatternLine : patternlineproc

Hook to draw a patterned line

PutImage : putimageproc

PutImage Places the bitmap in Bitmap on the screen at (X₁, Y₁). How determines how the bitmap will be placed on the screen. Possible values are:

- CopyPut
- XORPut
- ORPut
- AndPut
- NotPut

PutPixel : putpixelproc

Puts a point at (X, Y) using color Color

RestoreVideoState : restorestateproc

Hook to restore a saved video mode

SaveVideoState : savestateproc

Hook to save the current video state

SetActivePage : setactivepageproc

Sets Page as the active page for all graphical output.

SetAllPalette : SetAllPaletteProc

Sets the current palette to Palette. Palette is an untyped variable, usually pointing to a record of type PaletteType

SetBkColor : SetBkColorProc

Sets the background color to Color.

SetRGBPalette : setrgbpaletteproc

SetRGBPalette sets the ColorNr-th entry in the palette to the color with RGB-values Red, Green Blue.

SetVisualPage : setvisualpageproc

SetVisualPage sets the video page to page number Page.

VLine : vlineproc

Hook to draw a solid vertical line

18.13 Procedures and functions

18.13.1 Arc

Synopsis: Draw part of a circle

Declaration: procedure Arc(X: SmallInt; Y: SmallInt; StartAngle: Word; EndAngle: Word;
Radius: Word)

Visibility: default

Description: Arc draws part of a circle with center at (X, Y), radius radius, starting from angle start, stopping at angle stop. These angles are measured counterclockwise.

Errors: None.

See also: Circle (665), Ellipse (669), GetArcCoords (670), PieSlice (679), Sector (680)

18.13.2 Bar

Synopsis: Draw filled rectangle

Declaration: procedure Bar(x1: SmallInt; y1: SmallInt; x2: SmallInt; y2: SmallInt)

Visibility: default

Description: Draws a rectangle with corners at (X1, Y1) and (X2, Y2) and fills it with the current color and fill-style.

Errors: None.

See also: Bar3D (668), Rectangle (679)

18.13.3 Bar3D

Synopsis: Draw filled 3-dimensional rectangle

Declaration: procedure Bar3D(x1: SmallInt; y1: SmallInt; x2: SmallInt; y2: SmallInt; depth: Word; top: Boolean)

Visibility: default

Description: Bar3d draws a 3-dimensional Bar with corners at (X1, Y1) and (X2, Y2) and fills it with the current color and fill-style. Depth specifies the number of pixels used to show the depth of the bar.

If Top is true; then a 3-dimensional top is drawn.

Errors: None.

See also: Bar ([667](#)), Rectangle ([679](#))

18.13.4 ClearDevice

Synopsis: Clear the complete screen

Declaration: procedure ClearDevice

Visibility: default

Description: Clears the graphical screen (with the current background color), and sets the pointer at (0, 0).

Errors: None.

See also: ClearViewPort ([665](#)), SetBkColor ([667](#))

18.13.5 Closegraph

Synopsis: Close graphical system.

Declaration: procedure Closegraph

Visibility: default

Description: Closes the graphical system, and restores the screen modus which was active before the graphical modus was activated.

Errors: None.

See also: InitGraph ([676](#))

18.13.6 DetectGraph

Synopsis: Detect correct graphical driver to use

Declaration: procedure DetectGraph(var GraphDriver: SmallInt; var GraphMode: SmallInt)

Visibility: default

Description: DetectGraph checks the hardware in the PC and determines the driver and screen-modus to be used. These are returned in Driver and Modus, and can be fed to InitGraph. See the InitGraph for a list of drivers and modi.

Errors: None.

See also: InitGraph ([676](#))

18.13.7 DrawPoly

Synopsis: Draw a polygone

Declaration: procedure DrawPoly(NumPoints: Word; var polypoints)

Visibility: default

Description: DrawPoly draws a polygone with NumberOfPoints corner points, using the current color and line-style. PolyPoints is an array of type PointType (662).

Errors: None.

See also: Bar (667), Bar3D (668), Rectangle (679)

18.13.8 Ellipse

Synopsis: Draw an ellipse

Declaration: procedure Ellipse(X: SmallInt; Y: SmallInt; stAngle: Word; EndAngle: Word; XRadius: Word; YRadius: Word)

Visibility: default

Description: Ellipse draws part of an ellipse with center at (X, Y). XRadius and Yradius are the horizontal and vertical radii of the ellipse. Start and Stop are the starting and stopping angles of the part of the ellipse. They are measured counterclockwise from the X-axis (3 o'clock is equal to 0 degrees). Only positive angles can be specified.

Errors: None.

See also: Arc (667), Circle (665), FillEllipse (669)

18.13.9 FillEllipse

Synopsis: Draw and fill an ellipse

Declaration: procedure FillEllipse(X: SmallInt; Y: SmallInt; XRadius: Word; YRadius: Word)

Visibility: default

Description: Ellipse draws an ellipse with center at (X, Y). XRadius and Yradius are the horizontal and vertical radii of the ellipse. The ellipse is filled with the current color and fill-style.

Errors: None.

See also: Arc (667), Circle (665), GetArcCoords (670), PieSlice (679), Sector (680)

18.13.10 FillPoly

Synopsis: Draw, close and fill a polygone

Declaration: procedure FillPoly(NumPoints: Word; var PolyPoints)

Visibility: default

Description: FillPoly draws a polygone with NumberOfPoints corner points and fills it using the current color and line-style. PolyPoints is an array of type PointType.

Errors: None.

See also: Bar (667), Bar3D (668), Rectangle (679)

18.13.11 FloodFill

Synopsis: Fill an area with a given color

Declaration: procedure FloodFill(x: SmallInt; y: SmallInt; Border: Word)

Visibility: default

Description: Fills the area containing the point (X, Y), bounded by the color BorderColor.

Errors: None

See also: SetColor (681), SetBkColor (667)

18.13.12 GetArcCoords

Synopsis: Return coordinates of last drawn arc or ellipse.

Declaration: procedure GetArcCoords(var ArcCoords: ArcCoordsType)

Visibility: default

Description: GetArcCoords returns the coordinates of the latest Arc or Ellipse call.

Errors: None.

See also: Arc (667), Ellipse (669)

18.13.13 GetAspectRatio

Synopsis: Return screen resolution

Declaration: procedure GetAspectRatio(var Xasp: Word; var Yasp: Word)

Visibility: default

Description: GetAspectRatio determines the effective resolution of the screen. The aspect ratio can then be calculated as Xasp/Yasp.

Errors: None.

See also: InitGraph (676), SetAspectRatio (681)

18.13.14 GetColor

Synopsis: Return current drawing color

Declaration: function GetColor : Word

Visibility: default

Description: GetColor returns the current drawing color (the palette entry).

Errors: None.

See also: GetColor (670), SetBkColor (667)

18.13.15 GetDefaultPalette

Synopsis: Return default palette

Declaration: procedure GetDefaultPalette(var Palette: PaletteType)

Visibility: default

Description: GetDefaultPalette returns the current palette in Palette.

Errors: None.

See also: [GetColor \(670\)](#), [GetBkColor \(665\)](#)

18.13.16 GetDirectVideo

Synopsis: Determine whether direct video mode is active.

Declaration: function GetDirectVideo : Boolean

Visibility: default

Description: Determine whether direct video mode is active.

18.13.17 GetDriverName

Synopsis: Return current driver name

Declaration: function GetDriverName : string

Visibility: default

Description: GetDriverName returns a string containing the name of the current driver.

Errors: None.

See also: [GetModeName \(673\)](#), [InitGraph \(676\)](#)

18.13.18 GetFillPattern

Synopsis: Return current fill pattern

Declaration: procedure GetFillPattern(var FillPattern: FillPatternType)

Visibility: default

Description: GetFillPattern returns an array with the current fill-pattern in FillPattern

Errors: None

See also: [SetFillPattern \(681\)](#)

18.13.19 GetFillSettings

Synopsis: Return current fill settings

Declaration: procedure GetFillSettings(var Fillinfo: FillSettingsType)

Visibility: default

Description: GetFillSettings returns the current fill-settings in FillInfo

Errors: None.

See also: SetFillPattern ([681](#))

18.13.20 GetGraphMode

Synopsis: Get current graphical modus

Declaration: function GetGraphMode : SmallInt

Visibility: default

Description: GetGraphMode returns the current graphical modus

Errors: None.

See also: InitGraph ([676](#))

18.13.21 GetLineSettings

Synopsis: Get current line drawing settings

Declaration: procedure GetLineSettings(var ActiveLineInfo: LineSettingsType)

Visibility: default

Description: GetLineSettings returns the current Line settings in LineInfo

Errors: None.

See also: SetLineStyle ([682](#))

18.13.22 GetMaxColor

Synopsis: return maximum number of colors

Declaration: function GetMaxColor : Word

Visibility: default

Description: GetMaxColor returns the maximum color-number which can be set with SetColor. Contrary to Turbo Pascal, this color isn't always guaranteed to be white (for instance in 256+ color modes).

Errors: None.

See also: SetColor ([681](#)), GetPaletteSize ([674](#))

18.13.23 GetMaxMode

Synopsis: Return biggest mode for the current driver

Declaration: function GetMaxMode : SmallInt

Visibility: default

Description: GetMaxMode returns the highest modus for the current driver.

Errors: None.

See also: [InitGraph \(676\)](#)

18.13.24 GetMaxX

Synopsis: Return maximal X coordinate

Declaration: function GetMaxX : SmallInt

Visibility: default

Description: GetMaxX returns the maximum horizontal screen length

Errors: None.

See also: [GetMaxY \(673\)](#)

18.13.25 GetMaxY

Synopsis: Return maximal Y coordinate

Declaration: function GetMaxY : SmallInt

Visibility: default

Description: GetMaxY returns the maximum number of screen lines

Errors: None.

See also: [GetMaxY \(673\)](#)

18.13.26 GetModeName

Synopsis: Return description a modus

Declaration: function GetModeName(ModeNumber: SmallInt) : string

Visibility: default

Description: GetModeName Returns a string with the name of modus Modus

Errors: None.

See also: [GetDriverName \(671\)](#), [InitGraph \(676\)](#)

18.13.27 GetModeRange

Synopsis: Return lowest and highest modus of current driver

Declaration: procedure GetModeRange(GraphDriver: SmallInt; var LoMode: SmallInt;
var HiMode: SmallInt)

Visibility: default

Description: GetModeRange returns the Lowest and Highest modus of the currently installed driver. If no modes are supported for this driver, HiModus will be -1.

Errors: None.

See also: InitGraph ([676](#))

18.13.28 GetPalette

Synopsis: Return current palette

Declaration: procedure GetPalette(var Palette: PaletteType)

Visibility: default

Description: GetPalette returns in Palette the current palette.

Errors: None.

See also: GetPaletteSize ([674](#)), SetPalette ([683](#))

18.13.29 GetPaletteSize

Synopsis: Return maximal number of entries in current palette

Declaration: function GetPaletteSize : SmallInt

Visibility: default

Description: GetPaletteSize returns the maximum number of entries in the current palette.

Errors: None.

See also: GetPalette ([674](#)), SetPalette ([683](#))

18.13.30 GetTextSettings

Synopsis: Return current text style

Declaration: procedure GetTextSettings(var TextInfo: TextSettingsType)

Visibility: default

Description: GetTextSettings returns the current text style settings : The font, direction, size and placement as set with SetTextStyle and SetTextJustify

Errors: None.

See also: SetTextStyle ([684](#)), SetTextJustify ([683](#))

18.13.31 GetViewSettings

Synopsis: Return current viewport

Declaration: procedure GetViewSettings (var *viewport*: ViewPortType)

Visibility: default

Description: GetViewSettings returns the current viewport and clipping settings in ViewPort.

Errors: None.

See also: SetViewPort ([685](#))

18.13.32 GetX

Synopsis: Return current cursor X position

Declaration: function GetX : SmallInt

Visibility: default

Description: GetX returns the X-coordinate of the current position of the graphical pointer

Errors: None.

See also: GetY ([675](#))

18.13.33 GetY

Synopsis: Return current cursor Y position

Declaration: function GetY : SmallInt

Visibility: default

Description: GetY returns the Y-coordinate of the current position of the graphical pointer

Errors: None.

See also: GetX ([675](#))

18.13.34 GraphDefaults

Synopsis: Reset graphical mode to defaults

Declaration: procedure GraphDefaults

Visibility: default

Description: GraphDefaults resets all settings for viewport, palette, foreground and background pattern, line-style and pattern, filling style, filling color and pattern, font, text-placement and text size.

Errors: None.

See also: SetViewPort ([685](#)), SetFillStyle ([682](#)), SetColor ([681](#)), SetBkColor ([667](#)), SetLineStyle ([682](#))

18.13.35 GraphErrorMsg

Synopsis: Return a description of an error

Declaration: function GraphErrorMsg(ErrorCode: SmallInt) : string

Visibility: default

Description: GraphErrorMsg returns a string describing the error ErrorCode. This string can be used to let the user know what went wrong.

Errors: None.

See also: GraphResult (1)

18.13.36 GraphResult

Synopsis: Result of last graphical operation

Declaration: function GraphResult : SmallInt

Visibility: default

Description: GraphResult returns an error-code for the last graphical operation. If the returned value is zero, all went well. A value different from zero means an error has occurred. besides all operations which draw something on the screen, the following procedures also can produce a GraphResult different from zero:

- InstallUserFont (677)
- SetLineStyle (682)
- SetWriteMode (685)
- SetFillStyle (682)
- SetTextJustify (683)
- SetGraphMode (682)
- SetTextStyle (684)

Errors: None.

See also: GraphErrorMsg (1)

18.13.37 InitGraph

Synopsis: Initialize graphical system

Declaration: procedure InitGraph(var GraphDriver: SmallInt; var GraphMode: SmallInt;
const PathToDriver: string)

Visibility: default

Description: InitGraph initializes the graph package. GraphDriver has two valid values: GraphDriver=0 which performs an auto detect and initializes the highest possible mode with the most colors. 1024x768x64K is the highest possible resolution supported by the driver, if you need a higher resolution, you must edit MODES.PPI. If you need another mode, then set GraphDriver to a value different from zero and graphmode to the mode you wish (VESA modes where 640x480x256 is 101h etc.). PathToDriver is only needed, if you use the BGI fonts from Borland. Free Pascal does not offer BGI fonts like Borland, these must be obtained separately.

Example code:

```
var
  gd,gm : integer;
  PathToDriver : string;
begin
  gd:=detect; { highest possible resolution }
  gm:=0; { not needed, auto detection }
  PathToDriver:='C:\PP\BGI'; { path to BGI fonts,
                               drivers aren't needed }
  InitGraph(gd,gm,PathToDriver);
  if GraphResult<>grok then
    halt; ..... { whatever you need }
  CloseGraph; { restores the old graphics mode }
end.
```

Errors: None.

See also: Modes (638), DetectGraph (668), CloseGraph (668), GraphResult (1)

18.13.38 InstallUserDriver

Synopsis: Install a user driver

Visibility: default

Description: `InstallUserDriver` adds the device-driver `DriverPath` to the list of .BGI drivers. `AutoDetectPtr` is a pointer to a possible auto-detect function.

Errors: None.

See also: [InitGraph](#) (676), [InstallUserFont](#) (677)

18.13.39 InstallUserFont

Synopsis: Install a user-defined font

Declaration: function InstallUserFont(const FontFileName: string) : SmallInt

Visibility: default

Description: InstallUserFont adds the font in FontPath to the list of fonts of the .BGI system.

Errors: None.

See also: [InitGraph \(676\)](#), [InstallUserDriver \(677\)](#)

18.13.40 LineRel

Synopsis: Draw a line starting from current position in given direction

Declaration: procedure LineRel(Dx: SmallInt; Dy: SmallInt)

Visibility: default

Description: LineRel draws a line starting from the current pointer position to the point (DX, DY), **relative** to the current position, in the current line style and color. The Current Position is set to the endpoint of the line.

Errors: None.

See also: Line ([666](#)), LineTo ([678](#))

18.13.41 LineTo

Synopsis: Draw a line starting from current position to a given point

Declaration: procedure LineTo (X: SmallInt; Y: SmallInt)

Visibility: default

Description: LineTo draws a line starting from the current pointer position to the point (DX, DY), **relative** to the current position, in the current line style and color. The Current position is set to the end of the line.

Errors: None.

See also: LineRel ([677](#)), Line ([666](#))

18.13.42 MoveRel

Synopsis: Move cursor relative to current position

Declaration: procedure MoveRel (Dx: SmallInt; Dy: SmallInt)

Visibility: default

Description: MoveRel moves the pointer to the point (DX, DY), relative to the current pointer position

Errors: None.

See also: MoveTo ([678](#))

18.13.43 MoveTo

Synopsis: Move cursor to absolute position.

Declaration: procedure MoveTo (X: SmallInt; Y: SmallInt)

Visibility: default

Description: MoveTo moves the pointer to the point (X, Y).

Errors: None.

See also: MoveRel ([678](#))

18.13.44 OutText

Synopsis: Write text on the screen at the current location.

Declaration: procedure OutText(const TextString: string)

Visibility: default

Description: OutText puts TextString on the screen, at the current pointer position, using the current font and text settings. The current position is moved to the end of the text.

Errors: None.

See also: OutTextXY (666)

18.13.45 PieSlice

Synopsis: Draw a pie-slice

Declaration: procedure PieSlice(X: SmallInt;Y: SmallInt;startAngle: SmallInt;
endAngle: SmallInt;Radius: Word)

Visibility: default

Description: PieSlice draws and fills a sector of a circle with center (X, Y) and radius Radius, starting at angle Start and ending at angle Stop.

Errors: None.

See also: Arc (667), Circle (665), Sector (680)

18.13.46 queryadapterinfo

Synopsis: Function called to retrieve the current video adapter settings.

Declaration: function queryadapterinfo : PModeInfo

Visibility: default

18.13.47 Rectangle

Synopsis: Draw a rectangle on the screen.

Declaration: procedure Rectangle(x1: SmallInt;y1: SmallInt;x2: SmallInt;y2: SmallInt)

Visibility: default

Description: Draws a rectangle with corners at (X1, Y1) and (X2, Y2), using the current color and style.

Errors: None.

See also: Bar (667), Bar3D (668)

18.13.48 RegisterBGI_driver

Synopsis: Register a new BGI driver.

Declaration: function RegisterBGI_driver(driver: pointer) : SmallInt

Visibility: default

Description: Registers a user-defined BGI driver

Errors: None.

See also: InstallUserDriver ([677](#)), RegisterBGIFont ([680](#))

18.13.49 RegisterBGIfont

Synopsis: Register a new BGI font

Declaration: function RegisterBGIfont(font: pointer) : SmallInt

Visibility: default

Description: Registers a user-defined BGI driver

Errors: None.

See also: InstallUserFont ([677](#)), RegisterBGI_driver ([680](#))

18.13.50 RestoreCrtMode

Synopsis: Restore text screen

Declaration: procedure RestoreCrtMode

Visibility: default

Description: Restores the screen modus which was active before the graphical modus was started.

To get back to the graph mode you were last in, you can use SetGraphMode (GetGraphMode)

Errors: None.

See also: InitGraph ([676](#))

18.13.51 Sector

Synopsis: Draw and fill a sector of an ellipse

Declaration: procedure Sector(x: SmallInt; y: SmallInt; StartAngle: Word; EndAngle: Word;
XRadius: Word; YRadius: Word)

Visibility: default

Description: Sector draws and fills a sector of an ellipse with center (X, Y) and radii XRadius and YRadius,
starting at angle Start and ending at angle Stop.

Errors: None.

See also: Arc ([667](#)), Circle ([665](#)), PieSlice ([679](#))

18.13.52 SetAspectRatio

Synopsis: Set aspect ration of the screen

Declaration: procedure SetAspectRatio(Xasp: Word; Yasp: Word)

Visibility: default

Description: Sets the aspect ratio of the current screen to Xasp/Yasp.

Errors: None

See also: InitGraph (676), GetAspectRatio (670)

18.13.53 SetColor

Synopsis: Set foreground drawing color

Declaration: procedure SetColor(Color: Word)

Visibility: default

Description: Sets the foreground color to Color.

Errors: None.

See also: GetColor (670), SetBkColor (667), SetWriteMode (685)

18.13.54 SetDirectVideo

Synopsis: Attempt to enter direct video mode.

Declaration: procedure SetDirectVideo(DirectAccess: Boolean)

Visibility: default

Description: SetDirectVideo attempts to enter direct video mode. In that mode, everything is drawn straight in the video buffer.

18.13.55 SetFillPattern

Synopsis: Set drawing fill pattern

Declaration: procedure SetFillPattern(Pattern: FillPatternType; Color: Word)

Visibility: default

Description: SetFillPattern sets the current fill-pattern to Pattern, and the filling color to Color
The pattern is an 8x8 raster, corresponding to the 64 bits in Pattern.

Errors: None

See also: GetFillPattern (671), SetFillStyle (682), SetWriteMode (685)

18.13.56 SetFillStyle

Synopsis: Set drawing fill style

Declaration: procedure SetFillStyle(Pattern: Word; Color: Word)

Visibility: default

Description: SetFillStyle sets the filling pattern and color to one of the predefined filling patterns. Pattern can be one of the following predefined constants :

EmptyFillUses backgroundcolor.

SolidFillUses filling color

LineFillFills with horizontal lines.

LtSlashFillFills with lines from left-under to top-right.

SlashFillIdem as previous, thick lines.

BkSlashFillFills with thick lines from left-Top to bottom-right.

LtBkSlashFillIdem as previous, normal lines.

HatchFillFills with a hatch-like pattern.

XHatchFillFills with a hatch pattern, rotated 45 degrees.

InterLeaveFill

WideDotFillFills with dots, wide spacing.

CloseDotFillFills with dots, narrow spacing.

UserFillFills with a user-defined pattern.

Errors: None.

See also: SetFillPattern (681), SetWriteMode (685)

18.13.57 SetGraphMode

Synopsis: Set graphical mode

Declaration: procedure SetGraphMode (Mode: SmallInt)

Visibility: default

Description: SetGraphMode sets the graphical mode and clears the screen.

Errors: None.

See also: InitGraph (676)

18.13.58 SetLineStyle

Synopsis: Set line drawing style

Declaration: procedure SetLineStyle(LineStyle: Word; Pattern: Word; Thickness: Word)

Visibility: default

Description: SetLineStyle sets the drawing style for lines. You can specify a LineStyle which is one of the following pre-defined constants:

SolidIndraws a solid line.

DottedInDraws a dotted line.

CenterIndraws a non-broken centered line.

DashedIndraws a dashed line.

UserBitInDraws a User-defined bit pattern.

If **UserBitIn** is specified then **Pattern** contains the bit pattern. In all another cases, **Pattern** is ignored. The parameter **Width** indicates how thick the line should be. You can specify one of the following pre-defined constants:

NormWidthNormal line width

ThickWidthDouble line width

Errors: None.

See also: [GetLineSettings \(672\)](#), [SetWriteMode \(685\)](#)

18.13.59 SetPalette

Synopsis: Set palette entry using color constant

Declaration: procedure **SetPalette**(ColorNum: Word; Color: ShortInt)

Visibility: default

Description: **SetPalette** changes the **ColorNr**-th entry in the palette to **NewColor**

Errors: None.

See also: [SetAllPalette \(666\)](#), [SetRGBPalette \(667\)](#)

18.13.60 SetTextJustify

Synopsis: Set text placement style

Declaration: procedure **SetTextJustify**(horiz: Word; vert: Word)

Visibility: default

Description: **SetTextJustify** controls the placement of new text, relative to the (graphical) cursor position. **Horizontal** controls horizontal placement, and can be one of the following pre-defined constants:

LeftTextText is set left of the pointer.

CenterTextText is set centered horizontally on the pointer.

RightTextText is set to the right of the pointer.

Vertical controls the vertical placement of the text, relative to the (graphical) cursor position. Its value can be one of the following pre-defined constants :

BottomTextText is placed under the pointer.

CenterTextText is placed centered vertically on the pointer.

TopTextText is placed above the pointer.

Errors: None.

See also: [OutText \(679\)](#), [OutTextXY \(666\)](#)

18.13.61 SetTextStyle

Synopsis: Set text style

Declaration: procedure SetTextStyle(font: Word; direction: Word; charsize: Word)

Visibility: default

Description: SetTextStyle controls the style of text to be put on the screen. pre-defined constants for Font are:

DefaultFontThe default font

TriplexFontA special font

SmallFontA smaller font

SansSerifFontA sans-serif font (like Arial)

GothicFontA gothic font

ScriptFontA script font

SimpleFontA simple font

TSCRFontTerminal screen font

LCOMFont?

EuroFont?

BoldFontA bold typeface font

Pre-defined constants for Direction are :

HorizDirWrite horizontal

VertDirWrite vertical

Errors: None.

See also: GetTextSettings ([674](#))

18.13.62 SetUserCharSize

Synopsis: Set user character size for vector font

Declaration: procedure SetUserCharSize(Multx: Word; Divx: Word; Multy: Word; Divy: Word)

Visibility: default

Description: Sets the width and height of vector-fonts. The horizontal size is given by Xasp1/Xasp2, and the vertical size by Yasp1/Yasp2.

Errors: None.

See also: SetTextStyle ([684](#))

18.13.63 SetViewPort

Synopsis: Set the graphical drawing window

Declaration: `procedure SetViewPort(X1: SmallInt; Y1: SmallInt; X2: SmallInt; Y2: SmallInt; Clip: Boolean)`

Visibility: default

Description: Sets the current graphical viewport (window) to the rectangle defined by the top-left corner (X_1, Y_1) and the bottom-right corner (X_2, Y_2). If `Clip` is true, anything drawn outside the viewport (window) will be clipped (i.e. not drawn). Coordinates specified after this call are relative to the top-left corner of the viewport.

Errors: None.

See also: [GetViewSettings \(675\)](#)

18.13.64 SetWriteMode

Synopsis: Specify binary operation to perform when drawing on screen

Declaration: `procedure SetWriteMode(WriteMode: SmallInt)`

Visibility: default

Description: `SetWriteMode` controls the drawing of lines on the screen. It controls the binary operation used when drawing lines on the screen. `Mode` can be one of the following pre-defined constants:

CopyPutDraw as specified using current bitmask and color

XORPutDraw XOR-ing current bitmask and color

Errors: None.

See also: [SetColor \(681\)](#), [SetBkColor \(667\)](#), [SetLineStyle \(682\)](#), [SetFillStyle \(682\)](#)

18.13.65 TextHeight

Synopsis: Return height (in pixels) of the given string

Declaration: `function TextHeight(const TextString: string) : Word`

Visibility: default

Description: `TextHeight` returns the height (in pixels) of the string `S` in the current font and text-size.

Errors: None.

See also: [TextWidth \(685\)](#)

18.13.66 TextWidth

Synopsis: Return width (in pixels) of the given string

Declaration: `function TextWidth(const TextString: string) : Word`

Visibility: default

Description: `TextHeight` returns the width (in pixels) of the string `S` in the current font and text-size.

Errors: None.

See also: [TextHeight \(685\)](#)

Chapter 19

Reference for unit 'heaptc'

19.1 Overview

This document describes the HEAPTRC unit for Free Pascal. It was written by Pierre Muller. It is system independent, and works on all supported systems.

The HEAPTRC unit can be used to debug your memory allocation/deallocation. It keeps track of the calls to getmem/freemem, and, implicitly, of New/Dispose statements.

When the program exits, or when you request it explicitly. It displays the total memory used, and then dumps a list of blocks that were allocated but not freed. It also displays where the memory was allocated.

If there are any inconsistencies, such as memory blocks being allocated or freed twice, or a memory block that is released but with wrong size, this will be displayed also.

The information that is stored/displayed can be customized using some constants.

19.2 Controlling HeapTrc with environment variables

The `HeapTrc` unit can be controlled with the `HEAPTRC` environment variable. The contents of this variable controls the initial setting of some constants in the unit. `HEAPTRC` consists of one or more of the following strings, separated by spaces:

keepreleased If this string occurs, then the `KeepReleased` (689) variable is set to `True`

disabled If this string occurs, then the `UseHeapTrace` (690) variable is set to `False` and the heap trace is disabled. It does not make sense to combine this value with other values.

nohalt If this string occurs, then the `HaltOnError` (689) variable is set to `False`, so the program continues executing even in case of a heap error.

log=filename If this string occurs, then the output of `heaptc` is sent to the specified `Filename`.
(see also `SetHeapTraceOutput` (692))

The following are valid values for the `HEAPTRC` variable:

```
HEAPTRC=disabled  
HEAPTRC="keepreleased log=heap.log"  
HEAPTRC="log=myheap.log nohalt"
```

Note that these strings are case sensitive, and the name of the variable too.

19.3 HeapTrc Usage

All that you need to do is to include `heaptrc` in the `uses` clause of your program. Make sure that it is the first unit in the clause, otherwise memory allocated in initialization code of units that precede the `heaptrc` unit will not be accounted for, causing an incorrect memory usage report.

If you use the `-gh` switch, the compiler will insert the unit by itself, so you don't have to include it in your `uses` clause.

The below example shows how to use the `heaptrc` unit.

This is the memory dump shown when running this program in a standard way:

```
Marked memory at 0040FA50 invalid
Wrong size : 128 allocated 64 freed
  0x00408708
  0x0040CB49
  0x0040C481
Call trace for block 0x0040FA50 size 128
  0x0040CB3D
  0x0040C481
```

If you use the `lineinfo` unit (or use the `-gl` switch) as well, then `heaptrc` will also give you the filenames and line-numbers of the procedures in the backtrace:

```
Marked memory at 00410DA0 invalid
Wrong size : 128 allocated 64 freed
  0x004094B8
  0x0040D8F9  main,  line 25 of heapex.pp
  0x0040D231
Call trace for block 0x00410DA0 size 128
  0x0040D8ED  main,  line 23 of heapex.pp
  0x0040D231
```

If lines without filename/line-number occur, this means there is a unit which has no debug info included.

Listing: ./heapex/heapex.pp

```
Program heapex;

{ Program used to demonstrate the usage of heaptrc unit }

Uses heaptrc;

Var P1 : ^ Longint;
    P2 : Pointer;
    I : longint;

begin
  New(P1);
  // causes previous allocation not to be de-allocated
  New(P1);
  Dispose(P1);
  For I:=1 to 10 do
    begin
      GetMem (P2,128);
      // When I is even, deallocate block. We loose 5 times 128
```

```
// bytes this way.
If (I mod 2) = 0 Then FreeMem(P2,128);
end;
GetMem(P2,128);
// This will provoke an error and a memory dump
Freemem (P2,64);
end.
```

19.4 Constants, types and variables

19.4.1 Constants

add_tail : Boolean = True

If add_tail is True (the default) then a check is also performed on the memory location just behind the allocated memory.

HaltOnError : Boolean = True

If HaltOnError is set to True then an illegal call to FreeMem will cause the memory manager to execute a halt (1) instruction, causing a memory dump. By Default it is set to True.

HaltOnNotReleased : Boolean = False

HaltOnNotReleased can be set to True to make the DumpHeap (690) procedure halt (exit code 203) the program if any memory was not released when the dump is made. If it is False (the default) then DumpHeap just returns.

keepreleased : Boolean = False

If keepreleased is set to true, then a list of freed memory blocks is kept. This is useful if you suspect that the same memory block is released twice. However, this option is very memory intensive, so use it sparingly, and only when it's really necessary.

maxprintedblocklength : Integer = 128

maxprintedblocklength determines the maximum number of bytes written by a memory block dump, as produced when printleakedblock (690) or printfaultyblock (689) are true. If the size of the memory block is larger than this size, then only the first maxprintedblocklength will be included in the dump.

printfaultyblock : Boolean = False

printleakedblock can be set to True to print a memory dump of daulty memory blocks (in case a memory override occurs) The block is printed as a series of hexadecimal numbers, representing the bytes in the memory block. At most maxprintedblocklength (689) bytes of the memory block will be printed.

printleakedblock : Boolean = False

`printleakedblock` can be set to `True` to print a memory dump of unreleased blocks when the `heaptc` unit produces a summary of memory leaks. The block is printed as a series of hexadecimal numbers, representing the bytes in the memory block. At most `maxprintedblocklength` (689) bytes of the memory block will be printed.

```
quicktrace : Boolean = True
```

`Quicktrace` determines whether the memory manager checks whether a block that is about to be released is allocated correctly. This is a rather time consuming search, and slows program execution significantly, so by default it is set to `True`.

```
tracesize = 8
```

`Tracesize` specifies how many levels of calls are displayed of the call stack during the memory dump. If you specify `keepreleased:=True` then half the `TraceSize` is reserved for the `GetMem` call stack, and the other half is reserved for the `FreeMem` call stack. For example, the default value of 8 will cause eight levels of call frames to be dumped for the `getmem` call if `keepreleased` is `False`. If `KeepReleased` is true, then 4 levels of call frames will be dumped for the `GetMem` call and 4 frames wil be dumped for the `FreeMem` call. If you want to change this value, you must recode the `heaptc` unit.

```
usecrc : Boolean = True
```

If `usecrc` is `True` (the default) then a crc check is performed on locations before and after the allocated memory. This is useful to detect memory overwrites.

```
useheaptrace : Boolean = True
```

This variable must be set at program startup, through the help of an environment variable.

19.4.2 Types

```
tdisplayextrainfoProc = procedure(var ptext: text;p: pointer)
```

The `TDisplayExtraInfoType` is a procedural type used in the `SetHeapExtraInfo` (691) call to display a memory location which was previously filled with `TFillExtraInfoProc` (690)

```
tFillExtraInfoProc = procedure(p: pointer)
```

The `TFillExtraInfoProc` is a procedural type used in the `SetHeapExtraInfo` (691) call to fill a memory location with extra data for displaying.

19.5 Procedures and functions

19.5.1 DumpHeap

Synopsis: Dump memory usage report to `stderr`.

Declaration: `procedure DumpHeap`

Visibility: `default`

Description: `DumpHeap` dumps to standard output a summary of memory usage. It is called automatically by the `heaptc` unit when your program exits (by installing an exit procedure), but it can be called at any time.

Errors: None.

19.5.2 SetHeapExtraInfo

Synopsis: Store extra information in blocks.

Declaration: `procedure SetHeapExtraInfo(size: ptruint; fillproc: tFillExtraInfoProc;
displayproc: tdisplayextrainfoProc)`

Visibility: default

Description: You can use `SetHeapExtraInfo` to store extra info in the blocks that the heaptrc unit reserves when tracing `getmem` calls. `Size` indicates the size (in bytes) that the trace mechanism should reserve for your extra information. For each call to `getmem`, `FillProc` will be called, and passed a pointer to the memory reserved.

When dumping the memory summary, the extra info is shown by calling `displayproc` and passing it the memory location which was filled by `fillproc`. It should write the information in readable form to the text file provided in the call to `displayproc`.

Errors: You can only call `SetHeapExtraInfo` if no memroy has been allocated yet. If memory was already allocated prior to the call to `SetHeapExtraInfo`, then an error will be displayed on standard error output, and a `DumpHeap` (690) is executed.

See also: `DumpHeap` (690), `SetHeapTraceOutput` (692)

Listing: `./heapex/setinfo.pp`

```
Program heapex;

{ Program used to demonstrate the usage of heaptrc unit }

Uses heaptrc;

Var P1 : ^ Longint;
      P2 : Pointer;
      I : longint;
      Marker : Longint;

Procedure SetMarker (P : pointer);

Type PLongint = ^ Longint;

begin
  PLongint(P)^:=Marker;
end;

Procedure Part1;

begin
  // Blocks allocated here are marked with $FFAAFFAA = -5570646
  Marker := $FFAAFFAA;
  New(P1);
  New(P1);
  Dispose(P1);
  For I:=1 to 10 do
    begin
      GetMem (P2,128);
      If (I mod 2) = 0 Then FreeMem(P2,128);
      end;
  GetMem(P2,128);
end;
```

```

Procedure Part2;

begin
  // Blocks allocated here are marked with $FAFAFAFA = -84215046
  Marker := $FAFAFAFA;
  New(P1);
  New(P1);
  Dispose(P1);
  For I:=1 to 10 do
    begin
      GetMem (P2,128);
      If (I mod 2) = 0 Then FreeMem(P2,128);
      end;
      GetMem(P2,128);
  end;

begin
  SetExtraInfo (SizeOf(Marker),@SetMarker);
  WriteLn ('Part 1');
  part1;
  WriteLn ('Part 2');
  part2;
end.

```

19.5.3 SetHeapTraceOutput

Synopsis: Specify filename for heap trace output.

Declaration: procedure SetHeapTraceOutput (const name: string)

Visibility: default

Description: SetHeapTraceOutput sets the filename into which heap trace info will be written. By default information is written to standard output, this function allows you to redirect the information to a file with full filename name.

Errors: If the file cannot be written to, errors will occur when writing the trace.

See also: SetHeapExtraInfo (691)

Chapter 20

Reference for unit 'ipc'

20.1 Used units

Table 20.1: Used units by unit 'ipc'

Name	Page
BaseUnix	102
System	1229
unixtype	1713

20.2 Overview

This document describes the IPC unit for Free Pascal. It was written for linux by Michael Van Canneyt. It gives all the functionality of System V Inter-Process Communication: shared memory, semaphores and messages. It works only on the linux operating system.

Many constants here are provided for completeness only, and should under normal circumstances not be used by the programmer.

20.3 Constants, types and variables

20.3.1 Constants

`IPC_CREAT = 1 shl 9`

Create if key is nonexistent

`IPC_EXCL = 2 shl 9`

fail if key exists

`IPC_INFO = 3`

For ipcs call

IPC_NOWAIT = 4 shl 9

return error on wait

IPC_RMID = 0

Remove resource

IPC_SET = 1

set ipc_perm options

IPC_STAT = 2

get ipc_perm options

MSGMAX = 4056

Internal Message control code. Do not use

MSGMNB = 16384

Internal Message control code. Do not use

MSGMNI = 128

Internal Message control code. Do not use

MSG_EXCEPT = 2 shl 12

Internal Message control code. Do not use

MSG_NOERROR = 1 shl 12

Internal Message control code. Do not use

SEM_GETALL = 13

Semaphore operation: Get all semaphore values

SEM_GETNCNT = 14

Semaphore operation: Get number of processes waiting for resource.

SEM_GETPID = 11

Semaphore operation: Get process ID of last operation.

SEM_GETVAL = 12

Semaphore operation: Get current value of semaphore

SEM_GETZCNT = 15

Semaphore operation: Get number of processes waiting for semaphores to reach zero

SEM_SEMMNI = 128

Semaphore operation: ?

SEM_SEMMNS = SEM_SEMMNI * SEM_SEMMSL

Semaphore operation: ?

SEM_SEMMSL = 32

Semaphore operation: ?

SEM_SEMOPM = 32

Semaphore operation: ?

SEM_SEMVMX = 32767

Semaphore operation: ?

SEM_SETALL = 17

Semaphore operation: Set all semaphore values

SEM_SETVAL = 16

Semaphore operation: Set semaphore value

SEM_UNDO = \$1000

Constant for use in semop ([709](#))

SHM_LOCK = 11

This constant is used in the shmctl ([711](#)) call.

SHM_R = 4 shl 6

This constant is used in the shmctl ([711](#)) call.

SHM_RDONLY = 1 shl 12

This constant is used in the shmctl ([711](#)) call.

SHM_REMAP = 4 shl 12

This constant is used in the shmctl ([711](#)) call.

SHM_RND = 2 shl 12

This constant is used in the shmctl (711) call.

SHM_UNLOCK = 12

This constant is used in the shmctl (711) call.

SHM_W = 2 shl 6

This constant is used in the shmctl (711) call.

20.3.2 Types

key_t = TKey

Alias for TKey (697) type

msglen_t = culong

Message length type

msgqnum_t = culong

Message queue number type

PIPC_Perm = ^TIPC_Perm

Pointer to TIPC_Perm (697) record.

PMSG = ^TMSG

Pointer to TMSG (697) record

PMSGbuf = ^TMSGbuf

Pointer to TMsgBuf (698) record

PMSGinfo = ^TMSGinfo

Pointer to TMSGinfo (698) record

PMSQid_ds = ^TMSQid_ds

Pointer to TMSQid_ds (698)

PSEMbuf = ^TSEMbuf

Pointer to TSembuf (698) record.

```
PSEMid_ds = ^TSEMid_ds
```

Pointer to TSEMid_ds ([699](#)) record.

```
PSEMinfo = ^TSEMinfo
```

Pointer to TSEMinfo ([699](#)) record.

```
PSEMun = ^TSEMun
```

Pointer to TSEMun ([699](#)) record

```
PShmid_DS = ^TShmid_ds
```

Pointer to TSHMid_ds ([699](#)) record.

```
PSHMinfo = ^TSHMinfo
```

```
TIPC_Perm = record
  key : TKey;
  uid : kernel_uid_t;
  gid : kernel_gid_t;
  cuid : kernel_uid_t;
  cgid : kernel_gid_t;
  mode : kernel_mode_t;
  seq : cushort;
end
```

TIPC_Perm is used in all IPC systems to specify the permissions. It should never be used directly.

```
TKey = cint
```

Type returned by the ftok ([700](#)) key generating function.

```
TMSG = record
  msg_next : PMSG;
  msg_type : LongInt;
  msg_spot : PChar;
  msg_stime : LongInt;
  msg_ts : Integer;
end
```

Record used in the handling of message queues. Do not use directly.

```
TMSGbuf = record
  mtype : clong;
  mtext : Array[0..0] of Char;
end
```

The TMSGbuf record is a record containing the data of a record. you should never use this record directly, instead you should make your own record that follows the structure of the TMSGbuf record, but that has a size that is big enough to accomodate your messages. The type field should always be present, and should always be filled.

```
TMSGinfo = record
    msgpool : cint;
    msgmap : cint;
    msgmax : cint;
    msgmnb : cint;
    msgmni : cint;
    msgsz : cint;
    msgtql : cint;
    msgseg : cushort;
end
```

Internal message system record. Do not use directly.

```
TMSQid_ds = record
    msg_perm : TIPC_Perm;
    msg_first : PMSG;
    msg_last : PMSG;
    msg_stime : time_t;
    msg_rtime : time_t;
    msg_ctime : time_t;
    msg_cbytes : Word;
    msg_qnum : Word;
    msg_qbytes : Word;
    msg_lspid : ipc_pid_t;
    msg_lrpid : ipc_pid_t;
end
```

This record should never be used directly, it is an internal kernel record. It's fields may change at any time.

```
TSEMbuf = record
    sem_num : cushort;
    sem_op : cshort;
    sem_flg : cshort;
end
```

The TSEMbuf record is used in the semop ([709](#)) call, and is used to specify which operations you want to do.

```
TSEMId_ds = record
    sem_perm : TIPC_Perm;
    sem_otime : time_t;
    sem_ctime : time_t;
    sem_base : pointer;
    sem_pending : pointer;
```

```

sem_pending_last : pointer;
undo : pointer;
sem_nsems : cushort;
end

```

Structure returned by the semctl (704) call, contains all data of a semahore

```

TSEMinfo = record
  semmap : cint;
  semmni : cint;
  semmns : cint;
  semmnu : cint;
  semmsl : cint;
  semopm : cint;
  semume : cint;
  semusz : cint;
  semvmx : cint;
  semaem : cint;
end

```

Internal semaphore system record. Do not use.

```

TSEMun = record
end

```

Record used in semctl (704) call.

```

TShmid_ds = record
  shm_perm : TIPC_Perm;
  shm_segsz : size_t;
  shm_atime : time_t;
  shm_dtime : time_t;
  shm_ctime : time_t;
  shm_cpid : pid_t;
  shm_lpid : pid_t;
  shm_nattch : culong;
  __unused4 : culong;
  __unused5 : culong;
end

```

Record used in the shmctl (711) call to set or retrieve settings for shared memory.

```

TSHMinfo = record
  shmmmax : cint;
  shmmmin : cint;
  shmmnmi : cint;
  shmseg : cint;
  shmall : cint;
end

```

Record used by the shared memory system, Do not use directly.

20.4 Procedures and functions

20.4.1 ftok

Synopsis: Create token from filename

Declaration: function ftok(Path: PChar; ID: cint) : TKey

Visibility: default

Description: `ftok` returns a key that can be used in a `semget` (709)`shmget` (713) or `msgget` (702) call to access a new or existing IPC resource.

`Path` is the name of a file in the file system, `ID` is a character of your choice. The `ftok` call does the same as it's C counterpart, so a pascal program and a C program will access the same resource if they use the same `Path` and `ID`

For an example, see `msgctl` (700), `semctl` (704) or `shmctl` (711).

Errors: `ftok` returns -1 if the file in `Path` doesn't exist.

See also: `semget` (709), `shmget` (713), `msgget` (702)

20.4.2 msgctl

Synopsis: Perform various operations on a message queue

Declaration: function msgctl(msqid: cint; cmd: cint; buf: PMSQid_ds) : cint

Visibility: default

Description: `msgctl` performs various operations on the message queue with id `ID`. Which operation is performed, depends on the `cmd` parameter, which can have one of the following values:

IPC_STATIn this case, the `msgctl` call fills the `TMSQid_ds` structure with information about the message queue.

IPC_SETIn this case, the `msgctl` call sets the permissions of the queue as specified in the `ipc_perm` record inside `buf`.

IPC_RMIDIf this is specified, the message queue will be removed from the system.

`buf` contains the data that are needed by the call. It can be `Nil` in case the message queue should be removed.

The function returns `True` if successfull, `False` otherwise.

Errors: On error, `False` is returned, and `IPCError` is set accordingly.

See also: `msgget` (702), `msgsnd` (703), `msgrcv` (703)

Listing: ./ipcx/msgtool.pp

program msgtool;

Uses ipc, baseunix;

Type

```
PMyMsgBuf = ^TMyMsgBuf;
TMyMsgBuf = record
  mtype : Longint;
  mtext : string[255];
```

```

end;

Procedure DoError (Const Msg : string);
begin
  Writeln (msg,' returned an error : ',fpgeterrno);
  halt(1);
end;

Procedure SendMessage (Id : Longint;
  Var Buf : TMyMsgBuf;
  MType : Longint;
  Const MText : String);
begin
  Writeln ('Sending message.');
  Buf.mtype:=mtype;
  Buf.Mtext:=mtext;
  If msgsnd(Id ,PMsgBuf(@Buf),256 ,0)=-1 then
    DoError('msgsnd');
end;

Procedure ReadMessage (ID : Longint;
  Var Buf : TMyMsgBuf;
  MType : longint);
begin
  Writeln ('Reading message.');
  Buf.MType:=MType;
  If msgrcv(ID ,PMSGBuf(@Buf),256 ,mtype,0)<>-1 then
    Writeln ('Type : ',buf.mtype,' Text : ',buf.mtext)
  else
    DoError ('msgrcv');
end;

Procedure RemoveQueue ( ID : Longint);
begin
  If msgctl (id ,IPC_RMID,Nil)<>-1 then
    Writeln ('Removed Queue with id ',Id);
end;

Procedure ChangeQueueMode ( ID ,mode : longint);
Var QueueDS : TMSQid_ds;
begin
  If msgctl (Id ,IPC_STAT,@QueueDS)=-1 then
    DoError ('msgctl : stat');
  Writeln ('Old permissions : ',QueueDS.msg_perm.mode);
  QueueDS.msg_perm.mode:=Mode;
  if msgctl (ID ,IPC_SET,@QueueDS)=0 then
    Writeln ('New permissions : ',QueueDS.msg_perm.mode)
  else
    DoError ('msgctl : IPC_SET');
end;

procedure usage;

```

```

begin
  Writeln ('Usage : msgtool s(end)    <type> <text> (max 255 characters)');
  Writeln ('                  r(eceive) <type>');
  Writeln ('                  d(elete)');
  Writeln ('                  m(ode) <decimal mode>');
  halt(1);
end;

Function StrToInt (S : String): longint;

Var M : longint;
  C : Integer;

begin
  val (S,M,C);
  If C<>0 Then DoError ('StrToInt : '+S);
  StrToInt:=M;
end;

Var
  Key : TKey;
  ID  : longint;
  Buf : TMyMsgBuf;

const ipckey = '.'#0;

begin
  If ParamCount<1 then Usage;
  key := Ftok(@ipckey[1], ord('M'));
  ID := msgget(key, IPC_CREAT or 438);
  If ID<0 then DoError ('MsgGet');
  Case upCase(Paramstr(1)[1]) of
    'S' : If ParamCount<>3 then
      Usage
    else
      SendMessage (id, Buf, StrToInt(Paramstr(2)), paramstr(3));
    'R' : If ParamCount<>2 then
      Usage
    else
      ReadMessage (id, buf, strtoint(Paramstr(2)));
    'D' : If ParamCount<>1 then
      Usage
    else
      RemoveQueue (ID);
    'M' : If ParamCount<>2 then
      Usage
    else
      ChangeQueueMode (id, strtoint(paramstr(2)));
    else
      Usage
    end;
end.

```

20.4.3 msgget

Synopsis: Return message queue ID, possibly creating the queue

Declaration: function msgget(key: TKey; msgflg: cint) : cint

Visibility: default

Description: `msgget` returns the ID of the message queue described by `key`. Depending on the flags in `msgflg`, a new queue is created.

`msgflg` can have one or more of the following values (combined by ORs):

IPC_CREATThe queue is created if it doesn't already exist.

IPC_EXCLIf used in combination with `IPC_CREAT`, causes the call to fail if the queue already exists. It cannot be used by itself.

Optionally, the flags can be ORed with a permission mode, which is the same mode that can be used in the file system.

For an example, see `msgctl` (700).

Errors: On error, -1 is returned, and `IPCError` is set.

See also: `ftok` (700), `msgsnd` (703), `msgrcv` (703), `msgctl` (700)

20.4.4 msgrcv

Synopsis: Retrieve a message from the queue

Declaration: function msgrcv(msqid: cint; msgp: PMSGbuf; msgsiz: size_t; msgtyp: clong; msgflg: cint) : cint

Visibility: default

Description: `msgrcv` retrieves a message of type `msgtyp` from the message queue with ID `msqid`. `msgtyp` corresponds to the `mtype` field of the `TMSGbuf` record. The message is stored in the `MSGbuf` structure pointed to by `msgp`.

The `msgflg` parameter can be used to control the behaviour of the `msgrcv` call. It consists of an ORed combination of the following flags:

0No special meaning.

IPC_NOWAITIf no messages are available, then the call returns immediately, with the `ENOMSG` error.

MSG_NOERRORIf the message size is wrong (too large), no error is generated, instead the message is truncated. Normally, in such cases, the call returns an error (`E2BIG`)

The function returns `True` if the message was received correctly, `False` otherwise.

For an example, see `msgctl` (700).

Errors: In case of error, `False` is returned, and `IPCError` is set.

See also: `msgget` (702), `msgsnd` (703), `msgctl` (700)

20.4.5 msgsnd

Synopsis: Send a message to the message queue

Declaration: function msgsnd(msqid: cint; msgp: PMSGbuf; msgsiz: size_t; msgflg: cint) : cint

Visibility: default

Description: `msgsend` sends a message to a message queue with ID `msqid`. `msgp` is a pointer to a message buffer, that should be based on the `TMsgBuf` type. `msgsiz` is the size of the message (NOT of the message buffer record !)

The `msgflg` can have a combination of the following values (ORed together):

0No special meaning. The message will be written to the queue. If the queue is full, then the process is blocked.

IPC_NOWAITIf the queue is full, then no message is written, and the call returns immediately.

The function returns `True` if the message was sent successfully, `False` otherwise.

For an example, see `msgctl` (700).

Errors: In case of error, the call returns `False`, and `IPCerror` is set.

See also: `msgget` (702), `msgrcv` (703), `msgctl` (700)

20.4.6 semctl

Synopsis: Perform various control operations on a semaphore set

Declaration: `function semctl(semid: cint; semnum: cint; cmd: cint; var arg: TSEMun)`
`: cint`

Visibility: default

Description: `semctl` performs various operations on the semaphore `semnum` with semaphore set id `ID`.

The `arg` parameter supplies the data needed for each call. This is a variant record that should be filled differently, according to the command:

```
Type
TSEMun = record
  case longint of
    0 : ( val : longint );
    1 : ( buf : PSEMid_ds );
    2 : ( arr : PWord );
    3 : ( padbuf : PSeminfo );
    4 : ( padpad : pointer );
  end;
```

Which operation is performed, depends on the `cmd` parameter, which can have one of the following values:

IPC_STATIn this case, the `arg` record should have it's `buf` field set to the address of a `TSEMid_ds` record. The `semctl` call fills this `TSEMid_ds` structure with information about the semaphore set.

IPC_SETIn this case, the `arg` record should have it's `buf` field set to the address of a `TSEMid_ds` record. The `semctl` call sets the permissions of the queue as specified in the `ipc_perm` record.

IPC_RMIDIf this is specified, the semaphore set is removed from from the system.

GETALLIn this case, the `arr` field of `arg` should point to a memory area where the values of the semaphores will be stored. The size of this memory area is `\var{SizeOf(Word)} * Number of semaphores in the set`. This call will then fill the memory array with all the values of the semaphores.

GETNCNTThis will fill the `val` field of the `arg` union with the number of processes waiting for resources.

GETPID`semctl` returns the process ID of the process that performed the last `semop` (709) call.

GETVAL`semctl` returns the value of the semaphore with number `semnum`.

GETZCNT`semctl` returns the number of processes waiting for semaphores that reach value zero.

SETALLIn this case, the `arr` field of `arg` should point to a memory area where the values of the semaphores will be retrieved from. The size of this memory area is `\var{SizeOf(Word)}* Number of semaphores in the set}`. This call will then set the values of the semaphores from the memory array.

SETVALThis will set the value of semaphore `semnum` to the value in the `val` field of the `arg` parameter.

The function returns -1 on error.

Errors: The function returns -1 on error, and `IPCError` is set accordingly.

See also: `semget` (709), `semop` (709)

Listing: ./ipcx/semttool.pp

```

Program semtool;

{ Program to demonstrate the use of semaphores }

Uses ipc,baseunix;

Const MaxSemValue = 5;

Procedure DoError (Const Msg : String);
var
  error: cint;
begin
  error:=fpgeterrno;
  WriteLn ('Error : ',msg,' Code : ',error);
  Halt(1);
end;

Function getsemval (ID,Member : longint) : longint;

Var S : TSEMun;

begin
  GetSemVal:=SemCtl(id,member,SEM_GETVAL,S);
end;

Procedure DispVal (ID,member : longint);

begin
  writeln ('Value for member ',member,' is ',GetSemVal(ID,Member));
end;

Function GetMemberCount (ID : Longint) : longint;

Var opts : TSEMun;
  semds : TSEMid_ds;
```

```

begin
  opts.buf:=@semds;
  If semctl(Id,0,IPC_STAT,opts)<>-1 then
    GetMemberCount:=semds.sem_nsems
  else
    GetMemberCount:=-1;
end;

Function OpenSem (Key : TKey) : Longint;

begin
  OpenSem:=semget(Key,0,438);
  If OpenSem=-1 then
    DoError ('OpenSem');
end;

Function CreateSem (Key : TKey; Members : Longint) : Longint;

Var Count : Longint;
  Semopts : TSemun;

begin
// the semmsl constant seems kernel specific
{ If members>semmsl then
  DoError ('Sorry, maximum number of semaphores in set exceeded');
}
  Writeln ('Trying to create a new semaphore set with ',members,' members.');
CreateSem:=semget(key,members,IPC_CREAT or IPC_Excl or 438);
If CreateSem=-1 then
  DoError ('Semaphore set already exists.');
Semopts.val:=MaxSemValue; { Initial value of semaphores }
For Count:=0 to Members-1 do
  semctl(CreateSem,Count,SEM_SETVAL,semopts);
end;

Procedure lockSem (ID,Member: Longint);

Var lock : TSEMBuf;

begin
  With lock do
    begin
      sem_num:=0;
      sem_op:=-1;
      sem_flg:=IPC_NOWAIT;
    end;
    if (member<0) or (member>GetMemberCount(ID)-1) then
      DoError ('Semaphore member out of range');
    if getsemval(ID,member)=0 then
      DoError ('Semaphore resources exhausted (no lock)');
    lock.sem_num:=member;
    Writeln ('Attempting to lock member ',member,' of semaphore ',ID);
    if semop(Id,@lock,1)=-1 then
      DoError ('Lock failed')
    else
      Writeln ('Semaphore resources decremented by one');
      dispval(ID,Member);
end;

```

```

Procedure UnlockSem (ID ,Member: Longint);

Var Unlock : TSEMbuf;

begin
  With Unlock do
    begin
      sem_num:=0;
      sem_op:=1;
      sem_flg:=IPC_NOWAIT;
    end;
    if (member<0) or (member>GetMemberCount(ID)-1) then
      DoError ('semaphore member out of range');
    if getsemval(ID ,member)=MaxSemValue then
      DoError ('Semaphore not locked');
    Unlock.sem_num:=member;
    Writeln ('Attempting to unlock member ',member, ' of semaphore ',ID );
    if semop(Id ,@unlock,1)=-1 then
      DoError ('Unlock failed');
    else
      Writeln ('Semaphore resources incremented by one');
      dispval(ID ,Member);
  end;

Procedure RemoveSem (ID : longint);

var S : TSemun;

begin
  If semctl(Id ,0 ,IPC_RMID,S)<>-1 then
    Writeln ('Semaphore removed')
  else
    DoError ('Couldn''t remove semaphore');
  end;

Procedure ChangeMode (ID ,Mode : longint);

Var rc : longint;
  opts : TSEMun;
  semds : TSEMid_ds;

begin
  opts.buf:=@semds;
  If not semctl (Id ,0 ,IPC_STAT,opts)<>-1 then
    DoError ('Couldn''t stat semaphore');
  Writeln ('Old permissions were : ',semds.sem_perm.mode);
  semds.sem_perm.mode:=mode;
  If semctl(id ,0 ,IPC_SET,opts)<>-1 then
    Writeln ('Set permissions to ',mode)
  else
    DoError ('Couldn''t set permissions');
  end;

Procedure PrintSem (ID : longint);

Var l,cnt : longint;

```

```

begin
  cnt:=getmembercount(ID);
  Writeln ('Semaphore ',ID,' has ',cnt,' Members');
  For I:=0 to cnt-1 Do
    DispVal(id,i);
end;

Procedure USage;

begin
  Writeln ('Usage : semtool c(reate) <count>');
  Writeln ('          l(ock) <member>');
  Writeln ('          u(nlock) <member>');
  Writeln ('          d(elete)');
  Writeln ('          m(ode) <mode>');
  Writeln ('          p(rint)');
  halt(1);
end;

Function StrToInt (S : String): longint;

Var M : longint;
    C : Integer;

begin
  val (S,M,C);
  If C<>0 Then DoError ('StrToInt : '+S);
  StrToInt:=M;
end;

Var Key : TKey;
    ID : Longint;

const ipckey='.#0;

begin
  If ParamCount<1 then USage;
  key:=ftok(@ipckey[1],ORD('s'));
  Case UpCase(Paramstr(1)[1]) of
    'C' : begin
      if paramcount<>2 then usage;
      CreateSem (key, strtoint(paramstr(2)));
    end;
    'L' : begin
      if paramcount<>2 then usage;
      ID:=OpenSem (key);
      LockSem (ID, strtoint(paramstr(2)));
    end;
    'U' : begin
      if paramcount<>2 then usage;
      ID:=OpenSem (key);
      UnLockSem (ID, strtoint(paramstr(2)));
    end;
    'M' : begin
      if paramcount<>2 then usage;
      ID:=OpenSem (key);
    end;

```

```

    ChangeMode ( ID , strtoint(paramstr(2)) );
end;
'D' : Begin
    ID := OpenSem( Key );
    RemoveSem( Id );
end;
'P' : begin
    ID := OpenSem( Key );
    PrintSem( Id );
end;
else
    Usage
end;
end.

```

20.4.7 semget

Synopsis: Return the ID of a semaphore set, possibly creating the set

Declaration: function semget(key: TKey; nsems: cint; semflg: cint) : cint

Visibility: default

Description: msgget returns the ID of the semaphore set described by key. Depending on the flags in semflg, a new queue is created.

semflg can have one or more of the following values (combined by ORs):

IPC_CREATThe queue is created if it doesn't already exist.

IPC_EXCLIf used in combination with **IPC_CREAT**, causes the call to fail if the set already exists.
It cannot be used by itself.

Optionally, the flags can be ORed with a permission mode, which is the same mode that can be used in the file system.

if a new set of semaphores is created, then there will be nsems semaphores in it.

Errors: On error, -1 is returned, and **IPCError** is set.

See also: ftok ([700](#)), semop ([709](#)), semctl ([704](#))

20.4.8 semop

Synopsis: Perform semaphore operation.

Declaration: function semop(semid: cint;sops: PSEMbuf;nsops: cuint) : cint

Visibility: default

Description: semop performs a set of operations on a message queue. sops points to an array of type TSEMbuf.
The array should contain nsops elements.

The fields of the TSEMbuf ([698](#)) structure

```

TSEMbuf = record
    sem_num : word;
    sem_op   : integer;
    sem_flg  : integer;

```

should be filled as follows:

sem_numThe number of the semaphore in the set on which the operation must be performed.

sem_opThe operation to be performed. The operation depends on the sign of **sem_op**: A positive number is simply added to the current value of the semaphore. If 0 (zero) is specified, then the process is suspended until the specified semaphore reaches zero. If a negative number is specified, it is subtracted from the current value of the semaphore. If the value would become negative then the process is suspended until the value becomes big enough, unless **IPC_NOWAIT** is specified in the **sem_flg**.

sem_flgOptional flags: if **IPC_NOWAIT** is specified, then the calling process will never be suspended.

The function returns **True** if the operations were successful, **False** otherwise.

Errors: In case of error, **False** is returned, and **IPCerror** is set.

See also: [semget \(709\)](#), [semctl \(704\)](#)

20.4.9 semtimedop

Synopsis: Perform semaphore operation using timeout.

Declaration: `function semtimedop(semid: cint;sops: PSEMbuf;nsops: cuint;
timeOut: ptimespec) : cint`

Visibility: default

Description: `semop` performs a set of operations on a message queue, just as `semop` ([709](#)). `sops` points to an array of type `TSEMbuf`. The array should contain `nsops` elements. The `timeOut` argument points to a time specification: if the operations cannot be performed within the specified time, the function will return with an error.

For more information on the actual operations, see `semop` ([709](#)).

See also: [semop \(709\)](#)

20.4.10 shmat

Synopsis: Attach a shared memory block.

Declaration: `function shmat(shmid: cint;shmaddr: pointer;shmflg: cint) : pointer`

Visibility: default

Description: `shmat` attaches a shared memory block with identified `shmid` to the current process. The function returns a pointer to the shared memory block.

If `shmaddr` is `Nil`, then the system chooses a free unmapped memory region, as high up in memory space as possible.

If `shmaddr` is non-nil, and `SHM_RND` is in `shmflg`, then the returned address is `shmaddr`, rounded down to `SHMLBA`. If `SHM_RND` is not specified, then `shmaddr` must be a page-aligned address.

The parameter `shmflg` can be used to control the behaviour of the `shmat` call. It consists of a ORed combination of the following constants:

SHM_RNDThe suggested address in `shmaddr` is rounded down to `SHMLBA`.

SHM_RDONLYthe shared memory is attached for read access only. Otherwise the memory is attached for read-write. The process then needs read-write permissions to access the shared memory.

For an example, see [shmctl \(711\)](#).

Errors: If an error occurs, -1 is returned, and `IPCerror` is set.

See also: [shmget \(713\)](#), [shmdt \(713\)](#), [shmctl \(711\)](#)

20.4.11 `shmctl`

Synopsis: Perform control operations on a shared memory block.

Declaration: `function shmctl(shmid: cint;cmd: cint;buf: PShmid_DS) : cint`

Visibility: default

Description: `shmctl` performs various operations on the shared memory block identified by identifier `shmid`.

The `buf` parameter points to a `TSHMid_ds` record. The `cmd` parameter is used to pass which operation is to be performed. It can have one of the following values :

IPC_STAT`shmctl` fills the `TSHMid_ds` record that `buf` points to with the available information about the shared memory block.

IPC_SETapplies the values in the `ipc_perm` record that `buf` points to, to the shared memory block.

IPC_RMIDthe shared memory block is destroyed (after all processes to which the block is attached, have detached from it).

If successful, the function returns `True`, `False` otherwise.

Errors: If an error occurs, the function returns `False`, and `IPCerror` is set.

See also: [shmget \(713\)](#), [shmat \(710\)](#), [shmdt \(713\)](#)

Listing: ./ipcex/shmtool.pp

```

Program shmtool;

uses ipc , strings , Baseunix ;

Const SegSize = 100;

var key : Tkey;
      shmid,cntr : longint;
      segptr : pchar;

Procedure USage;

begin
  Writeln ( 'Usage : shmtool w(rite) text' );
  writeln ( '           r(ead)' );
  writeln ( '           d(elete)' );
  writeln ( '           m(ode change) mode' );
  halt(1);
end;

```

```

Procedure Writeshm (ID : Longint; ptr : pchar; S : string);
begin
  strcpy (ptr,S);
end;

Procedure Readshm(ID : longint; ptr : pchar);

begin
  Writeln ('Read : ',ptr);
end;

Procedure removeshm (ID : Longint);

begin
  shmctl (ID,IPC_RMID,Nil);
  writeln ('Shared memory marked for deletion');
end;

Procedure CHangeMode (ID : longint; mode : String);

Var m : word;
    code : integer;
    data : TSHMid_ds;

begin
  val (mode,m,code);
  if code<>0 then
    usage;
  If shmctl (shmid,IPC_STAT,@data)=-1 then
    begin
      writeln ('Error : shmctl :,fpgeterrno');
      halt(1);
    end;
  writeln ('Old permissions : ',data.shm_perm.mode);
  data.shm_perm.mode:=m;
  If shmctl (shmid,IPC_SET,@data)=-1 then
    begin
      writeln ('Error : shmctl :,fpgeterrno');
      halt(1);
    end;
  writeln ('New permissions : ',data.shm_perm.mode);
end;

const ftokpath = '.'#0;

begin
  if paramcount<1 then usage;
  key := ftok (pchar(@ftokpath[1]),ord('S'));
  shmid := shmget(key,segsize,IPC_CREAT or IPC_EXCL or 438);
  If shmid=-1 then
    begin
      Writeln ('Shared memory exists. Opening as client');
      shmid := shmget(key,segsize,0);
      If shmid = -1 then
        begin
          Writeln ('shmget : Error !',fpgeterrno);
          halt(1);
        end;
    end;

```

```

    end
  end
else
  Writeln ('Creating new shared memory segment.');
  segptr:=shmat(shmid, nil, 0);
  if longint(segptr)=-1 then
    begin
      Writeln ('Shmat : error !',fpgeterrno);
      halt(1);
    end;
  case upcase(paramstr(1)[1]) of
    'W' : writeshm (shmid,segptr,paramstr(2));
    'R' : readshm (shmid,segptr);
    'D' : removeshm(shmid);
    'M' : changemode (shmid,paramstr(2));
  else
    begin
      writeln (paramstr(1));
      usage;
    end;
  end;
end;
end.
```

20.4.12 shmdt

Synopsis: Detach shared memory block.

Declaration: function shmdt (shmaddr: pointer) : cint

Visibility: default

Description: shmdt detaches the shared memory at address shmaddr. This shared memory block is unavailable to the current process, until it is attached again by a call to shmat ([710](#)).

The function returns True if the memory block was detached successfully, False otherwise.

Errors: On error, False is returned, and IPCError is set.

See also: shmget ([713](#)), shmat ([710](#)), shmctl ([711](#))

20.4.13 shmget

Synopsis: Return the ID of a shared memory block, possibly creating it

Declaration: function shmget (key: TKey; size: size_t; flag: cint) : cint

Visibility: default

Description: shmget returns the ID of a shared memory block, described by key. Depending on the flags in flag, a new memory block is created.

flag can have one or more of the following values (combined by ORs):

IPC_CREAT The queue is created if it doesn't already exist.

IPC_EXCL If used in combination with **IPC_CREAT**, causes the call to fail if the queue already exists. It cannot be used by itself.

Optionally, the flags can be ORed with a permission mode, which is the same mode that can be used in the file system.

if a new memory block is created, then it will have size `Size` bytes in it.

Errors: On error, -1 is returned, and `IPCError` is set.

Chapter 21

Reference for unit 'keyboard'

21.1 Overview

The Keyboard unit implements a keyboard access layer which is system independent. It can be used to poll the keyboard state and wait for certain events. Waiting for a keyboard event can be done with the GetKeyEvent ([729](#)) function, which will return a driver-dependent key event. This key event can be translated to a interpretable event by the TranslateKeyEvent ([738](#)) function. The result of this function can be used in the other event examining functions.

A custom keyboard driver can be installed using the SetKeyboardDriver ([737](#)) function. The current keyboard driver can be retrieved using the GetKeyboardDriver ([729](#)) function. The last section of this chapter demonstrates how to make a keyboard driver.

21.2 Unix specific notes

On Unix, applications run on a "terminal", and the application writes to the screen and reads from the keyboard by communicating with the terminal. Unix keyboard handling is mostly backward compatible with the DEC vt100 and vt220 terminals from tens of years ago. The vt100 and vt220 had very different keyboards than todays PC's and this is where the problems start. To make it worse the protocol of both terminals has not been very well designed.

Because of this, the keyboard unit on Unix operating systems does a best effort to provide keyboard functionality. An implementation with full keyboard facilities like on other operating systems is not possible.

The exception is the Linux kernel. The terminal emulation of the Linux kernel is from a PC keyboard viewpoint hopeless as well, but unlike other terminal emulators it is configurable. On the Linux console, the Free Pascal keyboard unit tries to implement full functionality.

Users of applications using the keyboard unit should expect the following:

- Full functionality on the Linux console. It must be the bare console, SSH into another machine will kill the full functionality.
- Limited functionality otherwise.

Notes about Linux full functionality:

- The keyboard is reprogrammed. If the keyboard is for whatever reason not restored in its original state, please load your keymap to reinitialize it.

- Alt+function keys generate keycodes for those keys. To switch virtual consoles, use ctrl+alt+function key.
- Unlike what you're used to with other Unix software, escape works as you intuitively expect, it generates the keycode for an escape key **without a delay**.

The limited functionality does include these quirks:

- Escape must be pressed two times before it has effect.
- On the Linux console, when the user runs the program by logging into another machine:
 - Shift+F1 and Shift+F12 will generate keycodes for F11 and F12.
 - Shift+arrow keys, shift+ins, shift+del, shift+home, shift+end do not work. The same is true about the control and alt combinations.
 - Alt+function keys will switch virtual consoles instead of generating the right key sequences.
 - Ctrl+function keys will generate the keycodes for the function keys without ctrl
- In Xterm:
 - Shift+insert pastes the x clipboard, no keycode will be generated.
- In Konsole:
 - Shift+insert pastes the x clipboard, no keycode will be generated.
 - Shift+arrow keys doesn't work, nor does ctrl+arrow keys

If you have a non-standard terminal, some keys may not work at all. When in limited functionality mode, the user can work around using an escape prefix:

- Esc+1 = F1, Esc+2 = F2.
- Esc before another key is equal to alt+key.

In such cases, if the terminal does output an escape sequence for those keys, please submit a bug report so we can add them.

21.3 Writing a keyboard driver

Writing a keyboard driver means that hooks must be created for most of the keyboard unit functions. The TKeyboardDriver record contains a field for each of the possible hooks:

```
TKeyboardDriver = Record
  InitDriver : Procedure;
  DoneDriver : Procedure;
  GetKeyEvent : Function : TKeyEvent;
  PollKeyEvent : Function : TKeyEvent;
  GetShiftState : Function : Byte;
  TranslateKeyEvent : Function (KeyEvent: TKeyEvent): TKeyEvent;
  TranslateKeyEventUniCode: Function (KeyEvent: TKeyEvent): TKeyEvent;
end;
```

The meaning of these hooks is explained below:

InitDriver Called to initialize and enable the driver. Guaranteed to be called only once. This should initialize all needed things for the driver.

DoneDriver Called to disable and clean up the driver. Guaranteed to be called after a call to initDriver. This should clean up all things initialized by InitDriver.

GetKeyEvent Called by GetKeyEvent (729). Must wait for and return the next key event. It should NOT store keys.

PollKeyEvent Called by PollKeyEvent (734). It must return the next key event if there is one. Should not store keys.

GetShiftState Called by PollShiftStateEvent (735). Must return the current shift state.

TranslateKeyEvent Should translate a raw key event to a correct key event, i.e. should fill in the shiftstate and convert function key scancodes to function key keycodes. If the TranslateKeyEvent is not filled in, a default translation function will be called which converts the known scancodes from the tables in the previous section to a correct keyevent.

TranslateKeyEventUniCode Should translate a key event to a unicode key representation.

Strictly speaking, only the GetKeyEvent and PollKeyEvent hooks must be implemented for the driver to function correctly.

The example unit demonstrates how a keyboard driver can be installed. It takes the installed driver, and hooks into the GetKeyEvent function to register and log the key events in a file. This driver can work on top of any other driver, as long as it is inserted in the uses clause *after* the real driver unit, and the real driver unit should set the driver record in its initialization section.

Note that with a simple extension of this unit could be used to make a driver that is capable of recording and storing a set of keyboard strokes, and replaying them at a later time, so a 'keyboard macro' capable driver. This driver could sit on top of any other driver.

Listing: ./kbdex/logkeys.pp

```

unit logkeys;

interface

Procedure StartKeyLogging;
Procedure StopKeyLogging;
Function IsKeyLogging : Boolean;
Procedure SetKeyLogFileName(FileName : String);

implementation

uses sysutils, keyboard;

var
  NewKeyBoardDriver,
  OldKeyBoardDriver : TKeyboardDriver;
  Active, Logging : Boolean;
  LogFileName : String;
  KeyLog : Text;

Function TimeStamp : String;

```

```
begin
  TimeStamp:=FormatDateTime( 'hh:nn:ss ',Time());
end;

Procedure StartKeyLogging;
begin
  Logging:=True;
  WriteLn(KeyLog,'Start logging keystrokes at: ',TimeStamp);
end;

Procedure StopKeyLogging;
begin
  WriteLn(KeyLog,'Stop logging keystrokes at: ',TimeStamp);
  Logging:=False;
end;

Function IsKeyLogging : Boolean;
begin
  IsKeyLogging:=Logging;
end;

Function LogGetKeyEvent : TKeyEvent;
Var
  K : TKeyEvent;
begin
  K:=OldKeyboardDriver.GetKeyEvent();
  If Logging then
    begin
      Write(KeyLog,TimeStamp,': Key event: ');
      WriteLn(KeyLog,KeyEventToString(TranslateKeyEvent(K)));
    end;
  LogGetKeyEvent:=K;
end;

Procedure LogInitKeyBoard;
begin
  OldKeyboardDriver.InitDriver();
  Assign(KeyLog,logFileName);
  Rewrite(KeyLog);
  Active:=True;
  StartKeyLogging;
end;

Procedure LogDoneKeyBoard;
begin
  StopKeyLogging;
  Close(KeyLog);
  Active:=False;
  OldKeyboardDriver.DoneDriver();
end;
```

```

Procedure SetKeyLogFileName(FileName : String);
begin
  If Not Active then
    LogFileName:=FileName;
end;

Initialization
  GetKeyBoardDriver(OldKeyBoardDriver);
  NewKeyBoardDriver:=OldKeyBoardDriver;
  NewKeyBoardDriver.GetKeyEvent:="@LogGetKeyEvent";
  NewKeyBoardDriver.InitDriver:="@LogInitKeyboard";
  NewKeyBoardDriver.DoneDriver:="@LogDoneKeyboard";
  LogFileName:='keyboard.log';
  Logging:=False;
  SetKeyboardDriver(NewKeyBoardDriver);
end.

```

Listing: ./kbdex/ex9.pp

```

program example9;

{ This program demonstrates the logkeys unit }

uses keyboard,logkeys;

Var
  K : TKeyEvent;

begin
  InitKeyBoard;
  WriteLn('Press keys, press "q" to end, "s" toggles logging.');
  Repeat
    K:=GetKeyEvent;
    K:=TranslateKeyEvent(K);
    WriteLn('Got key : ',KeyEventToString(K));
    if GetKeyEventChar(K)='s' then
      if IsKeyLogging then
        StopKeyLogging
      else
        StartKeyLogging;
    Until (GetKeyEventChar(K)='q');
  DoneKeyBoard;
end.

```

21.4 Keyboard scan codes

Special physical keys are encoded with the DOS scan codes for these keys in the second byte of the TKeyEvent ([726](#)) type. A complete list of scan codes can be found in the below table. This is the list of keys that is used by the default key event translation mechanism. When writing a keyboard driver, either these constants should be returned by the various key event functions, or the TranslateKeyEvent hook should be implemented by the driver.

Table 21.1: Key Scancodes

Code	Key	Code	Key	Code	Key
00	NoKey	3D	F3	70	ALT-F9
01	ALT-Esc	3E	F4	71	ALT-F10
02	ALT-Space	3F	F5	72	CTRL-PrtSc
04	CTRL-Ins	40	F6	73	CTRL-Left
05	SHIFT-Ins	41	F7	74	CTRL-Right
06	CTRL-Del	42	F8	75	CTRL-end
07	SHIFT-Del	43	F9	76	CTRL-PgDn
08	ALT-Back	44	F10	77	CTRL-Home
09	ALT-SHIFT-Back	47	Home	78	ALT-1
0F	SHIFT-Tab	48	Up	79	ALT-2
10	ALT-Q	49	PgUp	7A	ALT-3
11	ALT-W	4B	Left	7B	ALT-4
12	ALT-E	4C	Center	7C	ALT-5
13	ALT-R	4D	Right	7D	ALT-6
14	ALT-T	4E	ALT-GrayPlus	7E	ALT-7
15	ALT-Y	4F	end	7F	ALT-8
16	ALT-U	50	Down	80	ALT-9
17	ALT-I	51	PgDn	81	ALT-0
18	ALT-O	52	Ins	82	ALT-Minus
19	ALT-P	53	Del	83	ALT-Equal
1A	ALT-LftBrack	54	SHIFT-F1	84	CTRL-PgUp
1B	ALT-RgtBrack	55	SHIFT-F2	85	F11
1E	ALT-A	56	SHIFT-F3	86	F12
1F	ALT-S	57	SHIFT-F4	87	SHIFT-F11
20	ALT-D	58	SHIFT-F5	88	SHIFT-F12
21	ALT-F	59	SHIFT-F6	89	CTRL-F11
22	ALT-G	5A	SHIFT-F7	8A	CTRL-F12
23	ALT-H	5B	SHIFT-F8	8B	ALT-F11
24	ALT-J	5C	SHIFT-F9	8C	ALT-F12
25	ALT-K	5D	SHIFT-F10	8D	CTRL-Up
26	ALT-L	5E	CTRL-F1	8E	CTRL-Minus
27	ALT-SemiCol	5F	CTRL-F2	8F	CTRL-Center
28	ALT-Quote	60	CTRL-F3	90	CTRL-GreyPlus
29	ALT-OpQuote	61	CTRL-F4	91	CTRL-Down
2B	ALT-BkSlash	62	CTRL-F5	94	CTRL-Tab
2C	ALT-Z	63	CTRL-F6	97	ALT-Home
2D	ALT-X	64	CTRL-F7	98	ALT-Up
2E	ALT-C	65	CTRL-F8	99	ALT-PgUp
2F	ALT-V	66	CTRL-F9	9B	ALT-Left
30	ALT-B	67	CTRL-F10	9D	ALT-Right
31	ALT-N	68	ALT-F1	9F	ALT-end
32	ALT-M	69	ALT-F2	A0	ALT-Down
33	ALT-Comma	6A	ALT-F3	A1	ALT-PgDn
34	ALT-Period	6B	ALT-F4	A2	ALT-Ins
35	ALT-Slash	6C	ALT-F5	A3	ALT-Del
37	ALT-GreyAst	6D	ALT-F6	A5	ALT-Tab
3B	F1	6E	ALT-F7		
3C	F2	6F	ALT-F8		

A list of scan codes for special keys and combinations with the SHIFT, ALT and CTRL keys can be found in the following table: They are for quick reference only.

Table 21.2: Special keys scan codes

Key	Code	SHIFT-Key	CTRL-Key	Alt-Key
NoKey	00			
F1	3B	54	5E	68
F2	3C	55	5F	69
F3	3D	56	60	6A
F4	3E	57	61	6B
F5	3F	58	62	6C
F6	40	59	63	6D
F7	41	5A	64	6E
F8	42	5A	65	6F
F9	43	5B	66	70
F10	44	5C	67	71
F11	85	87	89	8B
F12	86	88	8A	8C
Home	47		77	97
Up	48		8D	98
PgUp	49		84	99
Left	4B		73	9B
Center	4C		8F	
Right	4D		74	9D
end	4F		75	9F
Down	50		91	A0
PgDn	51		76	A1
Ins	52	05	04	A2
Del	53	07	06	A3
Tab	8	0F	94	A5
GreyPlus			90	4E

21.5 Constants, types and variables

21.5.1 Constants

`AltPrefix : Byte = 0`

Keycode for alternate prefix key for Alt key. Unix Only

`CtrlPrefix : Byte = 0`

Keycode for alternate prefix key for Ctrl key. Unix only

`errKbdBase = 1010`

Base of keyboard routine error reporting constants.

`errKbdInitError = errKbdBase + 0`

Failed to initialize keyboard driver

errKbdNotImplemented = errKbdBase + 1

Keyboard driver not implemented.

kbAlt = 8

Alt key modifier

kbASCII = \$00

Ascii code key event

kbCtrl = 4

Control key modifier

kbdApps = \$FF17

Application key (popup-menu) pressed.

kbdDelete = \$FF2A

Delete key pressed

kbdDown = \$FF27

Arrow down key pressed

kbdEnd = \$FF26

End key pressed

kbdF1 = \$FF01

F1 function key pressed.

kbdF10 = \$FF0A

F10 function key pressed.

kbdF11 = \$FF0B

F12 function key pressed.

kbdF12 = \$FF0C

F12 function key pressed.

kbdF13 = \$FF0D

F13 function key pressed.

kbdF14 = \$FF0E

F14 function key pressed.

kbdF15 = \$FF0F

F15 function key pressed.

kbdF16 = \$FF10

F16 function key pressed.

kbdF17 = \$FF11

F17 function key pressed.

kbdF18 = \$FF12

F18 function key pressed.

kbdF19 = \$FF13

F19 function key pressed.

kbdF2 = \$FF02

F2 function key pressed.

kbdF20 = \$FF14

F20 function key pressed.

kbdF3 = \$FF03

F3 function key pressed.

kbdF4 = \$FF04

F4 function key pressed.

kbdF5 = \$FF05

F5 function key pressed.

kbdF6 = \$FF06

F6 function key pressed.

kbdF7 = \$FF07

F7 function key pressed.

kbdF8 = \$FF08

F8 function key pressed.

kbdF9 = \$FF09

F9 function key pressed.

kbdHome = \$FF20

Home key pressed

kbdInsert = \$FF29

Insert key pressed

kbdLeft = \$FF23

Arrow left key pressed

kbdLWin = \$FF15

Left windows key pressed.

kbdMiddle = \$FF24

Middle key pad key pressed (numerical 5)

kbdPgDn = \$FF28

Page down key pressed

kbdPgUp = \$FF22

Page Up key pressed

kbdRight = \$FF25

Arrow right key pressed

kbdRWin = \$FF16

Right windows key pressed.

kbdUp = \$FF21

Arrow up key pressed

kbFnKey = \$02

function key pressed.

kbLeftShift = 1

Left shift key modifier

kbPhys = \$03

Physical key code event

kbReleased = \$04

Key release event (not implemented in FPC)

kbRightShift = 2

Right shift key modifier

kbShift = kbLeftShift or kbRightShift

Shift key modifier

kbUniCode = \$01

Unicode code key event

SAnd : string = 'AND'

This constant is used as the 'And' word in key descriptions. This constant is used by the key event description routines. It can be changed to localize the key descriptions when needed.

ShiftPrefix : Byte = 0

Keycode for alternate prefix key for Shift key. Unix Only

SKeyPad : Array[0..(\$FF2F-kbdHome)] of = ('Home', 'Up', 'PgUp', 'Left', 'Middle', 'Right')

This constant describes all keypad keys. This constant is used by the key event description routines. It can be changed to localize the key descriptions when needed.

SLeftRight : Array[1..2] of = ('LEFT', 'RIGHT')

This constant contains strings to describe left and right keys. This constant is used by the key event description routines. It can be changed to localize the key descriptions when needed.

SScanCode : string = 'Key with scancode '

This constant contains a string to denote a scancode key event. This constant is used by the key event description routines. It can be changed to localize the key descriptions when needed.

SShift : Array[1..3] of = ('SHIFT', 'CTRL', 'ALT')

This constant describes the various modifier keys. This constant is used by the key event description routines. It can be changed to localize the key descriptions when needed.

```
SUnicodeChar : string = 'Unicode character '
```

This constant contains a string to denote a unicode key event. This constant is used by the key event description routines. It can be changed to localize the key descriptions when needed.

```
SUnknownFunctionKey : string = 'Unknown function key : '
```

This constant contains a string to denote that an unknown function key was found. This constant is used by the key event description routines. It can be changed to localize the key descriptions when needed.

21.5.2 Types

```
PTreeElement = ^TTreeElement
```

Pointer to TTreeElement ([727](#)) record

```
TKeyboardDriver = record
  InitDriver : procedure;
  DoneDriver : procedure;
  GetKeyEvent : function : TKeyEvent;
  PollKeyEvent : function : TKeyEvent;
  GetShiftState : function : Byte;
  TranslateKeyEvent : function(KeyEvent: TKeyEvent) : TKeyEvent;
  TranslateKeyEventUniCode : function(KeyEvent: TKeyEvent) : TKeyEvent;
end
```

The TKeyboardDriver record can be used to install a custom keyboard driver with the SetKeyboardDriver ([737](#)) function.

The various fields correspond to the different functions of the keyboard unit interface. For more information about this record see kbddriver ([716](#))

```
TKeyEvent = Cardinal
```

The TKeyEvent type is the base type for all keyboard events.

The key stroke is encoded in the 4 bytes of the TKeyEvent type. The various fields of the key stroke encoding can be obtained by typecasting the TKeyEvent type to the TKeyRecord ([726](#)) type.

```
TKeyRecord = packed record
  KeyCode : Word;
  ShiftState : Byte;
  Flags : Byte;
end
```

The structure of a TKeyRecord structure is explained in the following table:

Table 21.3: Structure of TKeyRecord

Field	Meaning
KeyCode	Depending on flags either the physical representation of a key (under DOS scancode, ascii code pair), or the translated key-code.
ShiftState	Shift-state when this key was pressed (or shortly after)
Flags	Determine how to interpret KeyCode

The shift-state can be checked using the various shift-state constants, and the flags in the last byte can be checked using one of the kbASCII, kbUniCode, kbFnKey, kbPhys, kbReleased constants.

If there are two keys returning the same char-code, there's no way to find out which one was pressed (Gray+ and Simple+). If it needs to be known which was pressed, the untranslated keycodes must be used, but these are system dependent. System dependent constants may be defined to cover those, with possibly having the same name (but different value).

```
Tprocedure = procedure
```

Procedure prototype

```
TTreeElement = record
  Next : PTreeElement;
  Parent : PTreeElement;
  Child : PTreeElement;
  CanBeTerminal : Boolean;
  char : Byte;
  ScanValue : Byte;
  CharValue : Byte;
  SpecialHandler : Tprocedure;
end
```

TTreeElement is used to describe key scancode sequences, and is used to handle special key combinations in AddSpecialSequence ([727](#)) on unix platforms. There should be no need to handle records of this type.

21.6 Procedures and functions

21.6.1 AddSequence

Declaration: `procedure AddSequence(const St: string; AChar: Byte; AScan: Byte)`

Visibility: default

21.6.2 AddSpecialSequence

Synopsis: Add a handler for a special key sequence

Declaration: `function AddSpecialSequence(const St: string; Proc: Tprocedure)
 : PTreeElement`

Visibility: default

Description: AddSpecialSequence adds a sequence of key combinations to the keyboard handler. When the key combination specified in `st` is encountered, then `Proc` will be executed. The function returns the element in the special key sequence handling tree which handles `st`.

See also: [AddSequence \(727\)](#)

21.6.3 DoneKeyboard

Synopsis: Deactivate keyboard driver.

Declaration: procedure DoneKeyboard

Visibility: default

Description: DoneKeyboard de-initializes the keyboard interface if the keyboard driver is active. If the keyboard driver is not active, the function does nothing.

This will cause the keyboard driver to clear up any allocated memory, or restores the console or terminal the program was running in to its initial state before the call to InitKeyBoard ([733](#)). This function should be called on program exit. Failing to do so may leave the terminal or console window in an unusable state. Its exact action depends on the platform on which the program is running.

On Unix the default keyboard driver restores the line ending of system.output to #10.

For an example, see most other functions.

Errors: None.

See also: [InitKeyBoard \(733\)](#)

21.6.4 FindSequence

Declaration: function FindSequence(const St: string; var AChar: Byte; var Ascan: Byte) : Boolean

Visibility: default

21.6.5 FunctionKeyName

Synopsis: Return string representation of a function key code.

Declaration: function FunctionKeyName(KeyCode: Word) : string

Visibility: default

Description: FunctionKeyName returns a string representation of the function key with code KeyCode. This can be an actual function key, or one of the cursor movement keys.

Errors: In case KeyCode does not contain a function code, the SUnknownFunctionKey string is returned, appended with the KeyCode.

See also: [ShiftStateToString \(738\)](#), [KeyEventToString \(734\)](#)

Listing: ./kbdex/ex8.pp

```

Program Example8;

{ Program to demonstrate the FunctionKeyName function. }

Uses keyboard;

Var
  K : TKeyEvent;

begin
  InitKeyboard;
  Writeln('Press function keys, press "q" to end.');
  Repeat
    K:=GetKeyEvent;
    K:=TranslateKeyEvent(K);
    If IsFunctionKey(k) then
      begin
        Write('Got function key : ');
        Writeln(FunctionKeyName(TkeyRecord(K).KeyCode));
      end;
  Until (GetKeyEventChar(K)= 'q');
  DoneKeyboard;
end.

```

21.6.6 GetKeyboardDriver

Synopsis: Return the current keyboard driver record.

Declaration: procedure GetKeyboardDriver(var Driver: TKeyboardDriver)

Visibility: default

Description: GetKeyboardDriver returns in Driver the currently active keyboard driver. This function can be used to enhance an existing keyboarddriver.

For more information on getting and setting the keyboard driver kbddriver ([716](#)).

Errors: None.

See also: SetKeyboardDriver ([737](#))

21.6.7 GetKeyEvent

Synopsis: Get the next raw key event, wait if needed.

Declaration: function GetKeyEvent : TKeyEvent

Visibility: default

Description: GetKeyEvent returns the last keyevent if it is available, or waits for one if none is available. A non-blocking version is available in PollKeyEvent ([734](#)).

The returned key is encoded as a TKeyEvent type variable, and is normally the physical key scan code, (the scan code is driver dependent) which can be translated with one of the translation functions TranslateKeyEvent ([738](#)) or TranslateKeyEventUniCode ([738](#)). See the types section for a description of how the key is described.

Errors: If no key became available (e.g. when the driver does not support it), 0 is returned.

See also: PutKeyEvent ([736](#)), PollKeyEvent ([734](#)), TranslateKeyEvent ([738](#)), TranslateKeyEventUniCode ([738](#))

Listing: ./kbdex/ex1.pp

```
program example1;
{ This program demonstrates the GetKeyEvent function }

uses keyboard;

Var
  K : TKeyEvent;

begin
  InitKeyBoard;
  Writeln('Press keys, press "q" to end.');
  Repeat
    K:=GetKeyEvent;
    K:=TranslateKeyEvent(K);
    Write('Got key event with ');
    Case GetKeyEventFlags(K) of
      kbASCII   : Writeln('ASCII key');
      kbUniCode : Writeln('Unicode key');
      kbFnKey   : Writeln('Function key');
      kbPhys    : Writeln('Physical key');
      kbReleased : Writeln('Released key event');
    end;
    Writeln('Got key : ', KeyEventToString(K));
  Until (GetKeyEventChar(K)='q');
  DoneKeyBoard;
end.
```

21.6.8 GetKeyEventChar

Synopsis: Get the character key part of a key event.

Declaration: function GetKeyEventChar (KeyEvent: TKeyEvent) : Char

Visibility: default

Description: GetKeyEventChar returns the charcode part of the given KeyEvent, if it contains a translated character key keycode. The charcode is simply the ascii code of the character key that was pressed. It returns the null character if the key was not a character key, but e.g. a function key.
For an example, see GetKeyEvent ([729](#))

Errors: None.

See also: GetKeyEventUniCode ([732](#)), GetKeyEventShiftState ([732](#)), GetKeyEventFlags ([731](#)), GetKeyEventCode ([730](#)), GetKeyEvent ([729](#))

21.6.9 GetKeyEventCode

Synopsis: Translate function key part of a key event code.

Declaration: function GetKeyEventCode (KeyEvent: TKeyEvent) : Word

Visibility: default

Description: GetKeyEventCode returns the translated function keycode part of the given KeyEvent, if it contains a translated function key.

If the key pressed was not a function key, the null character is returned.

Errors: None.

See also: GetKeyEventUniCode (732), GetKeyEventShiftState (732), GetKeyEventFlags (731), GetKeyEventChar (730), GetKeyEvent (729)

Listing: ./kbdex/ex2.pp

Program Example2;

{ Program to demonstrate the GetKeyEventCode function. }

Uses keyboard;

Var

K : TKeyEvent;

begin

InitKeyboard;

WriteIn('Press function keys, or press "q" to end.');

Repeat

K:=GetKeyEvent;

K:=TranslateKeyEvent(K);

If (GetKeyEventFlags(K)<>KbfnKey) **then**

 WriteIn('Not a function key')

else

begin

 Write('Got key (',GetKeyEventCode(K));

 WriteIn(' : ',KeyEventToString(K));

end;

Until (GetKeyEventChar(K)= 'q');

DoneKeyboard;

end.

21.6.10 GetKeyEventFlags

Synopsis: Extract the flags from a key event.

Declaration: function GetKeyEventFlags(KeyEvent: TKeyEvent) : Byte

Visibility: default

Description: GetKeyEventFlags returns the flags part of the given KeyEvent.

For an example, see GetKeyEvent (729)

Errors: None.

See also: GetKeyEventUniCode (732), GetKeyEventShiftState (732), GetKeyEventCode (730), GetKeyEventChar (730), GetKeyEvent (729)

21.6.11 GetKeyEventShiftState

Synopsis: Return the current state of the shift keys.

Declaration: function GetKeyEventShiftState(KeyEvent: TKeyEvent) : Byte

Visibility: default

Description: GetKeyEventShiftState returns the shift-state values of the given KeyEvent. This can be used to detect which of the modifier keys Shift, Alt or Ctrl were pressed. If none were pressed, zero is returned.

Note that this function does not always return expected results; In a unix X-Term, the modifier keys do not always work.

Errors: None.

See also: GetKeyEventUniCode (732), GetKeyEventFlags (731), GetKeyEventCode (730), GetKeyEventChar (730), GetKeyEvent (729)

Listing: ./kbdex/ex3.pp

```

Program Example3;

{ Program to demonstrate the GetKeyEventShiftState function. }

Uses keyboard;

Var
  K : TKeyEvent;
  S : Byte;

begin
  InitKeyboard;
  Write( 'Press keys combined with CTRL/SHIFT/ALT' );
  Writeln( ', or press "q" to end.' );
  Repeat
    K:=GetKeyEvent;
    K:=TranslateKeyEvent(K);
    S:=GetKeyEventShiftState(K);
    If (S=0) then
      Writeln( 'No special keys pressed' )
    else
      begin
        Writeln( 'Detected special keys : ', ShiftStateToString(K, False) );
        Writeln( 'Got key : ', KeyEventToString(K) );
      end;
  Until (GetKeyEventChar(K)= 'q');
  DoneKeyboard;
end.

```

21.6.12 GetKeyEventUniCode

Synopsis: Return the unicode key event.

Declaration: function GetKeyEventUniCode(KeyEvent: TKeyEvent) : Word

Visibility: default

Description: GetKeyEventUniCode returns the unicode part of the given KeyEvent if it contains a translated unicode character.

Errors: None.

See also: GetKeyEventShiftState (732), GetKeyEventFlags (731), GetKeyEventCode (730), GetKeyEventChar (730), GetKeyEvent (729)

21.6.13 InitKeyboard

Synopsis: Initialize the keyboard driver.

Declaration: procedure InitKeyboard

Visibility: default

Description: InitKeyboard initializes the keyboard driver. If the driver is already active, it does nothing. When the driver is initialized, it will do everything necessary to ensure the functioning of the keyboard, including allocating memory, initializing the terminal etc.

This function should be called once, before using any of the keyboard functions. When it is called, the DoneKeyboard (728) function should also be called before exiting the program or changing the keyboard driver with SetKeyboardDriver (737).

On Unix, the default keyboard driver sets terminal in raw mode. In raw mode the line feed behaves as an actual linefeed, i.e. the cursor is moved down one line. while the x coordinate does not change. To compensate, the default keyboard sets driver line ending of system.output to #13#10.

For an example, see most other functions.

Errors: None.

See also: DoneKeyboard (728), SetKeyboardDriver (737)

21.6.14 IsFunctionKey

Synopsis: Check whether a given event is a function key event.

Declaration: function IsFunctionKey(KeyEvent: TKeyEvent) : Boolean

Visibility: default

Description: IsFunctionKey returns True if the given key event in KeyEvent was a function key or not.

Errors: None.

See also: GetKeyEvent (729)

Listing: ./kbdex/ex7.pp

```
program example1;

{ This program demonstrates the GetKeyEvent function }

uses keyboard;

Var
  K : TKeyEvent;

begin
```

```

InitKeyboard;
WriteLn('Press keys, press "q" to end.');
Repeat
  K:=GetKeyEvent;
  K:=TranslateKeyEvent(K);
  If IsFunctionKey(K) then
    WriteLn('Got function key : ', KeyEventToString(K))
  else
    WriteLn('not a function key.');
  Until (GetKeyEventChar(K)='q');
DoneKeyboard;
end.

```

21.6.15 KeyEventToString

Synopsis: Return a string describing the key event.

Declaration: function KeyEventToString(KeyEvent: TKeyEvent) : string

Visibility: default

Description: KeyEventToString translates the key event in KeyEvent to a human-readable description of the pressed key. It will use the constants described in the constants section to do so.

For an example, see most other functions.

Errors: If an unknown key is passed, the scancode is returned, prefixed with the SScanCode string.

See also: FunctionKeyName (728), ShiftStateToString (738)

21.6.16 KeyPressed

Synopsis: Check event queue for key press

Declaration: function KeyPressed : Boolean

Visibility: default

Description: KeyPressed checks the keyboard event queue to see whether a key event is present, and returns True if a key event is available. This function simply calls PollKeyEvent (734) and checks for a valid result.

Errors: None.

See also: PollKeyEvent (734), GetKeyEvent (729)

21.6.17 PollKeyEvent

Synopsis: Get next key event, but does not wait.

Declaration: function PollKeyEvent : TKeyEvent

Visibility: default

Description: PollKeyEvent checks whether a key event is available, and returns it if one is found. If no event is pending, it returns 0.

Note that this does not remove the key from the pending keys. The key should still be retrieved from the pending key events list with the GetKeyEvent (729) function.

Errors: None.

See also: PutKeyEvent ([736](#)), GetKeyEvent ([729](#))

Listing: ./kbdex/ex4.pp

```
program example4;

{ This program demonstrates the PollKeyEvent function }

uses keyboard;

Var
  K : TKeyEvent;

begin
  InitKeyBoard;
  Writeln('Press keys, press "q" to end.');
  Repeat
    K:=PollKeyEvent;
    If k<>0 then
      begin
        K:=GetKeyEvent;
        K:=TranslateKeyEvent(K);
        writeln;
        Writeln('Got key : ', KeyEventToString(K));
        end
    else
      write('.');
    Until (GetKeyEventChar(K)= 'q');
  DoneKeyBoard;
end.
```

21.6.18 PollShiftStateEvent

Synopsis: Check current shift state.

Declaration: function PollShiftStateEvent : TKeyEvent

Visibility: default

Description: PollShiftStateEvent returns the current shiftstate in a keyevent. This will return 0 if there is no key event pending.

Errors: None.

See also: PollKeyEvent ([734](#)), GetKeyEvent ([729](#))

Listing: ./kbdex/ex6.pp

```
program example6;

{ This program demonstrates the PollShiftStateEvent function }

uses keyboard;

Var
  K : TKeyEvent;
```

```

begin
  InitKeyBoard;
  WriteLn('Press keys, press "q" to end.');
  Repeat
    K:=PollKeyEvent;
    If k<>0 then
      begin
        K:=PollShiftStateEvent;
        WriteLn('Got shift state : ',ShiftStateToString(K,False));
        // Consume the key.
        K:=GetKeyEvent;
        K:=TranslateKeyEvent(K);
        end
    { else
      write('.');
    }
    Until (GetKeyEventChar(K)='q');
    DoneKeyBoard;
end.

```

21.6.19 PutKeyEvent

Synopsis: Put a key event in the event queue.

Declaration: procedure PutKeyEvent (KeyEvent: TKeyEvent)

Visibility: default

Description: PutKeyEvent adds the given KeyEvent to the input queue. Please note that depending on the implementation this can hold only one value, i.e. when calling PutKeyEvent multiple times, only the last pushed key will be remembered.

Errors: None

See also: PollKeyEvent (734), GetKeyEvent (729)

Listing: ./kbdex/ex5.pp

```

program example5;

{ This program demonstrates the PutKeyEvent function }

uses keyboard;

Var
  K,k2 : TKeyEvent;

begin
  InitKeyBoard;
  WriteLn('Press keys, press "q" to end.');
  K2:=0;
  Repeat
    K:=GetKeyEvent;
    If k<>0 then
      begin
        if (k2 mod 2)=0 then
          K2:=K+1
        else

```

```

K2:=0;
K:=TranslateKeyEvent(K);
WriteLn('Got key : ', KeyEventToString(K));
if (K2<>0) then
begin
  PutKeyEvent(k2);
  K2:=TranslateKeyEvent(K2);
  WriteLn('Put key : ', KeyEventToString(K2))
end
end
Until (GetKeyEventChar(K)='q');
DoneKeyboard;
end.

```

21.6.20 Raw.ReadKey

Declaration: function Raw.ReadKey : Char

Visibility: default

21.6.21 Raw.ReadString

Declaration: function Raw.ReadString : string

Visibility: default

21.6.22 RestoreStartMode

Declaration: procedure RestoreStartMode

Visibility: default

21.6.23 SetKeyboardDriver

Synopsis: Set a new keyboard driver.

Declaration: function SetKeyboardDriver(const Driver: TKeyboardDriver) : Boolean

Visibility: default

Description: SetKeyboardDriver sets the keyboard driver to Driver, if the current keyboard driver is not yet initialized. If the current keyboard driver is initialized, then SetKeyboardDriver does nothing. Before setting the driver, the currently active driver should be disabled with a call to DoneKeyboard ([728](#)).

The function returns True if the driver was set, False if not.

For more information on setting the keyboard driver, see kbddriver ([716](#)).

Errors: None.

See also: GetKeyboardDriver ([729](#)), DoneKeyboard ([728](#))

21.6.24 ShiftStateToString

Synopsis: Return description of key event shift state

Declaration: function ShiftStateToString (KeyEvent: TKeyEvent; UseLeftRight: Boolean) : string

Visibility: default

Description: ShiftStateToString returns a string description of the shift state of the key event KeyEvent.

This can be an empty string.

The shift state is described using the strings in the SShift constant.

For an example, see PollShiftStateEvent ([735](#)).

Errors: None.

See also: FunctionKeyName ([728](#)), KeyEventToString ([734](#))

21.6.25 TranslateKeyEvent

Synopsis: Translate raw event to ascii key event

Declaration: function TranslateKeyEvent (KeyEvent: TKeyEvent) : TKeyEvent

Visibility: default

Description: TranslateKeyEvent performs ASCII translation of the KeyEvent. It translates a physical key to a function key if the key is a function key, and translates the physical key to the ordinal of the ascii character if there is an equivalent character key.

For an example, see GetKeyEvent ([729](#))

Errors: None.

See also: TranslateKeyEventUniCode ([738](#))

21.6.26 TranslateKeyEventUniCode

Synopsis: Translate raw event to UNICode key event

Declaration: function TranslateKeyEventUniCode (KeyEvent: TKeyEvent) : TKeyEvent

Visibility: default

Description: TranslateKeyEventUniCode performs Unicode translation of the KeyEvent. It is not yet implemented for all platforms.

Errors: If the function is not yet implemented, then the ErrorCode of the system unit will be set to errKbdNotImplemented

See also: TranslateKeyEvent ([738](#))

Chapter 22

Reference for unit 'lineinfo'

22.1 Overview

The lineinfo provides a routine that reads the debug information of an executable (if any exists) and returns source code information about this address. It works with Stabs debug information. Note that this unit is not thread-safe, and that its behaviour is undefined if multiple threads try to write a backtrace at the same time.

For DWARF debug information, the Infodwrf ([762](#)) unit must be used.

22.2 Procedures and functions

22.2.1 GetLineInfo

Synopsis: Return source line information about an address.

Declaration: `function GetLineInfo(addr: ptruint; var func: string; var source: string;
var line: LongInt) : Boolean`

Visibility: default

Description: `GetLineInfo` returns source line information about the address `addr`. It searches this information in the stabs debugging information found in the binary: If the file was compiled without debug information, nothing will be returned. Upon successful retrieval of the debug information, `True` is returned, and the `func` parameter is filled with the name of the function in which the address is located. The `source` parameter contains the name of the file in which the function was implemented, and `line` contains the line number in the source file for `addr`.

Errors: If no debug information is found, `False` is returned.

Chapter 23

Reference for unit 'Linux'

23.1 Used units

Table 23.1: Used units by unit 'Linux'

Name	Page
BaseUnix	102
System	1229
unixtype	1713

23.2 Overview

The `linux` unit contains linux specific operating system calls.

The platform independent functionality of the FPC 1.0.X version of the `linux` unit has been split out over the `unix` ([1676](#)), `baseunix` ([102](#)) and `unixutil` ([1728](#)) units.

The X86-specific parts have been moved to the X86 ([1761](#)) unit.

People wanting to use the old version (FPC 1.0.X and before) of the `linux` can use the `oldlinux` ([1011](#)) unit instead.

23.3 Constants, types and variables

23.3.1 Constants

`CAP_AUDIT_CONTROL` = 30

Allow manipulation of kernel auditing features

`CAP_AUDIT_WRITE` = 29

Allow writing to kernel audit log

`CAP_CHOWN` = 0

Perform chown operation

CAP_DAC_OVERRIDE = 1

Bypass file operation (rwx) checks

CAP_DAC_READ_SEARCH = 2

Bypass file read-only operation checks

CAP_FOWNER = 3

Bypass owner ID checks

CAP_FSETID = 4

Do not clear SUID/GUID bits on modified files

CAP_FS_MASK = \$1f

?

CAP_IPC_LOCK = 14

Allow memory locking calls

CAP_IPC_OWNER = 15

Bypass permission checks on IPC operations

CAP_KILL = 5

Bypass permission checks for sending signals

CAPLEASE = 28

Allow file leases

CAP_LINUX_IMMUTABLE = 9

Allow setting ext2 file attributes

CAP_MKNOD = 27

Allow creation of special files through mknod calls

CAP_NET_ADMIN = 12

Allow network operations (e.g. setting socket options)

CAP_NET_BIND_SERVICE = 10

Allow binding to ports less than 1024

CAP_NET_BROADCAST = 11

Allow socket broadcast operations

CAP_NET_RAW = 13

Allow use of RAW and PACKET sockets

CAP_SETGID = 6

Allow GID manipulations

CAP_SETPCAP = 8

Allow to set other process' capabilities

CAP_SETUID = 7

Allow process ID manipulations

CAP_SYS_ADMIN = 21

Allow various system administration calls

CAP_SYS_BOOT = 22

Allow reboot calls

CAP_SYS_CHROOT = 18

Allow chroot calls.

CAP_SYS_MODULE = 16

Allow loading/unloading of kernel modules

CAP_SYS_NICE = 23

Allowing raising process and thread priorities

CAP_SYS_PACCT = 20

Allow acct calls

CAP_SYS_PTRACE = 19

Allow ptrace calls

CAP_SYS_RAWIO = 17

Allow raw I/O port operations

CAP_SYS_RESOURCE = 24

Allow use of special resources or raising of resource limits

CAP_SYS_TIME = 25

Allow system or real-time clock modification

CAP_SYS_TTY_CONFIG = 26

Allow vhangup calls

CLOCKS_MASK = CLOCK_REALTIME or CLOCK_MONOTONIC

CLOCKS_MONO = CLOCK_MONOTONIC

CLOCK_MONOTONIC = 1

CLOCK_MONOTONIC_COARSE = 6

CLOCK_MONOTONIC_RAW = 4

CLOCK_PROCESS_CPUTIME_ID = 2

CLOCK_REALTIME = 0

CLOCK_REALTIME_COARSE = 5

CLOCK_SGI_CYCLE = 10

CLOCK_THREAD_CPUTIME_ID = 3

CLONE_CHILD_CLEARTID = \$00200000

Clone option: Erase child thread ID in child memory space when child exits.

CLONE_CHILD_SETTID = \$01000000

Clone option: Store child thread ID in child memory.

CLONE_DETACHED = \$00400000

Clone option: Start clone detached.

CLONE_FILES = \$00000400

Clone (102) option: open files shared between processes

CLONE_FS = \$00000200

Clone (102) option: fs info shared between processes

CLONE_NEWNS = \$00020000

Clone options: Start child in new (filesystem) namespace.

CLONE_PARENT = \$00008000

Clone options: Set child parent to parent of calling process.

CLONE_PARENT_SETTID = \$00100000

Clone option: Store child thread ID in memory in both parent and child.

CLONE_PID = \$00001000

Clone (102) option: PID shared between processes

CLONE_PTRACE = \$00002000

Clone options: if parent is traced, trace child also

CLONE_SETTLS = \$00080000

Clone option: The newtls parameter is the TLS descriptor of the child

CLONE_SIGHAND = \$00000800

Clone (102) option: signal handlers shared between processes

CLONE_STOPPED = \$02000000

Clone option: Start child in stopped state.

CLONE_SYSVSEM = \$00040000

Clone option: Caller and child share the same semaphore undo values

CLONE_THREAD = \$00010000

Clone options: Set child in thread group of calling process.

CLONE_UNTRACED = \$00800000

Clone option: Do not allow a ptrace call on this clone.

CLONE_VFORK = \$00004000

Clone options: suspend parent till child execs

CLONE_VM = \$00000100

Clone (102) option: VM shared between processes

CSIGNAL = \$000000ff

Clone (102) option: Signal mask to be sent at exit

EPOLLERR = \$08

event_wait error condition on file descriptor

EPOLLET = \$80000000

Set event_wait edge trigger behaviour on file descriptor

EPOLLHUP = \$10

event_wait hang up event

EPOLLIN = \$01

event_wait input file descriptor ready event

EPOLLONESHOT = \$40000000

Set single-shot behaviour on epoll_wait.

EPOLLOUT = \$04

event_wait output file descriptor ready event

EPOLLPRI = \$02

event_wait high priority data available on input file descriptor

EPOLL_CTL_ADD = 1

Add filedescriptor to list of events

EPOLL_CTL_DEL = 2

Delete event for filedescriptor

EPOLL_CTL_MOD = 3

Modify event for filedescriptor

FUTEX_CMP_REQUEUE = 4

Futex option: requeue waiting processes on other futex, but check it's value first

FUTEX_FD = 2

Futex option: Associate file descriptor with futex.

FUTEX_LOCK_PI = 6

Futex option: Undocumented

FUTEX_OP_ADD = 1

Futex operation: Undocumented

FUTEX_OP_ANDN = 3

Futex operation: Undocumented

FUTEX_OP_CMP_EQ = 0

Futex operation: Undocumented

FUTEX_OP_CMP_GE = 5

Futex operation: Undocumented

FUTEX_OP_CMP_GT = 4

Futex operation: Undocumented

FUTEX_OP_CMP_LE = 3

Futex operation: Undocumented

FUTEX_OP_CMP_LT = 2

Futex operation: Undocumented

FUTEX_OP_CMP_NE = 1

Futex operation: Undocumented

FUTEX_OP_OPARG_SHIFT = 8

Futex operation: Undocumented

FUTEX_OP_OR = 2

Futex operation: Undocumented

`FUTEX_OP_SET = 0`

Futex operation: Undocumented

`FUTEX_OP_XOR = 4`

Futex operation: Undocumented

`FUTEX_REQUEUE = 3`

Futex option: requeue waiting processes on other futex.

`FUTEX_TRYLOCK_PI = 8`

Futex option: Undocumented

`FUTEX_UNLOCK_PI = 7`

Futex option: Undocumented

`FUTEX_WAIT = 0`

Futex option: Wait on futex till wake call arrives.

`FUTEX_WAKE = 1`

Futex option: wakes any waiting processes on this futex

`FUTEX_WAKE_OP = 5`

Futex option: Undocumented

`GIO_CMAP = $4B70`

IOCTL: Get colour palette on VGA+

`GIO_FONT = $4B60`

IOCTL: Get font in expanded form.

`GIO_FONTX = $4B6B`

IOCTL: Get font in `consolefontdesc` record.

`GIO_SCRNMAP = $4B40`

IOCTL: get screen mapping from kernel

`GIO_UNIMAP = $4B66`

IOCTL: get unicode-to-font mapping from kernel

GIO_UNISCRNMAP = \$4B69

IOCTL: get full Unicode screen mapping

IN_ACCESS = \$00000001

IN_ALL_EVENTS = IN_ACCESS or IN MODIFY or IN_ATTRIB or IN_CLOSE or IN_OPEN or IN_MOVE

IN_ATTRIB = \$00000004

IN_CLOEXEC = &02000000

IN_CLOSE = IN_CLOSE_WRITE or IN_CLOSE_NOWRITE

IN_CLOSE_NOWRITE = \$00000010

IN_CLOSE_WRITE = \$00000008

IN_CREATE = \$00000100

IN_DELETE = \$00000200

IN_DELETE_SELF = \$00000400

IN_DONT_FOLLOW = \$02000000

IN_IGNORED = \$00008000

IN_ISDIR = \$40000000

IN_MASK_ADD = \$20000000

IN MODIFY = \$00000002

IN_MOVE = IN_MOVED_FROM or IN_MOVED_TO

IN_MOVED_FROM = \$00000040

IN_MOVED_TO = \$00000080

IN_MOVE_SELF = \$00000800

IN_NONBLOCK = &00004000

IN_ONESHOT = \$80000000

IN_ONLYDIR = \$01000000

IN_OPEN = \$00000020

IN_Q_OVERFLOW = \$00004000

IN_UNMOUNT = \$00002000

KB_101 = 2

IOCTL: Keyboard types: 101 keys

KB_84 = 1

IOCTL: Keyboard types: 84 keys

KB_OTHER = 3

IOCTL: Keyboard types: other type

KDADDIO = \$4B34

IOCTL: add i/o port as valid

KDELIO = \$4B35

IOCTL: delete i/o port as valid

KDDISABIO = \$4B37

IOCTL: disable i/o to video board

KDENABIO = \$4B36

IOCTL: enable i/o to video board

KDFONTOP = \$4B72

IOCTL: font operations

KDGETKEYCODE = \$4B4C

IOCTL: read kernel keycode table entry

KDGETLED = \$4B31

IOCTL: return current led state

KDGETMODE = \$4B3B

IOCTL: get current mode

KDGKBDIACR = \$4B4A

IOCTL: read kernel accent table

KDGKBTYPE = \$4B33

IOCTL: get keyboard type

KDMAPDISP = \$4B3C

IOCTL: map display into address space

KDMKTONE = \$4B30

IOCTL: generate tone

KDSETKEYCODE = \$4B4D

IOCTL: write kernel keycode table entry

KDSETLED = \$4B32

IOCTL: set led state

KDSETMODE = \$4B3A

IOCTL: set text/graphics mode

KDSIGACCEPT = \$4B4E

IOCTL: accept kbd generated signals

KDSKBDIACR = \$4B4B

IOCTL: write kernel accent table

KDUNMAPDISP = \$4B3D

IOCTL: unmap display from address space

KD_GRAPHICS = 1

IOCTL: Tty modes: graphics mode

KD_TEXT = 0

IOCTL: Tty modes: Text mode

KD_TEXT0 = 2

IOCTL: Tty modes: Text mode (obsolete)

KD_TEXT1 = 3

IOCTL: Tty modes: Text mode (obsolete)

KIOCSOUND = \$4B2F

IOCTL: start/stop sound generation (0 for off)

LED_CAP = 4

IOCTL: LED_CAP : caps lock led

LED_NUM = 2

IOCTL: LED_SCR : Num lock led

LED_SCR = 1

IOCTL: LED_SCR : scroll lock led

LINUX_CAPABILITY_VERSION = \$19980330

Current capability version in use by kernel

MAP_DENYWRITE = \$800

Read-only

MAP_EXECUTABLE = \$1000

Memory area is marked as executable

MAP_GROWSDOWN = \$100

Memory map grows down, like stack

MAP_LOCKED = \$2000

Memory pages are locked

MAP_NORESERVE = \$4000

Do not check for reservations

MAX_CLOCKS = 16

PIO_CMAP = \$4B71

IOCTL: Set colour palette on VGA+

PIO_FONT = \$4B61

IOCTL: Use font in expanded form.

PIO_FONTRESET = \$4B6D

IOCTL: Reset to default font

PIO_FONTX = \$4B6C

IOCTL: Set font in consolefontdesc record.

PIO_SCRNMAP = \$4B41

IOCTL: put screen mapping table in kernel

PIO_UNIMAP = \$4B67

IOCTL: put unicode-to-font mapping in kernel

PIO_UNIMAPCLR = \$4B68

IOCTL: clear table, possibly advise hash algorithm

PIO_UNISCRNMAP = \$4B6A

IOCTL: set full Unicode screen mapping

POLLMSG = \$0400

Unused in linux

POLLRDHUP = \$2000

Peer Shutdown/closed writing half of connection

POLLREMOVE = \$1000

Undocumented linux extension of Poll

SPLICE_F_GIFT = 8

Pages spliced in are a gift

SPLICE_F_MORE = 4

Expect more data

SPLICE_F_MOVE = 1

Move pages instead of copying

SPLICE_F_NONBLOCK = 2

Don't block on pipe splicing operations

SYNC_FILE_RANGE_WAIT_AFTER = 4

Wait upon write-out of specified pages in the range after performing any write.

SYNC_FILE_RANGE_WAIT_BEFORE = 1

Wait for write-out of previously-submitted specified pages before writing more data.

SYNC_FILE_RANGE_WRITE = 2

Initiate write of all dirty pages in the specified range.

23.3.2 Types

clockid_t = cint

```
EPoll_Data = record  
end
```

Data structure used in EPOLL IOCTL call.

```
EPoll_Event = record  
  Events : cuint32;  
  Data : TEPoll_Data;  
end
```

Structure used in epoll_ctl ([756](#)) call.

```
inotify_event = record
  wd : cint;
  mask : cuint32;
  cookie : cuint32;
  len : cuint32;
  name : Char;
end
```

PEPoll_Data = ^EPoll_Data

Pointer to EPoll_Data ([753](#)) record

PEpoll_Event = ^EPoll_Event

Pointer to EPoll_Event ([753](#)) type

Pinotify_event = ^inotify_event

PSysInfo = ^TSysInfo

Pointer to TSysInfo ([755](#)) record.

Puser_cap_data = ^user_cap_data

Pointer to user_cap_data ([755](#)) record

Puser_cap_header = ^user_cap_header

Pointer to user_cap_header ([755](#)) record

TCloneFunc = function(args: pointer) : LongInt

Clone function prototype.

TEPoll_Data = EPoll_Data

Alias for EPoll_Data ([753](#)) type

TEPoll_Event = EPoll_Event

Alias for EPoll_Event ([753](#)) type

```
TSysInfo = record
  uptime : clong;
  loads : Array[0..2] of culong;
  totalram : culong;
  freeram : culong;
  sharedram : culong;
  bufferram : culong;
```

```

totalswap : culong;
freeswap : culong;
procs : cushort;
pad : cushort;
totalhigh : culong;
freehigh : culong;
mem_unit : cuint;
_f : Array[0..19-2*sizeof(clong)-sizeof(cint)] of cchar;
end

```

Record with system information, used by the SysInfo ([760](#)) call.

```

user_cap_data = record
  effective : cuint32;
  permitted : cuint32;
  inheritable : cuint32;
end

```

`user_cap_data` describes the set of capabilities for the indicated thread.

```

user_cap_header = record
  version : cuint32;
  pid : cint;
end

```

`user_cap_header` describes the root user capabilities for the current thread, as set by capget ([755](#)) and capset ([755](#))

23.4 Procedures and functions

23.4.1 capget

Synopsis: Return the capabilities for the indicated thread

Declaration: function capget(header: Puser_cap_header;data: Puser_cap_data) : cint

Visibility: default

Description: capget returns the capabilities of the indicated thread in header. The thread is identified by the process ID, or -1 for all caller (and child) process ID's.

Refer to the linux man pages (7 capabilities) for more info.

Errors: On success, zero is returned, on error -1 is returned, and fperrno is set to the error.

See also: capset ([755](#))

23.4.2 capset

Synopsis: Set the capabilities for the indicated thread

Declaration: function capset(header: Puser_cap_header;data: Puser_cap_data) : cint

Visibility: default

Description: capget sets the capabilities of the indicated thread in header. The thread is identified by the process ID, or -1 for all caller (and child) process ID's.

Refer to the linux man pages (7 capabilities) for more info.

Errors: On success, zero is returned, on error -1 is returned, and fperrno is set to the error.

See also: capget ([755](#))

23.4.3 **clock_getres**

Declaration: function clock_getres(clk_id: clockid_t;res: ptimespec) : cint

Visibility: default

23.4.4 **clock_gettime**

Declaration: function clock_gettime(clk_id: clockid_t;tp: ptimespec) : cint

Visibility: default

23.4.5 **clock_settime**

Declaration: function clock_settime(clk_id: clockid_t;tp: ptimespec) : cint

Visibility: default

23.4.6 **epoll_create**

Synopsis: Create new epoll file descriptor

Declaration: function epoll_create(size: cint) : cint

Visibility: default

Description: epoll_create creates a new epoll file descriptor. The size argument indicates to the kernel approximately how many structures should be allocated, but is by no means an upper limit.

On success, a file descriptor is returned that can be used in subsequent epoll_ctl ([756](#)) or epoll_wait ([757](#)) calls, and should be closed using the fpClose ([147](#)) call.

Errors: On error, -1 is returned, and errno ([156](#)) is set.

See also: epoll_ctl ([756](#)), epoll_wait ([757](#)), fpClose ([147](#))

23.4.7 **epoll_ctl**

Synopsis: Modify an epoll file descriptor

Declaration: function epoll_ctl(epfd: cint;op: cint;fd: cint;event: PEpoll_Event) : cint

Visibility: default

Description: `epoll_ctl` performs the `op` operation on epoll file descriptor `epfd`. The operation will be monitored on file descriptor `fd`, and is optionally controlled by `event`.

`op` can be one of the following values:

EPOLL_CTL_ADDAdd filedescriptor to list of events

EPOLL_CTL_MODModify event for filedescriptor

EPOLL_CTL_DELDelete event for filedescriptor

The `events` field in `event_data` is a bitmask of one or more of the following values:

EPOLLINThe file is ready for read operations

EPOLLOUTThe file is ready for write operations.

EPOLLPRIUrgent data is available for read operations.

EPOLLERRAn error condition is signaled on the file descriptor.

EPOLLHUPA hang up happened on the file descriptor.

EPOLLETSet the Edge Triggered behaviour for the file descriptor.

EPOLLONESHOTSet One-Shot behaviour for the file descriptor. The event will be triggered only once.

Errors: On error -1 is returned, and `errno` is set accordingly.

See also: `epoll_create` (756), `epoll_wait` (757), `fpClose` (147)

23.4.8 epoll_wait

Synopsis: Wait for an event on an epoll file descriptor.

Declaration: `function epoll_wait(epfd: cint; events: PEpoll_Event; maxevents: cint; timeout: cint) : cint`

Visibility: default

Description: `epoll_wait` waits for `timeout` milliseconds for an event to occur on epoll file descriptor `epfd`.

If `timeout` is -1, it waits indefinitely, if `timeout` is zero, it does not wait, but returns immediately, even if no events were detected.

On return, data for at most `maxevents` will be returned in the memory pointed to by `events`. The function returns the number of file descriptors for which events were reported. This can be zero if the timeout was reached.

Errors: On error -1 is returned, and `errno` is set accordingly.

See also: `epoll_create` (756), `epoll_ctl` (756), `fpClose` (147)

23.4.9 fdatasync

Synopsis: Synchronize the data in memory with the data on storage device

Declaration: `function fdatasync(fd: cint) : cint`

Visibility: default

Description: `fdatasync` does the same as `fpfsync` but does not flush the metadata, unless it is vital to the correct reading/writing of the file. In practice, this means that unless the file size changed, the file metadata will not be synced.

See also: `#rtl.unix.fsync` (1704)

23.4.10 futex

Synopsis: Perform a futex operation

```
Declaration: function futex(uaddr: pcint;op: cint;val: cint;timeout: ptimespec;
                         addr2: pcint;val3: cint) : cint
function futex(var uaddr;op: cint;val: cint;timeout: ptimespec;
               var addr2;val3: cint) : cint
function futex(var uaddr;op: cint;val: cint;var timeout: TTimeSpec;
               var addr2;val3: cint) : cint
function futex(uaddr: pcint;op: cint;val: cint;timeout: ptimespec)
               : cint
function futex(var uaddr;op: cint;val: cint;timeout: ptimespec) : cint
function futex(var uaddr;op: cint;val: cint;var timeout: TTimeSpec)
               : cint
```

Visibility: default

Description: futex performs an operation on a memory futex as described in the kernel manual page for futex. The mutex is located at `uaddr`, the operation `op` is one of the following constants:

FUTEX_WAITFutex option: Wait on futex till wake call arrives.

FUTEX_WAKEFutex option: Wait on futex till wake call arrives.

FUTEX_FDFutex option: Associate file descriptor with futex.

FUTEX_REQUEUEFutex option: requeue waiting processes on other futex.

FUTEX_CMP_REQUEUEFutex option: requeue waiting processes on other futex, but check it's value first

The value to check for is indicated in `val`, and a timeout can be specified in `timeout`. The optional arguments `addr2` and `val3` are used only with the `FUTEX_REQUEUE` and `FUTEX_CMP_REQUEUE` operations.

In case of an error, -1 is returned. All other return values must be interpreted according to the operation performed.

This call directly interfaces with the Linux kernel, more information can be found in the kernel manual pages.

Errors: On error, -1 is returned. Use `#rtl.baseunix.fpgeterrno` (156) to get the error code.

23.4.11 futex_op

Synopsis: Futex operation:

```
Declaration: function futex_op(op: cint;oparg: cint;cmp: cint;cmparg: cint) : cint
```

Visibility: default

Description: `FUTEX_OP` Performs an operation on a futex:

```
FUTEX_OP := ((op and $F) shl 28) or
            ((cmp and $F) shl 24) or
            ((oparg and $FFF) shl 12)
            or (cmparg and $FFF);
```

23.4.12 inotify_add_watch

Declaration: function inotify_add_watch(fd: cint;name: PChar;mask: cuint32) : cint

Visibility: default

23.4.13 inotify_init

Declaration: function inotify_init : cint

Visibility: default

23.4.14 inotify_init1

Declaration: function inotify_init1(flags: cint) : cint

Visibility: default

23.4.15 inotify_rm_watch

Declaration: function inotify_rm_watch(fd: cint;wd: cint) : cint

Visibility: default

23.4.16 sched_yield

Synopsis: Yield the processor to another thread.

Declaration: procedure sched_yield

Visibility: default

Description: `sched_yield` yields the processor to another thread. The current thread is put at the back of its queue. If there is only 1 thread in the application, the thread continues to run. The call always returns zero.

23.4.17 sync_file_range

Synopsis: Force committing of data to disk

Declaration: function sync_file_range(fd: cint;offset: off64_t;nbytes: off64_t;
flags: cuint) : cint

Visibility: default

Description: `sync_file_range` forces the linux kernel to write any data pages of a specified file (file descriptor `fd`) to disk. The range of the file is specified by the offset `offset` and the number of bytes `nbytes`. Options is an OR-ed combination of

SYNC_FILE_RANGE_WAIT_BEFOREWait for write-out of previously-submitted specified pages before writing more data.

SYNC_FILE_RANGE_WRITEInitiate write of all dirty pages in the specified range.

SYNC_FILE_RANGE_WAIT_AFTERWait upon write-out of specified pages in the range after performing any write.

If none is specified, the operation does nothing.

Errors: On return -1 is returned and fperrno is set to the actual error code. See the linux man page for more on the error codes.

See also: fdatasync ([757](#))

23.4.18 Sysinfo

Synopsis: Return kernel system information

Declaration: function Sysinfo(Info: PSysInfo) : cint

Visibility: default

Description: SysInfo returns system information in Info. Returned information in Info includes:

- uptime**Number of seconds since boot.
- loads1**, 5 and 15 minute load averages.
- totalram**total amount of main memory.
- freeram**amount of free memory.
- sharedram**amount of shared memory.
- bufferram**amount of memory used by buffers.
- totalswap**total amount of swap space.
- freeswap**amount of free swap space.
- procs**number of current processes.

Errors: None.

See also: #rtl.baseunix.fpUname ([192](#))

Listing: ./linuxex/ex64.pp

```

program Example64;

{ Example to demonstrate the SysInfo function.
  Sysinfo is Linux-only. }

{$ifdef Linux}
Uses Linux;

Function Mb(L : Longint) : longint;

begin
  Mb:=L div (1024*1024);
end;

Var Info : TSysInfo;
  D,M,Secs,H : longint;
{$endif}

begin
  {$ifdef Linux}
  If Not SysInfo(Info) then
    Halt(1);

```

```
With Info do
begin
D:=Uptime div (3600*24);
UpTime:=UpTime mod (3600*24);
h:=uptime div 3600;
uptime:=uptime mod 3600;
m:=uptime div 60;
secs:=uptime mod 60;
Writeln('Uptime : ',d,'days, ',h,' hours, ',m,' min, ',secs,' s.');
Writeln('Loads : ',Loads[1],'/',Loads[2],'/',Loads[3]);
Writeln('Total Ram : ',Mb(totalram), 'Mb.');
Writeln('Free Ram : ',Mb(freeram), 'Mb.');
Writeln('Shared Ram : ',Mb(sharedram), 'Mb.');
Writeln('Buffer Ram : ',Mb(bufferram), 'Mb.');
Writeln('Total Swap : ',Mb(totalswap), 'Mb.');
Writeln('Free Swap : ',Mb(freeswap), 'Mb.');
end;
{$endif}
end.
```

Chapter 24

Reference for unit 'Infodwrf'

24.1 Overview

The Infodwrf provides a routine that reads the debug information of an executable (if any exists) and returns source code information about this address. It works with DWARF debug information. Note that this unit is not thread-safe, and that its behaviour is undefined if multiple threads try to write a backtrace at the same time.

For stabs debug information, the lineinfo ([739](#)) unit must be used.

24.2 Procedures and functions

24.2.1 GetLineInfo

Synopsis: Return source line information about an address.

Declaration: `function GetLineInfo(addr: ptruint; var func: string; var source: string; var line: LongInt) : Boolean`

Visibility: default

Description: `GetLineInfo` returns source line information about the address `addr`. It searches this information in the DWARF debugging information found in the binary: If the file was compiled without debug information, nothing will be returned. Upon successful retrieval of the debug information, `True` is returned, and the `func` parameter is filled with the name of the function in which the address is located. The `source` parameter contains the name of the file in which the function was implemented, and `line` contains the line number in the source file for `addr`.

Errors: If no debug information is found, `False` is returned.

Chapter 25

Reference for unit 'math'

25.1 Used units

Table 25.1: Used units by unit 'math'

Name	Page
System	1229
sysutils	1449

25.2 Overview

This document describes the `math` unit. The `math` unit was initially written by Florian Klaempfl. It provides mathematical functions which aren't covered by the system unit.

This chapter starts out with a definition of all types and constants that are defined, after which an overview is presented of the available functions, grouped by category, and the last part contains a complete explanation of each function.

The following things must be taken into account when using this unit:

1. This unit is compiled in Object Pascal mode so all `integers` are 32 bit.
2. Some overloaded functions exist for data arrays of integers and floats. When using the address operator (`@`) to pass an array of data to such a function, make sure the address is typecasted to the right type, or turn on the 'typed address operator' feature. failing to do so, will cause the compiler not be able to decide which function you want to call.

25.3 Geometrical functions

Table 25.2:

Name	Description
<code>hypot</code> (781)	Hypotenuse of triangle
<code>norm</code> (792)	Euclidian norm

25.4 Statistical functions

Table 25.3:

Name	Description
mean (788)	Mean of values
meanandstddev (789)	Mean and standard deviation of values
momentskewkurtosis (792)	Moments, skew and kurtosis
popnstddev (793)	Population standarddeviation
popnvariance (794)	Population variance
randg (797)	Gaussian distributed random value
stddev (801)	Standard deviation
sum (802)	Sum of values
sumofsquares (803)	Sum of squared values
sumsandsquares (804)	Sum of values and squared values
totalvariance (806)	Total variance of values
variance (806)	variance of values

25.5 Number converting

Table 25.4:

Name	Description
ceil (773)	Round to infinity
floor (778)	Round to minus infinity
frexp (778)	Return mantissa and exponent

25.6 Exponential and logarithmic functions

Table 25.5:

Name	Description
intpower (782)	Raise float to integer power
ldexp (783)	Calculate $2^{\text{p}} \times \$$
lnxpl (784)	calculate $\log(x+1)$
log10 (784)	calculate 10-base log
log2 (785)	calculate 2-base log
logn (785)	calculate N-base log
power (795)	raise float to arbitrary power

25.7 Hyperbolic functions

Table 25.6:

Name	Description
arcosh (770)	calculate reverse hyperbolic cosine
arsinh (772)	calculate reverse hyperbolic sine
artanh (772)	calculate reverse hyperbolic tangent
cosh (774)	calculate hyperbolic cosine
sinh (801)	calculate hyperbolic sine
tanh (805)	calculate hyperbolic tangent

25.8 Trigonometric functions

Table 25.7:

Name	Description
arccos (769)	calculate reverse cosine
arcsin (770)	calculate reverse sine
arctan2 (771)	calculate reverse tangent
cotan (775)	calculate cotangent
sincos (800)	calculate sine and cosine
tan (805)	calculate tangent

25.9 Angle unit conversion

Routines to convert angles between different angle units.

Table 25.8:

Name	Description
cyclerad (776)	convert cycles to radians
degtograd (776)	convert degrees to grads
degtorad (777)	convert degrees to radians
gradtodeg (779)	convert grads to degrees
gradtorad (780)	convert grads to radians
radtocycle (795)	convert radians to cycles
radtodeg (796)	convert radians to degrees
radtograd (796)	convert radians to grads

25.10 Min/max determination

Functions to determine the minimum or maximum of numbers:

Table 25.9:

Name	Description
max (786)	Maximum of 2 values
maxIntValue (786)	Maximum of an array of integer values
maxvalue (787)	Maximum of an array of values
min (789)	Minimum of 2 values
minIntValue (790)	Minimum of an array of integer values
minvalue (791)	Minimum of an array of values

25.11 Constants, types and variables

25.11.1 Constants

EqualsValue = 0

Values are the same

GreaterThanValue = (TValueRelationship)

First values is greater than second value

Infinity = 1.0 / 0.0

Value is infinity

LessThanValue = (TValueRelationship)

First value is less than second value

MaxExtended = 1.1e + 4932

Maximum value of extended type

MaxFloat = MaxExtended

Maximum value of float type

MinExtended = 3.4e - 4932

Minimum value (closest to zero) of extended type

MinFloat = MinExtended

Minimum value (closest to zero) of float type

NaN = 0.0 / 0.0

Value is Not a Number

```
NegativeValue = (TValueSign)
```

Value is negative

```
NegInfinity = (-1.0) / 0.0
```

Value is negative (minus) infinity

```
PositiveValue = (TValueSign)
```

Value is positive

```
ZeroValue = 0
```

Value is zero

25.11.2 Types

```
float = extended
```

All calculations are done with the Float type. This allows to recompile the unit with a different float type to obtain a desired precision. The pointer type PFloat (767) is used in functions that accept an array of values of arbitrary length.

```
PFloat = ^float
```

Pointer to Float (767) type.

```
PInteger = ObjPas.PInteger
```

Pointer to integer type

```
TFPUException = (exInvalidOp, exDenormalized, exZeroDivide, exOverflow,
                  exUnderflow, exPrecision)
```

Table 25.10: Enumeration values for type TFPUException

Value	Explanation
exDenormalized	
exInvalidOp	Invalid operation error
exOverflow	Float overflow error
exPrecision	Precision error
exUnderflow	Float underflow error
exZeroDivide	Division by zero error.

Type describing Floating Point processor exceptions.

```
TFPUExceptionMask = Set of TFPUException
```

Type to set the Floating Point Unit exception mask.

```
TFPUPrecisionMode = (pmSingle, pmReserved, pmDouble, pmExtended)
```

Table 25.11: Enumeration values for type TFPUPrecisionMode

Value	Explanation
pmDouble	Double-type precision
pmExtended	Extended-type precision
pmReserved	?
pmSingle	Single-type precision

Type describing the default precision for the Floating Point processor.

```
TFPURoundingMode = (rmNearest, rmDown, rmUp, rmTruncate)
```

Table 25.12: Enumeration values for type TFPURoundingMode

Value	Explanation
rmDown	Round to biggest integer smaller than value.
rmNearest	Round to nearest integer value
rmTruncate	Cut off fractional part.
rmUp	Round to smallest integer larger than value.

Type describing the rounding mode for the Floating Point processor.

```
tpaymenttime = (ptendofperiod, ptstartofperiod)
```

Table 25.13: Enumeration values for type tpaymenttime

Value	Explanation
ptendofperiod	End of period.
ptstartofperiod	Start of period.

Type used in financial (interest) calculations.

```
TRoundToRange = -37..37
```

TRoundToRange is the range of valid digits to be used in the RoundTo (798) function.

```
TValueRelationship = -1..1
```

Type to describe relational order between values

```
TValueSign = -1..1
```

Type indicating sign of a valuea

25.12 Procedures and functions

25.12.1 arccos

Synopsis: Return inverse cosine

Declaration: function arccos(x: float) : float

Visibility: default

Description: Arccos returns the inverse cosine of its argument x. The argument x should lie between -1 and 1 (borders included).

Errors: If the argument x is not in the allowed range, an EInvalidArgument exception is raised.

See also: arcsin (770), arcosh (770), arsinh (772), artanh (772)

Listing: ./mathex/ex1.pp

```
Program Example1;

{ Program to demonstrate the arccos function. }

Uses math;

Procedure WriteRadDeg(X : float);

begin
  Writeln(X:8:5, ' rad = ', raddrdeg(x):8:5, ' degrees.')
end;

begin
  WriteRadDeg (arccos(1));
  WriteRadDeg (arccos(sqrt(3)/2));
  WriteRadDeg (arccos(sqrt(2)/2));
  WriteRadDeg (arccos(1/2));
  WriteRadDeg (arccos(0));
  WriteRadDeg (arccos(-1));
end.
```

25.12.2 arccosh

Synopsis: Return inverse hyperbolic cosine

Declaration: function arccosh(x: float) : float

Visibility: default

Description: arccosh returns the inverse hyperbolic cosine of it's argument x.

This function is an alias for arcosh (770), provided for Delphi compatibility.

See also: arcosh (770)

25.12.3 arcosh

Synopsis: Return inverse hyperbolic cosine

Declaration: function arcosh(x: float) : float

Visibility: default

Description: Arcosh returns the inverse hyperbolic cosine of its argument x. The argument x should be larger than 1. The arccosh variant of this function is supplied for Delphi compatibility.

Errors: If the argument x is not in the allowed range, an EInvalidArgument exception is raised.

See also: cosh (774), sinh (801), arcsin (770), arsinh (772), artanh (772), tanh (805)

Listing: ./mathex/ex3.pp

```
Program Example3;

{ Program to demonstrate the arcosh function. }

Uses math;

begin
  Writeln(arcosh(1));
  Writeln(arcosh(2));
end.
```

25.12.4 arcsin

Synopsis: Return inverse sine

Declaration: function arcsin(x: float) : float

Visibility: default

Description: Arcsin returns the inverse sine of its argument x. The argument x should lie between -1 and 1.

Errors: If the argument x is not in the allowed range, an EInvalidArgument exception is raised.

See also: arccos (769), arcosh (770), arsinh (772), artanh (772)

Listing: ./mathex/ex2.pp

```
Program Example1;

{ Program to demonstrate the arcsin function. }

Uses math;

Procedure WriteRadDeg(X : float);

begin
  Writeln(X:8:5, ' rad = ', radtodeg(x):8:5, ' degrees.')
end;

begin
  WriteRadDeg (arcsin(1));
  WriteRadDeg (arcsin(sqrt(3)/2));
end.
```

```

WriteRadDeg ( arcsin( sqrt(2)/2));
WriteRadDeg ( arcsin(1/2));
WriteRadDeg ( arcsin(0));
WriteRadDeg ( arcsin(-1));
end.

```

25.12.5 **arcsinh**

Synopsis: Return inverse hyperbolic sine

Declaration: function arcsinh(x: float) : float

Visibility: default

Description: arcsinh returns the inverse hyperbolic sine of it's argument x.

This function is an alias for arsinh ([772](#)), provided for Delphi compatibility.

See also: arsinh ([772](#))

25.12.6 **arctan2**

Synopsis: Return arctangent of (y/x)

Declaration: function arctan2(y: float;x: float) : float

Visibility: default

Description: arctan2 calculates arctan (y/x), and returns an angle in the correct quadrant. The returned angle will be in the range \$-\pi\$ to \$\pi\$ radians. The values of x and y must be between -2 $\sqrt{64}$ and 2 $\sqrt{64}$, moreover x should be different from zero. On Intel systems this function is implemented with the native intel fpatan instruction.

Errors: If x is zero, an overflow error will occur.

See also: arccos ([769](#)), arcosh ([770](#)), arsinh ([772](#)), artanh ([772](#))

Listing: ./mathex/ex6.pp

Program Example6;

{ Program to demonstrate the arctan2 function. }

Uses math;

Procedure WriteRadDeg(X : float);

begin

WriteLn(X:8:5, ' rad = ', radtodeg(x):8:5, ' degrees.')

end;

begin

 WriteRadDeg (arctan2(2,1));

end.

25.12.7 arctanh

Synopsis: Return inverse hyperbolic tangent

Declaration: function arctanh(x: float) : float

Visibility: default

Description: arctanh returns the inverse hyperbolic tangent of it's argument x.

This function is an alias for artanh (772), provided for Delphi compatibility.

See also: artanh (772)

25.12.8 arsinh

Synopsis: Return inverse hyperbolic sine

Declaration: function arsinh(x: float) : float

Visibility: default

Description: arsinh returns the inverse hyperbolic sine of its argument x. The arscsinh variant of this function is supplied for Delphi compatibility.

Errors: None.

See also: arcosh (770), arccos (769), arcsin (770), artanh (772)

Listing: ./mathex/ex4.pp

Program Example4;

{ Program to demonstrate the arsinh function. }

Uses math;

begin

Writeln(arsinh(0));
 Writeln(arsinh(1));

end.

25.12.9 artanh

Synopsis: Return inverse hyperbolic tangent

Declaration: function artanh(x: float) : float

Visibility: default

Description: artanh returns the inverse hyperbolic tangent of its argument x, where x should lie in the interval [-1,1], borders included. The arctanh variant of this function is supplied for Delphi compatibility.

Errors: In case x is not in the interval [-1,1], an EInvalidArgument exception is raised.

See also: arcosh (770), arccos (769), arcsin (770), artanh (772)

Listing: ./mathex/ex5.pp

```
Program Example5;

{ Program to demonstrate the artanh function. }

Uses math;

begin
  Writeln(artanh(0));
  Writeln(artanh(0.5));
end.
```

25.12.10 ceil

Synopsis: Return the lowest integer number greater than or equal to argument

Declaration: function ceil(x: float) : Integer

Visibility: default

Description: Ceil returns the lowest integer number greater than or equal to x. The absolute value of x should be less than maxint.

Errors: If the absolute value of x is larger than maxint, an overflow error will occur.

See also: floor ([778](#))

Listing: ./mathex/ex7.pp

```
Program Example7;
```

```
{ Program to demonstrate the Ceil function. }
```

```
Uses math;
```

```
begin
```

```
  Writeln(Ceil(-3.7)); // should be -3
  Writeln(Ceil(3.7)); // should be 4
  Writeln(Ceil(-4.0)); // should be -4
end.
```

25.12.11 ClearExceptions

Synopsis: Clear Floating Point Unit exceptions

Declaration: procedure ClearExceptions(RaisePending: Boolean)

Visibility: default

Description: Clear Floating Point Unit exceptions

25.12.12 CompareValue

Synopsis: Compare 2 values

```
Declaration: function CompareValue(const A: Integer;const B: Integer)
              : TValueRelationship
    function CompareValue(const A: Int64;const B: Int64)
              : TValueRelationship
    function CompareValue(const A: QWord;const B: QWord)
              : TValueRelationship
    function CompareValue(const A: Extended;const B: Extended;
              delta: Extended) : TValueRelationship
```

Visibility: default

Description: CompareValue compares 2 integer or floating point values A and B and returns one of the following values:

-1if A < B
0if A = B
1if A > B

See also: TValueRelationship (768)

25.12.13 cosecant

Synopsis: Calculate cosecant

Declaration: function cosecant(x: float) : float

Visibility: default

Description: cosecant calculates the cosecant ($1/\sin(x)$) of its argument x.

Errors: If 0 or 180 degrees is specified, an exception will be raised.

See also: secant (799)

25.12.14 \cosh

Synopsis: Return hyperbolic cosine

Declaration: function cosh(x: float) : float

Visibility: default

Description: Cosh returns the hyperbolic cosine of it's argument {x}.

Errors: None.

See also: [arcosh](#) (770), [sinh](#) (801), [arsinh](#) (772)

Listing: ./mathex/ex8.pp

Program Example8 ;

{ Program to demonstrate the cosh function. }

Uses math;

begin

```
Writeln(Cosh(0));  
Writeln(Cosh(1));
```

end.

25.12.15 cot

Synopsis: Alias for Cotan

Declaration: function cot(x: float) : float

Visibility: default

Description: cot is an alias for the cotan (775) function.

See also: cotan (775)

25.12.16 cotan

Synopsis: Return cotangent

Declaration: function cotan(x: float) : float

Visibility: default

Description: Cotan returns the cotangent of it's argument x. The argument x must be in radians. x should be different from zero.

Errors: If x is zero then a overflow error will occur.

See also: tanh (805)

Listing: ./mathex/ex9.pp

```

Program Example9;

{ Program to demonstrate the cotan function. }

Uses math;

begin
  writeln(cotan(pi/2));
  Writeln(cotan(pi/3));
  Writeln(cotan(pi/4));
end.

```

25.12.17 csc

Synopsis: Alias for cosecant

Declaration: function csc(x: float) : float

Visibility: default

Description: csc is an alias for the cosecant (774) function.

See also: cosecant (774)

25.12.18 cycletorad

Synopsis: Convert cycle angle to radians angle

Declaration: function cycletorad(cycle: float) : float

Visibility: default

Description: Cycletorad transforms it's argument `cycle` (an angle expressed in cycles) to radians. (1 cycle is 2π radians).

Errors: None.

See also: degtograd (776), degtorad (777), radtodeg (796), radtograd (796), radtocycle (795)

Listing: ./mathex/ex10.pp

Program Example10;

{ Program to demonstrate the cycletorad function. }

Uses math;

```
begin
    writeln(cos(cycletorad(1/6))); // Should print 1/2
    writeln(cos(cycletorad(1/8))); // should be sqrt(2)/2
end.
```

25.12.19 degtograd

Synopsis: Convert degree angle to grads angle

Declaration: function degtograd(deg: float) : float

Visibility: default

Description: Degtograd transforms it's argument `deg` (an angle in degrees) to grads. (90 degrees is 100 grad.)

Errors: None.

See also: cycletorad (776), degtorad (777), radtodeg (796), radtograd (796), radtocycle (795)

Listing: ./mathex/ex11.pp

Program Example11;

{ Program to demonstrate the degtograd function. }

Uses math;

```
begin
    writeln(degtograd(90));
    writeln(degtograd(180));
    writeln(degtograd(270))
end.
```

25.12.20 degtorad

Synopsis: Convert degree angle to radians angle.

Declaration: function degtorad(deg: float) : float

Visibility: default

Description: Degtord converts it's argument deg (an angle in degrees) to radians. (pi radians is 180 degrees)

Errors: None.

See also: cycletorad (776), degtograd (776), radtodeg (796), radtograd (796), radtocycle (795)

Listing: ./mathex/ex12.pp

Program Example12;

{ Program to demonstrate the degtorad function. }

Uses math;

```
begin
  writeln(degtorad(45));
  writeln(degtorad(90));
  writeln(degtorad(180));
  writeln(degtorad(270));
  writeln(degtorad(360));
end.
```

25.12.21 DivMod

Synopsis: Return DIV and MOD of arguments

```
Declaration: procedure DivMod(Dividend: Integer;Divisor: Word;var Result: Word;
                           var Remainder: Word)
procedure DivMod(Dividend: Integer;Divisor: Word;var Result: SmallInt;
                var Remainder: SmallInt)
procedure DivMod(Dividend: DWord;Divisor: DWord;var Result: DWord;
                var Remainder: DWord)
procedure DivMod(Dividend: Integer;Divisor: Integer;var Result: Integer;
                var Remainder: Integer)
```

Visibility: default

Description: DivMod returns Dividend DIV Divisor in Result, and Dividend MOD Divisor in Remainder

25.12.22 EnsureRange

Synopsis: Change value to it falls in specified range.

```
Declaration: function EnsureRange(const AValue: Integer;const AMin: Integer;
                                   const AMax: Integer) : Integer; Overload
function EnsureRange(const AValue: Int64;const AMin: Int64;
                     const AMax: Int64) : Int64; Overload
```

Visibility: default

Description: EnsureRange returns Value if AValue is in the range AMin..AMax. It returns AMin if the value is less than AMin, or AMax if the value is larger than AMax.

See also: InRange (781)

25.12.23 floor

Synopsis: Return the largest integer smaller than or equal to argument

Declaration: function floor(x: float) : Integer

Visibility: default

Description: Floor returns the largest integer smaller than or equal to x. The absolute value of x should be less than maxint.

Errors: If x is larger than maxint, an overflow will occur.

See also: ceil (773)

Listing: ./mathex/ex13.pp

```
Program Example13;
{ Program to demonstrate the floor function. }

Uses math;

begin
  Writeln(Ceil(-3.7)); // should be -4
  Writeln(Ceil(3.7)); // should be 3
  Writeln(Ceil(-4.0)); // should be -4
end.
```

25.12.24 Frexp

Synopsis: Return mantissa and exponent.

Declaration: procedure Frexp(X: float; var Mantissa: float; var Exponent: Integer)

Visibility: default

Description: Frexp returns the mantissa and exponent of it's argument x in mantissa and exponent.

Errors: None

Listing: ./mathex/ex14.pp

```
Program Example14;
{ Program to demonstrate the frexp function. }

Uses math;

Procedure dofrep(Cost X : extended);
```

```

var man : extended;
      exp: longint;

begin
  man:=0;
  exp:=0;
  frexp(x,man,exp);
  write(x, ' has ');
  Writeln('mantissa ',man,' and exponent ',exp);
end;

begin
//   dofrep(1.00);
  dofrep(1.02e-1);
  dofrep(1.03e-2);
  dofrep(1.02e1);
  dofrep(1.03e2);
end.

```

25.12.25 GetExceptionMask

Synopsis: Get the Floating Point Unit exception mask.

Declaration: function GetExceptionMask : TFPUExceptionMask

Visibility: default

Description: Get the Floating Point Unit exception mask.

25.12.26 GetPrecisionMode

Synopsis: Return the Floating Point Unit precision mode.

Declaration: function GetPrecisionMode : TFPUPrecisionMode

Visibility: default

Description: Return the Floating Point Unit precision mode.

25.12.27 GetRoundMode

Synopsis: Return the Floating Point Unit rounding mode.

Declaration: function GetRoundMode : TFPURoundingMode

Visibility: default

Description: Return the Floating Point Unit rounding mode.

25.12.28 gradtodeg

Synopsis: Convert grads angle to degrees angle

Declaration: function gradtodeg(grad: float) : float

Visibility: default

Description: `Gradtodeg` converts its argument `grad` (an angle in grads) to degrees. (100 grad is 90 degrees)

Errors: None.

See also: `cyclerad` (776), `degtograd` (776), `radtodeg` (796), `radtograd` (796), `radtcycle` (795), `gradtorad` (780)

Listing: `./mathex/ex15.pp`

Program Example15;

{ Program to demonstrate the `gradtodeg` function. }

Uses math;

```
begin
    writeln(gradtodeg(100));
    writeln(gradtodeg(200));
    writeln(gradtodeg(300));
end.
```

25.12.29 gradtorad

Synopsis: Convert grads angle to radians angle

Declaration: `function gradtorad(grad: float) : float`

Visibility: default

Description: `Gradtorad` converts its argument `grad` (an angle in grads) to radians. (200 grad is pi degrees).

Errors: None.

See also: `cyclerad` (776), `degtograd` (776), `radtodeg` (796), `radtograd` (796), `radtcycle` (795), `gradtodeg` (779)

Listing: `./mathex/ex16.pp`

Program Example16;

{ Program to demonstrate the `gradtorad` function. }

Uses math;

```
begin
    writeln(gradtorad(100));
    writeln(gradtorad(200));
    writeln(gradtorad(300));
end.
```

25.12.30 hypot

Synopsis: Return hypotenuse of triangle

Declaration: function hypot(x: float;y: float) : float

Visibility: default

Description: Hypot returns the hypotenuse of the triangle where the sides adjacent to the square angle have lengths x and y. The function uses Pythagoras' rule for this.

Errors: None.

Listing: ./mathex/ex17.pp

Program Example17;

```
{ Program to demonstrate the hypot function. }
```

```
Uses math;
```

```
begin
```

```
    Writeln(hypot(3,4)); // should be 5
```

```
end.
```

25.12.31 ifthen

Synopsis: Return one of two values, depending on a boolean condition

Declaration: function ifthen(val: Boolean;const iftrue: Integer;
 const ifffalse: Integer) : Integer; Overload
function ifthen(val: Boolean;const iftrue: Int64;const ifffalse: Int64)
 : Int64; Overload
function ifthen(val: Boolean;const iftrue: Double;const ifffalse: Double)
 : Double; Overload

Visibility: default

Description: ifthen returns iftrue if val is True, and ifffalse if val is False.

This function can be used in expressions.

25.12.32 InRange

Synopsis: Check whether value is in range.

Declaration: function InRange(const AValue: Integer;const AMin: Integer;
 const AMax: Integer) : Boolean; Overload
function InRange(const AValue: Int64;const AMin: Int64;
 const AMax: Int64) : Boolean; Overload

Visibility: default

Description: InRange returns True if AValue is in the range AMin..AMax. It returns False if Value lies outside the specified range.

See also: EnsureRange ([777](#))

25.12.33 intpower

Synopsis: Return integer power.

Declaration: function intpower(base: float; const exponent: Integer) : float

Visibility: default

Description: Intpower returns base to the power exponent, where exponent is an integer value.

Errors: If base is zero and the exponent is negative, then an overflow error will occur.

See also: power (795)

Listing: ./mathex/ex18.pp

```
Program Example18;

{ Program to demonstrate the intpower function. }

Uses math;

Procedure Dolntpower (X : extended; Pow : Integer);

begin
  writeln(X:8:4, '^', Pow:2, ' = ', intpower(X,pow):8:4);
end;

begin
  dolntpower(0.0,0);
  dolntpower(1.0,0);
  dolntpower(2.0,5);
  dolntpower(4.0,3);
  dolntpower(2.0,-1);
  dolntpower(2.0,-2);
  dolntpower(-2.0,4);
  dolntpower(-4.0,3);
end.
```

25.12.34 IsInfinite

Synopsis: Check whether value is infinite

Declaration: function IsInfinite(const d: Double) : Boolean

Visibility: default

Description: IsInfinite returns True if the double d contains the infinite value.

See also: IsZero (783), IsInfinite (782)

25.12.35 IsNan

Synopsis: Check whether value is Not a Number

Declaration: function IsNan(const d: Single) : Boolean; Overload
function IsNan(const d: Extended) : Boolean; Overload

Visibility: default

Description: `IsNaN` returns `True` if the double `d` contains Not A Number (a value which cannot be represented correctly in double format).

See also: `IsZero` (783), `IsInfinite` (782)

25.12.36 `IsZero`

Synopsis: Check whether value is zero

Declaration: `function IsZero(const A: Single; Epsilon: Single) : Boolean; Overload`
`function IsZero(const A: Single) : Boolean; Overload`
`function IsZero(const A: Extended; Epsilon: Extended) : Boolean;`
`; Overload`
`function IsZero(const A: Extended) : Boolean; Overload`

Visibility: default

Description: `IsZero` checks whether the float value `A` is zero, up to a precision of `Epsilon`. It returns `True` if `Abs(A)` is less than `Epsilon`.

The default value for `Epsilon` depends on the type of the argument: it is `1E-4` for `Single`, `1E-12` for `Double` and `1E-16` for `extended`.

See also: `IsNaN` (782), `IsInfinite` (782), `SameValue` (798)

25.12.37 `Idexp`

Synopsis: Return (2 to the power `p`) times `x`

Declaration: `function Idexp(x: float; const p: Integer) : float`

Visibility: default

Description: `Idexp` returns (2 to the power `p`) times `x`.

Errors: None.

See also: `Lnxp1` (784), `log10` (784), `log2` (785), `logn` (785)

Listing: ./mathex/ex19.pp

Program Example19;

{ Program to demonstrate the `Idexp` function. }

Uses math;

begin

writeln(`Idexp(2,4):8:4`);
 writeln(`Idexp(0.5,3):8:4`);

end.

25.12.38 **Inxp1**

Synopsis: Return natural logarithm of 1+X

Declaration: function `lnxp1(x: float) : float`

Visibility: default

Description: `Lnxp1` returns the natural logarithm of $1+x$. The result is more precise for small values of x . x should be larger than -1.

Errors: If $x \leq -1$ then an `EInvalidArgument` exception will be raised.

See also: `Idexp` (783), `log10` (784), `log2` (785), `logn` (785)

Listing: `./mathex/ex20.pp`

Program Example20 ;

{ Program to demonstrate the `lnxp1` function. }

Uses math;

begin
 writeln(`lnxp1(0)`);
 writeln(`lnxp1(0.5)`);
 writeln(`lnxp1(1)`);
end.

25.12.39 **log10**

Synopsis: Return 10-Based logarithm.

Declaration: function `log10(x: float) : float`

Visibility: default

Description: `Log10` returns the 10-base logarithm of x .

Errors: If x is less than or equal to 0 an 'invalid fpu operation' error will occur.

See also: `Idexp` (783), `lnxp1` (784), `log2` (785), `logn` (785)

Listing: `./mathex/ex21.pp`

Program Example21 ;

{ Program to demonstrate the `log10` function. }

Uses math;

begin
 Writeln(`Log10(10):8:4`);
 Writeln(`Log10(100):8:4`);
 Writeln(`Log10(1000):8:4`);
 Writeln(`Log10(1):8:4`);
 Writeln(`Log10(0.1):8:4`);
 Writeln(`Log10(0.01):8:4`);
 Writeln(`Log10(0.001):8:4`);
end.

25.12.40 log2

Synopsis: Return 2-based logarithm

Declaration: function log2(x: float) : float

Visibility: default

Description: Log2 returns the 2-base logarithm of X.

Errors: If x is less than or equal to 0 an 'invalid fpu operation' error will occur.

See also: Idexp ([783](#)), Inxp1 ([784](#)), log10 ([784](#)), logn ([785](#))

Listing: ./mathex/ex22.pp

Program Example22;

{ Program to demonstrate the log2 function. }

Uses math;

begin

```
  Writeln(Log2(2):8:4);
  Writeln(Log2(4):8:4);
  Writeln(Log2(8):8:4);
  Writeln(Log2(1):8:4);
  Writeln(Log2(0.5):8:4);
  Writeln(Log2(0.25):8:4);
  Writeln(Log2(0.125):8:4);
end.
```

25.12.41 logn

Synopsis: Return N-based logarithm.

Declaration: function logn(n: float;x: float) : float

Visibility: default

Description: Logn returns the n-base logarithm of X.

Errors: If x is less than or equal to 0 an 'invalid fpu operation' error will occur.

See also: Idexp ([783](#)), Inxp1 ([784](#)), log10 ([784](#)), log2 ([785](#))

Listing: ./mathex/ex23.pp

Program Example23;

{ Program to demonstrate the logn function. }

Uses math;

begin

```
  Writeln(Logn(3,4):8:4);
  Writeln(Logn(2,4):8:4);
  Writeln(Logn(6,9):8:4);
  Writeln(Logn(exp(1),exp(1)):8:4);
```

```

Writeln(Logn(0.5,1):8:4);
Writeln(Logn(0.25,3):8:4);
Writeln(Logn(0.125,5):8:4);
end.

```

25.12.42 Max

Synopsis: Return largest of 2 values

Declaration: function Max(a: Integer;b: Integer) : Integer; Overload
 function Max(a: Int64;b: Int64) : Int64; Overload
 function Max(a: Extended;b: Extended) : Extended; Overload

Visibility: default

Description: Max returns the maximum of Int1 and Int2.

Errors: None.

See also: min (789), maxIntValue (786), maxvalue (787)

Listing: ./mathex/ex24.pp

```

Program Example24;
{ Program to demonstrate the max function. }
Uses math;

Var
  A,B : Cardinal;

begin
  A:=1;b:=2;
  writeln(max(a,b));
end.

```

25.12.43 MaxIntValue

Synopsis: Return largest element in integer array

Declaration: function MaxIntValue(const Data: Array of Integer) : Integer

Visibility: default

Description: MaxIntValue returns the largest integer out of the Data array.

This function is provided for Delphi compatibility, use the maxvalue (787) function instead.

Errors: None.

See also: maxvalue (787), minValue (791), minIntValue (790)

Listing: ./mathex/ex25.pp

```

Program Example25;

{ Program to demonstrate the MaxIntValue function. }

{ Make sure integer is 32 bit
{$mode objfpc}

Uses math;

Type
  TExArray = Array[1..100] of Integer;

Var
  I : Integer;
  ExArray : TExArray;

begin
  Randomize;
  for I:=low(exarray) to high(exarray) do
    ExArray[i]:=Random(I)-Random(100);
  Writeln(MaxIntValue(ExArray));
end.

```

25.12.44 maxvalue

Synopsis: Return largest value in array

Declaration: `function maxvalue(const data: Array of Extended) : Extended`
`function maxvalue(const data: PExtended; const N: Integer) : Extended`
`function maxvalue(const data: Array of Integer) : Integer`
`function maxvalue(const data: PInteger; const N: Integer) : Integer`

Visibility: default

Description: `Maxvalue` returns the largest value in the `data` array with integer or float values. The return value has the same type as the elements of the array.

The third and fourth forms accept a pointer to an array of `N` integer or float values.

Errors: None.

See also: `maxIntValue` (786), `minvalue` (791), `minIntValue` (790)

Listing: ./mathex/ex26.pp

```

program Example26;

{ Program to demonstrate the MaxValue function. }

{ Make sure integer is 32 bit
{$mode objfpc}

uses math;

var i:1..100;
  f_array:array[1..100] of Float;
  i_array:array[1..100] of Integer;

```

```

Pf_array : Pfloat;
Pi_array : Pinteger;

begin
  randomize;

  Pf_array := @f_array[1];
  Pi_array := @i_array[1];

  for i := low(f_array) to high(f_array) do
    f_array[i] := (random-random)*100;
  for i := low(i_array) to high(i_array) do
    i_array[i] := random(1)-random(100);

  Writeln('Max Float      : ', maxValue(f_array):8:4);
  Writeln('Max Float (b) : ', maxValue(Pf_array, 100):8:4);
  Writeln('Max Integer   : ', maxValue(i_array):8);
  Writeln('Max Integer (b) : ', maxValue(Pi_array, 100):8);
end.

```

25.12.45 mean

Synopsis: Return mean value of array

Declaration: function mean(const data: Array of Extended) : float
 function mean(const data: PExtended; const N: LongInt) : float

Visibility: default

Description: Mean returns the average value of data. The second form accepts a pointer to an array of N values.

Errors: None.

See also: meanandstddev (789), momentskewkurtosis (792), sum (802)

Listing: ./mathex/ex27.pp

```

Program Example27;

{ Program to demonstrate the Mean function. }

Uses math;

Type
  TExArray = Array[1..100] of Float;

Var
  I : Integer;
  ExArray : TExArray;

begin
  Randomize;
  for I := low(ExArray) to high(ExArray) do
    ExArray[I] := (Random-Random)*100;
  Writeln('Max       : ', maxValue(ExArray):8:4);
  Writeln('Min       : ', minValue(ExArray):8:4);
  Writeln('Mean     : ', Mean(ExArray):8:4);
  Writeln('Mean (b) : ', Mean(@ExArray[1], 100):8:4);

```

end.

25.12.46 meanandstddev

Synopsis: Return mean and standard deviation of array

Declaration: procedure meanandstddev(const data: Array of Extended; var mean: float;
var stddev: float);
procedure meanandstddev(const data: PExtended; const N: LongInt;
var mean: float; var stddev: float)

Visibility: default

Description: meanandstddev calculates the mean and standard deviation of data and returns the result in mean and stddev, respectively. Stddev is zero if there is only one value. The second form accepts a pointer to an array of N values.

Errors: None.

See also: mean ([788](#)), sum ([802](#)), sumofsquares ([803](#)), momentskewkurtosis ([792](#))

Listing: ./mathex/ex28.pp

Program Example28;

{ Program to demonstrate the Meanandstddev function. }

Uses math;

Type

TExArray = Array[1..100] of Extended;

Var

I : Integer;
ExArray : TExArray;
Mean, stddev : Extended;

begin

Randomize;
for I:=low(ExArray) **to** high(ExArray) **do**
 ExArray[i]:=(Random-Random)*100;
 MeanAndStdDev(ExArray, Mean, StdDev);
 Writeln('Mean : ', Mean:8:4);
 Writeln('StdDev : ', StdDev:8:4);
 MeanAndStdDev(@ExArray[1], 100, Mean, StdDev);
 Writeln('Mean (b) : ', Mean:8:4);
 Writeln('StdDev (b) : ', StdDev:8:4);

end.

25.12.47 Min

Synopsis: Return smallest of two values.

Declaration: function Min(a: Integer;b: Integer) : Integer; Overload
function Min(a: Int64;b: Int64) : Int64; Overload
function Min(a: Extended;b: Extended) : Extended; Overload

Visibility: default

Description: `min` returns the smallest value of `Int1` and `Int2`;

Errors: None.

See also: [max \(786\)](#)

Listing: ./mathex/ex29.pp

Program Example29;

{ Program to demonstrate the min function. }

Uses math;

Var

A,B : Cardinal;

begin

A:=1;b:=2;

writeln(min(a,b));

end.

25.12.48 MinIntValue

Synopsis: Return smallest value in integer array

Declaration: `function MinIntValue(const Data: Array of Integer) : Integer`

Visibility: default

Description: `MinIntValue` returns the smallest value in the `Data` array.

This function is provided for Delphi compatibility, use `minvalue` instead.

Errors: None

See also: [minvalue \(791\)](#), [maxIntValue \(786\)](#), [maxvalue \(787\)](#)

Listing: ./mathex/ex30.pp

Program Example30;

{ Program to demonstrate the MinIntValue function. }

{ Make sure integer is 32 bit}

{\$mode objfpc}

Uses math;

Type

TExArray = **Array**[1..100] **of** Integer;

Var

I : Integer;

ExArray : TExArray;

begin

```

Randomize;
for I:=low(ExArray) to high(ExArray) do
  ExArray[i]:=Random(I)-Random(100);
  WriteLn(MinIntValue(ExArray));
end.

```

25.12.49 minvalue

Synopsis: Return smallest value in array

Declaration: function minvalue(const data: Array of Extended) : Extended
 function minvalue(const data: PExtended; const N: Integer) : Extended
 function minvalue(const data: Array of Integer) : Integer
 function MinValue(const Data: PInteger; const N: Integer) : Integer

Visibility: default

Description: Minvalue returns the smallest value in the data array with integer or float values. The return value has the same type as the elements of the array.

The third and fourth forms accept a pointer to an array of N integer or float values.

Errors: None.

See also: maxIntValue (786), maxvalue (787), minIntValue (790)

Listing: ./mathex/ex31.pp

```

program Example31;

{ Program to demonstrate the MinValue function. }

{ Make sure integer is 32 bit }
{$mode objfpc}

uses math;

var i:1..100;
  f_array:array[1..100] of Float;
  i_array:array[1..100] of Integer;
  Pf_array:Pfloat;
  Pi_array:Pinteger;

begin
  randomize;

  Pf_array:=@f_array[1];
  Pi_array:=@i_array[1];

  for i:=low(f_array) to high(f_array) do
    f_array[i]:=(random-random)*100;
  for i:=low(i_array) to high(i_array) do
    i_array[i]:=random(I)-random(100);

  WriteLn('Min Float      : ',MinValue(f_array):8:4);
  WriteLn('Min Float (b) : ',MinValue(Pf_array,100):8:4);
  WriteLn('Min Integer   : ',MinValue(i_array):8);
  WriteLn('Min Integer (b) : ',MinValue(Pi_array,100):8);
end.

```

25.12.50 momentskewkurtosis

Synopsis: Return 4 first moments of distribution

Declaration:

```
procedure momentskewkurtosis(const data: Array of Extended;
                               out m1: float;out m2: float;out m3: float;
                               out m4: float;out skew: float;
                               out kurtosis: float)
procedure momentskewkurtosis(const data: PExtended;const N: Integer;
                               out m1: float;out m2: float;out m3: float;
                               out m4: float;out skew: float;
                               out kurtosis: float)
```

Visibility: default

Description: momentskewkurtosis calculates the 4 first moments of the distribution of values in data and returns them in m1,m2,m3 and m4, as well as the skew and kurtosis.

Errors: None.

See also: mean (788), meanandstddev (789)

Listing: ./mathex/ex32.pp

```
program Example32;
{ Program to demonstrate the momentskewkurtosis function. }

uses math;

var distarray:array[1..1000] of float;
   i:longint;
   m1,m2,m3,m4,skew,kurtosis:float;

begin
  randomize;
  for i:=low(distarray) to high(distarray) do
    distarray[i]:=random;
  momentskewkurtosis(DistArray ,m1,m2,m3,m4,skew ,kurtosis );

  Writeln ('1st moment : ',m1:8:6);
  Writeln ('2nd moment : ',m2:8:6);
  Writeln ('3rd moment : ',m3:8:6);
  Writeln ('4th moment : ',m4:8:6);
  Writeln ('Skew       : ',skew:8:6);
  Writeln ('kurtosis   : ',kurtosis :8:6);
end.
```

25.12.51 norm

Synopsis: Return Euclidian norm

Declaration:

```
function norm(const data: Array of Extended) : float
function norm(const data: PExtended;const N: Integer) : float
```

Visibility: default

Description: `Norm` calculates the Euclidian norm of the array of data. This equals `sqrts (sumofsquares (data))`.

The second form accepts a pointer to an array of `N` values.

Errors: None.

See also: `sumofsquares` (803)

Listing: `./mathex/ex33.pp`

```
program Example33;

{ Program to demonstrate the norm function. }

uses math;

var v:array[1..10] of Float;
   i:1..10;

begin
  for i:=low(v) to high(v) do
    v[i]:=random;
  writeln(norm(v));
end.
```

25.12.52 operator **(float, float): float

Declaration: `operator operator **(float, float): float(bas: float; expo: float)`
`: float`

Visibility: default

25.12.53 operator **(Int64, Int64): Int64

Declaration: `operator operator **(Int64, Int64): Int64(bas: Int64; expo: Int64)`
`: Int64`

Visibility: default

25.12.54 popnstddev

Synopsis: Return population variance

Declaration: `function popnstddev(const data: Array of Extended) : float`
`function popnstddev(const data: PExtended; const N: Integer) : float`

Visibility: default

Description: `Popnstddev` returns the square root of the population variance of the values in the `Data` array. It returns zero if there is only one value.

The second form of this function accepts a pointer to an array of `N` values.

Errors: None.

See also: `popnvariance` (794), `mean` (788), `meanandstddev` (789), `stddev` (801), `momentskewkurtosis` (792)

Listing: ./mathex/ex35.pp

Program Example35;

{ Program to demonstrate the PopnStdDev function. }

Uses Math;

Type

TExArray = **Array**[1..100] **of** Float;

Var

I : Integer;
ExArray : TExArray;

begin

Randomize;

for I:=low(ExArray) to high(ExArray) do

ExArray[i]:= (Random-Random)*100;

Writeln('Max' : ,.MaxValue(ExArray):8:4);

Writeln('Min' : ,.MinValue(ExArray):8:4);

Writeln('Pop. stddev.' : ,PopnStdDev(ExArray):8:4);

Writeln('Pop. stddev. (b)' : ,PopnStdDev(@ExArray[1],100):8:4);

end.

25.12.55 popnvariance

Synopsis: Return population variance

Declaration: function popnvariance(const data: PExtended; const N: Integer) : float
function popnvariance(const data: Array of Extended) : float

Visibility: default

Description: Popnvariance the population variance of the values in the Data array. It returns zero if there is only one value.

The second form of this function accepts a pointer to an array of N values.

Errors: None.

See also: popnstddev (793), mean (788), meanandstddev (789), stddev (801), momentskewkurtosis (792)

Listing: ./mathex/ex36.pp

Program Example36;

{ Program to demonstrate the PopnVariance function. }

Uses math;

Var

I : Integer;
ExArray : **Array**[1..100] **of** Float;

begin

Randomize;

for I:=low(ExArray) to high(ExArray) do

ExArray[i]:= (Random-Random)*100;

```

Writeln( 'Max' : ',.MaxValue(ExArray):8:4);
Writeln( 'Min' : ',.MinValue(ExArray):8:4);
Writeln( 'Pop. var.' : ',PopnVariance(ExArray):8:4);
Writeln( 'Pop. var. (b)' : ',PopnVariance(@ExArray[1],100):8:4);
end.

```

25.12.56 power

Synopsis: Return real power.

Declaration: function power(base: float; exponent: float) : float

Visibility: default

Description: power raises base to the power power. This is equivalent to `exp(power*ln(base))`. Therefore base should be non-negative.

Errors: None.

See also: intpower ([782](#))

Listing: ./mathex/ex34.pp

```

Program Example34;
{ Program to demonstrate the power function. }

Uses Math;

procedure dopower(x,y : float);

begin
  writeln(x:8:6,'^',y:8:6,' = ',power(x,y):8:6)
end;

begin
  dopower(2,2);
  dopower(2,-2);
  dopower(2,0.0);
end.

```

25.12.57 radtocykle

Synopsis: Convert radians angle to cycle angle

Declaration: function radtocykle(rad: float) : float

Visibility: default

Description: Radtocykle converts its argument rad (an angle expressed in radians) to an angle in cycles.

(1 cycle equals 2 pi radians)

Errors: None.

See also: degtograd ([776](#)), degtorad ([777](#)), radtodeg ([796](#)), radtograd ([796](#)), cycletorad ([776](#))

Listing: ./mathex/ex37.pp

Program Example37;

{ Program to demonstrate the radtocykle function. }

Uses math;

begin

```
writeln(radtocykle(2*pi):8:6);
writeln(radtocykle(pi):8:6);
writeln(radtocykle(pi/2):8:6);
```

end.

25.12.58 radtodeg

Synopsis: Convert radians angle to degrees angle

Declaration: function radtodeg(rad: float) : float

Visibility: default

Description: Radtodeg converts its argument rad (an angle expressed in radians) to an angle in degrees. (180 degrees equals pi radians)

Errors: None.

See also: degtograd (776), degtorad (777), radtocykle (795), radtograd (796), cycletorad (776)

Listing: ./mathex/ex38.pp

Program Example38;

{ Program to demonstrate the radtodeg function. }

Uses math;

begin

```
writeln(radtodeg(2*pi):8:6);
writeln(radtodeg(pi):8:6);
writeln(radtodeg(pi/2):8:6);
```

end.

25.12.59 radtograd

Synopsis: Convert radians angle to grads angle

Declaration: function radtograd(rad: float) : float

Visibility: default

Description: Radtograd converts its argument rad (an angle expressed in radians) to an angle in grads.
(200 grads equals pi radians)

Errors: None.

See also: degtograd (776), degtorad (777), radtocykle (795), radtodeg (796), cycletorad (776)

Listing: ./mathex/ex39.pp

Program Example39;

{ Program to demonstrate the radtograd function. }

Uses math;

```
begin
  writeln(radtograd(2*pi):8:6);
  writeln(radtograd(pi):8:6);
  writeln(radtograd(pi/2):8:6);
end.
```

25.12.60 randg

Synopsis: Return gaussian distributed random number.

Declaration: function randg(mean: float; stddev: float) : float

Visibility: default

Description: randg returns a random number which - when produced in large quantities - has a Gaussian distribution with mean mean and standarddeviation stddev.

Errors: None.

See also: mean (788), stddev (801), meanandstddev (789)

Listing: ./mathex/ex40.pp

Program Example40;

{ Program to demonstrate the randg function. }

Uses Math;

```
Var
  I : Integer;
  ExArray : Array[1..10000] of Float;;
  Mean, stddev : Float;

begin
  Randomize;
  for I:=low(ExArray) to high(ExArray) do
    ExArray[i]:=Randg(1,0.2);
  MeanAndStdDev(ExArray,Mean,StdDev);
  Writeln('Mean' : ' ',Mean:8:4);
  Writeln('StdDev' : ' ',StdDev:8:4);
end.
```

25.12.61 RandomFrom

Synopsis: Return a random element of an array of numbers

Declaration: function RandomFrom(const AValues: Array of Double) : Double; Overload
 function RandomFrom(const AValues: Array of Integer) : Integer
 ; Overload
 function RandomFrom(const AValues: Array of Int64) : Int64; Overload

Visibility: default

Description: RandomFrom returns a random element from the array AValues. The return value has the same type as the type of the array elements.

See also: #rtl.system.Random (1384), RandomRange (798)

25.12.62 RandomRange

Synopsis: Return a random number in a range

Declaration: function RandomRange(const aFrom: Integer; const aTo: Integer) : Integer
 function RandomRange(const aFrom: Int64; const aTo: Int64) : Int64

Visibility: default

Description: RandomRange returns a random value in the range AFrom to ATo. AFrom and ATo do not need to be in increasing order. The upper border is not included in the generated value, but the lower border is.

See also: #rtl.system.Random (1384), RandomFrom (797)

25.12.63 RoundTo

Synopsis: Round to the specified number of digits

Declaration: function RoundTo(const AValue: Extended; const Digits: TRoundToRange) : Extended

Visibility: default

Description: RoundTo rounds the specified float AValue to the specified number of digits and returns the result. This result is accurate to "10 to the power Digits". It uses the standard Round function for this.

See also: TRoundToRange (768), SimpleRoundTo (800)

25.12.64 SameValue

Synopsis: Check whether 2 float values are the same

Declaration: function SameValue(const A: Extended; const B: Extended) : Boolean
 ; Overload
 function SameValue(const A: Single; const B: Single) : Boolean; Overload
 function SameValue(const A: Extended; const B: Extended;
 Epsilon: Extended) : Boolean; Overload
 function SameValue(const A: Single; const B: Single; Epsilon: Single)
 : Boolean; Overload

Visibility: default

Description: `SameValue` returns `True` if the floating-point values `A` and `B` are the same, i.e. whether the absolute value of their difference is smaller than `Epsilon`. If their difference is larger, then `False` is returned.

If unspecified, the default value for Epsilon is 0.0.

See also: MinFloat (766), IsZero (783)

25.12.65 sec

Synopsis: Alias for secant

Declaration: function sec(x: float) : float

Visibility: default

Description: sec is an alias for the secant (799) function.

See also: secant (799)

25.12.66 secant

Synopsis: Calculate secant

Declaration: function secant(x: float) : float

Visibility: default

Description: Secant calculates the secant ($1/\cos(x)$) of its argument x .

Errors: If 90 or 270 degrees is specified, an exception will be raised.

See also: cosecant (774)

25.12.67 SetExceptionMask

Synopsis: Set the Floating Point Unit exception mask.

Declaration: function SetExceptionMask(const Mask: TFPUExceptionMask);

Visibility: default

Description: Set the Floating Point Unit exception mask.

25.12.68 SetPrecisionMode

Synopsis: Set the Floating Point Unit precision mode.

Declaration: function SetPrecisionMode(const Precision: TFPUPrecisionMode);

Visibility: default

Description: Set the Floating Point Unit precision mode.

25.12.69 SetRoundMode

Synopsis: Set the Floating Point Unit rounding mode.

Declaration: function SetRoundMode(const RoundMode: TFPURoundingMode)
 : TFPURoundingMode

Visibility: default

Description: Set the Floating Point Unit rounding mode.

25.12.70 Sign

Synopsis: Return sign of argument

```
Declaration: function Sign(const AValue: Integer) : TValueSign; Overload  
function Sign(const AValue: Int64) : TValueSign; Overload  
function Sign(const AValue: Double) : TValueSign; Overload  
function Sign(const AValue: Extended) : TValueSign; Overload
```

Visibility: default

Description: Sign returns the sign of it's argument, which can be an Integer, 64 bit integer, or a double. The returned value is an integer which is -1, 0 or 1, and can be used to do further calculations with.

25.12.71 SimpleRoundTo

Synopsis: Round to the specified number of digits (rounding up if needed)

Declaration: function SimpleRoundTo(const AValue: Extended;
const Digits: TRoundToRange) : Extended

Visibility: default

Description: SimpleRoundTo rounds the specified float AValue to the specified number of digits, but rounds up, and returns the result. This result is accurate to "10 to the power Digits". It uses the standard Round function for this.

See also: TRoundToRange (768), RoundTo (798)

25.12.72 sincos

Synopsis: Return sine and cosine of argument

Declaration: procedure sincos(theta: float; out sinus: float; out cosinus: float)

Visibility: default

Description: Sincos calculates the sine and cosine of the angle theta, and returns the result in sinus and cosinus.

On Intel hardware, This calculation will be faster than making 2 calls to calculate the sine and cosine separately.

Errors: None.

See also: [arcsin](#) (770), [arccos](#) (769)

Listing: ./mathex/ex41.pp

```
Program Example41;

{ Program to demonstrate the sincos function. }

Uses math;

Procedure dosincos(Angle : Float);

Var
  Sine, Cosine : Float;

begin
  sincos(angle, sine, cosine);
  Write('Angle : ', Angle:8:6);
  Write(' Sine : ', sine:8:6);
  Write(' Cosine : ', cosine:8:6);
end;

begin
  dosincos(pi);
  dosincos(pi/2);
  dosincos(pi/3);
  dosincos(pi/4);
  dosincos(pi/6);
end.
```

25.12.73 sinh

Synopsis: Return hyperbolic sine

Declaration: function sinh(x: float) : float

Visibility: default

Description: Sinh returns the hyperbolic sine of its argument x.

See also: cosh ([774](#)), arsinh ([772](#)), tanh ([805](#)), artanh ([772](#))

Listing: ./mathex/ex42.pp

```
Program Example42;

{ Program to demonstrate the sinh function. }

Uses math;

begin
  writeln(sinh(0));
  writeln(sinh(1));
  writeln(sinh(-1));
end.
```

25.12.74 stddev

Synopsis: Return standard deviation of data

Declaration: function stddev(const data: Array of Extended) : float
 function stddev(const data: PExtended; const N: Integer) : float

Visibility: default

Description: Stddev returns the standard deviation of the values in Data. It returns zero if there is only one value.

The second form of the function accepts a pointer to an array of N values.

Errors: None.

See also: mean (788), meanandstddev (789), variance (806), totalvariance (806)

Listing: ./mathex/ex43.pp

```
Program Example40;

{ Program to demonstrate the stddev function. }

Uses Math;

Var
  I : Integer;
  ExArray : Array[1..10000] of Float;

begin
  Randomize;
  for I:=low(ExArray) to high(ExArray) do
    ExArray[i]:=Randg(1,0.2);
  Writeln('StdDev      : ',StdDev(ExArray):8:4);
  Writeln('StdDev (b) : ',StdDev(@ExArray[0],10000):8:4);
end.
```

25.12.75 sum

Synopsis: Return sum of values

Declaration: function sum(const data: Array of Extended) : float
 function sum(const data: PExtended; const N: LongInt) : float

Visibility: default

Description: Sum returns the sum of the values in the data array.

The second form of the function accepts a pointer to an array of N values.

Errors: None.

See also: sumofsquares (803), sumsandsquares (804), totalvariance (806), variance (806)

Listing: ./mathex/ex44.pp

```
Program Example44;

{ Program to demonstrate the Sum function. }

Uses math;
```

```

Var
  I : 1..100;
  ExArray : Array[1..100] of Float;

begin
  Randomize;
  for I:=low(ExArray) to high(ExArray) do
    ExArray[i]:=Random*100;
  Writeln('Max      : ',.MaxValue(ExArray):8:4);
  Writeln('Min      : ',.MinValue(ExArray):8:4);
  Writeln('Sum      : ',Sum(ExArray):8:4);
  Writeln('Sum (b) : ',Sum(@ExArray[1],100):8:4);
end.

```

25.12.76 sumInt

Synopsis: Return the sum of an array of integers

Declaration: function sumInt(const data: PInt64;const N: LongInt) : Int64
 function sumInt(const data: **Array** of Int64) : Int64

Visibility: default

Description: SumInt returns the sum of the N integers in the Data array, where this can be an open array or a pointer to an array.

Errors: An overflow may occur.

25.12.77 sumofsquares

Synopsis: Return sum of squares of values

Declaration: function sumofsquares(const data: **Array** of Extended) : float
 function sumofsquares(const data: PExtended;const N: Integer) : float

Visibility: default

Description: Sumofsquares returns the sum of the squares of the values in the data array.

The second form of the function accepts a pointer to an array of N values.

Errors: None.

See also: sum (802), sumsandsquares (804), totalvariance (806), variance (806)

Listing: ./mathex/ex45.pp

Program Example45;

{ Program to demonstrate the SumOfSquares function. }

Uses math;

Var

I : 1..100;
 ExArray : **Array**[1..100] **of** **Float**;

begin

```

Randomize;
for I:=low(ExArray) to high(ExArray) do
  ExArray[i]:= (Random-Random)*100;
Writeln('Max' : ',.MaxValue(ExArray):8:4);
Writeln('Min' : ',.MinValue(ExArray):8:4);
Writeln('Sum squares' : ',SumOfSquares(ExArray):8:4);
Writeln('Sum squares (b)' : ',SumOfSquares(@ExArray[1],100):8:4);
end.

```

25.12.78 sumsandsquares

Synopsis: Return sum and sum of squares of values.

Declaration: procedure sumsandsquares(const data: Array of Extended; var sum: float;
var sumofsquares: float)
procedure sumsandsquares(const data: PExtended; const N: Integer;
var sum: float; var sumofsquares: float)

Visibility: default

Description: sumsandsquares calculates the sum of the values and the sum of the squares of the values in the data array and returns the results in sum and sumofsquares.

The second form of the function accepts a pointer to an array of N values.

Errors: None.

See also: sum (802), sumofsquares (803), totalvariance (806), variance (806)

Listing: ./mathex/ex46.pp

```

Program Example45;
{ Program to demonstrate the SumOfSquares function. }

Uses math;

Var
  I : 1..100;
  ExArray : Array[1..100] of Float
  s,ss : float;

begin
  Randomize;
  for I:=low(ExArray) to high(ExArray) do
    ExArray[i]:= (Random-Random)*100;
  Writeln('Max' : ',.MaxValue(ExArray):8:4);
  Writeln('Min' : ',.MinValue(ExArray):8:4);
  SumsAndSquares(ExArray,S,SS);
  Writeln('Sum' : ',S:8:4);
  Writeln('Sum squares' : ',SS:8:4);
  SumsAndSquares(@ExArray[1],100,S,SS);
  Writeln('Sum (b)' : ',S:8:4);
  Writeln('Sum squares (b)' : ',SS:8:4);
end.

```

25.12.79 tan

Synopsis: Return tangent

Declaration: function tan(x: float) : float

Visibility: default

Description: Tan returns the tangent of x. The argument x must be in radians.

Errors: If x (normalized) is pi/2 or 3pi/2 then an overflow will occur.

See also: tanh (805), arcsin (770), sincos (800), arccos (769)

Listing: ./mathex/ex47.pp

Program Example47;

{ Program to demonstrate the Tan function. }

Uses math;

Procedure DoTan(Angle : Float);

begin

Write('Angle : ', RadToDeg(Angle):8:6);
 WriteLn(' Tangent : ', Tan(Angle):8:6);

end;

begin

 DoTan(0);
 DoTan(**Pi**);
 DoTan(**Pi**/3);
 DoTan(**Pi**/4);
 DoTan(**Pi**/6);

end.

25.12.80 tanh

Synopsis: Return hyperbolic tangent

Declaration: function tanh(x: float) : float

Visibility: default

Description: Tanh returns the hyperbolic tangent of x.

Errors: None.

See also: arcsin (770), sincos (800), arccos (769)

Listing: ./mathex/ex48.pp

Program Example48;

{ Program to demonstrate the Tanh function. }

Uses math;

```
begin
  writeln(tanh(0));
  writeln(tanh(1));
  writeln(tanh(-1));
end.
```

25.12.81 totalvariance

Synopsis: Return total variance of values

Declaration: function totalvariance(const data: Array of Extended) : float
 function totalvariance(const data: PExtended; const N: Integer) : float

Visibility: default

Description: TotalVariance returns the total variance of the values in the data array. It returns zero if there is only one value.

The second form of the function accepts a pointer to an array of N values.

Errors: None.

See also: variance (806), stddev (801), mean (788)

Listing: ./mathex/ex49.pp

Program Example49;

{ Program to demonstrate the TotalVariance function. }

Uses math;

Type

TExArray = **Array**[1..100] **of** Float;

Var

I : Integer;
 ExArray : TExArray;
 TV : float;

begin

Randomize;
 for I:=1 **to** 100 **do**
 ExArray[i]:= (Random-Random)*100;
 TV:=TotalVariance(ExArray);
 Writeln('Total variance : ',TV:8:4);
 TV:=TotalVariance(@ExArray[1],100);
 Writeln('Total Variance (b) : ',TV:8:4);

end.

25.12.82 variance

Synopsis: Return variance of values

Declaration: function variance(const data: Array of Extended) : float
 function variance(const data: PExtended; const N: Integer) : float

Visibility: default

Description: Variance returns the variance of the values in the `data` array. It returns zero if there is only one value.

The second form of the function accepts a pointer to an array of N values.

Errors: None.

See also: totalvariance (806), stddev (801), mean (788)

Listing: ./mathex/ex50.pp

```
Program Example50;

{ Program to demonstrate the Variance function. }

Uses math;

Var
  I : 1..100;
  ExArray : Array[1..100] of Float;
  V : float;

begin
  Randomize;
  for I:=low(ExArray) to high(ExArray) do
    ExArray[i]:= (Random-Random)*100;
  V:=Variance(ExArray);
  Writeln('Variance      : ',V:8:4);
  V:=Variance(@ExArray[1],100);
  Writeln('Variance (b) : ',V:8:4);
end.
```

25.13 EInvalidArgument

25.13.1 Description

Exception raised when invalid arguments are passed to a function.

Chapter 26

Reference for unit 'matrix'

26.1 Overview

The unit matrix is a unit that provides objects for the common two, three and four dimensional vectors matrixes. These vectors and matrixes are very common in computer graphics and are often implemented from scratch by programmers while every implementation provides exactly the same functionality.

It makes therefore sense to provide this functionality in the runtime library. This eliminates the need for programmers to reinvent the wheel and also allows libraries that use matrix operations to become more compatible.

The matrix unit does not provide n-dimensional matrixes. The functionality needs of a general matrix unit varies from application to application; one can think of reduced memory usage tricks for matrixes that only have data around the diagonal etc., desire for parallelization etc. etc. It is believed that programmers that do use n-dimensional matrices would not necessarily benefit from such a unit in the runtime library.

Design goals:

- Provide common dimensions, two three and four.
- Provide multiple floating point precisions, single, double, extended.
- Simple trivial binary representation; it is possible to typecast vectors into other implementations that use the same trivial representation.
- No dynamic memory management in the background. It must be possible to write expressions like matrix $A * B * C$ without worrying about memory management.

Design decisions:

- Class object model is ruled out. The objects object model, without virtual methods, is suitable.
- Operator overloading is a good way to allow programmers to write matrix expressions.
- 3 dimensions * 3 precision means 9 vector and 9 matrix objects. Macro's have been used in the source to take care of this.

26.2 Constants, types and variables

26.2.1 Types

```
Tmatrix2_double_data = Array[0..1,0..1] of Double
```

This is the matrix internal data for a matrix. It uses a simple array structure so data from other libraries that define their own matrix type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tmatrix2_extended_data = Array[0..1,0..1] of extended
```

This is the matrix internal data for a matrix. It uses a simple array structure so data from other libraries that define their own matrix type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tmatrix2_single_data = Array[0..1,0..1] of single
```

This is the matrix internal data for a matrix. It uses a simple array structure so data from other libraries that define their own matrix type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tmatrix3_double_data = Array[0..2,0..2] of Double
```

This is the matrix internal data for a matrix. It uses a simple array structure so data from other libraries that define their own matrix type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tmatrix3_extended_data = Array[0..2,0..2] of extended
```

This is the matrix internal data for a matrix. It uses a simple array structure so data from other libraries that define their own matrix type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tmatrix3_single_data = Array[0..2,0..2] of single
```

This is the matrix internal data for a matrix. It uses a simple array structure so data from other libraries that define their own matrix type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tmatrix4_double_data = Array[0..3,0..3] of Double
```

This is the matrix internal data for a matrix. It uses a simple array structure so data from other libraries that define their own matrix type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tmatrix4_extended_data = Array[0..3,0..3] of extended
```

This is the matrix internal data for a matrix. It uses a simple array structure so data from other libraries that define their own matrix type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tmatrix4_single_data = Array[0..3,0..3] of single
```

This is the matrix internal data for a matrix. It uses a simple array structure so data from other libraries that define their own matrix type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tvector2_double_data = Array[0..1] of Double
```

This is the vector internal data for a vector. It uses a simple array structure so data from other libraries that define their own vector type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tvector2_extended_data = Array[0..1] of extended
```

This is the vector internal data for a vector. It uses a simple array structure so data from other libraries that define their own vector type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tvector2_single_data = Array[0..1] of single
```

This is the vector internal data for a vector. It uses a simple array structure so data from other libraries that define their own vector type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tvector3_double_data = Array[0..2] of Double
```

This is the vector internal data for a vector. It uses a simple array structure so data from other libraries that define their own vector type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tvector3_extended_data = Array[0..2] of extended
```

This is the vector internal data for a vector. It uses a simple array structure so data from other libraries that define their own vector type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tvector3_single_data = Array[0..2] of single
```

This is the vector internal data for a vector. It uses a simple array structure so data from other libraries that define their own vector type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

```
Tvector4_double_data = Array[0..3] of Double
```

This is the vector internal data for a vector. It uses a simple array structure so data from other libraries that define their own vector type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

Tvector4_extended_data = Array[0..3] of extended

This is the vector internal data for a vector. It uses a simple array structure so data from other libraries that define their own vector type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

Tvector4_single_data = Array[0..3] of single

This is the vector internal data for a vector. It uses a simple array structure so data from other libraries that define their own vector type as a simple array structure can simply be moved to and from this data, or typecasted into it. As this is the only field in the object, the object itself can be used just as fine for typecasting purposes etc.

26.3 Procedures and functions

26.3.1 operator *(Tmatrix2_double, Double): Tmatrix2_double

Synopsis: Multiply a two-dimensional double precision matrix by a scalar

Declaration: operator operator *(Tmatrix2_double, Double): Tmatrix2_double

Visibility: default

Description: This operator allows you to multiply a matrix with a scalar. All elements in the matrix are multiplied by the scalar, the result is returned as a new matrix.

26.3.2 operator *(Tmatrix2_double, Tmatrix2_double): Tmatrix2_double

Synopsis: Give product of two two-dimensional double precision matrices

Declaration: operator operator *(Tmatrix2_double, Tmatrix2_double): Tmatrix2_double

Visibility: default

Description: This operator allows you to multiply two two-dimensional single precision matrices. A new matrix is returned which is the product of both matrices. The product is calculated using the well known matrix multiplication algorithm.

26.3.3 operator *(Tmatrix2_double, Tvector2_double): Tvector2_double

Synopsis: Give product of a two-dimendional double precision matrix and vector

Declaration: `operator operator *(Tmatrix2_double, Tvector2_double): Tvector2_double`

```
(const m: Tmat
const v: Tvect
: Tvector2_d
```

Visibility: default

Description: This operator allows you to multipy a two-dimensional double precision matrices with a two dimensional double precision vector. A new vector is returned which is the product of the matrix and the vector. The product is calculated using the well known matrix-vector multiplication algorithm.

26.3.4 operator *(Tmatrix2_extended, extended): Tmatrix2_extended

Synopsis: Multiply a two-dimensional extended precision matrix by a scalar

Declaration: `operator operator *(Tmatrix2_extended, extended): Tmatrix2_extended`

```
(const m: Tmatrix
const x: extended
: Tmatrix2_exten
```

Visibility: default

Description: This operator allows you to multiply a matrix with a scalar. All elements in the matrix are multiplied by the scalar, the result is returned as a new matrix.

26.3.5 operator *(Tmatrix2_extended, Tmatrix2_extended): Tmatrix2_extended

Synopsis: Give product of two two-dimensional extended precision matrices

Declaration:

```
operator
(const m
const m2
: Tmatr
```

Visibility: default

Description: This operator allows you to multipy two two-dimensional single precision matrices. A new matrix is returned which is the product of both matrices. The product is calculated using the well known matrix multiplication algorithm.

26.3.6 operator *(Tmatrix2_extended, Tvector2_extended): Tvector2_extended

Synopsis: Give product of a two-dimendional extended precision matrix and vector

Declaration:

```
operator
(const m
const v:
: Tvect
```

Visibility: default

Description: This operator allows you to multiply a two-dimensional extended precision matrices with a two dimensional extended precision vector. A new vector is returned which is the product of the matrix and the vector. The product is calculated using the well known matrix-vector multiplication algorithm.

26.3.7 operator *(Tmatrix2_single, single): Tmatrix2_single

Synopsis: Multiply a two-dimensional single precision matrix by a scalar

Declaration: operator operator *(Tmatrix2_single, single): Tmatrix2_single

```
(const m: Tmatrix2_single
const x: single)
: Tmatrix2_single
```

Visibility: default

Description: This operator allows you to multiply a matrix with a scalar. All elements in the matrix are multiplied by the scalar, the result is returned as a new matrix.

26.3.8 operator *(Tmatrix2_single, Tmatrix2_single): Tmatrix2_single

Synopsis: Give product of two two-dimensional single precision matrices

Declaration: operator operator *(Tmatrix2_single, Tmatrix2_single): Tmatrix2_single

```
(const m1: Tmatrix2_single
const m2: Tmatrix2_single
: Tmatrix2_single)
```

Visibility: default

Description: This operator allows you to multiply two two-dimensional single precision matrices. A new matrix is returned which is the product of both matrices. The product is calculated using the well known matrix multiplication algorithm.

26.3.9 operator *(Tmatrix2_single, Tvector2_single): Tvector2_single

Synopsis: Give product of a two-dimensional single precision matrix and vector

Declaration: operator operator *(Tmatrix2_single, Tvector2_single): Tvector2_single

```
(const m: Tmatrix2_single
const v: Tvector2_single
: Tvector2_single)
```

Visibility: default

Description: This operator allows you to multiply a two-dimensional single precision matrices with a two dimensional single precision vector. A new vector is returned which is the product of the matrix and the vector. The product is calculated using the well known matrix-vector multiplication algorithm.

26.3.10 operator *(Tmatrix3_double, Double): Tmatrix3_double

Synopsis: Multiply a three-dimensional double precision matrix by a scalar

Declaration: operator operator *(Tmatrix3_double, Double): Tmatrix3_double

```
(const m: Tmatrix3_double
const x: Double)
: Tmatrix3_double
```

Visibility: default

Description: This operator allows you to multiply a matrix with a scalar. All elements in the matrix are multiplied by the scalar, the result is returned as a new matrix.

26.3.11 operator *(Tmatrix3_double, Tmatrix3_double): Tmatrix3_double

Synopsis: Give product of two three-dimensional double precision matrices

Declaration: `operator operator *(Tmatrix3_double, Tmatrix3_double) : Tmatrix3_double`

```
(const m1: Tma  
const m2: Tmat  
: Tmatrix3_doo
```

Visibility: default

Description: This operator allows you to multiply two two-dimensional single precision matrices. A new matrix is returned which is the product of both matrices. The product is calculated using the well known matrix multiplication algorithm.

26.3.12 operator *(Tmatrix3_double, Tvector3_double): Tvector3_double

Synopsis: Give product of a three-dimendional double precision matrix and vector

Declaration: `operator operator *(Tmatrix3_double, Tvector3_double) : Tvector3_double`

```
(const m: Tmat  
const v: Tvect  
: Tvector3_doo
```

Visibility: default

Description: This operator allows you to multiply a three-dimensional double precision matrices with a three dimensional double precision vector. A new vector is returned which is the product of the matrix and the vector. The product is calculated using the well known matrix-vector multiplication algorithm.

26.3.13 operator *(Tmatrix3_extended, extended): Tmatrix3_extended

Synopsis: Multiply a three-dimensional extended precision matrix by a scalar

Declaration: `operator operator *(Tmatrix3_extended, extended) : Tmatrix3_extended`

```
(const m: Tmatrix  
const x: extended  
: Tmatrix3_exten
```

Visibility: default

Description: This operator allows you to multiply a matrix with a scalar. All elements in the matrix are multiplied by the scalar, the result is returned as a new matrix.

26.3.14 operator *(Tmatrix3_extended, Tmatrix3_extended): Tmatrix3_extended

Synopsis: Give product of two three-dimensional extended precision matrices

Declaration:

```
operator
(const m
const m2
: Tmatr
```

Visibility: default

Description: This operator allows you to multiply two two-dimensional single precision matrices. A new matrix is returned which is the product of both matrices. The product is calculated using the well known matrix multiplication algorithm.

26.3.15 operator *(Tmatrix3_extended, Tvector3_extended): Tvector3_extended

Synopsis: Give product of a three-dimendional extended precision matrix and vector

Declaration:

```
operator
(const m
const v:
: Tvect
```

Visibility: default

Description: This operator allows you to multiply a three-dimensional extended precision matrices with a three dimensional extended precision vector. A new vector is returned which is the product of the matrix and the vector. The product is calculated using the well known matrix-vector multiplication algorithm.

26.3.16 operator *(Tmatrix3_single, single): Tmatrix3_single

Synopsis: Multiply a three-dimensional single precision matrix by a scalar

Declaration: operator operator *(Tmatrix3_single, single): Tmatrix3_single

```
(const m: Tmatrix3_sing
const x: single)
: Tmatrix3_single
```

Visibility: default

Description: This operator allows you to multiply a matrix with a scalar. All elements in the matrix are multiplied by the scalar, the result is returned as a new matrix.

26.3.17 operator *(Tmatrix3_single, Tmatrix3_single): Tmatrix3_single

Synopsis: Give product of two three-dimensional single precision matrices

Declaration: operator operator *(Tmatrix3_single, Tmatrix3_single): Tmatrix3_single

```
(const m1: Tma
const m2: Tmat
: Tmatrix3_si
```

Visibility: default

Description: This operator allows you to multiply two two-dimensional single precision matrices. A new matrix is returned which is the product of both matrices. The product is calculated using the well known matrix multiplication algorithm.

26.3.18 operator *(Tmatrix3_single, Tvector3_single): Tvector3_single

Synopsis: Give product of a three-dimendional single precision matrix and vector

Declaration: `operator operator *(Tmatrix3_single, Tvector3_single): Tvector3_single`

```
(const m: Tmat
const v: Tvect
: Tvector3_si
```

Visibility: default

Description: This operator allows you to multipy a three-dimensional single precision matrices with a three dimensional single precision vector. A new vector is returned which is the product of the matrix and the vector. The product is calculated using the well known matrix-vector multiplication algorithm.

26.3.19 operator *(Tmatrix4_double, Double): Tmatrix4_double

Synopsis: Multiply a four-dimensional double precision matrix by a scalar

Declaration: `operator operator *(Tmatrix4_double, Double): Tmatrix4_double`

```
(const m: Tmatrix4_doub
const x: Double)
: Tmatrix4_double
```

Visibility: default

Description: This operator allows you to multiply a matrix with a scalar. All elements in the matrix are multiplied by the scalar, the result is returned as a new matrix.

26.3.20 operator *(Tmatrix4_double, Tmatrix4_double): Tmatrix4_double

Synopsis: Give product of two four-dimensional double precision matrices

Declaration: `operator operator *(Tmatrix4_double, Tmatrix4_double): Tmatrix4_double`

```
(const m1: Tma
const m2: Tmat
: Tmatrix4_dou
```

Visibility: default

Description: This operator allows you to multipy two two-dimensional single precision matrices. A new matrix is returned which is the product of both matrices. The product is calculated using the well known matrix multiplication algorithm.

26.3.21 operator *(Tmatrix4_double, Tvector4_double): Tvector4_double

Synopsis: Give product of a four-dimendional double precision matrix and vector

Declaration: `operator operator *(Tmatrix4_double, Tvector4_double): Tvector4_double`

```
(const m: Tmat
const v: Tvect
: Tvector4_dou
```

Visibility: default

Description: This operator allows you to multipy a four-dimensional double precision matrices with a four dimensional double precision vector. A new vector is returned which is the product of the matrix and the vector. The product is calculated using the well known matrix-vector multiplication algorithm.

26.3.22 operator *(Tmatrix4_extended, extended): Tmatrix4_extended

Synopsis: Multiply a four-dimensional extended precision matrix by a scalar

Declaration: operator operator *(Tmatrix4_extended, extended): Tmatrix4_extended

```
(const m: Tmatrix4_extended
const x: extended
: Tmatrix4_extended)
```

Visibility: default

Description: This operator allows you to multiply a matrix with a scalar. All elements in the matrix are multiplied by the scalar, the result is returned as a new matrix.

26.3.23 operator *(Tmatrix4_extended, Tmatrix4_extended): Tmatrix4_extended

Synopsis: Give product of two four-dimensional extended precision matrices

Declaration:

```
operator
(const m1:
const m2:
: Tmatrix4_extended)
```

Visibility: default

Description: This operator allows you to multiply two two-dimensional single precision matrices. A new matrix is returned which is the product of both matrices. The product is calculated using the well known matrix multiplication algorithm.

26.3.24 operator *(Tmatrix4_extended, Tvector4_extended): Tvector4_extended

Synopsis: Give product of a four-dimensional extended precision matrix and vector

Declaration:

```
operator
(const m:
const v:
: Tvector4_extended)
```

Visibility: default

Description: This operator allows you to multiply a four-dimensional extended precision matrices with a four dimensional extended precision vector. A new vector is returned which is the product of the matrix and the vector. The product is calculated using the well known matrix-vector multiplication algorithm.

26.3.25 operator *(Tmatrix4_single, single): Tmatrix4_single

Synopsis: Multiply a four-dimensional single precision matrix by a scalar

Declaration: operator operator *(Tmatrix4_single, single): Tmatrix4_single

```
(const m: Tmatrix4_single
const x: single
: Tmatrix4_single)
```

Visibility: default

Description: This operator allows you to multiply a matrix with a scalar. All elements in the matrix are multiplied by the scalar, the result is returned as a new matrix.

26.3.26 operator *(Tmatrix4_single, Tmatrix4_single): Tmatrix4_single

Synopsis: Give product of two four-dimensional single precision matrices

Declaration: `operator operator *(Tmatrix4_single, Tmatrix4_single) : Tmatrix4_single`

```
(const m1: Tma
const m2: Tmat
: Tmatrix4_si
```

Visibility: default

Description: This operator allows you to multiply two two-dimensional single precision matrices. A new matrix is returned which is the product of both matrices. The product is calculated using the well known matrix multiplication algorithm.

26.3.27 operator *(Tmatrix4_single, Tvector4_single): Tvector4_single

Synopsis: Give product of a four-dimensional single precision matrix and vector

Declaration: `operator operator *(Tmatrix4_single, Tvector4_single) : Tvector4_single`

```
(const m: Tmat
const v: Tvect
: Tvector4_si
```

Visibility: default

Description: This operator allows you to multiply a four-dimensional single precision matrix with a four dimensional single precision vector. A new vector is returned which is the product of the matrix and the vector. The product is calculated using the well known matrix-vector multiplication algorithm.

26.3.28 operator *(Tvector2_double, Double): Tvector2_double

Synopsis: Multiply a two-dimensional double precision vector by a scalar

Declaration: `operator operator *(Tvector2_double, Double) : Tvector2_double`

```
(const x: Tvector2_doub
y: Double)
: Tvector2_double
```

Visibility: default

Description: This operator allows you to multiply a vector by a scalar value. Each vector element is multiplied by the scalar value; the result is returned as a new vector.

26.3.29 operator *(Tvector2_double, Tvector2_double): Tvector2_double

Synopsis: Multiply two vectors element wise

Declaration: `operator operator *(Tvector2_double, Tvector2_double) : Tvector2_double`

```
(const x: Tvec
const y: Tvect
: Tvector2_dou
```

Visibility: default

Description: This operator returns a vector that contains the element by element multiplication of the two multiplied vectors.

26.3.30 operator *(Tvector2_extended, extended): Tvector2_extended

Synopsis: Multiply a two-dimensional extended precision vector by a scalar

Declaration: `operator operator *(Tvector2_extended, extended): Tvector2_extended`

```
(const x: Tvector2_extended
y: extended)
: Tvector2_extended
```

Visibility: default

Description: This operator allows you to multiply a vector by a scalar value. Each vector element is multiplied by the scalar value; the result is returned as a new vector.

26.3.31 operator *(Tvector2_extended, Tvector2_extended): Tvector2_extended

Synopsis: Multiply two vectors element wise

Declaration:

```
operator
(const x:
const y:
: Tvector2_extended)
```

Visibility: default

Description: This operator returns a vector that contains the element by element multiplication of the two multiplied vectors.

26.3.32 operator *(Tvector2_single, single): Tvector2_single

Synopsis: Multiply a two-dimensional single precision vector by a scalar

Declaration: `operator operator *(Tvector2_single, single): Tvector2_single`

```
(const x: Tvector2_single
y: single)
: Tvector2_single
```

Visibility: default

Description: This operator allows you to multiply a vector by a scalar value. Each vector element is multiplied by the scalar value; the result is returned as a new vector.

26.3.33 operator *(Tvector2_single, Tvector2_single): Tvector2_single

Synopsis: Multiply two vectors element wise

Declaration: `operator operator *(Tvector2_single, Tvector2_single): Tvector2_single`

```
(const x: Tvector2_single
const y: Tvector2_single
: Tvector2_single)
```

Visibility: default

Description: This operator returns a vector that contains the element by element multiplication of the two multiplied vectors.

26.3.34 operator *(Tvector3_double, Double): Tvector3_double

Synopsis: Multiply a three-dimensional double precision vector by a scalar

Declaration: operator operator *(Tvector3_double, Double); Tvector3_double

```
(const x: Tvector3_doub  
y: Double)  
  : Tvector3_double
```

Visibility: default

Description: This operator allows you to multiply a vector by a scalar value. Each vector element is multiplied by the scalar value; the result is returned as a new vector.

26.3.35 operator *(Tvector3_double, Tvector3_double): Tvector3_double

Synopsis: Multiply two vectors element wise

Declaration: operator operator * (Tvector3_double, Tvector3_double): Tvector3_double

```
(const x: Tvec  
const y: Tvect  
: Tvector3_dos
```

Visibility: default

Description: This operator returns a vector that contains the element by element multiplication of the two multiplied vectors.

26.3.36 operator *(Tvector3_extended, extended): Tvector3_extended

Synopsis: Multiply a three-dimensional extended precision vector by a scalar

Declaration: operator operator *(Tvector3_extended, extended): Tvector3_extended

```
(const x: Tvector  
y: extended)  
: Tvector3_exten
```

Visibility: default

Description: This operator allows you to multiply a vector by a scalar value. Each vector element is multiplied by the scalar value; the result is returned as a new vector.

operator *(Tvector3_extended, Tvector3_extended): Tvector3_extended

Synopsis: Multiply two vectors element wise

Declaration:

```
operator  
(const x  
const y:  
    : Tvect
```

Visibility: default

Description: This operator returns a vector that contains the element by element multiplication of the two multiplied vectors.

26.3.38 operator *(Tvector3_single, single): Tvector3_single

Synopsis: Multiply a three-dimensional single precision vector by a scalar

Declaration: operator operator * (Tvector3_single, single): Tvector3_single

```
(const x: Tvector3_single  
y: single)  
: Tvector3_single
```

Visibility: default

Description: This operator allows you to multiply a vector by a scalar value. Each vector element is multiplied by the scalar value; the result is returned as a new vector.

26.3.39 operator *(Tvector3_single, Tvector3_single): Tvector3_single

Synopsis: Multiply two vectors element wise

Declaration: operator operator * (Tvector3_single, Tvector3_single); Tvector3_single

```
(const x: Tvec  
const y: Tvect  
: Tvector3_si
```

Visibility: default

Description: This operator returns a vector that contains the element by element multiplication of the two multiplied vectors.

26.3.40 operator *(Tvector4_double, Double): Tvector4_double

Synopsis: Multiply a four-dimensional double precision vector by a scalar

Declaration: operator operator *(Tvector4 double, Double); Tvector4 double

```
(const x: Tvector4_doub  
y: Double)  
  : Tvector4_double
```

Visibility: default

Description: This operator allows you to multiply a vector by a scalar value. Each vector element is multiplied by the scalar value; the result is returned as a new vector.

26.3.41 operator *(Tvector4 double, Tvector4 double): Tvector4 double

Synopsis: Multiply two vectors element wise

Declaration: operator operator * (Tvector4 double, Tvector4 double); Tvector4 double

```
(const x: Tvec  
const y: Tvect  
  : Tvector4 do
```

Visibility: default

Description: This operator returns a vector that contains the element by element multiplication of the two multiplied vectors.

26.3.42 operator *(Tvector4_extended, extended): Tvector4_extended

Synopsis: Multiply a four-dimensional extended precision vector by a scalar

Declaration: `operator operator *(Tvector4_extended, extended): Tvector4_extended`

```
(const x: Tvector
y: extended)
: Tvector4_exten
```

Visibility: default

Description: This operator allows you to multiply a vector by a scalar value. Each vector element is multiplied by the scalar value; the result is returned as a new vector.

26.3.43 operator *(Tvector4_extended, Tvector4_extended): Tvector4_extended

Synopsis: Multiply two vectors element wise

Declaration:

```
operator
(const x
const y:
: Tvect
```

Visibility: default

Description: This operator returns a vector that contains the element by element multiplication of the two multiplied vectors.

26.3.44 operator *(Tvector4_single, single): Tvector4_single

Synopsis: Multiply a four-dimensional single precision vector by a scalar

Declaration: `operator operator *(Tvector4_single, single): Tvector4_single`

```
(const x: Tvector4_sing
y: single)
: Tvector4_single
```

Visibility: default

Description: This operator allows you to multiply a vector by a scalar value. Each vector element is multiplied by the scalar value; the result is returned as a new vector.

26.3.45 operator *(Tvector4_single, Tvector4_single): Tvector4_single

Synopsis: Multiply two vectors element wise

Declaration: `operator operator *(Tvector4_single, Tvector4_single): Tvector4_single`

```
(const x: Tvec
const y: Tvect
: Tvector4_si
```

Visibility: default

Description: This operator returns a vector that contains the element by element multiplication of the two multiplied vectors.

26.3.46 operator **(Tvector2_double, Tvector2_double): Double

Synopsis: Calculate the internal product of two vectors.

Declaration: `operator operator **(Tvector2_double, Tvector2_double): Double`

```
(const x: Tvector2_double
const y: Tvector2_double
: Double)
```

Visibility: default

Description: This operator returns the internal product of the two vectors, that is, the elements of the two vectors are element-wise multiplied, and then added together.

26.3.47 operator **(Tvector2_extended, Tvector2_extended): extended

Synopsis: Calculate the internal product of two vectors.

Declaration: `operator operator **(Tvector2_extended, Tvector2_extended): extended`

```
(const x: Tvector2_extended
const y: Tvector2_extended
: extended)
```

Visibility: default

Description: This operator returns the internal product of the two vectors, that is, the elements of the two vectors are element-wise multiplied, and then added together.

26.3.48 operator **(Tvector2_single, Tvector2_single): single

Synopsis: Calculate the internal product of two vectors.

Declaration: `operator operator **(Tvector2_single, Tvector2_single): single`

```
(const x: Tvector2_single
const y: Tvector2_single
: single)
```

Visibility: default

Description: This operator returns the internal product of the two vectors, that is, the elements of the two vectors are element-wise multiplied, and then added together.

26.3.49 operator **(Tvector3_double, Tvector3_double): Double

Synopsis: Calculate the internal product of two vectors.

Declaration: `operator operator **(Tvector3_double, Tvector3_double): Double`

```
(const x: Tvector3_double
const y: Tvector3_double
: Double)
```

Visibility: default

Description: This operator returns the internal product of the two vectors, that is, the elements of the two vectors are element-wise multiplied, and then added together.

26.3.50 operator **(Tvector3_extended, Tvector3_extended): extended

Synopsis: Calculate the internal product of two vectors.

Declaration: `operator operator **(Tvector3_extended, Tvector3_extended) : extended`

```
(const x: Tvector3_extended  
const y: Tvector3_extended  
: extended)
```

Visibility: default

Description: This operator returns the internal product of the two vectors, that is, the elements of the two vectors are element-wise multiplied, and then added together.

26.3.51 operator **(Tvector3_single, Tvector3_single): single

Synopsis: Calculate the internal product of two vectors.

Declaration: `operator operator **(Tvector3_single, Tvector3_single) : single`

```
(const x: Tvector3_single  
const y: Tvector3_single  
: single)
```

Visibility: default

Description: This operator returns the internal product of the two vectors, that is, the elements of the two vectors are element-wise multiplied, and then added together.

26.3.52 operator **(Tvector4_double, Tvector4_double): Double

Synopsis: Calculate the internal product of two vectors.

Declaration: `operator operator **(Tvector4_double, Tvector4_double) : Double`

```
(const x: Tvector4_double  
const y: Tvector4_double  
: Double)
```

Visibility: default

Description: This operator returns the internal product of the two vectors, that is, the elements of the two vectors are element-wise multiplied, and then added together.

26.3.53 operator **(Tvector4_extended, Tvector4_extended): extended

Synopsis: Calculate the internal product of two vectors.

Declaration: `operator operator **(Tvector4_extended, Tvector4_extended) : extended`

```
(const x: Tvector4_extended  
const y: Tvector4_extended  
: extended)
```

Visibility: default

Description: This operator returns the internal product of the two vectors, that is, the elements of the two vectors are element-wise multiplied, and then added together.

26.3.54 operator **(Tvector4_single, Tvector4_single): single

Synopsis: Calculate the internal product of two vectors.

Declaration: `operator operator **(Tvector4_single, Tvector4_single): single`

```
(const x: Tvector4_single
  const y: Tvector4_single
  : single)
```

Visibility: default

Description: This operator returns the internal product of the two vectors, that is, the elements of the two vectors are element-wise multiplied, and then added together.

26.3.55 operator +(Tmatrix2_double, Double): Tmatrix2_double

Synopsis: Add scalar to two-dimensional double precision matrix

Declaration: `operator operator +(Tmatrix2_double, Double): Tmatrix2_double`

```
(const m: Tmatrix2_double
  const x: Double
  : Tmatrix2_double)
```

Visibility: default

Description: This operator allows you to add a scalar value to a matrix. The scalar is added to all elements of the matrix, the result is returned as a new vector.

26.3.56 operator +(Tmatrix2_double, Tmatrix2_double): Tmatrix2_double

Synopsis: Add two two-dimensional double precision matrices together.

Declaration: `operator operator +(Tmatrix2_double, Tmatrix2_double): Tmatrix2_double`

```
(const m1: Tmatrix2_double
  const m2: Tmatrix2_double
  : Tmatrix2_double)
```

Visibility: default

Description: This operator allows you to add two two-dimensional double precision matrices together. A new matrix is returned with all elements of the two matrices added together.

26.3.57 operator +(Tmatrix2_extended, extended): Tmatrix2_extended

Synopsis: Add scalar to two-dimensional extended precision matrix

Declaration: `operator operator +(Tmatrix2_extended, extended): Tmatrix2_extended`

```
(const m: Tmatrix2_extended
  const x: extended
  : Tmatrix2_extended)
```

Visibility: default

Description: This operator allows you to add a scalar value to a matrix. The scalar is added to all elements of the matrix, the result is returned as a new vector.

26.3.58 operator +(Tmatrix2_extended, Tmatrix2_extended): Tmatrix2_extended

Synopsis: Add two two-dimensional extended precision matrices together.

Declaration:

```
operator
(const m
const m2
: Tmatr
```

Visibility: default

Description: This operator allows you to add two two-dimensional extended precision matrices together. A new matrix is returned with all elements of the two matrices added together.

26.3.59 operator +(Tmatrix2_single, single): Tmatrix2_single

Synopsis: Add scalar to two-dimensional single precision matrix

Declaration: `operator operator +(Tmatrix2_single, single): Tmatrix2_single`

```
(const m: Tmatrix2_sing
const x: single)
: Tmatrix2_single
```

Visibility: default

Description: This operator allows you to add a scalar value to a matrix. The scalar is added to all elements of the matrix, the result is returned as a new vector.

26.3.60 operator +(Tmatrix2_single, Tmatrix2_single): Tmatrix2_single

Synopsis: Add two two-dimensional single precision matrices together.

Declaration: `operator operator +(Tmatrix2_single, Tmatrix2_single): Tmatrix2_single`

```
(const m1: Tma
const m2: Tmat
: Tmatrix2_si
```

Visibility: default

Description: This operator allows you to add two two-dimensional single precision matrices together. A new matrix is returned with all elements of the two matrices added together.

26.3.61 operator +(Tmatrix3_double, Double): Tmatrix3_double

Synopsis: Add scalar to three-dimensional double precision matrix

Declaration: `operator operator +(Tmatrix3_double, Double): Tmatrix3_double`

```
(const m: Tmatrix3_doub
const x: Double)
: Tmatrix3_double
```

Visibility: default

Description: This operator allows you to add a scalar value to a matrix. The scalar is added to all elements of the matrix, the result is returned as a new vector.

26.3.62 operator +(Tmatrix3_double, Tmatrix3_double): Tmatrix3_double

Synopsis: Add two three-dimensional double precision matrices together.

Declaration: `operator operator +(Tmatrix3_double, Tmatrix3_double) : Tmatrix3_double`
`(const m1: Tma`
`const m2: Tmat`
`: Tmatrix3_doo`

Visibility: default

Description: This operator allows you to add two three-dimensional double precision matrices together. A new matrix is returned with all elements of the two matrices added together.

26.3.63 operator +(Tmatrix3_extended, extended): Tmatrix3_extended

Synopsis: Add scalar to three-dimensional extended precision matrix

Declaration: `operator operator +(Tmatrix3_extended, extended) : Tmatrix3_extended`
`(const m: Tmatrix`
`const x: extended`
`: Tmatrix3_exten`

Visibility: default

Description: This operator allows you to add a scalar value to a matrix. The scalar is added to all elements of the matrix, the result is returned as a new vector.

26.3.64 operator +(Tmatrix3_extended, Tmatrix3_extended): Tmatrix3_extended

Synopsis: Add two three-dimensional extended precision matrices together.

Declaration:

`operator`
`(const m`
`const m2`
`: Tmatr`

Visibility: default

Description: This operator allows you to add two three-dimensional extended precision matrices together. A new matrix is returned with all elements of the two matrices added together.

26.3.65 operator +(Tmatrix3_single, single): Tmatrix3_single

Synopsis: Add scalar to three-dimensional single precision matrix

Declaration: `operator operator +(Tmatrix3_single, single) : Tmatrix3_single`
`(const m: Tmatrix3_sing`
`const x: single)`
`: Tmatrix3_single`

Visibility: default

Description: This operator allows you to add a scalar value to a matrix. The scalar is added to all elements of the matrix, the result is returned as a new vector.

26.3.66 operator +(Tmatrix3_single, Tmatrix3_single): Tmatrix3_single

Synopsis: Add two three-dimensional single precision matrices together.

Declaration: `operator operator +(Tmatrix3_single, Tmatrix3_single): Tmatrix3_single`

```
(const m1: Tma
const m2: Tmat
: Tmatrix3_si
```

Visibility: default

Description: This operator allows you to add two three-dimensional single precision matrices together. A new matrix is returned with all elements of the two matrices added together.

26.3.67 operator +(Tmatrix4_double, Double): Tmatrix4_double

Synopsis: Add scalar to four-dimensional double precision matrix

Declaration: `operator operator +(Tmatrix4_double, Double): Tmatrix4_double`

```
(const m: Tmatrix4_doub
const x: Double)
: Tmatrix4_double
```

Visibility: default

Description: This operator allows you to add a scalar value to a matrix. The scalar is added to all elements of the matrix, the result is returned as a new vector.

26.3.68 operator +(Tmatrix4_double, Tmatrix4_double): Tmatrix4_double

Synopsis: Add two four-dimensional double precision matrices together.

Declaration: `operator operator +(Tmatrix4_double, Tmatrix4_double): Tmatrix4_double`

```
(const m1: Tma
const m2: Tmat
: Tmatrix4_doo
```

Visibility: default

Description: This operator allows you to add two four-dimensional double precision matrices together. A new matrix is returned with all elements of the two matrices added together.

26.3.69 operator +(Tmatrix4_extended, extended): Tmatrix4_extended

Synopsis: Add scalar to four-dimensional extended precision matrix

Declaration: `operator operator +(Tmatrix4_extended, extended): Tmatrix4_extended`

```
(const m: Tmatrix
const x: extended
: Tmatrix4_exten
```

Visibility: default

Description: This operator allows you to add a scalar value to a matrix. The scalar is added to all elements of the matrix, the result is returned as a new vector.

26.3.70 operator +(Tmatrix4_extended, Tmatrix4_extended): Tmatrix4_extended

Synopsis: Add two four-dimensional extended precision matrices together.

Declaration:

```
operator
(const m1
const m2
: Tmatrix4_extended)
```

Visibility: default

Description: This operator allows you to add two four-dimensional extended precision matrices together. A new matrix is returned with all elements of the two matrices added together.

26.3.71 operator +(Tmatrix4_single, single): Tmatrix4_single

Synopsis: Add scalar to four-dimensional single precision matrix

Declaration: `operator operator +(Tmatrix4_single, single): Tmatrix4_single`

```
(const m: Tmatrix4_single
const x: single
: Tmatrix4_single)
```

Visibility: default

Description: This operator allows you to add a scalar value to a matrix. The scalar is added to all elements of the matrix, the result is returned as a new vector.

26.3.72 operator +(Tmatrix4_single, Tmatrix4_single): Tmatrix4_single

Synopsis: Add two four-dimensional single precision matrices together.

Declaration: `operator operator +(Tmatrix4_single, Tmatrix4_single): Tmatrix4_single`

```
(const m1: Tmatrix4_single
const m2: Tmatrix4_single
: Tmatrix4_single)
```

Visibility: default

Description: This operator allows you to add two four-dimensional single precision matrices together. A new matrix is returned with all elements of the two matrices added together.

26.3.73 operator +(Tvector2_double, Double): Tvector2_double

Synopsis: Add scalar to two-dimensional double precision vector

Declaration: `operator operator +(Tvector2_double, Double): Tvector2_double`

```
(const x: Tvector2_double
y: Double
: Tvector2_double)
```

Visibility: default

Description: This operator allows you to add a scalar value to a vector. The scalar is added to all elements of the vector, the result is returned as a new vector.

26.3.74 operator +(Tvector2_double, Tvector2_double): Tvector2_double

Synopsis: Add two-dimensional double precision vectors together

Declaration: `operator operator +(Tvector2_double, Tvector2_double) : Tvector2_double`

```
(const x: Tvec
const y: Tvect
: Tvector2_d
```

Visibility: default

Description: This operator allows you to add two two-dimensional vectors with double precision together. The result is a new vector which consists of the sums of the individual elements of the two vectors.

26.3.75 operator +(Tvector2_extended, extended): Tvector2_extended

Synopsis: Add scalar to two-dimensional extended precision vector

Declaration: `operator operator +(Tvector2_extended, extended) : Tvector2_extended`

```
(const x: Tvector
y: extended)
: Tvector2_exten
```

Visibility: default

Description: This operator allows you to add a scalar value to a vector. The scalar is added to all elements of the vector, the result is returned as a new vector.

26.3.76 operator +(Tvector2_extended, Tvector2_extended): Tvector2_extended

Synopsis: Add two-dimensional extended precision vectors together

Declaration:

```
operator
(const x
const y:
: Tvect
```

Visibility: default

Description: This operator allows you to add two two-dimensional vectors with extended precision together. The result is a new vector which consists of the sums of the individual elements of the two vectors.

26.3.77 operator +(Tvector2_single, single): Tvector2_single

Synopsis: Add scalar to two-dimensional single precision vector

Declaration: `operator operator +(Tvector2_single, single) : Tvector2_single`

```
(const x: Tvector2_sing
y: single)
: Tvector2_single
```

Visibility: default

Description: This operator allows you to add a scalar value to a vector. The scalar is added to all elements of the vector, the result is returned as a new vector.

26.3.78 operator +(Tvector2_single, Tvector2_single): Tvector2_single

Synopsis: Add two-dimensional single precision vectors together

Declaration: `operator operator +(Tvector2_single, Tvector2_single): Tvector2_single`

```
(const x: Tvec
const y: Tvect
: Tvector2_si
```

Visibility: default

Description: This operator allows you to add two two-dimensional vectors with single precision together. The result is a new vector which consists of the sums of the individual elements of the two vectors.

26.3.79 operator +(Tvector3_double, Double): Tvector3_double

Synopsis: Add scalar to three-dimensional double precision vector

Declaration: `operator operator +(Tvector3_double, Double): Tvector3_double`

```
(const x: Tvector3_doub
y: Double)
: Tvector3_double
```

Visibility: default

Description: This operator allows you to add a scalar value to a vector. The scalar is added to all elements of the vector, the result is returned as a new vector.

26.3.80 operator +(Tvector3_double, Tvector3_double): Tvector3_double

Synopsis: Add three-dimensional double precision vectors together

Declaration: `operator operator +(Tvector3_double, Tvector3_double): Tvector3_double`

```
(const x: Tvec
const y: Tvect
: Tvector3_doo
```

Visibility: default

Description: This operator allows you to add two three-dimensional vectors with double precision together. The result is a new vector which consists of the sums of the individual elements of the two vectors.

26.3.81 operator +(Tvector3_extended, extended): Tvector3_extended

Synopsis: Add scalar to three-dimensional extended precision vector

Declaration: `operator operator +(Tvector3_extended, extended): Tvector3_extended`

```
(const x: Tvector
y: extended)
: Tvector3_exten
```

Visibility: default

Description: This operator allows you to add a scalar value to a vector. The scalar is added to all elements of the vector, the result is returned as a new vector.

26.3.82 operator +(Tvector3_extended, Tvector3_extended): Tvector3_extended

Synopsis: Add three-dimensional extended precision vectors together

Declaration:

```
operator
(const x
const y:
: Tvect
```

Visibility: default

Description: This operator allows you to add two three-dimensional vectors with extended precision together. The result is a new vector which consists of the sums of the individual elements of the two vectors.

26.3.83 operator +(Tvector3_single, single): Tvector3_single

Synopsis: Add scalar to three-dimensional single precision vector

Declaration: operator operator +(Tvector3_single, single): Tvector3_single

```
(const x: Tvector3_sing
y: single)
: Tvector3_single
```

Visibility: default

Description: This operator allows you to add a scalar value to a vector. The scalar is added to all elements of the vector, the result is returned as a new vector.

26.3.84 operator +(Tvector3_single, Tvector3_single): Tvector3_single

Synopsis: Add three-dimensional extended precision vectors together

Declaration: operator operator +(Tvector3_single, Tvector3_single): Tvector3_single

```
(const x: Tvec
const y: Tvect
: Tvector3_si
```

Visibility: default

Description: This operator allows you to add two three-dimensional vectors with single precision together. The result is a new vector which consists of the sums of the individual elements of the two vectors.

26.3.85 operator +(Tvector4_double, Double): Tvector4_double

Synopsis: Add scalar to four-dimensional double precision vector

Declaration: operator operator +(Tvector4_double, Double): Tvector4_double

```
(const x: Tvector4_doub
y: Double)
: Tvector4_double
```

Visibility: default

Description: This operator allows you to add a scalar value to a vector. The scalar is added to all elements of the vector, the result is returned as a new vector.

26.3.86 operator +(Tvector4_double, Tvector4_double): Tvector4_double

Synopsis: Add four-dimensional double precision vectors together

Declaration: `operator operator +(Tvector4_double, Tvector4_double) : Tvector4_double`
`(const x: Tvec`
`const y: Tvect`
`: Tvector4_doo`

Visibility: default

Description: This operator allows you to add two four-dimensional vectors with single precision together. The result is a new vector which consists of the sums of the individual elements of the two vectors.

26.3.87 operator +(Tvector4_extended, extended): Tvector4_extended

Synopsis: Add scalar to four-dimensional extended precision vector

Declaration: `operator operator +(Tvector4_extended, extended) : Tvector4_extended`
`(const x: Tvector`
`y: extended)`
`: Tvector4_exten`

Visibility: default

Description: This operator allows you to add a scalar value to a vector. The scalar is added to all elements of the vector, the result is returned as a new vector.

26.3.88 operator +(Tvector4_extended, Tvector4_extended): Tvector4_extended

Synopsis: Add four-dimensional extended precision vectors together

Declaration:

operator
 (const x
 const y:
 : Tvect

Visibility: default

Description: This operator allows you to add two two-dimensional vectors with extended precision together. The result is a new vector which consists of the sums of the individual elements of the two vectors.

26.3.89 operator +(Tvector4_single, single): Tvector4_single

Synopsis: Add scalar to four-dimensional single precision vector

Declaration: `operator operator +(Tvector4_single, single) : Tvector4_single`
`(const x: Tvector4_sing`
`y: single)`
`: Tvector4_single`

Visibility: default

Description: This operator allows you to add a scalar value to a vector. The scalar is added to all elements of the vector, the result is returned as a new vector.

26.3.90 operator +(Tvector4_single, Tvector4_single): Tvector4_single

Synopsis: Add four-dimensional single precision vectors together

Declaration: operator operator +(Tvector4_single, Tvector4_single): Tvector4_single
(const x: Tvec
const y: Tvect
: Tvector4_si

Visibility: default

Description: This operator allows you to add two four-dimensional vectors with single precision together. The result is a new vector which consists of the sums of the individual elements of the two vectors.

26.3.91 operator -(Tmatrix2_double): Tmatrix2_double

Synopsis: Negate two-dimensional double precision matrix.

Visibility: default

Description: This operation returns a matrix with all elements negated.

26.3.92 operator -(Tmatrix2_double, Double): Tmatrix2_double

Synopsis: Subtract scalar to two-dimensional double precision matrix

Visibility: default

Description: This operator allows you to subtract a scalar value from a matrix. The scalar is subtracted from all elements of the matrix, the result is returned as a new matrix.

26.3.93 operator -(Tmatrix2_double, Tmatrix2_double): Tmatrix2_double

Synopsis: Subtract a two-dimensional double precision matrix from another.

Visibility: default

Description: This operator allows you to subtract a two-dimensional double precision matrix from another. A new matrix is returned with all elements of the two matrices subtracted from each other.

26.3.94 operator -(Tmatrix2_extended): Tmatrix2_extended

Synopsis: Negate two-dimensional extended precision matrix.

Declaration: operator operator -(Tmatrix2_extended) : Tmatrix2_extended

```
(const m1: Tmatrix2_extended
 : Tmatrix2_extended)
```

Visibility: default

Description: This operation returns a matrix with all elements negated.

26.3.95 operator -(Tmatrix2_extended, extended): Tmatrix2_extended

Synopsis: Add scalar to two-dimensional extended precision matrix

Declaration: operator operator -(Tmatrix2_extended, extended) : Tmatrix2_extended

```
(const m: Tmatrix2_extended
 const x: extended
 : Tmatrix2_extended)
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a matrix. The scalar is subtracted from all elements of the matrix, the result is returned as a new matrix.

26.3.96 operator -(Tmatrix2_extended, Tmatrix2_extended): Tmatrix2_extended

Synopsis: Subtract a two-dimensional extended precision matrix from another.

Declaration:

```
operator
(const m
const m2
: Tmatrix2_extended)
```

Visibility: default

Description: This operator allows you to subtract a two-dimensional extended precision matrix from another. A new matrix is returned with all elements of the two matrices subtracted from each other.

26.3.97 operator -(Tmatrix2_single): Tmatrix2_single

Synopsis: Negate two-dimensional single precision matrix.

Declaration: operator operator -(Tmatrix2_single) : Tmatrix2_single

```
(const m1: Tmatrix2_single
 : Tmatrix2_single)
```

Visibility: default

Description: This operation returns a matrix with all elements negated.

26.3.98 operator -(Tmatrix2_single, single): Tmatrix2_single

Synopsis: Subtract scalar to two-dimensional single precision matrix

Declaration: operator operator -(Tmatrix2_single, single); Tmatrix2_single

```
(const m: Tmatrix2_sing  
const x: single)  
: Tmatrix2_single
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a matrix. The scalar is subtracted from all elements of the matrix, the result is returned as a new matrix.

26.3.99 operator -(Tmatrix2_single, Tmatrix2_single): Tmatrix2_single

Synopsis: Subtract a two-dimensional single precision matrix from another.

Declaration: operator operator -(Tmatrix2_single, Tmatrix2_single); Tmatrix2_single

```
(const m1: Tma  
const m2: Tmat  
: Tmatrix2_si
```

Visibility: default

Description: This operator allows you to subtract a two-dimensional single precision matrix from another. A new matrix is returned with all elements of the two matrices subtracted from each other.

26.3.100 operator -(Tmatrix3_double): Tmatrix3_double

Synopsis: Negate three-dimensional double precision matrix.

Declaration: operator operator -(Tmatrix3_double); Tmatrix3_double

```
(const m1: Tmatrix3_double)
  : Tmatrix3_double
```

Visibility: default

Description: This operation returns a matrix with all elements negated.

26.3.101 operator -(Tmatrix3_double, Double): Tmatrix3_double

Synopsis: Add scalar to three-dimensional double precision matrix

Declaration: operator operator -(Tmatrix3_double, Double): Tmatrix3_double

```
(const m: Tmatrix3_doub  
const x: Double)  
: Tmatrix3_double
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a matrix. The scalar is subtracted from all elements of the matrix, the result is returned as a new matrix.

26.3.102 operator -(Tmatrix3_double, Tmatrix3_double): Tmatrix3_double

Synopsis: Subtract a three-dimensional double precision matrix from another.

Declaration: `operator operator -(Tmatrix3_double, Tmatrix3_double) : Tmatrix3_double`

```
(const m1: Tma
const m2: Tmat
: Tmatrix3_doo
```

Visibility: default

Description: This operator allows you to subtract a three-dimensional double precision matrix from another. A new matrix is returned with all elements of the two matrices subtracted from each other.

26.3.103 operator -(Tmatrix3_extended): Tmatrix3_extended

Synopsis: Negate three-dimensional extended precision matrix.

Declaration: `operator operator -(Tmatrix3_extended) : Tmatrix3_extended`

```
(const m1: Tmatrix3_extende
: Tmatrix3_extende
```

Visibility: default

Description: This operation returns a matrix with all elements negated.

26.3.104 operator -(Tmatrix3_extended, extended): Tmatrix3_extended

Synopsis: Add scalar to three-dimensional extended precision matrix

Declaration: `operator operator -(Tmatrix3_extended, extended) : Tmatrix3_extended`

```
(const m: Tmatrix3_
const x: extended
: Tmatrix3_exten
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a matrix. The scalar is subtracted from all elements of the matrix, the result is returned as a new matrix.

26.3.105 operator -(Tmatrix3_extended, Tmatrix3_extended): Tmatrix3_extended

Synopsis: Subtract a three-dimensional extended precision matrix from another.

Declaration:

```
operator
(const m
const m2
: Tmatr
```

Visibility: default

Description: This operator allows you to subtract a three-dimensional extended precision matrix from another. A new matrix is returned with all elements of the two matrices subtracted from each other.

26.3.106 operator -(Tmatrix3_single): Tmatrix3_single

Synopsis: Negate three-dimensional single precision matrix.

Visibility: default

Description: This operation returns a matrix with all elements negated.

26.3.107 operator -(Tmatrix3_single, single): Tmatrix3_single

Synopsis: Add scalar to three-dimensional single precision matrix

```
Declaration: operator operator -(Tmatrix3_single, single): Tmatrix3_single
                           (const m: Tmatrix3_single;
                            const x: single)
                           : Tmatrix3_single
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a matrix. The scalar is subtracted from all elements of the matrix, the result is returned as a new matrix.

26.3.108 operator -(Tmatrix3_single, Tmatrix3_single): Tmatrix3_single

Synopsis: Subtract a three-dimensional single precision matrix from another.

```
Declaration: operator operator -(Tmatrix3_single, Tmatrix3_single): Tmatrix3_single
                           (const m1: Tma
                           const m2: Tmat
                           : Tmatrix3_si
```

Visibility: default

Description: This operator allows you to subtract a three-dimensional single precision matrix from another. A new matrix is returned with all elements of the two matrices subtracted from each other.

26.3.109 operator -(Tmatrix4_double): Tmatrix4_double

Synopsis: Negate four-dimensional double precision matrix.

Visibility: default

Description: This operation returns a matrix with all elements negated.

26.3.110 operator -(Tmatrix4_double, Double): Tmatrix4_double

Synopsis: Add scalar to four-dimensional double precision matrix

Declaration: `operator operator -(Tmatrix4_double, Double): Tmatrix4_double`

```
(const m: Tmatrix4_double
const x: Double)
: Tmatrix4_double
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a matrix. The scalar is subtracted from all elements of the matrix, the result is returned as a new matrix.

26.3.111 operator -(Tmatrix4_double, Tmatrix4_double): Tmatrix4_double

Synopsis: Subtract a four-dimensional double precision matrix from another.

Declaration: `operator operator -(Tmatrix4_double, Tmatrix4_double): Tmatrix4_double`

```
(const m1: Tmatrix4_double
const m2: Tmatrix4_double
: Tmatrix4_double)
```

Visibility: default

Description: This operator allows you to subtract a four-dimensional double precision matrix from another. A new matrix is returned with all elements of the two matrices subtracted from each other.

26.3.112 operator -(Tmatrix4_extended): Tmatrix4_extended

Synopsis: Negate four-dimensional extended precision matrix.

Declaration: `operator operator -(Tmatrix4_extended): Tmatrix4_extended`

```
(const m1: Tmatrix4_extended
: Tmatrix4_extended)
```

Visibility: default

Description: This operation returns a matrix with all elements negated.

26.3.113 operator -(Tmatrix4_extended, extended): Tmatrix4_extended

Synopsis: Add scalar to four-dimensional extended precision matrix

Declaration: `operator operator -(Tmatrix4_extended, extended): Tmatrix4_extended`

```
(const m: Tmatrix4_extended
const x: extended
: Tmatrix4_extended)
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a matrix. The scalar is subtracted from all elements of the matrix, the result is returned as a new matrix.

26.3.114 operator -(Tmatrix4_extended, Tmatrix4_extended): Tmatrix4_extended

Synopsis: Subtract a four-dimensional extended precision matrix from another.

Declaration:

```
operator  
(const m  
const m2  
: Tmatr.
```

Visibility: default

Description: This operator allows you to subtract a four-dimensional extended precision matrix from another. A new matrix is returned with all elements of the two matrices subtracted from each other.

26.3.115 operator -(Tmatrix4_single): Tmatrix4_single

Synopsis: Negate four-dimensional single precision matrix.

```
Declaration: operator operator -(Tmatrix4_single): Tmatrix4_single  
                           (const m1: Tmatrix4_single)  
                           : Tmatrix4_single
```

Visibility: default

Description: This operation returns a matrix with all elements negated.

26.3.116 operator -(Tmatrix4_single, single): Tmatrix4_single

Synopsis: Add scalar to four-dimensional single precision matrix

Declaration: operator operator -(Tmatrix4_single, single); Tmatrix4_single

```
(const m: Tmatrix4_sing  
const x: single)  
  : Tmatrix4_single
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a matrix. The scalar is subtracted from all elements of the matrix, the result is returned as a new matrix.

26.3.117 operator -(Tmatrix4_single, Tmatrix4_single): Tmatrix4_single

Synopsis: Subtract a four-dimensional single precision matrix from another.

Declaration: operator operator -(Tmatrix4_single, Tmatrix4_single): Tmatrix4_single
(
c

Visibility: default

Description: This operator allows you to subtract a four-dimensional single precision matrix from another. A new matrix is returned with all elements of the two matrices subtracted from each other.

26.3.118 operator -(Tvector2_double): Tvector2_double

Synopsis: Negate two-dimensional vector.

Declaration: `operator operator -(Tvector2_double) : Tvector2_double
(const x: Tvector2_double)
: Tvector2_double`

Visibility: default

Description: This operation returns a vector in the opposite direction of the vector that is passed. In order to do so, all values in the vector are negated.

26.3.119 operator -(Tvector2_double, Double): Tvector2_double

Synopsis: Subtract scalar from two-dimensional double precision vector

Declaration: `operator operator -(Tvector2_double, Double) : Tvector2_double
(const x: Tvector2_double)
y: Double
: Tvector2_double`

Visibility: default

Description: This operator allows you to subtract a scalar value from a vector. The scalar is subtracted from all elements of the vector, the result is returned as a new vector.

26.3.120 operator -(Tvector2_double, Tvector2_double): Tvector2_double

Synopsis: Subtract two-dimensional double precision vectors from each other

Declaration: `operator operator -(Tvector2_double, Tvector2_double) : Tvector2_double
(const x: Tvector2_double)
const y: Tvector2_double
: Tvector2_double`

Visibility: default

Description: This operator allows you to subtract two two-dimensional vectors with double precision from each other. The result is a new vector which consists of the difference of the individual elements of the two vectors.

26.3.121 operator -(Tvector2_extended): Tvector2_extended

Synopsis: Negate two-dimensional vector.

Declaration: `operator operator -(Tvector2_extended) : Tvector2_extended
(const x: Tvector2_extended)
: Tvector2_extended`

Visibility: default

Description: This operation returns a vector in the opposite direction of the vector that is passed. In order to do so, all values in the vector are negated.

26.3.122 operator -(Tvector2_extended, extended): Tvector2_extended

Synopsis: Subtract scalar from two-dimensional extended precision vector

Declaration: operator operator -(Tvector2_extended, extended): Tvector2_extended

```
(const x: Tvector2_extended
y: extended)
: Tvector2_extended
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a vector. The scalar is subtracted from all elements of the vector, the result is returned as a new vector.

26.3.123 operator -(Tvector2_extended, Tvector2_extended): Tvector2_extended

Synopsis: Subtract two-dimensional extended precision vectors from each other

Declaration:

```
operator
(const x:
const y:
: Tvect
```

Visibility: default

Description: This operator allows you to subtract two two-dimensional vectors with extended precision from each other. The result is a new vector which consists of the difference of the individual elements of the two vectors.

26.3.124 operator -(Tvector2_single): Tvector2_single

Synopsis: Negate two-dimensional vector.

Declaration: operator operator -(Tvector2_single): Tvector2_single

```
(const x: Tvector2_single)
: Tvector2_single
```

Visibility: default

Description: This operation returns a vector in the opposite direction of the vector that is passed. In order to do so, all values in the vector are negated.

26.3.125 operator -(Tvector2_single, single): Tvector2_single

Synopsis: Subtract scalar from two-dimensional single precision vector

Declaration: operator operator -(Tvector2_single, single): Tvector2_single

```
(const x: Tvector2_single
y: single)
: Tvector2_single
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a vector. The scalar is subtracted from all elements of the vector, the result is returned as a new vector.

26.3.126 operator -(Tvector2_single, Tvector2_single): Tvector2_single

Synopsis: Subtract two-dimensional single precision vectors from each other

Declaration: `operator operator -(Tvector2_single, Tvector2_single): Tvector2_single`

```
(const x: Tvec
const y: Tvect
: Tvector2_si
```

Visibility: default

Description: This operator allows you to subtract two two-dimensional vectors with single precision from each other. The result is a new vector which consists of the difference of the individual elements of the two vectors.

26.3.127 operator -(Tvector3_double): Tvector3_double

Synopsis: Negate three-dimensional vector.

Declaration: `operator operator -(Tvector3_double): Tvector3_double`

```
(const x: Tvector3_double)
: Tvector3_double
```

Visibility: default

Description: This operation returns a vector in the opposite direction of the vector that is passed. In order to do so, all values in the vector are negated.

26.3.128 operator -(Tvector3_double, Double): Tvector3_double

Synopsis: Subtract scalar from three-dimensional double precision vector

Declaration: `operator operator -(Tvector3_double, Double): Tvector3_double`

```
(const x: Tvector3_doub
y: Double)
: Tvector3_double
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a vector. The scalar is subtracted from all elements of the vector, the result is returned as a new vector.

26.3.129 operator -(Tvector3_double, Tvector3_double): Tvector3_double

Synopsis: Subtract three-dimensional double precision vectors from each other

Declaration: `operator operator -(Tvector3_double, Tvector3_double): Tvector3_double`

```
(const x: Tvec
const y: Tvect
: Tvector3_doub
```

Visibility: default

Description: This operator allows you to subtract two two-dimensional vectors with double precision from each other. The result is a new vector which consists of the difference of the individual elements of the two vectors.

26.3.130 operator -(Tvector3_extended): Tvector3_extended

Synopsis: Negate three-dimensional vector.

Declaration: `operator operator -(Tvector3_extended) : Tvector3_extended`

```
(const x: Tvector3_extended
 : Tvector3_extended)
```

Visibility: default

Description: This operation returns a vector in the opposite direction of the vector that is passed. In order to do so, all values in the vector are negated.

26.3.131 operator -(Tvector3_extended, extended): Tvector3_extended

Synopsis: Subtract scalar from three-dimensional extended precision vector

Declaration: `operator operator -(Tvector3_extended, extended) : Tvector3_extended`

```
(const x: Tvector3_extended
 y: extended
 : Tvector3_extended)
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a vector. The scalar is subtracted from all elements of the vector, the result is returned as a new vector.

26.3.132 operator -(Tvector3_extended, Tvector3_extended): Tvector3_extended

Synopsis: Subtract three-dimensional extended precision vectors from each other

Declaration:

```
operator
(const x
const y:
: Tvect
```

Visibility: default

Description: This operator allows you to subtract two three-dimensional vectors with extended precision from each other. The result is a new vector which consists of the difference of the individual elements of the two vectors.

26.3.133 operator -(Tvector3_single): Tvector3_single

Synopsis: Negate three-dimensional vector.

Declaration: `operator operator -(Tvector3_single) : Tvector3_single`

```
(const x: Tvector3_single
 : Tvector3_single)
```

Visibility: default

Description: This operation returns a vector in the opposite direction of the vector that is passed. In order to do so, all values in the vector are negated.

26.3.134 operator -(Tvector3_single, single): Tvector3_single

Synopsis: Subtract scalar from three-dimensional single precision vector

Declaration: operator operator -(Tvector3_single, single); Tvector3_single

```
(const x: Tvector3_sing  
y: single)  
  : Tvector3_single
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a vector. The scalar is subtracted from all elements of the vector, the result is returned as a new vector.

26.3.135 operator -(Tvector3_single, Tvector3_single): Tvector3_single

Synopsis: Subtract three-dimensional single precision vectors from each other

Declaration: operator operator -(Tvector3_single, Tvector3_single); Tvector3_single

```
(const x: Tvec  
const y: Tvect  
: Tvector3_si
```

Visibility: default

Description: This operator allows you to subtract two three-dimensional vectors with single precision from each other. The result is a new vector which consists of the difference of the individual elements of the two vectors.

26.3.136 operator -(Tvector4_double): Tvector4_double

Synopsis: Negate four-dimensional vector.

Declaration: operator operator -(Tvector4_double): Tvector4_double

```
(const x: Tvector4_double)
  : Tvector4_double
```

Visibility: default

Description: This operation returns a vector in the opposite direction of the vector that is passed. In order to do so, all values in the vector are negated.

26.3.137 operator -(Tvector4_double, Double): Tvector4_double

Synopsis: Subtract scalar from four-dimensional double precision vector

Declaration: operator operator -(Tvector4_double, Double); Tvector4_double

```
(const x: Tvector4_doub  
y: Double)  
  : Tvector4_double
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a vector. The scalar is subtracted from all elements of the vector, the result is returned as a new vector.

26.3.138 operator -(Tvector4_double, Tvector4_double): Tvector4_double

Synopsis: Subtract four-dimensional double precision vectors from each other

Declaration: `operator operator -(Tvector4_double, Tvector4_double) : Tvector4_double`

```
(const x: Tvec
const y: Tvect
: Tvector4_d
```

Visibility: default

Description: This operator allows you to subtract two four-dimensional vectors with double precision from each other. The result is a new vector which consists of the difference of the individual elements of the two vectors.

26.3.139 operator -(Tvector4_extended): Tvector4_extended

Synopsis: Negate four-dimensional vector.

Declaration: `operator operator -(Tvector4_extended) : Tvector4_extended`

```
(const x: Tvector4_extended
: Tvector4_extended
```

Visibility: default

Description: This operation returns a vector in the opposite direction of the vector that is passed. In order to do so, all values in the vector are negated.

26.3.140 operator -(Tvector4_extended, extended): Tvector4_extended

Synopsis: Subtract scalar from four-dimensional extended precision vector

Declaration: `operator operator -(Tvector4_extended, extended) : Tvector4_extended`

```
(const x: Tvector
y: extended)
: Tvector4_exten
```

Visibility: default

Description: This operator allows you to subtract a scalar value from a vector. The scalar is subtracted from all elements of the vector, the result is returned as a new vector.

26.3.141 operator -(Tvector4_extended, Tvector4_extended): Tvector4_extended

Synopsis: Subtract four-dimensional extended precision vectors from each other

Declaration:

```
operator
(const x
const y:
: Tvect
```

Visibility: default

Description: This operator allows you to subtract two four-dimensional vectors with extended precision from each other. The result is a new vector which consists of the difference of the individual elements of the two vectors.

26.3.142 operator -(Tvector4_single): Tvector4_single

Synopsis: Negate four-dimensional vector.

Visibility: default

Description: This operation returns a vector in the opposite direction of the vector that is passed. In order to do so, all values in the vector are negated.

26.3.143 operator -(Tvector4_single, single): Tvector4_single

Synopsis: Subtract scalar from four-dimensional single precision vector

Visibility: default

Description: This operator allows you to subtract a scalar value from a vector. The scalar is subtracted from all elements of the vector, the result is returned as a new vector.

26.3.144 operator -(Tvector4_single, Tvector4_single): Tvector4_single

Synopsis: Subtract four-dimensional single precision vectors from each other

Visibility: default

Description: This operator allows you to subtract two four-dimensional vectors with single precision from each other. The result is a new vector which consists of the difference of the individual elements of the two vectors.

26.3.145 operator /(Tmatrix2 double, Double): Tmatrix2 double

Synopsis: Divide a two-dimensional single precision matrix by a scalar

Visibility: default

Description: This operator allows you to divide a matrix by a scalar. All elements in the matrix are divided by the scalar, the result is returned as a new matrix.

26.3.146 operator /(Tmatrix2_extended, extended): Tmatrix2_extended

Synopsis: Divide a two-dimensional single precision matrix by a scalar

Declaration: `operator operator / (Tmatrix2_extended, extended) : Tmatrix2_extended`

```
(const m: Tmatrix2_extended
const x: extended
: Tmatrix2_extended)
```

Visibility: default

Description: This operator allows you to divide a matrix by a scalar. All elements in the matrix are divided by the scalar, the result is returned as a new matrix.

26.3.147 operator /(Tmatrix2_single, single): Tmatrix2_single

Synopsis: Divide a two-dimensional single precision matrix by a scalar

Declaration: `operator operator / (Tmatrix2_single, single) : Tmatrix2_single`

```
(const m: Tmatrix2_single
const x: single
: Tmatrix2_single)
```

Visibility: default

Description: This operator allows you to divide a matrix by a scalar. All elements in the matrix are divided by the scalar, the result is returned as a new matrix.

26.3.148 operator /(Tmatrix3_double, Double): Tmatrix3_double

Synopsis: Divide a two-dimensional single precision matrix by a scalar

Declaration: `operator operator / (Tmatrix3_double, Double) : Tmatrix3_double`

```
(const m: Tmatrix3_double
const x: Double
: Tmatrix3_double)
```

Visibility: default

Description: This operator allows you to divide a matrix by a scalar. All elements in the matrix are divided by the scalar, the result is returned as a new matrix.

26.3.149 operator /(Tmatrix3_extended, extended): Tmatrix3_extended

Synopsis: Divide a two-dimensional single precision matrix by a scalar

Declaration: `operator operator / (Tmatrix3_extended, extended) : Tmatrix3_extended`

```
(const m: Tmatrix3_extended
const x: extended
: Tmatrix3_extended)
```

Visibility: default

Description: This operator allows you to divide a matrix by a scalar. All elements in the matrix are divided by the scalar, the result is returned as a new matrix.

26.3.150 operator /(Tmatrix3_single**, **single**): **Tmatrix3_single****

Synopsis: Divide a two-dimensional single precision matrix by a scalar

Declaration: operator operator / (Tmatrix3_single, single); Tmatrix3_single

```
(const m: Tmatrix3_sing  
const x: single)  
: Tmatrix3_single
```

Visibility: default

Description: This operator allows you to divide a matrix by a scalar. All elements in the matrix are divided by the scalar, the result is returned as a new matrix.

26.3.151 operator /(*Tmatrix4_double*, *Double*): *Tmatrix4_double*

Synopsis: Divide a two-dimensional single precision matrix by a scalar

Declaration: operator operator / (Tmatrix<4>_double, Double): Tmatrix<4>_double

```
(const m: Tmatrix4_doub  
const x: Double)  
: Tmatrix4_double
```

Visibility: default

Description: This operator allows you to divide a matrix by a scalar. All elements in the matrix are divided by the scalar, the result is returned as a new matrix.

26.3.152 operator /(Tmatrix4 extended, extended): Tmatrix4 extended

Synopsis: Divide a two-dimensional single precision matrix by a scalar

Declaration: operator operator / (Tmatrix<4> extended, extended); Tmatrix<4> extended

```
(const m: Tmatrix  
const x: extended  
: Tmatrix4_extended)
```

Visibility: default

Description: This operator allows you to divide a matrix by a scalar. All elements in the matrix are divided by the scalar, the result is returned as a new matrix.

26.3.153 operator /(Tmatrix4_single**, **single**): **Tmatrix4_single****

Synopsis: Divide a two-dimensional single precision matrix by a scalar

Declaration: operator operator / (Tmatrix4 single, single); Tmatrix4 single

```
(const m: Tmatrix4_sing  
const x: single)  
: Tmatrix4_single
```

Visibility: default

Description: This operator allows you to divide a matrix by a scalar. All elements in the matrix are divided by the scalar, the result is returned as a new matrix.

26.3.154 operator /(Tvector2_double, Double): Tvector2_double

Synopsis: Divide a two-dimensional double precision vector by a scalar

Declaration: `operator operator / (Tvector2_double, Double): Tvector2_double`

```
(const x: Tvector2_double
y: Double)
: Tvector2_double
```

Visibility: default

Description: This operator allows you to divide a vector by a scalar value. Each vector element is divided by the scalar value; the result is returned as a new vector.

26.3.155 operator /(Tvector2_extended, extended): Tvector2_extended

Synopsis: Divide a two-dimensional extended precision vector by a scalar

Declaration: `operator operator / (Tvector2_extended, extended): Tvector2_extended`

```
(const x: Tvector2_extended
y: extended)
: Tvector2_extended
```

Visibility: default

Description: This operator allows you to divide a vector by a scalar value. Each vector element is divided by the scalar value; the result is returned as a new vector.

26.3.156 operator /(Tvector2_single, single): Tvector2_single

Synopsis: Divide a two-dimensional single precision vector by a scalar

Declaration: `operator operator / (Tvector2_single, single): Tvector2_single`

```
(const x: Tvector2_single
y: single)
: Tvector2_single
```

Visibility: default

Description: This operator allows you to divide a vector by a scalar value. Each vector element is divided by the scalar value; the result is returned as a new vector.

26.3.157 operator /(Tvector3_double, Double): Tvector3_double

Synopsis: Divide a three-dimensional double precision vector by a scalar

Declaration: `operator operator / (Tvector3_double, Double): Tvector3_double`

```
(const x: Tvector3_double
y: Double)
: Tvector3_double
```

Visibility: default

Description: This operator allows you to divide a vector by a scalar value. Each vector element is divided by the scalar value; the result is returned as a new vector.

26.3.158 operator /(Tvector3_extended, extended): Tvector3_extended

Synopsis: Divide a three-dimensional extended precision vector by a scalar

Declaration: `operator operator / (Tvector3_extended, extended) : Tvector3_extended`

```
(const x: Tvector3_extended
y: extended)
: Tvector3_extended
```

Visibility: default

Description: This operator allows you to divide a vector by a scalar value. Each vector element is divided by the scalar value; the result is returned as a new vector.

26.3.159 operator /(Tvector3_single, single): Tvector3_single

Synopsis: Divide a three-dimensional single precision vector by a scalar

Declaration: `operator operator / (Tvector3_single, single) : Tvector3_single`

```
(const x: Tvector3_single
y: single)
: Tvector3_single
```

Visibility: default

Description: This operator allows you to divide a vector by a scalar value. Each vector element is divided by the scalar value; the result is returned as a new vector.

26.3.160 operator /(Tvector4_double, Double): Tvector4_double

Synopsis: Divide a four-dimensional double precision vector by a scalar

Declaration: `operator operator / (Tvector4_double, Double) : Tvector4_double`

```
(const x: Tvector4_double
y: Double)
: Tvector4_double
```

Visibility: default

Description: This operator allows you to divide a vector by a scalar value. Each vector element is divided by the scalar value; the result is returned as a new vector.

26.3.161 operator /(Tvector4_extended, extended): Tvector4_extended

Synopsis: Divide a four-dimensional extended precision vector by a scalar

Declaration: `operator operator / (Tvector4_extended, extended) : Tvector4_extended`

```
(const x: Tvector4_extended
y: extended)
: Tvector4_extended
```

Visibility: default

Description: This operator allows you to divide a vector by a scalar value. Each vector element is divided by the scalar value; the result is returned as a new vector.

26.3.162 operator /(Tvector4_single, single): Tvector4_single

Synopsis: Divide a four-dimensional single precision vector by a scalar

Declaration: operator operator / (Tvector4_single, single); Tvector4_single

```
(const x: Tvector4_sing  
y: single)  
  : Tvector4_single
```

Visibility: default

Description: This operator allows you to divide a vector by a scalar value. Each vector element is divided by the scalar value; the result is returned as a new vector.

26.3.163 operator :=(Tmatrix2_double): Tmatrix2_extended

Synopsis: Allow assignment of two-dimensional double precision matrix to two-dimensional extended precision matrix

Declaration: operator operator :=(Tmatrix2_double): Tmatrix2_extended

```
(const v: Tmatrix2_double)
  : Tmatrix2_extended
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with double precision values wherever a two-dimensional matrix with extended precision is expected.

26.3.164 operator :=(Tmatrix2_double): Tmatrix2_single

Synopsis: Allow assignment of two-dimensional double precision matrix to two-dimensional single precision matrix

Declaration: operator operator :=(Tmatrix2_double): Tmatrix2_single

```
(const v: Tmatrix2_double)
  : Tmatrix2_single
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with double precision values wherever a two-dimensional matrix with single precision is expected. Some accuracy is lost because of the conversion.

26.3.165 operator :=(Tmatrix2_double): Tmatrix3_double

Synopsis: Allow assignment of two-dimensional double precision matrix to three-dimensional double precision matrix

Declaration: operator operator :=(Tmatrix2_double): Tmatrix3_double

```
(const v: Tmatrix2_double)
  : Tmatrix3_double
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with double precision values wherever a three-dimensional matrix with double precision is expected. The extra fields are set to 0.

26.3.166 operator :=(Tmatrix2_double): Tmatrix3_extended

Synopsis: Allow assignment of two-dimensional double precision matrix to three-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix2_double): Tmatrix3_extended
(const v: Tmatrix2_double)
: Tmatrix3_extended`

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with double precision values wherever a three-dimensional matrix with extended precision is expected. The extra fields are set to 0.

26.3.167 operator :=(Tmatrix2_double): Tmatrix3_single

Synopsis: Allow assignment of two-dimensional single precision matrix to three-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix2_double): Tmatrix3_single
(const v: Tmatrix2_double)
: Tmatrix3_single`

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with single precision values wherever a three-dimensional matrix with single precision is expected. The extra fields are set to 0 and some accuracy is lost because of the conversion.

26.3.168 operator :=(Tmatrix2_double): Tmatrix4_double

Synopsis: Allow assignment of two-dimensional double precision matrix to four-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix2_double): Tmatrix4_double
(const v: Tmatrix2_double)
: Tmatrix4_double`

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with double precision values wherever a four-dimensional matrix with double precision is expected. The extra fields are set to 0.

26.3.169 operator :=(Tmatrix2_double): Tmatrix4_extended

Synopsis: Allow assignment of two-dimensional double precision matrix to four-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix2_double): Tmatrix4_extended
(const v: Tmatrix2_double)
: Tmatrix4_extended`

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with double precision values wherever a four-dimensional matrix with extended precision is expected. The extra fields are set to 0.

26.3.170 operator :=(Tmatrix2_double): Tmatrix4_single

Synopsis: Allow assignment of two-dimensional double precision matrix to four-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix2_double) : Tmatrix4_single
(const v: Tmatrix2_double)
: Tmatrix4_single`

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with double precision values wherever a four-dimensional matrix with single precision is expected. The extra fields are set to 0 and some precision is lost because of the conversion.

26.3.171 operator :=(Tmatrix2_extended): Tmatrix2_double

Synopsis: Allow assignment of two-dimensional extended precision matrix to two-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix2_extended) : Tmatrix2_double
(const v: Tmatrix2_extended)
: Tmatrix2_double`

Visibility: default

Description: This operator allows you to use a two-dimensional two with extended precision values wherever a two-dimensional matrix with double precision is expected. Some accuracy is lost because of the conversion.

26.3.172 operator :=(Tmatrix2_extended): Tmatrix2_single

Synopsis: Allow assignment of two-dimensional extended precision matrix to two-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix2_extended) : Tmatrix2_single
(const v: Tmatrix2_extended)
: Tmatrix2_single`

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with extended precision values wherever a two-dimensional matrix with single precision is expected. Some accuracy is lost because of the conversion.

26.3.173 operator :=(Tmatrix2_extended): Tmatrix3_double

Synopsis: Allow assignment of two-dimensional extended precision matrix to three-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix2_extended) : Tmatrix3_double
(const v: Tmatrix2_extended)
: Tmatrix3_double`

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with extended precision values wherever a three-dimensional matrix with double precision is expected. The extra fields are set to 0 and some accuracy is lost because of the conversion.

26.3.174 operator :=(Tmatrix2_extended): Tmatrix3_extended

Synopsis: Allow assignment of two-dimensional extended precision matrix to three-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix2_extended) : Tmatrix3_extended`

```
(const v: Tmatrix2_extended  
: Tmatrix3_extended)
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with extended precision values wherever a three-dimensional matrix with extended precision is expected. The extra fields are set to 0.

26.3.175 operator :=(Tmatrix2_extended): Tmatrix3_single

Synopsis: Allow assignment of two-dimensional extended precision matrix to three-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix2_extended) : Tmatrix3_single`

```
(const v: Tmatrix2_extended  
: Tmatrix3_single)
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with extended precision values wherever a three-dimensional matrix with single precision is expected. The extra fields are set to 0 and some accuracy is lost because of the conversion.

26.3.176 operator :=(Tmatrix2_extended): Tmatrix4_double

Synopsis: Allow assignment of two-dimensional extended precision matrix to four-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix2_extended) : Tmatrix4_double`

```
(const v: Tmatrix2_extended  
: Tmatrix4_double)
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with extended precision values wherever a four-dimensional matrix with double precision is expected. The extra fields are set to 0 and some accuracy is lost because of the conversion.

26.3.177 operator :=(Tmatrix2_extended): Tmatrix4_extended

Synopsis: Allow assignment of two-dimensional extended precision matrix to four-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix2_extended) : Tmatrix4_extended`

```
(const v: Tmatrix2_extended  
: Tmatrix4_extended)
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with single precision values wherever a four-dimensional matrix with single precision is expected. The extra fields are set to 0.

26.3.178 operator :=(Tmatrix2_extended): Tmatrix4_single

Synopsis: Allow assignment of two-dimensional extended precision matrix to four-dimensional single precision matrix

Declaration: operator operator₁ :=(Tmatrix2_extended): Tmatrix4_single

```
(const v: Tmatrix2_extended)
  : Tmatrix4_single
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with extended precision values wherever a four-dimensional matrix with single precision is expected. The extra fields are set to 0 and some precision is lost because of the conversion.

26.3.179 operator :=(Tmatrix2_single): Tmatrix2_double

Synopsis: Allow assignment of two-dimensional single precision matrix to two-dimensional double precision matrix

Declaration: operator operator := (Tmatrix \times 2_single): Tmatrix \times 2_double

```
(const v: Tmatrix2_single)
  : Tmatrix2_double
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with single precision values wherever a two-dimensional matrix with double precision is expected.

26.3.180 operator :=(Tmatrix2_single): Tmatrix2_extended

Synopsis: Allow assignment of two-dimensional single precision matrix to two-dimensional extended precision matrix

Declaration: operator operator₁ :=(Tmatrix2_single): Tmatrix2_extended

```
(const v: Tmatrix2_single)
  : Tmatrix2_extended
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with single precision values wherever a two-dimensional matrix with extended precision is expected.

26.3.181 operator :=(Tmatrix2_single): Tmatrix3_double

Synopsis: Allow assignment of two-dimensional single precision matrix to three-dimensional double precision matrix

Declaration: operator operator := (Tmatrix2_single) : Tmatrix3_double

```
(const v: Tmatrix2_single)
  : Tmatrix3_double
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with single precision values wherever a three-dimensional matrix with double precision is expected. The extra fields are set to 0.

26.3.182 operator :=(Tmatrix2_single): Tmatrix3_extended

Synopsis: Allow assignment of two-dimensional single precision matrix to three-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix2_single): Tmatrix3_extended`

```
(const v: Tmatrix2_single)
: Tmatrix3_extended
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with single precision values wherever a three-dimensional matrix with extended precision is expected. The extra fields are set to 0.

26.3.183 operator :=(Tmatrix2_single): Tmatrix3_single

Synopsis: Allow assignment of two-dimensional single precision matrix to three-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix2_single): Tmatrix3_single`

```
(const v: Tmatrix2_single)
: Tmatrix3_single
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with single precision values wherever a three-dimensional matrix with single precision is expected. The extra fields are set to 0.

26.3.184 operator :=(Tmatrix2_single): Tmatrix4_double

Synopsis: Allow assignment of two-dimensional single precision matrix to four-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix2_single): Tmatrix4_double`

```
(const v: Tmatrix2_single)
: Tmatrix4_double
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with single precision values wherever a four-dimensional matrix with double precision is expected. The extra fields are set to 0.

26.3.185 operator :=(Tmatrix2_single): Tmatrix4_extended

Synopsis: Allow assignment of two-dimensional single precision matrix to four-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix2_single): Tmatrix4_extended`

```
(const v: Tmatrix2_single)
: Tmatrix4_extended
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with single precision values wherever a four-dimensional matrix with extended precision is expected. The extra fields are set to 0.

26.3.186 operator :=(Tmatrix2_single): Tmatrix4_single

Synopsis: Allow assignment of two-dimensional single precision matrix to four-dimensional single precision matrix

Declaration: operator operator := (Tmatrix2_single): Tmatrix4_single

```
(const v: Tmatrix2_single)
  : Tmatrix4_single
```

Visibility: default

Description: This operator allows you to use a two-dimensional matrix with single precision values wherever a four-dimensional matrix with single precision is expected. The extra fields are set to 0.

26.3.187 operator :=(Tmatrix3_double): Tmatrix2_double

Synopsis: Allow assignment of three-dimensional double precision matrix to two-dimensional double precision matrix

Declaration: operator operator :=(Tmatrix<double>): Tmatrix<double>

```
(const v: Tmatrix3_double)
  : Tmatrix2_double
```

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with double precision values wherever a two-dimensional matrix with double precision is expected. The surplus fields are thrown away.

26.3.188 operator :=(Tmatrix3_double): Tmatrix2_extended

Synopsis: Allow assignment of three-dimensional double precision matrix to two-dimensional extended precision matrix

Declaration: operator operator $\hat{=}$ (Tmatrix3_double): Tmatrix2_extended

```
(const v: Tmatrix3_double)
  : Tmatrix2_extended
```

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with double precision values wherever a two-dimensional matrix with extended precision is expected. The surplus fields are thrown away.

26.3.189 operator :=(Tmatrix3_double): Tmatrix2_single

Synopsis: Allow assignment of three-dimensional double precision matrix to two-dimensional single precision matrix

Declaration: operator operator $\text{:=}(\text{Tmatrix3_double})$: Tmatrix2_single

```
(const v: Tmatrix3_double)
 : Tmatrix2_single
```

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with double precision values wherever a two-dimensional matrix with single precision is expected. The surplus fields are thrown away and some accuracy is lost because of the conversion.

26.3.190 operator :=(Tmatrix3_double): Tmatrix3_extended

Synopsis: Allow assignment of three-dimensional double precision matrix to three-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix3_double): Tmatrix3_extended`

```
(const v: Tmatrix3_double)
: Tmatrix3_extended
```

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with double precision values wherever a three-dimensional matrix with extended precision is expected.

26.3.191 operator :=(Tmatrix3_double): Tmatrix3_single

Synopsis: Allow assignment of three-dimensional double precision matrix to three-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix3_double): Tmatrix3_single`

```
(const v: Tmatrix3_double)
: Tmatrix3_single
```

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with double precision values wherever a three-dimensional matrix with single precision is expected. Some precision is lost because of the conversion.

26.3.192 operator :=(Tmatrix3_double): Tmatrix4_double

Synopsis: Allow assignment of three-dimensional double precision matrix to four-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix3_double): Tmatrix4_double`

```
(const v: Tmatrix3_double)
: Tmatrix4_double
```

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with double precision values wherever a four-dimensional matrix with double precision is expected.

26.3.193 operator :=(Tmatrix3_double): Tmatrix4_extended

Synopsis: Allow assignment of three-dimensional double precision matrix to four-dimensional extended precision matrix

Declaration: operator operator :=(Tmatrix3_double): Tmatrix4_extended
(const v: Tmatrix3_double)
: Tmatrix4_extended

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with double precision values wherever a four-dimensional matrix with extended precision is expected.

26.3.194 operator :=(Tmatrix3_double): Tmatrix4_single

Synopsis: Allow assignment of three-dimensional double precision matrix to four-dimensional single precision matrix

Declaration: operator operator :=(Tmatrix3_double): Tmatrix4_single
(const v: Tmatrix3_double)
: Tmatrix4_single

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with double precision values wherever a four-dimensional matrix with single precision is expected. Some precision is lost because of the conversion.

26.3.195 operator :=(Tmatrix3_extended): Tmatrix2_double

Synopsis: Allow assignment of three-dimensional extended precision matrix to two-dimensional double precision matrix

Declaration: operator operator :=(Tmatrix3_extended): Tmatrix2_double
(const v: Tmatrix3_extended)
: Tmatrix2_double

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with extended precision values wherever a two-dimensional matrix with double precision is expected. The surplus fields are thrown away and some accuracy is lost because of the conversion.

26.3.196 operator :=(Tmatrix3_extended): Tmatrix2_extended

Synopsis: Allow assignment of three-dimensional extended precision matrix to two-dimensional extended precision matrix

Declaration: operator operator :=(Tmatrix3_extended): Tmatrix2_extended
(const v: Tmatrix3_extended)
: Tmatrix2_extended

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with extended precision values wherever a two-dimensional matrix with extended precision is expected. The surplus fields are thrown away.

26.3.197 operator :=(Tmatrix3_extended): Tmatrix2_single

Synopsis: Allow assignment of three-dimensional extended precision matrix to two-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix3_extended) : Tmatrix2_single
(const v: Tmatrix3_extended)
: Tmatrix2_single`

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with extended precision values wherever a two-dimensional matrix with single precision is expected. The surplus fields are thrown away and some precision is lost because of the conversion.

26.3.198 operator :=(Tmatrix3_extended): Tmatrix3_double

Synopsis: Allow assignment of three-dimensional extended precision matrix to three-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix3_extended) : Tmatrix3_double
(const v: Tmatrix3_extended)
: Tmatrix3_double`

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with extended precision values wherever a three-dimensional matrix with double precision is expected. Some precision is lost because of the conversion.

26.3.199 operator :=(Tmatrix3_extended): Tmatrix3_single

Synopsis: Allow assignment of three-dimensional extended precision matrix to three-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix3_extended) : Tmatrix3_single
(const v: Tmatrix3_extended)
: Tmatrix3_single`

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with extended precision values wherever a three-dimensional matrix with single precision is expected. Some precision is lost because of the conversion.

26.3.200 operator :=(Tmatrix3_extended): Tmatrix4_double

Synopsis: Allow assignment of three-dimensional extended precision matrix to four-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix3_extended) : Tmatrix4_double
(const v: Tmatrix3_extended)
: Tmatrix4_double`

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with extended precision values wherever a four-dimensional matrix with double precision is expected. Some precision is lost because of the conversion.

26.3.201 operator :=(Tmatrix3_extended): Tmatrix4_extended

Synopsis: Allow assignment of three-dimensional extended precision matrix to four-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix3_extended) : Tmatrix4_extended`

```
(const v: Tmatrix3_extended
    : Tmatrix4_extended)
```

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with extended precision values wherever a four-dimensional matrix with extended precision is expected.

26.3.202 operator :=(Tmatrix3_extended): Tmatrix4_single

Synopsis: Allow assignment of three-dimensional extended precision matrix to four-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix3_extended) : Tmatrix4_single`

```
(const v: Tmatrix3_extended
    : Tmatrix4_single)
```

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with extended precision values wherever a four-dimensional matrix with single precision is expected. Some precision is lost because of the conversion.

26.3.203 operator :=(Tmatrix3_single): Tmatrix2_double

Synopsis: Allow assignment of three-dimensional single precision matrix to two-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix3_single) : Tmatrix2_double`

```
(const v: Tmatrix3_single
    : Tmatrix2_double)
```

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with single precision values wherever a two-dimensional matrix with double precision is expected. The surplus fields are thrown away.

26.3.204 operator :=(Tmatrix3_single): Tmatrix2_extended

Synopsis: Allow assignment of three-dimensional single precision matrix to two-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix3_single) : Tmatrix2_extended`

```
(const v: Tmatrix3_single
    : Tmatrix2_extended)
```

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with single precision values wherever a two-dimensional matrix with extended precision is expected. The surplus fields are thrown away.

26.3.205 operator :=(Tmatrix3_single): Tmatrix2_single

Synopsis: Allow assignment of three-dimensional single precision matrix to two-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix3_single): Tmatrix2_single
(const v: Tmatrix3_single)
: Tmatrix2_single`

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with single precision values wherever a two-dimensional matrix with single precision is expected. The surplus fields are thrown away.

26.3.206 operator :=(Tmatrix3_single): Tmatrix3_double

Synopsis: Allow assignment of three-dimensional single precision matrix to three-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix3_single): Tmatrix3_double
(const v: Tmatrix3_single)
: Tmatrix3_double`

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with single precision values wherever a three-dimensional matrix with double precision is expected.

26.3.207 operator :=(Tmatrix3_single): Tmatrix3_extended

Synopsis: Allow assignment of three-dimensional single precision matrix to three-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix3_single): Tmatrix3_extended
(const v: Tmatrix3_single)
: Tmatrix3_extended`

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with single precision values wherever a three-dimensional matrix with extended precision is expected.

26.3.208 operator :=(Tmatrix3_single): Tmatrix4_double

Synopsis: Allow assignment of three-dimensional single precision matrix to four-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix3_single): Tmatrix4_double
(const v: Tmatrix3_single)
: Tmatrix4_double`

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with single precision values wherever a four-dimensional matrix with double precision is expected.

26.3.209 operator :=(Tmatrix3_single): Tmatrix4_extended

Synopsis: Allow assignment of three-dimensional single precision matrix to four-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix3_single): Tmatrix4_extended
(const v: Tmatrix3_single)
: Tmatrix4_extended`

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with single precision values wherever a four-dimensional matrix with extended precision is expected.

26.3.210 operator :=(Tmatrix3_single): Tmatrix4_single

Synopsis: Allow assignment of three-dimensional single precision matrix to four-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix3_single): Tmatrix4_single
(const v: Tmatrix3_single)
: Tmatrix4_single`

Visibility: default

Description: This operator allows you to use a three-dimensional matrix with single precision values wherever a four-dimensional matrix with single precision is expected.

26.3.211 operator :=(Tmatrix4_double): Tmatrix2_double

Synopsis: Allow assignment of four-dimensional double precision matrix to two-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix4_double): Tmatrix2_double
(const v: Tmatrix4_double)
: Tmatrix2_double`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with double precision values wherever a two-dimensional matrix with double precision is expected. The surplus fields are thrown away.

26.3.212 operator :=(Tmatrix4_double): Tmatrix2_extended

Synopsis: Allow assignment of four-dimensional double precision matrix to two-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix4_double): Tmatrix2_extended
(const v: Tmatrix4_double)
: Tmatrix2_extended`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with double precision values wherever a two-dimensional matrix with extended precision is expected. The surplus fields are thrown away.

26.3.213 operator :=(Tmatrix4_double): Tmatrix2_single

Synopsis: Allow assignment of four-dimensional double precision matrix to two-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix4_double): Tmatrix2_single
(const v: Tmatrix4_double)
: Tmatrix2_single`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with double precision values wherever a two-dimensional matrix with single precision is expected. The surplus fields are thrown away and some precision is lost in the conversion.

26.3.214 operator :=(Tmatrix4_double): Tmatrix3_double

Synopsis: Allow assignment of four-dimensional double precision matrix to three-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix4_double): Tmatrix3_double
(const v: Tmatrix4_double)
: Tmatrix3_double`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with double precision values wherever a three-dimensional matrix with double precision is expected. The surplus fields are thrown away.

26.3.215 operator :=(Tmatrix4_double): Tmatrix3_extended

Synopsis: Allow assignment of four-dimensional double precision matrix to three-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix4_double): Tmatrix3_extended
(const v: Tmatrix4_double)
: Tmatrix3_extended`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with double precision values wherever a three-dimensional matrix with extended precision is expected. The surplus fields are thrown away.

26.3.216 operator :=(Tmatrix4_double): Tmatrix3_single

Synopsis: Allow assignment of four-dimensional double precision matrix to three-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix4_double): Tmatrix3_single
(const v: Tmatrix4_double)
: Tmatrix3_single`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with double precision values wherever a three-dimensional matrix with single precision is expected. The surplus fields are thrown away and some precision is lost because of the conversion.

26.3.217 operator :=(Tmatrix4_double): Tmatrix4_extended

Synopsis: Allow assignment of four-dimensional double precision matrix to four-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix4_double): Tmatrix4_extended`

```
(const v: Tmatrix4_double)
: Tmatrix4_extended
```

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with double precision values wherever a four-dimensional matrix with extended precision is expected.

26.3.218 operator :=(Tmatrix4_double): Tmatrix4_single

Synopsis: Allow assignment of four-dimensional single precision matrix to four-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix4_double): Tmatrix4_single`

```
(const v: Tmatrix4_double)
: Tmatrix4_single
```

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with double precision values wherever a four-dimensional matrix with single precision is expected. Some precision is lost because of the conversion.

26.3.219 operator :=(Tmatrix4_extended): Tmatrix2_double

Synopsis: Allow assignment of four-dimensional extended precision matrix to two-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix4_extended): Tmatrix2_double`

```
(const v: Tmatrix4_extended)
: Tmatrix2_double
```

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with extended precision values wherever a two-dimensional matrix with double precision is expected. The surplus fields are thrown away and some precision is lost in the conversion.

26.3.220 operator :=(Tmatrix4_extended): Tmatrix2_extended

Synopsis: Allow assignment of four-dimensional extended precision matrix to two-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix4_extended): Tmatrix2_extended`

```
(const v: Tmatrix4_extended)
: Tmatrix2_extended
```

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with single precision values wherever a two-dimensional matrix with single precision is expected. The surplus fields are thrown away.

26.3.221 operator :=(Tmatrix4_extended): Tmatrix2_single

Synopsis: Allow assignment of four-dimensional extended precision matrix to two-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix4_extended) : Tmatrix2_single`

```
(const v: Tmatrix4_extended
    : Tmatrix2_single)
```

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with extended precision values wherever a two-dimensional matrix with single precision is expected. The surplus fields are thrown away and some precision is lost in the conversion.

26.3.222 operator :=(Tmatrix4_extended): Tmatrix3_double

Synopsis: Allow assignment of four-dimensional extended precision matrix to three-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix4_extended) : Tmatrix3_double`

```
(const v: Tmatrix4_extended
    : Tmatrix3_double)
```

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with extended precision values wherever a three-dimensional matrix with double precision is expected. The surplus fields are thrown away.

26.3.223 operator :=(Tmatrix4_extended): Tmatrix3_extended

Synopsis: Allow assignment of four-dimensional extended precision matrix to three-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix4_extended) : Tmatrix3_extended`

```
(const v: Tmatrix4_extended
    : Tmatrix3_extended)
```

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with extended precision values wherever a three-dimensional matrix with double precision is expected. The surplus fields are thrown away.

26.3.224 operator :=(Tmatrix4_extended): Tmatrix3_single

Synopsis: Allow assignment of four-dimensional extended precision matrix to three-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix4_extended) : Tmatrix3_single`

```
(const v: Tmatrix4_extended
    : Tmatrix3_single)
```

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with extended precision values wherever a three-dimensional matrix with single precision is expected. The surplus fields are thrown away and some precision is lost because of the conversion.

26.3.225 operator :=(Tmatrix4_extended): Tmatrix4_double

Synopsis: Allow assignment of four-dimensional extended precision matrix to four-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix4_extended) : Tmatrix4_double
(const v: Tmatrix4_extended
: Tmatrix4_double)`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with extended precision values wherever a four-dimensional matrix with double precision is expected.

26.3.226 operator :=(Tmatrix4_extended): Tmatrix4_single

Synopsis: Allow assignment of four-dimensional extended precision matrix to four-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix4_extended) : Tmatrix4_single
(const v: Tmatrix4_extended
: Tmatrix4_single)`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with extended precision values wherever a four-dimensional matrix with single precision is expected. Some precision is lost because of the conversion.

26.3.227 operator :=(Tmatrix4_single): Tmatrix2_double

Synopsis: Allow assignment of four-dimensional single precision matrix to two-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix4_single) : Tmatrix2_double
(const v: Tmatrix4_single
: Tmatrix2_double)`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with single precision values wherever a two-dimensional matrix with double precision is expected. The surplus fields are thrown away.

26.3.228 operator :=(Tmatrix4_single): Tmatrix2_extended

Synopsis: Allow assignment of four-dimensional single precision matrix to two-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix4_single) : Tmatrix2_extended
(const v: Tmatrix4_single
: Tmatrix2_extended)`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with single precision values wherever a two-dimensional matrix with extended precision is expected. The surplus fields are thrown away.

26.3.229 operator :=(Tmatrix4_single): Tmatrix2_single

Synopsis: Allow assignment of four-dimensional single precision matrix to two-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix4_single): Tmatrix2_single
(const v: Tmatrix4_single)
: Tmatrix2_single`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with single precision values wherever a two-dimensional matrix with single precision is expected. The surplus fields are thrown away.

26.3.230 operator :=(Tmatrix4_single): Tmatrix3_double

Synopsis: Allow assignment of four-dimensional single precision matrix to three-dimensional double precision matrix

Declaration: `operator operator :=(Tmatrix4_single): Tmatrix3_double
(const v: Tmatrix4_single)
: Tmatrix3_double`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with single precision values wherever a three-dimensional matrix with double precision is expected. The surplus fields are thrown away.

26.3.231 operator :=(Tmatrix4_single): Tmatrix3_extended

Synopsis: Allow assignment of four-dimensional single precision matrix to three-dimensional extended precision matrix

Declaration: `operator operator :=(Tmatrix4_single): Tmatrix3_extended
(const v: Tmatrix4_single)
: Tmatrix3_extended`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with single precision values wherever a three-dimensional matrix with extended precision is expected. The surplus fields are thrown away.

26.3.232 operator :=(Tmatrix4_single): Tmatrix3_single

Synopsis: Allow assignment of four-dimensional single precision matrix to three-dimensional single precision matrix

Declaration: `operator operator :=(Tmatrix4_single): Tmatrix3_single
(const v: Tmatrix4_single)
: Tmatrix3_single`

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with single precision values wherever a three-dimensional matrix with single precision is expected. The surplus fields are thrown away.

26.3.233 operator :=(Tmatrix4_single): Tmatrix4_double

Synopsis: Allow assignment of four-dimensional single precision matrix to four-dimensional double precision matrix

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with single precision values wherever a four-dimensional matrix with double precision is expected.

26.3.234 operator :=(Tmatrix4_single): Tmatrix4_extended

Synopsis: Allow assignment of four-dimensional single precision matrix to four-dimensional extended precision matrix

Visibility: default

Description: This operator allows you to use a four-dimensional matrix with single precision values wherever a four-dimensional matrix with extended precision is expected.

26.3.235 operator :=(Tvector2_double): Tvector2_extended

Synopsis: Allow assignment of double precision vector to extended precision vector

Declaration: operator operator :=(Tvector2_double): Tvector2_extended

Visibility: default

Description: This operator allows you to use a vector with double precision values wherever an extended precision vector is expected.

26.3.236 operator :=(Tvector2_double): Tvector2_single

Synopsis: Allow assignment of double precision vector to single precision vector

Visibility: default

Description: This operator allows you to use a vector with double precision values wherever a single precision vector is expected, at the cost of loosing some precision.

26.3.237 operator :=(Tvector2_double): Tvector3_double

Synopsis: Allow assignment of two-dimensional double precision vector to three-dimensional double precision vector

Declaration: `operator operator :=(Tvector2_double): Tvector3_double
(const v: Tvector2_double)
: Tvector3_double`

Visibility: default

Description: This operator allows you to use a two-dimensional vector with double precision values wherever a three-dimensional vector with double precision is expected. The third dimension is set to 0.0.

26.3.238 operator :=(Tvector2_double): Tvector3_extended

Synopsis: Allow assignment of two-dimensional double precision vector to three-dimensional extended precision vector

Declaration: `operator operator :=(Tvector2_double): Tvector3_extended
(const v: Tvector2_double)
: Tvector3_extended`

Visibility: default

Description: This operator allows you to use a two-dimensional vector with double precision values wherever a three-dimensional vector with extended precision is expected. The third dimension is set to 0.0.

26.3.239 operator :=(Tvector2_double): Tvector3_single

Synopsis: Allow assignment of two-dimensional double precision vector to three-dimensional single precision vector

Declaration: `operator operator :=(Tvector2_double): Tvector3_single
(const v: Tvector2_double)
: Tvector3_single`

Visibility: default

Description: This operator allows you to use a two-dimensional vector with double precision values wherever a three-dimensional vector with single precision is expected. Some accuracy is lost because of the conversion and the third dimension is set to 0.0.

26.3.240 operator :=(Tvector2_double): Tvector4_double

Synopsis: Allow assignment of two-dimensional double precision vector to four-dimensional double precision vector

Declaration: `operator operator :=(Tvector2_double): Tvector4_double
(const v: Tvector2_double)
: Tvector4_double`

Visibility: default

Description: This operator allows you to use a two-dimensional vector with double precision values wherever a four-dimensional vector with double precision is expected. The third and fourth dimensions are set to 0.0.

26.3.241 operator :=(Tvector2_double): Tvector4_extended

Synopsis: Allow assignment of two-dimensional double precision vector to four-dimensional extended precision vector

Declaration: `operator operator :=(Tvector2_double): Tvector4_extended`

```
(const v: Tvector2_double)
  : Tvector4_extended
```

Visibility: default

Description: This operator allows you to use a two-dimensional vector with single precision values wherever a four-dimensional vector with extended precision is expected. The third and fourth dimensions are set to 0.0.

26.3.242 operator :=(Tvector2_double): Tvector4_single

Synopsis: Allow assignment of two-dimensional double precision vector to four-dimensional single precision vector

Declaration: `operator operator :=(Tvector2_double): Tvector4_single`

```
(const v: Tvector2_double)
  : Tvector4_single
```

Visibility: default

Description: This operator allows you to use a two-dimensional vector with double precision values wherever a four-dimensional vector with single precision is expected. Some accuracy is lost because of the conversion and the third and fourth dimensions are set to 0.0.

26.3.243 operator :=(Tvector2_extended): Tvector2_double

Synopsis: Allow assignment of extended precision vector to double precision vector

Declaration: `operator operator :=(Tvector2_extended): Tvector2_double`

```
(const v: Tvector2_extended)
  : Tvector2_double
```

Visibility: default

Description: This operator allows you to use a vector with extended precision values wherever a double precision vector is expected, at the cost of loosing some precision.

26.3.244 operator :=(Tvector2_extended): Tvector2_single

Synopsis: Allow assignment of extended precision vector to single precision vector

Declaration: `operator operator :=(Tvector2_extended): Tvector2_single`

```
(const v: Tvector2_extended)
  : Tvector2_single
```

Visibility: default

Description: This operator allows you to use a vector with extended precision values wherever a single precision vector is expected, at the cost of loosing some precision.

26.3.245 operator :=(Tvector2_extended): Tvector3_double

Synopsis: Allow assignment of two-dimensional extended precision vector to three-dimensional double precision vector

Declaration: `operator operator :=(Tvector2_extended) : Tvector3_double`

```
(const v: Tvector2_extended  
: Tvector3_double)
```

Visibility: default

Description: This operator allows you to use a two-dimensional vector with extended precision values wherever a three-dimensional vector with double precision is expected. Some accuracy is lost because of the conversion and the third dimension is set to 0.0.

26.3.246 operator :=(Tvector2_extended): Tvector3_extended

Synopsis: Allow assignment of two-dimensional extened precision vector to three-dimensional extended pre-cision vector

Declaration: `operator operator :=(Tvector2_extended) : Tvector3_extended`

```
(const v: Tvector2_extended  
: Tvector3_extended)
```

Visibility: default

Description: This operator allows you to use a two-dimensional vector with extended precision values wherever a three-dimensional vector with extended precision is expected. The third dimension is set to 0.0.

26.3.247 operator :=(Tvector2_extended): Tvector3_single

Synopsis: Allow assignment of two-dimensional extended precision vector to three-dimensional single preci-sion vector

Declaration: `operator operator :=(Tvector2_extended) : Tvector3_single`

```
(const v: Tvector2_extended  
: Tvector3_single)
```

Visibility: default

Description: This operator allows you to use a two-dimensional vector with extended precision values wherever a three-dimensional vector with single precision is expected. Some accuracy is lost because of the conversion and the third dimension is set to 0.0.

26.3.248 operator :=(Tvector2_extended): Tvector4_double

Synopsis: Allow assignment of two-dimensional extended precision vector to four-dimensional double preci-sion vector

Declaration: `operator operator :=(Tvector2_extended) : Tvector4_double`

```
(const v: Tvector2_extended  
: Tvector4_double)
```

Visibility: default

Description: This operator allows you to use a two-dimensional vector with extended precision values wherever a four-dimensional vector with double precision is expected. Some accuracy is lost because of the conversion and the third and fourth dimensions are set to 0.0.

26.3.249 operator :=(Tvector2_extended): Tvector4_extended

Synopsis: Allow assignment of two-dimensional extended precision vector to four-dimensional extended precision vector

Declaration: `operator operator :=(Tvector2_extended) : Tvector4_extended`

```
(const v: Tvector2_extended
    : Tvector4_extended)
```

Visibility: default

Description: This operator allows you to use a two-dimensional vector with extended precision values wherever a four-dimensional vector with extended precision is expected. The third and fourth dimensions are set to 0.0.

26.3.250 operator :=(Tvector2_extended): Tvector4_single

Synopsis: Allow assignment of two-dimensional extended precision vector to four-dimensional single precision vector

Declaration: `operator operator :=(Tvector2_extended) : Tvector4_single`

```
(const v: Tvector2_extended
    : Tvector4_single)
```

Visibility: default

Description: This operator allows you to use a two-dimensional vector with extended precision values wherever a four-dimensional vector with single precision is expected. Some accuracy is lost because of the conversion and the third and fourth dimensions are set to 0.0.

26.3.251 operator :=(Tvector2_single): Tvector2_double

Synopsis: Allow assignment of single precision vector to double precision vector

Declaration: `operator operator :=(Tvector2_single) : Tvector2_double`

```
(const v: Tvector2_single
    : Tvector2_double)
```

Visibility: default

Description: This operator allows you to use a vector with single precision values wherever a double precision vector is expected.

26.3.252 operator :=(Tvector2_single): Tvector2_extended

Synopsis: Allow assignment of single precision vector to extended precision vector

Declaration: `operator operator :=(Tvector2_single) : Tvector2_extended`

```
(const v: Tvector2_single
    : Tvector2_extended)
```

Visibility: default

Description: This operator allows you to use a vector with single precision values wherever an extended precision vector is expected.

26.3.253 operator :=(Tvector2_single): Tvector3_double

Synopsis: Allow assignment of two-dimensional single precision vector to three-dimensional double precision vector

Declaration: `operator operator :=(Tvector2_single): Tvector3_double
(const v: Tvector2_single)
: Tvector3_double`

Visibility: default

Description: This operator allows you to use a two-dimensional vector with single precision values wherever a three-dimensional vector with double precision is expected. The third dimension is set to 0.0.

26.3.254 operator :=(Tvector2_single): Tvector3_extended

Synopsis: Allow assignment of two-dimensional single precision vector to three-dimensional extended precision vector

Declaration: `operator operator :=(Tvector2_single): Tvector3_extended
(const v: Tvector2_single)
: Tvector3_extended`

Visibility: default

Description: This operator allows you to use a two-dimensional vector with single precision values wherever a three-dimensional vector with extended precision is expected. The third dimension is set to 0.0.

26.3.255 operator :=(Tvector2_single): Tvector3_single

Synopsis: Allow assignment of two-dimensional single precision vector to three-dimensional single precision vector

Declaration: `operator operator :=(Tvector2_single): Tvector3_single
(const v: Tvector2_single)
: Tvector3_single`

Visibility: default

Description: This operator allows you to use a two-dimensional vector with single precision values wherever a three-dimensional vector with single precision is expected. The third dimension is set to 0.0.

26.3.256 operator :=(Tvector2_single): Tvector4_double

Synopsis: Allow assignment of two-dimensional single precision vector to four-dimensional double precision vector

Declaration: `operator operator :=(Tvector2_single): Tvector4_double
(const v: Tvector2_single)
: Tvector4_double`

Visibility: default

Description: This operator allows you to use a two-dimensional vector with single precision values wherever a four-dimensional vector with double precision is expected. The third and fourth dimensions are set to 0.0.

26.3.257 operator :=(Tvector2_single): Tvector4_extended

Synopsis: Allow assignment of two-dimensional single precision vector to four-dimensional extended precision vector

Declaration: `operator operator :=(Tvector2_single): Tvector4_extended
(const v: Tvector2_single)
: Tvector4_extended`

Visibility: default

Description: This operator allows you to use a two-dimensional vector with single precision values wherever a four-dimensional vector with extended precision is expected. The third and fourth dimensions are set to 0.0.

26.3.258 operator :=(Tvector2_single): Tvector4_single

Synopsis: Allow assignment of two-dimensional single precision vector to four-dimensional single precision vector

Declaration: `operator operator :=(Tvector2_single): Tvector4_single
(const v: Tvector2_single)
: Tvector4_single`

Visibility: default

Description: This operator allows you to use a two-dimensional vector with single precision values wherever a four-dimensional vector with single precision is expected. The third and fourth dimensions are set to 0.0.

26.3.259 operator :=(Tvector3_double): Tvector2_double

Synopsis: Allow assignment of three-dimensional double precision vector to two-dimensional double precision vector

Declaration: `operator operator :=(Tvector3_double): Tvector2_double
(const v: Tvector3_double)
: Tvector2_double`

Visibility: default

Description: This operator allows you to use a three-dimensional vector with double precision values wherever a two-dimensional vector with double precision is expected. The third dimension is thrown away.

26.3.260 operator :=(Tvector3_double): Tvector2_extended

Synopsis: Allow assignment of three-dimensional double precision vector to two-dimensional extended precision vector

Declaration: `operator operator :=(Tvector3_double): Tvector2_extended
(const v: Tvector3_double)
: Tvector2_extended`

Visibility: default

Description: This operator allows you to use a three-dimensional vector with double precision values wherever a two-dimensional vector with extended precision is expected. The third dimension is thrown away.

26.3.261 operator :=(Tvector3_double): Tvector2_single

Synopsis: Allow assignment of three-dimensional double precision vector to two-dimensional single precision vector

Visibility: default

Description: This operator allows you to use a three-dimensional vector with double precision values wherever a two-dimensional vector with single precision is expected. The third dimension is thrown away and some precision is lost because of the conversion.

26.3.262 operator :=(Tvector3_double): Tvector3_extended

Synopsis: Allow assignment of three-dimensional double precision vector to three-dimensional extended precision vector

Declaration: operator operator :=(Tvector3_double): Tvector3_extended

Visibility: default

Description: This operator allows you to use a three-dimensional vector with double precision values wherever a three-dimensional vector with extended precision is expected.

26.3.263 operator :=(Tvector3_double): Tvector3_single

Synopsis: Allow assignment of three-dimensional double precision vector to three-dimensional single precision vector

```
Declaration: operator operator :=(Tvector3_double): Tvector3_single  
                                (const v: Tvector3_double)  
                                : Tvector3_single
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with double precision values wherever a three-dimensional vector with single precision is expected. Some precision is lost because of the conversion.

26.3.264 operator :=(Tvector3_double): Tvector4_double

Synopsis: Allow assignment of three-dimensional double precision vector to four-dimensional double precision vector

Visibility: default

Description: This operator allows you to use a three-dimensional vector with double precision values wherever a four-dimensional vector with double precision is expected. The fourth dimension is set to 0.

26.3.265 operator :=(Tvector3_double): Tvector4_extended

Synopsis: Allow assignment of three-dimensional double precision vector to four-dimensional extended precision vector

Declaration: `operator operator :=(Tvector3_double) : Tvector4_extended
(const v: Tvector3_double)
: Tvector4_extended`

Visibility: default

Description: This operator allows you to use a three-dimensional vector with double precision values wherever a four-dimensional vector with extended precision is expected. The fourth dimension is set to 0.

26.3.266 operator :=(Tvector3_double): Tvector4_single

Synopsis: Allow assignment of three-dimensional double precision vector to four-dimensional single precision vector

Declaration: `operator operator :=(Tvector3_double) : Tvector4_single
(const v: Tvector3_double)
: Tvector4_single`

Visibility: default

Description: This operator allows you to use a three-dimensional vector with single precision values wherever a four-dimensional vector with double precision is expected. The fourth dimension is set to 0 and some precision is lost because of the conversion.

26.3.267 operator :=(Tvector3_extended): Tvector2_double

Synopsis: Allow assignment of three-dimensional extended precision vector to two-dimensional double precision vector

Declaration: `operator operator :=(Tvector3_extended) : Tvector2_double
(const v: Tvector3_extended)
: Tvector2_double`

Visibility: default

Description: This operator allows you to use a three-dimensional vector with extended precision values wherever a two-dimensional vector with double precision is expected. The third dimension is thrown away and some precision is lost because of the conversion.

26.3.268 operator :=(Tvector3_extended): Tvector2_extended

Synopsis: Allow assignment of three-dimensional extended precision vector to two-dimensional extended precision vector

Declaration: `operator operator :=(Tvector3_extended) : Tvector2_extended
(const v: Tvector3_extended)
: Tvector2_extended`

Visibility: default

Description: This operator allows you to use a three-dimensional vector with extended precision values wherever a two-dimensional vector with extended precision is expected. The third dimension is thrown away.

26.3.269 operator :=(Tvector3_extended): Tvector2_single

Synopsis: Allow assignment of three-dimensional extended precision vector to two-dimensional single precision vector

Declaration: `operator operator :=(Tvector3_extended) : Tvector2_single`

```
(const v: Tvector3_extended
    : Tvector2_single)
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with extended precision values wherever a two-dimensional vector with single precision is expected. The third dimension is thrown away and some precision is lost because of the conversion.

26.3.270 operator :=(Tvector3_extended): Tvector3_double

Synopsis: Allow assignment of three-dimensional extended precision vector to three-dimensional double precision vector

Declaration: `operator operator :=(Tvector3_extended) : Tvector3_double`

```
(const v: Tvector3_extended
    : Tvector3_double)
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with extended precision values wherever a three-dimensional vector with double precision is expected. Some precision is lost because of the conversion.

26.3.271 operator :=(Tvector3_extended): Tvector3_single

Synopsis: Allow assignment of three-dimensional single precision vector to three-dimensional double precision vector

Declaration: `operator operator :=(Tvector3_extended) : Tvector3_single`

```
(const v: Tvector3_extended
    : Tvector3_single)
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with single precision values wherever a three-dimensional vector with double precision is expected. Some precision is lost because of the conversion.

26.3.272 operator :=(Tvector3_extended): Tvector4_double

Synopsis: Allow assignment of three-dimensional extended precision vector to four-dimensional double precision vector

Declaration: `operator operator :=(Tvector3_extended) : Tvector4_double`

```
(const v: Tvector3_extended
    : Tvector4_double)
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with extended precision values wherever a four-dimensional vector with double precision is expected. The fourth dimension is set to 0 and some accuracy is lost because of the conversion.

26.3.273 operator :=(Tvector3_extended): Tvector4_extended

Synopsis: Allow assignment of three-dimensional extended precision vector to four-dimensional extended precision vector

Declaration: `operator operator :=(Tvector3_extended) : Tvector4_extended`

```
(const v: Tvector3_extended  
: Tvector4_extended)
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with extended precision values wherever a four-dimensional vector with extended precision is expected. The fourth dimension is set to 0.

26.3.274 operator :=(Tvector3_extended): Tvector4_single

Synopsis: Allow assignment of three-dimensional extended precision vector to four-dimensional single precision vector

Declaration: `operator operator :=(Tvector3_extended) : Tvector4_single`

```
(const v: Tvector3_extended  
: Tvector4_single)
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with extended precision values wherever a four-dimensional vector with single precision is expected. The fourth dimension is set to 0 and some accuracy is lost because of the conversion.

26.3.275 operator :=(Tvector3_single): Tvector2_double

Synopsis: Allow assignment of three-dimensional single precision vector to two-dimensional double precision vector

Declaration: `operator operator :=(Tvector3_single) : Tvector2_double`

```
(const v: Tvector3_single  
: Tvector2_double)
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with single precision values wherever a two-dimensional vector with double precision is expected. The third dimension is thrown away.

26.3.276 operator :=(Tvector3_single): Tvector2_extended

Synopsis: Allow assignment of three-dimensional single precision vector to two-dimensional extended precision vector

Declaration: `operator operator :=(Tvector3_single) : Tvector2_extended`

```
(const v: Tvector3_single  
: Tvector2_extended)
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with single precision values wherever a two-dimensional vector with extended precision is expected. The third dimension is thrown away.

26.3.277 operator :=(Tvector3_single): Tvector2_single

Synopsis: Allow assignment of three-dimensional single precision vector to two-dimensional single precision vector

Declaration: operator operator := (Tvector3_single): Tvector2_single

```
(const v: Tvector3_single)
  : Tvector2_single
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with single precision values wherever a two-dimensional vector with single precision is expected. The third dimension is thrown away.

26.3.278 operator :=(Tvector3_single): Tvector3_double

Synopsis: Allow assignment of three-dimensional single precision vector to three-dimensional double precision vector

Declaration: operator operator :=(Tvector3_single): Tvector3_double

```
(const v: Tvector3_single)
  : Tvector3_double
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with single precision values wherever a three-dimensional vector with double precision is expected.

26.3.279 operator :=(Tvector3_single): Tvector3_extended

Synopsis: Allow assignment of three-dimensional single precision vector to three-dimensional extended precision vector

Declaration: operator operator :=(Tvector3_single): Tvector3_extended

```
(const v: Tvector3_single)
  : Tvector3_extended
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with single precision values wherever a three-dimensional vector with extended precision is expected.

26.3.280 operator :=(Tvector3_single): Tvector4_double

Synopsis: Allow assignment of three-dimensional single precision vector to four-dimensional double precision vector

Declaration: operator operator :=(Tvector3_single) : Tvvector4_double

```
(const v: Tvector3_single)
  : Tvector4_double
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with single precision values wherever a four-dimensional vector with double precision is expected. The fourth dimension is set to 0.

26.3.281 operator :=(Tvector3_single): Tvector4_extended

Synopsis: Allow assignment of three-dimensional single precision vector to four-dimensional extended precision vector

Declaration: `operator operator :=(Tvector3_single): Tvector4_extended`

```
(const v: Tvector3_single)
: Tvector4_extended
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with single precision values wherever a four-dimensional vector with extended precision is expected. The fourth dimension is set to 0.

26.3.282 operator :=(Tvector3_single): Tvector4_single

Synopsis: Allow assignment of three-dimensional single precision vector to four-dimensional single precision vector

Declaration: `operator operator :=(Tvector3_single): Tvector4_single`

```
(const v: Tvector3_single)
: Tvector4_single
```

Visibility: default

Description: This operator allows you to use a three-dimensional vector with single precision values wherever a four-dimensional vector with single precision is expected. The fourth dimension is set to 0.

26.3.283 operator :=(Tvector4_double): Tvector2_double

Synopsis: Allow assignment of four-dimensional double precision vector to two-dimensional double precision vector

Declaration: `operator operator :=(Tvector4_double): Tvector2_double`

```
(const v: Tvector4_double)
: Tvector2_double
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with double precision values wherever a two-dimensional vector with double precision is expected. The third and fourth dimensions are thrown away.

26.3.284 operator :=(Tvector4_double): Tvector2_extended

Synopsis: Allow assignment of four-dimensional double precision vector to two-dimensional extended precision vector

Declaration: `operator operator :=(Tvector4_double): Tvector2_extended`

```
(const v: Tvector4_double)
: Tvector2_extended
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with double precision values wherever a two-dimensional vector with extended precision is expected. The third and fourth dimensions are thrown away.

26.3.285 operator :=(Tvector4_double): Tvector2_single

Synopsis: Allow assignment of four-dimensional double precision vector to two-dimensional single precision vector

Visibility: default

Description: This operator allows you to use a four-dimensional vector with double precision values wherever a two-dimensional vector with single precision is expected. The third and fourth dimensions are thrown away and some accuracy is lost because of the conversion.

26.3.286 operator :=(Tvector4 double): Tvector3 double

Synopsis: Allow assignment of four-dimensional double precision vector to three-dimensional double precision vector

Visibility: default

Description: This operator allows you to use a four-dimensional vector with double precision values wherever a three-dimensional vector with double precision is expected. The fourth dimension is thrown away.

26.3.287 operator :=(Tvector4 double): Tvector3 extended

Synopsis: Allow assignment of four-dimensional double precision vector to three-dimensional extended precision vector

Visibility: default

Description: This operator allows you to use a four-dimensional vector with double precision values wherever a three-dimensional vector with extended precision is expected. The fourth dimension is thrown away.

26.3.288 operator :=(Tvector4 double): Tvector3 single

Synopsis: Allow assignment of four-dimensional double precision vector to three-dimensional single precision vector

Visibility: default

Description: This operator allows you to use a four-dimensional vector with double precision values wherever a three-dimensional vector with single precision is expected. The fourth dimension is thrown away and some accuracy is lost because of the conversion.

26.3.289 operator :=(Tvector4_double): Tvector4_extended

Synopsis: Allow assignment of four-dimensional single precision vector to four-dimensional extended precision vector

Visibility: default

Description: This operator allows you to use a four-dimensional vector with double precision values wherever a four-dimensional vector with extended precision is expected.

26.3.290 operator :=(Tvector4_double): Tvector4_single

Synopsis: Allow assignment of four-dimensional double precision vector to four-dimensional single precision vector

Visibility: default

Description: This operator allows you to use a four-dimensional vector with double precision values wherever a four-dimensional vector with single precision is expected. Some accuracy is lost because of the conversion.

26.3.291 operator :=(Tvector4_extended): Tvector2_double

Synopsis: Allow assignment of four-dimensional extended precision vector to two-dimensional double precision vector

Visibility: default

Description: This operator allows you to use a four-dimensional vector with extended precision values wherever a two-dimensional vector with double precision is expected. The third and fourth dimensions are thrown away and some accuracy is lost because of the conversion.

26.3.292 operator :=(Tvector4_extended): Tvector2_extended

Synopsis: Allow assignment of four-dimensional extended precision vector to two-dimensional extended precision vector

Declaration: operator operator :=(Tvector4_extended) : Tvector2_extended

```
(const v: Tvector4_extended  
: Tvector2_extended)
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with extended precision values wherever a two-dimensional vector with extended precision is expected. The third and fourth dimensions are thrown away.

26.3.293 operator :=(Tvector4_extended): Tvector2_single

Synopsis: Allow assignment of four-dimensional extended precision vector to two-dimensional single precision vector

Declaration: operator operator :=(Tvector4_extended) : Tvector2_single

```
(const v: Tvector4_extended  
: Tvector2_single)
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with extended precision values wherever a two-dimensional vector with single precision is expected. The third and fourth dimensions are thrown away and some accuracy is lost because of the conversion.

26.3.294 operator :=(Tvector4_extended): Tvector3_double

Synopsis: Allow assignment of four-dimensional extended precision vector to three-dimensional double precision vector

Declaration: operator operator :=(Tvector4_extended) : Tvector3_double

```
(const v: Tvector4_extended  
: Tvector3_double)
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with extended precision values wherever a three-dimensional vector with double precision is expected. The fourth dimension is thrown away and some accuracy is lost because of the conversion.

26.3.295 operator :=(Tvector4_extended): Tvector3_extended

Synopsis: Allow assignment of four-dimensional extended precision vector to three-dimensional extended precision vector

Declaration: operator operator :=(Tvector4_extended) : Tvector3_extended

```
(const v: Tvector4_extended  
: Tvector3_extended)
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with extended precision values wherever a three-dimensional vector with extended precision is expected. The fourth dimensions are thrown away.

26.3.296 operator :=(Tvector4_extended): Tvector3_single

Synopsis: Allow assignment of four-dimensional extended precision vector to three-dimensional single precision vector

Declaration: `operator operator :=(Tvector4_extended) : Tvector3_single`

```
(const v: Tvector4_extended)
    : Tvector3_single
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with extended precision values wherever a three-dimensional vector with single precision is expected. The fourth dimension is thrown away and some accuracy is lost because of the conversion.

26.3.297 operator :=(Tvector4_extended): Tvector4_double

Synopsis: Allow assignment of four-dimensional single precision vector to four-dimensional double precision vector

Declaration: `operator operator :=(Tvector4_extended) : Tvector4_double`

```
(const v: Tvector4_extended)
    : Tvector4_double
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with extended precision values wherever a four-dimensional vector with double precision is expected. Some accuracy is lost because of the conversion.

26.3.298 operator :=(Tvector4_extended): Tvector4_single

Synopsis: Allow assignment of four-dimensional extended precision vector to four-dimensional single precision vector

Declaration: `operator operator :=(Tvector4_extended) : Tvector4_single`

```
(const v: Tvector4_extended)
    : Tvector4_single
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with extended precision values wherever a four-dimensional vector with single precision is expected. Some accuracy is lost because of the conversion.

26.3.299 operator :=(Tvector4_single): Tvector2_double

Synopsis: Allow assignment of four-dimensional single precision vector to two-dimensional double precision vector

Visibility: default

Description: This operator allows you to use a four-dimensional vector with single precision values wherever a two-dimensional vector with double precision is expected. The third and fourth dimensions are thrown away.

26.3.300 operator :=(Tvector4_single): Tvector2_extended

Synopsis: Allow assignment of four-dimensional single precision vector to two-dimensional extended precision vector

Visibility: default

Description: This operator allows you to use a four-dimensional vector with single precision values wherever a two-dimensional vector with extended precision is expected. The third and fourth dimensions are thrown away.

26.3.301 operator :=(Tvector4_single): Tvector2_single

Synopsis: Allow assignment of four-dimensional single precision vector to two-dimensional single precision vector

```
Declaration: operator operator :=(Tvector4_single): Tvector2_single  
                                (const v: Tvector4_single)  
                                : Tvector2_single
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with single precision values wherever a two-dimensional vector with single precision is expected. The third and fourth dimensions are thrown away.

26.3.302 operator :=(Tvector4_single): Tvector3_double

Synopsis: Allow assignment of four-dimensional single precision vector to three-dimensional double precision vector

```
Declaration: operator operator :=(Tvector4_single): Tvector3_double  
                                (const v: Tvector4_single)  
                                : Tvector3_double
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with single precision values wherever a three-dimensional vector with double precision is expected. The fourth dimension is thrown away.

26.3.303 operator :=(Tvector4_single): Tvector3_extended

Synopsis: Allow assignment of four-dimensional single precision vector to three-dimensional extended precision vector

Declaration: `operator operator :=(Tvector4_single): Tvector3_extended`

```
(const v: Tvector4_single)
: Tvector3_extended
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with single precision values wherever a three-dimensional vector with extended precision is expected. The fourth dimension is thrown away.

26.3.304 operator :=(Tvector4_single): Tvector3_single

Synopsis: Allow assignment of four-dimensional single precision vector to three-dimensional single precision vector

Declaration: `operator operator :=(Tvector4_single): Tvector3_single`

```
(const v: Tvector4_single)
: Tvector3_single
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with single precision values wherever a three-dimensional vector with single precision is expected. The fourth dimension is thrown away.

26.3.305 operator :=(Tvector4_single): Tvector4_double

Synopsis: Allow assignment of four-dimensional single precision vector to four-dimensional double precision vector

Declaration: `operator operator :=(Tvector4_single): Tvector4_double`

```
(const v: Tvector4_single)
: Tvector4_double
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with single precision values wherever a four-dimensional vector with double precision is expected.

26.3.306 operator :=(Tvector4_single): Tvector4_extended

Synopsis: Allow assignment of four-dimensional single precision vector to four-dimensional extended precision vector

Declaration: `operator operator :=(Tvector4_single): Tvector4_extended`

```
(const v: Tvector4_single)
: Tvector4_extended
```

Visibility: default

Description: This operator allows you to use a four-dimensional vector with single precision values wherever a four-dimensional vector with extended precision is expected.

26.3.307 operator ><(Tvector3_double, Tvector3_double): Tvector3_double

Synopsis: Calculate the external product of two three-dimensional vectors

Declaration: operator operator ><(Tvector3_double, Tvector3_double): Tvector3_double

```
(const x: Tve
const y: Tve
: Tvector3_d
```

Visibility: default

Description: This operator returns the external product of two three dimensional vector. It is a vector orthonormal to the two multiplied vectors. The length of that vector is equal to the surface area of a parallelogram with the two vectors as sides.

The external product is often used to get a vector orthonormal to two other vectors, but of a predefined length. In order to do so, the result vector from the external product, is divided by its length, and then multiplied by the desired size.

26.3.308 operator ><(Tvector3_extended, Tvector3_extended): Tvector3_extended

Synopsis: Calculate the external product of two three-dimensional vectors

Declaration:

```
operator
(const
const y
: Tvec
```

Visibility: default

Description: This operator returns the external product of two three dimensional vector. It is a vector orthonormal to the two multiplied vectors. The length of that vector is equal to the surface area of a parallelogram with the two vectors as sides.

The external product is often used to get a vector orthonormal to two other vectors, but of a predefined length. In order to do so, the result vector from the external product, is divided by its length, and then multiplied by the desired size.

26.3.309 operator ><(Tvector3_single, Tvector3_single): Tvector3_single

Synopsis: Calculate the external product of two three-dimensional vectors

Declaration: operator operator ><(Tvector3_single, Tvector3_single): Tvector3_single

```
(const x: Tve
const y: Tve
: Tvector3_s
```

Visibility: default

Description: This operator returns the external product of two three dimensional vector. It is a vector orthonormal to the two multiplied vectors. The length of that vector is equal to the surface area of a parallelogram with the two vectors as sides.

The external product is often used to get a vector orthonormal to two other vectors, but of a predefined length. In order to do so, the result vector from the external product, is divided by its length, and then multiplied by the desired size.

26.4 Tmatrix2_double

26.4.1 Description

The Tmatrix2_double object provides a matrix of 2*2 double precision scalars.

26.4.2 Method overview

Page	Property	Description
891	determinant	Calculates the determinant of the matrix.
891	get_column	Returns the c-th column of the matrix as vector.
891	get_row	Returns the r-th row of the matrix as vector.
890	init	Initializes the matrix, setting its elements to the values passed to the constructor.
890	init_identity	Initializes the matrix and sets its elements to the identity matrix.
890	init_zero	Initializes the matrix and sets its elements to zero
891	inverse	Calculates the inverse of the matrix.
891	set_column	Sets c-th column of the matrix with a vector.
891	set_row	Sets r-th row of the matrix with a vector.
892	transpose	Returns the transposition of the matrix.

26.4.3 Tmatrix2_double.init_zero

Synopsis: Initializes the matrix and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.4.4 Tmatrix2_double.init_identity

Synopsis: Initializes the matrix and sets its elements to the identity matrix.

Declaration: constructor init_identity

Visibility: default

Description: Initializes the matrix and sets its elements to the identity matrix, that is, elements to 1 on the left-upper to right-lower diagonal, the rest zero.

26.4.5 Tmatrix2_double.init

Synopsis: Initializes the matrix, setting its elements to the values passed to the constructor.

Declaration: constructor init(aa: Double; ab: Double; ba: Double; bb: Double)

Visibility: default

Description: Initializes the matrix, setting its elements to the values passed to the constructor. The order of the values is left to right, then top to bottom.

26.4.6 Tmatrix2_double.get_column

Synopsis: Returns the c-th column of the matrix as vector.

Declaration: function get_column(c: Byte) : Tvector2_double

Visibility: default

Description: Returns the c-th column of the matrix as vector. The column numbering starts at 0.

26.4.7 Tmatrix2_double.get_row

Synopsis: Returns the r-th row of the matrix as vector.

Declaration: function get_row(r: Byte) : Tvector2_double

Visibility: default

Description: Returns the r-th row of the matrix as vector. The row numbering starts at 0.

26.4.8 Tmatrix2_double.set_column

Synopsis: Sets c-th column of the matrix with a vector.

Declaration: procedure set_column(c: Byte; const v: Tvector2_double)

Visibility: default

Description: Replaces the c-th column of the matrix with vector v. The column numbering starts at 0.

26.4.9 Tmatrix2_double.set_row

Synopsis: Sets r-th row of the matrix with a vector.

Declaration: procedure set_row(r: Byte; const v: Tvector2_double)

Visibility: default

Description: Replaces the r-th row of the matrix with vector v. The row numbering starts at 0.

26.4.10 Tmatrix2_double.determinant

Synopsis: Calculates the determinant of the matrix.

Declaration: function determinant : Double

Visibility: default

Description: Returns the determinant of the matrix.

26.4.11 Tmatrix2_double.inverse

Synopsis: Calculates the inverse of the matrix.

Declaration: function inverse(Adeterminant: Double) : Tmatrix2_double

Visibility: default

Description: Tmatrix2_double.inverse returns a new matrix that is the inverse of the matrix. You must pass the determinant of the matrix as parameter.

26.4.12 Tmatrix2_double.transpose

Synopsis: Returns the transposition of the matrix.

Declaration: function transpose : Tmatrix2_double

Visibility: default

Description: Tmatrix2_double.transpose returns a new matrix that is the transposition of the matrix, that is, the matrix with the x and y coordinates of the values swapped.

26.5 Tmatrix2_extended

26.5.1 Description

The Tmatrix2_extended object provides a matrix of 2*2 extended precision scalars.

26.5.2 Method overview

Page	Property	Description
893	determinant	Calculates the determinant of the matrix.
893	get_column	Returns the c-th column of the matrix as vector.
893	get_row	Returns the r-th row of the matrix as vector.
893	init	Initializes the matrix, setting its elements to the values passed to the constructor.
892	init_identity	Initializes the matrix and sets its elements to the identity matrix.
892	init_zero	Initializes the matrix and sets its elements to zero
894	inverse	Calculates the inverse of the matrix.
893	set_column	Sets c-th column of the matrix with a vector.
893	set_row	Sets r-th row of the matrix with a vector.
894	transpose	Returns the transposition of the matrix.

26.5.3 Tmatrix2_extended.init_zero

Synopsis: Initializes the matrix and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.5.4 Tmatrix2_extended.init_identity

Synopsis: Initializes the matrix and sets its elements to the identity matrix.

Declaration: constructor init_identity

Visibility: default

Description: Initializes the matrix and sets its elements to the identity matrix, that is, elements to 1 on the left-upper to right-lower diagonal, the rest zero.

26.5.5 Tmatrix2_extended.init

Synopsis: Initializes the matrix, setting its elements to the values passed to the constructor.

Declaration: constructor init(aa: extended; ab: extended; ba: extended; bb: extended)

Visibility: default

Description: Initializes the matrix, setting its elements to the values passed to the constructor. The order of the values is left to right, then top to bottom.

26.5.6 Tmatrix2_extended.get_column

Synopsis: Returns the c-th column of the matrix as vector.

Declaration: function get_column(c: Byte) : Tvector2_extended

Visibility: default

Description: Returns the c-th column of the matrix as vector. The column numbering starts at 0.

26.5.7 Tmatrix2_extended.get_row

Synopsis: Returns the r-th row of the matrix as vector.

Declaration: function get_row(r: Byte) : Tvector2_extended

Visibility: default

Description: Returns the r-th row of the matrix as vector. The row numbering starts at 0.

26.5.8 Tmatrix2_extended.set_column

Synopsis: Sets c-th column of the matrix with a vector.

Declaration: procedure set_column(c: Byte; const v: Tvector2_extended)

Visibility: default

Description: Replaces the c-th column of the matrix with vector v. The column numbering starts at 0.

26.5.9 Tmatrix2_extended.set_row

Synopsis: Sets r-th row of the matrix with a vector.

Declaration: procedure set_row(r: Byte; const v: Tvector2_extended)

Visibility: default

Description: Replaces the r-th row of the matrix with vector v. The row numbering starts at 0.

26.5.10 Tmatrix2_extended.determinant

Synopsis: Calculates the determinant of the matrix.

Declaration: function determinant : extended

Visibility: default

Description: Returns the determinant of the matrix.

26.5.11 Tmatrix2_extended.inverse

Synopsis: Calculates the inverse of the matrix.

Declaration: function inverse(Adeterminant: extended) : Tmatrix2_extended

Visibility: default

Description: Tmatrix2_extended.inverse returns a new matrix that is the inverse of the matrix. You must pass the determinant of the matrix as parameter.

26.5.12 Tmatrix2_extended.transpose

Synopsis: Returns the transposition of the matrix.

Declaration: function transpose : Tmatrix2_extended

Visibility: default

Description: Tmatrix2_extended.transpose returns a new matrix that is the transposition of the matrix, that is, the matrix with the x and y coordinates of the values swapped.

26.6 Tmatrix2_single

26.6.1 Description

The Tmatrix2_single object provides a matrix of 2*2 single precision scalars.

26.6.2 Method overview

Page	Property	Description
896	determinant	Calculates the determinant of the matrix.
895	get_column	Returns the c-th column of the matrix as vector.
895	get_row	Returns the r-th row of the matrix as vector.
895	init	Initializes the matrix, setting its elements to the values passed to the constructor.
895	init_identity	Initializes the matrix and sets its elements to the identity matrix.
894	init_zero	Initializes the matrix and sets its elements to zero
896	inverse	Calculates the inverse of the matrix.
895	set_column	Sets c-th column of the matrix with a vector.
896	set_row	Sets r-th row of the matrix with a vector.
896	transpose	Returns the transposition of the matrix.

26.6.3 Tmatrix2_single.init_zero

Synopsis: Initializes the matrix and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.6.4 Tmatrix2_single.init_identity

Synopsis: Initializes the matrix and sets its elements to the identity matrix.

Declaration: constructor init_identity

Visibility: default

Description: Initializes the matrix and sets its elements to the identity matrix, that is, elements to 1 on the left-upper to right-lower diagonal, the rest zero.

26.6.5 Tmatrix2_single.init

Synopsis: Initializes the matrix, setting its elements to the values passed to the constructor.

Declaration: constructor init(aa: single;ab: single;ba: single;bb: single)

Visibility: default

Description: Initializes the matrix, setting its elements to the values passed to the constructor. The order of the values is left to right, then top to bottom.

26.6.6 Tmatrix2_single.get_column

Synopsis: Returns the c-th column of the matrix as vector.

Declaration: function get_column(c: Byte) : Tvector2_single

Visibility: default

Description: Returns the c-th column of the matrix as vector. The column numbering starts at 0.

26.6.7 Tmatrix2_single.get_row

Synopsis: Returns the r-th row of the matrix as vector.

Declaration: function get_row(r: Byte) : Tvector2_single

Visibility: default

Description: Returns the r-th row of the matrix as vector. The row numbering starts at 0.

26.6.8 Tmatrix2_single.set_column

Synopsis: Sets c-th column of the matrix with a vector.

Declaration: procedure set_column(c: Byte; const v: Tvector2_single)

Visibility: default

Description: Replaces the c-th column of the matrix with vector v. The column numbering starts at 0.

26.6.9 Tmatrix2_single.set_row

Synopsis: Sets r-th row of the matrix with a vector.

Declaration: procedure set_row(r: Byte; const v: Tvector2_single)

Visibility: default

Description: Replaces the r-th row of the matrix with vector v. The row numbering starts at 0.

26.6.10 Tmatrix2_single.determinant

Synopsis: Calculates the determinant of the matrix.

Declaration: function determinant : single

Visibility: default

Description: Returns the determinant of the matrix.

26.6.11 Tmatrix2_single.inverse

Synopsis: Calculates the inverse of the matrix.

Declaration: function inverse(Adeterminant: single) : Tmatrix2_single

Visibility: default

Description: Tmatrix2_single.inverse returns a new matrix that is the inverse of the matrix. You must pass the determinant of the matrix as parameter.

26.6.12 Tmatrix2_single.transpose

Synopsis: Returns the transposition of the matrix.

Declaration: function transpose : Tmatrix2_single

Visibility: default

Description: Tmatrix2_single.transpose returns a new matrix that is the transposition of the matrix, that is, the matrix with the x and y coordinates of the values swapped.

26.7 Tmatrix3_double

26.7.1 Description

The Tmatrix3_double object provides a matrix of 3*3 double precision scalars.

26.7.2 Method overview

Page	Property	Description
898	determinant	Calculates the determinant of the matrix.
897	get_column	Returns the c-th column of the matrix as vector.
898	get_row	Returns the r-th row of the matrix as vector.
897	init	Initializes the matrix, setting its elements to the values passed to the constructor.
897	init_identity	Initializes the matrix and sets its elements to the identity matrix.
897	init_zero	Initializes the matrix and sets its elements to zero
898	inverse	Calculates the inverse of the matrix.
898	set_column	Sets c-th column of the matrix with a vector.
898	set_row	Sets r-th row of the matrix with a vector.
898	transpose	Returns the transposition of the matrix.

26.7.3 Tmatrix3_double.init_zero

Synopsis: Initializes the matrix and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.7.4 Tmatrix3_double.init_identity

Synopsis: Initializes the matrix and sets its elements to the identity matrix.

Declaration: constructor init_identity

Visibility: default

Description: Initializes the matrix and sets its elements to the identity matrix, that is, elements to 1 on the left-upper to right-lower diagonal, the rest zero.

26.7.5 Tmatrix3_double.init

Synopsis: Initializes the matrix, setting its elements to the values passed to the constructor.

Declaration: constructor init(aa: Double;ab: Double;ac: Double;ba: Double;bb: Double;
bc: Double;ca: Double;cb: Double;cc: Double)

Visibility: default

Description: Initializes the matrix, setting its elements to the values passed to the constructor. The order of the values is left to right, then top to bottom.

26.7.6 Tmatrix3_double.get_column

Synopsis: Returns the c-th column of the matrix as vector.

Declaration: function get_column(c: Byte) : Tvector3_double

Visibility: default

Description: Returns the c-th column of the matrix as vector. The column numbering starts at 0.

26.7.7 Tmatrix3_double.get_row

Synopsis: Returns the r-th row of the matrix as vector.

Declaration: function get_row(r: Byte) : Tvector3_double

Visibility: default

Description: Returns the r-th row of the matrix as vector. The row numbering starts at 0.

26.7.8 Tmatrix3_double.set_column

Synopsis: Sets c-th column of the matrix with a vector.

Declaration: procedure set_column(c: Byte; const v: Tvector3_double)

Visibility: default

Description: Replaces the c-th column of the matrix with vector v. The column numbering starts at 0.

26.7.9 Tmatrix3_double.set_row

Synopsis: Sets r-th row of the matrix with a vector.

Declaration: procedure set_row(r: Byte; const v: Tvector3_double)

Visibility: default

Description: Replaces the r-th row of the matrix with vector v. The row numbering starts at 0.

26.7.10 Tmatrix3_double.determinant

Synopsis: Calculates the determinant of the matrix.

Declaration: function determinant : Double

Visibility: default

Description: Returns the determinant of the matrix.

26.7.11 Tmatrix3_double.inverse

Synopsis: Calculates the inverse of the matrix.

Declaration: function inverse(Adeterminant: Double) : Tmatrix3_double

Visibility: default

Description: Tmatrix3_double.inverse returns a new matrix that is the inverse of the matrix. You must pass the determinant of the matrix as parameter.

26.7.12 Tmatrix3_double.transpose

Synopsis: Returns the transposition of the matrix.

Declaration: function transpose : Tmatrix3_double

Visibility: default

Description: Tmatrix2_double.transpose returns a new matrix that is the transposition of the matrix, that is, the matrix with the x and y coordinates of the values swapped.

26.8 Tmatrix3_extended

26.8.1 Description

The Tmatrix3_extended object provides a matrix of 3*3 extended precision scalars.

26.8.2 Method overview

Page	Property	Description
900	determinant	Calculates the determinant of the matrix.
900	get_column	Returns the c-th column of the matrix as vector.
900	get_row	Returns the r-th row of the matrix as vector.
899	init	Initializes the matrix, setting its elements to the values passed to the constructor.
899	init_identity	Initializes the matrix and sets its elements to the identity matrix.
899	init_zero	Initializes the matrix and sets its elements to zero
900	inverse	Calculates the inverse of the matrix.
900	set_column	Sets r-th column of the matrix with a vector.
900	set_row	Sets r-th row of the matrix with a vector.
901	transpose	Returns the transposition of the matrix.

26.8.3 Tmatrix3_extended.init_zero

Synopsis: Initializes the matrix and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.8.4 Tmatrix3_extended.init_identity

Synopsis: Initializes the matrix and sets its elements to the identity matrix.

Declaration: constructor init_identity

Visibility: default

Description: Initializes the matrix and sets its elements to the identity matrix, that is, elements to 1 on the left-upper to right-lower diagonal, the rest zero.

26.8.5 Tmatrix3_extended.init

Synopsis: Initializes the matrix, setting its elements to the values passed to the constructor.

Declaration: constructor init(aa: extended; ab: extended; ac: extended; ba: extended;
bb: extended; bc: extended; ca: extended; cb: extended;
cc: extended)

Visibility: default

Description: Initializes the matrix, setting its elements to the values passed to the constructor. The order of the values is left to right, then top to bottom.

26.8.6 Tmatrix3_extended.get_column

Synopsis: Returns the c-th column of the matrix as vector.

Declaration: function get_column(c: Byte) : Tvector3_extended

Visibility: default

Description: Returns the c-th column of the matrix as vector. The column numbering starts at 0.

26.8.7 Tmatrix3_extended.get_row

Synopsis: Returns the r-th row of the matrix as vector.

Declaration: function get_row(r: Byte) : Tvector3_extended

Visibility: default

Description: Returns the r-th row of the matrix as vector. The row numbering starts at 0.

26.8.8 Tmatrix3_extended.set_column

Synopsis: Sets r-th column of the matrix with a vector.

Declaration: procedure set_column(c: Byte; const v: Tvector3_extended)

Visibility: default

Description: Replaces the c-th column of the matrix with vector v. The column numbering starts at 0.

26.8.9 Tmatrix3_extended.set_row

Synopsis: Sets r-th row of the matrix with a vector.

Declaration: procedure set_row(r: Byte; const v: Tvector3_extended)

Visibility: default

Description: Replaces the r-th row of the matrix with vector v. The row numbering starts at 0.

26.8.10 Tmatrix3_extended.determinant

Synopsis: Calculates the determinant of the matrix.

Declaration: function determinant : extended

Visibility: default

Description: Returns the determinant of the matrix.

26.8.11 Tmatrix3_extended.inverse

Synopsis: Calculates the inverse of the matrix.

Declaration: function inverse(Adeterminant: extended) : Tmatrix3_extended

Visibility: default

Description: Tmatrix3_extended.inverse returns a new matrix that is the inverse of the matrix. You must pass the determinant of the matrix as parameter.

26.8.12 Tmatrix3_extended.transpose

Synopsis: Returns the transposition of the matrix.

Declaration: function transpose : Tmatrix3_extended

Visibility: default

Description: Tmatrix2_extended.transpose returns a new matrix that is the transposition of the matrix, that is, the matrix with the x and y coordinates of the values swapped.

26.9 Tmatrix3_single

26.9.1 Description

The Tmatrix3_single object provides a matrix of 3*3 single precision scalars.

26.9.2 Method overview

Page	Property	Description
903	determinant	Calculates the determinant of the matrix.
902	get_column	Returns the c-th column of the matrix as vector.
902	get_row	Returns the r-th row of the matrix as vector.
902	init	Initializes the matrix, setting its elements to the values passed to the constructor.
901	init_identity	Initializes the matrix and sets its elements to the identity matrix.
901	init_zero	Initializes the matrix and sets its elements to zero
903	inverse	Calculates the inverse of the matrix.
902	set_column	Sets c-th column of the matrix with a vector.
902	set_row	Sets r-th row of the matrix with a vector.
903	transpose	Returns the transposition of the matrix.

26.9.3 Tmatrix3_single.init_zero

Synopsis: Initializes the matrix and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.9.4 Tmatrix3_single.init_identity

Synopsis: Initializes the matrix and sets its elements to the identity matrix.

Declaration: constructor init_identity

Visibility: default

Description: Initializes the matrix and sets its elements to the identity matrix, that is, elements to 1 on the left-upper to right-lower diagonal, the rest zero.

26.9.5 Tmatrix3_single.init

Synopsis: Initializes the matrix, setting its elements to the values passed to the constructor.

Declaration: constructor init(aa: single;ab: single;ac: single;ba: single;bb: single;
bc: single;ca: single;cb: single;cc: single)

Visibility: default

Description: Initializes the matrix, setting its elements to the values passed to the constructor. The order of the values is left to right, then top to bottom.

26.9.6 Tmatrix3_single.get_column

Synopsis: Returns the c-th column of the matrix as vector.

Declaration: function get_column(c: Byte) : Tvector3_single

Visibility: default

Description: Returns the c-th column of the matrix as vector. The column numbering starts at 0.

26.9.7 Tmatrix3_single.get_row

Synopsis: Returns the r-th row of the matrix as vector.

Declaration: function get_row(r: Byte) : Tvector3_single

Visibility: default

Description: Returns the r-th row of the matrix as vector. The row numbering starts at 0.

26.9.8 Tmatrix3_single.set_column

Synopsis: Sets c-th column of the matrix with a vector.

Declaration: procedure set_column(c: Byte; const v: Tvector3_single)

Visibility: default

Description: Replaces the c-th column of the matrix with vector v. The column numbering starts at 0.

26.9.9 Tmatrix3_single.set_row

Synopsis: Sets r-th row of the matrix with a vector.

Declaration: procedure set_row(r: Byte; const v: Tvector3_single)

Visibility: default

Description: Replaces the r-th row of the matrix with vector v. The row numbering starts at 0.

26.9.10 Tmatrix3_single.determinant

Synopsis: Calculates the determinant of the matrix.

Declaration: function determinant : single

Visibility: default

Description: Returns the determinant of the matrix.

26.9.11 Tmatrix3_single.inverse

Synopsis: Calculates the inverse of the matrix.

Declaration: function inverse(Adeterminant: single) : Tmatrix3_single

Visibility: default

Description: Tmatrix3_single.inverse returns a new matrix that is the inverse of the matrix. You must pass the determinant of the matrix as parameter.

26.9.12 Tmatrix3_single.transpose

Synopsis: Returns the transposition of the matrix.

Declaration: function transpose : Tmatrix3_single

Visibility: default

Description: Tmatrix2_single.transpose returns a new matrix that is the transposition of the matrix, that is, the matrix with the x and y coordinates of the values swapped.

26.10 Tmatrix4_double

26.10.1 Description

The Tmatrix4_double object provides a matrix of 4*4 double precision scalars.

26.10.2 Method overview

Page	Property	Description
905	determinant	Calculates the determinant of the matrix.
904	get_column	Returns the c-th column of the matrix as vector.
904	get_row	Returns the r-th row of the matrix as vector.
904	init	Initializes the matrix, setting its elements to the values passed to the constructor.
904	init_identity	Initializes the matrix and sets its elements to the identity matrix.
904	init_zero	Initializes the matrix and sets its elements to zero
905	inverse	Calculates the inverse of the matrix.
905	set_column	Sets c-th column of the matrix with a vector.
905	set_row	Sets r-th row of the matrix with a vector.
905	transpose	Returns the transposition of the matrix.

26.10.3 Tmatrix4_double.init_zero

Synopsis: Initializes the matrix and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.10.4 Tmatrix4_double.init_identity

Synopsis: Initializes the matrix and sets its elements to the identity matrix.

Declaration: constructor init_identity

Visibility: default

Description: Initializes the matrix and sets its elements to the identity matrix, that is, elements to 1 on the left-upper to right-lower diagonal, the rest zero.

26.10.5 Tmatrix4_double.init

Synopsis: Initializes the matrix, setting its elements to the values passed to the constructor.

Declaration: constructor init(aa: Double; ab: Double; ac: Double; ad: Double; ba: Double;
bb: Double; bc: Double; bd: Double; ca: Double; cb: Double;
cc: Double; cd: Double; da: Double; db: Double; dc: Double;
dd: Double)

Visibility: default

Description: Initializes the matrix, setting its elements to the values passed to the constructor. The order of the values is left to right, then top to bottom.

26.10.6 Tmatrix4_double.get_column

Synopsis: Returns the c-th column of the matrix as vector.

Declaration: function get_column(c: Byte) : Tvector4_double

Visibility: default

Description: Returns the c-th column of the matrix as vector. The column numbering starts at 0.

26.10.7 Tmatrix4_double.get_row

Synopsis: Returns the r-th row of the matrix as vector.

Declaration: function get_row(r: Byte) : Tvector4_double

Visibility: default

Description: Returns the r-th row of the matrix as vector. The row numbering starts at 0.

26.10.8 Tmatrix4_double.set_column

Synopsis: Sets c-th column of the matrix with a vector.

Declaration: procedure set_column(c: Byte; const v: Tvector4_double)

Visibility: default

Description: Replaces the c-th column of the matrix with vector v. The column numbering starts at 0.

26.10.9 Tmatrix4_double.set_row

Synopsis: Sets r-th row of the matrix with a vector.

Declaration: procedure set_row(r: Byte; const v: Tvector4_double)

Visibility: default

Description: Replaces the r-th row of the matrix with vector v. The row numbering starts at 0.

26.10.10 Tmatrix4_double.determinant

Synopsis: Calculates the determinant of the matrix.

Declaration: function determinant : Double

Visibility: default

Description: Returns the determinant of the matrix. Note: Calculating the determinant of a 4*4 matrix requires quite a few operations.

26.10.11 Tmatrix4_double.inverse

Synopsis: Calculates the inverse of the matrix.

Declaration: function inverse(Adeterminant: Double) : Tmatrix4_double

Visibility: default

Description: Tmatrix4_double.inverse returns a new matrix that is the inverse of the matrix. You must pass the determinant of the matrix as parameter. Note: Calculating the inverse of a 4*4 matrix requires quite a few operations.

26.10.12 Tmatrix4_double.transpose

Synopsis: Returns the transposition of the matrix.

Declaration: function transpose : Tmatrix4_double

Visibility: default

Description: Tmatrix2_double.transpose returns a new matrix that is the transposition of the matrix, that is, the matrix with the x and y coordinates of the values swapped.

26.11 Tmatrix4_extended

26.11.1 Description

The Tmatrix4_extended object provides a matrix of 4*4 extended precision scalars.

26.11.2 Method overview

Page	Property	Description
907	determinant	Calculates the determinant of the matrix.
907	get_column	Returns the c-th column of the matrix as vector.
907	get_row	Returns the r-th row of the matrix as vector.
906	init	Initializes the matrix, setting its elements to the values passed to the constructor.
906	init_identity	Initializes the matrix and sets its elements to the identity matrix.
906	init_zero	Initializes the matrix and sets its elements to zero
908	inverse	Calculates the inverse of the matrix.
907	set_column	Sets c-th column of the matrix with a vector.
907	set_row	Sets r-th row of the matrix with a vector.
908	transpose	Returns the transposition of the matrix.

26.11.3 Tmatrix4_extended.init_zero

Synopsis: Initializes the matrix and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.11.4 Tmatrix4_extended.init_identity

Synopsis: Initializes the matrix and sets its elements to the identity matrix.

Declaration: constructor init_identity

Visibility: default

Description: Initializes the matrix and sets its elements to the identity matrix, that is, elements to 1 on the left-upper to right-lower diagonal, the rest zero.

26.11.5 Tmatrix4_extended.init

Synopsis: Initializes the matrix, setting its elements to the values passed to the constructor.

Declaration: constructor init(aa: extended; ab: extended; ac: extended; ad: extended;
ba: extended; bb: extended; bc: extended; bd: extended;
ca: extended; cb: extended; cc: extended; cd: extended;
da: extended; db: extended; dc: extended; dd: extended)

Visibility: default

Description: Initializes the matrix, setting its elements to the values passed to the constructor. The order of the values is left to right, then top to bottom.

26.11.6 Tmatrix4_extended.get_column

Synopsis: Returns the c-th column of the matrix as vector.

Declaration: function get_column(c: Byte) : Tvector4_extended

Visibility: default

Description: Returns the c-th column of the matrix as vector. The column numbering starts at 0.

26.11.7 Tmatrix4_extended.get_row

Synopsis: Returns the r-th row of the matrix as vector.

Declaration: function get_row(r: Byte) : Tvector4_extended

Visibility: default

Description: Returns the r-th row of the matrix as vector. The row numbering starts at 0.

26.11.8 Tmatrix4_extended.set_column

Synopsis: Sets c-th column of the matrix with a vector.

Declaration: procedure set_column(c: Byte; const v: Tvector4_extended)

Visibility: default

Description: Replaces the c-th column of the matrix with vector v. The column numbering starts at 0.

26.11.9 Tmatrix4_extended.set_row

Synopsis: Sets r-th row of the matrix with a vector.

Declaration: procedure set_row(r: Byte; const v: Tvector4_extended)

Visibility: default

Description: Replaces the r-th row of the matrix with vector v. The row numbering starts at 0.

26.11.10 Tmatrix4_extended.determinant

Synopsis: Calculates the determinant of the matrix.

Declaration: function determinant : extended

Visibility: default

Description: Returns the determinant of the matrix. Note: Calculating the determinant of a 4*4 matrix requires quite a few operations.

26.11.11 Tmatrix4_extended.inverse

Synopsis: Calculates the inverse of the matrix.

Declaration: function inverse(Adeterminant: extended) : Tmatrix4_extended

Visibility: default

Description: Tmatrix4_extended.inverse returns a new matrix that is the inverse of the matrix. You must pass the determinant of the matrix as parameter. Note: Calculating the inverse of a 4*4 matrix requires quite a few operations.

26.11.12 Tmatrix4_extended.transpose

Synopsis: Returns the transposition of the matrix.

Declaration: function transpose : Tmatrix4_extended

Visibility: default

Description: Tmatrix2_extended.transpose returns a new matrix that is the transposition of the matrix, that is, the matrix with the x and y coordinates of the values swapped.

26.12 Tmatrix4_single

26.12.1 Description

The Tmatrix4_single object provides a matrix of 4*4 single precision scalars.

26.12.2 Method overview

Page	Property	Description
910	determinant	Calculates the determinant of the matrix.
909	get_column	Returns the c-th column of the matrix as vector.
909	get_row	Returns the r-th row of the matrix as vector.
909	init	Initializes the matrix, setting its elements to the values passed to the constructor.
909	init_identity	Initializes the matrix and sets its elements to the identity matrix.
908	init_zero	Initializes the matrix and sets its elements to zero
910	inverse	Calculates the inverse of the matrix.
909	set_column	Sets c-th column of the matrix with a vector.
910	set_row	Sets r-th row of the matrix with a vector.
910	transpose	Returns the transposition of the matrix.

26.12.3 Tmatrix4_single.init_zero

Synopsis: Initializes the matrix and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.12.4 Tmatrix4_single.init_identity

Synopsis: Initializes the matrix and sets its elements to the identity matrix.

Declaration: constructor init_identity

Visibility: default

Description: Initializes the matrix and sets its elements to the identity matrix, that is, elements to 1 on the left-upper to right-lower diagonal, the rest zero.

26.12.5 Tmatrix4_single.init

Synopsis: Initializes the matrix, setting its elements to the values passed to the constructor.

Declaration: constructor init(aa: single;ab: single;ac: single;ad: single;ba: single;
bb: single;bc: single;bd: single;ca: single;cb: single;
cc: single;cd: single;da: single;db: single;dc: single;
dd: single)

Visibility: default

Description: Initializes the matrix, setting its elements to the values passed to the constructor. The order of the values is left to right, then top to bottom.

26.12.6 Tmatrix4_single.get_column

Synopsis: Returns the c-th column of the matrix as vector.

Declaration: function get_column(c: Byte) : Tvector4_single

Visibility: default

Description: Returns the c-th column of the matrix as vector. The column numbering starts at 0.

26.12.7 Tmatrix4_single.get_row

Synopsis: Returns the r-th row of the matrix as vector.

Declaration: function get_row(r: Byte) : Tvector4_single

Visibility: default

Description: Returns the r-th row of the matrix as vector. The row numbering starts at 0.

26.12.8 Tmatrix4_single.set_column

Synopsis: Sets c-th column of the matrix with a vector.

Declaration: procedure set_column(c: Byte;const v: Tvector4_single)

Visibility: default

Description: Replaces the c-th column of the matrix with vector v. The column numbering starts at 0.

26.12.9 Tmatrix4_single.set_row

Synopsis: Sets r-th row of the matrix with a vector.

Declaration: procedure set_row(r: Byte; const v: Tvector4_single)

Visibility: default

Description: Replaces the r-th row of the matrix with vector v. The row numbering starts at 0.

26.12.10 Tmatrix4_single.determinant

Synopsis: Calculates the determinant of the matrix.

Declaration: function determinant : single

Visibility: default

Description: Returns the determinant of the matrix. Note: Calculating the determinant of a 4*4 matrix requires quite a few operations.

26.12.11 Tmatrix4_single.inverse

Synopsis: Calculates the inverse of the matrix.

Declaration: function inverse(Adeterminant: single) : Tmatrix4_single

Visibility: default

Description: Tmatrix4_single.inverse returns a new matrix that is the inverse of the matrix. You must pass the determinant of the matrix as parameter. Note: Calculating the inverse of a 4*4 matrix requires quite a few operations.

26.12.12 Tmatrix4_single.transpose

Synopsis: Returns the transposition of the matrix.

Declaration: function transpose : Tmatrix4_single

Visibility: default

Description: Tmatrix2_single.transpose returns a new matrix that is the transposition of the matrix, that is, the matrix with the x and y coordinates of the values swapped.

26.13 Tvector2_double

26.13.1 Description

The Tvector2_double object provides a vector of two double precision scalars.

26.13.2 Method overview

Page	Property	Description
911	init	Initializes the vector, setting its elements to the values passed to the constructor.
911	init_one	Initializes the vector and sets its elements to one
911	init_zero	Initializes the vector and sets its elements to zero
911	length	Calculates the length of the vector.
911	squared_length	Calculates the squared length of the vector.

26.13.3 Tvector2_double.init_zero

Synopsis: Initializes the vector and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.13.4 Tvector2_double.init_one

Synopsis: Initializes the vector and sets its elements to one

Declaration: constructor init_one

Visibility: default

26.13.5 Tvector2_double.init

Synopsis: Initializes the vector, setting its elements to the values passed to the constructor.

Declaration: constructor init(a: Double; b: Double)

Visibility: default

26.13.6 Tvector2_double.length

Synopsis: Calculates the length of the vector.

Declaration: function length : Double

Visibility: default

Description: Calculate the length of the vector: $\text{length} = \sqrt{\text{data}[0]^2 + \text{data}[1]^2}$. Try to use squared_length (1) if you are able to, as it is faster.

26.13.7 Tvector2_double.squared_length

Synopsis: Calculates the squared length of the vector.

Declaration: function squared_length : Double

Visibility: default

Description: Calculate the squared length of the vector: $\text{SquaredLength} = \text{data}[0]^2 + \text{data}[1]^2$.

26.14 Tvector2_extended

26.14.1 Description

The Tvector2_extended object provides a vector of two extended precision scalars.

26.14.2 Method overview

Page	Property	Description
912	init	Initializes the vector, setting its elements to the values passed to the constructor.
912	init_one	Initializes the vector and sets its elements to one
912	init_zero	Initializes the vector and sets its elements to zero
912	length	Calculates the length of the vector.
913	squared_length	Calculates the squared length of the vector.

26.14.3 Tvector2_extended.init_zero

Synopsis: Initializes the vector and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.14.4 Tvector2_extended.init_one

Synopsis: Initializes the vector and sets its elements to one

Declaration: constructor init_one

Visibility: default

26.14.5 Tvector2_extended.init

Synopsis: Initializes the vector, setting its elements to the values passed to the constructor.

Declaration: constructor init(a: extended; b: extended)

Visibility: default

26.14.6 Tvector2_extended.length

Synopsis: Calculates the length of the vector.

Declaration: function length : extended

Visibility: default

Description: Calculate the length of the vector: length=sqrt(data[0]**2+data[1]**2). Try to use squared_length (1) if you are able to, as it is faster.

26.14.7 Tvector2_extended.squared_length

Synopsis: Calculates the squared length of the vector.

Declaration: function squared_length : extended

Visibility: default

Description: Calculate the squared length of the vector: squared_length=data[0]**2+data[1]**2.

26.15 Tvector2_single

26.15.1 Description

The Tvector2_single object provides a vector of two single precision scalars.

26.15.2 Method overview

Page	Property	Description
913	init	Initializes the vector, setting its elements to the values passed to the constructor.
913	init_one	Initializes the vector and sets its elements to one
913	init_zero	Initializes the vector and sets its elements to zero
914	length	Calculates the length of the vector.
914	squared_length	Calculates the squared length of the vector.

26.15.3 Tvector2_single.init_zero

Synopsis: Initializes the vector and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.15.4 Tvector2_single.init_one

Synopsis: Initializes the vector and sets its elements to one

Declaration: constructor init_one

Visibility: default

26.15.5 Tvector2_single.init

Synopsis: Initializes the vector, setting its elements to the values passed to the constructor.

Declaration: constructor init(a: single;b: single)

Visibility: default

26.15.6 Tvector2_single.length

Synopsis: Calculates the length of the vector.

Declaration: function length : single

Visibility: default

Description: Calculate the length of the vector: $\text{length} = \sqrt{\text{data}[0]^{**2} + \text{data}[1]^{**2}}$. Try to use squared_length (1) if you are able to, as it is faster.

26.15.7 Tvector2_single.squared_length

Synopsis: Calculates the squared length of the vector.

Declaration: function squared_length : single

Visibility: default

Description: Calculate the squared length of the vector: $\text{squared_length} = \text{data}[0]^{**2} + \text{data}[1]^{**2}$.

26.16 Tvector3_double

26.16.1 Description

The Tvector3_double object provides a vector of three double precision scalars.

26.16.2 Method overview

Page	Property	Description
915	init	Initializes the vector, setting its elements to the values passed to the constructor.
914	init_one	Initializes the vector and sets its elements to one
914	init_zero	Initializes the vector and sets its elements to zero
915	length	Calculates the length of the vector.
915	squared_length	Calculates the squared length of the vector.

26.16.3 Tvector3_double.init_zero

Synopsis: Initializes the vector and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.16.4 Tvector3_double.init_one

Synopsis: Initializes the vector and sets its elements to one

Declaration: constructor init_one

Visibility: default

26.16.5 Tvector3_double.init

Synopsis: Initializes the vector, setting its elements to the values passed to the constructor.

Declaration: constructor init(a: Double;b: Double;c: Double)

Visibility: default

26.16.6 Tvector3_double.length

Synopsis: Calculates the length of the vector.

Declaration: function length : Double

Visibility: default

Description: Calculate the length of the vector: `length=sqrt(data[0]**2+data[1]**2+data[2]**2)`. Try to use `squared_length` (1) if you are able to, as it is faster.

26.16.7 Tvector3_double.squared_length

Synopsis: Calculates the squared length of the vector.

Declaration: function squared_length : Double

Visibility: default

Description: Calculate the squared length of the vector: `squared_length=data[0]**2+data[1]**2+data[2]**2`.

26.17 Tvector3_extended

26.17.1 Description

The `Tvector3_extended` object provides a vector of three extended precision scalars.

26.17.2 Method overview

Page	Property	Description
916	init	Initializes the vector, setting its elements to the values passed to the constructor.
916	init_one	Initializes the vector and sets its elements to one
915	init_zero	Initializes the vector and sets its elements to zero
916	length	Calculates the length of the vector.
916	squared_length	Calculates the squared length of the vector.

26.17.3 Tvector3_extended.init_zero

Synopsis: Initializes the vector and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.17.4 Tvector3_extended.init_one

Synopsis: Initializes the vector and sets its elements to one

Declaration: constructor init_one

Visibility: default

26.17.5 Tvector3_extended.init

Synopsis: Initializes the vector, setting its elements to the values passed to the constructor.

Declaration: constructor init(a: extended;b: extended;c: extended)

Visibility: default

26.17.6 Tvector3_extended.length

Synopsis: Calculates the length of the vector.

Declaration: function length : extended

Visibility: default

Description: Calculate the length of the vector: $\text{length} = \sqrt{\text{data}[0]^2 + \text{data}[1]^2 + \text{data}[2]^2}$. Try to use squared_length (1) if you are able to, as it is faster.

26.17.7 Tvector3_extended.squared_length

Synopsis: Calculates the squared length of the vector.

Declaration: function squared_length : extended

Visibility: default

Description: Calculate the squared length of the vector: $\text{squared_length} = \text{data}[0]^2 + \text{data}[1]^2 + \text{data}[2]^2$.

26.18 Tvector3_single

26.18.1 Description

The Tvector3_single object provides a vector of three single precision scalars.

26.18.2 Method overview

Page	Property	Description
917	init	Initializes the vector, setting its elements to the values passed to the constructor.
917	init_one	Initializes the vector and sets its elements to one
917	init_zero	Initializes the vector and sets its elements to zero
917	length	Calculates the length of the vector.
917	squared_length	Calculates the squared length of the vector.

26.18.3 Tvector3_single.init_zero

Synopsis: Initializes the vector and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.18.4 Tvector3_single.init_one

Synopsis: Initializes the vector and sets its elements to one

Declaration: constructor init_one

Visibility: default

26.18.5 Tvector3_single.init

Synopsis: Initializes the vector, setting its elements to the values passed to the constructor.

Declaration: constructor init(a: single;b: single;c: single)

Visibility: default

26.18.6 Tvector3_single.length

Synopsis: Calculates the length of the vector.

Declaration: function length : single

Visibility: default

Description: Calculate the length of the vector: $\text{length}=\sqrt{\text{data}[0]^2+\text{data}[1]^2+\text{data}[2]^2}$. Try to use squared_length (1) if you are able to, as it is faster.

26.18.7 Tvector3_single.squared_length

Synopsis: Calculates the squared length of the vector.

Declaration: function squared_length : single

Visibility: default

Description: Calculate the squared length of the vector: $\text{squared_length}=\text{data}[0]^2+\text{data}[1]^2+\text{data}[2]^2$.

26.19 Tvector4_double

26.19.1 Description

The Tvector4_double object provides a vector of four double precision scalars.

26.19.2 Method overview

Page	Property	Description
918	init	Initializes the vector, setting its elements to the values passed to the constructor.
918	init_one	Initializes the vector and sets its elements to one
918	init_zero	Initializes the vector and sets its elements to zero
918	length	Calculates the length of the vector.
918	squared_length	Calculates the squared length of the vector.

26.19.3 Tvector4_double.init_zero

Synopsis: Initializes the vector and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.19.4 Tvector4_double.init_one

Synopsis: Initializes the vector and sets its elements to one

Declaration: constructor init_one

Visibility: default

26.19.5 Tvector4_double.init

Synopsis: Initializes the vector, setting its elements to the values passed to the constructor.

Declaration: constructor init(a: Double; b: Double; c: Double; d: Double)

Visibility: default

26.19.6 Tvector4_double.length

Synopsis: Calculates the length of the vector.

Declaration: function length : Double

Visibility: default

Description: Calculate the length of the vector: $\text{length} = \sqrt{\text{data}[0]^2 + \text{data}[1]^2 + \text{data}[2]^2 + \text{data}[3]^2}$. Try to use squared_length (1) if you are able to, as it is faster.

26.19.7 Tvector4_double.squared_length

Synopsis: Calculates the squared length of the vector.

Declaration: function squared_length : Double

Visibility: default

Description: Calculate the squared length of the vector: $\text{squared_length} = \text{data}[0]^2 + \text{data}[1]^2 + \text{data}[2]^2 + \text{data}[3]^2$.

26.20 Tvector4_extended

26.20.1 Description

The Tvector4_extended object provides a vector of four extended precision scalars.

26.20.2 Method overview

Page	Property	Description
919	init	Initializes the vector, setting its elements to the values passed to the constructor.
919	init_one	Initializes the vector and sets its elements to one
919	init_zero	Initializes the vector and sets its elements to zero
919	length	Calculates the length of the vector.
920	squared_length	Calculates the squared length of the vector.

26.20.3 Tvector4_extended.init_zero

Synopsis: Initializes the vector and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.20.4 Tvector4_extended.init_one

Synopsis: Initializes the vector and sets its elements to one

Declaration: constructor init_one

Visibility: default

26.20.5 Tvector4_extended.init

Synopsis: Initializes the vector, setting its elements to the values passed to the constructor.

Declaration: constructor init(a: extended;b: extended;c: extended;d: extended)

Visibility: default

26.20.6 Tvector4_extended.length

Synopsis: Calculates the length of the vector.

Declaration: function length : extended

Visibility: default

Description: Calculate the length of the vector: $\text{length} = \sqrt{\text{data}[0]^2 + \text{data}[1]^2 + \text{data}[2]^2 + \text{data}[3]^2}$. Try to use squared_length (1) if you are able to, as it is faster.

26.20.7 Tvector4_extended.squared_length

Synopsis: Calculates the squared length of the vector.

Declaration: function squared_length : extended

Visibility: default

Description: Calculate the squared length of the vector: squared_length=data[0]**2+data[1]**2+data[2]**2+data[3]**2.

26.21 Tvector4_single

26.21.1 Description

The Tvector4_single object provides a vector of four single precision scalars.

26.21.2 Method overview

Page	Property	Description
920	init	Initializes the vector, setting its elements to the values passed to the constructor.
920	init_one	Initializes the vector and sets its elements to one
920	init_zero	Initializes the vector and sets its elements to zero
921	length	Calculates the length of the vector.
921	squared_length	Calculates the squared length of the vector.

26.21.3 Tvector4_single.init_zero

Synopsis: Initializes the vector and sets its elements to zero

Declaration: constructor init_zero

Visibility: default

26.21.4 Tvector4_single.init_one

Synopsis: Initializes the vector and sets its elements to one

Declaration: constructor init_one

Visibility: default

26.21.5 Tvector4_single.init

Synopsis: Initializes the vector, setting its elements to the values passed to the constructor.

Declaration: constructor init(a: single;b: single;c: single;d: single)

Visibility: default

26.21.6 Tvector4_single.length

Synopsis: Calculates the length of the vector.

Declaration: function length : single

Visibility: default

Description: Calculate the length of the vector: $\text{length} = \sqrt{\text{data}[0]^{**2} + \text{data}[1]^{**2} + \text{data}[2]^{**2} + \text{data}[3]^{**2}}$. Try to use squared_length ([1](#)) if you are able to, as it is faster.

26.21.7 Tvector4_single.squared_length

Synopsis: Calculates the squared length of the vector.

Declaration: function squared_length : single

Visibility: default

Description: Calculate the squared length of the vector: $\text{squared_length} = \text{data}[0]^{**2} + \text{data}[1]^{**2} + \text{data}[2]^{**2} + \text{data}[3]^{**2}$.

Chapter 27

Reference for unit 'mmx'

27.1 Overview

This document describes the MMX unit. This unit allows you to use the MMX capabilities of the Free Pascal compiler. It was written by Florian Klaempfl for the I386 processor. It should work on all platforms that use the Intel processor.

27.2 Constants, types and variables

27.2.1 Constants

```
is_amd_3d_cpu : Boolean = False
```

The `is_amd_3d_cpu` initialized constant allows you to determine if the computer has the AMD 3D extensions. It is set correctly in the unit's initialization code.

```
is_amd_3d_DSP_cpu : Boolean = False
```

The `is_amd_3d_DSP_cpu` initialized constant allows you to determine if the computer has the AMD 3D DSP extensions. It is set correctly in the unit's initialization code.

```
is_amd_3d_mmx_cpu : Boolean = False
```

The `is_amd_3d_mmx_cpu` initialized constant allows you to determine if the computer has the AMD 3D MMX extensions. It is set correctly in the unit's initialization code.

```
is_mmx_cpu : Boolean = False
```

The `is_mmx_cpu` initialized constant allows you to determine if the computer has MMX extensions. It is set correctly in the unit's initialization code.

```
is_sse2_cpu : Boolean = False
```

The `is_sse2_cpu` initialized constant allows you to determine if the computer has the SSE2 extensions. It is set correctly in the unit's initialization code.

```
is_sse_cpu : Boolean = False
```

The `is_sse_cpu` initialized constant allows you to determine if the computer has the SSE extensions. It is set correctly in the unit's initialization code.

27.2.2 Types

pmmxbyte = ^tmmxbyte

Pointer to tmmxbyte (923) array type

pmmxcardinal = ^tmmxcardinal

Pointer to tmmxcardinal (923) array type

pmmxinteger = ^tmmxinteger

Pointer to tmmxinteger (923) array type

pmmxlongint = ^tmmxlongint

Pointer to tmmxlongint (923) array type

pmmxshortint = ^tmmxshortint

Pointer to tmmxshortint (923) array type

pmmxsingle = ^tmmxsingle

Pointer to tmmxsingle (923) array type

pmmxword = ^tmmxword

Pointer to tmmxword (923) array type

tmmxbyte = Array[0..7] of Byte

Array of bytes, 64 bits in size

tmmxcardinal = Array[0..1] of Cardinal

Array of cardinals, 64 bits in size

tmmxinteger = Array[0..3] of Integer

Array of integers, 64 bits in size

tmmxlongint = Array[0..1] of LongInt

Array of longint, 64 bits in size

tmmxshortint = Array[0..7] of ShortInt

Array of shortints, 64 bits in size

tmmxsingle = Array[0..1] of single

Array of singles, 64 bits in size

tmmxword = Array[0..3] of Word

Array of words, 64 bits in size

27.3 Procedures and functions

27.3.1 emms

Synopsis: Reset floating point registers

Declaration: procedure emms

Visibility: default

Description: Emms sets all floating point registers to empty. This procedure must be called after you have used any MMX instructions, if you want to use floating point arithmetic. If you just want to move floating point data around, it isn't necessary to call this function, the compiler doesn't use the FPU registers when moving data. Only when doing calculations, you should use this function. The following code demonstrates this:

```
Program MMXDemo;
uses mmx;
var
  d1 : double;
  a : array[0..10000] of double;
  i : longint;
begin
  d1:=1.0;
{$mmx+}
  { floating point data is used, but we do _no_ arithmetic }
  for i:=0 to 10000 do
    a[i]:=d2; { this is done with 64 bit moves }
{$mmx-}
  emms; { clear fpu }
  { now we can do floating point arithmetic again }
end.
```

See also: [femms \(924\)](#)

27.3.2 femms

Synopsis: Reset floating point registers - AMD version

Declaration: procedure femms

Visibility: default

Description: femms executes the femms assembler instruction for AMD processors. It is not supported by all assemblers, hence it is coded as byte codes.

See also: [emms \(924\)](#)

Chapter 28

Reference for unit 'Mouse'

28.1 Overview

The Mouse unit implements a platform independent mouse handling interface. It is implemented identically on all platforms supported by Free Pascal and can be enhanced with custom drivers, should this be needed. It is intended to be used only in text-based screens, for instance in conjunction with the keyboard and video unit. No support for graphical screens is implemented, and there are (currently) no plans to implement this.

28.2 Writing a custom mouse driver

The mouse unit has support for adding a custom mouse driver. This can be used to add support for mouses not supported by the standard Free Pascal driver, but also to enhance an existing driver for instance to log mouse events or to implement a record and playback function.

The following unit shows how a mouse driver can be enhanced by adding some logging capabilities to the driver.

Listing: ./mouseex/logmouse.pp

```
unit logmouse;

interface

Procedure StartMouseLogging;
Procedure StopMouseLogging;
Function IsMouseLogging : Boolean;
Procedure SetMouseLogFileName(FileName : String);
```

implementation

```
uses sysutils,Mouse;

var
  NewMouseDriver,
  OldMouseDriver : TMouseDriver;
  Active, Logging : Boolean;
  LogFileName : String;
  MouseLog : Text;
```

```
Function TimeStamp : String;  
begin  
  TimeStamp:=FormatDateTime( 'hh:nn:ss' ,Time() );  
end ;  
  
Procedure StartMouseLogging ;  
begin  
  Logging:=True ;  
  WriteLn(MouseLog , ' Start logging mouse events at: ' ,TimeStamp);  
end ;  
  
Procedure StopMouseLogging ;  
begin  
  WriteLn(MouseLog , 'Stop logging mouse events at: ' ,TimeStamp);  
  Logging:=False ;  
end ;  
  
Function IsMouseLogging : Boolean ;  
begin  
  IsMouseLogging:=Logging ;  
end ;  
  
Procedure LogGetMouseEvent(Var Event : TMouseEvent);  
  
Var  
  M : TMouseEvent;  
  
begin  
  OldMouseDriver.GetMouseEvent(M) ;  
  If Logging then  
    begin  
      Write(MouseLog ,TimeStamp , ': Mouse ' );  
      With M do  
        begin  
          Case Action of  
            MouseActionDown : Write(MouseLog , 'down' );  
            MouseActionUp : Write(MouseLog , 'up' );  
            MouseActionMove : Write(MouseLog , 'move' );  
          end ;  
          Write(MouseLog , ' event at ' ,X , ' , ' ,Y);  
          If (Buttons <>0) then  
            begin  
              Write(MouseLog , ' for buttons: ' );  
              If (Buttons and MouseLeftbutton)<>0 then  
                Write(MouseLog , 'Left ' );  
              If (Buttons and MouseRightbutton)<>0 then  
                Write(MouseLog , 'Right ' );  
              If (Buttons and MouseMiddlebutton)<>0 then  
                Write(MouseLog , 'Middle ' );  
              end ;  
              WriteLn(MouseLog );  
            end ;  
          end ;  
        end ;  
    end ;
```

```
end;

Procedure LogInitMouse;

begin
  OldMouseDriver.InitDriver();
  Assign(MouseLog, logFileName);
  Rewrite(MouseLog);
  Active := True;
  StartMouseLogging;
end;

Procedure LogDoneMouse;

begin
  StopMouseLogging;
  Close(MouseLog);
  Active := False;
  OldMouseDriver.DoneDriver();
end;

Procedure SetMouseLogFileName(FileName : String);

begin
  If Not Active then
    LogFileName := FileName;
end;

Initialization
  GetMouseDriver(OldMouseDriver);
  NewMouseDriver := OldMouseDriver;
  NewMouseDriver.GetMouseEvent := @LogGetMouseEvent;
  NewMouseDriver.InitDriver := @LogInitMouse;
  NewMouseDriver.DoneDriver := @LogDoneMouse;
  LogFileName := 'Mouse.log';
  Logging := False;
  SetMouseDriver(NewMouseDriver);
end.
```

28.3 Constants, types and variables

28.3.1 Constants

```
errMouseBase = 1030
```

Base for mouse error codes.

```
errMouseInitError = errMouseBase + 0
```

Mouse initialization error

```
errMouseNotImplemented = errMouseBase + 1
```

Mouse driver not implemented.

MouseActionDown = \$0001

Mouse button down event signal.

MouseActionMove = \$0004

Mouse cursor move event signal.

MouseActionUp = \$0002

Mouse button up event signal.

MouseEventBufSize = 16

The mouse unit has a mechanism to buffer mouse events. This constant defines the size of the event buffer.

MouseLeftButton = \$01

Left mouse button event.

MouseMiddleButton = \$04

Middle mouse button event.

MouseRightButton = \$02

Right mouse button event.

28.3.2 Types

PMouseEvent = ^TMouseEvent

Pointer to TMouseEvent ([929](#)) record.

```
TMouseEvent = record
  UseDefaultQueue : Boolean;
  InitDriver : procedure;
  DoneDriver : procedure;
  DetectMouse : function : Byte;
  ShowMouse : procedure;
  HideMouse : procedure;
  GetMouseX : function : Word;
  GetMouseY : function : Word;
  GetMouseButtons : function : Word;
  SetMouseXY : procedure(x: Word;y: Word);
  GetMouseEvent : procedure(var MouseEvent: TMouseEvent);
  PollMouseEvent : function(var MouseEvent: TMouseEvent) : Boolean;
  PutMouseEvent : procedure(const MouseEvent: TMouseEvent);
end
```

The `TMouseDriver` record is used to implement a mouse driver in the `SetMouseDriver` ([934](#)) function. Its fields must be filled in before calling the `SetMouseDriver` ([934](#)) function.

```
TMouseEvent = packed record
  buttons : Word;
  x : Word;
  y : Word;
  Action : Word;
end
```

The `TMouseEvent` is the central type of the mouse unit, it is used to describe all mouse events.

The `Buttons` field describes which buttons were down when the event occurred. The `x`, `y` fields describe where the event occurred on the screen. The `Action` describes what action was going on when the event occurred. The `Buttons` and `Action` field can be examined using the constants defined in the unit interface.

28.3.3 Variables

```
MouseButtons : Byte
```

This variable keeps track of the last known mouse button state. Do not use.

```
MouseIntFlag : Byte
```

This variable keeps track of the last known internal mouse state. Do not use.

```
MouseWhereX : Word
```

This variable keeps track of the last known cursor position. Do not use.

```
MouseWhereY : Word
```

This variable keeps track of the last known cursor position. Do not use.

28.4 Procedures and functions

28.4.1 DetectMouse

Synopsis: Detect the presence of a mouse.

Declaration: `function DetectMouse : Byte`

Visibility: default

Description: `DetectMouse` detects whether a mouse is attached to the system or not. If there is no mouse, then zero is returned. If a mouse is attached, then the number of mouse buttons is returned.

This function should be called after the mouse driver was initialized.

Errors: None.

See also: `InitMouse` ([933](#)), `DoneMouse` ([930](#))

Listing: ./mouseex/ex1.pp

```
Program Example1;

{ Program to demonstrate the DetectMouse function. }

Uses mouse;

Var
  Buttons : Byte;

begin
  InitMouse;
  Buttons:=DetectMouse;
  If Buttons=0 then
    Writeln( 'No mouse present.' )
  else
    Writeln( 'Found mouse with ',Buttons,' buttons.' );
  DoneMouse;
end.
```

28.4.2 DoneMouse

Synopsis: Deinitialize mouse driver.

Declaration: procedure DoneMouse

Visibility: default

Description: DoneMouse De-initializes the mouse driver. It cleans up any memory allocated when the mouse was initialized, or removes possible mouse hooks from memory. The mouse functions will not work after DoneMouse was called. If DoneMouse is called a second time, it will exit at once. InitMouse should be called before DoneMouse can be called again.

For an example, see most other mouse functions.

Errors: None.

See also: DetectMouse ([929](#)), InitMouse ([933](#))

28.4.3 GetMouseButtons

Synopsis: Get the state of the mouse buttons

Declaration: function GetMouseButtons : Word

Visibility: default

Description: GetMouseButtons returns the current button state of the mouse, i.e. it returns a or-ed combination of the following constants:

MouseLeftButton When the left mouse button is held down.

MouseRightButton When the right mouse button is held down.

MouseMiddleButton When the middle mouse button is held down.

Errors: None.

See also: GetMouseEvent ([931](#)), GetMouseX ([931](#)), GetMouseY ([932](#))

Listing: ./mouseex/ex2.pp

Program Example2;

{ Program to demonstrate the GetMouseButtons function. }

Uses mouse;

```
begin
  InitMouse;
  WriteLn('Press right mouse button to exit program');
  While (GetMouseButtons<>MouseRightButton) do;
  DoneMouse;
end.
```

28.4.4 GetMouseDriver

Synopsis: Get a copy of the currently active mouse driver.

Declaration: procedure GetMouseDriver(var Driver: TMouseDriver)

Visibility: default

Description: GetMouseDriver returns the currently set mouse driver. It can be used to retrieve the current mouse driver, and override certain callbacks.

A more detailed explanation about getting and setting mouse drivers can be found in mousdrv ([925](#)).

For an example, see the section on writing a custom mouse driver, mousdrv ([925](#))

Errors: None.

See also: SetMouseDriver ([934](#))

28.4.5 GetMouseEvent

Synopsis: Get next mouse event from the queue.

Declaration: procedure GetMouseEvent(var MouseEvent: TMouseEvent)

Visibility: default

Description: GetMouseEvent returns the next mouse event (a movement, button press or button release), and waits for one if none is available in the queue.

Some mouse drivers can implement a mouse event queue which can hold multiple events till they are fetched. Others don't, and in that case, a one-event queue is implemented for use with PollMouseEvent ([934](#)).

Errors: None.

See also: GetMouseButtons ([930](#)), GetMouseX ([931](#)), GetMouseY ([932](#))

28.4.6 GetMouseX

Synopsis: Query the current horizontal position of the mouse cursor.

Declaration: function GetMouseX : Word

Visibility: default

Description: GetMouseX returns the current X position of the mouse. X is measured in characters, starting at 0 for the left side of the screen.

Errors: None.

See also: GetMouseButtons (930), GetMouseEvent (931), GetMouseY (932)

Listing: ./mouseex/ex4.pp

```
Program Example4;

{ Program to demonstrate the GetMouseX, GetMouseY functions. }

Uses mouse;

Var
  X,Y : Word;

begin
  InitMouse;
  Writeln( 'Move mouse cursor to square 10,10 to end' );
  Repeat
    X:=GetMouseX;
    Y:=GetMouseY;
    Writeln( 'X,Y= ( ',X,' , ',Y,' )' );
  Until (X=9) and (Y=9);
  DoneMouse;
end.
```

28.4.7 GetMouseY

Synopsis: Query the current vertical position of the mouse cursor.

Declaration: function GetMouseY : Word

Visibility: default

Description: GetMouseY returns the current Y position of the mouse. Y is measured in characters, starting at 0 for the top of the screen.

For an example, see GetMouseX (931)

Errors: None.

See also: GetMouseButtons (930), GetMouseEvent (931), GetMouseX (931)

28.4.8 HideMouse

Synopsis: Hide the mouse cursor.

Declaration: procedure HideMouse

Visibility: default

Description: HideMouse hides the mouse cursor. This may or may not be implemented on all systems, and depends on the driver.

Errors: None.

See also: ShowMouse ([935](#))

Listing: ./mouseex/ex5.pp

```

Program Example5;

{ Program to demonstrate the HideMouse function. }

Uses mouse;

Var
  Event : TMouseEvent;
  Visible : Boolean;

begin
  InitMouse;
  ShowMouse;
  Visible:=True;
  WriteLn( 'Press left mouse button to hide/show, right button quits' );
Repeat
  GetMouseEvent(Event);
  With Event do
    If ( Buttons=MouseLeftbutton ) and
      ( Action=MouseActionDown ) then
      begin
        If Visible then
          HideMouse
        else
          ShowMouse;
        Visible:=Not Visible;
      end;
    Until ( Event.Buttons=MouseRightButton ) and
      ( Event.Action=MouseActionDown );
  DoneMouse;
end.

```

28.4.9 InitMouse

Synopsis: Initialize the FPC mouse driver.

Declaration: procedure InitMouse

Visibility: default

Description: `InitMouse` Initializes the mouse driver. This will allocate any data structures needed for the mouse to function. All mouse functions can be used after a call to `InitMouse`.

A call to `InitMouse` must always be followed by a call to `DoneMouse` ([930](#)) at program exit. Failing to do so may leave the mouse in an unusable state, or may result in memory leaks.

For an example, see most other functions.

Errors: None.

See also: `DoneMouse` ([930](#)), `DetectMouse` ([929](#))

28.4.10 PollMouseEvent

Synopsis: Query next mouse event. Do not wait if none available.

Declaration: function PollMouseEvent (var MouseEvent: TMouseEvent) : Boolean

Visibility: default

Description: PollMouseEvent checks whether a mouse event is available, and returns it in MouseEvent if one is found. The function result is True in that case. If no mouse event is pending, the function result is False, and the contents of MouseEvent is undefined.

Note that after a call to PollMouseEvent, the event should still be removed from the mouse event queue with a call to GetMouseEvent.

Errors: None.

See also: GetMouseEvent (931), PutMouseEvent (934)

28.4.11 PutMouseEvent

Synopsis: Put a mouse event in the venet queue.

Declaration: procedure PutMouseEvent (const MouseEvent: TMouseEvent)

Visibility: default

Description: PutMouseEvent adds MouseEvent to the input queue. The next call to GetMouseEvent (931) or PollMouseEvent will then return MouseEvent.

Please note that depending on the implementation the mouse event queue can hold only one value.

Errors: None.

See also: GetMouseEvent (931), PollMouseEvent (934)

28.4.12 SetMouseDriver

Synopsis: Set a new mouse driver.

Declaration: procedure SetMouseDriver (const Driver: TMouseDriver)

Visibility: default

Description: SetMouseDriver sets the mouse driver to Driver. This function should be called before InitMouse (933) is called, or after DoneMouse is called. If it is called after the mouse has been initialized, it does nothing.

For more information on setting the mouse driver, mousdrv (925).

For an example, see mousdrv (925)

See also: InitMouse (933), DoneMouse (930), GetMouseDriver (931)

28.4.13 SetMouseXY

Synopsis: Set the mouse cursor position.

Declaration: procedure SetMouseXY(x: Word; y: Word)

Visibility: default

Description: SetMouseXY places the mouse cursor on X, Y. X and Y are zero based character coordinates: 0, 0 is the top-left corner of the screen, and the position is in character cells (i.e. not in pixels).

Errors: None.

See also: GetMouseX (931), GetMouseY (932)

Listing: ./mouseex/ex7.pp

```
Program Example7;

{ Program to demonstrate the SetMouseXY function. }

Uses mouse;

begin
  InitMouse;
  Writeln('Click right mouse button to quit.');
  SetMouseXY(40,12);
  Repeat
    Writeln(GetMouseX, ', ', GetMouseY);
    If (GetMouseX>70) then
      SetMouseXY(10,GetMouseY);
    If (GetMouseY>20) then
      SetMouseXY(GetMouseX,5);
  Until (GetMouseButtons=MouseButtonRight);
  DoneMouse;
end.
```

28.4.14 ShowMouse

Synopsis: Show the mouse cursor.

Declaration: procedure ShowMouse

Visibility: default

Description: ShowMouse shows the mouse cursor if it was previously hidden. The capability to hide or show the mouse cursor depends on the driver.

For an example, see HideMouse (932)

Errors: None.

See also: HideMouse (932)

Chapter 29

Reference for unit 'Objects'

29.1 Overview

This document documents the objects unit. The unit was implemented by many people, and was mainly taken from the FreeVision sources. It has been ported to all supported platforms.

The methods and fields that are in a `Private` part of an object declaration have been left out of this documentation.

29.2 Constants, types and variables

29.2.1 Constants

`coIndexError = -1`

Collection list error: Index out of range

`coOverflow = -2`

Collection list error: Overflow

`DefaultTPCompatible : Boolean = False`

`DefaultTPCompatible` is used to initialize `tstream.tpcCompatible` ([1](#)).

`MaxBytes = 128 * 1024 * 128`

Maximum data size (in bytes)

`MaxCollectionSize = MaxBytes div (Pointer)`

Maximum collection size (in items)

`MaxPtrs = MaxBytes div (Pointer)`

Maximum data size (in pointers)

MaxReadBytes = \$7fffffff

Maximum data that can be read from a stream (not used)

MaxTPCompatibleCollectionSize = 65520 div 4

Maximum collection size (in items, same value as in TP)

MaxWords = MaxBytes div (Word)

Maximum data size (in words)

RCollection : TStreamRec = (ObjType: 50; VmtLink: (^ (TCollection))); Load: @TCollecti

Default stream record for the TCollection ([953](#)) object.

RStrCollection : TStreamRec = (ObjType: 69; VmtLink: (^ (TStrCollection))); Load: @TSt

Default stream record for the TStringCollection ([992](#)) object.

RStringCollection : TStreamRec = (ObjType: 51; VmtLink: (^ (TStringCollection))); Load:

Default stream record for the TStringCollection ([1002](#)) object.

RStringList : TStreamRec = (ObjType: 52; VmtLink: (^ (TStringList))); Load: @TStringLi

Default stream record for the TStringList ([1004](#)) object.

RStrListMaker : TStreamRec = (ObjType: 52; VmtLink: (^ (TStrListMaker))); Load: Nil; S

Default stream record for the TStringListMaker ([1006](#)) object.

stCreate = \$3C00

Stream initialization mode: Create new file

stError = -1

Stream error codes: Access error

stGetError = -5

Stream error codes: Get object error

stInitError = -2

Stream error codes: Initialize error

stOk = 0

Stream error codes: No error

stOpen = \$3D02

Stream initialization mode: Read/write access

stOpenError = -8

Stream error codes: Error opening stream

stOpenRead = \$3D00

Stream initialization mode: Read access only

stOpenWrite = \$3D01

Stream initialization mode: Write access only

stPutError = -6

Stream error codes: Put object error

stReadError = -3

Stream error codes: Stream read error

StreamError : Pointer = Nil

Pointer to default stream error handler.

stSeekError = -7

Stream error codes: Seek error in stream

stWriteError = -4

Stream error codes: Stream write error

vmtHeaderSize = 8

Size of the VMT header in an object (not used).

29.2.2 Types

AsciiZ = Array[0..255] of Char

FName - null terminated array of characters.

FNameStr = String

Filename - shortstring version.

```
LongRec = packed record
  Hi : Word;
  Lo : Word;
end
```

Record describing a longint (in Words)

```
PBufStream = ^TBufStream
```

Pointer to TBufStream ([949](#)) object.

```
PByteArray = ^TByteArray
```

Pointer to TByteArray ([941](#))

```
PCharSet = ^TCharSet
```

Pointer to TCharSet ([941](#)).

```
PCollection = ^TCollection
```

Pointer to TCollection ([953](#)) object.

```
PDosStream = ^TDosStream
```

Pointer to TDosStream ([967](#)) object.

```
PItemList = ^TItemList
```

Pointer to TItemList ([941](#)) object.

```
PMemoryStream = ^TMemoryStream
```

Pointer to TMemoryStream ([972](#)) object.

```
PObject = ^TObject
```

Pointer to TObject ([974](#)) object.

```
PPoint = ^TPoint
```

Pointer to TPoint ([976](#)) record.

```
PPointerArray = ^TPointerArray
```

Pointer to TPointerArray ([941](#))

```
PRect = ^TRect
```

Pointer to TRect ([976](#)) object.

PResourceCollection = ^TResourceCollection

Pointer to TResourceCollection ([982](#)) object.

PResourceFile = ^TResourceFile

Pointer to TResourceFile ([983](#)) object.

PSortedCollection = ^TSortedCollection

Pointer to TSortedCollection ([986](#)) object.

PStrCollection = ^TStrCollection

Pointer to TStrCollection ([992](#)) object.

PStream = ^TStream

Pointer type to TStream ([994](#))

PStreamRec = ^TStreamRec

Pointer to TStreamRec ([941](#))

PStrIndex = ^TStrIndex

Pointer to TStrIndex ([941](#)) array.

PString = PShortString

Pointer to a shortstring.

PStringCollection = ^TStringCollection

Pointer to TStringCollection ([1002](#)) object.

PStringList = ^TStringList

Pointer to TStringList ([1004](#)) object.

PStrListMaker = ^TStrListMaker

Pointer to TStrListMaker ([1006](#)) object.

```
PtrRec = packed record
  Ofs : Word;
  Seg : Word;
end
```

Record describing a pointer to a memory location.

PUnSortedStrCollection = ^TUnSortedStrCollection

Pointer to TUnsortedStrCollection ([1007](#)) object.

PWordArray = ^TWordArray

Pointer to TWordArray ([942](#))

Sw_Integer = LongInt

Alias for longint

Sw_Word = Cardinal

Alias for Cardinal

TByteArray = Array[0..MaxBytes-1] of Byte

Array with maximum allowed number of bytes.

TCharSet = Set of Char

Generic set of characters type.

TItemList = Array[0..MaxCollectionSize-1] of Pointer

Pointer array type used in a TCollection ([953](#))

TPointerArray = Array[0..MaxPtrs-1] of Pointer

Array with maximum allowed number of pointers

```
TStreamRec = packed record
  ObjType : Sw_Word;
  VmtLink : pointer;
  Load : Pointer;
  Store : Pointer;
  Next : PStreamRec;
end
```

TStreamRec is used by the Objects unit streaming mechanism: when an object is registered, a TStreamRec record is added to a list of records. This list is used when objects need to be streamed from/streamed to a stream. It contains all the information needed to stream the object.

TStrIndex = Array[0..9999] of TStrIndexRec

Pointer array type used in a TStringList ([1004](#))

```
TStrIndexRec = packed record
  Key : Sw_Word;
  Count : Word;
  Offset : Word;
end
```

Record type used in a TStringList ([1004](#)) to store the strings

```
TWordArray = Array[0..MaxWords-1] of Word
```

Array with maximum allowed number of words.

```
WordRec = packed record
  Hi : Byte;
  Lo : Byte;
end
```

Record describing a Word (in bytes)

29.2.3 Variables

invalidhandle : THandle

Value for invalid handle. Initial value for file stream handles or when the stream is closed.

29.3 Procedures and functions

29.3.1 Abstract

Synopsis: Abstract error handler.

Declaration: procedure Abstract

Visibility: default

Description: When implementing abstract methods, do not declare them as `abstract`. Instead, define them simply as `virtual`. In the implementation of such abstract methods, call the `Abstract` procedure. This allows explicit control of what happens when an abstract method is called.

The current implementation of `Abstract` terminates the program with a run-time error 211.

Errors: None.

29.3.2 CallPointerConstructor

Synopsis: Call a constructor with a pointer argument.

Declaration: function CallPointerConstructor(Ctor: pointer; Obj: pointer; VMT: pointer;
Param1: pointer) : pointer

Visibility: default

Description: CallVoidConstructor calls the constructor of an object. Ctor is the address of the constructor, Obj is a pointer to the instance. If it is Nil, then a new instance is allocated. VMT is a pointer to the object's VMT. Param1 is passed to the constructor. The return value is a pointer to the instance.

Note that this can only be used on constructors that require a pointer as the sole argument. It can also be used to call a constructor with a single argument by reference.

Errors: If the constructor expects other arguments than a pointer, the stack may be corrupted.

See also: [CallVoidConstructor](#) (944), [CallPointerMethod](#) (943), [CallVoidLocal](#) (944), [CallPointerLocal](#) (943), [CallVoidMethodLocal](#) (945), [CallPointerMethodLocal](#) (943)

29.3.3 CallPointerLocal

Synopsis: Call a local nested function with a pointer argument

Visibility: default

Description: CallPointerLocal calls the local procedure with address Func, where Frame is the frame of the wrapping function. It passes Param1 to the local function.

Errors: If the local function expects other parameters than a pointer, the stack may become corrupted.

See also: [CallPointerMethod](#) (943), [CallVoidMethod](#) (944), [CallVoidLocal](#) (944), [CallVoidMethodLocal](#) (945), [CallPointerMethodLocal](#) (943), [CallVoidConstructor](#) (944), [CallPointerConstructor](#) (942)

29.3.4 CallPointerMethod

Synopsis: Call a method with a single pointer argument

Visibility: default

Description: CallPointerMethod calls the method with address Method for instance Obj. It passes Param1 to the method as the single argument. It returns a pointer to the instance.

Errors: If the method expects other parameters than a single pointer, the stack may become corrupted.

See also: [CallVoidMethod](#) (944), [CallVoidLocal](#) (944), [CallPointerLocal](#) (943), [CallVoidMethodLocal](#) (945), [CallPointerMethodLocal](#) (943), [CallVoidConstructor](#) (944), [CallPointerConstructor](#) (942)

29.3.5 CallPointerMethodLocal

Synopsis: Call a local procedure of a method with a pointer argument

Declaration: function CallPointerMethodLocal(Func: pointer;Frame: Pointer;
Obj: pointer;Param1: pointer) : pointer

Visibility: default

Description: CallPointerMethodLocal calls the local procedure with address Func, where Frame is the frame of the wrapping method. It passes Param1 to the local function.

Errors: If the local function expects other parameters than a pointer, the stack may become corrupted.

See also: [CallPointerMethod](#) (943), [CallVoidMethod](#) (944), [CallPointerLocal](#) (943), [CallVoidLocal](#) (944), [CallVoidMethodLocal](#) (945), [CallVoidConstructor](#) (944), [CallPointerConstructor](#) (942)

29.3.6 CallVoidConstructor

Synopsis: Call a constructor with no arguments

Declaration: `function CallVoidConstructor(Ctor: pointer; Obj: pointer; VMT: pointer) : pointer`

Visibility: default

Description: `CallVoidConstructor` calls the constructor of an object. `Ctor` is the address of the constructor, `Obj` is a pointer to the instance. If it is `Nil`, then a new instance is allocated. `VMT` is a pointer to the object's VMT. The return value is a pointer to the instance.

Note that this can only be used on constructors that require no arguments.

Errors: If the constructor expects arguments, the stack may be corrupted.

See also: [CallPointerConstructor](#) (942), [CallPointerMethod](#) (943), [CallVoidLocal](#) (944), [CallPointerLocal](#) (943), [CallVoidMethodLocal](#) (945), [CallPointerMethodLocal](#) (943)

29.3.7 CallVoidLocal

Synopsis: Call a local nested procedure.

Declaration: `function CallVoidLocal(Func: pointer; Frame: Pointer) : pointer`

Visibility: default

Description: `CallVoidLocal` calls the local procedure with address `Func`, where `Frame` is the frame of the wrapping function.

Errors: If the local function expects parameters, the stack may become corrupted.

See also: [CallPointerMethod](#) (943), [CallVoidMethod](#) (944), [CallPointerLocal](#) (943), [CallVoidMethodLocal](#) (945), [CallPointerMethodLocal](#) (943), [CallVoidConstructor](#) (944), [CallPointerConstructor](#) (942)

29.3.8 CallVoidMethod

Synopsis: Call an object method

Declaration: `function CallVoidMethod(Method: pointer; Obj: pointer) : pointer`

Visibility: default

Description: `CallVoidMethod` calls the method with address `Method` for instance `Obj`. It returns a pointer to the instance.

Errors: If the method expects parameters, the stack may become corrupted.

See also: [CallPointerMethod](#) (943), [CallVoidLocal](#) (944), [CallPointerLocal](#) (943), [CallVoidMethodLocal](#) (945), [CallPointerMethodLocal](#) (943), [CallVoidConstructor](#) (944), [CallPointerConstructor](#) (942)

29.3.9 CallVoidMethodLocal

Synopsis: Call a local procedure of a method

Visibility: default

Description: CallVoidMethodLocal calls the local procedure with address Func, where Frame is the frame of the wrapping method.

Errors: If the local function expects parameters, the stack may become corrupted.

See also: [CallPointerMethod](#) (943), [CallVoidMethod](#) (944), [CallPointerLocal](#) (943), [CallVoidLocal](#) (944), [CallPointerMethodLocal](#) (943), [CallVoidConstructor](#) (944), [CallPointerConstructor](#) (942)

29.3.10 DisposeStr

Synopsis: Dispose of a shortstring which was allocated on the heap.

Declaration: procedure DisposeStr(P: PString)

Visibility: default

Description: DisposeStr removes a dynamically allocated string from the heap.

For an example, see NewStr (946).

Errors: None.

See also: [NewStr \(946\)](#), [SetStr \(948\)](#)

29.3.11 LongDiv

Synopsis: Overflow safe divide

Declaration: function LongDiv(X: LongInt;Y: Integer) : Integer

Visibility: default

Description: LongDiv divides X by Y. The result is of type Integer instead of type Longint, as you would get normally.

Errors: If Y is zero, a run-time error will be generated.

See also: LongMul (945)

29.3.12 LongMul

Synopsis: Overflow safe multiply.

Declaration: function LongMul(X: Integer;Y: Integer) : LongInt

Visibility: default

Description: `LongMul` multiplies `X` with `Y`. The result is of type `Longint`. This avoids possible overflow errors you would normally get when multiplying `X` and `Y` that are too big.

Errors: None.

See also: LongDiv (945)

29.3.13 NewStr

Synopsis: Allocate a copy of a shortstring on the heap.

Declaration: function NewStr(const S: string) : PString

Visibility: default

Description: NewStr makes a copy of the string S on the heap, and returns a pointer to this copy. If the string is empty then Nil is returned.

The allocated memory is not based on the declared size of the string passed to NewStr, but is based on the actual length of the string.

Errors: If not enough memory is available, an 'out of memory' error will occur.

See also: DisposeStr (945), SetStr (948)

Listing: ./objectex/ex40.pp

```
Program ex40;

{ Program to demonstrate the NewStr function }

Uses Objects;

Var S : String;
    P : PString;

begin
  S:= 'Some really cute string';
  P:=NewStr(S);
  If P^<>S then
    Writeln ('Oh-oh... Something is wrong !!');
  DisposeStr(P);
end.
```

29.3.14 RegisterObjects

Synopsis: Register standard objects.

Declaration: procedure RegisterObjects

Visibility: default

Description: RegisterObjects registers the following objects for streaming:

1. TCollection, see TCollection (953).
2. TStringCollection, see TStringCollection (1002).
3. TStrCollection, see TStrCollection (992).

Errors: None.

See also: RegisterType (947)

29.3.15 RegisterType

Synopsis: Register new object for streaming.

Declaration: procedure RegisterType(var S: TStreamRec)

Visibility: default

Description: RegisterType registers a new type for streaming. An object cannot be streamed unless it has been registered first. The stream record S needs to have the following fields set:

ObjType: **Sw_Word** This should be a unique identifier. Each possible type should have its own identifier.

VmtLink: **pointer** This should contain a pointer to the VMT (Virtual Method Table) of the object you try to register.

Load : **Pointer** is a pointer to a method that initializes an instance of that object, and reads the initial values from a stream. This method should accept as its sole argument a **PStream** type variable.

Store: **Pointer** is a pointer to a method that stores an instance of the object to a stream. This method should accept as its sole argument a **PStream** type variable.

The VMT of the object can be retrieved with the following expression:

```
VmtLink: Ofs(TypeOf(MyType)^);
```

Errors: In case of error (if a object with the same ObjType) is already registered), run-time error 212 occurs.

Listing: ./objectex/myobject.pp

Unit MyObject;

Interface

Uses Objects;

Type

```
PMyObject = ^TMyObject;
TMyObject = Object(TObject)
  Field : Longint;
  Constructor Init;
  Constructor Load (Var Stream : TStream);
  Destructor Done;
  Procedure Store (Var Stream : TStream);
  Function GetField : Longint;
  Procedure SetField (Value : Longint);
end;
```

Implementation

```
Constructor TMyobject.Init;
begin
  Inherited Init;
  Field:=-1;
end;
```

```

Constructor TMyobject.Load (Var Stream : TStream);

begin
  Stream.Read(Field, Sizeof(Field));
end;

Destructor TMyObject.Done;

begin
end;

Function TMyObject.GetField : Longint;

begin
  GetField:=Field;
end;

Procedure TMyObject.SetField (Value : Longint);

begin
  Field:=Value;
end;

Procedure TMyObject.Store (Var Stream : TStream);

begin
  Stream.Write(Field, SizeOf(Field));
end;

Const MyObjectRec : TStreamRec = (
  Objtype : 666;
  vmtlink : Ofs(TypeOf(TMyObject)^);
  Load : @TMyObject.Load;
  Store : @TMyObject.Store;
);

begin
  RegisterObjects;
  RegisterType (MyObjectRec);
end.

```

29.3.16 SetStr

Synopsis: Allocate a copy of a shortstring on the heap.

Declaration: procedure SetStr(var p: PString; const s: string)

Visibility: default

Description: SetStr makes a copy of the string S on the heap and returns the pointer to this copy in P. If P pointed to another string (i.e. was not Nil, the memory is released first. Contrary to NewStr (946), if the string is empty then a pointer to an empty string is returned.

The allocated memory is not based on the declared size of the string passed to NewStr, but is based on the actual length of the string.

Errors: If not enough memory is available, an 'out of memory' error will occur.

See also: [DisposeStr](#) (945), [NewStr](#) (946)

29.4 TBufStream

29.4.1 Description

`Bufstream` implements a buffered file stream. That is, all data written to the stream is written to memory first. Only when the buffer is full, or on explicit request, the data is written to disk.

Also, when reading from the stream, first the buffer is checked if there is any unread data in it. If so, this is read first. If not the buffer is filled again, and then the data is read from the buffer.

The size of the buffer is fixed and is set when constructing the file.

This is useful if you need heavy throughput for your stream, because it speeds up operations.

29.4.2 Method overview

Page	Property	Description
950	Close	Flush data and Close the file.
950	Done	Close the file and cleans up the instance.
950	Flush	FLush data from buffer, and write it to stream.
949	Init	Initialize an instance of <code>TBufStream</code> and open the file.
952	Open	Open the file if it is closed.
952	Read	Read data from the file to a buffer in memory.
951	Seek	Set current position in file.
951	Truncate	Flush buffer, and truncate the file at current position.
952	Write	Write data to the file from a buffer in memory.

29.4.3 TBufStream.Init

Synopsis: Initialize an instance of `TBufStream` and open the file.

Declaration: `constructor Init(FileName: FNameStr; Mode: Word; Size: Word)`

Visibility: default

Description: `Init` instantiates an instance of `TBufStream`. The name of the file that contains (or will contain) the data of the stream is given in `FileName`. The `Mode` parameter determines whether a new file should be created and what access rights you have on the file. It can be one of the following constants:

stCreateCreates a new file.

stOpenReadRead access only.

stOpenWriteWrite access only.

stOpenRead and write access.

The `Size` parameter determines the size of the buffer that will be created. It should be different from zero.

For an example see `TBufStream.Flush` (1).

Errors: On error, `Status` is set to `stInitError`, and `ErrorInfo` is set to the dos error code.

See also: `TDosStream.Init` (1), `TBufStream.Done` (1)

29.4.4 **TBufStream.Done**

Synopsis: Close the file and cleans up the instance.

Declaration: `destructor Done; Virtual`

Visibility: default

Description: Done flushes and closes the file if it was open and cleans up the instance of TBufStream.

For an example see [TBufStream.Flush \(1\)](#).

Errors: None.

See also: [TDosStream.Done \(1\)](#), [TBufStream.Init \(1\)](#), [TBufStream.Close \(1\)](#)

29.4.5 **TBufStream.Close**

Synopsis: Flush data and Close the file.

Declaration: `procedure Close; Virtual`

Visibility: default

Description: Close flushes and closes the file if it was open, and sets Handle to -1. Contrary to Done (1) it does not clean up the instance of TBufStream

For an example see [TBufStream.Flush \(1\)](#).

Errors: None.

See also: [TStream.Close \(1\)](#), [TBufStream.Init \(1\)](#), [TBufStream.Done \(1\)](#)

29.4.6 **TBufStream.Flush**

Synopsis: Flush data from buffer, and write it to stream.

Declaration: `procedure Flush; Virtual`

Visibility: default

Description: When the stream is in write mode, the contents of the buffer are written to disk, and the buffer position is set to zero. When the stream is in read mode, the buffer position is set to zero.

Errors: Write errors may occur if the file was in write mode. see [Write \(1\)](#) for more info on the errors.

See also: [TStream.Close \(1\)](#), [TBufStream.Init \(1\)](#), [TBufStream.Done \(1\)](#)

Listing: ./objectex/ex15.pp

Program ex15;

{ Program to demonstrate the TStream.Flush method }

Uses Objects;

Var L : String;
P : PString;
S : PBufStream; { Only one with Flush implemented. }

begin

```

L:= 'Some constant string';
{ Buffer size of 100 }
S:=New(PBufStream, Init('test.dat', stCreate, 100));
WriteLn ('Writing ', L, '" to stream with handle ', S^.Handle);
S^.WriteStr(@L);
{ At this moment, there is no data on disk yet. }
S^.Flush;
{ Now there is. }
S^.WriteStr(@L);
{ Close calls flush first }
S^.Close;
WriteLn ('Closed stream. File handle is ', S^.Handle);
S^.Open(stOpenRead);
P:=S^.ReadStr;
L:=P^;
DisposeStr(P);
WriteLn ('Read ', L, " from stream with handle ', S^.Handle);
S^.Close;
Dispose(S, Done);
end.

```

29.4.7 TBufStream.Truncate

Synopsis: Flush buffer, and truncate the file at current position.

Declaration: procedure Truncate; Virtual

Visibility: default

Description: If the status of the stream is `stOK`, then `Truncate` tries to flush the buffer, and then truncates the stream size to the current file position.

For an example, see `TDosStream.Truncate` (1).

Errors: Errors can be those of `Flush` (1) or `TDosStream.Truncate` (1).

See also: `TStream.Truncate` (1), `TDosStream.Truncate` (1), `TStream.GetSize` (1)

29.4.8 TBufStream.Seek

Synopsis: Set current position in file.

Declaration: procedure Seek(Pos: LongInt); Virtual

Visibility: default

Description: If the stream's status is `stOK`, then `Seek` sets the file position to `Pos`. `Pos` is a zero-based offset, counted from the beginning of the file.

For an example, see `TStream.Seek` (1);

Errors: In case an error occurs, the stream's status is set to `stSeekError`, and the OS error code is stored in `ErrorInfo`.

See also: `TStream.Seek` (1), `TStream.GetPos` (1)

29.4.9 **TBufStream.Open**

Synopsis: Open the file if it is closed.

Declaration: procedure Open(OpenMode: Word); Virtual

Visibility: default

Description: If the stream's status is `stOK`, and the stream is closed then `Open` re-opens the file stream with mode `OpenMode`. This call can be used after a `Close` (1) call.

For an example, see `TDosStream.Open` (1).

Errors: If an error occurs when re-opening the file, then `Status` is set to `stOpenError`, and the OS error code is stored in `ErrorInfo`.

See also: `TStream.Open` (1), `TBufStream.Close` (1)

29.4.10 **TBufStream.Read**

Synopsis: Read data from the file to a buffer in memory.

Declaration: procedure Read(var Buf; Count: LongInt); Virtual

Visibility: default

Description: If the Stream is open and the stream status is `stOK` then `Read` will read `Count` bytes from the stream and place them in `Buf`.

`Read` will first try to read the data from the stream's internal buffer. If insufficient data is available, the buffer will be filled before continuing to read. This process is repeated until all needed data has been read.

For an example, see `TStream.Read` (1).

Errors: In case of an error, `Status` is set to `StReadError`, and `ErrorInfo` gets the OS specific error, or 0 when an attempt was made to read beyond the end of the stream.

See also: `TStream.Read` (1), `TBufStream.Write` (1)

29.4.11 **TBufStream.Write**

Synopsis: Write data to the file from a buffer in memory.

Declaration: procedure Write(var Buf; Count: LongInt); Virtual

Visibility: default

Description: If the Stream is open and the stream status is `stOK` then `Write` will write `Count` bytes from `Buf` and place them in the stream.

`Write` will first try to write the data to the stream's internal buffer. When the internal buffer is full, then the contents will be written to disk. This process is repeated until all data has been written.

For an example, see `TStream.Read` (1).

Errors: In case of an error, `Status` is set to `StWriteError`, and `ErrorInfo` gets the OS specific error.

See also: `TStream.Write` (1), `TBufStream.Read` (1)

29.5 TCollection

29.5.1 Description

The TCollection object manages a collection of pointers or objects. It also provides a series of methods to manipulate these pointers or objects.

Whether or not objects are used depends on the kind of calls you use. All kinds come in 2 flavors, one for objects, one for pointers.

29.5.2 Method overview

Page	Property	Description
955	At	Return the item at a certain index.
963	AtDelete	Delete item at certain position.
962	AtFree	Free an item at the indicates position, calling it's destructor.
966	AtInsert	Insert an element at a certain position in the collection.
966	AtPut	Set collection item, overwriting an existing value.
962	Delete	Delete an item from the collection, but does not destroy it.
960	DeleteAll	Delete all elements from the collection. Objects are not destroyed.
954	Done	Clean up collection, release all memory.
965	Error	Set error code.
957	FirstThat	Return first item which matches a test.
964	ForEach	Execute procedure for each item in the list.
961	Free	Free item from collection, calling it's destructor.
959	FreeAll	Release all objects from the collection.
963	FreeItem	Destroy a non-nil item.
956	GetItem	Read one item off the stream.
955	IndexOf	Find the position of a certain item.
953	Init	Instantiate a new collection.
961	Insert	Insert a new item in the collection at the end.
957	LastThat	Return last item which matches a test.
954	Load	Initialize a new collection and load collection from a stream.
958	Pack	Remove all >Nil pointers from the collection.
967	PutItem	Put one item on the stream
965	SetLimit	Set maximum number of elements in the collection.
967	Store	Write collection to a stream.

29.5.3 TCollection.Init

Synopsis: Instantiate a new collection.

Declaration: constructor Init (ALimit: Sw_Integer; ADelta: Sw_Integer)

Visibility: default

Description: Init initializes a new instance of a collection. It sets the (initial) maximum number of items in the collection to ALimit. ADelta is the increase size : The number of memory places that will be allocated in case ALimit is reached, and another element is added to the collection.

For an example, see TCollection.ForEach (1).

Errors: None.

See also: TCollection.Load (1), TCollection.Done (1)

29.5.4 TCollection.Load

Synopsis: Initialize a new collection and load collection from a stream.

Declaration: constructor Load(var S: TStream)

Visibility: default

Description: Load initializes a new instance of a collection. It reads from stream S the item count, the item limit count, and the increase size. After that, it reads the specified number of items from the stream.

Errors: Errors returned can be those of GetItem (1).

See also: TCollection.Init (1), TCollection.GetItem (1), TCollection.Done (1)

Listing: ./objectex/ex22.pp

```
Program ex22;

{ Program to demonstrate the TCollection.Load method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;
    M : PMyObject;
    I : Longint;
    S : PMemoryStream;

begin
  C:=New(PCollection, Init(100,10));
  For I:=1 to 100 do
    begin
      M:=New(PMyObject, Init());
      M^.SetField(100-I);
      C^.Insert(M);
    end;
  Writeln ('Inserted ',C^.Count,' objects');
  S:=New(PMemoryStream, Init(1000,10));
  C^.Store(S^);
  C^.FreeAll;
  Dispose(C,Done);
  S^.Seek(0);
  C^.Load(S^);
  Writeln ('Read ',C^.Count,' objects from stream.');
  Dispose(S,Done);
  Dispose(C,Done);
end.
```

29.5.5 TCollection.Done

Synopsis: Clean up collection, release all memory.

Declaration: destructor Done; Virtual

Visibility: default

Description: Done frees all objects in the collection, and then releases all memory occupied by the instance.

For an example, see TCollection.ForEach (1).

Errors: None.

See also: [TCollection.Init](#) ([1](#)), [TCollection.FreeAll](#) ([1](#))

29.5.6 TCollection.At

Synopsis: Return the item at a certain index.

Declaration: `function At (Index: Sw_Integer) : Pointer`

Visibility: default

Description: `At` returns the item at position `Index`.

Errors: If `Index` is less than zero or larger than the number of items in the collection, see `pl{Error}` (`TCollection.Error`) is called with `coIndexError` and `Index` as arguments, resulting in a run-time error.

See also: [TCollection.Insert](#) ([1](#))

Listing: `./objectex/ex23.pp`

Program ex23;

```
{ Program to demonstrate the TCollection.At method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;
    M : PMyObject;
    I : Longint;

begin
  C:=New(PCollection, Init(100,10));
  For I:=1 to 100 do
    begin
      M:=New(PMyObject, Init);
      M^.SetField(100-I);
      C^.Insert(M);
    end;
  For I:=0 to C^.Count-1 do
    begin
      M:=C^.At(I);
      WriteLn ('Object ',I,', has field : ',M^.GetField);
    end;
  C^.FreeAll;
  Dispose(C,Done);
end.
```

29.5.7 TCollection.IndexOf

Synopsis: Find the position of a certain item.

Declaration: `function IndexOf(Item: Pointer) : Sw_Integer; Virtual`

Visibility: default

Description: `IndexOf` returns the index of `Item` in the collection. If `Item` isn't present in the collection, -1 is returned.

Errors: If the item is not present, -1 is returned.

See also: TCollection.At (1), TCollection.GetItem (1), TCollection.Insert (1)

Listing: ./objectex/ex24.pp

```
Program ex24;

{ Program to demonstrate the TCollection.IndexOf method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;
    M, Keep : PMyObject;
    I : Longint;

begin
    Randomize;
    C:=New(PCollection, Init(100,10));
    Keep:=Nil;
    For I:=1 to 100 do
        begin
            M:=New(PMyObject, Init);
            M^.SetField(I-1);
            If Random<0.1 then
                Keep:=M;
            C^.Insert(M);
        end;
    If Keep=Nil then
        begin
            Writeln ('Please run again. No object selected');
            Halt(1);
        end;
    Writeln ('Selected object has field : ',Keep^.GetField);
    Write ('Selected object has index : ',C^.IndexOf(Keep));
    Writeln (' should match it''s field.');
    C^.FreeAll;
    Dispose(C,Done);
end.
```

29.5.8 TCollection.GetItem

Synopsis: Read one item off the stream.

Declaration: function GetItem(var S: TStream) : Pointer; Virtual

Visibility: default

Description: GetItem reads a single item off the stream S, and returns a pointer to this item. This method is used internally by the Load method, and should not be used directly.

Errors: Possible errors are the ones from TStream.Get (1).

See also: TStream.Get (1), TCollection.Store (1)

29.5.9 TCollection.LastThat

Synopsis: Return last item which matches a test.

Declaration: function LastThat(Test: Pointer) : Pointer

Visibility: default

Description: This function returns the last item in the collection for which Test returns a non-nil result. Test is a function that accepts 1 argument: a pointer to an object, and that returns a pointer as a result.

Errors: None.

See also: TCollection.FirstThat ([1](#))

Listing: ./objectex/ex25.pp

```
Program ex21;

{ Program to demonstrate the TCollection.Foreach method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;
    M : PMyObject;
    I : Longint;

Function CheckField (Dummy: Pointer;P : PMyObject) : Longint;

begin
  If P^.GetField <56 then
    Checkfield:=1
  else
    CheckField:=0;
end;

begin
  C:=New( PCollection , Init(100,10));
  For I:=1 to 100 do
    begin
      M:=New(PMyObject , Init );
      M^.SetField(I);
      C^.Insert(M);
    end;
  Writeln ('Inserted ',C^.Count,' objects');
  Writeln ('Last one for which Field<56 has index (should be 54) : ',
            C^.IndexOf(C^.LastThat(@CheckField)));
  C^.FreeAll;
  Dispose(C,Done);
end.
```

29.5.10 TCollection.FirstThat

Synopsis: Return first item which matches a test.

Declaration: function FirstThat(Test: Pointer) : Pointer

Visibility: default

Description: This function returns the first item in the collection for which `Test` returns a non-nil result. `Test` is a function that accepts 1 argument: a pointer to an object, and that returns a pointer as a result.

Errors: None.

See also: `TCollection.LastThat` (1)

Listing: ./objectex/ex26.pp

```

Program ex21;

{ Program to demonstrate the TCcollection.FirstThat method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;
     M : PMyObject;
     I : Longint;

Function CheckField (Dummy: Pointer;P : PMyObject) : Longint;

begin
  If P^.GetField>56 then
    Checkfield:=1
  else
    CheckField:=0;
end;

begin
  C:=New(PCollection, Init(100,10));
  For I:=1 to 100 do
    begin
      M:=New(PMyObject, Init);
      M^.SetField(I);
      C^.Insert(M);
    end;
  Writeln ('Inserted ',C^.Count,' objects');
  Writeln ('first one for which Field>56 has index (should be 56) : ',
            C^.Indexof(C^.FirstThat(@CheckField)));
  C^.FreeAll;
  Dispose(C,Done);
end.

```

29.5.11 **TCollection.Pack**

Synopsis: Remove all >Nil pointers from the collection.

Declaration: `procedure Pack`

Visibility: default

Description: `Pack` removes all `Nil` pointers from the collection, and adjusts `Count` to reflect this change. No memory is freed as a result of this call. In order to free any memory, you can call `SetLimit` with an argument of `Count` after a call to `Pack`.

Errors: None.

See also: `TCollection.SetLimit` (1)

Listing: ./objectex/ex26.pp

```

Program ex21;

{ Program to demonstrate the TCollection.FirstThat method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;
     M : PMyObject;
     I : Longint;

Function CheckField (Dummy: Pointer; P : PMyObject) : Longint;

begin
  If P^.GetField > 56 then
    CheckField := 1
  else
    CheckField := 0;
end;

begin
  C := New(PCollection, Init(100, 10));
  For I := 1 to 100 do
    begin
      M := New(PMyObject, Init);
      M^.SetField(I);
      C^.Insert(M);
    end;
  Writeln ('Inserted ', C^.Count, ' objects');
  Writeln ('first one for which Field > 56 has index (should be 56) : ',
            C^.IndexOf(C^.FirstThat(@CheckField)));
  C^.FreeAll;
  Dispose(C, Done);
end.

```

29.5.12 TCollection.FreeAll

Synopsis: Release all objects from the collection.

Declaration: procedure FreeAll

Visibility: default

Description: FreeAll calls the destructor of each object in the collection. It doesn't release any memory occupied by the collection itself, but it does set Count to zero.

See also: TCollection.DeleteAll ([1](#)), TCollection.FreeItem ([1](#))

Listing: ./objectex/ex28.pp

```

Program ex28;

{ Program to demonstrate the TCollection.FreeAll method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;

```

```

M : PMyObject;
I : Longint;

begin
  Randomize;
  C:=New( PCollection , Init(120,10));
  For I:=1 to 100 do
    begin
      M:=New(PMyObject , Init );
      M^. SetField(I-1);
      C^. Insert(M);
    end;
  Writeln ( 'Added 100 Items.' );
  C^. FreeAll;
  Writeln ( 'Freed all objects.' );
  Dispose(C,Done);
end.

```

29.5.13 TCollection.DeleteAll

Synopsis: Delete all elements from the collection. Objects are not destroyed.

Declaration: procedure DeleteAll

Visibility: default

Description: DeleteAll deletes all elements from the collection. It just sets the Count variable to zero. Contrary to FreeAll (1), DeleteAll doesn't call the destructor of the objects.

Errors: None.

See also: TCollection.FreeAll (1), TCollection.Delete (1)

Listing: ./objectex/ex29.pp

```

Program ex29;

{
  Program to demonstrate the TCollection.DeleteAll method
  Compare with example 28, where FreeAll is used.
}

Uses Objects ,MyObject; { For TMyObject definition and registration }

Var C : PCollection;
     M : PMyObject;
     I : Longint;

begin
  Randomize;
  C:=New( PCollection , Init(120,10));
  For I:=1 to 100 do
    begin
      M:=New(PMyObject , Init );
      M^. SetField(I-1);
      C^. Insert(M);
    end;
  Writeln ( 'Added 100 Items.' );

```

```
C^.DeleteAll;
Writeln ('Deleted all objects.');
Dispose(C.Done);
end.
```

29.5.14 TCollection.Free

Synopsis: Free item from collection, calling it's destructor.

Declaration: procedure Free(Item: Pointer)

Visibility: default

Description: Free Deletes Item from the collection, and calls the destructor Done of the object.

Errors: If the Item is not in the collection, Error will be called with coIndexError.

See also: TCollection.FreeItem (1)

Listing: ./objectex/ex30.pp

```
Program ex30;

{ Program to demonstrate the TCollection.Free method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;
    M : PMyObject;
    I : Longint;

begin
    Randomize;
    C:=New(PCollection, Init(120,10));
    For I:=1 to 100 do
        begin
            M:=New(PMyObject, Init);
            M^.SetField(I-1);
            C^.Insert(M);
        end;
    Writeln ('Added 100 items.');
    With C^ do
        While Count>0 do Free(At(Count-1));
    Writeln ('Freed all objects.');
    Dispose(C.Done);
end.
```

29.5.15 TCollection.Insert

Synopsis: Insert a new item in the collection at the end.

Declaration: procedure Insert(Item: Pointer); Virtual

Visibility: default

Description: Insert inserts Item in the collection. TCollection inserts this item at the end, but descendent objects may insert it at another place.

Errors: None.

See also: TCollection.AtInsert ([1](#)), TCollection.AtPut ([1](#))

29.5.16 TCollection.Delete

Synopsis: Delete an item from the collection, but does not destroy it.

Declaration: procedure Delete(Item: Pointer)

Visibility: default

Description: Delete deletes Item from the collection. It doesn't call the item's destructor, though. For this the Free ([1](#)) call is provided.

Errors: If the Item is not in the collection, Error will be called with coIndexError.

See also: TCollection.AtDelete ([1](#)), TCollection.Free ([1](#))

Listing: ./objectex/ex31.pp

```
Program ex31;

{ Program to demonstrate the TCollection.Delete method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;
    M : PMyObject;
    I : Longint;

begin
    Randomize;
    C:=New(PCollection, Init(120,10));
    For I:=1 to 100 do
        begin
            M:=New(PMyObject, Init);
            M^.SetField(I-1);
            C^.Insert(M);
        end;
    Writeln ('Added 100 Items.');
    With C^ do
        While Count>0 do Delete(At(Count-1));
    Writeln ('Freed all objects');
    Dispose(C, Done);
end.
```

29.5.17 TCollection.AtFree

Synopsis: Free an item at the indicates position, calling it's destructor.

Declaration: procedure AtFree(Index: Sw_Integer)

Visibility: default

Description: AtFree deletes the item at position Index in the collection, and calls the item's destructor if it is not Nil.

Errors: If `Index` isn't valid then Error (1) is called with `CoIndexError`.

See also: `TCollection.Free` (1), `TCollection.AtDelete` (1)

Listing: ./objectex/ex32.pp

```

Program ex32;

{ Program to demonstrate the TCollection.AtFree method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;
     M : PMyObject;
     I : Longint;

begin
  Randomize;
  C:=New(PCollection, Init(120,10));
  For I:=1 to 100 do
    begin
      M:=New(PMyObject, Init);
      M^.SetField(I-1);
      C^.Insert(M);
    end;
  Writeln ('Added 100 Items');
  With C^ do
    While Count>0 do AtFree(Count-1);
  Writeln ('Freed all objects.');
  Dispose(C,Done);
end.

```

29.5.18 TCollection.FreeItem

Synopsis: Destroy a non-nil item.

Declaration: `procedure FreeItem(Item: Pointer); Virtual`

Visibility: default

Description: `FreeItem` calls the destructor of `Item` if it is not nil.

Remark: This function is used internally by the `TCollection` object, and should not be called directly.

Errors: None.

See also: `TCollection.Free` (1), `TCollection.AtFree` (1)

29.5.19 TCollection.AtDelete

Synopsis: Delete item at certain position.

Declaration: `procedure AtDelete(Index: Sw_Integer)`

Visibility: default

Description: `AtDelete` deletes the pointer at position `Index` in the collection. It doesn't call the object's destructor.

Errors: If Index isn't valid then Error (1) is called with CoIndexError.

See also: TCollection.Delete (1)

Listing: ./objectex/ex33.pp

```
Program ex33;

{ Program to demonstrate the TCollection.AtDelete method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;
    M : PMyObject;
    I : Longint;

begin
    Randomize;
    C:=New(PCollection, Init(120,10));
    For I:=1 to 100 do
        begin
            M:=New(PMyObject, Init);
            M^.SetField(I-1);
            C^.Insert(M);
        end;
    Writeln ('Added 100 Items.');
    With C^ do
        While Count>0 do AtDelete(Count-1);
    Writeln ('Freed all objects.');
    Dispose(C,Done);
end.
```

29.5.20 TCollection.ForEach

Synopsis: Execute procedure for each item in the list.

Declaration: procedure ForEach(Action: Pointer)

Visibility: default

Description: ForEach calls Action for each element in the collection, and passes the element as an argument to Action.

Action is a procedural type variable that accepts a pointer as an argument.

Errors: None.

See also: TCollection.FirstThat (1), TCollection.LastThat (1)

Listing: ./objectex/ex21.pp

```
Program ex21;

{ Program to demonstrate the TCollection.Foreach method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;
```

```

M : PMyObject;
I : Longint;

Procedure PrintField (Dummy: Pointer;P : PMyObject);

begin
  Writeln ('Field : ',P^.GetField);
end ;

begin
  C:=New(PCollection ,Init(100,10));
  For I:=1 to 100 do
    begin
      M:=New(PMyObject ,Init );
      M^.SetField(100-I);
      C^.Insert(M);
    end;
  Writeln ('Inserted ',C^.Count,' objects');
  C^.ForEach(@PrintField);
  C^.FreeAll;
  Dispose(C,Done);
end.

```

29.5.21 TCollection.SetLimit

Synopsis: Set maximum number of elements in the collection.

Declaration: procedure SetLimit (ALimit: Sw_Integer); Virtual

Visibility: default

Description: SetLimit sets the maximum number of elements in the collection. ALimit must not be less than Count, and should not be larger than MaxCollectionSize

For an example, see Pack ([1](#)).

Errors: None.

See also: TCollection.Init ([1](#))

29.5.22 TCollection.Error

Synopsis: Set error code.

Declaration: procedure Error (Code: Integer; Info: Integer); Virtual

Visibility: default

Description: Error is called by the various TCollection methods in case of an error condition. The default behaviour is to make a call to RunError with an error of 212-Code.

This method can be overridden by descendant objects to implement a different error-handling.

See also: Abstract ([942](#))

29.5.23 TCollection.AtPut

Synopsis: Set collection item, overwriting an existing value.

Declaration: procedure AtPut (Index: Sw_Integer; Item: Pointer)

Visibility: default

Description: AtPut sets the element at position Index in the collection to Item. Any previous value is overwritten.

For an example, see Pack (1).

Errors: If Index isn't valid then Error (1) is called with CoIndexError.

29.5.24 TCollection.AtInsert

Synopsis: Insert an element at a certain position in the collection.

Declaration: procedure AtInsert (Index: Sw_Integer; Item: Pointer)

Visibility: default

Description: AtInsert inserts Item in the collection at position Index, shifting all elements by one position. In case the current limit is reached, the collection will try to expand with a call to SetLimit

Errors: If Index isn't valid then Error (1) is called with CoIndexError. If the collection fails to expand, then coOverflow is passed to Error.

See also: TCollection.Insert (1)

Listing: ./objectex/ex34.pp

```

Program ex34;

{ Program to demonstrate the TCollection.AtInsert method }

Uses Objects, MyObject; { For TMyObject definition and registration }

Var C : PCollection;
     M : PMyObject;
     I : Longint;

Procedure PrintField (Dummy: Pointer; P : PMyObject);

begin
  Writeln ('Field : ', P^.GetField);
end;
```



```

begin
  Randomize;
  C:=New(PCollection, Init(120,10));
  Writeln ('Inserting 100 records at random places.');
  For I:=1 to 100 do
    begin
      M:=New(PMyObject, Init );
      M^.SetField(I-1);
      If I=1 then
        C^.Insert(M)
    
```

```

else
  With C^ do
    AtInsert(Random(Count),M);
  end;
  WriteLn ('Values : ');
  C^.Foreach(@PrintField);
  Dispose(C,Done);
end.

```

29.5.25 TCollection.Store

Synopsis: Write collection to a stream.

Declaration: procedure Store(var S: TStream)

Visibility: default

Description: Store writes the collection to the stream S. It does this by writing the current Count, Limit and Delta to the stream, and then writing each item to the stream.

The contents of the stream are then suitable for instantiating another collection with Load (1).

For an example, see TCollection.Load (1).

Errors: Errors returned are those by TStream.Put (1).

See also: TCollection.Load (1), TCollection.PutItem (1)

29.5.26 TCollection.PutItem

Synopsis: Put one item on the stream

Declaration: procedure PutItem(var S: TStream; Item: Pointer); Virtual

Visibility: default

Description: PutItem writes Item to stream S. This method is used internally by the TCollection object, and should not be called directly.

Errors: Errors are those returned by TStream.Put (1).

See also: Store (1), GetItem (1)

29.6 TDosStream

29.6.1 Description

TDosStream is a stream that stores its contents in a file. It overrides a couple of methods of TStream (994) for this.

In addition to the fields inherited from TStream (see TStream (994)), there are some extra fields, that describe the file. (mainly the name and the OS file handle)

No buffering in memory is done when using TDosStream. All data are written directly to the file. For a stream that buffers in memory, see TBufStream (949).

29.6.2 Method overview

Page	Property	Description
969	Close	Close the file.
968	Done	Closes the file and cleans up the instance.
968	Init	Instantiate a new instance of TDosStream.
971	Open	Open the file stream
971	Read	Read data from the stream to a buffer.
970	Seek	Set file position.
969	Truncate	Truncate the file on the current position.
972	Write	Write data from a buffer to the stream.

29.6.3 TDosStream.Init

Synopsis: Instantiate a new instance of TDosStream.

Declaration: constructor Init(FileName: FNameStr; Mode: Word)

Visibility: default

Description: `Init` instantiates an instance of TDosStream. The name of the file that contains (or will contain) the data of the stream is given in `FileName`. The `Mode` parameter determines whether a new file should be created and what access rights you have on the file. It can be one of the following constants:

stCreateCreates a new file.

stOpenReadRead access only.

stOpenWriteWrite access only.

stOpenRead and write access.

For an example, see `TDosStream.Truncate` (1).

Errors: On error, `Status` (1) is set to `stInitError`, and `ErrorInfo` is set to the dos error code.

See also: `TDosStream.Done` (1)

29.6.4 TDosStream.Done

Synopsis: Closes the file and cleans up the instance.

Declaration: destructor Done; Virtual

Visibility: default

Description: `Done` closes the file if it was open and cleans up the instance of TDosStream.

for an example, see e.g. `TDosStream.Truncate` (1).

Errors: None.

See also: `TDosStream.Init` (1), `TDosStream.Close` (1)

29.6.5 TDosStream.Close

Synopsis: Close the file.

Declaration: procedure Close; Virtual

Visibility: default

Description: Close closes the file if it was open, and sets Handle to -1. Contrary to Done (1) it does not clean up the instance of TDosStream

For an example, see TDosStream.Open (1).

Errors: None.

See also: TStream.Close (1), TDosStream.Init (1), TDosStream.Done (1)

29.6.6 TDosStream.Truncate

Synopsis: Truncate the file on the current position.

Declaration: procedure Truncate; Virtual

Visibility: default

Description: If the status of the stream is stOK, then Truncate tries to truncate the stream size to the current file position.

Errors: If an error occurs, the stream's status is set to stError and ErrorInfo is set to the OS error code.

See also: TStream.Truncate (1), TStream.GetSize (1)

Listing: ./objectex/ex16.pp

```
Program ex16;

{ Program to demonstrate the TStream.Truncate method }

Uses Objects;

Var L : String;
    P : PString;
    S : PDosStream; { Only one with Truncate implemented. }

begin
    L:='Some constant string';
    { Buffer size of 100 }
    S:=New(PDosStream,Init('test.dat',stcreate));
    Writeln ('Writing ''',L,'" to stream with handle ',S^.Handle);
    S^.WriteStr(@L);
    S^.WriteStr(@L);
    { Close calls flush first }
    S^.Close;
    S^.Open (stOpen);
    Writeln ('Size of stream is : ',S^.GetSize);
    P:=S^.ReadStr;
    L:=P^;
    DisposeStr(P);
    Writeln ('Read ''',L,'" from stream with handle ',S^.Handle);
```

```

S^.Truncate;
WriteLn ('Truncated stream. Size is : ', S^.GetSize);
S^.Close;
Dispose (S, Done);
end.

```

29.6.7 TDosStream.Seek

Synopsis: Set file position.

Declaration: procedure Seek (Pos: LongInt); Virtual

Visibility: default

Description: If the stream's status is stOK, then Seek sets the file position to Pos. Pos is a zero-based offset, counted from the beginning of the file.

Errors: In case an error occurs, the stream's status is set to stSeekError, and the OS error code is stored in ErrorInfo.

See also: TStream.Seek ([1](#)), TStream.GetPos ([1](#))

Listing: ./objectex/ex17.pp

Program ex17;

{ Program to demonstrate the TStream.Seek method }

Uses Objects;

```

Var L : String;
    Marker : Word;
    P : PString;
    S : PDosStream;

begin
    L:='Some constant string';
    { Buffer size of 100 }
    S:=New(PDosStream, Init('test.dat', stCreate));
    WriteLn ('Writing ', L, ' to stream.');
    S^.WriteStr(@L);
    Marker:=S^.GetPos;
    WriteLn ('Set marker at ', Marker);
    L:='Some other constant String';
    WriteLn ('Writing ', L, ' to stream.');
    S^.WriteStr(@L);
    S^.Close;
    S^.Open (stOpenRead);
    WriteLn ('Size of stream is : ', S^.GetSize);
    WriteLn ('Seeking to marker');
    S^.Seek(Marker);
    P:=S^.ReadStr;
    L:=P^;
    DisposeStr(P);
    WriteLn ('Read ', L, ' from stream.');
    S^.Close;
    Dispose (S, Done);
end.

```

29.6.8 TDosStream.Open

Synopsis: Open the file stream

Declaration: procedure Open(OpenMode: Word); Virtual

Visibility: default

Description: If the stream's status is stOK, and the stream is closed then Open re-opens the file stream with mode OpenMode. This call can be used after a Close (1) call.

Errors: If an error occurs when re-opening the file, then Status is set to stOpenError, and the OS error code is stored in ErrorInfo

See also: TStream.Open (1), TDosStream.Close (1)

Listing: ./objectex/ex14.pp

```
Program ex14;

{ Program to demonstrate the TStream.Close method }

Uses Objects;

Var L : String;
    P : PString;
    S : PDosStream; { Only one with Close implemented. }

begin
  L:='Some constant string';
  S:=New(PDosStream, Init('test.dat',stcreate));
  Writeln ('Writing ',L,'" to stream with handle ',S^.Handle);
  S^.WriteStr(@L);
  S^.Close;
  Writeln ('Closed stream. File handle is ',S^.Handle);
  S^.Open (stOpenRead);
  P:=S^.ReadStr;
  L:=P^;
  DisposeStr(P);
  Writeln ('Read ',L,'" from stream with handle ',S^.Handle);
  S^.Close;
  Dispose (S,Done);
end.
```

29.6.9 TDosStream.Read

Synopsis: Read data from the stream to a buffer.

Declaration: procedure Read(var Buf;Count: LongInt); Virtual

Visibility: default

Description: If the Stream is open and the stream status is stOK then Read will read Count bytes from the stream and place them in Buf.

For an example, see TStream.Read (1).

Errors: In case of an error, Status is set to StReadError, and ErrorInfo gets the OS specific error, or 0 when an attempt was made to read beyond the end of the stream.

See also: TStream.Read (1), TDosStream.Write (1)

29.6.10 TDosStream.Write

Synopsis: Write data from a buffer to the stream.

Declaration: procedure Write(var Buf; Count: LongInt); Virtual

Visibility: default

Description: If the Stream is open and the stream status is stOK then Write will write Count bytes from Buf and place them in the stream.

For an example, see TStream.Read ([1](#)).

Errors: In case of an error, Status is set to StWriteError, and ErrorInfo gets the OS specific error.

See also: TStream.Write ([1](#)), TDosStream.Read ([1](#))

29.7 TMemoryStream

29.7.1 Description

The TMemoryStream object implements a stream that stores its data in memory. The data is stored on the heap, with the possibility to specify the maximum amount of data, and the size of the memory blocks being used.

See also: TStream ([994](#))

29.7.2 Method overview

Page	Property	Description
973	Done	Clean up memory and destroy the object instance.
972	Init	Initialize memory stream, reserves memory for stream data.
974	Read	Read data from the stream to a location in memory.
973	Truncate	Set the stream size to the current position.
974	Write	Write data to the stream.

29.7.3 TMemoryStream.Init

Synopsis: Initialize memory stream, reserves memory for stream data.

Declaration: constructor Init(ALimit: LongInt; ABlockSize: Word)

Visibility: default

Description: Init instantiates a new TMemoryStream object. The memorystreamobject will initially allocate at least ALimit bytes memory, divided into memory blocks of size ABlockSize. The number of blocks needed to get to ALimit bytes is rounded up.

By default, the number of blocks is 1, and the size of a block is 8192. This is selected if you specify 0 as the blocksize.

For an example, see e.g TStream.CopyFrom ([1](#)).

Errors: If the stream cannot allocate the initial memory needed for the memory blocks, then the stream's status is set to stInitError.

See also: TMemoryStream.Done ([1](#))

29.7.4 TMemoryStream.Done

Synopsis: Clean up memory and destroy the object instance.

Declaration: `destructor Done; Virtual`

Visibility: default

Description: `Done` releases the memory blocks used by the stream, and then cleans up the memory used by the stream object itself.

For an example, see e.g `TStream.CopyFrom` (1).

Errors: None.

See also: `TMemoryStream.Init` (1)

29.7.5 TMemoryStream.Truncate

Synopsis: Set the stream size to the current position.

Declaration: `procedure Truncate; Virtual`

Visibility: default

Description: `Truncate` sets the size of the memory stream equal to the current position. It de-allocates any memory-blocks that are no longer needed, so that the new size of the stream is the current position in the stream, rounded up to the first multiple of the stream blocksize.

Errors: If an error occurs during memory de-allocation, the stream's status is set to `stError`

See also: `TStream.Truncate` (1)

Listing: `./objectex/ex20.pp`

```

Program ex20;

{ Program to demonstrate the TMemoryStream.Truncate method }

Uses Objects;

Var L : String;
      P : PString;
      S : PMemoryStream;
      I : Longint;

begin
  L:= 'Some constant string';
  { Buffer size of 100 }
  S:=New(PMemoryStream, Init(1000,100));
  Writeln ('Writing 100 times " ',L,'" to stream.');
  For I:=1 to 100 do
    S^.WriteStr(@L);
  Writeln ('Finished.');
  S^.Seek(100);
  S^.Truncate;
  Writeln ('Truncated at byte 100.');
  Dispose (S,Done);
  Writeln ('Finished.');
end.

```

29.7.6 TMemoryStream.Read

Synopsis: Read data from the stream to a location in memory.

Declaration: procedure Read(var Buf; Count: LongInt); Virtual

Visibility: default

Description: Read reads Count bytes from the stream to Buf. It updates the position of the stream.

For an example, see TStream.Read ([1](#)).

Errors: If there is not enough data available, no data is read, and the stream's status is set to stReadError.

See also: TStream.Read ([1](#)), TMemoryStream.Write ([1](#))

29.7.7 TMemoryStream.Write

Synopsis: Write data to the stream.

Declaration: procedure Write(var Buf; Count: LongInt); Virtual

Visibility: default

Description: Write copies Count bytes from Buf to the stream. It updates the position of the stream.

If not enough memory is available to hold the extra Count bytes, then the stream will try to expand, by allocating as much blocks with size BlkSize (as specified in the constructor call Init ([1](#))) as needed.

For an example, see TStream.Read ([1](#)).

Errors: If the stream cannot allocate more memory, then the status is set to stWriteError

See also: TStream.Write ([1](#)), TMemoryStream.Read ([1](#))

29.8 TObject

29.8.1 Description

This type serves as the basic object for all other objects in the Objects unit.

29.8.2 Method overview

Page	Property	Description
976	Done	Destroy an object.
975	Free	Destroy an object and release all memory.
974	Init	Construct (initialize) a new object
975	Is_Object	Check whether a pointer points to an object.

29.8.3 TObject.Init

Synopsis: Construct (initialize) a new object

Declaration: constructor Init

Visibility: default

Description: Instantiates a new object of type `TObject`. It fills the instance up with Zero bytes.

For an example, see [Free \(1\)](#)

Errors: None.

See also: `TObject.Free (1)`, `TObject.Done (1)`

29.8.4 `TObject.Free`

Synopsis: Destroy an object and release all memory.

Declaration: `procedure Free`

Visibility: default

Description: `Free` calls the destructor of the object, and releases the memory occupied by the instance of the object.

Errors: No checking is performed to see whether `self` is `nil` and whether the object is indeed allocated on the heap.

See also: `TObject.Init (1)`, `TObject.Done (1)`

Listing: `./objectex/ex7.pp`

```
program ex7;

{ Program to demonstrate the TObject.Free call }

Uses Objects;

Var O : PObject;

begin
  // Allocate memory for object.
  O:=New(PObject, Init);
  // Free memory of object.
  O^.free;
end.
```

29.8.5 `TObject.Is_Object`

Synopsis: Check whether a pointer points to an object.

Declaration: `function Is_Object (P: Pointer) : Boolean`

Visibility: default

Description: `Is_Object` returns `True` if the pointer `P` points to an instance of a `TObject` descendent, it returns `false` otherwise.

29.8.6 TObject.Done

Synopsis: Destroy an object.

Declaration: `destructor Done; virtual`

Visibility: default

Description: Done, the destructor of TObject does nothing. It is mainly intended to be used in the TObject.Free (1) method.

The destructore Done does not free the memory occupied by the object.

Errors: None.

See also: TObject.Free (1), TObject.Init (1)

Listing: ./objectex/ex8.pp

```
program ex8;

{ Program to demonstrate the TObject.Done call }

Uses Objects;

Var O : PObject;

begin
  // Allocate memory for object.
  O:=New(PObject,Init);
  O^.Done;
end.
```

29.9 TPoint

29.9.1 Description

Record describing a point in a 2 dimensional plane.

29.10 TRect

29.10.1 Description

Describes a rectangular region in a plane.

29.10.2 Method overview

Page	Property	Description
981	Assign	Set rectangle corners.
978	Contains	Determine if a point is inside the rectangle
978	Copy	Copy cornerpoints from another rectangle.
977	Empty	Is the surface of the rectangle zero
978	Equals	Do the corners of the rectangles match
981	Grow	Expand rectangle with certain size.
979	Intersect	Reduce rectangle to intersection with another rectangle
980	Move	Move rectangle along a vector.
979	Union	Enlarges rectangle to encompas another rectangle.

29.10.3 TRect.Empty

Synopsis: Is the surface of the rectangle zero

Declaration: function Empty : Boolean

Visibility: default

Description: Empty returns True if the rectangle defined by the corner points A, B has zero or negative surface.

Errors: None.

See also: TRect.Equals (1), TRect.Contains (1)

Listing: ./objectex/ex1.pp

Program ex1;

{ Program to demonstrate TRect.Empty }

Uses objects;

```

Var ARect,BRect : TRect;
      P : TPoint;

begin
  With ARect.A do
    begin
      X:=10;
      Y:=10;
    end;
  With ARect.B do
    begin
      X:=20;
      Y:=20;
    end;
  { Offset B by (5,5) }
  With BRect.A do
    begin
      X:=15;
      Y:=15;
    end;
  With BRect.B do
    begin
      X:=25;
      Y:=25;
    end;
  { Point }
  With P do
    begin
      X:=15;
      Y:=15;
    end;
  Writeln ('A empty : ',ARect.Empty);
  Writeln ('B empty : ',BRect.Empty);
  Writeln ('A Equals B : ',ARect.Equals(BRect));
  Writeln ('A Contains (15,15) : ',ARect.Contains(P));
end.
```

29.10.4 TRect.Equals

Synopsis: Do the corners of the rectangles match

Declaration: function Equals(R: TRect) : Boolean

Visibility: default

Description: Equals returns True if the rectangle has the same corner points A, B as the rectangle R, and False otherwise.

For an example, see TRect.Empty ([1](#))

Errors: None.

See also: TRect.Empty ([1](#)), TRect.Contains ([1](#))

29.10.5 TRect.Contains

Synopsis: Determine if a point is inside the rectangle

Declaration: function Contains(P: TPoint) : Boolean

Visibility: default

Description: Contains returns True if the point P is contained in the rectangle (including borders), False otherwise.

Errors: None.

See also: TRect.Intersect ([1](#)), TRect.Equals ([1](#))

29.10.6 TRect.Copy

Synopsis: Copy cornerpoints from another rectangle.

Declaration: procedure Copy(R: TRect)

Visibility: default

Description: Assigns the rectangle R to the object. After the call to Copy, the rectangle R has been copied to the object that invoked Copy.

Errors: None.

See also: TRect.Assign ([1](#))

Listing: ./objectex/ex2.pp

Program ex2;

{ Program to demonstrate TRect.Copy }

Uses objects;

Var ARect,BRect,CRect : TRect;

begin

ARect.Assign(10,10,20,20);

BRect.Assign(15,15,25,25);

```
CRect.Copy(ARect);
If ARect.Equals(CRect) Then
  WriteLn ('ARect equals CRect')
Else
  WriteLn ('ARect does not equal CRect !');
end.
```

29.10.7 TRect.Union

Synopsis: Enlarges rectangle to encompass another rectangle.

Declaration: procedure Union(R: TRect)

Visibility: default

Description: Union enlarges the current rectangle so that it becomes the union of the current rectangle with the rectangle R.

Errors: None.

See also: TRect.Intersect (1)

Listing: ./objectex/ex3.pp

```
Program ex3;

{ Program to demonstrate TRect.Union }

Uses objects;

Var ARect, BRect, CRect : TRect;

begin
  ARect.Assign(10,10,20,20);
  BRect.Assign(15,15,25,25);
  { CRect is union of ARect and BRect }
  CRect.Assign(10,10,25,25);
  { Calculate it explicitly }
  ARect.Union(BRect);
  If ARect.Equals(CRect) Then
    WriteLn ('ARect equals CRect')
  Else
    WriteLn ('ARect does not equal CRect !');
end.
```

29.10.8 TRect.Intersect

Synopsis: Reduce rectangle to intersection with another rectangle

Declaration: procedure Intersect(R: TRect)

Visibility: default

Description: Intersect makes the intersection of the current rectangle with R. If the intersection is empty, then the rectangle is set to the empty rectangle at coordinate (0,0).

Errors: None.

See also: TRect.Union (1)

Listing: ./objectex/ex4.pp

```
Program ex4;
{ Program to demonstrate TRect.Intersect }

Uses objects;

Var ARect, BRect, CRect : TRect;

begin
  ARect.Assign(10,10,20,20);
  BRect.Assign(15,15,25,25);
  { CRect is intersection of ARect and BRect }
  CRect.Assign(15,15,20,20);
  { Calculate it explicitly }
  ARect.Intersect(BRect);
  If ARect.Equals(CRect) Then
    Writeln ('ARect equals CRect')
  Else
    Writeln ('ARect does not equal CRect !');
  BRect.Assign(25,25,30,30);
  Arect.Intersect(BRect);
  If ARect.Empty Then
    Writeln ('ARect is empty');
end.
```

29.10.9 TRect.Move

Synopsis: Move rectangle along a vector.

Declaration: procedure Move (ADX: Sw_Integer; ADY: Sw_Integer)

Visibility: default

Description: Move moves the current rectangle along a vector with components (ADX, ADY). It adds ADX to the X-coordinate of both corner points, and ADY to both end points.

Errors: None.

See also: TRect.Grow (1)

Listing: ./objectex/ex5.pp

```
Program ex5;
{ Program to demonstrate TRect.Move }

Uses objects;

Var ARect, BRect : TRect;
```

```
begin
  ARect. Assign(10,10,20,20);
  ARect. Move(5,5);
  // Brect should be where new ARect is.
  BRect. Assign(15,15,25,25);
  If ARect. Equals(BRect) Then
    WriteLn ('ARect equals BRect')
  Else
    WriteLn ('ARect does not equal BRect !');
end.
```

29.10.10 TRect.Grow

Synopsis: Expand rectangle with certain size.

Declaration: procedure Grow(ADX: Sw_Integer; ADY: Sw_Integer)

Visibility: default

Description: Grow expands the rectangle with an amount ADX in the X direction (both on the left and right side of the rectangle, thus adding a length 2*ADX to the width of the rectangle), and an amount ADY in the Y direction (both on the top and the bottom side of the rectangle, adding a length 2*ADY to the height of the rectangle).

ADX and ADY can be negative. If the resulting rectangle is empty, it is set to the empty rectangle at (0, 0).

Errors: None.

See also: TRect.Move ([1](#))

Listing: ./objectex/ex6.pp

```
Program ex6;
  { Program to demonstrate TRect.Grow }

  Uses objects;

  Var ARect, BRect : TRect;

begin
  ARect. Assign(10,10,20,20);
  ARect. Grow(5,5);
  // Brect should be where new ARect is.
  BRect. Assign(5,5,25,25);
  If ARect. Equals(BRect) Then
    WriteLn ('ARect equals BRect')
  Else
    WriteLn ('ARect does not equal BRect !');
end.
```

29.10.11 TRect.Assign

Synopsis: Set rectangle corners.

Declaration: procedure Assign(XA: Sw_Integer; YA: Sw_Integer; XB: Sw_Integer; YB: Sw_Integer)

Visibility: default

Description: Assign sets the corner points of the rectangle to (XA, YA) and (XB, YB).

For an example, see TRect.Copy ([1](#)).

Errors: None.

See also: TRect.Copy ([1](#))

29.11 TResourceCollection

29.11.1 Description

A TResourceCollection manages a collection of resource names. It stores the position and the size of a resource, as well as the name of the resource. It stores these items in records that look like this:

```
TYPE
  TResourceItem = packed RECORD
    Posn: LongInt;
    Size: LongInt;
    Key : String;
  End;
  PResourceItem = ^TResourceItem;
```

It overrides some methods of TStringCollection in order to accomplish this.

Remark: Remark that the TResourceCollection manages the names of the resources and their associated positions and sizes, it doesn't manage the resources themselves.

29.11.2 Method overview

Page	Property	Description
983	FreeItem	Release memory occupied by item.
983	GetItem	Read an item from the stream.
982	KeyOf	Return the key of an item in the collection.
983	PutItem	Write an item to the stream.

29.11.3 TResourceCollection.KeyOf

Synopsis: Return the key of an item in the collection.

Declaration: function KeyOf(Item: Pointer) : Pointer; Virtual

Visibility: default

Description: KeyOf returns the key of an item in the collection. For resources, the key is a pointer to the string with the resource name.

Errors: None.

See also: TStringCollection.Compare ([1](#))

29.11.4 TResourceCollection.GetItem

Synopsis: Read an item from the stream.

Declaration: function GetItem(var S: TStream) : Pointer; Virtual

Visibility: default

Description: GetItem reads a resource item from the stream S. It reads the position, size and name from the stream, in that order. It DOES NOT read the resource itself from the stream.

The resulting item is not inserted in the collection. This call is mainly for internal use by the TCollection.Load ([1](#)) method.

Errors: Errors returned are those by TStream.Read ([1](#))

See also: TCollection.Load ([1](#)), TStream.Read ([1](#))

29.11.5 TResourceCollection.FreeItem

Synopsis: Release memory occupied by item.

Declaration: procedure FreeItem(Item: Pointer); Virtual

Visibility: default

Description: FreeItem releases the memory occupied by Item. It de-allocates the name, and then the resourceitem record.

It does NOT remove the item from the collection.

Errors: None.

See also: TCollection.FreeItem ([1](#))

29.11.6 TResourceCollection.PutItem

Synopsis: Write an item to the stream.

Declaration: procedure PutItem(var S: TStream; Item: Pointer); Virtual

Visibility: default

Description: PutItem writes Item to the stream S. It does this by writing the position and size and name of the resource item to the stream.

This method is used primarily by the Store ([1](#)) method.

Errors: Errors returned are those by TStream.Write ([1](#)).

See also: TCollection.Store ([1](#))

29.12 TResourceFile

29.12.1 Description

TResourceFile ([983](#)) represents the resources in a binary file image.

29.12.2 Method overview

Page	Property	Description
984	Count	Number of resources in the file
986	Delete	Delete a resource from the file
984	Done	Destroy the instance and remove it from memory.
985	Flush	Writes the resources to the stream.
985	Get	Return a resource by key name.
984	Init	Instantiate a new instance.
985	KeyAt	Return the key of the item at a certain position.
986	Put	Set a resource by key name.
985	SwitchTo	Write resources to a new stream.

29.12.3 TResourceFile.Init

Synopsis: Instantiate a new instance.

Declaration: constructor Init (AStream: PStream)

Visibility: default

Description: Init instantiates a new instance of a TResourceFile object. If AStream is not nil then it is considered as a stream describing an executable image on disk.

Init will try to position the stream on the start of the resources section, and read all resources from the stream.

Errors: None.

See also: TResourceFile.Done (1)

29.12.4 TResourceFile.Done

Synopsis: Destroy the instance and remove it from memory.

Declaration: destructor Done; Virtual

Visibility: default

Description: Done cleans up the instance of the TResourceFile Object. If Stream was specified at initialization, then Stream is disposed of too.

Errors: None.

See also: TResourceFile.Init (1)

29.12.5 TResourceFile.Count

Synopsis: Number of resources in the file

Declaration: function Count : Sw_Integer

Visibility: default

Description: Count returns the number of resources. If no resources were read, zero is returned.

Errors: None.

See also: TResourceFile.Init (1)

29.12.6 TResourceFile.KeyAt

Synopsis: Return the key of the item at a certain position.

Declaration: function KeyAt (I: Sw_Integer) : string

Visibility: default

Description: KeyAt returns the key (the name) of the I-th resource.

Errors: In case I is invalid, TCollection.Error will be executed.

See also: TResourceFile.Get ([1](#))

29.12.7 TResourceFile.Get

Synopsis: Return a resource by key name.

Declaration: function Get (Key: string) : PObject

Visibility: default

Description: Get returns a pointer to a instance of a resource identified by Key. If Key cannot be found in the list of resources, then Nil is returned.

Errors: Errors returned may be those by TStream.Get

29.12.8 TResourceFile.SwitchTo

Synopsis: Write resources to a new stream.

Declaration: function SwitchTo (AStream: PStream; Pack: Boolean) : PStream

Visibility: default

Description: SwitchTo switches to a new stream to hold the resources in. AStream will be the new stream after the call to SwitchTo.

If Pack is true, then all the known resources will be copied from the current stream to the new stream (AStream). If Pack is False, then only the current resource is copied.

The return value is the value of the original stream: Stream.

The Modified flag is set as a consequence of this call.

Errors: Errors returned can be those of TStream.Read ([1](#)) and TStream.Write ([1](#)).

See also: TResourceFile.Flush ([1](#))

29.12.9 TResourceFile.Flush

Synopsis: Writes the resources to the stream.

Declaration: procedure Flush

Visibility: default

Description: If the Modified flag is set to True, then Flush writes the resources to the stream Stream. It sets the Modified flag to true after that.

Errors: Errors can be those by TStream.Seek ([1](#)) and TStream.Write ([1](#)).

See also: TResourceFile.SwitchTo ([1](#))

29.12.10 TResourceFile.Delete

Synopsis: Delete a resource from the file

Declaration: procedure Delete(Key: string)

Visibility: default

Description: Delete deletes the resource identified by Key from the collection. It sets the Modified flag to true.

Errors: None.

See also: TResourceFile.Flush ([1](#))

29.12.11 TResourceFile.Put

Synopsis: Set a resource by key name.

Declaration: procedure Put(Item: PObject; Key: string)

Visibility: default

Description: Put sets the resource identified by Key to Item. If no such resource exists, a new one is created. The item is written to the stream.

Errors: Errors returned may be those by TStream.Put ([1](#)) and TStream.Seek

See also: Get ([1](#))

29.13 TSortedCollection

29.13.1 Description

TSortedCollection is an abstract class, implementing a sorted collection. You should never use an instance of TSortedCollection directly, instead you should declare a descendent type, and override the Compare ([1](#)) method.

Because the collection is ordered, TSortedCollection overrides some TCollection methods, to provide faster routines for lookup.

The Compare ([1](#)) method decides how elements in the collection should be ordered. Since TCollection has no way of knowing how to order pointers, you must override the compare method.

Additionally, TCollection provides a means to filter out duplicates. if you set Duplicates to False (the default) then duplicates will not be allowed.

The example below defines a descendent of TSortedCollection which is used in the examples.

29.13.2 Method overview

Page	Property	Description
988	Compare	Compare two items in the collection.
988	IndexOf	Return index of an item in the collection.
987	Init	Instantiates a new instance of a TSortedCollection
990	Insert	Insert new item in collection.
987	KeyOf	Return the key of an item
987	Load	Instantiates a new instance of a TSortedCollection and loads it from stream.
989	Search	Search for item with given key.
991	Store	Write the collection to the stream.

29.13.3 TSortedCollection.Init

Synopsis: Instantiates a new instance of a TSortedCollection

Declaration: constructor Init(ALimit: Sw_Integer; ADelta: Sw_Integer)

Visibility: default

Description: Init calls the inherited constructor (see TCollection.Init (1)) and sets the Duplicates flag to false.

You should not call this method directly, since TSortedCollection is a abstract class. Instead, the descendent classes should call it via the `inherited` keyword.

Errors: None.

See also: TSortedCollection.Load (1), TCollection.Done (1)

29.13.4 TSortedCollection.Load

Synopsis: Instantiates a new instance of a TSortedCollection and loads it from stream.

Declaration: constructor Load(var S: TStream)

Visibility: default

Description: Load calls the inherited constructor (see TCollection.Load (1)) and reads the Duplicates flag from the stream..

You should not call this method directly, since TSortedCollection is a abstract class. Instead, the descendent classes should call it via the `inherited` keyword.

For an example, see TCollection.Load (1).

Errors: None.

See also: TSortedCollection.Init (1), TCollection.Done (1)

29.13.5 TSortedCollection.KeyOf

Synopsis: Return the key of an item

Declaration: function KeyOf(Item: Pointer) : Pointer; Virtual

Visibility: default

Description: KeyOf returns the key associated with Item. TSortedCollection returns the item itself as the key, descendent objects can override this method to calculate a (unique) key based on the item passed (such as hash values).

Keys are used to sort the objects, they are used to search and sort the items in the collection. If descendent types override this method then it allows possibly for faster search/sort methods based on keys rather than on the objects themselves.

Errors: None.

See also: TSortedCollection.IndexOf ([1](#)), TSortedCollection.Compare ([1](#))

29.13.6 TSortedCollection.IndexOf

Synopsis: Return index of an item in the collection.

Declaration: function IndexOf(Item: Pointer) : Sw_Integer; Virtual

Visibility: default

Description: IndexOf returns the index of Item in the collection. It searches for the object based on its key. If duplicates are allowed, then it returns the index of last object that matches Item.

In case Item is not found in the collection, -1 is returned.

For an example, see TCollection.IndexOf ([1](#))

Errors: None.

See also: TSortedCollection.Search ([1](#)), TSortedCollection.Compare ([1](#))

29.13.7 TSortedCollection.Compare

Synopsis: Compare two items in the collection.

Declaration: function Compare(Key1: Pointer;Key2: Pointer) : Sw_Integer; Virtual

Visibility: default

Description: Compare is an abstract method that should be overridden by descendent objects in order to compare two items in the collection. This method is used in the Search ([1](#)) method and in the Insert ([1](#)) method to determine the ordering of the objects.

The function should compare the two keys of items and return the following function results:

Result < 0If Key1 is logically before Key2 (Key1<Key2)

Result = 0If Key1 and Key2 are equal. (Key1=Key2)

Result > 0If Key1 is logically after Key2 (Key1>Key2)

Errors: An 'abstract run-time error' will be generated if you call TSortedCollection.Compare directly.

See also: TSortedCollection.IndexOf ([1](#)), TSortedCollection.Search ([1](#))

Listing: ./objectex/mysortc.pp

Unit MySortC;

Interface

Uses Objects;

Type

```
PMysortedCollection = ^TMySortedCollection;
TMySortedCollection = Object(TSortedCollection)
  Function Compare (Key1, Key2 : Pointer): Sw_integer; virtual;
end;
```

Implementation

Uses MyObject;

```
Function TMySortedCollection.Compare (Key1, Key2 : Pointer) : sw_integer;
begin
  Compare := PMyobject(Key1)^.GetField - PMyObject(Key2)^.GetField;
end;
```

end.

29.13.8 TSORTEDCOLLECTION.SEARCH

Synopsis: Search for item with given key.

Declaration: function Search(Key: Pointer; var Index: Sw_Integer) : Boolean; Virtual
Visibility: default

Description: Search looks for the item with key Key and returns the position of the item (if present) in the collection in Index.

Instead of a linear search as TCollection does, TSORTEDCOLLECTION uses a binary search based on the keys of the objects. It uses the Compare ([1](#)) function to implement this search.

If the item is found, Search returns True, otherwise False is returned.

Errors: None.

See also: TCollection.IndexOf ([1](#))

Listing: ./objectex/ex36.pp

Program ex36;

```
{ Program to demonstrate the TSORTEDCOLLECTION.Insert method }
```

```
Uses Objects, MyObject, MySortC;
{ For TMyObject, TMySortedCollection definition and registration }
```

```
Var C : PSortedCollection;
  M : PMyObject;
  I : Longint;
```

```
Procedure PrintField (Dummy: Pointer; P : PMyObject);
```

```

begin
  Writeln ('Field : ',P^.GetField);
end;
```



```

begin
  Randomize;
  C:=New(PMySortedCollection,Init(120,10));
  C^.Duplicates:=True;
  Writeln ('Inserting 100 records at random places.');
  For I:=1 to 100 do
    begin
      M:=New(PMyObject,Init);
      M^.SetField(Random(100));
      C^.Insert(M)
    end;
  M:=New(PMyObject,Init);
  Repeat;
    Write ('Value to search for (-1 stops) :');
    read (I);
    If I<>-1 then
      begin
        M^.SetField(i);
        If Not C^.Search (M,I) then
          Writeln ('No such value found')
        else
          begin
            Write ('Value ',PMyObject(C^.At(I))^ .GetField );
            Writeln (' present at position ',I);
          end;
      end;
    Until I=-1;
  Dispose(M,Done);
  Dispose(C,Done);
end.
```

29.13.9 TSortedCollection.Insert

Synopsis: Insert new item in collection.

Declaration: procedure Insert(Item: Pointer); Virtual

Visibility: default

Description: Insert inserts an item in the collection at the correct position, such that the collection is ordered at all times. You should never use Atinsert (1), since then the collection ordering is not guaranteed.

If Item is already present in the collection, and Duplicates is False, the item will not be inserted.

Errors: None.

See also: TCollections.AtInsert (1)

Listing: ./objectex/ex35.pp

```

Program ex35;

{ Program to demonstrate the TSortedCollection.Insert method }

Uses Objects, MyObject, MySortC;
{ For TMyObject, TMySortedCollection definition and registration }

Var C : PSortedCollection;
    M : PMyObject;
    I : Longint;

Procedure PrintField (Dummy: Pointer; P : PMyObject);

begin
    Writeln ('Field : ', P^.GetField);
end;

begin
    Randomize;
    C:=New(PMySortedCollection, Init(120,10));
    Writeln ('Inserting 100 records at random places.');
    For I:=1 to 100 do
        begin
            M:=New(PMyObject, Init);
            M^.SetField(Random(100));
            C^.Insert(M);
        end;
    Writeln ('Values : ');
    C^.Foreach(@PrintField);
    Dispose(C, Done);
end.

```

29.13.10 TSortedCollection.Store

Synopsis: Write the collection to the stream.

Declaration: procedure Store(var S: TStream)

Visibility: default

Description: Store writes the collection to the stream S. It does this by calling the inherited TCollection.Store ([1](#)), and then writing the Duplicates flag to the stream.

After a Store, the collection can be loaded from the stream with the constructor Load ([1](#))

For an example, see TCollection.Load ([1](#)).

Errors: Errors can be those of TStream.Put ([1](#)).

See also: TSortedCollection.Load ([1](#))

29.14 TStrCollection

29.14.1 Description

The `TStrCollection` object manages a sorted collection of null-terminated strings (pchar strings). To this end, it overrides the `Compare` (1) method of `TSortedCollection`, and it introduces methods to read/write strings from a stream.

29.14.2 Method overview

Page	Property	Description
992	Compare	Compare two strings in the collection.
993	FreeItem	Free null-terminated string from the collection.
993	GetItem	Read a null-terminated string from the stream.
993	PutItem	Write a null-terminated string to the stream.

29.14.3 `TStrCollection.Compare`

Synopsis: Compare two strings in the collection.

Declaration: `function Compare(Key1: Pointer;Key2: Pointer) : Sw_Integer; Virtual`

Visibility: default

Description: `TStrCollection` overrides the `Compare` function so it compares the two keys as if they were pointers to strings. The compare is done case sensitive. It returns

- 1if the first string is alphabetically earlier than the second string.
- 0if the two strings are equal.
- 1if the first string is alphabetically later than the second string.

Errors: None.

See also: `TSortedCollection.Compare` (1)

Listing: ./objectex/ex38.pp

```
Program ex38;

{ Program to demonstrate the TStrCollection.Compare method }

Uses Objects, Strings;

Var C : PStrCollection;
    S : String;
    I : longint;
    P : Pchar;

begin
    Randomize;
    C:=New(PStrCollection, Init(120,10));
    C^.Duplicates:=True; { Duplicates allowed }
    Writeln ('Inserting 100 records at random places.');
    For I:=1 to 100 do
        begin
            Str(Random(100),S);
            C^.PutItem(S);
        end;
    end.
```

```

S:= 'String with value '+S;
P:= StrAlloc(Length(S)+1);
C^.Insert(StrPCopy(P,S));
end;
For I:=0 to 98 do
  With C^ do
    If Compare (At(I),At(I+1))=0 then
      Writeln ('Duplicate string found at position ',I);
      Dispose(C,Done);
end.

```

29.14.4 TStrCollection.GetItem

Synopsis: Read a null-terminated string from the stream.

Declaration: function GetItem(var S: TStream) : Pointer; Virtual

Visibility: default

Description: GetItem reads a null-terminated string from the stream S and returns a pointer to it. It doesn't insert the string in the collection.

This method is primarily introduced to be able to load and store the collection from and to a stream.

Errors: The errors returned are those of TStream.StrRead ([1](#)).

See also: TStrCollection.PutItem ([1](#))

29.14.5 TStrCollection.FreeItem

Synopsis: Free null-terminated string from the collection.

Declaration: procedure FreeItem(Item: Pointer); Virtual

Visibility: default

Description: TStrCollection overrides FreeItem so that the string pointed to by Item is disposed from memory.

Errors: None.

See also: TCollections.FreeItem ([1](#))

29.14.6 TStrCollection.PutItem

Synopsis: Write a null-terminated string to the stream.

Declaration: procedure PutItem(var S: TStream; Item: Pointer); Virtual

Visibility: default

Description: PutItem writes the string pointed to by Item to the stream S.

This method is primarily used in the Load and Store methods, and should not be used directly.

Errors: Errors are those of TStream.StrWrite ([1](#)).

See also: TStrCollection.GetItem ([1](#))

29.15 TStream

29.15.1 Description

The `TStream` object is the ancestor for all streaming objects, i.e. objects that have the capability to store and retrieve data.

It defines a number of methods that are common to all objects that implement streaming, many of them are virtual, and are only implemented in the descendent types.

Programs should not instantiate objects of type `TStream` directly, but instead instantiate a descendant type, such as `TDosStream`, `TMemoryStream`.

See also: `PStream` (940), `TDosStream` (967), `TMemoryStream` (972)

29.15.2 Method overview

Page	Property	Description
998	<code>Close</code>	Close the stream
1002	<code>CopyFrom</code>	Copy data from another stream.
1000	<code>Error</code>	Set stream status
999	<code>Flush</code>	Flush the stream data from the buffer, if any.
994	<code>Get</code>	Read an object definition from the stream.
996	<code>GetPos</code>	Return current position in the stream
996	<code>GetSize</code>	Return the size of the stream.
994	<code>Init</code>	Constructor for <code>TStream</code> instance
998	<code>Open</code>	Open the stream
999	<code>Put</code>	Write an object to the stream.
1001	<code>Read</code>	Read data from stream to buffer.
997	<code>ReadStr</code>	Read a shortstring from the stream.
998	<code>Reset</code>	Reset the stream
1000	<code>Seek</code>	Set stream position.
995	<code>StrRead</code>	Read a null-terminated string from the stream.
1000	<code>StrWrite</code>	Write a null-terminated string to the stream.
999	<code>Truncate</code>	Truncate the stream size on current position.
1001	<code>Write</code>	Write a number of bytes to the stream.
1000	<code>WriteStr</code>	Write a pascal string to the stream.

29.15.3 TStream.Init

Synopsis: Constructor for `TStream` instance

Declaration: constructor `Init`

Visibility: default

Description: `Init` initializes a `TStream` instance. Descendent streams should always call the inherited `Init`.

29.15.4 TStream.Get

Synopsis: Read an object definition from the stream.

Declaration: function `Get` : `PObject`

Visibility: default

Description: Get reads an object definition from a stream, and returns a pointer to an instance of this object.

Errors: On error, TStream.Status (1) is set, and NIL is returned.

See also: TStream.Put (1)

Listing: ./objectex/ex9.pp

```
Program ex9;

{ Program to demonstrate TStream.Get and TStream.Put }

Uses Objects, MyObject; { Definition and registration of TMyObject}

Var Obj : PMyObject;
    S : PStream;

begin
    Obj:=New(PMyObject, Init);
    Obj^.SetField($1111);
    Writeln ('Field value : ', Obj^.GetField);
    { Since Stream is an abstract type, we instantiate a TMemoryStream }
    S:=New(PMemoryStream, Init(100,10));
    S^.Put(Obj);
    Writeln ('Disposing object');
    S^.Seek(0);
    Dispose(Obj, Done);
    Writeln ('Reading object');
    Obj:=PMyObject(S^.Get);
    Writeln ('Field Value : ', Obj^.GetField);
    Dispose(Obj, Done);
end.
```

29.15.5 TStream.StrRead

Synopsis: Read a null-terminated string from the stream.

Declaration: function StrRead : PChar

Visibility: default

Description: StrRead reads a string from the stream, allocates memory for it, and returns a pointer to a null-terminated copy of the string on the heap.

Errors: On error, Nil is returned.

See also: TStream.StrWrite (1), TStream.ReadStr (1)

Listing: ./objectex/ex10.pp

```
Program ex10;

{
Program to demonstrate the TStream.StrRead TStream.StrWrite functions
}

Uses objects;
```

```

Var P : PChar;
      S : PStream;

begin
  P:= 'Constant Pchar string';
  Writeln ('Writing to stream : " ',P,'"');
  S:=New(PMemoryStream, Init(100,10));
  S^.StrWrite(P);
  S^.Seek(0);
  P:=Nil;
  P:=S^.StrRead;
  Dispose (S.Done);
  Writeln ('Read from stream : " ',P,'"');
  Freemem(P, Strlen(P)+1);
end.

```

29.15.6 TStream.GetPos

Synopsis: Return current position in the stream

Declaration: function GetPos : LongInt; Virtual

Visibility: default

Description: If the stream's status is stOk, GetPos returns the current position in the stream. Otherwise it returns -1

Errors: -1 is returned if the status is an error condition.

See also: TStream.Seek ([1](#)), TStream.GetSize ([1](#))

Listing: ./objectex/ex11.pp

```

Program ex11;

{ Program to demonstrate the TStream.GetPos function }

Uses objects;

Var L : String;
      S : PStream;

begin
  L:='Some kind of string';
  S:=New(PMemoryStream, Init(100,10));
  Writeln ('Stream position before write : ',S^.GetPos);
  S^.WriteStr(@L);
  Writeln ('Stream position after write : ',S^.GetPos);
  Dispose(S.Done);
end.

```

29.15.7 TStream.GetSize

Synopsis: Return the size of the stream.

Declaration: function GetSize : LongInt; Virtual

Visibility: default

Description: If the stream's status is `stOk` then `GetSize` returns the size of the stream, otherwise it returns `-1`.

Errors: `-1` is returned if the status is an error condition.

See also: `TStream.Seek` (1), `TStream.GetPos` (1)

Listing: ./objectex/ex12.pp

```
Program ex12;

{ Program to demonstrate the TStream.GetSize function }

Uses objects;

Var L : String;
    S : PStream;

begin
    L:= 'Some kind of string';
    S:=New(PMemoryStream, Init(100,10));
    Writeln ('Stream size before write : ',S^.GetSize);
    S^.WriteStr(@L);
    Writeln ('Stream size after write : ',S^.GetSize);
    Dispose(S,Done);
end.
```

29.15.8 TStream.ReadStr

Synopsis: Read a shortstring from the stream.

Declaration: function `ReadStr` : `PString`

Visibility: default

Description: `ReadStr` reads a string from the stream, copies it to the heap and returns a pointer to this copy.
The string is saved as a pascal string, and hence is NOT null terminated.

Errors: On error (e.g. not enough memory), `Nil` is returned.

See also: `TStream.StrRead` (1)

Listing: ./objectex/ex13.pp

```
Program ex13;

{
Program to demonstrate the TStream.ReadStr TStream.WriteStr functions
}

Uses objects;

Var P : PString;
    L : String;
    S : PStream;

begin
```

```

L:='Constant string line';
WriteLn ('Writing to stream : " ',L,'"');
S:=New(PMemoryStream, Init(100,10));
S^.WriteStr(@L);
S^.Seek(0);
P:=S^.ReadStr;
L:=P^;
DisposeStr(P);
Dispose (S,Done);
WriteLn ('Read from stream : " ',L,'"');
end.

```

29.15.9 TStream.Open

Synopsis: Open the stream

Declaration: procedure Open(OpenMode: Word); Virtual

Visibility: default

Description: Open is an abstract method, that should be overridden by descendent objects. Since opening a stream depends on the stream's type this is not surprising.

For an example, see TDosStream.Open ([1](#)).

Errors: None.

See also: TStream.Close ([1](#)), TStream.Reset ([1](#))

29.15.10 TStream.Close

Synopsis: Close the stream

Declaration: procedure Close; Virtual

Visibility: default

Description: Close is an abstract method, that should be overridden by descendent objects. Since Closing a stream depends on the stream's type this is not surprising.

for an example, see TDosStream.Open ([1](#)).

Errors: None.

See also: TStream.Open ([1](#)), TStream.Reset ([1](#))

29.15.11 TStream.Reset

Synopsis: Reset the stream

Declaration: procedure Reset

Visibility: default

Description: Reset sets the stream's status to 0, as well as the ErrorInfo

Errors: None.

See also: TStream.Open ([1](#)), TStream.Close ([1](#))

29.15.12 TStream.Flush

Synopsis: Flush the stream data from the buffer, if any.

Declaration: procedure Flush; Virtual

Visibility: default

Description: Flush is an abstract method that should be overridden by descendent objects. It serves to enable the programmer to tell streams that implement a buffer to clear the buffer.
for an example, see [TBufStream.Flush \(1\)](#).

Errors: None.

See also: [TStream.Truncate \(1\)](#)

29.15.13 TStream.Truncate

Synopsis: Truncate the stream size on current position.

Declaration: procedure Truncate; Virtual

Visibility: default

Description: Truncate is an abstract procedure that should be overridden by descendent objects. It serves to enable the programmer to truncate the size of the stream to the current file position.
For an example, see [TDosStream.Truncate \(1\)](#).

Errors: None.

See also: [TStream.Seek \(1\)](#)

29.15.14 TStream.Put

Synopsis: Write an object to the stream.

Declaration: procedure Put (P: PObject)

Visibility: default

Description: Put writes the object pointed to by P. P should be non-nil. The object type must have been registered with RegisterType ([947](#)).

After the object has been written, it can be read again with [Get \(1\)](#).

For an example, see [TStream.Get \(1\)](#);

Errors: No check is done whether P is Nil or not. Passing Nil will cause a run-time error 216 to be generated. If the object has not been registered, the status of the stream will be set to stPutError.

See also: [TStream.Get \(1\)](#)

29.15.15 TStream.StrWrite

Synopsis: Write a null-terminated string to the stream.

Declaration: procedure StrWrite(P: PChar)

Visibility: default

Description: StrWrite writes the null-terminated string P to the stream. P can only be 65355 bytes long.

For an example, see TStream.StrRead (1).

Errors: None.

See also: TStream.WriteString (1), TStream.StrRead (1), TStream.ReadStr (1)

29.15.16 TStream.WriteString

Synopsis: Write a pascal string to the stream.

Declaration: procedure WriteStr(P: PString)

Visibility: default

Description: StrWrite writes the pascal string pointed to by P to the stream.

For an example, see TStream.ReadStr (1).

Errors: None.

See also: TStream.StrWrite (1), TStream.StrRead (1), TStream.ReadStr (1)

29.15.17 TStream.Seek

Synopsis: Set stream position.

Declaration: procedure Seek(Pos: LongInt); Virtual

Visibility: default

Description: Seek sets the position to Pos. This position is counted from the beginning, and is zero based. (i.e. seek(0) sets the position pointer on the first byte of the stream)

For an example, see TDosStream.Seek (1).

Errors: If Pos is larger than the stream size, Status is set to StSeekError.

See also: TStream.GetPos (1), TStream.GetSize (1)

29.15.18 TStream.Error

Synopsis: Set stream status

Declaration: procedure Error(Code: Integer; Info: Integer); Virtual

Visibility: default

Description: Error sets the stream's status to Code and ErrorInfo to Info. If the StreamError procedural variable is set, Error executes it, passing Self as an argument.

This method should not be called directly from a program. It is intended to be used in descendent objects.

Errors: None.

29.15.19 TStream.Read

Synopsis: Read data from stream to buffer.

Declaration: procedure Read(var Buf;Count: LongInt); Virtual

Visibility: default

Description: Read is an abstract method that should be overridden by descendent objects.

Read reads Count bytes from the stream into Buf. It updates the position pointer, increasing it's value with Count. Buf must be large enough to contain Count bytes.

Errors: No checking is done to see if Buf is large enough to contain Count bytes.

See also: TStream.Write ([1](#)), TStream.ReadStr ([1](#)), TStream.StrRead ([1](#))

Listing: ./objectex/ex18.pp

```
program ex18;

{ Program to demonstrate the TStream.Read method }

Uses Objects;

Var Buf1,Buf2 : Array[1..1000] of Byte;
   I : longint;
   S : PMemoryStream;

begin
  For I:=1 to 1000 do
    Buf1[I]:=Random(1000);
  Buf2:=Buf1;
  S:=New(PMemoryStream,Init(100,10));
  S^.Write(Buf1,SizeOf(Buf1));
  S^.Seek(0);
  For I:=1 to 1000 do
    Buf1[I]:=0;
  S^.Read(Buf1,SizeOf(Buf1));
  For I:=1 to 1000 do
    If Buf1[I]<>buf2[i] then
      Writeln ('Buffer differs at position ',I);
  Dispose(S,Done);
end.
```

29.15.20 TStream.Write

Synopsis: Write a number of bytes to the stream.

Declaration: procedure Write(var Buf;Count: LongInt); Virtual

Visibility: default

Description: Write is an abstract method that should be overridden by descendent objects.

Write writes Count bytes to the stream from Buf. It updates the position pointer, increasing it's value with Count.

For an example, see TStream.Read ([1](#)).

Errors: No checking is done to see if Buf actually contains Count bytes.

See also: TStream.Read ([1](#)), TStream.WriteStr ([1](#)), TStream.StrWrite ([1](#))

29.15.21 TStream.CopyFrom

Synopsis: Copy data from another stream.

Declaration: procedure CopyFrom(var S: TStream; Count: LongInt)

Visibility: default

Description: CopyFrom reads Count bytes from stream S and stores them in the current stream. It uses the Read (1) method to read the data, and the Write (1) method to write in the current stream.

Errors: None.

See also: Read (1), Write (1)

Listing: ./objectex/ex19.pp

```
Program ex19;

{ Program to demonstrate the TStream.CopyFrom function }

Uses objects;

Var P : PString;
    L : String;
    S1,S2 : PStream;

begin
    L:='Constant string line';
    Writeln ('Writing to stream 1 : ',L,'');
    S1:=New(PMemoryStream,Init(100,10));
    S2:=New(PMemoryStream,Init(100,10));
    S1^.WriteStr(@L);
    S1^.Seek(0);
    Writeln ('Copying contents of stream 1 to stream 2');
    S2^.Copyfrom(S1^,S1^.GetSize);
    S2^.Seek(0);
    P:=S2^.ReadStr;
    L:=P^;
    DisposeStr(P);
    Dispose (S1.Done);
    Dispose (S2.Done);
    Writeln ('Read from stream 2 : ',L,'');
end.
```

29.16 TStringCollection

29.16.1 Description

The TStringCollection object manages a sorted collection of pascal strings. To this end, it overrides the Compare (1) method of TSortedCollection, and it introduces methods to read/write strings from a stream.

29.16.2 Method overview

Page	Property	Description
1003	Compare	Compare two strings in the collection.
1004	FreeItem	Dispose a string in the collection from memory.
1003	GetItem	Get string from the stream.
1004	PutItem	Write a string to the stream.

29.16.3 TStringCollection.GetItem

Synopsis: Get string from the stream.

Declaration: function GetItem(var S: TStream) : Pointer; Virtual

Visibility: default

Description: GetItem reads a string from the stream S and returns a pointer to it. It doesn't insert the string in the collection.

This method is primarily introduced to be able to load and store the collection from and to a stream.

Errors: The errors returned are those of TStream.ReadStr (1).

See also: TStringCollection.PutItem (1)

29.16.4 TStringCollection.Compare

Synopsis: Compare two strings in the collection.

Declaration: function Compare(Key1: Pointer; Key2: Pointer) : Sw_Integer; Virtual

Visibility: default

Description: TStringCollection overrides the Compare function so it compares the two keys as if they were pointers to strings. The compare is done case sensitive. It returns the following results:

- 1if the first string is alphabetically earlier than the second string.
- 0if the two strings are equal.
- 1if the first string is alphabetically later than the second string.

Errors: None.

See also: TSortedCollection.Compare (1)

Listing: ./objectex/ex37.pp

```

Program ex37;

{ Program to demonstrate the TStringCollection.Compare method }

Uses Objects;

Var C : PStringCollection;
     S : String;
     I : longint;

begin
  Randomize;

```

```

C:=New(PStringCollection,Init(120,10));
C^.Duplicates:=True; { Duplicates allowed }
Writeln ('Inserting 100 records at random places.');
For I:=1 to 100 do
  begin
    Str(Random(100),S);
    S:='String with value '+S;
    C^.Insert(NewStr(S));
  end;
For I:=0 to 98 do
  With C^ do
    If Compare (At(i),At(i+1))=0 then
      Writeln ('Duplicate string found at position ',i);
    Dispose(C,Done);
end.

```

29.16.5 TStringCollection.FreeItem

Synopsis: Dispose a string in the collection from memory.

Declaration: procedure FreeItem(Item: Pointer); Virtual

Visibility: default

Description: TStringCollection overrides FreeItem so that the string pointed to by Item is disposed from memory.

Errors: None.

See also: TCollection.FreeItem ([1](#))

29.16.6 TStringCollection.PutItem

Synopsis: Write a string to the stream.

Declaration: procedure PutItem(var S: TStream; Item: Pointer); Virtual

Visibility: default

Description: PutItem writes the string pointed to by Item to the stream S.

This method is primarily used in the Load and Store methods, and should not be used directly.

Errors: Errors are those of TStream.WriteString ([1](#)).

See also: TStringCollection.GetItem ([1](#))

29.17 TStringList

29.17.1 Description

A TStringList object can be used to read a collection of strings stored in a stream. If you register this object with the RegisterType ([947](#)) function, you cannot register the TStringListMaker object.

29.17.2 Method overview

Page	Property	Description
1005	Done	Clean up the instance
1005	Get	Return a string by key name
1005	Load	Load stringlist from stream.

29.17.3 TStringList.Load

Synopsis: Load stringlist from stream.

Declaration: constructor Load(var S: TStream)

Visibility: default

Description: The Load constructor reads the TStringList object from the stream S. It also reads the descriptions of the strings from the stream. The string descriptions are stored as an array of TstrIndexrec records, where each record describes a string on the stream. These records are kept in memory.

Errors: If an error occurs, a stream error is triggered.

See also: TStringList.Done (1)

29.17.4 TStringList.Done

Synopsis: Clean up the instance

Declaration: destructor Done; Virtual

Visibility: default

Description: The Done destructor frees the memory occupied by the string descriptions, and destroys the object.

Errors: None.

See also: Load (1), TObject.Done (1)

29.17.5 TStringList.Get

Synopsis: Return a string by key name

Declaration: function Get (Key: Sw_Word) : string

Visibility: default

Description: Get reads the string with key Key from the list of strings on the stream, and returns this string. If there is no string with such a key, an empty string is returned.

Errors: If no string with key Key is found, an empty string is returned. A stream error may result if the stream doesn't contain the needed strings.

See also: TStringList.Put (1)

29.18 TStrListMaker

29.18.1 Description

The `TStrListMaker` object can be used to generate a stream with strings, which can be read with the `TStringList` object. If you register this object with the `RegisterType` (947) function, you cannot register the `TStringList` object.

29.18.2 Method overview

Page	Property	Description
1006	Done	Clean up the instance and free all related memory.
1006	Init	Instantiate a new instance of <code>TStrListMaker</code>
1006	Put	Add a new string to the list with associated key.
1007	Store	Write the strings to the stream.

29.18.3 `TStrListMaker.Init`

Synopsis: Instantiate a new instance of `TStrListMaker`

Declaration: constructor `Init (AStringSize: Sw_Word; AIndexSize: Sw_Word)`

Visibility: default

Description: The `Init` constructor creates a new instance of the `TstrListMaker` object. It allocates `AStringSize` bytes on the heap to hold all the strings you wish to store. It also allocates enough room for `AIndexSize` key description entries (of the type `TStrIndexrec`).

`AStringSize` must be large enough to contain all the strings you wish to store. If not enough memory is allocated, other memory will be overwritten. The same is true for `AIndexSize`: maximally `AIndexSize` strings can be written to the stream.

Errors: None.

See also: `TObject.Init (1)`, `TStrListMaker.Done (1)`

29.18.4 `TStrListMaker.Done`

Synopsis: Clean up the instance and free all related memory.

Declaration: destructor `Done;` Virtual

Visibility: default

Description: The `Done` destructor de-allocates the memory for the index description records and the string data, and then destroys the object.

Errors: None.

See also: `TObject.Done (1)`, `TStrListMaker.Init (1)`

29.18.5 `TStrListMaker.Put`

Synopsis: Add a new string to the list with associated key.

Declaration: procedure `Put (Key: Sw_Word; S: string)`

Visibility: default

Description: Put adds they string *S* with key *Key* to the collection of strings. This action doesn't write the string to a stream. To write the strings to the stream, see the Store ([1](#)) method.

Errors: None.

See also: TStrListMaker.Store ([1](#))

29.18.6 TStrListMaker.Store

Synopsis: Write the strings to the stream.

Declaration: procedure Store (var *S*: TStream)

Visibility: default

Description: Store writes the collection of strings to the stream *S*. The collection can then be read with the TStringList object.

Errors: A stream error may occur when writing the strings to the stream.

See also: TStringList.Load ([1](#)), TStrListMaker.Put ([1](#))

29.19 TUnSortedStrCollection

29.19.1 Description

The TUnSortedStrCollection object manages an unsorted list of strings. To this end, it overrides the TStringCollection.Insert ([1](#)) method to add strings at the end of the collection, rather than in the alphabetically correct position.

Take care, the Search ([1](#)) and IndexOf ([1](#)) methods will not work on an unsorted string collection.

29.19.2 Method overview

Page	Property	Description
1007	Insert	Insert a new string in the collection.

29.19.3 TUnSortedStrCollection.Insert

Synopsis: Insert a new string in the collection.

Declaration: procedure Insert (Item: Pointer); Virtual

Visibility: default

Description: Insert inserts a string at the end of the collection, instead of on it's alphabetical place, resulting in an unsorted collection of strings.

Errors: None.

See also: TCollection.Insert ([1](#))

Listing: ./objectex/ex39.pp

```
Program ex39;  
{ Program to demonstrate the TUnsortedStrCollection.Insert method }  
  
Uses Objects, Strings;  
  
Var C : PUnsortedStrCollection;  
    S : String;  
    I : longint;  
    P : Pchar;  
  
begin  
    Randomize;  
    C:=New(PUnsortedStrCollection,Init(120,10));  
    Writeln ('Inserting 100 records at random places.');//  
    For I:=1 to 100 do  
        begin  
            Str(Random(100),S);  
            S:='String with value '+S;  
            C^.Insert(NewStr(S));  
        end;  
    For I:=0 to 99 do  
        Writeln (I:2,': ',PString(C^.At(i))^ );  
    Dispose(C,Done);  
end.
```

Chapter 30

Reference for unit 'objpas'

30.1 Overview

The `objpas` unit is meant for compatibility with Object Pascal as implemented by Delphi. The unit is loaded automatically by the Free Pascal compiler whenever the `Delphi` or `objfpc` mode is entered, either through the command line switches `-Sd` or `-Sh` or with the `{$MODE DELPHI}` or `{$MODE OBJFPC}` directives.

It redefines some basic pascal types, introduces some functions for compatibility with Delphi's system unit, and introduces some methods for the management of the resource string tables.

30.2 Constants, types and variables

30.2.1 Constants

`MaxInt` = `MaxLongint`

Maximum value for Integer (1009) type.

30.2.2 Types

`Integer` = `LongInt`

In OBPAS mode and in DELPHI mode, an `Integer` has a size of 32 bit. In TP or regular FPC mode, an integer is 16 bit.

`IntegerArray` = `Array[0..$efffffff] of Integer`

Generic array of integer (1009)

`PInteger` = `^Integer`

Pointer to Integer (1009) type.

`PIntegerArray` = `^IntegerArray`

Pointer to `TIntegerArray` (1010) type.

PointerArray = Array[0..512*1024*1024-2] of Pointer

Generic Array of pointers.

PPointerArray = ^PointerArray

Pointer to PointerArray ([1010](#))

PString = PAnsiString

Pointer to ansistring type.

TBoundArray = Array of Integer

Array of integer, used in interfaces.

TIntegerArray = IntegerArray

Alias for IntegerArray ([1009](#))

TPointerArray = PointerArray

Alias for PointerArray ([1010](#))

Chapter 31

Reference for unit 'oldlinux'

31.1 Overview

This document describes the LINUX unit for Free Pascal. The unit was written by Michael van Canneyt. It works only on the Linux/X86 operating system.

31.2 Utility routines

Auxiliary functions that are useful in connection with the other functions.

Table 31.1:

Name	Description
CreateShellArgV (1073)	Create an array of pchars from string
EpochToLocal (1076)	Convert epoch time to local time
FD_Clr (1086)	Clear item of select filedescriptors
FD_IsSet (1087)	Check item of select filedescriptors
FD_Set (1087)	Set item of select filedescriptors
FD_ZERO (1087)	Clear all items in select filedescriptors
LocalToEpoch (1106)	Convert local time to epoch time
MMap (1108)	Map a file into memory
MUnMap (1110)	Unmap previously mapped memory file
Octal (1112)	Convert octal to digital
S_ISBLK (1128)	Check file mode for block device
S_ISCHR (1128)	Check file mode for character device
S_ISDIR (1128)	Check file mode for directory
S_ISFIFO (1129)	Check file mode for FIFO
S_ISLNK (1129)	Check file mode for symboloc link
S_ISREG (1130)	Check file mode for regular file
S_ISSOCK (1130)	Check file mode for socket
StringToPPchar (1124)	Create an array of pchars from string

31.3 Terminal functions

Functions for controlling the terminal to which the process is connected.

Table 31.2:

Name	Description
CFMakeRaw (1068)	Set terminal to raw mode
CFSetISpeed (1068)	Set terminal reading speed
CFSetOSpeed (1068)	Set terminal writing speed
IOCtl (1103)	General IO control call
IsATTY (1104)	See if filedescriptor is a terminal
TCDrain (1130)	Wait till all output was written
TCFlow (1130)	Suspend transmission or receipt of data
TCFlush (1131)	Discard data written to terminal
TCGetAttr (1131)	Get terminal attributes
TCGetPGrp (1132)	Return PID of foreground process
TCSendBreak (1132)	Send data for specific time
TCSetAttr (1133)	Set terminal attributes
TCSetPGrp (1133)	Set foreground process
TTYName (1134)	Name of tty file

31.4 System information

Functions for retrieving system information such as date and time.

Table 31.3:

Name	Description
GetDate (1093)	Return system date
GetDateTime (1094)	Return system date and time
GetDomainName (1094)	Return system domain name
GetEpochTime (1096)	Return epoch time
GetHostName (1098)	Return system host name
GetLocalTimezone (1098)	Return system timezone
GetTime (1100)	Return system time
GetTimeOfDay (1101)	Return system time
GetTimezoneFile (1101)	Return name of timezone file
ReadTimezoneFile (1116)	Read timezone file contents
SysInfo (1127)	Return general system information
Uname (1134)	Return system information

31.5 Signals

Functions for managing and responding to signals.

Table 31.4:

Name	Description
Alarm (1064)	Send alarm signal to self
Kill (1104)	Send arbitrary signal to process
pause (1113)	Wait for signal to arrive
SigAction (1120)	Set signal action
Signal (1122)	Set signal action
SigPending (1123)	See if signals are waiting
SigProcMask (1123)	Set signal processing mask
SigRaise (1123)	Send signal to self
SigSuspend (1124)	Sets signal mask and waits for signal
NanoSleep (1110)	Waits for a specific amount of time

31.6 Process handling

Functions for managing processes and programs.

Table 31.5:

Name	Description
Clone (1071)	Create a thread
Execl (1076)	Execute process with command-line list
Execle (1077)	Execute process with command-line list and environment
Execlp (1078)	Search in path and execute process with command list
Execv (1079)	Execute process
Execve (1080)	Execute process with environment
Execvp (1081)	Search in path and execute process
Fork (1089)	Spawn child process
GetEGid (1095)	Get effective group id
GetEnv (1095)	Get environment variable
GetEUid (1096)	Get effective user id
GetGid (1097)	Get group id
GetPid (1099)	Get process id
GetPPid (1099)	Get parent process id
GetPriority (1100)	Get process priority
GetUid (1101)	Get user id
Nice (1111)	Change priority of process
SetPriority (1119)	Change priority of process
Shell (1120)	Execute shell command
WaitPid (1136)	Wait for child process to terminate

31.7 Directory handling routines

Functions for reading and searching directories.

Table 31.6:

Name	Description
CloseDir (1073)	Close directory handle
Glob (1102)	Return files matching a search expression
GlobFree (1103)	Free result of Glob
OpenDir (1112)	Open directory for reading
ReadDir (1115)	Read directory entry
SeekDir (1117)	Seek directory
TellDir (1133)	Seek directory

31.8 Pipes, FIFOs and streams

Functions for creating and managing pipes.

Table 31.7:

Name	Description
AssignPipe (1065)	Create a pipe
AssignStream (1066)	Create pipes to program's input and output
MkFifo (1108)	Make a fifo
PClose (1114)	Close a pipe
POpen (1114)	Open a pipe for to program's input or output

31.9 General File handling routines

Functions for handling files on disk.

Table 31.8:

Name	Description
Access (1063)	Check access rights on file
BaseName (1067)	Return name part of file
Chown (1070)	Change owner of file
Chmod (1068)	Change access rights on file
DirName (1074)	Return directory part of file
FSplit (1091)	Split filename in parts
FExpand (1087)	Return full-grown filename
FLock (1088)	Set lock on a file
FNMatch (1088)	Match filename to searchpattern
FSearch (1090)	Search for a file in a path
FSStat (1091)	Return filesystem information
FStat (1092)	Return file information
FRename (1089)	Rename file
LStat (1107)	Return information on a link
Link (1105)	Create a link
ReadLink (1115)	Read contents of a symbolic link
Symlink (1125)	Create a symbolic link
Umask (1134)	Set the file creation mask
UnLink (1135)	Remove a file
Utime (1135)	Change file timestamps

31.10 File Input/Output routines

Functions for handling file input/output.

Table 31.9:

Name	Description
Dup (1074)	Duplicate a file handle
Dup2 (1075)	Copy one file handle to another
Fcntl (1082)	General file control
fdClose (1083)	Close file descriptor
fdFlush (1083)	Flush file descriptor
fdOpen (1083)	Open new file descriptor
fdRead (1084)	Read from file descriptor
fdSeek (1085)	Position in file
fdTruncate (1086)	Truncate file
fdWrite (1086)	Write to file descriptor
GetFS (1097)	Get file descriptor of pascal file
Select (1117)	Wait for input from file descriptor
SelectText (1118)	Wait for input from pascal file

31.11 Constants, types and variables

31.11.1 Constants

B0 = \$0000000

B110 = \$0000003

B115200 = \$0001002

B1200 = \$0000009

B134 = \$0000004

B150 = \$0000005

B1800 = \$000000A

B19200 = \$000000E

B200 = \$0000006

B230400 = \$0001003

B2400 = \$000000B

B300 = \$0000007

B38400 = \$000000F

B460800 = \$0001004

B4800 = \$000000C

B50 = \$0000001

B57600 = \$0001001

B600 = \$0000008

B75 = \$0000002

B9600 = \$000000D

BRKINT = \$0000002

BS0 = \$0000000

BS1 = \$0002000

BSDLY = \$0002000

CBAUD = \$000100F

CBAUDEX = \$0001000

CIBAUD = \$100F0000

CLOCAL = \$0000800

CLONE_FILES = \$00000400

Clone ([1071](#)) option: open files shared between processes

CLONE_FS = \$00000200

Clone ([1071](#)) option: fs info shared between processes

CLONE_PID = \$00001000

Clone ([1071](#)) option: PID shared between processes

CLONE_SIGHAND = \$00000800

Clone ([1071](#)) option: signal handlers shared between processes

CLONE_VM = \$00000100

Clone ([1071](#)) option: VM shared between processes

CMSPAR = \$40000000

CR0 = \$0000000

CR1 = \$0000200

CR2 = \$0000400

CR3 = \$0000600

CRDLY = \$0000600

CREAD = \$0000080

CRTSCTS = \$80000000

CS5 = \$0000000

CS6 = \$00000010

CS7 = \$00000020

CS8 = \$00000030

CSIGNAL = \$000000ff

Clone ([1071](#)) option: Signal mask to be sent at exit

CSIZE = \$0000030

CSTOPB = \$0000040

ECHO = \$0000008

ECHOCTL = \$0000200

ECHOE = \$00000010

ECHOK = \$00000020

ECHOKE = \$0000800

ECHONL = \$0000040

ECHOPRT = \$0000400

EXTA = B19200

EXTB = B38400

FF0 = \$0000000

FF1 = \$0008000

FFDLY = \$0008000

FIOASYNC = \$5452

FIOCLEX = \$5451

FIONBIO = \$5421

FIONCLEX = \$5450

FIONREAD = \$541B

FLUSHO = \$0001000

fs_ext = \$137d

File system type (FSStat (1091)): (ext) Extended

fs_ext2 = \$ef53

File system type (FSStat (1091)): (ext2) Second extended

fs_iso = \$9660

File system type (FSStat (1091)): ISO 9660

fs_minix = \$137f

File system type (FSStat (1091)): Minix

`fs_minix_30 = $138f`

File system type (FSStat ([1091](#))): Minix 3.0

`fs_minux_V2 = $2468`

File system type (FSStat ([1091](#))): Minix V2

`fs_msdos = $4d44`

File system type (FSStat ([1091](#))): MSDOS (FAT)

`fs_nfs = $6969`

File system type (FSStat ([1091](#))): NFS

`fs_old_ext2 = $ef51`

File system type (FSStat ([1091](#))): (ext2) Old second extended

`fs_proc = $9fa0`

File system type (FSStat ([1091](#))): PROC fs

`fs_xia = $012FD16D`

File system type (FSStat ([1091](#))): XIA

`F_GetFd = 1`

FCntl ([1082](#)) command: Get close-on-exec flag

`F_GetF1 = 3`

FCntl ([1082](#)) command: Get filedescriptor flags

`F_GetLk = 5`

FCntl ([1082](#)) command: Get lock

`F_GetOwn = 9`

FCntl ([1082](#)) command: get owner of filedescriptor events

`F_OK = 0`

Access ([1063](#)) call test: file exists.

`F_SetFd = 2`

FCntl ([1082](#)) command: Set close-on-exec flag

F_SetFl = 4

FCntl (1082) command: Set filedescriptor flags

F_SetLk = 6

FCntl (1082) command: Set lock

F_SetLkW = 7

FCntl (1082) command: Test lock

F_SetOwn = 8

FCntl (1082) command: Set owner of filedescriptor events

HUPCL = \$0000400

ICANON = \$0000002

ICRNL = \$0000100

IEXTEN = \$0008000

IGNBRK = \$0000001

IGNCR = \$0000080

IGNPAR = \$0000004

IMAXBEL = \$0002000

INLCR = \$0000040

INPCK = \$0000010

IOCtl_TCGETS = \$5401

IOCTL call number: get Terminal Control settings

ISIG = \$0000001

ISTRIP = \$0000020

IUCLC = \$0000200

IXANY = \$0000800

IXOFF = \$0001000

IXON = \$0000400

LOCK_EX = 2

FLock (1088) Exclusive lock

LOCK_NB = 4

FLock (1088) Non-blocking operation

LOCK_SH = 1

FLock (1088) Shared lock

LOCK_UN = 8

FLock (1088) unlock

MAP_ANONYMOUS = \$20

MMap (1108) map type: Don't use a file

MAP_DENYWRITE = \$800

MMap (1108) option: Ignored.

MAP_EXECUTABLE = \$1000

MMap (1108) option: Ignored.

MAP_FIXED = \$10

MMap (1108) map type: Interpret addr exactly

MAP_GROWSDOWN = \$100

MMap (1108) option: Memory grows downward (like a stack)

MAP_LOCKED = \$2000

MMap (1108) option: lock the pages in memory.

MAP_NORESERVE = \$4000

MMap (1108) option: Do not reserve swap pages for this memory.

MAP_PRIVATE = 2

MMap (1108) map type: Changes are private

MAP_SHARED = \$1

MMap (1108) map type: Share changes

MAP_TYPE = \$f

MMap (1108) map type: Bitmask for type of mapping

MINSIGSTKSZ = 2048

NCC = 8

Number of control characters in termio (1059) record.

NCCS = 32

Number of control characters in termios (1059) record.

NL0 = \$0000000

NL1 = \$0000100

NLDLY = \$0000100

NOFLSH = \$0000080

OCRNL = \$0000008

OFDEL = \$0000080

OFILL = \$0000040

OLCUC = \$0000002

ONLCR = \$0000004

ONLRET = \$0000020

ONOCSR = \$00000010

Open_Accmode = 3

Bitmask to determine access mode in open flags.

Open_Append = 2 shl 9

File open mode: Append to file

Open_Creat = 1 shl 6

File open mode: Create if file does not yet exist.

Open_Direct = 4 shl 12

File open mode: Minimize caching effects

Open_Directory = 2 shl 15

File open mode: File must be directory.

Open_Excl = 2 shl 6

File open mode: Open exclusively

Open_LargeFile = 1 shl 15

File open mode: Open for 64-bit I/O

Open_NDelay = Open_NonBlock

File open mode: Alias for Open_NonBlock ([1024](#))

Open_NoCtty = 4 shl 6

File open mode: No TTY control.

Open_NoFollow = 4 shl 15

File open mode: Fail if file is symbolic link.

Open_NonBlock = 4 shl 9

File open mode: Open in non-blocking mode

Open_RdOnly = 0

File open mode: Read only

Open_RdWr = 2

File open mode: Read/Write

Open_Sync = 1 shl 12

File open mode: Write to disc at once

Open_Trunc = 1 shl 9

File open mode: Truncate file to length 0

Open_WrOnly = 1

File open mode: Write only

OPOST = \$0000001

PARENB = \$0000100

PARMRK = \$0000008

PARODD = \$0000200

PENDIN = \$0004000

Prio_PGrp = 1

Get/set process group priority

Prio_Process = 0

Get/Set process priority

Prio_User = 2

Get/set user priority

PROT_EXEC = \$4

MMap ([1108](#)) memory access: page can be executed

PROT_NONE = \$0

MMap ([1108](#)) memory access: page can not be accessed

PROT_READ = \$1

MMap ([1108](#)) memory access: page can be read

PROT_WRITE = \$2

MMap ([1108](#)) memory access: page can be written

P_IN = 1

Input file descriptor of pipe pair.

P_OUT = 2

Output file descriptor of pipe pair.

R_OK = 4

Access ([1063](#)) call test: read allowed

SA_INTERRUPT = \$20000000

Sigaction options: ?

SA_NOCLDSTOP = 1

Sigaction options: Do not receive notification when child processes stop

SA_NOMASK = \$40000000

Sigaction options: Do not prevent the signal from being received when it is handled.

SA_ONESHOT = \$80000000

Sigaction options: Restore the signal action to the default state.

SA_ONSTACK = SA_STACK

Socket option

SA_RESTART = \$10000000

Sigaction options: Provide behaviour compatible with BSD signal semantics

SA_SHIRQ = \$04000000

Sigaction options: ?

SA_STACK = \$08000000

Sigaction options: Call the signal handler on an alternate signal stack.

Seek_Cur = 1

Seek option: Set position relative to current position.

Seek_End = 2

Seek option: Set position relative to end of file.

Seek_set = 0

Seek option: Set absolute position.

SIGABRT = 6

Signal: ABRT (Abort)

SIGALRM = 14

Signal: ALRM (Alarm clock)

SIGBUS = 7

Signal: BUS (bus error)

SIGCHLD = 17

Signal: CHLD (child status changed)

SIGCONT = 18

Signal: CONT (Continue)

SIGFPE = 8

Signal: FPE (Floating point error)

SIGHUP = 1

Signal: HUP (Hangup)

SIGILL = 4

Signal: ILL (Illegal instruction)

SIGINT = 2

Signal: INT (Interrupt)

SIGIO = 29

Signal: IO (I/O operation possible)

SIGIOT = 6

Signal: IOT (IOT trap)

SIGKILL = 9

Signal: KILL (unblockable)

SIGPIPE = 13

Signal: PIPE (Broken pipe)

SIGPOLL = SIGIO

Signal: POLL (Pollable event)

SIGPROF = 27

Signal: PROF (Profiling alarm)

SIGPWR = 30

Signal: PWR (power failure restart)

SIGQUIT = 3

Signal: QUIT

SIGSEGV = 11

Signal: SEGV (Segmentation violation)

SIGSTKFLT = 16

Signal: STKFLT (Stack Fault)

SIGSTKSZ = 8192

Signal Stack size error

SIGSTOP = 19

Signal: STOP (Stop, unblockable)

SIGTERM = 15

Signal: TERM (Terminate)

SIGTRAP = 5

Signal: TRAP (Trace trap)

SIGTSTP = 20

Signal: TSTP (keyboard stop)

SIGTTIN = 21

Signal: TTIN (Terminal input, background)

SIGTTOU = 22

Signal: TTOU (Terminal output, background)

SIGUNUSED = 31

Signal: Unused

SIGURG = 23

Signal: URG (Socket urgent condition)

SIGUSR1 = 10

Signal: USR1 (User-defined signal 1)

SIGUSR2 = 12

Signal: USR2 (User-defined signal 2)

SIGVTALRM = 26

Signal: VTALRM (Virtual alarm clock)

SIGWINCH = 28

Signal: WINCH (Window/Terminal size change)

SIGXCPU = 24

Signal: XCPU (CPU limit exceeded)

SIGXFSZ = 25

Signal: XFSZ (File size limit exceeded)

SIG_BLOCK = 0

Sigprocmask flags: Add signals to the set of blocked signals.

SIG_DFL = 0

Signal handler: Default signal handler

SIG_ERR = -1

Signal handler: error

SIG_IGN = 1

Signal handler: Ignore signal

SIG_SETMASK = 2

Sigprocmask flags: Set of blocked signals is given.

SIG_UNBLOCK = 1

Sigprocmask flags: Remove signals from the set set of blocked signals.

SI_PAD_SIZE = 128 / (longint) - 3

Signal information record pad bytes size. Do not use.

SS_DISABLE = 2

Socket options

SS_ONSTACK = 1

Socket options

STAT_IFBLK = \$6000

File (stat ([1058](#)) record) mode: Block device

STAT_IFCHR = \$2000

File (stat ([1058](#)) record) mode: Character device

STAT_IFDIR = \$4000

File (stat ([1058](#)) record) mode: Directory

STAT_IFIFO = \$1000

File (stat ([1058](#)) record) mode: FIFO

STAT_IFLNK = \$a000

File (stat ([1058](#)) record) mode: Link

STAT_IFMT = \$f000

File (stat ([1058](#)) record) mode: File type bit mask

STAT_IFREG = \$8000

File (stat (1058) record) mode: Regular file

STAT_IFSOCK = \$c000

File (stat (1058) record) mode: Socket

STAT_IRGRP = STAT_IROTH shl 3

File (stat (1058) record) mode: Group read permission

STAT_IROTH = \$4

File (stat (1058) record) mode: Other read permission

STAT_IRUSR = STAT_IROTH shl 6

File (stat (1058) record) mode: Owner read permission

STAT_IRWXG = STAT_IRWXO shl 3

File (stat (1058) record) mode: Group permission bits mask

STAT_IRWXO = \$7

File (stat (1058) record) mode: Other permission bits mask

STAT_IRWXU = STAT_IRWXO shl 6

File (stat (1058) record) mode: Owner permission bits mask

STAT_ISGID = \$0400

File (stat (1058) record) mode: GID bit set

STAT_ISUID = \$0800

File (stat (1058) record) mode: UID bit set

STAT_ISVTX = \$0200

File (stat (1058) record) mode: Sticky bit set

STAT_IWGRP = STAT_IWOTH shl 3

File (stat (1058) record) mode: Group write permission

STAT_IWOTH = \$2

File (stat (1058) record) mode: Other write permission

```
STAT_IWUSR = STAT_IWOTH shl 6
```

File (stat ([1058](#)) record) mode: Owner write permission

```
STAT_IXGRP = STAT_IXOTH shl 3
```

File (stat ([1058](#)) record) mode: Others execute permission

```
STAT_IXOTH = $1
```

File (stat ([1058](#)) record) mode: Others execute permission

```
STAT_IXUSR = STAT_IXOTH shl 6
```

File (stat ([1058](#)) record) mode: Others execute permission

```
syscall_nr_access = 33
```

```
syscall_nr_acct = 51
```

```
syscall_nr_adjtimex = 124
```

```
syscall_nr_afs_syscall = 137
```

```
syscall_nr_alarm = 27
```

```
syscall_nr_bdfflush = 134
```

```
syscall_nr_break = 17
```

```
syscall_nr_brk = 45
```

```
syscall_nr_chdir = 12
```

```
syscall_nr_chmod = 15
```

```
syscall_nr_chown = 16
```

```
syscall_nr_chroot = 61
```

```
syscall_nr_clone = 120
```

```
syscall_nr_close = 6  
  
syscall_nr_creat = 8  
  
syscall_nr_create_module = 127  
  
syscall_nr_delete_module = 129  
  
syscall_nr_dup = 41  
  
syscall_nr_dup2 = 63  
  
syscall_nr_execve = 11  
  
syscall_nr_exit = 1  
  
syscall_nr_fchdir = 133  
  
syscall_nr_fchmod = 94  
  
syscall_nr_fchown = 95  
  
syscall_nr_fcntl = 55  
  
syscall_nr_fdatasync = 148  
  
syscall_nr_flock = 143  
  
syscall_nr_fork = 2  
  
syscall_nr_fstat = 108  
  
syscall_nr_fstatfs = 100  
  
syscall_nr_fsync = 118  
  
syscall_nr_ftime = 35
```

```
syscall_nr_ftruncate = 93  
  
syscall_nr_getdents = 141  
  
syscall_nr_getegid = 50  
  
syscall_nr_geteuid = 49  
  
syscall_nr_getgid = 47  
  
syscall_nr_getgroups = 80  
  
syscall_nr_getitimer = 105  
  
syscall_nr_getpgid = 132  
  
syscall_nr_getpgrp = 65  
  
syscall_nr_getpid = 20  
  
syscall_nr_getppid = 64  
  
syscall_nr_getpriority = 96  
  
syscall_nr_getresuid = 165  
  
syscall_nr_getrlimit = 76  
  
syscall_nr_getrusage = 77  
  
syscall_nr_getsid = 147  
  
syscall_nr_gettimeofday = 78  
  
syscall_nr_getuid = 24  
  
syscall_nr_get_kernel_syms = 130
```

```
syscall_nr_gtty = 32  
  
syscall_nr_idle = 112  
  
syscall_nr_init_module = 128  
  
syscall_nr_ioctl = 54  
  
syscall_nr_ioperm = 101  
  
syscall_nr_iopl = 110  
  
syscall_nr_ipc = 117  
  
syscall_nr_kill = 37  
  
syscall_nr_link = 9  
  
syscall_nr_lock = 53  
  
syscall_nr_lseek = 19  
  
syscall_nr_lstat = 107  
  
syscall_nr_mkdir = 39  
  
syscall_nr_mknod = 14  
  
syscall_nr_mlock = 150  
  
syscall_nr_mlockall = 152  
  
syscall_nr_mmap = 90  
  
syscall_nr_modify_ldt = 123  
  
syscall_nr_mount = 21
```

```
syscall_nr_mprotect = 125  
  
syscall_nr_mpx = 56  
  
syscall_nr_mremap = 163  
  
syscall_nr_msync = 144  
  
syscall_nr_munlock = 151  
  
syscall_nr_munlockall = 153  
  
syscall_nr_munmap = 91  
  
syscall_nr_nanosleep = 162  
  
syscall_nr_nice = 34  
  
syscall_nr_oldfstat = 28  
  
syscall_nr_oldlstat = 84  
  
syscall_nr_oldolduname = 59  
  
syscall_nr_oldstat = 18  
  
syscall_nr_olduname = 109  
  
syscall_nr_open = 5  
  
syscall_nr_pause = 29  
  
syscall_nr_personality = 136  
  
syscall_nr_phys = 52  
  
syscall_nr_pipe = 42
```

```
syscall_nr_poll = 168  
  
syscall_nr_prof = 44  
  
syscall_nr_profil = 98  
  
syscall_nr_ptrace = 26  
  
syscall_nr_query_module = 167  
  
syscall_nr_quotactl = 131  
  
syscall_nr_read = 3  
  
syscall_nr_readdir = 89  
  
syscall_nr_readlink = 85  
  
syscall_nr_readv = 145  
  
syscall_nr_reboot = 88  
  
syscall_nr_rename = 38  
  
syscall_nr_rmdir = 40  
  
syscall_nr_sched_getparam = 155  
  
syscall_nr_sched_getscheduler = 157  
  
syscall_nr_sched_get_priority_max = 159  
  
syscall_nr_sched_get_priority_min = 160  
  
syscall_nr_sched_rr_get_interval = 161  
  
syscall_nr_sched_setparam = 154
```

```
syscall_nr_sched_setscheduler = 156  
  
syscall_nr_sched_yield = 158  
  
syscall_nr_select = 82  
  
syscall_nr_setdomainname = 121  
  
syscall_nr_setfsgid = 139  
  
syscall_nr_setfsuid = 138  
  
syscall_nr_setgid = 46  
  
syscall_nr_setgroups = 81  
  
syscall_nr_sethostname = 74  
  
syscall_nr_setitimer = 104  
  
syscall_nr_setpgid = 57  
  
syscall_nr_setpriority = 97  
  
syscall_nr_setregid = 71  
  
syscall_nr_setresuid = 164  
  
syscall_nr_setreuid = 70  
  
syscall_nr_setrlimit = 75  
  
syscall_nr_setsid = 66  
  
syscall_nr_settimeofday = 79  
  
syscall_nr_setuid = 23
```

```
syscall_nr_setup = 0  
  
syscall_nr_sgetmask = 68  
  
syscall_nr_sigaction = 67  
  
syscall_nr_sigaltstack = 186  
  
syscall_nr_signal = 48  
  
syscall_nr_sigpending = 73  
  
syscall_nr_sigprocmask = 126  
  
syscall_nr_sigreturn = 119  
  
syscall_nr_sigsuspend = 72  
  
syscall_nr_socketcall = 102  
  
syscall_nr_ssetmask = 69  
  
syscall_nr_stat = 106  
  
syscall_nr_statfs = 99  
  
syscall_nr_stime = 25  
  
syscall_nr_stty = 31  
  
syscall_nr_swapoff = 115  
  
syscall_nr_swapon = 87  
  
syscall_nr_symlink = 83  
  
syscall_nr_sync = 36
```

```
syscall_nr_sysfs = 135  
  
syscall_nr_sysinfo = 116  
  
syscall_nr_syslog = 103  
  
syscall_nr_time = 13  
  
syscall_nr_times = 43  
  
syscall_nr_truncate = 92  
  
syscall_nr_ulimit = 58  
  
syscall_nr_umask = 60  
  
syscall_nr_umount = 22  
  
syscall_nr_uname = 122  
  
syscall_nr_unlink = 10  
  
syscall_nr_uselib = 86  
  
syscall_nr_ustat = 62  
  
syscall_nr_utime = 30  
  
syscall_nr_vhangup = 111  
  
syscall_nr_vm86 = 166  
  
syscall_nr_vm86old = 113  
  
syscall_nr_wait4 = 114  
  
syscall_nr_waitpid = 7
```

```
syscall_nr_write = 4  
  
syscall_nr_writev = 146  
  
syscall_nr_llseek = 140  
  
syscall_nr_newselect = 142  
  
syscall_nr_sysctl = 149  
  
Sys_E2BIG = 7  
  
Sys_EACCES = 13  
  
Sys_EADDRINUSE = 98  
  
Sys_EADDRNOTAVAIL = 99  
  
Sys_EADV = 68  
  
Sys_EAFNOSUPPORT = 97  
  
Sys_EAGAIN = 11  
  
Sys_EALREADY = 114  
  
Sys_EBADE = 52  
  
Sys_EBADF = 9  
  
Sys_EBADFD = 77  
  
Sys_EBADMSG = 74  
  
Sys_EBADR = 53  
  
Sys_EBADRQC = 56
```

Sys_EBADSLT = 57

Sys_EBFONT = 59

Sys_EBUSY = 16

Sys_ECHILD = 10

Sys_ECHRNG = 44

Sys_ECOMM = 70

Sys_ECONNABORTED = 103

Sys_ECONNREFUSED = 111

Sys_ECONNRESET = 104

Sys_EDEADLK = 35

Sys_EDEADLOCK = 58

Sys_EDESTADDRREQ = 89

Sys_EDOM = 33

Sys_EDOTDOT = 73

Sys_EDQUOT = 122

Sys_EEXIST = 17

Sys_EFAULT = 14

Sys_EFBIG = 27

Sys_EHOSTDOWN = 112

Sys_EHOSTUNREACH = 113

Sys_EIDRM = 43

Sys_EILSEQ = 84

Sys_EINPROGRESS = 115

Sys_EINTR = 4

Sys_EINVAL = 22

Sys_EIO = 5

Sys_EISCONN = 106

Sys_EISDIR = 21

Sys_EISNAM = 120

Sys_EL2HLT = 51

Sys_EL2NSYNC = 45

Sys_EL3HLT = 46

Sys_EL3RST = 47

Sys_ELIBACC = 79

Sys_ELIBBAD = 80

Sys_ELIBEXEC = 83

Sys_ELIBMAX = 82

Sys_ELIBSCN = 81

Sys_ELNRRNG = 48

Sys_ELOOP = 40

Sys_EMFILE = 24

Sys_EMLINK = 31

Sys_EMSGSIZE = 90

Sys_EMULTIHOP = 72

Sys_ENAMETOOLONG = 36

Sys_ENAVAIL = 119

Sys_ENETDOWN = 100

Sys_ENETRESET = 102

Sys_ENETUNREACH = 101

Sys_ENFILE = 23

Sys_ENOANO = 55

Sys_ENOBUFS = 105

Sys_ENOCSI = 50

Sys_ENODATA = 61

Sys_ENODEV = 19

Sys_ENOENT = 2

Sys_ENOEXEC = 8

Sys_ENOLCK = 37

Sys_ENOLINK = 67

Sys_ENOMEM = 12

Sys_ENOMSG = 42

Sys_ENONET = 64

Sys_ENOPKG = 65

Sys_ENOPROTOOPT = 92

Sys_ENOSPC = 28

Sys_ENOSR = 63

Sys_ENOSTR = 60

Sys_ENOSYS = 38

Sys_ENOTBLK = 15

Sys_ENOTCONN = 107

Sys_ENOTDIR = 20

Sys_ENOTEMPTY = 39

Sys_ENOTNAM = 118

Sys_ENOTSOCK = 88

Sys_ENOTTY = 25

Sys_ENOTUNIQ = 76

```
Sys_ENXIO = 6

Sys_EOPNOTSUPP = 95

Sys_EOVERFLOW = 75

Sys_EPERM = 1

Sys_EPFNOSUPPORT = 96

Sys_EPIPE = 32

Sys_EPROTO = 71

Sys_EPROTONOSUPPORT = 93

Sys_EPROTOTYPE = 91

Sys_ERANGE = 34

Sys_EREMCHG = 78

Sys_EREMOTE = 66

Sys_EREMOTEIO = 121

Sys_ERESTART = 85

SysEROFS = 30

Sys_ERROR_MAX = $ffff

Sys_ESHUTDOWN = 108

Sys_ESOCKTNOSUPPORT = 94

Sys_ESPIPE = 29
```

```
Sys_ESRCH = 3

Sys_ESRMNT = 69

Sys_ESTALE = 116

Sys_ESTRPIPE = 86

SysETIME = 62

Sys_ETIMEDOUT = 110

SysETOOMANYREFS = 109

Sys_EXTBTSY = 26

Sys_EUCLEAN = 117

Sys_EUNATCH = 49

Sys_EUSERS = 87

Sys_EWOULDBLOCK = Sys_EAGAIN

Sys_EXDEV = 18

Sys_EXFULL = 54

TAB0 = $0000000

TAB1 = $0000800

TAB2 = $0001000

TAB3 = $0001800

TABDLY = $0001800
```

TCFLSH = \$540B

TCGETA = \$5405

TCGETS = \$5401

TCI fflush = 0

TCIOFF = 2

TCIOFLUSH = 2

TCION = 3

TCO fflush = 1

TCOOFF = 0

TCOON = 1

TCSADRAIN = 1

TCSA fflush = 2

TCSANOW = 0

TCSBRK = \$5409

TCSBRKP = \$5425

TCSETA = \$5406

TCSETAF = \$5408

TCSETAW = \$5407

TCSETS = \$5402

TCSETSF = \$5404

TCSETSW = \$5403

TCXONC = \$540A

TIOCCONS = \$541D

TIOCEXCL = \$540C

TIOCGETD = \$5424

TIOCGICOUNT = \$545D

TIOCGLKTRMIOS = \$5456

TIOCGPGRP = \$540F

TIOCGSERIAL = \$541E

TIOCGSOFTCAR = \$5419

TIOCGWINSZ = \$5413

TIOCINQ = FIONREAD

TIOCLINUX = \$541C

TIOCMBIC = \$5417

TIOCMBIS = \$5416

TIOCGET = \$5415

TIOCMIWAIT = \$545C

TIOCSET = \$5418

TIOCM_CAR = \$040

TIOCM_CD = TIOCM_CAR

TIOCM_CTS = \$020

TIOCM_DSR = \$100

TIOCM_DTR = \$002

TIOCM_LE = \$001

TIOCM_OUT1 = \$2000

TIOCM_OUT2 = \$4000

TIOCM_RI = TIOCM_RNG

TIOCM_RNG = \$080

TIOCM_RTS = \$004

TIOCM_SR = \$010

TIOCM_ST = \$008

TIOCNOTTY = \$5422

TIOCNXCL = \$540D

TIOCOUTQ = \$5411

TIOCPKT = \$5420

TIOCPKT_DATA = 0

TIOCPKT_DOSTOP = 32

TIOCPKT_FLUSHREAD = 1

TIOCPKT_FLUSHWRITE = 2

TIOCPKT_NOSTOP = 16

TIOCPKT_START = 8

TIOCPKT_STOP = 4

TIOCSCTTY = \$540E

TIOCSERCONFIG = \$5453

TIOCSEGETLSR = \$5459

TIOCSEGETMULTI = \$545A

TIOCSERGSTRUCT = \$5458

TIOCSERGWILD = \$5454

TIOCSESETMULTI = \$545B

TIOCSERSWILD = \$5455

TIOCSETD = \$5423

TIOCSLKTRMIOS = \$5457

TIOCSPGRP = \$5410

TIOCSSERIAL = \$541F

TIOCSSOFTCAR = \$541A

TIOCSTI = \$5412

TIOCSWINSZ = \$5414

TIOCTTYGSTRUCT = \$5426

TOSTOP = \$0000100

VDISCARD = 13

VEOF = 4

VEOL = 11

VEOL2 = 16

VERASE = 2

VINTR = 0

VKILL = 3

VLNEXT = 15

VMIN = 6

VQUIT = 1

VREPRINT = 12

VSTART = 8

VSTOP = 9

VSUSP = 10

VSWTC = 7

VT0 = \$0000000

VT1 = \$0004000

VTDLY = \$0004000

VTIME = 5

VWERASE = 14

Wait_Any = -1

WaitPID ([1136](#)): Wait on any process

Wait_Clone = \$80000000

WaitPID ([1136](#)): Wait on clone processes only.

Wait_MyPGRP = 0

WaitPID ([1136](#)): Wait processes from current process group

Wait_NoHang = 1

WaitPID ([1136](#)): Do not wait

Wait_UnTraced = 2

WaitPID ([1136](#)): Also report stopped but untraced processes

WNOHANG = \$1

Waitpid ([1136](#)) option: Do not wait for processes to terminate.

WUNTRACED = \$2

Waitpid ([1136](#)) option: Also report children which were stopped but not yet reported

W_OK = 2

Access ([1063](#)) call test: write allowed

XCASE = \$0000004

XTABS = \$0001800

X_OK = 1

Access ([1063](#)) call test: execute allowed

__WCLONE = \$80000000

Waitpid option: Wait for clone children only

31.11.2 Types

ComStr = string

Command-line string type.

dev_t = Word

Device descriptor type

```
dirent = packed record
  ino : LongInt;
  off : LongInt;
  reclen : Word;
  name : Array[0..255] of Char;
end
```

Record used in the ReadDir ([1115](#)) function to return files in a directory.

DirStr = string

Filename directory part string type.

ExtStr = string

Filename extension part string type.

fdSet = Array[0..7] of LongInt

Array containing file descriptor bitmask for the Select ([1117](#)) call.

NameStr = string

Filename name part string type.

PathStr = string

Filename path part string type.

PDir = ^TDir

Pointer to TDir ([1059](#)) record

pdirent = ^dirent

Pointer to Dirent ([1054](#)) record.

pfdset = ^fdSet

Pointer to FDSet ([1054](#)) array.

pfpstate = ^tfpstate

Pointer to tfpstate ([1060](#)) record.

pglob = ^tglob

Pointer to TGlob ([1060](#)) record.

PSigActionRec = ^SigActionRec

Pointer to SigActionRec ([1056](#)) record.

PSigAltStack = ^SigAltStack

Pointer to SigAltStack ([1056](#)) record

PSigContextRec = ^SigContextRec

Pointer to SigContextRec ([1057](#)) record

PSignalHandler = ^SignalHandler

Pointer to SignalHandler ([1057](#)) type.

PSignalRestorer = ^SignalRestorer

Pointer to SignalRestorer ([1057](#)) type

PSigSet = ^SigSet

Pointer to signal set.

pstack_t = ^stack_t

Pointer to stack_t ([1057](#)) record

PStat = ^Stat

Pointer to Stat ([1058](#)) record.

PStatFS = ^Statfs

Pointer to StatFS ([1058](#)) record.

PSysCallRegs = ^SysCallRegs

Pointer to SysCallRegs ([1058](#)) record.

PSysInfo = ^TSysinfo

Pointer to TSysInfo ([1061](#)) record.

```
ptimeval = ^timeval
```

Pointer to TTimeVal ([1061](#)) record

```
ptimezone = ^timezone
```

Pointer to TimeZone ([1060](#)) record.

```
PUTimeBuf = ^UTimeBuf
```

Pointer to UTimeBuf ([1062](#)) record

```
PUTSName = ^utsname
```

Pointer to UTSName ([1062](#)) record.

```
SigActionRec = packed record
  Handler : record
  end;
  Sa_Mask : SigSet;
  Sa_Flags : LongInt;
  Sa_restorer : SignalRestorer;
end
```

Record used in SigAction ([1120](#)) call.

```
SigAltStack = record
  ss_sp : pointer;
  ss_flags : LongInt;
  ss_size : Size_T;
end
```

Alternate stack registers record

```
SigContextRec = record
  gs : Word;
  __gsh : Word;
  fs : Word;
  __fsh : Word;
  es : Word;
  __esh : Word;
  ds : Word;
  __dsh : Word;
  edi : Cardinal;
  esi : Cardinal;
  ebp : Cardinal;
  esp : Cardinal;
  ebx : Cardinal;
  edx : Cardinal;
  ecx : Cardinal;
```

```
eax : Cardinal;
trapno : Cardinal;
err : Cardinal;
eip : Cardinal;
cs : Word;
__csh : Word;
eflags : Cardinal;
esp_at_signal : Cardinal;
ss : Word;
__ssh : Word;
fpstate : pfpstate;
oldmask : Cardinal;
cr2 : Cardinal;
end
```

The above records contain information about the processor state and process state at the moment a signal is sent to your program.

SignalHandler = procedure(Sig: LongInt)

Function prototype for the Signal ([1122](#)) call.

SignalRestorer = procedure

Signal restorer function prototype

SigSet = LongInt

Signal set type

Size_T = Cardinal

Size type

stack_t = SigAltStack

Alias for SigAltStack ([1056](#)) type

```
Stat = packed record
  dev : dev_t;
  pad1 : Word;
  ino : LongInt;
  mode : Word;
  nlink : Word;
  uid : Word;
  gid : Word;
  rdev : dev_t;
  pad2 : Word;
  size : LongInt;
  blksize : LongInt;
  blocks : LongInt;
```

```
  atime : LongInt;
  unused1 : LongInt;
  mtime : LongInt;
  unused2 : LongInt;
  ctime : LongInt;
  unused3 : LongInt;
  unused4 : LongInt;
  unused5 : LongInt;
end
```

Record describing an inode (file) in the fstat ([1092](#)) call.

```
Statfs = packed record
  fstype : LongInt;
  bsize : LongInt;
  blocks : LongInt;
  bfree : LongInt;
  bavail : LongInt;
  files : LongInt;
  ffree : LongInt;
  fsid : LongInt;
  namelen : LongInt;
  spare : Array[0..6] of LongInt;
end
```

Record describing a file system in the fsstat ([1091](#)) call.

```
SysCallRegs = record
  reg1 : LongInt;
  reg2 : LongInt;
  reg3 : LongInt;
  reg4 : LongInt;
  reg5 : LongInt;
  reg6 : LongInt;
end
```

Register describing system calls.

```
TCloneFunc = function(args: pointer) : LongInt
```

Clone function prototype.

```
TDir = packed record
  fd : Integer;
  loc : LongInt;
  size : Integer;
  buf : pdirent;
  nextoff : LongInt;
  dd_max : Integer;
  lock : pointer;
end
```

Record used in OpenDir (1112) and ReadDir (1115) calls

```
TDirEnt = dirent
```

Alias for DirEnt (1054) record

```
Termio = packed record
  c_iflag : Word;
  c_oflag : Word;
  c_cflag : Word;
  c_lflag : Word;
  c_line : Word;
  c_cc : Array[0..NCC-1] of Char;
end
```

Terminal I/O description record (small)

```
Termios = record
  c_iflag : Cardinal;
  c_oflag : Cardinal;
  c_cflag : Cardinal;
  c_lflag : Cardinal;
  c_line : Char;
  c_cc : Array[0..NCCS-1] of Byte;
  c_ispeed : LongInt;
  c_ospeed : LongInt;
end
```

Terminal I/O description record

```
TFDSet = fdSet
```

Alias for FDSet (1054) type.

```
tfpreg = record
  significand : Array[0..3] of Word;
  exponent : Word;
end
```

Record describing floating point register in signal handler.

```
tfpstate = record
  cw : Cardinal;
  sw : Cardinal;
  tag : Cardinal;
  ipoff : Cardinal;
  cs sel : Cardinal;
  dataoff : Cardinal;
  dataset : Cardinal;
```

```
  st : Array[0..7] of tfpreg;
  status : Cardinal;
end
```

Record describing floating point unit in signal handler.

```
tglob = record
  name : pchar;
  next : pglob;
end
```

Record containing one entry in the result of Glob ([1102](#))

```
timespec = packed record
  tv_sec : LongInt;
  tv_nsec : LongInt;
end
```

Time interval for the NanoSleep ([1110](#)) function.

```
timeval = packed record
  sec : LongInt;
  usec : LongInt;
end
```

Record specifying a time inteval.

```
timezone = packed record
  minuteswest : LongInt;
  dsttime : LongInt;
end
```

Record describing a timezone

```
tmmapargs = record
  address : LongInt;
  size : LongInt;
  prot : LongInt;
  flags : LongInt;
  fd : LongInt;
  offset : LongInt;
end
```

Record containing mmap args.

```
Tpipe = Array[1..2] of LongInt
```

Array describing a pipe pair of filedescriptors.

```
TSigAction = procedure(Sig: LongInt; SigContext: SigContextRec)
```

Function prototype for SigAction ([1120](#)) call.

```
TStat = Stat
```

Alias for Stat ([1058](#)) record.

```
TStatFS = Statfs
```

Alias for StatFS ([1058](#)) type.

```
TSysCallRegs = SysCallRegs
```

Alias for SysCallRegs ([1058](#)) record

```
TSysinfo = packed record
  uptime : LongInt;
  loads : Array[1..3] of LongInt;
  totalram : LongInt;
  freeram : LongInt;
  sharedram : LongInt;
  bufferram : LongInt;
  totalswap : LongInt;
  freeswap : LongInt;
  procs : Integer;
  s : string;
end
```

Record with system information, used by the SysInfo ([1127](#)) call.

```
TTermio = Termio
```

Alias for TermIO ([1059](#)) record

```
TTermios = Termios
```

Alias for Termios ([1059](#)) record.

```
TTimeVal = timeval
```

Alias for TimeVal ([1060](#)) record.

```
TTimeZone = timezone
```

Alias for TimeZone ([1060](#)) record.

```
TUTimeBuf = UTimeBuf
```

Alias for UTimBuf ([1062](#)) record.

```
TUTSName = utsname
```

Alias for UTSName ([1062](#)) record.

```
TWinSize = winsize
```

Alias for WinSize ([1062](#)) record.

```
UTimBuf = packed record
  actime : LongInt;
  modtime : LongInt;
end
```

Record used in Utime ([1135](#)) to set file access and modificaton times.

```
UTimeBuf = UTimBuf
```

Alias for UTimBuf ([1062](#)) record.

```
utsname = packed record
  sysname : Array[0..64] of Char;
  nodename : Array[0..64] of Char;
  release : Array[0..64] of Char;
  version : Array[0..64] of Char;
  machine : Array[0..64] of Char;
  domainname : Array[0..64] of Char;
end
```

The elements of this record are null-terminated C style strings, you cannot access them directly.

```
winsize = packed record
  ws_row : Word;
  ws_col : Word;
  ws_xpixel : Word;
  ws_ypixel : Word;
end
```

Record describing terminal window size.

31.11.3 Variables

```
ErrNo : LongInt
```

Error number of last operation.

```
LinuxError : LongInt
```

`Linuxerror` is the variable in which the procedures in the `linux` unit report errors.

`tzdaylight` : Boolean

Indicates whether daylight savings time is active.

`tzname` : Array[boolean] of pchar

Timezone name.

`tzseconds` : LongInt

Seconds west of GMT

31.12 Procedures and functions

31.12.1 Access

Synopsis: Check file access

Declaration: function Access(Path: PathStr; mode: Integer) : Boolean

Visibility: default

Description: `Access` tests user's access rights on the specified file. `Mode` is a mask existing of one or more of the following:

R_OKUser has read rights.

W_OKUser has write rights.

X_OKUser has execute rights.

F_OKfile exists.

The test is done with the real user ID, instead of the effective user ID. If access is denied, or an error occurred, `False` is returned.

Errors: `LinuxError` is used to report errors:

sys_eaccessThe requested access is denied, either to the file or one of the directories in its path.

sys EINVAL`Mode` was incorrect.

sys ENOENTA directory component in `Path` doesn't exist or is a dangling symbolic link.

sys ENOTDIRA directory component in `Path` is not a directory.

sys ENOMEMInsufficient kernel memory.

sys ELOOP`Path` has a circular symbolic link.

See also: [Chown \(1070\)](#), [Chmod \(1068\)](#)

Listing: `./olinuxex/ex26.pp`

Program Example26 ;

{ Program to demonstrate the Access function. }

Uses oldlinux ;

begin

if Access ('/etc/passwd',W_OK) **then**

begin

WriteLn ('Better check your system.');

WriteLn ('I can write to the /etc/passwd file !');

end;

end.

31.12.2 Alarm

Synopsis: Schedule an alarm signal to be delivered

Declaration: function Alarm(Sec: LongInt) : LongInt

Visibility: default

Description: Alarm schedules an alarm signal to be delivered to your process in Sec seconds. When Sec seconds have elapsed, Linux will send a SIGALRM signal to the current process. If Sec is zero, then no new alarm will be set. Whatever the value of Sec, any previous alarm is cancelled.

The function returns the number of seconds till the previously scheduled alarm was due to be delivered, or zero if there was none.

See also: [SigAction \(1120\)](#)

Listing: ./olinuxex/ex59.pp

Program Example59 ;

{ Program to demonstrate the Alarm function. }

Uses oldlinux ;

Procedure AlarmHandler(Sig : longint);**cdecl**;

begin

WriteLn ('Got to alarm handler');

end;

begin

WriteLn ('Setting alarm handler');

 Signal(SIGALRM,@AlarmHandler);

WriteLn ('Scheduling Alarm in 10 seconds');

 Alarm(10);

WriteLn ('Pausing');

 Pause;

WriteLn ('Pause returned');

end.

31.12.3 AssignPipe

Synopsis: Create a set of pipe file handlers

```
Declaration: function AssignPipe(var pipe_in: LongInt;var pipe_out: LongInt)
            : Boolean
function AssignPipe(var pipe_in: text;var pipe_out: text) : Boolean
function AssignPipe(var pipe_in: File;var pipe_out: File) : Boolean
```

Visibility: default

Description: AssignPipe creates a pipe, i.e. two file objects, one for input, one for output. What is written to Pipe_out, can be read from Pipe_in.

This call is overloaded. The in and out pipe can take three forms: an typed or untyped file, a text file or a file descriptor.

If a text file is passed then reading and writing from/to the pipe can be done through the usual Readln(Pipe_in,...) and Writeln(Pipe_out,...) procedures.

The function returns True if everything went successfully, False otherwise.

Errors: In case the function fails and returns False, LinuxError is used to report errors:

sys_emfileToo many file descriptors for this process.
sys_enfileThe system file table is full.

See also: POpen (1114), MkFifo (1108)

Listing: ./olinuxex/ex36.pp

Program Example36;

```
{ Program to demonstrate the AssignPipe function. }

Uses oldlinux;

Var pipi,pipo : Text;
    s : String;

begin
    Writeln ('Assigning Pipes.');
    If Not assignpipe(pipi,pipo) then
        Writeln('Error assigning pipes !',LinuxError);
    Writeln ('Writing to pipe , and flushing .');
    Writeln (pipo,'This is a textstring');close(pipo);
    Writeln ('Reading from pipe .');
    While not eof(pipi) do
        begin
        Readln (pipi,s);
        Writeln ('Read from pipe : ',s);
        end;
    close (pipi);
    writeln ('Closed pipes .');
    writeln
end.
```

31.12.4 AssignStream

Synopsis: Assign stream for in and output to a program

```
Declaration: function AssignStream(var StreamIn: text;var Streamout: text;
                                const Prog: string) : LongInt
            function AssignStream(var StreamIn: Text;var StreamOut: Text;
                                var StreamErr: Text;const prog: string) : LongInt
```

Visibility: default

Description: AssignStream creates a 2 or 3 pipes, i.e. two (or three) file objects, one for input, one for output,(and one for standard error) the other ends of these pipes are connected to standard input and output (and standard error) of Prog. Prog is the name of a program (including path) with options, which will be executed.

What is written to StreamOut, will go to the standard input of Prog. Whatever is written by Prog to it's standard output can be read from StreamIn. Whatever is written by Prog to it's standard error read from StreamErr, if present.

Reading and writing happens through the usual Readln(StreamIn,...) and Writeln (StreamOut,...) procedures.

Remark: You should *not* use Reset or Rewrite on a file opened with POpen. This will close the file before re-opening it again, thereby closing the connection with the program.

The function returns the process ID of the spawned process, or -1 in case of error.

Errors: In case of error (return value -1) LinuxError is used to report errors:

sys_emfileToo many file descriptors for this process.
sys_enfileThe system file table is full.

Other errors include the ones by the fork and exec programs

See also: AssignPipe (1065), POpen (1114)

Listing: ./olinuxex/ex38.pp

Program Example38;

```
{ Program to demonstrate the AssignStream function. }
```

```
Uses oldlinux;

Var Si,So : Text;
S : String;
i : longint;

begin
  if not (paramstr(1)='son') then
    begin
      Writeln ('Calling son');
      Assignstream (Si,So,'./ex38 -son');
      if linuxerror<>0 then
        begin
          writeln ('AssignStream failed !');
          halt(1);
        end;
      Writeln ('Speaking to son');
      For i:=1 to 10 do
```

```

begin
  writeln (so, 'Hello son !');
  if ioreult<>0 then writeln ( 'Can ''t speak to son... ');
  end;
For i:=1 to 3 do writeln ( so, 'Hello chap !');
close ( so);
while not eof(si) do
  begin
    readln ( si,s);
    writeln ( 'Father: Son said : ',S);
    end;
Writeln ( 'Stopped conversation');
Close ( Si);
Writeln ( 'Put down phone');
end
Else
  begin
    Writeln ( 'This is the son ');
    While not eof (input) do
      begin
        readln ( s);
        if pos ('Hello son !',S)<>0 then
          Writeln ( 'Hello Dad !')
        else
          writeln ( 'Who are you ?');
        end;
      close (output);
    end
  end.

```

31.12.5 Basename

Synopsis: Return basename of a file

Declaration: function Basename(const path: PathStr;const suf: PathStr) : PathStr

Visibility: default

Description: Returns the filename part of Path, stripping off Suf if it exists. The filename part is the whole name if Path contains no slash, or the part of Path after the last slash. The last character of the result is not a slash, unless the directory is the root directory.

Errors: None.

See also: DirName (1074), FExpand (1087)

Listing: ./olinuxex/ex48.pp

Program Example48;

{ Program to demonstrate the BaseName function. }

Uses oldlinux;

Var S : String;

begin

 S:=FExpand(**Paramstr**(0));

```
  Writeln ('This program is called : ',Basename(S,' '));
end.
```

31.12.6 CFMakeRaw

Synopsis: Sets flags in Termios ([1059](#)) record.

Declaration: procedure CFMakeRaw(var tios: Termios)

Visibility: default

Description: CFMakeRaw sets the flags in the Termios structure Tios to a state so that the terminal will function in Raw Mode.

For an example, see TCGetAttr ([1131](#)).

Errors: None.

See also: CFSetOSpeed ([1068](#)), CFSetISpeed ([1068](#))

31.12.7 CFSetISpeed

Synopsis: Set input baud rate in Termios ([1059](#)) record

Declaration: procedure CFSetISpeed(var tios: Termios; speed: Cardinal)

Visibility: default

Description: CFSetISpeed Sets the input baudrate in the Termios structure Tios to Speed.

Errors: None.

See also: CFSetOSpeed ([1068](#)), CFMakeRaw ([1068](#))

31.12.8 CFSetOSpeed

Synopsis: Set output baud rate in Termios ([1059](#)) record

Declaration: procedure CFSetOSpeed(var tios: Termios; speed: Cardinal)

Visibility: default

Description: CFSetOSpeed Sets the output baudrate in the Termios structure Tios to Speed.

Errors: None.

See also: CFSetISpeed ([1068](#)), CFMakeRaw ([1068](#))

31.12.9 Chmod

Synopsis: Change file permission bits

Declaration: function Chmod(path: PathStr; Newmode: LongInt) : Boolean

Visibility: default

Description: Chmod Sets the Mode bits of the file in Path to NewMode. Newmode can be specified by 'or'-ing the following:

S_ISUIDSet user ID on execution.
S_ISGIDSet Group ID on execution.
S_ISVTXSet sticky bit.
S_IRUSRRead by owner.
S_IWUSRWrite by owner.
S_IXUSRExecute by owner.
S_IRGRPRead by group.
S_IWGRPWrite by group.
S_IXGRPExecute by group.
S_IROTHRead by others.
S_IWOTHWrite by others.
S_IXOTHExecute by others.
S_IRWXORead, write, execute by others.
S_IRWXGRead, write, execute by groups.
S_IRWXURead, write, execute by user.

Errors: Errors are returned in `LinuxError`.

sys_epermThe effective UID doesn't match the ownership of the file, and is not zero. Owner or group were not specified correctly.
sys_eaccessOne of the directories in `Path` has no search (=execute) permission.
sys_enoentA directory entry in `Path` does not exist or is a symbolic link pointing to a non-existent directory.
sys_enomemInsufficient kernel memory.
sys_eroofsThe file is on a read-only filesystem.
sys_eloop`Path` has a reference to a circular symbolic link, i.e. a symbolic link, whose expansion points to itself.

See also: Chown (1070), Access (1063), Octal (1112)

Listing: `./olinuxex/ex23.pp`

Program Example23;

```

{ Program to demonstrate the Chmod function. }

Uses oldlinux;

Var F : Text;

begin
  { Create a file }
  Assign (f, 'testex21');
  Rewrite (F);
  Writeln (f, '#!/bin/sh');
  Writeln (f, 'echo Some text for this file');
  Close (F);
  { Octal() makes the correct number from a
    number that LOOKS octal }
  Chmod ('testex21', octal (777));
  { File is now executable }
  execl ('./testex21');
end.

```

31.12.10 Chown

Synopsis: Change owner of file

Declaration: function Chown(path: PathStr; NewUid: LongInt; NewGid: LongInt) : Boolean

Visibility: default

Description: Chown sets the User ID and Group ID of the file in Path to NewUid, NewGid. The function returns True if the call was successful, False if the call failed.

Errors: Errors are returned in LinuxError.

sys_eperm The effective UID doesn't match the ownership of the file, and is not zero. Owner or group were not specified correctly.

sys_eaccess One of the directories in Path has no search (=execute) permission.

sys_enoent A directory entry in Path does not exist or is a symbolic link pointing to a non-existent directory.

sys_enomem Insufficient kernel memory.

sys_eroofs The file is on a read-only filesystem.

sys_eloop Path has a reference to a circular symbolic link, i.e. a symbolic link, whose expansion points to itself.

See also: Chmod ([1068](#)), Access ([1063](#))

Listing: ./olinuxex/ex24.pp

Program Example24;

{ Program to demonstrate the Chown function. }

Uses oldlinux;

Var UID,GID : Longint;
F : Text;

begin

```
    Writeln ('This will only work if you are root.');
    Write ('Enter a UID : ');readln(UID);
    Write ('Enter a GID : ');readln(GID);
    Assign (f,'test.txt');
    Rewrite (f);
    Writeln (f,'The owner of this file should become : ');
    Writeln (f,'UID : ',UID);
    Writeln (f,'GID : ',GID);
    Close (F);
    if not Chown ('test.txt',UID,GID) then
        if LinuxError=Sys_EPERM then
            Writeln ('You are not root !')
        else
            Writeln ('Chmod failed with exit code : ',LinuxError)
    else
        Writeln ('Changed owner successfully !');
end.
```

31.12.11 Clone

Synopsis: Clone current process (create new thread)

Declaration: function Clone(func: TCloneFunc; sp: pointer; flags: LongInt; args: pointer) : LongInt

Visibility: default

Description: `Clone` creates a child process which is a copy of the parent process, just like `Fork` (1089) does. In difference with `Fork`, however, the child process shares some parts of its execution context with its parent, so it is suitable for the implementation of threads: many instances of a program that share the same memory.

When the child process is created, it starts executing the function `Func`, and passes it `Args`. The return value of `Func` is either the explicit return value of the function, or the exit code of the child process.

The `sp` pointer points to the memory reserved as stack space for the child process. This address should be the top of the memory block to be used as stack.

The `Flags` determine the behaviour of the `Clone` call. The low byte of the `Flags` contains the number of the signal that will be sent to the parent when the child dies. This may be bitwise OR'ed with the following constants:

CLONE_VMParent and child share the same memory space, including memory (un)mapped with subsequent `mmap` calls.

CLONE_FSParent and child have the same view of the filesystem; the `chroot`, `chdir` and `umask` calls affect both processes.

CLONE_FILES the file descriptor table of parent and child is shared.

CLONE_SIGHAND the parent and child share the same table of signal handlers. The signal masks are different, though.

CLONE_PIDPARENT and child have the same process ID.

`Clone` returns the process ID in the parent process, and -1 if an error occurred.

Errors: On error, -1 is returned to the parent, and no child is created.

sys_eagain Too many processes are running.

sys_enomem Not enough memory to create child process.

See also: `Fork` (1089)

Listing: ./olinuxex/ex71.pp

```
program TestC{ lone };

uses
  oldlinux , Errors , crt;

const
  Ready : Boolean = false;
  aChar : Char     = 'a';

function CloneProc( Arg: Pointer ): LongInt; Cdecl;
begin
  WriteLn('Hello from the clone ',PChar(Arg));
  repeat
```

```

Write(aChar);
  Select(0,Nil,Nil,Nil,Nil);
until Ready;
WriteLn('Clone finished.');
  CloneProc := 1;
end;

var
  PID : LongInt;

procedure MainProc;
begin
  WriteLn('cloned process PID: ', PID );
  WriteLn('Press <ESC> to kill ... ');
  repeat
    Write('.');
    Select(0,Nil,Nil,Nil,Nil);
    if KeyPressed then
      case ReadKey of
        #27: Ready := true;
        'a': aChar := 'A';
        'A': aChar := 'a';
        'b': aChar := 'b';
        'B': aChar := 'B';
      end;
    until Ready;
    WriteLn('Ready.');
  end;

const
  StackSze = 16384;
  theFlags = CLONE_VM+CLONE_FS+CLONE_FILES+CLONE_SIGHAND;
  aMsg     : PChar = 'Oops !';

var
  theStack : Pointer;
  ExitStat : LongInt;

begin
  GetMem(theStack, StackSze);
  PID := Clone(@CloneProc,
    Pointer( LongInt(theStack)+StackSze),
    theFlags,
    aMsg);
  if PID < 0 then
    WriteLn('Error : ', LinuxError, ' when cloning.')
  else
    begin
      MainProc;
      case WaitPID(0,@ExitStat,Wait_Untraced or wait_clone) of
        -1: WriteLn('error:',LinuxError,'; ',StrError(LinuxError));
        0: WriteLn('error:',LinuxError,'; ',StrError(LinuxError));
      else
        WriteLn('Clone exited with: ',ExitStat shr 8);
      end;
    end;
  FreeMem( theStack , StackSze );
end.

```

31.12.12 CloseDir

Synopsis: Close directory file descriptor

Declaration: function CloseDir(p: PDir) : Integer

Visibility: default

Description: CloseDir closes the directory pointed to by p. It returns zero if the directory was closed successfully, -1 otherwise.

For an example, see OpenDir ([1112](#)).

Errors: Errors are returned in LinuxError.

See also: OpenDir ([1112](#)), ReadDir ([1115](#)), SeekDir ([1117](#)), TellDir ([1133](#))

31.12.13 CreateShellArgV

Synopsis: Create an array of null-terminated strings

Declaration: function CreateShellArgV(const prog: string) : ppchar
function CreateShellArgV(const prog: Ansistring) : ppchar

Visibility: default

Description: CreateShellArgV creates an array of 3 PChar pointers that can be used as arguments to ExecVE the first elements in the array will contain /bin/sh, the second will contain -c, and the third will contain prog.

The function returns a pointer to this array, of type PPChar.

Errors: None.

See also: Shell ([1120](#))

Listing: ./olinuxex/ex61.pp

```

Program ex61;

{ Example program to demonstrate the CreateShellArgV function }

uses oldlinux;

Var
  S: String;
  PP : PPchar;
  I : longint;

begin
  S:= 'script -a -b -c -d -e fghijk';
  PP:=CreateShellArgV(S);
  I:=0;
  If PP<>Nil then
    While PP[I]<>Nil do
      begin
        Writeln ('Got : " ',PP[I], '''');
        Inc(I);
      end;
  end.

```

31.12.14 Dirname

Synopsis: Extract directory part from filename

Declaration: function Dirname(const path: PathStr) : PathStr

Visibility: default

Description: Returns the directory part of Path. The directory is the part of Path before the last slash, or empty if there is no slash. The last character of the result is not a slash, unless the directory is the root directory.

Errors: None.

See also: [BaseName \(1067\)](#), [FExpand \(1087\)](#)

Listing: ./olinuxex/ex47.pp

```
Program Example47;

{ Program to demonstrate the DirName function. }

Uses oldlinux;

Var S : String;

begin
  S:=FExpand(Paramstr(0));
  WriteLn ('This program is in directory : ',Dirname(S));
end.
```

31.12.15 Dup

Synopsis: Duplicate a file handle

Declaration: function Dup(Oldfile: LongInt; var Newfile: LongInt) : Boolean
 function Dup(var Oldfile: text; var Newfile: text) : Boolean
 function Dup(var Oldfile: File; var Newfile: File) : Boolean

Visibility: default

Description: Makes NewFile an exact copy of OldFile, after having flushed the buffer of OldFile in case it is a Text file or untyped file. Due to the buffering mechanism of Pascal, this has not the same functionality as the dup call in C. The internal Pascal buffers are not the same after this call, but when the buffers are flushed (e.g. after output), the output is sent to the same file. Doing an lseek will, however, work as in C, i.e. doing a lseek will change the fileposition in both files.

The function returns False in case of an error, True if successful.

Errors: In case of errors, Linuxerror is used to report errors.

sys_ebadf OldFile hasn't been assigned.

sys_emfile Maximum number of open files for the process is reached.

See also: [Dup2 \(1075\)](#)

Listing: ./olinuxex/ex31.pp

```

program Example31;

{ Program to demonstrate the Dup function. }

uses oldlinux;

var f : text;

begin
  if not dup (output,f) then
    Writeln ('Dup Failed !');
  writeln ('This is written to stdout.');
  writeln (f,'This is written to the dup file , and flushed');flush(f);
  writeln
end.

```

31.12.16 Dup2

Synopsis: Duplicate one filehandle to another

Declaration: function Dup2(oldfile: LongInt;newfile: LongInt) : Boolean
 function Dup2(var oldfile: text;var newfile: text) : Boolean
 function Dup2(var oldfile: File;var newfile: File) : Boolean

Visibility: default

Description: Makes NewFile an exact copy of OldFile, after having flushed the buffer of OldFile in the case of text or untyped files.

NewFile can be an assigned file. If newfile was open, it is closed first. Due to the buffering mechanism of Pascal, this has not the same functionality as the dup2 call in C. The internal Pascal buffers are not the same after this call, but when the buffers are flushed (e.g. after output), the output is sent to the same file. Doing an lseek will, however, work as in C, i.e. doing a lseek will change the fileposition in both files.

The function returns True if succesful, false otherwise.

Errors: In case of error, Linuxerror is used to report errors.

sys_ebadfOldFile hasn't been assigned.

sys_emfileMaximum number of open files for the process is reached.

See also: Dup ([1074](#))

Listing: ./olinuxex/ex32.pp

```

program Example31;

```

```
{ Program to demonstrate the Dup function. }
```

```
uses oldlinux;
```

```
var f : text;
  i : longint;
```

```
begin
  Assign (f, 'text.txt');
```

```

Rewrite (F);
For i:=1 to 10 do writeln (F, 'Line : ', i);
if not dup2 (output,f) then
  Writeln ('Dup2 Failed !');
writeln ('This is written to stdout.');
writeln (f,'This is written to the dup file , and flushed');
flush(f);
writeln;
{ Remove file. Comment this if you want to check flushing.}
Unlink ('text.txt');
end.

```

31.12.17 EpochToLocal

Synopsis: Convert epoch time to local time

Declaration: procedure EpochToLocal(epoch: LongInt;var year: Word;var month: Word;
var day: Word;var hour: Word;var minute: Word;
var second: Word)

Visibility: default

Description: Converts the epoch time (=Number of seconds since 00:00:00 , January 1, 1970, corrected for your time zone) to local date and time.

This function takes into account the timzeone settings of your system.

Errors: None

See also: GetEpochTime ([1096](#)), LocalToEpoch ([1106](#)), GetTime ([1100](#)), GetDate ([1093](#))

Listing: ./olinuxex/ex3.pp

```

Program Example3;

{ Program to demonstrate the EpochToLocal function. }

Uses oldlinux;

Var Year,month,day,hour,minute,seconds : Word;

begin
  EpochToLocal (GetEpochTime,Year,month,day,hour,minute,seconds);
  Writeln ('Current date : ',Day:2,'/',Month:2,'/',Year:4);
  Writeln ('Current time : ',Hour:2,':',minute:2,':',seconds:2);
end.

```

31.12.18 Exec1

Synopsis: Execute process (using argument list)

Declaration: procedure Exec1(const Todo: string)
procedure Exec1(const Todo: Ansistring)

Visibility: default

Description: Replaces the currently running program with the program, specified in path. Path is split into a command and it's options. The executable in path is NOT searched in the path. The current environment is passed to the program. On success, execl does not return.

Errors: Errors are reported in LinuxError:

sys_eaccesFile is not a regular file, or has no execute permission. A component of the path has no search permission.
sys_epermThe file system is mounted *noexec*.
sys_e2bigArgument list too big.
sys_enoexecThe magic number in the file is incorrect.
sys_enoentThe file does not exist.
sys_enomemNot enough memory for kernel, or to split command line.
sys_enotdirA component of the path is not a directory.
sys_eloopThe path contains a circular reference (via symlinks).

See also: Execve ([1080](#)), Execv ([1079](#)), Execvp ([1081](#)), Execle ([1077](#)), Execlp ([1078](#)), Fork ([1089](#))

Listing: ./olinuxex/ex10.pp

```
Program Example10;

{ Program to demonstrate the Execl function. }

Uses oldlinux, strings;

begin
  { Execute 'ls -l', with current environment. }
  { 'ls' is NOT looked for in PATH environment variable.}
  Execl ('/bin/ls -l');
end.
```

31.12.19 Execle

Synopsis: Execute process (using argument list, environment)

Declaration: procedure Execle(Todo: string; Ep: ppchar)
procedure Execle(Todo: AnsiString; Ep: ppchar)

Visibility: default

Description: Replaces the currently running program with the program, specified in path. Path is split into a command and it's options. The executable in path is searched in the path, if it isn't an absolute filename. The environment in ep is passed to the program. On success, execle does not return.

Errors: Errors are reported in LinuxError:

sys_eaccesFile is not a regular file, or has no execute permission. A component of the path has no search permission.
sys_epermThe file system is mounted *noexec*.
sys_e2bigArgument list too big.
sys_enoexecThe magic number in the file is incorrect.
sys_enoentThe file does not exist.

sys_enomemNot enough memory for kernel, or to split command line.

sys_enotdirA component of the path is not a directory.

sys_eloopThe path contains a circular reference (via symlinks).

See also: Execve (1080), Execv (1079), Execvp (1081), Execle (1076), Execlp (1078), Fork (1089)

Listing: ./olinuxex/ex11.pp

```
Program Example11;

{ Program to demonstrate the Execle function. }

Uses oldlinux, strings;

begin
  { Execute 'ls -l', with current environment. }
  { 'ls' is NOT looked for in PATH environment variable.}
  { envp is defined in the system unit.}
  Execle ('/bin/ls -l',envp);
end.
```

31.12.20 Execlp

Synopsis: Execute process (using argument list, environment; search path)

Declaration: procedure Execlp(Todo: string; Ep: ppchar)
procedure Execlp(Todo: Ansistring; Ep: ppchar)

Visibility: default

Description: Replaces the currently running program with the program, specified in path. Path is split into a command and it's options. The executable in path is searched in the path, if it isn't an absolute filename. The current environment is passed to the program. On success, execlp does not return.

Errors: Errors are reported in LinuxError:

sys_eaccesFile is not a regular file, or has no execute permission. A component of the path has no search permission.

sys_epermThe file system is mounted *noexec*.

sys_e2bigArgument list too big.

sys_enoexecThe magic number in the file is incorrect.

sys_enoentThe file does not exist.

sys_enomemNot enough memory for kernel, or to split command line.

sys_enotdirA component of the path is not a directory.

sys_eloopThe path contains a circular reference (via symlinks).

See also: Execve (1080), Execv (1079), Execvp (1081), Execle (1077), Execle (1076), Fork (1089)

Listing: ./olinuxex/ex12.pp

Program Example12;

```
{ Program to demonstrate the Execlp function. }

Uses oldlinux , strings;

begin
{ Execute 'ls -l', with current environment. }
{ 'ls' is looked for in PATH environment variable.}
{ envp is defined in the system unit.}
  Execlp ('ls -l',envp);
end.
```

31.12.21 Execv

Synopsis: Execute process

Declaration: procedure Execv(const path: PathStr;args: ppchar)
procedure Execv(const path: AnsiString;args: ppchar)

Visibility: default

Description: Replaces the currently running program with the program, specified in *path*. It gives the program the options in *args*. This is a pointer to an array of pointers to null-terminated strings. The last pointer in this array should be nil. The current environment is passed to the program. On success, execv does not return.

Errors: Errors are reported in LinuxError:

- sys_eacces**File is not a regular file, or has no execute permission. A component of the path has no search permission.
- sys_eperm**The file system is mounted *noexec*.
- sys_e2big**Argument list too big.
- sys_enoexec**The magic number in the file is incorrect.
- sys_enoent**The file does not exist.
- sys_enomem**Not enough memory for kernel.
- sys_enotdir**A component of the path is not a directory.
- sys_eloop**The path contains a circular reference (via symlinks).

See also: Execve ([1080](#)), Execvp ([1081](#)), Execle ([1077](#)), Execl ([1076](#)), Execlp ([1078](#)), Fork ([1089](#))

Listing: ./olinuxex/ex8.pp

Program Example8;

```
{ Program to demonstrate the Execv function. }

Uses oldlinux , strings;

Const Arg0 : PChar = '/bin/ls';
  Arg1 : Pchar = '-l';

Var PP : PPchar;
```

```

begin
  GetMem (PP,3*SizeOf(Pchar));
  PP[0]:=Arg0;
  PP[1]:=Arg1;
  PP[3]:=Nil;
  { Execute '/bin/ls -l', with current environment }
  Execv ('/bin/ls',pp);
end.

```

31.12.22 Execve

Synopsis: Execute process using environment

Declaration: procedure Execve(Path: PathStr;args: ppchar;ep: ppchar)
procedure Execve(Path: AnsiString;args: ppchar;ep: ppchar)
procedure Execve(path: pchar;args: ppchar;ep: ppchar)

Visibility: default

Description: Replaces the currently running program with the program, specified in path. It gives the program the options in args, and the environment in ep. They are pointers to an array of pointers to null-terminated strings. The last pointer in this array should be nil. On success, execve does not return.

Errors: Errors are reported in LinuxError:

sys_eaccesFile is not a regular file, or has no execute permission. A component of the path has no search permission.
sys_epermThe file system is mounted *noexec*.
sys_e2bigArgument list too big.
sys_enoexecThe magic number in the file is incorrect.
sys_enoentThe file does not exist.
sys_enomemNot enough memory for kernel.
sys_enotdirA component of the path is not a directory.
sys_eloopThe path contains a circular reference (via symlinks).

See also: Execve ([1080](#)), Execv ([1079](#)), Execvp ([1081](#)), Execle ([1077](#)), Execl ([1076](#)), Execlp ([1078](#)), Fork ([1089](#))

Listing: ./olinuxex/ex7.pp

```

Program Example7;

{ Program to demonstrate the Execve function. }

Uses oldlinux , strings;

Const Arg0 : PChar = '/bin/ls';
        Arg1 : Pchar = '-l';

Var PP : PPchar;

```

```

begin
  GetMem (PP,3*SizeOf(Pchar));
  PP[0]:=Arg0;
  PP[1]:=Arg1;
  PP[3]:=Nil;
  { Execute '/bin/ls -l', with current environment }
  { Env is defined in system.inc }
  ExecVe ('/bin/ls',pp,envp);
end.

```

31.12.23 Execvp

Synopsis: Execute process, search path

Declaration: procedure Execvp(Path: PathStr;Args: ppchar;Ep: ppchar)
procedure Execvp(Path: AnsiString;Args: ppchar;Ep: ppchar)

Visibility: default

Description: Replaces the currently running program with the program, specified in path. The executable in path is searched in the path, if it isn't an absolute filename. It gives the program the options in args. This is a pointer to an array of pointers to null-terminated strings. The last pointer in this array should be nil. The current environment is passed to the program. On success, execvp does not return.

Errors: Errors are reported in LinuxError:

sys_eaccesFile is not a regular file, or has no execute permission. A component of the path has no search permission.
sys_epermThe file system is mounted *noexec*.
sys_e2bigArgument list too big.
sys_enoexecThe magic number in the file is incorrect.
sys_enoentThe file does not exist.
sys_enomemNot enough memory for kernel.
sys_enotdirA component of the path is not a directory.
sys_eloopThe path contains a circular reference (via symlinks).

See also: Execve ([1080](#)), Execv ([1079](#)), Execle ([1077](#)), Execl ([1076](#)), Execlp ([1078](#)), Fork ([1089](#))

Listing: ./olinuxex/ex9.pp

```

Program Example9;

{ Program to demonstrate the Execvp function. }

Uses oldlinux , strings ;

Const Arg0 : PChar = 'ls';
        Arg1 : Pchar = '-l';

Var PP : PPchar;

begin

```

```

GetMem (PP,3*SizeOf(Pchar));
PP[0]:=Arg0;
PP[1]:=Arg1;
PP[3]:=Nil;
{ Execute 'ls -l', with current environment. }
{ 'ls' is looked for in PATH environment variable.}
{ Envp is defined in the system unit. }
Execvp ('ls',pp,envp);
end.

```

31.12.24 ExitProcess

Synopsis: Exit the current process

Declaration: procedure ExitProcess(val: LongInt)

Visibility: default

Description: ExitProcess exits the currently running process, and report Val as the exit status.

Remark: If this call is executed, the normal unit finalization code will not be executed. This may lead to unexpected errors and stray files on your system. It is therefore recommended to use the Halt call instead.

Errors: None.

See also: Fork (1089), ExecVE (1080)

31.12.25 Fcntl

Synopsis: File control operations.

Declaration: function Fcntl(Fd: LongInt;Cmd: LongInt) : LongInt
procedure Fcntl(Fd: LongInt;Cmd: LongInt;Arg: LongInt)
function Fcntl(var Fd: Text;Cmd: LongInt) : LongInt
procedure Fcntl(var Fd: Text;Cmd: LongInt;Arg: LongInt)

Visibility: default

Description: Read a file's attributes. Fd is an assigned file, or a valid file descriptor. Cmd specifies what to do, and is one of the following:

F_GetFdRead the close_on_exec flag. If the low-order bit is 0, then the file will remain open across execve calls.

F_GetFIRead the descriptor's flags.

F_GetOwnGet the Process ID of the owner of a socket.

F_SetFdSet the close_on_exec flag of Fd. (only the least significant bit is used).

F_GetLkReturn the flock record that prevents this process from obtaining the lock, or set the l_type field of the lock if there is no obstruction. Arg is a pointer to a flock record.

F_SetLkSet the lock or clear it (depending on l_type in the flock structure). if the lock is held by another process, an error occurs.

F_GetLkwSame as for **F_Setlk**, but wait until the lock is released.

F_SetOwnSet the Process or process group that owns a socket.

Errors: `LinuxError` is used to report errors.

sys_ebadf `Fd` has a bad file descriptor.

sys_eagain or **sys_eaccess** For `F_SetLk`, if the lock is held by another process.

31.12.26 fdClose

Synopsis: Close file descriptor

Declaration: `function fdClose(fd: LongInt) : Boolean`

Visibility: default

Description: `fdClose` closes a file with file descriptor `Fd`. The function returns `True` if the file was closed successfully, `False` otherwise.

For an example, see [fdOpen \(1083\)](#).

Errors: Errors are returned in `LinuxError`.

See also: [fdOpen \(1083\)](#), [fdRead \(1084\)](#), [fdWrite \(1086\)](#), [fdTruncate \(1086\)](#), [fdFlush \(1083\)](#), [fdSeek \(1085\)](#)

31.12.27 fdFlush

Synopsis: Flush kernel file buffer

Declaration: `function fdFlush(fd: LongInt) : Boolean`

Visibility: default

Description: `fdflush` flushes the Linux kernel file buffer, so the file is actually written to disk. This is NOT the same as the internal buffer, maintained by Free Pascal. The function returns `True` if the call was successful, `false` if an error occurred.

For an example, see [fdRead \(1084\)](#).

Errors: Errors are returned in `LinuxError`.

See also: [fdOpen \(1083\)](#), [fdClose \(1083\)](#), [fdRead \(1084\)](#), [fdWrite \(1086\)](#), [fdTruncate \(1086\)](#), [fdSeek \(1085\)](#)

31.12.28 fdOpen

Synopsis: Open file and return file descriptor

Declaration: `function fdOpen(pathname: string; flags: LongInt) : LongInt`
 `function fdOpen(pathname: string; flags: LongInt; mode: LongInt) : LongInt`
 `function fdOpen(pathname: pchar; flags: LongInt) : LongInt`
 `function fdOpen(pathname: pchar; flags: LongInt; mode: LongInt) : LongInt`

Visibility: default

Description: `fdOpen` opens a file in `PathName` with flags `flags` One of the following:

Open_RdOnlyFile is opened Read-only

Open_WrOnlyFile is opened Write-only

Open_RdWrFile is opened Read-Write

The flags may be OR-ed with one of the following constants:

Open_CreatFile is created if it doesn't exist.

Open_ExclIf the file is opened with `Open_Creat` and it already exists, the call wil fail.

Open_NoCttyIf the file is a terminal device, it will NOT become the process' controlling terminal.

Open_TruncIf the file exists, it will be truncated.

Open_Appendthe file is opened in append mode. *Before each write*, the file pointer is positioned at the end of the file.

Open_NonBlockThe file is opened in non-blocking mode. No operation on the file descriptor will cause the calling process to wait till.

Open_NDelayIdem as `Open_NonBlock`

Open_SyncThe file is opened for synchronous IO. Any write operation on the file will not return untill the data is physically written to disk.

Open_NoFollowif the file is a symbolic link, the open fails. (linux 2.1.126 and higher only)

Open_Directoryif the file is not a directory, the open fails. (linux 2.1.126 and higher only)

PathName can be of type `PChar` or `String`. The optional mode argument specifies the permissions to set when opening the file. This is modified by the umask setting. The real permissions are Mode and not umask. The return value of the function is the filedescriptor, or a negative value if there was an error.

Errors: Errors are returned in `LinuxError`.

See also: `fdClose` (1083), `fdRead` (1084), `fdWrite` (1086), `fdTruncate` (1086), `fdFlush` (1083), `fdSeek` (1085)

Listing: ./olinuxex/ex19.pp

Program Example19;

```
{ Program to demonstrate the fdOpen , fdwrite and fdClose functions . }

Uses oldlinux;

Const Line : String[80] = 'This is easy writing !';

Var FD : Longint;

begin
  FD:=fdOpen ('Test.dat',Open_WrOnly or Open_Creat);
  if FD>0 then
    begin
      if length(Line)<>fdwrite (FD,Line[1],Length(Line)) then
        Writeln ('Error when writing to file !');
      fdClose(FD);
    end;
  end.

```

31.12.29 fdRead

Synopsis: Read data from file descriptor

Declaration: function `fdRead(fd: LongInt;var buf;size: LongInt) : LongInt`

Visibility: default

Description: fdRead reads at most `size` bytes from the file descriptor `fd`, and stores them in `buf`. The function returns the number of bytes actually read, or -1 if an error occurred. No checking on the length of `buf` is done.

Errors: Errors are returned in LinuxError.

See also: fdOpen (1083), fdClose (1083), fdWrite (1086), fdTruncate (1086), fdFlush (1083), fdSeek (1085)

Listing: ./olinuxex/ex20.pp

Program Example20;

{ Program to demonstrate the fdRead and fdTruncate functions. }

Uses oldlinux;

Const Data : **string**[10] = '12345687890';

Var FD : Longint;
I : longint;

begin

FD:=fdOpen('test.dat',open_wronly or open_creat,octal(666));

if FD>0 **then**

begin

{ Fill file with data }

for I:=1 **to** 10 **do**

if fdWrite (FD,Data[1],10)<>10 **then**

begin

writeln ('Error when writing !');

halt(1);

end;

fdClose(FD);

FD:=fdOpen('test.dat',open_rdonly);

{ Read data again }

If FD>0 **then**

begin

For I:=1 **to** 5 **do**

if fdRead (FD,Data[1],10)<>10 **then**

begin

writeln ('Error when Reading !');

halt(2);

end;

fdClose(FD);

{ Truncating file at 60 bytes }

{ For truncating, file must be open or write }

FD:=fdOpen('test.dat',open_wronly,octal(666));

if FD>0 **then**

begin

if not fdTruncate(FD,60) **then**

writeln ('Error when truncating !');

fdClose (FD);

end;

end;

end;

end.

31.12.30 fdSeek

Synopsis: Set file pointer position.

Declaration: function fdSeek(fd: LongInt; pos: LongInt; seektype: LongInt) : LongInt

Visibility: default

Description: fdSeek sets the current fileposition of file `fd` to `Pos`, starting from `SeekType`, which can be one of the following:

`Seek_SetPos` is the absolute position in the file.

`Seek_CurPos` is relative to the current position.

`Seek_endPos` is relative to the end of the file.

The function returns the new fileposition, or -1 if an error occurred.

For an example, see [fdOpen \(1083\)](#).

Errors: Errors are returned in `LinuxError`.

See also: [fdOpen \(1083\)](#), [fdWrite \(1086\)](#), [fdClose \(1083\)](#), [fdRead \(1084\)](#), [fdTruncate \(1086\)](#), [fdFlush \(1083\)](#)

31.12.31 fdTruncate

Synopsis: Truncate file on certain size.

Declaration: function fdTruncate(fd: LongInt; size: LongInt) : Boolean

Visibility: default

Description: fdTruncate sets the length of a file in `fd` on `size` bytes, where `size` must be less than or equal to the current length of the file in `fd`. The function returns `True` if the call was successful, `false` if an error occurred.

Errors: Errors are returned in `LinuxError`.

See also: [fdOpen \(1083\)](#), [fdClose \(1083\)](#), [fdRead \(1084\)](#), [fdWrite \(1086\)](#), [fdFlush \(1083\)](#), [fdSeek \(1085\)](#)

31.12.32 fdWrite

Synopsis: Write data to file descriptor

Declaration: function fdWrite(fd: LongInt; const buf; size: LongInt) : LongInt

Visibility: default

Description: fdWrite writes at most `size` bytes from `buf` to file descriptor `fd`. The function returns the number of bytes actually written, or -1 if an error occurred.

Errors: Errors are returned in `LinuxError`.

See also: [fdOpen \(1083\)](#), [fdClose \(1083\)](#), [fdRead \(1084\)](#), [fdTruncate \(1086\)](#), [fdSeek \(1085\)](#), [fdFlush \(1083\)](#)

31.12.33 FD_Clr

Synopsis: Clears a filedescriptor in a set

Declaration: procedure FD_Clr(fd: LongInt; var fds: fdSet)

Visibility: default

Description: FD_Clr clears file descriptor fd in filedescriptor set fds.

For an example, see Select (1117).

Errors: None.

See also: Select (1117), SelectText (1118), GetFS (1097), FD_ZERO (1087), FD_Set (1087), FD_IsSet (1087)

31.12.34 FD_IsSet

Synopsis: Check whether a filedescriptor is set

Declaration: function FD_IsSet(fd: LongInt; var fds: fdSet) : Boolean

Visibility: default

Description: FD_Set Checks whether file descriptor fd in filedescriptor set fds is set.

For an example, see Select (1117).

Errors: None.

See also: Select (1117), SelectText (1118), GetFS (1097), FD_ZERO (1087), FD_Clr (1086), FD_Set (1087)

31.12.35 FD_Set

Synopsis: Set a filedescriptor in a set

Declaration: procedure FD_Set(fd: LongInt; var fds: fdSet)

Visibility: default

Description: FD_Set sets file descriptor fd in filedescriptor set fds.

For an example, see Select (1117).

Errors: None.

See also: Select (1117), SelectText (1118), GetFS (1097), FD_ZERO (1087), FD_Clr (1086), FD_IsSet (1087)

31.12.36 FD_Zero

Synopsis: Clear all file descriptors in set

Declaration: procedure FD_Zero(var fds: fdSet)

Visibility: default

Description: FD_ZERO clears all the filedescriptors in the file descriptor set fds.

For an example, see Select (1117).

Errors: None.

See also: Select (1117), SelectText (1118), GetFS (1097), FD_Clr (1086), FD_Set (1087), FD_IsSet (1087)

31.12.37 FExpand

Synopsis: Expand filename to fully qualified path

Declaration: function FExpand(const Path: PathStr) : PathStr

Visibility: default

Description: FExpand expands Path to a full path, starting from root, eliminating directory references such as . and .. from the result.

Errors: None

See also: [BaseName \(1067\)](#), [DirName \(1074\)](#)

Listing: ./olinuxex/ex45.pp

```
Program Example45;

{ Program to demonstrate the FExpand function. }

Uses oldlinux;

begin
  Writeln ('This program is in : ',FExpand(Paramstr(0)));
end.
```

31.12.38 Flock

Synopsis: Lock a file (advisory lock)

Declaration: function Flock(fd: LongInt;mode: LongInt) : Boolean
 function Flock(var T: text;mode: LongInt) : Boolean
 function Flock(var F: File;mode: LongInt) : Boolean

Visibility: default

Description: FLock implements file locking. it sets or removes a lock on the file F. F can be of type Text or File, or it can be a linux filedescriptor (a longint) Mode can be one of the following constants :

LOCK_SHsets a shared lock.

LOCK_EXsets an exclusive lock.

LOCK_UNunlocks the file.

LOCK_NBThis can be OR-ed together with the other. If this is done the application doesn't block when locking.

The function returns True if successful, False otherwise.

Errors: If an error occurs, it is reported in `LinuxError`.

See also: [Fcntl \(1082\)](#)

31.12.39 FNMatch

Synopsis: Check whether filename matches wildcard specification

Declaration: function FNMatch(const Pattern: string; const Name: string) : Boolean

Visibility: default

Description: FNMatch returns True if the filename in Name matches the wildcard pattern in Pattern, False otherwise.

Pattern can contain the wildcards * (match zero or more arbitrary characters) or ? (match a single character).

Errors: None.

See also: FSearch ([1090](#)), FExpand ([1087](#))

Listing: ./olinuxex/ex69.pp

```

Program Example69;

{ Program to demonstrate the FNMatch function. }

Uses oldlinux;

Procedure TestMatch(Pattern,Name : String);

begin
  Write (' ',Name, ' ');
  If FNMatch (Pattern,Name) then
    Write ('matches')
  else
    Write ('does not match');
  WriteLn(' ',Pattern,'.');
end;

begin
  TestMatch('*','FileName');
  TestMatch('.*','FileName');
  TestMatch('*a*','FileName');
  TestMatch('?ile*','FileName');
  TestMatch('?','FileName');
  TestMatch('.?','FileName');
  TestMatch('?a*','FileName');
  TestMatch('??*me?','FileName');
end.

```

31.12.40 Fork

Synopsis: Create child process

Declaration: function Fork : LongInt

Visibility: default

Description: Fork creates a child process which is a copy of the parent process. Fork returns the process ID in the parent process, and zero in the child's process. (you can get the parent's PID with GetPPid ([1099](#))).

Errors: On error, -1 is returned to the parent, and no child is created.

sys_eagainNot enough memory to create child process.

See also: Execve ([1080](#)), Clone ([1071](#))

31.12.41 FReName

Synopsis: Rename file

Declaration: function FReName(OldName: Pchar; NewName: Pchar) : Boolean
function FReName(OldName: string; NewName: string) : Boolean

Visibility: default

Description: FReName renames the file OldName to NewName. NewName can be in a different directory than OldName, but it cannot be on another partition (device). Any existing file on the new location will be replaced.

If the operation fails, then the OldName file will be preserved.

The function returns True on success, False on failure.

Errors: On error, errors are reported in LinuxError. Possible errors include:

sys_eisdirNewName exists and is a directory, but OldName is not a directory.

sys_exdevNewName and OldName are on different devices.

sys_enotempty or **sys_eexist**NewName is an existing, non-empty directory.

sys_ebusyOldName or NewName is a directory and is in use by another process.

sys_einvalNewName is part of OldName.

sys_emlinkOldPath or NewPath already have the maximum amount of links pointing to them.

sys_enotdirpart of OldName or NewName is not directory.

sys_efaultFor the pchar case: One of the pointers points to an invalid address.

sys_eaccessaccess is denied when attempting to move the file.

sys_enametoolongEither OldName or NewName is too long.

sys_enoentdirectory component in OldName or NewName didn't exist.

sys_enomemnot enough kernel memory.

sys_erofsNewName or OldName is on a read-only file system.

sys_elooptoo many symbolic links were encountered trying to expand OldName or NewName

sys_enospcthe filesystem has no room for the new directory entry.

See also: UnLink ([1135](#))

31.12.42 FSearch

Synopsis: Search for file in search path.

Declaration: function FSearch(const path: PathStr; dirlist: string) : PathStr

Visibility: default

Description: FSearch searches in DirList, a colon separated list of directories, for a file named Path. It then returns a path to the found file.

Errors: An empty string if no such file was found.

See also: [BaseName \(1067\)](#), [DirName \(1074\)](#), [FExpand \(1087\)](#), [FNMatch \(1088\)](#)

Listing: ./olinuxex/ex46.pp

```
Program Example46;

{ Program to demonstrate the FSearch function. }

Uses oldlinux ,strings;

begin
  WriteLn ('Is is in : ',FSearch ('Is',strpas(Getenv('PATH'))));
end.
```

31.12.43 FSplit

Synopsis: Split filename into path, name and extension

Declaration: `procedure FSPLIT(const Path: PathStr;var Dir: DirStr;var Name: NameStr;
var Ext: ExtStr)`

Visibility: default

Description: FSPLIT splits a full file name into 3 parts : A Path, a Name and an extension (in ext). The extension is taken to be all letters after the last dot (.).

Errors: None.

See also: [FSearch \(1090\)](#)

Listing: ./olinuxex/ex67.pp

```
Program Example67;

uses oldlinux;

{ Program to demonstrate the FSPLIT function. }

var
  Path ,Name ,Ext : string ;

begin
  FSPLIT(ParamStr(1),Path ,Name ,Ext);
  WriteLn('Split ',ParamStr(1), ' in : ');
  WriteLn('Path      : ',Path );
  WriteLn('Name      : ',Name );
  WriteLn('Extension: ',Ext);
end.
```

31.12.44 FSStat

Synopsis: Retrieve filesystem information.

Declaration: `function FSStat(Path: PathStr;var Info: Statfs) : Boolean
function FSStat(Fd: LongInt;var Info: Statfs) : Boolean`

Visibility: default

Description: FSStat returns in Info information about the filesystem on which the file Path resides, or on which the file with file descriptor fd resides. Info is of type statfs. The function returns True if the call was successful, False if the call failed.

Errors: LinuxError is used to report errors.

sys_enotdirA component of Path is not a directory.
sys_einvalInvalid character in Path.
sys_enoentPath does not exist.
sys_eaccessSearch permission is denied for component inPath.
sys_eloopA circular symbolic link was encountered in Path.
sys_eioAn error occurred while reading from the filesystem.

See also: FStat (1092), LStat (1107)

Listing: ./olinuxex/ex30.pp

```
program Example30;

{ Program to demonstrate the FSStat function. }

uses oldlinux;

var s : string;
    info : statfs;

begin
  writeln ('Info about current partition : ');
  s:= '.';
  while s<>'q' do
    begin
      if not fsstat (s,info) then
        begin
          writeln('Fstat failed. Errno : ',linuxerror);
          halt (1);
        end;
      writeln;
      writeln ('Result of fsstat on file ''',s,'''');
      writeln ('fstype   : ',info.fstype);
      writeln ('bsize    : ',info.bsize);
      writeln ('bfree    : ',info.bfree);
      writeln ('bavail   : ',info.bavail);
      writeln ('files    : ',info.files);
      writeln ('ffree    : ',info.ffree);
      writeln ('fsid     : ',info.fsid);
      writeln ('Namelen : ',info.namelen);
      write ('Type name of file to do fsstat. (q quits) : ');
      readln (s)
    end;
end.
```

31.12.45 FStat

Synopsis: Retrieve information about a file

Declaration:

```
function FStat(Path: PathStr;var Info: Stat) : Boolean
  function FStat(Fd: LongInt;var Info: Stat) : Boolean
  function FStat(var F: Text;var Info: Stat) : Boolean
  function FStat(var F: File;var Info: Stat) : Boolean
```

Visibility: default

Description: FStat gets information about the file specified in one of the following:

Patha file on the filesystem.

Fda valid file descriptor.

Fan opened text file or untyped file.

and stores it in **Info**, which is of type stat. The function returns True if the call was succesfull, False if the call failed.

Errors: LinuxError is used to report errors.

sys_enoentPath does not exist.

See also: FSStat (1091), LStat (1107)

Listing: ./olinuxex/ex28.pp

```
program example28;

{ Program to demonstrate the FStat function. }

uses oldlinux;

var f : text;
    i : byte;
    info : stat;

begin
  { Make a file }
  assign (f,'test.fil');
  rewrite (f);
  for i:=1 to 10 do writeln (f,'Testline # ',i);
  close (f);
  { Do the call on made file. }
  if not fstat ('test.fil',info) then
    begin
      writeln ('Fstat failed. Errno : ',linuxerror);
      halt (1);
    end;
  writeln;
  writeln ('Result of fstat on file ''test.fil''.');
  writeln ('Inode     : ',info.ino);
  writeln ('Mode      : ',info.mode);
  writeln ('nlink     : ',info.nlink);
  writeln ('uid       : ',info.uid);
  writeln ('gid       : ',info.gid);
  writeln ('rdev      : ',info.rdev);
  writeln ('Size      : ',info.size);
```

```

writeln ('Blksize : ',info.blksze);
writeln ('Blocks : ',info.blocks);
writeln ('atime : ',info.atime);
writeln ('mtime : ',info.mtime);
writeln ('ctime : ',info.ctime);
{ Remove file }
erase (f);
end.

```

31.12.46 GetDate

Synopsis: Return the system date

Declaration: procedure GetDate(var Year: Word; var Month: Word; var Day: Word)

Visibility: default

Description: Returns the current date.

Errors: None

See also: GetEpochTime (1096), GetTime (1100), GetDateTime (1094), EpochToLocal (1076)

Listing: ./olinuxex/ex6.pp

Program Example6;

```

{ Program to demonstrate the GetDate function. }

Uses oldlinux;

Var Year, Month, Day : Word;

begin
  GetDate (Year, Month, Day);
  writeln ('Date : ',Day:2,'/',Month:2,'/',Year:4);
end.

```

31.12.47 GetDateTime

Synopsis: Return system date and time

Declaration: procedure GetDateTime(var Year: Word; var Month: Word; var Day: Word;
var hour: Word; var minute: Word; var second: Word)

Visibility: default

Description: Returns the current date and time. The time is corrected for the local time zone. This procedure is equivalent to the GetDate (1093) and GetTime calls.

Errors: None

See also: GetEpochTime (1096), GetTime (1100), EpochToLocal (1076), GetDate (1093)

Listing: ./olinuxex/ex60.pp

```
Program Example6;

{ Program to demonstrate the GetDateTime function. }

Uses oldlinux;

Var Year, Month, Day, Hour, min, sec : Word;

begin
  GetDateTime (Year, Month, Day, Hour, min, sec);
  WriteLn ('Date : ',Day:2,'/',Month:2,'/',Year:4);
  WriteLn ('Time : ',Hour:2,':',Min:2,':',Sec:2);
end.
```

31.12.48 GetDomainName

Synopsis: Return current domain name

Declaration: function GetDomainName : string

Visibility: default

Description: Get the domain name of the machine on which the process is running. An empty string is returned if the domain is not set.

Errors: None.

See also: GetHostName ([1098](#))

Listing: ./olinuxex/ex39.pp

```
Program Example39;
```

```
{ Program to demonstrate the GetDomainName function. }
```

```
Uses oldlinux;
```

```
begin
  WriteLn ('Domain name of this machine is : ',GetDomainName);
end.
```

31.12.49 GetEGid

Synopsis: Return effective group ID

Declaration: function GetEGid : LongInt

Visibility: default

Description: Get the effective group ID of the currently running process.

Errors: None.

See also: GetGid ([1097](#))

Listing: ./olinuxex/ex18.pp

```
Program Example18;

{ Program to demonstrate the GetGid and GetEGid functions. }

Uses oldlinux;

begin
  writeln ('Group Id = ',getgid,' Effective group Id = ',getegid);
end.
```

31.12.50 GetEnv

Synopsis: Return value of environment variable.

Declaration: function GetEnv(P: string) : Pchar

Visibility: default

Description: GetEnv returns the value of the environment variable in P. If the variable is not defined, nil is returned. The value of the environment variable may be the empty string. A PChar is returned to accomodate for strings longer than 255 bytes, TERMCAP and LS_COLORS, for instance.

Errors: None.

Listing: ./olinuxex/ex41.pp

```
Program Example41;
```

```
{ Program to demonstrate the GetEnv function. }
```

```
Uses oldlinux;
```

```
begin
  writeln ('Path is : ',Getenv( 'PATH' ));
end.
```

31.12.51 GetEpochTime

Synopsis: Return the current unix time

Declaration: function GetEpochTime : LongInt

Visibility: default

Description: returns the number of seconds since 00:00:00 gmt, january 1, 1970. it is adjusted to the local time zone, but not to DST.

Errors: no errors

See also: EpochToLocal ([1076](#)), GetTime ([1100](#))

Listing: ./olinuxex/ex1.pp

```
Program Example1;  
  
{ Program to demonstrate the GetEpochTime function. }  
  
Uses oldlinux;  
  
begin  
  Write ('Secs past the start of the Epoch (00:00 1/1/1980) : ' );  
  WriteLn (GetEpochTime);  
end.
```

31.12.52 GetEUid

Synopsis: Return effective user ID

Declaration: function GetEUid : LongInt

Visibility: default

Description: Get the effective user ID of the currently running process.

Errors: None.

See also: GetUid ([1101](#))

Listing: ./olinuxex/ex17.pp

```
Program Example17;  
  
{ Program to demonstrate the GetUid and GetEUid functions. }  
  
Uses oldlinux;  
  
begin  
  writeln ('User Id = ',getuid,' Effective user Id = ',geteuid);  
end.
```

31.12.53 GetFS

Synopsis: Return file selector

Declaration: function GetFS(var T: Text) : LongInt
function GetFS(var F: File) : LongInt

Visibility: default

Description: GetFS returns the file selector that the kernel provided for your file. In principle you don' need this file selector. Only for some calls it is needed, such as the Select ([1117](#)) call or so.

Errors: In case the file was not opened, then -1 is returned.

See also: Select ([1117](#))

Listing: ./olinuxex/ex34.pp

```
Program Example33;

{ Program to demonstrate the SelectText function. }

Uses oldlinux;

Var tv : TimeVal;

begin
  Writeln ('Press the <ENTER> to continue the program.');
  { Wait until File descriptor 0 (=Input) changes }
  SelectText (Input, nil);
  { Get rid of <ENTER> in buffer }
  readln;
  Writeln ('Press <ENTER> key in less than 2 seconds... ');
  tv.sec:=2;
  tv.usec:=0;
  if SelectText (Input,@tv)>0 then
    Writeln ('Thank you !')
  else
    Writeln ('Too late !');
end.
```

31.12.54 GetGid

Synopsis: Return real group ID

Declaration: function GetGid : LongInt

Visibility: default

Description: Get the real group ID of the currently running process.

Errors: None.

See also: GetEGid ([1095](#))

Listing: ./olinuxex/ex18.pp

Program Example18;

```
{ Program to demonstrate the GetGid and GetEGid functions. }
```

Uses oldlinux;

```
begin
  writeln ('Group Id = ',getgid,' Effective group Id = ',getegid);
end.
```

31.12.55 GetHostName

Synopsis: Return host name

Declaration: function GetHostName : string

Visibility: default

Description: Get the hostname of the machine on which the process is running. An empty string is returned if hostname is not set.

Errors: None.

See also: [GetDomainName \(1094\)](#)

Listing: ./olinuxex/ex40.pp

```
Program Example40;
{ Program to demonstrate the GetHostName function. }
Uses oldlinux;

begin
  WriteLn ( 'Name of this machine is : ',GetHostName );
end.
```

31.12.56 GetLocalTimezone

Synopsis: Return local timzeone information

Declaration: procedure GetLocalTimezone(timer: LongInt;var leap_correct: LongInt;
 var leap_hit: LongInt)
procedure GetLocalTimezone(timer: LongInt)

Visibility: default

Description: GetLocalTimezone returns the local timezone information. It also initializes the TZSeconds variable, which is used to correct the epoch time to local time.

There should never be any need to call this function directly. It is called by the initialization routines of the Linux unit.

See also: [GetTimezoneFile \(1101\)](#), [ReadTimezoneFile \(1116\)](#)

31.12.57 GetPid

Synopsis: Return current process ID

Declaration: function GetPid : LongInt

Visibility: default

Description: Get the Process ID of the currently running process.

Errors: None.

See also: [GetPPid \(1099\)](#)

Listing: ./olinuxex/ex16.pp

```
Program Example16;
{ Program to demonstrate the GetPid , GetPPid function . }
Uses oldlinux ;
```

```
begin
  Writeln ('Process Id = ',getpid,' Parent process Id = ',getppid);
end.
```

31.12.58 GetPPid

Synopsis: Return parent process ID

Declaration: function GetPPid : LongInt

Visibility: default

Description: Get the Process ID of the parent process.

Errors: None.

See also: GetPid ([1099](#))

Listing: ./olinuxex/ex16.pp

Program Example16;

{ Program to demonstrate the GetPid , GetPPid function . }

Uses oldlinux;

begin

Writeln ('Process Id = ',getpid,' Parent process Id = ',getppid);

end.

31.12.59 GetPriority

Synopsis: Return process priority

Declaration: function GetPriority(Which: Integer;Who: Integer) : Integer

Visibility: default

Description: GetPriority returns the priority with which a process is running. Which process(es) is determined by the Which and Who variables. Which can be one of the pre-defined Prio_Process, Prio_PGrp, Prio_User, in which case Who is the process ID, Process group ID or User ID, respectively.

For an example, see Nice ([1111](#)).

Errors: Error checking must be done on LinuxError, since a priority can be negative.

sys_esrchNo process found using which and who.

sys_eINVALWhich was not one of Prio_Process, Prio_Grp or Prio_User.

See also: SetPriority ([1119](#)), Nice ([1111](#))

31.12.60 GetTime

Synopsis: Return current system time

Declaration:

```
procedure GetTime(var hour: Word; var min: Word; var sec: Word;
                  var msec: Word; var usec: Word)
procedure GetTime(var hour: Word; var min: Word; var sec: Word;
                  var sec100: Word)
procedure GetTime(var hour: Word; var min: Word; var sec: Word)
```

Visibility: default

Description: Returns the current time of the day, adjusted to local time. Upon return, the parameters are filled with

hourHours since 00:00 today.
minminutes in current hour.
secseconds in current minute.
sec100hundreds of seconds in current second.
msecmilliseconds in current second.
usecmicroseconds in current second.

Errors: None

See also: [GetEpochTime \(1096\)](#), [GetDate \(1093\)](#), [GetDateTime \(1094\)](#), [EpochToLocal \(1076\)](#)

Listing: ./olinuxex/ex5.pp

```
Program Example5;

{ Program to demonstrate the GetTime function. }

Uses oldlinux;

Var Hour, Minute, Second : Word;

begin
  GetTime (Hour, Minute, Second);
  Writeln ('Time : ',Hour:2,':',Minute:2,':',Second:2);
end.
```

31.12.61 GetTimeOfDay

Synopsis: Return kernel time of day in GMT

Declaration:

```
procedure GetTimeOfDay(var tv: timeval)
function GetTimeOfDay : LongInt
```

Visibility: default

Description: GetTimeOfDay returns the number of seconds since 00:00, January 1 1970, GMT in a timeval record. This time NOT corrected any way, not taking into account timezones, daylight savings time and so on.

It is simply a wrapper to the kernel system call. To get the local time, [GetTime \(1100\)](#).

Errors: None.

See also: [GetTime \(1100\)](#), [GetTimeOfDay \(1101\)](#)

31.12.62 GetTimezoneFile

Synopsis: Return name of timezone information file

Declaration: function GetTimezoneFile : string

Visibility: default

Description: GetTimezoneFile returns the location of the current timezone file. The location of file is determined as follows:

- 1.If /etc/timezone exists, it is read, and the contents of this file is returned. This should work on Debian systems.
- 2.If /usr/lib/zoneinfo/localtime exists, then it is returned. (this file is a symlink to the timezone file on SuSE systems)
- 3.If /etc/localtime exists, then it is returned. (this file is a symlink to the timezone file on RedHat systems)

Errors: If no file was found, an empty string is returned.

See also: ReadTimezoneFile ([1116](#))

31.12.63 GetUid

Synopsis: Return current user ID

Declaration: function GetUid : LongInt

Visibility: default

Description: Get the real user ID of the currently running process.

Errors: None.

See also: GetEUid ([1096](#))

Listing: ./olinuxex/ex17.pp

```
Program Example17;

{ Program to demonstrate the GetUid and GetEUid functions. }

Uses oldlinux;

begin
  writeln ('User Id = ',getuid,' Effective user Id = ',geteuid);
end.
```

31.12.64 Glob

Synopsis: Find filenames matching a wildcard pattern

Declaration: function Glob(const path: PathStr) : pglob

Visibility: default

Description: Glob returns a pointer to a glob structure which contains all filenames which exist and match the pattern in Path. The pattern can contain wildcard characters, which have their usual meaning.

Errors: Returns nil on error, and `LinuxError` is set.

sys_enomem No memory on heap for glob structure.
others As returned by the `opendir` call, and `sys_readdir`.

See also: `GlobFree` (1103)

Listing: `./olinuxex/ex49.pp`

```
Program Example49;

{ Program to demonstrate the Glob and GlobFree functions. }

Uses oldlinux;

Var G1,G2 : PGlob;

begin
  G1:=Glob ('*');
  if LinuxError=0 then
    begin
      G2:=G1;
      Writeln ('Files in this directory : ');
      While g2<>Nil do
        begin
          Writeln (g2^.name);
          g2:=g2^.next;
        end;
      GlobFree (g1);
    end;
end.
```

31.12.65 Globfree

Synopsis: Free result of `Glob` (1102) call

Declaration: `procedure Globfree(var p: pglob)`

Visibility: default

Description: Releases the memory, occupied by a `pglob` structure. `P` is set to nil.

For an example, see `Glob` (1102).

Errors: None

See also: `Glob` (1102)

31.12.66 IOCTL

Synopsis: General kernel IOCTL call.

Declaration: `function IOCTL(Handle: LongInt;Ndx: LongInt;Data: Pointer) : Boolean`

Visibility: default

Description: This is a general interface to the Unix/ linux ioctl call. It performs various operations on the filedescriptor Handle. Ndx describes the operation to perform. Data points to data needed for the Ndx function. The structure of this data is function-dependent, so we don't elaborate on this here. For more information on this, see various manual pages under linux.

Errors: Errors are reported in LinuxError. They are very dependent on the used function, that's why we don't list them here

Listing: ./olinuxex/ex54.pp

```
Program Example54;

uses oldlinux;

{ Program to demonstrate the IOCTL function. }

var
  tios : Termios;
begin
  IOCTL(1,TCGETS,@tios);
  WriteLn('Input Flags : $',hexstr(tios.c_iflag,8));
  WriteLn('Output Flags : $',hexstr(tios.c_oflag,8));
  WriteLn('Line Flags   : $',hexstr(tios.c_lflag,8));
  WriteLn('Control Flags: $',hexstr(tios.c_cflag,8));
end.
```

31.12.67 IOperm

Synopsis: Set permission on IO ports

Declaration: function IOperm(From: Cardinal;Num: Cardinal;Value: LongInt) : Boolean

Visibility: default

Description: IOperm sets permissions on Num ports starting with port From to Value. The function returns True if the call was successfull, False otherwise.

Note:

- This works ONLY as root.
- Only the first 0x03ff ports can be set.
- When doing a Fork ([1089](#)), the permissions are reset. When doing a Execve ([1080](#)) they are kept.

Errors: Errors are returned in LinuxError

31.12.68 IoPL

Synopsis: Set I/O privilege level

Declaration: function IoPL(Level: LongInt) : Boolean

Visibility: default

Description: IoPL sets the I/O privilege level. It is intended for completeness only, one should normally not use it.

31.12.69 IsATTY

Synopsis: Check if filehandle is a TTY (terminal)

Declaration: function IsATTY(Handle: LongInt) : Boolean
function IsATTY(var f: text) : Boolean

Visibility: default

Description: Check if the filehandle described by *f* is a terminal. *f* can be of type

- 1.longint for file handles;
- 2.Text for text variables such as input etc.

Returns True if *f* is a terminal, False otherwise.

Errors: No errors are reported

See also: IOCTL ([1103](#)), TTYName ([1134](#))

31.12.70 Kill

Synopsis: Send a signal to a process

Declaration: function Kill(Pid: LongInt;Sig: LongInt) : Integer

Visibility: default

Description: Send a signal *Sig* to a process or process group. If *Pid*>0 then the signal is sent to *Pid*, if it equals -1, then the signal is sent to all processes except process 1. If *Pid*<-1 then the signal is sent to process group -*Pid*. The return value is zero, except in case three, where the return value is the number of processes to which the signal was sent.

Errors: LinuxError is used to report errors:

- sys_einval**An invalid signal is sent.
- sys_esrch**The *Pid* or process group don't exist.
- sys_eperm**The effective userid of the current process doesn't math the one of process *Pid*.

See also: SigAction ([1120](#)), Signal ([1122](#))

31.12.71 Link

Synopsis: Create a hard link to a file

Declaration: function Link(OldPath: PathStr;NewPath: PathStr) : Boolean

Visibility: default

Description: Link makes *NewPath* point to the same file als *OldPath*. The two files then have the same inode number. This is known as a 'hard' link. The function returns True if the call was succesfull, False if the call failed.

Errors: Errors are returned in LinuxError.

- sys_exdev***OldPath* and *NewPath* are not on the same filesystem.
- sys_eperm**The filesystem containing oldpath and newpath doesn't support linking files.

sys_eaccess Write access for the directory containing Newpath is disallowed, or one of the directories in OldPath or {NewPath} has no search (=execute) permission.

sys_enoent A directory entry in OldPath or NewPath does not exist or is a symbolic link pointing to a non-existent directory.

sys_enotdir A directory entry in OldPath or NewPath is nor a directory.

sys_enomem Insufficient kernel memory.

sys_eroofs The files are on a read-only filesystem.

sys_eexist NewPath already exists.

sys_emlink OldPath has reached maximal link count.

sys_eloop OldPath or NewPath has a reference to a circular symbolic link, i.e. a symbolic link, whose expansion points to itself.

sys_enospc The device containing NewPath has no room for another entry.

sys_eperm OldPath points to . or .. of a directory.

See also: SymLink (1125), UnLink (1135)

Listing: ./olinuxex/ex21.pp

Program Example21;

```
{ Program to demonstrate the Link and UnLink functions. }

Uses oldlinux;

Var F : Text;
      S : String;
begin
  Assign (F, 'test.txt');
  Rewrite (F);
  Writeln (F, 'This is written to test.txt');
  Close(f);
{ new.txt and test.txt are now the same file }
  if not Link ('test.txt', 'new.txt') then
    writeln ('Error when linking !');
{ Removing test.txt still leaves new.txt }
  if not Unlink ('test.txt') then
    writeln ('Error when unlinking !');
  Assign (f, 'new.txt');
  Reset (F);
  While not EOF(f) do
    begin
      Readln(F,S);
      Writeln ('> ',S);
    end;
  Close (f);
{ Remove new.txt also }
  if not Unlink ('new.txt') then
    writeln ('Error when unlinking !');
end.
```

31.12.72 LocalToEpoch

Synopsis: Convert local time to epoch (unix) time

Declaration: function LocalToEpoch(year: Word;month: Word;day: Word;hour: Word;
minute: Word;second: Word) : LongInt

Visibility: default

Description: Converts the Local time to epoch time (=Number of seconds since 00:00:00 , January 1, 1970).

Errors: None

See also: GetEpochTime (1096), EpochToLocal (1076), GetTime (1100), GetDate (1093)

Listing: ./olinuxex/ex4.pp

```
Program Example4;

{ Program to demonstrate the LocalToEpoch function. }

Uses oldlinux;

Var year,month,day,hour,minute,second : Word;

begin
  Write ('Year    : ');readln(Year);
  Write ('Month   : ');readln(Month);
  Write ('Day     : ');readln(Day);
  Write ('Hour    : ');readln(Hour);
  Write ('Minute  : ');readln(Minute);
  Write ('Seconds : ');readln(Second);
  Write ('This is : ');
  Write (LocalToEpoch(year,month,day,hour,minute,second));
  writeln (' seconds past 00:00 1/1/1980');
end.
```

31.12.73 Lstat

Synopsis: Return information about symbolic link. Do not follow the link

Declaration: function Lstat(Filename: PathStr;var Info: Stat) : Boolean

Visibility: default

Description: LStat gets information about the link specified in Path, and stores it in Info, which is of type stat. Contrary to FStat, it stores information about the link, not about the file the link points to. The function returns True if the call was succesfull, False if the call failed.

Errors: LinuxError is used to report errors.

sys_enoentPath does not exist.

See also: FStat (1092), FSStat (1091)

Listing: ./olinuxex/ex29.pp

```
program example29;

{ Program to demonstrate the LStat function. }

uses oldlinux;
```

```

var f : text;
    i : byte;
    info : stat;

begin
{ Make a file }
assign (f,'test.fil');
rewrite (f);
for i:=1 to 10 do writeln (f,'Testline # ',i);
close (f);
{ Do the call on made file. }
if not fstat ('test.fil',info) then
begin
writeln('Fstat failed. Errno : ',linuxerror);
halt (1);
end;
writeln;
writeln ('Result of fstat on file ''test.fil''.');
writeln ('Inode : ',info.ino);
writeln ('Mode : ',info.mode);
writeln ('nlink : ',info.nlink);
writeln ('uid : ',info.uid);
writeln ('gid : ',info.gid);
writeln ('rdev : ',info.rdev);
writeln ('Size : ',info.size);
writeln ('Blksize : ',info.blksze);
writeln ('Blocks : ',info.blocks);
writeln ('atime : ',info.atime);
writeln ('mtime : ',info.mtime);
writeln ('ctime : ',info.ctime);

If not SymLink ('test.fil','test.lnk') then
writeln ('Link failed ! Errno : ',linuxerror);

if not lstat ('test.lnk',info) then
begin
writeln('LStat failed. Errno : ',linuxerror);
halt (1);
end;
writeln;
writeln ('Result of fstat on file ''test.lnk''.');
writeln ('Inode : ',info.ino);
writeln ('Mode : ',info.mode);
writeln ('nlink : ',info.nlink);
writeln ('uid : ',info.uid);
writeln ('gid : ',info.gid);
writeln ('rdev : ',info.rdev);
writeln ('Size : ',info.size);
writeln ('Blksize : ',info.blksze);
writeln ('Blocks : ',info.blocks);
writeln ('atime : ',info.atime);
writeln ('mtime : ',info.mtime);
writeln ('ctime : ',info.ctime);
{ Remove file and link }
erase (f);
unlink ('test.lnk');
end.

```

31.12.74 mkFifo

Synopsis: Create FIFO (named pipe) in file system

Declaration: function mkFifo(pathname: string; mode: LongInt) : Boolean

Visibility: default

Description: MkFifo creates named a named pipe in the filesystem, with name PathName and mode Mode.

Errors: LinuxError is used to report errors:

sys_emfileToo many file descriptors for this process.

sys_enfileThe system file table is full.

See also: POpen ([1114](#)), MkFifo ([1108](#))

31.12.75 MMap

Synopsis: Create memory map of a file

Declaration: function MMap(const m: tmmapargs) : LongInt

Visibility: default

Description: MMap maps or unmaps files or devices into memory. The different fields of the argument m determine what and how the mmap maps this:

addressAddress where to mmap the device. This address is a hint, and may not be followed.

sizeSize (in bytes) of area to be mapped.

protProtection of mapped memory. This is a OR-ed combination of the following constants:

PROT_EXECThe memory can be executed.

PROT_READThe memory can be read.

PROT_WRITEThe memory can be written.

PROT_NONEThe memory can not be accessed.

flagsContains some options for the mmap call. It is an OR-ed combination of the following constants:

MAP_FIXEDDo not map at another address than the given address. If the address cannot be used, MMap will fail.

MAP_SHAREDShare this map with other processes that map this object.

MAP_PRIVATECreate a private map with copy-on-write semantics.

MAP_ANONYMOUSfd does not have to be a file descriptor.

One of the options MAP_SHARED and MAP_PRIVATE must be present, but not both at the same time.

fdFile descriptor from which to map.

offsetOffset to be used in file descriptor fd.

The function returns a pointer to the mapped memory, or a -1 in case of en error.

Errors: On error, -1 is returned and LinuxError is set to the error code:

Sys_EBADFfd is not a valid file descriptor and MAP_ANONYMOUS was not specified.

Sys_EACCESMAP_PRIVATE was specified, but fd is not open for reading. Or MAP_SHARED was asked and PROT_WRITE is set, fd is not open for writing

Sys_EINVALOne of the record fields Start, length or offset is invalid.

Sys_ETXTBUSYMAP_DENYWRITE was set but the object specified by fd is open for writing.

Sys_EAGAINfd is locked, or too much memory is locked.

Sys_ENOMEMNot enough memory for this operation.

See also: MUnMap (1110)

Listing: ./olinuxex/ex66.pp

Program Example66;

{ Program to demonstrate the MMap function. }

Uses oldlinux;

```

Var S : String;
      fd,Len : Longint;
      args : tmmmapargs;
      P : PChar;

begin
  S:='This is a string '#0;
  Len:=Length(S);
  fd:=fdOpen('testfile.txt',Open_wrOnly or open_creat);
  If fd=-1 then
    Halt(1);
  If fdWrite(fd,S[1],Len)=-1 then
    Halt(2);
  fdClose(fd);
  fdOpen('testfile.txt',Open_rdOnly);
  if fd=-1 then
    Halt(3);
  args.address:=0;
  args.offset:=0;
  args.size:=Len+1;
  args.fd:=Fd;
  args.flags:=MAP_PRIVATE;
  args.prot:=PROT_READ or PROT_WRITE;
  P:=Pchar(mmap(args));
  If longint(P)=-1 then
    Halt(4);
  Writeln('Read in memory : ',P);
  fdclose(fd);
  if Not MUnMap(P,Len) Then
    Halt(LinuxError);
end.
```

31.12.76 MUnMap

Synopsis: Unmap previously mapped memory block

Declaration: function MUnMap(P: Pointer;Size: LongInt) : Boolean

Visibility: default

Description: MUnMap unmaps the memory block of size `Size`, pointed to by `P`, which was previously allocated with MMap ([1108](#)).

The function returns `True` if successful, `False` otherwise.

For an example, see MMap ([1108](#)).

Errors: In case of error the function returns `False` and `LinuxError` is set to an error value. See MMap ([1108](#)) for possible error values.

See also: MMap ([1108](#))

31.12.77 NanoSleep

Synopsis: Suspend process for a short time

Declaration: `function NanoSleep(const req: timespec; var rem: timespec) : LongInt`

Visibility: default

Description: NanoSleep suspends the process till a time period as specified in `req` has passed. Then the function returns. If the call was interrupted (e.g. by some signal) then the function may return earlier, and `rem` will contain the remaining time till the end of the intended period. In this case the return value will be -1, and `LinuxError` will be set to `EINTR`.

If the function returns without error, the return value is zero.

Errors: If the call was interrupted, -1 is returned, and `LinuxError` is set to `EINTR`. If invalid time values were specified, then -1 is returned and `LinuxError` is set to `EINVAL`.

See also: Pause ([1113](#)), Alarm ([1064](#))

Listing: ./olinuxex/ex72.pp

```

program example72;

{ Program to demonstrate the NanoSleep function. }

uses oldlinux;

Var
  Req,Rem : TimeSpec;
  Res : Longint;

begin
  With Req do
    begin
      tv_sec:=10;
      tv_nsec:=100;
    end;
  Write('NanoSleep returned : ');
  Flush(Output);
  Res:=(NanoSleep(Req,rem));
  Writeln(res);
  If (res<>0) then
    With rem do
      begin
        Writeln('Remaining seconds      : ',tv_sec);
        Writeln('Remaining nanoseconds : ',tv_nsec);
      end;
  end.

```

31.12.78 Nice

Synopsis: Set process priority

Declaration: procedure Nice(N: Integer)

Visibility: default

Description: Nice adds -N to the priority of the running process. The lower the priority numerically, the less the process is favored. Only the superuser can specify a negative N, i.e. increase the rate at which the process is run.

Errors: Errors are returned in LinuxError

sys_epermA non-superuser tried to specify a negative N, i.e. do a priority increase.

See also: GetPriority (1100), SetPriority (1119)

Listing: ./olinuxex/ex15.pp

Program Example15;

{ Program to demonstrate the Nice and Get/SetPriority functions. }

Uses oldlinux;

begin

```
writeln ('Setting priority to 5');
setpriority (prio_process, getpid, 5);
writeln ('New priority = ', getpriority (prio_process, getpid));
writeln ('Doing nice 10');
nice (10);
writeln ('New Priority = ', getpriority (prio_process, getpid));
end.
```

31.12.79 Octal

Synopsis: Convert octal to decimal value

Declaration: function Octal(l: LongInt) : LongInt

Visibility: default

Description: Octal will convert a number specified as an octal number to it's decimal value.

This is useful for the Chmod (1068) call, where permissions are specified as octal numbers.

Errors: No checking is performed whether the given number is a correct Octal number. e.g. specifying 998 is possible; the result will be wrong in that case.

See also: Chmod (1068)

Listing: ./olinuxex/ex68.pp

Program Example68;

{ Program to demonstrate the Octal function. }

Uses oldlinux;

```
begin
  Writeln( 'Mode 777 : ', Octal(777));
  Writeln( 'Mode 644 : ', Octal(644));
  Writeln( 'Mode 755 : ', Octal(755));
end.
```

31.12.80 OpenDir

Synopsis: Open directory for reading

Declaration: function OpenDir(f: pchar) : PDir
function OpenDir(f: string) : PDir

Visibility: default

Description: OpenDir opens the directory f, and returns a pdir pointer to a Dir record, which can be used to read the directory structure. If the directory cannot be opened, nil is returned.

Errors: Errors are returned in LinuxError.

See also: CloseDir (1073), ReadDir (1115), SeekDir (1117), TellDir (1133)

Listing: ./olinuxex/ex35.pp

Program Example35;

{ Program to demonstrate the
OpenDir, ReadDir, SeekDir and TellDir functions. }

Uses oldlinux;

```
Var TheDir : PDir;
  ADirent : PDirent;
  Entry : Longint;

begin
  TheDir:=OpenDir( './.' );
  Repeat
    Entry:=TellDir(TheDir);
    ADirent:=ReadDir (TheDir);
    If ADirent<>Nil then
      With ADirent^ do
        begin
          Writeln ( 'Entry No : ',Entry );
          Writeln ( 'Inode     : ',ino );
          Writeln ( 'Offset     : ',off );
          Writeln ( 'Reclen    : ',reclen );
          Writeln ( 'Name      : ',pchar(@name[0]));
        end;
    Until ADirent=Nil;
  Repeat
    Write ( 'Entry No. you would like to see again (-1 to stop): ' );
    ReadLn (Entry);
    If Entry<>-1 then
      begin
        SeekDir (TheDir,Entry);
        ADirent:=ReadDir (TheDir);
```

```

If ADirent<>Nil then
  With ADirent^ do
    begin
      Writeln ('Entry No : ', Entry);
      Writeln ('Inode     : ', ino);
      Writeln ('Offset     : ', off);
      Writeln ('Reclen    : ', reclen);
      Writeln ('Name      : ', pchar(@name[0]));
    end;
  end;
  Until Entry=-1;
  CloseDir (TheDir);
end.

```

31.12.81 Pause

Synopsis: Wait for a signal

Declaration: procedure Pause

Visibility: default

Description: `Pause` puts the process to sleep and waits until the application receives a signal. If a signal handler is installed for the received signal, the handler will be called and after that pause will return control to the process.

For an example, see [Alarm \(1064\)](#).

31.12.82 PClose

Synopsis: Close file opened with POpen ([1114](#))

Declaration: function PClose(var F: text) : LongInt
function PClose(var F: File) : LongInt

Visibility: default

Description: `PClose` closes a file opened with `POpen` ([1114](#)). It waits for the command to complete, and then returns the exit status of the command.

For an example, see [POpen \(1114\)](#)

Errors: `LinuxError` is used to report errors. If it is different from zero, the exit status is not valid.

See also: `POpen` ([1114](#))

31.12.83 POpen

Synopsis: Pipe file to standard input/output of program

Declaration: procedure POpen(var F: text; const Prog: string; rw: Char)
procedure POpen(var F: File; const Prog: string; rw: Char)

Visibility: default

Description: POpen runs the command specified in Cmd, and redirects the standard in or output of the command to the other end of the pipe F. The parameter rw indicates the direction of the pipe. If it is set to 'W', then F can be used to write data, which will then be read by the command from stdinput. If it is set to 'R', then the standard output of the command can be read from F. F should be reset or rewritten prior to using it. F can be of type Text or File. A file opened with POpen can be closed with Close, but also with PClose (1114). The result is the same, but PClose returns the exit status of the command Cmd.

Errors: Errors are reported in LinuxError and are essentially those of the Execve, Dup and AssignPipe commands.

See also: AssignPipe (1065), PClose (1114)

Listing: ./olinuxex/ex37.pp

```
Program Example37;

{ Program to demonstrate the Popen function. }

uses oldlinux;

var f : text;
    i : longint;

begin
    writeln ('Creating a shell script to which echoes its arguments');
    writeln ('and input back to stdout');
    assign (f, 'test21a');
    rewrite (f);
    writeln (f, '#!/bin/sh');
    writeln (f, 'echo this is the child speaking.... ');
    writeln (f, 'echo got arguments $*');
    writeln (f, 'cat');
    writeln (f, 'exit 2');
    writeln (f);
    close (f);
    chmod ('test21a', octal (755));
    popen (f, './test21a arg1 arg2', 'W');
    if linuxerror<>0 then
        writeln ('error from POpen : Linuxerror : ', Linuxerror);
    for i:=1 to 10 do
        writeln (f, 'This is written to the pipe, and should appear on stdout.');
    Flush(f);
    Writeln ('The script exited with status : ', PClose (f));
    writeln;
    writeln ('Press <return> to remove shell script.');
    readln;
    assign (f, 'test21a');
    erase (f)
end.
```

31.12.84 ReadDir

Synopsis: Read entry from directory

Declaration: function ReadDir(p: PDir) : pdirent

Visibility: default

Description: ReadDir reads the next entry in the directory pointed to by p. It returns a pdirent pointer to a structure describing the entry. If the next entry can't be read, Nil is returned.

For an example, see OpenDir (1112).

Errors: Errors are returned in LinuxError.

See also: CloseDir (1073), OpenDir (1112), SeekDir (1117), TellDir (1133)

31.12.85 ReadLink

Synopsis: Read destination of symbolic link

Declaration: function ReadLink(name: pchar; linkname: pchar; maxlen: LongInt) : LongInt
function ReadLink(name: PathStr) : PathStr

Visibility: default

Description: ReadLink returns the file the symbolic link name is pointing to. The first form of this function accepts a buffer linkname of length maxlen where the filename will be stored. It returns the actual number of characters stored in the buffer.

The second form of the function returns simply the name of the file.

Errors: On error, the first form of the function returns -1; the second one returns an empty string. LinuxError is set to report errors:

SYS_ENOTDIR A part of the path in Name is not a directory.

SYS_EINVAL maxlen is not positive, or the file is not a symbolic link.

SYS_ENAMETOOLONG pathname, or a component of a pathname, was too long.

SYS_ENOENT the link name does not exist.

SYS_EACCES No permission to search a directory in the path

SYS_ELOOP Too many symbolic links were encountered in translating the pathname.

SYS_EIO An I/O error occurred while reading from the file system.

SYS_EFAULT The buffer is not part of the process's memory space.

SYS_ENOMEM Not enough kernel memory was available.

See also: SymLink (1125)

Listing: ./olinuxex/ex62.pp

Program Example62;

{ Program to demonstrate the ReadLink function. }

Uses oldlinux;

Var F : Text;
S : String;

begin
Assign (F, 'test.txt');
Rewrite (F);
WriteLn (F, 'This is written to test.txt');

```

Close(f);
{ new.txt and test.txt are now the same file }
if not SymLink ('test.txt','new.txt') then
  writeln ('Error when symlinking !');
S:=ReadLink('new.txt');
If S=' ' then
  writeln ('Error reading link !')
Else
  writeln ('Link points to : ',S);
{ Now remove links }
if not Unlink ('new.txt') then
  writeln ('Error when unlinking !');
if not Unlink ('test.txt') then
  writeln ('Error when unlinking !');
end.

```

31.12.86 ReadTimezoneFile

Synopsis: Read the timezone file and initialize time routines

Declaration: procedure ReadTimezoneFile(fn: string)

Visibility: default

Description: ReadTimezoneFile reads the timezone file *fn* and initializes the local time routines based on the information found there.

There should be no need to call this function. The initialization routines of the linux unit call this routine at unit startup.

Errors: None.

See also: [GetTimezoneFile \(1101\)](#), [GetLocalTimezone \(1098\)](#)

31.12.87 SeekDir

Synopsis: Seek to position in directory

Declaration: procedure SeekDir(p: PDir; off: LongInt)

Visibility: default

Description: SeekDir sets the directory pointer to the *off*-th entry in the directory structure pointed to by *p*.

For an example, see [OpenDir \(1112\)](#).

Errors: Errors are returned in LinuxError.

See also: [CloseDir \(1073\)](#), [ReadDir \(1115\)](#), [OpenDir \(1112\)](#), [TellDir \(1133\)](#)

31.12.88 Select

Synopsis: Wait for events on file descriptors

Declaration: function Select (N: LongInt; readfds: pfdset; writefds: pfdset;
exceptfds: pfdset; TimeOut: ptimerval) : LongInt
function Select (N: LongInt; readfds: pfdset; writefds: pfdset;
exceptfds: pfdset; TimeOut: LongInt) : LongInt

Visibility: default

Description: Select checks one of the file descriptors in the FDSets to see if its status changed.

`readfds`, `writelfds` and `exceptfds` are pointers to arrays of 256 bits. If you want a file descriptor to be checked, you set the corresponding element in the array to 1. The other elements in the array must be set to zero. Three arrays are passed : The entries in `readfds` are checked to see if characters become available for reading. The entries in `writelfds` are checked to see if it is OK to write to them, while entries in `exceptfds` are checked to see if an exception occurred on them.

You can use the functions `FD_ZERO` (1087) `FD_Clr` (1086), `FD_Set` (1087) or `FD_IsSet` (1087) to manipulate the individual elements of a set.

The pointers can be `Nil`.

`N` is the largest index of a nonzero entry plus 1. (= the largest file-descriptor + 1).

`TimeOut` can be used to set a time limit. If `TimeOut` can be two types :

1. `TimeOut` is of type `PTime` and contains a zero time, the call returns immediately. If `TimeOut` is `Nil`, the kernel will wait forever, or until a status changed.
2. `TimeOut` is of type `Longint`. If it is -1, this has the same effect as a `Timeout` of type `PTime` which is `Nil`. Otherwise, `TimeOut` contains a time in milliseconds.

When the `TimeOut` is reached, or one of the file descriptors has changed, the `Select` call returns. On return, it will have modified the entries in the array which have actually changed, and it returns the number of entries that have been changed. If the timeout was reached, and no descriptor changed, zero is returned; The arrays of indexes are undefined after that. On error, -1 is returned.

Errors: On error, the function returns -1, and Errors are reported in `LinuxError` :

SYS_EBADF An invalid descriptor was specified in one of the sets.

SYS_EINTR A non blocked signal was caught.

SYS_EINVAL N is negative or too big.

SYS_ENOMEM `Select` was unable to allocate memory for its internal tables.

See also: `SelectText` (1118), `GetFS` (1097), `FD_ZERO` (1087), `FD_Clr` (1086), `FD_Set` (1087), `FD_IsSet` (1087)

Listing: ./olinuxex/ex33.pp

Program Example33;

```
{ Program to demonstrate the Select function. }

Uses oldlinux;

Var FDS : FDSet;

begin
  FD_Zero (FDS);
  FD_Set (0,FDS);
  Writeln ('Press the <ENTER> to continue the program.');
  { Wait until File descriptor 0 (=Input) changes }
  Select (1,@FDS,nil,nil,nil);
  { Get rid of <ENTER> in buffer }
  readln;
  Writeln ('Press <ENTER> key in less than 2 seconds ...');
  FD_Zero (FDS);
```

```

FD_Set (0 ,FDS);
if Select (1 ,@FDS, nil ,nil ,2000)>0 then
    Writeln ('Thank you !')
    { FD_ISSET(0,FDS) would be true here. }
else
    Writeln ('Too late !');
end.

```

31.12.89 SelectText

Synopsis: Wait for event on typed ontyped file.

Declaration: function SelectText(var T: Text;TimeOut: ptimeval) : LongInt
function SelectText(var T: Text;TimeOut: LongInt) : LongInt

Visibility: default

Description: SelectText executes the Select (1117) call on a file of type Text. You can specify a timeout in TimeOut. The SelectText call determines itself whether it should check for read or write, depending on how the file was opened : With Reset it is checked for reading, with Rewrite and Append it is checked for writing.

Errors: See Select (1117). SYS_EBADF can also mean that the file wasn't opened.

See also: Select (1117), GetFS (1097)

31.12.90 SetDate

Synopsis: Set the current system date.

Declaration: function SetDate(Year: Word;Month: Word;Day: Word) : Boolean

Visibility: default

Description: SetDate sets the system date to year, month, day. This is the kernel date, so it is in GMT. The time is not touched. The function returns True if the call was executed correctly, False otherwise.

Remark: You must be root to execute this call.

Errors: Errors are returned in LinuxError (1063)

See also: GetDate (1093), SetTime (1120), SetDateTime (1119)

31.12.91 SetDateTime

Synopsis: Set the current system date and time

Declaration: function SetDateTime(Year: Word;Month: Word;Day: Word;hour: Word;
minute: Word;second: Word) : Boolean

Visibility: default

Description: SetDate sets the system date and time to year, month, day, hour, min, Sec. This is the kernel date/time, so it is in GMT. The time is not touched. The function returns True if the call was executed correctly, False otherwise.

Remark: You must be root to execute this call.

Errors: Errors are returned in LinuxError (1063)

See also: SetDate (1118), SetTime (1120), GetDateTime (1094)

31.12.92 SetPriority

Synopsis: Set process priority

Declaration: procedure SetPriority (Which: Integer; Who: Integer; What: Integer)

Visibility: default

Description: SetPriority sets the priority with which a process is running. Which process(es) is determined by the Which and Who variables. Which can be one of the pre-defined constants:

Prio_ProcessWho is interpreted as process ID

Prio_PGrpWho is interpreted as process group ID

Prio_UserWho is interpreted as user ID

Prio is a value in the range -20 to 20.

For an example, see [Nice \(1111\)](#).

Errors: Error checking must be done on LinuxError, since a priority can be negative.

sys_esrchNo process found using which and who.

sys_einvalWhich was not one of Prio_Process, Prio_Grp or Prio_User.

sys_epermA process was found, but neither its effective or real user ID match the effective user ID of the caller.

sys_eaccesA non-superuser tried to a priority increase.

See also: [GetPriority \(1100\)](#), [Nice \(1111\)](#)

31.12.93 SetTime

Synopsis: Set the current system time.

Declaration: function SetTime (Hour: Word; Min: Word; Sec: Word) : Boolean

Visibility: default

Description: SetTime sets the system time to hour, min, Sec. This is the kernel time, so it is in GMT. The date is not touched. The function returns True if the call was executed correctly, False otherwise.

Remark: You must be root to execute this call.

Errors: Errors are returned in LinuxError ([1063](#))

See also: [GetTime \(1100\)](#), [SetDate \(1118\)](#), [SetDateTime \(1119\)](#)

31.12.94 Shell

Synopsis: Execute and feed command to system shell

Declaration: function Shell (const Command: string) : LongInt
function Shell (const Command: AnsiString) : LongInt

Visibility: default

Description: Shell invokes the bash shell (/bin/sh), and feeds it the command Command (using the -c option). The function then waits for the command to complete, and then returns the exit status of the command, or 127 if it could not complete the Fork ([1089](#)) or Execve ([1080](#)) calls.

Errors: Errors are reported in LinuxError.

See also: POpen (1114), Fork (1089), Execve (1080)

Listing: ./olinuxex/ex56.pp

```
program example56;
uses oldlinux;

{ Program to demonstrate the Shell function }

Var S : Longint;

begin
  Writeln ('Output of ls -l *.pp');
  S:=Shell ('ls -l *.pp');
  Writeln ('Command exited wwith status : ',S);
end.
```

31.12.95 SigAction

Synopsis: Install signal handler

Declaration: procedure SigAction(Signum: LongInt;Act: PSigActionRec;
OldAct: PSigActionRec)

Visibility: default

Description: Changes the action to take upon receipt of a signal. **Act** and **Oldact** are pointers to a **SigActionRec** record. **SigNum** specifies the signal, and can be any signal except **SIGKILL** or **SIGSTOP**.

If **Act** is non-nil, then the new action for signal **SigNum** is taken from it. If **OldAct** is non-nil, the old action is stored there. **Sa_Handler** may be **SIG_DFL** for the default action or **SIG_IGN** to ignore the signal. **Sa_Mask** Specifies which signals should be ignored during the execution of the signal handler. **Sa_Flags** Specifies a series of flags which modify the behaviour of the signal handler. You can 'or' none or more of the following :

- SA_NOCLDSTOP**If signum is **SIGCHLD** do not receive notification when child processes stop.
- SA_ONESHOT** or **SA_RESETHAND**Restore the signal action to the default state once the signal handler has been called.
- SA_RESTART**For compatibility with BSD signals.
- SA_NOMASK** or **SA_NODEFER**Do not prevent the signal from being received from within its own signal handler.

Errors: LinuxError is used to report errors.

- sys_einval**an invalid signal was specified, or it was **SIGKILL** or **SIGSTOP**.
- sys_efault****Act**, **OldAct** point outside this process address space
- sys_eintr**System call was interrupted.

See also: SigProcMask (1123), SigPending (1123), SigSuspend (1124), Kill (1104)

Listing: ./olinuxex/ex57.pp

```

Program example57;

{ Program to demonstrate the SigAction function.}

{
do a kill -USR1 pid from another terminal to see what happens.
replace pid with the real pid of this program.
You can get this pid by running 'ps'.
}

uses oldlinux;

Var
  oa,na : PSigActionRec;

Procedure DoSig(sig : Longint);cdecl;

begin
  writeln('Receiving signal: ',sig);
end;

begin
  new(na);
  new(oa);
  na^.Handler.sh:=@DoSig;
  na^.Sa_Mask:=0;
  na^.Sa_Flags:=0;
  na^.Sa_Restorer:=Nil;
  SigAction(SigUsr1,na,oa);
  if LinuxError<>0 then
    begin
      writeln('Error: ',linuxerror,'.');
      halt(1);
    end;
  writeln('Send USR1 signal or press <ENTER> to exit');
  readln;
end.

```

31.12.96 Signal

Synopsis: Install signal handler (deprecated)

Declaration: `function Signal(Signum: LongInt; Handler: SignalHandler) : SignalHandler`

Visibility: default

Description: `Signal` installs a new signal handler for signal `SigNum`. This call has the same functionality as the **SigAction** call. The return value for `Signal` is the old signal handler, or nil on error.

Errors: `LinuxError` is used to report errors :

SIG_ERRAn error occurred.

See also: [SigAction \(1120\)](#), [Kill \(1104\)](#)

Listing: `./olinuxex/ex58.pp`

```

Program example58;

{ Program to demonstrate the Signal function.}

{
do a kill -USR1 pid from another terminal to see what happens.
replace pid with the real pid of this program.
You can get this pid by running 'ps'.
}

uses oldlinux;

Procedure DoSig(sig : Longint);cdecl;

begin
  writeln('Receiving signal: ',sig);
end;

begin
  Signal(SigUsr1,@DoSig);
  if LinuxError<>0 then
    begin
      writeln('Error: ',linuxerror,'.');
      halt(1);
    end;
  writeln('Send USR1 signal or press <ENTER> to exit');
  readln;
end.

```

31.12.97 SigPending

Synopsis: Return set of currently pending signals

Declaration: function SigPending : SigSet

Visibility: default

Description: Sigpending allows the examination of pending signals (which have been raised while blocked.) The signal mask of pending signals is returned.

Errors: None

See also: [SigAction \(1120\)](#), [SigProcMask \(1123\)](#), [SigSuspend \(1124\)](#), [Signal \(1122\)](#), [Kill \(1104\)](#)

31.12.98 SigProcMask

Synopsis: Set list of blocked signals

Declaration: procedure SigProcMask(How: LongInt; SSet: PSigSet; OldSSet: PSigSet)

Visibility: default

Description: Changes the list of currently blocked signals. The behaviour of the call depends on How :

SIG_BLOCKThe set of blocked signals is the union of the current set and the SSet argument.

SIG_UNBLOCKThe signals in SSet are removed from the set of currently blocked signals.

SIG_SETMASK The list of blocked signals is set so SSet.

If OldSSet is non-nil, then the old set is stored in it.

Errors: LinuxError is used to report errors.

sysefault SSet or OldSSet point to an address outside the range of the process.

sys_eintr System call was interrupted.

See also: [SigAction \(1120\)](#), [SigPending \(1123\)](#), [SigSuspend \(1124\)](#), [Kill \(1104\)](#)

31.12.99 SigRaise

Synopsis: Raise a signal (send to current process)

Declaration: procedure SigRaise(Sig: Integer)

Visibility: default

Description: SigRaise sends a Sig signal to the current process.

Errors: None.

See also: [Kill \(1104\)](#), [GetPid \(1099\)](#)

Listing: ./olinuxex/ex65.pp

```
Program example64;

{ Program to demonstrate the SigRaise function. }

uses oldlinux;

Var
  oa,na : PSigActionRec;

Procedure DoSig(sig : Longint); cdecl;
begin
  writeln('Receiving signal: ',sig);
end;

begin
  new(na);
  new(oa);
  na^.handler.sh:=@DoSig;
  na^.Sa_Mask:=0;
  na^.Sa_Flags:=0;
  na^.Sa_Restorer:=Nil;
  SigAction(SIGUSR1,na,oa);
  if LinuxError<>0 then
    begin
      writeln('Error: ',linuxerror,'.');
      halt(1);
    end;
  writeln('Sending USR1 (' ,sigusr1 ,') signal to self.');
  SigRaise(sigusr1);
end.
```

31.12.100 SigSuspend

Synopsis: Set signal mask and suspend process till signal is received

Declaration: procedure SigSuspend(Mask: SigSet)

Visibility: default

Description: SigSuspend temporarily replaces the signal mask for the process with the one given in Mask, and then suspends the process until a signal is received.

Errors: None

See also: [SigAction \(1120\)](#), [SigProcMask \(1123\)](#), [SigPending \(1123\)](#), [Signal \(1122\)](#), [Kill \(1104\)](#)

31.12.101 StringToPPChar

Synopsis: Split string in list of null-terminated strings

Declaration: function StringToPPChar(var S: string) : ppchar
 function StringToPPChar(var S: AnsiString) : ppchar
 function StringToPPChar(S: Pchar) : ppchar

Visibility: default

Description: StringToPPChar splits the string S in words, replacing any whitespace with zero characters. It returns a pointer to an array of pchars that point to the first letters of the words in S. This array is terminated by a Nil pointer.

The function does *not* add a zero character to the end of the string unless it ends on whitespace.

The function reserves memory on the heap to store the array of PChar; The caller is responsible for freeing this memory.

This function can be called to create arguments for the various Exec calls.

Errors: None.

See also: [CreateShellArgV \(1073\)](#), [Execve \(1080\)](#), [Execv \(1079\)](#)

Listing: ./olinuxex/ex70.pp

```

Program Example70;

{ Program to demonstrate the StringToPPchar function. }

Uses oldlinux;

Var S : String;
      P : PPChar;
      I : longint;

begin
  // remark whitespace at end.
  S:= 'This is a string with words. ';
  P:=StringToPPChar(S);
  I:=0;
  While P[i]<>Nil do
    begin
      WriteLn('Word ',I,' : ',P[i]);
      Inc(I);
    
```

```

    end;
FreeMem(P, i * SizeOf(Pchar));
end.
```

31.12.102 SymLink

Synopsis: Create a symbolic link

Declaration: function SymLink(OldPath: PathStr; NewPath: PathStr) : Boolean

Visibility: default

Description: SymLink makes Newpath point to the file in OldPath, which doesn't necessarily exist. The two files DO NOT have the same inode number. This is known as a 'soft' link.

The permissions of the link are irrelevant, as they are not used when following the link. Ownership of the file is only checked in case of removal or renaming of the link.

The function returns True if the call was succesfull, False if the call failed.

Errors: Errors are returned in LinuxError.

sys_eperm The filesystem containing oldpath and newpath does not support linking files.

sys_eaccess Write access for the directory containing Newpath is disallowed, or one of the directories in OldPath or NewPath has no search (=execute) permission.

sys_enoent A directory entry in OldPath or NewPath does not exist or is a symbolic link pointing to a non-existent directory.

sys_enotdir A directory entry in OldPath or NewPath is nor a directory.

sys_enomem Insufficient kernel memory.

sys_erofs The files are on a read-only filesystem.

sys_eexist NewPath already exists.

sys_eloop OldPath or NewPath has a reference to a circular symbolic link, i.e. a symbolic link, whose expansion points to itself.

sys_enospc The device containing NewPath has no room for another entry.

See also: Link (1105), UnLink (1135), ReadLink (1115)

Listing: ./olinuxex/ex22.pp

```

Program Example22;

{ Program to demonstrate the SymLink and UnLink functions. }

Uses oldlinux;

Var F : Text;
      S : String;

begin
  Assign (F, 'test.txt');
  Rewrite (F);
  WriteLn (F, 'This is written to test.txt');
  Close(f);
  { new.txt and test.txt are now the same file }
  if not SymLink ('test.txt', 'new.txt') then
```

```

writeln ('Error when symlinking !');
{ Removing test.txt still leaves new.txt
  Pointing now to a non-existent file ! }
If not Unlink ('test.txt') then
  WriteLn ('Error when unlinking !');
Assign (f, 'new.txt');
{ This should fail, since the symbolic link
  points to a non-existent file ! }
{$i-}
Reset (F);
{$i+}
If IOResult=0 then
  WriteLn ('This shouldn''t happen');
{ Now remove new.txt also }
If not Unlink ('new.txt') then
  WriteLn ('Error when unlinking !');
end.

```

31.12.103 SysCall

Synopsis: Execute system call.

Declaration: function SysCall(callnr: LongInt; var regs: SysCallRegs) : LongInt

Visibility: default

Description: SysCall can be used to execute a direct system call. The call parameters must be encoded in `regs` and the call number must be specified by `callnr`. The call result is returned, and any modified registers are in `regs`

Errors: None.

See also: SysCallregs ([1058](#))

31.12.104 Sysinfo

Synopsis: Return kernel system information

Declaration: function Sysinfo(var Info: TSysinfo) : Boolean

Visibility: default

Description: SysInfo returns system information in `Info`. Returned information in `Info` includes:

- uptime**Number of seconds since boot.
- loads**1, 5 and 15 minute load averages.
- totalram**total amount of main memory.
- freeram**amount of free memory.
- sharedram**amount of shared memory.
- bufferram**amount of memory used by buffers.
- totalswapt**total amount of swapspace.
- freeswap**amount of free swapspace.
- procs**number of current processes.

Errors: None.

See also: Uname ([1134](#))

Listing: ./olinuxex/ex64.pp

```

program Example64;

{ Example to demonstrate the SysInfo function }

Uses oldlinux;

Function Mb(L : Longint) : longint;

begin
  Mb:=L div (1024*1024);
end;

Var Info : TSysInfo;
  D,M,Secs,H : longint;

begin
  If Not SysInfo(Info) then
    Halt(1);
  With Info do
    begin
      D:=Uptime div (3600*24);
      UpTime:=UpTime mod (3600*24);
      h:=uptime div 3600;
      uptime:=uptime mod 3600;
      m:=uptime div 60;
      secs:=uptime mod 60;
      Writeln('Uptime : ',d,'days, ',h,' hours, ',m,' min, ',secs,' s.');
      Writeln('Loads : ',Loads[1],'/',Loads[2],'/',Loads[3]);
      Writeln('Total Ram : ',Mb(totalram), 'Mb.');
      Writeln('Free Ram : ',Mb(freeram), 'Mb.');
      Writeln('Shared Ram : ',Mb(sharedram), 'Mb.');
      Writeln('Buffer Ram : ',Mb(bufferram), 'Mb.');
      Writeln('Total Swap : ',Mb(totalswap), 'Mb.');
      Writeln('Free Swap : ',Mb(freeswap), 'Mb.');
    end;
end.

```

31.12.105 S_ISBLK

Synopsis: Is file a block device

Declaration: function S_ISBLK(m: Word) : Boolean

Visibility: default

Description: S_ISBLK checks the file mode m to see whether the file is a block device file. If so it returns True.

See also: FStat ([1092](#)), S_ISLNK ([1129](#)), S_ISREG ([1130](#)), S_ISDIR ([1128](#)), S_ISCHR ([1128](#)), S_ISFIFO ([1129](#)), S_ISSOCK ([1130](#))

31.12.106 S_ISCHR

Synopsis: Is file a character device

Declaration: function S_ISCHR(m: Word) : Boolean

Visibility: default

Description: S_ISCHR checks the file mode m to see whether the file is a character device file. If so it returns True.

See also: FStat (1092), S_ISLNK (1129), S_ISREG (1130), S_ISDIR (1128), S_ISBLK (1128), S_ISFIFO (1129), S_ISSOCK (1130)

31.12.107 S_ISDIR

Synopsis: Is file a directory

Declaration: function S_ISDIR(m: Word) : Boolean

Visibility: default

Description: S_ISDIR checks the file mode m to see whether the file is a directory. If so it returns True

See also: FStat (1092), S_ISLNK (1129), S_ISREG (1130), S_ISCHR (1128), S_ISBLK (1128), S_ISFIFO (1129), S_ISSOCK (1130)

31.12.108 S_ISFIFO

Synopsis: Is file a FIFO

Declaration: function S_ISFIFO(m: Word) : Boolean

Visibility: default

Description: S_ISFIFO checks the file mode m to see whether the file is a fifo (a named pipe). If so it returns True.

See also: FStat (1092), S_ISLNK (1129), S_ISREG (1130), S_ISCHR (1128), S_ISBLK (1128), S_ISDIR (1128), S_ISSOCK (1130)

31.12.109 S_ISLNK

Synopsis: Is file a symbolic link

Declaration: function S_ISLNK(m: Word) : Boolean

Visibility: default

Description: S_ISLNK checks the file mode m to see whether the file is a symbolic link. If so it returns True

See also: FStat (1092), S_ISFIFO (1129), S_ISREG (1130), S_ISCHR (1128), S_ISBLK (1128), S_ISDIR (1128), S_ISSOCK (1130)

Listing: ./olinuxex/ex53.pp

```

Program Example53;

{ Program to demonstrate the S_ISLNK function. }

Uses oldlinux;

Var Info : Stat;

begin
  if LStat (paramstr(1),info) then
    begin
      if S_ISLNK(info.mode) then
        Writeln ('File is a link');
      if S_ISREG(info.mode) then
        Writeln ('File is a regular file');
      if S_ISDIR(info.mode) then
        Writeln ('File is a directory');
      if S_ISCHR(info.mode) then
        Writeln ('File is a character device file');
      if S_ISBLK(info.mode) then
        Writeln ('File is a block device file');
      if S_ISFIFO(info.mode) then
        Writeln ('File is a named pipe (FIFO)');
      if S_ISSOCK(info.mode) then
        Writeln ('File is a socket');
    end;
end.

```

31.12.110 S_ISREG

Synopsis: Is file a regular file

Declaration: function S_ISREG(m: Word) : Boolean

Visibility: default

Description: S_ISREG checks the file mode m to see whether the file is a regular file. If so it returns True

See also: FStat ([1092](#)), S_ISFIFO ([1129](#)), S_ISLNK ([1129](#)), S_ISCHR ([1128](#)), S_ISBLK ([1128](#)), S_ISDIR ([1128](#)), S_ISSOCK ([1130](#))

31.12.111 S_ISSOCK

Synopsis: Is file a unix socket

Declaration: function S_ISSOCK(m: Word) : Boolean

Visibility: default

Description: S_ISSOCK checks the file mode m to see whether the file is a socket. If so it returns True.

See also: FStat ([1092](#)), S_ISFIFO ([1129](#)), S_ISLNK ([1129](#)), S_ISCHR ([1128](#)), S_ISBLK ([1128](#)), S_ISDIR ([1128](#)), S_ISREG ([1130](#))

31.12.112 TCDrain

Synopsis: Terminal control: Wait till all data was transmitted

Declaration: function TCDrain(fd: LongInt) : Boolean

Visibility: default

Description: TCDrain waits until all data to file descriptor Fd is transmitted.

The function returns True if the call was succesfull, False otherwise.

Errors: Errors are reported in LinuxError

See also: TCFlow ([1130](#)), TCFlush ([1131](#)), TCGetAttr ([1131](#)), TCGetPGrp ([1132](#)), TCSendBreak ([1132](#)), TCSetAttr ([1133](#)), TCSetPGrp ([1133](#)), TTYName ([1134](#)), IsATTY ([1104](#))

31.12.113 TCFlow

Synopsis: Terminal control: Suspend transmission of data

Declaration: function TCFlow(fd: LongInt;act: LongInt) : Boolean

Visibility: default

Description: TCFlow suspends/resumes transmission or reception of data to or from the file descriptor Fd, depending on the action Act.

This can be one of the following pre-defined values:

TCOFFsuspend reception/transmission

TCONresume reception/transmission

TCIOFFtransmit a stop character to stop input from the terminal

TCIONtransmit start to resume input from the terminal.

The function returns True if the call was succesfull, False otherwise.

Errors: Errors are reported in LinuxError.

See also: TCDrain ([1130](#)), TCFlush ([1131](#)), TCGetAttr ([1131](#)), TCGetPGrp ([1132](#)), TCSendBreak ([1132](#)), TCSetAttr ([1133](#)), TCSetPGrp ([1133](#)), TTYName ([1134](#)), IsATTY ([1104](#))

31.12.114 TCFlush

Synopsis: Terminal control: Discard data buffer

Declaration: function TCFlush(fd: LongInt;qsel: LongInt) : Boolean

Visibility: default

Description: TCFlush discards all data sent or received to/from file descriptor fd. QSel indicates which queue should be discard. It can be one of the following pre-defined values :

TCIFLUSHinput buffer

TCOFLUSHoutput buffer

TCIOFLUSHboth input and output buffers

The function returns True if the call was succesfull, False otherwise.

Errors: Errors are reported in LinuxError.

See also: TCDrain ([1130](#)), TCFlow ([1130](#)), TCGetAttr ([1131](#)), TCGetPGrp ([1132](#)), TCSendBreak ([1132](#)), TCSetAttr ([1133](#)), TCSetPGrp ([1133](#)), TTYName ([1134](#)), IsATTY ([1104](#))

31.12.115 TCGetAttr

Synopsis: Terminal Control: Get terminal attributes

Declaration: function TCGetAttr(fd: LongInt; var tios: Termios) : Boolean

Visibility: default

Description: TCGetAttr gets the terminal parameters from the terminal referred to by the file descriptor fd and returns them in a TermIOS structure tios. The function returns True if the call was successful, False otherwise.

Errors: Errors are reported in LinuxError

See also: TCDrain ([1130](#)), TCFlow ([1130](#)), TCFflush ([1131](#)), TCGetPGrp ([1132](#)), TCSendBreak ([1132](#)), TCSetAttr ([1133](#)), TCSetPGrp ([1133](#)), TTYName ([1134](#)), IsATTY ([1104](#))

Listing: ./olinuxex/ex55.pp

```
Program Example55;

uses oldlinux;

{ Program to demonstrate the TCGetAttr/TCSetAttr/CFMakeRaw functions. }

procedure ShowTermios(var tios:Termios);
begin
  WriteLn('Input Flags   : $',hexstr(tios.c_iflag,8)+#13);
  WriteLn('Output Flags  : $',hexstr(tios.c_oflag,8));
  WriteLn('Line Flags    : $',hexstr(tios.c_lflag,8));
  WriteLn('Control Flags: $',hexstr(tios.c_cflag,8));
end;

var
  oldios,
  tios : Termios;
begin
  WriteLn('Old attributes:');
  TCGetAttr(1,tios);
  ShowTermios(tios);
  oldios:=tios;
  WriteLn('Setting raw terminal mode');
  CFMakeRaw(tios);
  TCSetAttr(1,TCSANOW,tios);
  WriteLn('Current attributes:');
  TCGetAttr(1,tios);
  ShowTermios(tios);
  TCSetAttr(1,TCSANOW,oldios);
end.
```

31.12.116 TCGetPGrp

Synopsis: Terminal control: Get process group

Declaration: function TCGetPGrp(fd: LongInt; var id: LongInt) : Boolean

Visibility: default

Description: TCGetPGrp returns the process group ID of a foreground process group in `Id`. The function returns `True` if the call was successful, `False` otherwise.

Errors: Errors are reported in `LinuxError`

See also: [TCDrain \(1130\)](#), [TCFlow \(1130\)](#), [TCFlush \(1131\)](#), [TCGetAttr \(1131\)](#), [TCSendBreak \(1132\)](#), [TCSetAttr \(1133\)](#), [TCSetPGrp \(1133\)](#), [TTYName \(1134\)](#), [IsATTY \(1104\)](#)

31.12.117 TCSendBreak

Synopsis: Terminal control: Send break

Declaration: `function TCSendBreak(fd: LongInt; duration: LongInt) : Boolean`

Visibility: default

Description: TCSendBreak Sends zero-valued bits on an asynchronous serial connection described by file-descriptor `Fd`, for duration `Duration`. The function returns `True` if the action was performed successfully, `False` otherwise.

Errors: Errors are reported in `LinuxError`.

See also: [TCDrain \(1130\)](#), [TCFlow \(1130\)](#), [TCFlush \(1131\)](#), [TCGetAttr \(1131\)](#), [TCGetPGrp \(1132\)](#), [TCSetAttr \(1133\)](#), [TCSetPGrp \(1133\)](#), [TTYName \(1134\)](#), [IsATTY \(1104\)](#)

31.12.118 TCSetAttr

Synopsis: Terminal control: Set attributes

Declaration: `function TCSetAttr(fd: LongInt; OptAct: LongInt; const tios: Termios) : Boolean`

Visibility: default

Description: TCSetAttr sets the terminal parameters you specify in a `Termios` structure `Tios` for the terminal referred to by the file descriptor `Fd`.

`OptAct` specifies an optional action when the set need to be done, this could be one of the following pre-defined values:

TCSANOWset immediately.

TCSADRAINwait for output.

TCSAFLUSHwait for output and discard all input not yet read.

The function Returns `True` if the call was successful, `False` otherwise.

For an example, see [TCGetAttr \(1131\)](#).

Errors: Errors are reported in `LinuxError`.

See also: [TCDrain \(1130\)](#), [TCFlow \(1130\)](#), [TCFlush \(1131\)](#), [TCGetAttr \(1131\)](#), [TCGetPGrp \(1132\)](#), [TCSendBreak \(1132\)](#), [TCSetPGrp \(1133\)](#), [TTYName \(1134\)](#), [IsATTY \(1104\)](#)

31.12.119 TCSetPGrp

Synopsis: Terminal control: Set process group

Declaration: function TCSetPGrp(fd: LongInt; id: LongInt) : Boolean

Visibility: default

Description: TCSetPGrp Sets the Process Group Id to Id. The function returns True if the call was successful, False otherwise.

For an example, see TCGetPGrp (1132).

Errors: Errors are returned in LinuxError.

See also: TCDrain (1130), TCFlow (1130), TCFlush (1131), TCGetAttr (1131), TCGetPGrp (1132), TCSend-Break (1132), TCSetAttr (1133), TTYName (1134), IsATTY (1104)

31.12.120 TellDir

Synopsis: Return current location in a directory

Declaration: function TellDir(p: PDir) : LongInt

Visibility: default

Description: TellDir returns the current location in the directory structure pointed to by p. It returns -1 on failure.

For an example, see OpenDir (1112).

Errors: Errors are returned in LinuxError.

See also: CloseDir (1073), ReadDir (1115), SeekDir (1117), OpenDir (1112)

31.12.121 TTYname

Synopsis: Terminal control: Get terminal name

Declaration: function TTYname(Handle: LongInt) : string
function TTYname(var F: Text) : string

Visibility: default

Description: TTYName Returns the name of the terminal pointed to by f. f must be a terminal. f can be of type:

- 1.longint for file handles;
- 2.Text for text variables such as input etc.

Errors: Returns an empty string in case of an error. Linuxerror may be set to indicate what error occurred, but this is uncertain.

See also: TCDrain (1130), TCFlow (1130), TCFlush (1131), TCGetAttr (1131), TCGetPGrp (1132), TCSend-Break (1132), TCSetAttr (1133), TCSetPGrp (1133), IsATTY (1104), IOCTL (1103)

31.12.122 Umask

Synopsis: Set file creation mask.

Declaration: function Umask(Mask: Integer) : Integer

Visibility: default

Description: Change the file creation mask for the current user to Mask. The current mask is returned.

See also: Chmod ([1068](#))

Listing: ./olinuxex/ex27.pp

```
Program Example27;

{ Program to demonstrate the Umask function. }

Uses oldlinux;

begin
  Writeln ('Old Umask was : ',Umask(Octal(111)));
  WRiteLn ('New Umask is : ',Octal(111));
end.
```

31.12.123 Uname

Synopsis: Return system name.

Declaration: function Uname(var unamerec: utsname) : Boolean

Visibility: default

Description: Uname gets the name and configuration of the current linux kernel, and returns it in unamerec.

Errors: LinuxError is used to report errors.

See also: GetHostName ([1098](#)), GetDomainName ([1094](#))

31.12.124 UnLink

Synopsis: Unlink (i.e. remove) a file.

Declaration: function UnLink(Path: PathStr) : Boolean
function UnLink(Path: pchar) : Boolean

Visibility: default

Description: UnLink decreases the link count on file Path. Path can be of type PathStr or PChar. If the link count is zero, the file is removed from the disk. The function returns True if the call was successful, False if the call failed.

For an example, see Link ([1105](#)).

Errors: Errors are returned in LinuxError.

sys_eaccess You have no write access right in the directory containing Path, or you have no search permission in one of the directory components of Path.

sys_eperm The directory containing pathname has the sticky-bit set and the process's effective uid is neither the uid of the file to be deleted nor that of the directory containing it.

sys_enoent A component of the path doesn't exist.

sys_enotdir A directory component of the path is not a directory.

sys_eisdir Path refers to a directory.

sys_enomem Insufficient kernel memory.

sys_eroofs Path is on a read-only filesystem.

See also: [Link \(1105\)](#), [SymLink \(1125\)](#)

31.12.125 Utime

Synopsis: Set access and modification times of a file (touch).

Declaration: function Utime (const path: PathStr; utim: UTimeBuf) : Boolean

Visibility: default

Description: Utime sets the access and modification times of a file. the `utimbuf` record contains 2 fields, `actime`, and `modtime`, both of type Longint. They should be filled with an epoch-like time, specifying, respectively, the last access time, and the last modification time. For some filesystem (most notably, FAT), these times are the same.

Errors: Errors are returned in `LinuxError`.

sys_eaccess One of the directories in `Path` has no search (=execute) permission.

sys_enoent A directory entry in `Path` does not exist or is a symbolic link pointing to a non-existent directory.

Other errors may occur, but aren't documented.

See also: [GetEpochTime \(1096\)](#), [Chown \(1070\)](#), [Access \(1063\)](#)

Listing: ./olinuxex/ex25.pp

Program Example25;

{ Program to demonstrate the UTime function. }

Uses oldlinux;

Var utim : utimbuf;
year,month,day,hour,minute,second : Word;

begin

{ Set access and modification time of executable source }

GetTime (hour,minute,second);

GetDate (year,month,day);

utim.actime := LocalToEpoch(year,month,day,hour,minute,second);

utim.modtime := utim.actime;

if not Utime('ex25.pp',utim) **then**

writeln ('Call to UTime failed !')

else

begin

Write ('Set access and modification times to : '');

Write (Hour:2,':',minute:2,':',second,',');

```

WriteIn (Day:2 , '/' ,month:2 , '/' ,year:4);
end;
end.

```

31.12.126 WaitPid

Synopsis: Wait for a process to terminate

Declaration: function WaitPid(Pid: LongInt; Status: pointer; Options: LongInt)
 : LongInt

Visibility: default

Description: WaitPid waits for a child process with process ID Pid to exit. The value of Pid can be one of the following:

Pid < -1Causes WaitPid to wait for any child process whose process group ID equals the absolute value of pid.

Pid = -1Causes WaitPid to wait for any child process.

Pid = 0Causes WaitPid to wait for any child process whose process group ID equals the one of the calling process.

Pid > 0Causes WaitPid to wait for the child whose process ID equals the value of Pid.

The Options parameter can be used to specify further how WaitPid behaves:

WNOHANGCauses Waitpid to return immediately if no child has exited.

WUNTRACEDCauses WaitPid to return also for children which are stopped, but whose status has not yet been reported.

_WCLONECauses WaitPid also to wait for threads created by the Clone ([1071](#)) call.

Upon return, it returns the exit status of the process, or -1 in case of failure.

For an example, see Fork ([1089](#)).

Errors: Errors are returned in LinuxError.

See also: Fork ([1089](#)), Execve ([1080](#))

31.12.127 WaitProcess

Synopsis: Wait for process to terminate.

Declaration: function WaitProcess(Pid: LongInt) : LongInt

Visibility: default

Description: WaitProcess waits for process PID to exit. WaitProcess is equivalent to the WaitPID ([1136](#)) call:

```
WaitPid(PID, @result, 0)
```

Handles of Signal interrupts (errno=EINTR), and returns the Exitcode of Process PID (>=0) or - Status if it was terminated

Errors: None.

See also: WaitPID ([1136](#)), WTERMSIG ([1138](#)), WSTOPSIG ([1138](#)), WIFEXITED ([1137](#)), WIFSTOPPED ([1138](#)), WIFSIGNALED ([1138](#)), W_EXITCODE ([1139](#)), W_STOPCODE ([1139](#)), WEXITSTATUS ([1137](#))

31.12.128 WEXITSTATUS

Synopsis: Extract the exit status from the WaitPID ([1136](#)) result.

Declaration: function WEXITSTATUS(*Status*: Integer) : Integer

Visibility: default

Description: WEXITSTATUS can be used to extract the exit status from *Status*, the result of the WaitPID ([1136](#)) call.

See also: WaitPID ([1136](#)), WaitProcess ([1137](#)), WTERMSIG ([1138](#)), WSTOPSIG ([1138](#)), WIFEXITED ([1137](#)), WIFSTOPPED ([1138](#)), WIFSIGNALED ([1138](#)), W_EXITCODE ([1139](#)), W_STOPCODE ([1139](#))

31.12.129 WIFEXITED

Synopsis: Check whether the process exited normally

Declaration: function WIFEXITED(*Status*: Integer) : Boolean

Visibility: default

Description: WIFEXITED checks *Status* and returns True if the status indicates that the process terminated normally, i.e. was not stopped by a signal.

See also: WaitPID ([1136](#)), WaitProcess ([1137](#)), WTERMSIG ([1138](#)), WSTOPSIG ([1138](#)), WIFSTOPPED ([1138](#)), WIFSIGNALED ([1138](#)), W_EXITCODE ([1139](#)), W_STOPCODE ([1139](#)), WEXITSTATUS ([1137](#))

31.12.130 WIFSIGNALED

Synopsis: Check whether the process was exited by a signal.

Declaration: function WIFSIGNALED(*Status*: Integer) : Boolean

Visibility: default

Description: WIFSIGNALED returns True if *Status* indicates that the process exited because it received a signal.

See also: WaitPID ([1136](#)), WaitProcess ([1137](#)), WTERMSIG ([1138](#)), WSTOPSIG ([1138](#)), WIFEXITED ([1137](#)), WIFSTOPPED ([1138](#)), W_EXITCODE ([1139](#)), W_STOPCODE ([1139](#)), WEXITSTATUS ([1137](#))

31.12.131 WIFSTOPPED

Synopsis: Check whether the process is currently stopped.

Declaration: function WIFSTOPPED(*Status*: Integer) : Boolean

Visibility: default

Description: WIFSTOPPED checks *Status* and returns true if the process is currently stopped. This is only possible if WUNTRACED was specified in the options of WaitPID ([1136](#)).

See also: WaitPID ([1136](#)), WaitProcess ([1137](#)), WTERMSIG ([1138](#)), WSTOPSIG ([1138](#)), WIFEXITED ([1137](#)), WIFSIGNALED ([1138](#)), W_EXITCODE ([1139](#)), W_STOPCODE ([1139](#)), WEXITSTATUS ([1137](#))

31.12.132 WSTOPSIG

Synopsis: Return the exit code from the process.

Declaration: function WSTOPSIG(Status: Integer) : Integer

Visibility: default

Description: WSTOPSIG is an alias for WEXITSTATUS (1137).

See also: WaitPID (1136), WaitProcess (1137), WTERMSIG (1138), WIFEXITED (1137), WIFSTOPPED (1138), WIFSIGNALLED (1138), W_EXITCODE (1139), W_STOPCODE (1139), WEXITSTATUS (1137)

31.12.133 WTERMSIG

Synopsis: Return the signal that caused a process to exit.

Declaration: function WTERMSIG(Status: Integer) : Integer

Visibility: default

Description: WTERMSIG extracts from Status the signal number which caused the process to exit.

See also: WaitPID (1136), WaitProcess (1137), WSTOPSIG (1138), WIFEXITED (1137), WIFSTOPPED (1138), WIFSIGNALLED (1138), W_EXITCODE (1139), W_STOPCODE (1139), WEXITSTATUS (1137)

31.12.134 W_EXITCODE

Synopsis: Construct an exit status based on an return code and signal.

Declaration: function W_EXITCODE(ReturnCode: Integer; Signal: Integer) : Integer

Visibility: default

Description: W_EXITCODE combines ReturnCode and Signal to a status code fit for WaitPid.

See also: WaitPID (1136), WaitProcess (1137), WTERMSIG (1138), WSTOPSIG (1138), WIFEXITED (1137), WIFSTOPPED (1138), WIFSIGNALLED (1138), W_STOPCODE (1139), WEXITSTATUS (1137)

31.12.135 W_STOPCODE

Synopsis: Construct an exit status based on a signal.

Declaration: function W_STOPCODE(Signal: Integer) : Integer

Visibility: default

Description: W_STOPCODE constructs an exit status based on Signal, which will cause WIFSIGNALLED (1138) to return True

See also: WaitPID (1136), WaitProcess (1137), WTERMSIG (1138), WSTOPSIG (1138), WIFEXITED (1137), WIFSTOPPED (1138), WIFSIGNALLED (1138), W_EXITCODE (1139), WEXITSTATUS (1137)

Chapter 32

Reference for unit 'ports'

32.1 Overview

The ports unit implements the `port` constructs found in Turbo Pascal. It uses classes and default array properties to do this.

The unit exists on linux, os/2 and dos. It is implemented only for compatibility with Turbo Pascal. Its usage is discouraged, because using ports is not portable programming, and the operating system may not even allow it (for instance Windows).

Under linux, your program must be run as root, or the `IOPerm` call must be set in order to set appropriate permissions on the port access.

32.2 Constants, types and variables

32.2.1 Variables

```
port : tport
```

Default instance of type `TPort` ([1141](#)). Do not free. This variable is initialized in the unit initialization code, and freed at finalization.

Since there is a default property for a variable of this type, a sentence as

```
port[221]:=12;
```

Will result in the integer 12 being written to port 221, if port is defined as a variable of type `tport`

```
portb : tport
```

Default instance of type `TPort` ([1141](#)). Do not free. This variable is initialized in the unit initialization code, and freed at finalization.

Since there is a default property for a variable of this type, a sentence as

```
portb[221]:=12;
```

Will result in the byte 12 being written to port 221, if port is defined as a variable of type `tport`

```
portl : tportl
```

Default instance of type TPortL (1142). Do not free. This variable is initialized in the unit initialization code, and freed at finalization.

Since there is a default property for a variable of this type, a sentence as

```
portl[221]:=12;
```

Will result in the longint 12 being written to port 221, if port is defined as a variable of type tport

```
portw : tportw
```

Default instance of type TPortW (1142). Do not free. This variable is initialized in the unit initialization code, and freed at finalization.

Since there is a default property for a variable of this type, a sentence as

```
portw[221]:=12;
```

Will result in the word 12 being written to port 221, if port is defined as a variable of type tport

32.3 tport

32.3.1 Description

The TPort type is implemented specially for access to the ports in a TP compatible manner. There is no need to create an instance of this type: the standard TP variables are instantiated at unit initialization.

See also: port (1140), TPortW (1142), TPortL (1142)

32.3.2 Property overview

Page	Property	Access	Description
1141	pp	rw	Access integer-sized port by port number

32.3.3 tport.pp

Synopsis: Access integer-sized port by port number

Declaration: Property pp[w: LongInt]: Byte; default

Visibility: public

Access: Read,Write

Description: Access integer-sized port by port number

32.4 tportl

32.4.1 Description

The `TPortL` type is implemented specially for access to the ports in a TP compatible manner. There is no need to create an instance of this type: the standard TP variables are instantiated at unit initialization.

See also: [portw \(1141\)](#), [TPort \(1141\)](#), [TPortL \(1142\)](#)

32.4.2 Property overview

Page	Property	Access	Description
1142	pp	rw	Access Longint-sized port by port number

32.4.3 tportl.pp

Synopsis: Access Longint-sized port by port number

Declaration: `Property pp[w: LongInt]: LongInt; default`

Visibility: public

Access: Read,Write

Description: Access Longint-sized port by port number

32.5 tportw

32.5.1 Description

The `TPortW` type is implemented specially for access to the ports in a TP compatible manner. There is no need to create an instance of this type: the standard TP variables are instantiated at unit initialization.

See also: [portw \(1141\)](#), [TPort \(1141\)](#), [TPortL \(1142\)](#)

32.5.2 Property overview

Page	Property	Access	Description
1142	pp	rw	Access word-sized port by port number

32.5.3 tportw.pp

Synopsis: Access word-sized port by port number

Declaration: `Property pp[w: LongInt]: Word; default`

Visibility: public

Access: Read,Write

Description: Access word-sized port by port number

Chapter 33

Reference for unit 'printer'

33.1 Overview

This chapter describes the printer unit for Free Pascal. It was written for DOS by Florian Klaempfl, and it was written for Linux by Michael Van Canneyt, and has been ported to Windows and OS/2 as well. Its basic functionality is the same for all supported systems, although there are minor differences on Linux and UNIX.

33.2 Constants, types and variables

33.2.1 Variables

Lst : text

Lst is the standard printing device.

On Linux, Lst is set up using AssignLst ('/tmp/PID.lst').

33.3 Procedures and functions

33.3.1 AssignLst

Synopsis: Assign text file to printing device

Declaration: procedure AssignLst (var F: text; ToFile: string)

Visibility: default

Description: AssignLst assigns to F a printing device - *UNIX only*. ToFile is a string with the following form:

- '|filename options': This sets up a pipe with the program filename, with the given options, such as in the popen() call.
- 'filename': Prints to file filename. Filename can contain the string 'PID' (No Quotes), which will be replaced by the PID of your program. When closing lst, the file will be sent to lpr and deleted. (lpr should be in PATH)
- {'filename|'}: Same as previous, only the file is *not* sent to lpr, nor is it deleted. (useful for opening /dev/printer or for later printing)

See also: [Ist](#) (1143)

Listing: ./printex/printex.pp

```

program testprn;

uses printer;

var i : integer;
    f : text;

begin
    writeln ('Test of printer unit');
    writeln ('Writing to Ist...');
    for i:=1 to 80 do writeln (Ist, 'This is line ',i,'.#13);
    close (Ist);
    writeln ('Done.');
    {$ifdef Unix}
    writeln ('Writing to pipe...');
    assignIst (f, '|/usr/bin/lpr -m');
    rewrite (f);
    for i:=1 to 80 do writeln (f, 'This is line ',i,'.#13);
    close (f);
    writeln ('Done.')
    {$endif}
end.

```

33.3.2 InitPrinter

Synopsis: Initialize the printer

Declaration: procedure InitPrinter(const PrinterName: string)

Visibility: default

Description: Initialize the printer

33.3.3 IsLstAvailable

Synopsis: Determine whether printer is available.

Declaration: function IsLstAvailable : Boolean

Visibility: default

Description: Determine whether printer is available.

Chapter 34

Reference for unit 'Sockets'

34.1 Used units

Table 34.1: Used units by unit 'Sockets'

Name	Page
BaseUnix	102
System	1229
unixtype	1713

34.2 Overview

This document describes the SOCKETS unit for Free Pascal. it was written for linux by Michael Van Canneyt, and ported to Windows by Florian Klaempfl.

34.3 Constants, types and variables

34.3.1 Constants

AF_APPLETALK = 5

Address family Appletalk DDP

AF_ASH = 18

Address family: Ash

AF_ATMPVC = 8

Address family: ATM PVCs

AF_ATMSVC = 20

Address family: ATM SVCs

AF_AX25 = 3

Address family Amateur Radio AX.25

AF_BLUETOOTH = 31

Address family: Bluetooth sockets

AF_BRIDGE = 7

Address family Multiprotocol bridge

AF_DECnet = 12

Address family: Reserved for DECnet project.

AF_ECONET = 19

Address family: Acorn Econet

AF_INET = 2

Address family Internet IP Protocol

AF_INET6 = 10

Address family IP version 6

AF_IPX = 4

Address family Novell IPX

AF_IRDA = 23

Address family: IRDA sockets

AF_KEY = 15

Address family: PF_KEY key management API

AF_LLC = 26

Address family: Linux LLC

AF_LOCAL = 1

Address family: Unix socket

AF_MAX = 32

Address family Maximum value

AF_NETBEUI = 13

Address family: Reserved for 802.2LLC project

AF_NETLINK = 16

Address family: ?

AF_NETROM = 6

Address family Amateur radio NetROM

AF_PACKET = 17

Address family: Packet family

AF_PPPOX = 24

Address family: PPPoX sockets

AF_ROSE = 11

Address family: Amateur Radio X.25 PLP

AF_ROUTE = AF_NETLINK

Address family: Alias to emulate 4.4BSD.

AF_SECURITY = 14

Address family: Security callback pseudo AF

AF_SNA = 22

Addresss family: Linux SNA project

AF_TIPC = 30

Address family: TIPC sockets

AF_UNIX = 1

Address family Unix domain sockets

AF_UNSPEC = 0

Address family Not specified

AF_WANPIPE = 25

Address family: Wanpipe API Sockets

AF_X25 = 9

Address family Reserved for X.25 project

EsockEACCESS = ESysEAccess

Access forbidden error

EsockEBADF = EsysEBADF

Alias: bad file descriptor

EsockEFAULT = EsyseFAULT

Alias: an error occurred

EsockEINTR = EsysEINTR

Alias : operation interrupted

EsockEINVAL = EsyseINVAL

Alias: Invalid value specified

EsockEMFILE = ESysEmfile

Error code ?

EsockEMSGSIZE = ESysEMsgSize

Wrong message size error

EsockENOBUFS = ESysENoBufs

No buffer space available error

EsockENOTCONN = ESysENotConn

Not connected error

EsockENOTSOCK = ESysENotSock

File descriptor is not a socket error

EsockEPTONOSUPPORT = ESysEProtoNoSupport

Protocol not supported error

EsockWOULDBLOCK = ESysEWouldBlock

Operation would block error

INADDR_ANY = (0)

A bitmask matching any IP address on the local machine.

INADDR_NONE = (\$FFFFFF)

A bitmask matching no valid IP address

IPPROTO_AH = 51

authentication header.

IPPROTO_COMP = 108

Compression Header Protocol.

IPPROTO_DSTOPTS = 60

IPv6 destination options.

IPPROTO_EGP = 8

Exterior Gateway Protocol.

IPPROTO_ENCAP = 98

Encapsulation Header.

IPPROTO_ESP = 50

encapsulating security payload.

IPPROTO_FRAGMENT = 44

IPv6 fragmentation header.

IPPROTO_GRE = 47

General Routing Encapsulation.

IPPROTO_HOPOPTS = 0

IPv6 Hop-by-Hop options.

IPPROTO_ICMP = 1

Internet Control Message Protocol.

IPPROTO_ICMPV6 = 58

ICMPv6.

IPPROTO_IDP = 22

XNS IDP protocol.

IPPROTO_IGMP = 2

Internet Group Management Protocol.

IPPROTO_IP = 0

Dummy protocol for TCP.

IPPROTO_IPIP = 4

IPIP tunnels (older KA9Q tunnels use 94).

IPPROTO_IPV6 = 41

IPv6 header.

IPPROTO_MAX = 255

Maximum value for IPPROTO options

IPPROTO_MTP = 92

Multicast Transport Protocol.

IPPROTO_NONE = 59

IPv6 no next header.

IPPROTO_PIM = 103

Protocol Independent Multicast.

IPPROTO_PUP = 12

PUP protocol.

IPPROTO_RAW = 255

Raw IP packets.

IPPROTO_ROUTING = 43

IPv6 routing header.

IPPROTO_RSVP = 46

Reservation Protocol.

IPPROTO_SCTP = 132

Stream Control Transmission Protocol.

IPPROTO_TCP = 6

Transmission Control Protocol.

IPPROTO_TP = 29

SO Transport Protocol Class 4.

IPPROTO_UDP = 17

User Datagram Protocol.

IPV6_ADDRFORM = 1

Change the IPV6 address into a different address family. Deprecated

IPV6_ADD_MEMBERSHIP = IPV6_JOIN_GROUP

Undocumented Getsockopt option ?

IPV6_AUTHHDR = 10

GetSockOpt/SetSockopt: Deliver authentication header messages

IPV6_CHECKSUM = 7

Undocumented Getsockopt option ?

IPV6_DROP_MEMBERSHIP = IPV6_LEAVE_GROUP

Undocumented Getsockopt option ?

IPV6_DSTOPTS = 4

Deliver destination option control messages

IPV6_HOPLIMIT = 8

Deliver an integer containing the HOP count

IPV6_HOPOPTS = 3

Deliver hop option control messages

IPV6_IPSEC_POLICY = 34

Undocumented Getsockopt option ?

IPV6_JOIN_ANYCAST = 27

Undocumented Getsockopt option ?

IPV6_JOIN_GROUP = 20

GetSockOpt/SetSockopt: Control membership (join group) in multicast groups

IPV6_LEAVE_ANYCAST = 28

Undocumented Getsockopt option ?

IPV6_LEAVE_GROUP = 21

GetSockOpt/SetSockopt: Control membership (leave group)in multicast groups

IPV6_MTU = 24

GetSockOpt/SetSockopt: Get/Set the MTU for the socket

IPV6_MTU_DISCOVER = 23

GetSockOpt/SetSockopt: Get/Set Control path MTU Discovery on the socket

IPV6_MULTICAST_HOPS = 18

GetSockOpt/SetSockopt: Get/Set the multicast hop limit.

IPV6_MULTICAST_IF = 17

GetSockOpt/SetSockopt: Get/Set device for multicast packages on the socket.

IPV6_MULTICAST_LOOP = 19

GetSockOpt/SetSockopt: Control whether socket sees multicast packages that it has sent itself

IPV6_NEXTHOP = 9

sendmsg: set next hop for IPV6 datagram

IPV6_PKTINFO = 2

Change delivery options for incoming IPV6 datagrams

IPV6_PKTOPTIONS = 6

Undocumented Getsockopt option ?

IPV6_PMTUDISC_DO = 2

Always DF.

IPV6_PMTUDISC_DONT = 0

Never send DF frames.

IPV6_PMTUDISC_WANT = 1

Use per route hints.

IPV6_RECVERR = 25

GetSockOpt/SetSockopt: Control receiving of asynchronous error options

IPV6_ROUTER_ALERT = 22

GetSockOpt/SetSockopt: Get/Set Pass all forwarded packets containing router alert option

IPV6_RTHDR = 5

Deliver routing header control messages

IPV6_RTHDR_LOOSE = 0

Hop doesn't need to be neighbour.

IPV6_RTHDR_STRICT = 1

Hop must be a neighbour.

IPV6_RTHDR_TYPE_0 = 0

IPv6 Routing header type 0.

IPV6_RXDSTOPTS = IPV6_DSTOPTS

Undocumented Getsockopt option ?

IPV6_RXHOPOPTS = IPV6_HOPOPTS

Undocumented Getsockopt option ?

IPV6_RXSRCRT = IPV6_RTHDR

Undocumented Getsockopt option ?

IPV6_UNICAST_HOPS = 16

GetSockOpt/SetSockopt: Get/Set unicast hop limit

IPV6_V6ONLY = 26

GetSockOpt/SetSockopt: Handle IPV6 connections only

IPV6_XFRM_POLICY = 35

Undocumented Getsockopt option ?

IP_ADD_MEMBERSHIP = 35

add an IP group membership

IP_ADD_SOURCE_MEMBERSHIP = 39

join source group

IP_BLOCK_SOURCE = 38

block data from source

IP_DEFAULT_MULTICAST_LOOP = 1

Undocumented ?

IP_DEFAULT_MULTICAST_TTL = 1

Undocumented ?

IP_DROP_MEMBERSHIP = 36

drop an IP group membership

IP_DROP_SOURCE_MEMBERSHIP = 40

leave source group

IP_HDRINCL = 3

Header is included with data.

IP_MAX_MEMBERSHIPS = 20

Maximum group memberships for multicast messages

IP_MSFILTER = 41

Undocumented ?

IP_MTU_DISCOVER = 10

Undocumented ?

IP_MULTICAST_IF = 32

set/get IP multicast i/f

IP_MULTICAST_LOOP = 34

set/get IP multicast loopback

IP_MULTICAST_TTL = 33

set/get IP multicast ttl

IP_OPTIONS = 4

IP per-packet options.

IP_PKTINFO = 8

Undocumented ?

IP_PKTOPTIONS = 9

Undocumented ?

IP_PMTUDISC = 10

Undocumented ?

IP_PMTUDISC_DO = 2

Always DF.

IP_PMTUDISC_DONT = 0

Never send DF frames.

IP_PMTUDISC_WANT = 1

Use per route hints.

IP_RECVERR = 11

Undocumented ?

IP_RECVOPTS = 6

Receive all IP options w/datagram.

IP_RECVRETOPTS = IP_RETOPTS

Receive IP options for response.

IP_RECVTOS = 13

Undocumented ?

IP_RECVTTL = 12

Undocumented ?

IP_RECVOPTS = 7

Set/get IP per-packet options.

IP_ROUTER_ALERT = 5

Undocumented ?

IP_TOS = 1

IP type of service and precedence.

IP_TTL = 2

IP time to live.

IP_UNBLOCK_SOURCE = 37

unblock data from source

MCAST_BLOCK_SOURCE = 43

block from given group

MCAST_EXCLUDE = 0

Undocumented ?

MCAST_INCLUDE = 1

Undocumented ?

MCAST_JOIN_GROUP = 42

join any-source group

MCAST_JOIN_SOURCE_GROUP = 46

join source-spec gruoup

MCAST_LEAVE_GROUP = 45

leave any-source group

MCAST_LEAVE_SOURCE_GROUP = 47

leave source-spec group

MCAST_MSFILTER = 48

Undocumented ?

MCAST_UNBLOCK_SOURCE = 44

unblock from given group

MSG_CONFIRM = \$0800

Send flags: Conform connection

MSG_CTRUNC = \$0008

Receive flags: Control Data was discarded (buffer too small)

MSG_DONTROUTE = \$0004

Send flags: don't use gateway

MSG_DONTWAIT = \$0040

Receive flags: Non-blocking operation request.

MSG_EOF = MSG_FIN

Alias for MSG_FIN

MSG_EOR = \$0080

Receive flags: End of record

MSG_ERRQUERE = \$2000

Receive flags: ?

MSG_FIN = \$0200

Receive flags: ?

MSG_MORE = \$8000

Receive flags: ?

MSG_NOSIGNAL = \$4000

Receive flags: Suppress SIG_PIPE signal.

MSG_OOB = \$0001

Receive flags: receive out-of-band data.

MSG_PEEK = \$0002

Receive flags: peek at data, don't remove from buffer.

MSG_PROXY = \$0010

Receive flags: ?

MSG_RST = \$1000

Receive flags: ?

MSG_SYN = \$0400

Receive flags: ?

MSG_TRUNC = \$0020

Receive flags: packet Data was discarded (buffer too small)

MSG_TRYHARD = MSG_DONTROUTE

Receive flags: ?

MSG_WAITALL = \$0100

Receive flags: Wait till operation completed.

NoAddress : in_addr = (s_addr: 0)

Constant indicating invalid (no) network address.

NoAddress6 : in6_addr = (u6_addr16: (0, 0, 0, 0, 0, 0, 0, 0))

Constant indicating invalid (no) IPV6 network address.

NoNet : in_addr = (s_addr: 0)

Constant indicating invalid (no) network address.

NoNet6 : in6_addr = (u6_addr16: (0, 0, 0, 0, 0, 0, 0, 0))

Constant indicating invalid (no) IPV6 network address.

PF_APPLETALK = AF_APPLETALK

Protocol family: Appletalk DDP

PF_ASH = AF_ASH

Protocol family: Ash

PF_ATMPVC = AF_ATMPVC

Protocol family: ATM PVCs

PF_ATMSVC = AF_ATMSVC

Protocol family: ATM SVCs

PF_AX25 = AF_AX25

Protocol family: Amateur Radio AX.25

PF_BLUETOOTH = AF_BLUETOOTH

Protocol family: Bluetooth sockets

PF_BRIDGE = AF_BRIDGE

Protocol family: Multiprotocol bridge

PF_DECnet = AF_DECnet

Protocol Family: DECNET project

PF_ECONET = AF_ECONET

Protocol family: Acorn Econet

PF_INET = AF_INET

Protocol family: Internet IP Protocol

PF_INET6 = AF_INET6

Protocol family: IP version 6

PF_IPX = AF_IPX

Protocol family: Novell IPX

PF_IRDA = AF_IRDA

Protocol family: IRDA sockets

PF_KEY = AF_KEY

Protocol family: Key management API

PF_LLC = AF_LLC

Protocol family: Linux LLC

PF_LOCAL = AF_LOCAL

Protocol family: Unix socket

PF_MAX = AF_MAX

Protocol family: Maximum value

PF_NETBEUI = AF_NETBEUI

Protocol family: Reserved for 802.2LLC project

PF_NETLINK = AF_NETLINK

Protocol family: ?

PF_NETROM = AF_NETROM

Protocol family: Amateur radio NetROM

PF_PACKET = AF_PACKET

Protocol family: Packet family

PF_PPPOX = AF_PPPOX

Protocol family: PPPoX sockets

PF_ROSE = AF_ROSE

Protocol family: Amateur Radio X.25 PLP

PF_ROUTE = AF_ROUTE

Protocol Family: ?

PF_SECURITY = AF_SECURITY

Protocol family: Security callback pseudo PF

PF_SNA = AF_SNA

Protocol Family: Linux SNA project

PF_TIPC = AF_TIPC

Protocol family: TIPC sockets

PF_UNIX = AF_UNIX

Protocol family: Unix domain sockets

PF_UNSPEC = AF_UNSPEC

Protocol family: Unspecified

PF_WANPIPE = AF_WANPIPE

Protocol family: Wanpipe API Sockets

PF_X25 = AF_X25

Protocol family: Reserved for X.25 project

SCM_SRCRT = IPV6_RXSRCRT

Undocumented Getsockopt option ?

SCM_TIMESTAMP = SO_TIMESTAMP

Socket option: ?

SHUT_RD = 0

Shutdown read part of full duplex socket

SHUT_RDWR = 2

Shutdown read and write part of full duplex socket

SHUT_WR = 1

Shutdown write part of full duplex socket

SOCK_DGRAM = 2

Type of socket: datagram (conn.less) socket (UDP)

SOCK_MAXADDRLEN = 255

Maximum socket address length for Bind ([1171](#)) call.

SOCK_RAW = 3

Type of socket: raw socket

SOCK_RDM = 4

Type of socket: reliably-delivered message

SOCK_SEQPACKET = 5

Type of socket: sequential packet socket

SOCK_STREAM = 1

Type of socket: stream (connection) type socket (TCP)

SOL_ICMPV6 = 58

Socket level values for IPv6: ICMPV6

SOL_IP = 0

Undocumented ?

SOL_IPV6 = 41

Socket level values for IPv6: IPV6

SOL_SOCKET = 1

Socket option level: Socket level

SOMAXCONN = 128

Maximum queue length specifiable by listen.

SO_ACCEPTCONN = 30

Socket option: ?

SO_ATTACH_FILTER = 26

Socket option: ?

SO_BINDTODEVICE = 25

Socket option: ?

SO_BROADCAST = 6

Socket option: Broadcast

SO_BSDCOMPAT = 14

Socket option: ?

SO_DEBUG = 1

Socket option level: debug

SO_DETACH_FILTER = 27

Socket option: ?

SO_DONTROUTE = 5

Socket option: Don't route

SO_ERROR = 4

Socket option: Error

SO_KEEPALIVE = 9

Socket option: keep alive

SO_LINGER = 13

Socket option: ?

SO_NO_CHECK = 11

Socket option: ?

SO_OOBINLINE = 10

Socket option: ?

SO_PASSCRED = 16

Socket option: ?

SO_PEERCRED = 17

Socket option: ?

SO_PEERNAME = 28

Socket option: ?

SO_PRIORITY = 12

Socket option: ?

SO_RCVBUF = 8

Socket option: receive buffer

SO_RCVLOWAT = 18

Socket option: ?

SO_RCVTIMEO = 20

Socket option: ?

SO_REUSEADDR = 2

Socket option: Reuse address

SO_SECURITY_AUTHENTICATION = 22

Socket option: ?

SO_SECURITY_ENCRYPTION_NETWORK = 24

Socket option: ?

SO_SECURITY_ENCRYPTION_TRANSPORT = 23

Socket option: ?

SO_SNDBUF = 7

Socket option: Send buffer

SO_SNDLOWAT = 19

Socket option: ?

SO_SNDTIMEO = 21

Socket option: ?

SO_TIMESTAMP = 29

Socket option: ?

SO_TYPE = 3

Socket option: Type

S_IN = 0

Input socket in socket pair.

S_OUT = 1

Output socket in socket pair

TCP_CONGESTION = 13

Get/set the congestion-control algorithm for this socket

TCP_CORK = 3

Get/Set CORK algorithm: Send only complete packets

TCP_DEFER_ACCEPT = 9

Get/Set deferred accept on server socket

TCP_INFO = 11

Get TCP connection information (linux only)

TCP_KEEPCNT = 6

Get/Set retry count for unacknowledged KEEPALIVE transmissions.

TCP_KEEPIDLE = 4

Get/Set inactivity interval between KEEPALIVE transmissions.

TCP_KEEPINTVL = 5

Get/Set retry interval for unacknowledged KEEPALIVE transmissions.

TCP_LINGER2 = 8

Get/Set Linger2 flag

TCP_MAXSEG = 2

Get/Set Maximum segment size

TCP_MD5SIG = 14

Get/Set TCP MD5 signature option

TCP_NODELAY = 1

Get/Set No delay flag: disable Nagle algorithm

TCP_QUICKACK = 12

Get/Set quik ACK packet option.

TCP_SYNCNT = 7

Get/Set number of SYN packets to send before givin up on connection establishment

TCP_WINDOW_CLAMP = 10

Get/Set maximum packet size

UDP_CORK = 1

Get/Set UDP CORK algorithm on datagram sockets

UDP_ENCAP = 100

Get/Set UDP encapsulation flag for IPSec datagram sockets

UDP_ENCAP_ESPINUDP = 2

? Undocumented datagram option, IPSec related

UDP_ENCAP_ESPINUDP_NON_IKE = 1

? Undocumented datagram option, IPSec related

UDP_ENCAP_L2TPINUDP = 3

? Undocumented datagram option, IPSec related

34.3.2 Types

```
in6_addr = packed record
end
```

Record used to describe a general IPV6 address.

```
in_addr = packed record
end
```

General inet socket address.

```
linger = packed record
    l_onoff : cint;
    l_linger : cint;
end
```

This record is used in the fpsetsockopt ([1180](#)) call to specify linger options.

PIn6Addr = pin6_addr

Pointer to in6_addr ([1166](#)) type.

pin6_addr = ^in6_addr

Pointer to Tin6_addr ([1168](#))

PInAddr = pin_addr

Alias for pin_addr ([1167](#))

PInetSockAddr = pssockaddr_in

Pointer to sockaddr_in ([1167](#))

```
PInetSockAddr6 = ps sockaddr_in6
```

Pointer to sockaddr_in6 ([1168](#)) type

```
pin_addr = ^in_addr
```

Pointer to in_addr ([1166](#)) record.

```
plinger = ^linger
```

Pointer to linger ([1166](#)) type.

```
ps sockaddr = ^sockaddr
```

Pointer to TSockAddr ([1168](#))

```
ps sockaddr_in = ^sockaddr_in
```

Pointer to sockaddr_in ([1167](#))

```
ps sockaddr_in6 = ^sockaddr_in6
```

Pointer to sockaddr_in6 ([1168](#))

```
ps sockaddr_un = ^sockaddr_un
```

Pointer to sockaddr_un ([1168](#)) type.

```
sa_family_t = c ushort
```

Address family type

```
sockaddr = packed record  
end
```

sockaddr is used to store a general socket address for the FPBind ([1174](#)), FPRecv ([1178](#)) and FPSend ([1179](#)) calls.

```
sockaddr_in = packed record  
end
```

sockaddr_in is used to store a INET socket address for the FPBind ([1174](#)), FPRecv ([1178](#)) and FPSend ([1179](#)) calls.

```
sockaddr_in6 = packed record
  sin6_family : sa_family_t;
  sin6_port : cuint16;
  sin6_flowinfo : cuint32;
  sin6_addr : in6_addr;
  sin6_scope_id : cuint32;
end
```

Alias for sockaddr_in6 ([1168](#))

```
sockaddr_un = packed record
  sun_family : sa_family_t;
  sun_path : Array[0..107] of Char;
end
```

sockaddr_un is used to store a UNIX socket address for the FPBind ([1174](#)), FPRcv ([1178](#)) and FPSend ([1179](#)) calls.

```
TIn6Addr = in6_addr
```

Alias for in6_addr ([1166](#)) type.

```
Tin6_addr = in6_addr
```

Alias for sockaddr_in6 ([1168](#))

```
TInAddr = in_addr
```

Alias for in_addr ([1166](#)) record type.

```
TI넷SockAddr = sockaddr_in
```

Alias for sockaddr_in ([1167](#))

```
TI넷SockAddr6 = sockaddr_in6
```

Alias for sockaddr_in6 ([1168](#))

```
TIn_addr = in_addr
```

Alias for in_addr ([1166](#)) record type.

```
TLinger = linger
```

Alias for linger ([1166](#))

```
TSockAddr = sockaddr
```

```
TSockArray = Array[1..2] of LongInt
```

Type returned by the FPSocketPair ([1181](#)) call.

```
Tsocket = LongInt
```

Alias for easy kylix porting

```
TSockLen = BaseUnix.TSocklen
```

The actual type of TSockLen depends on the platform.

```
TSockPairArray = Array[0..1] of LongInt
```

Array of sockets, used in FPSocketPair ([1181](#)) call.

```
TUnixSockAddr = packed record
  family : sa_family_t;
  path : Array[0..107] of Char;
end
```

Alias for sockaddr_un ([1168](#))

34.4 Procedures and functions

34.4.1 Accept

Synopsis: Accept a connection from a socket (deprecated).

```
Declaration: function Accept(Sock: LongInt; var addr: TInetSockAddr; var SockIn: File;
                           var SockOut: File) : Boolean
function Accept(Sock: LongInt; var addr: TInetSockAddr; var SockIn: text;
                var SockOut: text) : Boolean
function Accept(Sock: LongInt; var addr: string; var SockIn: text;
                var SockOut: text) : Boolean
function Accept(Sock: LongInt; var addr: string; var SockIn: File;
                var SockOut: File) : Boolean
```

Visibility: default

Description: Accept accepts a connection from a socket `Sock`, which was listening for a connection. If a connection is accepted, a file descriptor is returned. On error -1 is returned. The returned socket may NOT be used to accept more connections. The original socket remains open.

The Accept call fills the address of the connecting entity in `Addr`, and sets its length in `Addrlen`. `Addr` should be pointing to enough space, and `Addrlen` should be set to the amount of space available, prior to the call.

The alternate forms of the Accept ([1169](#)) command, with the `Text` or `File` parameters are equivalent to subsequently calling the regular Accept ([1169](#)) function and the Sock2Text ([1185](#)) or Sock2File ([1185](#)) functions. These functions return `True` if successful, `False` otherwise.

Errors: On error, -1 is returned, and errors are reported in `SocketError`, and include the following:

ESockEBADF ([1148](#)) The socket descriptor is invalid.

ESockENOTSOCK (1148)The descriptor is not a socket.

SYS_EOPNOTSUPPThe socket type doesn't support the Listen operation.

ESockEFAULT (1148)Addr points outside your address space.

ESockEWOULDBLOCK (1148)The requested operation would block the process.

See also: FPListen (1178), Connect (1171), FPConnect (1175), FPBind (1174)

Listing: ./sockex/socksvr.pp

Program server;

```

{
  Program to test Sockets unit by Michael van Canneyt and Peter Vreman
  Server Version, First Run sock_svr to let it create a socket and then
  sock_cli to connect to that socket
}
{$mode fpc}
uses Sockets;

Var
  FromName : string;
  Buffer    : string[255];
  S         : Longint;
  Sin,Sout : Text;
  SAddr     : TInetSockAddr;

procedure perror (const S:string);
begin
  writeln (S,SocketError);
  halt(100);
end;

begin
  S:=fpSocket (AF_INET,SOCK_STREAM,0);
  if SocketError<>0 then
    Perror ('Server : Socket : ');
  SAddr.sin_family:=AF_INET;
  { port 50000 in network order }
  SAddr.sin_port:=htons(5000);
  SAddr.sin_addr.s_addr:=0;
  if fpBind(S,@SAddr,sizeof(saddr))=-1 then
    PError ('Server : Bind : ');
  if fpListen (S,1)=-1 then
    PError ('Server : Listen : ');
  Writeln('Waiting for Connect from Client , run now sock_cli in an other tty');
  if Accept(S,FromName,Sin,Sout) then
    PError ('Server : Accept : '+fromname);
  Reset(Sin);
  ReWrite(Sout);
  Writeln(Sout,'Message From Server');
  Flush(SOut);
  while not eof(Sin) do
  begin
    Readln(Sin,Buffer);
    Writeln('Server : read : ',buffer);
  end;
end.

```

34.4.2 Bind

Declaration: function Bind(Sock: LongInt; const addr: string) : Boolean

Visibility: default

34.4.3 CloseSocket

Synopsis: Closes a socket handle.

Declaration: function CloseSocket(Sock: LongInt) : LongInt

Visibility: default

Description: CloseSocket closes a socket handle. It returns 0 if the socket was closed successfully, -1 if it failed.

Errors: On error, -1 is returned.

See also: FPSocket ([1181](#))

34.4.4 Connect

Synopsis: Open a connection to a server socket (deprecated).

Declaration: function Connect(Sock: LongInt; const addr: TInetSockAddr;
 var SockIn: text; var SockOut: text) : Boolean
function Connect(Sock: LongInt; const addr: TInetSockAddr;
 var SockIn: File; var SockOut: File) : Boolean
function Connect(Sock: LongInt; const addr: string; var SockIn: text;
 var SockOut: text) : Boolean
function Connect(Sock: LongInt; const addr: string; var SockIn: File;
 var SockOut: File) : Boolean

Visibility: default

Description: Connect opens a connection to a peer, whose address is described by Addr. AddrLen contains the length of the address. The type of Addr depends on the kind of connection you're trying to make, but is generally one of TSockAddr or TUnixSockAddr.

The forms of the Connect ([1171](#)) command with the Text or File arguments are equivalent to subsequently calling the regular Connect function and the Sock2Text ([1185](#)) or Sock2File ([1185](#)) functions. These functions return True if successfull, False otherwise.

The Connect function returns a file descriptor if the call was successfull, -1 in case of error.

Errors: On error, -1 is returned and errors are reported in SocketError.

See also: FPListen ([1178](#)), FPBind ([1174](#)), Accept ([1169](#)), FPAccept ([1173](#))

Listing: ./sockex/sockcli.pp

Program Client;

```
{  
  Program to test Sockets unit by Michael van Canneyt and Peter Vreman  
  Client Version, First Run sock_svr to let it create a socket and then  
  sock_cli to connect to that socket  
}
```

```

uses Sockets;

procedure PError(const S : string);
begin
  writeln(S, SocketError);
  halt(100);
end;

Var
  SAddr      : TI넷SockAddr;
  Buffer     : string [255];
  S          : Longint;
  Sin,Sout : Text;
  i          : integer;

begin
  S:=fpSocket (AF_INET,SOCK_STREAM,0);
  if s=-1 then
    Perror('Client : Socket : ');
  SAddr.sin_family:=AF_INET;
  { port 50000 in network order }
  SAddr.sin_port:=htons(5000);
  { localhost : 127.0.0.1 in network order }
  SAddr.sin_addr.s_addr:=HostToNet((127 shl 24) or 1);
  if not Connect (S,SAddr,Sin,Sout) then
    PError('Client : Connect : ');
  Reset(Sin);
  ReWrite(Sout);
  Buffer:='This is a textstring sent by the Client.';
  for i:=1 to 10 do
    Writeln(Sout,Buffer);
  Flush(Sout);
  ReadIn(Sin,Buffer);
  WriteLn(Buffer);
  Close(sout);
end.

```

Listing: ./sockex/pfinger.pp

```

program pfinger;

uses sockets, errors;

Var
  Addr : TI넷SockAddr;
  S : Longint;
  Sin,Sout : Text;
  Line : string;

begin
  Addr.sin_family:=AF_INET;
  { port 79 in network order }
  Addr.sin_port:=79 shl 8;
  { localhost : 127.0.0.1 in network order }
  Addr.sin_addr.s_addr:=((1 shl 24) or 127);
  S:=fpSocket(AF_INET,SOCK_STREAM,0);
  If Not Connect (S,ADDR,SIN,SOUT) Then

```

```

begin
  Writeln ('Couldn''t connect to localhost');
  Writeln ('Socket error : ',strerror(SocketError));
  halt(1);
end;
rewrite (sout);
reset(sin);
writeln (sout,paramstr(1));
flush(sout);
while not eof(sin) do
  begin
    readln (Sin,line);
    writeln (line);
  end;
  fpShutdown(s,2);
  close (sin);
  close (sout);
end.

```

34.4.5 fpaccept

Synopsis: Accept a connection from a socket.

Declaration: function fpaccept(s: cint;addrx: psockaddr;addrlen: pSockLen) : cint

Visibility: default

Description: Accept accepts a connection from a socket S, which was listening for a connection. If a connection is accepted, a file descriptor is returned (positive number). On error -1 is returned. The returned socket may NOT be used to accept more connections. The original socket remains open.

The Accept call fills the address of the connecting entity in Addrx, and sets its length in Addrlen. Addrx should be pointing to enough space, and Addrlen should be set to the amount of space available, prior to the call.

Errors: On error, -1 is returned, and errors are reported in SocketError, and include the following:

ESockEBADF (1148) The socket descriptor is invalid.

ESockENOTSOCK (1148) The descriptor is not a socket.

SYS_EOPNOTSUPP The socket type doesn't support the Listen operation.

ESockEFAULT (1148) Addr points outside your address space.

ESockEWOULDBLOCK (1148) The requested operation would block the process.

See also: fpListen (1178), fpConnect (1175), fpBind (1174)

Listing: ./sockex/socksvr.pp

Program server;

```

{
  Program to test Sockets unit by Michael van Canneyt and Peter Vreman
  Server Version, First Run sock_svr to let it create a socket and then
  sock_cli to connect to that socket
}
{$mode fpc}
uses Sockets;

```

Var

```

  FromName : string;
  Buffer    : string[255];
  S         : Longint;
  Sin,Sout : Text;
  SAddr     : TInetSockAddr;

procedure perror (const S:string);
begin
  writeln (S,SocketError);
  halt(100);
end;

begin
  S:=fpSocket (AF_INET,SOCK_STREAM,0);
  if SocketError<>0 then
    Perror ('Server : Socket : ');
  SAddr.sin_family:=AF_INET;
  { port 50000 in network order }
  SAddr.sin_port:=htons(5000);
  SAddr.sin_addr.s_addr:=0;
  if fpBind(S,@SAddr,sizeof(saddr))=-1 then
    PError ('Server : Bind : ');
  if fpListen (S,1)=-1 then
    PError ('Server : Listen : ');
  Writeln('Waiting for Connect from Client , run now sock_cli in an other tty');
  if Accept(S,FromName,Sin,Sout) then
    PError ('Server : Accept : '+fromname);
  Reset(Sin);
  ReWrite(Sout);
  Writeln(Sout, 'Message From Server');
  Flush(SOut);
  while not eof(Sin) do
    begin
      ReadIn(Sin,Buffer);
      Writeln('Server : read : ',buffer);
    end;
end.

```

34.4.6 fpbind

Synopsis: Bind a socket to an address.

Declaration: function fpbind(s: cint;addrx: psockaddr;addrlen: TSockLen) : cint

Visibility: default

Description: fpBind binds the socket s to address Addrx. Addrx has length Addrlen. The function returns 0 if the call was succesful, -1 if not.

Errors: Errors are returned in SocketError and include the following:

ESockEBADF (1148)The socket descriptor is invalid.

ESockEINVAL (1148)The socket is already bound to an address,

ESockEACCESS (1148)Address is protected and you don't have permission to open it.

More errors can be found in the Unix man pages.

See also: FPSocket (1181)

34.4.7 fpconnect

Synopsis: Open a connection to a server socket.

Declaration: function fpconnect (s: cint; name: pssockaddr; namelen: TSockLen) : cint

Visibility: default

Description: fpConnect uses the socket s to open a connection to a peer, whose address is described by Name.

NameLen contains the length of the address. The type of Name depends on the kind of connection you are trying to make, but is generally one of TSockAddr or TUnixSockAddr.

The fpConnect function returns zero if the call was successfull, -1 in case of error.

Errors: On error, -1 is returned and errors are reported in SocketError.

See also: fpListen (1178), fpBind (1174), fpAccept (1173)

Listing: ./sockex/sockcli.pp

Program Client;

```
{
  Program to test Sockets unit by Michael van Canneyt and Peter Vreman
  Client Version, First Run sock_svr to let it create a socket and then
  sock_cli to connect to that socket
}
```

uses Sockets;

```
procedure PError(const S : string);
begin
  writeln(S, SocketError);
  halt(100);
end;
```

Var

```
SAddr      : TI넷SockAddr;
Buffer     : string [255];
S          : Longint;
Sin, Sout : Text;
i          : integer;
```

begin

```
S:=fpSocket (AF_INET,SOCK_STREAM,0);
if s==1 then
  Perror('Client : Socket : ');
  SAddr.sin_family:=AF_INET;
  { port 50000 in network order }
  SAddr.sin_port:=htons(5000);
  { localhost : 127.0.0.1 in network order }
  SAddr.sin_addr.s_addr:=HostToNet((127 shl 24) or 1);
if not Connect (S,SAddr,Sin,Sout) then
  PError('Client : Connect :');
```

```

Reset(Sin);
ReWrite(Sout);
Buffer:= 'This is a textstring sent by the Client.';
for i:=1 to 10 do
  WriteLn(Sout, Buffer);
Flush(Sout);
ReadLn(SIn, Buffer);
WriteLn(Buffer);
Close(sout);
end.

```

Listing: ./sockex/pfinger.pp

```

program pfinger;

uses sockets, errors;

Var
  Addr : TI넷SockAddr;
  S : Longint;
  Sin, Sout : Text;
  Line : string;

begin
  Addr.sin_family:=AF_INET;
  { port 79 in network order }
  Addr.sin_port:=79 shl 8;
  { localhost : 127.0.0.1 in network order }
  Addr.sin_addr.s_addr:=((1 shl 24) or 127);
  S:=fpSocket(AF_INET,SOCK_STREAM,0);
  If Not Connect (S,ADDR,SIN,SOUT) Then
    begin
      WriteLn ('Couldn''t connect to localhost');
      WriteLn ('Socket error : ',strerror(SocketError));
      halt(1);
    end;
  rewrite (sout);
  reset(sin);
  writeln (sout,paramstr(1));
  flush(sout);
  while not eof(sin) do
    begin
      readLn (Sin,line);
      writeln (line);
    end;
  fpShutdown(s,2);
  close (sin);
  close (sout);
end.

```

34.4.8 fpgetpeername

Synopsis: Return the name (address) of the connected peer.

Declaration: function fpgetpeername(s: cint;name: psockaddr;namelen: pSockLen) : cint

Visibility: default

Description: fpGetPeerName returns the name of the entity connected to the specified socket S. The Socket must be connected for this call to work.

Name should point to enough space to store the name, the amount of space pointed to should be set in Namelen. When the function returns successfully, Name will be filled with the name, and Name will be set to the length of Name.

Errors: Errors are reported in `SocketError`, and include the following:

ESockEBADF (1148)The socket descriptor is invalid.

ESockENOBUFS (1148)The system doesn't have enough buffers to perform the operation.

ESockENOTSOCK (1148)The descriptor is not a socket.

ESockEFAULT (1148)Addr points outside your address space.

ESockENOTCONN (1148)The socket isn't connected.

See also: [fpConnect \(1175\)](#), [fpSocket \(1181\)](#)

34.4.9 fpgetsockname

Synopsis: Return name of socket.

Declaration: `function fpgetsockname(s: cint; name: pssockaddr; namelen: pSockLen) : cint`

Visibility: default

Description: fpGetSockName returns the current name of the specified socket S. Name should point to enough space to store the name, the amount of space pointed to should be set in Namelen. When the function returns successfully, Name will be filled with the name, and Namelen will be set to the length of Name.

Errors: Errors are reported in `SocketError`, and include the following:

ESockEBADF (1148)The socket descriptor is invalid.

ESockENOBUFS (1148)The system doesn't have enough buffers to perform the operation.

ESockENOTSOCK (1148)The descriptor is not a socket.

ESockEFAULT (1148)Addr points outside your address space.

See also: [fpBind \(1174\)](#)

34.4.10 fpgetsockopt

Synopsis: Get current socket options

Declaration: `function fpgetsockopt(s: cint; level: cint; optname: cint; optval: pointer; optlen: pSockLen) : cint`

Visibility: default

Description: fpGetSockOpt gets the connection option optname, for socket S. The socket may be obtained from different levels, indicated by Level, which can be one of the following:

SOL_SOCKETFrom the socket itself.

XXXset Level to XXX, the protocol number of the protocol which should interpret the option.

The options are stored in the memory location pointed to by `optval`. `optlen` should point to the initial length of `optval`, and on return will contain the actual length of the stored data.

On success, 0 is returned. On Error, -1 is returned.

Errors: Errors are reported in `SocketError`, and include the following:

ESockEBADF (1148) The socket descriptor is invalid.

ESockENOTSOCK (1148) The descriptor is not a socket.

ESockEFAULT (1148) `OptVal` points outside your address space.

See also: `fpSetSockOpt (1180)`

34.4.11 `fplisten`

Synopsis: Listen for connections on a socket.

Declaration: `function fplisten(s: cint; backlog: cint) : cint`

Visibility: default

Description: `fpListen` listens for up to `backlog` connections from socket `S`. The socket `S` must be of type `SOCK_STREAM` or `Sock_SEQPACKET`.

The function returns 0 if a connection was accepted, -1 if an error occurred.

Errors: Errors are reported in `SocketError`, and include the following:

ESockEBADF (1148) The socket descriptor is invalid.

ESockENOTSOCK (1148) The descriptor is not a socket.

SYS_EOPNOTSUPP The socket type doesn't support the `Listen` operation.

See also: `fpSocket (1181)`, `fpBind (1174)`, `fpConnect (1175)`

34.4.12 `frecv`

Synopsis: Receive data on socket

Declaration: `function frecv(s: cint; buf: pointer; len: size_t; flags: cint) : ssize_t`

Visibility: default

Description: `fpRecv` reads at most `len` bytes from socket `S` into address `buf`. The socket must be in a connected state. Flags can be one of the following:

1Process out-of band data.

4Bypass routing, use a direct interface.

??Wait for full request or report an error.

The functions returns the number of bytes actually read from the socket, or -1 if a detectable error occurred.

Errors: Errors are reported in `SocketError`, and include the following:

ESockEBADF (1148) The socket descriptor is invalid.

ESockENOTCONN (1148) The socket isn't connected.

ESockENOTSOCK ([1148](#)) The descriptor is not a socket.

ESockEFAULT ([1148](#)) The address is outside your address space.

ESockEMSGSIZE ([1148](#)) The message cannot be sent atomically.

ESockEWOULDBLOCK ([1148](#)) The requested operation would block the process.

ESockENOBUFS ([1148](#)) The system doesn't have enough free buffers available.

See also: [FPSSend](#) ([1179](#))

34.4.13 frecvfrom

Synopsis: Receive data from an unconnected socket

Declaration: `function frecvfrom(s: cint;buf: pointer;len: size_t;flags: cint;
from: pssockaddr;fromlen: pSockLen) : ssize_t`

Visibility: default

Description: fpRecvFrom receives data in buffer Buf with maximum length Len from socket S. Receipt is controlled by options in Flags. The location pointed to by from will be filled with the address from the sender, and its length will be stored in fromlen. The function returns the number of bytes received, or -1 on error. AddrLen.

Errors: On error, -1 is returned.

See also: [fpSocket](#) ([1181](#)), [frecv](#) ([1178](#))

34.4.14 fpssend

Synopsis: Send data through socket

Declaration: `function fpssend(s: cint;msg: pointer;len: size_t;flags: cint) : ssize_t`

Visibility: default

Description: fpSend sends Len bytes starting from address Msg to socket S. S must be in a connected state. Options can be passed in Flags.

The function returns the number of bytes sent, or -1 if a detectable error occurred.

Flags can be one of the following:

1Process out-of band data.

4Bypass routing, use a direct interface.

Errors: Errors are reported in `SocketError`, and include the following:

ESockEBADF ([1148](#)) The socket descriptor is invalid.

ESockENOTSOCK ([1148](#)) The descriptor is not a socket.

ESockEFAULT ([1148](#)) The address is outside your address space.

ESockEMSGSIZE ([1148](#)) The message cannot be sent atomically.

ESockEWOULDBLOCK ([1148](#)) The requested operation would block the process.

ESockENOBUFS ([1148](#)) The system doesn't have enough free buffers available.

See also: [fpRecv](#) ([1178](#))

34.4.15 fpsendto

Synopsis: Send data through an unconnected socket to an address.

Declaration: function fpSendTo(s: cint; msg: pointer; len: size_t; flags: cint; tox: psockaddr; tolen: TSockLen) : ssize_t

Visibility: default

Description: fpSendTo sends data from buffer `Msg` with length `len` through socket `S` with options `Flags`.
The data is sent to address `tox`, which has length `tolen`

Errors: On error, -1 is returned.

See also: fpSocket (1181), fpSend (1179), fpRecvFrom (1179)

34.4.16 fpsetsockopt

Synopsis: Set socket options.

Declaration: function fpSetSockOpt(s: cint; level: cint; optname: cint; optval: pointer; optlen: TSockLen) : cint

Visibility: default

Description: fpSetSockOpt sets the connection options for socket `S`. The socket may be manipulated at different levels, indicated by `Level`, which can be one of the following:

SOL_SOCKET To manipulate the socket itself.

XXX set `Level` to `XXX`, the protocol number of the protocol which should interpret the option.

The actual option is stored in a buffer pointed to by `optval`, with length `optlen`.

For more information on this call, refer to the unix manual page `setsockopt`

Errors: Errors are reported in `SocketError`, and include the following:

ESockEBADF (1148) The socket descriptor is invalid.

ESockENOTSOCK (1148) The descriptor is not a socket.

ESockEFAULT (1148) `OptVal` points outside your address space.

See also: fpGetSockOpt (1177)

34.4.17 fpshutdown

Synopsis: Close one end of full duplex connection.

Declaration: function fpShutdown(s: cint; how: cint) : cint

Visibility: default

Description: fpShutdown closes one end of a full duplex socket connection, described by `S`. The parameter `How` determines how the connection will be shut down, and can be one of the following:

0 Further receives are disallowed.

1 Further sends are disallowed.

2 Sending nor receiving are allowed.

On success, the function returns 0, on error -1 is returned.

Errors: `SocketError` is used to report errors, and includes the following:

- ESockEBADF (1148)**The socket descriptor is invalid.
- ESockENOTCONN (1148)**The socket isn't connected.
- ESockENOTSOCK (1148)**The descriptor is not a socket.

See also: `fpSocket (1181)`, `fpConnect (1175)`

34.4.18 `fpsocket`

Synopsis: Create new socket

Declaration: `function fpsocket(domain: cint; xtype: cint; protocol: cint) : cint`

Visibility: default

Description: `fpSocket` creates a new socket in domain `Domain`, from type `xType` using protocol `Protocol`. The Domain, Socket type and Protocol can be specified using predefined constants (see the section on constants for available constants) If successful, the function returns a socket descriptor, which can be passed to a subsequent `fpBind (1174)` call. If unsuccessful, the function returns -1. for an example, see `Accept (1169)`.

Errors: Errors are returned in `SocketError`, and include the following:

- ESockEPROTONOSUPPORT (1148)**The protocol type or the specified protocol is not supported within this domain.
- ESockEMFILE (1148)**The per-process descriptor table is full.
- SYS_ENFILE**The system file table is full.
- ESockEACCESS (1148)**Permission to create a socket of the specified type and/or protocol is denied.
- ESockENOBUFS (1148)**Insufficient buffer space is available. The socket cannot be created until sufficient resources are freed.

See also: `FPSocketPair (1181)`

34.4.19 `fpsocketpair`

Synopsis: Create socket pair.

Declaration: `function fpsocketpair(d: cint; xtype: cint; protocol: cint; sv: pcint) : cint`

Visibility: default

Description: `fpSocketPair` creates 2 sockets in domain `D`, from type `xType` and using protocol `Protocol`. The pair is returned in `sv`, and they are indistinguishable. The function returns -1 upon error and 0 upon success.

Errors: Errors are reported in `SocketError`, and are the same as in `FPSocket (1181)`

See also: `Str2UnixSockAddr (1185)`

34.4.20 HostAddrToStr

Synopsis: Convert a host address to a string.

Declaration: function HostAddrToStr(Entry: in_addr) : AnsiString

Visibility: default

Description: HostAddrToStr converts the host address in Entry to a string representation in human-readable form (a dotted quad).

Basically, it is the same as NetAddrToStr ([1183](#)), but with the bytes in correct order.

See also: NetAddrToStr ([1183](#)), StrToHostAddr ([1186](#)), StrToNetAddr ([1186](#))

34.4.21 HostAddrToStr6

Synopsis: Convert a IPV6 host address to a string representation.

Declaration: function HostAddrToStr6(Entry: Tin6_addr) : AnsiString

Visibility: default

Description: HostAddrToStr6 converts the IPV6 host address in Entry to a string representation in human-readable form.

Basically, it is the same as NetAddrToStr6 ([1183](#)), but with the bytes in correct order.

See also: NetAddrToStr ([1183](#)), StrToHostAddr ([1186](#)), StrToNetAddr ([1186](#)), StrToHostAddr6 ([1186](#))

34.4.22 HostToNet

Synopsis: Convert a host address to a network address

Declaration: function HostToNet(Host: in_addr) : in_addr
function HostToNet(Host: LongInt) : LongInt

Visibility: default

Description: HostToNet converts a host address to a network address. It takes care of endianness of the host machine. The address can be specified as a dotted quad or as a longint.

Errors: None.

See also: NetToHost ([1183](#)), NToHS ([1184](#)), HToNS ([1183](#)), ShortHostToNet ([1184](#)), ShortNetToHost ([1184](#))

34.4.23 htonl

Synopsis: Convert long integer from host ordered to network ordered

Declaration: function htonl(host: LongInt) : LongInt

Visibility: default

Description: htonl makes sure that the bytes in host are ordered in the correct way for sending over the network and returns the correctly ordered result.

See also: htons ([1183](#)), ntohl ([1184](#)), ntohs ([1184](#))

34.4.24 htons

Synopsis: Convert short integer from host ordered to network ordered

Declaration: function htons(host: Word) : Word

Visibility: default

Description: htons makes sure that the bytes in host are ordered in the correct way for sending over the network and returns the correctly ordered result.

See also: htonl ([1182](#)), ntohs ([1184](#))

34.4.25 NetAddrToStr

Synopsis: Convert a network address to a string.

Declaration: function NetAddrToStr(Entry: in_addr) : AnsiString

Visibility: default

Description: NetAddrToStr converts the network address in Entry to a string representation in human-readable form (a dotted quad).

See also: HostAddrToStr ([1182](#)), StrToNetAddr ([1186](#)), StrToHostAddr ([1186](#))

34.4.26 NetAddrToStr6

Synopsis: Convert a IPV6 network address to a string.

Declaration: function NetAddrToStr6(Entry: Tin6_addr) : AnsiString

Visibility: default

Description: NetAddrToStr6 converts the IPV6 network address in Entry to a string representation in human-readable form.

Basically, it is the same as NetAddrToStr6 ([1183](#)), but with the bytes in correct order.

See also: NetAddrToStr ([1183](#)), StrToHostAddr ([1186](#)), StrToNetAddr ([1186](#)), StrToHostAddr6 ([1186](#))

34.4.27 NetToHost

Synopsis: Convert a network address to a host address.

Declaration: function NetToHost(Net: in_addr) : in_addr
function NetToHost(Net: LongInt) : LongInt

Visibility: default

Description: NetToHost converts a network address to a host address. It takes care of endianness of the host machine. The address can be specified as a dotted quad or as a longint.

Errors: None.

See also: HostToNet ([1182](#)), NToHS ([1184](#)), HToNS ([1183](#)), ShortHostToNet ([1184](#)), ShortNetToHost ([1184](#))

34.4.28 NToHI

Synopsis: Convert long integer from network ordered to host ordered

Declaration: function NToHI(Net: LongInt) : LongInt

Visibility: default

Description: ntohs makes sure that the bytes in Net, received from the network, are ordered in the correct way for handling by the host machine, and returns the correctly ordered result.

See also: htonl ([1182](#)), htons ([1183](#)), ntohs ([1184](#))

34.4.29 NToHs

Synopsis: Convert short integer from network ordered to host ordered

Declaration: function NToHs(Net: Word) : Word

Visibility: default

Description: ntohs makes sure that the bytes in Net, received from the network, are ordered in the correct way for handling by the host machine, and returns the correctly ordered result.

See also: htonl ([1182](#)), htons ([1183](#)), ntohs ([1184](#))

34.4.30 ShortHostToNet

Synopsis: Convert a host port number to a network port number

Declaration: function ShortHostToNet(Host: Word) : Word

Visibility: default

Description: ShortHostToNet converts a host port number to a network port number. It takes care of endian-ness of the host machine.

Errors: None.

See also: ShortNetToHost ([1184](#)), HostToNet ([1182](#)), NToHS ([1184](#)), HToNS ([1183](#))

34.4.31 ShortNetToHost

Synopsis: Convert a network port number to a host port number

Declaration: function ShortNetToHost(Net: Word) : Word

Visibility: default

Description: ShortNetToHost converts a network port number to a host port number. It takes care of endian-ness of the host machine.

Errors: None.

See also: ShortNetToHost ([1184](#)), HostToNet ([1182](#)), NToHS ([1184](#)), HToNS ([1183](#))

34.4.32 Sock2File

Synopsis: Convert socket to untyped file descriptors

Declaration: procedure Sock2File(Sock: LongInt; var SockIn: File; var SockOut: File)

Visibility: default

Description: Sock2File transforms a socket Sock into 2 Pascal file descriptors of type File, one for reading from the socket (SockIn), one for writing to the socket (SockOut).

Errors: None.

See also: FPSocket (1181), Sock2Text (1185)

34.4.33 Sock2Text

Synopsis: Convert socket to text file descriptors

Declaration: procedure Sock2Text(Sock: LongInt; var SockIn: Text; var SockOut: Text)

Visibility: default

Description: Sock2Text transforms a socket Sock into 2 Pascal file descriptors of type Text, one for reading from the socket (SockIn), one for writing to the socket (SockOut).

Errors: None.

See also: FPSocket (1181), Sock2File (1185)

34.4.34 socketerror

Synopsis: Contains the error code for the last socket operation.

Declaration: function socketerror : cint

Visibility: default

Description: SocketError contains the error code for the last socket operation. It can be examined to return the last socket error.

34.4.35 Str2UnixSockAddr

Synopsis: Convert path to TUnixSockAddr (1169)

Declaration: procedure Str2UnixSockAddr(const addr: string; var t: TUnixSockAddr; var len: LongInt)

Visibility: default

Description: Str2UnixSockAddr transforms a Unix socket address in a string to a TUnixSockAddr structure which can be passed to the Bind (1171) call.

Errors: None.

See also: FPSocket (1181), FPBind (1174)

34.4.36 StrToHostAddr

Synopsis: Convert a string to a host address.

Declaration: function StrToHostAddr(IP: AnsiString) : in_addr

Visibility: default

Description: StrToHostAddr converts the string representation in IP to a host address and returns the host address.

Errors: On error, the host address is filled with zeroes.

See also: [NetAddrToStr \(1183\)](#), [HostAddrToStr \(1182\)](#), [StrToNetAddr \(1186\)](#)

34.4.37 StrToHostAddr6

Synopsis: Convert a string to a IPV6 host address.

Declaration: function StrToHostAddr6(IP: string) : Tin6_addr

Visibility: default

Description: StrToHostAddr6 converts the string representation in IP to a IPV6 host address and returns the host address.

Errors: On error, the address is filled with zeroes.

See also: [NetAddrToStr6 \(1183\)](#), [HostAddrToStr6 \(1182\)](#), [StrToHostAddr \(1186\)](#)

34.4.38 StrToNetAddr

Synopsis: Convert a string to a network address.

Declaration: function StrToNetAddr(IP: AnsiString) : in_addr

Visibility: default

Description: StrToNetAddr converts the string representation in IP to a network address and returns the network address.

Errors: On error, the network address is filled with zeroes.

See also: [NetAddrToStr \(1183\)](#), [HostAddrToStr \(1182\)](#), [StrToHostAddr \(1186\)](#)

34.4.39 StrToNetAddr6

Synopsis: Convert a string to a IPV6 network address

Declaration: function StrToNetAddr6(IP: AnsiString) : Tin6_addr

Visibility: default

Description: StrToNetAddr6 converts the string representation in IP to a IPV6 network address and returns the network address.

Errors: On error, the address is filled with zeroes.

See also: [NetAddrToStr6 \(1183\)](#), [HostAddrToStr6 \(1182\)](#), [StrToHostAddr6 \(1186\)](#)

Chapter 35

Reference for unit 'strings'

35.1 Overview

This chapter describes the STRINGS unit for Free Pascal. This unit is system independent, and therefore works on all supported platforms.

35.2 Procedures and functions

35.2.1 stralloc

Synopsis: Allocate memory for a new null-terminated string on the heap

Declaration: function stralloc(L: SizeInt) : pchar

Visibility: default

Description: StrAlloc reserves memory on the heap for a string with length Len, terminating #0 included, and returns a pointer to it.

Errors: If there is not enough memory, a run-time error occurs.

See also: StrNew (1196), StrPCopy (1197)

35.2.2 strcat

Synopsis: Concatenate 2 null-terminated strings.

Declaration: function strcat(dest: pchar; source: pchar) : pchar

Visibility: default

Description: Attaches Source to Dest and returns Dest.

Errors: No length checking is performed.

See also: StrLCat (1192)

Listing: ./stringex/ex11.pp

```

Program Example11;

Uses strings;

{ Program to demonstrate the StrCat function. }

Const P1 : PChar = 'This is a PChar String.';

Var P2 : PChar;

begin
  P2:=StrAlloc (StrLen(P1)*2+1);
  StrMove (P2,P1,StrLen(P1)+1); { P2=P1 }
  StrCat (P2,P1);           { Append P2 once more }
  Writeln ('P2 : ',P2);
  StrDispose(P2);
end.

```

35.2.3 strcmp

Synopsis: Compare 2 null-terminated strings, case sensitive.

Declaration: function strcmp(str1: pchar;str2: pchar) : SizeInt

Visibility: default

Description: Compares the null-terminated strings S1 and S2. The result is

- A negative SizeInt when S1<S2.
- 0 when S1=S2.
- A positive SizeInt when S1>S2.

For an example, see StrLComp (1193).

Errors: None.

See also: StrLComp (1193), StrIComp (1191), StrLIComp (1194)

35.2.4 strcpy

Synopsis: Copy a null-terminated string

Declaration: function strcpy(dest: pchar;source: pchar) : pchar; Overload

Visibility: default

Description: Copy the null terminated string in Source to Dest, and returns a pointer to Dest. Dest needs enough room to contain Source, i.e. StrLen(Source)+1 bytes.

Errors: No length checking is performed.

See also: StrPCopy (1197), StrLCopy (1193), StrECopy (1189)

Listing: ./stringex/ex4.pp

```

Program Example4;

Uses strings;

{ Program to demonstrate the StrCopy function. }

Const P : PChar = 'This is a PCHAR string.';

var PP : PChar;

begin
  PP:=StrAlloc(Strlen(P)+1);
  STrCopy (PP,P);
  If StrComp (PP,P)<>0 then
    Writeln ('Oh-oh problems... ')
  else
    Writeln ('All is well : PP= ',PP);
  StrDispose(PP);
end.

```

35.2.5 strdispose

Synopsis: disposes of a null-terminated string on the heap

Declaration: procedure strdispose(p: pchar)

Visibility: default

Description: Removes the string in P from the heap and releases the memory.

Errors: None.

See also: StrNew ([1196](#))

Listing: ./stringex/ex17.pp

```

Program Example17;

Uses strings;

{ Program to demonstrate the StrDispose function. }

Const P1 : PChar = 'This is a PChar string';

var P2 : PChar;

begin
  P2:=StrNew (P1);
  Writeln ('P2 : ',P2);
  StrDispose(P2);
end.

```

35.2.6 strecopy

Synopsis: Copy a null-terminated string, return a pointer to the end.

Declaration: function strecopy(dest: pchar; source: pchar) : pchar

Visibility: default

Description: Copies the Null-terminated string in Source to Dest, and returns a pointer to the end (i.e. the terminating Null-character) of the copied string.

Errors: No length checking is performed.

See also: StrLCopy ([1193](#)), StrCopy ([1188](#))

Listing: ./stringex/ex6.pp

```
Program Example6;

Uses strings;

{ Program to demonstrate the StrECopy function. }

Const P : PChar = 'This is a PCHAR string.';

Var PP : PChar;

begin
  PP:=StrAlloc (StrLen(P)+1);
  If Longint(StrECopy(PP,P))-Longint(PP)<>StrLen(P) then
    Writeln('Something is wrong here !')
  else
    Writeln ('PP= ',PP);
    StrDispose(PP);
end.
```

35.2.7 strend

Synopsis: Return a pointer to the end of a null-terminated string

Declaration: function strend(p: pchar) : pchar

Visibility: default

Description: Returns a pointer to the end of P. (i.e. to the terminating null-character).

Errors: None.

See also: StrLen ([1194](#))

Listing: ./stringex/ex7.pp

```
Program Example6;

Uses strings;

{ Program to demonstrate the StrEnd function. }

Const P : PChar = 'This is a PCHAR string.';

begin
  If Longint(StrEnd(P))-Longint(P)<>StrLen(P) then
    Writeln('Something is wrong here !')
```

```

else
  Writeln ('All is well..');
end.

```

35.2.8 **stricomp**

Synopsis: Compare 2 null-terminated strings, case insensitive.

Declaration: function **stricomp**(**str1**: **pchar**; **str2**: **pchar**) : **SizeInt**

Visibility: default

Description: Compares the null-terminated strings **S1** and **S2**, ignoring case. The result is

- A negative **SizeInt** when **S1**<**S2**.
- 0 when **S1**=**S2**.
- A positive **SizeInt** when **S1**>**S2**.

Errors: None.

See also: [StrLComp \(1193\)](#), [StrComp \(1188\)](#), [StrLIComp \(1194\)](#)

Listing: ./stringex/ex8.pp

```

Program Example8;

Uses strings;

{ Program to demonstrate the StrLComp function. }

Const P1 : PChar = 'This is the first string.';
      P2 : PChar = 'This is the second string.';

Var L : Longint;

begin
  Write ('P1 and P2 are ');
  If StrComp (P1,P2)<>0 then write ('NOT ');
  write ('equal. The first ');
  L:=1;
  While StrLComp(P1,P2,L)=0 do inc (L);
  dec(l);
  Writeln (l, ' characters are the same.');
end.

```

35.2.9 **stripos**

Synopsis: Return the position of a substring in a string, case insensitive.

Declaration: function **stripos**(**str1**: **pchar**; **str2**: **pchar**) : **pchar**

Visibility: default

Description: **stripos** returns the position of **str2** in **str1**. It searches in a case-insensitive manner, and if it finds a match, it returns a pointer to the location of the match. If no match is found, **Nil** is returned.

Errors: No checks are done on the validity of the pointers, and the pointers are assumed to point to a properly null-terminated string. If either of these conditions are not met, a run-time error may follow.

See also: [striscan \(1192\)](#), [strpos \(1198\)](#)

35.2.10 striscan

Synopsis: Scan a string for a character, case-insensitive

Declaration: function striscan(p: pchar;c: Char) : pchar

Visibility: default

Description: `striscan` does the same as `strscan` ([1199](#)) but compares the characters case-insensitively. It returns a pointer to the first occurrence of the character `c` in the null-terminated string `p`, or `Nil` if `c` is not present in the string.

See also: [strscan \(1199\)](#), [strriscan \(1198\)](#)

35.2.11 strlcat

Synopsis: Concatenate 2 null-terminated strings, with length boundary.

Declaration: function strlcat(dest: pchar;source: pchar;l: SizeInt) : pchar

Visibility: default

Description: Adds `L` characters from `Source` to `Dest`, and adds a terminating null-character. Returns `Dest`.

Errors: None.

See also: [StrCat \(1187\)](#)

Listing: ./stringex/ex12.pp

```
Program Example12;

Uses strings;

{ Program to demonstrate the StrLCat function. }

Const P1 : PChar = '1234567890';

Var P2 : PChar;

begin
  P2:=StrAlloc (StrLen(P1)*2+1);
  P2^:=#0; { Zero length }
  StrCat (P2,P1);
  StrLCat (P2,P1,5);
  Writeln ('P2 = ',P2);
  StrDispose(P2)
end.
```

35.2.12 strlcomp

Synopsis: Compare limited number of characters of 2 null-terminated strings

Declaration: function strlcomp(str1: pchar;str2: pchar;l: SizeInt) : SizeInt

Visibility: default

Description: Compares maximum L characters of the null-terminated strings S1 and S2. The result is

- A negative SizeInt when S1<S2.
- 0 when S1=S2.
- A positive SizeInt when S1>S2.

Errors: None.

See also: StrComp ([1188](#)), StrICmp ([1191](#)), StrLICmp ([1194](#))

Listing: ./stringex/ex8.pp

```
Program Example8;

Uses strings;

{ Program to demonstrate the StrLComp function. }

Const P1 : PChar = 'This is the first string.';
      P2 : PChar = 'This is the second string.';

Var L : Longint;

begin
  Write ('P1 and P2 are ');
  If StrComp (P1,P2)<>0 then write ('NOT ');
  write ('equal. The first ');
  L:=1;
  While StrLComp(P1,P2,L)=0 do inc (L);
  dec(1);
  writeln (1,' characters are the same.');
end.
```

35.2.13 strlcopy

Synopsis: Copy a null-terminated string, limited in length.

Declaration: function strlcopy(dest: pchar;source: pchar;maxlen: SizeInt) : pchar
; Overload

Visibility: default

Description: Copies MaxLen characters from Source to Dest, and makes Dest a null terminated string.

Errors: No length checking is performed.

See also: StrCopy ([1188](#)), StrECopy ([1189](#))

Listing: ./stringex/ex5.pp

```
Program Example5;

Uses strings;

{ Program to demonstrate the StrLCopy function. }

Const P : PChar = '123456789ABCDEF';

var PP : PChar;

begin
  PP:=StrAlloc(11);
  Writeln ('First 10 characters of P : ',StrLCopy (PP,P,10));
  StrDispose(PP);
end.
```

35.2.14 **strlen**

Synopsis: Length of a null-terminated string.

Declaration: function strlen(p: pchar) : sizeint

Visibility: default

Description: Returns the length of the null-terminated string P. If P equals Nil, then zero (0) is returned.

Errors: None.

See also: StrNew ([1196](#))

Listing: ./stringex/ex1.pp

```
Program Example1;

Uses strings;

{ Program to demonstrate the StrLen function. }

Const P : PChar = 'This is a constant pchar string';

begin
  Writeln ('P : ',P);
  Writeln ('length(P) : ',StrLen(P));
end.
```

35.2.15 **strlncmp**

Synopsis: Compare limited number of characters in 2 null-terminated strings, ignoring case.

Declaration: function strlncmp(str1: pchar;str2: pchar;l: SizeInt) : SizeInt

Visibility: default

Description: Compares maximum L characters of the null-terminated strings S1 and S2, ignoring case. The result is

- A negative SizeInt when S1 < S2.
- 0 when S1 = S2.
- A positive SizeInt when S1 > S2.

For an example, see StrIComp (1191)

Errors: None.

See also: StrLComp (1193), StrComp (1188), StrIComp (1191)

35.2.16 strlower

Synopsis: Convert null-terminated string to all-lowercase.

Declaration: function strlower(p: pchar) : pchar

Visibility: default

Description: Converts P to an all-lowercase string. Returns P.

Errors: None.

See also: StrUpper (1199)

Listing: ./stringex/ex14.pp

Program Example14;

Uses strings;

{ Program to demonstrate the StrLower and StrUpper functions. }

Const

```
P1 : PChar = 'THIS IS AN UPPERCASE PCHAR STRING';
P2 : PChar = 'this is a lowercase string';
```

begin

```
  Writeln ('Uppercase : ',StrUpper(P2));
  StrLower (P1);
  Writeln ('Lowercase : ',P1);
end.
```

35.2.17 strmove

Synopsis: Move a null-terminated string to new location.

Declaration: function strmove(dest: pchar; source: pchar;l: SizeInt) : pchar

Visibility: default

Description: Copies MaxLen characters from Source to Dest. No terminating null-character is copied. Returns Dest

Errors: None.

See also: StrLCopy (1193), StrCopy (1188)

Listing: ./stringex/ex10.pp

```

Program Example10;

Uses strings;

{ Program to demonstrate the StrMove function. }

Const P1 : PCHAR = 'This is a pchar string.';

Var P2 : Pchar;

begin
  P2:=StrAlloc(StrLen(P1)+1);
  StrMove (P2,P1,StrLen(P1)+1); { P2:=P1 }
  Writeln ('P2 = ',P2);
  StrDispose(P2);
end.

```

35.2.18 strnew

Synopsis: Allocate room for new null-terminated string.

Declaration: function strnew(p: pchar) : pchar

Visibility: default

Description: Copies P to the Heap, and returns a pointer to the copy.

Errors: Returns Nil if no memory was available for the copy.

See also: StrCopy (1188), StrDispose (1189)

Listing: ./stringex/ex16.pp

```

Program Example16;

Uses strings;

{ Program to demonstrate the StrNew function. }

Const P1 : PChar = 'This is a PChar string.';

var P2 : PChar;

begin
  P2:=StrNew (P1);
  If P1=P2 then
    writeln ('This can''t be happening... ')
  else
    writeln ('P2 : ',P2);
  StrDispose(P2);
end.

```

35.2.19 strpas

Synopsis: Convert a null-terminated string to a shortstring.

Declaration: function strpas(p: pchar) : shortstring

Visibility: default

Description: Converts a null terminated string in P to a Pascal string, and returns this string. The string is truncated at 255 characters.

Errors: None.

See also: StrPCopy (1197)

Listing: ./stringex/ex3.pp

```
Program Example3;

Uses strings;

{ Program to demonstrate the StrPas function. }

Const P : PChar = 'This is a PCHAR string';

Var S : string;

begin
  S:=StrPas (P);
  Writeln ('S : ',S);
end.
```

35.2.20 strpcopy

Synopsis: Copy a pascal string to a null-terminated string

Declaration: function strpcopy(d: pchar;const s: string) : pchar

Visibility: default

Description: Converts the Pascal string in S to a Null-terminated string, and copies it to D. D needs enough room to contain the string Source, i.e. Length(S)+1 bytes.

Errors: No length checking is performed.

See also: StrPas (1197)

Listing: ./stringex/ex2.pp

```
Program Example2;

Uses strings;

{ Program to demonstrate the StrPCopy function. }

Const S = 'This is a normal string.';

Var P : Pchar;
```

```
begin
  p:=StrAlloc (length(S)+1);
  if StrPCopy (P,S)<>P then
    Writeln ('This is impossible !!')
  else
    writeln (P);
  StrDispose(P);
end.
```

35.2.21 strpos

Synopsis: Search for a null-terminated substring in a null-terminated string

Declaration: function strpos(str1: pchar;str2: pchar) : pchar

Visibility: default

Description: Returns a pointer to the first occurrence of S2 in S1. If S2 does not occur in S1, returns Nil.

Errors: None.

See also: StrScan ([1199](#)), StrRScan ([1199](#))

Listing: ./stringex/ex15.pp

```
Program Example15;

Uses strings;

{ Program to demonstrate the StrPos function. }

Const P : PChar = 'This is a PChar string.';
      S : Pchar = 'is';
begin
  Writeln ('Position of ''is'' in P : ',sizeint(StrPos(P,S))-sizeint(P));
end.
```

35.2.22 strrscan

Synopsis: Scan a string reversely for a character, case-insensitive

Declaration: function strrscan(p: pchar;c: Char) : pchar

Visibility: default

Description: strrscan does the same as strrscan ([1199](#)) but compares the characters case-insensitively. It returns a pointer to the last occurrence of the character c in the null-terminated string p, or Nil if c is not present in the string.

See also: strrscan ([1199](#)), striscan ([1192](#))

35.2.23 **strrscan**

Synopsis: Find last occurrence of a character in a null-terminated string.

Declaration: function **strrscan**(*p*: pchar; *c*: Char) : pchar

Visibility: default

Description: Returns a pointer to the last occurrence of the character *C* in the null-terminated string *P*. If *C* does not occur, returns Nil.

For an example, see [StrScan \(1199\)](#).

Errors: None.

See also: [StrScan \(1199\)](#), [StrPos \(1198\)](#)

35.2.24 **strscan**

Synopsis: Find first occurrence of a character in a null-terminated string.

Declaration: function **strscan**(*p*: pchar; *c*: Char) : pchar

Visibility: default

Description: Returns a pointer to the first occurrence of the character *C* in the null-terminated string *P*. If *C* does not occur, returns Nil.

Errors: None.

See also: [StrRScan \(1199\)](#), [StrPos \(1198\)](#)

Listing: ./stringex/ex13.pp

```
Program Example13;

Uses strings;

{ Program to demonstrate the StrScan and StrRScan functions. }

Const P : PChar = 'This is a PCHAR string.';
      S : Char = 's';

begin
  Writeln ('P, starting from first ''s'' : ',StrScan(P,s));
  Writeln ('P, starting from last ''s'' : ',StrRScan(P,s));
end.
```

35.2.25 **strupper**

Synopsis: Convert null-terminated string to all-uppercase

Declaration: function **strupper**(*p*: pchar) : pchar

Visibility: default

Description: Converts *P* to an all-uppercase string. Returns *P*.

For an example, see [StrLower \(1195\)](#)

Errors: None.

See also: [StrLower \(1195\)](#)

Chapter 36

Reference for unit 'strutils'

36.1 Used units

Table 36.1: Used units by unit 'strutils'

Name	Page
System	1229
sysutils	1449

36.2 Constants, types and variables

36.2.1 Resource strings

SEResultStrings = 'Amount of search and replace strings don''t match'

Error message used in stringsreplace function

36.2.2 Constants

AnsiResemblesProc : TCompareTextProc = @SoundexProc

This procedural variable is standard set to SoundexProc ([1224](#)) but can be overriden with a user-defined algorithm. This algorithm should return True if AText resembles AOtherText, or False otherwise. The standard routine compares the soundexes of the two strings and returns True if they are equal.

Brackets = ['(', ')', '[', ']', '{', '}']

Set of characters that contain all possible bracket characters

DigitChars = ['0'..'9']

Set of digit characters

StdSwitchChars = ['- ', '/ ']

Standard characters for the `SwitchChars` argument of `GetCmdLineArg` (1213).

```
StdWordDelims = [#0..' ', ',', '.', ';', '/', '\', ':', '''', "''", '^' ] + Brackets
```

Standard word delimiter values.

```
WordDelimiters : Set of Char = [#0..#255] - ['a'..'z', 'A'..'Z', '1'..'9', '0']
```

Standard word delimiters, used in the `SearchBuf` (1223) call.

36.2.3 Types

```
TCompareTextProc = function(const AText: string; const AOther: string)
                      : Boolean
```

Function prototype for comparing two string in `AnsiResemblesText` (1206)

```
TSoundexIntLength = 1..8
```

Range of allowed integer soundex lengths.

```
TSoundexLength = 1..MaxInt
```

Range of allowed soundex lengths.

```
TStringSearchOption = TStringSearchOption
```

There is an typo error in the original Borland StrUtils unit. This type just refers to the correct `TStringSearchOption` (1201) and is provided for compatibility only.

```
TStringSearchOption = (soDown, soMatchCase, soWholeWord)
```

Table 36.2: Enumeration values for type `TStringSearchOption`

Value	Explanation
soDown	Search in down direction.
soMatchCase	Match case
soWholeWord	Search whole words only.

Possible options for `SearchBuf` (1223) call.

```
TStringSearchOptions = Set of TStringSearchOption
```

Set of options for `SearchBuf` (1223) call.

36.3 Procedures and functions

36.3.1 AddChar

Synopsis: Add characters to the left of a string till a certain length

Declaration: function AddChar(C: Char; const S: string; N: Integer) : string

Visibility: default

Description: AddChar adds characters (C) to the left of S till the length N is reached, and returns the resulting string. If the length of S is already equal to or larger than N, then no characters are added. The resulting string can be thought of as a right-aligned version of S, with length N.

Errors: None

See also: AddCharR ([1202](#)), PadLeft ([1218](#)), PadRight ([1219](#)), PadCenter ([1218](#))

36.3.2 AddCharR

Synopsis: Add chars at the end of a string till it reaches a certain length

Declaration: function AddCharR(C: Char; const S: string; N: Integer) : string

Visibility: default

Description: AddCharR adds characters (C) to the right of S till the length N is reached, and returns the resulting string. If the length of S is already equal to or larger than N, then no characters are added. The resulting string can be thought of as a left-aligned version of S, with length N.

Errors: None

See also: AddChar ([1202](#))

36.3.3 AnsiContainsStr

Synopsis: Checks whether a string contains a given substring

Declaration: function AnsiContainsStr(const AText: string; const ASubText: string) : Boolean

Visibility: default

Description: AnsiContainsString checks whether AText contains ASubText, and returns True if this is the case, or returns False otherwise. The search is performed case-sensitive.

Errors: None

See also: AnsiContainsText ([1202](#)), AnsiEndsStr ([1203](#)), AnsiIndexStr ([1203](#)), AnsiStartsStr ([1207](#))

36.3.4 AnsiContainsText

Synopsis: Check whether a string contains a certain substring, ignoring case.

Declaration: function AnsiContainsText(const AText: string; const ASubText: string) : Boolean

Visibility: default

Description: `AnsiContainsString` checks whether `AText` contains `ASubText`, and returns `True` if this is the case, or returns `False` otherwise. The search is performed case-insensitive.

See also: [AnsiContainsStr \(1202\)](#), [AnsiEndsText \(1203\)](#), [AnsiIndexText \(1204\)](#), [AnsiStartsText \(1207\)](#)

36.3.5 `AnsiEndsStr`

Synopsis: Check whether a string ends with a certain substring

Declaration: `function AnsiEndsStr(const ASubText: string; const AText: string) : Boolean`

Visibility: default

Description: `AnsiEndsStr` checks `AText` to see whether it ends with `ASubText`, and returns `True` if it does, `False` if not. The check is performed case-sensitive. Basically, it checks whether the position of `ASubText` equals the length of `AText` minus the length of `ASubText` plus one.

Errors: None.

See also: [AnsiEndsText \(1203\)](#), [AnsiStartsStr \(1207\)](#), [AnsiIndexStr \(1203\)](#), [AnsiContainsStr \(1202\)](#)

36.3.6 `AnsiEndsText`

Synopsis: Check whether a string ends with a certain substring, ignoring case.

Declaration: `function AnsiEndsText(const ASubText: string; const AText: string) : Boolean`

Visibility: default

Description: `AnsiEndsStr` checks `AText` to see whether it ends with `ASubText`, and returns `True` if it does, `False` if not. The check is performed case-insensitive. Basically, it checks whether the position of `ASubText` equals the length of `AText` minus the length of `ASubText` plus one.

Errors: None

See also: [AnsiStartsText \(1207\)](#), [AnsiEndsStr \(1203\)](#), [AnsiIndexText \(1204\)](#), [AnsiContainsText \(1202\)](#)

36.3.7 `AnsiIndexStr`

Synopsis: Searches, observing case, for a string in an array of strings.

Declaration: `function AnsiIndexStr(const AText: string; const AValues: Array of) : Integer`

Visibility: default

Description: `AnsiIndexStr` matches `AText` against each string in `AValues`. If a match is found, the corresponding index (zero-based) in the `AValues` array is returned. If no match is found, -1 is returned. The strings are matched observing case.

Errors: None.

See also: [AnsiIndexText \(1204\)](#), [AnsiMatchStr \(1204\)](#), [AnsiMatchText \(1204\)](#)

36.3.8 AnsiIndexText

Synopsis: Searches, case insensitive, for a string in an array of strings.

Visibility: default

Description: AnsiIndexStr matches AText against each string in AValues . If a match is found, the corresponding index (zero-based) in the AValues array is returned. If no match is found, -1 is returned. The strings are matched ignoring case.

Errors: None

See also: [AnsiIndexStr](#) (1203), [AnsiMatchStr](#) (1204), [AnsiMatchText](#) (1204)

36.3.9 AnsiLeftStr

Synopsis: Copies a number of characters starting at the left of a string

Declaration: function AnsiLeftStr(const AText: AnsiString; const ACount: Integer)
 : AnsiString

Visibility: default

Description: AnsiLeftStr returns the ACount leftmost characters from AText. If ACount is larger than the length of AText, only as much characters as available in AText will be copied. If ACount is zero or negative, no characters will be copied. The characters are counted as characters, not as Bytes.

Errors: None.

See also: [AnsiMidStr](#) ([1205](#)), [AnsiRightStr](#) ([1206](#)), [LeftStr](#) ([1216](#)), [RightStr](#) ([1222](#)), [MidStr](#) ([1217](#)), [LeftBStr](#) ([1216](#)), [RightBStr](#) ([1221](#)), [MidBStr](#) ([1217](#))

36.3.10 AnsiMatchStr

Synopsis: Check whether a string occurs in an array of strings, observing case.

Visibility: default

Description: AnsiIndexStr matches AText against each string in AValues. If a match is found, it returns True, otherwise False is returned. The strings are matched observing case.

This function simply calls `AnsiIndexStr` ([1203](#)) and checks whether it returns -1 or not.

36.3.11 AnsiMatchText

Synopsis: Check whether a string occurs in an array of strings, disregarding case.

Visibility: default

Description: AnsiIndexStr matches AText against each string in AValues. If a match is found, it returns True, otherwise False is returned. The strings are matched ignoring case.

This function simply calls AnsiIndexText (1204) and checks whether it returns -1 or not.

36.3.12 AnsiMidStr

Synopsis: Returns a number of characters copied from a given location in a string

Declaration: function AnsiMidStr(const AText: AnsiString; const AStart: Integer;
const ACount: Integer) : AnsiString

Visibility: default

Description: AnsiMidStr returns ACount characters from AText, starting at position AStart. If AStart+ACount is larger than the length of AText, only as much characters as available in AText (starting from AStart) will be copied. If ACount is zero or negative, no characters will be copied. The characters are counted as characters, not as Bytes.

This function corresponds to the Visual Basic MidStr function.

Errors: None

See also: AnsiLeftStr (1204), AnsiRightStr (1206), LeftStr (1216), RightStr (1222), MidStr (1217), LeftBStr (1216), RightBStr (1221), MidBStr (1217)

36.3.13 AnsiProperCase

Synopsis: Pretty-Print a string: make lowercase and capitalize first letters of words

Declaration: function AnsiProperCase(const S: string; const WordDelims: TSysCharSet)
: string

Visibility: default

Description: AnsiProperCase converts S to an all lowercase string, but capitalizes the first letter of every word in the string, and returns the resulting string. When searching for words, the characters in WordDelimiters are used to determine the boundaries of words. The constant StdWordDelims (1201) can be used for this.

36.3.14 AnsiReplaceStr

Synopsis: Search and replace all occurrences of a string, case sensitive.

Declaration: function AnsiReplaceStr(const AText: string; const AFromText: string;
const AToText: string) : string

Visibility: default

Description: AnsiReplaceString searches AText for all occurrences of the string AFromText and replaces them with AToText, and returns the resulting string. The search is performed observing case.

Errors: None.

See also: AnsiReplaceText (1206), SearchBuf (1223)

36.3.15 AnsiReplaceText

Synopsis: Search and replace all occurrences of a string, case insensitive.

Declaration: `function AnsiReplaceText(const AText: string; const AFromText: string;
const AToText: string) : string`

Visibility: default

Description: `AnsiReplaceString` searches `AText` for all occurrences of the string `AFromText` and replaces them with `AToText`, and returns the resulting string. The search is performed ignoring case.

Errors: None.

See also: `AnsiReplaceStr` ([1205](#)), `SearchBuf` ([1223](#))

36.3.16 AnsiResemblesText

Synopsis: Check whether 2 strings resemble each other.

Declaration: `function AnsiResemblesText(const AText: string; const AOther: string)
: Boolean`

Visibility: default

Description: `AnsiResemblesText` will check whether `AnsiResemblesProc` ([1200](#)) is set. If it is not set, `False` is returned. If it is set, `AText` and `AOtherText` are passed to it and its result is returned.

Errors: None.

See also: `AnsiResemblesProc` ([1200](#)), `SoundexProc` ([1224](#))

36.3.17 AnsiReverseString

Synopsis: Reverse the letters in a string.

Declaration: `function AnsiReverseString(const AText: AnsiString) : AnsiString`

Visibility: default

Description: `AnsiReverseString` returns a string with all characters of `AText` in reverse order.
if the result of this function equals `AText`, `AText` is called an anagram.

Errors: None.

36.3.18 AnsiRightStr

Synopsis: Copies a number of characters starting at the right of a string

Declaration: `function AnsiRightStr(const AText: AnsiString; const ACount: Integer)
: AnsiString`

Visibility: default

Description: `AnsiLeftStr` returns the `ACount` rightmost characters from `AText`. If `ACount` is larger than the length of `AText`, only as much characters as available in `AText` will be copied. If `ACount` is zero or negative, no characters will be copied. The characters are counted as characters, not as Bytes.

This function corresponds to the Visual Basic `RightStr` function.

Errors: None.

See also: [AnsiLeftStr \(1204\)](#), [AnsiMidStr \(1205\)](#), [LeftStr \(1216\)](#), [RightStr \(1222\)](#), [MidStr \(1217\)](#), [LeftBStr \(1216\)](#), [RightBStr \(1221\)](#), [MidBStr \(1217\)](#)

36.3.19 AnsiStartsStr

Synopsis: Check whether a string starts with a given substring, observing case

Declaration: `function AnsiStartsStr(const ASubText: string; const AText: string) : Boolean`

Visibility: default

Description: `AnsiStartsStr` checks `AText` to see whether it starts with `ASubText`, and returns `True` if it does, `False` if not. The check is performed case-sensitive. Basically, it checks whether the position of `ASubText` equals 1.

See also: [AnsiEndsStr \(1203\)](#), [AnsiStartsStr \(1207\)](#), [AnsiIndexStr \(1203\)](#), [AnsiContainsStr \(1202\)](#)

36.3.20 AnsiStartsText

Synopsis: Check whether a string starts with a given substring, ignoring case

Declaration: `function AnsiStartsText(const ASubText: string; const AText: string) : Boolean`

Visibility: default

Description: `AnsiStartsText` checks `AText` to see whether it starts with `ASubText`, and returns `True` if it does, `False` if not. The check is performed case-insensitive. Basically, it checks whether the position of `ASubText` equals 1.

Errors: None.

See also: [AnsiEndsText \(1203\)](#), [AnsiStartsStr \(1207\)](#), [AnsiIndexText \(1204\)](#), [AnsiContainsText \(1202\)](#)

36.3.21 BinToHex

Synopsis: Convert a binary buffer to a hexadecimal string

Declaration: `procedure BinToHex(BinValue: PChar; HexValue: PChar; BufSize: Integer)`

Visibility: default

Description: `BinToHex` converts the byte values in `BinValue` to a string consisting of 2-character hexadeciml strings in `HexValue`. `BufSize` specifies the length of `BinValue`, which means that `HexValue` must have size `2*BufSize`.

For example a buffer containing the byte values 255 and 0 will be converted to FF00.

Errors: No length checking is done, so if an invalid size is specified, an exception may follow.

See also: [HexToBin \(1214\)](#)

36.3.22 Copy2Space

Synopsis: Returns all characters in a string till the first space character (not included).

Declaration: `function Copy2Space(const S: string) : string`

Visibility: default

Description: `Copy2Space` determines the position of the first space in the string `S` and returns all characters up to this position. The space character itself is not included in the result string. The string `S` is left untouched. If there is no space in `S`, then the whole string `S` is returned.

This function simply calls `Copy2Symb` (1208) with the space (ASCII code 32) as the symbol argument.

Errors: None.

See also: `Copy2Symb` (1208), `Copy2SpaceDel` (1208)

36.3.23 Copy2SpaceDel

Synopsis: Deletes and returns all characters in a string till the first space character (not included).

Declaration: `function Copy2SpaceDel(var S: string) : string`

Visibility: default

Description: `Copy2SpaceDel` determines the position of the first space in the string `S` and returns all characters up to this position. The space character itself is not included in the result string. All returned characters, including the space, are deleted from the string `S`, after which it is right-trimmed. If there is no space in `S`, then the whole string `S` is returned, and `S` itself is emptied.

This function simply calls `Copy2SymbDel` (1209) with the space (ASCII code 32) as the symbol argument.

Errors: None.

See also: `Copy2SymbDel` (1209), `Copy2Space` (1208)

36.3.24 Copy2Symb

Synopsis: Returns all characters in a string till a given character (not included).

Declaration: `function Copy2Symb(const S: string; Symb: Char) : string`

Visibility: default

Description: `Copy2Symb` determines the position of the first occurrence of `Symb` in the string `S` and returns all characters up to this position. The `Symb` character itself is not included in the result string. The string `S` is left untouched. If `Symb` does not appear in `S`, then the whole of `S` is returned.

Errors: None.

See also: `Copy2Space` (1208), `Copy2SymbDel` (1209)

36.3.25 Copy2SymbDel

Synopsis: Deletes and returns all characters in a string till a given character (not included).

Declaration: function Copy2SymbDel(var S: string; Symb: Char) : string

Visibility: default

Description: Copy2SymbDel determines the position of the first occurrence of Symb in the string S and returns all characters up to this position. The Symb character itself is not included in the result string. All returned characters and the Symb character, are deleted from the string S, after which it is right-trimmed. If Symb does not appear in S, then the whole of S is returned, and S itself is emptied.

Errors: None.

See also: [Copy2SpaceDel \(1208\)](#), [Copy2Symb \(1208\)](#)

36.3.26 Dec2Numb

Synopsis: Convert a decimal number to a string representation, using given a base.

Declaration: function Dec2Numb(N: LongInt; Len: Byte; Base: Byte) : string

Visibility: default

Description: Dec2Numb converts N to its representation using base Base. The resulting string is left-padded with zeroes till it has length Len. Base must be in the range 2-36 to be meaningful, but no checking on this is performed.

Errors: If Base is out of range, the resulting string will contain unreadable (non-alphanumeric) characters.

See also: [Hex2Dec \(1213\)](#), [IntToBin \(1214\)](#), [intToRoman \(1215\)](#), [RomanToInt \(1222\)](#)

36.3.27 DecodeSoundexInt

Synopsis: Decodes the integer representation of a soundex code and returns the original soundex code.

Declaration: function DecodeSoundexInt(AValue: Integer) : string

Visibility: default

Description: DecodeSoundexInt converts the integer value AValue to a soundex string. It performs the reverse operation of the SoundexInt ([1224](#)) function. The result is the soundex string corresponding to AValue. .

Errors: None.

See also: [SoundexInt \(1224\)](#), [DecodeSoundexWord \(1209\)](#), [Soundex \(1223\)](#)

36.3.28 DecodeSoundexWord

Synopsis: Decodes the word-sized representation of a soundex code and returns the original soundex code.

Declaration: function DecodeSoundexWord(AValue: Word) : string

Visibility: default

Description: DecodeSoundexWord converts the integer value AValue to a soundex string. It performs the reverse operation of the SoundexWord ([1225](#)) function. The result is the soundex string corresponding to AValue .

Errors: None.

See also: SoundexInt ([1224](#)), DecodeSoundexInt ([1209](#)), Soundex ([1223](#))

36.3.29 DelChars

Synopsis: Delete all occurrences of a given character from a string.

Declaration: `function DelChars(const S: string;Chr: Char) : string`

Visibility: default

Description: `DelChars` returns a copy of `S` with all `Chr` characters removed from it.

Errors: None.

See also: `DelSpace` ([1210](#)), `DelSpace1` ([1210](#))

36.3.30 DelSpace

Synopsis: Delete all occurrences of a space from a string.

Declaration: `function DelSpace(const S: string) : string`

Visibility: default

Description: `DelSpace` returns a copy of `S` with all spaces (ASCII code 32) removed from it.

Errors: None.

See also: `DelChars` ([1210](#)), `DelSpace1` ([1210](#))

36.3.31 DelSpace1

Synopsis: Reduces sequences of space characters to 1 space character.

Declaration: `function DelSpace1(const S: string) : string`

Visibility: default

Description: `DelSpace1` returns a copy of `S` with all sequences of spaces reduced to 1 space.

Errors: None.

See also: `DelChars` ([1210](#)), `DelSpace` ([1210](#))

36.3.32 DupeString

Synopsis: Creates and concatenates N copies of a string

Declaration: `function DupeString(const AText: string;ACount: Integer) : string`

Visibility: default

Description: `DupeString` returns a string consisting of `ACount` concatenations of `AText`. Thus

```
DupeString('1234567890', 3);
```

will produce a string

```
'123456789012345678901234567890'
```

Errors: None.

36.3.33 ExtractDelimited

Synopsis: Extract the N-th delimited part from a string.

Declaration: `function ExtractDelimited(N: Integer; const S: string;
const Delims: TSysCharSet) : string`

Visibility: default

Description: `ExtractDelimited` extracts the N-th part from the string `S`. The set of characters in `Delims` are used to mark part boundaries. When a delimiter is encountered, a new part is started and the old part is ended. Another way of stating this is that any (possibly empty) series of characters not in `Delims`, situated between 2 characters in `Delims`, it is considered as piece of a part. This means that if 2 delimiter characters appear next to each other, there is an empty part between it. If an N-th part cannot be found, an empty string is returned. However, unlike `ExtractWord` (1212), an empty string is a valid return value, i.e. a part can be empty.

The pre-defined constant `StdWordDelims` (1201) can be used for the `Delims` argument. The pre-defined constant `Brackets` (1200) would be better suited the `Delims` argument e.g. in case factors in a mathematical expression are searched.

Errors: None.

See also: `ExtractSubStr` (1211), `ExtractWord` (1212), `ExtractWordPos` (1212)

36.3.34 ExtractSubstr

Synopsis: Extract a word from a string, starting at a given position in the string.

Declaration: `function ExtractSubstr(const S: string; var Pos: Integer;
const Delims: TSysCharSet) : string`

Visibility: default

Description: `ExtractSubstr` returns all characters from `S` starting at position `Pos` till the first character in `Delims`, or till the end of `S` is reached. The delimiter character is not included in the result. `Pos` is then updated to point to the next first non-delimiter character in `S`. If `Pos` is larger than the Length of `S`, an empty string is returned.

The pre-defined constant `StdWordDelims` (1201) can be used for the `Delims` argument.

Errors: None.

See also: `ExtractDelimited` (1211), `ExtractWord` (1212), `ExtractWordPos` (1212)

36.3.35 ExtractWord

Synopsis: Extract the N-th word out of a string.

Declaration: function ExtractWord(N: Integer; const S: string;
const WordDelims: TSysCharSet) : string

Visibility: default

Description: ExtractWord extracts the N-th word from the string S. The set of characters in WordDelims are used to mark word boundaries. A word is defined as any non-empty sequence of characters which are not present in WordDelims: if a character is not in WordDelims, it is considered as part of a word. If an N-th word cannot be found, an empty string is returned.

Unlike ExtractDelimited (1211), an empty string is not a valid return value, i.e. is not a word. If an empty string is returned, the index N was out of range.

The pre-defined constant StdWordDelims (1201) can be used for the WordDelims argument.

Errors: None.

See also: ExtractWordPos (1212), ExtractSubStr (1211), ExtractDelimited (1211), IsWordPresent (1216), WordCount (1227), WordPosition (1227)

36.3.36 ExtractWordPos

Synopsis: Extract a word from a string, and return the position where it was located in the string.

Declaration: function ExtractWordPos(N: Integer; const S: string;
const WordDelims: TSysCharSet; var Pos: Integer)
: string

Visibility: default

Description: ExtractWordPos extracts the N-th word from the string S and returns the position of this word in Pos. The set of characters in WordDelims are used to mark word boundaries. A word is defined as any non-empty sequence of characters which are not present in WordDelims : if a character is not in WordDelims , it is considered as part of a word. If an N -th word cannot be found, an empty string is returned and Pos is zero.

Unlike ExtractDelimited (1211), an empty string is not a valid return value, i.e. is not a word. If an empty string is returned, the index N was out of range.

The pre-defined constant StdWordDelims (1201) can be used for the WordDelims argument.

Errors: None.

See also: ExtractWord (1212), ExtractSubStr (1211), IsWordPresent (1216), WordCount (1227), WordPosition (1227)

36.3.37 FindPart

Synopsis: Search for a substring in a string, using wildcards.

Declaration: function FindPart(const HelpWilds: string; const InputStr: string)
: Integer

Visibility: default

Description: `FindPart` searches the string `InputStr` and returns the first string that matches the wildcards specification in `HelpWilds`. If no match is found, an empty string is returned. Currently, the only valid wildcards is the "?" character.

Errors: None.

See also: `SearchBuf` ([1223](#))

36.3.38 GetCmdLineArg

Synopsis: Returns the command-line argument following the given switch.

Declaration: `function GetCmdLineArg(const Switch: string; SwitchChars: TSysCharSet) : string`

Visibility: default

Description: `GetCmdLineArg` returns the value for the `Switch` option on the command-line, if any is given. Command-line arguments are considered switches if they start with one of the characters in the `SwitchChars` set. The value is the command-line argument following the switch command-line argument.

Gnu-style (long) Options of the form `switch=value` are not supported.

The `StdSwitchChars` ([1201](#)) constant can be used as value for the `SwitchChars` parameter.

Errors: The `GetCmdLineArg` does not check whether the value of the option does not start with a switch character. i.e.

```
myprogram -option1 -option2
```

will result in "-option2" as the result of the `GetCmdLineArg` call for option1.

See also: `StdSwitchChars` ([1201](#))

36.3.39 Hex2Dec

Synopsis: Converts a hexadecimal string to a decimal value

Declaration: `function Hex2Dec(const S: string) : LongInt`

Visibility: default

Description: `Hex2Dec` converts the hexadecimal value in the string `S` to its decimal value. Unlike the standard `StrToInt` functions, there need not be a \$ sign in front of the hexadecimal value to indicate that it is indeed a hexadecimal value.

Errors: If `S` does not contain a valid hexadecimal value, an `EConvertError` exception will be raised.

See also: `Dec2Numb` ([1209](#)), `IntToBin` ([1214](#)), `intToRoman` ([1215](#)), `RomanToInt` ([1222](#))

36.3.40 HexToBin

Synopsis: Convert a hexadecimal string to a binary buffer

Declaration: function HexToBin(HexValue: PChar; BinValue: PChar; BinBufSize: Integer)
 : Integer

Visibility: default

Description: HexToBin scans the hexadecimal string representation in HexValue and transforms every 2 character hexadecimal number to a byte and stores it in BinValue. The buffer size is the size of the binary buffer. Scanning will stop if the size of the binary buffer is reached or when an invalid character is encountered. The return value is the number of stored bytes.

Errors: No length checking is done, so if an invalid size is specified, an exception may follow.

See also: BinToHex (1207)

36.3.41 IfThen

Synopsis: Returns one of two strings, depending on a boolean expression

Declaration: function IfThen(AValue: Boolean; const ATrue: string;
const AFalse: string) : string; Overload

Visibility: default

Description: IfThen returns ATrue if AValue is True, and returns AFalse if AValue is false.

Errors: None.

See also: [AnsiMatchStr](#) (1204), [AnsiMatchText](#) (1204)

36.3.42 IntToBin

Synopsis: Converts an integer to a binary string representation, inserting spaces at fixed locations.

```
Declaration: function IntToBin(Value: LongInt;Digits: Integer;Spaces: Integer)
              : string
    function IntToBin(Value: LongInt;Digits: Integer) : string
    function intToBin(Value: Int64;Digits: Integer) : string
```

Visibility: default

Description: IntToBin converts Value to a string with it's binary (base 2) representation. The resulting string contains at least Digits digits, with spaces inserted every Spaces digits. Spaces should be a nonzero value. If Digits is larger than 32, it is truncated to 32.

Errors: If spaces is zero, a division by zero error will occur.

See also: [Hex2Dec](#) (1213), [IntToRoman](#) (1215)

36.3.43 IntToRoman

Synopsis: Represent an integer with roman numerals

Declaration: function `IntToRoman(Value: LongInt) : string`

Visibility: default

Description: `IntToRoman` converts `Value` to a string with the Roman representation of `Value`. Number up to 1 million can be represented this way.

Errors: None.

See also: [RomanToInt \(1222\)](#), [Hex2Dec \(1213\)](#), [IntToBin \(1214\)](#)

36.3.44 IsEmptyStr

Synopsis: Check whether a string is empty, disregarding whitespace characters

Declaration: function `IsEmptyStr(const S: string; const EmptyChars: TSysCharSet) : Boolean`

Visibility: default

Description: `IsEmptyStr` returns `True` if the string `S` only contains characters whitespace characters, all characters in `EmptyChars` are considered whitespace characters. If a character not present in `EmptyChars` is found in `S`, `False` is returned.

Errors: None.

See also: [IsWild \(1215\)](#), [FindPart \(1212\)](#), [IsWordPresent \(1216\)](#)

36.3.45 IsWild

Synopsis: Check whether a string matches a wildcard search expression.

Declaration: function `IsWild(InputStr: string; Wilds: string; IgnoreCase: Boolean) : Boolean`

Visibility: default

Description: `IsWild` checks `InputStr` for the presence of the `Wilds` string. `Wilds` may contain "?" and "*" wildcard characters, which have their usual meaning: "*" matches any series of characters, possibly empty. "?" matches any single character. The function returns `True` if a string is found that matches `Wilds`, `False` otherwise.

If `IgnoreCase` is `True`, the non-wildcard characters are matched case insensitively. If it is `False`, case is observed when searching.

Errors: None.

See also: [SearchBuf \(1223\)](#), [FindPart \(1212\)](#)

36.3.46 IsWordPresent

Synopsis: Check for the presence of a word in a string.

Declaration: `function IsWordPresent(const W: string; const S: string;
const WordDelims: TSysCharSet) : Boolean`

Visibility: default

Description: `IsWordPresent` checks for the presence of the word `W` in the string `S`. Words are delimited by the characters found in `WordDelims`. The function returns `True` if a match is found, `False` otherwise. The search is performed case sensitive.

This function is equivalent to the `SearchBuf` ([1223](#)) function with the `soWholeWords` option specified.

Errors: None.

See also: `SearchBuf` ([1223](#))

36.3.47 LeftBStr

Synopsis: Copies Count characters starting at the left of a string.

Declaration: `function LeftBStr(const AText: AnsiString; const AByteCount: Integer)
: AnsiString`

Visibility: default

Description: `LeftBStr` returns a string containing the leftmost `AByteCount` bytes from the string `AText` . If `AByteCount` is larger than the length (in bytes) of `AText` , only as many bytes as available are returned.

Errors: None.

See also: `LeftStr` ([1216](#)), `AnsiLeftStr` ([1204](#)), `RightBStr` ([1221](#)), `MidBStr` ([1217](#))

36.3.48 LeftStr

Synopsis: Copies Count characters starting at the left of a string.

Declaration: `function LeftStr(const AText: AnsiString; const ACount: Integer)
: AnsiString
function LeftStr(const AText: WideString; const ACount: Integer)
: WideString`

Visibility: default

Description: `LeftStr` returns a string containing the leftmost `ACount` characters from the string `AText` . If `ACount` is larger than the length (in characters) of `AText` , only as many characters as available are returned.

Errors: None.

See also: `LeftBStr` ([1216](#)), `AnsiLeftStr` ([1204](#)), `RightStr` ([1222](#)), `MidStr` ([1217](#))

36.3.49 MidBStr

Synopsis: Copies a number of characters starting at a given position in a string.

Declaration: `function MidBStr(const AText: AnsiString; const AByteStart: Integer;
const AByteCount: Integer) : AnsiString`

Visibility: default

Description: `MidBStr` returns a string containing the first `AByteCount` bytes from the string `AText` starting at position `AByteStart`. If `AByteStart+AByteCount` is larger than the length (in bytes) of `AText`, only as many bytes as available are returned. If `AByteStart` is less than 1 or larger than the length of `AText`, then no characters are returned.

Errors: None.

See also: [LeftBStr \(1216\)](#), [AnsiMidStr \(1205\)](#), [RightBStr \(1221\)](#), [MidStr \(1217\)](#)

36.3.50 MidStr

Synopsis: Copies a number of characters starting at a given position in a string.

Declaration: `function MidStr(const AText: AnsiString; const AStart: Integer;
const ACount: Integer) : AnsiString
function MidStr(const AText: WideString; const AStart: Integer;
const ACount: Integer) : WideString`

Visibility: default

Description: `MidStr` returns a string containing the first `ACount` bytes from the string `AText` starting at position `AStart`. If `AStart+ACount` is larger than the length (in characters) of `AText`, only as many characters as available are returned. If `AStart` is less than 1 or larger than the length of `AText`, then no characters are returned.

This function is equivalent to the standard `Copy` function, and is provided for completeness only.

Errors: None.

See also: [LeftStr \(1216\)](#), [AnsiMidStr \(1205\)](#), [RightStr \(1222\)](#), [MidBStr \(1217\)](#)

36.3.51 NPos

Synopsis: Returns the position of the `N`-th occurrence of a substring in a string.

Declaration: `function NPos(const C: string; S: string; N: Integer) : Integer`

Visibility: default

Description: `NPos` checks `S` for the position of the `N`-th occurrence of `C`. If `C` occurs less than `N` times in `S`, or does not occur in `S` at all, 0 is returned. If `N` is less than 1, zero is returned.

Errors: None.

See also: [WordPosition \(1227\)](#), [FindPart \(1212\)](#)

36.3.52 Numb2Dec

Synopsis: Converts a string representation of a number to its numerical value, given a certain base.

Declaration: function Numb2Dec(S: string; Base: Byte) : LongInt

Visibility: default

Description: Numb2Dec converts the number in string S to a decimal value. It assumes the number is represented using Base as the base. No checking is performed to see whether S contains a valid number using base Base.

Errors: None.

See also: Hex2Dec ([1213](#)), Numb2USA ([1218](#))

36.3.53 Numb2USA

Synopsis: Insert thousand separators.

Declaration: function Numb2USA(const S: string) : string

Visibility: default

Description: Numb2USA inserts thousand separators in the string S at the places where they are supposed to be, i.e. every 3 digits. The string S should contain a valid integer number, i.e. no digital number. No checking on this is done.

Errors: None.

36.3.54 PadCenter

Synopsis: Pad the string to a certain length, so the string is centered.

Declaration: function PadCenter(const S: string; Len: Integer) : string

Visibility: default

Description: PadCenter add spaces to the left and right of the string S till the result reaches length Len. If the number of spaces to add is odd, then the extra space will be added at the end. If the string S has length equal to or larger than Len, no spaces are added, and the string S is returned as-is.

Errors: None.

See also: PadLeft ([1218](#)), PadRight ([1219](#)), AddChar ([1202](#)), AddCharR ([1202](#))

36.3.55 PadLeft

Synopsis: Add spaces to the left of a string till a certain length is reached.

Declaration: function PadLeft(const S: string; N: Integer) : string

Visibility: default

Description: PadLeft add spaces to the left of the string S till the result reaches length Len. If the string S has length equal to or larger than Len, no spaces are added, and the string S is returned as-is. The resulting string is S, right-justified on length Len.

Errors: None.

See also: PadLeft ([1218](#)), PadCenter ([1218](#)), AddChar ([1202](#)), AddCharR ([1202](#))

36.3.56 PadRight

Synopsis: Add spaces to the right of a string till a certain length is reached.

Declaration: function PadRight(const S: string; N: Integer) : string

Visibility: default

Description: PadRight add spaces to the left of the string S till the result reaches length Len. If the string S has length equal to or larger than Len, no spaces are added, and the string S is returned as-is. The resulting string is S, left-justified on length Len.

Errors: None.

See also: PadLeft ([1218](#)), PadCenter ([1218](#)), AddChar ([1202](#)), AddCharR ([1202](#))

36.3.57 PosEx

Synopsis: Search for the occurrence of a character in a string, starting at a certain position.

Declaration: function PosEx(const SubStr: string; const S: string; Offset: Cardinal) : Integer
 function PosEx(const SubStr: string; const S: string) : Integer
 function PosEx(c: Char; const S: string; Offset: Cardinal) : Integer

Visibility: default

Description: PosEx returns the position of the first occurrence of the character C or the substring SubStr in the string S, starting the search at position Offset (default 1). If C or SubStr does not occur in S after the given Offset, zero is returned. The position Offset is also searched.

Errors: None.

See also: NPos ([1217](#)), AnsiContainsText ([1202](#)), AnsiContainsStr ([1202](#))

36.3.58 PosSet

Synopsis: Return the position in a string of any character out of a set of characters

Declaration: function PosSet(const c: TSysCharSet; const s: ansistring) : Integer
 function PosSet(const c: string; const s: ansistring) : Integer

Visibility: default

Description: PosSet returns the position in s of the first found character which is in the set c. If none of the characters in c is found in s, then 0 is returned.

Errors: None.

See also: PosEx ([1219](#)), PosSetEx ([1219](#)), #rtl.system.pos ([1382](#)), RPosEx ([1222](#))

36.3.59 PosSetEx

Synopsis: Return the position in a string of any character out of a set of characters, starting at a certain position

Declaration: function PosSetEx(const c: TSysCharSet; const s: ansistring; count: Integer) : Integer
 function PosSetEx(const c: string; const s: ansistring; count: Integer) : Integer

Visibility: default

Description: `PosSetEx` returns the position in `s` of the first found character which is in the set `c`, and starts searching at character position `Count`. If none of the characters in `c` is found in `s`, then 0 is returned.

Errors: None.

See also: [PosEx \(1219\)](#), [PosSet \(1219\)](#), [#rtl.system.pos \(1382\)](#), [RPosEx \(1222\)](#)

36.3.60 RandomFrom

Synopsis: Choose a random string from an array of strings.

Declaration: `function RandomFrom(const AValues: Array of) : string; Overload`

Visibility: default

Description: `RandomFrom` picks at random a valid index in the array `AValues` and returns the string at that position in the array.

Errors: None.

See also: [AnsiMatchStr \(1204\)](#), [AnsiMatchText \(1204\)](#)

36.3.61 Removeleadingchars

Synopsis: Remove any leading characters in a set from a string

Declaration: `procedure Removeleadingchars (var S: AnsiString; const CSet: TSysCharSet)`

Visibility: default

Description: `Removeleadingchars` removes any starting characters from `S` that appear in the set `CSet`. It stops removing characters as soon as a character not in `CSet` is encountered. This is similar in behaviour to `TrimLeft (1594)` which used whitespace as the set.

Errors: None.

See also: [TrimLeft \(1594\)](#), [RemoveTrailingChars \(1221\)](#), [RemovePadChars \(1220\)](#), [TrimLeftSet \(1226\)](#)

36.3.62 RemovePadChars

Synopsis: Remove any trailing or leading characters in a set from a string

Declaration: `procedure RemovePadChars (var S: AnsiString; const CSet: TSysCharSet)`

Visibility: default

Description: `RemovePadChars` removes any leading/trailing characters from `S` that appear in the set `CSet`, i.e. it starts with the last character and works its way to the start of the string, and it stops removing characters as soon as a character not in `CSet` is encountered. Then the same procedure is repeated starting from the beginning of the string. This is similar in behaviour to `Trim (1593)` which used whitespace as the set.

Errors: None.

See also: [Trim \(1593\)](#), [RemoveLeadingChars \(1220\)](#), [RemoveTrailingChars \(1221\)](#), [TrimSet \(1227\)](#), [TrimLeftSet \(1226\)](#), [TrimRightSet \(1226\)](#)

36.3.63 RemoveTrailingChars

Synopsis: Remove any trailing characters in a set from a string

Declaration: procedure RemoveTrailingChars(var S: AnsiString; const CSet: TSysCharSet)

Visibility: default

Description: RemoveTrailingChars removes any trailing characters from S that appear in the set CSet, i.e. it starts with the last character and works its way to the start of the string. It stops removing characters as soon as a character not in CSet is encountered. This is similar in behaviour to TrimRight ([1595](#)) which used whitespace as the set.

See also: TrimRight ([1594](#)), RemoveLeadingChars ([1220](#)), TrimRightSet ([1226](#))

36.3.64 ReplaceStr

Declaration: function ReplaceStr(const AText: string; const AFromText: string;
const AToText: string) : string

Visibility: default

36.3.65 ReplaceText

Declaration: function ReplaceText(const AText: string; const AFromText: string;
const AToText: string) : string

Visibility: default

36.3.66 ReverseString

Synopsis: Reverse characters in a string

Declaration: function ReverseString(const AText: string) : string

Visibility: default

Description: ReverseString returns a string, made up of the characters in string AText, in reverse order.

Errors: None.

See also: RandomFrom ([1220](#))

36.3.67 RightBStr

Synopsis: Copy a given number of characters (bytes), counting from the right of a string.

Declaration: function RightBStr(const AText: AnsiString; const AByteCount: Integer)
: AnsiString

Visibility: default

Description: RightBStr returns a string containing the rightmost AByteCount bytes from the string AText. If AByteCount is larger than the length (in bytes) of AText, only as many bytes as available are returned.

Errors: None.

See also: LeftBStr ([1216](#)), AnsiRightStr ([1206](#)), RightStr ([1222](#)), MidBStr ([1217](#))

36.3.68 RightStr

Synopsis: Copy a given number of characters, counting from the right of a string.

Declaration:

```
function RightStr(const AText: AnsiString; const ACount: Integer)
            : AnsiString
function RightStr(const AText: WideString; const ACount: Integer)
            : WideString
```

Visibility: default

Description: RightStr returns a string containing the rightmost ACount characters from the string AText . If ACount is larger than the length (in characters) of AText , only as many characters as available are returned.

Errors: None.

See also: [LeftStr \(1216\)](#), [AnsiRightStr \(1206\)](#), [RightBStr \(1221\)](#), [MidStr \(1217\)](#)

36.3.69 RomanToInt

Synopsis: Convert a string with a Roman number to it's decimal value.

Declaration:

```
function RomanToInt(const S: string) : LongInt
```

Visibility: default

Description: RomanToInt returns the decimal equivalent of the Roman numerals in the string S. Invalid characters are dropped from S. A negative numeral is supported as well.

Errors: None.

See also: [IntToRoman \(1215\)](#), [Hex2Dec \(1213\)](#), [Numb2Dec \(1218\)](#)

36.3.70 RPos

Synopsis: Find last occurrence of substring or character in a string

Declaration:

```
function RPos(c: Char; const S: AnsiString) : Integer; Overload
function RPos(const Substr: AnsiString; const Source: AnsiString)
            : Integer; Overload
```

Visibility: default

Description: RPos looks in S for the character C or the string SubStr. It starts looking at the end of the string, and searches towards the beginning of the string. If a match is found, it returns the position of the match.

See also: [RPosEx \(1222\)](#)

36.3.71 RPoseX

Synopsis: Find last occurrence substring or character in a string, starting at a certain position

Declaration:

```
function RPosEX(C: Char; const S: AnsiString; offs: Cardinal) : Integer
            ; Overload
function RPoseX(const Substr: AnsiString; const Source: AnsiString;
               offs: Cardinal) : Integer; Overload
```

Visibility: default

Description: RPos looks in S for the character C or the string SubStr. It starts looking at position Offs (counted from the start of the string), and searches towards the beginning of the string. If a match is found, it returns the position of the match.

See also: RPos ([1222](#))

36.3.72 SearchBuf

Synopsis: Search a buffer for a certain string.

Declaration:

```
function SearchBuf (Buf: PChar; BufLen: Integer; SelStart: Integer;
                    SelLength: Integer; SearchString: string;
                    Options: TStringSearchOptions) : PChar
function SearchBuf (Buf: PChar; BufLen: Integer; SelStart: Integer;
                    SelLength: Integer; SearchString: string) : PChar
```

Visibility: default

Description: SearchBuf searches the buffer Buf for the occurrence of searchString. At most BufLen characters are searched, and the search is started at SelStart+SelLength. If a match is found, a pointer to the position of the match is returned. The parameter Options ([1201](#)) specifies how the search is conducted. It is a set of the following options:

Table 36.3:

Option	Effect
soDown	Searches forward, starting at the end of the selection. Default is searching up
soMatchCase	Observe case when searching. Default is to ignore case.
soWholeWord	Match only whole words. Default also returns parts of words

The standard constant WordDelimiters ([1201](#)) is used to mark the boundaries of words.

The SelStart parameter is zero based.

Errors: BufLen must be the real length of the string, no checking on this is performed.

See also: FindPart ([1212](#)), ExtractWord ([1212](#)), ExtractWordPos ([1212](#)), ExtractSubStr ([1211](#)), IsWordPresent ([1216](#))

36.3.73 Soundex

Synopsis: Compute the soundex of a string

Declaration:

```
function Soundex (const AText: string; ALength: TSoundexLength) : string
function Soundex (const AText: string) : string
```

Visibility: default

Description: Soundex computes a soundex code for AText. The resulting code will at most have ALength characters. The soundex code is computed according to the US system of soundex computing, which may result in inaccurate results in other languages.

Note that AText may not contain null characters.

Errors: None.

See also: SoundexCompare ([1224](#)), SoundexInt ([1224](#)), SoundexProc ([1224](#)), SoundexWord ([1225](#)), SoundexSimilar ([1225](#))

36.3.74 SoundexCompare

Synopsis: Compare soundex values of 2 strings.

Declaration: `function SoundexCompare(const AText: string; const AOther: string;
ALength: TSoundexLength) : Integer
function SoundexCompare(const AText: string; const AOther: string)
: Integer`

Visibility: default

Description: SoundexCompare computes the soundex codes of AText and AOther and feeds these to CompareText. It will return -1 if the soundex code of AText is less than the soundex code of AOther, 0 if they are equal, and 1 if the code of AOther is larger than the code of AText.

Errors: None.

See also: Soundex ([1223](#)), SoundexInt ([1224](#)), SoundexProc ([1224](#)), SoundexWord ([1225](#)), SoundexSimilar ([1225](#))

36.3.75 SoundexInt

Synopsis: Soundex value as an integer.

Declaration: `function SoundexInt(const AText: string; ALength: TSoundexIntLength)
: Integer
function SoundexInt(const AText: string) : Integer`

Visibility: default

Description: SoundexInt computes the Soundex ([1223](#)) code (with length ALength, default 4) of AText, and converts the code to an integer value.

Errors: None.

See also: Soundex ([1223](#)), SoundexCompare ([1224](#)), SoundexProc ([1224](#)), SoundexWord ([1225](#)), SoundexSimilar ([1225](#))

36.3.76 SoundexProc

Synopsis: Default AnsiResemblesText implementation.

Declaration: `function SoundexProc(const AText: string; const AOther: string) : Boolean`

Visibility: default

Description: SoundexProc is the standard implementation for the AnsiResemblesText ([1206](#)) procedure: By default, AnsiResemblesProc is set to this function. It compares the soundex codes of AOther and AText and returns True if they are equal, or False if they are not.

Errors: None.

See also: Soundex ([1223](#)), SoundexCompare ([1224](#)), SoundexInt ([1224](#)), SoundexWord ([1225](#)), SoundexSimilar ([1225](#))

36.3.77 SoundexSimilar

Synopsis: Check whether 2 strings have equal soundex values

Declaration: function SoundexSimilar(const AText: string; const AOther: string;
 ALength: TSoundexLength) : Boolean
function SoundexSimilar(const AText: string; const AOther: string)
 : Boolean

Visibility: default

Description: SoundexSimilar returns True if the soundex codes (with length ALength) of AText and AOther are equal, and False if they are not.

Errors: None.

See also: Soundex ([1223](#)), SoundexCompare ([1224](#)), SoundexInt ([1224](#)), SoundexProc ([1224](#)), SoundexWord ([1225](#)), Soundex ([1223](#))

36.3.78 SoundexWord

Synopsis: Calculate a word-sized soundex value

Declaration: function SoundexWord(const AText: string) : Word

Visibility: default

Description: SoundexInt computes the Soundex ([1223](#)) code (with length 4) of AText, and converts the code to a word-sized value.

AText may not contain null characters.

Errors: None.

See also: Soundex ([1223](#)), SoundexCompare ([1224](#)), SoundexInt ([1224](#)), SoundexProc ([1224](#)), SoundexSimilar ([1225](#))

36.3.79 StringsReplace

Synopsis: Replace occurrences of a set of strings to another set of strings

Declaration: function StringsReplace(const S: string; OldPattern: Array of ;
 NewPattern: Array of ; Flags: TReplaceFlags)
 : string

Visibility: default

Description: StringsReplace scans S for the occurrence of one of the strings in OldPattern and replaces it with the corresponding string in NewPattern. It takes into account Flags, which has the same meaning as in StringReplace ([1572](#)).

Corresponding strings are matched by location: the N-th string in OldPattern is replaced by the N-th string in NewPattern. Note that this means that the number of strings in both arrays must be the same.

Errors: If the number of strings in both arrays is different, then an exception is raised.

See also: StringReplace ([1572](#)), TReplaceFlags ([1469](#))

36.3.80 StuffString

Synopsis: Replace part of a string with another string.

Declaration: `function StuffString(const AText: string; AStart: Cardinal; ALength: Cardinal; const ASubText: string) : string`

Visibility: default

Description: `StuffString` returns a copy of `AText` with the segment starting at `AStart` with length `ALength`, replaced with the string `ASubText`. Basically it deletes the segment of `AText` and inserts the new text in its place.

Errors: No checking on the validity of the `AStart` and `ALength` parameters is done. Providing invalid values may result in access violation errors.

See also: [FindPart](#) (1212), [DelChars](#) (1210), [DelSpace](#) (1210), [ExtractSubStr](#) (1211), [DupeString](#) (1210)

36.3.81 Tab2Space

Synopsis: Convert tab characters to a number of spaces

Declaration: `function Tab2Space(const S: string; Numb: Byte) : string`

Visibility: default

Description: `Tab2Space` returns a copy of `S` with all tab characters (ASCII character 9) converted to `Numb` spaces.

Errors: None.

See also: [StuffString](#) (1226), [FindPart](#) (1212), [ExtractWord](#) (1212), [DelChars](#) (1210), [DelSpace](#) (1210), [DelSpace1](#) (1210), [DupeString](#) (1210)

36.3.82 TrimLeftSet

Synopsis: Remove any leading characters in a set from a string and returns the result

Declaration: `function TrimLeftSet(const S: string; const CSet: TSysCharSet) : string`

Visibility: default

Description: `TrimLeftSet` performs the same action as `RemoveLeadingChars` (1220), but returns the resulting string.

Errors: None.

See also: [TrimLeft](#) (1594), [RemoveLeadingChars](#) (1220), [RemoveTrailingChars](#) (1221), [RemovePadChars](#) (1220), [TrimSet](#) (1227), [TrimRightSet](#) (1226)

36.3.83 TrimRightSet

Synopsis: Remove any trailing characters in a set from a string and returns the result

Declaration: `function TrimRightSet(const S: string; const CSet: TSysCharSet) : string`

Visibility: default

Description: TrimLeftSet performs the same action as RemoveTrailingChars (1221), but returns the resulting string.

Errors: None.

See also: TrimRight (1595), RemoveLeadingChars (1220), RemoveTrailingChars (1221), RemovePadChars (1220), TrimSet (1227), TrimLeftSet (1226)

36.3.84 TrimSet

Synopsis: Remove any leading or trailing characters in a set from a string and returns the result

Declaration: function TrimSet(const S: string; const CSet: TSysCharSet) : string

Visibility: default

Description: TrimSet performs the same action as RemovePadChars (1220), but returns the resulting string.

Errors: None.

See also: Trim (1593), RemoveLeadingChars (1220), RemoveTrailingChars (1221), RemovePadChars (1220), TrimRightSet (1226), TrimLeftSet (1226)

36.3.85 WordCount

Synopsis: Count the number of words in a string.

Declaration: function WordCount(const S: string; const WordDelims: TSysCharSet) : Integer

Visibility: default

Description: WordCount returns the number of words in the string S. A word is a non-empty string of characters bounded by one of the characters in WordDelims.

The pre-defined StdWordDelims (1201) constant can be used for the WordDelims argument.

Errors: None.

See also: WordPosition (1227), StdWordDelims (1201), ExtractWord (1212), ExtractWordPos (1212)

36.3.86 WordPosition

Synopsis: Search position of Nth word in a string.

Declaration: function WordPosition(const N: Integer; const S: string; const WordDelims: TSysCharSet) : Integer

Visibility: default

Description: WordPosition returns the position (in characters) of the N-th word in the string S. A word is a non-empty string of characters bounded by one of the characters in WordDelims. If N is out of range, zero is returned.

The pre-defined StdWordDelims (1201) constant can be used for the WordDelims argument.

Errors: None

See also: WordCount (1227), StdWordDelims (1201), ExtractWord (1212), ExtractWordPos (1212)

36.3.87 XorDecode

Synopsis: Decode a string encoded with XorEncode ([1228](#))

Declaration: `function XorDecode(const Key: string; const Source: string) : string`

Visibility: default

Description: `XorDecode` decodes `Source` and returns the original string that was encrypted using `XorEncode` ([1228](#)) with key `Key`. If a different key is used than the key used to encode the string, the result will be unreadable.

Errors: If the string `Source` is not a valid `XorEncode` result (e.g. contains non-numerical characters), then a `EConversionError` exception will be raised.

See also: `XorEncode` ([1228](#)), `XorString` ([1228](#))

36.3.88 XorEncode

Synopsis: Encode a string by XOR-ing its characters using characters of a given key, representing the result as hex values.

Declaration: `function XorEncode(const Key: string; const Source: string) : string`

Visibility: default

Description: `XorEncode` encodes the string `Source` by XOR-ing each character in `Source` with the corresponding character in `Key` (repeating `Key` as often as necessary) and representing the resulting ASCII code as a hexadecimal number (of length 2). The result is therefore twice as long as the original string, and every 2 bytes represent an ASCII code.

Feeding the resulting string with the same key `Key` to the `XorDecode` ([1228](#)) function will result in the original `Source` string.

This function can be used e.g. to trivially encode a password in a configuration file.

Errors: None.

See also: `XorDecode` ([1228](#)), `XorString` ([1228](#)), `Hex2Dec` ([1213](#))

36.3.89 XorString

Synopsis: Encode a string by XOR-ing its characters using characters of a given key.

Declaration: `function XorString(const Key: ShortString; const Src: ShortString) : ShortString`

Visibility: default

Description: `XorString` encodes the string `Src` by XOR-ing each character in `Source` with the corresponding character in `Key`, repeating `Key` as often as necessary. The resulting string may contain unreadable characters and may even contain null characters. For this reason it may be a better idea to use the `XorEncode` ([1228](#)) function instead, which will representing each resulting ASCII code as a hexadecimal number (of length 2).

Feeding the result again to `XorString` with the same `Key`, will result in the original string `Src`.

Errors: None.

See also: `XorEncode` ([1228](#)), `XorDecode` ([1228](#))

Chapter 37

Reference for unit 'System'

37.1 Overview

The system unit contains the standard supported functions of Free Pascal. It is the same for all platforms. Basically it is the same as the system unit provided with Borland or Turbo Pascal.

Functions are listed in alphabetical order. Arguments of functions or procedures that are optional are put between square brackets.

The pre-defined constants and variables are listed in the first section. The second section contains an overview of all functions, grouped by functionality, and the last section contains the supported functions and procedures.

37.2 A string consisting of widechars.

`UnicodeString` is a string of `WideChars`. The main difference with `WideString` is that `unicode-string` is reference counted, and `WideString` is not reference counted on Windows.

37.3 Miscellaneous functions

Functions that do not belong in one of the other categories.

Table 37.1:

Name	Description
Assert (1288)	Conditionally abort program with error
Break (1294)	Abort current loop
Continue (1304)	Next cycle in current loop
Exclude (1316)	Exclude an element from a set
Exit (1317)	Exit current function or procedure
Include (1335)	Include an element into a set
LongJmp (1348)	Jump to execution point
Ord (1379)	Return ordinal value of enumerated type
Pred (1383)	Return previous value of ordinal type
SetJmp (1401)	Mark execution point for jump
SizeOf (1407)	Return size of variable or type
Succ (1413)	Return next value of ordinal type

37.4 Operating System functions

Functions that are connected to the operating system.

Table 37.2:

Name	Description
Chdir (1297)	Change working directory
Getdir (1327)	Return current working directory
Halt (1331)	Halt program execution
Paramcount (1380)	Number of parameters with which program was called
Paramstr (1381)	Retrieve parameters with which program was called
Mkdir (1350)	Make a directory
Rmdir (1392)	Remove a directory
Runerror (1397)	Abort program execution with error condition

37.5 String handling

All things connected to string handling.

Table 37.3:

Name	Description
BinStr (1292)	Construct binary representation of integer
Chr (1297)	Convert ASCII code to character
Concat (1303)	Concatenate two strings
Copy (1305)	Copy part of a string
Delete (1308)	Delete part of a string
HexStr (1332)	Construct hexadecimal representation of integer
Insert (1340)	Insert one string in another
Length (1345)	Return length of string
Lowercase (1349)	Convert string to all-lowercase
OctStr (1353)	Construct octal representation of integer
Pos (1382)	Calculate position of one string in another
SetLength (1402)	Set length of a string
SetString (1403)	Set contents and length of a string
Str (1410)	Convert number to string representation
StringOfChar (1411)	Create string consisting of a number of characters
Upcase (1423)	Convert string to all-uppercase
Val (1425)	Convert string to number

37.6 Mathematical routines

Functions connected to calculating and converting numbers.

Table 37.4:

Name	Description
Abs (1284)	Calculate absolute value
Arctan (1287)	Calculate inverse tangent
Cos (1305)	Calculate cosine of angle
Dec (1306)	Decrease value of variable
Exp (1318)	Exponentiate
Frac (1325)	Return fractional part of floating point value
Hi (1332)	Return high byte/word of value
Inc (1334)	Increase value of variable
Int (1341)	Calculate integer part of floating point value
Ln (1347)	Calculate logarithm
Lo (1347)	Return low byte/word of value
Odd (1353)	Is a value odd or even ?
Pi (1381)	Return the value of pi
Random (1384)	Generate random number
Randomize (1385)	Initialize random number generator
Round (1395)	Round floating point value to nearest integer number
Sin (1406)	Calculate sine of angle
Sqr (1409)	Calculate the square of a value
Sqrt (1409)	Calculate the square root of a value
Swap (1414)	Swap high and low bytes/words of a variable
Trunc (1419)	Truncate a floating point value

37.7 Memory management functions

Functions concerning memory issues.

Table 37.5:

Name	Description
Addr (1285)	Return address of variable
Assigned (1289)	Check if a pointer is valid
CompareByte (1298)	Compare 2 memory buffers byte per byte
CompareChar (1299)	Compare 2 memory buffers byte per byte
CompareDWord (1301)	Compare 2 memory buffers byte per byte
CompareWord (1302)	Compare 2 memory buffers byte per byte
CSeg (1306)	Return code segment
Dispose (1309)	Free dynamically allocated memory
DSeg (1310)	Return data segment
FillByte (1320)	Fill memory region with 8-bit pattern
FillChar (1321)	Fill memory region with certain character
FillDWord (1321)	Fill memory region with 32-bit pattern
FillQWord (1322)	Fill memory region with 64-bit pattern
FillWord (1322)	Fill memory region with 16-bit pattern
Freemem (1325)	Release allocated memory
Getmem (1328)	Allocate new memory
GetMemoryManager (1328)	Return current memory manager
High (1333)	Return highest index of open array or enumerated
IndexByte (1336)	Find byte-sized value in a memory range
IndexChar (1336)	Find char-sized value in a memory range
IndexDWord (1337)	Find DWord-sized (32-bit) value in a memory range
IndexQWord (1338)	Find QWord-sized value in a memory range
IndexWord (1338)	Find word-sized value in a memory range
IsMemoryManagerSet (1344)	Is the memory manager set
Low (1349)	Return lowest index of open array or enumerated
Move (1350)	Move data from one location in memory to another
MoveChar0 (1351)	Move data till first zero character
New (1351)	Dynamically allocate memory for variable
Ofs (1354)	Return offset of variable
Ptr (1383)	Combine segment and offset to pointer
ReAllocMem (1389)	Resize a memory block on the heap
Seg (1400)	Return segment
SetMemoryManager (1402)	Set a memory manager
Sptr (1408)	Return current stack pointer
SSeg (1410)	Return stack segment register value

37.8 File handling functions

Functions concerning input and output from and to file.

Table 37.6:

Name	Description
Append (1287)	Open a file in append mode
Assign (1288)	Assign a name to a file
Blockread (1292)	Read data from a file into memory
Blockwrite (1293)	Write data from memory to a file
Close (1298)	Close a file
Eof (1314)	Check for end of file
Eoln (1314)	Check for end of line
Erase (1315)	Delete file from disk
Filepos (1319)	Position in file
Filesize (1319)	Size of file
Flush (1324)	Write file buffers to disk
IOresult (1343)	Return result of last file IO operation
Read (1385)	Read from file into variable
Readln (1387)	Read from file into variable and goto next line
Rename (1389)	Rename file on disk
Reset (1390)	Open file for reading
Rewrite (1391)	Open file for writing
Seek (1398)	Set file position
SeekEof (1399)	Set file position to end of file
SeekEoln (1400)	Set file position to end of line
SetTextBuf (1403)	Set size of file buffer
Truncate (1419)	Truncate the file at position
Write (1429)	Write variable to file
WriteLn (1429)	Write variable to file and append newline

37.9 Constants, types and variables

37.9.1 Constants

```
AbstractErrorProc : TAbstractErrorProc = Nil
```

If set, the `AbstractErrorProc` constant is used when an abstract error occurs. If it is not set, then the standard error handling is done: A stack dump is performed, and the program exits with error code 211.

The `SysUtils` unit sets this procedure and raises an exception in its handler.

```
AllFilesMask = '*'
```

`AllFilesMask` is the wildcard that can be used to return all files in a directory. On windows and dos based systems, this will be `'*.*'`, while for unix systems, this will be `'*'.`

```
AllowDirectorySeparators : Set of Char = ['\', '/']
```

`AllowDirectorySeparators` is the set of characters which are considered directory separators by the RTL units. By default, this is set to the most common directory separators: forward slash and backslash, so routines will work in a cross-platform manner, no matter which character was used:

```
AllowDirectorySeparators : set of char = ['\', '/'];
```

If a more strict behaviour is desired, then `AllowDirectorySeparators` can be set to the only character allowed on the current operating system, and all RTL routines that handle filenames (splitting filenames, extracting parts of the filename and so on) will use that character only.

```
AllowDriveSeparators : Set of Char = []
```

`AllowDriveSeparators` are the characters which are considered to separate the drive part from the directory part in a filename. This will be an empty set on systems that do not support drive letters. Other systems (dos, windows and OS/2) will have the colon (:) character as the only member of this set.

```
AssertErrorProc : TAssertErrorProc = @SysAssert
```

If set, the `AbstractErrorProc` constant is used when an assert error occurs. If it is not set, then the standard error handling is done: The assertion error message is printed, together with the location of the assertion, and A stack dump is performed, and the program exits with error code 227.

The `SysUtils` unit sets this procedure and raises an exception in its handler.

```
BackTraceStrFunc : TBackTraceStrFunc = @SysBackTraceStr
```

This handler is called to get a standard format for the backtrace routine.

```
CtrlZMarksEOF : Boolean = False
```

`CtrlZMarksEOF` indicates whether on this system, an CTRL-Z character (ordinal 26) in a file marks the end of the file. This is `False` on most systems apart from DOS and Windows.

To get DOS/Windows-compatible behaviour, this constant can be set to `True`

```
DefaultStackSize = 4 * 1024 * 1024
```

Default size for a new thread's stack (4MiB by default).

```
DefaultTextLineBreakStyle : TTextLineBreakStyle = tlbsLF
```

`DefaultTextLineBreakStyle` contains the default OS setting for the `TTextLineBreakStyle` ([1274](#)) type. It is initialized by the system unit, and is used to determine the default line ending when writing to text files.

This constant is part of a set of constants that describe the OS characteristics. These constants should be used instead of hardcoding OS characteristics.

```
DirectorySeparator = '/'
```

`DirectorySeparator` is the character used by the current operating system to separate directory parts in a pathname. This constant is system dependent, and should not be set.

This constant is part of a set of constants that describe the OS characteristics. These constants should be used instead of hardcoding OS characteristics.

```
DriveSeparator = ''
```

On systems that support driveletters, the `DriveSeparator` constant denotes the character that separates the drive indicator from the directory part in a filename path.

This constant is part of a set of constants that describe the OS characteristics. These constants should be used instead of hardcoding OS characteristics.

`Erroraddr : pointer = Nil`

Address where the last error occurred.

`Errorcode : Word = 0`

Last error code.

`ErrorProc : TErrorProc = Nil`

If set, the `ErrorProc` constant is used when a run-time error occurs. If it is not set, then the standard error handling is done: a stack dump is performed, and the program exits with the indicated error code.

The `SysUtils` unit sets this procedure and raises an exception in its handler.

`ExceptProc : TExceptProc = Nil`

This constant points to the current exception handling procedure. This routine is called when an unhandled exception occurs, i.e. an exception that is not stopped by a `except` block.

If the handler is not set, the RTL will emit a run-time error 217 when an unhandler exception occurs.

It is set by the `sysutils` ([1449](#)) unit.

`ExitProc : pointer = Nil`

Exit procedure pointer.

`ExtensionSeparator = '.'`

`ExtensionSeparator` is the character which separates the filename from the file extension. On all current platforms, this is the `.` (dot) character. All RTL filename handling routines use this constant.

`E_NOINTERFACE = ($80004002)`

Interface call result: Error: not an interface

`E_NOTIMPL = ($80004001)`

Interface call result: Interface not implemented

`E_UNEXPECTED = ($8000FFFF)`

Interface call result: Unexpected error

`Filemode : Byte = 2`

Default file mode for untyped files.

```
FileNameCaseSensitive : Boolean = True
```

FileNameCaseSensitive is True if case is important when using filenames on the current OS. In this case, the OS will treat files with different cased names as different files. Note that this may depend on the filesystem: Unix operating systems that access a DOS or Windows partition will have this constant set to true, but when writing to the DOS partition, the casing is ignored.

This constant is part of a set of constants that describe the OS characteristics. These constants should be used instead of hardcoding OS characteristics.

```
float_flag_denormal = 2
```

IEC/IEEE floating-point exception flag: ?

```
float_flag_divbyzero = 4
```

IEC/IEEE floating-point exception flag: Division by zero error

```
float_flag_inexact = 32
```

IEC/IEEE floating-point exception flag: ?

```
float_flag_invalid = 1
```

IEC/IEEE floating-point exception flag: Invalid operation error

```
float_flag_overflow = 8
```

IEC/IEEE floating-point exception flag: Overflow error

```
float_flag_underflow = 16
```

IEC/IEEE floating-point exception flag: Underflow error

```
float_round_down = 1
```

Round down

```
float_round_nearest_even = 0
```

Round to nearest even number

```
float_round_to_zero = 3
```

Round in the direction of zero (down for positive, up for negative)

```
float_round_up = 2
```

Round up

`fmAppend = $D7B4`

File mode: File is open for writing, appending to the end.

`fmClosed = $D7B0`

File mode: File is closed.

`fmInOut = $D7B3`

File mode: File is open for reading and writing.

`fmInput = $D7B1`

File mode: File is open for reading.

`fmOutput = $D7B2`

File mode: File is open for writing.

`fpc_in_abs_long = 64`

Internal ABS function

`fpc_in_abs_real = 127`

FPC compiler internal procedure index: abs (real)

`fpc_in_addr_x = 42`

FPC compiler internal procedure index: addr

`fpc_in_arctan_real = 130`

FPC compiler internal procedure index: arctan (real)

`fpc_in_assert_x_y = 41`

FPC compiler internal procedure index: assert

`fpc_in_assigned_x = 19`

FPC compiler internal procedure index: assigned

`fpc_in_bitsof_x = 61`

FPC compiler internal procedure index: bitsof

`fpc_in_break = 39`

FPC compiler internal procedure index: break

fpc_in_bsfx = 74

FPC compiler internal procedure index: bsfx

fpc_in_bsr_x = 75

FPC compiler internal procedure index: bsr_x

fpc_in_chr_byte = 7

FPC compiler internal procedure index: chr

fpc_in_concat_x = 18

FPC compiler internal procedure index: concat

fpc_in_const_abs = 101

FPC compiler internal procedure index: abs

fpc_in_const_odd = 102

FPC compiler internal procedure index: sqr

fpc_in_const_ptr = 103

FPC compiler internal procedure index: sqr

fpc_in_const_sqr = 100

FPC compiler internal procedure index: sqr

fpc_in_const_swap_long = 105

FPC compiler internal procedure index: swap (long)

fpc_in_const_swap_qword = 108

FPC compiler internal procedure index: swap (qword)

fpc_in_const_swap_word = 104

FPC compiler internal procedure index: swap (word)

fpc_in_continue = 40

FPC compiler internal procedure index: continue

fpc_in_copy_x = 49

FPC compiler internal procedure index: copy

fpc_in_cos_real = 125

FPC compiler internal procedure index: cos (real)

fpc_in_cycle = 52

FPC compiler internal procedure index: cycle

fpc_in_dec_x = 36

FPC compiler internal procedure index: dec

fpc_in_dispose_x = 47

FPC compiler internal procedure index: dispose

fpc_in_exclude_xy = 38

FPC compiler internal procedure index: exclude

fpc_in_exit = 48

FPC compiler internal procedure index: exit

fpc_in_exp_real = 124

FPC internal compiler routine: in_exp_real

fpc_in_fillchar_x = 55

FPC internal compiler routine: in_fillchar_x

fpc_in_finalize_x = 45

FPC compiler internal procedure index: finalize

fpc_in_frac_real = 122

FPC internal compiler routine: in_frac_real

fpc_in_get_caller_addr = 57

FPC internal compiler routine: in_get_caller_addr

fpc_in_get_caller_frame = 58

FPC internal compiler routine: in_get_caller_frame

fpc_in_get_frame = 56

FPC internal compiler routine: in_get_frame

fpc_in_high_x = 28

FPC compiler internal procedure index: high

fpc_in_hi_long = 4

FPC compiler internal procedure index: hi (long)

fpc_in_hi_qword = 107

FPC compiler internal procedure index: hi (qword)

fpc_in_hi_word = 2

FPC compiler internal procedure index: hi (word)

fpc_in_include_xy = 37

FPC compiler internal procedure index: include

fpc_in_inc_x = 35

FPC compiler internal procedure index: inc

fpc_in_initialize_x = 50

FPC compiler internal procedure index: initialize

fpc_in_int_real = 123

FPC internal compiler routine: in_int_real

fpc_in_leave = 51

FPC compiler internal procedure index: leave

fpc_in_length_string = 6

FPC compiler internal procedure index: length

fpc_in_ln_real = 131

FPC compiler internal procedure index: ln (real)

fpc_in_low_x = 27

FPC compiler internal procedure index: low

fpc_in_lo_long = 3

FPC compiler internal procedure index: lo (long)

fpc_in_lo_qword = 106

FPC compiler internal procedure index: lo (qword)

fpc_in_lo_word = 1

FPC compiler internal procedure index: lo (word)

fpc_in_mmxx_pccmpeqqb = 200

FPC compiler internal procedure index: MMX

fpc_in_mmxx_pccmpeqqd = 202

FPC compiler internal procedure index: MMX

fpc_in_mmxx_pccmpeqqw = 201

FPC compiler internal procedure index: MMX

fpc_in_mmxx_pcmpgtb = 203

FPC compiler internal procedure index: MMX

fpc_in_mmxx_pcmpgtd = 205

FPC compiler internal procedure index: MMX

fpc_in_mmxx_pcmpgtw = 204

FPC compiler internal procedure index: MMX

fpc_in_move_x = 54

FPC internal compiler routine: in_move_x

fpc_in_new_x = 46

FPC compiler internal procedure index: new

fpc_in_ofs_x = 21

FPC compiler internal procedure index: ofs

fpc_in_ord_x = 5

FPC compiler internal procedure index: ord

fpc_in_pack_x_y_z = 59

FPC compiler internal procedure index: pack

fpc_in_pi_real = 126

FPC internal compiler routine: in_pi_real

fpc_in_pred_x = 30

FPC compiler internal procedure index: pred

fpc_in_prefetch_var = 109

FPC compiler internal procedure index: prefetch

fpc_in_readln_x = 17

FPC compiler internal procedure index: readln

fpc_in_readstr_x = 63

Internal read string procedure

fpc_in_read_x = 16

FPC compiler internal procedure index: read

fpc_in_reset_typedfile = 32

FPC compiler internal procedure index: reset

fpc_in_reset_x = 25

FPC compiler internal procedure index: reset

fpc_in_rewrite_typedfile = 33

FPC compiler internal procedure index: rewrite

fpc_in_rewrite_x = 26

FPC compiler internal procedure index: rewrite

fpc_in_rol_x = 67

fpc_in_rol_x_x = 68

fpc_in_ror_x = 65

fpc_in_ror_x_x = 66

fpc_in_round_real = 121

FPC internal compiler routine: in_round_real

fpc_in_sar_x = 73

FPC compiler internal procedure index: sar_x

fpc_in_sar_x_y = 72

FPC compiler internal procedure index: sar_x_y

fpc_in_seg_x = 29

FPC compiler internal procedure index: seg

fpc_in_setlength_x = 44

FPC compiler internal procedure index: setlength

fpc_in_settextbuf_file_x = 34

FPC compiler internal procedure index: settextbuf

fpc_in_sin_real = 132

FPC compiler internal procedure index: sin (real)

fpc_in_sizeof_x = 22

FPC compiler internal procedure index: sizeof

fpc_in_slice = 53

FPC internal compiler routine: in_slice

fpc_in_sqrt_real = 129

FPC compiler internal procedure index: sqrt (real)

fpc_in_sqr_real = 128

FPC compiler internal procedure index: sqr (real)

fpc_in_str_x_string = 20

FPC compiler internal procedure index: str

fpc_in_succ_x = 31

FPC compiler internal procedure index: succ

fpc_in_trunc_real = 120

FPC internal compiler routine: in_trunc_real

fpc_in_typeinfo_x = 43

FPC compiler internal procedure index: typeinfo

fpc_in_typeof_x = 23

FPC compiler internal procedure index: typeof

fpc_in_unpack_x_y_z = 60

FPC compiler internal procedure index: unpack

fpc_in_val_x = 24

FPC compiler internal procedure index: val

fpc_in writeln_x = 15

FPC compiler internal procedure index: writeln

fpc_in writestr_x = 62

Internal write string procedure

fpc_in_write_x = 14

FPC compiler internal procedure index: write

fpc_objc_encode_x = 71

FPC compiler internal procedure index: encode

fpc_objc_protocol_x = 70

FPC compiler internal procedure index: protocol

fpc_objc_selector_x = 69

growheapsizel : PtrUInt = 256 * 1024

Grow rate for block less than 256 Kb.

growheapsize2 : PtrUInt = 1024 * 1024

Grow rate for block larger than 256 Kb.

```
growheapsizesmall : PtrUInt = 32 * 1024
```

Fixed size small blocks grow rate

```
InitProc : Pointer = Nil
```

`InitProc` is a routine that can be called after all units were initialized. It can be set by units to execute code that can be initialized after all units were initialized.

Remark: When setting the value of `InitProc`, the previous value should always be saved, and called when the installed initialization routine has finished executing.

```
IObjectInstance : TGuid = '{D91C9AF4-3C93-420F-A303-BF5BA82BFD23}'
```

`IObjectInstance` is an internal GUID, which should not be used in end-user code. It is used in the `as` operator.

```
IsMultiThread : longbool = False
```

Indicates whether more than one thread is running in the application.

```
LFNSupport = True
```

`LFNSupport` determines whether the current OS supports long file names, i.e. filenames that are not of the form 8.3 as on ancient DOS systems. If the value of this constant is `True` then long filenames are supported. If it is `false`, then not.

This constant is part of a set of constants that describe the OS characteristics. These constants should be used instead of hardcoding OS characteristics.

```
LineEnding = #10
```

`LineEnding` is a constant which contains the current line-ending character. This character is system dependent, and is initialized by the system. It should not be set.

This constant is part of a set of constants that describe the OS characteristics. These constants should be used instead of hardcoding OS characteristics.

```
maxExitCode = 255
```

`maxExitCode` is the maximum value for the [Halt \(1331\)](#) call.

```
maxint = maxsmallint
```

Maximum integer value.

```
MaxKeptOSChunks : DWord = 4
```

`MaxKeptOSChunks` tells the heap manager how many free chunks of OS-allocated memory it should keep in memory. When freeing memory, it can happen that a memory block obtained from the OS is completely free. If more than `MaxKeptOSChunks` such blocks are free, then the heap manager will return them to the OS, to reduce memory requirements.

```
maxLongint = $7fffffff
```

Maximum longint value.

```
MaxPathLen = 4096
```

This constant is system dependent.

```
MaxSIntValue = (ValsInt)
```

Maximum String-size value.

```
maxSmallint = 32767
```

Maximum smallint value.

```
MaxUIntValue = (ValUInt)
```

Maximum unsigned integer value.

```
Max_Frame_Dump : Word = 8
```

Maximum number of frames to show in error frame dump.

```
ModuleIsCpp : Boolean = False
```

ModuleIsCpp is always false for FPC programs, it is provided for Delphi compatibility only.

```
ModuleIsLib : Boolean = False
```

ModuleIsLib is set by the compiler when linking a library, program or package, and determines whether the current module is a library (or package) (True) or program (False).

```
ModuleIsPackage : Boolean = False
```

ModuleIsLib is set by the compiler when linking a library, program or package, and determines whether the current module is a package (True) or a library or program (False).

```
PathSeparator = ':'
```

PathSeparator is the character used commonly on the current operating system to separate paths in a list of paths, such as the PATH environment variable.

This constant is part of a set of constants that describe the OS characteristics. These constants should be used instead of hardcoding OS characteristics.

```
RaiseMaxFrameCount : LongInt = 16
```

Maximum number of frames to include in TExceptObject ([1268](#))

```
RaiseProc : TExceptProc = Nil
```

Procedure to raise an exception.

RT_ACCELERATOR = (9)

Constant identifying an accelerator resource

RT_ANICURSOR = (21)

This constant can be used to specify a resource of type "animated cursor".

RT_ANICON = (22)

This constant can be used to specify a resource of type "animated icon".

RT_BITMAP = (2)

Constant identifying a bitmap resource

RT_CURSOR = (1)

Constant identifying a cursor resource

RT_DIALOG = (5)

Constant identifying a dialog resource

RT_FONT = (8)

Constant identifying a font resource

RT_FONTPDIR = (7)

Constant identifying a font directory resource

RT_GROUP_CURSOR = (12)

Constant identifying a group cursor resource

RT_GROUP_ICON = (14)

Constant identifying a group icon resource

RT_HTML = (23)

This constant can be used to specify a resource of type "HTML data".

RT_ICON = (3)

Constant identifying an icon resource

RT_MANIFEST = (24)

This constant can be used to specify a resource of type "Manifest".

RT_MENU = (4)

Constant identifying a menu resource

RT_MESSAGETABLE = (11)

Constant identifying a message data resource

RT_RCDATA = (10)

Constant identifying a binary data resource

RT_STRING = (6)

Constant identifying a string table resource

RT_VERSION = (16)

Constant identifying a version info resource

RuntimeErrorExitCodes : Array[TRuntimeError] of Byte = (0, 203, 204, 200, 201, 215, ...)

This array is used by the Error ([1316](#)) routine to convert a TRuntimeError ([1272](#)) enumeration type to a process exit code.

SafeCallErrorProc : TSafeCallErrorProc = Nil

SafeCallErrorProc is a Handler called in case of a safecall calling convention error. Error is the error number (passed by the Windows operating system) and Addr is the address where the error occurred.

sLineBreak = LineEnding

sLineBreak is an alias for LineEnding ([1245](#)) and is supplied for Delphi compatibility.

This constant is part of a set of constants that describe the OS characteristics. These constants should be used instead of hardcoding OS characteristics.

StackError : Boolean = False

Indicate whether there was a stack error.

StdErrorHandle = 2

Value of the OS handle for the standard error-output file.

StdInputHandle = 0

Value of the OS handle for the standard input file.

StdOutputHandle = 1

Value of the OS handle for the standard output file.

S_FALSE = 1

Interface call result: Not OK

S_OK = 0

Interface call result: OK

ThreadingAlreadyUsed : Boolean = False

Internal constant for the threading system. Don't use.

UnixGetModuleByAddrHook : procedure(addr: pointer; var baseaddr: pointer; var filename: string);

UnixGetModuleByAddrHook is used on unix systems to retrieve a module name based on an address. It is used in the exeinfo ([573](#)) unit to map addresses to module (programs or library) names.

UnusedHandle = -1

Value indicating an unused file handle (as reported by the OS).

VarAddRefProc : procedure(var v: tvardata) = Nil

Callback to increase reference count of a variant.

varany = \$101

Variant type: Any

vararray = \$2000

Variant type: variant Array

varboolean = 11

Variant type: Boolean type

varbyref = \$4000

Variant type: By reference

varbyte = 17

Variant type: Byte (8 bit)

VarClearProc : procedure(var v: tvardata) = Nil

Callback to clear a variant.

VarCopyProc : procedure(var d: tvardata;const s: tvardata) = Nil

Callback to copy a variant

varcurrency = 6

Variant type: Currency

vardate = 7

Variant type: Date

vardecimal = 14

Variant type: Decimal (BCD)

vardispatch = 9

Variant type: dispatch interface

vardouble = 5

Variant type: Double float

varempty = 0

Variant type: Empty variant

varerror = 10

Variant type: Error type

varint64 = 20

Variant type: Integer (64-Bit)

varinteger = 3

Variant type: Integer (32-bit)

varlongword = 19

Variant type: Word (32 bit)

varnull = 1

Variant type: Null ([1352](#)) variant

varolestr = 8

Variant type: OLE string (widestring)

varqword = 21

Variant type: Word (64-bit)

varrecord = 36

Record variant type

varshortint = 16

Variant type: Shortint (16 bit)

varsingle = 4

Variant type: Single float

varsmallint = 2

Variant type: smallint (8 bit)

varstrarg = \$48

Variant type: String

varstring = \$100

Variant type: String

VarToLStrProc : procedure(var d: AnsiString;const s: tvardata) = Nil

Callback to convert a variant to a ansistring.

VarToWStrProc : procedure(var d: WideString;const s: tvardata) = Nil

Callback to convert a variant to a widestring.

vartypemask = \$fff

Variant type: Mask to extract type

varuint64 = varqword

varuint64 denotes an unsigned 64-bit value in a variant. It is one of the values found in the VType field of the variant record tvardata ([1277](#)).

varunknown = 13

Variant type: Unknown

varustrarg = \$49

`varustrarg` denotes a unicode string argument in `DispInvoke` call. It will be converted to `varustring` in a variant.

`varustring = $102`

`varustring` denotes a unicode string value in a variant. It is one of the values found in the `VType` field of the variant record `tvardata` ([1277](#)).

`varvariant = 12`

Variant type: Variant (arrays only)

`varword = 18`

Variant type: Word (16 bit)

`varword64 = varqword`

Variant type: Word (64-bit)

`vmtAfterConstruction = vmtMethodStart + ((pointer) * 5)`

VMT Layout: ?

`vmtAutoTable = vmtParent + ((pointer) * 7)`

VMT layout: ?

`vmtBeforeDestruction = vmtMethodStart + ((pointer) * 6)`

VMT Layout: ?

`vmtClassName = vmtParent + (pointer)`

VMT Layout: location of class name.

`vmtDefaultHandler = vmtMethodStart + ((pointer) * 4)`

VMT Layout: ?

`vmtDefaultHandlerStr = vmtMethodStart + ((pointer) * 7)`

VMT Layout: ?

`vmtDestroy = vmtMethodStart`

VMT Layout: Location of destructor pointer.

`vmtDispatch = vmtMethodStart + ((pointer) * 8)`

vmtDispatch is the offset from the VMT start, in bytes to the dispatch table for a class. The dispatch table is used when dispatching messages in TObject.Dispatch (1)

```
vmtDispatchStr = vmtMethodStart + ((pointer) * 9)
```

vmtDispatchStr is the offset from the VMT start, in bytes to the dispatch table for a class. The dispatch table is used when dispatching messages in TObject.DispatchStr (1)

```
vmtDynamicTable = vmtParent + ((pointer) * 2)
```

VMT Layout: location of dynamic methods table.

```
vmtEquals = vmtMethodStart + ((pointer) * 10)
```

vmtEquals contains the offset from the VMT start, of the location of the TObject.Equals (1) method pointer.

```
vmtFieldTable = vmtParent + ((pointer) * 4)
```

VMT Layout: Location of fields table.

```
vmtFreeInstance = vmtMethodStart + ((pointer) * 2)
```

VMT Layout: location of FreeInstance method.

```
vmtGetHashCode = vmtMethodStart + ((pointer) * 11)
```

vmtGetHashCode contains the offset from the VMT start, of the location of the TObject.GetHashCode (1) method pointer.

```
vmtInitTable = vmtParent + ((pointer) * 6)
```

VMT Layout: ?

```
vmtInstanceSize = 0
```

VMT Layout: Location of class instance size in VMT

```
vmtIntfTable = vmtParent + ((pointer) * 8)
```

VMT layout: Interface table

```
vmtMethodStart = vmtParent + ((pointer) * 10)
```

VMT layout: start of method table.

```
vmtMethodTable = vmtParent + ((pointer) * 3)
```

VMT Layout: Method table start.

```
vmtMsgStrPtr = vmtParent + ((pointer) * 9)
```

VMT layout: message strings table.

```
vmtNewInstance = vmtMethodStart + (pointer)
```

VMT Layout: location of NewInstance method.

```
vmtParent = (ptruint) * 2
```

VMT Layout: location of pointer to parent VMT.

```
vmtSafeCallException = vmtMethodStart + ((pointer) * 3)
```

VMT Layout: ?

```
vmtToString = vmtMethodStart + ((pointer) * 12)
```

vmtToString contains the offset from the VMT start, of the location of the TObject.ToString ([1](#)) method pointer.

```
vmtTypeInfo = vmtParent + ((pointer) * 5)
```

VMT Layout: Location of class type information.

```
vtAnsiString = 11
```

TVarRec type: Ansistring

```
vtBoolean = 1
```

TVarRec type: Boolean

```
vtChar = 2
```

TVarRec type: Char

```
vtClass = 8
```

TVarRec type: Class type

```
vtCurrency = 12
```

TVarRec type: Currency

```
vtExtended = 3
```

TVarRec type: Extended

```
vtInt64 = 16
```

TVarRec type: Int64 (signed 64-bit integer)

vtInteger = 0

TVarRec type: Integer

vtInterface = 14

TVarRec type: Interface

vtObject = 7

TVarRec type: Object instance

vtPChar = 6

TVarRec type: PChar

vtPointer = 5

TVarRec type: pointer

vtPWideChar = 10

TVarRec type: PWideChar

vtQWord = 17

TVarRec type: QWord (unsigned 64-bit integer)

vtString = 4

TVarRec type: String

vtUnicodeString = 18

vtUnicodeString denotes a unicode string argument in the array of const. The TVarRec.VUnicodeString field will contain the actual value.

vtVariant = 13

TVarRec type: Variant

vtWideChar = 9

TVarRec type: Widechar

vtWideString = 15

TVarRec type: WideString

37.9.2 Types

AnsiChar = Char

Alias for 1-byte sized char.

Cardinal = LongWord

An unsigned 32-bits integer.

DWord = LongWord

An unsigned 32-bits integer

```
EnumResLangProc = function(ModuleHandle: TFPResourceHMODULE;
                           ResourceType: PChar; ResourceName: PChar;
                           IDLanguage: Word; lParam: PtrInt) : LongBool
```

EnumResNameProcs used in the EnumResourceLanguages ([1313](#)) call. It is called for all languages for a resource of the specified type and name, and is passed the ModuleHandle, ResourceName, ResourceName and IDLanguage values for each language encountered for the specified resource. Additionally, the lParam parameter from the EnumResourceLanguages is passed unaltered.

```
EnumResNameProc = function(ModuleHandle: TFPResourceHMODULE;
                           ResourceType: PChar; ResourceName: PChar;
                           lParam: PtrInt) : LongBool
```

EnumResNameProcs used in the EnumResourceNames ([1313](#)) call. It is called for all resources of the specified type, and is passed the ModuleHandle, ResourceType, ResourceName values for each resource encountered. Additionally, the lParam parameter from the EnumResourceNames is passed unaltered.

```
EnumResTypeProc = function(ModuleHandle: TFPResourceHMODULE;
                           ResourceType: PChar; lParam: PtrInt)
                           : LongBool
```

EnumResTypeProc is used in the EnumResourceTypes ([1313](#)) call. It is called for all resources, and is passed the ModuleHandle, ResourceType values for each resource encountered. Additionally, the lParam parameter from the EnumResourceTypes is passed unaltered.

HGLOBAL = PtrUInt

This is an opaque type.

HMODULE = PtrUInt

This is an opaque type.

HRESULT = LongInt

32-Bit signed integer.

```
IInterface = IUnknown
```

`IInterface` is the basic interface from which all COM style interfaces descend.

```
Int16 = SmallInt
```

```
Int32 = LongInt
```

```
Int8 = ShortInt
```

```
Integer = SmallInt
```

The system unit defines `Integer` as a signed 16-bit integer. But when `DELPHI` or `OBJFPC` mode are active, then the `objpas` unit redefines `Integer` as a 32-bit integer.

```
IntegerArray = Array[0..$ffff] of Integer
```

Generic array of integer.

```
IntPtr = PtrInt
```

```
jmp_buf = packed record
  ebx : LongInt;
  esi : LongInt;
  edi : LongInt;
  bp : Pointer;
  sp : Pointer;
  pc : Pointer;
end
```

Record type to store processor information.

```
MAKEINTRESOURCE = PChar
```

Alias for the `PChar` ([1258](#)) type.

```
NativeInt = PtrInt
```

`NativeInt` is defined for Delphi compatibility. It is a signed integer with the size of a pointer, so 32-bit on 32-bit platforms, 64-bit on 64-bit platforms.

```
NativeUInt = PtrUInt
```

`NativeInt` is defined for Delphi compatibility. It is an unsigned integer with the size of a pointer, so 32-bit on 32-bit platforms, 64-bit on 64-bit platforms.

```
PAnsiChar = PChar
```

Alias for PChar ([1258](#)) type.

```
PAnsiString = ^AnsiString
```

Pointer to an ansistring type.

```
PBoolean = ^Boolean
```

Pointer to a Boolean type.

```
PByte = ^Byte
```

Pointer to byte ([1](#)) type

```
pcalldesc = ^tcalldesc
```

Pointer to TCallDesc ([1266](#)) record.

```
PCardinal = ^Cardinal
```

Pointer to Cardinal ([1256](#)) type

```
PChar = ^Char
```

Or the same as a pointer to an array of char. See the reference manual for more information about this type.

```
PClass = ^TClass
```

Pointer to TClass ([1266](#))

```
PComp = ^Comp
```

PComp is a pointer to a complex type.

```
PCurrency = ^Currency
```

Pointer to currency type.

```
PDate = ^TDateTime
```

Pointer to a TDateTime ([1266](#)) type.

```
PDateTime = ^TDateTime
```

Pointer to TDatetime

```
PDispatch = ^IDispatch
```

Pointer to IDispatch ([1431](#)) interface type

`pdispdesc = ^tdispdesc`

Pointer to tdispdesc ([1267](#)) record

`PDouble = ^Double`

Pointer to double-sized float value.

`PDWord = ^DWord`

Pointer to DWord ([1256](#)) type

`pdynarrayindex = ^tdynarrayindex`

Pointer to tdynarrayindex ([1267](#)) type.

`pdynarraytypeinfo = ^tdynarraytypeinfo`

Pointer to TDynArrayTypeInfo ([1267](#)) type.

`PError = ^TError`

Pointer to an Error ([1316](#)) type.

`PEventState = pointer`

Pointer to EventState, which is an opaque type.

`PExceptObject = ^TExceptObject`

Pointer to Exception handler procedural type TExceptProc ([1268](#))

`PExtended = ^Extended`

Pointer to extended-sized float value.

`PGuid = ^TGuid`

Pointer to TGUID ([1268](#)) type.

`PInt64 = ^Int64`

Pointer to Int 64 type

`PInteger = ^Integer`

Pointer to integer ([1257](#)) type

`PIntegerArray = ^IntegerArray`

Pointer to IntegerArray ([1257](#)) type

PInterface = PUnknown

Pointer to IInterface (1257) interface

pinterfaceentry = ^tinterfaceentry

Pointer to tinterfaceentry (1269) record.

pinterfacetable = ^tinterfacetable

Pointer to tinterfacetable (1270) record.

PJmp_buf = ^jmp_buf

Pointer to jmp_buf (1257) record

PLongBool = ^LongBool

Pointer to a LongBool type.

PLongint = ^LongInt

Pointer to Longint (1) type

PLongWord = ^LongWord

Pointer to LongWord type

PMemoryManager = ^TMemoryManager

Pointer to TMemoryManager (1270) record

PMsgStrTable = ^TMsgStrTable

Pointer to array of TMsgStrTable (1270) records.

PointerArray = Array[0..512*1024*1024-2] of Pointer

Generic pointer array.

POleVariant = ^OleVariant

Pointer to OleVariant type.

PPAnsiChar = PPChar

Alias for PPChar (1261) type.

PPByte = ^PByte

PPByte is a pointer to a PByte (1258) type.

PPChar = ^PChar

Pointer to an array of pointers to null-terminated strings.

PPCharArray = ^TPCharArray

Pointer to TPCharArray ([1270](#)) type.

PPDispatch = ^PDispatch

Pointer to PDispatch ([1258](#)) pointer type

PPDouble = ^PDouble

PPDouble is a pointer to a PDouble ([1259](#)) type.

PPLongint = ^PLongint

PPLongint is a pointer to a PLongint ([1260](#)) type.

PPointer = ^Pointer

Pointer to a pointer type.

PPointerArray = ^PointerArray

Pointer to PointerArray ([1260](#)) type

PPPChar = ^PPChar

PPPChar is a pointer to a PPChar ([1261](#))

PPPointer = ^PPointer

Pointer to a PPPointer ([1261](#)) type.

PPWideChar = ^PPWideChar

PPWideChar is a pointer to a PPWideChar ([1262](#)) type.

PPtrInt = ^PtrInt

Pointer to PtrInt ([1262](#)) type.

PPtrUInt = ^PtrUInt

Pointer to unsigned integer of pointer size

PPUnknown = ^PUnknown

Pointer to untyped pointer

PPWideChar = ^PWideChar

Pointer to link id="PWideChar"> type.

PQWord = ^QWord

Pointer to QWord type

PRTLCriticalSection = ^TRTLCriticalSection

Pointer to #rtl.system.TRRTLCriticalSection ([1271](#)) type.

PRTLEvent = pointer

Pointer to RTLEvent, which is an opaque type.

PShortInt = ^ShortInt

Pointer to shortint ([1](#)) type

PShortString = ^ShortString

Pointer to a shortstring type.

PSingle = ^Single

Pointer to single-sized float value.

PSizeInt = ^SizeInt

Pointer to a SizeInt ([1265](#)) type

PSmallInt = ^SmallInt

Pointer to smallint ([1](#)) type

pstringmessagetable = ^TStringMessageTable

Pointer to TStringMessageTable ([1274](#)) record.

PText = ^Text

Pointer to text file.

PtrInt = LongInt

Ptrint is a signed integer type which has always the same size as a pointer. Ptrint is considered harmful and should almost never be used in actual code, because pointers are normally unsigned. For example, consider the following code:

```
getmem(p,2048);           {Assume the address of p becomes $7fffffff0.}
q:=pointer(ptrint(p)+1024)); {Overflow error.}
writeln(q>p);            {Incorrect answer.}
```

Pprint might have a valid use when two pointers are subtracted from each other if it is unknown which pointer has the largest address. However, even in this case pprint causes trouble in case the distance is larger than high(pprint) and must be used with great care.

The introduction of the `pprint` type was a mistake. Please use `ptruint` (1263) instead.

`PtrUInt = DWord`

`PtrUInt` is an unsigned integer type which has always the same size as a pointer. When using integers which will be cast to pointers and vice versa, use this type, never the regular `Cardinal` type.

`PUCS2Char = PWideChar`

Pointer to UCS2Char (1280) character.

`PUCS4Char = ^UCS4Char`

Pointer to UCS4Char (1280)

`PUCS4CharArray = ^TUCS4CharArray`

Pointer to array of UCS4Char (1280) characters.

`PUnicodeChar = ^UnicodeChar`

`PUnicodeChar` is a pointer to a unicode character, just like `PChar` is a pointer to a `Char` an-
sistring character.

`PUnicodeString = ^UnicodeString`

`PUnicodeString` is a pointer to a `UnicodeString` string.

`PUnknown = ^IUnknown`

Untyped pointer

`PUTF8String = ^UTF8String`

Pointer to UTF8String (1281)

`pvararray = ^tvararray`

Pointer to TVarArray (1277) type.

`pvararraybound = ^tvararraybound`

Pointer to tvararraybound (1277) type.

pvararrayboundarray = ^tvararrayboundarray

Pointer to tvararrayboundarray ([1277](#)) type.

pvararraycoorarray = ^tvararraycoorarray

Pointer to tvararraycoorarray ([1277](#)) type.

pvardata = ^tvardata

Pointer to TVarData ([1277](#)) record.

PVariant = ^Variant

Pointer to Variant type.

pvariantmanager = ^tvariantmanager

Pointer to TVariantManager ([1278](#)) record.

PVarRec = ^TVarRec

Pointer to TVarRec ([1279](#)) type.

PVmt = ^TVmt

Pointer to TVMT ([1280](#)) record

PWideChar = ^WideChar

Pointer to WChar ([1281](#)).

PWideString = ^WideString

Pointer to widestring type

PWord = ^Word

Pointer to word ([1](#)) type

PWordBool = ^WordBool

Pointer to a WordBool type.

Real = Double

Alias for real type

real48 = Array[0..5] of Byte

TP compatible real type (6 bytes) definition

SizeInt = LongInt

Signed integer type which fits for sizes

SizeUInt = DWord

Unsigned Integer type which fits for sizes

TAbstractErrorProc = procedure

Abstract error handler procedural type.

TAllocateThreadVarsHandler = procedure

Threadvar allocation callback type for TThreadManager ([1275](#)).

TAnsiChar = Char

Alias for 1-byte sized char.

```
TAssertErrorProc = procedure(const msg: ShortString;
                               const fname: ShortString; lineno: LongInt;
                               erroraddr: pointer)
```

Assert error handler procedural type.

TBackTraceStrFunc = function(Addr: Pointer) : ShortString

Type for formatting of backtrace dump.

```
TBasicEventCreateHandler = function(EventAttributes: Pointer;
                                    AManualReset: Boolean;
                                    InitialState: Boolean;
                                    const Name: ansistring)
                                    : PEventState
```

callback type for creating eventstate in TThreadManager ([1275](#)).

TBasicEventHandler = procedure(state: PEventState)

Generic callback type for handling eventstate in TThreadManager ([1275](#)).

```
TBasicEventWaitForHandler = function(timeout: Cardinal;
                                       state: PEventState) : LongInt
```

Wait for basic event callback type for TThreadManager ([1275](#)).

```
TBeginThreadHandler = function(sa: Pointer; stacksize: PtrUInt;
                                ThreadFunction: TThreadFunc; p: pointer;
                                creationFlags: DWord;
                                var ThreadId: TThreadID) : TThreadID
```

Callback for thread start in TThreadManager (1275).

```
TBoundArray = Array of SizeInt
```

Dynamic array of integer.

```
tcalldesc = packed record
  calltype : Byte;
  argcount : Byte;
  namedargcount : Byte;
  argtypes : Array[0..255] of Byte;
end
```

`tcalldesc` is used to encode the arguments to a dispatch call to an OLE dual interface. It is used on windows only. It describes the arguments to a call.

```
TClass = Class of TObject
```

Class of TObject (1438).

```
TCriticalSectionHandler = procedure(var cs)
```

Generic callback type for critical section handling in TThreadManager (1275).

```
TCriticalSectionHandlerTryEnter = function(var cs) : LongInt
```

`TCriticalSectionHandlerTryEnter` is the function prototype for the TryEnterCriticalSection (1420) function, in the TThreadManager (1275) record's TryEnterCriticalSection field.

```
TCtrlBreakHandler = function(CtrlBreak: Boolean) : Boolean
```

`TCtrlBreakHandler` is the prototype for the CTRL-C handler. If `CtrlBreak` is True then Ctrl-Break was hit, otherwise CTRL-C was hit. The handlers should return True to signal that the key-combination was handled. If False is returned, then default handling will be used, which by default means an exception will be raised if the sysutils unit is used.

```
TDate = TDateTime
```

`TDate` is defined for Delphi compatibility. This type is deprecated, use `TDateTime` (1266) instead.

```
TDateTime = Double
```

Encoded Date-Time type.

```
tdispdesc = packed record
  dispid : LongInt;
  restype : Byte;
  calldesc : tcalldesc;
end
```

`tcalldesc` is used to encode a dispatch call to an OLE dispatch interface. It is used on windows only. It describes the dispath call call.

```
tdynarrayindex = SizeInt
```

A variable of type `tdynarrayindex` will always have the correct size, suitable for serving as an index in a dynamic array.

```
tdynarraytypeinfo = packed record
  kind : Byte;
  nameolen : Byte;
  elesize : SizeInt;
  eletype : pdynarraytypeinfo;
  vartype : LongInt;
end
```

`tdynarraytypeinfo` describes the structure of a multi-dimensional dynamical array. It is used in the `DynArraySetLength` ([1311](#)) call.

```
TEndThreadHandler = procedure(ExitCode: DWord)
```

Callback for thread end in `TThreadManager` ([1275](#)).

```
TEntryInformation = record
  InitFinalTable : Pointer;
  ThreadvarTablesTable : Pointer;
  asm_exit : procedure;
  PascalMain : procedure;
  valgrind_used : Boolean;
end
```

`TEntryInformation` is used to initialize a Free Pascal program or library. Under normal circumstances, there should be no need to use this structure directly: it is used by the system unit and special linking units.

```
TError = LongInt
```

Error type, used in variants.

```
TErrorProc = procedure(ErrNo: LongInt;Address: Pointer;Frame: Pointer)
```

Standard error handler procedural type.

```
TExceptObject = record
  FObject : TObject;
  Addr : pointer;
  Next : PExceptObject;
  refcount : LongInt;
  Framecount : LongInt;
  Frames : PPointer;
end
```

TExceptObject is the exception description record which is found on the exception stack.

```
TExceptProc = procedure(Obj: TObject; Addr: Pointer; FrameCount: LongInt;
Frame: PPointer)
```

Exception handler procedural type

```
TextFile = Text
```

Alias for Text file type.

```
TFPCHeapStatus = record
  MaxHeapSize : PtrUInt;
  MaxHeapUsed : PtrUInt;
  CurrHeapSize : PtrUInt;
  CurrHeapUsed : PtrUInt;
  CurrHeapFree : PtrUInt;
end
```

TFPCHeapStatus describes the state of the FPC heap manager. This is not equivalent to the THeapsStatus ([1269](#)) record defined by Delphi, which contains information not meaningful for the FPC heap manager. The heap status can be retrieved by the GetFPCHeapStatus ([1327](#)) call.

```
TFPResourceHandle = PtrUInt
```

TFPResourceHandle represents a handle to a binary resource and is used in the various resource calls. Its actual type and size may differ accross platforms.

```
TFPResourceHGLOBAL = PtrUInt
```

TFPResourceHGLOBAL represents a handle to the global module containing a resource. It is used in the various resource calls. It is an opaque type: its actual type and size may differ accross platforms.

```
TFPResourceHMODULE = PtrUInt
```

TFPResourceHMODULE represents a module (library, executable, other) in which a resource is located. It is used in the various resource calls. It is an opaque type: its actual type and size may differ accross platforms.

```
TGetCurrentThreadIdHandler = function : TThreadID
```

Callback type for retrieving thread ID in TThreadManager ([1275](#)).

```
TGuid = packed record
end
```

Standard GUID representation type.

```
THandle = LongInt
```

This type should be considered opaque. It is used to describe file and other handles.

```
THeapStatus = record
  TotalAddrSpace : Cardinal;
  TotalUncommitted : Cardinal;
  TotalCommitted : Cardinal;
  TotalAllocated : Cardinal;
  TotalFree : Cardinal;
  FreeSmall : Cardinal;
  FreeBig : Cardinal;
  Unused : Cardinal;
  Overhead : Cardinal;
  HeapErrorCode : Cardinal;
end
```

`THeapStatus` is the record describing the current heap status. It is returned by the `GetHeapStatus` ([1327](#)) call.

```
TInitThreadVarHandler = procedure(var offset: DWord; size: DWord)
```

Threadvar initialization callback type for `TThreadManager` ([1275](#)).

```
TInterfacedClass = Class of TInterfacedObject
```

`TInterfacedClass` is a descendent of

```
tinterfaceentry = record
  IID : PGuid;
  VTable : Pointer;
  IOffset : PtrUInt;
  IIDStr : PShortString;
end
```

`tinterfaceentry` is used to store the list of Interfaces of a class. This list is stored as an array of `tinterfaceentry` records.

```
tinterfaceentrytype = (etStandard, etVirtualMethodResult,
                      etStaticMethodResult, etFieldValue,
                      etVirtualMethodClass, etStaticMethodClass,
                      etFieldValueClass)
```

Table 37.7: Enumeration values for type `tinterfaceentrytype`

Value	Explanation
etFieldValue	Field value
etFieldValueClass	Interface provided by a class field
etStandard	Standard entry
etStaticMethodClass	Interface provided by a static class method
etStaticMethodResult	Statis method
etVirtualMethodClass	Interface provided by a virtual class method
etVirtualMethodResult	Virtual method

This is an internal type for the compiler to encode calls to dispatch interfaces.

```
tinterfacetable = record
  EntryCount : PtrUInt;
  Entries : Array[0..0] of tinterfaceentry;
end
```

Record to store list of interfaces of a class.

```
TMemoryManager = record
  NeedLock : Boolean;
  Getmem : function(Size: PtrUInt) : Pointer;
  Freemem : function(p: pointer) : PtrUInt;
  FreememSize : function(p: pointer;Size: PtrUInt) : PtrUInt;
  AllocMem : function(Size: PtrUInt) : Pointer;
  ReAllocMem : function(var p: pointer;Size: PtrUInt) : Pointer;
  MemSize : function(p: pointer) : PtrUInt;
  InitThread : procedure;
  DoneThread : procedure;
  RelocateHeap : procedure;
  GetHeapStatus : function : THeapStatus;
  GetFPCHeapStatus : function : TFPCHeapStatus;
end
```

TMemoryManager describes the memory manager. For more information about the memory manager, see the programmer's reference.

```
TMethod = record
  Code : Pointer;
  Data : Pointer;
end
```

TMethod describes a general method pointer, and is used in Run-Time Type Information handling.

```
TMsgStrTable = record
  name : PShortString;
  method : pointer;
end
```

Record used in string message handler table.

```
TPCharArray = packed Array[0..(MaxLongintdivSizeOf(PChar))-1] of PChar
```

Array of PChar

```
TProcedure = procedure
```

Simple procedural type.

```
TReleaseThreadVarsHandler = procedure
```

Threadvar release callback type for TThreadManager ([1275](#)).

```
TRelocateThreadVarHandler = function(offset: DWord) : pointer
```

Threadvar relocalization callback type for TThreadManager ([1275](#)).

```
TResourceHandle = PtrUInt
```

This is an opaque type.

```
TResourceManager = record
  HINSTANCEFunc : function : TFPResourceHMODULE;
  EnumResourceTypesFunc : function(ModuleHandle: TFPResourceHMODULE;EnumFunc: EnumRe
    lParam: PtrInt) : LongBool;
  EnumResourceNamesFunc : function(ModuleHandle: TFPResourceHMODULE;ResourceType: PC
    EnumFunc: EnumResNameProc;lParam: PtrInt) : LongBool;
  EnumResourceLanguagesFunc : function(ModuleHandle: TFPResourceHMODULE;ResourceType
    ResourceName: PChar;EnumFunc: EnumResLangProc;lParam: PtrInt)
    : LongBool;
  FindResourceFunc : function(ModuleHandle: TFPResourceHMODULE;ResourceName: PChar;
    ResourceType: PChar) : TFPResourceHandle;
  FindResourceExFunc : function(ModuleHandle: TFPResourceHMODULE;ResourceType: PChar
    resourceName: PChar;Language: Word) : TFPResourceHandle;
  LoadResourceFunc : function(ModuleHandle: TFPResourceHMODULE;ResHandle: TFPResourc
    : TFPResourceHGLOBAL;
  SizeofResourceFunc : function(ModuleHandle: TFPResourceHMODULE;ResHandle: TFPResou
    : LongWord;
  LockResourceFunc : function(ResData: TFPResourceHGLOBAL) : Pointer;
  UnlockResourceFunc : function(ResData: TFPResourceHGLOBAL) : LongBool;
  FreeResourceFunc : function(ResData: TFPResourceHGLOBAL) : LongBool;
end
```

TResourceManager is the record describing the resource manager. Depending on the kind of resources (internal, external), another resource managing handler is installed by the system. The resource manager record is used by all resource handling functions to do the actual work: for each function in the API, a handler function is available. People wishing to implement their own resource manager, must implement all handler functions in their implementation.

As soon as resources are used, the compiler will install a resource manager, depending on the platform, this may be an internal or an external resource manager.

```
TRTLCREATEEventHandler = function : PRTLEvent
```

Callback type for creating a TRTLEvent type in TThreadManager ([1275](#)).

```
TRTLCriticalSection = Opaque type
```

TRTLCriticalSection represents a critical section (a mutex). This is an opaque type, it can differ from operating system to operating system. No assumptions should be made about its structure or contents.

```
TRTLEventHandler = procedure (AEvent: PRTLEvent)
```

Generic TRTLEvent handling type for TThreadManager ([1275](#)).

```
TRTLEventHandlerTimeout = procedure (AEvent: PRTLEvent; timeout: LongInt)
```

TRTLEvent timeout handling type for TThreadManager ([1275](#)).

```
TRTLEventSyncHandler = procedure (m: trtlmethod; p: TProcedure)
```

Callback type for event synchronization in TThreadManager ([1275](#)).

```
trtlmethod = procedure of object
```

Callback type for synchronization event.

```
TRuntimeError = (reNone, reOutOfMemory, reInvalidPtr, reDivByZero,
                 reRangeError, reIntOverflow, reInvalidOp, reZeroDivide,
                 reOverflow, reUnderflow, reInvalidCast, reAccessViolation,
                 rePrivInstruction, reControlBreak, reStackOverflow,
                 reVarTypeCast, reVarInvalidOp, reVarDispatch,
                 reVarArrayCreate, reVarNotArray, reVarArrayBounds,
                 reAssertionFailed, reExternalException, reIntfCastError,
                 reSafeCallError, reQuit, reCodesetConversion)
```

Table 37.8: Enumeration values for type TRuntimeError

Value	Explanation
reAccessViolation	Access Violation
reAssertionFailed	Assertion failed error
reCodeSetConversion	Code set conversion error
reControlBreak	User pressed CTRL-C
reDivByZero	Division by zero error
reExternalException	An external exception occurred
reIntfCastError	Interface typecast error
reIntOverflow	Integer overflow error
reInvalidCast	Invalid (class) typecast error
reInvalidOp	Invalid operation error
reInvalidPtr	Invalid pointer error
reNone	No error
reOutOfMemory	Out of memory error
reOverflow	Overflow error
rePrivInstruction	Privileged instruction error
reQuit	Quit signal error
reRangeError	Range check error
reSafeCallError	Safecall (IDispatchInterface) error
reStackOverflow	Stack overflow error
reUnderflow	Underflow error
reVarArrayBounds	Variant array bounds error
reVarArrayCreate	Variant array creation error
reVarDispatch	Variant Dispatch error.
reVarInvalidOp	Invalid variant operation error
reVarNotArray	Variant is not an array error.
reVarTypeCast	Invalid typecase from variant
reZeroDivide	Division by zero error

TRuntimeError is used in the Error (1316) procedure to indicate what kind of error should be reported.

```
TSafeCallErrorHandler = procedure(error: HRESULT; addr: pointer)
```

Prototype of a safecall error handler routine. Error is the error number (passed by the Windows operating system) and Addr is the address where the error occurred.

```
TSemaphoreDestroyHandler = procedure(const sem: Pointer)
```

TSemaphoreDestroyHandler is the function prototype to destroy an existing semaphore, as returned by (ThreadManager.SemaphoreInit). It is used by the thread manager (ThreadManager.SemaphoreDest-

```
TSemaphorePostHandler = procedure(const sem: Pointer)
```

TSemaphorePostHandler is the function prototype to post an event to the semaphore. It should handle a pointer as returned by the ThreadManager.SemaphoreInit procedure. it's used by the thread manager ThreadManager.SemaphorePost.

```
TSemaphoreWaitHandler = procedure(const sem: Pointer)
```

`TSemaphoreWaitHandler` is the function prototype to wait on an event on the semaphore (which should be posted to the semaphore with `ThreadManager.SemaphorePost`). It should handle a pointer as returned by the `ThreadManager.SemaphoreInit` procedure. It's used by the thread manager `ThreadManager.SemaphoreWait`.

```
TSempahoreInitHandler = function : Pointer
```

`TSempahoreInitHandler` is the function prototype for initializing a semaphore. It is used by the thread manager (`ThreadManager.SemaphoreInit`) to create semaphores. The function should return a pointer, usable by the other semaphore functions of the thread manager.

```
TStringMessageTable = record
  count : LongInt;
  msgstrtable : Array[0..0] of TMsgStrTable;
end
```

Record used to describe the string messages handled by a class. It consists of a count, followed by an array of `TMsgStrTable` (1270) records.

```
TTextLineBreakStyle = (tlbsLF, tlbsCRLF, tlbsCR)
```

Table 37.9: Enumeration values for type `TTextLineBreakStyle`

Value	Explanation
tlbsCR	Carriage-return (#13, Mac-OS style)
tlbsCRLF	Carriage-return, line-feed (#13#30, Windows style)
tlbsLF	Line-feed only (#10, unix style)

Text line break style. (end of line character)

```
TThreadFunc = function(parameter: pointer) : PtrInt
```

Thread function prototype

```
TThreadGetPriorityHandler = function(threadHandle: TThreadID) : LongInt
```

Callback type for thread priority getting in `TThreadManager` (1275).

```
TThreadHandler = function(threadHandle: TThreadID) : DWord
```

Generic thread handler callback for `TThreadManager` (1275).

```
TThreadID = PtrUInt
```

This is an opaque type, it can differ from operating system to operating system.

```

TThreadManager = record
  InitManager : function : Boolean;
  DoneManager : function : Boolean;
  BeginThread : TBeginThreadHandler;
  EndThread : TEndThreadHandler;
  SuspendThread : TThreadHandler;
  ResumeThread : TThreadHandler;
  KillThread : TThreadHandler;
  CloseThread : TThreadHandler;
  ThreadSwitch : TThreadSwitchHandler;
  WaitForThreadTerminate : TWaitForThreadTerminateHandler;
  ThreadSetPriority : TThreadSetPriorityHandler;
  ThreadGetPriority : TThreadGetPriorityHandler;
  GetCurrentThreadId : TGetCurrentThreadIdHandler;
  InitCriticalSection : TCriticalSectionHandler;
  DoneCriticalSection : TCriticalSectionHandler;
  EnterCriticalSection : TCriticalSectionHandler;
  TryEnterCriticalSection : TCriticalSectionHandlerTryEnter;
  LeaveCriticalSection : TCriticalSectionHandler;
  InitThreadVar : TInitThreadVarHandler;
  RelocateThreadVar : TRelocateThreadVarHandler;
  AllocateThreadVars : TAllocateThreadVarsHandler;
  ReleaseThreadVars : TReleaseThreadVarsHandler;
  BasicEventCreate : TBasicEventCreateHandler;
  BasicEventDestroy : TBasicEventHandler;
  BasicEventResetEvent : TBasicEventHandler;
  BasicEventSetEvent : TBasicEventHandler;
  BasicEventWaitFor : TBasicEventWaitForHandler;
  RTLEventCreate : TRTLCreateEventHandler;
  RTLEventDestroy : TRTLEventHandler;
  RTLEventSetEvent : TRTLEventHandler;
  RTLEventResetEvent : TRTLEventHandler;
  RTLEventWaitFor : TRTLEventHandler;
  RTLEventSync : TRTLEventSyncHandler;
  RTLEventWaitForTimeout : TRTLEventHandlerTimeout;
  SemaphoreInit : TSemaphoreInitHandler;
  SemaphoreDestroy : TSemaphoreDestroyHandler;
  SemaphorePost : TSemaphorePostHandler;
  SemaphoreWait : TSemaphoreWaitHandler;
end

```

`TThreadManager` is a record that contains all callbacks needed for the thread handling routines of the Free Pascal Run-Time Library. The thread manager can be set by the `SetThreadManager` ([1405](#)) procedure, and the current thread manager can be retrieved with the `GetThreadManager` ([1329](#)) procedure.

The Windows RTL will set the thread manager automatically to a system thread manager, based on the Windows threading routines. Unix operating systems provide a unit `cthreads` which implements threads based on the C library POSIX thread routines. It is not included by default, because it would make the system unit dependent on the C library.

For more information about thread programming, see the programmer's guide.

```
TThreadSetPriorityHandler = function(threadHandle: TThreadID;
```

```
Prio: LongInt) : Boolean
```

Callback type for thread priority setting in TThreadManager ([1275](#)).

```
TThreadSwitchHandler = procedure
```

Callback type for thread switch in TThreadManager ([1275](#)).

```
TTime = TDateTime
```

TTime is defined for Delphi compatibility. This type is deprecated, use TDateTime ([1266](#)) instead.

```
TUCS4CharArray = Array[0..$efffffff] of UCS4Char
```

Array of UCS4Char ([1280](#)) characters.

```
TUnicodeStringManager = record
  Wide2AnsiMoveProc : procedure(source: PWideChar; var dest: ansistring; len: SizeInt);
  Ansi2WideMoveProc : procedure(source: PChar; var dest: widestring; len: SizeInt);
  UpperWideStringProc : function(const S: WideString) : WideString;
  LowerWideStringProc : function(const S: WideString) : WideString;
  CompareWideStringProc : function(const s1: WideString; const s2: WideString) : PtrInt;
  CompareTextWideStringProc : function(const s1: WideString; const s2: WideString) : PtrInt;
  CharLengthPCharProc : function(const Str: PChar) : PtrInt;
  CodePointLengthProc : function(const Str: PChar; MaxLookAhead: PtrInt) : PtrInt;
  UpperAnsiStringProc : function(const s: ansistring) : ansistring;
  LowerAnsiStringProc : function(const s: ansistring) : ansistring;
  CompareStrAnsiStringProc : function(const S1: ansistring; const S2: ansistring) : Integer;
  CompareTextAnsiStringProc : function(const S1: ansistring; const S2: ansistring) : Integer;
  StrCompAnsiStringProc : function(S1: PChar; S2: PChar) : PtrInt;
  StrICompAnsiStringProc : function(S1: PChar; S2: PChar) : PtrInt;
  StrLCompAnsiStringProc : function(S1: PChar; S2: PChar; MaxLen: PtrUInt) : PtrInt;
  StrLICompAnsiStringProc : function(S1: PChar; S2: PChar; MaxLen: PtrUInt) : PtrInt;
  StrLowerAnsiStringProc : function(Str: PChar) : PChar;
  StrUpperAnsiStringProc : function(Str: PChar) : PChar;
  ThreadInitProc : procedure;
  ThreadFiniProc : procedure;
  Unicode2AnsiMoveProc : procedure(source: PUnicodeChar; var dest: ansistring; len: SizeInt);
  Ansi2UnicodeMoveProc : procedure(source: PChar; var dest: unicodestring; len: SizeInt);
  UpperUnicodeStringProc : function(const S: UnicodeString) : UnicodeString;
  LowerUnicodeStringProc : function(const S: UnicodeString) : UnicodeString;
  CompareUnicodeStringProc : function(const s1: UnicodeString; const s2: UnicodeString) : Integer;
  CompareTextUnicodeStringProc : function(const s1: UnicodeString; const s2: UnicodeString) : Integer;
end
```

TUnicodeStringManager is currently the same as the TUnicodeStringManager ([1276](#)) manager record. It performs the same functions: converting unicode strings to ansistrings and vice-versa, performing uppercase to lowercase transformations and comparing strings.

```
tvararray = record
  dimcount : Word;
```

```

flags : Word;
elementsized : LongInt;
lockcount : LongInt;
data : pointer;
bounds : tvararrayboundarray;
end

```

tvararray is a record describing a variant array. It contains some general data, followed by a number of TVarArrayBound (1277) records equal to the number of dimensions in the array (dimcoun).

```

tvararraybound = record
  elementcount : LongInt;
  lowbound : LongInt;
end

```

tvararraybound is used to describe one dimension in a variant array.

```

tvararrayboundarray = Array[0..0] of tvararraybound
array of tvararraybound (1277) records.

```

```
tvararraycoorarray = Array[0..0] of LongInt
```

Array of variant array coordinates

```

tvardata = packed record
  vtype : tvartype;
end

```

TVarData is a record representation of a variant. It contains the internal structure of a variant and is handled by the various variant handling routines.

```

tvariantmanager = record
  vartoint : function(const v: variant) : LongInt;
  vartoint64 : function(const v: variant) : Int64;
  vartoword64 : function(const v: variant) : QWord;
  vartobool : function(const v: variant) : Boolean;
  vartoreal : function(const v: variant) : extended;
  vartotdatetime : function(const v: variant) : TDateTime;
  vartocurr : function(const v: variant) : currency;
  vartopstr : procedure(var s;const v: variant);
  vartolstr : procedure(var s: ansistring;const v: variant);
  vartowstr : procedure(var s: widestring;const v: variant);
  vartointf : procedure(var intf: IInterface;const v: variant);
  vartodisp : procedure(var disp: IDispatch;const v: variant);
  vartodynarray : procedure(var dynarr: pointer;const v: variant;typeinfo: pointer);
  varfrombool : procedure(var dest: variant;const source: Boolean);
  varfromint : procedure(var dest: variant;const source: LongInt;const Range: LongIn
  varfromint64 : procedure(var dest: variant;const source: Int64);
```

```

varfromword64 : procedure(var dest: variant;const source: QWord);
varfromreal : procedure(var dest: variant;const source: extended);
varfromdatetime : procedure(var dest: Variant;const source: TDateTime);
varfromcurr : procedure(var dest: Variant;const source: Currency);
varfrompstr : procedure(var dest: variant;const source: ShortString);
varfromlstr : procedure(var dest: variant;const source: ansistring);
varfromwstr : procedure(var dest: variant;const source: WideString);
varfromintf : procedure(var dest: variant;const source: IInterface);
varfromdisp : procedure(var dest: variant;const source: IDispatch);
varfromdynarray : procedure(var dest: variant;const source: pointer;typeinfo: point;
olevarfrompstr : procedure(var dest: olevariant;const source: shortstring);
olevarfromlstr : procedure(var dest: olevariant;const source: ansistring);
olevarfromvar : procedure(var dest: olevariant;const source: variant);
olevarfromint : procedure(var dest: olevariant;const source: LongInt;
                           const range: ShortInt);
varop : procedure(var left: variant;const right: variant;opcode: tvarop);
cmpop : function(const left: variant;const right: variant;const opcode: tvarop)
          : Boolean;
varneg : procedure(var v: variant);
varnot : procedure(var v: variant);
varinit : procedure(var v: variant);
varclear : procedure(var v: variant);
varaddref : procedure(var v: variant);
varcopy : procedure(var dest: variant;const source: variant);
varcast : procedure(var dest: variant;const source: variant;vartype: LongInt);
varcastole : procedure(var dest: variant;const source: variant;vartype: LongInt);
dispinvoke : procedure(dest: pvardata;const source: tvardata;calldesc: pcalldesc;
                           params: pointer);
vararrayredim : procedure(var a: variant;highbound: SizeInt);
vararrayget : function(const a: variant;indexcount: SizeInt;indices: PLongint)
                           : variant;
vararrayput : procedure(var a: variant;const value: variant;indexcount: SizeInt;
                           indices: PLongint);
writevariant : function(var t: text;const v: variant;width: LongInt) : Pointer;
write0Variant : function(var t: text;const v: Variant) : Pointer;
end

```

TVariantManager describes the variant manager as expected by the SetVariantManager ([1405](#)) call.

```
tvarop = (opadd,opsubtract,opmultiply,opdivide,opintdivide,opmodulus,
          opshiftleft,opshiftright,opand,opor,opxor,opcompare,opnegate,
          opnot,opcmeq,opcmpne,opcmplt,opcmple,opcmpgt,opcmpge,oppower)
```

Table 37.10: Enumeration values for type tvarop

Value	Explanation
opadd	Variant operation: Addition.
opand	Variant operation: Binary AND operation
opccmpeq	Variant operation: Compare equal.
opcmpge	Variant operation: Compare larger than or equal
opcmpgt	Variant operation: Compare larger than
opcmple	Variant operation: Compare less than or equal to
opcmplt	Variant operation: Compare less than.
opcmpne	Variant operation: Compare not equal
opcompare	Variant operation: Compare
opdivide	Variant operation: division
opintdivide	Variant operation: integer divide
opmodulus	Variant operation: Modulus
opmultiply	Variant operation: multiplication
opnegate	Variant operation: negation.
opnot	Variant operation: Binary NOT operation.
opor	Variant operation: Binary OR operation
oppower	Variant operation: Power
opshiftleft	Variant operation: Shift left
opshiftright	Variant operation: Shift right
opsubtract	Variant operation: Substraction
opxor	Variant operation: binary XOR operation.

tvarop describes a variant operation. It is mainly used for the variant manager to implement the various conversions and mathematical operations on a variant.

```
TVarRec = record
end
```

TVarRec is a record generated by the compiler for each element in a array of const call. The procedure that receives the constant array receives an array of TVarRec elements, with lower bound zero and high bound equal to the number of elements in the array minus one (as returned by High(Args))

```
tvartype = Word
```

Type with size of variant type.

```
TVmt = record
  vInstanceSize : SizeInt;
  vInstanceSize2 : SizeInt;
  vParent : PVmt;
  vClassName : PShortString;
  vDynamicTable : Pointer;
  vMethodTable : Pointer;
  vFieldTable : Pointer;
  vTypeInfo : Pointer;
  vInitTable : Pointer;
```

```

vAutoTable : Pointer;
vIntfTable : pinterfacetable;
vMsgStrPtr : pstringmessagetable;
vDestroy : Pointer;
vNewInstance : Pointer;
vFreeInstance : Pointer;
vSafeCallException : Pointer;
vDefaultHandler : Pointer;
vAfterConstruction : Pointer;
vBeforeDestruction : Pointer;
vDefaultHandlerStr : Pointer;
vDispatch : Pointer;
vDispatchStr : Pointer;
vEquals : Pointer;
vGetHashCode : Pointer;
vToString : Pointer;
end

```

TVMT is a record describing the VMT of a class. It's various fields represent the available information in the VMT, as far as it is common to all classes.

```
TWaitForThreadTerminateHandler = function(threadHandle: TThreadID;
                                         TimeoutMs: LongInt) : DWord
```

Callback type for thread termination in TThreadManager ([1275](#)).

```
TWideStringManager = TUnicodeStringManager
```

TWideStringManager contains the definition of the widestring manager.

```
UCS2Char = WideChar
```

UCS2 unicode character.

```
UCS4Char =
```

UCS unicode character (unsigned 32 bit word)

```
UCS4String = Array of UCS4Char
```

String of UCS4Char ([1280](#)) characters.

```
UInt16 = Word
```

```
UInt32 = Cardinal
```

```
UInt64 = QWord
```

Unsigned 64-bit integer

```
UInt8 = Byte  
  
UIntPtr = PtrUInt  
  
UnicodeChar = WideChar
```

UnicodeChar is a single character from a UnicodeString. It equals WideChar in all respects.

```
UTF8String = ansistring  
  
UTF-8 unicode (ansi) string.
```

```
ValReal = Extended
```

ValReal is an alias for the largest available floating point type on the architecture the program runs on. On most processors, it should be one of Double or Extended.

```
ValsInt = LongInt
```

Integer with the same size as the return code of the Val ([1425](#)) function.

```
ValUInt = Cardinal
```

Integer with the same size as the return code of the Val ([1425](#)) function.

```
WChar = WideChar
```

Wide char (16-bit sized char)

37.9.3 Variables

```
argc : LongInt; external name 'operatingsystem_parameter_argc'
```

argc contains the number of command-line arguments passed to the program by the OS. It is not available on all systems.

```
argv : PPChar; external name 'operatingsystem_parameter_argv'
```

argv contains a pointer to a nil-terminated array of null-terminated strings, containing the command-line arguments passed to the program by the OS. It is not available on all systems.

```
DispCallByIDProc : pointer
```

VarDispProc is called by the compiler if it needs to perform an interface call from a variant which contains a dispatch interface. For instance, the following call:

```
Var  
  V : OleVariant;  
begin  
  (V as IWord).OpenDocument('c:\temp\mydoc.doc');  
end;
```

where IWord is a dispatch interface is encoded by the compiler and passed to DispCallByIDProc. This pointer must be set by a routine that calls the OS COM handling routines.

envp : PPChar; external name 'operatingsystem_parameter_envp'

envp contains a pointer to a nil-terminated array of null-terminated strings, containing the environment variables passed to the program by the OS. It is not available on all systems.

ErrOutput : Text

ErrOutput is provided for Delphi compatibility.

ExitCode : LongInt; public name 'operatingsystem_result'

Exit code for the program, will be communicated to the OS on exit.

fpc_threadvar_relocate_proc : pointer; public name 'FPC_THREADVAR_RELOCATE'

InOutRes : Word

Result of last I/O operation. Read-Only.

Input : Text

Standard input text file.

IsConsole : Boolean; public name 'operatingsystem_isconsole' = False

True for console applications, False for GUI applications.

IsLibrary : Boolean; public name 'operatingsystem_islibrary' = False

True if the current module is a library. Otherwise module is an executable

mem : Array[0..\$7fffffff-1] of Byte

mem is an array of bytes, representing the computer's memory. This array is available only when compiling for the Dos Go32V2 target. Its use is not recommended, and it is not even available on other platforms.

meml : Array[0..(\$7fffffffdivsizeof(longint))-1] of LongInt

memw is an array of longints, representing the computer's memory as 32-bit signed integers. This array is available only when compiling for the Dos Go32V2 target. Its use is not recommended, and it is not even available on other platforms.

memw : Array[0..(\$7fffffffdivsizeof(word))-1] of Word

memw is an array of words, representing the computer's memory as 2-byte words. This array is available only when compiling for the Dos Go32V2 target. Its use is not recommended, and it is not even available on other platforms.

Output : Text

Standard output text file.

RandSeed : Cardinal

Seed for Random ([1384](#)) function.

ReturnNilIfGrowHeapFails : Boolean

ReturnNilIfGrowHeapFails describes what happens if there is no more memory available from the operating system. If set to True the memory manager will return Nil. If set to False then a run-time error will occur.

softfloat_exception_flags : Byte

Current soft float exception flags

softfloat_exception_mask : Byte

Current soft float exception mask

softfloat_rounding_mode : Byte

softfloat_rounding_mode determines how the software floating-point emulation routines do the rounding. The value can be one of the following:

float_round_nearest_even Round to nearest even number

float_round_down Round down

float_round_up Round up

float_round_to_zero Round in the direction of zero (down for positive, up for negative)

StackBottom : Pointer

Current stack bottom.

StackLength : SizeUInt

Maximum stack length.

StackTop : Pointer

StackTop contains the top of the stack for the current process. It is used to check the heap on some operating systems, and is set by the system unit initialization code. Do not use or modify this value.

StdErr : Text

Standard diagnostic output text file.

StdOut : Text

Alias for Output ([1283](#)).

ThreadID : TThreadID

Current Thread ID.

widestringmanager : TUnicodeStringManager

Contains the current widestring manager. Do not use directly.

37.10 Procedures and functions

37.10.1 abs

Synopsis: Calculate absolute value

Declaration: function abs(l: LongInt) : LongInt
 function abs(l: Int64) : Int64
 function abs(d: ValReal) : ValReal

Visibility: default

Description: Abs returns the absolute value of a variable. The result of the function has the same type as its argument, which can be any numerical type.

Errors: None.

See also: Round ([1395](#))

Listing: ./refex/ex1.pp

```
Program Example1;

{ Program to demonstrate the Abs function. }

Var
  r : real;
  i : integer;

begin
  r := abs(-1.0);    { r:=1.0 }
  i := abs(-21);    { i:=21 }
end.
```

37.10.2 AbstractError

Synopsis: Generate an abstract error.

Declaration: procedure AbstractError

Visibility: default

Description: AbstractError generates an abstract error (run-time error 211). If the AbstractErrorProc (1233) constant is set, it will be called instead.

Errors: This routine causes a run-time error 211.

See also: AbstractErrorProc (1233)

37.10.3 AcquireExceptionObject

Synopsis: Obtain a reference to the current exception object

Declaration: function AcquireExceptionObject : Pointer

Visibility: default

Description: AcquireExceptionObject returns the current exception object. It raises the reference count of the exception object, so it will not be freed. Calling this method is only valid within an except block.

The effect of this function is countered by re-raising an exception via `raise;`

To make sure that the exception object is released when it is no longer needed, ReleaseExceptionObject (1389) must be called when the reference is no longer needed.

Errors: If there is no current exception, a run-time error 231 will occur.

See also: ReleaseExceptionObject (1389)

37.10.4 AddExitProc

Synopsis: Add an exit procedure to the exit procedure chain.

Declaration: procedure AddExitProc(Proc: TProcedure)

Visibility: default

Description: AddExitProc adds Proc to the exit procedure chain. At program exit, all procedures added in this way will be called in reverse order.

Errors: None.

See also: ExitProc (1235)

37.10.5 Addr

Synopsis: Return address of a variable

Declaration: function Addr(X: TAnytype) : Pointer

Visibility: default

Description: Addr returns a pointer to its argument, which can be any type, or a function or procedure name. The returned pointer isn't typed. The same result can be obtained by the @ operator, which can return a typed pointer (see the programmer's guide).

Errors: None

See also: SizeOf (1407)

Listing: ./refex/ex2.pp

```
Program Example2;

{ Program to demonstrate the Addr function. }

Const Zero : integer = 0;

Var p : pointer;
    i : Integer;

begin
    p:=Addr(p);      { P points to itself }
    p:=Addr(i);      { P points to i }
    p:=Addr(Zero);   { P points to 'Zero' }
end.
```

37.10.6 Align

Synopsis: Return aligned version of an address

Declaration: function Align(Addr: PtrUInt;Alignment: PtrUInt) : PtrUInt
 function Align(Addr: Pointer;Alignment: PtrUInt) : Pointer

Visibility: default

Description: Align returns Address, aligned to Alignment bytes.

Errors: None.

37.10.7 AllocMem

Synopsis: Allocate and clear memory.

Declaration: function AllocMem(Size: PtrUInt) : pointer

Visibility: default

Description: AllocMem calls getmem GetMem (1328), and clears the allocated memory, i.e. the allocated memory is filled with Size zero bytes.

See also: GetMem (1328)

37.10.8 AnsiToUtf8

Synopsis: Convert ansi string to UTF-8 string

Declaration: function AnsiToUtf8(const s: ansistring) : UTF8String

Visibility: default

Description: AnsiToUtf8 converts the ansistring S to a UTF-8 format, that is, it converts the string from whatever codepage is currently in use, to UTF-8.

The current codepage is fetched from the system, if internationalization support is enabled. It can be UTF-8, in which case the function simply returns S.

Errors: None.

See also: Utf8toAnsi (1425)

37.10.9 Append

Synopsis: Open a file in append mode

Declaration: procedure Append(var t: Text)

Visibility: default

Description: Append opens an existing file in append mode. Any data written to F will be appended to the file.
Only text files can be opened in append mode. After a call to Append, the file F becomes write-only.
File sharing is not taken into account when calling Append.

Errors: If the file doesn't exist when appending, a run-time error will be generated. This behaviour has changed on Windows and Linux platforms, where in versions prior to 1.0.6, the file would be created in append mode.

See also: Rewrite (1391), Close (1298), Reset (1390)

Listing: ./refex/ex3.pp

```
Program Example3;

{ Program to demonstrate the Append function. }

Var f : text;

begin
  Assign (f, 'test.txt');
  Rewrite (f);           { file is opened for write, and emptied }
  Writeln (f, 'This is the first line of text.txt');
  close (f);
  Append(f);            { file is opened for write, but NOT emptied.
                        any text written to it is appended.}
  Writeln (f, 'This is the second line of text.txt');
  close (f);
end.
```

37.10.10 arctan

Synopsis: Calculate inverse tangent

Declaration: function arctan(d: ValReal) : ValReal

Visibility: default

Description: Arctan returns the Arctangent of X, which can be any Real type. The resulting angle is in radial units.

Errors: None

See also: Sin (1406), Cos (1305)

Listing: ./refex/ex4.pp

```
Program Example4;

{ Program to demonstrate the ArcTan function. }

Var R : Real;
```

```
begin
  R:=ArcTan(0);      { R:=0 }
  R:=ArcTan(1)/pi;   { R:=0.25 }
end.
```

37.10.11 ArrayStringToPPchar

Synopsis: Concert an array of string to an array of null-terminated strings

Declaration: function ArrayStringToPPchar(const S: Array of AnsiString;
reserveentries: LongInt) : PPChar

Visibility: default

Description: ArrayStringToPPchar creates an array of null-terminated strings that point to strings which are the same as the strings in the array S. The function returns a pointer to this array. The array and the strings it contains must be disposed of after being used, because it they are allocated on the heap. The ReserveEntries parameter tells ArrayStringToPPchar to allocate room at the end of the array for another ReserveEntries entries.

Errors: If not enough memory is available, an error may occur.

See also: StringToPPChar (1412)

37.10.12 Assert

Synopsis: Check validity of a given condition.

Declaration: procedure Assert (Expr: Boolean)
procedure Assert (Expr: Boolean; const Msg: string)

Visibility: default

Description: With assertions on, Assert tests if expr is false, and if so, aborts the application with a Runtime error 227 and an optional error message in msg. If expr is true, program execution continues normally. If assertions are not enabled at compile time, this routine does nothing, and no code is generated for the Assert call. Enabling and disabling assertions at compile time is done via the \\$C or \\$ASSERTIONS compiler switches. These are global switches. The default behavior of the assert call can be changed by setting a new handler in the AssertErrorProc variable. Sysutils overrides the default handler to raise a EAssertionFailed exception.

Errors: None.

See also: Halt (1331), Runerror (1397)

37.10.13 Assign

Synopsis: Assign a name to a file

Declaration: procedure Assign(out f: File;const Name: string)
procedure Assign(out f: File;p: PChar)
procedure Assign(out f: File;c: Char)
procedure Assign(out f: TypedFile;const Name: string)
procedure Assign(out f: TypedFile;p: PChar)

```

procedure Assign(out f: TypedFile;c: Char)
procedure Assign(out t: Text;const s: string)
procedure Assign(out t: Text;p: PChar)
procedure Assign(out t: Text;c: Char)

```

Visibility: default

Description: Assign assigns a name to F, which can be any file type. This call doesn't open the file, it just assigns a name to a file variable, and marks the file as closed.

Errors: None.

See also: Reset (1390), Rewrite (1391), Append (1287)

Listing: ./refex/ex5.pp

```

Program Example5;

{ Program to demonstrate the Assign function. }

Var F : text;

begin
  Assign (F, '');
  Rewrite (f);
  { The following can be put in any file by redirecting it
    from the command line. }
  Writeln (f, 'This goes to standard output !');
  Close (f);
  Assign (F, 'Test.txt');
  rewrite (f);
  writeln (f, 'This doesn''t go to standard output !');
  close (f);
end.

```

37.10.14 Assigned

Synopsis: Check if a pointer is valid

Declaration: function Assigned(P: Pointer) : Boolean

Visibility: default

Description: Assigned returns True if P is non-nil and returns False if P is nil. The main use of Assigned is that Procedural variables, method variables and class-type variables also can be passed to Assigned.

Errors: None

See also: New (1351)

Listing: ./refex/ex96.pp

```

Program Example96;

{ Program to demonstrate the Assigned function. }

Var P : Pointer;

```

```

begin
  If Not Assigned(P) then
    Writeln ('Pointer is initially NIL');
  P:=@P;
  If Not Assigned(P) then
    Writeln ('Internal inconsistency')
  else
    Writeln ('All is well in FPC')
end.

```

37.10.15 BasicEventCreate

Synopsis: Obsolete. Don't use

Declaration: function BasicEventCreate(EventAttributes: Pointer;
 AManualReset: Boolean;InitialState: Boolean;
 const Name: ansistring) : PEventState

Visibility: default

Description: BasicEventCreate is obsolete, use RTLEventCreate ([1395](#)) instead.

See also: RTLEventCreate ([1395](#))

37.10.16 basiceventdestroy

Synopsis: Obsolete. Don't use

Declaration: procedure basiceventdestroy(state: PEventState)

Visibility: default

Description: basiceventdestroy is obsolete. Use RTLEventDestroy ([1396](#)) instead.

See also: RTLEventDestroy ([1396](#))

37.10.17 basiceventResetEvent

Synopsis: Obsolete. Don't use

Declaration: procedure basiceventResetEvent(state: PEventState)

Visibility: default

Description: basiceventResetEvent is obsolete. Use RTLEventResetEvent ([1396](#)) instead.

See also: RTLEventResetEvent ([1396](#))

37.10.18 basiceventSetEvent

Synopsis: Obsolete. Don't use

Declaration: procedure basiceventSetEvent(state: PEventState)

Visibility: default

Description: basiceventSetEvent is obsolete. Use RTLEventSetEvent ([1396](#)) instead.

See also: RTLEventSetEvent ([1396](#))

37.10.19 basiceventWaitFor

Synopsis: Obsolete. Don't use

Declaration: function basiceventWaitFor(Timeout: Cardinal; state: PEventState) : LongInt

Visibility: default

Description: basiceventwaitfor is obsolete. Use RTLEventWaitFor ([1396](#)) instead.

See also: RTLEventWaitFor ([1396](#))

37.10.20 BeginThread

Synopsis: Start a new thread.

```
Declaration: function BeginThread(sa: Pointer; stacksize: SizeUInt;
                                ThreadFunction: TThreadFunc;p: pointer;
                                creationFlags: DWord;var ThreadId: TThreadID)
                                : TThreadID
function BeginThread(ThreadFunction: TThreadFunc) : TThreadID
function BeginThread(ThreadFunction: TThreadFunc;p: pointer) : TThreadID
function BeginThread(ThreadFunction: TThreadFunc;p: pointer;
                     var ThreadId: TThreadID) : TThreadID
function BeginThread(ThreadFunction: TThreadFunc;p: pointer;
                     var ThreadId: TThreadID;const stacksize: SizeUInt)
                     : TThreadID
```

Visibility: default

Description: BeginThread starts a new thread and executes ThreadFunction in the new thread. If P is specified, then it is passed to ThreadFunction. If ThreadId is specified, it is filled with the thread ID of the newly started thread. If StackSize is specified, it is set as the stack size for the new thread. If none is specified, a default stack size of 4MiB is used.

The function returns the thread handle (or ID, on some other operating systems like Linux or \ostwo) on success, or 0 if an error occurred. Note that the thread ID and handle are the same on unix processes, and that the thread ID and thread handle are different on windows systems.

Errors: On error, the value "0" is returned.

See also: EndThread ([1312](#))

37.10.21 BEtoN

Synopsis: Convert Big Endian-ordered integer to Native-ordered integer

```
Declaration: function BEtoN(const AValue: SmallInt) : SmallInt
function BEtoN(const AValue: Word) : Word
function BEtoN(const AValue: LongInt) : LongInt
function BEtoN(const AValue: DWord) : DWord
function BEtoN(const AValue: Int64) : Int64
function BEtoN(const AValue: QWord) : QWord
```

Visibility: default

Description: BEToN will rearrange the bytes in a Big-Endian number to the native order for the current processor. That is, for a big-endian processor, it will do nothing, and for a little-endian processor, it will invert the order of the bytes.

See also: LEtoN (1346), NtoBE (1352), NtoLE (1352)

37.10.22 binStr

Synopsis: Convert integer to string with binary representation.

Declaration: function binStr(Val: LongInt;cnt: Byte) : shortstring
 function binStr(Val: Int64;cnt: Byte) : shortstring
 function binStr(Val: QWord;cnt: Byte) : shortstring

Visibility: default

Description: BinStr returns a string with the binary representation of Value. The string has at most cnt characters. (i.e. only the cnt rightmost bits are taken into account) To have a complete representation of any longint-type value, 32 bits are needed, i.e. cnt=32

Errors: None.

See also: Str (1410), Val (1425), HexStr (1332), OctStr (1353)

Listing: ./refex/ex82.pp

```
Program example82;

{ Program to demonstrate the BinStr function }

Const Value = 45678;

Var I : longint;

begin
  For I:=8 to 20 do
    Writeln (BinStr(Value,I):20);
end.
```

37.10.23 BlockRead

Synopsis: Read data from an untyped file into memory

Declaration: procedure BlockRead(var f: File;var Buf;count: Int64;var Result: Int64)
 procedure BlockRead(var f: File;var Buf;count: LongInt;
 var Result: LongInt)
 procedure BlockRead(var f: File;var Buf;count: Cardinal;
 var Result: Cardinal)
 procedure BlockRead(var f: File;var Buf;count: Word;var Result: Word)
 procedure BlockRead(var f: File;var Buf;count: Word;var Result: Integer)
 procedure BlockRead(var f: File;var Buf;count: Int64)

Visibility: default

Description: Blockread reads count or less records from file F. A record is a block of bytes with size specified by the Rewrite (1391) or Reset (1390) statement. The result is placed in Buffer, which must contain enough room for Count records. The function cannot read partial records. If Result is specified, it contains the number of records actually read. If Result isn't specified, and less than Count records were read, a run-time error is generated. This behavior can be controlled by the {\$I} switch.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Blockwrite (1293), Close (1298), Reset (1390), Assign (1288)

Listing: ./refex/ex6.pp

Program Example6;

```
{ Program to demonstrate the BlockRead and BlockWrite functions. }

Var Fin, fout : File;
      NumRead, NumWritten : Word;
      Buf : Array[1..2048] of byte;
      Total : Longint;

begin
  Assign (Fin, Paramstr(1));
  Assign (Fout, Paramstr(2));
  Reset (Fin, 1);
  Rewrite (Fout, 1);
  Total:=0;
  Repeat
    BlockRead (Fin, buf, Sizeof(buf), NumRead);
    BlockWrite (Fout, Buf, NumRead, NumWritten);
    inc(Total, NumWritten);
  Until (NumRead=0) or (NumWritten<>NumRead);
  Write ('Copied ', Total, ' bytes from file ', paramstr(1));
  Writeln (' to file ', paramstr(2));
  close(fin);
  close(fout);
end.
```

37.10.24 BlockWrite

Synopsis: Write data from memory to an untyped file

Declaration: procedure BlockWrite(var f: File; const Buf; Count: Int64;
 var Result: Int64)
 procedure BlockWrite(var f: File; const Buf; Count: LongInt;
 var Result: LongInt)
 procedure BlockWrite(var f: File; const Buf; Count: Cardinal;
 var Result: Cardinal)
 procedure BlockWrite(var f: File; const Buf; Count: Word; var Result: Word)
 procedure BlockWrite(var f: File; const Buf; Count: Word;
 var Result: Integer)
 procedure BlockWrite(var f: File; const Buf; Count: LongInt)

Visibility: default

Description: BlockWrite writes count records from buffer to the file F. A record is a block of bytes with size specified by the Rewrite (1391) or Reset (1390) statement. If the records couldn't be written to disk, a run-time error is generated. This behavior can be controlled by the {\$I} switch.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Blockread (1292), Close (1298), Rewrite (1391), Assign (1288)

37.10.25 Break

Synopsis: Exit current loop construct.

Declaration: procedure Break

Visibility: default

Description: Break jumps to the statement following the end of the current repetitive statement. The code between the Break call and the end of the repetitive statement is skipped. The condition of the repetitive statement is NOT evaluated.

This can be used with For, var{repeat} and While statements.

Note that while this is a procedure, Break is a reserved word and hence cannot be redefined.

Errors: None.

See also: Continue (1304), Exit (1317)

Listing: ./refex/ex87.pp

Program Example87;

```
{ Program to demonstrate the Break function. }

Var I : longint;

begin
  I:=0;
  While I<10 Do
    begin
      Inc(I);
      If I>5 Then
        Break;
      Writeln (i);
    end;
  I:=0;
  Repeat
    Inc(I);
    If I>5 Then
      Break;
    Writeln (i);
  Until I>=10;
  For I:=1 to 10 do
    begin
      If I>5 Then
        Break;
      Writeln (i);
    end;
end.
```

37.10.26 **BsfByte**

Synopsis: Return the position of the rightmost set bit in an 8-bit value

Declaration: function BsfByte(const AValue: Byte) : Byte

Visibility: default

Description: BsfByte scans the byte AValue, starting at position 0 (rightmost position) and returns the index of the first set bit. The position is measured from the 0-th, rightmost bit.

See also: BsrByte ([1296](#)), BsfWord ([1295](#)), BsfDWord ([1295](#)), BsfQWord ([1295](#))

37.10.27 **BsfDWord**

Synopsis: Return the position of the rightmost set bit in a 32-bit value

Declaration: function BsfDWord(const AValue: DWord) : Cardinal

Visibility: default

Description: BsfDWord scans the DWord AValue, starting at position 0 (rightmost position) , and returns the index of the first set bit. The position is measured from the 0-th, rightmost bit.

See also: BsfByte ([1295](#)), BsfWord ([1295](#)), BsrDWord ([1296](#)), BsfQWord ([1295](#))

37.10.28 **BsfQWord**

Synopsis: Return the position of the rightmost set bit in a 64-bit value

Declaration: function BsfQWord(const AValue: QWord) : Cardinal

Visibility: default

Description: BsfQWord scans the QWord AValue, starting at position 0 (rightmost position) , and returns the index of the first set bit. The position is measured from the 0-th, rightmost bit.

See also: BsfByte ([1295](#)), BsfWord ([1295](#)), BsfDWord ([1295](#)), BsrQWord ([1296](#))

37.10.29 **BsfWord**

Synopsis: Return the position of the rightmost set bit in a 16-bit value

Declaration: function BsfWord(const AValue: Word) : Cardinal

Visibility: default

Description: BsfWord scans the word AValue, starting at position 0 (rightmost position) , and returns the index of the first set bit. The position is measured from the 0-th, rightmost bit.

See also: BsfByte ([1295](#)), BsrWord ([1296](#)), BsfDWord ([1295](#)), BsfQWord ([1295](#))

37.10.30 BsrByte

Synopsis: Return the position of the leftmost set bit in an 8-bit value

Declaration: function BsrByte(const AValue: Byte) : Byte

Visibility: default

Description: BsrByte scans the byte AValue, starting at the leftmost position and working towards position 0, and returns the index of the first set bit. The position is measured from the 0-th, rightmost bit.

See also: BsfByte ([1295](#)), BsrWord ([1296](#)), BsrDWord ([1296](#)), BsrQWord ([1296](#))

37.10.31 BsrDWord

Synopsis: Return the position of the leftmost set bit in a 32-bit value

Declaration: function BsrDWord(const AValue: DWord) : Cardinal

Visibility: default

Description: BsrDWord scans the DWord AValue, starting at the leftmost position and working towards position 0, and returns the index of the first set bit. The position is measured from the 0-th, rightmost bit.

See also: BsrByte ([1296](#)), BsrWord ([1296](#)), BsfDWord ([1295](#)), BsrQWord ([1296](#))

37.10.32 BsrQWord

Synopsis: Return the position of the leftmost set bit in a 64-bit value

Declaration: function BsrQWord(const AValue: QWord) : Cardinal

Visibility: default

Description: BsfQWord scans the QWord AValue, starting at the leftmost position and working towards position 0, and returns the index of the first set bit. The position is measured from the 0-th, rightmost bit.

See also: BsfByte ([1295](#)), BsfWord ([1295](#)), BsfDWord ([1295](#)), BsrQWord ([1296](#))

37.10.33 BsrWord

Synopsis: Return the position of the leftmost set bit in a 16-bit value

Declaration: function BsrWord(const AValue: Word) : Cardinal

Visibility: default

Description: BsrWord scans the word AValue, starting at the leftmost position and working towards position 0, and returns the index of the first set bit. The position is measured from the 0-th, rightmost bit.

See also: BsrByte ([1296](#)), BsfWord ([1295](#)), BsrDWord ([1296](#)), BsrQWord ([1296](#))

37.10.34 chdir

Synopsis: Change current working directory.

Declaration: procedure chdir(const s: string); Overload

Visibility: default

Description: Chdir changes the working directory of the process to S.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Mkdir (1350), Rmdir (1392)

Listing: ./refex/ex7.pp

```
Program Example7;

{ Program to demonstrate the ChDir function. }

begin
{$I-}
ChDir (ParamStr(1));
if IOresult<>0 then
  Writeln ('Cannot change to directory : ',paramstr (1));
end.
```

37.10.35 chr

Synopsis: Convert byte value to character value

Declaration: function chr(b: Byte) : Char

Visibility: default

Description: Chr returns the character which has ASCII value X.

Historical note:

Originally, Pascal did not have typecasts and chr was a necessary function in order to do certain operations on ASCII values of characters. With the arrival of typecasting a generic approach became possible, making chr mostly obsolete. However, chr is not considered deprecated and remains in wide use today.

Errors: None.

See also: Ord (1379), Str (1410)

Listing: ./refex/ex8.pp

```
Program Example8;

{ Program to demonstrate the Chr function. }

begin
  Write (chr(10),chr(13)); { The same effect as Writeln; }
end.
```

37.10.36 Close

Synopsis: Close a file

Declaration: procedure Close(var f: File)
procedure Close(var t: Text)

Visibility: default

Description: Close flushes the buffer of the file F and closes F. After a call to Close, data can no longer be read from or written to F. To reopen a file closed with Close, it isn't necessary to assign the file again. A call to Reset (1390) or Rewrite (1391) is sufficient.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Assign (1288), Reset (1390), Rewrite (1391), Flush (1324)

Listing: ./refex/ex9.pp

```
Program Example9;

{ Program to demonstrate the Close function. }

Var F : text;

begin
  Assign (f, 'Test.txt');
  Rewrite (F);
  Writeln (F, 'Some text written to Test.txt');
  close (f); { Flushes contents of buffer to disk,
               closes the file. Omitting this may
               cause data NOT to be written to disk.}
end.
```

37.10.37 CloseThread

Synopsis: Close a thread and free up resources used by the thread

Declaration: function CloseThread(threadHandle: TThreadID) : DWord

Visibility: default

Description: CloseThread must be called on any thread started with BeginThread (1291). It must be called after the thread has ended (either by exiting the thread function or after calling EndThread (1312)).

Errors: If no threadmanager is installed, an exception may be raised or runtime error 232 may occur if no exceptions are used.

See also: BeginThread (1291), EndThread (1312)

37.10.38 CompareByte

Synopsis: Compare 2 memory buffers byte per byte

Declaration: function CompareByte(const buf1;const buf2;len: SizeInt) : SizeInt

Visibility: default

Description: CompareByte compares two memory regions buf1,buf2 on a byte-per-byte basis for a total of len bytes.

The function returns one of the following values:

less than 0 if buf1 and buf2 contain different bytes in the first len bytes, and the first such byte is smaller in buf1 than the byte at the same position in buf2.

0 if the first len bytes in buf1 and buf2 are equal.

greater than 0 if buf1 and buf2 contain different bytes in the first len bytes, and the first such byte is larger in buf1 than the byte at the same position in buf2.

Errors: None.

See also: CompareChar (1299), CompareChar0 (1301), CompareWord (1302), CompareDWord (1301)

Listing: ./refex/ex99.pp

Program Example99;

{ Program to demonstrate the CompareByte function. }

Const

```
  ArraySize      = 100;
  HalfArraySize = ArraySize Div 2;
```

Var

```
  Buf1,Buf2 : Array[1..ArraySize] of byte;
  I : longint;
```

Procedure CheckPos(Len : Longint);

Begin

```
  Write('First ',Len,' positions are ');
  if CompareByte(Buf1,Buf2,Len)<>0 then
    Write('NOT ');
    Writeln('equal');
  end;
```

begin

For I:=1 **to** ArraySize **do**

begin

Buf1[i]:=I;

If I<=HalfArraySize **Then**

Buf2[I]:=I

else

Buf2[i]:=HalfArraySize-I;

end;

CheckPos(HalfArraySize div 2);

CheckPos(HalfArraySize);

CheckPos(HalfArraySize+1);

CheckPos(HalfArraySize + HalfArraySize Div 2);

end.

37.10.39 CompareChar

Synopsis: compare 2 memory buffers character per character

Declaration: function CompareChar(const buf1;const buf2;len: SizeInt) : SizeInt

Visibility: default

Description: CompareChar compares two memory regions buf1,buf2 on a character-per-character basis for a total of len characters.

The CompareChar0 variant compares len bytes, or until a zero character is found.

The function returns one of the following values:

-1if buf1 and buf2 contain different characters in the first len positions, and the first such character is smaller in buf1 than the character at the same position in buf2.

0if the first len characters in buf1 and buf2 are equal.

1if buf1 and buf2 contain different characters in the first len positions, and the first such character is larger in buf1 than the character at the same position in buf2.

Errors: None.

See also: CompareByte (1298), CompareChar0 (1301), CompareWord (1302), CompareDWord (1301)

Listing: ./refex/ex100.pp

Program Example100;

{ Program to demonstrate the CompareChar function. }

Const

 ArraySize = 100;
 HalfArraySize = ArraySize Div 2;

Var

 Buf1,Buf2 : **Array**[1..ArraySize] **of** char;
 I : longint;

Procedure CheckPos(Len : Longint);

Begin

Write('First ',Len,' characters are ');\n **if** CompareChar(Buf1,Buf2,Len)<>0 **then**\n **Write**('NOT ');\n **Writeln**('equal');\n **end**;

Procedure CheckNullPos(Len : Longint);

Begin

Write('First ',Len,' non-null characters are ');\n **if** CompareChar0(Buf1,Buf2,Len)<>0 **then**\n **Write**('NOT ');\n **Writeln**('equal');\n **end**;

begin

For I:=1 **to** ArraySize **do**\n **begin**\n Buf1[i]:=chr(I);\n **If** I<=HalfArraySize **Then**\n Buf2[I]:=chr(I)

```

else
  Buf2[ i ]:=chr( HalfArraySize - l );
end;
CheckPos( HalfArraySize div 2 );
CheckPos( HalfArraySize );
CheckPos( HalfArraySize + 1 );
CheckPos( HalfArraySize + HalfArraySize Div 2 );
For l := 1 to 4 do
  begin
    buf1[ Random( ArraySize )+1]:=Chr( 0 );
    buf2[ Random( ArraySize )+1]:=Chr( 0 );
  end;
Randomize;
CheckNullPos( HalfArraySize div 2 );
CheckNullPos( HalfArraySize );
CheckNullPos( HalfArraySize + 1 );
CheckNullPos( HalfArraySize + HalfArraySize Div 2 );
end.

```

37.10.40 CompareChar0

Synopsis: Compare two buffers character by character till a null-character is reached.

Declaration: function CompareChar0(const buf1; const buf2; len: SizeInt) : SizeInt

Visibility: default

Description: CompareChar0 compares 2 buffers buf1 and buf2 for a maximum length of len or till a null character is reached in either buffer. The result depends on the contents of the buffers:

- < 0 If buf1 contains a character less than the corresponding character in buf2.
- 0 If both buffers are equal
- > 0 If buf1 contains a character greater than the corresponding character in buf2.

Errors: None.

See also: CompareByte (1298), CompareChar (1299), CompareDWord (1301), CompareWord (1302)

37.10.41 CompareDWord

Synopsis: Compare 2 memory buffers DWord per DWord

Declaration: function CompareDWord(const buf1; const buf2; len: SizeInt) : SizeInt

Visibility: default

Description: CompareDWord compares two memory regions buf1,buf2 on a DWord-per-DWord basis for a total of len DWords. (A DWord is 4 bytes).

The function returns one of the following values:

- 1 if buf1 and buf2 contain different DWords in the first len DWords, and the first such DWord is smaller in buf1 than the DWord at the same position in buf2.
- 0 if the first len DWords in buf1 and buf2 are equal.
- 1 if buf1 and buf2 contain different DWords in the first len DWords, and the first such DWord is larger in buf1 than the DWord at the same position in buf2.

Errors: None.

See also: CompareChar (1299), CompareByte (1298), CompareWord (1302)

Listing: ./refex/ex101.pp

```

Program Example101;

{ Program to demonstrate the CompareDWord function. }

Const
  ArraySize      = 100;
  HalfArraySize = ArraySize Div 2;

Var
  Buf1,Buf2 : Array[1..ArraySize] of Dword;
  I : longint;

Procedure CheckPos(Len : Longint);

Begin
  Write('First ',Len,' DWords are ');
  if CompareDWord(Buf1,Buf2,Len)<>0 then
    Write('NOT ');
  Writeln('equal');
  end;

begin
  For I:=1 to ArraySize do
    begin
      Buf1[i]:=I;
      If I<=HalfArraySize Then
        Buf2[I]:=I
      else
        Buf2[i]:=HalfArraySize-I;
      end;
      CheckPos(HalfArraySize div 2);
      CheckPos(HalfArraySize);
      CheckPos(HalfArraySize+1);
      CheckPos(HalfArraySize + HalfArraySize Div 2);
  end.

```

37.10.42 CompareWord

Synopsis: Compare 2 memory buffers word per word

Declaration: **function** CompareWord(**const** buf1;**const** buf2;**len**: SizeInt) : SizeInt

Visibility: default

Description: CompareWord compares two memory regions buf1,buf2 on a Word-per-Word basis for a total of len Words. (A Word is 2 bytes).

The function returns one of the following values:

- 1 if buf1 and buf2 contain different Words in the first len Words, and the first such Word is smaller in buf1 than the Word at the same position in buf2.

0if the first *len* Words in *buf1* and *buf2* are equal.

1if *buf1* and *buf2* contain different Words in the first *len* Words, and the first such Word is larger in *buf1* than the Word at the same position in *buf2*.

Errors: None.

See also: CompareChar (1299), CompareByte (1298), CompareDWord (1301)

Listing: ./refex/ex102.pp

Program Example102;

{ *Program to demonstrate the CompareWord function.* }

Const

 ArraySize = 100;
 HalfArraySize = ArraySize **Div** 2;

Var

 Buf1, Buf2 : **Array**[1..ArraySize] **of** Word;
 I : longint;

Procedure CheckPos(Len : Longint);

Begin

Write('First ',Len,' words are ');\n **if** CompareWord(Buf1,Buf2,Len)<>0 **then**\n **Write**('NOT ');\n **Writeln**('equal');\n **end**;

begin

For I:=1 **to** ArraySize **do**
 begin
 Buf1[i]:=I;
 If I<=HalfArraySize **Then**
 Buf2[I]:=I
 else
 Buf2[i]:=HalfArraySize-I;
 end;
 CheckPos(HalfArraySize **div** 2);
 CheckPos(HalfArraySize);
 CheckPos(HalfArraySize+1);
 CheckPos(HalfArraySize + HalfArraySize **Div** 2);
end.

37.10.43 Concat

Synopsis: Append one string to another.

Declaration: **function** Concat(**const** S1: string; **const** S2: string; **const** S3: string;
 const Sn: string) : string

Visibility: default

Description: Concat concatenates the strings S1,S2 etc. to one long string. The resulting string is truncated at a length of 255 bytes. The same operation can be performed with the + operation.

Errors: None.

See also: Copy (1305), Delete (1308), Insert (1340), Pos (1382), Length (1345)

Listing: ./refex/ex10.pp

```
Program Example10;

{ Program to demonstrate the Concat function. }
Var
  S : String;

begin
  S:=Concat( 'This can be done' , ' Easier ' , 'with the + operator ! ');
end.
```

37.10.44 Continue

Synopsis: Continue with next loop cycle.

Declaration: procedure Continue

Visibility: default

Description: Continue jumps to the end of the current repetitive statement. The code between the Continue call and the end of the repetitive statement is skipped. The condition of the repetitive statement is then checked again.

This can be used with For, repeat and While statements.

Note that while this is a procedure, Continue is a reserved word and hence cannot be redefined.

Errors: None.

See also: Break (1294), Exit (1317)

Listing: ./refex/ex86.pp

```
Program Example86;

{ Program to demonstrate the Continue function. }

Var I : longint;

begin
  I:=0;
  While I<10 Do
    begin
      Inc(I);
      If I<5 Then
        Continue;
      Writeln ( i );
      end;
  I:=0;
  Repeat
    Inc(I);
    If I<5 Then
      Continue;
    Writeln ( i );
```

```

Until I >=10;
For I:=1 to 10 do
  begin
    If I <5 Then
      Continue;
    WriteLn ( i );
  end;
end.

```

37.10.45 Copy

Synopsis: Copy part of a string.

Declaration: function Copy(S: AStringType; Index: Integer; Count: Integer) : string
 function Copy(A: DynArrayType; Index: Integer; Count: Integer) : DynArray

Visibility: default

Description: Copy returns a string which is a copy of the Count characters in S, starting at position Index. If Count is larger than the length of the string S, the result is truncated. If Index is larger than the length of the string S, then an empty string is returned. Index is 1-based.

For dynamical arrays, Copy returns a new dynamical array of the same type as the original one, and copies Count elements from the old array, starting at position Index.

Errors: None.

See also: Delete (1308), Insert (1340), Pos (1382)

Listing: ./refex/ex11.pp

```

Program Example11;

{ Program to demonstrate the Copy function. }

Var S,T : String;

begin
  T:='1234567';
  S:=Copy (T,1,2); { S:='12' }
  S:=Copy (T,4,2); { S:='45' }
  S:=Copy (T,4,8); { S:='4567' }
end.

```

37.10.46 cos

Synopsis: Calculate cosine of angle

Declaration: function cos(d: ValReal) : ValReal

Visibility: default

Description: Cos returns the cosine of X, where X is an angle, in radians. If the absolute value of the argument is larger than 263, then the result is undefined.

Errors: None.

See also: Arctan (1287), Sin (1406)

Listing: ./refex/ex12.pp

```
Program Example12;

{ Program to demonstrate the Cos function. }

Var R : Real;

begin
  R:=Cos(Pi);    { R:=-1 }
  R:=Cos(Pi/2);  { R:=0 }
  R:=Cos(0);     { R:=1 }
end.
```

37.10.47 Cseg

Synopsis: Return code segment

Declaration: function Cseg : Word

Visibility: default

Description: CSeg returns the Code segment register. In Free Pascal, it returns always a zero, since Free Pascal is a 32/64 bit compiler.

Errors: None.

See also: DSeg (1310), Seg (1400), Ofs (1354), Ptr (1383)

Listing: ./refex/ex13.pp

```
Program Example13;

{ Program to demonstrate the CSeg function. }

var W : word;

begin
  W:=CSeg; {W:=0, provided for compatibility,
             FPC is 32 bit.}
end.
```

37.10.48 Dec

Synopsis: Decrease value of variable

Declaration: procedure Dec(var X: TOrdinal)
 procedure Dec(var X: TOrdinal;Decrement: TOrdinal)

Visibility: default

Description: Dec decreases the value of X with Decrement. If Decrement isn't specified, then 1 is taken as a default.

Errors: A range check can occur, or an underflow error, if an attempt is made to decrease X below its minimum value.

See also: Inc ([1334](#))

Listing: ./refex/ex14.pp

Program Example14;

{ Program to demonstrate the Dec function. }

Var

```
I : Integer;
L : Longint;
W : Word;
B : Byte;
Si : ShortInt;
```

begin

```
I:=1;
L:=2;
W:=3;
B:=4;
Si:=5;
Dec (i); { i:=0 }
Dec (L,2); { L:=0 }
Dec (W,2); { W:=1 }
Dec (B,-2); { B:=6 }
Dec (Si,0); { Si:=5 }
end.
```

37.10.49 DefaultAnsi2UnicodeMove

Synopsis: Standard widestring manager callback

Declaration: procedure DefaultAnsi2UnicodeMove(source: PChar; var dest: unicodestring;
len: SizeInt)

Visibility: default

Description: DefaultAnsi2UnicodeMove is the standard callback used for the widestring manager when an ansistring must be converted to a unicodestring. It simply copies over all characters from the ansistring to the unicodestring, no conversion whatsoever is performed.

37.10.50 DefaultAnsi2WideMove

Synopsis: Standard implementation of Ansi to Widestring conversion routine

Declaration: procedure DefaultAnsi2WideMove(source: PChar; var dest: widestring;
len: SizeInt)

Visibility: default

Description: DefaultAnsi2WideMove simply copies each character of the null-terminated ansi-string Source to the corresponding WideChar in Dest. At most Len characters will be copied.

Errors: None.

See also: DefaultWide2AnsiMove ([1308](#))

37.10.51 DefaultUnicode2AnsiMove

Synopsis: Standard widestring manager callback

Declaration: procedure DefaultUnicode2AnsiMove(source: PUnicodeChar;
var dest: ansistring; len: SizeInt)

Visibility: default

Description: DefaultUnicode2AnsiMove is the standard callback used for the widestring manager when a unicode string must be converted to an ansistring. It replaces all words with value < 256 with their value as ASCII code.

Errors: None.

See also: WidestringManager ([1284](#))

37.10.52 DefaultWide2AnsiMove

Synopsis: Standard implementation of Widestring to Ansi conversion routine

Declaration: procedure DefaultWide2AnsiMove(source: PWideChar; var dest: ansistring;
len: SizeInt)

Visibility: default

Description: DefaultWide2AnsiMove simply copies each character from Source having an ordinal value of less than 255 to the corresponding character in Dest. Characters having an ordinal value larger than 255 will be replaced by question marks. At most Len characters will be copied.

Errors: None.

See also: DefaultAnsi2WideMove ([1307](#))

37.10.53 Delete

Synopsis: Delete part of a string.

Declaration: procedure Delete(var s: shortstring; index: SizeInt; count: SizeInt)
procedure Delete(var S: AnsiString; Index: SizeInt; Size: SizeInt)
procedure Delete(var S: UnicodeString; Index: SizeInt; Size: SizeInt)
procedure Delete(var S: WideString; Index: SizeInt; Size: SizeInt)

Visibility: default

Description: Delete removes Count characters from string S, starting at position Index. All characters after the deleted characters are shifted Count positions to the left, and the length of the string is adjusted.

Errors: Shortstring variant's third parameter is called Count, in other overloaded variants it is called Index

See also: Copy ([1305](#)), Pos ([1382](#)), Insert ([1340](#))

Listing: ./refex/ex15.pp

Program Example15;

{ Program to demonstrate the Delete function. }

Var

```

S : String;
begin
  S:='This is not easy !';
  Delete (S,9,4); { S:='This is easy !' }
end.
```

37.10.54 Dispose

Synopsis: Free dynamically allocated memory

Declaration: procedure Dispose(P: Pointer)
procedure Dispose(P: TypedPointer; Des: TProcedure)

Visibility: default

Description: The first form `Dispose` releases the memory allocated with a call to `New` (1351). The pointer `P` must be typed. The released memory is returned to the heap.

The second form of `Dispose` accepts as a first parameter a pointer to an object type, and as a second parameter the name of a destructor of this object. The destructor will be called, and the memory allocated for the object will be freed.

Errors: An runtime error will occur if the pointer doesn't point to a location in the heap.

See also: `New` (1351), `Getmem` (1328), `Freemem` (1325)

Listing: ./refex/ex16.pp

```

Program Example16;

{ Program to demonstrate the Dispose and New functions. }

Type SS = String[20];

AnObj = Object
  I : integer;
  Constructor Init;
  Destructor Done;
end;

Var
  P : ^SS;
  T : ^AnObj;

Constructor AnObj.Init;

begin
  Writeln ('Initializing an instance of AnObj !');
end;

Destructor AnObj.Done;

begin
  Writeln ('Destroying an instance of AnObj !');
end;

begin
```

```

New (P);
P^:= 'Hello , World ! ';
Dispose (P);
{ P is undefined from here on ! }
New(T, Init);
T^.i:=0;
Dispose (T, Done);
end.

```

37.10.55 DoneCriticalSection

Synopsis: Clean up a critical section.

Declaration: procedure DoneCriticalSection(var cs: TRTCriticalSection)

Visibility: default

Description: DoneCriticalSection cleans up the critical section CS. After a call to DoneCriticalSection, the critical section can no longer be used with EnterCriticalSection (1312) or LeaveCriticalSection (1345), unless it is again initialized with InitCriticalSection (1339)

See also: InitCriticalSection (1339), EnterCriticalSection (1312), LeaveCriticalSection (1345)

37.10.56 DoneThread

Synopsis: End the current thread

Declaration: procedure DoneThread

Visibility: default

Description: DoneThread should be used to end the current thread. It performs the necessary housekeeping before actually ending the thread. Using the operating system calls to end the thread may result in data corruption or memory leaks.

See also: BeginThread (1291)

37.10.57 Dseg

Synopsis: Return data segment

Declaration: function Dseg : Word

Visibility: default

Description: DSeg returns the data segment register. In Free Pascal, it returns always a zero, since Free Pascal is a 32/64 bit compiler.

Errors: None.

See also: CSeg (1306), Seg (1400), Ofs (1354), Ptr (1383)

Listing: ./refex/ex17.pp

```
Program Example17;

{ Program to demonstrate the DSeg function. }

Var
  W : Word;

begin
  W:=DSeg; {W:=0, This function is provided for compatibility,
             FPC is a 32 bit compiler.}
end.
```

37.10.58 DumpExceptionBackTrace

Synopsis: Create backtrace

Declaration: procedure DumpExceptionBackTrace(var f: text)

Visibility: default

Description: DumpExceptionBackTrace writes a backtrace of the current exception to the file f. If no exception is currently being raised, nothing is written. As much frames as available are written. If debug info is available, then file names and line numbers will be written as well.

Errors: No check is done to see whether f is opened for writing.

See also: dump_stack ([1311](#))

37.10.59 Dump_Stack

Synopsis: Dump stack to the given text file.

Declaration: procedure Dump_Stack(var f: text;bp: pointer)

Visibility: default

Description: Dump_Stack prints a stack dump to the file f, with base frame pointer bp

Errors: The file f must be opened for writing or an error will occur.

See also: get_caller_addr ([1330](#)), get_caller_frame ([1331](#)), get_frame ([1331](#))

37.10.60 DynArraySetLength

Synopsis: Set the length of a dynamic array

Declaration: procedure DynArraySetLength(var a: Pointer;typeInfo: Pointer;
 dimCnt: SizeInt;lengthVec: PSizeInt)

Visibility: default

Description: DynArraySetLength sets the length of the dynamical array a to the first dimCnt lengths specified in the array lengthVec. The dynamical array type is described in typeInfo which points to a record of type TDynArrayType (1267)

It should never be necessary to call this function directly, the standard SetLength ([1402](#)) function should be used instead.

Errors: If an invalid pointer is specified, an error may occur.

See also: SetLength ([1402](#)), tdynarraytypeinfo ([1267](#))

37.10.61 EndThread

Synopsis: End the current thread.

Declaration: procedure EndThread(ExitCode: DWord)
procedure EndThread

Visibility: default

Description: EndThread ends the current thread. If ExitCode is supplied, it is returned as the exit code for the thread to a function waiting for the thread to terminate (WaitForThreadTerminate ([1427](#))). If it is omitted, zero is used.

This function does not return.

See also: WaitForThreadTerminate ([1427](#)), BeginThread ([1291](#))

37.10.62 EnterCriticalSection

Synopsis: Enter a critical section

Declaration: procedure EnterCriticalSection(var cs: TRTCriticalSection)

Visibility: default

Description: EnterCriticalSection will suspend the current thread if another thread has currently entered the critical section. When the other thread has left the critical section (through LeaveCriticalSection ([1345](#))), the current thread resumes execution. The result is that only 1 thread is executing code which is protected by a EnterCriticalSection and LeaveCriticalSection pair.

The critical section must have been initialized with InitCriticalSection ([1339](#)) prior to a call to EnterCriticalSection.

A call to EnterCriticalSection must always be matched by a call to LeaveCriticalSection ([1345](#)). To avoid problems, it is best to include the code to be execute in a try...finally block, as follows:

```
EnterCriticalSection(Section);
Try
  // Code to be protected goes here.
Finally
  LeaveCriticalSection(Section);
end;
```

For performance reasons it is best to limit the code between the entering and leaving of a critical section as short as possible.

See also: InitCriticalSection ([1339](#)), DoneCriticalSection ([1310](#)), LeaveCriticalSection ([1345](#))

37.10.63 EnumResourceLanguages

Synopsis: Enumerate available languages for a resource of given type and name

Declaration: function EnumResourceLanguages (ModuleHandle: TFPResourceHMODULE;
 ResourceType: PChar; ResourceName: PChar;
 EnumFunc: EnumResLangProc; lParam: PtrInt)
 : LongBool

Visibility: default

Description: EnumResourceLanguages enumerates the available languages for a resource of given ResourceName and type ResourceType in the module ModuleHandle. For each language available, it calls EnumFunc and passes it ModuleHandle, the type of the resource ResourceType, the name of the resource ResourceName, the language ID, and lParam. It returns False if no resources are available for the specified resource type and module, or True if there are resources available.

Errors: None.

See also: [EnumResourceTypes \(1313\)](#), [EnumResourceNames \(1313\)](#), [EnumResourceLanguages \(1313\)](#)

37.10.64 EnumResourceNames

Synopsis: Enumerate available resource names for a specified resource type

Declaration: function EnumResourceNames (ModuleHandle: TFPResourceHMODULE;
 ResourceType: PChar; EnumFunc: EnumResNameProc;
 lParam: PtrInt) : LongBool

Visibility: default

Description: EnumResourceNames enumerates the names of all resources of type ResourceType in the module ModuleHandle. For each resource available it calls EnumFunc and passes it ModuleHandle, the type of the resource ResourceType, the name of the resource, and lParam. It returns False if no resources are available for the specified resource type and module, or True if there are resources available.

Errors: None.

See also: [EnumResourceTypes \(1313\)](#), [EnumResourceLanguages \(1313\)](#)

37.10.65 EnumResourceTypes

Synopsis: Enumerate available resource types

Declaration: function EnumResourceTypes (ModuleHandle: TFPResourceHMODULE;
 EnumFunc: EnumResTypeProc; lParam: PtrInt)
 : LongBool

Visibility: default

Description: EnumResourceTypes enumerates the types of all resources in the module ModuleHandle. For each resource available it calls EnumFunc and passes it ModuleHandle, the type of the resource, and lParam. It returns False if no resources are available for the specified module, or True if there are resources available.

Errors: None.

See also: [EnumResourceNames \(1313\)](#), [EnumResourceLanguages \(1313\)](#)

37.10.66 EOF

Synopsis: Check for end of file

Declaration: function EOF(var f: File) : Boolean
 function EOF(var t: Text) : Boolean
 function EOF : Boolean

Visibility: default

Description: Eof returns True if the file-pointer has reached the end of the file, or if the file is empty. In all other cases Eof returns False. If no file F is specified, standard input is assumed.

Note that calling this function may cause your program to wait: to determine whether you are at EOF, it is necessary to read data. If the file descriptor is not a real file (for instance for standard input or sockets), then this call may seem to hang the program while it is waiting for data to appear or for the file descriptor to be closed.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Eoln (1314), Assign (1288), Reset (1390), Rewrite (1391)

Listing: ./refex/ex18.pp

Program Example18;

```
{ Program to demonstrate the Eof function. }

Var T1,T2 : text;
      C : Char;

begin
  { Set file to read from. Empty means from standard input. }
  assign (t1,paramstr(1));
  reset (t1);
  { Set file to write to. Empty means to standard output. }
  assign (t2,paramstr(2));
  rewrite (t2);
  While not eof(t1) do
    begin
      read (t1,C);
      write (t2,C);
    end;
  Close (t1);
  Close (t2);
end.
```

37.10.67 EOLn

Synopsis: Check for end of line

Declaration: function EOLn(var t: Text) : Boolean
 function EOLn : Boolean

Visibility: default

Description: Eof returns True if the file pointer has reached the end of a line, which is demarcated by a line-feed character (ASCII value 10), or if the end of the file is reached. In all other cases Eof returns False. If no file F is specified, standard input is assumed. It can only be used on files of type Text.

Errors: None.

See also: Eof (1314), Assign (1288), Reset (1390), Rewrite (1391)

Listing: ./refex/ex19.pp

```
Program Example19;
{ Program to demonstrate the Eoln function. }

begin
  { This program waits for keyboard input. }
  { It will print True when an empty line is put in,
    and false when you type a non-empty line.
    It will only stop when you press enter.}
  While not Eoln do
    Writeln (eoln);
end.
```

37.10.68 Erase

Synopsis: Delete a file from disk

Declaration: procedure Erase(var f: File)
procedure Erase(var t: Text)

Visibility: default

Description: Erase removes an unopened file from disk. The file should be assigned with Assign, but not opened with Reset or Rewrite

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Assign (1288)

Listing: ./refex/ex20.pp

```
Program Example20;
{ Program to demonstrate the Erase function. }

Var F : Text;

begin
  { Create a file with a line of text in it}
  Assign (F, 'test.txt');
  Rewrite (F);
  Writeln (F, 'Try and find this when I ''m finished !');
  close (f);
  { Now remove the file }
  Erase (f);
end.
```

37.10.69 Error

Synopsis: Generate run-time error

Declaration: procedure Error(RunTimeError: TRuntimeError)

Visibility: default

Description: Error generates a run-time error with an exit code corresponding to RunTimeError. This function is implemented for Delphi compatibility, and is not used by the Free Pascal Run-Time Library.

See also: RunError (1397), Halt (1331)

37.10.70 Exclude

Synopsis: Exclude element from a set if it is present.

Declaration: procedure Exclude(var S: TSetType; E: TSetElement)

Visibility: default

Description: Exclude removes E from the set S if it is included in the set. E should be of the same type as the base type of the set S.

Thus, the two following statements do the same thing:

```
S:=S-[E];
Exclude(S,E);
```

Errors: If the type of the element E is not equal to the base type of the set S, the compiler will generate an error.

See also: Include (1335)

Listing: ./refex/ex111.pp

```
program Example111;

{ Program to demonstrate the Include/Exclude functions }

Type
TEnumA = (aOne,aTwo,aThree);
TEnumAs = Set of TEnumA;

Var
SA : TEnumAs;

Procedure PrintSet(S : TEnumAs);

var
B : Boolean;

procedure DoEl(A : TEnumA; Desc : String);

begin
If A in S then
begin
If B then
Write( ',');
```

```

B:=True;
Write(Desc);
end;
end;

begin
  Write('[');
  B:=False;
  DoEI(aOne, 'aOne');
  DoEI(aTwo, 'aTwo');
  DoEI(aThree, 'aThree');
  WriteIn(']');
end;

begin
  SA:=[];
  Include(SA,aOne);
  PrintSet(SA);
  Include(SA,aThree);
  PrintSet(SA);
  Exclude(SA,aOne);
  PrintSet(SA);
  Exclude(SA,aTwo);
  PrintSet(SA);
  Exclude(SA,aThree);
  PrintSet(SA);
end.

```

37.10.71 Exit

Synopsis: Exit current subroutine.

Declaration: procedure Exit(const X: TAnyType)
procedure Exit

Visibility: default

Description: Exit exits the current subroutine, and returns control to the calling routine. If invoked in the main program routine, exit stops the program. The optional argument X allows to specify a return value, in the case Exit is invoked in a function. The function result will then be equal to X.

Errors: None.

See also: Halt ([1331](#))

Listing: ./refex/ex21.pp

```

Program Example21;

{ Program to demonstrate the Exit function. }

Procedure DoAnExit (Yes : Boolean);

{ This procedure demonstrates the normal Exit }

begin
  WriteIn ('Hello from DoAnExit !');
  If Yes then

```

```

begin
  Writeln ('Bailing out early.');
  exit;
  end;
  Writeln ('Continuing to the end.');
end;

Function Positive (Which : Integer) : Boolean;

{ This function demonstrates the extra FPC feature of Exit :
  You can specify a return value for the function }

begin
  if Which>0 then
    exit (True)
  else
    exit (False);
end;

begin
  { This call will go to the end }
  DoAnExit (False);
  { This call will bail out early }
  DoAnExit (True);
  if Positive (-1) then
    Writeln ('The compiler is nuts, -1 is not positive.')
  else
    Writeln ('The compiler is not so bad, -1 seems to be negative.');
end.

```

37.10.72 exp

Synopsis: Exponentiate

Declaration: function exp(d: ValReal) : ValReal

Visibility: default

Description: Exp returns the exponent of X, i.e. the number e to the power X.

Errors: None.

See also: Ln (1347), Power (1383)

Listing: ./refex/ex22.pp

Program Example22;

{ Program to demonstrate the Exp function. }

```

begin
  Writeln (Exp(1):8:2); { Should print 2.72 }
end.

```

37.10.73 FilePos

Synopsis: Get position in file

Declaration: function FilePos(var f: File) : Int64

Visibility: default

Description: Filepos returns the current record position of the file-pointer in file F. It cannot be invoked with a file of type Text. A compiler error will be generated if this is attempted.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Filesize (1319)

Listing: ./refex/ex23.pp

```

Program Example23;

{ Program to demonstrate the FilePos function. }

Var F : File of Longint;
L,FP : longint;

begin
{ Fill a file with data :
  Each position contains the position ! }
Assign (F, 'test.tmp');
Rewrite (F);
For L:=0 to 100 do
  begin
    FP:=FilePos(F);
    Write (F,FP);
    end;
Close (F);
Reset (F);
{ If all goes well, nothing is displayed here. }
While not (Eof(F)) do
  begin
    FP:=FilePos (F);
    Read (F,L);
    if L<>FP then
      Writeln ('Something wrong: Got ',L,' on pos ',FP);
    end;
Close (F);
Erase (f);
end.

```

37.10.74 FileSize

Synopsis: Size of file

Declaration: function FileSize(var f: File) : Int64

Visibility: default

Description: Filesize returns the total number of records in file F. It cannot be invoked with a file of type Text. (under linux and unix, this also means that it cannot be invoked on pipes). If F is empty, 0 is returned.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use `IOResult` to check for errors.

See also: [Filepos \(1319\)](#)

Listing: `./refex/ex24.pp`

```
Program Example24;

{ Program to demonstrate the FileSize function. }

Var F : File Of byte;
L : File Of Longint;

begin
  Assign (F,paramstr(1));
  Reset (F);
  Writeln ('File size in bytes : ',FileSize(F));
  Close (F);
  Assign (L,paramstr (1));
  Reset (L);
  Writeln ('File size in Longints : ',FileSize(L));
  Close (f);
end.
```

37.10.75 FillByte

Synopsis: Fill memory region with 8-bit pattern

Declaration: `procedure FillByte(var x; count: SizeInt; value: Byte)`

Visibility: default

Description: `FillByte` fills the memory starting at `X` with `Count` bytes with value equal to `Value`. This is useful for quickly zeroing out a memory location. When the size of the memory location to be filled out is a multiple of 2 bytes, it is better to use `FillWord` (1322), and if it is a multiple of 4 bytes it is better to use `FillDWord` (1321), these routines are optimized for their respective sizes.

Errors: No checking on the size of `X` is done.

See also: [Fillchar \(1321\)](#), [FillDWord \(1321\)](#), [FillWord \(1322\)](#), [Move \(1350\)](#)

Listing: `./refex/ex103.pp`

```
Program Example103;

{ Program to demonstrate the FillByte function. }

Var S : String[10];
I : Byte;

begin
  For i:=10 downto 0 do
    begin
      { Fill S with i bytes }
      FillByte (S,SizeOf(S),32);
      { Set Length }
      SetLength(S,I);
    
```

```

Writeln (s, '*');
end;
end.

```

37.10.76 FillChar

Synopsis: Fill memory region with certain character

Declaration: procedure FillChar(var x;count: SizeInt;Value: Byte)
procedure FillChar(var x;count: SizeInt;Value: Boolean)
procedure FillChar(var x;count: SizeInt;Value: Char)

Visibility: default

Description: Fillchar fills the memory starting at X with Count bytes or characters with value equal to Value.

Errors: No checking on the size of X is done.

See also: Fillword ([1322](#)), Move ([1350](#)), FillByte ([1320](#)), FillDWord ([1321](#))

Listing: ./refex/ex25.pp

Program Example25;

```

{ Program to demonstrate the FillChar function. }

Var S : String[10];
    I : Byte;
begin
    For i:=10 downto 0 do
        begin
            { Fill S with i spaces }
            FillChar (S,SizeOf(S), ' ');
            { Set Length }
            SetLength(S,I);
            Writeln (s,'*');
        end;
end.

```

37.10.77 FillDWord

Synopsis: Fill memory region with 32-bit pattern

Declaration: procedure FillDWord(var x;count: SizeInt;value: DWord)

Visibility: default

Description: Fillword fills the memory starting at X with Count DWords with value equal to Value. A DWord is 4 bytes in size.

Errors: No checking on the size of X is done.

See also: FillByte ([1320](#)), Fillchar ([1321](#)), Fillword ([1322](#)), Move ([1350](#))

Listing: ./refex/ex104.pp

```
Program Example104;

{ Program to demonstrate the FillDWord function. }

Const
  ArraySize = 1000;

Var
  S : Array [1..ArraySize] of DWord;
  I : longint;

begin
  FillDWord(S, ArraySize, 0);
  For I:=1 to ArraySize do
    If S[i]<>0 then
      Writeln('Position ', i, ' not zeroed out');
end.
```

37.10.78 FillQWord

Synopsis: Fill memory range with QWord (64-bit) values

Declaration: procedure FillQWord(var x; count: SizeInt; value: QWord)

Visibility: default

Description: FillQWord fills the memory location of x with Count times value. The size of the filled memory location is therefor 8*count bytes.

Errors: No checks are made to see if X actually has a minimum size of (Count*8) bytes. Therefor, other variables can be overwritten or the memory may be out of the accessible memory for the program. In the latter case a run-error or exception may be triggered.

See also: FillChar ([1321](#)), FillWord ([1322](#))

37.10.79 FillWord

Synopsis: Fill memory region with 16-bit pattern

Declaration: procedure FillWord(var x; count: SizeInt; Value: Word)

Visibility: default

Description: Fillword fills the memory starting at X with Count words with value equal to Value. A word is 2 bytes in size.

Errors: No checking on the size of X is done.

See also: Fillchar ([1321](#)), Move ([1350](#))

Listing: ./refex/ex76.pp

Program Example76;

```
{ Program to demonstrate the FillWord function. }
```

```
Var W : Array[1..100] of Word;
```

```
begin
  { Quick initialization of array W }
  FillWord(W,100,0);
end.
```

37.10.80 FindResource

Synopsis: Locate a resource and return a handle to it.

Declaration: function FindResource(ModuleHandle: TFPResourceHMODULE;
 ResourceName: PChar; ResourceType: PChar)
 : TFPResourceHandle
 function FindResource(ModuleHandle: TFPResourceHMODULE;
 ResourceName: AnsiString; ResourceType: AnsiString)
 : TFPResourceHandle

Visibility: default

Description: FindResource searches for a resource with name ResourceName and of type ResourceType in the executable or library identified by ModuleHandle. It returns a TResourceHandle which can be used to load the resource with LoadResource ([1348](#)).

Errors: None. In case the resource was not found, 0 is returned.

See also: [FreeResource](#) ([1326](#)), [LoadResource](#) ([1348](#)), [SizeofResource](#) ([1407](#)), [LockResource](#) ([1348](#)), [UnlockResource](#) ([1423](#)), [FreeResource](#) ([1326](#))

37.10.81 FindResourceEx

Synopsis: Find a resource based on type, name, language

Declaration: function FindResourceEx(ModuleHandle: TFPResourceHMODULE;
 ResourceType: PChar; ResourceName: PChar;
 Language: Word) : TFPResourceHandle
 function FindResourceEx(ModuleHandle: TFPResourceHMODULE;
 ResourceType: AnsiString;
 ResourceName: AnsiString; Language: Word)
 : TFPResourceHandle

Visibility: default

Description: FindResourceEx looks in module ModuleHandle for a resource of type ResourceType and name ResourceName with language ID Language. Both Resourcename and ResourceName can be specified as a null-terminated array of characters, or as an AnsiString.

If the requested language/sublanguage is not found, then the search is conducted

- 1.with only primary language.
- 2.with the neutral language (`LANG_NEUTRAL`)
- 3.with the english language

If none of these has returned a match, then the first available language is returned.

If a match is found, a handle to the resource is returned. If none is found, an empty handle (nil or 0) is returned.

Errors: None.

37.10.82 float_raise

Synopsis: Raise floating point exception

Declaration: procedure float_raise(i: ShortInt)

Visibility: default

Description: float_raise raises the floating point exceptions specified by softfloat_exception_flags (1283).

See also: softfloat_exception_flags (1283), softfloat_exception_mask (1283)

37.10.83 Flush

Synopsis: Write file buffers to disk

Declaration: procedure Flush(var t: Text)

Visibility: default

Description: Flush empties the internal buffer of an opened file F and writes the contents to disk. The file is \textit{not} closed as a result of this call.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Close (1298)

Listing: ./refex/ex26.pp

Program Example26;

```
{ Program to demonstrate the Flush function. }

Var F : Text;

begin
  { Assign F to standard output }
  Assign (F, '');
  Rewrite (F);
  Writeln (F, 'This line is written first, but appears later !');
  { At this point the text is in the internal pascal buffer,
    and not yet written to standard output }
  Writeln ('This line appears first, but is written later !');
  { A writeln to 'output' always causes a flush - so this text is
    written to screen }
  Flush (f);
  { At this point, the text written to F is written to screen. }
  Write (F, 'Finishing ');
  Close (f); { Closing a file always causes a flush first }
  Writeln ('off.');
end.
```

37.10.84 FlushThread

Synopsis: Flush all standard files

Declaration: procedure FlushThread

Visibility: default

Description: FlushThread flushes any buffers from standard file descriptors such as standard input/output/error. It should normally not be called by user code, but is executed when a thread exits.

See also: EndThread ([1312](#))

37.10.85 FPower10

Synopsis: Fast multiply with a power of 10

Declaration: function FPower10(val: Extended; Power: LongInt) : Extended

Visibility: default

Description: FPower10 multiplies val with 10 to the power Power. It uses a fast algorithm to calculate the result.

37.10.86 frac

Synopsis: Return fractional part of floating point value.

Declaration: function frac(d: ValReal) : ValReal

Visibility: default

Description: Frac returns the non-integer part of X.

Errors: None.

See also: Round ([1395](#)), Int ([1341](#))

Listing: ./refex/ex27.pp

```
Program Example27;

{ Program to demonstrate the Frac function. }

Var R : Real;

begin
  Writeln (Frac (123.456):0:3); { Prints 0.456 }
  Writeln (Frac (-123.456):0:3); { Prints -0.456 }
end.
```

37.10.87 Freemem

Synopsis: Release allocated memory

Declaration: procedure Freemem(p: pointer; Size: PtrUInt)
 function Freemem(p: pointer) : PtrUInt

Visibility: default

Description: Freemem releases the memory occupied by the pointer P, of size Count (in bytes), and returns it to the heap. P should point to the memory allocated to a dynamic variable.

Errors: An error will occur when P doesn't point to the heap.

See also: Getmem (1328), New (1351), Dispose (1309)

Listing: ./refex/ex28.pp

Program Example28;

{ Program to demonstrate the FreeMem and GetMem functions. }

```
Var P : Pointer;
    MM : Longint;

begin
    { Get memory for P }
    GetMem (P,80);
    FillChar (P^,80,' ');
    FreeMem (P,80);
end.
```

37.10.88 Freememory

Synopsis: Alias for FreeMem (1325)

Declaration: procedure Freememory(p: pointer; Size: PtrUInt)
function Freememory(p: pointer) : PtrUInt

Visibility: default

Description: FreeMemory is an alias for FreeMem (1325).

See also: FreeMem (1325)

37.10.89 FreeResource

Synopsis: Free a loaded resource

Declaration: function FreeResource(ResData: TFPResourceHGLOBAL) : LongBool

Visibility: default

Description: FreeResource unloads the resource identified by ResData from memory. The resource must have been loaded by LoadResource (1348). It returns True if the operation was successful, False otherwise.

Errors: On error, False is returned.

See also: FindResource (1323), LoadResource (1348), SizeofResource (1407), LockResource (1348), UnlockResource (1423), FreeResource (1326)

37.10.90 GetCurrentThreadId

Synopsis: Return the id of the currently running thread.

Declaration: function GetCurrentThreadId : TThreadID

Visibility: default

Description: GetCurrentThreadId returns the ID of the currently running thread. It can be used in calls such as KillThread ([1345](#)) or ThreadSetPriority ([1418](#))

Errors: None.

See also: KillThread ([1345](#)), ThreadSetPriority ([1418](#))

37.10.91 getdir

Synopsis: Return the current directory

Declaration: procedure getdir(drivenr: Byte; var dir: shortstring)
procedure getdir(drivenr: Byte; var dir: ansistring)

Visibility: default

Description: Getdir returns in dir the current directory on the drive drivenr, where {drivenr} is 1 for the first floppy drive, 3 for the first hard disk etc. A value of 0 returns the directory on the current disk. On linux and unix systems, drivenr is ignored, as there is only one directory tree.

Errors: An error is returned under dos, if the drive requested isn't ready.

See also: Chdir ([1297](#))

Listing: ./refex/ex29.pp

```
Program Example29;

{ Program to demonstrate the GetDir function. }

Var S : String;

begin
  GetDir (0,S);
  Writeln ('Current directory is : ',S);
end.
```

37.10.92 GetFPCHeapStatus

Synopsis: Return FPC heap manager status information

Declaration: function GetFPCHeapStatus : TFPCHepStatus

Visibility: default

Description: Return FPC heap manager status information

37.10.93 GetHeapStatus

Synopsis: Return the memory manager heap status.

Declaration: function GetHeapStatus : THeapStatus

Visibility: default

37.10.94 GetMem

Synopsis: Allocate new memory on the heap

Declaration: procedure Getmem(out p: pointer; Size: PtrUInt)
 function GetMem(size: PtrUInt) : pointer

Visibility: default

Description: `Getmem` reserves `Size` bytes memory on the heap, and returns a pointer to this memory in `p`. What happens if no more memory is available, depends on the value of the variable `ReturnNilIfGrowHeapfails` (1283): if the variable is `True` then `Nil` is returned. If the variable is `False`, a run-time error is generated. The default value is `False`, so by default an error is generated.

The newly allocated memory is not initialized in any way, and may contain garbage data. It must be cleared with a call to `FillChar` (1321) or `FillWord` (1322).

For an example, see `Freemem` (1325).

Errors: None.

See also: `Freemem` (1325), `Dispose` (1309), `New` (1351), `returnnilifgrowheapsfails` (1283)

37.10.95 GetMemory

Synopsis: Alias for `GetMem` (1328)

Declaration: procedure Getmemory(out p: pointer; Size: PtrUInt)
 function GetMemory(size: PtrUInt) : pointer

Visibility: default

Description: `Getmemory` is an alias for `GetMem` (1328).

See also: `GetMem` (1328)

37.10.96 GetMemoryManager

Synopsis: Return current memory manager

Declaration: procedure GetMemoryManager(var MemMgr: TMemoryManager)

Visibility: default

Description: `GetMemoryManager` stores the current Memory Manager record in `MemMgr`.

For an example, see the programmer's guide.

Errors: None.

See also: `SetMemoryManager` (1402), `IsMemoryManagerSet` (1344)

37.10.97 GetProcessID

Synopsis: Get the current process ID

Declaration: function GetProcessID : SizeUInt

Visibility: default

Description: GetProcessID returns the current process ID. The meaning of the return value of this call is system dependent.

Errors: None.

See also: GetThreadID ([1329](#))

37.10.98 GetResourceManager

Synopsis: Return the currently active resource manager

Declaration: procedure GetResourceManager (var Manager: TResourceManager)

Visibility: default

Description: GetResourceManager returns the currently active resource manager record in Manager. There is always an active resource manager record.

Errors: None.

See also: TResourceManager ([1271](#)), SetResourceManager ([1403](#))

37.10.99 GetThreadID

Synopsis: Get the current Thread ID.

Declaration: function GetThreadID : TThreadID

Visibility: default

Description: GetThreadID returns the current process ID. The meaning of the return value of this call is system dependent.

See also: GetProcessID ([1328](#))

37.10.100 GetThreadManager

Synopsis: Return the current thread manager

Declaration: function GetThreadManager (var TM: TThreadManager) : Boolean

Visibility: default

Description: GetThreadManager returns the currently used thread manager in TM.

For more information about thread programming, see the programmer's guide.

See also: SetThreadManager ([1405](#)), TThreadManager ([1275](#))

37.10.101 GetUnicodeStringManager

Synopsis: Return a copy of the currently active unicodestring manager.

Declaration: procedure GetUnicodeStringManager (var Manager: TUnicodeStringManager)

Visibility: default

Description: `GetUnicodeStringManager` returns a copy of the currently active unicode string manager in `Old`

UnicodeStrings are implemented in different ways on different platforms. Therefore, the Free Pascal Runtime library has no fixed implementation of widestring routines. Instead, it defines a UnicodeStringManager record, with callbacks that can be set to an implementation which is most efficient on the current platform. On windows, standard Windows routines will be used. On Unix and Linux, an implementation based on the C library is available (in unit `cwstring`).

It is possible to implement a custom unicodestring manager, optimized for the current application, without having to recompile the complete Run-Time Library.

See also: [SetUnicodeStringManager \(1405\)](#), [TUnicodeStringManager \(1276\)](#)

37.10.102 GetVariantManager

Synopsis: Return the current variant manager.

Declaration: `procedure GetVariantManager(var VarMgr: tvariantmanager)`

Visibility: default

Description: `GetVariantManager` returns the current variant manager in `varmgr`.

See also: [SetVariantManager \(1405\)](#)

37.10.103 GetWideStringManager

Synopsis: Return a copy of the currently active widestring manager.

Declaration: `procedure GetWideStringManager(var Manager: TUnicodeStringManager)`

Visibility: default

Description: `GetWideStringManager` returns a copy of the currently active heap manager in `Old`

WideStrings are implemented in different ways on different platforms. Therefore, the Free Pascal Runtime library has no fixed implementation of widestring routines. Instead, it defines a WideString manager record, with callbacks that can be set to an implementation which is most efficient on the current platform. On windows, standard Windows routines will be used. On Unix and Linux, an implementation based on the C library is available (in unit `cwstring`).

It is possible to implement a custom widestring manager, optimized for the current application, without having to recompile the complete Run-Time Library.

See also: [SetWideStringManager \(1406\)](#), [TWideStringManager \(1280\)](#)

37.10.104 get_caller_addr

Synopsis: Return the address of the caller.

Declaration: `function get_caller_addr(framebp: pointer) : pointer`

Visibility: default

Description: `get_caller_frame` returns a pointer to address (the return address) of the caller of the routine which has as frame `framebp`.

See also: [get_frame \(1331\)](#), [get_caller_frame \(1331\)](#), [Dump_Stack \(1311\)](#)

37.10.105 get_caller_frame

Synopsis: Return the frame pointer of the caller

Declaration: function get_caller_frame(framebp: pointer) : pointer

Visibility: default

Description: `get_caller_frame` returns a pointer to the frame of the caller of the routine which has as frame `framebp`.

See also: [get_caller_addr \(1330\)](#), [get_frame \(1331\)](#), [Dump_Stack \(1311\)](#)

37.10.106 get_cmdline

Synopsis: Return the command-line as a null-terminated string

Declaration: function get_cmdline : PChar

Visibility: default

Description: `get_cmdline` returns the complete command-line as a null-terminated string. It is not recommended to use this function, since it builds a complete value from the actual command-line arguments. Instead, `ParamCount (1380)` and `ParamStr (1381)` should be used.

See also: [ParamCount \(1380\)](#), [ParamStr \(1381\)](#)

37.10.107 get_frame

Synopsis: Return the current frame

Declaration: function get_frame : pointer

Visibility: default

Description: `get_frame` returns a pointer to the current stack frame.

See also: [get_caller_addr \(1330\)](#), [get_caller_frame \(1331\)](#)

37.10.108 halt

Synopsis: Stop program execution.

Declaration: procedure halt (errnum: LongInt)
procedure halt

Visibility: default

Description: `Halt` stops program execution and returns control to the calling program. The optional argument `Errnum` specifies an exit value. If omitted, zero is returned.

Errors: None.

See also: [Exit \(1317\)](#)

Listing: ./refex/ex30.pp

```
Program Example30;

{ Program to demonstrate the Halt function. }

begin
  WriteLn ('Before Halt.');
  Halt (1); { Stop with exit code 1 }
  WriteLn ('After Halt doesn''t get executed.');
end.
```

37.10.109 hexStr

Synopsis: Convert integer value to string with hexadecimal representation.

Declaration: function hexStr(Val: LongInt;cnt: Byte) : shortstring
 function hexStr(Val: Int64;cnt: Byte) : shortstring
 function hexStr(Val: QWord;cnt: Byte) : shortstring
 function hexStr(Val: Pointer) : shortstring

Visibility: default

Description: HexStr returns a string with the hexadecimal representation of Value. The string has exactly cnt charaters. (i.e. only the cnt rightmost nibbles are taken into account) To have a complete representation of a Longint-type value, 8 nibbles are needed, i.e. cnt=8.

Errors: None.

See also: Str (1410), Val (1425), BinStr (1292)

Listing: ./refex/ex81.pp

```
Program example81;

{ Program to demonstrate the HexStr function }

Const Value = 45678;

Var I : longint;

begin
  For I:=1 to 10 do
    WriteLn (HexStr(Value,I));
end.
```

37.10.110 hi

Synopsis: Return high byte/word of value.

Declaration: function hi(b: Byte) : Byte
 function hi(i: Integer) : Byte
 function hi(w: Word) : Byte
 function hi(l: LongInt) : Word
 function hi(l: DWord) : Word
 function hi(i: Int64) : DWord
 function hi(q: QWord) : DWord

Visibility: default

Description: `Hi` returns the high byte or word from `X`, depending on the size of `X`. If the size of `X` is 4, then the high word is returned. If the size is 2 then the high byte is returned. `Hi` cannot be invoked on types of size 1, such as byte or char.

Errors: None

See also: `Lo` ([1347](#))

Listing: `./refex/ex31.pp`

Program Example31;

{ Program to demonstrate the `Hi` function. }

```
var
  L : Longint;
  W : Word;

begin
  L:=1 Shl 16;      { = $10000 }
  W:=1 Shl 8;       { = $100 }
  Writeln (Hi(L)); { Prints 1 }
  Writeln (Hi(W)); { Prints 1 }
end.
```

37.10.111 High

Synopsis: Return highest index of open array or enumerated

Declaration: `function High(Arg: TypeOrVariable) : TOrdinal`

Visibility: default

Description: The return value of `High` depends on it's argument:

- 1.If the argument is an ordinal type, `High` returns the highest value in the range of the given ordinal type.
- 2.If the argument is an array type or an array type variable then `High` returns the highest possible value of it's index.
- 3.If the argument is an open array identifier in a function or procedure, then `High` returns the highest index of the array, as if the array has a zero-based index.
- 4.If the argument is a set type then it returns the highest value of the underlying ordinal type.

The return type is always the same type as the type of the argument (This can lead to some nasty surprises!).

Errors: None.

See also: `Low` ([1349](#)), `Ord` ([1379](#)), `Pred` ([1383](#)), `Succ` ([1413](#))

Listing: `./refex/ex80.pp`

```

Program example80;

{ Example to demonstrate the High and Low functions. }

Type TEnum = ( North, East, South, West );
TRange = 14..55;
TArray = Array [2..10] of Longint;

Function Average (Row : Array of Longint) : Real;

Var I : longint;
      Temp : Real;

begin
  Temp := Row[0];
  For I := 1 to High(Row) do
    Temp := Temp + Row[i];
  Average := Temp / (High(Row)+1);
end;

Var A : TEnum;
      B : TRange;
      C : TArray;
      I : longint;

begin
  Writeln ('TEnum goes from : ',Ord(Low(TEnum)), ' to ', Ord(high(TEnum)), '.');
  Writeln ('A goes from : ',Ord(Low(A)), ' to ', Ord(high(A)), '.');
  Writeln ('TRange goes from : ',Ord(Low(TRange)), ' to ', Ord(high(TRange)), '.');
  Writeln ('B goes from : ',Ord(Low(B)), ' to ', Ord(high(B)), '.');
  Writeln ('TArray index goes from : ',Ord(Low(TArray)), ' to ', Ord(high(TArray)), '.');
  Writeln ('C index goes from : ',Low(C), ' to ', high(C), '.');
  For I:=Low(C) to High(C) do
    C[i]:=I;
  Writeln ('Average : ',Average(c));
  Write ('Type of return value is always same as type of argument:');
  Writeln (high(high(word)));
end.

```

37.10.112 HINSTANCE

Synopsis: Windows compatibility type for use in resources

Declaration: function HINSTANCE : TFPResourceHMODULE

Visibility: default

Description: This is an opaque type.

37.10.113 Inc

Synopsis: Increase value of integer variable

Declaration: procedure Inc(var X: TOrdinal)
procedure Inc(var X: TOrdinal; Increment: TOrdinal)

Visibility: default

Description: `Inc` increases the value of `X` with `Increment`. If `Increment` isn't specified, then 1 is taken as a default.

Errors: If range checking is on, then A range check can occur, or an overflow error, when an attempt is made to increase `X` over its maximum value.

See also: [Dec \(1306\)](#)

Listing: `./refex/ex32.pp`

Program Example32;

{ Program to demonstrate the Inc function. }

Const

```
C : Cardinal    = 1;
L : Longint     = 1;
I : Integer      = 1;
W : Word         = 1;
B : Byte          = 1;
SI : ShortInt   = 1;
CH : Char        = 'A';
```

begin

```
Inc (C);       { C:=2      }
Inc (L,5);     { L:=6      }
Inc (I,-3);    { I:=-2     }
Inc (W,3);     { W:=4      }
Inc (B,100);   { B:=101    }
Inc (SI,-3);   { Si:=-2    }
Inc (CH,1);    { ch:='B'   }
```

end.

37.10.114 Include

Synopsis: Include element in set if it was not yet present.

Declaration: `procedure Include(var S: TSetType; E: TSetElement)`

Visibility: default

Description: `Include` includes `E` in the set `S` if it is not yet part of the set. `E` should be of the same type as the base type of the set `S`.

Thus, the two following statements do the same thing:

```
S:=S+[E];
Include(S,E);
```

For an example, see [Exclude \(1316\)](#)

Errors: If the type of the element `E` is not equal to the base type of the set `S`, the compiler will generate an error.

See also: [Exclude \(1316\)](#)

37.10.115 IndexByte

Synopsis: Search for a byte in a memory range.

Declaration: function IndexByte(const buf;len: SizeInt;b: Byte) : SizeInt

Visibility: default

Description: IndexByte searches the memory at buf for maximally len positions for the byte b and returns its position if it found one. If b is not found then -1 is returned. The position is zero-based.

Errors: Buf and Len are not checked to see if they are valid values.

See also: IndexChar ([1336](#)), IndexDWord ([1337](#)), IndexWord ([1338](#)), CompareByte ([1298](#))

Listing: ./refex/ex105.pp

```
Program Example105;

{ Program to demonstrate the IndexByte function. }

Const
  ArraySize = 256;
  MaxValue = 256;

Var
  Buffer : Array[1..ArraySize] of Byte;
  I,J : longint;
  K : Byte;

begin
  Randomize;
  For I:=1 To ArraySize do
    Buffer[I]:=Random(MaxValue);
  For I:=1 to 10 do
    begin
      K:=Random.MaxValue;
      J:=IndexByte(Buffer,ArraySize,K);
      if J=-1 then
        Writeln('Value ',K,' was not found in buffer.')
      else
        Writeln('Found ',K,' at position ',J,' in buffer');
    end;
end.
```

37.10.116 IndexChar

Synopsis: Search for a character in a memory range.

Declaration: function IndexChar(const buf;len: SizeInt;b: Char) : SizeInt

Visibility: default

Description: IndexChar searches the memory at buf for maximally len positions for the character b and returns its position if it found one. If b is not found then -1 is returned. The position is zero-based. The IndexChar0 variant stops looking if a null character is found, and returns -1 in that case.

Errors: Buf and Len are not checked to see if they are valid values.

See also: IndexByte (1336), IndexDWord (1337), IndexWord (1338), CompareChar (1299)

Listing: ./refex/ex108.pp

```

Program Example108;

{ Program to demonstrate the IndexChar function. }

Const
  ArraySize = 1000;
  MaxValue = 26;

Var
  Buffer : Array[1..ArraySize] of Char;
  I,J : longint;
  K : Char;

begin
  Randomize;
  For I:=1 To ArraySize do
    Buffer[I]:=chr(Ord('A')+Random(MaxValue));
  For I:=1 to 10 do
    begin
      K:=chr(Ord('A')+Random(MaxValue));
      J:=IndexChar(Buffer,ArraySize,K);
      if J=-1 then
        Writeln('Value ',K,' was not found in buffer.');
      else
        Writeln('Found ',K,' at position ',J,' in buffer');
      end;
  end.

```

37.10.117 IndexChar0

Synopsis: Return index of a character in null-terminated array of char.

Declaration: function IndexChar0(const buf;len: SizeInt;b: Char) : SizeInt

Visibility: default

Description: IndexChar0 returns the index of the character b in the null-terminated array Buf. At most len characters will be searched, or the null character if it is encountered first. If the character is not found, -1 is returned.

Errors: On error, -1 is returned.

See also: IndexByte (1336), IndexChar (1336), IndexWord (1338), IndexDWord (1337), CompareChar0 (1301)

37.10.118 IndexDWord

Synopsis: Search for a DWord value in a memory range.

Declaration: function IndexDWord(const buf;len: SizeInt;b: DWord) : SizeInt

Visibility: default

Description: IndexChar searches the memory at buf for maximally len positions for the DWord DW and returns it's position if it found one. If DW is not found then -1 is returned. The position is zero-based.

Errors: Buf and Len are not checked to see if they are valid values.

See also: IndexByte (1336), IndexChar (1336), IndexWord (1338), CompareDWord (1301)

Listing: ./refex/ex106.pp

Program Example106;

{ Program to demonstrate the IndexDWord function. }

Const

 ArraySize = 1000;
 MaxValue = 1000;

Var

 Buffer : **Array**[1..ArraySize] **of** DWord;
 I,J : longint;
 K : DWord;

begin

Randomize;
 For I:=1 **To** ArraySize **do**
 Buffer[I]:=Random(MaxValue);
 For I:=1 **to** 10 **do**
 begin
 K:=Random(MaxValue);
 J:=IndexDWord(Buffer,ArraySize,K);
 if J=-1 **then**
 WriteLn('Value ',K,' was not found in buffer.')
 else
 WriteLn('Found ',K,' at position ',J,' in buffer');
 end;
 end.

37.10.119 IndexQWord

Synopsis: Return the position of a QWord in a memory range

Declaration: `function IndexQWord(const buf;len: SizeInt;b: QWord) : SizeInt`

Visibility: default

Description: `IndexQWord` checks the first `len` qwords starting at `Buf`, and returns the position (zero-based) of `b`. If `b` does not appear in the first `len` qwords, then -1 is returned.

Note that the search is done on QWord boundaries, but that the address of `buf` need not be on a QWord boundary.

Errors: No check is done to see whether the indicated memory range is valid. If it is not, a run-error or exception may be triggered.

See also: IndexDWord (1337)

37.10.120 Indexword

Synopsis: Search for a WORD value in a memory range.

Declaration: `function Indexword(const buf;len: SizeInt;b: Word) : SizeInt`

Visibility: default

Description: `IndexChar` searches the memory at `buf` for maximally `len` positions for the Word `W` and returns its position if it found one. If `W` is not found then -1 is returned.

Errors: `Buf` and `Len` are not checked to see if they are valid values.

See also: `IndexByte` (1336), `IndexDWord` (1337), `IndexChar` (1336), `CompareWord` (1302)

Listing: ./refex/ex107.pp

Program Example107;

```
{ Program to demonstrate the IndexWord function. }

Const
  ArraySize = 1000;
  MaxValue = 1000;

Var
  Buffer : Array[1..ArraySize] of Word;
  I,J : longint;
  K : Word;

begin
  Randomize;
  For I:=1 To ArraySize do
    Buffer[I]:=Random(MaxValue);
  For I:=1 to 10 do
    begin
      K:=Random.MaxValue;
      J:=IndexWord(Buffer,ArraySize,K);
      if J=-1 then
        Writeln('Value ',K,' was not found in buffer.')
      else
        Writeln('Found ',K,' at position ',J,' in buffer');
      end;
  end.

---


```

37.10.121 InitCriticalSection

Synopsis: Initialize a critical section

Declaration: `procedure InitCriticalSection(var cs: TRTCriticalSection)`

Visibility: default

Description: `InitCriticalSection` initializes a critical section `CS` for use. Before using a critical section with `EnterCriticalSection` (1312) or `LeaveCriticalSection` (1345) the critical section should be initialized with `InitCriticalSection`.

When a critical section is no longer used, it should be disposed of with `DoneCriticalSection` (1310)

See also: `DoneCriticalSection` (1310), `EnterCriticalSection` (1312), `LeaveCriticalSection` (1345)

37.10.122 InitThread

Synopsis: Initialize a thread

Declaration: procedure InitThread(stklen: SizeUInt)

Visibility: default

Description: Do not use, this is used internally by the thread manager.

37.10.123 InitThreadVars

Synopsis: Initialize threadvars

Declaration: procedure InitThreadVars(RelocProc: Pointer)

Visibility: default

Description: This routine should be called when threading is started. It is called by the compiler and should never be called manually, only from a thread manager.

Errors: None.

See also: TThreadManager (1275), TThreadManager.InitThreadVar (1)

37.10.124 Insert

Synopsis: Insert one string in another.

```
Declaration: procedure Insert(const source: shortstring; var s: shortstring;
                           index: SizeInt)
procedure Insert(source: Char; var s: shortstring; index: SizeInt)
procedure Insert(const Source: AnsiString; var S: AnsiString;
                Index: SizeInt)
procedure Insert(const Source: UnicodeString; var S: UnicodeString;
                Index: SizeInt)
procedure Insert(const Source: WideString; var S: WideString;
                Index: SizeInt)
```

Visibility: default

Description: Insert inserts string Source in string S, at position Index, shifting all characters after Index to the right. The resulting string is truncated at 255 characters, if needed. (i.e. for shortstrings)

Errors: None.

See also: Delete (1308), Copy (1305), Pos (1382)

Listing: ./refex/ex33.pp

Program Example33;

{ Program to demonstrate the Insert function. }

Var S : String;

begin
S:= 'Free Pascal is difficult to use !';
Insert ('NOT ',S,**pos**('difficult',S));

```
writeln (s);
end.
```

37.10.125 int

Synopsis: Calculate integer part of floating point value.

Declaration: function int(d: ValReal) : ValReal

Visibility: default

Description: Int returns the integer part of any Real X, as a Real.

Errors: None.

See also: Frac ([1325](#)), Round ([1395](#))

Listing: ./refex/ex34.pp

Program Example34;

{ Program to demonstrate the Int function. }

begin

 Writeln (Int(123.456):0:1); { Prints 123.0 }
 Writeln (Int(-123.456):0:1); { Prints -123.0 }

end.

37.10.126 InterlockedCompareExchange

Synopsis: Conditional exchange

Declaration: function InterlockedCompareExchange(var Target: LongInt;
 NewValue: LongInt;Comperand: LongInt)
 : LongInt
 function InterlockedCompareExchange(var Target: Pointer;
 NewValue: Pointer;Comperand: Pointer)
 : Pointer
 function InterlockedCompareExchange(var Target: Cardinal;
 NewValue: Cardinal;
 Comperand: Cardinal) : Cardinal

Visibility: default

Description: InterlockedCompareExchange does an compare-and-exchange operation on the specified values in a thread-safe way. The function compares Target and Comperand and exchanges Target with NewValue if Target and Comperand are equal. It returns the old value of Target. This is done in a thread-safe way, i.e., only one processor is accessing the Target variable at a time.

Errors: None.

See also: InterLockedDecrement ([1342](#)), InterLockedIncrement ([1343](#)), InterLockedExchange ([1342](#)), InterLockedExchangeAdd ([1342](#))

37.10.127 InterLockedDecrement

Synopsis: Thread-safe decrement

Declaration: function InterLockedDecrement(var Target: LongInt) : LongInt
 function InterLockedDecrement(var Target: Pointer) : Pointer
 function InterLockedDecrement(var Target: Cardinal) : Cardinal

Visibility: default

Description: InterLockedDecrement decrements Target with 1 and returns the result. This is done in a thread-safe way. (i.e. only one processor is accessing the variable at a time).

Errors: None.

See also: [InterLockedIncrement \(1343\)](#), [InterLockedExchange \(1342\)](#), [InterLockedExchangeAdd \(1342\)](#), [InterlockedCompareExchange \(1341\)](#)

37.10.128 InterLockedExchange

Synopsis: Exchange 2 integers in a thread-safe way

Declaration: function InterLockedExchange(var Target: LongInt; Source: LongInt) : LongInt
 function InterLockedExchange(var Target: Pointer; Source: Pointer) : Pointer
 function InterLockedExchange(var Target: Cardinal; Source: Cardinal) : Cardinal

Visibility: default

Description: InterLockedExchange stores Source in Target and returns the old value of Target. This is done in a thread-safe way, i.e., only one processor is accessing the Target variable at a time.

Errors: None.

See also: [InterLockedDecrement \(1342\)](#), [InterLockedIncrement \(1343\)](#), [InterLockedExchangeAdd \(1342\)](#), [InterlockedCompareExchange \(1341\)](#)

37.10.129 InterLockedExchangeAdd

Synopsis: Thread-safe add and exchange of 2 values

Declaration: function InterLockedExchangeAdd(var Target: LongInt; Source: LongInt) : LongInt
 function InterLockedExchangeAdd(var Target: Pointer; Source: Pointer) : Pointer
 function InterLockedExchangeAdd(var Target: Cardinal; Source: Cardinal) : Cardinal

Visibility: default

Description: InterLockedExchangeAdd adds to Target the value of Source in a thread-safe way, and returns the old value of Target. This is done in a thread-safe way, i.e., only one processor is accessing the Target variable at a time.

Errors: None.

See also: [InterLockedDecrement \(1342\)](#), [InterLockedIncrement \(1343\)](#), [InterLockedExchange \(1342\)](#), [InterlockedCompareExchange \(1341\)](#)

37.10.130 InterLockedIncrement

Synopsis: Thread-safe increment

Declaration: function InterLockedIncrement(var Target: LongInt) : LongInt
function InterLockedIncrement(var Target: Pointer) : Pointer
function InterLockedIncrement(var Target: Cardinal) : Cardinal

Visibility: default

Description: InterLockedIncrement increments Target with 1 and returns the result. This is done in a thread-safe way (i.e. only one processor is accessing the variable at a time).

Errors: None.

See also: InterLockedDecrement ([1342](#)), InterLockedExchange ([1342](#)), InterLockedExchangeAdd ([1342](#)), InterlockedCompareExchange ([1341](#))

37.10.131 IOResult

Synopsis: Return result of last file IO operation

Declaration: function IOResult : Word

Visibility: default

Description: IOresult contains the result of any input/output call, when the `\$i-` compiler directive is active, disabling IO checking. When the flag is read, it is reset to zero. If IOresult is zero, the operation completed successfully. If non-zero, an error occurred. The following errors can occur:

dos errors :

2File not found.

3Path not found.

4Too many open files.

5Access denied.

6Invalid file handle.

12Invalid file-access mode.

15Invalid disk number.

16Cannot remove current directory.

17Cannot rename across volumes.

I/O errors :

100Error when reading from disk.

101Error when writing to disk.

102File not assigned.

103File not open.

104File not opened for input.

105File not opened for output.

106Invalid number.

Fatal errors :

150Disk is write protected.

151Unknown device.

152Drive not ready.

153Unknown command.

154CRC check failed.

155Invalid drive specified..

156Seek error on disk.

157Invalid media type.

158Sector not found.

159Printer out of paper.

160Error when writing to device.

161Error when reading from device.

162Hardware failure.

Errors: None.

Listing: ./refex/ex35.pp

```
Program Example35;
{ Program to demonstrate the IOResult function. }

Var F : text;

begin
  Assign (f, paramstr(1));
  {$i-}
  Reset (f);
  {$i+}
  If IOresult<>0 then
    writeln ('File ', paramstr(1), ' doesn''t exist')
  else
    writeln ('File ', paramstr(1), ' exists');
end.
```

37.10.132 IsMemoryManagerSet

Synopsis: Is the memory manager set

Declaration: function IsMemoryManagerSet : Boolean

Visibility: default

Description: IsMemoryManagerSet will return True if the memory manager has been set to another value than the system heap manager, it will return False otherwise.

Errors: None.

See also: SetMemoryManager (1402), GetMemoryManager (1328)

37.10.133 Is_IntResource

Synopsis: Check whether a resource is an internal resource

Declaration: function Is_IntResource(aStr: PChar) : Boolean

Visibility: default

Description: Is_IntResource returns True if the resource type is internal (system predefined) resource or false if it is a user-defined resource type.

Errors: None.

37.10.134 KillThread

Synopsis: Kill a running thread

Declaration: function KillThread(threadHandle: TThreadID) : DWord

Visibility: default

Description: KillThread causes a running thread to be aborted. The thread is identified by its handle or ID threadHandle.

The function returns zero if successful. A nonzero return value indicates failure.

Errors: If a failure occurred, a nonzero result is returned. The meaning is system dependent.

See also: WaitForThreadTerminate (1427), EndThread (1312), SuspendThread (1413)

37.10.135 LeaveCriticalSection

Synopsis: Leave a critical section

Declaration: procedure LeaveCriticalSection(var cs: TRTCriticalSection)

Visibility: default

Description: LeaveCriticalSection signals that the current thread is exiting the critical section CS it has entered with EnterCriticalSection (1312).

The critical section must have been initialized with InitCriticalSection (1339) prior to a call to EnterCriticalSection and LeaveCriticalSection.

See also: InitCriticalSection (1339), DoneCriticalSection (1310), EnterCriticalSection (1312)

37.10.136 Length

Synopsis: Returns length of a string or array.

Declaration: function Length(S: AStringType) : Integer
function Length(A: DynArrayType) : Integer

Visibility: default

Description: Length returns the length of the string or array S, which is limited to 255 for shortstrings. If the string S is empty, 0 is returned.

Note: The length of the string S is stored in S[0] for shortstrings only. The Length function should always be used on ansistrings and widestrings.

For dynamical or statical arrays, the function returns the number of elements in the array.

Length also supports arguments of type PChar and PWideChar, in which case it is identical to the StrLen and WStrLen functions, respectively. In this case, the function actually calculates the length of the null-terminated string, and its execution time is proportional to the string length because the terminating null character is searched through a linear scan.

Errors: None.

See also: Pos (1382), SetLength (1402)

Listing: ./refex/ex36.pp

```
Program Example36;

{ Program to demonstrate the Length function. }

type
  somebytes = array [6..10] of byte;
  somewords = array [3..10] of word;

Var
  S : String;
  I : Integer;
  bytes : somebytes;
  words : somewords;

begin
  S:= '';
  for i:=1 to 10 do
    begin
      S:=S+'*';
      Writeln (Length(S):2,' : ',S);
    end;
  Writeln ('Bytes : ',length(bytes));
  Writeln ('Words : ',length(words));
end.
```

37.10.137 LEtoN

Synopsis: Convert Little-Endian-ordered integer to Native-ordered integer

Declaration: function LEtoN(const AValue: SmallInt) : SmallInt
 function LEtoN(const AValue: Word) : Word
 function LEtoN(const AValue: LongInt) : LongInt
 function LEtoN(const AValue: DWord) : DWord
 function LEtoN(const AValue: Int64) : Int64
 function LEtoN(const AValue: QWord) : QWord

Visibility: default

Description: LEtoN will rearrange the bytes in a Little-Endian number to the native order for the current processor. That is, for a little-endian processor, it will do nothing, and for a big-endian processor, it will invert the order of the bytes.

See also: BEtoN (1291), NtoBE (1352), NtoLE (1352)

37.10.138 In

Synopsis: Calculate logarithm

Declaration: function ln(d: ValReal) : ValReal

Visibility: default

Description: Ln returns the natural logarithm of the Real parameter X. X must be positive.

Errors: An run-time error will occur when X is negative.

See also: Exp (1318), Power (1383)

Listing: ./refex/ex37.pp

Program Example37;

{ Program to demonstrate the Ln function. }

```
begin
  Writeln (Ln(1)); { Prints 0 }
  Writeln (Ln(Exp(1))); { Prints 1 }
end.
```

37.10.139 Lo

Synopsis: Return low byte/word of value.

Declaration: function lo(B: Byte) : Byte
 function lo(i: Integer) : Byte
 function lo(w: Word) : Byte
 function lo(l: LongInt) : Word
 function lo(l: DWord) : Word
 function lo(i: Int64) : DWord
 function lo(q: QWord) : DWord

Visibility: default

Description: Lo returns the low byte of its argument if this is of type Integer or Word. It returns the low word of its argument if this is of type Longint or Cardinal.

Errors: None.

See also: Ord (1379), Chr (1297), Hi (1332)

Listing: ./refex/ex38.pp

Program Example38;

{ Program to demonstrate the Lo function. }

```
Var L : Longint;
     W : Word;

begin
  L:=(1 Shl 16) + (1 Shl 4); { $10010 }
  Writeln (Lo(L)); { Prints 16 }
  W:=(1 Shl 8) + (1 Shl 4); { $110 }
```

```
  WriteIn (Lo(W));           { Prints 16 }
end.
```

37.10.140 LoadResource

Synopsis: Load a resource for use

Declaration: function LoadResource (ModuleHandle: TFPResourceHMODULE;
ResHandle: TFPResourceHandle) : TFPResourceHGLOBAL

Visibility: default

Description: LoadResource loads a resource identified by ResHandle from a module identified by ModuleHandle into memory. It returns a handle to the resource.

Loaded resources must be unloaded again using the FreeResource ([1326](#)) function.

Errors: On error, 0 is returned.

See also: FindResource ([1323](#)), FreeResource ([1326](#)), SizeofResource ([1407](#)), LockResource ([1348](#)), UnlockResource ([1423](#)), FreeResource ([1326](#))

37.10.141 LockResource

Synopsis: Lock a resource

Declaration: function LockResource (ResData: TFPResourceHGLOBAL) : Pointer

Visibility: default

Description: LockResource locks a resource previously loaded by LoadResource into memory. This means that any attempt to modify the resource will fail while it is locked. The function returns a pointer to the resource location in memory.

The resource can be freed again using the UnlockResource ([1423](#)) function.

Errors: if the function fails, Nil is returned.

See also: FindResource ([1323](#)), FreeResource ([1326](#)), SizeofResource ([1407](#)), LoadResource ([1348](#)), UnlockResource ([1423](#)), FreeResource ([1326](#))

37.10.142 longjmp

Synopsis: Jump to address.

Declaration: procedure longjmp (var S: jmp_buf; value: LongInt)

Visibility: default

Description: LongJmp jumps to the address in the envjmp_buf, and restores the registers that were stored in it at the corresponding SetJmp ([1401](#)) call. In effect, program flow will continue at the SetJmp call, which will return value instead of 0. If a value equal to zero is passed, it will be converted to 1 before passing it on. The call will not return, so it must be used with extreme care. This can be used for error recovery, for instance when a segmentation fault occurred.

For an example, see SetJmp ([1401](#))

Errors: None.

See also: SetJmp ([1401](#))

37.10.143 Low

Synopsis: Return lowest index of open array or enumerated

Declaration: function Low(Arg: TypeOrVariable) : TOrdinal

Visibility: default

Description: The return value of Low depends on it's argument:

- 1.If the argument is an ordinal type, Low returns the lowest value in the range of the given ordinal type.
- 2.If the argument is an array type or an array type variable then Low returns the lowest possible value of it's index.
- 3.If the argument is an open array identifier in a function or procedure, then Low returns the lowest element of the array, which is always zero.
- 4.If the argument is a set type then it returns the lowest value of the underlying ordinal type.

The return type is always the same type as the type of the argument.

for an example, see High ([1333](#)).

Errors: None.

See also: High ([1333](#)), Ord ([1379](#)), Pred ([1383](#)), Succ ([1413](#))

37.10.144 lowerCase

Synopsis: Return lowercase version of a string.

Declaration: function lowerCase(const s: shortstring) : shortstring; Overload
 function lowerCase(c: Char) : Char; Overload
 function lowercase(const s: ansistring) : ansistring

Visibility: default

Description: Lowercase returns the lowercase version of its argument C. If its argument is a string, then the complete string is converted to lowercase. The type of the returned value is the same as the type of the argument.

Errors: None.

See also: Upcase ([1423](#))

Listing: ./refex/ex73.pp

```
program Example73;

{ Program to demonstrate the Lowercase function. }

var c:char;

begin
  for c:= 'A' to 'Z' do
    write(lowercase(c));
  Writeln;
  Writeln(lowercase('ABCDEFGHIJKLMNPQRSTUVWXYZ'));
end.
```

37.10.145 MakeLangID

Synopsis: Create a language ID

Declaration: function MakeLangID(primary: Word; sub: Word) : Word

Visibility: default

Description: MakeLangID creates a language ID from the primary and sub language IDs.

37.10.146 MemSize

Synopsis: Return the size of a memory block.

Declaration: function MemSize(p: pointer) : PtrUInt

Visibility: default

Description: MemSize returns the size of a memory block on the heap.

Errors: Passing an invalid pointer may lead to run-time errors (access violations).

See also: GetMem ([1328](#)), FreeMem ([1325](#))

37.10.147 mkdir

Synopsis: Create a new directory.

Declaration: procedure mkdir(const s: string); Overload

Visibility: default

Description: Mkdir creates a new directory S.

For an example, see Rmdir ([1392](#)).

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Chdir ([1297](#)), Rmdir ([1392](#))

37.10.148 Move

Synopsis: Move data from one location in memory to another

Declaration: procedure Move(const source; var dest; count: SizeInt)

Visibility: default

Description: Move moves Count bytes from Source to Dest.

Errors: If either Dest or Source is outside the accessible memory for the process, then a run-time error will be generated.

See also: Fillword ([1322](#)), Fillchar ([1321](#))

Listing: ./refex/ex42.pp

```
Program Example42;

{ Program to demonstrate the Move function. }

Var S1,S2 : String [30];

begin
  S1:= 'Hello World !';
  S2:= 'Bye, bye !';
  Move (S1,S2,Sizeof(S1));
  Writeln (S2);
end.
```

37.10.149 MoveChar0

Synopsis: Move data till first zero character

Declaration: procedure MoveChar0(const buf1;var buf2;len: SizeInt)

Visibility: default

Description: MoveChar0 moves Count bytes from buf1 to buf2, and stops moving if a zero character is found.

Errors: No checking is done to see if Count stays within the memory allocated to the process.

See also: [Move \(1350\)](#)

Listing: ./refex/ex109.pp

```
Program Example109;

{ Program to demonstrate the MoveChar0 function. }

Var
  Buf1,Buf2 : Array[1..80] of char;
  l : longint;

begin
  Randomize;
  For l:=low(buf1) to high(buf1) do
    Buf1[i]:=chr(Random(16)+Ord('A'));
  Writeln('Original buffer');
  writeln(Buf1);
  Buf1[Random(80)+1]:=#0;
  MoveChar0(Buf1,Buf2,80);
  Writeln('Randomly zero-terminated Buffer');
  Writeln(Buf2);
end.
```

37.10.150 New

Synopsis: Dynamically allocate memory for variable

Declaration: procedure New(var P: Pointer)
procedure New(var P: Pointer;Cons: TProcedure)

Visibility: default

Description: New allocates a new instance of the type pointed to by P, and puts the address in P. If P is an object, then it is possible to specify the name of the constructor with which the instance will be created.

The newly allocated memory is not initialized in any way, and may contain garbage data. It must be cleared with a call to FillChar ([1321](#)) or FillWord ([1322](#)).

For an example, see Dispose ([1309](#)).

Errors: If not enough memory is available, Nil will be returned.

See also: Dispose ([1309](#)), Freemem ([1325](#)), Getmem ([1328](#))

37.10.151 NtoBE

Synopsis: Convert Native-ordered integer to a Big Endian-ordered integer

Declaration: function NtoBE(const AValue: SmallInt) : SmallInt
function NtoBE(const AValue: Word) : Word
function NtoBE(const AValue: LongInt) : LongInt
function NtoBE(const AValue: DWord) : DWord
function NtoBE(const AValue: Int64) : Int64
function NtoBE(const AValue: QWord) : QWord

Visibility: default

Description: NToBE will rearrange the bytes in a natively-ordered number to the Big-Endian order. That is, for a Little-Endian processor, it will invert the order of the bytes and for a big-endian processor, it will do nothing.

See also: BEtoN ([1291](#)), LEtoN ([1346](#)), NtoLE ([1352](#))

37.10.152 NtoLE

Synopsis: Convert Native-ordered integer to a Little Endian-ordered integer

Declaration: function NtoLE(const AValue: SmallInt) : SmallInt
function NtoLE(const AValue: Word) : Word
function NtoLE(const AValue: LongInt) : LongInt
function NtoLE(const AValue: DWord) : DWord
function NtoLE(const AValue: Int64) : Int64
function NtoLE(const AValue: QWord) : QWord

Visibility: default

Description: NToLE will rearrange the bytes in a natively-ordered number to the little-Endian order. That is, for a Big-Endian processor, it will invert the order of the bytes and for a Little-Endian processor, it will do nothing.

See also: BEtoN ([1291](#)), LEtoN ([1346](#)), NtoBE ([1352](#))

37.10.153 Null

Synopsis: Null variant

Declaration: function Null : Variant

Visibility: default

37.10.154 OctStr

Synopsis: Convert integer to a string with octal representation.

Declaration: function OctStr(Val: LongInt;cnt: Byte) : shortstring
 function OctStr(Val: Int64;cnt: Byte) : shortstring
 function OctStr(Val: QWord;cnt: Byte) : shortstring

Visibility: default

Description: OctStr returns a string with the octal representation of Value. The string has exactly cnt characters.

Errors: None.

See also: Str (1410), Val (1425), BinStr (1292), HexStr (1332)

Listing: ./refex/ex112.pp

```
Program example112;

{ Program to demonstrate the OctStr function }

Const Value = 45678;

Var I : longint;

begin
  For I:=1 to 10 do
    Writeln (OctStr(Value,I));
  For I:=1 to 16 do
    Writeln (OctStr(I,3));
end.
```

37.10.155 odd

Synopsis: Is a value odd or even ?

Declaration: function odd(l: LongInt) : Boolean
 function odd(l: LongWord) : Boolean
 function odd(l: Int64) : Boolean
 function odd(l: QWord) : Boolean

Visibility: default

Description: Odd returns True if X is odd, or False otherwise.

Errors: None.

See also: Abs (1284), Ord (1379)

Listing: ./refex/ex43.pp

```
Program Example43;

{ Program to demonstrate the Odd function. }

begin
  If Odd(1) Then
```

```

  Writeln ('Everything OK with 1 !');
  If Not Odd(2) Then
    Writeln ('Everything OK with 2 !');
end.
```

37.10.156 Ofs

Synopsis: Return offset of a variable.

Declaration: function Ofs(var X) : LongInt

Visibility: default

Description: Ofs returns the offset of the address of a variable. This function is only supported for compatibility. In Free Pascal, it returns always the complete address of the variable, since Free Pascal is a 32/64 bit compiler.

Errors: None.

See also: DSeg ([1310](#)), CSeg ([1306](#)), Seg ([1400](#)), Ptr ([1383](#))

Listing: ./refex/ex44.pp

```

Program Example44;
{ Program to demonstrate the Ofs function. }

Var W : Pointer;

begin
  W:= Pointer(Ofs(W)); { W contains its own offset. }
end.
```

37.10.157 operator *(variant, variant): variant

Synopsis: Implement multiplication (*) operation on variants.

Declaration: operator operator *(variant, variant): variant(const op1: variant;
 const op2: variant)
 : variant

Visibility: default

Description: The implementation of the multiplication * operation is delegated to the variant manager with operation opMultiply.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator /(variant, variant): variant ([1356](#))

37.10.158 operator **(variant, variant): variant

Synopsis: Implement power ($\star\star$) operation on variants.

Declaration: `operator operator **(variant, variant): variant(const op1: variant;
const op2: variant)
: variant`

Visibility: default

Description: The implementation of the power $\star\star$ operation is delegated to the variant manager with operation `opPower`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: [operator *\(variant, variant\): variant \(1354\)](#)

37.10.159 operator +(variant, variant): variant

Synopsis: Implement addition (+) operation on variants.

Declaration: `operator operator +(variant, variant): variant(const op1: variant;
const op2: variant)
: variant`

Visibility: default

Description: The implementation of the addition + operation is delegated to the variant manager with operation `opAdd`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: [operator -\(variant, variant\): variant \(1356\)](#)

37.10.160 operator -(variant): variant

Synopsis: Implement – (unary minus, negation) operation on variants.

Declaration: `operator operator -(variant): variant(const op: variant) : variant`

Visibility: default

Description: The implementation of the unary minus (–) operation is delegated to the variant manager with operation `varNeg`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: [operator -\(variant, variant\): variant \(1356\)](#)

37.10.161 operator -(variant, variant): variant

Synopsis: Implement subtraction (-) operation on variants.

Declaration: operator operator -(variant, variant): variant(const op1: variant;
const op2: variant)
: variant

Visibility: default

Description: The implementation of the subtraction – operation is delegated to the variant manager with operation opSubtract.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator -(variant, variant): variant (1356)

37.10.162 operator /(variant, variant): variant

Synopsis: Implement division (/) operation on variants.

Visibility: default

Description: The implementation of the division / operation is delegated to the variant manager with operation `opDivide`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator *(variant, variant): variant (1354)

37.10.163 operator :=(ansistring): olevariant

Synopsis:

Declaration: operator operator :=(ansistring): olevariant(const source: ansistring); olevariant

Visibility: default

Description:

37.10.164 operator :=(ansistring): variant

Synopsis:

Visibility: default

Description:

37.10.165 operator :=(Boolean): olevariant

Synopsis:

Declaration: `operator operator :=(Boolean): olevariant(const source: Boolean)`
 `: olevariant`

Visibility: default

Description:

37.10.166 operator :=(Boolean): variant

Synopsis:

Declaration: `operator operator :=(Boolean): variant(const source: Boolean) : variant`

Visibility: default

Description:

37.10.167 operator :=(Byte): olevariant

Synopsis:

Declaration: `operator operator :=(Byte): olevariant(const source: Byte) : olevariant`

Visibility: default

Description:

37.10.168 operator :=(Byte): variant

Synopsis:

Declaration: `operator operator :=(Byte): variant(const source: Byte) : variant`

Visibility: default

Description:

37.10.169 operator :=(Char): olevariant

Synopsis:

Declaration: `operator operator :=(Char): olevariant(const source: Char) : olevariant`

Visibility: default

Description:

37.10.170 operator :=(Char): variant

Synopsis:

Declaration: `operator operator :=(Char): variant(const source: Char) : variant`

Visibility: default

Description:

37.10.171 operator :=(comp): olevariant

Declaration: operator operator :=(comp): olevariant(const source: comp) : olevariant

Visibility: default

37.10.172 operator :=(comp): variant

Declaration: operator operator :=(comp): variant(const source: comp) : variant

Visibility: default

37.10.173 operator :=(currency): olevariant

Synopsis:

Visibility: default

Description:

37.10.174 operator :=(currency): variant

Synopsis:

Visibility: default

Description:

37.10.175 operator :=(Double): olevariant

Synopsis:

Visibility: default

Description:

37.10.176 operator :=(Double): variant

Synopsis:

Declaration: operator operator := (Double): variant (const source: Double) : variant

Visibility: default

Description:

37.10.177 operator :=(DWord): olevariant

Synopsis:

Visibility: default

Description:

37.10.178 operator :=(DWord): variant

Synopsis:

Declaration: operator operator := (DWord) : variant (const source: DWord) : variant

Visibility: default

Description:

37.10.179 operator :=(extended): olevariant

Visibility: default

37.10.180 operator :=(extended): variant

Visibility: default

37-10-181 operator :=(Int64): olevariant

Synopsis:

Declaration: operator operator :=(Int64): olevariant(const source: Int64);

Visibility: default

Description:

37.10.182 operator :=(Int64): variant

Synopsis:

Declaration: operator operator :=(Int64); variant(const source: Int64) : variant;

Visibility: default

Description:

37.10.183 operator :=(longbool): olevariant

Synopsis:

Visibility: default

Description:

37.10.184 operator :=(longbool): variant

Synopsis:

Visibility: default

Description:

37.10.185 operator :=(LongInt): olevariant

Synopsis:

Visibility: default

Description:

37.10.186 operator :=(LongInt): variant

Synopsis:

Declaration: operator operator :=(LongInt); variant(const source: LongInt) : variant;

Visibility: default

Description:

37.10.187 operator :=(olevariant): ansistring

Synopsis:

Declaration: operator operator :=(olevariant): ansistring(const source: olevariant); ansistring

Visibility: default

Description:

37.10.188 operator :=(olevariant): Boolean

Synopsis:

Declaration: operator operator :=(olevariant): Boolean (const source: olevariant); Boolean

Visibility: default

Description:

37.10.189 operator :=(olevariant): Byte

Synopsis:

Declaration: operator operator :=(olevariant): Byte(const source: olevariant) : Byte

Visibility: default

Description:

37.10.190 operator :=(olevariant): Char

Synopsis:

Declaration: operator operator :=(olevariant) : Char (const source: olevariant) : Char

Visibility: default

Description:

37.10.191 operator :=(olevariant): comp

Declaration: operator operator :=(olevariant): comp(const source: olevariant) : comp

Visibility: default

37.10.192 operator :=(olevariant): currency

Synopsis:

Visibility: default

Description:

37.10.193 operator :=(olevariant): Double

Synopsis:

Declaration: operator operator :=(olevariant): Double(const source: olevariant);

Visibility: default

Description:

37.10.194 operator :=(olevariant): DWord

Synopsis:

Declaration: operator operator :=(olevariant): DWord(const source: olevariant);

Visibility: default

Description:

37.10.195 operator :=(olevariant): extended

Visibility: default

37.10.196 operator :=(olevariant): Int64

Synopsis:

Declaration: operator operator :=(olevariant): Int64(const source: olevariant);

Visibility: default

Description:

37-10-197 operator :=(olevariant): longbool

Synopsis:

Declaration: operator operator :=(olevariant): longbool(const source: olevariant);

Visibility: default

Description:

37 10 198 operator :=(olevariant): LongInt

Synopsis:

Declaration: operator operator :=(olevariant): LongInt (const source: olevariant);

Visibility: default

Description:

37.10.199 operator :=(olevariant): QWord

Synopsis:

Declaration: operator operator :=(olevariant): QWord(const source: olevariant); QWord

Visibility: default

Description:

37.10.200 operator :=(olevariant): Real

Declaration: operator operator :=(olevariant): Real(const source: olevariant) : Real

Visibility: default

37.10.201 operator :=(olevariant): ShortInt

Synopsis:

Declaration: operator operator :=(olevariant): ShortInt (const source: olevariant);

Visibility: default

Description:

37.10.202 operator :=(olevariant): shortstring

Synopsis:

Visibility: default

Description:

37.10.203 operator :=(olevariant): single

Visibility: default

37 10 204 operator :=(olevariant): SmallInt

Synopsis:

Declaration: operator operator :=(olevariant): SmallInt (const source: olevariant);

Visibility: default

Description:

37.10.205 operator :=(olevariant): TDateTime

Synopsis:

Declaration: operator operator :=(olevariant): TDateTime(const source: olevariant);

Visibility: default

Description:

37.10.206 operator :=(olevariant): TError

Synopsis:

Visibility: default

Description:

37.10.207 operator :=(olevariant): UnicodeString

```
Declaration: operator operator :=(olevariant): UnicodeString  
                                (const source: olevariant)  
                                : UnicodeString
```

Visibility: default

37.10.208 operator :=(olevariant): variant

Synopsis:

Visibility: default

Description:

37.10.209 operator `:=`(olevariant): WideChar

Synopsis:

Declaration: operator operator :=(olevariant): WideChar(const source: olevariant);

Visibility: default

Description:

37.10.210 operator :=(olevariant): widestring

Synopsis:

Visibility: default

Description:

37.10.211 operator :=(olevariant): Word

Synopsis:

Declaration: operator operator :=(olevariant): Word(const source: olevariant) : Word

Visibility: default

Description:

37.10.212 operator :=(olevariant): wordbool

Synopsis:

Declaration: operator operator :=(olevariant): wordbool(const source: olevariant); wordbool

Visibility: default

Description:

37.10.213 operator :=(QWord): olevariant

Synopsis:

Visibility: default

Description:

37.10.214 operator :=(QWord): variant

Synopsis:

Declaration: operator operator :=(QWord) : variant (const source: QWord) : variant

Visibility: default

Description:

37.10.215 operator :=(Real): olevariant

Declaration: operator operator :=(Real): olevariant(const source: Real) : olevariant

Visibility: default

37.10.216 operator :=(Real): variant

Declaration: operator operator :=(Real): variant (const source: Real) : variant

Visibility: default

37.10.217 operator :=(real48): Double

Synopsis:

Declaration: operator operator :=(real48): Double (b: real48) : Double

Visibility: default

Description:

37.10.218 operator :=(real48): extended

Declaration: operator operator :=(real48): extended (b: real48) : extended

Visibility: default

37.10.219 operator :=(ShortInt): olevariant

Synopsis:

Declaration: operator operator :=(ShortInt): olevariant (const source: ShortInt) : olevariant

Visibility: default

Description:

37.10.220 operator :=(ShortInt): variant

Synopsis:

Declaration: operator operator :=(ShortInt): variant (const source: ShortInt) : variant

Visibility: default

Description:

37.10.221 operator :=(shortstring): olevariant

Synopsis:

Declaration: operator operator :=(shortstring): olevariant (const source: shortstring) : olevariant

Visibility: default

Description:

37.10.222 operator :=(shortstring): variant

Synopsis:

Declaration: operator operator :=(shortstring): variant(const source: shortstring); variant

Visibility: default

Description:

37.10.223 operator :=(single): olevariant

Visibility: default

37.10.224 operator :=(single): variant

Declaration: operator operator :=(single): variant(const source: single) : variant

Visibility: default

37.10.225 operator :=(SmallInt): olevariant

Synopsis:

Visibility: default

Description:

37.10.226 operator :=(SmallInt): variant

Synopsis:

Declaration: operator operator :=(SmallInt): variant(const source: SmallInt); variant

Visibility: default

Description:

37-10-227 operator :=(TDateTime): olevariant

Synopsis:

Visibility: default

Description:

37.10.228 operator :=(TDateTime): variant

Synopsis:

Visibility: default

Description:

37.10.229 operator :=(TError): olevariant

Synopsis:

Visibility: default

Description:

37.10.230 operator :=(TError): variant

Synopsis:

Declaration: operator operator := (TError) : variant (const source: TError) : variant

Visibility: default

Description:

37.10.231 operator :=(UCS4String): variant

Visibility: default

37.10.232 operator :=(UnicodeString): olevariant

Visibility: default

37.10.233 operator :=(UnicodeString): variant

Visibility: default

37.10.234 operator :=(UTF8String): variant

Visibility: default

37.10.235 operator :=(variant): ansistring

Synopsis:

Visibility: default

Description:

37.10.236 operator :=(variant): Boolean

Synopsis:

Declaration: operator operator :=(variant): Boolean (const source: variant) : Boolean

Visibility: default

Description:

37.10.237 operator :=(variant): Byte

Synopsis:

Declaration: operator operator :=(variant): Byte(const source: variant) : Byte

Visibility: default

Description:

37.10.238 operator :=(variant): Char

Synopsis:

Declaration: operator operator :=(variant): Char(const source: variant) : Char

Visibility: default

Description:

37.10.239 operator :=(variant): comp

Declaration: operator operator :=(variant): comp(const source: variant) : comp

Visibility: default

37.10.240 operator :=(variant): currency

Synopsis:

Declaration: `operator operator :=(variant): currency(const source: variant)`
 `: currency`

Visibility: default

Description:

37.10.241 operator :=(variant): Double

Synopsis:

Declaration: `operator operator :=(variant): Double(const source: variant) : Double`

Visibility: default

Description:

37.10.242 operator :=(variant): DWord

Synopsis:

Declaration: `operator operator :=(variant): DWord(const source: variant) : DWord`

Visibility: default

Description:

37.10.243 operator :=(variant): extended

Declaration: `operator operator :=(variant): extended(const source: variant)`
 `: extended`

Visibility: default

37.10.244 operator :=(variant): Int64

Synopsis:

Declaration: `operator operator :=(variant): Int64(const source: variant) : Int64`

Visibility: default

Description:

37.10.245 operator :=(variant): longbool

Synopsis:

Declaration: `operator operator :=(variant): longbool(const source: variant)`
 `: longbool`

Visibility: default

Description:

37.10.246 operator :=(variant): LongInt

Synopsis:

Declaration: `operator operator :=(variant): LongInt(const source: variant) : LongInt`

Visibility: default

Description:

37.10.247 operator :=(variant): olevariant

Synopsis:

Declaration: `operator operator :=(variant): olevariant(const source: variant) : olevariant`

Visibility: default

Description:

37.10.248 operator :=(variant): QWord

Synopsis:

Declaration: `operator operator :=(variant): QWord(const source: variant) : QWord`

Visibility: default

Description:

37.10.249 operator :=(variant): Real

Declaration: `operator operator :=(variant): Real(const source: variant) : Real`

Visibility: default

37.10.250 operator :=(variant): ShortInt

Synopsis:

Declaration: `operator operator :=(variant): ShortInt(const source: variant) : ShortInt`

Visibility: default

Description:

37.10.251 operator :=(variant): shortstring

Synopsis:

Declaration: `operator operator :=(variant): shortstring(const source: variant) : shortstring`

Visibility: default

Description:

37.10.252 operator :=(variant): single

Declaration: operator operator :=(variant): single(const source: variant) : single

Visibility: default

37.10.253 operator :=(variant): SmallInt

Synopsis:

Visibility: default

Description:

37.10.254 operator :=(variant): TDateTime

Synopsis:

Declaration: operator operator :=(variant): TDateTime(const source: variant);

Visibility: default

Description:

37.10.255 operator :=(variant): TError

Synopsis:

Declaration: operator operator :=(variant) : TError(const source: variant) : TError

Visibility: default

Description:

37.10.256 operator :=(variant): unicodestring

Visibility: default

37.10.257 operator :=(variant): UTF8String

Visibility: default

37.10.258 operator :=(variant): WideChar

Synopsis:

Declaration: `operator operator :=(variant): WideChar(const source: variant)`
 `: WideChar`

Visibility: default

Description:

37.10.259 operator :=(variant): widestring

Synopsis:

Declaration: `operator operator :=(variant): widestring(const source: variant)`
 `: widestring`

Visibility: default

Description:

37.10.260 operator :=(variant): Word

Synopsis:

Declaration: `operator operator :=(variant): Word(const source: variant) : Word`

Visibility: default

Description:

37.10.261 operator :=(variant): wordbool

Synopsis:

Declaration: `operator operator :=(variant): wordbool(const source: variant)`
 `: wordbool`

Visibility: default

Description:

37.10.262 operator :=(WideChar): olevariant

Synopsis:

Declaration: `operator operator :=(WideChar): olevariant(const source: WideChar)`
 `: olevariant`

Visibility: default

Description:

37.10.263 operator :=(WideChar): variant

Synopsis:

Declaration: `operator operator :=(WideChar): variant(const source: WideChar)`
 `: variant`

Visibility: default

Description:

37.10.264 operator :=(widestring): olevariant

Synopsis:

Declaration: `operator operator :=(widestring): olevariant(const source: widestring)`
 `: olevariant`

Visibility: default

Description:

37.10.265 operator :=(widestring): variant

Synopsis:

Declaration: `operator operator :=(widestring): variant(const source: widestring)`
 `: variant`

Visibility: default

Description:

37.10.266 operator :=(Word): olevariant

Synopsis:

Declaration: `operator operator :=(Word): olevariant(const source: Word) : olevariant`

Visibility: default

Description:

37.10.267 operator :=(Word): variant

Synopsis:

Declaration: `operator operator :=(Word): variant(const source: Word) : variant`

Visibility: default

Description:

37.10.268 operator :=(wordbool): olevariant

Synopsis:

Visibility: default

Description:

37.10.269 operator :=(wordbool): variant

Synopsis:

Visibility: default

Description:

37.10.270 operator <(variant, variant): Boolean

Synopsis: Implement $<$ (less than) operation on variants.

Visibility: default

Description: The implementation of the "less than" comparison (`<`) operation is delegated to the variant manager with operation `opcmplt`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator >(variant, variant): boolean (1376)

37.10.271 operator <=(variant, variant): Boolean

Synopsis: Implement `<=` (less than or equal) operation on variants.

Visibility: default

Description: The implementation of the "less than or equal" comparison (\leq) operation is delegated to the variant manager with operation `opcmple`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator <(variant, variant): boolean (1375)

37.10.272 operator =(variant, variant): Boolean

Synopsis: Implement = (equality) operation on variants.

Declaration: operator operator =(variant, variant): Boolean(const op1: variant;
const op2: variant)
: Boolean

Visibility: default

Description: The implementation of the equality ($=$) operation is delegated to the variant manager with operation `opcmpeq`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator <(variant, variant): boolean (1375)

37.10.273 operator >(variant, variant): Boolean

Synopsis: Implement $>$ (greater than) operation on variants.

Declaration: operator operator >(variant, variant): Boolean(const op1: variant;
const op2: variant)
: Boolean

Visibility: default

Description: The implementation of the "greater than" comparison ($>$) operation is delegated to the variant manager with operation `opcmpgt`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator <(variant, variant): boolean (1375)

37.10.274 operator >=(variant, variant): Boolean

Synopsis: Implement \geq (greater than or equal) operation on variants.

Visibility: default

Description: The implementation of the "greater than or equal" comparison (\geq) operation is delegated to the variant manager with operation `opCmpGe`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator <(variant, variant): boolean (1375)

37.10.275 operator and(variant, variant): variant

Synopsis: Implement logical/binary and operation on variants

Declaration: operator operator and(variant, variant): variant(const op1: variant;
const op2: variant)
: variant

Visibility: default

Description: The implementation of the `and` operation is delegated to the variant manager with operation opnd.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator or(variant, variant): variant (1378), operator xor(variant, variant): variant (1379), operator not(variant): variant (1378)

37.10.276 operator div(variant, variant): variant

Synopsis: Implement `div` (integer division) operation on variants.

Declaration: operator operator div(variant, variant): variant
const op1: variant;
const op2: variant)
: variant

Visibility: default

Description: The implementation of the integer division Div operation is delegated to the variant manager with operation opintdivide.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator mod(variant, variant): variant (1377)

37.10.277 operator mod(variant, variant): variant

Synopsis: Implement mod (modulo) operation on variants.

Declaration: operator operator mod(variant, variant): variant(const op1: variant;
const op2: variant)
: variant

Visibility: default

Description: The implementation of the modulo Mod operation is delegated to the variant manager with operation opModulus.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator div(variant, variant): variant (1377)

37.10.278 operator not(variant): variant

Synopsis: Implement logical/binary not operation on variants

Declaration: operator operator not(variant): variant(const op: variant) : variant

Visibility: default

Description: The implementation of the `not` operation is delegated to the variant manager with operation `opnot`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator and(variant, variant): variant (1377), operator or(variant, variant): variant (1378), operator xor(variant, variant): variant (1379)

37.10.279 operator or(variant, variant): variant

Synopsis: Implement logical/binary or operation on variants

```
Declaration: operator operator or(variant, variant): variant(const opl: variant;  
                                         const op2: variant)  
                                         : variant
```

Visibility: default

Description: The implementation of the `or` operation is delegated to the variant manager with operation `opOr`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: [operator and\(variant, variant\): variant \(1377\)](#), [operator xor\(variant, variant\): variant \(1379\)](#), [operator not\(variant\): variant \(1378\)](#)

37.10.280 operator shl(variant, variant): variant

Synopsis: Implement binary `shl` operation on variants.

```
Declaration: operator operator_shl(variant, variant): variant(const op1: variant;  
                                         const op2: variant)  
                                         : variant
```

Visibility: default

Description: The implementation of the `shl` operation is delegated to the variant manager with operation `opshiftleft`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator shr(variant, variant): variant (1378)

37.10.281 operator shr(variant, variant): variant

Synopsis: Implement binary `shr` operation on variants.

Visibility: default

Description: The implementation of the `shr` operation is delegated to the variant manager with operation `opshiftright`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator `shl(variant, variant): variant` (1378)

37.10.282 operator xor(variant, variant): variant

Synopsis: Implement logical/binary `xor` operation on variants

Declaration: operator operator `xor(variant, variant): variant` (const `op1: variant;`
 `const op2: variant`)
 `: variant`

Visibility: default

Description: The implementation of the `xor` operation is delegated to the variant manager with operation `opxor`.

Errors: Execution of this operator may result in an exception if no variant manager is installed or if the types of the operand are not suitable for the operation.

See also: operator `or(variant, variant): variant` (1378), operator `and(variant, variant): variant` (1377), operator `not(variant): variant` (1378)

37.10.283 Ord

Synopsis: Return ordinal value of an ordinal type.

Declaration: function `Ord(X: TOrdinal) : LongInt`

Visibility: default

Description: `Ord` returns the Ordinal value of a ordinal-type variable `X`.

Historical note:

Originally, Pascal did not have typecasts and `ord` was a necessary function in order to do certain operations on non-integer ordinal types. With the arrival of typecasting a generic approach became possible, making `ord` mostly obsolete. However `ord` is not considered deprecated and remains in wide use today.

Errors: None.

See also: `Chr` (1297), `Succ` (1413), `Pred` (1383), `High` (1333), `Low` (1349)

Listing: ./refex/ex45.pp

Program Example45;

{ Program to demonstrate the `Ord`, `Pred`, `Succ` functions . }

Type

`TEnum = (Zero, One, Two, Three, Four);`

Var

`X : Longint;`
`Y : TEnum;`

```
begin
  X:=125;
  Writeln (Ord(X)); { Prints 125 }
  X:=Pred(X);
  Writeln (Ord(X)); { prints 124 }
  Y:= One;
  Writeln (Ord(y)); { Prints 1 }
  Y:=Succ(Y);
  Writeln (Ord(Y)); { Prints 2}
end.
```

37.10.284 Pack

Synopsis: Create packed array from normal array

Declaration: procedure Pack(const A: UnpackedArrayType; StartIndex: TIndexType;
 out Z: PackedArrayType)

Visibility: default

Description: Pack will copy the elements of an unpacked array (A) to a packed array (Z). It will start the copy at the index denoted by StartIndex. The type of the index variable StartIndex must match the type of the index of A. The elements are always transferred to the beginning of the packed array Z. (i.e. it starts at Low(Z)).

Obviously, the type of the elements of the arrays A and Z must match.

See also: [unpack \(1423\)](#)

37.10.285 Paramcount

Synopsis: Return number of command-line parameters passed to the program.

Declaration: function Paramcount : LongInt

Visibility: default

Description: Paramcount returns the number of command-line arguments. If no arguments were given to the running program, 0 is returned.

Errors: None.

See also: [Paramstr \(1381\)](#)

Listing: ./refex/ex46.pp

Program Example46;

{ Program to demonstrate the ParamCount and ParamStr functions. }

Var

 I : Longint;

begin

Writeln (paramstr(0), ' : Got ',**ParamCount**, ' command-line parameters: '');

For i:=1 **to** ParamCount **do**

Writeln (ParamStr (i));

end.

37.10.286 ParamStr

Synopsis: Return value of a command-line argument.

Declaration: function ParamStr(l: LongInt) : string

Visibility: default

Description: Paramstr returns the L-th command-line argument. L must be between 0 and Paramcount, these values included. The zeroth argument is the path and file name with which the program was started.

The command-line parameters will be truncated to a length of 255, even though the operating system may support bigger command-lines. The Objpas unit (used in objfpc or delphi mode) defines versions of Paramstr which return the full-length command-line arguments, using ansistrings.

In the interest of portability, the ParamStr function tries to behave the same on all operating systems: like the original ParamStr function in Turbo Pascal. This means even on Unix, paramstr(0) returns the full path to the program executable. A notable exception is Mac OS X, where the return value depends on how the application was started. It may be that just the name of the application is returned (in case of a command-line launch)

In general, it's a bad idea to rely on the location of the binary. Often, this goes against best OS practices. Configuration data should (or can) not be stored next to the binary, but on designated locations. What locations these are, is very much operating system dependent. Therefore, ParamStr(0) should be used with care.

For an example, see Paramcount ([1380](#)).

Errors: None.

See also: Paramcount ([1380](#))

37.10.287 pi

Synopsis: Return the value of PI.

Declaration: function pi : ValReal

Visibility: default

Description: Pi returns the value of Pi (3.1415926535897932385).

Errors: None.

See also: Cos ([1305](#)), Sin ([1406](#))

Listing: ./refex/ex47.pp

```
Program Example47;
{ Program to demonstrate the Pi function. }

begin
  Writeln (Pi);           {3.1415926}
  Writeln (Sin(Pi));
end.
```

37.10.288 Pos

Synopsis: Search for substring in a string.

```
Declaration: function Pos(const substr: shortstring;const s: shortstring) : SizeInt
function Pos(C: Char;const s: shortstring) : SizeInt
function Pos(const Substr: ShortString;const Source: AnsiString)
           : SizeInt
function pos(const substr: shortstring;c: Char) : SizeInt
function Pos(const Substr: AnsiString;const Source: AnsiString)
           : SizeInt
function Pos(c: Char;const s: AnsiString) : SizeInt
function Pos(const Substr: UnicodeString;const Source: UnicodeString)
           : SizeInt
function Pos(c: Char;const s: UnicodeString) : SizeInt
function Pos(c: UnicodeChar;const s: UnicodeString) : SizeInt
function Pos(c: AnsiString;const s: UnicodeString) : SizeInt
function Pos(c: UnicodeString;const s: AnsiString) : SizeInt
function Pos(c: ShortString;const s: UnicodeString) : SizeInt
function Pos(const Substr: WideString;const Source: WideString)
           : SizeInt
function Pos(c: Char;const s: WideString) : SizeInt
function Pos(c: WideChar;const s: WideString) : SizeInt
function Pos(c: WideChar;const s: AnsiString) : SizeInt
function Pos(c: AnsiString;const s: WideString) : SizeInt
function Pos(c: WideString;const s: AnsiString) : SizeInt
function Pos(c: ShortString;const s: WideString) : SizeInt
function Pos(c: Char;const v: Variant) : SizeInt
function Pos(s: ShortString;const v: Variant) : SizeInt
function Pos(a: AnsiString;const v: Variant) : SizeInt
function Pos(w: WideString;const v: Variant) : SizeInt
function Pos(w: UnicodeString;const v: Variant) : SizeInt
function Pos(v: Variant;const c: Char) : SizeInt
function Pos(v: Variant;const s: ShortString) : SizeInt
function Pos(v: Variant;const a: AnsiString) : SizeInt
function Pos(v: Variant;const w: WideString) : SizeInt
function Pos(v: Variant;const w: UnicodeString) : SizeInt
function Pos(v1: Variant;const v2: Variant) : SizeInt
```

Visibility: default

Description: Pos returns the index of Substr in S, if S contains Substr. In case Substr isn't found, 0 is returned. The search is case-sensitive.

Errors: None

See also: Length (1345), Copy (1305), Delete (1308), Insert (1340)

Listing: ./refex/ex48.pp

Program Example48;

{ Program to demonstrate the Pos function. }

Var

S : String;

```

begin
  S:= 'The first space in this sentence is at position : ';
  Writeln (S,pos(' ',S));
  S:= 'The last letter of the alphabet doesn''t appear in this sentence ';
  If (Pos ('Z',S)=0) and (Pos ('z',S)=0) then
    Writeln (S);
end.

```

37.10.289 Power

Declaration: `function Power(Base: Double;expon: Double) : Double`
`function Power(Base: LongInt;expon: LongInt) : LongInt`

Visibility: default

37.10.290 Pred

Synopsis: Return previous element for an ordinal type.

Declaration: `function Pred(X: TOrdinal) : TOrdinal`

Visibility: default

Description: `Pred` returns the element that precedes the element that was passed to it. If it is applied to the first value of the ordinal type, and the program was compiled with range checking on (`{$R+}`), then a run-time error will be generated.
 for an example, see [Ord \(1379\)](#)

Errors: Run-time error 201 is generated when the result is out of range.

See also: [Ord \(1379\)](#), [Pred \(1383\)](#), [High \(1333\)](#), [Low \(1349\)](#)

37.10.291 prefetch

Synopsis: Prefetch a memory location

Declaration: `procedure prefetch(const mem)`

Visibility: default

Description: `Prefetch` can be used to optimize the CPU behaviour by already loading a memory location. It is mainly used as a hint for those processors that support it.

Errors: None.

37.10.292 ptr

Synopsis: Combine segment and offset to pointer

Declaration: `function ptr(sel: LongInt;off: LongInt) : farpointer`

Visibility: default

Description: `Ptr` returns a pointer, pointing to the address specified by segment `sel` and offset `off`.

Remark:

- 1.In the 32/64-bit flat-memory model supported by Free Pascal, this function is obsolete.
- 2.The returned address is simply the offset.

Errors: None.

See also: Addr ([1285](#))

Listing: ./refex/ex59.pp

```
Program Example59;

{ Program to demonstrate the Ptr (compatibility) function.

}

type pString = ^String;

Var P : pString;
    S : String;

begin
    S:= 'Hello , World !';
    P:= pString(Ptr(Seg(S), Longint(Off(S)))); 
    {P now points to S !}
    Writeln (P^);
end.
```

37.10.293 RaiseList

Synopsis: List of currently raised exceptions.

Declaration: function RaiseList : PExceptObject

Visibility: default

Description: RaiseList returns a pointer to the list of currently raised exceptions (i.e. a pointer to the first exception block).

37.10.294 Random

Synopsis: Generate random number

Declaration: function Random(l: LongInt) : LongInt
 function Random(l: Int64) : Int64
 function Random : extended

Visibility: default

Description: Random returns a random number larger or equal to 0 and strictly less than L. If the argument L is omitted, a Real number between 0 and 1 is returned (0 included, 1 excluded).

Remark: The Free Pascal implementation of the Random routine uses the Mersenne Twister to simulate randomness. This implementation has a better statistical distribution than for example a Linear Congruential generator algorithm, but is considerably slower than the latter. If speed is an issue, then alternate random number generators should be considered.

Errors: None.

See also: Randomize ([1385](#))

Listing: ./refex/ex49.pp

```

Program Example49;

{ Program to demonstrate the Random and Randomize functions. }

Var I,Count,guess : Longint;
      R : Real;

begin
  Randomize; { This way we generate a new sequence every time
                 the program is run}
  Count:=0;
  For i:=1 to 1000 do
    If Random>0.5 then inc(Count);
    Writeln ('Generated ',Count,' numbers > 0.5');
    Writeln ('out of 1000 generated numbers.');
    count:=0;
    For i:=1 to 5 do
      begin
        write ('Guess a number between 1 and 5 : ');
        readIn(Guess);
        If Guess=Random(5)+1 then inc(count);
        end;
    Writeln ('You guessed ',Count,' out of 5 correct.');
end.

```

37.10.295 Randomize

Synopsis: Initialize random number generator

Declaration: procedure Randomize

Visibility: default

Description: Randomize initializes the random number generator of Free Pascal, by giving a value to Randseed, calculated with the system clock.

For an example, see Random ([1384](#)).

Errors: None.

See also: Random ([1384](#))

37.10.296 Read

Synopsis: Read from a text file into variable

Declaration: procedure Read(var F: Text;Args: Arguments)
 procedure Read(Args: Arguments)

Visibility: default

Description: Read reads one or more values from a file F, and stores the result in V1, V2, etc.; If no file F is specified, then standard input is read. If F is of type Text, then the variables V1, V2 etc. must be of type Char, Integer, Real, String. If F is a typed file, then each of the variables must be of the type specified in the declaration of F. Untyped files are not allowed as an argument.

In earlier versions of FPC, it was also allowed to read Pchar null-terminated strings, but this has been removed, since there is no buffer checking possible.

Errors: If no data is available, empty values are returned (0 for ordinal values, empty strings for string values)

See also: [ReadLn](#) (1387), [Blockread](#) (1292), [Write](#) (1429), [Blockwrite](#) (1293)

Listing: [./refex/ex50.pp](#)

Program Example50;

```
{ Program to demonstrate the Read(Ln) function. }

Var S : String;
      C : Char;
      F : File of char;

begin
  Assign (F, 'ex50.pp');
  Reset (F);
  C:= 'A';
  Writeln ('The characters before the first space in ex50.pp are : ');
  While not Eof(f) and (C<> ' ') do
    Begin
      Read (F,C);
      Write (C);
      end;
  Writeln;
  Close (F);
  Writeln ('Type some words. An empty line ends the program.');
  repeat
    ReadLn (S);
  until S= '';
end.
```

37.10.297 ReadBarrier

Synopsis: Memory Read Barrier

Declaration: procedure ReadBarrier

Visibility: default

Description: `ReadBarrier` is a low-level instruction to force a read barrier in the CPU: all memory reads before the instruction will be finished before this instruction, before memory reads after the instruction occur.

See also: [ReadDependencyBarrier](#) (1386), [ReadWriteBarrier](#) (1388), [WriteBarrier](#) (1429)

37.10.298 ReadDependencyBarrier

Synopsis: Memory Read Dependency Barrier

Declaration: procedure ReadDependencyBarrier

Visibility: default

Description: `ReadDependencyBarrier` is a low-level instruction to force a read barrier in the CPU: all memory reads (loads) depending on previous loads are separate from the ones following the instruction.

See also: [ReadBarrier](#) (1386), [ReadWriteBarrier](#) (1388), [WriteBarrier](#) (1429)

37.10.299 ReadLn

Synopsis: Read from a text file into variable and goto next line

Declaration: procedure ReadLn(var F: Text; Args: Arguments)
procedure ReadLn(Args: Arguments)

Visibility: default

Description: Read reads one or more values from a file F, and stores the result in V1, V2, etc. After that it goes to the next line in the file. The end of the line is marked by the LineEnding character sequence (which is platform dependent). The end-of-line marker is not considered part of the line and is ignored.

If no file F is specified, then standard input is read. The variables V1, V2 etc. must be of type Char, Integer, Real, String or PChar.

For an example, see [Read \(1385\)](#).

Errors: If no data is available, empty values are returned (0 for ordinal values, empty strings for string values)

See also: [Read \(1385\)](#), [Blockread \(1292\)](#), [Write \(1429\)](#), [Blockwrite \(1293\)](#)

37.10.300 ReadStr

Synopsis: Read variables from a string

Declaration: procedure ReadStr(const S: string; Args: Arguments)

Visibility: default

Description: ReadStr behaves like [Read \(1385\)](#), except that it reads its input from the string variable S instead of a file. Semantically, the ReadStr call is equivalent to writing the string to a file using the Write call, and then reading them into the various arguments Arg using the Read call from the same file:

```
var
  F : Text;
begin
  Rewrite(F);
  Write(F, S);
  Close(F);
  Reset(F);
  Read(F, Args);
  Close(F);
end;
```

Obviously, the ReadStr call does not use a temporary file.

ReadStr is defined in the ISO Extended Pascal standard. More information on the allowed arguments and the behaviour of the arguments can be found in the description of [Read \(1385\)](#).

See also: [Read \(1385\)](#), [WriteStr \(1430\)](#), [Write \(1429\)](#)

37.10.301 ReadWriteBarrier

Synopsis: Memory read/write barrier

Declaration: procedure ReadWriteBarrier

Visibility: default

Description: `ReadWriteBarrier` is a low-level instruction to force a read/write barrier in the CPU: both read (Loads) and write (stores) operations before and after the barrier are separate.

See also: [ReadBarrier \(1386\)](#), [ReadDependencyBarrier \(1386\)](#), [WriteBarrier \(1429\)](#)

37.10.302 Real2Double

Synopsis: Convert Turbo Pascal style real to double.

Declaration: function Real2Double(r: real48) : Double

Visibility: default

Description: The `Real2Double` function converts a Turbo Pascal style real (6 bytes long) to a native Free Pascal double type. It can be used e.g. to read old binary TP files with FPC and convert them to Free Pascal binary files.

Note that the assignment operator has been overloaded so a `Real48` type can be assigned directly to a double or extended.

Errors: None.

Listing: ./refex/ex110.pp

```

program Example110;

{ Program to demonstrate the Real2Double function. }

Var
  i : integer;
  R : Real48;
  D : Double;
  E : Extended;
  F : File of Real48;

begin
  Assign(F, 'reals.dat');
  Reset(f);
  For I:=1 to 10 do
    begin
      Read(F,R);
      D:=Real2Double(R);
      Writeln('Real ',i,' : ',D);
      D:=R;
      Writeln('Real (direct to double) ',i,' : ',D);
      E:=R;
      Writeln('Real (direct to Extended) ',i,' : ',E);
    end;
  Close(f);
end.

```

37.10.303 ReAllocMem

Synopsis: Re-allocate memory on the heap

Declaration: function ReAllocMem(var p: pointer;Size: PtrUInt) : pointer

Visibility: default

Description: ReAllocMem resizes the memory pointed to by P so it has size Size. The value of P may change during this operation. The contents of the memory pointed to by P (if any) will be copied to the new location, but may be truncated if the newly allocated memory block is smaller in size. If a larger block is allocated, only the used memory is initialized, extra memory will not be zeroed out.

Note that P may be nil, in that case the behaviour of ReAllocMem is equivalent to Getmem.

See also: GetMem ([1328](#)), FreeMem ([1325](#))

37.10.304 ReAllocMemory

Synopsis: Alias for ReAllocMem ([1389](#))

Declaration: function ReAllocMemory(p: pointer;Size: PtrUInt) : pointer

Visibility: default

Description: ReAllocMemory is an alias for ReAllocMem ([1389](#)).

See also: ReAllocMem ([1389](#))

37.10.305 ReleaseExceptionObject

Synopsis: Decrease the reference count of the current exception object.

Declaration: procedure ReleaseExceptionObject

Visibility: default

Description: ReleaseExceptionObject decreases the reference count of the current exception object. This should be called whenever a reference to the exception object was obtained via the AcquireExceptionObject ([1285](#)) call.

Calling this method is only valid within an except block.

Errors: If there is no current exception object, a run-time error 231 will occur.

See also: AcquireExceptionObject ([1285](#))

37.10.306 Rename

Synopsis: Rename file on disk

Declaration: procedure Rename(var f: File;const s: string)
 procedure Rename(var f: File;p: PChar)
 procedure Rename(var f: File;c: Char)
 procedure Rename(var t: Text;const s: string)
 procedure Rename(var t: Text;p: PChar)
 procedure Rename(var t: Text;c: Char)

Visibility: default

Description: Rename changes the name of the assigned file F to S. F must be assigned, but not opened.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Erase ([1315](#))

Listing: ./refex/ex77.pp

```
Program Example77;

{ Program to demonstrate the Rename function. }
Var F : Text;

begin
  Assign (F,paramstr(1));
  Rename (F,paramstr(2));
end.
```

37.10.307 Reset

Synopsis: Open file for reading

Declaration: procedure Reset(var f: File;l: LongInt)
procedure Reset(var f: File)
procedure Reset(var f: TypedFile)
procedure Reset(var t: Text)

Visibility: default

Description: Reset opens a file F for reading. F can be any file type. If F is a text file, or refers to standard I/O (e.g.:") then it is opened read-only, otherwise it is opened using the mode specified in filemode. If F is an untyped file, the record size can be specified in the optional parameter L. A default value of 128 is used. File sharing is not taken into account when calling Reset.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Rewrite ([1391](#)), Assign ([1288](#)), Close ([1298](#)), Append ([1287](#))

Listing: ./refex/ex51.pp

```
Program Example51;

{ Program to demonstrate the Reset function. }

Function FileExists (Name : String) : boolean;

Var F : File;

begin
  {$I-}
  Assign (F,Name);
  Reset (F);
  {$I+}
  FileExists:=(IoResult=0) and (Name<>' ');
  Close (f);
```

```

end;

begin
  If FileExists (Paramstr(1)) then
    Writeln ('File found')
  else
    Writeln ('File NOT found');
end.

```

37.10.308 ResumeThread

Synopsis: Resume a suspended thread.

Declaration: function ResumeThread(threadHandle: TThreadID) : DWord

Visibility: default

Description: ResumeThread causes a suspended thread (using SuspendThread (1413)) to resume it's execution.

The thread is identified with it's handle or ID threadHandle.

The function returns zero if succesful. A nonzero return value indicates failure.

Errors: If a failure occurred, a nonzero result is returned. The meaning is system dependent.

See also: SuspendThread (1413), KillThread (1345)

37.10.309 Rewrite

Synopsis: Open file for writing

Declaration: procedure Rewrite(var f: File;l: LongInt)
procedure Rewrite(var f: File)
procedure Rewrite(var f: TypedFile)
procedure Rewrite(var t: Text)

Visibility: default

Description: Rewrite opens a file F for writing. F can be any file type. If F is an untyped or typed file, then it is opened for reading and writing. If F is an untyped file, the record size can be specified in the optional parameter L. Default a value of 128 is used. if Rewrite finds a file with the same name as F, this file is truncated to length 0. If it doesn't find such a file, a new file is created. Contrary to Turbo Pascal, Free Pascal opens the file with mode fmoutput. If it should be opened in fminout mode, an extra call to Reset (1390) is needed. File sharing is not taken into account when calling Rewrite.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Reset (1390), Assign (1288), Close (1298), Flush (1324), Append (1287)

Listing: ./refex/ex52.pp

Program Example52;

{ Program to demonstrate the Rewrite function. }

Var F : File;

```

I : longint;

begin
  Assign (F, 'Test.tmp');
  { Create the file. Recordsize is 4 }
  Rewrite (F, Sizeof(I));
  For I:=1 to 10 do
    BlockWrite (F,I,1);
  close (f);
  { F contains now a binary representation of
    10 longints going from 1 to 10 }
end.

```

37.10.310 rmdir

Synopsis: Remove directory when empty.

Declaration: procedure rmdir(const s: string); Overload

Visibility: default

Description: Rmdir removes the directory S.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Chdir (1297), Mkdir (1350)

Listing: ./refex/ex53.pp

Program Example53;

```

{ Program to demonstrate the MkDir and RmDir functions. }

Const D : String[8] = 'TEST.DIR';

Var S : String;

begin
  Writeln ('Making directory ',D);
  Mkdir (D);
  Writeln ('Changing directory to ',D);
  ChDir (D);
  GetDir (0,S);
  Writeln ('Current Directory is : ',S);
  WRiteln ('Going back');
  ChDir ('..');
  Writeln ('Removing directory ',D);
  RmDir (D);
end.

```

37.10.311 RolByte

Synopsis: Rotate bits of a byte value to the left

Declaration: function RolByte(const AValue: Byte) : Byte
 function RolByte(const AValue: Byte; const Dist: Byte) : Byte

Visibility: default

Description: `RolByte` rotates the bits of the byte `AValue` with `Dist` positions to the left. If `Dist` is not specified, then 1 is assumed.

Errors: None.

See also: [RorByte \(1394\)](#), [RolWord \(1393\)](#), [RolDWord \(1393\)](#), [RolQWord \(1393\)](#)

37.10.312 RolDWord

Synopsis: Rotate bits of a DWord (cardinal) value to the left

Declaration: `function RolDWord(const AValue: DWord) : DWord`
 `function RolDWord(const AValue: DWord; const Dist: Byte) : DWord`

Visibility: default

Description: `RolDWord` rotates the bits of the DWord (cardinal) `AValue` with `Dist` positions to the left. If `Dist` is not specified, then 1 is assumed.

Errors: None.

See also: [RolByte \(1392\)](#), [RolWord \(1393\)](#), [RorDWord \(1394\)](#), [RolQWord \(1393\)](#)

37.10.313 RolQWord

Synopsis: Rotate bits of a QWord (64-bit) value to the left

Declaration: `function RolQWord(const AValue: QWord) : QWord`
 `function RolQWord(const AValue: QWord; const Dist: Byte) : QWord`

Visibility: default

Description: `RolQWord` rotates the bits of the QWord (64-bit) `AValue` with `Dist` positions to the left. If `Dist` is not specified, then 1 is assumed.

Errors: None.

See also: [RolByte \(1392\)](#), [RolWord \(1393\)](#), [RolDWord \(1393\)](#), [RorQWord \(1394\)](#)

37.10.314 RolWord

Synopsis: Rotate bits of a word value to the left

Declaration: `function RolWord(const AValue: Word) : Word`
 `function RolWord(const AValue: Word; const Dist: Byte) : Word`

Visibility: default

Description: `RolWord` rotates the bits of the word `AValue` with `Dist` positions to the right. If `Dist` is not specified, then 1 is assumed.

Errors: None.

See also: [RolByte \(1392\)](#), [RorWord \(1394\)](#), [RolDWord \(1393\)](#), [RolQWord \(1393\)](#)

37.10.315 RorByte

Synopsis: Rotate bits of a byte value to the right

Declaration: function RorByte(const AValue: Byte) : Byte
function RorByte(const AValue: Byte; const Dist: Byte) : Byte

Visibility: default

Description: RorByte rotates the bits of the byte AValue with Dist positions to the right. If Dist is not specified, then 1 is assumed.

Errors: None.

See also: RolByte ([1392](#)), RorWord ([1394](#)), RorDWord ([1394](#)), RorQWord ([1394](#))

37.10.316 RorDWord

Synopsis: Rotate bits of a DWord (cardinal) value to the right

Declaration: function RorDWord(const AValue: DWord) : DWord
function RorDWord(const AValue: DWord; const Dist: Byte) : DWord

Visibility: default

Description: RorDWord rotates the bits of the DWord (cardinal) AValue with Dist positions to the right. If Dist is not specified, then 1 is assumed.

Errors: None.

See also: RorByte ([1394](#)), RolDWord ([1393](#)), RorWord ([1394](#)), RorQWord ([1394](#))

37.10.317 RorQWord

Synopsis: Rotate bits of a QWord (64-bit) value to the right

Declaration: function RorQWord(const AValue: QWord) : QWord
function RorQWord(const AValue: QWord; const Dist: Byte) : QWord

Visibility: default

Description: RorQWord rotates the bits of the QWord (64-bit) AValue with Dist positions to the right. If Dist is not specified, then 1 is assumed.

Errors: None.

See also: RorByte ([1394](#)), RorWord ([1394](#)), RorDWord ([1394](#)), RolQWord ([1393](#))

37.10.318 RorWord

Synopsis: Rotate bits of a word value to the right

Declaration: function RorWord(const AValue: Word) : Word
function RorWord(const AValue: Word; const Dist: Byte) : Word

Visibility: default

Description: RorWord rotates the bits of the word AValue with Dist positions to the right. If Dist is not specified, then 1 is assumed.

Errors: None.

See also: RorByte (1394), RolWord (1393), RorDWord (1394), RorQWord (1394)

37.10.319 round

Synopsis: Round floating point value to nearest integer number.

Declaration: function round(d: ValReal) : Int64

Visibility: default

Description: Round rounds X to the closest integer, which may be bigger or smaller than X.

In the case of .5, the algorithm uses "banker's rounding": .5 values are always rounded towards the even number.

Errors: None.

See also: Frac (1325), Int (1341), Trunc (1419)

Listing: ./refex/ex54.pp

Program Example54;

{ Program to demonstrate the Round function. }

```
begin
  Writeln (Round(1234.56)); { Prints 1235      }
  Writeln (Round(-1234.56)); { Prints -1235     }
  Writeln (Round(12.3456)); { Prints 12          }
  Writeln (Round(-12.3456)); { Prints -12         }
  Writeln (Round(2.5));      { Prints 2 (down)   }
  Writeln (Round(3.5));      { Prints 4 (up)    }
```

end.

37.10.320 RTLEventCreate

Synopsis: Create a new RTL event

Declaration: function RTLEventCreate : PRTLEvent

Visibility: default

Description: RTLEventCreate creates and initializes a new RTL event. RTL events are used to notify other threads that a certain condition is met, and to notify other threads of condition changes (conditional variables).

The function returns an initialized RTL event, which must be disposed of with RTLEventDestroy (1396)

RTLEvent is used mainly for the synchronize method.

See also: RTLEventDestroy (1396), RTLEventSetEvent (1396), RTLEventReSetEvent (1396), RTLEventWaitFor (1396)

37.10.321 RTLeventdestroy

Synopsis: Destroy a RTL Event

Declaration: procedure RTLeventdestroy(state: PRTLEvent)

Visibility: default

Description: RTLeventdestroy destroys the RTL event State. After a call to RTLeventdestroy, the State RTL event may no longer be used.

See also: RTLEventCreate ([1395](#)), RTLEventResetEvent ([1396](#)), RTLEventSetEvent ([1396](#))

37.10.322 RTLeventResetEvent

Synopsis: Reset an event

Declaration: procedure RTLeventResetEvent(state: PRTLEvent)

Visibility: default

Description: RTLeventResetEvent resets the event: this should be used to undo the signaled state of an event. Resetting an event that is not set (or was already reset) has no effect.

See also: RTLEventCreate ([1395](#)), RTLEventDestroy ([1396](#)), RTLEventSetEvent ([1396](#)), RTLEventWaitFor ([1396](#))

37.10.323 RTLeventSetEvent

Synopsis: Notify threads of the event.

Declaration: procedure RTLeventSetEvent(state: PRTLEvent)

Visibility: default

Description: RTLeventSetEvent notifies other threads which are listening, that the event has occurred.

See also: RTLEventCreate ([1395](#)), RTLEventResetEvent ([1396](#)), RTLEventDestroy ([1396](#)), RTLEventWaitFor ([1396](#))

37.10.324 RTLeventsync

Synopsis: Obsolete. Don't use

Declaration: procedure RTLeventsync(m: trtlmethod;p: TProcedure)

Visibility: default

Description: RTLeventsync is obsolete, don't use it.

37.10.325 RTLeventWaitFor

Synopsis: Wait for an event.

Declaration: procedure RTLeventWaitFor(state: PRTLEvent)
procedure RTLeventWaitFor(state: PRTLEvent;timeout: LongInt)

Visibility: default

Description: RTLEventWaitFor suspends the thread till the event occurs. The event will occur when another thread calls RTLEventSetEvent (1396) on State.

By default, the thread will be suspended indefinitely. However, if TimeOut is specified, then the thread will resume after timeout milliseconds have elapsed.

See also: RTLEventCreate (1395), RTLEventDestroy (1396), RTLEventSetEvent (1396), RTLEventWaitFor (1396)

37.10.326 RunError

Synopsis: Generate a run-time error.

Declaration: procedure RunError (w: Word)
procedure RunError

Visibility: default

Description: Runerror stops the execution of the program, and generates a run-time error ErrorCode.

Errors: None.

See also: Exit (1317), Halt (1331)

Listing: ./refex/ex55.pp

Program Example55;

{ Program to demonstrate the RunError function. }

```
begin
  { The program will stop end emit a run-error 106 }
  RunError (106);
end.
```

37.10.327 SarInt64

Synopsis: 64-bit Shift Arithmetic Right

Declaration: function SarInt64 (const AValue: Int64; const Shift: Byte) : Int64

Visibility: default

Description: SarInt64 performs an arithmetic right shift for Shift positions on a 64-bit integer AValue and returns the result. Shift is optional, and is 1 by default. The difference with the regular Shr shift operation is that the leftmost bit is preserved during the shift operation.

See also: SarShortInt (1398), SarSmallInt (1398), SarLongInt (1397)

37.10.328 SarLongint

Synopsis: 32-bit Shift Arithmetic Right

Declaration: function SarLongint (const AValue: LongInt; const Shift: Byte) : LongInt

Visibility: default

Description: SarLongint performs an arithmetic right shift for Shift positions on a 32-bit integer AValue and returns the result. Shift is optional, and is 1 by default. The difference with the regular Shr shift operation is that the leftmost bit is preserved during the shift operation.

See also: SarShortInt (1398), SarSmallInt (1398), SarInt64 (1397)

37.10.329 SarShortint

Synopsis: 8-bit Shift Arithmetic Right

Declaration: function SarShortint (const AValue: ShortInt; const Shift: Byte)
: ShortInt

Visibility: default

Description: SarShortint performs an arithmetic right shift for Shift positions on an 8-bit integer AValue and returns the result. Shift is optional, and is 1 by default. The difference with the regular Shr shift operation is that the leftmost bit is preserved during the shift operation.

See also: SarSmallInt (1398), SarLongint (1397), SarInt64 (1397)

37.10.330 SarSmallint

Synopsis: 16-bit Shift Arithmetic Right

Declaration: function SarSmallint (const AValue: SmallInt; const Shift: Byte)
: SmallInt

Visibility: default

Description: SarSmallint performs an arithmetic right shift for Shift positions on an 16-bit integer AValue and returns the result. Shift is optional, and is 1 by default. The difference with the regular Shr shift operation is that the leftmost bit is preserved during the shift operation.

See also: SarShortint (1398), SarLongint (1397), SarInt64 (1397)

37.10.331 Seek

Synopsis: Set file position

Declaration: procedure Seek (var f: File; Pos: Int64)

Visibility: default

Description: Seek sets the file-pointer for file F to record Nr. Count. The first record in a file has Count=0. F can be any file type, except Text. If F is an untyped file, with no record size specified in Reset (1390) or Rewrite (1391), 128 is assumed.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Eof (1314), SeekEof (1399), SeekEoln (1400)

Listing: ./refex/ex56.pp

```

Program Example56;

{ Program to demonstrate the Seek function. }

Var
  F : File;
  I, j : longint;

begin
  { Create a file and fill it with data }
  Assign (F, 'test.tmp');
  Rewrite(F); { Create file }
  Close(f);
  FileMode:=2;
  ReSet (F, Sizeof(i)); { Opened read/write }
  For I:=0 to 10 do
    BlockWrite (F,I,1);
  { Go Back to the begining of the file }
  Seek(F,0);
  For I:=0 to 10 do
    begin
      BlockRead (F,J,1);
      If J<>I then
        Writeln ('Error: expected ',i,', got ',j);
      end;
    Close (f);
end.

```

37.10.332 SeekEOF

Synopsis: Set file position to end of file

Declaration: function SeekEOF(var t: Text) : Boolean
 function SeekEOF : Boolean

Visibility: default

Description: SeekEof returns True is the file-pointer is at the end of the file. It ignores all whitespace. Calling this function has the effect that the file-position is advanced until the first non-whitespace character or the end-of-file marker is reached.

If the end-of-file marker is reached, True is returned. Otherwise, False is returned.

If the parameter F is omitted, standard Input is assumed.

Remark: The SeekEOF function can only be used on real textfiles: when assigning the file to other kinds of (virtual) text files, the function may fail, although it will perform a number of tests to guard against wrong usage.

Errors: A run-time error is generated if the file F isn't opened.

See also: Eof (1314), SeekEoln (1400), Seek (1398)

Listing: ./refex/ex57.pp

Program Example57;

{ Program to demonstrate the SeekEof function. }

```

Var C : Char;

begin
  { this will print all characters from standard input except
    Whitespace characters. }
  While Not SeekEof do
    begin
      Read (C);
      Write (C);
      end;
  end.

```

37.10.333 SeekEOLn

Synopsis: Set file position to end of line

Declaration: function SeekEOLn(var t: Text) : Boolean
function SeekEOLn : Boolean

Visibility: default

Description: SeekEOLn returns True if the file-pointer is at the end of the current line. It ignores all whitespace. Calling this function has the effect that the file-position is advanced until the first non-whitespace character or the end-of-line marker is reached. If the end-of-line marker is reached, True is returned. Otherwise, False is returned. The end-of-line marker is defined as #10, the LineFeed character. If the parameter F is omitted, standard Input is assumed.

Errors: A run-time error is generated if the file F isn't opened.

See also: Eof (1314), SeekEof (1399), Seek (1398)

Listing: ./refex/ex58.pp

```

Program Example58;

{ Program to demonstrate the SeekEoln function. }

Var
  C : Char;

begin
  { This will read the first line of standard output and print
    all characters except whitespace. }
  While not SeekEoln do
    Begin
      Read (c);
      Write (c);
      end;
  end.

```

37.10.334 Seg

Synopsis: Return segment

Declaration: function Seg(var X) : LongInt

Visibility: default

Description: `Seg` returns the segment of the address of a variable. This function is only supported for compatibility. In Free Pascal, it returns always 0, since Free Pascal uses a flat 32/64 bit memory model. In such a memory model segments have no meaning.

Errors: None.

See also: [DSeg \(1310\)](#), [CSeg \(1306\)](#), [Ofs \(1354\)](#), [Ptr \(1383\)](#)

Listing: [./refex/ex60.pp](#)

```
Program Example60;

{ Program to demonstrate the Seg function. }
Var
  W : Word;

begin
  W:=Seg(W); { W contains its own Segment}
end.
```

37.10.335 Setjmp

Synopsis: Save current execution point.

Declaration: `function Setjmp(var S: jmp_buf) : LongInt`

Visibility: default

Description: `SetJmp` fills `env` with the necessary data for a jump back to the point where it was called. It returns zero if called in this way. If the function returns nonzero, then it means that a call to `LongJmp` ([1348](#)) with `env` as an argument was made somewhere in the program.

Errors: None.

See also: [LongJmp \(1348\)](#)

Listing: [./refex/ex79.pp](#)

```
program example79;

{ Program to demonstrate the setjmp , longjmp functions }

procedure dojmp(var env : jmp_buf; value : longint);

begin
  value:=2;
  WriteLn ('Going to jump !');
  { This will return to the setjmp call ,
    and return value instead of 0 }
  longjmp(env,value);
end;

var env : jmp_buf;

begin
  if setjmp(env)=0 then
    begin
      writeln ('Passed first time.');
    end;
  else
    begin
      writeln ('Not passed first time.');
    end;
end;
```

```

dojmp(env,2);
end
else
  writeln ('Passed second time.');
end.
```

37.10.336 SetLength

Synopsis: Set length of a string.

Declaration: procedure SetLength(var S: AStringType; Len: Integer)
procedure SetLength(var A: DynArrayType; Len: Integer)

Visibility: default

Description: SetLength sets the length of the string S to Len. S can be an ansistring, a short string or a widestring. For ShortStrings, Len can maximally be 255. For AnsiStrings it can have any value. For AnsiString strings, SetLength \emph{must} be used to set the length of the string. In the case of a dynamical array A, setlength sets the number of elements. The elements are numbered from index 0, so the count runs from 0 to Len-1. If Zero is specified, the array is cleared.

Errors: None.

See also: Length ([1345](#))

Listing: ./refex/ex85.pp

```

Program Example85;

{ Program to demonstrate the SetLength function. }

Var S : String;

begin
  FillChar(S[1],100,#32);
  SetLength(S,100);
  Writeln ('"',S,'"');
end.
```

37.10.337 SetMemoryManager

Synopsis: Set a memory manager

Declaration: procedure SetMemoryManager(const MemMgr: TMemoryManager)

Visibility: default

Description: SetMemoryManager sets the current memory manager record to MemMgr.
For an example, see the programmer's guide.

Errors: None.

See also: GetMemoryManager ([1328](#)), IsMemoryManagerSet ([1344](#))

37.10.338 SetResourceManager

Synopsis: Set the resource manager

Declaration: procedure SetResourceManager (const New: TResourceManager)

Visibility: default

Description: SetResourceManager sets the active resource manager to Manager. After a call to SetResourceManager, the functions in the Manager record will be used to handle resources.

Note that it is not supported to change resource managers on-the-fly: any resources or information about resources obtained should be discarded prior to a call to SetResourceManager. Typically, SetResourceManager should be called once, at program startup.

Errors: None.

See also: [TResourceManager \(1271\)](#), [GetResourceManager \(1329\)](#)

37.10.339 SetString

Synopsis: Set length of a string and copy buffer.

Declaration: procedure SetString(out S: AnsiString;Buf: PChar;Len: SizeInt)
procedure SetString(out S: AnsiString;Buf: PWideChar;Len: SizeInt)
procedure SetString(out S: Shortstring;Buf: PChar;Len: SizeInt)
procedure SetString(out S: UnicodeString;Buf: PUnicodeChar;Len: SizeInt)
procedure SetString(out S: UnicodeString;Buf: PChar;Len: SizeInt)
procedure SetString(out S: WideString;Buf: PWideChar;Len: SizeInt)
procedure SetString(out S: WideString;Buf: PChar;Len: SizeInt)

Visibility: default

Description: SetString sets the length of the string S to Len and if Buf is non-nil, copies Len characters from Buf into S. S can be an ansistring, a short string or a widestring. For ShortStrings, Len can maximally be 255.

Errors: None.

See also: [SetLength \(1402\)](#)

37.10.340 SetTextBuf

Synopsis: Set size of text file internal buffer

Declaration: procedure SetTextBuf(var f: Text;var Buf)
procedure SetTextBuf(var f: Text;var Buf;Size: SizeInt)

Visibility: default

Description: SetTextBuf assigns an I/O buffer to a text file. The new buffer is located at Buf and is Size bytes long. If Size is omitted, then `SizeOf(Buf)` is assumed. The standard buffer of any text file is 128 bytes long. For heavy I/O operations this may prove too slow. The SetTextBuf procedure allows to set a bigger buffer for the I/O of the application, thus reducing the number of system calls, and thus reducing the load on the system resources. The maximum size of the newly assigned buffer is 65355 bytes.

Remark:

- Never assign a new buffer to an opened file. A new buffer can be assigned immediately after a call to Rewrite (1391), Reset (1390) or Append, but not after the file was read from/written to. This may cause loss of data. If a new buffer must be assigned after read/write operations have been performed, the file should be flushed first. This will ensure that the current buffer is emptied.
- Take care that the assigned buffer is always valid. If a local variable is assigned as a buffer, then after the program exits the local program block, the buffer will no longer be valid, and stack problems may occur.

Errors: No checking on `Size` is done.

See also: Assign (1288), Reset (1390), Rewrite (1391), Append (1287)

Listing: ./refex/ex61.pp

```
Program Example61;

{ Program to demonstrate the SetTextBuf function. }

Var
  Fin, Fout : Text;
  Ch : Char;
  Bufin, Bufout : Array[1..10000] of byte;

begin
  Assign (Fin, paramstr(1));
  Reset (Fin);
  Assign (Fout, paramstr(2));
  Rewrite (Fout);
  { This is harmless before IO has begun }
  { Try this program again on a big file,
    after commenting out the following 2
    lines and recompiling it. }
  SetTextBuf (Fin, Bufin);
  SetTextBuf (Fout, Bufout);
  While not eof(Fin) do
    begin
      Read (Fin, ch);
      write (Fout, ch);
    end;
  Close (Fin);
  Close (Fout);
end.
```

37.10.341 SetTextLineEnding

Synopsis: Set the end-of-line character for the given text file.

Declaration: procedure SetTextLineEnding(var f: Text; Ending: string)

Visibility: default

Description: SetTextLineEnding sets the end-of-line character for the text file F to Ending. By default, this is the string indicated by DefaultTextLineStyle (1234).

Errors: None.

See also: DefaultTextLineStyle (1234), TTextLineStyle (1274)

37.10.342 SetThreadManager

Synopsis: Set the thread manager, optionally return the current thread manager.

Declaration:

```
function SetThreadManager(const NewTM: TThreadManager;
                           var OldTM: TThreadManager) : Boolean
function SetThreadManager(const NewTM: TThreadManager) : Boolean
```

Visibility: default

Description: SetThreadManager sets the thread manager to NewTM. If OldTM is given, SetThreadManager uses it to return the previously used thread manager.

The function returns True if the threadmanager was set successfully, False if an error occurred.

For more information about thread programming, see the programmer's guide.

Errors: If an error occurred cleaning up the previous manager, or an error occurred initializing the new manager, False is returned.

See also: GetThreadManager ([1329](#)), TThreadManager ([1275](#))

37.10.343 SetUnicodeStringManager

Synopsis: Set the unicodestring manager

Declaration:

```
procedure SetUnicodeStringManager(const New: TUnicodeStringManager)
procedure SetUnicodeStringManager(const New: TUnicodeStringManager;
                                 var Old: TUnicodeStringManager)
```

Visibility: default

Description: SetUnicodeStringManager sets the current unicodestring manager to New. Optionally, it returns the currently active widestring manager in Old.

UnicodeStrings are implemented in different ways on different platforms. Therefore, the Free Pascal Runtime library has no fixed implementation of widestring routines. Instead, it defines a UnicodeString manager record, with callbacks that can be set to an implementation which is most efficient on the current platform. On windows, standard Windows routines will be used. On Unix and Linux, an implementation based on the C library is available (in unit `cwstring`).

It is possible to implement a custom unicodestring manager, optimized for the current application, without having to recompile the complete Run-Time Library.

See also: TUnicodeStringManager ([1276](#))

37.10.344 SetVariantManager

Synopsis: Set the current variant manager.

Declaration:

```
procedure SetVariantManager(const VarMgr: tvariantmanager)
```

Visibility: default

Description: SetVariantManager sets the variant manager to varmgr.

See also: GetVariantManager ([1330](#))

37.10.345 SetWideStringManager

Synopsis: Set the widestring manager

Declaration: `procedure SetWideStringManager(const New: TUnicodeStringManager)`
`procedure SetWideStringManager(const New: TUnicodeStringManager;`
`var Old: TUnicodeStringManager)`

Visibility: default

Description: `SetWideStringManager` sets the current widestring manager to `New`. Optionally, it returns the currently active widestring manager in `Old`.

WideStrings are implemented in different ways on different platforms. Therefore, the Free Pascal Runtime library has no fixed implementation of widestring routines. Instead, it defines a WideString manager record, with callbacks that can be set to an implementation which is most efficient on the current platform. On windows, standard Windows routines will be used. On Unix and Linux, an implementation based on the C library is available (in unit `cwstring`).

It is possible to implement a custom widestring manager, optimized for the current application, without having to recompile the complete Run-Time Library.

See also: `TWideStringManager` (1280)

37.10.346 ShortCompareText

Synopsis: Compare 2 shortstrings

Declaration: `function ShortCompareText(const S1: shortstring; const S2: shortstring)`
`: SizeInt`

Visibility: default

Description: `ShortCompareText` compares two shortstrings, `S1` and `S2`, and returns the following result:

```
<0if S1<S2.  
0if S1=S2.  
>0if S1>S2.
```

The comparision of the two strings is case-insensitive. The function does not take internationalization settings into account, it simply compares ASCII values.

Errors: None.

See also: `CompareText` (1495)

37.10.347 sin

Synopsis: Calculate sine of angle

Declaration: `function sin(d: ValReal) : ValReal`

Visibility: default

Description: `Sin` returns the sine of its argument `X`, where `X` is an angle in radians. If the absolute value of the argument is larger than 2π , then the result is undefined.

Errors: None.

See also: Cos (1305), Pi (1381), Exp (1318), Ln (1347)

Listing: ./refex/ex62.pp

Program Example62;

{ Program to demonstrate the Sin function. }

```
begin
  Writeln (Sin(Pi):0:1); { Prints 0.0 }
  Writeln (Sin(Pi/2):0:1); { Prints 1.0 }
end.
```

37.10.348 SizeOf

Synopsis: Return size of a variable or type.

Declaration: function SizeOf(X: TAnyType) : LongInt

Visibility: default

Description: SizeOf returns the size, in bytes, of any variable or type-identifier.

Remark: This isn't really a RTL function. Its result is calculated at compile-time, and hard-coded in the executable.

Errors: None.

See also: Addr (1285)

Listing: ./refex/ex63.pp

Program Example63;

{ Program to demonstrate the SizeOf function. }

```
Var
  I : Longint;
  S : String [10];
```

```
begin
  Writeln (SizeOf(I)); { Prints 4 }
  Writeln (SizeOf(S)); { Prints 11 }
end.
```

37.10.349 SizeofResource

Synopsis: Return the size of a particular resource

Declaration: function SizeofResource(ModuleHandle: TFPResourceHMODULE;
ResHandle: TFPResourceHandle) : LongWord

Visibility: default

Description: SizeOfResource returns the size of the resource identified by ResHandle in module identified by ModuleHandle. ResHandle should be obtained from a call to LoadResource (1348)

Errors: In case of an error, 0 is returned.

See also: FindResource (1323), FreeResource (1326), LoadResource (1348), LockResource (1348), UnlockResource (1423), FreeResource (1326)

37.10.350 Slice

Synopsis: Return part of an array

Declaration: function Slice(const A: ArrayType; ACount: Integer) : ArrayType2

Visibility: default

Description: Slice returns the first ACount elements from the array A. It returns an array with the same element type as A, but this array is not assignment compatible to any other array, and can therefore only be used in open array arguments to functions.

See also: Length (1345), SetLength (1402)

Listing: ./refex/ex113.pp

```
Program Example113;

{ Program to demonstrate the Slice function. }

procedure ShowArray(const A: array of Integer);
var
  I: Integer;
begin
  for I := Low(A) to High(A) do
    WriteLn(I, ': ', A[I]);
end;

begin
  ShowArray(Slice([1, 2, 3, 4], 2));
end.
```

37.10.351 Space

Synopsis: Return a string of spaces

Declaration: function Space(b: Byte) : shortstring

Visibility: default

Description: Space returns a shortstring with length B, consisting of spaces.

See also: StringOfChar (1411)

37.10.352 Sptr

Synopsis: Return current stack pointer

Declaration: function Sptr : Pointer

Visibility: default

Description: Sptr returns the current stack pointer.

Errors: None.

See also: SSeg (1410)

Listing: ./refex/ex64.pp

```
program Example64;

{ Program to demonstrate the sptr function. }

var p:ptruint;

begin
  p:=ofs(sptr); { P Contains now the current stack position. }
end.
```

37.10.353 sqr

Synopsis: Calculate the square of a value.

Declaration: function sqr(l: LongInt) : LongInt
function sqr(l: Int64) : Int64
function sqr(l: QWord) : QWord
function sqr(d: ValReal) : ValReal

Visibility: default

Description: Sqr returns the square of its argument X.

Errors: None.

See also: Sqrt (1409), Ln (1347), Exp (1318)

Listing: ./refex/ex65.pp

```
Program Example65;
```

```
{ Program to demonstrate the Sqr function. }
Var i : Integer;

begin
  For i:=1 to 10 do
    writeln (Sqr(i):3);
end.
```

37.10.354 sqrt

Synopsis: Calculate the square root of a value

Declaration: function sqrt(d: ValReal) : ValReal

Visibility: default

Description: Sqrt returns the square root of its argument X, which must be positive.

Errors: If X is negative, then a run-time error is generated.

See also: Sqr (1409), Ln (1347), Exp (1318)

Listing: ./refex/ex66.pp

```
Program Example66;

{ Program to demonstrate the Sqrt function. }

begin
  Writeln (Sqrt(4):0:3); { Prints 2.000 }
  Writeln (Sqrt(2):0:3); { Prints 1.414 }
end.
```

37.10.355 Sseg

Synopsis: Return stack segment register value.

Declaration: function Sseg : Word

Visibility: default

Description: SSeg returns the Stack Segment. This function is only supported for compatibility reasons, as Sptr returns the correct contents of the stackpointer.

Errors: None.

See also: Sptr (1408)

Listing: ./refex/ex67.pp

```
Program Example67;
```

```
{ Program to demonstrate the SSeg function. }
Var W : Longint;
```

```
begin
  W:=SSeg;
end.
```

37.10.356 Str

Synopsis: Convert a numerical value to a string.

Declaration: procedure Str(var X: TNumericType; var S: string)

Visibility: default

Description: Str returns a string which represents the value of X. X can be any numerical type. The actual declaration of Str is not according to pascal syntax, and should be

```
procedure Str(var X: TNumericType[:NumPlaces[:Decimals]]; var S: String)
```

Where the optional NumPlaces and Decimals specifiers control the formatting of the string: NumPlaces gives the total width of the string, and Decimals the number of decimals after the decimal separator char.

Errors: None.

See also: Val (1425)

Listing: ./refex/ex68.pp

```

Program Example68;

{ Program to demonstrate the Str function. }
Var S : String;

Function IntToStr (I : Longint) : String;

Var S : String;

begin
  Str (I,S);
  IntToStr:=S;
end;

begin
  S:= '*'+IntToStr(-233)+'*';
  Writeln (S);
end.

```

37.10.357 StringOfChar

Synopsis: Return a string consisting of 1 character repeated N times.

Declaration: function StringOfChar(c: Char;l: SizeInt) : AnsiString

Visibility: default

Description: StringOfChar creates a new String of length l and fills it with the character c.

It is equivalent to the following calls:

```

SetLength(StringOfChar,l);
FillChar(Pointer(StringOfChar)^,Length(StringOfChar),c);

```

Errors: None.

See also: SetLength ([1402](#))

Listing: ./refex/ex97.pp

```

Program Example97;

{$H+}

{ Program to demonstrate the StringOfChar function. }

Var S : String;

begin
  S:=StringOfChar(' ',40)+ 'Aligned at column 41.';
  Writeln(s);
end.

```

37.10.358 StringToPPChar

Synopsis: Split string in list of null-terminated strings

Declaration: function StringToPPChar(var S: AnsiString; ReserveEntries: Integer) : PPChar
function StringToPPChar(S: PChar; ReserveEntries: Integer) : PPChar

Visibility: default

Description: StringToPPChar splits the string S in words, replacing any whitespace with zero characters. It returns a pointer to an array of pchars that point to the first letters of the words in S. This array is terminated by a Nil pointer.

The function does *not* add a zero character to the end of the string unless it ends on whitespace.

The function reserves memory on the heap to store the array of PChar; The caller is responsible for freeing this memory.

This function is only available on certain platforms.

Errors: None.

See also: [ArrayStringToPPchar \(1288\)](#)

37.10.359 StringToUnicodeChar

Synopsis: Convert an ansistring to a null-terminated array of unicode characters.

Declaration: function StringToUnicodeChar(const Src: AnsiString; Dest: PUnicodeChar; DestSize: SizeInt) : PUnicodeChar

Visibility: default

Description: StringToUnicodeChar converts the ansistring S to a unicodestring and places the result in Dest. The size of the memory location pointed to by Dest must be given in DestSize. If the result string is longer than the available size, the result string will be truncated.

The function always returns Dest.

Errors: No check is performed to see whether Dest points to a valid memory location.

See also: [UnicodeCharToString \(1421\)](#), [UnicodeCharLenToString \(1421\)](#)

37.10.360 StringToWideChar

Synopsis: Convert a string to an array of widechars.

Declaration: function StringToWideChar(const Src: AnsiString; Dest: PWideChar; DestSize: SizeInt) : PWideChar

Visibility: default

Description: StringToWideChar converts an ansistring Src to a null-terminated array of WideChars. The destination for this array is pointed to by Dest, and contains room for at least DestSize widechars.

Errors: No validity checking is performed on Dest.

See also: [WideCharToString \(1428\)](#), [WideCharToStrVar \(1428\)](#), [WideCharLenToStrVar \(1428\)](#), [WideCharLenToString \(1427\)](#)

37.10.361 **strlen**

Synopsis: Length of a null-terminated string.

Declaration: function `strlen(p: PChar) : SizeInt`

Visibility: default

Description: Returns the length of the null-terminated string `P`.

Errors: None.

37.10.362 **strpas**

Synopsis: Convert a null-terminated string to a shortstring.

Declaration: function `strpas(p: PChar) : shortstring`

Visibility: default

Description: Converts a null terminated string in `P` to a Pascal string, and returns this string. The string is truncated at 255 characters.

Errors: None.

37.10.363 **Succ**

Synopsis: Return next element of ordinal type.

Declaration: function `Succ(X: TOrdinal) : TOrdinal`

Visibility: default

Description: `Succ` returns the element that succeeds the element that was passed to it. If it is applied to the last value of the ordinal type, and the program was compiled with range checking on (`{$R+}`), then a run-time error will be generated.

for an example, see `Ord` (1379).

Errors: Run-time error 201 is generated when the result is out of range.

See also: `Ord` (1379), `Pred` (1383), `High` (1333), `Low` (1349)

37.10.364 **SuspendThread**

Synopsis: Suspend a running thread.

Declaration: function `SuspendThread(threadHandle: TThreadID) : DWord`

Visibility: default

Description: `SuspendThread` suspends a running thread. The thread is identified with its handle or ID `threadHandle`.

The function returns zero if successful. A nonzero return value indicates failure.

Errors: If a failure occurred, a nonzero result is returned. The meaning is system dependent.

See also: `ResumeThread` (1391), `KillThread` (1345)

37.10.365 Swap

Synopsis: Swap high and low bytes/words of a variable

Declaration:

```
function swap(X: Word) : Word
function Swap(X: Integer) : Integer
function swap(X: LongInt) : LongInt
function Swap(X: Cardinal) : Cardinal
function Swap(X: QWord) : QWord
function swap(X: Int64) : Int64
```

Visibility: default

Description: Swap swaps the high and low order bytes of X if X is of type Word or Integer, or swaps the high and low order words of X if X is of type Longint or Cardinal. The return type is the type of X

Errors: None.

See also: Lo ([1347](#)), Hi ([1332](#))

Listing: ./refex/ex69.pp

```
Program Example69;

{ Program to demonstrate the Swap function. }
Var W : Word;
    L : Longint;

begin
  W:=$1234;
  W:=Swap(W);
  if W>$3412 then
    writeln ('Error when swapping word !');
  L:=$12345678;
  L:=Swap(L);
  if L<>$56781234 then
    writeln ('Error when swapping Longint !');
end.
```

37.10.366 SwapEndian

Synopsis: Swap endianness of the argument

Declaration:

```
function SwapEndian(const AValue: SmallInt) : SmallInt
function SwapEndian(const AValue: Word) : Word
function SwapEndian(const AValue: LongInt) : LongInt
function SwapEndian(const AValue: DWord) : DWord
function SwapEndian(const AValue: Int64) : Int64
function SwapEndian(const AValue: QWord) : QWord
```

Visibility: default

Description: SwapEndian will swap the endianness of the bytes in its argument.

Errors: None.

See also: hi ([1332](#)), lo ([1347](#)), swap ([1414](#)), BEToN ([1291](#)), NToBE ([1352](#)), NToLE ([1352](#)), LEToN ([1346](#))

37.10.367 SysAllocMem

Synopsis: System memory manager: Allocate memory

Declaration: function SysAllocMem(size: PtrUInt) : Pointer

Visibility: default

Description: SysFreeMem is the system memory manager implementation for AllocMem ([1286](#))

See also: AllocMem ([1286](#))

37.10.368 SysAssert

Synopsis: Standard Assert failure implementation

Declaration: procedure SysAssert(const Msg: ShortString; const FName: ShortString;
LineNo: LongInt; ErrorAddr: Pointer)

Visibility: default

Description: SysAssert is the standard implementation of the assertion failed code. It is the default value of the AssertErrorProc constant. It will print the assert message Msg together with the filename FName and linenumber LineNo to standard error output (StdErr) and will halt the program with exit code 227. The error address ErrorAddr is ignored.

See also: AssertErrorProc ([1234](#))

37.10.369 SysBackTraceStr

Synopsis: Format an address suitable for inclusion in a backtrace

Declaration: function SysBackTraceStr(Addr: Pointer) : ShortString

Visibility: default

Description: SysBackTraceStr will create a string representation of the address Addr, suitable for inclusion in a stack backtrace.

Errors: None.

37.10.370 SysFlushStdIO

Synopsis:

Declaration: procedure SysFlushStdIO

Visibility: default

Description:

37.10.371 SysFreeMem

Synopsis: System memory manager free routine.

Declaration: function SysFreeMem(p: pointer) : PtrUInt

Visibility: default

Description: SysFreeMem is the system memory manager implementation for FreeMem ([1325](#))

See also: FreeMem ([1325](#))

37.10.372 SysFreememSize

Synopsis: System memory manager free routine.

Declaration: function SysFreememSize(p: pointer; Size: PtrUInt) : PtrUInt

Visibility: default

Description: SysFreememSize is the system memory manager implementation for FreeMem ([1325](#))

See also: MemSize ([1350](#))

37.10.373 SysGetFPCHeapStatus

Synopsis: Return the status of the FPC heapmanager

Declaration: function SysGetFPCHeapStatus : TFPCHepStatus

Visibility: default

Description: SysGetFPCHeapStatus returns the status of the default FPC heapmanager. It is set as the default value of the corresponding GetFPCHeapStatus ([1327](#)) function.

Errors: None. The result of this function is bogus information if the current heapmanager is not the standard FPC heapmanager.

See also: GetFPCHeapStatus ([1327](#))

37.10.374 SysGetHeapStatus

Synopsis: System implementation of GetHeapStatus ([1327](#))

Declaration: function SysGetHeapStatus : THeapStatus

Visibility: default

Description: SysGetHeapStatus is the system implementation of the GetHeapStatus ([1327](#)) call.

See also: GetHeapStatus ([1327](#))

37.10.375 SysGetmem

Synopsis: System memory manager memory allocator.

Declaration: function SysGetmem(Size: PtrUInt) : Pointer

Visibility: default

Description: SysGetmem is the system memory manager implementation for GetMem ([1328](#))

See also: GetMem ([1328](#)), GetMemory ([1328](#))

37.10.376 SysInitExceptions

Synopsis: Initialize exceptions.

Declaration: procedure SysInitExceptions

Visibility: default

Description: SysInitExceptions initializes the exception system. This procedure should never be called directly, it is taken care of by the RTL.

37.10.377 SysInitFPU

Synopsis: Initialize the FPU

Declaration: procedure SysInitFPU

Visibility: default

Description: SysInitFPU initializes (resets) the floating point unit, if one is available. It is called for instance when a new thread is started.

See also: BeginThread ([1291](#))

37.10.378 SysInitStdIO

Synopsis: Initialize standard input and output.

Declaration: procedure SysInitStdIO

Visibility: default

Description: SysInitStdIO initializes the standard input and output files: Output ([1283](#)), Input ([1282](#)) and StdErr ([1283](#)). This routine is called by the initialization code of the system unit, there should be no need to call it directly.

37.10.379 SysMemSize

Synopsis: System memory manager: free size.

Declaration: function SysMemSize(p: pointer) : PtrUInt

Visibility: default

Description: SysFreeMemSize is the system memory manager implementation for MemSize ([1350](#))

See also: MemSize ([1350](#))

37.10.380 SysReAllocMem

Synopsis: System memory manager: Reallocate memory

Declaration: function SysReAllocMem(var p: pointer; size: PtrUInt) : Pointer

Visibility: default

Description: SysReallocMem is a help routine for the system memory manager implementation for ReAllocMem ([1389](#)).

See also: ReAllocMem ([1389](#))

37.10.381 SysResetFPU

Synopsis: Reset the floating point unit.

Declaration: procedure SysResetFPU

Visibility: default

Description: SysResetFPU resets the floating point unit. There should normally be no need to call this unit; the compiler itself takes care of this.

37.10.382 SysSetCtrlBreakHandler

Synopsis: System CTRL-C handler

Visibility: default

Description: SysSetCtrlBreakHandler sets the CTRL-C handler to the Handler callback, and returns the previous value of the handler.

See also: [TCtrlBreakHandler](#) (1266)

37.10.383 SysTryResizeMem

Synopsis: System memory manager: attempt to resize memory.

Declaration: function SysTryResizeMem(var p: pointer; size: PtrUInt) : Boolean

Visibility: default

Description: SysTryResizeMem is a help routine for the system memory manager implementation for ReAllocMem (1389), SysReAllocMem (1417)

See also: [SysReAllocMem](#) (1417), [ReAllocMem](#) (1389)

37.10.384 ThreadGetPriority

Synopsis: Return the priority of a thread.

Declaration: function ThreadGetPriority(threadHandle: TThreadID) : LongInt

Visibility: default

Description: ThreadGetPriority returns the priority of thread TThreadID to Prio. The returned priority is a value between -15 and 15.

Errors: None.

See also: [ThreadSetPriority](#) (1418)

37.10.385 ThreadSetPriority

Synopsis: Set the priority of a thread.

Visibility: default

Description: ThreadSetPriority sets the priority of thread TThreadID to Prio. Priority is a value between -15 and 15.

Errors: None.

See also: [ThreadGetPriority](#) (1418)

37.10.386 ThreadSwitch

Synopsis: Signal possibility of thread switch

Declaration: procedure ThreadSwitch

Visibility: default

Description: ThreadSwitch signals the operating system that the thread should be suspended and that another thread should be executed.

This call is a hint only, and may be ignored.

See also: SuspendThread (1413), ResumeThread (1391), KillThread (1345)

37.10.387 trunc

Synopsis: Truncate a floating point value.

Declaration: function trunc(d: ValReal) : Int64

Visibility: default

Description: Trunc returns the integer part of X, which is always smaller than (or equal to) X in absolute value.

Errors: None.

See also: Frac (1325), Int (1341), Round (1395)

Listing: ./refex/ex70.pp

Program Example70;

```
{ Program to demonstrate the Trunc function. }

begin
  Writeln (Trunc(123.456)); { Prints 123 }
  Writeln (Trunc(-123.456)); { Prints -123 }
  Writeln (Trunc(12.3456)); { Prints 12 }
  Writeln (Trunc(-12.3456)); { Prints -12 }
end.
```

37.10.388 Truncate

Synopsis: Truncate the file at position

Declaration: procedure Truncate(var F: File)

Visibility: default

Description: Truncate truncates the (opened) file F at the current file position.

Errors: Depending on the state of the {\$I} switch, a runtime error can be generated if there is an error. In the {\$I-} state, use IOResult to check for errors.

See also: Append (1287), Filepos (1319), Seek (1398)

Listing: ./refex/ex71.pp

```

Program Example71;

{ Program to demonstrate the Truncate function. }

Var F : File of longint;
    I,L : Longint;

begin
    Assign (F, 'test.tmp');
    Rewrite (F);
    For I:=1 to 10 Do
        Write (F,I);
        Writeln ('Filesize before Truncate : ',FileSize(F));
    Close (f);
    Reset (F);
    Repeat
        Read (F,I);
    Until i=5;
    Truncate (F);
    Writeln ('Filesize after Truncate : ',Filesize(F));
    Close (f);
end.

```

37.10.389 TryEnterCriticalSection

Synopsis: Try entering a critical section

Declaration: function TryEnterCriticalSection(var cs: TRTCriticalSection) : LongInt

Visibility: default

Description: TryEnterCriticalSection attempts to enter critical section *cs*. It returns at once. The return value is zero if another thread owns the critical section, or nonzero if the current thread already owns or successfully obtained the critical section.

37.10.390 UCS4StringToUnicodeString

Synopsis: Convert a UCS-4 encoded string to a unicode string

Declaration: function UCS4StringToUnicodeString(const s: UCS4String) : UnicodeString

Visibility: default

Description: UCS4StringToUnicodeString converts the UCS-4 encoded string *s* to a unicode string and returns the resulting string.

This function requires the widestring manager.

See also: UnicodeStringToUCS4String ([1422](#))

37.10.391 UCS4StringToWideString

Synopsis:

Declaration: function UCS4StringToWideString(const s: UCS4String) : WideString

Visibility: default

Description:

37.10.392 Unassigned

Synopsis: Unassigned variant.

Declaration: function Unassigned : Variant

Visibility: default

37.10.393 UnicodeCharLenToString

Synopsis: Convert a memory buffer with unicode characters to an ansistring

Visibility: default

Description: UnicodeCharLenToString converts the unicode characters in buffer S with at most len bytes length, to an ansistring and returns the result.

This function requires the use of a `widestring` manager.

Errors: No checking is done to see if the pointer `S` or length `len` are valid.

See also: [StringToUnicodeChar \(1412\)](#), [UnicodeCharToString \(1421\)](#)

37.10.394 UnicodeCharLenToStrVar

Synopsis: Convert a memory buffer with unicode characters to an ansistring

Declaration: procedure UnicodeCharLenToStrVar(Src: PUnicodeChar; Len: SizeInt;
out Dest: AnsiString)

Visibility: default

Description: UnicodeCharLenToString converts the unicode characters in buffer S with at most len bytes length, to an ansistring and returns the result in Dest

This function does the same as `UnicodeCharLenToString` (1421).

Errors: No checking is done to see if the pointer `S` or length `len` are valid.

See also: [StringToUnicodeChar \(1412\)](#), [UnicodeCharToString \(1421\)](#), [UnicodeCharLenToString \(1421\)](#), [UnicodeCharToStrVar \(1422\)](#)

37.10.395 UnicodeCharToString

Synopsis: Convert unicode character to string

Declaration: function UnicodeCharToString(S: PUnicodeChar) : AnsiString;

Visibility: default

Description: UnicodeCharToString converts a null-word-terminated array of unicode characters in S to an AnsiString value. It simply calls UnicodeCharLenToString (1421) with the length of the string S.

This function requires the use of a widestring manager.

Errors: No checking is done to see if the pointer S is valid.

See also: StringToUnicodeChar (1412), UnicodeCharLenToString (1421), WidestringManager (1284)

37.10.396 UnicodeCharToStrVar

Synopsis: Convert a null-terminated memory buffer with unicode characters to an ansistring

Declaration: procedure UnicodeCharToStrVar(S: PUnicodeChar; out Dest: AnsiString)

Visibility: default

Description: UnicodeCharLenToString converts the unicode characters in buffer S up to the first null word, to an ansistring and returns the result in Dest

This function does the same as UnicodeCharToString (1421).

Errors: No checking is done to see if the pointer S is valid.

See also: StringToUnicodeChar (1412), UnicodeCharToString (1421), UnicodeCharLenToString (1421), UnicodeCharToString (1421)

37.10.397 UnicodeStringToUCS4String

Synopsis: Convert a unicode string to a UCS-4 string.

Declaration: function UnicodeStringToUCS4String(const s: UnicodeString) : UCS4String

Visibility: default

Description: UnicodeStringToUCS4String converts a unicode string S to a UCS-4 encoded string, and returns the resulting string.

This function requires the widestring manager.

See also: UCS4StringToUnicodeString (1420)

37.10.398 UnicodeToUtf8

Synopsis:

```
Declaration: function UnicodeToUtf8(Dest: PChar; Source: PUnicodeChar;
                                    MaxBytes: SizeInt) : SizeInt
function UnicodeToUtf8(Dest: PChar; MaxDestBytes: SizeUInt;
                      Source: PUnicodeChar; SourceChars: SizeUInt)
                      : SizeUInt
function UnicodeToUtf8(Dest: PChar; Source: PWideChar; MaxBytes: SizeInt)
                      : SizeInt
function UnicodeToUtf8(Dest: PChar; MaxDestBytes: SizeUInt;
                      Source: PWideChar; SourceChars: SizeUInt)
                      : SizeUInt
```

Visibility: default

Description:

37.10.399 UniqueString

Synopsis: Make sure reference count of string is 1

Declaration: procedure UniqueString(var S: AnsiString)
procedure UniqueString(var S: UnicodeString)
procedure UniqueString(var S: WideString)

Visibility: default

Description: UniqueString ensures that the ansistring S has reference count 1. It makes a copy of S if this is necessary, and returns the copy in S

Errors: None.

37.10.400 UnlockResource

Synopsis: Unlock a previously locked resource

Declaration: function UnlockResource(ResData: TFPResourceHGLOBAL) : LongBool

Visibility: default

Description: UnlockResource unlocks a previously locked resource. Note that this function does not exist on windows, it's only needed on other platforms.

Errors: The function returns False if it failed.

See also: FindResource (1323), FreeResource (1326), SizeofResource (1407), LoadResource (1348), lockResource (1348), FreeResource (1326)

37.10.401 UnPack

Synopsis: Create unpacked array from packed array

Declaration: procedure UnPack(const Z: PackedArrayType; out A: UnpackedArrayType;
StartIndex: TIndexType)

Visibility: default

Description: UnPack will copy the elements of a packed array (Z) to an unpacked array (A). All elements in Z are copied to A, starting at index StartIndex in A. The type of the index variable StartIndex must match the type of the index of A.

Obviously, the type of the elements of the arrays A and Z must match.

See also: Pack (1380)

37.10.402 upCase

Synopsis: Convert a string to all uppercase.

Declaration: function upCase(const s: shortstring) : shortstring
function upCase(c: Char) : Char
function upcase(const s: ansistring) : ansistring
function UpCase(const s: UnicodeString) : UnicodeString
function UpCase(c: UnicodeChar) : UnicodeChar
function UpCase(const s: WideString) : WideString

Visibility: default

Description: `Uppercase` returns the uppercase version of its argument `C`. If its argument is a string, then the complete string is converted to uppercase. The type of the returned value is the same as the type of the argument.

Errors: None.

See also: [Lowercase \(1349\)](#)

Listing: `./refex/ex72.pp`

```
program Example72;
{ Program to demonstrate the upcase function. }

var c:char;

begin
  for c:='a' to 'z' do
    write(upcase(c));
  Writeln;
{ This doesn't work in TP, but it does in Free Pascal }
  Writeln(upcase('abcdefghijklmnopqrstuvwxyz'));
end.
```

37.10.403 UTF8Decode

Synopsis: Convert an UTF-8 encoded unicode string to a widestring

Declaration: `function UTF8Decode(const s: UTF8String) : UnicodeString`

Visibility: default

Description: `UTF8Decode` converts the UTF-8 encoded unicode string `S` to a widestring and returns the resulting string. It calls the low-level `Utf8ToUnicode` (1425) function to do the actual work.

For this function to work, a widestring manager must be installed.

See also: [UTF8Encode \(1424\)](#), [Utf8ToAnsi \(1425\)](#), [SetWideStringManager \(1406\)](#), [Utf8ToUnicode \(1425\)](#)

37.10.404 UTF8Encode

Synopsis: Convert a widestring to an UTF-8 encoded unicode string

Declaration: `function UTF8Encode(const s: Ansistring) : UTF8String`
`function UTF8Encode(const s: UnicodeString) : UTF8String`
`function UTF8Encode(const s: WideString) : UTF8String`

Visibility: default

Description: `UTF8Encode` converts an ansistring or widestring `S` to the equivalent UTF-8 encoded unicode string and returns this resulting string. It calls the low-level `UnicodeToUTF8` (1422) function to do the actual work.

For this function to work, a widestring manager must be installed.

See also: [UTF8Decode \(1424\)](#), [Utf8ToAnsi \(1425\)](#), [UnicodeToUtf8 \(1422\)](#), [SetWideStringManager \(1406\)](#)

37.10.405 Utf8ToAnsi

Synopsis: Convert a UTF-8 encoded unicode string to an ansistring

Declaration: function Utf8ToAnsi(const s: UTF8String) : ansistring

Visibility: default

Description: Utf8ToAnsi converts an utf8-encode unicode string to an ansistring. It converts the string to a widestring and then converts the widestring to an ansistring.

For this function to work, a widestring manager must be installed.

See also: [UTF8Encode \(1424\)](#), [UTF8Decode \(1424\)](#), [SetWideStringManager \(1406\)](#)

37.10.406 Utf8ToUnicode

Synopsis: Convert a buffer with UTF-8 characters to widestring characters

```
Declaration: function Utf8ToUnicode(Dest: PUnicodeChar; Source: PChar;
                                  MaxChars: SizeInt) : SizeInt
            function Utf8ToUnicode(Dest: PUnicodeChar; MaxDestChars: SizeUInt;
                                  Source: PChar; SourceBytes: SizeUInt) : SizeUInt
            function Utf8ToUnicode(Dest: PWideChar; Source: PChar; MaxChars: SizeInt)
                                  : SizeInt
            function Utf8ToUnicode(Dest: PWideChar; MaxDestChars: SizeUInt;
                                  Source: PChar; SourceBytes: SizeUInt) : SizeUInt
```

Visibility: default

Description: Utf8ToUnicode converts the buffer in *Source* with a length of *SourceBytes* or for a maximum length of *MaxChars* (or *MaxDestChars*) widestring characters to the buffer pointed to by *Dest*.

The function returns the number of copied widestring characters.

For this function to work, a widestring manager must be installed.

Errors: On error, -1 is returned.

See also: [UTF8Encode \(1424\)](#), [UTF8Decode \(1424\)](#), [Utf8ToAnsi \(1425\)](#), [SetWideStringManager \(1406\)](#)

37.10.407 Val

Synopsis: Calculate numerical/enumerated value of a string.

Declaration: procedure Val(const S: string; var V; var Code: Word)

Visibility: default

Description: Val converts the value represented in the string *S* to a numerical value or an enumerated value, and stores this value in the variable *V*, which can be of type Longint, Real and Byte or any enumerated type. If the conversion isn't successful, then the parameter *Code* contains the index of the character in *S* which prevented the conversion. The string *S* is allowed to contain spaces in the beginning.

The string *S* can contain a number in decimal, hexadecimal, binary or octal format, as described in the language reference. For enumerated values, the string must be the name of the enumerated value. The name is searched case insensitively.

The conversion to enumerated exists only as of version 2.3.1 (or later) of the compiler.

Errors: If the conversion doesn't succeed, the value of `Code` indicates the position where the conversion went wrong. The value of `V` is then undefined.

See also: [Str \(1410\)](#)

Listing: ./refex/ex74.pp

```
Program Example74;

{ Program to demonstrate the Val function. }
Var I, Code : Integer;

begin
  Val (ParamStr (1), I, Code);
  If Code<>0 then
    Writeln ('Error at position ', code, ' : ', Paramstr(1)[Code])
  else
    Writeln ('Value : ', I);
end.
```

37.10.408 VarArrayGet

Synopsis:

Declaration: `function VarArrayGet(const A: Variant; const Indices: Array of LongInt) : Variant`

Visibility: default

Description:

37.10.409 VarArrayPut

Synopsis: Put a value in a single cell of a variant array

Declaration: `procedure VarArrayPut(var A: Variant; const Value: Variant; const Indices: Array of LongInt)`

Visibility: default

Description: `VarArrayPut` puts `Value` in the variant array `A` at the location indicated by `Indices`. Thus the statement

`VarArrayPut (A, B, [2,1]);`

is equivalent to

`A[2,1]:=B;`

The difference is that the previous is usable when the amount of indices is not known at compile time.

Errors: If the number of indices is wrong (or out of range) an exception may be raised.

See also: [VarArrayGet \(1426\)](#)

37.10.410 VarArrayRedim

Synopsis: Redimension a variant array

Declaration: procedure VarArrayRedim(var A: Variant; HighBound: SizeInt)

Visibility: default

Description: VarArrayRedim re-sizes the first dimension of the variant array A, giving it a new high bound HighBound. Obviously, A must be a variant array for this function to work.

37.10.411 VarCast

Synopsis: Cast a variant to a certain type

Declaration: procedure VarCast(var dest: variant; const source: variant; vartype: LongInt)

Visibility: default

Description: VarCast converts the variant in Source to the type indicated in Vartype and returns the result in dest. The Vartype must be one of the pre-defined VarNNN constants.

Errors: If the conversion is not possible because the value cannot be correctly casted, then a run-time error or an exception may occur.

37.10.412 WaitForThreadTerminate

Synopsis: Wait for a thread to terminate.

Declaration: function WaitForThreadTerminate(threadHandle: TThreadID; TimeoutMs: LongInt) : DWord

Visibility: default

Description: WaitForThreadTerminate waits for a thread to finish its execution. The thread is identified by its handle or ID threadHandle. If the thread does not exit within TimeoutMs milliseconds, the function will return with an error value.

The function returns the exit code of the thread.

See also: EndThread ([1312](#)), KillThread ([1345](#))

37.10.413 WideCharLenToString

Synopsis: Convert a length-limited array of widechar to an ansistring

Declaration: function WideCharLenToString(S: PWideChar; Len: SizeInt) : AnsiString

Visibility: default

Description: WideCharLenToString converts at most Len widecharacters from the null-terminated widechar array S to an ansistring, and returns the ansistring.

Errors: No validity checking is performed on S. Passing an invalid pointer may lead to access violations.

See also: StringToWideChar ([1412](#)), WideCharToString ([1428](#)), WideCharToStrVar ([1428](#)), WideCharLenToStrVar ([1428](#))

37.10.414 WideCharLenToStrVar

Synopsis: Convert a length-limited array of widechar to an ansistring

Declaration: procedure WideCharLenToStrVar(Src: PWideChar; Len: SizeInt;
out Dest: AnsiString)

Visibility: default

Description: `WideCharLenToString` converts at most `Len` widecharacters from the null-terminated widechar array `Src` to an ansistring, and returns the ansistring in `Dest`.

Errors: No validity checking is performed on `Src`. Passing an invalid pointer may lead to access violations.

See also: [StringToWideChar \(1412\)](#), [WideCharToString \(1428\)](#), [WideCharToStrVar \(1428\)](#), [WideCharLenToString \(1427\)](#)

37.10.415 WideCharToString

Synopsis: Convert a null-terminated array of widechar to an ansistring

Declaration: function WideCharToString(S: PWideChar) : AnsiString

Visibility: default

Description: `WideCharToString` converts the null-terminated widechar array `S` to an ansistring, and returns the ansistring.

Errors: No validity checking is performed on `Src`. Passing an invalid pointer, or an improperly terminated array may lead to access violations.

See also: [StringToWideChar \(1412\)](#), [WideCharToStrVar \(1428\)](#), [WideCharLenToStrVar \(1428\)](#), [WideCharLenToString \(1427\)](#)

37.10.416 WideCharToStrVar

Synopsis: Convert a null-terminated array of widechar to an ansistring

Declaration: procedure WideCharToStrVar(S: PWideChar; out Dest: AnsiString)

Visibility: default

Description: `WideCharToString` converts the null-terminated widechar array `S` to an ansistring, and returns the ansistring in `Dest`.

Errors: No validity checking is performed on `S`. Passing an invalid pointer, or an improperly terminated array may lead to access violations.

See also: [StringToWideChar \(1412\)](#), [WideCharToString \(1428\)](#), [WideCharToStrVar \(1428\)](#), [WideCharLenToString \(1427\)](#)

37.10.417 WideStringToUCS4String

Synopsis: Convert a widestring to a UCS-4 encoded string.

Declaration: function WideStringToUCS4String(const s: WideString) : UCS4String

Visibility: default

Description: Convert a widestring to a UCS-4 encoded string.

37.10.418 Write

Synopsis: Write variable to a text file

Declaration: `procedure Write(Args: Arguments)`
`procedure Write(var F: Text;Args: Arguments)`

Visibility: default

Description: `Write` writes the contents of the variables V1, V2 etc. to the file F. F can be a typed file, or a Text file. If F is a typed file, then the variables V1, V2 etc. must be of the same type as the type in the declaration of F. Untyped files are not allowed. If the parameter F is omitted, standard output is assumed. If F is of type Text, then the necessary conversions are done such that the output of the variables is in human-readable format. This conversion is done for all numerical types. Strings are printed exactly as they are in memory, as well as PChar types. The format of the numerical conversions can be influenced through the following modifiers: `OutputVariable : NumChars [: Decimals]` This will print the value of `OutputVariable` with a minimum of `NumChars` characters, from which `Decimals` are reserved for the decimals. If the number cannot be represented with `NumChars` characters, `NumChars` will be increased, until the representation fits. If the representation requires less than `NumChars` characters then the output is filled up with spaces, to the left of the generated string, thus resulting in a right-aligned representation. If no formatting is specified, then the number is written using its natural length, with nothing in front of it if it's positive, and a minus sign if it's negative. Real numbers are, by default, written in scientific notation.

Errors: If an error occurs, a run-time error is generated. This behavior can be controlled with the `{$I}` switch.

See also: [WriteLn \(1429\)](#), [Read \(1385\)](#), [ReadLn \(1387\)](#), [Blockwrite \(1293\)](#)

37.10.419 WriteBarrier

Synopsis: Memory write barrier

Declaration: `procedure WriteBarrier`

Visibility: default

Description: `WriteBarrier` is a low-level instruction to force a write barrier in the CPU: write (store) operations before and after the barrier are separate.

See also: [ReadBarrier \(1386\)](#), [ReadDependencyBarrier \(1386\)](#), [ReadWriteBarrier \(1388\)](#)

37.10.420 WriteLn

Synopsis: Write variable to a text file and append newline

Declaration: `procedure Writeln(Args: Arguments)`
`procedure WriteLn(var F: Text;Args: Arguments)`

Visibility: default

Description: `WriteLn` does the same as `Write (1429)` for text files, and emits a Carriage Return - LineFeed character pair after that. If the parameter F is omitted, standard output is assumed. If no variables are specified, a Carriage Return - LineFeed character pair is emitted, resulting in a new line in the file F.

Remark: Under linux and unix, the Carriage Return character is omitted, as customary in Unix environments.

Errors: If an error occurs, a run-time error is generated. This behavior can be controlled with the `{$I}` switch.

See also: Write (1429), Read (1385), Readln (1387), Blockwrite (1293)

Listing: ./refex/ex75.pp

Program Example75;

```
{ Program to demonstrate the Write(In) function. }

Var
  F : File of Longint;
  L : Longint;

begin
  Write ('This is on the first line ! '); { No CR/LF pair! }
  Writeln ('And this too... ');
  Writeln ('But this is already on the second line ... ');
  Assign (f, 'test.tmp');
  Rewrite (f);
  For L:=1 to 10 do
    write (F,L); { No writeln allowed here ! }
  Close (f);
end.
```

37.10.421 WriteStr

Synopsis: Write variables to a string

Declaration: procedure WriteStr(out S: string;Args: Arguments)

Visibility: default

Description: WriteStr behaves like Write (1429), except that it stores its output in the string variable S instead of a file. Semantically, the WriteStr call is equivalent to writing the arguments to a file using the Write call, and then reading them into S using the Read call from the same file:

```
var
  F : Text;
begin
  Rewrite(F);
  Write(F,Args);
  Close(F);
  Reset(F);
  Read(F,S);
  Close(F);
end;
```

Obviously, the WriteStr call does not use a temporary file.

WriteStr is defined in the ISO Extended Pascal standard. More information on the allowed arguments and the possible formatting can be found in the description of Write (1429).

See also: Write (1429), ReadStr (1387), Read (1385)

37.11 IDispatch

37.11.1 Description

`IDispatch` is the pascal definition of the Windows Dispatch interface definition.

See also: [IUnknown \(1434\)](#)

37.11.2 Method overview

Page	Property	Description
1431	<code>GetIDsOfNames</code>	Return IDs of named procedures
1431	<code>GetTypeInfo</code>	Return type information about properties
1431	<code>GetTypeInfoCount</code>	Return number of properties.
1431	<code>Invoke</code>	Invoke a dispatch method

37.11.3 IDispatch.GetTypeInfoCount

Synopsis: Return number of properties.

Declaration: `function GetTypeInfoCount(out count: LongInt) : HRESULT`

Visibility: default

37.11.4 IDispatch.GetTypeInfo

Synopsis: Return type information about properties

Declaration: `function GetTypeInfo(Index: LongInt; LocaleID: LongInt; out TypeInfo) : HRESULT`

Visibility: default

37.11.5 IDispatch.GetIDsOfNames

Synopsis: Return IDs of named procedures

Declaration: `function GetIDsOfNames(const iid: TGuid; names: Pointer; NameCount: LongInt; LocaleID: LongInt; DispIDs: Pointer) : HRESULT`

Visibility: default

Description: Return the ID of a procedure.

37.11.6 IDispatch.Invoke

Synopsis: Invoke a dispatch method

Declaration: `function Invoke(DispID: LongInt; const iid: TGuid; LocaleID: LongInt; Flags: Word; var params; VarResult: pointer; ExcepInfo: pointer; ArgErr: pointer) : HRESULT`

Visibility: default

37.12 I Enumerable

37.12.1 Description

`IEnumerable` can be used to get an enumerator from a class. If a class implements `IEnumerable`, it can return an enumerator interface `IEnumerator` ([1432](#)).

See also: `IEnumerator` ([1432](#))

37.12.2 Method overview

Page	Property	Description
1432	<code>GetEnumerator</code>	Return an enumerator interface for this class

37.12.3 `IEnumerable.GetIEnumerator`

Synopsis: Return an enumerator interface for this class

Declaration: `function GetEnumerator : IEnumerator`

Visibility: default

Description: `GetEnumerator` returns a new `IEnumerator` ([1432](#)) interface for this class. This is called by the compiler whenever a `for` in loop is encountered in the source code to retrieve the enumerator instance.

See also: `IEnumerator` ([1432](#))

37.13 I Enumerator

37.13.1 Description

`IEnumerator` is the interface needed by the `For ... in ...` language construct, when operating on classes. It contains all methods that the compiler needs to implement a loop.

A `for` in loop like the following:

```
For O in MyObject do
begin
// do things
end;
```

is treated by the compiler as equivalent to the following code:

```
Var
I : IEnumerator;
O : TObject;

begin
I:=MyObject.GetEnumerator;
While I.MoveNext do
begin
O:=I.GetCurrent;
// Do things
```

```
    end;
end.
```

Any class that implements the `IEnumerable` interface must be able to return an `IEnumerator` instance for the compiler to use in a `For in` loop.

See also: [IEnumerable \(1432\)](#)

37.13.2 Method overview

Page	Property	Description
1433	<code>GetCurrent</code>	Returns the current element in the iteration cycle
1433	<code>MoveNext</code>	Move to the next value
1434	<code>Reset</code>	Reset the pointer

37.13.3 Property overview

Page	Property	Access	Description
1434	<code>Current</code>	r	Return the current item

37.13.4 `IEnumerator.GetCurrent`

Synopsis: Returns the current element in the iteration cycle

Declaration: `function GetCurrent : TObject`

Visibility: default

Description: `GetCurrent` should return the object instance representing the current value in the `for in` loop. `GetCurrent` will always be called immediately after `IEnumerator.MoveNext (1)` returned `True`.

Remark: The actual return type of the interface should not necessarily be `TObject`, it can be any type. The compiler will check the actual return type with the type of the loop variable, and they should match.

See also: `IEnumerator.MoveNext (1)`, `IEnumerator.Reset (1)`

37.13.5 `IEnumerator.MoveNext`

Synopsis: Move to the next value

Declaration: `function MoveNext : Boolean`

Visibility: default

Description: `MoveNext` should move the current item pointer to the next available item. It should return `True` if an item is available, `False` if no more items are available. The first time it is called it will be called at the beginning of the `for` loop, so it should position the enumerator on the first value (if there is one). After `MoveNext` has returned `True`, `IEnumerator.GetCurrent (1)` will be called to retrieve the item.

See also: `IEnumerator.Reset (1)`, `IEnumerator.GetCurrent (1)`

37.13.6 IEnumator.Reset

Synopsis: Reset the pointer

Declaration: procedure Reset

Visibility: default

Description: Reset can be implemented to put the pointer at the start of the list. It is not mandatory to implement this method, the compiler does not use it.

See also: IEnumator.GetCurrent ([1](#)), IEnumator.MoveNext ([1](#))

37.13.7 IEnumator.Current

Synopsis: Return the current item

Declaration: Property Current : TObject

Visibility: default

Access: Read

Description: Current simply is the redefinition of IEnumator.GetCurrent ([1](#)) as a property. It is read-only.

See also: IEnumator.GetCurrent ([1](#)), IEnumator.MoveNext ([1](#))

37.14 IIInvokable

37.14.1 Description

IIInvokable is a descendent of IIInterface ([1257](#)), compiled in the { \$M+ } state, so Run-Time Type Information (RTTI) is generated for it.

See also: IDispatch ([1431](#)), IIInterface ([1257](#))

37.15 IUnknown

37.15.1 Description

IUnknown is defined by windows. It's the basic interface which all COM objects must implement. The definition does not contain any code.

See also: IIInterface ([1257](#)), IDispatch ([1431](#)), IIInvokable ([1434](#))

37.15.2 Method overview

Page	Property	Description
1435	_AddRef	Increase reference count of the interface
1435	QueryInterface	Return pointer to VMT table of interface
1435	_Release	Decrease reference count of the interface

37.15.3 IUnknown.QueryInterface

Synopsis: Return pointer to VMT table of interface

Declaration: function QueryInterface(const iid: TGuid;out obj) : LongInt

Visibility: default

37.15.4 IUnknown._AddRef

Synopsis: Increase reference count of the interface

Declaration: function _AddRef : LongInt

Visibility: default

See also: IUnknown._Release ([1](#))

37.15.5 IUnknown._Release

Synopsis: Decrease reference count of the interface

Declaration: function _Release : LongInt

Visibility: default

See also: IUnknown._AddRef ([1](#))

37.16 TAggregatedObject

37.16.1 Description

TAggregatedObject implements an object whose lifetime is governed by an external object (or interface). It does not implement the IUnknown interface by itself, but delegates all methods to the controller object, as exposed in the Controller ([1](#)) property. In effect, the reference count of the aggregated object is the same as that of its controller, and additionally, all interfaces of the controller are exposed by the aggregated object.

Note that the aggregated object maintains a non-counted reference to the controller.

Aggregated objects should be used when using delegation to implement reference counted objects: the delegated interfaces can be implemented safely by TAggregatedObject descendants.

See also: Create ([1](#)), Controller ([1](#))

37.16.2 Method overview

Page	Property	Description
1436	Create	Create a new instance of TAggregatedObject

37.16.3 Property overview

Page	Property	Access	Description
1436	Controller	r	Controlling instance

37.16.4 TAggregatedObject.Create

Synopsis: Create a new instance of TAggregatedObject

Declaration: constructor Create(const aController: IUnknown)

Visibility: public

Description: Create creates a new instance of TAggregatedObject on the heap, and stores a reference to aController, so it can be exposed in the Controller ([1](#)) property.

Errors: If not enough memory is present on the heap, an exception will be raised. If the aController is Nil, exceptions will occur when any of the TAggregatedObject methods (actually, the IUnknown methods) are used.

See also: Controller ([1](#))

37.16.5 TAggregatedObject.Controller

Synopsis: Controlling instance

Declaration: Property Controller : IUnknown

Visibility: public

Access: Read

Description: Controller exposes the controlling object, with all interfaces it has.

The value of the controller is set when the TAggregatedObject instance is created.

See also: TAggregatedObject.Create ([1](#))

37.17 TContainedObject

37.17.1 Description

TContainedObject is the base class for contained objects, i.e. objects that do not implement a reference counting mechanism themselves, but are owned by some other object which handles the reference counting mechanism. It implements the IUnknown interface and, more specifically, the QueryInterface method of IUnknown.

See also: IInterface ([1257](#))

37.17.2 Interfaces overview

Page	Property	Description
1257	IInterface	Basic interface for all COM based interfaces

37.18 TInterfacedObject

37.18.1 Description

TInterfacedObject is a descendent of TObject ([1438](#)) which implements the IUnknown ([1434](#)) interface. It can be used as a base class for all classes which need reference counting.

See also: IUnknown ([1434](#)), TObject ([1438](#))

37.18.2 Interfaces overview

Page	Property	Description
1434	IUnknown	Basic interface for all COM-based interfaces

37.18.3 Method overview

Page	Property	Description
1437	AfterConstruction	Handle reference count properly.
1437	BeforeDestruction	Check reference count.
1437	NewInstance	Create a new instance

37.18.4 Property overview

Page	Property	Access	Description
1438	RefCount	r	Return the current reference count

37.18.5 TInterfacedObject.AfterConstruction

Synopsis: Handle reference count properly.

Declaration: procedure AfterConstruction; Override

Visibility: public

Description: AfterConstruction overrides the basic method in TObject and adds some additional reference count handling.

Errors: None.

See also: BeforeDestruction ([1](#))

37.18.6 TInterfacedObject.BeforeDestruction

Synopsis: Check reference count.

Declaration: procedure BeforeDestruction; Override

Visibility: public

Description: AfterConstruction overrides the basic method in TObject and adds a reference count check: if the reference count is not zero, an error occurs.

Errors: A runtime-error 204 will be generated if the reference count is nonzero when the object is destroyed.

See also: AfterConstruction ([1](#))

37.18.7 TInterfacedObject.NewInstance

Synopsis: Create a new instance

Declaration: class function NewInstance; Override

Visibility: public

Description: NewInstance initializes a new instance of TInterfacedObject ([1436](#))

Errors: None.

37.18.8 TInterfacedObject.RefCount

Synopsis: Return the current reference count

Declaration: Property RefCount : LongInt

Visibility: public

Access: Read

Description: RefCount returns the current reference count. This reference count cannot be manipulated, except through the methods of IUnknown ([1434](#)). When it reaches zero, the class instance is destroyed.

See also: IUnknown ([1434](#))

37.19 TObject

37.19.1 Description

TObject is the parent root class for all classes in Object Pascal. If a class has no parent class explicitly declared, it is dependent on TObject. TObject introduces class methods that deal with the class' type information, and contains all necessary methods to create an instance at runtime, and to dispatch messages to the correct method (both string and integer messages).

See also: TClass ([1266](#))

37.19.2 Method overview

Page	Property	Description
1444	AfterConstruction	Method called after the constructor was called.
1445	BeforeDestruction	Method called before the destructor is called.
1442	ClassInfo	Return a pointer to the type information for this class.
1442	ClassName	Return the current class name.
1442	ClassNameIs	Check whether the class name equals the given name.
1443	ClassParent	Return the parent class.
1442	ClassType	Return a "class of" pointer for the current class
1441	CleanupInstance	Finalize the class instance.
1439	Create	TObject Constructor
1441	DefaultHandler	Default handler for integer message handlers.
1445	DefaultHandlerStr	Default handler for string messages.
1440	Destroy	TObject destructor.
1445	Dispatch	Dispatch an integer message
1445	DispatchStr	Dispatch a string message.
1448	Equals	Check if two objects are equal.
1444	FieldAddress	Return the address of a field.
1441	Free	Check for Nil and call destructor.
1440	FreeInstance	Clean up instance and free the memory reserved for the instance.
1448	GetHashCode	Return a hash code for the object
1446	GetInterface	Return a reference to an interface
1446	GetInterfaceByStr	Return an interface based on its GUID
1447	GetInterfaceEntry	Return the interface table entry by GUID
1447	GetInterfaceEntryByStr	Return the interface table entry by string
1447	GetInterfaceTable	Return a pointer to the table of implemented interfaces for a class
1446	GetInterfaceWeak	Get a reference to an interface, not increasing the reference count
1443	InheritsFrom	Check whether class is an ancestor.
1441	InitInstance	Initialize a new class instance.
1443	InstanceState	Return the size of an instance.
1444	MethodAddress	Return the address of a method
1444	MethodName	Return the name of a method.
1440	newinstance	Allocate memory on the heap for a new instance
1440	SafeCallException	Handle exception object
1443	StringMessageTable	Return a pointer to the string message table.
1448	ToString	Return a string representation for the object
1447	UnitName	Unit name

37.19.3 TObject.Create

Synopsis: TObject Constructor

Declaration: constructor Create

Visibility: public

Description: Create creates a new instance of TObject. Currently it does nothing. It is also not virtual, so there is in principle no need to call it directly.

See also: Destroy (1)

37.19.4 **TObject.Destroy**

Synopsis: TObject destructor.

Declaration: `destructor Destroy; Virtual`

Visibility: public

Description: `Destroy` is the destructor of `TObject`. It will clean up the memory assigned to the instance. Descendent classes should override `destroy` if they want to do additional clean-up. No other destructor should be implemented.

It is bad programming practice to call `Destroy` directly. It is better to call the `Free` (1) method, because that one will check first if `Self` is different from `Nil`.

To clean up an instance and reset the refence to the instance, it is best to use the `FreeAndNil` (1545) function.

See also: Create (1), Free (1)

37.19.5 **TObject.newinstance**

Synopsis: Allocate memory on the heap for a new instance

Declaration: `class function newinstance; Virtual`

Visibility: public

Description: `NewInstance` allocates memory on the heap for a new instance of the current class. If the memory was allocated, the class will be initialized by a call to `InitInstance` (1). The function returns the newly initialized instance.

Errors: If not enough memory is available, a `Nil` pointer may be returned, or an exception may be raised.

See also: Create (1), `InitInstance` (1), `InstanceSize` (1), `FreeInstance` (1)

37.19.6 **TObject.FreeInstance**

Synopsis: Clean up instance and free the memory reserved for the instance.

Declaration: `procedure FreeInstance; Virtual`

Visibility: public

Description: `FreeInstance` cleans up an instance of the current class, and releases the heap memory occupied by the class instance.

See also: `Destroy` (1), `InitInstance` (1), `NewInstance` (1)

37.19.7 **TObject.SafeCallException**

Synopsis: Handle exception object

Declaration: `function SafeCallException(exceptobject: TObject; exceptaddr: pointer): HRESULT; Virtual`

Visibility: public

Description: `SafeCallException` should be overridden to handle exceptions in a method marked with the `savecall` directive. The implementation in `TObject` simply returns zero.

37.19.8 **TObject.DefaultHandler**

Synopsis: Default handler for integer message handlers.

Declaration: procedure DefaultHandler(var message); Virtual

Visibility: public

Description: DefaultHandler is the default handler for messages. If a message has an unknown message ID (i.e. does not appear in the table with integer message handlers), then it will be passed to DefaultHandler by the Dispatch (1) method.

See also: Dispatch (1), DefaultHandlerStr (1)

37.19.9 **TObject.Free**

Synopsis: Check for Nil and call destructor.

Declaration: procedure Free

Visibility: public

Description: Free will check the Self pointer and calls Destroy (1) if it is different from Nil. This is a safer method than calling Destroy directly. If a reference to the object must be reset as well (a recommended technique), then the function FreeAndNil (1545) should be called.

Errors: None.

See also: Destroy (1), FreeAndNil (1545)

37.19.10 **TObject.InitInstance**

Synopsis: Initialize a new class instance.

Declaration: class function InitInstance(instance: pointer)

Visibility: public

Description: InitInstance initializes the memory pointer to by Instance. This means that the VMT is initialized, and the interface pointers are set up correctly. The function returns the newly initialized instance.

See also: NewInstance (1), Create (1)

37.19.11 **TObject.CleanupInstance**

Synopsis: Finalize the class instance.

Declaration: procedure CleanupInstance

Visibility: public

Description: CleanUpinstance finalizes the instance, i.e. takes care of all reference counted objects, by decreasing their reference count by 1, and freeing them if their count reaches zero.

Normally, CleanupInstance should never be called, it is called automatically when the object is freed with it's constructor.

Errors: None.

See also: Destroy (1), Free (1), InitInstance (1)

37.19.12 **TObject.ClassType**

Synopsis: Return a "class of" pointer for the current class

Declaration: class function ClassType

Visibility: public

Description: ClassType returns a TClass ([1266](#)) class type reference for the current class.

See also: TClass ([1266](#)), ClassInfo ([1](#)), ClassName ([1](#))

37.19.13 **TObject.ClassInfo**

Synopsis: Return a pointer to the type information for this class.

Declaration: class function ClassInfo

Visibility: public

Description: ClassInfo returns a pointer to the type information for this class. This pointer can be used in the various type information routines.

37.19.14 **TObject.ClassName**

Synopsis: Return the current class name.

Declaration: class function ClassName

Visibility: public

Description: ClassName returns the class name for the current class, in all-uppercase letters. To check for the class name, use the ClassNameIs ([1](#)) class method.

Errors: None.

See also: ClassInfo ([1](#)), ClassType ([1](#)), ClassNameIs ([1](#))

37.19.15 **TObject.ClassNameIs**

Synopsis: Check whether the class name equals the given name.

Declaration: class function ClassNameIs(const name: string)

Visibility: public

Description: ClassNameIs checks whether Name equals the class name. It takes of case sensitivity, i.e. it converts both names to uppercase before comparing.

See also: ClassInfo ([1](#)), ClassType ([1](#)), ClassName ([1](#))

37.19.16 **TObject.ClassParent**

Synopsis: Return the parent class.

Declaration: class function ClassParent

Visibility: public

Description: ClassParent returns the class of the parent class of the current class. This is always different from Nil, except for TObject.

Errors: None.

See also: [ClassInfo \(1\)](#), [ClassType \(1\)](#), [ClassNameIs \(1\)](#)

37.19.17 **TObject.InstanceSize**

Synopsis: Return the size of an instance.

Declaration: class function InstanceSize

Visibility: public

Description: InstanceSize returns the number of bytes an instance takes in memory. This is Just the memory occupied by the class structure, and does not take into account any additional memory that might be allocated by the constructor of the class.

Errors: None.

See also: [InitInstance \(1\)](#), [ClassName \(1\)](#), [ClassInfo \(1\)](#), [ClassType \(1\)](#)

37.19.18 **TObject.InheritsFrom**

Synopsis: Check whether class is an ancestor.

Declaration: class function InheritsFrom(aClass: TClass)

Visibility: public

Description: InheritsFrom returns True if AClass is an ancestor class from the current class, and returns false if it is not.

See also: [ClassName \(1\)](#), [ClassInfo \(1\)](#), [ClassType \(1\)](#), [TClass \(1266\)](#)

37.19.19 **TObject.StringMessageTable**

Synopsis: Return a pointer to the string message table.

Declaration: class function StringMessageTable

Visibility: public

Description: StringMessageTable returns a pointer to the string message table, which can be used to look up methods for dispatching a string message. It is used by the DispatchStr ([1](#)) method.

Errors: If there are no string message handlers, nil is returned.

See also: [DispatchStr \(1\)](#), [Dispatch \(1\)](#)

37.19.20 TObject.MethodAddress

Synopsis: Return the address of a method

Declaration: class function MethodAddress (const name: shortstring)

Visibility: public

Description: MethodAddress returns the address of a method, searching the method by its name. The Name parameter specifies which method should be taken. The search is conducted in a case-insensitive manner.

Errors: If no matching method is found, Nil is returned.

See also: [MethodName \(1\)](#), [FieldAddress \(1\)](#)

37.19.21 TObject.MethodName

Synopsis: Return the name of a method.

Declaration: class function MethodName (address: pointer)

Visibility: public

Description: MethodName searches the VMT for a method with the specified address and returns the name of the method.

Errors: If no method with the matching address is found, an empty string is returned.

See also: [MethodAddress \(1\)](#), [FieldAddress \(1\)](#)

37.19.22 TObject.FieldAddress

Synopsis: Return the address of a field.

Declaration: function FieldAddress (const name: shortstring) : pointer

Visibility: public

Description: FieldAddress returns the address of the field with name name. The address is the address of the field in the current class instance.

Errors: If no field with the specified name is found, Nil is returned.

See also: [MethodAddress \(1\)](#), [MethodName \(1\)](#)

37.19.23 TObject.AfterConstruction

Synopsis: Method called after the constructor was called.

Declaration: procedure AfterConstruction; Virtual

Visibility: public

Description: AfterConstruction is a method called after the constructor was called. It does nothing in the implementation of TObject and must be overridden by descendent classes to provide specific behaviour that is executed after the constructor has finished executing. (for instance, call an event handler)

Errors: None.

See also: [BeforeDestruction \(1\)](#), [Create \(1\)](#)

37.19.24 **TObject.BeforeDestruction**

Synopsis: Method called before the destructor is called.

Declaration: procedure BeforeDestruction; Virtual

Visibility: public

Description: BeforeDestruction is a method called before the destructor is called. It does nothing in the implementation of TObject and must be overridden by descendent classes to provide specific behaviour that is executed before the destructor has finished executing. (for instance, call an event handler)

Errors: None.

See also: AfterConstruction (1), Destroy (1), Free (1)

37.19.25 **TObject.DefaultHandlerStr**

Synopsis: Default handler for string messages.

Declaration: procedure DefaultHandlerStr(var message); Virtual

Visibility: public

Description: DefaultHandlerStr is called for string messages which have no handler associated with them in the string message handler table. The implementation of DefaultHandlerStr in TObject does nothing and must be overridden by descendent classes to provide specific message handling behaviour.

See also: DispatchStr (1), Dispatch (1), DefaultHandler (1)

37.19.26 **TObject.Dispatch**

Synopsis: Dispatch an integer message

Declaration: procedure Dispatch(var message); Virtual

Visibility: public

Description: Dispatch looks in the message handler table for a handler that handles message. The message is identified by the first dword (cardinal) in the message structure.

If no matching message handler is found, the message is passed to the DefaultHandler (1) method, which can be overridden by descendent classes to add custom handling of messages.

See also: DispatchStr (1), DefaultHandler (1)

37.19.27 **TObject.DispatchStr**

Synopsis: Dispatch a string message.

Declaration: procedure DispatchStr(var message); Virtual

Visibility: public

Description: DispatchStr extracts the message identifier from Message and checks the message handler table to see if a handler for the message is found, and calls the handler, passing along the message. If no handler is found, the default DefaultHandlerStr (1) is called.

Errors: None.

See also: DefaultHandlerStr (1), Dispatch (1), DefaultHandler (1)

37.19.28 TObject.GetInterface

Synopsis: Return a reference to an interface

Declaration: `function GetInterface(const iid: TGuid; out obj) : Boolean`
`function GetInterface(const iidstr: shortstring; out obj) : Boolean`

Visibility: public

Description: `GetInterface` scans the interface tables and returns a reference to the interface `iid`. The reference is stored in `Obj` which should be an interface reference. It returns `True` if the interface was found, `False` if not.

The reference count of the interface is increased by this call.

Errors: If no interface was found, `False` is returned.

See also: GetInterfaceByStr (1)

37.19.29 TObject.GetInterfaceByStr

Synopsis: Return an interface based on its GUID

Declaration: `function GetInterfaceByStr(const iidstr: shortstring; out obj) : Boolean`

Visibility: public

Description: `GetInterfaceByStr` returns in `obj` a pointer to the interface identified by `iidstr`. The function returns `True` if the interface is indeed implemented by the class, or `False` otherwise.

The `iidstr` is the unique GUID by which the interface was declared.

Errors: The function returns false if the requested interface is not implemented.

See also: TObject.GetInterfaceEntry (1), TObject.GetInterfaceEntryByStr (1)

37.19.30 TObject.GetInterfaceWeak

Synopsis: Get a reference to an interface, not increasing the reference count

Declaration: `function GetInterfaceWeak(const iid: TGuid; out obj) : Boolean`

Visibility: public

Description: `GetInterfaceWeak` performs the same function as `Getinterface` (1), but unlike the latter, it will not increase the reference count of the interface.

See also: TObject.GetInterface (1)

37.19.31 **TObject.GetInterfaceEntry**

Synopsis: Return the interface table entry by GUID

Declaration: class function GetInterfaceEntry(const iid: TGuid)

Visibility: public

Description: GetInterfaceEntry returns the internal interface table entry for the interface identified by *iid* (the GUID used in the declaration of the interface). If the interface is not implemented by the class, the function returns *Nil*.

See also: TObject.GetInterfaceByStr (1), TObject.GetInterfaceEntryByStr (1)

37.19.32 **TObject.GetInterfaceEntryByStr**

Synopsis: Return the interface table entry by string

Declaration: class function GetInterfaceEntryByStr(const iidstr: shortstring)

Visibility: public

Description: GetInterfaceEntryByStr returns the internal interface table entry for the interface identified by *iidstr* (A string representation of the GUID used in the declaration of the interface). If the interface is not implemented by the class, the function returns *Nil*.

See also: TObject.GetInterfaceByStr (1), TObject.GetInterfaceEntry (1)

37.19.33 **TObject.GetInterfaceTable**

Synopsis: Return a pointer to the table of implemented interfaces for a class

Declaration: class function GetInterfaceTable

Visibility: public

Description: GetInterfaceTable returns a pointer to the internal table of implemented interfaces for a class. The result will always point to a valid address, if the class implements no interfaces the EntryCount field of the interface table will be zero.

See also: TObject.GetInterfaceByStr (1), TObject.GetInterfaceEntry (1)

37.19.34 **TObject.UnitName**

Synopsis: Unit name

Declaration: class function UnitName

Visibility: public

Description: UnitName returns the unit name in which the class was defined. The name is obtained from the class definition data the compiler generates for each class.

37.19.35 **TObject.Equals**

Synopsis: Check if two objects are equal.

Declaration: function Equals(Obj: TObject) : Boolean; Virtual

Visibility: public

Description: Equals returns True if the object instance pointer (*Self*) equals the instance pointer *Obj*.

Descendent classes can override to check properties etc. in case the instance pointers are different.

See also: TObject.GetHashCode (1), TObject.ToString (1)

37.19.36 **TObject.GetHashCode**

Synopsis: Return a hash code for the object

Declaration: function GetHashCode : PtrInt; Virtual

Visibility: public

Description: GetHashCode should return a hash code for the object. By default, the numerical (integer) address of *Self* is returned.

Descendent classes can use this to generate better suitable values to be used in a hash table.

See also: TObject.ToString (1), TObject.Equals (1)

37.19.37 **TObject.ToString**

Synopsis: Return a string representation for the object

Declaration: function ToString : ansistring; Virtual

Visibility: public

Description: ToString returns by default the class name of the object. It is useful during sending of debug messages.

Descendent classes can override this method to give a better description of the object than just the class name.

See also: TObject.GetHashCode (1), TObject.Equals (1)

Chapter 38

Reference for unit 'sysutils'

38.1 Used units

Table 38.1: Used units by unit 'sysutils'

Name	Page
errors	??
sysconst	??
System	1229
Unix	1676
unixtype	1713

38.2 Overview

This documentation describes the `sysutils` unit. The `sysutils` unit was started by Gertjan Schouten, and completed by Michael Van Canneyt. It aims to be compatible to the Delphi `sysutils` unit, but in contrast with the latter, it is designed to work on multiple platforms. It is implemented on all supported platforms.

38.3 Localization support

Localization support depends on various constants and structures being initialized correctly. On Windows and OS/2 this is done automatically: a widestring manager is installed by default which helps taking care of the current locale when performing various operations on strings. The various internationalization settings (date/time format, currency, language etc) are also initialized correctly on these platforms.

On unixes, the widestring support is in a separate unit: `cwstring`, which loads the various needed functions from the C library. It should be added manually to the `uses` clause of your program. No internationalization (or localisation) settings are applied by this unit, these must be initialized separately by including the `clocale` unit in the `uses` clause of your program.

38.4 Miscellaneous conversion routines

Functions for various conversions.

Table 38.2:

Name	Description
BCDToInt (1491)	Convert BCD number to integer
CompareMem (1494)	Compare two memory regions
FloatToStrF (1531)	Convert float to formatted string
FloatToStr (1530)	Convert float to string
FloatToText (1533)	Convert float to string
FormatFloat (1543)	Format a floating point value
GetDirs (1547)	Split string in list of directories
IntToHex (1554)	return hexadecimal representation of integer
IntToStr (1555)	return decimal representation of integer
StrToIntDef (1586)	Convert string to integer with default value
StrToInt (1585)	Convert string to integer
StrtoFloat (1584)	Convert string to float
TexttoFloat (1590)	Convert null-terminated string to float

38.5 Date/time routines

Functions for date and time handling.

Table 38.3:

Name	Description
DateTimeToFileDate (1500)	Convert DateTime type to file date
DateTimeToStr (1500)	Construct string representation of DateTime
DateTimeToString (1501)	Construct string representation of DateTime
DateTimeToSystemTime (1502)	Convert DateTime to system time
DateTimeToTimeStamp (1502)	Convert DateTime to timestamp
DateToStr (1503)	Construct string representation of date
Date (1499)	Get current date
DayOfWeek (1503)	Get day of week
DecodeDate (1504)	Decode DateTime to year month and day
DecodeTime (1505)	Decode DateTime to hours, minutes and seconds
EncodeDate (1508)	Encode year, day and month to DateTime
EncodeTime (1509)	Encode hours, minutes and seconds to DateTime
FormatDateTime (1543)	Return string representation of DateTime
IncMonth (1553)	Add 1 to month
IsLeapYear (1556)	Determine if year is leap year
MSecsToTimeStamp (1559)	Convert nr of milliseconds to timestamp
Now (1560)	Get current date and time
StrToDate (1582)	Convert string to Date
StrToDate (1581)	Convert string to date
StrToTime (1587)	Convert string to time
SystemTimeToDate (1590)	Convert system time to datetime
TimeStampToDate (1592)	Convert time stamp to Date
TimeStampToMSecs (1592)	Convert Timestamp to number of millicoseconds
TimeToStr (1593)	return string representation of Time
Time (1591)	Get current tyme

38.6 FileName handling routines

Functions for file manipulation.

Table 38.4:

Name	Description
AnsiCompareFileName (1477)	Compare 2 filenames
AnsiLowerCaseFileName (1482)	Create lowercase filename
AnsiUpperCaseFileName (1490)	Create uppercase filename
AddDisk (1476)	Add disk to list of disk drives
ChangeFileExt (1493)	Change extension of file name
CreateDir (1497)	Create a directory
DeleteFile (1505)	Delete a file
DiskFree (1506)	Free space on disk
DiskSize (1507)	Total size of disk
ExpandFileName (1513)	Create full file name
ExpandFileNameCase (1513)	Create full file name case insensitively
ExpandUNCFileName (1514)	Create full UNC file name
ExtractFileDir (1514)	Extract drive and directory part of filename
ExtractFileDrive (1515)	Extract drive part of filename
ExtractFileExt (1515)	Extract extension part of filename
ExtractFileName (1516)	Extract name part of filename
ExtractFilePath (1516)	Extract path part of filename
ExtractRelativePath (1516)	Construct relative path between two files
FileAge (1517)	Return file age
FileDateToDateTime (1519)	Convert file date to system date
FileExists (1520)	Determine whether a file exists on disk
FileGetAttr (1520)	Get attributes of file
FileGetDate (1521)	Get date of last file modification
FileSearch (1524)	Search for file in path
FileSetAttr (1525)	Get file attributes
FileSetDate (1526)	Get file dates
FindFirst (1527)	Start finding a file
FindNext (1528)	Find next file
GetCurrentDir (1546)	Return current working directory
RemoveDir (1562)	Remove a directory from disk
RenameFile (1562)	Rename a file on disk
SameFileName (1564)	Check whether 2 filenames are the same
SetCurrentDir (1564)	Set current working directory
SetDirSeparators (1565)	Set directory separator characters
FindClose (1527)	Stop searching a file
DoDirSeparators (1508)	Replace directory separator characters

38.7 File input/output routines

Functions for reading/writing to file.

Table 38.5:

Name	Description
FileCreate (1518)	Create a file and return handle
FileOpen (1522)	Open file end return handle
FileRead (1523)	Read from file
FileSeek (1525)	Set file position
FileTruncate (1526)	Truncate file length
FileWrite (1526)	Write to file
FileClose (1518)	Close file handle

38.8 PChar related functions

Most PChar functions are the same as their counterparts in the STRINGS unit. The following functions are the same :

1. StrCat (1567) : Concatenates two PChar strings.
2. StrComp (1568) : Compares two PChar strings.
3. StrCopy (1569) : Copies a PChar string.
4. StrECopy (1570) : Copies a PChar string and returns a pointer to the terminating null byte.
5. StrEnd (1570) : Returns a pointer to the terminating null byte.
6. StrIComp (1571) : Case insensitive compare of 2 PChar strings.
7. StrLCat (1573) : Appends at most L characters from one PChar to another PChar.
8. StrLComp (1573) : Case sensitive compare of at most L characters of 2 PChar strings.
9. StrLCopy (1574) : Copies at most L characters from one PChar to another.
10. StrLen (1575) : Returns the length (exclusive terminating null byte) of a PChar string.
11. StrLIComp (1576) : Case insensitive compare of at most L characters of 2 PChar strings.
12. StrLower (1576) : Converts a PChar to all lowercase letters.
13. StrMove (1577) : Moves one PChar to another.
14. StrNew (1577) : Makes a copy of a PChar on the heap, and returns a pointer to this copy.
15. StrPos (1579) : Returns the position of one PChar string in another?
16. StrRScan (1579) : returns a pointer to the last occurrence of on PChar string in another one.
17. StrScan (1580) : returns a pointer to the first occurrence of on PChar string in another one.
18. StrUpper (1589) : Converts a PChar to all uppercase letters.

The subsequent functions are different from their counterparts in STRINGS, although the same examples can be used.

38.9 Date and time formatting characters

Various date and time formatting routines accept a format string. to format the date and or time. The following characters can be used to control the date and time formatting:

c shortdateformat + ' ' + longtimeformat
d day of month
dd day of month (leading zero)
ddd day of week (abbreviation)
ddd day of week (full)
dddd shortdateformat
dddddd longdateformat
m month
mm month (leading zero)
mmm month (abbreviation)
mmmm month (full)
y year (2 digits)
yy year (two digits)
yyyy year (with century)
h hour
hh hour (leading zero)
n minute
nn minute (leading zero)
s second
ss second (leading zero)
t shorttimeformat
tt longtimeformat
am/pm use 12 hour clock and display am and pm accordingly
a/p use 12 hour clock and display a and p accordingly
/ insert date separator
: insert time separator
"xx" literal text
'xx' literal text
z milliseconds
zzz milliseconds(leading zero)

38.10 Formatting strings

Functions for formatting strings.

Table 38.6:

Name	Description
AdjustLineBreaks (1477)	Convert line breaks to line breaks for system
FormatBuf (1542)	Format a buffer
Format (1535)	Format arguments in string
FmtStr (1534)	Format buffer
QuotedStr (1561)	Quote a string
StrFmt (1571)	Format arguments in a string
StrLFmt (1575)	Format maximum L characters in a string
TrimLeft (1594)	Remove whitespace at the left of a string
TrimRight (1595)	Remove whitespace at the right of a string
Trim (1593)	Remove whitespace at both ends of a string

38.11 String functions

Functions for handling strings.

Table 38.7:

Name	Description
AnsiCompareStr (1478)	Compare two strings
AnsiCompareText (1479)	Compare two strings, case insensitive
AnsiExtractQuotedStr (1480)	Removes quotes from string
AnsiLastChar (1480)	Get last character of string
AnsiLowerCase (1481)	Convert string to all-lowercase
AnsiQuotedStr (1482)	Quotes a string
AnsiStrComp (1483)	Compare strings case-sensitive
AnsiStrIComp (1484)	Compare strings case-insensitive
AnsiStrLComp (1485)	Compare L characters of strings case sensitive
AnsiStrLIComp (1486)	Compare L characters of strings case insensitive
AnsiStrLastChar (1485)	Get last character of string
AnsiStrLower (1487)	Convert string to all-lowercase
AnsiStrUpper (1488)	Convert string to all-uppercase
AnsiUpperCase (1489)	Convert string to all-uppercase
AppendStr (1490)	Append 2 strings
AssignStr (1491)	Assign value of strings on heap
CompareStr (1494)	Compare two strings case sensitive
CompareText (1495)	Compare two strings case insensitive
DisposeStr (1507)	Remove string from heap
IsValidIdent (1557)	Is string a valid pascal identifier
LastDelimiter (1557)	Last occurrence of character in a string
LeftStr (1558)	Get first N characters of a string
LoadStr (1558)	Load string from resources
LowerCase (1558)	Convert string to all-lowercase
NewStr (1560)	Allocate new string on heap
RightStr (1563)	Get last N characters of a string
StrAlloc (1566)	Allocate memory for string
StrBufSize (1567)	Reserve memory for a string
StrDispose (1569)	Remove string from heap
StrPas (1578)	Convert PChar to pascal string
StrPCopy (1578)	Copy pascal string
StrPLCopy (1579)	Copy N bytes of pascal string
UpperCase (1600)	Convert string to all-uppercase

38.12 Constants, types and variables

38.12.1 Constants

```
ConfigExtension : string = '.cfg'
```

ConfigExtension is the default extension used by the GetAppConfigFile ([1546](#)) call. It can be set to any valid extension for the current OS.

```
DateDelta = 693594
```

Days between 1/1/0001 and 12/31/1899

```
DriveDelim = DriveSeparator
```

DriveDelim refers to the system unit's DriveSeparator constant, it is for Delphi compatibility only.

EmptyStr : string = ''

Empty String Constant

EmptyWideStr : WideString = ''

Empty wide string.

faAnyFile = \$0000003f

Use this attribute in the FindFirst ([1527](#)) call to find all matching files.

faArchive = \$00000020

Attribute of a file, meaning the file has the archive bit set. Used in TSearchRec ([1470](#)) and FindFirst ([1527](#))

faDirectory = \$00000010

Attribute of a file, meaning the file is a directory. Used in TSearchRec ([1470](#)) and FindFirst ([1527](#))

faHidden = \$00000002

Attribute of a file, meaning the file is read-only. Used in TSearchRec ([1470](#)) and FindFirst ([1527](#))

faReadOnly = \$00000001

Attribute of a file, meaning the file is read-only. Used in TSearchRec ([1470](#)) and FindFirst ([1527](#))

faSymLink = \$00000040

faSymLink means the file (as returned e.g. by FindFirst ([1527](#))/FindNext ([1528](#))), is a symlink. It's ignored under Windows.

faSysFile = \$00000004

Attribute of a file, meaning the file is a system file. Used in TSearchRec ([1470](#)) and FindFirst ([1527](#))

faVolumeId = \$00000008

Attribute of a file, meaning the entry contains the volume ID. Used in TSearchRec ([1470](#)) and FindFirst ([1527](#))

feInvalidHandle : THandle = (-1)

feInvalidHandle is the return value of FileOpen ([1522](#)) in case of an error.

filerecnamelength = 255

`filerecnamelength` describes the length of the FileRec ([1463](#)) filename field.

`fmOpenRead = $0000`

`fmOpenRead` is used in the FileOpen ([1522](#)) call to open a file in read-only mode.

`fmOpenReadWrite = $0002`

`fmOpenReadWrite` is used in the FileOpen ([1522](#)) call to open a file in read-write mode.

`fmOpenWrite = $0001`

`fmOpenWrite` is used in the FileOpen ([1522](#)) call to open a file in write-only mode.

`fmShareCompat = $0000`

`fmOpenShareCompat` is used in the FileOpen ([1522](#)) call OR-ed together with one of `fmOpenReadWrite` ([1458](#)), `fmOpenRead` ([1458](#)) or `fmOpenWrite` ([1458](#)), to open a file in a sharing modus that is equivalent to sharing implemented in MS-DOS.

`fmShareDenyNone = $0040`

`fmShareDenyNone` is used in the FileOpen ([1522](#)) call OR-ed together with one of `fmOpenReadWrite` ([1458](#)), `fmOpenRead` ([1458](#)) or `fmOpenWrite` ([1458](#)), to open a file so other processes can read/write the file as well.

`fmShareDenyRead = $0030`

`fmOpenShareRead` is used in the FileOpen ([1522](#)) call OR-ed together with one of `fmOpenReadWrite` ([1458](#)), `fmOpenRead` ([1458](#)) or `fmOpenWrite` ([1458](#)), to open a file so other processes cannot read from it.

This constant only works on Windows, because other operating systems do not support this constants.

`fmShareDenyWrite = $0020`

`fmOpenShareWrite` is used in the FileOpen ([1522](#)) call OR-ed together with one of `fmOpenReadWrite` ([1458](#)), `fmOpenRead` ([1458](#)) or `fmOpenWrite` ([1458](#)), to open a file so other processes cannot write to it, they can only read.

`fmShareExclusive = $0010`

`fmOpenShareExclusive` is used in the FileOpen ([1522](#)) call OR-ed together with one of `fmOpenReadWrite` ([1458](#)), `fmOpenRead` ([1458](#)) or `fmOpenWrite` ([1458](#)), to open a file exclusively.

`fsFromBeginning = 0`

`fsFromBeginning` is used to indicate in the FileSeek ([1525](#)) call that a seek operation should be started at the start of the file.

`fsFromCurrent = 1`

`fsFromBeginning` is used to indicate in the `FileSeek` (1525) call that a seek operation should be started at the current position in the file.

`fsFromEnd = 2`

`fsFromBeginning` is used to indicate in the `FileSeek` (1525) call that a seek operation should be started at the last position in the file.

`GUID_NULL : TGuid = '{00000000-0000-0000-0000-000000000000}'`

NULL GUID constant

`HexDisplayPrefix : string = '$'`

`HexDisplayPrefix` is used by the formatting routines to indicate that the number which follows the prefix is in Hexadecimal notation.

`HoursPerDay = 24`

Number of hours in a day.

`JulianEpoch = (-2415018.5)`

Starting point of the Julian calendar

`LeadBytes : Set of Char = []`

`LeadBytes` contains the set of bytes that serve as lead byte in a MBCS string.

`MaxCurrency : Currency = 922337203685477.0000`

Maximum currency value

`MaxDateTime : TDateTime = 2958465.99999`

Maximum `TDateTime` value.

`MAX_PATH = MaxPathLen`

`MAX_PATH` is the maximum number of characters that a filename (including path) can contain on the current operating system.

`MinCurrency : Currency = -922337203685477.0000`

Minimum Currency value

`MinDateTime : TDateTime = -693593.0`

Minimum `TDateTime` value.

`MinsPerDay = HoursPerDay * MinsPerHour`

Number of minutes per day.

MinsPerHour = 60

Number of minutes per hour.

MonthDays : Array[Boolean] of TDayTable = ((31, 28, 31, 30, 31, 30, 31, 31, 31, 30, 31,

Array with number of days in the months for leap and non-leap years.

MSecsPerDay = SecsPerDay * MSecsPerSec

Number of milliseconds per day

MSecsPerSec = 1000

Number of milliseconds per second

NullStr : PString = @EmptyStr

Pointer to an empty string

PathDelim = DirectorySeparator

PathDelim refers to the system unit's DirectorySeparator constant, it is for Delphi compatibility only.

PathSep = PathSeparator

PathSep refers to the system unit's PathSeparator constant, it is for Delphi compatibility only.

pfBCB4Produced = \$08000000

Not used in Free Pascal.

pfDelphi4Produced = \$0C000000

Not used in Free Pascal.

pfDesignOnly = \$00000002

Package is a design-time only package

pfExeModule = \$00000000

Package is an executable

pfIgnoreDupUnits = \$00000008

Ignore duplicate units in package

pfLibraryModule = \$80000000

Package is a library

pfModuleTypeMask = \$C0000000

Mask for module type flags

pfNeverBuild = \$00000001

Never-build flag was specified when compiling package

pfPackageModule = \$40000000

Package is a real package (not exe)

pfProducerMask = \$0C000000

Mask for producer flags

pfProducerUndefined = \$04000000

Not used in Free Pascal.

pfRunOnly = \$00000004

Package is a run-time only package

pfV3Produced = \$00000000

Not used in Free Pascal.

RTL_SIGBUS = 4

Bus error signal number (Unix only)

RTL_SIGDEFAULT = -1

Default signal handler (Unix only)

RTL_SIGFPE = 1

Floating Point Error signal number (Unix only)

RTL_SIGILL = 3

Illegal instruction signal number (Unix only)

RTL_SIGINT = 0

INTERRUPT signal number (Unix only)

RTL_SIGLAST = RTL_SIGQUIT

Last signal number (Unix only)

RTL_SIGQUIT = 5

QUIT signal number (Unix only)

RTL_SIGSEGV = 2

Segmentation fault signal number (Unix only)

SecsPerDay = MinsPerDay * SecsPerMin

Number of seconds per day

SecsPerMin = 60

Number of seconds per minute

SwitchChars = ['-']

The characters in this set will be used by the FindCmdLineSwitch ([1527](#)) function to determine whether a command-line argument is a switch (an option) or a value. If the first character of an argument is in `SwitchChars`, it will be considered an option or switch.

SysConfigDir : string = ''

`SysConfigDir` is the default system configuration directory. It is set at application startup by the `sysutils` initialization routines.

This directory may be returned by the `GetAppConfigDir` ([1545](#)) call on some systems.

TextRecBufSize = 256

Buffer size of text file record.

TextRecNameLength = 256

Length of text file record filename field

ufImplicitUnit = \$10

Unit was implicitly imported into package (did not appear in package contains list)

ufMainUnit = \$01

Unit is the main unit of the package

ufOrgWeakUnit = \$08

Unit is the original weak packaged unit

ufPackageUnit = \$02

Unit is a packaged unit (appeared in package contains list)

ufWeakPackageUnit = ufPackageUnit or ufWeakUnit

Weak (original or not) packaged unit

ufWeakUnit = \$04

Unit is a weak packaged unit

UnixDateDelta = (UnixEpoch)

Number of days between 1.1.1900 and 1.1.1970

UnixEpoch = JulianEpoch + (2440587.5)

Starting point of the unix calendar (1/1/1970)

38.12.2 Types

EHeapException = EHeapMemoryError

EHeapMemoryError is raised when an error occurs in the heap management routines.

ExceptClass = Class of Exception

ExceptClass is a Exception ([1611](#)) class reference.

```
FileRec = packed record
  Handle : THandle;
  Mode : LongInt;
  RecSize : SizeInt;
  _private : Array[1..3*SizeOf(SizeInt)+5*SizeOf(pointer)] of Byte;
  UserData : Array[1..32] of Byte;
  name : Array[0..filerecnamelength] of Char;
end
```

FileRec describes a untyped file. This record is made available so it can be used to implement drivers for other than the normal file system file records.

```
Int128Rec = packed record
end
```

Int128Rec is a record defining a 128-bit integer. It is made up of 2 QWords or 4 DWords or 8 words or 16 bytes.

```
Int64Rec = packed record
end
```

`Int64Rec` can be used to extract the parts of a `Int64`: the high and low cardinal, or a zero-based array of 4 words, or a zero based array of 8 bytes. Note that the meaning of the High and Low parts are different on various CPUs.

```
LongRec = packed record
end
```

`LongRec` can be used to extract the parts of an `long Integer`: the high and low word, or the 4 separate bytes as a zero-based array of bytes. Note that the meaning of High and Low parts are different on various CPUs.

```
OWordRec = packed record
end
```

`OWordRec` is a record defining a 128-bit integer. It is made up of 2 `QWords` or 4 `DWords` or 8 words or 16 bytes.

```
PByteArray = ^TByteArray
```

Generic pointer to `TByteArray` ([1464](#)). Use to access memory regions as a byte array.

```
PDayTable = ^TDayTable
```

Pointer to `TDayTable` type.

```
PString = ^
```

Pointer to a `ansistring`

```
PSysCharSet = ^TSysCharSet
```

Pointer to `TSysCharSet` ([1470](#)) type.

```
PWordarray = ^TWordArray
```

Generic pointer to `TWordArray` ([1471](#)). Use to access memory regions as a word array.

```
TBeepHandler = procedure
```

`TBeepHandler` is the prototype used by the `OnBeep` ([1473](#)) handler. This in turn is called by the `Beep` ([1492](#)) call to actually implement the beep functionality. The call takes no arguments.

```
TByteArray = Array[0..32767] of Byte
```

`TByteArray` is a generic array definition, mostly for use as a base type of the `PByteArray` ([1464](#)) type.

```
TBytes = Array of Byte
```

TBytes defines a dynamic array of bytes. This can be used to typecast e.g. strings to manipulate them byte for byte.

```
TCreateGUIDFunc = function(out GUID: TGuid) : Integer
```

TCreateGUIDFunc is the prototype for a GUID creation handler. On return, the GUID argument should contain a new (unique) GUID. The return value of the function should be zero for success, nonzero for failure.

```
TDayTable = Array[1..12] of Word
```

Array of day names.

```
TEventType = (etCustom, etInfo, etWarning, etError, etDebug)
```

Table 38.8: Enumeration values for type TEventType

Value	Explanation
etCustom	Custom log event, with application-specific meaning
etDebug	Debug message.
etError	Error condition message
etInfo	General information event message
etWarning	Warning message

TEventType is a type to be used by logging mechanisms (in particular, the `TCustomApplication` and `TEventLog` classes. It can be used to filter events, and write only certain types of event to the event log.

```
TEventTypes = Set of TEventType
```

TEventTypes is a set type of `TEventType`, defined for convenience. It is used in the custom application classes for logging purposes.

```
TExecuteFlags= Set of (ExecInheritsHandles)
```

Table 38.9: Enumeration values for type

Value	Explanation
ExecInheritsHandles	The new process inherits all (file) handles owned by the current process

TExecuteFlags is a set of flags to influence the behaviour of the `ExecuteProcess` ([1512](#)) call.

```
TextBuf = Array[0..TextRecBufSize-1] of Char
```

TextBuf is the type for the default buffer in `TextRec` ([1466](#))

```

TextRec = packed record
  Handle : THandle;
  Mode : LongInt;
  bufsize : SizeInt;
  _private : SizeInt;
  bufpos : SizeInt;
  bufend : SizeInt;
  bufptr : ^TextBuf;
  openfunc : pointer;
  inoutfunc : pointer;
  flushfunc : pointer;
  closefunc : pointer;
  UserData : Array[1..32] of Byte;
  name : Array[0..textrecnamelength-1] of Char;
  LineEnd : TLineEndStr;
  buffer : TextBuf;
end

```

`TextRec` describes a text file. This record is made available so it can be used to implement drivers for other than the normal file system file records.

To implement a driver, an `Assign` procedure must be implemented, which fills in the various fields of the record. Most notably, the callback functions must be filled in appropriately. After this, the normal file operations will handle all necessary calls to the various callbacks.

`TFilename` = String

`TFileName` is used in the `TSearchRec` ([1470](#)) definition.

`TFilenameCaseMatch` = (mkNone, mkExactMatch, mkSingleMatch, mkAmbiguous)

Table 38.10: Enumeration values for type `TFilenameCaseMatch`

Value	Explanation
mkAmbiguous	More than one file will match the filename in a case-insensitive way
mkExactMatch	The filename can be used to refer to a file on the system (findfirst will find it).
mkNone	No file was found
mkSingleMatch	Exactly one match was found, but case didn't match.

`TFilenameCaseMatch` describes how `ExpandFileNameCase` ([1513](#)) found the file.

`TFileRec` = FileRec

Alias for `FileRec` ([1463](#)) for Delphi compatibility.

`TFileSearchOption` = (sfoImplicitCurrentDir, sfoStripQuotes)

Table 38.11: Enumeration values for type TFileSearchOption

Value	Explanation
sfoImplicitCurrentDir	Always search the current directory first, even if it is not specified.
sfoStripQuotes	Strip quotes from the components in the search path.

TFileSearchOption enumerates the options that can be used in the FileSearch call to control the behaviour of the search mechanism

```
TFileSearchOptions = Set of TFileSearchOption
```

TFileSearchOptions is a set of TFileSearchOption ([1466](#)) values, used in the FileSearch ([1524](#)) call when searching for files.

```
TFloatFormat = (ffGeneral, ffExponent, fffixed, ffNumber, ffCurrency)
```

Table 38.12: Enumeration values for type TFloatFormat

Value	Explanation
ffCurrency	Monetary format.
ffExponent	Scientific format.
ffFixed	Fixed point format.
ffGeneral	General number format.
ffNumber	Fixed point format with thousand separatord

TFloatFormat is used to determine how a float value should be formatted in the FloatToText ([1533](#)) function.

```
TFloatRec = record
  Exponent : Integer;
  Negative : Boolean;
  Digits : Array[0..18] of Char;
end
```

TFloatRec is used to describe a floating point value by the FloatToDecimal ([1529](#)) function.

```
TFloatValue = (fvExtended, fvCurrency, fvSingle, fvReal, fvDouble, fvComp)
```

Table 38.13: Enumeration values for type TFloatValue

Value	Explanation
fvComp	Comp value
fvCurrency	Currency value
fvDouble	Double value
fvExtended	Extended value
fvReal	Real value
fvSingle	Single value

`TFloatValue` determines which kind of value should be returned in the (untyped) buffer used by the `TextToFloat` ([1590](#)) function.

```
TFormatSettings = record
  CurrencyFormat : Byte;
  NegCurrFormat : Byte;
  ThousandSeparator : Char;
  DecimalSeparator : Char;
  CurrencyDecimals : Byte;
  DateSeparator : Char;
  TimeSeparator : Char;
  ListSeparator : Char;
  CurrencyString : string;
  ShortDateFormat : string;
  LongDateFormat : string;
  TimeAMString : string;
  TimePMString : string;
  ShortTimeFormat : string;
  LongTimeFormat : string;
  ShortMonthNames : TMonthNameArray;
  LongMonthNames : TMonthNameArray;
  ShortDayNames : TWeekNameArray;
  LongDayNames : TWeekNameArray;
  TwoDigitYearCenturyWindow : Word;
end
```

`TFormatSettings` is a record that contains a copy of all variables which determine formatting in the various string formatting routines. It is used to pass local copies of these values to the various formatting routines in a thread-safe way.

```
TGetAppNameEvent = function : string
```

This callback type is used by the `OnGetApplicationName` ([1474](#)) to return an alternative application name.

```
TGetTempDirEvent = function(Global: Boolean) : string
```

Function prototype for `OnGetTempDir` ([1474](#)) handler.

```
TGetTempFileEvent = function(const Dir: string; const Prefix: string)
  : string
```

Function prototype for `OnGetTempFile` ([1474](#)) handler.

```
TGetVendorNameEvent = function : string
```

`TGetVendorNameEvent` is the function prototype for the `OnGetVendorName` ([1474](#)) callback, used by the `VendorName` ([1601](#)) function.

```
THandle = System.THandle
```

`THandle` refers to the definition of `THandle` in the system unit, and is provided for backward compatibility only.

```
TIntegerSet = Set of
```

`TIntegerSet` is a generic integer subrange set definition whose size fits in a single integer.

```
TLineEndStr = string
```

`TLineEndStr` is used in the `TextRec` ([1466](#)) record to indicate the end-of-line sequence for a text file.

```
TMbcsByteType = (mbSingleByte, mbLeadByte, mbTrailByte)
```

Table 38.14: Enumeration values for type `TMbcsByteType`

Value	Explanation
<code>mbLeadByte</code>	Uses lead-byte
<code>mbSingleByte</code>	Single bytes
<code>mbTrailByte</code>	Uses trailing byte

Type of multi-byte character set.

```
TMonthNameArray = Array[1..12] of
```

`TMonthNameArray` is used in the month long and short name arrays.

```
TProcedure = procedure
```

`TProcedure` is a general definition of a procedural callback.

```
TReplaceFlags= Set of (rfReplaceAll, rfIgnoreCase)
```

Table 38.15: Enumeration values for type

Value	Explanation
<code>rfIgnoreCase</code>	Search case insensitive.
<code>rfReplaceAll</code>	Replace all occurrences of the search string with the replacement string.

`TReplaceFlags` determines the behaviour of the `StringReplace` ([1572](#)) function.

```
TSearchRec = record
  Time : LongInt;
  Size : Int64;
  Attr : LongInt;
  Name : TFilename;
  ExcludeAttr : LongInt;
```

```

FindHandle : Pointer;
Mode : TMode;
PathOnly : AnsiStringdeprecated;
end

```

`TSearchRec` is a search handle description record. It is initialized by a call to `FindFirst` (1527) and can be used to do subsequent calls to `FindNext` (1528). It contains the result of these function calls. It must be used to close the search sequence with a call to `FindClose` (1527).

Remark: Not all fields of this record should be used. Some of the fields are for internal use only. (`PathOnly` for example, is only provided for Kylix compatibility)

```
TSignalState = (ssNotHooked, ssHooked, ssOverridden)
```

Table 38.16: Enumeration values for type `TSignalState`

Value	Explanation
<code>ssHooked</code>	A signal handler is set by the RTL code for the signal.
<code>ssNotHooked</code>	No signal handler is set for the signal.
<code>ssOverridden</code>	A signal handler was set for the signal by third-party code.

`TSignalState` indicates the state of a signal handler in a unix system for a particular signal.

```
TSysCharSet = Set of Char
```

Generic set of characters type.

```

TSysLocale = record
  DefaultLCID : Integer;
  PriLangID : Integer;
  SubLangID : Integer;
end

```

`TSysLocale` describes the current locale. If `Fareast` or `MBCS` is True, then the current locale uses a Multi-Byte Character Set. If `MiddleEast` or `RightToLeft` is True then words and sentences are read from right to left.

```
TTerminateProc = function : Boolean
```

`TTerminateProc` is the procedural type which should be used when adding exit procedures.

```
TTextRec = TextRec
```

Alias for `TextRec` (1466) for Delphi compatibility.

```

TTimeStamp = record
  Time : Integer;
  Date : Integer;
end

```

`TTimeStamp` contains a timestamp, with the date and time parts specified as separate `TDateTime` values.

`TWeekNameArray = Array[1..7] of`

`TWeekNameArray` is used in the day long and short name arrays.

`TWordArray = Array[0..16383] of Word`

`TWordArray` is a generic array definition, mostly for use as a base type of the `PWordArray` ([1464](#)) type.

```
WordRec = packed record
  Hi : Byte;
  Lo : Byte;
end
```

`LongRec` can be used to extract the parts of a word: the high and low byte. Note that the meaning of the High and Low parts are different on various CPUs.

38.12.3 Variables

`CurrencyDecimals : Bytedeprecated`

`CurrencyDecimals` is the number of decimals to be used when formatting a currency. It is used by the float formatting routines. The initialization routines of the `SysUtils` unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

`CurrencyFormat : Bytedeprecated`

`CurrencyFormat` is the default format string for positive currencies. It is used by the float formatting routines. The initialization routines of the `SysUtils` unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

`CurrencyString : stringdeprecated`

`CurrencyString` is the currency symbol for the current locale. It is used by the float formatting routines. The initialization routines of the `SysUtils` unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

`DateSeparator : Chardeprecated`

`DateSeparator` is the character used by various date/time conversion routines as the character that separates the day from the month and the month from the year in a date notation. It is used by the date formatting routines. The initialization routines of the `SysUtils` unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

`DecimalSeparator : Chardeprecated`

`DecimalSeparator` is used to display the decimal symbol in floating point numbers or currencies. It is used by the float formatting routines. The initialization routines of the **SysUtils** unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

```
DefaultFormatSettings : TFormatSettings = (CurrencyFormat: 1; NegCurrFormat: 5; Thou
```

`DefaultFormatSettings` contains the default settings for all type of formatting constants. If no thread-specific values are specified when a formatting function is called, this record is used as a default.

All other formatting constants refer to the fields of this variable using absolute addressing.

```
FalseBoolStrs : Array of
```

`FalseBoolStrs` contains the strings that will result in a `False` return value by [StrToBool \(1580\)](#).

```
FormatSettings : TFormatSettings
```

`FormatSettings` is provided for Delphi compatibility, and refers to the `DefaultFormatSettings` ([1472](#)) variable.

```
ListSeparator : Chardeprecated
```

`ListSeparator` is the character used in lists of values. It is locale dependent.

```
LongDateFormat : stringdeprecated
```

`LongDateFormat` contains a template to format a date in a long format. It is used by the date formatting routines. The initialization routines of the **SysUtils** unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

```
LongDayNames : TWeekNameArraydeprecated
```

`LongDayNames` is an array with the full names of days. It is used by the date formatting routines. The initialization routines of the **SysUtils** unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

```
LongMonthNames : TMonthNameArraydeprecated
```

`LongMonthNames` is an array with the full names of months. It is used by the date formatting routines. The initialization routines of the **SysUtils** unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

```
LongTimeFormat : stringdeprecated
```

`LongTimeFormat` contains a template to format a time in full notation. It is used by the time formatting routines. The initialization routines of the **SysUtils** unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

```
NegCurrFormat : Bytedeprecated
```

`CurrencyFormat` is the default format string for negative currencies. It is used by the float formatting routines. The initialization routines of the `SysUtils` unit initialize this string with a value conforming to the regional preferences of the user or system regional default:

- 0 Left parenthesis, currency symbol, amount, right parenthesis. Ex: (\$1.2)
- 1 Negative sign, currency symbol, amount. Ex: -\$1.2
- 2 Monetary symbol, negative sign, amount. Ex: \$-1.2
- 3 Monetary symbol, amount, negative sign. Ex: \$1.2-
- 4 Left parenthesis, amount, currency symbol, right parenthesis. Ex: (1.2\$)
- 5 Negative sign, amount, currency symbol. Ex: -1.2\$
- 5 6Amount, negative sign, currency symbol. Ex: 1.2-\$
- 5 7Amount, currency symbol, negative sign. Ex: 1.2\$-
- 5 8Negative sign, amount, space, currency symbol (as #5, adding a space before the currency symbol). Ex: -1.2 \$
- 9 Negative sign, currency symbol, space, amount (as #1, adding a space after the currency symbol). Ex: -\$ 1.2
- 10 Amount, space, currency symbol, negative sign (as #7, adding a space before the currency symbol). Ex: 1.2 \$-
- 11 Monetary symbol, space, amount, negative sign (as #3, adding a space after the currency symbol). Ex: \$ 1.2-
- 12 Monetary symbol, space, negative sign, amount (as #2, adding a space after the currency symbol). Ex: \$ -1.2
- 13 Amount, negative sign, space, currency symbol (as #6, adding a space before the currency symbol). Ex: 1.2- \$
- 14 Left parenthesis, currency symbol, space, amount, right parenthesis (as #0, adding a space after the currency symbol). Ex: (\$ 1.2)
- 15 Left parenthesis, amount, space, currency symbol, right parenthesis (as ##4, adding a space before the currency symbol). Ex: (1.2 \$)

```
OnBeep : TBeepHandler = Nil
```

`OnBeep` is called whenever `Beep` is called. `Beep` contains no implementation to actually produce a beep, since there is no way to implement beep in a meaningful way for all possible implementations.

```
OnCreateGUID : TCreateGUIDFunc = Nil
```

`OnCreateGUID` can be set to point to a custom routine that creates GUID values. If set, the `CreateGUID` ([1498](#)) function will use it to obtain a GUID value. If it is not set, a default implementation using random values will be used to create the unique value. The function should return a valid GUID in the `GUID` parameter, and should return zero in case of success.

```
OnGetApplicationName : TGetAppNameEvent
```

By default, the configuration file routines `GetAppConfigDir` (1545) and `GetAppConfigFile` (1546) use a default application name to construct a directory or filename. This callback can be used to provide an alternative application name.

Since the result of this callback will be used to construct a filename, care should be taken that the returned name does not contain directory separator characters or characters that cannot appear in a filename.

`OnGetTempDir : TGetTempDirEvent`

`OnGetTempDir` can be used to provide custom behaviour for the `GetTempDir` (1550) function. Note that the returned name should have a trailing directory delimiter character.

`OnGetTempFile : TGetTempFileEvent`

`OnGetTempDir` can be used to provide custom behaviour for the `GetTempFileName` (1550) function. Note that the values for `Prefix` and `Dir` should be observed.

`OnGetVendorName : TGetVendorNameEvent`

`OnGetVendorName` must be set in order for `VendorName` (1601) to return a value. It will then be used in `GetAppConfigDir` (1545) and `GetAppConfigFile` (1546) to determine the configuration directory. Set it to a callback that returns the actual vendor name for the application.

`OnShowException : procedure (Msg: ShortString)`

`OnShowException` is the callback that `ShowException` (1565) uses to display a message in a GUI application. For GUI applications, this variable should always be set. Note that no memory may be available when this callback is called, so the callback should already have all resources it needs, when the callback is set.

`ShortDateFormat : string`deprecated

`ShortDateFormat` contains a template to format a date in a short format. It is used by the date formatting routines. The initialization routines of the `SysUtils` unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

`ShortDayNames : TWeekNameArray`deprecated

`ShortDayNames` is an array with the abbreviated names of days. It is used by the date formatting routines. The initialization routines of the `SysUtils` unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

`ShortMonthNames : TMonthNameArray`deprecated

`ShortMonthNames` is an array with the abbreviated names of months. It is used by the date formatting routines. The initialization routines of the `SysUtils` unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

`ShortTimeFormat : string`deprecated

`ShortTimeFormat` contains a template to format a time in a short notation. It is used by the time formatting routines. The initialization routines of the `SysUtils` unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

SysLocale : TSysLocale

SysLocale is initialized by the initialization code of the **SysUtils** unit. For an explanation of the fields, see **TSysLocale** ([1470](#))

ThousandSeparator : Chardeprecated

ThousandSeparator is used to separate groups of thousands in floating point numbers or currencies. It is used by the float formatting routines. The initialization routines of the **SysUtils** unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

TimeAMString : stringdeprecated

TimeAMString is used to display the AM symbol in the time formatting routines. It is used by the time formatting routines. The initialization routines of the **SysUtils** unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

TimePMString : stringdeprecated

TimePMString is used to display the PM symbol in the time formatting routines. It is used by the time formatting routines. The initialization routines of the **SysUtils** unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

TimeSeparator : Chardeprecated

TimeSeparator is used by the time formatting routines to separate the hours from the minutes and the minutes from the seconds. It is used by the time formatting routines. The initialization routines of the **SysUtils** unit initialize this string with a value conforming to the regional preferences of the user or system regional default.

TrueBoolStrs : Array of

TrueBoolStrs contains the strings that will result in a True return value by **StrToBool** ([1580](#)).

TwoDigitYearCenturyWindow : Word

Window to determine what century 2 digit years are in.

38.13 Procedures and functions

38.13.1 AbandonSignalHandler

Synopsis: Abandon the signal handler

Declaration: procedure AbandonSignalHandler(RtlSigNum: Integer)

Visibility: default

Description: AbandonSignalHandler tells the system routines that they should not re-install the signal handler for signal RtlSigNum under any circumstances. Normally, signal handlers are re-set when they are called. If AbandonSignalHandler has been called for a signal that is handled by the system code, the signal will not be re-set again.

38.13.2 Abort

Synopsis: Abort program execution.

Declaration: procedure Abort

Visibility: default

Description: Abort raises an EAbort ([1604](#)) exception.

See also: EAbort ([1604](#))

38.13.3 AddDisk

Synopsis: Add a disk to the list of known disks (Unix only)

Declaration: function AddDisk(const path: string) : Byte

Visibility: default

Description: On Unix-like platforms both the DiskFree ([1506](#)) and DiskSize ([1507](#)) functions need a file on the specified drive, since is required for the statfs system call.

These filenames are set in drivestr[0..26], and the first 4 have been preset to :

Disk 0' .' default drive - hence current directory is used.

Disk 1' /fd0/ .' floppy drive 1.

Disk 2' /fd1/ .' floppy drive 2.

Disk 3' /' C: equivalent of DOS is the root partition.

Drives 4..26 can be set by your own applications with the AddDisk call.

The AddDisk call adds Path to the names of drive files, and returns the number of the disk that corresponds to this drive. If you add more than 21 drives, the count is wrapped to 4.

Errors: None.

See also: DiskFree ([1506](#)), DiskSize ([1507](#))

38.13.4 AddTerminateProc

Synopsis: Add a procedure to the exit chain.

Declaration: procedure AddTerminateProc(TermProc: TTerminateProc)

Visibility: default

Description: AddTerminateProc adds TermProc to the list of exit procedures. When the program exits, the list of exit procedures is run over, and all procedures are called one by one, in the reverse order that they were added to the exit chain.

Errors: If no memory is available on the heap, an exception may be raised.

See also: TTerminateProc ([1470](#)), CallTerminateProcs ([1493](#))

38.13.5 AdjustLineBreaks

Synopsis: Convert possible line-endings to the currently valid line ending.

```
Declaration: function AdjustLineBreaks(const S: string) : string  
function AdjustLineBreaks(const S: string;Style: TTextLineBreakStyle)  
                      : string
```

Visibility: default

Description: AdjustLineBreaks will change all occurrences of #13 and #10 characters with the correct line-ending characters for the current platform. This is #13#10 on Windows and Dos. On Unix-like platforms, this is #10 and for Mac OS X it is #13.

Errors: None.

See also: [AnsiCompareStr](#) (1478), [AnsiCompareText](#) (1479)

Listing: ./sysutex/ex48.pp

Program Example48 ;

{ This program demonstrates the AdjustLineBreaks function }

Uses sysutils;

Const

```
S = 'This is a string '#13 'with embedded'#10 'linefeed and '+  
    '#13 'CR characters ';
```

Begin

```
WriteLn (AdjustLineBreaks(S));
```

End .

38.13.6 AnsiCompareFileName

Synopsis: Compare 2 filenames.

Visibility: default

Description: AnsiCompareFileName compares 2 filenames S1 and S2, and returns

< 0 if $S_1 < S_2$.
= 0 if $S_1 = S_2$.
> 0 if $S_1 > S_2$.

The function actually checks `FileNameCaseSensitive` and returns the result of `AnsiCompareStr` ([1478](#)) or `AnsiCompareText` ([1479](#)) depending on whether `FileNameCaseSensitive` is `True` or `False`.

Errors: None.

See also: [AnsiCompareStr \(1478\)](#), [AnsiCompareText \(1479\)](#), [AnsiLowerCaseFileName \(1482\)](#)

38.13.7 AnsiCompareStr

Synopsis: Compare 2 ansistrings, case sensitive, ignoring accents characters.

Declaration: function AnsiCompareStr(const S1: string;const S2: string) : Integer

Visibility: default

Description: AnsiCompareStr compares two strings and returns the following result:

```
< 0if S1<S2.  
0if S1=S2.  
> 0if S1>S2.
```

The comparision takes into account Ansi characters, i.e. it takes care of strange accented characters. Contrary to AnsiCompareText (1479), the comparision is case sensitive.

Remark: A widestring manager must be installed in order for this function to work correctly with various character sets.

Errors: None.

See also: AdjustLineBreaks (1477), AnsiCompareText (1479)

Listing: ./sysutex/ex49.pp

Program Example49;

```
{ This program demonstrates the AnsiCompareStr function }  
{$H+}
```

```
Uses sysutils;
```

```
Procedure TestIt (S1,S2 : String);
```

```
Var R : Longint;
```

```
begin
```

```
R:=AnsiCompareStr(S1,S2);
Write ('"',S1,'" is ');
If R<0 then
  write ('less than ')
else If R=0 then
  Write ('equal to ')
else
  Write ('larger than ');
Writeln ('"',S2,'"');
```

```
end;
```

```
Begin
```

```
Testit('One string','One smaller string');
Testit('One string','one string');
Testit('One string','One string');
Testit('One string','One tall string');
```

```
End.
```

38.13.8 AnsiCompareText

Synopsis: Compare 2 ansistrings, case insensitive, ignoring accents characters.

Declaration: function AnsiCompareText(const S1: string; const S2: string) : Integer

Visibility: default

Description: AnsiCompareText compares two strings and returns the following result:

```
<0if S1<S2.  
0if S1=S2.  
>0if S1>S2.
```

the comparision takes into account Ansi characters, i.e. it takes care of strange accented characters. Contrary to AnsiCompareStr (1478), the comparision is case insensitive.

Remark: A widestring manager must be installed in order for this function to work correctly with various character sets.

Errors: None.

See also: AdjustLineBreaks (1477), AnsiCompareText (1479)

Listing: ./sysutex/ex50.pp

Program Example49;

```
{ This program demonstrates the AnsiCompareText function }  
{$H+}  
  
Uses sysutils;  
  
Procedure TestIt (S1,S2 : String);  
  
Var R : Longint;  
  
begin  
  R:=AnsiCompareText(S1,S2);  
  Write ('"',S1,'" is ');  
  If R<0 then  
    write ('less than ')  
  else If R=0 then  
    Write ('equal to ')  
  else  
    Write ('larger than ');\br/>  Writeln ('"',S2,'"');  
end;
```

```
Begin  
  Testit('One string','One smaller string');  
  Testit('One string','one string');  
  Testit('One string','One string');  
  Testit('One string','One tall string');  
End.
```

38.13.9 AnsiDequotedStr

Synopsis:

Declaration: function AnsiDequotedStr(const S: string; AQuote: Char) : string

Visibility: default

Description:

38.13.10 AnsiExtractQuotedStr

Synopsis: Removes the first quoted string from a string.

Declaration: function AnsiExtractQuotedStr(var Src: PChar; Quote: Char) : string

Visibility: default

Description: `AnsiExtractQuotedStr` returns the first quoted string in `Src`, and deletes the result from `Src`.

The resulting string has with `Quote` characters removed from the beginning and end of the string (if they are present), and double `Quote` characters replaced by a single `Quote` characters. As such, it reverses the action of `AnsiQuotedStr` (1482).

Errors: None.

See also: `AnsiQuotedStr` (1482)

Listing: ./sysutex/ex51.pp

```

Program Example51;
{ This program demonstrates the AnsiQuotedStr function }
Uses sysutils;

Var
  S : AnsiString;
  P : PChar;

Begin
  S:= 'He said "Hello" and walked on';
  P:=Pchar(S);
  S:=AnsiQuotedStr(P,'"');
  WriteLn (S);
  P:=Pchar(S);
  WriteLn(AnsiExtractQuotedStr(P,'"'));
End.

```

38.13.11 AnsiLastChar

Synopsis: Return a pointer to the last character of a string.

Declaration: function AnsiLastChar(const S: string) : PChar

Visibility: default

Description: This function returns a pointer to the last character of `S`.

Remark: A widestring manager must be installed in order for this function to work correctly with various character sets. If none is installed, this function is the same as `@S[Length[S]]`.

Errors: None.

See also: [AnsiStrLastChar \(1485\)](#)

Listing: ./sysutex/ex52.pp

```
Program Example52;

{ This program demonstrates the AnsiLastChar function }

Uses sysutils;

Var S : AnsiString;
     L : Longint;

Begin
  S:= 'This is an ansistring.';
  WriteLn ('Last character of S is : ',AnsiLastChar(S));
  L:=Longint(AnsiLastChar(S))-Longint(@S[1])+1;
  WriteLn ('Length of S is : ',L);
End.
```

38.13.12 AnsiLowerCase

Synopsis: Return a lowercase version of a string.

Declaration: `function AnsiLowerCase(const s: string) : string`

Visibility: default

Description: `AnsiLowerCase` converts the string `S` to lowercase characters and returns the resulting string. It takes into account the operating system language settings when doing this, so special characters are converted correctly as well.

Remark: A widestring manager must be installed in order for this function to work correctly with various character sets.

Errors: None.

See also: [AnsiUpperCase \(1489\)](#), [AnsiStrLower \(1487\)](#), [AnsiStrUpper \(1488\)](#)

Listing: ./sysutex/ex53.pp

```
Program Example53;

{ This program demonstrates the AnsiLowerCase function }

Uses sysutils;

Procedure Testit (S : String);

begin
  WriteLn (S, ' -> ',AnsiLowerCase(S))
end;
```

Begin

```
  Testit('AN UPPERCASE STRING');
  Testit('Some mixed STring');
  Testit('a lowercase string');
```

End.

38.13.13 AnsiLowerCaseFileName

Synopsis: Convert filename to lowercase.

Declaration: function AnsiLowerCaseFileName(const s: string) : string

Visibility: default

Description: AnsiLowerCaseFileName simply returns the result of

```
AnsiLowerCase(S);
```

See also: [AnsiLowerCase \(1481\)](#), [AnsiCompareFileName \(1477\)](#), [AnsiUpperCaseFileName \(1490\)](#)

38.13.14 AnsiPos

Synopsis: Return Position of one ansistring in another.

Declaration: function AnsiPos(const substr: string; const s: string) : SizeInt

Visibility: default

Description: AnsiPos does the same as the standard Pos function.

See also: [AnsiStrPos \(1487\)](#), [AnsiStrScan \(1488\)](#), [AnsiStrRScan \(1488\)](#)

38.13.15 AnsiQuotedStr

Synopsis: Return a quoted version of a string.

Declaration: function AnsiQuotedStr(const S: string; Quote: Char) : string

Visibility: default

Description: AnsiQuotedString quotes the string S and returns the result. This means that it puts the Quote character at both the beginning and end of the string and replaces any occurrence of Quote in S with 2 Quote characters. The action of AnsiQuotedString can be reversed by [AnsiExtractQuotedStr \(1480\)](#).

For an example, see [AnsiExtractQuotedStr \(1480\)](#)

Errors: None.

See also: [AnsiExtractQuotedStr \(1480\)](#)

38.13.16 AnsiSameStr

Synopsis: Checks whether 2 strings are the same (case sensitive)

Declaration: function AnsiSameStr(const s1: string; const s2: string) : Boolean

Visibility: default

Description: SameText calls [AnsiCompareStr \(1478\)](#) with S1 and S2 as parameters and returns True if the result of that call is zero, or False otherwise.

Remark: A widestring manager must be installed in order for this function to work correctly with various character sets.

Errors: None.

See also: [AnsiCompareStr \(1478\)](#), [SameText \(1564\)](#), [AnsiSameText \(1483\)](#)

38.13.17 AnsiSameText

Synopsis: Checks whether 2 strings are the same (case insensitive)

Declaration: function AnsiSameText (const s1: string; const s2: string) : Boolean

Visibility: default

Description: SameText calls AnsiCompareText (1479) with S1 and S2 as parameters and returns True if the result of that call is zero, or False otherwise.

See also: AnsiCompareText (1479), SameText (1564), AnsiSameStr (1482)

38.13.18 AnsiStrComp

Synopsis: Compare two null-terminated strings. Case sensitive.

Declaration: function AnsiStrComp (S1: PChar; S2: PChar) : Integer

Visibility: default

Description: AnsiStrComp compares 2 PChar strings, and returns the following result:

```
<0if S1<S2.  
0if S1=S2.  
>0if S1>S2.
```

The comparision of the two strings is case-sensitive.

Remark: A widestring manager must be installed in order for this function to work correctly with various character sets.

Errors: None.

See also: AnsiCompareText (1479), AnsiCompareStr (1478)

Listing: ./sysutex/ex54.pp

Program Example54;

```
{ This program demonstrates the AnsiStrComp function }
```

```
Uses sysutils;
```

```
Procedure TestIt (S1,S2 : Pchar);
```

```
Var R : Longint;
```

```
begin
```

```
  R:=AnsiStrComp(S1,S2);
  Write ('"',S1,'" is ');
  If R<0 then
    write ('less than ')
  else If R=0 then
    Write ('equal to ')
  else
    Write ('larger than ');
  Writeln ('"',S2,'"');
end;
```

```
Begin
  Testit('One string', 'One smaller string');
  Testit('One string', 'one string');
  Testit('One string', 'One string');
  Testit('One string', 'One tall string');
End.
```

38.13.19 AnsiStrICmp

Synopsis: Compare two null-terminated strings. Case insensitive.

Declaration: function AnsiStrICmp(S1: PChar; S2: PChar) : Integer

Visibility: default

Description: AnsiStrICmp compares 2 PChar strings, and returns the following result:

```
<0if S1<S2.
0if S1=S2.
>0if S1>S2.
```

The comparision of the two strings is case-insensitive.

Remark: A widestring manager must be installed in order for this function to work correctly with various character sets.

Errors: None.

See also: AnsiCompareText (1479), AnsiCompareStr (1478)

Listing: ./sysutex/ex55.pp

```
Program Example55;
{ This program demonstrates the AnsiStrICmp function }
Uses sysutils;

Procedure TestIt (S1,S2 : Pchar);
Var R : Longint;

begin
  R:=AnsiStrICmp(S1,S2);
  Write ('"',S1,'" is ');
  If R<0 then
    write ('less than ')
  else If R=0 then
    Write ('equal to ')
  else
    Write ('larger than ');
  Writeln ('"',S2,'"');
end;

Begin
  Testit('One string', 'One smaller string');
```

```

Testit('One string','one string');
Testit('One string','One string');
Testit('One string','One tall string');
End.

```

38.13.20 AnsiStrLastChar

Synopsis: Return a pointer to the last character of a string.

Declaration: function AnsiStrLastChar(Str: PChar) : PChar

Visibility: default

Description: Return a pointer to the last character of the null-terminated string.

Remark: A widestring manager must be installed in order for this function to work correctly with various character sets. If none is installed, this function is the same as @S[Length[S]].

Errors: None.

See also: [AnsiCompareText \(1479\)](#), [AnsiCompareStr \(1478\)](#)

Listing: ./sysutex/ex56.pp

Program Example56;

{ This program demonstrates the AnsiStrLComp function }

Uses sysutils;

Procedure TestIt (S1,S2 : Pchar; L : longint);

Var R : Longint;

begin

```

R:=AnsiStrLComp(S1,S2,L);
Write ('First ',L,' characters of "',S1,'" are ');
If R<0 then
  write ('less than ')
else If R=0 then
  Write ('equal to ')
else
  Write ('larger than ');
  Writeln ('those of "',S2,'"');
end;

```

Begin

```

Testit('One string','One smaller string',255);
Testit('One string','One String',4);
Testit('One string','1 string',0);
Testit('One string','One string.',9);
End.

```

38.13.21 AnsiStrLComp

Synopsis: Compare a limited number of characters of 2 strings

Declaration: function AnsiStrLComp(S1: PChar; S2: PChar; MaxLen: Cardinal) : Integer

Visibility: default

Description: AnsiStrLComp functions the same as AnsiStrComp (1483), but compares at most MaxLen characters. If the first MaxLen characters in both strings are the same, then zero is returned.

Note that this function processes embedded null characters, treating them as a normal character.

Errors: None.

See also: AnsiStrComp (1483), AnsiStrIComp (1484), AnsiStrLICOMP (1486)

38.13.22 AnsiStrLICOMP

Synopsis: Compares a given number of characters of a string, case insensitive.

Declaration: function AnsiStrLICOMP(S1: PChar; S2: PChar; MaxLen: Cardinal) : Integer

Visibility: default

Description: AnsiStrLICOMP compares the first Maxlen characters of 2 PChar strings, S1 and S2, and returns the following result:

```
<0if S1<S2.  
0if S1=S2.  
>0if S1>S2.
```

The comparision of the two strings is case-insensitive.

Remark: A widestring manager must be installed in order for this function to work correctly with various character sets.

Errors: None.

See also: AnsiCompareText (1479), AnsiCompareStr (1478)

Listing: ./sysutex/ex57.pp

Program Example57;

```
{ This program demonstrates the AnsiStrLICOMP function }
```

Uses sysutils;

Procedure TestIt (S1,S2 : Pchar; L : longint);

Var R : Longint;

begin

```
R:=AnsiStrLICOMP(S1,S2,L);
Write ('First ',L,' characters of "',S1,'" are ');
If R<0 then
  write ('less than ')
else If R=0 then
  Write ('equal to ')
else
  Write ('larger than ');
Writeln ('those of "',S2,'"');
```

```

end;

Begin
  Testit( 'One string' , 'One smaller string' ,255);
  Testit( 'ONE STRING' , 'one String' ,4);
  Testit( 'One string' , '1 STRING' ,0);
  Testit( 'One STRING' , 'one string.' ,9);
End.

```

38.13.23 AnsiStrLower

Synopsis: Convert a null-terminated string to all-lowercase characters.

Declaration: function AnsiStrLower(Str: PChar) : PChar

Visibility: default

Description: `AnsiStrLower` converts the PChar `Str` to lowercase characters and returns the resulting pchar.

Note that `Str` itself is modified, not a copy, as in the case of `AnsiLowerCase` ([1481](#)). It takes into account the operating system language settings when doing this, so special characters are converted correctly as well.

Remark: A widestring manager must be installed in order for this function to work correctly with various character sets.

Errors: None.

See also: `AnsiStrUpper` ([1488](#)), `AnsiLowerCase` ([1481](#))

Listing: ./sysutex/ex59.pp

```

Program Example59;

{ This program demonstrates the AnsiStrLower function }

Uses sysutils;

Procedure Testit (S : Pchar);

begin
  WriteLn (S, ' -> ', AnsiStrLower(S))
end;

Begin
  Testit( 'AN UPPERCASE STRING');
  Testit( 'Some mixed STring');
  Testit( 'a lowercase string');
End.

```

38.13.24 AnsiStrPos

Synopsis: Return position of one null-terminated substring in another

Declaration: function AnsiStrPos(str: PChar; substr: PChar) : PChar

Visibility: default

Description: `AnsiStrPos` returns a pointer to the first occurrence of `SubStr` in `Str`. If `SubStr` does not occur in `Str` then `Nil` is returned.

Errors: An access violation may occur if either `Str` or `SubStr` point to invalid memory.

See also: [AnsiPos \(1482\)](#), [AnsiStrScan \(1488\)](#), [AnsiStrRScan \(1488\)](#)

38.13.25 `AnsiStrRScan`

Synopsis: Find last occurrence of a character in a null-terminated string.

Declaration: `function AnsiStrRScan(Str: PChar; Chr: Char) : PChar`

Visibility: default

Description: `AnsiStrPos` returns a pointer to the *last* occurrence of the character `Chr` in `Str`. If `Chr` does not occur in `Str` then `Nil` is returned.

Errors: An access violation may occur if `Str` points to invalid memory.

See also: [AnsiPos \(1482\)](#), [AnsiStrScan \(1488\)](#), [AnsiStrPos \(1487\)](#)

38.13.26 `AnsiStrScan`

Synopsis: Find first occurrence of a character in a null-terminated string.

Declaration: `function AnsiStrScan(Str: PChar; Chr: Char) : PChar`

Visibility: default

Description: `AnsiStrPos` returns a pointer to the *first* occurrence of the character `Chr` in `Str`. If `Chr` does not occur in `Str` then `Nil` is returned.

Errors: An access violation may occur if `Str` points to invalid memory.

See also: [AnsiPos \(1482\)](#), [AnsiStrScan \(1488\)](#), [AnsiStrPos \(1487\)](#)

38.13.27 `AnsiStrUpper`

Synopsis: Convert a null-terminated string to all-uppercase characters.

Declaration: `function AnsiStrUpper(Str: PChar) : PChar`

Visibility: default

Description: `AnsiStrUpper` converts the `PChar` `Str` to uppercase characters and returns the resulting string.

Note that `Str` itself is modified, not a copy, as in the case of `AnsiUpperCase (1489)`. It takes into account the operating system language settings when doing this, so special characters are converted correctly as well.

Remark: A widestring manager must be installed in order for this function to work correctly with various character sets.

Errors: None.

See also: [AnsiUpperCase \(1489\)](#), [AnsiStrLower \(1487\)](#), [AnsiLowerCase \(1481\)](#)

Listing: `./sysutex/ex60.pp`

```
Program Example60;

{ This program demonstrates the AnsiStrUpper function }

Uses sysutils;

Procedure Testit (S : Pchar);

begin
  Writeln (S, ' -> ', AnsiStrUpper(S))
end;

Begin
  Testit('AN UPPERCASE STRING');
  Testit('Some mixed STring');
  Testit('a lowercase string');
End.
```

38.13.28 AnsiUpperCase

Synopsis: Return an uppercase version of a string, taking into account special characters.

Declaration: function AnsiUpperCase(const s: string) : string

Visibility: default

Description: AnsiUpperCase converts the string S to uppercase characters and returns the resulting string. It takes into account the operating system language settings when doing this, so special characters are converted correctly as well.

Remark: A widestring manager must be installed in order for this function to work correctly with various character sets.

Errors: None.

See also: [AnsiStrUpper \(1488\)](#), [AnsiStrLower \(1487\)](#), [AnsiLowerCase \(1481\)](#)

Listing: ./sysutex/ex61.pp

```
Program Example60;

{ This program demonstrates the AnsiUpperCase function }

Uses sysutils;

Procedure Testit (S : String);

begin
  Writeln (S, ' -> ', AnsiUpperCase(S))
end;

Begin
  Testit('AN UPPERCASE STRING');
  Testit('Some mixed STring');
  Testit('a lowercase string');
End.
```

38.13.29 AnsiUpperCaseFileName

Synopsis: Convert filename to uppercase.

Declaration: function AnsiUpperCaseFileName(const s: string) : string

Visibility: default

Description: AnsiUpperCaseFileName simply returns the result of

```
AnsiUpperCase(S);
```

See also: [AnsiUpperCase \(1489\)](#), [AnsiCompareFileName \(1477\)](#), [AnsiLowerCaseFileName \(1482\)](#)

38.13.30 AppendStr

Synopsis: Append one ansistring to another.

Declaration: procedure AppendStr(var Dest: string; const S: string)

Visibility: default

Description: AppendStr appends S to Dest.

This function is provided for Delphi compatibility only, since it is completely equivalent to `Dest := Dest + S`.

Errors: None.

See also: [AssignStr \(1491\)](#), [NewStr \(1560\)](#), [DisposeStr \(1507\)](#)

Listing: ./sysutex/ex62.pp

Program Example62;

```
{ This program demonstrates the AppendStr function }
```

Uses sysutils;

Var S : AnsiString;

Begin

```
S:= 'This is an ';
AppendStr(S, 'AnsiString');
Writeln ('S = ',S,'"');
```

End.

38.13.31 ApplicationName

Synopsis: Return a default application name

Declaration: function ApplicationName : string

Visibility: default

Description: ApplicationName returns the name of the current application. Standard this is equal to the filename part minus extension of ParamStr(0), but it can be customized by setting the OnGetApplicationName (1474) callback.

Note that the returned value is only the name portion. It does not contain any path or file extension.

Errors: None.

See also: [GetAppConfigDir](#) (1545), [OnGetApplicationName](#) (1474), [GetAppConfigFile](#) (1546), [ConfigExtension](#) (1456)

38.13.32 AssignStr

Synopsis: Assigns an ansistring to a null-terminated string.

Declaration: `procedure AssignStr(var P: PString; const S: string)`

Visibility: default

Description: `AssignStr` allocates `S` to `P`. The old value of `P` is disposed of.

This function is provided for Delphi compatibility only. `AnsiStrings` are managed on the heap and should be preferred to the mechanism of dynamically allocated strings.

Errors: None.

See also: [NewStr](#) (1560), [AppendStr](#) (1490), [DisposeStr](#) (1507)

Listing: `./sysutex/ex63.pp`

Program Example63;

```
{ This program demonstrates the AssignStr function }
{$H+}
```

Uses sysutils;

Var P : PString;

Begin

```
P:=NewStr('A first AnsiString');
WriteLn ('Before: P = ',P^,'');
AssignStr(P,'A Second ansistring');
WriteLn ('After : P = ',P^,'');
DisposeStr(P);
End.
```

38.13.33 BCDToInt

Synopsis: Convert a BCD coded integer to a normal integer.

Declaration: `function BCDToInt(Value: Integer) : Integer`

Visibility: default

Description: `BCDToInt` converts a BCD coded integer to a normal integer.

Errors: None.

See also: [StrToInt](#) (1585), [IntToStr](#) (1555)

Listing: `./sysutex/ex64.pp`

```
Program Example64;

{ This program demonstrates the BCDToInt function }

Uses sysutils;

Procedure Testit ( L : longint );
begin
  WriteLn (L, ' -> ',BCDToInt(L));
end;

Begin
  Testit(10);
  Testit(100);
  Testit(23);
End.
```

38.13.34 Beep

Synopsis: Sound the system bell.

Declaration: procedure Beep

Visibility: default

Description: Beep sounds the system bell, if one is available. The actual beep is produced by the OnBeep ([1473](#)) callback. The Sysutils unit itself contains no implementation of this call.

38.13.35 BoolToStr

Synopsis: Convert a boolean value to a string.

Declaration: function BoolToStr(B: Boolean;UseBoolStrs: Boolean) : string
 function BoolToStr(B: Boolean;const TrueS: string;const FalseS: string)
 : string

Visibility: default

Description: BoolToStr converts the boolean B to one of the strings 'TRUE' or 'FALSE'

Errors: None.

See also: StrToBool ([1580](#))

38.13.36 ByteToCharIndex

Synopsis: Convert a character index in Bytes to an Index in characters

Declaration: function ByteToCharIndex(const S: string;Index: Integer) : Integer

Visibility: default

Description: ByteToCharIndex returns the index (in characters) of the Index-th byte in S.

Errors: This function does not take into account MBCS yet.

See also: CharToByteLen ([1494](#)), ByteToCharLen ([1493](#))

38.13.37 ByteToCharLen

Synopsis: Convert a length in bytes to a length in characters.

Declaration: function ByteToCharLen(const S: string; MaxLen: Integer) : Integer

Visibility: default

Description: ByteToCharLen returns the number of bytes in S, but limits the result to MaxLen

Errors: This function does not take into account MBCS yet.

See also: CharToByteLen ([1494](#)), ByteToCharIndex ([1492](#))

38.13.38 ByteType

Synopsis: Return the type of byte in an ansistring for a multi-byte character set

Declaration: function ByteType(const S: string; Index: Integer) : TMbcsByteType

Visibility: default

Description: ByteType returns the type of byte in the ansistring S at (1-based) position Index.

Errors: No checking on the index is performed.

See also: TMbcsByteType ([1469](#)), StrByteType ([1567](#))

38.13.39 CallTerminateProcs

Synopsis: Call the exit chain procedures.

Declaration: function CallTerminateProcs : Boolean

Visibility: default

Description: CallTerminateProcs is run on program exit. It executes all terminate procedures that were added to the exit chain with AddTerminateProc ([1476](#)), and does this in reverse order.

Errors: If one of the exit procedure raises an exception, it is *not* caught, and the remaining exit procedures will not be executed.

See also: TTerminateProc ([1470](#)), AddTerminateProc ([1476](#))

38.13.40 ChangeFileExt

Synopsis: Change the extension of a filename.

Declaration: function ChangeFileExt(const FileName: string; const Extension: string) : string

Visibility: default

Description: ChangeFileExt changes the file extension in FileName to Extension. The extension Extension includes the starting . (dot). The previous extension of FileName are all characters after the last ., the . character included.

If FileName doesn't have an extension, Extension is just appended.

Errors: None.

See also: ExtractFileExt ([1515](#)), ExtractFileName ([1516](#)), ExtractFilePath ([1516](#)), ExpandFileName ([1513](#))

38.13.41 CharToByteLen

Synopsis: Convert a length in characters to a length in bytes.

Declaration: function CharToByteLen(const S: string; MaxLen: Integer) : Integer

Visibility: default

Description: CharToByteLen returns the number of bytes in S, but limits the result to MaxLen

Errors: This function does not take into account MBCS yet.

See also: ByteToCharLen ([1493](#)), ByteToCharIndex ([1492](#))

38.13.42 CompareMem

Synopsis: Compare two memory areas.

Declaration: function CompareMem(P1: Pointer; P2: Pointer; Length: PtrUInt) : Boolean

Visibility: default

Description: CompareMem compares, byte by byte, 2 memory areas pointed to by P1 and P2, for a length of L bytes.

The function returns True if all L bytes are the same, and False otherwise.

38.13.43 CompareMemRange

Synopsis: Compare 2 memory locations

Declaration: function CompareMemRange(P1: Pointer; P2: Pointer; Length: PtrUInt) : Integer

Visibility: default

Description: CompareMemRange compares the 2 memory locations pointed to by P1 and P2 byte per byte. It stops comparing after Length bytes have been compared, or when it has encountered 2 different bytes. The result is then

>0if a byte in range P1 was found that is bigger than the corresponding byte in range P2.

0if all bytes in range P1 are the same as the corresponding bytes in range P2.

<0if a byte in range P1 was found that is less than the corresponding byte in range P2.

Errors: None.

See also: SameText ([1564](#))

38.13.44 CompareStr

Synopsis: Compare 2 ansistrings case-sensitively, ignoring special characters.

Declaration: function CompareStr(const S1: string; const S2: string) : Integer
; Overload

Visibility: default

Description: CompareStr compares two strings, S1 and S2, and returns the following result:

```
<0if S1<S2.  
0if S1=S2.  
>0if S1>S2.
```

The comparision of the two strings is case-sensitive. The function does not take internationalization settings into account, it simply compares ASCII values.

Errors: None.

See also: [AnsiCompareText \(1479\)](#), [AnsiCompareStr \(1478\)](#), [CompareText \(1495\)](#)

Listing: ./sysutex/ex65.pp

Program Example65;

```
{ This program demonstrates the CompareStr function }  
{$H+}  
  
Uses sysutils;  
  
Procedure TestIt (S1,S2 : String);  
  
Var R : Longint;  
  
begin  
  R:=CompareStr(S1,S2);  
  Write ('"',S1,'" is ');  
  If R<0 then  
    write ('less than ')  
  else If R=0 then  
    Write ('equal to ')  
  else  
    Write ('larger than ');\br/>  Writeln ('"',S2,'"');  
end;  
  
Begin  
  Testit('One string','One smaller string');  
  Testit('One string','one string');  
  Testit('One string','One string');  
  Testit('One string','One tall string');  
End.
```

38.13.45 CompareText

Synopsis: Compare 2 ansistrings case insensitive.

Declaration: `function CompareText(const S1: string;const S2: string) : Integer`

Visibility: default

Description: CompareText compares two strings, S1 and S2, and returns the following result:

```
<0if S1<S2.  
0if S1=S2.  
>0if S1>S2.
```

The comparision of the two strings is case-insensitive. The function does not take internationalization settings into account, it simply compares ASCII values.

Errors: None.

See also: [AnsiCompareText \(1479\)](#), [AnsiCompareStr \(1478\)](#), [CompareStr \(1494\)](#)

Listing: ./sysutex/ex66.pp

Program Example66;

```
{ This program demonstrates the CompareText function }
{$H+}

Uses sysutils;

Procedure TestIt (S1,S2 : String);
Var R : Longint;

begin
  R:=CompareText(S1,S2);
  Write ('"',S1,'" is ');
  If R<0 then
    write ('less than ')
  else If R=0 then
    Write ('equal to ')
  else
    Write ('larger than ');
  Writeln ('"',S2,'"');
end;
```

```
Begin
  Testit('One string','One smaller string');
  Testit('One string','one string');
  Testit('One string','One string');
  Testit('One string','One tall string');
End.
```

38.13.46 ComposeDateTime

Synopsis: Add a date and time

Declaration: `function ComposeDateTime(Date: TDateTime;Time: TDateTime) : TDateTime`

Visibility: default

Description: `ComposeDateTime` correctly adds Date and Time, also for dates before 1899-12-31. For dates after this date, it is just the mathematical addition.

Errors: None.

See also: [#rtl.dateutils.EncodeDateTime \(466\)](#)

38.13.47 ConcatPaths

Synopsis: Concatenate an array of paths to form a single path

Declaration: function ConcatPaths(const Paths: Array of) : string

Visibility: default

Description: ConcatPaths will concatenate the different path components in Paths to a single path. It will insert directory separators between the various components of the path as needed. No directory separators will be added to the beginning or the end of the path, and none will be taken away.

See also: IncludeTrailingPathDelimiter (1553), IncludeLeadingPathDelimiter (1552), ExcludeTrailingPathDelimiter (1512), IncludeTrailingPathDelimiter (1553)

Listing: ./sysutex/ex96.pp

```
program ex96;

{ This program demonstrates the ConcatPaths function }

uses sysutils;

begin
  // will write /this/path/more/levels/
  Writeln(ConcatPaths(['this/','path','more/levels/']));
  // will write this/path/more/levels/
  Writeln(ConcatPaths(['this/','path','more/levels/']));
  // will write this/path/more/levels
  Writeln(ConcatPaths(['this/','path','more/levels']));
end.
```

38.13.48 CreateDir

Synopsis: Create a new directory

Declaration: function CreateDir(const NewDir: string) : Boolean

Visibility: default

Description: CreateDir creates a new directory with name NewDir. If the directory doesn't contain an absolute path, then the directory is created below the current working directory.

The function returns True if the directory was successfully created, False otherwise.

Errors: In case of an error, the function returns False.

See also: RemoveDir (1562)

Listing: ./sysutex/ex26.pp

```
Program Example26;
```

```
{ This program demonstrates the CreateDir and RemoveDir functions }
{ Run this program twice in the same directory }
```

```
Uses sysutils;
```

```
Begin
```

```
  If Not DirectoryExists('NewDir') Then
    If Not CreateDir ('NewDir') Then
      Writeln ('Failed to create directory !')
    else
```

```

WriteLn ('Created "NewDir" directory')
Else
  If Not RemoveDir ('NewDir') Then
    WriteLn ('Failed to remove directory !')
  else
    WriteLn ('Removed "NewDir" directory');
End.

```

38.13.49 CreateGUID

Synopsis: Create a new GUID

Declaration: function CreateGUID(out GUID: TGuid) : Integer

Visibility: default

Description: CreateGUID can be called to create a new GUID (Globally Unique Identifier) value. The function returns the new GUID value in GUID and returns zero in case the GUID was created successfully. If no GUID was created, a nonzero error code is returned.

The default mechanism for creating a new GUID is system dependent. If operating system support is available, it is used. If none is available, a default implementation using random numbers is used.

The OnCreateGUID callback can be set to hook a custom mechanism behind the CreateGUID function. This can be used to let the GUID be created by an external GUID creation library.

Errors: On error, a nonzero return value is returned.

See also: GUIDCase (1551), IsEqualGUID (1556), StringToGUID (1572), TryStringToGUID (1596), GUIDToString (1551)

38.13.50 CurrentYear

Synopsis: Return the current year

Declaration: function CurrentYear : Word

Visibility: default

Description: CurrentYear returns the current year as a 4-digit number.

Errors: None.

See also: Date (1499), Time (1591), Now (1560)

38.13.51 CurrToStr

Synopsis: Convert a currency value to a string.

Declaration: function CurrToStr(Value: Currency) : string
 function CurrToStr(Value: Currency;
 const FormatSettings: TFormatSettings) : string

Visibility: default

Description: CurrToStr will convert a currency value to a string with a maximum of 15 digits, and precision 2. Calling CurrToStr is equivalent to calling FloatToStrF (1531):

```
FloatToStrF(Value, ffNumber, 15, 2);
```

Errors: None.

See also: [FloatToStrF \(1531\)](#), [StrToCurr \(1581\)](#)

38.13.52 CurrToStrF

Synopsis: Format a currency to a string

Declaration: function CurrToStrF(Value: Currency;Format: TFloatFormat;
Digits: Integer) : string
function CurrToStrF(Value: Currency;Format: TFloatFormat;
Digits: Integer;
const FormatSettings: TFormatSettings) : string

Visibility: default

Description: CurrToStrF formats the currency Value according to the value in Format, using the number of digits specified in Digits, and a precision of 19. This function simply calls FloatToStrF ([1531](#)).

See also: [FloatToStrF \(1531\)](#)

38.13.53 Date

Synopsis: Return the current date.

Declaration: function Date : TDateTime

Visibility: default

Description: Date returns the current date in TDateTime format.

Errors: None.

See also: [Time \(1591\)](#), [Now \(1560\)](#)

Listing: ./sysutex/ex1.pp

```
Program Example1;

{ This program demonstrates the Date function }

uses sysutils;

Var YY,MM,DD : Word;

Begin
  WriteIn ('Date : ',Date);
  DeCodeDate (Date,YY,MM,DD);
  WriteIn (format ('Date is (DD/MM/YY): %d/%d/%d',[dd,mm,yy]));
End.
```

38.13.54 DateTimeToFileDate

Synopsis: Convert a TDateTime value to a file age (integer)

Declaration: function DateTimeToFileDate(DateTime: TDateTime) : LongInt

Visibility: default

Description: DateTimeToFileDate function converts a date/time indication in TDateTime format to a file-date function, such as returned for instance by the FileAge ([1517](#)) function.

Errors: None.

See also: Time ([1591](#)), Date ([1499](#)), FileDateToDate (1519), DateTimeToSystemTime ([1502](#)), Date-TimeToTimeStamp ([1502](#))

Listing: ./sysutex/ex2.pp

```
Program Example2;

{ This program demonstrates the DateTimeToFileDate function }

Uses sysutils;

Begin
  WriteLn ('FileTime of now would be: ', DateTimeToFileDate (Now));
End.
```

38.13.55 DateTimeToStr

Synopsis: Converts a TDateTime value to a string using a predefined format.

Declaration: function DateTimeToStr(DateTime: TDateTime) : string
function DateTimeToStr(DateTime: TDateTime;
 const FormatSettings: TFormatSettings) : string

Visibility: default

Description: DateTimeToStr returns a string representation of DateTime using the formatting specified in LongDateTimeFormat. It corresponds to a call to FormatDateTime ('c', DateTime) (see formatchars ([1454](#))).

Errors: None.

See also: FormatDateTime ([1543](#))

Listing: ./sysutex/ex3.pp

```
Program Example3;

{ This program demonstrates the DateTimeToStr function }

Uses sysutils;

Begin
  WriteLn ('Today is : ', DateTimeToStr(Now));
  WriteLn ('Today is : ', FormatDateTime('c', Now));
End.
```

38.13.56 **DateTimeToString**

Synopsis: Converts a `TDateTime` value to a string with a given format.

Declaration:

```
procedure DateTimeToString(out Result: string; const FormatStr: string;
                           const Date: TDateTime)
procedure DateTimeToString(out Result: string; const FormatStr: string;
                           const Date: TDateTime;
                           const FormatSettings: TFormatSettings)
```

Visibility: default

Description: `DateTimeToString` returns in `Result` a string representation of `Date` using the formatting specified in `FormatStr`. for a list of characters that can be used in the `FormatStr` formatting string, see `formatchars` ([1454](#)).

Errors: In case a wrong formatting character is found, an `EConvertError` is raised.

See also: `FormatDateTime` ([1543](#)), `formatchars` ([1454](#))

Listing: [./sysutex/ex4.pp](#)

```
Program Example4;

{ This program demonstrates the DateTimeToString function }

Uses sysutils;

Procedure today (Fmt : string);
Var S : AnsiString;
begin
  DateTimeToString (S,Fmt,Date);
  Writeln (S);
end;

Procedure Now (Fmt : string);
Var S : AnsiString;
begin
  DateTimeToString (S,Fmt,Time);
  Writeln (S);
end;

Begin
  Today (''Today is "ddd dd mmm yy '');
  Today (''Today is "d mmm yy');
  Today ('"Today is "d/mmm/yy');
  Now ('' ''The time is ''am/pmh:n:s '');
  Now ('' ''The time is ''hh:nn:ssam/pm');
  Now ('' ''The time is ''tt ');
End.
```

38.13.57 DateTimeToSystemTime

Synopsis: Converts a TDateTime value to a systemtime structure.

Declaration: procedure DateTimeToSystemTime (DateTime: TDateTime;
 out SystemTime: TSystemTime)

Visibility: default

Description: DateTimeToSystemTime converts a date/time pair in DateTime, with TDateTime format to a system time SystemTime.

Errors: None.

See also: DateTimeToFileDate ([1500](#)), SystemTimeToDateTIme ([1590](#)), DateTimeToTimeStamp ([1502](#))

Listing: ./sysutex/ex5.pp

Program Example5;

{ This program demonstrates the DateTimeToSystemTime function }

Uses sysutils;

Var ST : TSystemTime;

Begin

 DateTimeToSystemTime (Now, ST);

With St **do**

begin

Writeln ('Today is ', year, '/', month, '/', Day);

Writeln ('The time is ', Hour, ':', minute, ':', Second, '.', Millisecond);

end;

End.

38.13.58 DateTimeToTimeStamp

Synopsis: Converts a TDateTime value to a TimeStamp structure.

Declaration: function DateTimeToTimeStamp (DateTime: TDateTime) : TTImeStamp

Visibility: default

Description: DateTimeToSystemTime converts a date/time pair in DateTime, with TDateTime format to a TTImeStamp format.

Errors: None.

See also: DateTimeToFileDate ([1500](#)), SystemTimeToDateTIme ([1590](#)), DateTimeToSystemTime ([1502](#))

Listing: ./sysutex/ex6.pp

Program Example6;

{ This program demonstrates the DateTimeToTimeStamp function }

Uses sysutils;

Var TS : TTImeStamp;

```
Begin
  TS:=DateTimeToTimeStamp (Now);
  With TS do
    begin
      WriteLn ('Now is ',time, ' millisecond past midnight');
      WriteLn ('Today is ',Date, ' days past 1/1/0001');
    end;
End.
```

38.13.59 DateToStr

Synopsis: Converts a TDateTime value to a date string with a predefined format.

Declaration: function DateToStr(Date: TDateTime) : string
 function DateToStr(Date: TDateTime;
 const FormatSettings: TFormatSettings) : string

Visibility: default

Description: DateToStr converts Date to a string representation. It uses ShortDateFormat as it's formatting string. It is hence completely equivalent to a FormatDateTime('dddd', Date).

Errors: None.

See also: TimeToStr (1593), DateTimeToStr (1500), FormatDateTime (1543), StrToDate (1581)

Listing: ./sysutex/ex7.pp

```
Program Example7;
{ This program demonstrates the DateToStr function }

Uses sysutils;

Begin
  WriteLn(Format ('Today is: %s',[DateToStr(Date)]));
End.
```

38.13.60 DayOfWeek

Synopsis: Returns the day of the week.

Declaration: function DayOfWeek(DateTime: TDateTime) : Integer

Visibility: default

Description: DayOfWeek returns the day of the week from DateTime. Sunday is counted as day 1, Saturday is counted as day 7. The result of DayOfWeek can serve as an index to the LongDayNames constant array, to retrieve the name of the day.

Errors: None.

See also: Date (1499), DateToStr (1503)

Listing: ./sysutex/ex8.pp

```
Program Example8;

{ This program demonstrates the DayOfWeek function }

Uses sysutils;

Begin
  WriteLn ('Today''s day is ',LongDayNames[DayOfWeek(Date)]);
End.
```

38.13.61 DecodeDate

Synopsis: Decode a TDateTime to a year,month,day triplet

Declaration: procedure DecodeDate(Date: TDateTime; out Year: Word; out Month: Word;
out Day: Word)

Visibility: default

Description: DecodeDate decodes the Year, Month and Day stored in Date, and returns them in the Year, Month and Day variables.

Errors: None.

See also: EncodeDate ([1508](#)), DecodeTime ([1505](#))

Listing: ./sysutex/ex9.pp

```
Program Example9;
```

```
{ This program demonstrates the DecodeDate function }
```

```
Uses sysutils;
```

```
Var YY,MM,DD : Word;
```

```
Begin
  DecodeDate(Date,YY,MM,DD);
  WriteLn (Format ('Today is %d/%d/%d',[dd,mm,yy]));
End.
```

38.13.62 DecodeDateFully

Synopsis: Decode a date with additional date of the week.

Declaration: function DecodeDateFully(const DateTime: TDateTime; out Year: Word;
out Month: Word; out Day: Word; out DOW: Word)
: Boolean

Visibility: default

Description: DecodeDateFully, like DecodeDate ([1504](#)), decodes DateTime in its parts and returns these in Year, Month, Day but in addition returns the day of the week in DOW.

Errors: None.

See also: EncodeDate ([1508](#)), TryEncodeDate ([1595](#)), DecodeDate ([1504](#))

38.13.63 DecodeTime

Synopsis: Decode a TDateTime to a hour,minute,second,millisec quartet

Declaration: procedure DecodeTime(Time: TDateTime; out Hour: Word; out Minute: Word;
out Second: Word; out MilliSecond: Word)

Visibility: default

Description: DecodeDate decodes the hours, minutes, second and milliseconds stored in Time, and returns them in the Hour, Minute and Second and MilliSecond variables.

Errors: None.

See also: EncodeTime ([1509](#)), DecodeDate ([1504](#))

Listing: ./sysutex/ex10.pp

```
Program Example10;

{ This program demonstrates the DecodeTime function }

Uses sysutils;

Var HH,MM,SS,MS: Word;

Begin
  DecodeTime(Time,HH,MM,SS,MS);
  Writeln (format('The time is %d:%d:%d.%d',[hh,mm,ss,ms]));
End.
```

38.13.64 DeleteFile

Synopsis: Delete a file from the filesystem.

Declaration: function DeleteFile(const FileName: string) : Boolean

Visibility: default

Description: DeleteFile deletes file FileName from disk. The function returns True if the file was successfully removed, False otherwise.

Errors: On error, False is returned.

See also: FileCreate ([1518](#)), FileExists ([1520](#))

Listing: ./sysutex/ex31.pp

```
Program Example31;

{ This program demonstrates the DeleteFile function }

Uses sysutils;

Var
  Line : String;
  F,I : Longint;

Begin
```

```

F:=FileCreate('test.txt');
Line:='Some string line.'#10;
For I:=1 to 10 do
  FileWrite(F,Line[1],Length(Line));
FileClose(F);
DeleteFile('test.txt');
End.

```

38.13.65 DirectoryExists

Synopsis: Check whether a directory exists in the file system.

Declaration: function DirectoryExists(const Directory: string) : Boolean

Visibility: default

Description: DirectoryExists checks whether Directory exists in the filesystem and is actually a directory. If this is the case, the function returns True, otherwise False is returned.

See also: FileExists ([1520](#))

38.13.66 DiskFree

Synopsis: Return the amount of free diskspace

Declaration: function DiskFree(drive: Byte) : Int64

Visibility: default

Description: DiskFree returns the free space (in bytes) on disk Drive. Drive is the number of the disk drive:

- 0for the current drive.
- 1for the first floppy drive.
- 2for the second floppy drive.
- 3for the first hard-disk partition.
- 4-26for all other drives and partitions.

Remark: Under Linux, and Unix in general, the concept of disk is different than the dos one, since the filesystem is seen as one big directory tree. For this reason, the DiskFree and DiskSize ([1507](#)) functions must be mimicked using filenames that reside on the partitions. For more information, see AddDisk ([1476](#)).

Errors: On error, -1 is returned.

See also: DiskSize ([1507](#)), AddDisk ([1476](#))

Listing: ./sysutex/ex27.pp

```

Program Example27;

{ This program demonstrates the DiskFree function }

Uses sysutils;

Begin
  Write ('Size of current disk      : ',DiskSize(0));

```

```

Writeln (' (= ',DiskSize(0) div 1024,'k'));
Write ('Free space of current disk : ',Diskfree(0));
Writeln (' (= ',Diskfree(0) div 1024,'k'));
End.

```

38.13.67 DiskSize

Synopsis: Return the total amount of diskspace.

Declaration: function DiskSize(drive: Byte) : Int64

Visibility: default

Description: `DiskSize` returns the size (in bytes) of disk `Drive`. `Drive` is the number of the disk drive:

- 0for the current drive.
- 1for the first floppy drive.
- 2for the second floppy drive.
- 3for the first hard-disk partition.
- 4-26for all other drives and partitions.

Remark: Under Linux, and Unix in general, the concept of disk is different than the dos one, since the filesystem is seen as one big directory tree. For this reason, the `DiskFree` (1506) and `DiskSize` functions must be mimicked using filenames that reside on the partitions. For more information, see `AddDisk` (1476)

For an example, see `DiskFree` (1506).

Errors: On error, -1 is returned.

See also: `DiskFree` (1506), `AddDisk` (1476)

38.13.68 DisposeStr

Synopsis: Dispose an ansistring from the heap.

Declaration: procedure DisposeStr(S: PString); Overload
 procedure DisposeStr(S: PShortString); Overload

Visibility: default

Description: `DisposeStr` removes the dynamically allocated string `S` from the heap, and releases the occupied memory.

This function is provided for Delphi compatibility only. `AnsiStrings` are managed on the heap and should be preferred to the mechanism of dynamically allocated strings.

For an example, see `DisposeStr` (1507).

Errors: None.

See also: `NewStr` (1560), `AppendStr` (1490), `AssignStr` (1491)

38.13.69 DoDirSeparators

Synopsis: Convert known directory separators to the current directory separator.

Declaration: procedure DoDirSeparators(var FileName: string)

Visibility: default

Description: This function replaces all known directory separators in `FileName` to the directory separator character for the current system. The list of known separators is specified in the `AllowDirectorySeparators` (1233) constant.

Errors: None.

See also: ExtractFileName (1516), ExtractFilePath (1516)

Listing: ./sysutex/ex32.pp

Program Example32;

```
{ This program demonstrates the DoDirSeparators function }
{$H+}

Uses sysutils;

Procedure Testit (F : String);

begin
  WriteLn ('Before : ',F);
  DoDirSeparators (F);
  WriteLn ('After   : ',F);
end;

Begin
  Testit (GetCurrentDir);
  Testit ('c:\pp\bin\win32');
  Testit ('/usr/lib/fpc');
  Testit ('\usr\lib\fpc');
End.
```

38.13.70 EncodeDate

Synopsis: Encode a Year,Month,Day to a `TDateTime` value.

Declaration: function EncodeDate(Year: Word; Month: Word; Day: Word) : TDateTime

Visibility: default

Description: `EncodeDate` encodes the Year, Month and Day variables to a date in `TDateTime` format. It does the opposite of the `DecodeDate` (1504) procedure.

The parameters must lie within valid ranges (boundaries included):

Year must be between 1 and 9999.

Month must be within the range 1-12.

Day must be between 1 and 31.

Errors: In case one of the parameters is out of its valid range, an `EConvertError` (1605) exception is raised.

See also: EncodeTime ([1509](#)), DecodeDate ([1504](#))

Listing: ./sysutex/ex11.pp

```
Program Example11;
{ This program demonstrates the EncodeDate function }

Uses sysutils;

Var YY,MM,DD : Word;

Begin
  DecodeDate ( Date ,YY,MM,DD );
  WriteLn ( 'Today is : ',FormatDateTime ( 'dd mmmm yyyy' ,EnCodeDate(YY,Mm,Dd)) );
End.
```

38.13.71 EncodeTime

Synopsis: Encode a Hour,Min,Sec,millisec to a TDateTime value.

Declaration: function EncodeTime(Hour: Word;Minute: Word;Second: Word;
MilliSecond: Word) : TDateTime

Visibility: default

Description: EncodeTime encodes the Hour, Minute, Second, MilliSecond variables to a TDateTime format result. It does the opposite of the DecodeTime ([1505](#)) procedure.

The parameters must have a valid range (boundaries included):

Hour must be between 0 and 23.

Minute,second must both be between 0 and 59.

Millisecond must be between 0 and 999.

Errors: In case one of the parameters is out of it's valid range, an EConvertError ([1605](#)) exception is raised.

See also: EncodeDate ([1508](#)), DecodeTime ([1505](#))

Listing: ./sysutex/ex12.pp

```
Program Example12;
{ This program demonstrates the EncodeTime function }

Uses sysutils;

Var Hh,MM,SS,MS : Word;

Begin
  DeCodeTime ( Time ,Hh,MM,SS,MS );
  WriteLn ( 'Present Time is : ',FormatDateTime( 'hh:mm:ss' ,EnCodeTime ( HH,MM,SS,MS )) );
End.
```

38.13.72 ExceptAddr

Synopsis: Current exception address.

Declaration: function ExceptAddr : Pointer

Visibility: default

Description: ExceptAddr returns the address from the currently treated exception object when an exception is raised, and the stack is unwound.

See also: ExceptObject (1511), ExceptionErrorMessage (1510), ShowException (1565)

38.13.73 ExceptFrameCount

Synopsis: Number of frames included in an exception backtrace

Declaration: function ExceptFrameCount : LongInt

Visibility: default

Description: ExceptFrameCount returns the number of frames that are included in an exception stack frame backtrace. The function returns 0 if there is currently no exception being handled. (i.e. it only makes sense to call this function in an `finally..end` or `except..end` block).

Errors: None.

See also: ExceptFrames (1510), ExceptAddr (1510), ExceptObject (1511), #rtl.system.ExceptProc (1235)

38.13.74 ExceptFrames

Synopsis:

Declaration: function ExceptFrames : PPointer

Visibility: default

Description:

See also: ExceptFrameCount (1510), ExceptAddr (1510), ExceptObject (1511), #rtl.system.ExceptProc (1235)

38.13.75 ExceptionErrorMessage

Synopsis: Return a message describing the exception.

Declaration: function ExceptionErrorMessage(ExceptObject: TObject;
 ExceptAddr: Pointer; Buffer: PChar;
 Size: Integer) : Integer

Visibility: default

Description: ExceptionErrorMessage creates a string that describes the exception object ExceptObject at address ExceptAddr. It can be used to display exception messages. The string will be stored in the memory pointed to by Buffer, and will at most have Size characters.

The routine checks whether ExceptObject is a Exception (1611) object or not, and adapts the output accordingly.

See also: ExceptObject (1511), ExceptAddr (1510), ShowException (1565)

38.13.76 ExceptObject

Synopsis: Current Exception object.

Declaration: function ExceptObject : TObject

Visibility: default

Description: ExceptObject returns the currently treated exception object when an exception is raised, and the stack is unwound.

Errors: If there is no exception, the function returns Nil

See also: ExceptAddr (1510), ExceptionErrorMessage (1510), ShowException (1565)

38.13.77 ExcludeLeadingPathDelimiter

Synopsis: Strip the leading path delimiter of a path

Declaration: function ExcludeLeadingPathDelimiter(const Path: string) : string

Visibility: default

Description: ExcludeLeadingPathDelimiter will remove any path delimiter on the first position of Path if there is one. if there is none (or the path is empty), it is left untouched.

See also: IncludeTrailingPathDelimiter (1553), IncludeLeadingPathDelimiter (1552), ExcludeTrailingPathDelimiter (1512), ConcatPaths (1496)

Listing: ./sysutex/ex95.pp

Program Example95;

{ This program demonstrates the IncludeLeadingPathDelimiter function }

Uses sysutils;

Begin

```
// Will print "/this/path"
Writeln(IncludeLeadingPathDelimiter('this/path'));
// The same result
Writeln(IncludeLeadingPathDelimiter('/this/path'));
```

End.

38.13.78 ExcludeTrailingBackslash

Synopsis: Strip trailing directory separator from a pathname, if needed.

Declaration: function ExcludeTrailingBackslash(const Path: string) : string

Visibility: default

Description: ExcludeTrailingBackslash is provided for backwards compatibility with Delphi. Use ExcludeTrailingPathDelimiter (1512) instead.

See also: IncludeTrailingPathDelimiter (1553), ExcludeTrailingPathDelimiter (1512), PathDelim (1460), IsPathDelimiter (1556)

38.13.79 ExcludeTrailingPathDelimiter

Synopsis: Strip trailing directory separator from a pathname, if needed.

Declaration: function ExcludeTrailingPathDelimiter(const Path: string) : string

Visibility: default

Description: ExcludeTrailingPathDelimiter removes the trailing path delimiter character (PathDelim (1460)) from Path if it is present, and returns the result.

See also: ExcludeTrailingBackslash (1511), IncludeTrailingPathDelimiter (1553), PathDelim (1460), IsPathDelimiter (1556)

38.13.80 ExecuteProcess

Synopsis: Execute another process (program).

```
Declaration: function ExecuteProcess(const Path: AnsiString;
                                    const ComLine: AnsiString; Flags: TExecuteFlags)
                      : Integer
function ExecuteProcess(const Path: AnsiString;
                       const ComLine: Array of AnsiString;
                       Flags: TExecuteFlags) : Integer
```

Visibility: default

Description: ExecuteProcess will execute the program in Path, passing it the arguments in ComLine. ExecuteProcess will then wait for the program to finish, and will return the exit code of the executed program. In case ComLine is a single string, it will be split out in an array of strings, taking into account common whitespace and quote rules.

The program specified in Path is not searched in the searchpath specified in the PATH environment variable, so the full path to the executable must be specified in Path, although some operating systems may perform this search anyway (notably, windows)

Flags can be used to control the passing of file handles: if ExecInheritsHandles is included, the file handles of the current process will be passed on to the newly executed process.

Errors: In case the program could not be executed or an other error occurs, an EOSError (1608) exception will be raised.

See also: TExecuteFlags (1465), EOSError (1608)

38.13.81 ExeSearch

Synopsis: Search for an executable

Declaration: function ExeSearch(const Name: string; const DirList: string) : string

Visibility: default

Description: ExeSearch searches for an executable Name in the list of directories DirList (a list of directories, separator by PathSeparator (1246). If the current OS also searches implicitly in the current working directory, the current directory is searched in the first place.

If the executable is found, then the full path of the executable is returned. If it is not found, an empty string is returned.

No check is performed whether the found file is actually executable.

See also: FileSearch (1524)

38.13.82 ExpandFileName

Synopsis: Expand a relative filename to an absolute filename.

Declaration: function ExpandFileName(const FileName: string) : string

Visibility: default

Description: ExpandFileName expands the filename to an absolute filename. It changes all directory separator characters to the one appropriate for the system first.

Errors: None.

See also: ExpandFileNameCase (1513), ExtractFileName (1516), ExtractFilePath (1516), ExtractFileDir (1514), ExtractFileDrive (1515), ExtractFileExt (1515), ExtractRelativePath (1516)

Listing: ./sysutex/ex33.pp

Program Example33;

{ This program demonstrates the ExpandFileName function }

Uses sysutils;

Procedure Testit (F : String);

begin

WriteLn (F, ' expands to : ', **ExpandFileName**(F));

end;

Begin

 Testit('ex33.pp');

 Testit(**ParamStr**(0));

 Testit('/pp/bin/win32/ppc386');

 Testit('\pp\bin\win32\ppc386');

 Testit('.');

End.

38.13.83 ExpandFileNameCase

Synopsis: Expand a filename entered as case insensitive to the full path as stored on the disk.

Declaration: function ExpandFileNameCase(const FileName: string;
 out MatchFound: TFilenameCaseMatch) : string

Visibility: default

Description: On case insensitive platforms, ExpandFileNameCase behaves similarly to ExpandFileName (1513) except for the fact that it returns the final part of the path with the same case of letters as found on the disk (if it exists - otherwise the case equals the one provided on input). On case sensitive platforms it also checks whether one or more full paths exist on disk which would correspond to the provided input if treated case insensitively and returns the first such match found and information whether the match is unique or not.

Note that the behaviour is basically undefined if the input includes wildcards characters. Normally, wildcards in the last part of path provided on input are resolved to the first corresponding item found on the disk, but it is better not to rely on that and use other more suitable functions if working with wildcards like FindFirst (1527)/FindNext (1528).

Errors: None.

See also: [ExpandFileName \(1513\)](#), [ExtractFileName \(1516\)](#), [ExtractFilePath \(1516\)](#), [ExtractFileDir \(1514\)](#), [ExtractFileDrive \(1515\)](#), [ExtractFileExt \(1515\)](#), [ExtractRelativePath \(1516\)](#)

Listing: ./sysutex/ex33.pp

Program Example33;

{ This program demonstrates the ExpandFileName function }

Uses sysutils;

Procedure Testit (F : String);

begin

WriteLn (F, ' expands to : ', **ExpandFileName**(F));

end;

Begin

 Testit('ex33.pp');

 Testit(**ParamStr**(0));

 Testit('/pp/bin/win32/ppc386');

 Testit('\pp\bin\win32\ppc386');

 Testit('..');

End.

38.13.84 ExpandUNCFileName

Synopsis: Expand a relative filename to an absolute UNC filename.

Declaration: **function** ExpandUNCFileName(const FileName: string) : string

Visibility: default

Description: `ExpandUNCFileName` runs `ExpandFileName (1513)` on `FileName` and then attempts to replace the drive letter by the name of a shared disk.

Errors: None.

See also: [ExpandFileName \(1513\)](#), [ExtractFileName \(1516\)](#), [ExtractFilePath \(1516\)](#), [ExtractFileDir \(1514\)](#), [ExtractFileDrive \(1515\)](#), [ExtractFileExt \(1515\)](#), [ExtractRelativePath \(1516\)](#)

38.13.85 ExtractFileDir

Synopsis: Extract the drive and directory part of a filename.

Declaration: **function** ExtractFileDir(const FileName: string) : string

Visibility: default

Description: `ExtractFileDir` returns only the directory part of `FileName`, including a driveletter. The directory name has NO ending directory separator, in difference with `ExtractFilePath (1516)`.

Errors: None.

See also: [ExtractFileName \(1516\)](#), [ExtractFilePath \(1516\)](#), [ExtractFileDir \(1514\)](#), [ExtractFileDrive \(1515\)](#), [ExtractFileExt \(1515\)](#), [ExtractRelativePath \(1516\)](#)

Listing: ./sysutex/ex34.pp

Program Example34;

```
{ This program demonstrates the ExtractFileName function }
{$H+}
Uses sysutils;

Procedure Testit(F : String);

begin
  WriteLn ('FileName      : ',F);
  WriteLn ('Has Name      : ',ExtractFileName(F));
  WriteLn ('Has Path       : ',ExtractFilePath(F));
  WriteLn ('Has Extension   : ',ExtractFileExt(F));
  WriteLn ('Has Directory   : ',ExtractFileDir(F));
  WriteLn ('Has Drive       : ',ExtractFileDrive(F));
end;

Begin
  Testit (Paramstr(0));
  Testit ('/usr/local/bin/mysqld');
  Testit ('c:\pp\bin\win32\ppc386.exe');
  Testit ('/pp/bin/win32/ppc386.exe');
End.
```

38.13.86 ExtractFileDrive

Synopsis: Extract the drive part from a filename.

Declaration: function ExtractFileDrive(const FileName: string) : string

Visibility: default

Description: Extracts the drive letter from a filename. Note that some operating systems do not support drive letters.

For an example, see ExtractFileDir ([1514](#)).

See also: ExtractFileName ([1516](#)), ExtractFilePath ([1516](#)), ExtractFileDir ([1514](#)), ExtractFileDrive ([1515](#)), ExtractFileExt ([1515](#)), ExtractRelativePath ([1516](#))

38.13.87 ExtractFileExt

Synopsis: Return the extension from a filename.

Declaration: function ExtractFileExt(const FileName: string) : string

Visibility: default

Description: ExtractFileExt returns the extension (including the .(dot) character) of FileName.

For an example, see ExtractFileDir ([1514](#)).

Errors: None.

See also: ChangeFileExt ([1493](#)), ExtractFileName ([1516](#)), ExtractFilePath ([1516](#)), ExtractFileDir ([1514](#)), ExtractFileDrive ([1515](#)), ExtractFileExt ([1515](#)), ExtractRelativePath ([1516](#))

38.13.88 ExtractFileName

Synopsis: Extract the filename part from a full path filename.

Declaration: function ExtractFileName(const FileName: string) : string

Visibility: default

Description: ExtractFileName returns the filename part from FileName. The filename consists of all characters after the last directory separator character ('/' or '\') or drive letter.

The full filename can always be reconstructed by concatenating the result of ExtractFilePath ([1516](#)) and ExtractFileName.

For an example, see ExtractFileDir ([1514](#)).

Errors: None.

See also: ExtractFileName ([1516](#)), ExtractFilePath ([1516](#)), ExtractFileDir ([1514](#)), ExtractFileDrive ([1515](#)), ExtractFileExt ([1515](#)), ExtractRelativePath ([1516](#))

38.13.89 ExtractFilePath

Synopsis: Extract the path from a filename.

Declaration: function ExtractFilePath(const FileName: string) : string

Visibility: default

Description: ExtractFilePath returns the path part (including driveletter) from FileName. The path consists of all characters before the last directory separator character ('/' or '\'), including the directory separator itself. In case there is only a drive letter, that will be returned.

The full filename can always be reconstructed by concatenating the result of ExtractFilePath and ExtractFileName ([1516](#)).

For an example, see ExtractFileDir ([1514](#)).

Errors: None.

See also: ExtractFileName ([1516](#)), ExtractFilePath ([1516](#)), ExtractFileDir ([1514](#)), ExtractFileDrive ([1515](#)), ExtractFileExt ([1515](#)), ExtractRelativePath ([1516](#))

38.13.90 ExtractRelativePath

Synopsis: Extract a relative path from a filename, given a base directory.

Declaration: function ExtractRelativePath(const BaseName: string;
const DestName: string) : string

Visibility: default

Description: ExtractRelativePath constructs a relative path to go from BaseName to DestName. If DestName is on another drive (Not on Unix-like platforms) then the whole Destname is returned.

Note: This function does not exist in the Delphi unit.

Errors: None.

See also: ExtractFileName ([1516](#)), ExtractFilePath ([1516](#)), ExtractFileDir ([1514](#)), ExtractFileDrive ([1515](#)), ExtractFileExt ([1515](#))

Listing: ./sysutex/ex35.pp

```

Program Example35;

{ This program demonstrates the ExtractRelativePath function }

Uses sysutils;

Procedure Testit (FromDir, ToDir : String);

begin
  Write ('From " ', FromDir, '" to " ', ToDir, '" via " ');
  WriteLn (ExtractRelativePath(FromDir, ToDir), '"');
end;

Begin
  Testit ('/pp/src/compiler', '/pp/bin/win32/ppc386');
  Testit ('/pp/bin/win32/ppc386', '/pp/src/compiler');
  Testit ('e:/pp/bin/win32/ppc386', 'd:/pp/src/compiler');
  Testit ('e:\pp\bin\win32\ppc386', 'd:\pp\src\compiler');
End.

```

38.13.91 ExtractShortPathName

Synopsis: Returns a 8.3 path name

Declaration: `function ExtractShortPathName(const FileName: string) : string`

Visibility: default

Description: `ExtractShortPathName` returns a 8.3 compliant filename that represents the same file as `FileName`.
On platforms other than windows, this is `FileName` itself.

See also: [ExtractFilePath \(1516\)](#), [ExtractFileName \(1516\)](#)

38.13.92 FileAge

Synopsis: Return the timestamp of a file.

Declaration: `function FileAge(const FileName: string) : LongInt`
`function FileAge(const FileName: string; out FileDateTime: TDateTime;`
`FollowLink: Boolean) : Boolean`

Visibility: default

Description: `FileAge` returns the last modification time of file `FileName`. The `FileDate` format can be transformed to `TDateTime` format with the `FileDateToDateTime (1519)` function.

Errors: In case of errors, -1 is returned.

See also: [FileDateToDateTime \(1519\)](#), [FileExists \(1520\)](#), [FileGetAttr \(1520\)](#)

Listing: ./sysutex/ex36.pp

```

Program Example36;

{ This program demonstrates the FileAge function }

```

```

Uses sysutils;

Var S : TDateTime;
      fa : Longint;
Begin
  fa:=FileAge('ex36.pp');
  If Fa<>-1 then
    begin
      S:=FileDateToDateTime(fa);
      Writeln ('I ' 'm from ',DateTimeToStr(S))
    end;
End.

```

38.13.93 FileClose

Synopsis: Close a file handle.

Declaration: procedure FileClose(Handle: THandle)

Visibility: default

Description: FileClose closes the file handle Handle. After this call, attempting to read or write from the handle will result in an error.

For an example, see FileCreate ([1518](#))

Errors: None.

See also: FileCreate ([1518](#)), FileWrite ([1526](#)), FileOpen ([1522](#)), FileRead ([1523](#)), FileTruncate ([1526](#)), FileSeek ([1525](#))

38.13.94 FileCreate

Synopsis: Create a new file and return a handle to it.

Declaration: function FileCreate(const FileName: string) : THandle
 function FileCreate(const FileName: string; Rights: Integer) : THandle
 function FileCreate(const FileName: string; ShareMode: Integer;
 Rights: Integer) : THandle

Visibility: default

Description: FileCreate creates a new file with name FileName on the disk and returns a file handle which can be used to read or write from the file with the FileRead ([1523](#)) and FileWrite ([1526](#)) functions.

If a file with name FileName already existed on the disk, it is overwritten.

The optional Mode parameter only has an effect under unix, where it can be used to set the mode (read, write, execute, sticky bit, setgid and setuid flags) of the created file to the specified custom value. On other platforms, the Mode parameter is ignored.

Errors: If an error occurs (e.g. disk full or non-existent path), the function returns THandle (-1).

See also: FileClose ([1518](#)), FileWrite ([1526](#)), FileOpen ([1522](#)), FileRead ([1523](#)), FileTruncate ([1526](#)), FileSeek ([1525](#))

Listing: ./sysutex/ex37.pp

```

Program Example37;

{ This program demonstrates the FileCreate function }

Uses sysutils;

Var I,J,F : Longint;

Begin
  F:=FileCreate ('test.dat');
  If F=-1 then
    Halt(1);
  For I:=0 to 100 do
    FileWrite(F,I,SizeOf(i));
  FileClose(f);
  F:=FileOpen ('test.dat',fmOpenRead);
  For I:=0 to 100 do
    begin
      FileRead (F,J,SizeOF(J));
      If J<>I then
        Writeln ('Mismatch at file position ',I)
      end;
  FileSeek(F,0,fsFromBeginning);
  Randomize;
  Repeat
    FileSeek(F,Random(100)*4,fsFromBeginning);
    FileRead (F,J,SizeOf(J));
    Writeln ('Random read : ',j);
  Until J>80;
  FileClose(F);
  F:=FileOpen ('test.dat',fmOpenWrite);
  I:=50*SizeOf(Longint);
  If FileTruncate(F,I) then
    Writeln('Successfully truncated file to ',I,' bytes.');
  FileClose(F);
End.

```

38.13.95 FileDateToDateTIme

Synopsis: Convert a FileDate value to a TDateTime value.

Declaration: function FileDateToDateTIme(Filedate: LongInt) : TDateTime

Visibility: default

Description: FileDateToDateTIme converts the date/time encoded in filedate to a TDateTime encoded form. It can be used to convert date/time values returned by the FileAge ([1517](#)) or FindFirst ([1527](#))/FindNext ([1528](#)) functions to TDateTime form.

Errors: None.

See also: DateTimeToFileDate ([1500](#))

Listing: ./sysutex/ex13.pp

Program Example13;

```

{ This program demonstrates the FileDateToDateTime function }

Uses sysutils;

Var
  ThisAge : Longint;

Begin
  Write ('ex13.pp created on :');
  ThisAge:=FileAge('ex13.pp');
  Writeln (DateTimeToStr(FileDateToDateTime(ThisAge)));
End.

```

38.13.96 FileExists

Synopsis: Check whether a particular file exists in the filesystem.

Declaration: function FileExists(const FileName: string) : Boolean

Visibility: default

Description: FileExists returns True if a file with name FileName exists on the disk, False otherwise. On windows, this function will return False if a directory is passed as FileName. On unices, passing a directory name will result in True. The rationale is that on unix, a directory is a file as well.

Note that this function accepts a single filename as an argument, without wildcards. To check for the existence of multiple files, see the FindFirst ([1527](#)) function.

Errors: None.

See also: FindFirst ([1527](#)), FileAge ([1517](#)), FileGetAttr ([1520](#)), FileSetAttr ([1525](#))

Listing: ./sysutex/ex38.pp

Program Example38;

```
{ This program demonstrates the FileExists function }
```

Uses sysutils;

```

Begin
  If FileExists(ParamStr(0)) Then
    Writeln ('All is well, I seem to exist.');
End.

```

38.13.97 FileGetAttr

Synopsis: Return attributes of a file.

Declaration: function FileGetAttr(const FileName: string) : LongInt

Visibility: default

Description: FileGetAttr returns the attribute settings of file FileName. The attribute is a OR-ed combination of the following constants:

faReadOnlyThe file is read-only.

faHiddenThe file is hidden. (On unix, this means that the filename starts with a dot)

faSysFileThe file is a system file (On unix, this means that the file is a character, block or FIFO file).

faVolumeIDVolume Label. Only for DOS/Windows on a plain FAT (not VFAT or Fat32) filesystem.

faDirectoryFile is a directory.

faArchivefile should be archived. Not possible on Unix

Errors: In case of error, -1 is returned.

See also: FileSetAttr ([1525](#)), FileAge ([1517](#)), FileGetDate ([1521](#))

Listing: ./sysutex/ex40.pp

Program Example40;

{ This program demonstrates the FileGetAttr function }

Uses sysutils;

Procedure Testit (**Name** : String);

Var F : Longint;

Begin

```
F:=FileGetAttr(Name);
If F<>-1 then
  begin
    Writeln ('Testing : ',Name);
    If (F and faReadOnly)<>0 then
      Writeln ('File is ReadOnly');
    If (F and faHidden)<>0 then
      Writeln ('File is hidden');
    If (F and faSysFile)<>0 then
      Writeln ('File is a system file');
    If (F and faVolumeID)<>0 then
      Writeln ('File is a disk label');
    If (F and faArchive)<>0 then
      Writeln ('File is archive file');
    If (F and faDirectory)<>0 then
      Writeln ('File is a directory');
  end
else
  Writeln ('Error reading attributes of ',Name);
end;
```

begin

```
testit ('ex40.pp');
testit (ParamStr(0));
testit ('.');
testit ('/');
```

End.

38.13.98 FileGetDate

Synopsis: Return the file time of an opened file.

Declaration: function FileGetDate(Handle: THandle) : LongInt

Visibility: default

Description: FileGetdate returns the filetime of the opened file with filehandle Handle. It is the same as FileAge (1517), with this difference that FileAge only needs the file name, while Filegetdate needs an open file handle.

Errors: On error, -1 is returned.

See also: FileAge (1517)

Listing: ./sysutex/ex39.pp

Program Example39;

{ This program demonstrates the FileGetDate function }

Uses sysutils;

Var F,D : Longint;

Begin

```
F:=FileCreate('test.dat');
D:=FileGetDate(F);
WriteLn ('File created on ',DateTimeToStr(FileDateToDate(D)));
FileClose(F);
DeleteFile('test.dat');
```

End.

38.13.99 FileIsReadOnly

Synopsis: Check whether a file is read-only.

Declaration: function FileIsReadOnly(const FileName: string) : Boolean

Visibility: default

Description: FileIsReadOnly checks whether FileName exists in the filesystem and is a read-only file. If this is the case, the function returns True, otherwise False is returned.

See also: FileExists (1520)

38.13.100 FileOpen

Synopsis: Open an existing file and return a filehandle

Declaration: function FileOpen(const FileName: string;Mode: Integer) : THandle

Visibility: default

Description: FileOpen opens a file with name FileName with mode Mode. Mode can be one of the following constants:

fmOpenReadOpen file in read-only mode

fmOpenWriteOpen file in write-only mode

fmOpenReadWriteOpen file in read/write mode.

Under Windows and Unix, the above mode can be or-ed with one of the following sharing/locking flags:

fmShareCompatOpen file in DOS share-compatibility mode
fmShareExclusiveLock file for exclusive use
fmShareDenyWriteLock file so other processes can only read.
fmShareDenyReadLock file so other processes cannot read.
fmShareDenyNoneDo not lock file.

If the file has been successfully opened, it can be read from or written to (depending on the Mode parameter) with the `FileRead` (1523) and `FileWrite` functions.

Remark: Remark that you cannot open a file if it doesn't exist yet, i.e. it will not be created for you. If you want to create a new file, or overwrite an old one, use the `FileCreate` (1518) function.

There are some limitations to the sharing modes.

- 1.Sharing modes are only available on Unix and Windows platforms.
- 2.Unix only support sharing modes as of 2.4.0.
- 3.fmShareDenyRead only works under Windows at this time, and will always result in an error on Unix platforms because its file locking APIs do not support this concept.
- 4.File locking is advisory on Unix platforms. This means that the locks are only checked when a file is opened using a file locking mode. In other cases, existing locks are simply ignored. In particular, this means that `fmShareDenyNone` has no effect under Unix, because this can only be implemented as "use no locking" on those platforms. As a result, opening a file using this mode will always succeed under Unix as far as the locking is concerned, even if the file has already been opened using `fmShareExclusive`.
- 5.Under Solaris, closing a single file handle associated with a file will result in all locks on that file (even via other handles) being destroyed due to the behaviour of the underlying API (fcntl). Because of the same reason, on Solaris you cannot use `fmShareDenyWrite` in combination with `fmOpenWrite`, nor `fmShareExclusive` in combination with `fmOpenRead` although both work with `fmOpenReadWrite`.

For an example, see `FileCreate` (1518)

Errors: On Error, `THandle` (-1) is returned.

See also: `fmOpenRead` (1458), `fmOpenWrite` (1458), `fmOpenReadWrite` (1458), `fmShareDenyWrite` (1458), `fmShareExclusive` (1458), `fmShareDenyRead` (1458), `fmShareDenyNone` (1458), `fmShareCompat` (1458), `FileClose` (1518), `FileWrite` (1526), `FileCreate` (1518), `FileRead` (1523), `FileTruncate` (1526), `FileSeek` (1525)

38.13.101 FileRead

Synopsis: Read data from a filehandle in a buffer.

Declaration: `function FileRead(Handle: THandle; out Buffer; Count: LongInt) : LongInt`

Visibility: default

Description: `FileRead` reads `Count` bytes from file-handle `Handle` and stores them into `Buffer`. `Buffer` must be at least `Count` bytes long. No checking on this is performed, so be careful not to overwrite any memory. `Handle` must be the result of a `FileOpen` (1522) call.

The function returns the number of bytes actually read, or -1 on error.

For an example, see `FileCreate` (1518)

Errors: On error, -1 is returned.

See also: [FileClose \(1518\)](#), [FileWrite \(1526\)](#), [FileCreate \(1518\)](#), [FileOpen \(1522\)](#), [FileTruncate \(1526\)](#), [FileSeek \(1525\)](#)

38.13.102 FileSearch

Synopsis: Search for a file in a path.

Declaration: `function FileSearch(const Name: string;const DirList: string;
Options: TFileSearchOptions) : string
function FileSearch(const Name: string;const DirList: string;
ImplicitCurrentDir: Boolean) : string`

Visibility: default

Description: FileSearch looks for the file Name in DirList, where dirlist is a list of directories, separated by semicolons or colons. It returns the full filename of the first match found. The optional Options parameter may be specified to influence the behaviour of the search algorithm. It is a set of the following options:

sfoImplicitCurrentDir Always search the current directory first, even if it is not specified.

sfoStripQuotes Strip quotes from the components in the search path.

A deprecated form of the function allowed to specify using the boolean ImplicitCurrentDir parameter whether the current directory was searched implicitly or not. By default, the current directory is searched.

Errors: On error, an empty string is returned.

See also: [ExpandFileName \(1513\)](#), [FindFirst \(1527\)](#)

Listing: ./sysutex/ex41.pp

```
Program Example41;  
  
{ Program to demonstrate the FileSearch function. }  
  
Uses Sysutils;  
  
Const  
{$ifdef unix}  
FN = 'find';  
P = './bin:/usr/bin';  
{$else}  
FN = 'find.exe';  
P = 'c:\dos;c:\windows;c:\windows\system;c:\windows\system32';  
{$endif}  
  
begin  
  Writeln ('find is in : ',FileSearch (FN,P));  
end.
```

38.13.103 FileSeek

Synopsis: Set the current file position on a file handle.

Declaration:

```
function FileSeek(Handle: THandle; FOffset: LongInt; Origin: LongInt)
           : LongInt
function FileSeek(Handle: THandle; FOffset: Int64; Origin: LongInt)
           : Int64
```

Visibility: default

Description: FileSeek sets the file pointer on position `Offset`, starting from `Origin`. `Origin` can be one of the following values:

fsFromBeginningOffset is relative to the first byte of the file. This position is zero-based. i.e. the first byte is at offset 0.

fsFromCurrentOffset is relative to the current position.

fsFromEndOffset is relative to the end of the file. This means that `Offset` can only be zero or negative in this case.

If successfull, the function returns the new file position, relative to the beginning of the file.

Remark: The abovementioned constants do not exist in Delphi.

Errors: On error, -1 is returned.

See also: [FileClose \(1518\)](#), [FileWrite \(1526\)](#), [FileCreate \(1518\)](#), [FileOpen \(1522\)](#), [FileRead \(1523\)](#), [FileTruncate \(1526\)](#)

Listing: ./sysutex/ex42.pp

```
Program Example42;

{ This program demonstrates the FileSetAttr function }

Uses sysutils;

Begin
  If FileSetAttr ('ex40.pp',faReadOnly or faHidden)=0 then
    Writeln ('Successfully made file hidden and read-only.')
  else
    Writeln ('Coulnd''t make file hidden and read-only.');
End.
```

38.13.104 FileSetAttr

Synopsis: Set the attributes of a file.

Declaration:

```
function FileSetAttr(const Filename: string; Attr: LongInt) : LongInt
```

Visibility: default

Description: FileSetAttr sets the attributes of `FileName` to `Attr`. If the function was successful, 0 is returned, -1 otherwise. `Attr` can be set to an OR-ed combination of the pre-defined `faXXX` constants.

This function is not implemented on Unixes.

Errors: On error, -1 is returned (always on Unixes).

See also: [FileGetAttr \(1520\)](#), [FileGetDate \(1521\)](#), [FileSetDate \(1526\)](#)

38.13.105 FileSetDate

Synopsis: Set the date of a file.

Declaration: function FileSetDate(Handle: THandle; Age: LongInt) : LongInt
 function FileSetDate(const FileName: string; Age: LongInt) : LongInt

Visibility: default

Description: FileSetDate sets the file date of the open file with handle Handle or to Age, where Age is a DOS date-and-time stamp value.

Alternatively, the filename may be specified with the FileName argument. This variant of the call is mandatory on unices, since there is no OS support for setting a file timestamp based on a handle. (the handle may not be a real file at all).

The function returns zero if successfull.

Errors: On Unix, the handle variant always returns -1, since this is impossible to implement. On Windows and DOS, a negative error code is returned.

38.13.106 FileTruncate

Synopsis: Truncate an open file to a given size.

Declaration: function FileTruncate(Handle: THandle; Size: Int64) : Boolean

Visibility: default

Description: FileTruncate truncates the file with handle Handle to Size bytes. The file must have been opened for writing prior to this call. The function returns True is successful, False otherwise.

For an example, see FileCreate ([1518](#)).

Errors: On error, the function returns False.

See also: FileClose ([1518](#)), FileWrite ([1526](#)), FileCreate ([1518](#)), FileOpen ([1522](#)), FileRead ([1523](#)), FileSeek ([1525](#))

38.13.107 FileWrite

Synopsis: Write data from a buffer to a given filehandle.

Declaration: function FileWrite(Handle: THandle; const Buffer; Count: LongInt) : LongInt

Visibility: default

Description: FileWrite writes Count bytes from Buffer to the file with handle Handle. Prior to this call, the file must have been opened for writing. Buffer must be at least Count bytes large, or a memory access error may occur.

The function returns the number of bytes written, or -1 in case of an error.

For an example, see FileCreate ([1518](#)).

Errors: In case of error, -1 is returned.

See also: FileClose ([1518](#)), FileCreate ([1518](#)), FileOpen ([1522](#)), FileRead ([1523](#)), FileTruncate ([1526](#)), FileSeek ([1525](#))

38.13.108 FindClose

Synopsis: Close a find handle

Declaration: procedure FindClose(var F: TSearchRec)

Visibility: default

Description: FindClose ends a series of FindFirst ([1527](#))/FindNext ([1528](#)) calls, and frees any memory used by these calls. It is *absolutely* necessary to do this call, or huge memory losses may occur.

For an example, see FindFirst ([1527](#)).

Errors: None.

See also: FindFirst ([1527](#)), FindNext ([1528](#))

38.13.109 FindCmdLineSwitch

Synopsis: Check whether a certain switch is present on the command-line.

```
Declaration: function FindCmdLineSwitch(const Switch: string;
                                         const Chars: TSysCharSet; IgnoreCase: Boolean)
                                         : Boolean
function FindCmdLineSwitch(const Switch: string; IgnoreCase: Boolean)
                           : Boolean
function FindCmdLineSwitch(const Switch: string) : Boolean
```

Visibility: default

Description: FindCmdLineSwitch will check all command-line arguments for the presence of the option Switch. It will return True if it was found, False otherwise. Characters that appear in Chars (default is SwitchChars ([1462](#))) are assumed to indicate an option (switch). If the parameter IgnoreCase is True, case will be ignored when looking for the switch. Default is to search case sensitive.

Errors: None.

See also: SwitchChars ([1462](#))

38.13.110 FindFirst

Synopsis: Start a file search and return a findhandle

```
Declaration: function FindFirst(const Path: string; Attr: LongInt;
                               out Rslt: TSearchRec) : LongInt
```

Visibility: default

Description: FindFirst looks for files that match the name (possibly with wildcards) in Path and extra attributes Attr. It then fills up the Rslt record with data gathered about the file. It returns 0 if a file matching the specified criteria is found, a nonzero value (-1 on Unix-like platforms) otherwise.

Attr is an or-ed combination of the following constants:

faReadOnly The file is read-only.

faHidden The file is hidden. (On unix, this means that the filename starts with a dot)

faSysFile The file is a system file (On unix, this means that the file is a character, block or FIFO file).

faVolumeId Drive volume Label. Not possible under unix, and on Windows-like systems, this works only for plan FAT (not Fat32 or VFAT) filesystems.

faDirectoryFile is a directory.

faArchivefile needs to be archived. Not possible on Unix

It is a common misconception that **Attr** specifies a set of attributes which must be matched in order for a file to be included in the list. This is not so: The value of **Attr** specifies *additional* attributes, this means that the returned files are either normal files or have an attribute which is present in **Attr**.

Specifically: specifying **faDirectory** as a value for **Attr** does not mean that only directories will be returned. Normal files *and* directories will be returned.

The **Rslt** record can be fed to subsequent calls to **FindNext**, in order to find other files matching the specifications.

Remark: A **FindFirst** call must *always* be followed by a **FindClose** ([1527](#)) call with the same **Rslt** record. Failure to do so will result in memory loss.

Errors: On error the function returns -1 on Unix-like platforms, a nonzero error code on Windows.

See also: **FindClose** ([1527](#)), **FindNext** ([1528](#))

Listing: ./sysutex/ex43.pp

Program Example43;

{ This program demonstrates the FindFirst function }

Uses SysUtils;

```
Var Info : TSearchRec;
      Count : Longint;

Begin
  Count:=0;
  If FindFirst ('*',faAnyFile and faDirectory ,Info)=0 then
    begin
      Repeat
        Inc(Count);
        With Info do
          begin
            If (Attr and faDirectory) = faDirectory then
              Write('Dir : ');
              Writeln (Name:40,Size:15);
            end;
        Until FindNext(info)<>0;
      end;
      FindClose(Info);
      Writeln ('Finished search. Found ',Count,' matches');
    End;
End.
```

38.13.111 FindNext

Synopsis: Find the next entry in a findhandle.

Declaration: function FindNext(var Rslt: TSearchRec) : LongInt

Visibility: default

Description: FindNext finds a next occurrence of a search sequence initiated by FindFirst. If another record matching the criteria in Rslt is found, 0 is returned, a nonzero constant is returned otherwise.

Remark: The last FindNext call must *always* be followed by a FindClose call with the same Rslt record. Failure to do so will result in memory loss.

For an example, see FindFirst ([1527](#))

Errors: On error (no more file is found), a nonzero constant is returned.

See also: FindFirst ([1527](#)), FindClose ([1527](#))

38.13.112 FloattoCurr

Synopsis: Convert a float to a Currency value.

Declaration: function FloattoCurr(const Value: Extended) : Currency

Visibility: default

Description: FloattoCurr converts the Value floating point value to a Currency value. It checks whether Value is in the valid range of currencies (determined by MinCurrency ([1459](#)) and MaxCurrency ([1459](#))). If not, an EConvertError ([1605](#)) exception is raised.

Errors: If Value is out of range, an EConvertError ([1605](#)) exception is raised.

See also: EConvertError ([1605](#)), TryFloatToCurr ([1596](#)), MinCurrency ([1459](#)), MaxCurrency ([1459](#))

38.13.113 FloatToDateTIme

Synopsis: Convert a float to a TDateTime value.

Declaration: function FloatToDateTIme(const Value: Extended) : TDateTime

Visibility: default

Description: FloatToDateTIme converts the Value floating point value to a TDateTime value. It checks whether Value is in the valid range of dates (determined by MinDateTIme ([1459](#)) and MaxDateTIme ([1459](#))). If not, an EConvertError ([1605](#)) exception is raised.

Errors: If Value is out of range, an EConvertError ([1605](#)) exception is raised.

See also: EConvertError ([1605](#)), MinDateTIme ([1459](#)), MaxDateTIme ([1459](#))

38.13.114 FloatToDecimal

Synopsis: Convert a float value to a TFLOATRec value.

```
Declaration: procedure FloatToDecimal(out Result: TFLOATRec; const Value;
                                     ValueType: TFLOATValue; Precision: Integer;
                                     Decimals: Integer)
procedure FloatToDecimal(out Result: TFLOATRec; Value: Extended;
                        Precision: Integer; Decimals: Integer)
```

Visibility: default

Description: FloatToDecimal converts the float Value to a float description in the ResultTFLOATRec ([1467](#)) format. It will store Precision digits in the Digits field, of which at most Decimal decimals.

Errors: None.

See also: [TFloatRec \(1467\)](#)

38.13.115 **FloatToStr**

Synopsis: Convert a float value to a string using a fixed format.

Declaration:

```
function FloatToStr(Value: Double) : string
function FloatToStr(Value: Double; const FormatSettings: TFormatSettings)
  : string
function FloatToStr(Value: Single) : string
function FloatToStr(Value: Single; const FormatSettings: TFormatSettings)
  : string
function FloatToStr(Value: Currency) : string
function FloatToStr(Value: Currency;
  const FormatSettings: TFormatSettings) : string
function FloatToStr(Value: Comp) : string
function FloatToStr(Value: Comp; const FormatSettings: TFormatSettings)
  : string
function FloatToStr(Value: Int64) : string
function FloatToStr(Value: Int64; const FormatSettings: TFormatSettings)
  : string
```

Visibility: default

Description: `FloatToStr` converts the floating point variable `Value` to a string representation. It will choose the shortest possible notation of the two following formats:

Fixed format will represent the string in fixed notation,

Decimal format will represent the string in scientific notation.

More information on these formats can be found in `FloatToStrF (1531)`. `FloatToStr` is completely equivalent to the following call:

```
FloatToStrF(Value, ffGeneral, 15, 0);
```

Errors: None.

See also: [FloatToStrF \(1531\)](#), [FormatFloat \(1543\)](#), [StrToFloat \(1584\)](#)

Listing: [./sysutex/ex67.pp](#)

```
Program Example67;

{ This program demonstrates the FloatToStr function }

Uses sysutils;

Procedure Testit (Value : Extended);

begin
  Writeln (Value, ' -> ', FloatToStr(Value));
  Writeln (-Value, ' -> ', FloatToStr(-Value));
end;
```

```
Begin
  Testit (0.0);
  Testit (1.1);
  Testit (1.1e-3);
  Testit (1.1e-20);
  Testit (1.1e-200);
  Testit (1.1e+3);
  Testit (1.1e+20);
  Testit (1.1e+200);
End.
```

38.13.116 FloatToStrF

Synopsis: Convert a float value to a string using a given format.

Declaration:

```
function FloatToStrF(Value: Double;format: TFloatFormat;
                     Precision: Integer;Digits: Integer) : string
function FloatToStrF(Value: Double;format: TFloatFormat;
                     Precision: Integer;Digits: Integer;
                     const FormatSettings: TFormatSettings) : string
function FloatToStrF(Value: Single;format: TFloatFormat;
                     Precision: Integer;Digits: Integer) : string
function FloatToStrF(Value: Single;format: TFloatFormat;
                     Precision: Integer;Digits: Integer;
                     const FormatSettings: TFormatSettings) : string
function FloatToStrF(Value: Comp;format: TFloatFormat;
                     Precision: Integer;Digits: Integer) : string
function FloatToStrF(Value: Comp;format: TFloatFormat;
                     Precision: Integer;Digits: Integer;
                     const FormatSettings: TFormatSettings) : string
function FloatToStrF(Value: Currency;format: TFloatFormat;
                     Precision: Integer;Digits: Integer) : string
function FloatToStrF(Value: Currency;format: TFloatFormat;
                     Precision: Integer;Digits: Integer;
                     const FormatSettings: TFormatSettings) : string
function FloatToStrF(Value: Int64;format: TFloatFormat;
                     Precision: Integer;Digits: Integer) : string
function FloatToStrF(Value: Int64;format: TFloatFormat;
                     Precision: Integer;Digits: Integer;
                     const FormatSettings: TFormatSettings) : string
```

Visibility: default

Description: `FloatToStrF` converts the floating point number `Value` to a string representation, according to the settings of the parameters `Format`, `Precision` and `Digits`.

The meaning of the `Precision` and `Digits` parameter depends on the `Format` parameter. The format is controlled mainly by the `Format` parameter. It can have one of the following values:

ffCurrencyMoney format. `Value` is converted to a string using the global variables `CurrencyString`, `CurrencyFormat` and `NegCurrFormat`. The `Digits` parameter specifies the number of digits following the decimal point and should be in the range -1 to 18. If `Digits` equals -1, `CurrencyDecimals` is assumed. The `Precision` parameter is ignored.

ffExponent Scientific format. `Value` is converted to a string using scientific notation: 1 digit before the decimal point, possibly preceded by a minus sign if `Value` is negative. The number of digits after the decimal point is controlled by `Precision` and must lie in the range 0 to 15.

ffFixed Fixed point format. Value is converted to a string using fixed point notation. The result is composed of all digits of the integer part of Value, preceded by a minus sign if Value is negative. Following the integer part is DecimalSeparator and then the fractional part of Value, rounded off to Digits numbers. If the number is too large then the result will be in scientific notation.

ffGeneral General number format. The argument is converted to a string using ffExponent or ffFixed format, depending on which one gives the shortest string. There will be no trailing zeroes. If Value is less than 0.00001 or if the number of decimals left of the decimal point is larger than Precision then scientific notation is used, and Digits is the minimum number of digits in the exponent. Otherwise Digits is ignored.

ffnumber Is the same as ffFixed, except that thousand separators are inserted in the resulting string.

Errors: None.

See also: [FloatToStr \(1530\)](#), [FloatToText \(1533\)](#)

Listing: ./sysutex/ex68.pp

Program Example68;

```
{ This program demonstrates the FloatToStrF function }

Uses sysutils;

Const Fmt : Array [TFloatFormat] of string[10] =
  ('general', 'exponent', 'fixed', 'number', 'Currency');

Procedure Testit (Value : Extended);

Var I,J : longint;
    FF : TFloatFormat;

begin
  For I:=5 to 15 do
    For J:=1 to 4 do
      For FF:=ffgeneral to ffcurrency do
        begin
          Write (Value,'(Prec: ',I:2,',', Dig: ',J,', fmt : ',Fmt[ff],') : ');
          Writeln (FloatToStrf(Value,FF,I,J));
          Write (-Value,'(Prec: ',I:2,',', Dig: ',J,', fmt : ',Fmt[ff],') : ');
          Writeln (FloatToStrf(-Value,FF,I,J));
        end;
  end;

Begin
  Testit (1.1);
  Testit (1.1E1);
  Testit (1.1E-1);
  Testit (1.1E5);
  Testit (1.1E-5);
  Testit (1.1E10);
  Testit (1.1E-10);
  Testit (1.1E15);
  Testit (1.1E-15);
  Testit (1.1E100);
  Testit (1.1E-100);
End.
```

38.13.117 **FloatToText**

Synopsis: Return a string representation of a float, with a given format.

```
Declaration: function FloatToText(Buffer: PChar;Value: Extended;format: TFloatFormat;
                                 Precision: Integer;Digits: Integer) : LongInt
function FloatToText(Buffer: PChar;Value: Extended;format: TFloatFormat;
                     Precision: Integer;Digits: Integer;
                     const FormatSettings: TFormatSettings) : LongInt
```

Visibility: default

Description: `FloatToText` converts the floating point variable `Value` to a string representation and stores it in `Buffer`. The conversion is governed by `format`, `Precision` and `Digits`. more information on these parameters can be found in `FloatToStrF` (1531). `Buffer` should point to enough space to hold the result. No checking on this is performed.

The result is the number of characters that was copied in `Buffer`.

Errors: None.

See also: `FloatToStr` (1530), `FloatToStrF` (1531)

Listing: ./sysutex/ex69.pp

```
Program Example68;

{ This program demonstrates the FloatToStrF function }

Uses sysutils;

Const Fmt : Array [TFloatFormat] of string[10] =
      ('general', 'exponent', 'fixed', 'number', 'Currency');

Procedure Testit (Value : Extended);

Var I,J : longint;
    FF : TFloatFormat;
    S : ShortString;

begin
  For I:=5 to 15 do
    For J:=1 to 4 do
      For FF:=ffgeneral to ffcurrency do
        begin
          Write (Value,'(Prec: ',I:2,',', Dig: ',J,', fmt : ',Fmt[ff],') : ');
          SetLength(S,FloatToText (@S[1],Value,FF,I,J));
          Writeln (S);
          Write (-Value,'(Prec: ',I:2,',', Dig: ',J,', fmt : ',Fmt[ff],') : ');
          SetLength(S,FloatToText (@S[1],-Value,FF,I,J));
          Writeln (S);
        end;
  end;

Begin
  Testit (1.1);
  Testit (1.1E1);
  Testit (1.1E-1);
  Testit (1.1E5);
  Testit (1.1E-5);
```

```

Testit (1.1E10);
Testit (1.1E-10);
Testit (1.1E15);
Testit (1.1E-15);
Testit (1.1E100);
Testit (1.1E-100);
End.

```

38.13.118 FloatToTextFmt

Synopsis: Convert a float value to a string using a given mask.

Declaration: function FloatToTextFmt (Buffer: PChar; Value: Extended; format: PChar;
 FormatSettings: TFormatSettings) : Integer
 function FloatToTextFmt (Buffer: PChar; Value: Extended; format: PChar)
 : Integer

Visibility: default

Description: FloatToTextFmt returns a textual representation of Value in the memory location pointed to by Buffer. It uses the formatting specification in Format to do this. The return value is the number of characters that were written in the buffer.

For a list of valid formatting characters, see FormatFloat ([1543](#))

Errors: No length checking is performed on the buffer. The buffer should point to enough memory to hold the complete string. If this is not the case, an access violation may occur.

See also: FormatFloat ([1543](#))

38.13.119 FmtStr

Synopsis: Format a string with given arguments.

Declaration: procedure FmtStr (var Res: string; const Fmt: string;
 const args: Array of const)
 procedure FmtStr (var Res: string; const Fmt: string;
 const args: Array of const;
 const FormatSettings: TFormatSettings)

Visibility: default

Description: FmtStr calls Format ([1535](#)) with Fmt and Args as arguments, and stores the result in Res. For more information on how the resulting string is composed, see Format ([1535](#)).

Errors: In case of error, a EConvertError exception is raised.

See also: Format ([1535](#)), FormatBuf ([1542](#))

Listing: ./sysutex/ex70.pp

Program Example70;

```
{ This program demonstrates the FmtStr function }
```

```
Uses sysutils;
```

```

Var S : AnsiString;
Begin
  S:= '';
  FmtStr (S, 'For some nice examples of fomattting see %s.', ['Format']);
  WriteLn (S);
End.

```

38.13.120 ForceDirectories

Synopsis: Create a chain of directories

Declaration: function ForceDirectories(const Dir: string) : Boolean

Visibility: default

Description: ForceDirectories tries to create any missing directories in Dir till the whole path in Dir exists. It returns True if Dir already existed or was created successfully. If it failed to create any of the parts, False is returned.

38.13.121 Format

Synopsis: Format a string with given arguments.

Declaration: function Format(const Fmt: string;const Args: Array of const) : string
 function Format(const Fmt: string;const Args: Array of const;
 const FormatSettings: TFormatSettings) : string

Visibility: default

Description: Format replaces all placeholders in Fmt with the arguments passed in Args and returns the resulting string. A placeholder looks as follows:

'%' [[Index]':'] ['-' [Width] ['.' Precision] ArgType

elements between single quotes must be typed as shown without the quotes, and elements between square brackets [] are optional. The meaning of the different elements are shown below:

'%' starts the placeholder. If you want to insert a literal % character, then you must insert two of them : %%.

Index ':' takes the Index-th element in the argument array as the element to insert. If index is omitted, then the zeroth argument is taken.

'-' tells Format to left-align the inserted text. The default behaviour is to right-align inserted text. This can only take effect if the Width element is also specified.

Width the inserted string must have at least Width characters. If not, the inserted string will be padded with spaces. By default, the string is left-padded, resulting in a right-aligned string. This behaviour can be changed by the usage of the '-' character.

.' Precision Indicates the precision to be used when converting the argument. The exact meaning of this parameter depends on ArgType.

The Index, Width and Precision parameters can be replaced by *, in which case their value will be read from the next element in the Args array. This value must be an integer, or an EConvertError exception will be raised.

The argument type is determined from ArgType. It can have one of the following values (case insensitive):

Decimal format. The next argument in the `Args` array should be an integer. The argument is converted to a decimal string. If precision is specified, then the string will have at least `Precision` digits in it. If needed, the string is (left) padded with zeroes.

Escientific format. The next argument in the `Args` array should be a Floating point value. The argument is converted to a decimal string using scientific notation, using `FloatToStrF` (1531), where the optional precision is used to specify the total number of decimals. (defalt a valueof 15 is used). The exponent is formatted using maximally 3 digits.

In short, the E specifier formats it's argument as follows:

```
FloatToStrF(Argument, ffExponent, Precision, 3)
```

Fixed point format. The next argument in the `Args` array should be a floating point value. The argument is converted to a decimal string, using fixed notation (see `FloatToStrF` (1531)). `Precision` indicates the number of digits following the decimal point.

In short, the F specifier formats it's argument as follows:

```
FloatToStrF(Argument, ffFixed, ffixed, 9999, Precision)
```

General number format. The next argument in the `Args` array should be a floating point value. The argument is converted to a decimal string using fixed point notation or scientific notation, depending on which gives the shortest result. `Precision` is used to determine the number of digits after the decimal point.

In short, the G specifier formats it's argument as follows:

```
FloatToStrF(Argument, ffGeneral, Precision, 3)
```

MCurrency format. the next argument in the `var{Args}` array must be a floating point value. The argument is converted to a decimal string using currency notation. This means that fixed-point notation is used, but that the currency symbol is appended. If precision is specified, then then it overrides the `CurrencyDecimals` global variable used in the `FloatToStrF` (1531)

In short, the M specifier formats it's argument as follows:

```
FloatToStrF(Argument, ffCurrency, 9999, Precision)
```

Number format. This is the same as fixed point format, except that thousand separators are inserted in the resulting string.

Pointer format. The next argument in the `Args` array must be a pointer (typed or untyped). The pointer value is converted to a string of length 8, representing the hexadecimal value of the pointer.

String format. The next argument in the `Args` array must be a string. The argument is simply copied to the result string. If `Precision` is specified, then only `Precision` characters are copied to the result string.

Unsigned decimal format. The next argument in the `Args` array should be an unsigned integer. The argument is converted to a decimal string. If precision is specified, then the string will have at least `Precision` digits in it. If needed, the string is (left) padded with zeroes.

Xhexadecimal format. The next argument in the `Args` array must be an integer. The argument is converted to a hexadecimal string with just enough characters to contain the value of the integer. If `Precision` is specified then the resulting hexadecimal representation will have at least `Precision` characters in it (with a maximum value of 32).

Errors: In case of error, an `EConversionError` exception is raised. Possible errors are:

- 1.Errors in the format specifiers.
- 2.The next argument is not of the type needed by a specifier.

3.The number of arguments is not sufficient for all format specifiers.

See also: FormatBuf (1542)

Listing: ./sysutex/ex71.pp

```

Program example71;

{$mode objfpc}

{ This program demonstrates the Format function }

Uses sysutils;

Var P : Pointer;
      fmt,S : string;

{ Expected output:
  [%d] => [10]
  [%%] => [%]
  [%10d] => [          10]
  [.4d] => [0010]
  [%10.4d] => [          0010]
  [%0:d] => [10]
  [%0:10d] => [          10]
  [%0:10.4d] => [          0010]
  [%0:-10d] => [10          ]
  [%0:-10.4d] => [0010          ]
  [%-*.*d] => [00010]
}
Procedure TestInteger;
begin
  Try
    Fmt:= '[%d]';S:=Format (Fmt,[10]);writeln(Fmt:12,'=>',s);
    Fmt:= '[%%]';S:=Format (Fmt,[10]);writeln(Fmt:12,'=>',s);
    Fmt:= '%[10d]';S:=Format (Fmt,[10]);writeln(Fmt:12,'=>',s);
    fmt:= '%.4d';S:=Format (fmt,[10]);writeln(Fmt:12,'=>',s);
    Fmt:= '%[10.4d]';S:=Format (Fmt,[10]);writeln(Fmt:12,'=>',s);
    Fmt:= '%[0:d]';S:=Format (Fmt,[10]);writeln(Fmt:12,'=>',s);
    Fmt:= '%[0:10d]';S:=Format (Fmt,[10]);writeln(Fmt:12,'=>',s);
    Fmt:= '%[0:10.4d]';S:=Format (Fmt,[10]);writeln(Fmt:12,'=>',s);
    Fmt:= '%[0:-10d]';S:=Format (Fmt,[10]);writeln(Fmt:12,'=>',s);
    Fmt:= '%[0:-10.4d]';S:=Format (fmt,[10]);writeln(Fmt:12,'=>',s);
    Fmt:= '%-*.*d';S:=Format (fmt,[4,5,10]);writeln(Fmt:12,'=>',s);
  except
    On E : Exception do
      begin
        Writeln ('Exception caught : ',E.Message);
      end;
  end;
  writeln ('Press enter');
  readln;
end;

{ Expected output:
  [%x] => [A]
  [%10x] => [          A]
  [%10.4x] => [          000A]
  [%0:x] => [A]
```

```

[%"0:10x"] => [          A]
[%"0:10.4x"] => [        000A]
[%"0:-10x"] => [A        ]
[%"0:-10.4x"] => [000A      ]
[%"-*.*x"] => [0000A]
}

Procedure TestHexaDecimal;
begin
  try
    Fmt:= '[%x]'; S:=Format (Fmt,[10]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[%10x]'; S:=Format (Fmt,[10]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[%10.4x]'; S:=Format (Fmt,[10]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[%0:x]'; S:=Format (Fmt,[10]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[%0:10x]'; S:=Format (Fmt,[10]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[%0:10.4x]'; S:=Format (Fmt,[10]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[%0:-10x]'; S:=Format (Fmt,[10]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[%0:-10.4x]'; S:=Format (Fmt,[10]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[%-*.*x]'; S:=Format (Fmt,[4,5,10]); writeln(Fmt:12,'=> ',s);
  except
    On E : Exception do
      begin
        Writeln ('Exception caught : ',E.Message);
      end;
  end;
  writeln ('Press enter');
  readln;
end;

{ Expected output:
  [0x%p] => [0x0012D687]
  [0x%10p] => [0x 0012D687]
  [0x%10.4p] => [0x 0012D687]
  [0x%0:p] => [0x0012D687]
  [0x%0:10p] => [0x 0012D687]
  [0x%0:10.4p] => [0x 0012D687]
  [0x%0:-10p] => [0x0012D687 ]
  [0x%0:-10.4p] => [0x0012D687 ]
  [%-*.*p] => [0012D687]
}

Procedure TestPointer;
begin
  P:= Pointer(1234567);
  try
    Fmt:= '[0x%p]'; S:=Format (Fmt,[P]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[0x%10p]'; S:=Format (Fmt,[P]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[0x%10.4p]'; S:=Format (Fmt,[P]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[0x%0:p]'; S:=Format (Fmt,[P]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[0x%0:10p]'; S:=Format (Fmt,[P]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[0x%0:10.4p]'; S:=Format (Fmt,[P]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[0x%0:-10p]'; S:=Format (Fmt,[P]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[0x%0:-10.4p]'; S:=Format (Fmt,[P]); writeln(Fmt:12,'=> ',s);
    Fmt:= '[%-*.*p]'; S:=Format (Fmt,[4,5,P]); writeln(Fmt:12,'=> ',s);
  except
    On E : Exception do
      begin
        Writeln ('Exception caught : ',E.Message);
      end;
  end;

```

```

writeln ('Press enter');
readln;
end;

{ Expected output:
  [%s]=> [This is a string]
  [%0:s]=> [This is a string]
  [%0:18s]=> [ This is a string ]
  [%0:-18s]=> [This is a string ]
  [%0:18.12s]=> [      This is a st]
  [%-*.*s]=> [This is a st      ]
}

Procedure TestString;
begin
  try
    Fmt:='[%s]';S:=Format(Fmt,[ 'This is a string']);Writeln(Fmt:12,'=> ',s);
    Fmt:='[%0:s]';S:=Format(Fmt,[ 'This is a string']);Writeln(Fmt:12,'=> ',s);
    Fmt:='[%0:18s]';S:=Format(Fmt,[ 'This is a string']);Writeln(Fmt:12,'=> ',s);
    Fmt:='[%0:-18s]';S:=Format(Fmt,[ 'This is a string']);Writeln(Fmt:12,'=> ',s);
    Fmt:='[%0:18.12s]';S:=Format(Fmt,[ 'This is a string']);Writeln(Fmt:12,'=> ',s);
    Fmt:='[%-*.*s]';S:=Format(Fmt,[18,12,'This is a string']);Writeln(Fmt:12,'=> ',s);
  except
    On E : Exception do
      begin
        Writeln ('Exception caught : ',E.Message);
      end;
  end;
  writeln ('Press enter');
  readln;
end;

{ Expected output:
  [%e] => [1.234000000000000E+000]
  [%10e] => [1.234000000000000E+000]
  [%10.4e] => [1.234E+000]
  [%0:e] => [1.234000000000000E+000]
  [%0:10e] => [1.234000000000000E+000]
  [%0:10.4e] => [1.234E+000]
  [%0:-10e] => [1.234000000000000E+000]
  [%0:-10.4e] => [1.234E+000]
  [%-*.*e] => [1.2340E+000]
}

Procedure TestExponential;
begin
  Try
    Fmt:='[%e]';S:=Format (Fmt,[1.234]);writeln(Fmt:12,'=> ',s);
    Fmt:='[%10e]';S:=Format (Fmt,[1.234]);writeln(Fmt:12,'=> ',s);
    Fmt:='[%10.4e]';S:=Format (Fmt,[1.234]);writeln(Fmt:12,'=> ',s);
    Fmt:='[%0:e]';S:=Format (Fmt,[1.234]);writeln(Fmt:12,'=> ',s);
    Fmt:='[%0:10e]';S:=Format (Fmt,[1.234]);writeln(Fmt:12,'=> ',s);
    Fmt:='[%0:10.4e]';S:=Format (Fmt,[1.234]);writeln(Fmt:12,'=> ',s);
    Fmt:='[%0:-10e]';S:=Format (Fmt,[1.234]);writeln(Fmt:12,'=> ',s);
    Fmt:='[%0:-10.4e]';S:=Format (Fmt,[1.234]);writeln(Fmt:12,'=> ',s);
    Fmt:='[%-*.*e]';S:=Format (Fmt,[4,5,1.234]);writeln(Fmt:12,'=> ',s);
  except
    On E : Exception do
      begin
        Writeln ('Exception caught : ',E.Message);
      end;
  
```

```

    end;
end;
writeln ('Press enter');
readln;
end;

{ Expected output:
  [%e] => [-1.234000000000000E+000]
  [%10e] => [-1.234000000000000E+000]
  [%10.4e] => [-1.234E+000]
  [%0:e] => [-1.234000000000000E+000]
  [%0:10e] => [-1.234000000000000E+000]
  [%0:10.4e] => [-1.234E+000]
  [%0:-10e] => [-1.234000000000000E+000]
  [%0:-10.4e] => [-1.234E+000]
  [%-*.*e] => [-1.2340E+000]
}

Procedure TestNegativeExponential;
begin
Try
  Fmt:='[%e]';S:=Format (Fmt,[-1.234]);writeln(Fmt:12,'=>',s);
  Fmt:='[%10e]';S:=Format (Fmt,[-1.234]);writeln(Fmt:12,'=>',s);
  Fmt:='[%10.4e]';S:=Format (Fmt,[-1.234]);writeln(Fmt:12,'=>',s);
  Fmt:='[%0:e]';S:=Format (Fmt,[-1.234]);writeln(Fmt:12,'=>',s);
  Fmt:='[%0:10e]';S:=Format (Fmt,[-1.234]);writeln(Fmt:12,'=>',s);
  Fmt:='[%0:10.4e]';S:=Format (Fmt,[-1.234]);writeln(Fmt:12,'=>',s);
  Fmt:='[%0:-10e]';S:=Format (Fmt,[-1.234]);writeln(Fmt:12,'=>',s);
  Fmt:='[%0:-10.4e]';S:=Format (Fmt,[-1.234]);writeln(Fmt:12,'=>',s);
  Fmt:='[%-*.*e]';S:=Format (Fmt,[-1.234]);writeln(Fmt:12,'=>',s);
except
  On E : Exception do
    begin
      Writeln ('Exception caught : ',E.Message);
    end;
  end;
  writeln ('Press enter');
  readln;
end;

{ Expected output:
  [%e] => [1.234000000000000E-002]
  [%10e] => [1.234000000000000E-002]
  [%10.4e] => [1.234E-002]
  [%0:e] => [1.234000000000000E-002]
  [%0:10e] => [1.234000000000000E-002]
  [%0:10.4e] => [1.234E-002]
  [%0:-10e] => [1.230000000000000E-002]
  [%0:-10.4e] => [1.234E-002]
  [%-*.*e] => [1.2340E-002]
}

Procedure TestSmallExponential;
begin
Try
  Fmt:='[%e]';S:=Format (Fmt,[0.01234]);writeln(Fmt:12,'=>',s);
  Fmt:='[%10e]';S:=Format (Fmt,[0.01234]);writeln(Fmt:12,'=>',s);
  Fmt:='[%10.4e]';S:=Format (Fmt,[0.01234]);writeln(Fmt:12,'=>',s);
  Fmt:='[%0:e]';S:=Format (Fmt,[0.01234]);writeln(Fmt:12,'=>',s);
  Fmt:='[%0:10e]';S:=Format (Fmt,[0.01234]);writeln(Fmt:12,'=>',s);

```

```

Fmt:='[%0:10.4e]';S:=Format (Fmt,[0.01234]);writeln (Fmt:12,'=>',s);
Fmt:='[%0:-10e]';S:=Format (Fmt,[0.0123]);writeln (Fmt:12,'=>',s);
Fmt:='[%0:-10.4e]';S:=Format (fmt,[0.01234]);writeln (Fmt:12,'=>',s);
Fmt:='[%-*.*e]';S:=Format (fmt,[4,5,0.01234]);writeln (Fmt:12,'=>',s);
except
  On E : Exception do
    begin
      Writeln ('Exception caught : ',E.Message);
    end;
  end;
  writeln ('Press enter');
  readln;
end;

{ Expected output:
  [%e] => [-1.234000000000000E-002]
  [%10e] => [-1.234000000000000E-002]
  [%10.4e] => [-1.234E-002]
  [%0:e] => [-1.234000000000000E-002]
  [%0:10e] => [-1.234000000000000E-002]
  [%0:10.4e] => [-1.234E-002]
  [%0:-10e] => [-1.234000000000000E-002]
  [%0:-10.4e] => [-1.234E-002]
  [%-*.*e] => [-1.2340E-002]
}

Procedure TestSmallNegExponential;
begin
  Try
    Fmt:='[%e]';S:=Format (Fmt,[-0.01234]);writeln (Fmt:12,'=>',s);
    Fmt:='[%10e]';S:=Format (Fmt,[-0.01234]);writeln (Fmt:12,'=>',s);
    Fmt:='[%10.4e]';S:=Format (Fmt,[-0.01234]);writeln (Fmt:12,'=>',s);
    Fmt:='[%0:e]';S:=Format (Fmt,[-0.01234]);writeln (Fmt:12,'=>',s);
    Fmt:='[%0:10e]';S:=Format (Fmt,[-0.01234]);writeln (Fmt:12,'=>',s);
    Fmt:='[%0:10.4e]';S:=Format (Fmt,[-0.01234]);writeln (Fmt:12,'=>',s);
    Fmt:='[%0:-10e]';S:=Format (Fmt,[-0.01234]);writeln (Fmt:12,'=>',s);
    Fmt:='[%0:-10.4e]';S:=Format (fmt,[-0.01234]);writeln (Fmt:12,'=>',s);
    Fmt:='[%-*.*e]';S:=Format (fmt,[4,5,-0.01234]);writeln (Fmt:12,'=>',s);
  except
    On E : Exception do
      begin
        Writeln ('Exception caught : ',E.Message);
      end;
    end;
    writeln ('Press enter');
    readln;
  end;

  begin
    TestInteger;
    TestHexadecimal;
    TestPointer;
    teststring;
    TestExponential;
    TestNegativeExponential;
    TestSmallExponential;
    TestSmallNegExponential;
  end.

```

38.13.122 FormatBuf

Synopsis: Format a string with given arguments and store the result in a buffer.

Declaration:

```
function FormatBuf(var Buffer;BufLen: Cardinal;const Fmt;
                   fmtLen: Cardinal;const Args: Array of const
                   : Cardinal
function FormatBuf(var Buffer;BufLen: Cardinal;const Fmt;
                   fmtLen: Cardinal;const Args: Array of const;
                   const FormatSettings: TFormatSettings) : Cardinal
```

Visibility: default

Description: FormatBuf calls Format (1535) and stores the result in Buf.

See also: Format (1535)

Listing: ./sysutex/ex72.pp

Program Example72;

```
{ This program demonstrates the FormatBuf function }

Uses sysutils;

Var
  S : ShortString;

Const
  Fmt : ShortString =  'For some nice examples of fomating see %s.';

Begin
  S:= '';
  SetLength(S,FormatBuf (S[1],255,Fmt[1],Length(Fmt),['Format']));
  Writeln (S);
End.
```

38.13.123 FormatCurr

Synopsis: Format a currency

Declaration:

```
function FormatCurr(const Format: string;Value: Currency) : string
function FormatCurr(const Format: string;Value: Currency;
                   const FormatSettings: TFormatSettings) : string
```

Visibility: default

Description: FormatCurr formats the currency Value according to the formatting rule in Format, and returns the resulting string.

For an explanation of the formatting characters, see FormatFloat (1543).

See also: FormatFloat (1543), FloatToText (1533)

38.13.124 FormatDateTime

Synopsis: Return a string representation of a TDateTime value with a given format.

Declaration:

```
function FormatDateTime(const FormatStr: string; DateTime: TDateTime)
                      : string
function FormatDateTime(const FormatStr: string; DateTime: TDateTime;
                       const FormatSettings: TFormatSettings) : string
```

Visibility: default

Description: FormatDateTime formats the date and time encoded in DateTime according to the formatting given in FormatStr. The complete list of formatting characters can be found in formatchars (1454).

Errors: On error (such as an invalid character in the formatting string), and EConvertError exception is raised.

See also: DateTimeToStr (1500), DateToStr (1503), TimeToStr (1593), StrToDate (1582)

Listing: ./sysutex/ex14.pp

```
Program Example14;

{ This program demonstrates the FormatDateTime function }

Uses sysutils;

Var ThisMoment : TDateTime;

Begin
  ThisMoment:=Now;
  Writeln ('Now : ',FormatDateTime( 'hh:nn' ,ThisMoment));
  Writeln ('Now : ',FormatDateTime( 'DD MM YYYY' ,ThisMoment));
  Writeln ('Now : ',FormatDateTime( 'c' ,ThisMoment));
End.
```

38.13.125 FormatFloat

Synopsis: Format a float according to a certain mask.

Declaration:

```
function FormatFloat(const Format: string; Value: Extended) : string
function FormatFloat(const Format: string; Value: Extended;
                     const FormatSettings: TFormatSettings) : string
```

Visibility: default

Description: FormatFloat formats the floating-point value given by Value using the format specifications in Format. The format specifier can give format specifications for positive, negative or zero values (separated by a semicolon).

If the formatspecifier is empty or the value needs more than 18 digits to be correctly represented, the result is formatted with a call to FloatToStrF (1531) with the ffGeneral format option.

The following format specifiers are supported:

0is a digit place holder. If there is a corresponding digit in the value being formatted, then it replaces the 0. If not, the 0 is left as-is.

#is also a digit place holder. If there is a corresponding digit in the value being formatted, then it replaces the #. If not, it is removed. by a space.

.determines the location of the decimal point. Only the first '.' character is taken into account. If the value contains digits after the decimal point, then it is replaced by the value of the DecimalSeparator character.

,determines the use of the thousand separator character in the output string. If the format string contains one or more ',' characters, then thousand separators will be used. The ThousandSeparator character is used.

E+determines the use of scientific notation. If 'E+' or 'E-' (or their lowercase counterparts) are present then scientific notation is used. The number of digits in the output string is determined by the number of 0 characters after the 'E+'.

;
This character separates sections for positive, negative, and zero numbers in the format string.

Errors: If an error occurs, an exception is raised.

See also: [FloatToStr \(1530\)](#)

Listing: ./sysutex/ex89.pp

Program Example89;

{ This program demonstrates the FormatFloat function }

Uses sysutils;

Const

```
NrFormat=9;
FormatStrings : Array[1..NrFormat] of string =
  '',
  '0',
  '0.00',
  '#.##',
  '#,##0.00',
  '#,##0.00;(#,##0.00)',
  '#,##0.00;;Zero',
  '0.000E+00',
  '#.###E-0');
NrValue = 5;
FormatValues : Array[1..NrValue] of Double =
  (1234,-1234,0.5,0,-0.5);
```

```
Width = 12;
FWidth = 20;
```

Var

```
I,J : Integer;
S : String;
```

begin

```
  Write('Format':FWidth);
  For I:=1 to NrValue do
    Write(FormatValues[i]:Width:2);
  Writeln;
  For I:=1 to NrFormat do
    begin
      Write(FormatStrings[i]:FWidth);
      For J:=1 to NrValue do
```

```

begin
  S:=FormatFloat(FormatStrings[l], FormatValues[j]);
  Write(S:Width);
  end;
  Writeln;
  end;
End.

```

38.13.126 FreeAndNil

Synopsis: Free object if needed, and set object reference to Nil

Declaration: procedure FreeAndNil(var obj)

Visibility: default

Description: FreeAndNil will free the object in Obj and will set the reference in Obj to Nil. The reference is set to Nil first, so if an exception occurs in the destructor of the object, the reference will be Nil anyway.

Errors: Exceptions that occur during the destruction of Obj are not caught.

38.13.127 GetAppConfigDir

Synopsis: Return the appropriate directory for the application's configuration files.

Declaration: function GetAppConfigDir(Global: Boolean) : string

Visibility: default

Description: GetAppConfigDir returns the name of a directory in which the application should store its configuration files on the current OS. If the parameter Global is True then the directory returned is a global directory, i.e. valid for all users on the system. If the parameter Global is false, then the directory is specific for the user who is executing the program. On systems that do not support multi-user environments, these two directories may be the same.

The directory which is returned is the name of the directory where the application is supposed to store files. This does not mean that the directory exists, or that the user can write in this directory (especially if Global=True). It just returns the name of the appropriate location. Also note that the returned name always contains an ending path delimiter.

On systems where the operating system provides a call to determine this location, this call will be used. On systems where there is no such call, an algorithm is used which reflects common practice on that system.

The application name is deduced from the binary name via the ApplicationName (1490) call, but can be configured by means of the OnGetApplicationName (1474) callback.

If VendorName (1601) is not-empty, then VendorName will also be inserted before the application-specific directory.

Errors: None.

See also: GetAppConfigFile (1546), ApplicationName (1490), OnGetApplicationName (1474), CreateDir (1497), SysConfigDir (1462), VendorName (1601)

38.13.128 GetAppConfigFile

Synopsis: Return an appropriate name for an application configuration file.

Declaration: function GetAppConfigFile(Global: Boolean) : string
 function GetAppConfigFile(Global: Boolean; SubDir: Boolean) : string

Visibility: default

Description: `GetAppConfigFile` returns the name of a file in which the application can store its configuration parameters. The exact name and location of the file depends on the customs of the operating system.

The `Global` parameter determines whether it is a global configuration file (value `True`) or a personal configuration file (value `False`).

The parameter `SubDir`, in case it is set to `True`, will insert the name of a directory before the filename. This can be used in case the application needs to store other data than configuration data in an application-specific directory. Default behaviour is to set this to `False`.

Note that on Windows, even when `Subdir` is `False`, a subdirectory is created for the application configuration files, as per the windows specifications. Specifying `true` will create a subdirectory of the application settings subdirectory.

The default file extension of the returned file is: `.cfg`

No assumptions should be made about the existence or writeability of this file, or the directory where the file should reside. It is best to call `ForceDirectories` (1535) prior to opening a file with the resulting filename.

On systems where the operating system provides a call to determine the location of configuration files, this call will be used. On systems where there is no such call, an algorithm is used which reflects common practice on that system.

The application name is deduced from the binary name via the `ApplicationName` (1490) call, but can be configured by means of the `OnGetApplicationName` (1474) callback.

If `VendorName` (1601) is not-empty, then `VendorName` will be inserted in the path for the config file directory.

Errors: None.

See also: `GetAppConfigDir` (1545), `OnGetApplicationName` (1474), `ApplicationName` (1490), `CreateDir` (1497), `ConfigExtension` (1456), `SysConfigDir` (1462), `VendorName` (1601)

38.13.129 GetCurrentDir

Synopsis: Return the current working directory of the application.

Declaration: function GetCurrentDir : string

Visibility: default

Description: `GetCurrentDir` returns the current working directory.

Errors: None.

See also: `SetCurrentDir` (1564), `DiskFree` (1506), `DiskSize` (1507)

Listing: `./sysutex/ex28.pp`

```
Program Example28;

{ This program demonstrates the GetCurrentDir function }

Uses sysutils;

Begin
  WriteLn ('Current Directory is : ',GetCurrentDir);
End.
```

38.13.130 GetDirs

Synopsis: Return a list of directory names from a path.

Declaration: function GetDirs(var DirName: string;var Dirs: Array of PChar) : LongInt

Visibility: default

Description: GetDirs splits DirName in a null-byte separated list of directory names, Dirs is an array of PChars, pointing to these directory names. The function returns the number of directories found, or -1 if none were found. DirName must contain only OSDirSeparator as Directory separator chars.

Errors: None.

See also: ExtractRelativePath ([1516](#))

Listing: ./sysutex/ex45.pp

```
Program Example45;
```

```
{ This program demonstrates the GetDirs function }
{$H+}
```

```
Uses sysutils;
```

```
Var Dirs : Array[0..127] of pchar;
  I,Count : longint;
  Dir ,NewDir : String;
```

```
Begin
  Dir:=GetCurrentDir;
  WriteLn ('Dir : ',Dir);
  NewDir:='';
  count:=GetDirs(Dir ,Dirs );
  For I:=0 to Count-1 do
    begin
      NewDir:=NewDir+'/' +StrPas( Dirs[I]);
      WriteLn (NewDir);
    end;
End.
```

38.13.131 GetEnvironmentString

Synopsis: Return an environment variable by index.

Declaration: function GetEnvironmentString(Index: Integer) : string

Visibility: default

Description: GetEnvironmentString returns the Index-th environment variable. The index is 1 based, and is bounded from above by the result of GetEnvironmentVariableCount (1548).

For an example, GetEnvironmentVariableCount (1548).

Remark: Note that on Windows, environment strings can start with an equal sign (=). This is a trick used to pass the current working directory to a newly created process. In this case, extracting the variable name as the characters before the first equal sign will result in an empty name.

Errors: If there is no environment, an empty string is returned.

See also: GetEnvironmentVariable (1548), GetEnvironmentVariableCount (1548)

38.13.132 GetEnvironmentVariable

Synopsis: Return the value of an environment variable.

Declaration: function GetEnvironmentVariable(const EnvVar: string) : string

Visibility: default

Description: GetEnvironmentVariable returns the value of the EnvVar environment variable. If the specified variable does not exist or EnvVar is empty, an empty string is returned.

See also: GetEnvironmentString (1547), GetEnvironmentVariableCount (1548)

38.13.133 GetEnvironmentVariableCount

Synopsis: Return the number of variables in the environment.

Declaration: function GetEnvironmentVariableCount : Integer

Visibility: default

Description: GetEnvironmentVariableCount returns the number of variables in the environment. The number is 1 based, but the result may be zero if there are no environment variables.

Errors: If there is no environment, -1 may be returned.

See also: GetEnvironmentString (1547), GetEnvironmentVariable (1548)

Listing: ./sysutex/ex92.pp

```

{$h+}
program example92;

{ This program demonstrates the
GetEnvironmentVariableCount function }

uses sysutils;

Var
  I : Integer;

begin
  For I:=1 to GetEnvironmentVariableCount do
    Writeln(i:3, ' : ', GetEnvironmentString(i));
end.

```

38.13.134 GetFileHandle

Synopsis: Extract OS handle from an untyped file or text file.

Declaration: function GetFileHandle(var f: File) : THandle
function GetFileHandle(var f: Text) : THandle

Visibility: default

Description: GetFileHandle returns the operating system handle for the file descriptor F. It can be used in various file operations which are not directly supported by the pascal language.

38.13.135 GetLastOSError

Synopsis: Return the last code from the OS.

Declaration: function GetLastOSError : Integer

Visibility: default

Description: GetLastOSError returns the error code from the last operating system call. It does not reset this code. In general, it should be called when an operating system call reported an error condition. In that case, GetLastOSError gives extended information about the error.

No assumptions should be made about the resetting of the error code by subsequent OS calls. This may be platform dependent.

See also: RaiseLastOSError ([1561](#))

38.13.136 GetLocalTime

Synopsis: Get the local time.

Declaration: procedure GetLocalTime(var SystemTime: TSystemTime)

Visibility: default

Description: GetLocalTime returns the system time in a TSystemTime ([1](#)) format.

Errors: None.

See also: Now ([1560](#)), Date ([1499](#)), Time ([1591](#)), TSystemTime ([1](#))

38.13.137 GetLocalTimeOffset

Declaration: function GetLocalTimeOffset : Integer

Visibility: default

38.13.138 GetModuleName

Synopsis: Return the name of the current module

Declaration: function GetModuleName(Module: HMODULE) : string

Visibility: default

Description: GetModuleName returns the name of the current module. On windows, this is the name of the executable when executed in an executable, or the name of the library when executed in a library.

On all other platforms, the result is always empty, since they provide no such functionality.

38.13.139 GetTempDir

Synopsis: Return name of system's temporary directory

```
Declaration: function GetTempDir(Global: Boolean) : string  
            function GetTempDir : string
```

Visibility: default

Description: GetTempDir returns the temporary directory of the system. If Global is True (the default value) it returns the system temporary directory, if it is False then a directory private to the user is returned. The returned name will end with a directory delimiter character.

These directories may be the same. No guarantee is made that this directory exists or is writeable by the user.

The `OnGetTempDir` (1474) handler may be set to provide custom handling of this routine: One could implement callbacks which take into consideration frameworks like KDE or GNOME, and return a different value from the default system implementation.

Errors: On error, an empty string is returned.

See also: [OnGetTempDir](#) (1474), [GetTempFileName](#) (1550)

38.13.140 GetTempFileName

Synopsis: Return the name of a temporary file.

Visibility: default

Description: GetTempFileName returns the name of a temporary file in directory Dir. The name of the file starts with Prefix.

If Dir is empty, the value returned by GetTempDir is used, and if Prefix is empty, 'TMP' is used.

The `OnGetTempFile` (1474) handler may be set to provide custom handling of this routine: One could implement callbacks which take into consideration frameworks like KDE or GNOME, and return a different value from the default system implementation.

Errors: On error, an empty string is returned.

See also: [GetTempDir](#) (1550), [OnGetTempFile](#) (1474)

38.13.141 GetUserDir

Synopsis: Returns the current user's home directory.

Declaration: function GetUserDir : string

Visibility: default

Description: `GetUserDir` returns the home directory of the current user. On Unix-like systems (that includes Mac OS X), this is the value of the HOME environment variable. On Windows, this is the PROFILE special folder. On all other platforms, the application installation directory is returned.

If non-empty, it contains a trailing path delimiter.

See also: `GetAppConfigDir` ([1545](#))

38.13.142 GuidCase

Synopsis: Return the index of a GUID in an array of GUID values

Declaration: `function GuidCase(const GUID: TGuid; const List: Array of TGuid) : Integer`

Visibility: default

Description: `GuidCase` returns the index of GUID in the array `List`, where 0 denotes the first element in the list. If GUID is not present in the list, -1 is returned.

See also: `IsEqualGUID` ([1556](#))

38.13.143 GUIDToString

Synopsis: Convert a TGUID to a string representation.

Declaration: `function GUIDToString(const GUID: TGuid) : string`

Visibility: default

Description: `GUIDToString` converts the GUID identifier in `GUID` to a string representation in the form

{ XXXXXXXX-XXXX-XXXX-XXXX-XXXXXXXXXXXX }

Where each X is a hexadecimal digit.

Errors: None.

See also: `Supports` ([1589](#)), `#rtl.system.TGUID` ([1268](#)), `StringToGUID` ([1572](#)), `IsEqualGuid` ([1556](#))

38.13.144 HashName

Synopsis: Calculate a hash from a null-terminated string

Declaration: `function HashName(Name: PAnsiChar) : LongWord`

Visibility: default

Description: `HashName` calculates a hash value from a null terminated string. The hash value is calculated in such a way that it returns the same value for strings that only differ in case.

38.13.145 HookSignal

Synopsis: Hook a specified signal

Declaration: procedure HookSignal(RtlSigNum: Integer)

Visibility: default

Description: HookSignal installs the RTL default signal handler for signal RtlSigNum. It does not check whether the signal is already handled, and should therefore only be called if InquireSignal returns ssNotHooked.

38.13.146 IncAMonth

Synopsis: Increase a date with a certain amount of months

Declaration: procedure IncAMonth(var Year: Word; var Month: Word; var Day: Word; NumberOfMonths: Integer)

Visibility: default

Description: IncAMonth increases the date as specified by Year, Month, Day with NumberOfMonths. It takes care of the number of days in a month when calculating the result.

This function does the same as IncMonth (1553), but operates on an already decoded date.

See also: IncMonth (1553)

38.13.147 IncludeLeadingPathDelimiter

Synopsis: Prepend a path delimiter if there is not already one.

Declaration: function IncludeLeadingPathDelimiter(const Path: string) : string

Visibility: default

Description: IncludeLeadingPathDelimiter will insert a path delimiter (#rtl.system.DirectorySeparator (1234)) in the first position of Path, if there is not already a directory separator at that position. It will return the resulting string. If the path is empty, a DirectorySeparator character is returned.

See also: IncludeTrailingPathDelimiter (1553), ExcludeLeadingPathDelimiter (1511), ExcludeTrailingPathDelimiter (1512), ConcatPaths (1496)

Listing: ./sysutex/ex94.pp

Program Example94;

{ This program demonstrates the IncludeLeadingPathDelimiter function }

Uses sysutils;

Begin
End.

38.13.148 IncludeTrailingBackslash

Synopsis: Add trailing directory separator to a pathname, if needed.

Declaration: function IncludeTrailingBackslash(const Path: string) : string

Visibility: default

Description: `IncludeTrailingBackslash` is provided for backwards compatibility with Delphi. Use `IncludeTrailingPathDelimiter` (1553) instead.

See also: `IncludeTrailingPathDelimiter` (1553), `ExcludeTrailingPathDelimiter` (1512), `PathDelim` (1460), `IsPathDelimiter` (1556)

38.13.149 IncludeTrailingPathDelimiter

Synopsis: Add trailing directory separator to a pathname, if needed.

Declaration: function IncludeTrailingPathDelimiter(const Path: string) : string

Visibility: default

Description: `IncludeTrailingPathDelimiter` adds a trailing path delimiter character (`PathDelim` (1460)) to `Path` if none is present yet, and returns the result.

If `Path` is empty, a path delimiter is returned, for Delphi compatibility.

See also: `IncludeTrailingBackslash` (1553), `ExcludeTrailingPathDelimiter` (1512), `PathDelim` (1460), `IsPathDelimiter` (1556)

38.13.150 IncMonth

Synopsis: Increases the month in a `TDateTime` value with a given amount.

Declaration: function IncMonth(const DateTime: TDateTime; NumberOfMonths: Integer) : TDateTime

Visibility: default

Description: `IncMonth` increases the month number in `DateTime` with `NumberOfMonths`. It wraps the result as to get a month between 1 and 12, and updates the year accordingly. `NumberOfMonths` can be negative, and can be larger than 12 (in absolute value).

Errors: None.

See also: `Date` (1499), `Time` (1591), `Now` (1560)

Listing: ./sysutex/ex15.pp

Program Example15;

{ This program demonstrates the IncMonth function }

Uses sysutils;

Var ThisDay : TDateTime;

Begin

 ThisDay:=Date;
 Writeln ('ThisDay : ',DateToStr(ThisDay));

```

Writeln ('6 months ago : ',DateToStr(IncMonth(ThisDay,-6)));
Writeln ('6 months from now : ',DateToStr(IncMonth(ThisDay,6)));
Writeln ('12 months ago : ',DateToStr(IncMonth(ThisDay,-12)));
Writeln ('12 months from now : ',DateToStr(IncMonth(ThisDay,12)));
Writeln ('18 months ago : ',DateToStr(IncMonth(ThisDay,-18)));
Writeln ('18 months from now : ',DateToStr(IncMonth(ThisDay,18)));
End.

```

38.13.151 InquireSignal

Synopsis: Check whether a signal handler is set (unix only)

Declaration: function InquireSignal(RtlSigNum: Integer) : TSignalState

Visibility: default

Description: RtlSigNum will check whether the signal RtlSigNum is being handled, and by whom. It returns a TSignalState result to report the state of the signal, which can be one of the following values:

ssNotHookedNo signal handler is set for the signal.

ssHookedA signal handler is set by the RTL code for the signal.

ssOverriddenA signal handler was set for the signal by third-party code.

This routine works by resetting the signal handlers, so it is risky to call.

38.13.152 IntToHex

Synopsis: Convert an integer value to a hexadecimal string.

Declaration: function IntToHex(Value: Integer; Digits: Integer) : string
 function IntToHex(Value: Int64; Digits: Integer) : string
 function IntToHex(Value: QWord; Digits: Integer) : string

Visibility: default

Description: IntToHex converts Value to a hexadecimal string representation. The result will contain at least Digits characters. If Digits is less than the needed number of characters, the string will NOT be truncated. If Digits is larger than the needed number of characters, the result is padded with zeroes.

Errors: None.

See also: IntToStr ([1555](#))

Listing: ./sysutex/ex73.pp

Program Example73;

```
{ This program demonstrates the IntToHex function }
```

```
Uses sysutils;
```

```
Var I : longint;
```

```
Begin
```

```
For I:=0 to 31 do
```

```

begin
  Writeln (IntToHex(1 shl 1,8));
  Writeln (IntToHex(15 shl 1,8))
end;
End.

```

38.13.153 IntToStr

Synopsis: Convert an integer value to a decimal string.

Declaration: function IntToStr(Value: Integer) : string
 function IntToStr(Value: Int64) : string
 function IntToStr(Value: QWord) : string

Visibility: default

Description: IntToStr converts Value to its string representation. The resulting string has only as much characters as needed to represent the value. If the value is negative a minus sign is prepended to the string.

Errors: None.

See also: [IntToHex \(1554\)](#), [StrToInt \(1585\)](#)

Listing: ./sysutex/ex74.pp

```

Program Example74;

{ This program demonstrates the IntToStr function }

Uses sysutils;

Var I : longint;

Begin
  For I:=0 to 31 do
    begin
      Writeln (IntToStr(I));
      Writeln (IntToStr(15 shl I));
    end;
End.

```

38.13.154 IsDelimiter

Synopsis: Check whether a given string is a delimiter character.

Declaration: function IsDelimiter(const Delimiters: string; const S: string;
 Index: Integer) : Boolean

Visibility: default

Description: IsDelimiter checks whether the Index-th character in the string S is a delimiter character as passed in Delimiters. If Index is out of range, False is returned.

Errors: None.

See also: [LastDelimiter \(1557\)](#)

38.13.155 IsEqualGUID

Synopsis: Check whether two TGUID variables are equal.

Declaration: function IsEqualGUID(const guid1: TGuid; const guid2: TGuid) : Boolean

Visibility: default

Description: IsEqualGUID checks whether guid1 and guid2 are equal, and returns True if this is the case, or False otherwise.

See also: Supports (1589), #rtl.system.TGUID (1268), StringToGUID (1572), GuidToString (1551)

38.13.156 IsLeapYear

Synopsis: Determine whether a year is a leap year.

Declaration: function IsLeapYear(Year: Word) : Boolean

Visibility: default

Description: IsLeapYear returns True if Year is a leap year, False otherwise.

Errors: None.

See also: IncMonth (1553), Date (1499)

Listing: ./sysutex/ex16.pp

Program Example16;

{ This program demonstrates the IsLeapYear function }

Uses sysutils;

Var YY,MM,dd : Word;

Procedure TestYear (Y : Word);

begin

WriteLn (Y, ' is leap year : ',IsLeapYear(Y));

end;

Begin

DeCodeDate(**Date**,YY,mm,dd);

 TestYear(yy);

 TestYear(2000);

 TestYear(1900);

 TestYear(1600);

 TestYear(1992);

 TestYear(1995);

End.

38.13.157 IsPathDelimiter

Synopsis: Is the character at the given position a pathdelimiter ?

Declaration: function IsPathDelimiter(const Path: string; Index: Integer) : Boolean

Visibility: default

Description: `IsPathDelimiter` returns True if the character at position `Index` equals `PathDelim` ([1460](#)), i.e. if it is a path delimiter character for the current platform.

Errors: `IncludeTrailingPathDelimiter` ([1553](#))`ExcludeTrailingPathDelimiter` ([1512](#))`PathDelim` ([1460](#))

38.13.158 IsValidIdent

Synopsis: Check whether a string is a valid identifier name.

Declaration: `function IsValidIdent(const Ident: string) : Boolean`

Visibility: default

Description: `IsValidIdent` returns True if `Ident` can be used as a component name. It returns False otherwise. `Ident` must consist of a letter or underscore, followed by a combination of letters, numbers or underscores to be a valid identifier.

Errors: None.

Listing: `./sysutex/ex75.pp`

Program Example75;

{ This program demonstrates the `IsValidIdent` function }

Uses sysutils;

Procedure Testit (S : String);

begin

```
  Write ('"', S, '" is ');
  If not IsValidIdent(S) then
    Write('NOT ');
    Writeln ('a valid identifier');
end;
```

Begin

```
  Testit ('_MyObj');
  Testit ('My__Obj1');
  Testit ('My_1_Obj');
  Testit ('1MyObject');
  Testit ('My@Object');
  Testit ('M123');
```

End.

38.13.159 LastDelimiter

Synopsis: Return the last occurrence of a set of delimiters in a string.

Declaration: `function LastDelimiter(const Delimiters: string; const S: string) : Integer`

Visibility: default

Description: `LastDelimiter` returns the *last* occurrence of any character in the set `Delimiters` in the string `S`.

Listing: ./sysutex/ex88.pp

```
Program example88;

{ This program demonstrates the LastDelimiter function }

uses SysUtils;

begin
  Writeln(LastDelimiter('.:', 'c:\filename.ext'));
end.
```

38.13.160 LeftStr

Synopsis: Return a number of characters starting at the left of a string.

Declaration: function LeftStr(const S: string; Count: Integer) : string

Visibility: default

Description: LeftStr returns the Count leftmost characters of S. It is equivalent to a call to Copy(S, 1, Count).

Errors: None.

See also: RightStr (1563), TrimLeft (1594), TrimRight (1595), Trim (1593)

Listing: ./sysutex/ex76.pp

```
Program Example76;

{ This program demonstrates the LeftStr function }

Uses sysutils;

Begin
  Writeln (LeftStr('abcdefghijklmnopqrstuvwxyz',20));
  Writeln (LeftStr('abcdefghijklmnopqrstuvwxyz',15));
  Writeln (LeftStr('abcdefghijklmnopqrstuvwxyz',1));
  Writeln (LeftStr('abcdefghijklmnopqrstuvwxyz',200));
End.
```

38.13.161 LoadStr

Synopsis: Load a string from the resource tables.

Declaration: function LoadStr(Ident: Integer) : string

Visibility: default

Description: This function is not yet implemented. resources are not yet supported.

38.13.162 LowerCase

Synopsis: Return a lowercase version of a string.

Declaration: function LowerCase(const s: string) : string; Overload
function LowerCase(const V: variant) : string; Overload

Visibility: default

Description: `LowerCase` returns the lowercase equivalent of `S`. Ansi characters are not taken into account, only ASCII codes below 127 are converted. It is completely equivalent to the lowercase function of the system unit, and is provided for compatibility only.

Errors: None.

See also: [AnsiLowerCase \(1481\)](#), [UpperCase \(1600\)](#), [AnsiUpperCase \(1489\)](#)

Listing: `./sysutex/ex77.pp`

Program Example77;

{ This program demonstrates the LowerCase function }

Uses sysutils;

Begin
Writeln (`LowerCase('THIS WILL COME out all LoWeRcAsE !')`);
End.

38.13.163 MSecsToTimeStamp

Synopsis: Convert a number of milliseconds to a `TDateTime` value.

Declaration: `function MSecsToTimeStamp (MSecs: Comp) : TTimeStamp`

Visibility: default

Description: `MSecsToTimeStamp` converts the given number of milliseconds to a `TTimeStamp` date/time notation.

Use `TTimeStamp` variables if you need to keep very precise track of time.

Errors: None.

See also: [TimeStampToMSecs \(1592\)](#), [DateTimeToTimeStamp \(1502\)](#)

Listing: `./sysutex/ex17.pp`

Program Example17;

{ This program demonstrates the MSecsToTimeStamp function }

Uses sysutils;

Var MS : Comp;
 TS : TTimeStamp;
 DT : TDateTime;
Begin
`TS:=DateTimeToTimeStamp(Now);`
Writeln ('Now in days since 1/1/0001 : ', TS.Date);
Writeln ('Now in millisecs since midnight : ', TS.Time);
`MS:=TimeStampToMSecs(TS);`
Writeln ('Now in millisecs since 1/1/0001 : ', MS);
`MS:=MS-1000*3600*2;`
`TS:=MSecsToTimeStamp(MS);`
`DT:=TimeStampToDateTIme(TS);`

```
WriteLn ( 'Now minus 1 day : ',DateTimeToStr(DT));
End.
```

38.13.164 NewStr

Synopsis: Allocate a new ansistring on the heap.

Declaration: function NewStr(const S: string) : PString; Overload

Visibility: default

Description: NewStr assigns a new dynamic string on the heap, copies S into it, and returns a pointer to the newly assigned string.

This function is obsolete, and shouldn't be used any more. The AnsiString mechanism also allocates ansistrings on the heap, and should be preferred over this mechanism.

For an example, see AssignStr (1491).

Errors: If not enough memory is present, an EOutOfMemory exception will be raised.

See also: AssignStr (1491), DisposeStr (1507)

38.13.165 Now

Synopsis: Returns the current date and time.

Declaration: function Now : TDateTime

Visibility: default

Description: Now returns the current date and time. It is equivalent to Date+Time.

Errors: None.

See also: Date (1499), Time (1591)

Listing: ./sysutex/ex18.pp

```
Program Example18;

{ This program demonstrates the Now function }

Uses sysutils;

Begin
  WriteLn ( 'Now : ',DateTimeToStr(Now));
End.
```

38.13.166 OutOfMemoryError

Synopsis: Raise an EOutOfMemory exception

Declaration: procedure OutOfMemoryError

Visibility: default

Description: `OutOfMemory` raises an `EOutOfMemory` (1609) exception, with an exception object that has been allocated on the heap at program startup. The program should never create an `EOutOfMemory` (1609) exception, but always call this routine.

See also: `EOutOfMemory` (1609)

38.13.167 QuotedStr

Synopsis: Return a quoted version of a string.

Declaration: `function QuotedStr(const S: string) : string`

Visibility: default

Description: `QuotedStr` returns the string `S`, quoted with single quotes. This means that `S` is enclosed in single quotes, and every single quote in `S` is doubled. It is equivalent to a call to `AnsiQuotedStr(s, '')`.

Errors: None.

See also: `AnsiQuotedStr` (1482), `AnsiExtractQuotedStr` (1480)

Listing: `./sysutex/ex78.pp`

```
Program Example78;

{ This program demonstrates the QuotedStr function }

Uses sysutils;

Var S : AnsiString;

Begin
  S:= 'He said ''Hello'' and walked on';
  Writeln (S);
  Writeln (' becomes');
  Writeln (QuotedStr(S));
End.
```

38.13.168 RaiseLastOSError

Synopsis: Raise an exception with the last Operating System error code.

Declaration: `procedure RaiseLastOSError; Overload`
`procedure RaiseLastOSError(LastError: Integer); Overload`

Visibility: default

Description: `RaiseLastOSError` raises an `EOSError` (1608) exception with the error code returned by `GetLastOSError`. If the Error code is nonzero, then the corresponding error message will be returned. If the error code is zero, a standard message will be returned.

Errors: This procedure may not be implemented on all platforms. If it is not, then a normal `Exception` (1611) will be raised.

See also: `EOSError` (1608), `GetLastOSError` (1549), `Exception` (1611)

38.13.169 RemoveDir

Synopsis: Remove a directory from the filesystem.

Declaration: function RemoveDir(const Dir: string) : Boolean

Visibility: default

Description: RemoveDir removes directory Dir from the disk. If the directory is not absolute, it is appended to the current working directory.

For an example, see CreateDir ([1497](#)).

Errors: In case of error (e.g. the directory isn't empty) the function returns False. If successful, True is returned.

38.13.170 RenameFile

Synopsis: Rename a file.

Declaration: function RenameFile(const OldName: string; const NewName: string) : Boolean

Visibility: default

Description: RenameFile renames a file from OldName to NewName. The function returns True if successful, False otherwise. For safety, the new name must be a full path specification, including the directory, otherwise it will be assumed to be a filename relative to the current working directory.

Remark: The implementation of RenameFile relies on the underlying OS's support for renaming/moving a file. Whether or not a file can be renamed across disks or partitions depends entirely on the OS. On unix-like OS-es, the rename function will fail when used across partitions. On Windows, it will work.

Errors: On Error, False is returned.

See also: DeleteFile ([1505](#))

Listing: ./sysutex/ex44.pp

Program Example44;

{ This program demonstrates the RenameFile function }

Uses sysutils;

```

Var F : Longint;
      S : String;

Begin
  S:= 'Some short file.';
  F:= FileCreate ('test.dap');
  FileWrite(F,S[1],Length(S));
  FileClose(F);
  If RenameFile ('test.dap','test.dat') then
    Writeln ('Successfully renamed files.');
End.
```

38.13.171 ReplaceDate

Synopsis: Replace the date part of a date/time stamp

Declaration: procedure ReplaceDate(var DateTime: TDateTime; const NewDate: TDateTime)

Visibility: default

Description: ReplaceDate replaces the date part of DateTime with NewDate. The time part is left unchanged.

See also: ReplaceTime ([1563](#))

38.13.172 ReplaceTime

Synopsis: Replace the time part

Declaration: procedure ReplaceTime(var dati: TDateTime; NewTime: TDateTime)

Visibility: default

Description: ReplaceTime replaces the time part in dati with NewTime. The date part remains untouched.

38.13.173 RightStr

Synopsis: Return a number of characters from a string, starting at the end.

Declaration: function RightStr(const S: string; Count: Integer) : string

Visibility: default

Description: RightStr returns the Count rightmost characters of S. It is equivalent to a call to Copy(S, Length(S)+1-Count, Count). If Count is larger than the actual length of S only the real length will be used.

Errors: None.

See also: LeftStr ([1558](#)), Trim ([1593](#)), TrimLeft ([1594](#)), TrimRight ([1595](#))

Listing: ./sysutex/ex79.pp

Program Example79;

{ This program demonstrates the RightStr function }

Uses sysutils;

Begin

Writeln (RightStr('abcdefghijklmnopqrstuvwxyz', 20));
 Writeln (RightStr('abcdefghijklmnopqrstuvwxyz', 15));
 Writeln (RightStr('abcdefghijklmnopqrstuvwxyz', 1));
 Writeln (RightStr('abcdefghijklmnopqrstuvwxyz', 200));

End.

38.13.174 SafeLoadLibrary

Synopsis: Load a library safely

Declaration: function SafeLoadLibrary(const FileName: AnsiString; ErrorMode: DWord) : HMODULE

Visibility: default

Description: SafeLoadLibrary saves and restores some registers before and after issuing a call to LoadLibrary.

Errors: None.

38.13.175 SameFileName

Synopsis: Are two filenames referring to the same file ?

Declaration: function SameFileName(const S1: string; const S2: string) : Boolean

Visibility: default

Description: SameFileName returns True if calling AnsiCompareFileName (1477) with arguments S1 and S2 returns 0, and returns False otherwise.

Errors: None.

See also: AnsiCompareFileName (1477)

38.13.176 SameText

Synopsis: Checks whether 2 strings are the same (case insensitive)

Declaration: function SameText(const s1: string; const s2: string) : Boolean

Visibility: default

Description: SameText calls CompareText (1495) with S1 and S2 as parameters and returns True if the result of that call is zero, or False otherwise.

Errors: None.

See also: CompareText (1495), AnsiSameText (1483), AnsiSameStr (1482)

38.13.177 SetCurrentDir

Synopsis: Set the current directory of the application.

Declaration: function SetCurrentDir(const NewDir: string) : Boolean

Visibility: default

Description: SetCurrentDir sets the current working directory of your program to NewDir. It returns True if the function was successfull, False otherwise.

Errors: In case of error, False is returned.

See also: GetCurrentDir (1546)

38.13.178 SetDirSeparators

Synopsis: Set the directory separators to the known directory separators.

Declaration: function SetDirSeparators(const FileName: string) : string

Visibility: default

Description: SetDirSeparators returns FileName with all possible DirSeparators replaced by OSDirSeparator.

Errors: None.

See also: ExpandFileName (1513), ExtractFilePath (1516), ExtractFileDir (1514)

Listing: ./sysutex/ex47.pp

Program Example47;

{ This program demonstrates the SetDirSeparators function }

Uses sysutils;

Begin

WriteLn (SetDirSeparators('/pp\bin\win32\ppc386'));

End.

38.13.179 ShowException

Synopsis: Show the current exception to the user.

Declaration: procedure ShowException(ExceptObject: TObject; ExceptAddr: Pointer)

Visibility: default

Description: ShowException shows a message stating that a ExceptObject was raised at address ExceptAddr.

It uses ExceptionErrorMessage (1510) to create the message, and is aware of the fact whether the application is a console application or a GUI application. For a console application, the message is written to standard error output. For a GUI application, OnShowException (1474) is executed.

Errors: If, for a GUI application, OnShowException (1474) is not set, no message will be displayed to the user.

The exception message can be at most 255 characters long: It is possible that no memory can be allocated on the heap, so ansistrings are not available, so a shortstring is used to display the message.

See also: ExceptObject (1511), ExceptAddr (1510), ExceptionErrorMessage (1510)

38.13.180 Sleep

Synopsis: Suspend execution of a program for a certain time.

Declaration: procedure Sleep(milliseconds: Cardinal)

Visibility: default

Description: Sleep suspends the execution of the program for the specified number of milliseconds (milliseconds).

After the specified period has expired, program execution resumes.

Remark: The indicated time is not exact, i.e. it is a minimum time. No guarantees are made as to the exact duration of the suspension.

38.13.181 SScanf

Synopsis: Scan a string for substrings and return the substrings

Declaration: function SScanf(const s: string; const fmt: string;
const Pointers: Array of Pointer) : Integer

Visibility: default

Description: `SScanF` scans the string `S` for the elements specified in `Fmt`, and returns the elements in the pointers in `Pointers`. The `Fmt` can contain placeholders of the form `%X` where `X` can be one of the following characters:

dPlaceholder for a decimal number.

fPlaceholder for a floating point number (an extended)

sPlaceholder for a string of arbitrary length.

cPlaceholder for a single character

The `Pointers` array contains a list of pointers, each pointer should point to a memory location of a type that corresponds to the type of placeholder in that position:

dA pointer to an integer.

fA pointer to an extended.

sA pointer to an ansistring.

cA pointer to a single character.

Errors: No error checking is performed on the type of the memory location.

See also: Format ([1535](#))

38.13.182 StrAlloc

Synopsis: Allocate a null-terminated string on the heap.

Declaration: function StrAlloc(Size: Cardinal) : PChar

Visibility: default

Description: `StrAlloc` reserves memory on the heap for a string with length `Len`, terminating `#0` included, and returns a pointer to it.

Additionally, `StrAlloc` allocates 4 extra bytes to store the size of the allocated memory. Therefore this function is NOT compatible with the `StrAlloc` ([1187](#)) function of the `Strings` unit.

For an example, see `StrBufSize` ([1567](#)).

Errors: None.

See also: `StrBufSize` ([1567](#)), `StrDispose` ([1569](#)), `StrAlloc` ([1187](#))

38.13.183 StrBufSize

Synopsis: Return the size of a null-terminated string allocated on the heap.

Declaration: function StrBufSize(Str: PChar) : SizeUInt

Visibility: default

Description: StrBufSize returns the memory allocated for Str. This function ONLY gives the correct result if Str was allocated using StrAlloc ([1566](#)).

Errors: If no more memory is available, a runtime error occurs.

See also: StrAlloc ([1566](#)), StrDispose ([1569](#))

Listing: ./sysutex/ex46.pp

Program Example46;

```
{ This program demonstrates the StrBufSize function }
{$H+}
```

```
Uses sysutils;
```

```
Const S = 'Some nice string';
```

```
Var P : Pchar;
```

```
Begin
```

```
P:=StrAlloc(Length(S)+1);
StrPCopy(P,S);
Write (P, ' has length ',length(S));
Writeln (' and buffer size ',StrBufSize(P));
StrDispose(P);
```

```
End.
```

38.13.184 StrByteType

Synopsis: Return the type of byte in a null-terminated string for a multi-byte character set

Declaration: function StrByteType(Str: PChar; Index: Cardinal) : TMbcsByteType

Visibility: default

Description: StrByteType returns the type of byte in the null-terminated string Str at (0-based) position Index.

Errors: No checking on the index is performed.

See also: TMbcsByteType ([1469](#)), ByteType ([1493](#))

38.13.185 strcat

Synopsis: Concatenate 2 null-terminated strings.

Declaration: function strcat(dest: PChar; source: PChar) : PChar

Visibility: default

Description: Attaches Source to Dest and returns Dest.

Errors: No length checking is performed.

See also: StrLCat ([1573](#))

Listing: ./stringex/ex11.pp

```
Program Example11;

Uses strings;

{ Program to demonstrate the StrCat function. }

Const P1 : PChar = 'This is a PChar String.';

Var P2 : PChar;

begin
  P2:=StrAlloc (StrLen(P1)*2+1);
  StrMove (P2,P1,StrLen(P1)+1); { P2=P1 }
  StrCat (P2,P1); { Append P2 once more }
  Writeln ('P2 : ',P2);
  StrDispose(P2);
end.
```

38.13.186 StrCharLength

Synopsis: Return the length of a null-terminated string in characters.

Declaration: function StrCharLength(const Str: PChar) : Integer

Visibility: default

Description: StrCharLength returns the length of the null-terminated string Str (a widestring) in characters (not in bytes). It uses the widestring manager to do this.

38.13.187 strcomp

Synopsis: Compare 2 null-terminated strings, case sensitive.

Declaration: function strcomp(str1: PChar;str2: PChar) : SizeInt

Visibility: default

Description: Compares the null-terminated strings S1 and S2. The result is

- A negative Longint when S1<S2.
- 0 when S1=S2.
- A positive Longint when S1>S2.

For an example, see StrLComp ([1573](#)).

Errors: None.

See also: StrLComp ([1573](#)), StrIComp ([1571](#)), StrLIComp ([1576](#))

38.13.188 StrCopy

Synopsis: Copy a null-terminated string

Declaration: function strcpy(dest: PChar;source: PChar) : PChar; Overload
 function StrCopy(Dest: PWideChar;Source: PWideChar) : PWideChar
 ; Overload

Visibility: default

Description: Copy the null terminated string in Source to Dest, and returns a pointer to Dest. Dest needs enough room to contain Source, i.e. StrLen(Source)+1 bytes.

Errors: No length checking is performed.

See also: StrPCopy (1578), StrLCopy (1574), StrECopy (1570)

Listing: ./stringex/ex4.pp

```
Program Example4;

Uses strings;

{ Program to demonstrate the StrCopy function. }

Const P : PChar = 'This is a PCHAR string.';

var PP : PChar;

begin
  PP:=StrAlloc(Strlen(P)+1);
  StrCopy (PP,P);
  If StrComp (PP,P)<>0 then
    Writeln ('Oh-oh problems... ')
  else
    Writeln ('All is well : PP=',PP);
  StrDispose(PP);
end.
```

38.13.189 StrDispose

Synopsis: Dispose of a null-terminated string on the heap.

Declaration: procedure StrDispose(Str: PChar)

Visibility: default

Description: StrDispose frees any memory allocated for Str. This function will only function correctly if Str has been allocated using StrAlloc (1566) from the SysUtils unit.

For an example, see StrBufSize (1567).

Errors: If an invalid pointer is passed, or a pointer not allocated with StrAlloc, an error may occur.

See also: StrBufSize (1567), StrAlloc (1566), StrDispose (1569)

38.13.190 strecopy

Synopsis: Copy a null-terminated string, return a pointer to the end.

Declaration: function strecopy(dest: PChar; source: PChar) : PChar

Visibility: default

Description: Copies the Null-terminated string in Source to Dest, and returns a pointer to the end (i.e. the terminating Null-character) of the copied string.

Errors: No length checking is performed.

See also: StrLCopy ([1574](#)), StrCopy ([1569](#))

Listing: ./stringex/ex6.pp

```
Program Example6;

Uses strings;

{ Program to demonstrate the StrECopy function. }

Const P : PChar = 'This is a PCHAR string.';

Var PP : PChar;

begin
  PP:=StrAlloc (StrLen(P)+1);
  If Longint(StrECopy(PP,P))-Longint(PP)<>StrLen(P) then
    Writeln('Something is wrong here !')
  else
    Writeln ('PP= ',PP);
  StrDispose(PP);
end.
```

38.13.191 strend

Synopsis: Return a pointer to the end of a null-terminated string

Declaration: function strend(p: PChar) : PChar

Visibility: default

Description: Returns a pointer to the end of P. (i.e. to the terminating null-character).

Errors: None.

See also: StrLen ([1575](#))

Listing: ./stringex/ex7.pp

```
Program Example6;

Uses strings;

{ Program to demonstrate the StrEnd function. }

Const P : PChar = 'This is a PCHAR string.';
```

```
begin
  If Longint(StrEnd(P)) – Longint(P) <> StrLen(P) then
    WriteLn('Something is wrong here !')
  else
    WriteLn('All is well..');
end.
```

38.13.192 StrFmt

Synopsis: Format a string with given arguments, store the result in a buffer.

Declaration: function StrFmt(Buffer: PChar; Fmt: PChar; const args: Array of const) : PChar
 function StrFmt(Buffer: PChar; Fmt: PChar; const Args: Array of const; const FormatSettings: TFormatSettings) : PChar

Visibility: default

Description: StrFmt will format fmt with Args, as the Format ([1535](#)) function does, and it will store the result in Buffer. The function returns Buffer. Buffer should point to enough space to contain the whole result.

Errors: for a list of errors, see Format ([1535](#)).

See also: StrFmt ([1575](#)), FmtStr ([1534](#)), Format ([1535](#)), FormatBuf ([1542](#))

Listing: ./sysutex/ex80.pp

```
Program Example80;

{ This program demonstrates the StrFmt function }

Uses sysutils;

Var S : AnsiString;

Begin
  SetLength(S,80);
  WriteLn (StrFmt (@S[1], 'For some nice examples of fomattting see %s.', ['Format']));
End.
```

38.13.193 stricomp

Synopsis: Compare 2 null-terminated strings, case insensitive.

Declaration: function stricomp(str1: PChar; str2: PChar) : SizeInt

Visibility: default

Description: Compares the null-terminated strings S1 and S2, ignoring case. The result is

- A negative Longint when S1<S2.
- 0 when S1=S2.
- A positive Longint when S1>S2.

Errors: None.

See also: StrLComp (1573), StrComp (1568), StrLIComp (1576)

Listing: ./stringex/ex8.pp

```
Program Example8;

Uses strings;

{ Program to demonstrate the StrLComp function. }

Const P1 : PChar = 'This is the first string.';
      P2 : PChar = 'This is the second string.';

Var L : Longint;

begin
  Write ('P1 and P2 are ');
  If StrComp (P1,P2)<>0 then write ('NOT ');
  write ('equal. The first ');
  L:=1;
  While StrLComp(P1,P2,L)=0 do inc (L);
  dec(l);
  Writeln (l, ' characters are the same.');
end.
```

38.13.194 StringReplace

Synopsis: Replace occurrences of one substring with another in a string.

Declaration: function StringReplace(const S: string; const OldPattern: string;
 const NewPattern: string; Flags: TReplaceFlags)
 : string

Visibility: default

Description: StringReplace searches the string S for occurrences of the string OldPattern and, if it is found, replaces it with NewPattern. It returns the resulting string. The behaviour of StringReplace can be runed with Flags, which is of type TReplaceFlags (1469). Standard behaviour is to replace only the first occurrence of OldPattern, and to search case sensitively.

Errors: None.

See also: TReplaceFlags (1469)

38.13.195 StringToGUID

Synopsis: Convert a string to a native TGUID type.

Declaration: function StringToGUID(const S: string) : TGuid

Visibility: default

Description: StringToGUID converts the string S to a valid GUID. The string S should be of the form

{XXXXXXXX-XXXX-XXXX-XXXX-XXXXXXXXXXXX}

Where each X is a hexadecimal digit. The dashes and braces are required.

Errors: In case S contains an invalid GUID representation, a EConvertError ([1605](#)) exception is raised.

See also: Supports ([1589](#)), #rtl.system.TGUID ([1268](#)), GUIDToString ([1551](#)), IsEqualGuid ([1556](#))

38.13.196 strlcat

Synopsis: Concatenate 2 null-terminated strings, with length boundary.

Declaration: function strlcat(dest: PChar; source: PChar;l: SizeInt) : PChar

Visibility: default

Description: Adds MaxLen characters from Source to Dest, and adds a terminating null-character. Returns Dest.

Errors: None.

See also: StrCat ([1567](#))

Listing: ./stringex/ex12.pp

```
Program Example12;

Uses strings;

{ Program to demonstrate the StrLCat function. }

Const P1 : PChar = '1234567890';

Var P2 : PChar;

begin
  P2:=StrAlloc (StrLen(P1)*2+1);
  P2^:=#0; { Zero length }
  StrCat (P2,P1);
  StrLCat (P2,P1,5);
  WriteLn ('P2 = ',P2);
  StrDispose(P2)
end.
```

38.13.197 strlcomp

Synopsis: Compare limited number of characters of 2 null-terminated strings

Declaration: function strlcomp(str1: PChar;str2: PChar;l: SizeInt) : SizeInt

Visibility: default

Description: Compares maximum L characters of the null-terminated strings S1 and S2. The result is

- A negative Longint when S1<S2.
- 0 when S1=S2.
- A positive Longint when S1>S2.

Errors: None.

See also: StrComp (1568), StrICmp (1571), StrLIComp (1576)

Listing: ./stringex/ex8.pp

```
Program Example8;

Uses strings;

{ Program to demonstrate the StrLComp function. }

Const P1 : PChar = 'This is the first string.';
      P2 : PChar = 'This is the second string.';

Var L : Longint;

begin
  Write ('P1 and P2 are ');
  If StrComp (P1,P2)<>0 then write ('NOT ');
  write ('equal. The first ');
  L:=1;
  While StrLComp(P1,P2,L)=0 do inc (L);
  dec(l);
  Writeln (l, ' characters are the same.');
end.
```

38.13.198 StrLCopy

Synopsis: Copy a null-terminated string, limited in length.

Declaration: function strlcopy(dest: PChar;source: PChar;maxlen: SizeInt) : PChar
 ; Overload
 function StrLCopy(Dest: PWideChar;Source: PWideChar;MaxLen: SizeInt)
 : PWideChar; Overload

Visibility: default

Description: Copies MaxLen characters from Source to Dest, and makes Dest a null terminated string.

Errors: No length checking is performed.

See also: StrCopy (1569), StrECopy (1570)

Listing: ./stringex/ex5.pp

```
Program Example5;

Uses strings;

{ Program to demonstrate the StrLCopy function. }

Const P : PChar = '123456789ABCDEF';

var PP : PChar;

begin
  PP:=StrAlloc(11);
  Writeln ('First 10 characters of P : ',StrLCopy (PP,P,10));
  StrDispose(PP);
end.
```

38.13.199 StrLen

Synopsis: Length of a null-terminated string.

Declaration: function `strlen(p: PChar) : SizeInt;` Overload
`function StrLen(p: PWideChar) : SizeInt;` Overload

Visibility: default

Description: Returns the length of the null-terminated string `P`. If `P` equals `Nil` then zero (0) is returned.

Errors: None.

See also: `StrNew` (1577)

Listing: `./stringex/ex1.pp`

```
Program Example1;

Uses strings;

{ Program to demonstrate the StrLen function. }

Const P : PChar = 'This is a constant pchar string';

begin
  Writeln ('P : ',p);
  Writeln ('length(P) : ',StrLen(P));
end.
```

38.13.200 StrFmt

Synopsis: Format a string with given arguments, but with limited length.

Declaration: function `StrFmt(Buffer: PChar; Maxlen: Cardinal; Fmt: PChar;`
`const args: Array of const) : PChar`
`function StrFmt(Buffer: PChar; Maxlen: Cardinal; Fmt: PChar;`
`const args: Array of const;`
`const FormatSettings: TFormatSettings) : PChar`

Visibility: default

Description: `StrFmt` will format `fmt` with `Args`, as the `Format` (1535) function does, and it will store maximally `Maxlen` characters of the result in `Buffer`. The function returns `Buffer`. `Buffer` should point to enough space to contain `MaxLen` characters.

Errors: for a list of errors, see `Format` (1535).

See also: `StrFmt` (1571), `FmtStr` (1534), `Format` (1535), `FormatBuf` (1542)

Listing: `./sysutex/ex81.pp`

```
Program Example80;

{ This program demonstrates the StrFmt function }

Uses sysutils;

Var S : AnsiString;
```

```
Begin
  SetLength(S,80);
  Writeln (StrFmt (@S[1],80,'For some nice examples of fomattting see %s.',['Format']));
End.
```

38.13.201 strlncmp

Synopsis: Compare limited number of characters in 2 null-terminated strings, ignoring case.

Declaration: function strlncmp(str1: PChar; str2: PChar;l: SizeInt) : SizeInt

Visibility: default

Description: Compares maximum L characters of the null-terminated strings S1 and S2, ignoring case. The result is

- A negative Longint when S1<S2.
- 0 when S1=S2.
- A positive Longint when S1>S2.

For an example, see StrIComp ([1571](#))

Errors: None.

See also: StrLComp ([1573](#)), StrComp ([1568](#)), StrIComp ([1571](#))

38.13.202 strlower

Synopsis: Convert null-terminated string to all-lowercase.

Declaration: function strlower(p: PChar) : PChar

Visibility: default

Description: Converts P to an all-lowercase string. Returns P.

Errors: None.

See also: StrUpper ([1589](#))

Listing: ./stringex/ex14.pp

Program Example14;

Uses strings;

{ Program to demonstrate the StrLower and StrUpper functions. }

Const

P1 : PChar = 'THIS IS AN UPPERCASE PCHAR STRING';
P2 : PChar = 'this is a lowercase string';

begin

Writeln ('Uppercase : ',StrUpper(P2));
 StrLower (P1);
 Writeln ('Lowercase : ',P1);

end.

38.13.203 strmove

Synopsis: Move a null-terminated string to new location.

Declaration: function strmove(dest: PChar;source: PChar;l: SizeInt) : PChar

Visibility: default

Description: Copies MaxLen characters from Source to Dest. No terminating null-character is copied. Returns Dest

Errors: None.

See also: StrLCopy ([1574](#)), StrCopy ([1569](#))

Listing: ./stringex/ex10.pp

```
Program Example10;

Uses strings;

{ Program to demonstrate the StrMove function. }

Const P1 : PCHAR = 'This is a pchar string.';

Var P2 : Pchar;

begin
  P2:=StrAlloc(StrLen(P1)+1);
  StrMove (P2,P1,StrLen(P1)+1); { P2:=P1 }
  Writeln ('P2 = ',P2);
  StrDispose(P2);
end.
```

38.13.204 strnew

Synopsis: Allocate room for new null-terminated string.

Declaration: function strnew(p: PChar) : PChar

Visibility: default

Description: Copies P to the Heap, and returns a pointer to the copy.

Errors: Returns Nil if no memory was available for the copy.

See also: StrCopy ([1569](#)), StrDispose ([1569](#))

Listing: ./stringex/ex16.pp

```
Program Example16;

Uses strings;

{ Program to demonstrate the StrNew function. }

Const P1 : PChar = 'This is a PChar string ';
```

```

var P2 : PChar;

begin
  P2:=StrNew (P1);
  If P1=P2 then
    writeln ('This can ''t be happening... ')
  else
    writeln ('P2 : ',P2);
  StrDispose(P2);
end.

```

38.13.205 StrNextChar

Synopsis: Returns a pointer to the location of the next empty character in a null-terminated string

Declaration: function StrNextChar(const Str: PChar) : PChar

Visibility: default

Description: StrNextChar returns a pointer to the null-character that terminates the string Str

Errors: if Str is not properly terminated, an access violation may occur.

38.13.206 StrPas

Synopsis: Convert a null-terminated string to an ansistring.

Declaration: function StrPas(Str: PChar) : string

Visibility: default

Description: Converts a null terminated string in Str to an Ansistring, and returns this string. This string is NOT truncated at 255 characters as is the system unit's version.

Errors: None.

See also: StrPCopy ([1578](#)), StrPLCopy ([1579](#))

38.13.207 StrPCopy

Synopsis: Copy an ansistring to a null-terminated string.

Declaration: function StrPCopy(Dest: PChar; Source: string) : PChar; Overload

Visibility: default

Description: StrPCopy Converts the Ansistring in Source to a Null-terminated string, and copies it to Dest. Dest needs enough room to contain the string Source, i.e. Length(Source) +1 bytes.

Errors: No checking is performed to see whether Dest points to enough memory to contain Source.

See also: StrPLCopy ([1579](#)), StrPas ([1578](#))

38.13.208 StrPLCopy

Synopsis: Copy a limited number of characters from an ansistring to a null-terminated string.

Declaration: function StrPLCopy(Dest: PChar; Source: string; MaxLen: SizeUInt) : PChar
; Overload

Visibility: default

Description: StrPLCopy Converts maximally MaxLen characters of the Ansistring in Source to a Null-terminated string, and copies it to Dest. Dest needs enough room to contain the characters.

Errors: No checking is performed to see whether Dest points to enough memory to contain L characters of Source.

See also: StrPCopy ([1578](#))

38.13.209 strpos

Synopsis: Find position of one null-terminated substring in another.

Declaration: function strpos(str1: PChar; str2: PChar) : PChar

Visibility: default

Description: Returns a pointer to the first occurrence of S2 in S1. If S2 does not occur in S1, returns Nil.

Errors: None.

See also: StrScan ([1580](#)), StrRScan ([1579](#))

Listing: ./stringex/ex15.pp

Program Example15;

Uses strings;

{ Program to demonstrate the StrPos function. }

```
Const P : PChar = 'This is a PChar string.';
      S : Pchar = 'is';
begin
  Writeln ('Position of ''is'' in P : ', sizeint(StrPos(P,S))-sizeint(P));
end.
```

38.13.210 strrscan

Synopsis: Find last occurrence of a character in a null-terminated string.

Declaration: function strrscan(p: PChar;c: Char) : PChar

Visibility: default

Description: Returns a pointer to the last occurrence of the character C in the null-terminated string P. If C does not occur, returns Nil.

For an example, see StrScan ([1580](#)).

Errors: None.

See also: StrScan ([1580](#)), StrPos ([1579](#))

38.13.211 strscan

Synopsis: Find first occurrence of a character in a null-terminated string.

Declaration: function strscan(p: PChar; c: Char) : PChar

Visibility: default

Description: Returns a pointer to the first occurrence of the character C in the null-terminated string P. If C does not occur, returns Nil.

Errors: None.

See also: StrRScan (1579), StrPos (1579)

Listing: ./stringex/ex13.pp

Program Example13;

Uses strings;

{ Program to demonstrate the StrScan and StrRScan functions. }

```
Const P : PChar = 'This is a PCHAR string.';
      S : Char = 's';

begin
  Writeln ('P, starting from first ''s'' : ',StrScan(P,s));
  Writeln ('P, starting from last ''s'' : ',StrRScan(P,s));
end.
```

38.13.212 StrToBool

Synopsis: Convert a string to a boolean value

Declaration: function StrToBool(const S: string) : Boolean

Visibility: default

Description: StrToBool will convert the string S to a boolean value. The string S can contain one of 'True', 'False' (case is ignored) or a numerical value. If it contains a numerical value, 0 is converted to False, all other values result in True. If the string S contains no valid boolean, then an EConvertError (1605) exception is raised.

Errors: On error, an EConvertError (1605) exception is raised.

See also: BoolToStr (1492)

38.13.213 StrToBoolDef

Synopsis: Convert string to boolean value, returning default in case of error

Declaration: function StrToBoolDef(const S: string;Default: Boolean) : Boolean

Visibility: default

Description: StrToBoolDef tries to convert the string S to a boolean value, and returns the boolean value in case of success. In case S does not contain a valid boolean string, Default is returned.

See also: StrToBool (1580), TryStrToBool (1597)

38.13.214 StrToCurr

Synopsis: Convert a string to a currency value

Declaration: function StrToCurr(const S: string) : Currency
 function StrToCurr(const S: string;
 const FormatSettings: TFormatSettings) : Currency

Visibility: default

Description: StrToCurr converts a string to a currency value and returns the value. The string should contain a valid currency amount, without currency symbol. If the conversion fails, an EConvertError (1605) exception is raised.

Errors: On error, an EConvertError (1605) exception is raised.

See also: CurrToStr (1498), StrToCurrDef (1581)

38.13.215 StrToCurrDef

Synopsis: Convert a string to a currency value, using a default value

Declaration: function StrToCurrDef(const S: string;Default: Currency) : Currency
 function StrToCurrDef(const S: string;Default: Currency;
 const FormatSettings: TFormatSettings) : Currency

Visibility: default

Description: StrToCurrDef converts a string to a currency value and returns the value. The string should contain a valid currency amount, without currency symbol. If the conversion fails, the fallback Default value is returned.

Errors: On error, the Default value is returned.

See also: CurrToStr (1498), StrToCurr (1581)

38.13.216 StrToDate

Synopsis: Convert a date string to a TDateTime value.

Declaration: function StrToDate(const S: ShortString) : TDateTime
 function StrToDate(const S: Ansistring) : TDateTime
 function StrToDate(const S: ShortString;separator: Char) : TDateTime
 function StrToDate(const S: AnsiString;separator: Char) : TDateTime
 function StrToDate(const S: ShortString;const useformat: string;
 separator: Char) : TDateTime
 function StrToDate(const S: AnsiString;const useformat: string;
 separator: Char) : TDateTime
 function StrToDate(const S: PChar;Len: Integer;const useformat: string;
 separator: Char) : TDateTime

Visibility: default

Description: StrToDate converts the string S to a TDateTime date value. The Date must consist of 1 to three digits, separated by the DateSeparator character. If two numbers are given, they are supposed to form the day and month of the current year. If only one number is given, it is supposed to represent the day of the current month. (This is *not* supported in Delphi)

The order of the digits (y/m/d, m/d/y, d/m/y) is determined from the ShortDateFormat variable.

Errors: On error (e.g. an invalid date or invalid character), an `EConvertError` exception is raised.

See also: `StrToTime` (1587), `DateToStr` (1503), `TimeToStr` (1593)

Listing: ./sysutex/ex19.pp

Program Example19;

{ This program demonstrates the `StrToDate` function }

Uses sysutils;

Procedure TestStr (S : String);

begin

`WriteLn` (S, ' : ', **DateToStr**(**StrToDate**(S)));

end;

Begin

`WriteLn` ('ShortDateFormat ', ShortDateFormat);

 TestStr(**DateTimeToStr**(Date));

 TestStr('05'+DateSeparator+'05'+DateSeparator+'1999');

 TestStr('5'+DateSeparator+'5');

 TestStr('5');

End.

38.13.217 StrToDateDef

Synopsis: Convert string to date, returning a default value

Declaration: `function StrToDateDef(const S: ShortString; const Defvalue: TDateTime) : TDateTime`
`function StrToDateDef(const S: ShortString; const Defvalue: TDateTime; separator: Char) : TDateTime`
`function StrToDateDef(const S: AnsiString; const Defvalue: TDateTime) : TDateTime`
`function StrToDateDef(const S: AnsiString; const Defvalue: TDateTime; separator: Char) : TDateTime`

Visibility: default

Description: `StrToDateDef` tries to convert the string `S` to a valid `TDateTime` date value, and returns `DefValue` if `S` does not contain a valid date indication.

Errors: None.

See also: `StrToDate` (1581), `TryStrToDate` (1597), `StrToTimeDef` (1588)

38.13.218 StrToDateTime

Synopsis: Convert a date/time string to a `TDateTime` value.

Declaration: `function StrToDateTime(const S: string) : TDateTime`
`function StrToDateTime(const s: ShortString; const FormatSettings: TFormatSettings) : TDateTime`
`function StrToDateTime(const s: AnsiString; const FormatSettings: TFormatSettings) : TDateTime`

Visibility: default

Description: StrToDateTime converts the string S to a TDateTime date and time value. The date and time parts must be separated by a space.

For the date part, the same restrictions apply as for the StrToDate (1581) function: The Date must consist of 1 to three numbers, separated by the DateSeparator character. If two numbers are given, they are supposed to form the day and month of the current year. If only one number is given, it is supposed to represent the day of the current month. (This is *not* supported in Delphi)

The order of the 3 numbers (y/m/d, m/d/y, d/m/y) is determined from the ShortDateFormat variable.

Errors: On error (e.g. an invalid date or invalid character), an EConvertError exception is raised.

See also: StrToDate (1581), StrToTime (1587), DateTimeToStr (1500)

Listing: ./sysutex/ex20.pp

Program Example20;

```
{ This program demonstrates the StrToDateTime function }

Uses sysutils;

Procedure TestStr (S : String);

begin
  WriteLn (S, ' : ', DateTimeToStr(StrToDateTime(S)));
end;

Begin

  WriteLn ('ShortDateFormat ', ShortDateFormat);
  TestStr(DateTimeToStr(Now));
  TestStr('05-05-1999 15:50');
  TestStr('5-5 13:30');
  TestStr('5 1:30PM');

End.
```

38.13.219 StrToDateTimeDef

Synopsis: Convert string to date/time, returning a default value

Declaration: function StrToDateTimeDef(const S: ShortString;
 const Defvalue: TDateTime) : TDateTime
function StrToDateTimeDef(const S: AnsiString; const Defvalue: TDateTime)
 : TDateTime

Visibility: default

Description: StrToDateTimeDef tries to convert the string S to a valid TDateTime date and time value, and returns DefValue if S does not contain a valid date-time indication.

Errors: None.

See also: StrToTimeDef (1588), StrToDateDef (1582), TryStrToDateTime (1598), StrToDate (1582)

38.13.220 StrToFloat

Synopsis: Convert a string to a floating-point value.

Declaration: function StrToFloat(const S: string) : Extended
 function StrToFloat(const S: string;
 const FormatSettings: TFormatSettings) : Extended

Visibility: default

Description: StrToFloat converts the string S to a floating point value. S should contain a valid string representation of a floating point value (either in decimal or scientific notation). The thousandseparator character may however not be used.

Up to and including version 2.2.2 of the compiler, if the string contains a decimal value, then the decimal separator character can either be a '.' or the value of the DecimalSeparator variable.

As of version 2.3.1, the string may contain only the DecimalSeparator character. The dot ('.') can no longer be used instead of the DecimalSeparator.

Errors: If the string S doesn't contain a valid floating point string, then an exception will be raised.

See also: [TextToFloat \(1590\)](#), [FloatToStr \(1530\)](#), [FormatFloat \(1543\)](#), [StrToInt \(1585\)](#)

Listing: ./sysutex/ex90.pp

Program Example90;

```
{ This program demonstrates the StrToFloat function }
{$mode objfpc}
{$h+ }
```

Uses SysUtils;

Const

```
NrValues = 5;
TestStr : Array[1..NrValues] of string =
('1,1','−0,2','1,2E−4','0','1E4');
```

Procedure Testit;

Var

```
I : Integer;
E : Extended;
```

begin

```
Writeln('Using DecimalSeparator : ',DecimalSeparator);
```

```
For I:=1 to NrValues do
```

```
begin
```

```
Writeln('Converting : ',TestStr[i]);
```

```
Try
```

```
E:=StrToFloat(TestStr[i]);
```

```
Writeln('Converted value : ',E);
```

```
except
```

```
On E : Exception do
```

```
Writeln('Exception when converting : ',E.Message);
```

```
end;
```

```
end;
```

```
end;
```

Begin

```

DecimalSeparator:= ',' ;
Testit;
DecimalSeparator:= '.' ;
Testit;
End.

```

38.13.221 StrToFloatDef

Synopsis: Convert a string to a float, with a default value.

```
Declaration: function StrToFloatDef(const S: string;const Default: Extended)
                           : Extended
    function StrToFloatDef(const S: string;const Default: Extended;
                           const FormatSettings: TFormatSettings) : Extended
```

Visibility: default

Description: `StrToFloatDef` tries to convert the string `S` to a floating point value, and returns this value. If the conversion fails for some reason, the value `Default` is returned instead.

Errors: None. On error, the Default value is returned.

38.13.222 StrToInt

Synopsis: Convert a string to an integer value.

Declaration: function StrToInt(const s: string) : Integer

Visibility: default

Description: `StrToInt` will convert the string `Sto` an integer. If the string contains invalid characters or has an invalid format, then an `EConvertError` is raised.

To be successfully converted, a string can contain a combination of numerical characters, possibly preceded by a minus sign (-). Spaces are not allowed.

Errors: In case of error, an `EConvertError` is raised.

See also: [IntToStr \(1555\)](#), [StrToIntDef \(1586\)](#)

Listing: ./sysutex/ex82.pp

Program Example82 ;

```
{$mode objfpc}
```

{ This program demonstrates the StrToInt function }

Uses sysutils;

Begin

```
Writeln (StrToInt('1234'));  
Writeln (StrToInt('-1234'));  
Writeln (StrToInt('0'));
```

WII
TRY

```
Writeln ( StrToInt( '12345678901234567890' ));
```

writ
except

```
On E : EConvertError do
```

```

WriteLn ('Invalid number encountered');
end;
End.

```

38.13.223 StrToInt64

Synopsis: Convert a string to an Int64 value.

Declaration: function StrToInt64(const s: string) : Int64

Visibility: default

Description: StrToInt64 converts the string S to a Int64 value, and returns this value. The string can only contain numerical characters, and optionally a minus sign as the first character. Whitespace is not allowed.

Hexadecimal values (starting with the \$ character) are supported.

Errors: On error, a EConvertError ([1605](#)) exception is raised.

See also: TryStrToInt64 ([1599](#)), StrToInt64Def ([1586](#)), StrToInt ([1585](#)), TryStrToInt ([1599](#)), StrToIntDef ([1586](#))

38.13.224 StrToInt64Def

Synopsis: Convert a string to an Int64 value, with a default value

Declaration: function StrToInt64Def(const S: string; Default: Int64) : Int64

Visibility: default

Description: StrToInt64Def tries to convert the string S to a Int64 value, and returns this value. If the conversion fails for some reason, the value Default is returned instead.

Errors: None. On error, the Default value is returned.

See also: StrToInt64 ([1586](#)), TryStrToInt64 ([1599](#)), StrToInt ([1585](#)), TryStrToInt ([1599](#)), StrToIntDef ([1586](#))

38.13.225 StrToIntDef

Synopsis: Convert a string to an integer value, with a default value.

Declaration: function StrToIntDef(const S: string; Default: Integer) : Integer

Visibility: default

Description: StrToIntDef will convert a string to an integer. If the string contains invalid characters or has an invalid format, then Default is returned.

To be successfully converted, a string can contain a combination of numerical characters, possibly preceded by a minus sign (-). Spaces are not allowed.

Errors: None.

See also: IntToStr ([1555](#)), StrToInt ([1585](#))

Listing: ./sysutex/ex83.pp

```

Program Example82;

{$mode objfpc}

{ This program demonstrates the StrToInt function }

Uses sysutils;

Begin
  Writeln (StrToIntDef('1234',0));
  Writeln (StrToIntDef('-1234',0));
  Writeln (StrToIntDef('0',0));
  Try
    Writeln (StrToIntDef('12345678901234567890',0));
  except
    On E : EConvertError do
      Writeln ('Invalid number encountered');
  end;
End.

```

38.13.226 StrToQWord

Synopsis: Convert a string to a QWord.

Declaration: function StrToQWord(const s: string) : QWord

Visibility: default

Description: TryStrToQWord converts the string S to a valid QWord (unsigned 64-bit) value, and returns the result.

Errors: If the string S does not contain a valid QWord value, a EConvertError ([1605](#)) exception is raised.

See also: TryStrToQWord ([1599](#)), StrToQWordDef ([1587](#)), StrToInt64 ([1586](#)), StrToInt ([1585](#))

38.13.227 StrToQWordDef

Synopsis: Try to convert a string to a QWord, returning a default value in case of failure.

Declaration: function StrToQWordDef(const S: string; Default: QWord) : QWord

Visibility: default

Description: StrToQWordDef tries to convert the string S to a valid QWord (unsigned 64-bit) value, and returns the result. If the conversion fails, the function returns the value passed in Def.

See also: StrToQWord ([1587](#)), TryStrToQWord ([1599](#)), StrToInt64Def ([1586](#)), StrToIntDef ([1586](#))

38.13.228 StrToTime

Synopsis: Convert a time string to a TDateTime value.

Declaration: function StrToTime(const S: Shortstring) : TDateTime
 function StrToTime(const S: Ansistring) : TDateTime
 function StrToTime(const S: ShortString; separator: Char) : TDateTime
 function StrToTime(const S: AnsiString; separator: Char) : TDateTime

```

function StrToTime(const S: string;FormatSettings: TFormatSettings)
                  : TDateTime
function StrToTime(const S: PChar;Len: Integer;separator: Char)
                  : TDateTime

```

Visibility: default

Description: StrToTime converts the string S to a TDateTime time value. The time must consist of 1 to 4 digits, separated by the TimeSeparator character. If two numbers are given, they are supposed to form the hour and minutes.

Errors: On error (e.g. an invalid date or invalid character), an EConvertError exception is raised.

See also: StrToDate (1581), StrToDateDef (1582), TimeToStr (1593)

Listing: ./sysutex/ex21.pp

Program Example21;

```

{ This program demonstrates the StrToTime function }

Uses sysutils;

Procedure TestStr (S : String);

begin
  Writeln (S, ' : ',TimeToStr(StrToTime(S)));
end;

Begin
  teststr (TimeToStr(Time));
  teststr ('12:00');
  teststr ('15:30');
  teststr ('3:30PM');
End.

```

38.13.229 StrToTimeDef

Synopsis: Convert string to time, returning a default value

Declaration: function StrToTimeDef(const S: ShortString;const Defvalue: TDateTime)
 : TDateTime
function StrToTimeDef(const S: ShortString;const Defvalue: TDateTime;
 separator: Char) : TDateTime
function StrToTimeDef(const S: AnsiString;const Defvalue: TDateTime)
 : TDateTime
function StrToTimeDef(const S: AnsiString;const Defvalue: TDateTime;
 separator: Char) : TDateTime

Visibility: default

Description: StrToTimeDef tries to convert the string S to a valid TDateTime time value, and returns DefValue if S does not contain a valid time indication.

Errors: None.

See also: StrToTime (1587), TryStrToTime (1599), StrToDateDef (1582)

38.13.230 strupper

Synopsis: Convert null-terminated string to all-uppercase

Declaration: function strupper(p: PChar) : PChar

Visibility: default

Description: Converts P to an all-uppercase string. Returns P.

For an example, see StrLower ([1576](#))

Errors: None.

See also: StrLower ([1576](#))

38.13.231 Supports

Synopsis: Check whether a class or given interface supports an interface

```
Declaration: function Supports(const Instance: IInterface;const AClass: TClass;
                           out Obj) : Boolean; Overload
function Supports(const Instance: IInterface;const IID: TGuid;out Intf)
                 : Boolean; Overload
function Supports(const Instance: TObject;const IID: TGuid;out Intf)
                 : Boolean; Overload
function Supports(const Instance: TObject;const IID: Shortstring;
                  out Intf) : Boolean; Overload
function Supports(const Instance: IInterface;const AClass: TClass)
                 : Boolean; Overload
function Supports(const Instance: IInterface;const IID: TGuid) : Boolean
                 ; Overload
function Supports(const Instance: TObject;const IID: TGuid) : Boolean
                 ; Overload
function Supports(const Instance: TObject;const IID: Shortstring)
                 : Boolean; Overload
function Supports(const AClass: TClass;const IID: TGuid) : Boolean
                 ; Overload
function Supports(const AClass: TClass;const IID: Shortstring) : Boolean
                 ; Overload
```

Visibility: default

Description: Supports checks whether Instance supports the interface identified by IID. It returns True if it is supported, False. Optionally, a pointer to the interface is returned to Intf.

Errors: None.

See also: StringToGUID ([1572](#))

38.13.232 SysErrorMessage

Synopsis: Format a system error message.

Declaration: function SysErrorMessage(ErrorCode: Integer) : string

Visibility: default

Description: SysErrorMessage returns a string that describes the operating system error code ErrorCode.

Errors: This routine may not be implemented on all platforms.

See also: [EOSError \(1608\)](#)

38.13.233 SystemTimeToDateTIme

Synopsis: Convert a system time to a TDateTime value.

Declaration: function SystemTimeToDateTIme(const SystemTime: TSystemTime) : TDateTime

Visibility: default

Description: SystemTimeToDateTIme converts a TSystemTime record to a TDateTime style date/time indication.

Errors: None.

See also: [DateTimeToSystemTime \(1502\)](#)

Listing: ./sysutex/ex22.pp

Program Example22;

```
{ This program demonstrates the SystemTimeToDateTIme function }
```

```
Uses sysutils;
```

```
Var ST : TSystemTime;
```

```
Begin
```

```
    DateTimeToSystemTime(Now, ST);
```

```
    With ST do
```

```
        begin
```

```
            Writeln ('Today is ',year,'/',month,'/',Day);
```

```
            Writeln ('The time is ',Hour,':',minute,':',Second,'.',Millisecond);
```

```
        end;
```

```
        Writeln ('Converted : ',DateTimeToStr(SystemTimeToDateTIme(ST)));
```

```
End.
```

38.13.234 TextToFloat

Synopsis: Convert a buffer to a float value.

Declaration: function TextToFloat(Buffer: PChar;out Value: Extended) : Boolean
 function TextToFloat(Buffer: PChar;out Value: Extended;
 const FormatSettings: TFormatSettings) : Boolean
 function TextToFloat(Buffer: PChar;out Value;ValueType: TFloatValue)
 : Boolean
 function TextToFloat(Buffer: PChar;out Value;ValueType: TFloatValue;
 const FormatSettings: TFormatSettings) : Boolean

Visibility: default

Description: TextToFloat converts the string in Buffer to a floating point value. Buffer should contain a valid stroing representation of a floating point value (either in decimal or scientific notation). If the buffer contains a decimal value, then the decimal separator character can either be a '.' or the value of the DecimalSeparator variable.

The function returns True if the conversion was successful.

Errors: If there is an invalid character in the buffer, then the function returns `False`

See also: [StrToFloat \(1584\)](#), [FloatToStr \(1530\)](#), [FormatFloat \(1543\)](#)

Listing: `./sysutex/ex91.pp`

Program Example91;

```
{ This program demonstrates the TextToFloat function }
{$mode objfpc}
{$h+ }
```

Uses SysUtils;

Const

```
NrValues = 5;
TestStr : Array[1..NrValues] of pchar =
  ('1,1','-0,2','1,2E-4','0','1E4');
```

Procedure Testit;

Var

```
I : Integer;
E : Extended;
```

begin

```
  Writeln('Using DecimalSeparator : ',DecimalSeparator);
  For I:=1 to NrValues do
    begin
      Writeln('Converting : ',TestStr[i]);
      If TextToFloat(TestStr[i],E) then
        Writeln('Converted value : ',E)
      else
        Writeln('Unable to convert value.');
    end;
  end;
```

Begin

```
  DecimalSeparator:='.';
  Testit;
  DecimalSeparator:='.';
```

Testit;

End.

38.13.235 Time

Synopsis: Returns the current time.

Declaration: `function Time : TDateTime`

Visibility: default

Description: `Time` returns the current time in `TDateTime` format. The date part of the `TDateTimeValue` is set to zero.

Errors: None.

See also: [Now \(1560\)](#), [Date \(1499\)](#)

Listing: ./sysutex/ex23.pp

Program Example23;

{ This program demonstrates the Time function }

Uses sysutils;

Begin

WriteLn ('The time is : ',**TimeToStr**(Time));

End.

38.13.236 TimeStampToDateTIme

Synopsis: Convert a TimeStamp value to a TDateTime value.

Declaration: function TimeStampToDateTIme (const TimeStamp: TTImeStamp) : TDateTime

Visibility: default

Description: TimeStampToDateTIme converts TimeStamp to a TDateTime format variable. It is the inverse operation of DateTImeToTimeStamp ([1502](#)).

Errors: None.

See also: [DateTimeToTimeStamp](#) ([1502](#)), [TimeStampToMSecs](#) ([1592](#))

Listing: ./sysutex/ex24.pp

Program Example24;

{ This program demonstrates the TimeStampToDateTIme function }

Uses sysutils;

Var TS : TTImeStamp;
 DT : TDateTime;

Begin

 TS:=DateTimeToTimeStamp (**Now**);

With TS **do**

begin

WriteLn ('Now is ',**time**, ' millisecond past midnight');

WriteLn ('Today is ',**Date**, ' days past 1/1/0001');

end;

 DT:=TimeStampToDateTIme(TS);

WriteLn ('Together this is : ',**DateTimeToStr**(DT));

End.

38.13.237 TimeStampToMSecs

Synopsis: Converts a timestamp to a number of milliseconds.

Declaration: function TimeStampToMSecs (const TimeStamp: TTImeStamp) : comp

Visibility: default

Description: `TimeStampToMSecs` converts `TimeStamp` to the number of seconds since 1/1/0001.

Use `TTimeStamp` variables if you need to keep very precise track of time.

For an example, see `MSecsToTimeStamp` (1559).

Errors: None.

See also: `MSecsToTimeStamp` (1559), `TimeStampToDate` (1592)

38.13.238 TimeToStr

Synopsis: Convert a `TDateTime` time to a string using a predefined format.

Declaration: `function TimeToStr(Time: TDateTime) : string`
`function TimeToStr(Time: TDateTime;`
`const FormatSettings: TFormatSettings) : string`

Visibility: default

Description: `TimeToStr` converts the time in `Time` to a string. It uses the `LongDateFormat` variable to see what formatting needs to be applied. It is therefore entirely equivalent to a `FormatDateTime('tt', Time)` call.

Errors: None.

Listing: `./sysutex/ex25.pp`

Program Example25 ;
{ This program demonstrates the TimeToStr function }
Uses sysutils ;
Begin
 Writeln ('The current time is : ', **TimeToStr**(**Time**));
End.

38.13.239 Trim

Synopsis: Trim whitespace from the ends of a string.

Declaration: `function Trim(const S: string) : string`
`function Trim(const S: widestring) : widestring`

Visibility: default

Description: `Trim` strips blank characters (spaces and control characters) at the beginning and end of `S` and returns the resulting string. All characters with ordinal values less than or equal to 32 (a space) are stripped.

If the string contains only spaces, an empty string is returned.

Errors: None.

See also: `TrimLeft` (1594), `TrimRight` (1595)

Listing: `./sysutex/ex84.pp`

```
Program Example84;

{ This program demonstrates the Trim function }

Uses sysutils;
{$H+}

Procedure Testit (S : String);

begin
  Writeln ('', Trim(S), '');
end;

Begin
  Testit (' ha ha what gets lost ? ');
  Testit (#10#13'haha ');
  Testit ('           ');
End.
```

38.13.240 TrimLeft

Synopsis: Trim whitespace from the beginning of a string.

Declaration: function TrimLeft(const S: string) : string
function TrimLeft(const S: widestring) : widestring

Visibility: default

Description: Trim strips blank characters (spaces and control characters) at the beginning of S and returns the resulting string. All characters with ordinal values less than or equal to 32 (a space) are stripped.
If the string contains only spaces, an empty string is returned.

Errors: None.

See also: Trim ([1593](#)), TrimRight ([1595](#))

Listing: ./sysutex/ex85.pp

```
Program Example85;

{ This program demonstrates the TrimLeft function }

Uses sysutils;
{$H+}

Procedure Testit (S : String);

begin
  Writeln ('', TrimLeft(S), '');
end;

Begin
  Testit (' ha ha what gets lost ? ');
  Testit (#10#13'haha ');
  Testit ('           ');
End.
```

38.13.241 TrimRight

Synopsis: Trim whitespace from the end of a string.

Declaration: function TrimRight(const S: string) : string
function TrimRight(const S: widestring) : widestring

Visibility: default

Description: Trim strips blank characters (spaces and control characters) at the end of S and returns the resulting string. All characters with ordinal values less than or equal to 32 (a space) are stripped.

If the string contains only spaces, an empty string is returned.

Errors: None.

See also: Trim (1593), TrimLeft (1594)

Listing: ./sysutex/ex86.pp

Program Example86 ;

{ This program demonstrates the TrimRight function }

Uses sysutils ;
{\$H+}

Procedure Testit (S : String);

```
begin
  WriteLn ('" ', TrimRight(S), '" ');
end;
```

```
Begin
    Testit ( ' ha ha what gets lost ? ' );
    Testit (#10#13'haha ');
    Testit ( ' ' );
```

End .

38.13.242 TryEncodeDate

Synopsis: Try to encode a date, and indicate success.

Visibility: default

Description: TryEncodeDate will check the validity of the Year, Month and Day arguments, and if they are all valid, then they will be encoded as a TDateTime value and returned in Date. The function will return True in this case. If an invalid argument is passed, then False will be returned.

Errors: None. If an error occurs during the encoding, `False` is returned.

See also: [EncodeDate](#) (1508), [DecodeDateFully](#) (1504), [DecodeDate](#) (1504), [TryEncodeTime](#) (1596)

38.13.243 TryEncodeTime

Synopsis: Try to encode a time, and indicate success.

Declaration: function TryEncodeTime(Hour: Word;Min: Word;Sec: Word;MSec: Word;
out Time: TDateTime) : Boolean

Visibility: default

Description: TryEncodeTime will check the validity of the Hour, Min, Sec and MSec arguments, and will encode them in a TDateTime value which is returned in Time. If the arguments are valid, then True is returned, otherwise False is returned.

Errors: None. If an error occurs during the encoding, False is returned.

See also: [EncodeTime \(1509\)](#), [DecodeTime \(1505\)](#), [TryEncodeDate \(1595\)](#)

38.13.244 TryFloatToCurr

Synopsis: Try to convert a float value to a currency value and report on success.

Declaration: function TryFloatToCurr(const Value: Extended;var AResult: Currency)
: Boolean

Visibility: default

Description: TryFloatToCurr tries convert the Value floating point value to a Currency value. If successful, the function returns True and the resulting currency value is returned in AResult. It checks whether Value is in the valid range of currencies (determined by MinCurrency (1459) and MaxCurrency (1459)). If not, False is returned.

Errors: If Value is out of range, False is returned.

See also: [FloatToCurr \(1529\)](#), [MinCurrency \(1459\)](#), [MaxCurrency \(1459\)](#)

38.13.245 TryStringToGUID

Synopsis: Try to transform a string to a GUID

Declaration: function TryStringToGUID(const S: string;out Guid: TGuid) : Boolean

Visibility: default

Description: TryStringToGUID tries to convert the string S to a TGUID value, returned in GUID. It returns True if the conversion succeeds, and False if the string S does not contain a valid GUID notation. The string S must be 38 characters long, must start with { and end on }, and contain a valid GUID string (hex number grouped using 8-4-4-4-12 digits).

Errors: In case S does not contain a valid GUID number, False is returned.

See also: [StringToGUID \(1572\)](#)

38.13.246 TryStrToBool

Synopsis: Try to convert a string to a boolean value

Declaration: function TryStrToBool(const S: string;out Value: Boolean) : Boolean

Visibility: default

Description: TryStrToBool tries to convert the string S to a boolean value, and returns this value in Value.

In this case, the function returns True. If S does not contain a valid boolean string, the function returns False, and the contents of Value is indetermined.

Valid boolean string constants are in the FalseBoolStrs (1472) (for False values) and TrueBoolStrs (1475) (for True values) variables.

See also: StrToBool (1580), StrToBoolDef (1580)

38.13.247 TryStrToCurr

Synopsis: Try to convert a string to a currency

Declaration: function TryStrToCurr(const S: string;out Value: Currency) : Boolean
function TryStrToCurr(const S: string;out Value: Currency;
const FormatSettings: TFormatSettings) : Boolean

Visibility: default

Description: TryStrToCurr converts the string S to a currency value and returns the value in Value. The function returns True if it was successful, False if not. This is contrary to StrToCurr (1581), which raises an exception when the conversion fails.

The function takes into account locale information.

See also: StrToCurr (1581), TextToFloat (1590)

38.13.248 TryStrToDate

Synopsis: Try to convert a string with a date indication to a TDateTime value

Declaration: function TryStrToDate(const S: ShortString;out Value: TDateTime)
: Boolean
function TryStrToDate(const S: AnsiString;out Value: TDateTime)
: Boolean
function TryStrToDate(const S: ShortString;out Value: TDateTime;
separator: Char) : Boolean
function TryStrToDate(const S: AnsiString;out Value: TDateTime;
separator: Char) : Boolean
function TryStrToDate(const S: ShortString;out Value: TDateTime;
const useformat: string;separator: Char) : Boolean
function TryStrToDate(const S: AnsiString;out Value: TDateTime;
const useformat: string;separator: Char) : Boolean
function TryStrToDate(const S: string;out Value: TDateTime;
const FormatSettings: TFormatSettings) : Boolean

Visibility: default

Description: TryStrToDate tries to convert the string S to a TDateTime date value, and stores the date in Value. The Date must consist of 1 to three digits, separated by the DateSeparator character. If two numbers are given, they are supposed to form the day and month of the current year. If only one number is given, it is supposed to represent the day of the current month. (This is *not* supported in Delphi)

The order of the digits (y/m/d, m/d/y, d/m/y) is determined from the ShortDateFormat variable.
The function returns True if the string contained a valid date indication, False otherwise.

See also: StrToDate ([1581](#)), StrToTime ([1587](#)), TryStrToTime ([1599](#)), TryStrToDate ([1598](#)), DateToStr ([1503](#)), TimeToStr ([1593](#))

38.13.249 TryStrToDate

Synopsis: Try to convert a string with date/time indication to a TDateTime value

```
Declaration: function TryStrToDate (const S: ShortString; out Value: TDateTime)
            : Boolean
function TryStrToDate (const S: AnsiString; out Value: TDateTime)
            : Boolean
function TryStrToDate (const S: string; out Value: TDateTime;
            const FormatSettings: TFormatSettings)
            : Boolean
```

Visibility: default

Description: TryStrToDate tries to convert the string S to a TDateTime date and time value, and stores the result in Value. The date must consist of 1 to three digits, separated by the DateSeparator character. If two numbers are given, they are supposed to form the day and month of the current year. If only one number is given, it is supposed to represent the day of the current month (This is *not* supported in Delphi). The time must consist of 1 to 4 digits, separated by the TimeSeparator character. If two numbers are given, they are supposed to form the hour and minutes.

The function returns True if the string contained a valid date and time indication, False otherwise.

See also: TryStrToDate ([1597](#)), TryStrToTime ([1599](#)), StrToDate ([1582](#)), StrToTime ([1587](#)), DateToStr ([1503](#)), TimeToStr ([1593](#))

38.13.250 TryStrToFloat

Synopsis: Try to convert a string to a float.

```
Declaration: function TryStrToFloat (const S: string; out Value: Single) : Boolean
function TryStrToFloat (const S: string; out Value: Single;
            const FormatSettings: TFormatSettings) : Boolean
function TryStrToFloat (const S: string; out Value: Double) : Boolean
function TryStrToFloat (const S: string; out Value: Double;
            const FormatSettings: TFormatSettings) : Boolean
```

Visibility: default

Description: TryStrToFloat tries to convert the string S to a floating point value, and stores the result in Value. It returns True if the operation was successful, and False if it failed. This operation takes into account the system settings for floating point representations.

Errors: On error, False is returned.

See also: StrToFloat ([1584](#))

38.13.251 TryStrToInt

Synopsis: Try to convert a string to an integer, and report on success.

Declaration: function TryStrToInt(const s: string; out i: Integer) : Boolean

Visibility: default

Description: TryStrToInt tries to convert the string S to an integer, and returns True if this was successful.

In that case the converted integer is returned in I. If the conversion failed, (an invalid string, or the value is out of range) then False is returned.

Errors: None. On error, False is returned.

See also: StrToInt ([1585](#)), TryStrToInt64 ([1599](#)), StrToIntDef ([1586](#)), StrToInt64 ([1586](#)), StrToInt64Def ([1586](#))

38.13.252 TryStrToInt64

Synopsis: Try to convert a string to an int64 value, and report on success.

Declaration: function TryStrToInt64(const s: string; out i: Int64) : Boolean

Visibility: default

Description: TryStrToInt64 tries to convert the string S to a Int64 value, and returns this value in I if successful. If the conversion was successful, the function result is True, or False otherwise. The string can only contain numerical characters, and optionally a minus sign as the first character. Whitespace is not allowed.

Hexadecimal values (starting with the \$ character) are supported.

Errors: None. On error, False is returned.

See also: StrToInt64 ([1586](#)), StrToInt64Def ([1586](#)), StrToInt ([1585](#)), TryStrToInt ([1599](#)), StrToIntDef ([1586](#))

38.13.253 TryStrToQWord

Synopsis: Try to convert a string to a QWord value, and report on success

Declaration: function TryStrToQWord(const s: string; out Q: QWord) : Boolean

Visibility: default

Description: TryStrToQWord tries to convert the string S to a valid QWord (unsigned 64-bit) value, and stores the result in I. If the conversion fails, the function returns False, else it returns True.

See also: StrToQWord ([1587](#)), StrToQWordDef ([1587](#)), TryStrToInt64 ([1599](#)), TryStrToInt ([1599](#))

38.13.254 TryStrToTime

Synopsis: Try to convert a string with a time indication to a TDateTime value

```
Declaration: function TryStrToTime(const S: ShortString; out Value: TDateTime)
                      : Boolean
    function TryStrToTime(const S: AnsiString; out Value: TDateTime)
                      : Boolean
    function TryStrToTime(const S: ShortString; out Value: TDateTime;
                          separator: Char) : Boolean
    function TryStrToTime(const S: AnsiString; out Value: TDateTime;
```

```
separator: Char) : Boolean
function TryStrToTime(const S: string; out Value: TDateTime;
                      const FormatSettings: TFormatSettings) : Boolean
```

Visibility: default

Description: TryStrToTime tries to convert the string S to a TDateTime time value, and stores the result in Value. The time must consist of 1 to 4 digits, separated by the TimeSeparator character. If two numbers are given, they are supposed to form the hour and minutes.

The function returns True if the string contained a valid time indication, False otherwise.

See also: TryStrToDate (1597), TryStrToDate (1598), StrToDate (1581), StrToTime (1587), DateToStr (1503), TimeToStr (1593)

38.13.255 UnhookSignal

Synopsis: UnHook a specified signal

Declaration: procedure UnhookSignal(RtlSigNum: Integer; OnlyIfHooked: Boolean)

Visibility: default

Description: UnHookSignal de-installs the RTL default signal handler for signal RtlSigNum. If OnlyIfHooked is True then UnhookSignal will first check if the signal was hooked by the RTL routines, and has not been overridden since.

38.13.256 UpperCase

Synopsis: Return an uppercase version of a string.

Declaration: function UpperCase(const s: string) : string

Visibility: default

Description: UpperCase returns the uppercase equivalent of S. Ansi characters are not taken into account, only ASCII codes below 127 are converted. It is completely equivalent to the UpCase function of the system unit, and is provided for compatibility only.

Errors: None.

See also: AnsiLowerCase (1481), LowerCase (1558), AnsiUpperCase (1489)

Listing: ./sysutex/ex87.pp

Program Example87;

```
{ This program demonstrates the UpperCase function }
```

```
Uses sysutils;
```

```
Begin
```

```
WriteLn (UpperCase('this will come OUT ALL uPpErCaSe !'));
```

```
End.
```

38.13.257 VendorName

Synopsis: Return Application vendor Name

Declaration: function VendorName : string

Visibility: default

Description: VendorName returns the application vendor name. In order to set the application vendor name, the OnGetVendorName (1474) event must be set, and an appropriate return value must be returned. The Vendor name is used in GetAppConfigDir (1545) and GetAppConfigFile (1546) to determine the configuration directory.

Errors: If `OnGetVendorName` ([1474](#)) is not set, an empty string is returned.

See also: [OnGetVendorName](#) (1474), [GetAppConfigDir](#) (1545), [GetAppConfigFile](#) (1546)

38.13.258 WideCompareStr

Synopsis: Compare two widestrings (case sensitive)

Declaration: function WideCompareStr(const s1: WideString; const s2: WideString) : PtrInt;

Visibility: default

Description: WideCompareStr compares two widestrings and returns the following result:

< 0 if $s_1 < s_2$.

0if $s_1 = s_2$.

> 0 if $S_1 > S_2$.

The comparision takes into account wide characters, i.e. it takes care of strange accented characters. Contrary to WideCompareText (1601), the comparision is case sensitive.

Errors: None.

See also: [WideCompareText](#) (1601), [WideSameStr](#) (1603), [WideSameText](#) (1603)

38.13.259 WideCompareText

Synopsis: Compare two widestrings (ignoring case).

Declaration: function WideCompareText(const s1: WideString; const s2: WideString) : PtrInt

Visibility: default

Description: WideCompareStr compares two widestrings and returns the following result:

< 0 if $S_1 < S_2$.

0if S1=S2.

> 0 if $S_1 > S_2$.

The comparison takes into account wide characters, i.e. it takes care of strange accented characters. Contrary to `WideCompareStr` (1601), the comparison is case insensitive.

Errors: None.

See also: [WideCompareStr](#) (1601), [WideSameStr](#) (1603), [WideSameText](#) (1603)

38.13.260 WideFmtStr

Synopsis: Widestring format

```
Declaration: procedure WideFmtStr(var Res: WideString;const Fmt: WideString;
                                  const args: Array of const)
procedure WideFmtStr(var Res: WideString;const Fmt: WideString;
                      const args: Array of const;
                      const FormatSettings: TFormatSettings)
```

Visibility: default

Description: WideFmtStr formats Args according to the format string in Fmt and returns the resulting string in Res.

See also: [WideFormat \(1602\)](#), [WideFormatBuf \(1602\)](#), [Format \(1535\)](#)

38.13.261 WideFormat

Synopsis: Format a wide string.

```
Declaration: function WideFormat(const Fmt: WideString;const Args: Array of const)
                           : WideString
function WideFormat(const Fmt: WideString;const Args: Array of const;
                     const FormatSettings: TFormatSettings) : WideString
```

Visibility: default

Description: WideFormat does the same as Format (1535) but accepts as a formatting string a WideString. The resulting string is also a WideString.

For more information about the used formatting characters, see the Format (1535) string.

See also: [Format \(1535\)](#)

38.13.262 WideFormatBuf

Synopsis: Format widestring in a buffer.

```
Declaration: function WideFormatBuf(var Buffer;BufLen: Cardinal;const Fmt;
                                    fmtLen: Cardinal;const Args: Array of const)
                           : Cardinal
function WideFormatBuf(var Buffer;BufLen: Cardinal;const Fmt;
                       fmtLen: Cardinal;const Args: Array of const;
                       const FormatSettings: TFormatSettings) : Cardinal
```

Visibility: default

Description: WideFormatBuf calls simply WideFormat (1602) with Fmt (with length FmtLen bytes) and stores maximum BufLen bytes in the buffer buf. It returns the number of copied bytes.

See also: [WideFmtStr \(1602\)](#), [WideFormat \(1602\)](#), [Format \(1535\)](#), [FormatBuf \(1542\)](#)

38.13.263 WideLowerCase

Synopsis: Change a widestring to all-lowercase.

Declaration: `function WideLowerCase(const s: WideString) : WideString`

Visibility: default

Description: `WideLowerCase` converts the string `S` to lowercase characters and returns the resulting string. It takes into account the operating system language settings when doing this, so special characters are converted correctly as well.

Remark: On Unix-like platforms, a widestring manager must be installed for this function to work correctly.

Errors: None.

See also: [WideUpperCase \(1603\)](#)

38.13.264 WideSameStr

Synopsis: Check whether two widestrings are the same (case sensitive)

Declaration: `function WideSameStr(const s1: WideString; const s2: WideString) : Boolean`

Visibility: default

Description: `WideSameStr` returns True if `WideCompareStr (1601)` returns 0 (zero), i.e. when `S1` and `S2` are the same string (taking into account case).

See also: [WideSameText \(1603\)](#), [WideCompareStr \(1601\)](#), [WideCompareText \(1601\)](#), [AnsiSameStr \(1482\)](#)

38.13.265 WideSameText

Synopsis: Check whether two widestrings are the same (ignoring case)

Declaration: `function WideSameText(const s1: WideString; const s2: WideString) : Boolean`

Visibility: default

Description: `WideSameText` returns True if `WideCompareText (1601)` returns 0 (zero), i.e. when `S1` and `S2` are the same string (taking into account case).

See also: [WideSameStr \(1603\)](#), [WideCompareStr \(1601\)](#), [WideCompareText \(1601\)](#), [AnsiSameText \(1483\)](#)

38.13.266 WideUpperCase

Synopsis: Change a widestring to all-uppercase.

Declaration: `function WideUpperCase(const s: WideString) : WideString`

Visibility: default

Description: `WideUpperCase` converts the string `S` to uppercase characters and returns the resulting string. It takes into account the operating system language settings when doing this, so special characters are converted correctly as well.

Remark: On Unix-like platforms, a widestring manager must be installed for this function to work correctly.

Errors: None.

See also: [WideLowerCase \(1603\)](#)

38.13.267 WrapText

Synopsis: Word-wrap a text.

Declaration: function WrapText(const Line: string; const BreakStr: string;
 const BreakChars: TSysCharSet; MaxCol: Integer) : string
function WrapText(const Line: string; MaxCol: Integer) : string

Visibility: default

Description: WrapText does a wordwrap at column MaxCol of the string in Line. It breaks the string only at characters which are in BreakChars (default whitespace and hyphen) and inserts then the string BreakStr (default the lineending character for the current OS).

See also: StringReplace ([1572](#))

38.14 EAbort

38.14.1 Description

EAbort is raised by the Abort ([1476](#)) procedure. It is not displayed in GUI applications, and serves only to immediately abort the current procedure, and return control to the main program loop.

See also: Abort ([1476](#))

38.15 EAbstractError

38.15.1 Description

EAbstractError is raised when an abstract error occurs, i.e. when an unimplemented abstract method is called.

38.16 EAccessViolation

38.16.1 Description

EAccessViolation is raised when the OS reports an Access Violation, i.e. when invalid memory is accessed.

38.17 EArgumentException

38.17.1 Description

EArgumentException is raised by many character conversion/handling routines to indicate an erroneous argument was passed to the function (usually indicating an invalid codepoint in a unicode string).

See also: EArgumentOutOfRangeException ([1605](#))

38.18 EArgumentOutOfRangeException

38.18.1 Description

`EArgumentOutOfRangeException` is raised by many character conversion/handling routines to indicate an erroneous argument was passed to the function (indicating an invalid character index in a unicode string).

See also: `EArgumentException` ([1604](#))

38.19 EAssertionFailed

38.19.1 Description

`EAssertionFailed` is raised when an application that is compiled with assertions, encounters an invalid assertion.

38.20 EBusError

38.20.1 Description

`EBusError` is raised in case of a bus error.

38.21 EControlC

38.21.1 Description

`EControlC` is raised when the user has pressed CTRL-C in a console application.

38.22 EConvertError

38.22.1 Description

`EConvertError` is raised by the various conversion routines in the `SysUtils` unit. The message will contain more specific error information.

38.23 EDivByZero

38.23.1 Description

`EDivByZero` is used when the operating system or CPU signals a division by zero error.

38.24 EExternal

38.24.1 Description

`EExternal` is the base exception for all external exceptions, as reported by the CPU or operating system, as opposed to internal exceptions, which are raised by the program itself. The `SysUtils` unit converts all operating system errors to descendants of `EExternal`.

See also: [EInterror](#) ([1607](#)), [EExternal](#) ([1605](#)), [EMathError](#) ([1608](#)), [EExternalException](#) ([1606](#)), [EAccessViolation](#) ([1604](#)), [EPrivilege](#) ([1609](#)), [EStackOverflow](#) ([1610](#)), [EControlC](#) ([1605](#))

38.25 EExternalException

38.25.1 Description

`EExternalException` is raised when an external routine raises an exception.

See also: [EExternal](#) ([1605](#))

38.26 EFormatError

38.26.1 Description

`EFormatError` is raised in case of an error in one of the various `Format` ([1535](#)) functions.

See also: [Format](#) ([1535](#))

38.27 EHeapMemoryError

38.27.1 Description

`EHeapMemoryError` is raised when an error occurs in heap (dynamically allocated) memory.

See also: [EHeapException](#) ([1463](#)), [EOutOfMemory](#) ([1609](#)), [EInvalidPointer](#) ([1608](#))

38.27.2 Method overview

Page	Property	Description
1606	<code>FreeInstance</code>	Free the exception instance

38.27.3 EHeapMemoryError.FreeInstance

Synopsis: Free the exception instance

Declaration: `procedure FreeInstance; override`

Visibility: public

Description: `FreeInstance` checks whether the exception instance may be freed prior to calling the inherited `FreeInstance`. The exception is only freed in case of normal program shutdown, if a heap error occurred, the exception instance is not freed.

38.28 EInOutError

38.28.1 Description

`EInOutError` is raised when a IO routine of Free Pascal returns an error. The error is converted to an `EInOutError` only if the input/output checking feature of FPC is turned on. The error code of the input/output operation is returned in `ErrorCode` ([1](#)).

See also: [EInOutError.ErrorCode](#) (1)

38.29 EInterror

38.29.1 Description

`EInterror` is used when the operating system or CPU signals an integer operation error, e.g., an overflow.

38.30 EIntfCastError

38.30.1 Description

`EIntfCastError` is raised when an invalid interface cast is encountered.

See also: [EInvalidCast](#) (1607)

38.31 EIntOverflow

38.31.1 Description

`EIntOverflow` is used when the operating system or CPU signals a integer overflow error.

See also: [EIntError](#) (1607), [EDivByZero](#) (1605), [ERangeError](#) (1610)

38.32 EInvalidCast

38.32.1 Description

`EInvalidCast` is raised when an invalid typecast error (using the `as` operator) is encountered.

See also: [EIntfCastError](#) (1607)

38.33 EInvalidContainer

38.33.1 Description

`EInvalidContainer` is not yet used by Free Pascal, and is provided for Delphi compatibility only.

38.34 EInvalidInsert

38.34.1 Description

`EInvalidInsert` is not yet used by Free Pascal, and is provided for Delphi compatibility only.

38.35 EInvalidOp

38.35.1 Description

`EInvalidOp` is raised when an invalid operation is encountered.

38.36 EInvalidPointer

38.36.1 Description

`EInvalidPointer` is raised when an invalid heap pointer is used.

See also: [EHeapException \(1463\)](#), [EHeapMemoryError \(1606\)](#), [EOutOfMemory \(1609\)](#)

38.37 EMathError

38.37.1 Description

`EMathError` is used when the operating system or CPU signals a floating point overflow error.

See also: [EIntError \(1607\)](#), [EIntOverflow \(1607\)](#), [EDivByZero \(1605\)](#), [ERangeError \(1610\)](#)

38.38 ENoThreadSupport

38.38.1 Description

`ENoThreadSupport` is raised when some thread routines are invoked, and thread support was not enabled when the program was compiled.

38.39 ENotImplemented

38.39.1 Description

`ENotImplemented` can be used to raise an exception when a particular call had been defined, but was not implemented.

38.40 ENoWideStringSupport

38.40.1 Description

`ENoWideStringSupport` is the exception raised when a run-time 233 occurs, i.e. when widestring routines are called and the application does not contain widestring support.

38.41 EOSError

38.41.1 Description

`EOSError` is raised when some Operating System call fails. The `ErrorCode` (1) property contains the operating system error code.

See also: [EOSError.ErrorCode](#) (1)

38.42 EOutOfMemory

38.42.1 Description

`EOutOfMemory` occurs when memory can no longer be allocated on the heap. An instance of `EOutOfMemory` is allocated on the heap at program startup, so it is available when needed.

See also: [EHeapException](#) (1463), [EHeapMemoryError](#) (1606), [EInvalidPointer](#) (1608)

38.43 EOverflow

38.43.1 Description

`EOverflow` occurs when a float operation overflows. (i.e. result is too big to represent).

See also: [EIntError](#) (1607), [EIntOverflow](#) (1607), [EDivByZero](#) (1605), [ERangeError](#) (1610), [EUnderFlow](#) (1610)

38.44 EPackagerError

38.44.1 Description

`EPackagerError` is not yet used by Free Pascal, and is provided for Delphi compatibility only.

38.45 EPrivilege

38.45.1 Description

`EPrivilege` is raised when the OS reports that an invalid instruction was executed.

38.46 EPropReadOnly

38.46.1 Description

`EPropReadOnly` is raised when an attempt is made to write to a read-only property.

38.47 EPropWriteOnly

38.47.1 Description

`EPropWriteOnly` is raised when an attempt is made to read from a write-only property.

See also: [EPropReadOnly](#) (1609)

38.48 ERangeError

38.48.1 Description

`ERangeError` is raised by the Free Pascal runtime library if range checking is on, and a range check error occurs.

See also: [EIntError \(1607\)](#), [EDivByZero \(1605\)](#), [EIntOverflow \(1607\)](#)

38.49 ESafecallException

38.49.1 Description

`ESafecallException` is not yet used by Free Pascal, and is provided for Delphi compatibility only.

38.50 EStackOverflow

38.50.1 Description

`EStackOverflow` occurs when the stack has grown too big (e.g. by infinite recursion).

38.51 EUnderflow

38.51.1 Description

`EUnderflow` occurs when a float operation underflows (i.e. result is too small to represent).

See also: [EIntError \(1607\)](#), [EIntOverflow \(1607\)](#), [EDivByZero \(1605\)](#), [ERangeError \(1610\)](#), [EOverFlow \(1609\)](#)

38.52 EVariantError

38.52.1 Description

`EVariantError` is raised by the internal variant routines.

38.52.2 Method overview

Page	Property	Description
1610	CreateCode	Create an instance of <code>EVariantError</code> with a particular error code.

38.52.3 EVariantError.CreateCode

Synopsis: Create an instance of `EVariantError` with a particular error code.

Declaration: constructor CreateCode (Code: LongInt)

Visibility: default

Description: `CreateCode` calls the inherited constructor, and sets the `ErrCode` (1) property to `Code`.

See also: [ErrCode \(1\)](#)

38.53 Exception

38.53.1 Description

Exception is the base class for all exception handling routines in the RTL and FCL. While it is possible to raise an exception with any class descending from `TObject`, it is recommended to use `Exception` as the basis of exception class objects: the `Exception` class introduces properties to associate a message and a help context with the exception being raised. What is more, the `SysUtils` unit sets the necessary hooks to catch and display unhandled exceptions: in such cases, the message displayed to the end user, will be the message stored in the exception class.

See also: [ExceptObject \(1511\)](#), [ExceptAddr \(1510\)](#), [ExceptionErrorMessage \(1510\)](#), [ShowException \(1565\)](#), [Abort \(1476\)](#)

38.53.2 Method overview

Page	Property	Description
1611	Create	Constructs a new exception object with a given message.
1611	CreateFmt	Constructs a new exception object and formats a new message.
1612	CreateFmtHelp	Constructs a new exception object and sets the help context and formats the message
1612	CreateHelp	Constructs a new exception object and sets the help context.
1612	CreateRes	Constructs a new exception object and gets the message from a resource.
1612	CreateResFmt	Constructs a new exception object and formats the message from a resource.
1613	CreateResFmtHelp	Constructs a new exception object and sets the help context and formats the message from a resource
1613	CreateResHelp	Constructs a new exception object and sets the help context and gets the message from a resource

38.53.3 Property overview

Page	Property	Access	Description
1613	HelpContext	rw	Help context associated with the exception.
1613	Message	rw	Message associated with the exception.

38.53.4 Exception.Create

Synopsis: Constructs a new exception object with a given message.

Declaration: constructor Create(const msg: string)

Visibility: public

Errors: Construction may fail if there is not enough memory on the heap.

See also: [Exception.CreateFmt \(1\)](#), [Exception.Message \(1\)](#)

38.53.5 Exception.CreateFmt

Synopsis: Constructs a new exception object and formats a new message.

Declaration: constructor CreateFmt(const msg: string; const args: Array of const)

Visibility: public

Errors: Construction may fail if there is not enough memory on the heap.

See also: [Exception.Create \(1\)](#), [Exception.Message \(1\)](#), [Format \(1535\)](#)

38.53.6 Exception.CreateRes

Synopsis: Constructs a new exception object and gets the message from a resource.

Declaration: constructor CreateRes(ResString: PString)

Visibility: public

Errors: Construction may fail if there is not enough memory on the heap.

See also: [Exception.Create \(1\)](#), [Exception.CreateFmt \(1\)](#), [Exception.CreateResFmt \(1\)](#), [Exception.Message \(1\)](#)

38.53.7 Exception.CreateResFmt

Synopsis: Constructs a new exception object and formats the message from a resource.

Declaration: constructor CreateResFmt(ResString: PString; const Args: Array of const)

Visibility: public

Description: CreateResFmt does the same as CreateFmt (1), but fetches the message from the resource string ResString.

Errors: Construction may fail if there is not enough memory on the heap.

See also: [Exception.Create \(1\)](#), [Exception.CreateFmt \(1\)](#), [Exception.CreateRes \(1\)](#), [Exception.Message \(1\)](#)

38.53.8 Exception.CreateHelp

Synopsis: Constructs a new exception object and sets the help context.

Declaration: constructor CreateHelp(const Msg: string; AHelpContext: Integer)

Visibility: public

Description: CreateHelp does the same as the Create (1) constructor, but additionally stores AHelpContext in the HelpContext (1) property.

See also: [Exception.Create \(1\)](#)

38.53.9 Exception.CreateFmtHelp

Synopsis: Constructs a new exception object and sets the help context and formats the message

Declaration: constructor CreateFmtHelp(const Msg: string; const Args: Array of const; AHelpContext: Integer)

Visibility: public

Description: CreateFmtHelp does the same as the CreateFmt (1) constructor, but additionally stores AHelpContext in the HelpContext (1) property.

See also: [Exception.CreateFmt \(1\)](#)

38.53.10 Exception.CreateResHelp

Synopsis: Constructs a new exception object and sets the help context and gets the message from a resource

Declaration: constructor CreateResHelp(ResString: PString; AHelpContext: Integer)

Visibility: public

Description: CreateResHelp does the same as the CreateRes (1) constructor, but additionally stores AHelpContext in the HelpContext (1) property.

See also: Exception.CreateRes (1)

38.53.11 Exception.CreateResFmtHelp

Synopsis: Constructs a new exception object and sets the help context and formats the message from a resource

Declaration: constructor CreateResFmtHelp(ResString: PString;
const Args: Array of const;
AHelpContext: Integer)

Visibility: public

Description: CreateResFmtHelp does the same as the CreateResFmt (1) constructor, but additionally stores AHelpContext in the HelpContext (1) property.

See also: Exception.CreateResFmt (1)

38.53.12 Exception.HelpContext

Synopsis: Help context associated with the exception.

Declaration: Property HelpContext : LongInt

Visibility: public

Access: Read,Write

Description: HelpContext is the help context associated with the exception, and can be used to provide context-sensitive help when the exception error message is displayed. It should be set in the exception constructor.

See also: Exception.CreateHelp (1), Exception.Message (1)

38.53.13 Exception.Message

Synopsis: Message associated with the exception.

Declaration: Property Message : string

Visibility: public

Access: Read,Write

Description: Message provides additional information about the exception. It is shown to the user in e.g. the ShowException (1565) routine, and should be set in the constructor when the exception is raised.

See also: Exception.Create (1), Exception.HelpContext (1)

38.54 EZeroDivide

38.54.1 Description

EZeroDivide occurs when a float division by zero occurs.

See also: EIntError (1607), EIntOverflow (1607), EDivByZero (1605), ERangeError (1610)

38.55 IReadWriteSync

38.55.1 Description

IReadWriteSync is an interface for synchronizing read/write operations. Writers are always guaranteed to have exclusive access: readers may or may not have simultaneous access, depending on the implementation.

38.55.2 Method overview

Page	Property	Description
1614	BeginRead	Start a read operation.
1615	BeginWrite	Start a write operation.
1614	EndRead	End a read operation
1615	EndWrite	End a write operation.

38.55.3 IReadWriteSync.BeginRead

Synopsis: Start a read operation.

Declaration: procedure BeginRead

Visibility: default

Description: BeginRead indicates that a read operation is about to be started. If a write operation is in progress, then the call will block until the write operation finished. Depending on the implementation the call may also block if another read operation is in progress.

After BeginRead, any write operation started with BeginWrite (1) will block until EndRead (1) is called.

See also: IReadWriteSync.EndRead (1), IReadWriteSync.BeginWrite (1), IReadWriteSync.EndWrite (1)

38.55.4 IReadWriteSync.EndRead

Synopsis: End a read operation

Declaration: procedure EndRead

Visibility: default

Description: EndRead signals the end of a read operation. If there was any blocked write operation, that will be unblocked by a call to EndRead.

See also: IReadWriteSync.BeginRead (1), IReadWriteSync.BeginWrite (1), IReadWriteSync.EndWrite (1)

38.55.5 IReadWriteSync.BeginWrite

Synopsis: Start a write operation.

Declaration: function BeginWrite : Boolean

Visibility: default

Description: BeginWrite signals the begin of a write operation. This call will block if any other read or write operation is currently in progress. It will resume only after all other read or write operations have finished.

See also: IReadWriteSync.EndRead (1), IReadWriteSync.EndWrite (1), IReadWriteSync.BeginRead (1)

38.55.6 IReadWriteSync.EndWrite

Synopsis: End a write operation.

Declaration: procedure EndWrite

Visibility: default

Description: EndWrite signals the end of a write operation. After the call to EndWrite any other read or write operations can start.

See also: IReadWriteSync.EndRead (1), IReadWriteSync.EndWrite (1), IReadWriteSync.BeginRead (1)

38.56 TMultiReadExclusiveWriteSynchronizer

38.56.1 Description

TMultiReadExclusiveWriteSynchronizer is a default implementation of the IReadWriteSync (1614) interface. It uses a single mutex to protect access to the read/write resource, resulting in a single thread having access to the resource.

See also: IReadWriteSync (1614)

38.56.2 Interfaces overview

Page	Property	Description
1614	IReadWriteSync	Read/Write synchronizer

38.56.3 Method overview

Page	Property	Description
1617	Beginread	Request read access to the resource
1616	Beginwrite	Request write access to the resource.
1616	Create	Create a new instance of the TMultiReadExclusiveWriteSynchronizer class
1616	Destroy	Destroys the TMultiReadExclusiveWriteSynchronizer instance
1617	Endread	Release read access to the resource
1616	Endwrite	Release write access to the resource

38.56.4 TMultiReadExclusiveWriteSynchronizer.Create

Synopsis: Create a new instance of the TMultiReadExclusiveWriteSynchronizer class

Declaration: constructor Create; Virtual

Visibility: public

Description: Create creates a new instance of TMultiReadExclusiveWriteSynchronizer. It initializes a TRTLCriticalSection.

Errors: None.

See also: TRTLCriticalSection ([1271](#))

38.56.5 TMultiReadExclusiveWriteSynchronizer.Destroy

Synopsis: Destroys the TMultiReadExclusiveWriteSynchronizer instance

Declaration: destructor Destroy; Override

Visibility: public

Description: Create destroys the instance of TMultiReadExclusiveWriteSynchronizer. It frees the TRTLCriticalSection it initialized, and calls the inherited destructor.

Errors: None.

See also: TRTLCriticalSection ([1271](#))

38.56.6 TMultiReadExclusiveWriteSynchronizer.Beginwrite

Synopsis: Request write access to the resource.

Declaration: function Beginwrite : Boolean

Visibility: public

Description: Beginwrite is the implementation of IReadWriteSync.BeginWrite. It simply enters the critical section, and returns True.

Errors: None.

See also: IReadWriteSync.BeginWrite ([1](#)), EndWrite ([1](#))

38.56.7 TMultiReadExclusiveWriteSynchronizer.Endwrite

Synopsis: Release write access to the resource

Declaration: procedure Endwrite

Visibility: public

Description: Beginwrite is the implementation of IReadWriteSync.EndWrite. It simply leaves the critical section.

Errors: None.

See also: IReadWriteSync.EndWrite ([1](#)), BeginWrite ([1](#))

38.56.8 TMultiReadExclusiveWriteSynchronizer.Beginread

Synopsis: Request read access to the resource

Declaration: procedure Beginread

Visibility: public

Description: BeginRead is the implementation of IReadWriteSync.BeginRead. It simply attempts to enter the critical section.

Errors: None.

See also: IReadWriteSync.BeginRead (1), EndRead (1)

38.56.9 TMultiReadExclusiveWriteSynchronizer.Endread

Synopsis: Release read access to the resource

Declaration: procedure Endread

Visibility: public

Description: EndRead is the implementation of IReadWriteSync.EndRead. It simply leaves the critical section.

Errors: None.

See also: IReadWriteSync.EndRead (1), BeginRead (1)

38.57 TSimpleRWSync

38.57.1 Description

TSimpleRWSync implements a simple read/write locking mechanism. It controls access to an object: only a single thread is allowed access to an object for either read or write operations.

Access is controlled through a single critical section.

See also: TMultiReadExclusiveWriteSynchronizer (1615)

38.57.2 Interfaces overview

Page	Property	Description
1614	IReadWriteSync	Read/Write synchronizer

38.57.3 Method overview

Page	Property	Description
1619	Beginread	Acquire a read lock
1618	Beginwrite	Acquire a write lock
1618	Create	Create a new instance of TSimpleRWSync
1618	Destroy	Removes the TSimpleRWSync instance from memory
1619	Endread	Release the read lock
1618	Endwrite	Release the write lock

38.57.4 **TSimpleRWSync.Create**

Synopsis: Create a new instance of `TSimpleRWSync`

Declaration: constructor `Create`; Virtual

Visibility: public

Description: `Create` allocates a new instance of `TSimpleRWSync` and initializes the critical section for use in the various methods.

See also: `TSimpleRWSync.Destroy` ([1](#))

38.57.5 **TSimpleRWSync.Destroy**

Synopsis: Removes the `TSimpleRWSync` instance from memory

Declaration: destructor `Destroy`; Override

Visibility: public

Description: `Destroy` releases the critical section and removes the `TSimpleRWSync` instance from memory.

See also: `TSimpleRWSync.Create` ([1](#))

38.57.6 **TSimpleRWSync.Beginwrite**

Synopsis: Acquire a write lock

Declaration: function `Beginwrite` : Boolean

Visibility: public

Description: `Beginwrite` waits till all other threads have released their read or write locks on the object, and then aquires a write lock on the object.

See also: `TSimpleRWSync.BeginRead` ([1](#)), `TSimpleRWSync.EndWrite` ([1](#))

38.57.7 **TSimpleRWSync.Endwrite**

Synopsis: Release the write lock

Declaration: procedure `Endwrite`

Visibility: public

Description: `EndWrite` releases the current threads lock on the object, allowing other threads to acquire a read or write lock on the object.

See also: `TSimpleRWSync.BeginWrite` ([1](#)), `TSimpleRWSync.EndRead` ([1](#))

38.57.8 **TSimpleRWSync.Beginread**

Synopsis: Acquire a read lock

Declaration: procedure Beginread

Visibility: public

Description: BeginRead waits till all other threads have released their read or write locks on the object, and then aquires a read lock on the object.

See also: [TSimpleRWSync.BeginWrite \(1\)](#), [TSimpleRWSync.EndRead \(1\)](#)

38.57.9 **TSimpleRWSync.Endread**

Synopsis: Release the read lock

Declaration: procedure Endread

Visibility: public

Description: EndRead releases the current threads read lock on the object, allowing other threads to acquire a read or write lock on the object.

See also: [TSimpleRWSync.BeginRead \(1\)](#), [TSimpleRWSync.EndWrite \(1\)](#)

Chapter 39

Reference for unit 'types'

39.1 Overview

Starting with D6, types from Windows specific units that were needed in Kylix were extracted to this unit. So it mostly contains type of Windows origin that are needed in the VCL framework.

39.2 Constants, types and variables

39.2.1 Constants

E_FAIL = (\$80004005)

Defined for Delphi compatibility, this should not be used.

E_INVALIDARG = (\$80070057)

Defined for Delphi compatibility, this should not be used.

GUID_NULL : TGUID = '{00000000-0000-0000-0000-000000000000}'

GUID_NULL is the definition of the NULL (empty) GUID.

LOCK_EXCLUSIVE = 2

Defined for Delphi compatibility, this should not be used.

LOCK_ONLYONCE = 4

Defined for Delphi compatibility, this should not be used.

LOCK_WRITE = 1

Defined for Delphi compatibility, this should not be used.

RT_RCDATA = (10)

Resource type RCDATA

STATFLAG_DEFAULT = 0

Defined for Delphi compatibility, this should not be used.

STATFLAG_NONAME = 1

Defined for Delphi compatibility, this should not be used.

STATFLAG_NOOPEN = 2

Defined for Delphi compatibility, this should not be used.

STGTY_LOCKBYTES = 3

Defined for Delphi compatibility, this should not be used.

STGTY_PROPERTY = 4

Defined for Delphi compatibility, this should not be used.

STGTY_STORAGE = 1

Defined for Delphi compatibility, this should not be used.

STGTY_STREAM = 2

Defined for Delphi compatibility, this should not be used.

STG_E_ABNORMALAPIEXIT = (\$800300FA)

Defined for Delphi compatibility, this should not be used.

STG_E_ACCESSDENIED = (\$80030005)

Defined for Delphi compatibility, this should not be used.

STG_E_BADBASEADDRESS = (\$80030110)

Defined for Delphi compatibility, this should not be used.

STG_E_CANTSAVE = (\$80030103)

Defined for Delphi compatibility, this should not be used.

STG_E_DISKISWRITEPROTECTED = (\$80030013)

Defined for Delphi compatibility, this should not be used.

STG_E_DOCFILECORRUPT = (\$80030109)

Defined for Delphi compatibility, this should not be used.

STG_E_EXTANTMARSHALLINGS = (\$80030108)

Defined for Delphi compatibility, this should not be used.

STG_E_FILEALREADYEXISTS = (\$80030050)

Defined for Delphi compatibility, this should not be used.

STG_E_FILENOTFOUND = (\$80030002)

Defined for Delphi compatibility, this should not be used.

STG_E_INCOMPLETE = (\$80030201)

Defined for Delphi compatibility, this should not be used.

STG_E_INSUFFICIENTMEMORY = (\$80030008)

Defined for Delphi compatibility, this should not be used.

STG_E_INUSE = (\$80030100)

Defined for Delphi compatibility, this should not be used.

STG_E_INVALIDFLAG = (\$800300FF)

Defined for Delphi compatibility, this should not be used.

STG_E_INVALIDFUNCTION = (\$80030001)

Defined for Delphi compatibility, this should not be used.

STG_E_INVALIDHANDLE = (\$80030006)

Defined for Delphi compatibility, this should not be used.

STG_E_INVALIDHEADER = (\$800300FB)

Defined for Delphi compatibility, this should not be used.

STG_E_INVALIDNAME = (\$800300FC)

Defined for Delphi compatibility, this should not be used.

STG_E_INVALIDPARAMETER = (\$80030057)

Defined for Delphi compatibility, this should not be used.

STG_E_INVALIDPOINTER = (\$80030009)

Defined for Delphi compatibility, this should not be used.

STG_E_LOCKVIOLATION = (\$80030021)

Defined for Delphi compatibility, this should not be used.

STG_E_MEDIUMFULL = (\$80030070)

Defined for Delphi compatibility, this should not be used.

STG_E_NOMOREFILES = (\$80030012)

Defined for Delphi compatibility, this should not be used.

STG_E_NOTCURRENT = (\$80030101)

Defined for Delphi compatibility, this should not be used.

STG_E OLDDLL = (\$80030105)

Defined for Delphi compatibility, this should not be used.

STG_E_OLDFORMAT = (\$80030104)

Defined for Delphi compatibility, this should not be used.

STG_E_PATHNOTFOUND = (\$80030003)

Defined for Delphi compatibility, this should not be used.

STG_E_PROPSETMISMATCHED = (\$800300F0)

Defined for Delphi compatibility, this should not be used.

STG_E_READFAULT = (\$8003001E)

Defined for Delphi compatibility, this should not be used.

STG_E_REVERTED = (\$80030102)

Defined for Delphi compatibility, this should not be used.

STG_E_SEEKERROR = (\$80030019)

Defined for Delphi compatibility, this should not be used.

STG_E_SHAREREQUIRED = (\$80030106)

Defined for Delphi compatibility, this should not be used.

STG_E_SHAREVIOLATION = (\$80030020)

Defined for Delphi compatibility, this should not be used.

```
STG_E_TERMINATED = ($80030202)
```

Defined for Delphi compatibility, this should not be used.

```
STG_E_TOOMANYOPENFILES = ($80030004)
```

Defined for Delphi compatibility, this should not be used.

```
STG_E_UNIMPLEMENTEDFUNCTION = ($800300FE)
```

Defined for Delphi compatibility, this should not be used.

```
STG_E_UNKNOWN = ($800300FD)
```

Defined for Delphi compatibility, this should not be used.

```
STG_E_WRITEFAULT = ($8003001D)
```

Defined for Delphi compatibility, this should not be used.

```
STG_S_BLOCK = $00030201
```

Defined for Delphi compatibility, this should not be used.

```
STG_S_CONVERTED = $00030200
```

Defined for Delphi compatibility, this should not be used.

```
STG_S_MONITORING = $00030203
```

Defined for Delphi compatibility, this should not be used.

```
STG_S_RETRYNOW = $00030202
```

Defined for Delphi compatibility, this should not be used.

```
STREAM_SEEK_CUR = 1
```

Defined for Delphi compatibility, this should not be used.

```
STREAM_SEEK_END = 2
```

Defined for Delphi compatibility, this should not be used.

```
STREAM_SEEK_SET = 0
```

Defined for Delphi compatibility, this should not be used.

39.2.2 Types

ArgList = Pointer

ArgList is defined for Delphi/Kylix compatibility and should not be used.

DWORD = LongWord

Alias for cardinal type

FILETIME = _FILETIME

Alias for the _FILETIME type

Largeint = Int64

Largeint is an alias for the Int64 type defined in the system unit. This is an alias for Delphi/Kylix compatibility.

LargeUInt = QWord

LargeUInt is an alias for the QWord type defined in the system unit. This is an alias for Delphi/Kylix compatibility.

LARGE_INT = Largeint

LARGE_INT is an alias for the Int64 type defined in the system unit. This is an alias for Delphi/Kylix compatibility.

LARGE_UINT = LargeUInt

LARGE_UINT is an alias for the QWord type defined in the system unit. This is an alias for Delphi/Kylix compatibility.

PByte = System.PByte

PByte is defined in the system unit. This is an alias for Delphi/Kylix compatibility.

PCLSID = PGUID

PCLSID is a pointer to a TCLSID type.

PDisplay = Pointer

PDisplay is defined for Delphi/Kylix compatibility and should not be used.

PDouble = System.PDouble

PDouble is defined in the system unit. This is an alias for Delphi/Kylix compatibility.

PDWord = ^DWORD

PDWord is equivalent to the PCardinal type.

PEvent = Pointer

PEvent is defined for Delphi/Kylix compatibility and should not be used.

PFileTime = ^TFileTime

Pointer to TFileTime type

PLargeInt = ^Largeint

PLargeInt is an alias for the PInt64 type defined in the system unit. This is an alias for Delphi/Kylix compatibility.

PLargeUInt = ^LargeUint

PLargeUInt is an alias for the PQWord type defined in the system unit. This is an alias for Delphi/Kylix compatibility.

PLongint = System.PLongint

PLongint is defined in the system unit. This is an alias for Delphi/Kylix compatibility.

POleStr = PWideChar

POleStr is a pointer to a (double) null-terminated array of TOleChar characters.

PPoint = ^TPoint

PPoint is a typed pointer to the TPoint ([1629](#)) type.

PPOleStr = ^POleStr

PPOleStr is a typed pointer to a POleStr variable.

PRect = ^TRect

PRect is a typed pointer to the TRect ([1629](#)) type.

PSize = ^TSize

PSize is a typed pointer to the TSize ([1630](#)) type.

PSmallInt = System.PSmallInt

PSmallInt is defined in the system unit. This is an alias for Delphi/Kylix compatibility.

PSmallPoint = ^TSmallPoint

PSmallPoint is a typed pointer to the TSmallPoint ([1630](#)) record.

```
PStatStg = ^TStatStg
```

Pointer to TStatStg record.

```
PXrmOptionDescRec = ^TXrmOptionDescRec
```

PXrmOptionDescRec is defined for Delphi/Kylix compatibility and should not be used.

```
Region = Pointer
```

Region is defined for Delphi/Kylix compatibility and should not be used.

```
STATSTG = TStatStg
```

Alias for the TStatStg type.

```
tagPOINT = TPoint
```

tagPOINT is a simple alias for TPoint ([1629](#))

```
tagSIZE = TSize
```

tagSize is an alias for the TSize ([1630](#)) type.

```
tagSTATSTG = record
  pwcsName : POleStr;
  dwType : DWORD;
  cbSize : LARGE_UINT;
  mtime : TFileTime;
  ctime : TFileTime;
  atime : TFileTime;
  grfMode : DWORD;
  grfLocksSupported : DWORD;
  clsid : TGUID;
  grfStateBits : DWORD;
  reserved : DWORD;
end
```

tagSTATSTG is used in the IStream.Stat ([1](#)) call. It describes a storage medium (typically a file).

```
TBooleanDynArray = Array of Boolean
```

TBooleanDynArray is a standard definition of a dynamical array of booleans.

```
TByteDynArray = Array of Byte
```

TByteDynArray is a standard definition of a dynamical array of (8-bit, unsigned) bytes.

```
TCardinalDynArray = Array of Cardinal
```

`TCardinalDynArray` is a standard definition of a dynamical array of (32-bit, unsigned) cardinals.

```
TCLSID = TGUID
```

`TCLSID` is an alias for the `#rtl.system.TGUID` ([1268](#)) type.

```
TDoubleDynArray = Array of Double
```

`TSoubleDynArray` is a standard definition of a dynamical array of doubles. (regular floating point type)

```
TDuplicates = (dupIgnore, dupAccept, dupError)
```

Table 39.1: Enumeration values for type `TDuplicates`

Value	Explanation
<code>dupAccept</code>	Accept duplicates, adding them to the list.
<code>dupError</code>	Raise an error when an attempt is made to add a duplicate.
<code>dupIgnore</code>	Ignore the new item, do not add it to the list.

`TDuplicates` can be used to indicate how a list structure acts on the addition of a duplicate item to the list.

dupIgnore Ignore the new item, do not add it to the list.

dupAccept Accept duplicates, adding them to the list.

dupError Raise an error when an attempt is made to add a duplicate.

```
TFileTime = _FILETIME
```

Alias for the `_FILETIME` type

```
TInt64DynArray = Array of Int64
```

`TInt64DynArray` is a standard definition of a dynamical array of (64-bit, signed) int64s.

```
TIntegerDynArray = Array of Integer
```

`TIntegerDynArray` is a standard definition of a dynamical array of (32-bit, signed) integers.

```
TListCallback = procedure(data: pointer; arg: pointer) of object
```

`TListCallback` is the prototype for a `Foreach` operation on a list. It will be called with `as Data` the pointer in the list, and `Arg` will contain the extra user data added to the `Foreach` call. It can be used in methods of objects; for a version that can be used as a global procedure, see `TListStaticCallback` ([1629](#))

```
TListStaticCallback = procedure(data: pointer; arg: pointer)
```

`TListStaticCallback` is the prototype for a `Foreach` operation on a list. It will be called with `as Data` the pointer in the list, and `Arg` will contain the extra user data added to the `Foreach` call. It can be used in plain procedures; for a version that can be used as a method, see `TListCallback` ([1628](#))

```
TLongWordDynArray = Array of LongWord
```

`TLongWordDynArray` is a standard definition of a dynamical array of (32-bit, unsigned) LongWords.

```
TOleChar = WideChar
```

`TOleChar` is an alias for the `WideChar` type, defined in the system unit.

```
TPoint = packed record
  X : LongInt;
  Y : LongInt;
end
```

`TPoint` is a generic definition of a point in a 2-dimensional discrete plane, where `X` indicates the horizontal position, and `Y` the vertical position (positions usually measured in pixels), and `0, 0` is the origin of the plane.

Usually, the origin is the upper-left corner of the screen, with `Y` increasing as one moves further down the screen - this is opposite to the mathematical view where `Y` increases as one moves upwards.

The coordinates are integers, (32-bit, signed) so the coordinate system runs from `-MaxInt` to `MaxInt`.

```
TPointerDynArray = Array of Pointer
```

Dynamic array of untyped pointers

```
TQWordDynArray = Array of QWord
```

`TQWordDynArray` is a standard definition of a dynamical array of (64-bit, unsigned) QWords.

```
TRect = packed record
end
```

`TRect` defines a rectangle in a discrete plane. It is described by the horizontal (`left, right`) or vertical (`top, Bottom`) positions (in pixels) of the edges, or, alternatively, by the coordinates of the top left (`TopLeft`) and bottom right (`BottomRight`) corners.

```
TShortIntDynArray = Array of ShortInt
```

`TShortintDynArray` is a standard definition of a dynamical array of (8-bit, signed) shortints.

```
TSingleDynArray = Array of Single
```

`TSingleDynArray` is a standard definition of a dynamical array of singles. (smallest floating point type)

```
TSize = packed record
  cx : LongInt;
  cy : LongInt;
end
```

`TSize` is a type to describe the size of a rectangular area, where `cx` is the width, `cy` is the height (in pixels) of the rectangle.

```
TSmallIntDynArray = Array of SmallInt
```

`TSmallintDynArray` is a standard definition of a dynamical array of (16-bit, unsigned) integers.

```
TSmallPoint = packed record
  x : SmallInt;
  y : SmallInt;
end
```

`TSmallPoint` defines a point in a 2-dimensional plane, just like `TPoint` (1629), but the coordinates have a smaller range: The coordinates are smallints (16-bit, signed) and they run from `-MaxSmallInt` to `maxSmallint`.

```
TStatStg = tagSTATSTG
```

`TStatStg` is a record type describing a storage medium. It is uses in the `IStream.Stat` (1) function.

```
TStringDynArray = Array of AnsiString
```

`TStringDynArray` is a standard definition of a dynamical array of Ansistrings.

```
TWideStringDynArray = Array of WideString
```

`TWideStringDynArray` is a standard definition of a dynamical array of WideStrings.

```
TWordDynArray = Array of Word
```

`TWordDynArray` is a standard definition of a dynamical array of (16-bit, unsigned) words.

```
TXrmOptionDescRec = record
end
```

`TXrmOptionDescRec` is defined for Delphi/Kylix compatibility and should not be used.

```
Widget = Pointer
```

`Widget` is defined for Delphi/Kylix compatibility and should not be used.

```
WidgetClass = Pointer
```

`WidgetClass` is defined for Delphi/Kylix compatibility and should not be used.

```
XrmOptionDescRec = TXrmOptionDescRec
```

`XrmOptionDescRec` is defined for Delphi/Kylix compatibility and should not be used.

```
_FILETIME = packed record
  dwLowDateTime : DWORD;
  dwHighDateTime : DWORD;
end
```

`_FILETIME` describes a file time stamp. It is defined or Delphi/Kylix compatibility and should not be used except when implementing or accessing the `IStream` interface. The `TDateTime` type should be used instead.

39.3 Procedures and functions

39.3.1 Bounds

Synopsis: Create a rectangle, given a position and size

Declaration: `function Bounds (ALeft: Integer; ATop: Integer; AWidth: Integer;
AHeight: Integer) : TRect`

Visibility: default

Description: `Bounds` returns a `TRect` structure with the indicated position (`Left=ALeft` and `Top=ATop`) and size (`Right=ALeft+AWidth` and `Bottom=ATop+AHeight`)

See also: [Rect \(1633\)](#), [PtInRect \(1633\)](#), [IntersectRect \(1632\)](#), [UnionRect \(1634\)](#)

39.3.2 CenterPoint

Synopsis: Return the center point of a rectangle

Declaration: `function CenterPoint (const Rect: TRect) : TPoint`

Visibility: default

Description: `CenterPoint` returns the center point of the rectangle `Rect`.

See also: [PtInRect \(1633\)](#), [IntersectRect \(1632\)](#), [IsRectEmpty \(1632\)](#), [OffsetRect \(1632\)](#), [InflateRect \(1632\)](#), [Size \(1633\)](#), [IsRectEmpty \(1632\)](#)

39.3.3 EqualRect

Synopsis: Check if two rectangles are equal.

Declaration: `function EqualRect (const r1: TRect; const r2: TRect) : Boolean`

Visibility: default

Description: `EqualRect` returns `True` if the rectangles `R1` and `R2` are equal (i.e. have the position and size). If the rectangles differ, the function returns `False`

See also: [Rect \(1633\)](#), [Bounds \(1631\)](#), [PtInRect \(1633\)](#), [IntersectRect \(1632\)](#), [UnionRect \(1634\)](#), [IsRectEmpty \(1632\)](#), [OffsetRect \(1632\)](#), [InflateRect \(1632\)](#), [Size \(1633\)](#)

39.3.4 InflateRect

Synopsis: Increase the rectangle in size, keeping it centered

Declaration: function InflateRect(var Rect: TRect; dx: Integer; dy: Integer) : Boolean

Visibility: default

Description: InflateRect inflates the rectangle horizontally with dx pixels on each side, and vertically with dy pixels, thus keeping its center point on the same location. It returns true if the operation was successfully, False if it was not (only possible if the address of Rect is Nil).

See also: PtInRect (1633), IntersectRect (1632), IsRectEmpty (1632), OffsetRect (1632), CenterPoint (1631), Size (1633), IsRectEmpty (1632)

39.3.5 IntersectRect

Synopsis: Return the intersection of 2 rectangles

Declaration: function IntersectRect(var Rect: TRect; const R1: TRect; const R2: TRect) : Boolean

Visibility: default

Description: IntersectRect returns the intersection of the 2 rectangles R1 and R2 in Rect. It returns True if the 2 rectangles have an intersection, otherwise False is returned, and Rect is filled with zero.

See also: PtInRect (1633), UnionRect (1634), IsRectEmpty (1632), OffsetRect (1632), InflateRect (1632), Size (1633)

39.3.6 IsRectEmpty

Synopsis: Check whether a rectangle is empty

Declaration: function IsRectEmpty(const Rect: TRect) : Boolean

Visibility: default

Description: IsRectEmpty returns true if the rectangle is empty, i.e. has a zero or negative width or height.

See also: PtInRect (1633), IntersectRect (1632), IsRectEmpty (1632), OffsetRect (1632), InflateRect (1632), Size (1633)

39.3.7 OffsetRect

Synopsis: Offset the rectangle

Declaration: function OffsetRect(var Rect: TRect; DX: Integer; DY: Integer) : Boolean

Visibility: default

Description: OffsetRect offsets the rectangle Rect by a horizontal distance DX and a vertical distance DY. The operation returns True if the operation was successfull, false if it was not (only possible if the address of Rect is Nil).

See also: PtInRect (1633), IntersectRect (1632), IsRectEmpty (1632), OffsetRect (1632), InflateRect (1632), Size (1633), IsRectEmpty (1632)

39.3.8 Point

Synopsis: Create a point

Declaration: function Point (x: Integer; y: Integer) : TPoint

Visibility: default

Description: Point returns a TPoint structure with the given position (X, Y).

See also: Rect ([1633](#)), PtInRect ([1633](#))

39.3.9 PtInRect

Synopsis: Check whether a point is inside a rectangle.

Declaration: function PtInRect (const Rect: TRect; const p: TPoint) : Boolean

Visibility: default

Description: PtInRect returns True if p is located inside Rect, and False if it is located outside the rectangle.

Remark: Note that the bottom, right edges are not considered part of the rectangle, therefor a point located on one of these edges will not be considered part of the rectangle, meaning that for a record (10,10,100,100) the point (90,100) will not be considered part of the record, but 90, 0 will be.

See also: IntersectRect ([1632](#)), UnionRect ([1634](#)), IsRectEmpty ([1632](#)), OffsetRect ([1632](#)), InflateRect ([1632](#)), Size ([1633](#))

39.3.10 Rect

Synopsis: Create a rectangle record

Declaration: function Rect (Left: Integer; Top: Integer; Right: Integer; Bottom: Integer)
: TRect

Visibility: default

Description: Rect returns a rectangle structure with the 4 members Left, Top, Right and Bottom as passed in the arguments.

See also: Bounds ([1631](#)), PtInRect ([1633](#)), IntersectRect ([1632](#)), UnionRect ([1634](#)), IsRectEmpty ([1632](#)), OffsetRect ([1632](#)), InflateRect ([1632](#)), Size ([1633](#))

39.3.11 Size

Synopsis: Return the size of the rectangle

Declaration: function Size (AWidth: Integer; AHeight: Integer) : TSize
function Size (const ARect: TRect) : TSize

Visibility: default

Description: Size returns a TSize record with the indicated AWidth, AHeight. In the case ARect is passed, the width and height are calculated (taking into account that the right, bottom are not considered part of the rectangle).

See also: PtInRect ([1633](#)), IntersectRect ([1632](#)), IsRectEmpty ([1632](#)), OffsetRect ([1632](#)), InflateRect ([1632](#)), CenterPoint ([1631](#)), IsRectEmpty ([1632](#))

39.3.12 UnionRect

Synopsis: Return the union of 2 rectangles.

Declaration: function UnionRect (var Rect: TRect; const R1: TRect; const R2: TRect)
: Boolean

Visibility: default

Description: UnionRect returns the rectangle that encompasses both R1 and R2 in Rect. It returns True if the resulting rectangle is not empty, False if the result is an empty rectangle (in which case the result is filled with zeroes)

See also: PtInRect (1633), IntersectRect (1632), IsRectEmpty (1632), OffsetRect (1632), InflateRect (1632), Size (1633)

39.4 IClassFactory

39.4.1 Description

IClassFactory is defined for Delphi/Kylix compatibility and should not be used.

39.4.2 Method overview

Page	Property	Description
1634	CreateInstance	Create a new instance of an interface.
1634	LockServer	Lock ActiveX server object.

39.4.3 IClassFactory.CreateInstance

Synopsis: Create a new instance of an interface.

Declaration: function CreateInstance (const unkOuter: IUnknown; const riid: TGUID;
out vObject) : HResult

Visibility: default

Description: IClassFactory.CreateInstance is defined for Delphi/Kylix compatibility and should not be used.

39.4.4 IClassFactory.LockServer

Synopsis: Lock ActiveX server object.

Declaration: function LockServer (fLock: LongBool) : HResult

Visibility: default

Description: IClassFactory.LockServer is defined for Delphi/Kylix compatibility and should not be used.

39.5 ISequentialStream

39.5.1 Description

`ISequentialStream` is the interface for streams which only support sequential reading of chunks of data. It is defined for Delphi/Kylix compatibility and should not be used.

See also: [IStream \(1635\)](#)

39.5.2 Method overview

Page	Property	Description
1635	Read	Read data from the stream
1635	Write	Write data to the stream

39.5.3 ISequentialStream.Read

Synopsis: Read data from the stream

Declaration: `function Read(pv: Pointer; cb: DWORD; pcbRead: PDWord) : HRESULT`

Visibility: default

Description: `Read` reads `cbCount` bytes from the stream into the memory pointed to by `pv` and returns the number of bytes read in `pcbRead`. The result is zero for success or an error code.

See also: [ISequentialStream.Write \(1\)](#)

39.5.4 ISequentialStream.Write

Synopsis: Write data to the stream

Declaration: `function Write(pv: Pointer; cb: DWORD; pcbWritten: PDWord) : HRESULT`

Visibility: default

Description: `Write` writes `cbCount` bytes from the memory pointed to by `pv` to the stream and returns the number of bytes written in `pcbWritten`. The result is zero for success or an error code.

See also: [ISequentialStream.Read \(1\)](#)

39.6 IStream

39.6.1 Description

An abstract interface for an external (non pascal) stream, as defined in Microsoft COM interfaces

39.6.2 Method overview

Page	Property	Description
1638	Clone	Clone the stream instance
1637	Commit	Commit data to the stream
1636	CopyTo	Copy data from one stream to another
1637	LockRegion	Lock a region of bytes in the stream
1637	Revert	Revert changes
1636	Seek	Set the stream position
1636	SetSize	Set the stream size
1638	Stat	return information about the stream.
1637	UnlockRegion	Unlocks a previously locked region of bytes in the stream

39.6.3 IStream.Seek

Synopsis: Set the stream position

Declaration: function Seek(dlibMove: Largeint; dwOrigin: LongInt;
out libNewPosition: Largeint) : HResult

Visibility: default

Description: Seek sets the stream position at dlibMove bytes from dwOrigin (one of the SEEK_* constants) and returns the new absolute position in libNewPosition. The function returns zero on success, or an error code.

Errors: On error, a nonzero exit code is returned.

39.6.4 IStream.SetSize

Synopsis: Set the stream size

Declaration: function SetSize(libNewSize: Largeint) : HRESULT

Visibility: default

Description: SetSize sets the size of the stream to libNewSize bytes, if the stream allows it. On sucess, zero is returned.

Errors: On error, a nonzero exit code is returned.

39.6.5 IStream.CopyTo

Synopsis: Copy data from one stream to another

Declaration: function CopyTo(stm: IStream; cb: Largeint; out cbRead: Largeint;
out cbWritten: Largeint) : HRESULT

Visibility: default

Description: CopyTo copies cb bytes from the stream to target stream stm. cbRead returns how many bytes were read from the stream, cbwrite returns how many bytes were actually written to the destination stream. The function returns zero on success.

Errors: On error, a nonzero exit code is returned.

39.6.6 IStream.Commit

Synopsis: Commit data to the stream

Declaration: function Commit (grfCommitFlags: LongInt) : HRESULT

Visibility: default

Description: Commit commits the data in the stream to the underlying medium. Flags is a set of options to control the commit operation (see MSDN for the possible flags).

Errors: On error, a nonzero exit code is returned.

39.6.7 IStream.Revert

Synopsis: Revert changes

Declaration: function Revert : HRESULT

Visibility: default

Description: Revert reverts all changes that were done to a transacted stream, i.e. all changes since the last commit. The function returns zero on success.

Errors: On error, a nonzero exit code is returned.

39.6.8 IStream.LockRegion

Synopsis: Lock a region of bytes in the stream

Declaration: function LockRegion(libOffset: Largeint; cb: Largeint;
dwLockType: LongInt) : HRESULT

Visibility: default

Description: LockRegion locks a region of the storage, starting at libOffset, for cbCount bytes. The applied lock is of type dwLockType. The function returns zero if the lock was successfully applied.

Errors: On error, a nonzero exit code is returned.

39.6.9 IStream.UnlockRegion

Synopsis: Unlocks a previously locked region of bytes in the stream

Declaration: function UnlockRegion(libOffset: Largeint; cb: Largeint;
dwLockType: LongInt) : HRESULT

Visibility: default

Description: UnlockRegion removes the lock on a region of the storage, starting at libOffset, for cbCount bytes. The lock must be of type dwLockType. The function returns zero if the lock was successfully removed.

Errors: On error, a nonzero exit code is returned.

39.6.10 IStream.Stat

Synopsis: return information about the stream.

Declaration: function Stat (out statstg: TStatStg; grfStatFlag: LongInt) : HRESULT

Visibility: default

Description: Stat returns information about the stream in statstg, taking into account the flags in grfStatFlag (one of the STATFLAG_ constants). The function returns zero if the call was successful.

Errors: On error, a nonzero exit code is returned.

39.6.11 IStream.Clone

Synopsis: Clone the stream instance

Declaration: function Clone (out stm: IStream) : HRESULT

Visibility: default

Description: Clone returns an independent but initially equal copy of the stream in stm. The function returns zero if the call was successful.

Errors: On error, a nonzero exit code is returned.

Chapter 40

Reference for unit 'typinfo'

40.1 Used units

Table 40.1: Used units by unit 'typinfo'

Name	Page
System	1229
sysutils	1449

40.2 Overview

The **TypeInfo** unit contains many routines which can be used for the querying of the Run-Time Type Information (RTTI) which is generated by the compiler for classes that are compiled under the `{ $M+ }` switch. This information can be used to retrieve or set property values for published properties for totally unknown classes. In particular, it can be used to stream classes. The **TPersistent** class in the **Classes** unit is compiled in the `{ $M+ }` state and serves as the base class for all classes that need to be streamed.

The unit should be compatible to the Delphi 5 unit with the same name. The only calls that are still missing are the Variant calls, since Free Pascal does not support the variant type yet.

The examples in this chapter use a **rttiobj** auxiliary unit, which contains an object that has a published property for all supported types. It also contains some auxiliary routines and definitions. This unit is included in the documentation sources, in the directory **typinfex**.

40.3 Auxiliary functions

Other typinfo related functions.

Table 40.2:

Name	Description
GetEnumName (1649)	Get an enumerated type element name
GetEnumValue (1651)	Get ordinal number of an enumerated type, based on the name.
GetEnumNameCount (1650)	Get number of elements in an enumerated type.
GetTypeData (1663)	Skip type name and return a pointer to the type data
SetToString (1672)	Convert a set to its string representation
StringToSet (1674)	Convert a string representation of a set to a set

40.4 Getting or setting property values

Functions to set or set a property's value.

Table 40.3:

Name	Description
GetEnumProp (1650)	Return the value of an enumerated type property
GetFloatProp (1651)	Return the value of a float property
GetInt64Prop (1652)	Return the value of an Int64 property
GetMethodProp (1653)	Return the value of a procedural type property
GetObjectProp (1655)	Return the value of an object property
GetOrdProp (1657)	Return the value of an ordinal type property
GetPropValue (1660)	Return the value of a property as a variant
GetSetProp (1661)	Return the value of a set property
GetStrProp (1662)	Return the value of a string property
GetWideStrProp (1664)	Return the value of a widestring property
GetVariantProp (1664)	Return the value of a variant property
SetEnumProp (1668)	Set the value of an enumerated type property
SetFloatProp (1668)	Set the value of a float property
SetInt64Prop (1669)	Set the value of an Int64 property
SetMethodProp (1669)	Set the value of a procedural type property
SetObjectProp (1670)	Set the value of an object property
SetOrdProp (1670)	Set the value of an ordinal type property
SetPropValue (1671)	Set the value of a property through a variant
SetSetProp (1671)	Set the value of a set property
SetStrProp (1672)	Set the value of a string property
SetWideStrProp (1674)	Set the value of a widestring property
SetVariantProp (1674)	Set the value of a variant property

40.5 Examining published property information

Functions for retrieving or examining property information

Table 40.4:

Name	Description
FindPropInfo (1648)	Getting property type information, With error checking.
GetPropInfo (1658)	Getting property type information, No error checking.
GetPropInfos (1658)	Find property information of a certain kind
GetObjectPropClass (1656)	Return the declared class of an object property
GetPropList (1659)	Get a list of all published properties
IsPublishedProp (1664)	Is a property published
IsStoredProp (1665)	Is a property stored
PropIsType (1666)	Is a property of a certain kind
PropType (1667)	Return the type of a property

40.6 Constants, types and variables

40.6.1 Constants

```
BooleanIdents : Array[Boolean] of  = ('False', 'True')
```

Names for boolean values

```
DotSep : string = '..'
```

Name separator character

```
OnGetPropValue : TGetPropValue = Nil
```

This callback is set by the variants unit to enable reading of properties as a variant. If set, it is called by the GetPropValue (1660) function.

```
OnGetVariantprop : TGetVariantProp = Nil
```

This callback is set by the variants unit to enable reading of variant properties If set, it is called by the GetVariantProp (1664) function.

```
OnSetPropValue : TSetPropValue = Nil
```

This callback is set by the variants unit to enable writing of properties as a variant. If set, it is called by the SetPropValue (1671) function.

```
OnSetVariantprop : TSetVariantProp = Nil
```

This callback is set by the variants unit to enable writing of variant properties. If set, it is called by the GetVariantProp (1664) function.

```
ptConst = 3
```

Constant used in acces method

```
ptField = 0
```

Property acces directly from field

```
ptStatic = 1
```

Property acces via static method

```
ptVirtual = 2
```

Property acces via virtual method

```
tkAny = [ (TTypeKind) .. (TTypeKind) ]
```

Any property type

```
tkMethods = [tkMethod]
```

Only method properties. (event handlers)

```
tkProperties = tkAny - tkMethods - [tkUnknown]
```

Real properties. (not methods)

```
tkString = tksString
```

Alias for the `tssString` enumeration value

40.6.2 Types

```
PPropInfo = ^TPropInfo
```

Pointer to TPropInfo ([1646](#)) record

```
PPropList = ^TPropList
```

Pointer to TPropList ([1646](#))

```
PTypeInfo = ^PTypeInfo
```

Pointer to PTypeInfo ([1642](#)) pointer

```
PTypedata = ^TTypeData
```

Pointer to TTypeData ([1646](#)) record.

```
PTypeInfo = ^TTypeInfo
```

Pointer to TTypeInfo ([1646](#)) record

```
PVmtFieldEntry = ^TVmtFieldEntry
```

Pointer to #rtl.typinfo.TVmFieldEntry ([1647](#)) type.

```
PVmFieldTable = ^TVmFieldTable
```

Pointer to #rtl.typinfo.TVmFieldTable ([1648](#)) type.

```
ShortStringBase = string
```

`ShortStringBase` is the base definition of a short string.

```
TCallConv = (ccReg, ccCdecl, ccPascal, ccStdCall, ccSafeCall, ccCppdecl,
             ccFar16, ccOldFPCCall, ccInternProc, ccSysCall, ccSoftFloat,
             ccMWPascal)
```

Table 40.5: Enumeration values for type `TCallConv`

Value	Explanation
ccCdecl	Cdecl calling convention.
ccCppdecl	Cppdecl calling convention
ccFar16	Far16 calling convention (Delphi compatibility)
ccInternProc	InternProc calling convention (compiler internal)
ccMWPascal	MWPascal (MetroWerks Pascal) calling convention.
ccOldFPCCall	OldFPCCall calling convention (deprecated)
ccPascal	Pascal calling convention.
ccReg	Register calling convention
ccSafeCall	SafeCall calling convention.
ccSoftFloat	Softfloat calling convention.
ccStdCall	stdcall calling convention.
ccSysCall	SysCall calling convention.

`TCallConv` is a type describing the calling convention used by a method. It contains an element for all supported calling conventions.

```
TFloatType = (ftSingle, ftDouble, ftExtended, ftComp, ftCurr)
```

Table 40.6: Enumeration values for type `TFloatType`

Value	Explanation
ftComp	Comp-type float
ftCurr	Currency-type float
ftDouble	Double-sized float
ftExtended	Extended-size float
ftSingle	Single-sized float

The size of a float type.

```
TGetPropValue = function(Instance: TObject; const PropName: string;
                           PreferStrings: Boolean) : Variant
```

The callback function must return the property with name PropName of instance Instance. If PreferStrings is true, it should favour converting the property to a string value. The function needs to return the variant with the property value.

```
TGetVariantProp = function(Instance: TObject; PropInfo: PPropInfo)
                      : Variant
```

The callback function must return the variant property with name PropName of instance Instance.

```
TIntfFlag = (ifHasGuid, ifDispInterface, ifDispatch, ifHasStrGUID)
```

Table 40.7: Enumeration values for type TIntfFlag

Value	Explanation
ifDispatch	Interface is a dispatch interface
ifDispInterface	Interface is a dual dispatch interface
ifHasGuid	Interface has GUID identifier
ifHasStrGUID	Interface has a string GUID identifier

Type of interface.

```
TIntfFlags = Set of TIntfFlag
```

Set of TIntfFlag ([1644](#)).

```
TIntfFlagsBase = Set of TIntfFlag
```

Set of TIntfFlag ([1644](#)).

```
TMethodKind = (mkProcedure, mkFunction, mkConstructor, mkDestructor,
                mkClassProcedure, mkClassFunction, mkClassConstructor,
                mkClassDestructor, mkOperatorOverload)
```

Table 40.8: Enumeration values for type TMethodKind

Value	Explanation
mkClassConstructor	Class constructor method.
mkClassDestructor	Class destructor method.
mkClassFunction	Class function
mkClassProcedure	Class procedure
mkConstructor	Class constructor
mkDestructor	Class Descrtor
mkFunction	Function method
mkOperatorOverload	Operator overloader
mkProcedure	Procedure method.

Method type description

```
TOrdType = (otSByte, otUByte, otSWord, otUWord, otSLong, otULong)
```

Table 40.9: Enumeration values for type TOrdType

Value	Explanation
otSByte	Signed byte
otSLong	Signed longint
otSWord	Signed word
otUByte	Unsigned byte
otULong	Unsigned longint (Cardinal)
otUWord	Unsigned word

If the property is an ordinal type, then TOrdType determines the size and sign of the ordinal type:

```
TParamFlag = (pfVar, pfConst, pfArray, pfAddress, pfReference, pfOut)
```

Table 40.10: Enumeration values for type TParamFlag

Value	Explanation
pfAddress	Parameter is passed by address
pfArray	Parameter is an array parameter
pfConst	Parameter is a const parameter (i.e. cannot be modified)
pfOut	Parameter is a string parameter
pfReference	Parameter is passed by reference
pfVar	Parameter is a var parameter (passed by reference)

TParamFlag describes a parameter.

```
TParamFlags = Set of TParamFlag
```

The kind of parameter for a method

```
TProcInfoProc = procedure(PropInfo: PPropInfo) of object
```

Property info callback method

```
TPropData = packed record
  PropCount : Word;
  PropList : record
    _alignmentdummy : PtrInt;
  end;
end
```

The TPropData record is not used, but is provided for completeness and compatibility with Delphi.

```
TPropInfo = packed record
  PropType : PTypeInfo;
  GetProc : Pointer;
  SetProc : Pointer;
  StoredProcedure : Pointer;
  Index : Integer;
  Default : LongInt;
  NameIndex : SmallInt;
  PropProcs : Byte;
  Name : ShortString;
end
```

The `TPropInfo` record describes one published property of a class. The property information of a class are stored as an array of `TPropInfo` records.

The `Name` field is stored not with 255 characters, but with just as many characters as required to store the name.

```
TPropList = Array[0..65535] of PPropInfo
```

Array of property information pointers

```
TSetPropValue = procedure(Instance: TObject; const PropName: string;
                           const Value: Variant)
```

The callback function must set the property with name `PropName` of instance `Instance` to `Value`.

```
TSetVariantProp = procedure(Instance: TObject; PropInfo: PPropInfo;
                            const Value: Variant)
```

The callback function must set the variant property with name `PropName` of instance `Instance` to `Value`.

```
TTypedefData = packed record
end
```

If the typeinfo kind is `tkClass`, then the property information follows the `UnitName` string, as an array of `TPropInfo` ([1646](#)) records.

```
TTypedefInfo = record
  Kind : TTypeKind;
  Name : ShortString;
end
```

The `TypeInfo` function returns a pointer to a `TTypedefInfo` record.

Note that the `Name` field is stored with as much bytes as needed to store the name, it is not padded to 255 characters. The type data immediatly follows the `TTypedefInfo` record as a `TTypedefData` ([1646](#)) record.

```
TTypeKind = (tkUnknown, tkInteger, tkChar, tkEnumeration, tkFloat, tkSet,
              tkMethod, tkSString, tkLString, tkAString, tkWString, tkVariant,
              tkArray, tkRecord, tkInterface, tkClass, tkObject, tkWChar,
              tkBool, tkInt64, tkQWord, tkDynArray, tkInterfaceRaw, tkProcVar,
              tkUString, tkUChar, tkHelper)
```

Table 40.11: Enumeration values for type TTypeKind

Value	Explanation
tkArray	Array property.
tkAString	AnsiString property.
tkBool	Boolean property.
tkChar	Char property.
tkClass	Class property.
tkDynArray	Dynamical array property.
tkEnumeration	Enumeration type property.
tkFloat	Float property.
tkHelper	Helper class type.
tkInt64	Int64 property.
tkInteger	Integer property.
tkInterface	Interface property.
tkInterfaceRaw	Raw interface property.
tkLString	Longstring property.
tkMethod	Method property.
tkObject	Object property.
tkProcVar	Procedural variable
tkQWord	QWord property.
tkRecord	Record property.
tkSet	Set property.
tkSString	Shortstring property.
tkUChar	Unicode character
tkUnknown	Unknown property type.
tkUString	Unicode string
tkVariant	Variant property.
tkWChar	Widechar property.
tkWString	Widestring property.

Type of a property.

```
TTypeKinds = Set of TTypeKind
```

Set of TTypeKind ([1647](#)) enumeration.

```
TVmtFieldEntry = packed record
  FieldOffset : PtrUInt;
  TypeIndex : Word;
  Name : ShortString;
end
```

TVmtFieldEntry records are generated by the compiler for all fields of a record or class that have RTTI associated with them. They describe the field as known to the compiler.

```
TVmtFieldTable = packed record
  Count : Word;
  ClassTab : Pointer;
  Fields : Array[0..0] of TVmtFieldEntry;
end
```

`TVmtFieldTable` describes the fields for which RTTI was generated. A `TVmtFieldTable` entry is generated by the compiler in the RTI information, it is not something one creates manually. Basically it contains a list of `TVmtFieldEntry` (1647) values.

40.7 Procedures and functions

40.7.1 FindPropInfo

Synopsis: Return property information by property name.

Declaration:

```
function FindPropInfo(Instance: TObject; const PropName: string)
                  : PPropInfo
function FindPropInfo(Instance: TObject; const PropName: string;
                      AKinds: TTypeKinds) : PPropInfo
function FindPropInfo(AClass: TClass; const PropName: string) : PPropInfo
function FindPropInfo(AClass: TClass; const PropName: string;
                      AKinds: TTypeKinds) : PPropInfo
```

Visibility: default

Description: `FindPropInfo` examines the published property information of a class and returns a pointer to the property information for property `PropName`. The class to be examined can be specified in one of two ways:

AClass a class pointer.

Instance an instance of the class to be investigated.

If the property does not exist, a `EPropertyError` exception will be raised. The `GetPropInfo` (1658) function has the same function as the `FindPropInfo` function, but returns `Nil` if the property does not exist.

Errors: Specifying an invalid property name in `PropName` will result in an `EPropertyError` exception.

See also: `GetPropInfo` (1658), `GetPropList` (1659), `GetPropInfos` (1658)

Listing: ./typinfex/ex14.pp

```
Program example13;

{ This program demonstrates the FindPropInfo function }

{$mode objfpc}

uses
  rttiobj, typinfo, sysutils;

Var
  O : TMyTestObject;
  PT : PTypeData;
  PI : PPropInfo;
  I, J : Longint;
  PP : PPropList;
  prl : PPropInfo;

begin
```

```

O:= TMyTestObject.Create;
PI:=FindPropInfo(O, 'BooleanField');
Writeln('FindPropInfo(Instance, BooleanField) : ', PI^.Name);
PI:=FindPropInfo(O.ClassType, 'ByteField');
Writeln('FindPropInfo(Class, ByteField) : ', PI^.Name);
Write ('FindPropInfo(Class, NonExistingProp) : ');
Try
  PI:=FindPropInfo(O, 'NonExistingProp');
except
  On E: Exception do
    Writeln('Caught exception '' ,E.ClassName, '' with message : ', E.Message);
end;
O.Free;
end.

```

40.7.2 GetEnumName

Synopsis: Return name of enumeration constant.

Declaration: function GetEnumName(TypeInfo: PTypeInfo; Value: Integer) : string

Visibility: default

Description: GetEnumName scans the type information for the enumeration type described by TypeInfo and returns the name of the enumeration constant for the element with ordinal value equal to Value.

If Value is out of range, the first element of the enumeration type is returned. The result is lower-cased, but this may change in the future.

This can be used in combination with GetOrdProp to stream a property of an enumerated type.

Errors: No check is done to determine whether TypeInfo really points to the type information for an enumerated type.

See also: GetOrdProp (1657), GetEnumValue (1651)

Listing: ./typinfex/ex9.pp

```

program example9;

{ This program demonstrates the GetEnumName, GetEnumValue functions }

{$mode objfpc}

uses rttiobj, typinfo;

Var
  O : TMyTestObject;
  TI : PTypeInfo;

begin
  O:= TMyTestObject.Create;
  TI:=GetPropInfo(O, 'MyEnumField')^.PropType;
  Writeln('GetEnumName : ', GetEnumName(TI, Ord(O.MyEnumField)));
  Writeln('GetEnumValue(mefirst) : ', GetEnumName(TI, GetEnumValue(TI, 'mefirst')));
  O.Free;
end.

```

40.7.3 GetEnumNameCount

Synopsis: Return number of names in an enumerated type

Declaration: function GetEnumNameCount (enum1: PTyepInfo) : SizeInt

Visibility: default

Description: GetEnumNameCount returns the number of values (names) in the enumerated type, described by enum1

Errors: No checking is done to see whether Enum1 is really type information of an enumerated type.

See also: GetEnumValue (1651), GetEnumName (1649)

40.7.4 GetEnumProp

Synopsis: Return the value of an enumeration type property.

Declaration: function GetEnumProp(Instance: TObject; const PropName: string) : string
function GetEnumProp(Instance: TObject; const PropInfo: PPropInfo)
: string

Visibility: default

Description: GetEnumProp returns the value of an property of an enumerated type and returns the name of the enumerated value for the objetc Instance. The property whose value must be returned can be specified by its property info in PropInfo or by its name in PropName

Errors: No check is done to determine whether PropInfo really points to the property information for an enumerated type. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: SetEnumProp (1668), GetOrdProp (1657), GetStrProp (1662), GetInt64Prop (1652), GetMethod-Prop (1653), GetSetProp (1661), GetObjectProp (1655), GetEnumProp (1650)

Listing: ./typinfex/ex2.pp

```
program example2;

{ This program demonstrates the GetEnumProp function }

{$mode objfpc}

uses rttiobj, typinfo;

Var
  O : TMyTestObject;
  PI : PPropInfo;
  TI : PTyepInfo;

begin
  O:=TMyTestObject.Create;
  PI:=GetPropInfo(O, 'MyEnumField');
  TI:=PI^.PropType;
  Writeln('Enum property : ');
  Writeln('Value          : ', GetEnumName(TI, Ord(O.MyEnumField)));
  Writeln('Get (name)     : ', GetEnumProp(O, 'MyEnumField'));
  Writeln('Get (propinfo) : ', GetEnumProp(O, PI));
end.
```

```

SetEnumProp(O, 'MyEnumField', 'meFirst');
WriteLn('Set (name, meFirst) : ', GetEnumName(TI, Ord(O.MyEnumField)));
SetEnumProp(O, PI, 'meSecond');
WriteLn('Set (propinfo, meSecond) : ', GetEnumName(TI, Ord(O.MyEnumField)));
O.Free;
end.

```

40.7.5 GetEnumValue

Synopsis: Get ordinal value for enumerated type by name

Declaration: function GetEnumValue(TypeInfo: PTyepInfo; const Name: string) : Integer

Visibility: default

Description: GetEnumValue scans the type information for the enumeration type described by TypeInfo and returns the ordinal value for the element in the enumerated type that has identifier Name. The identifier is searched in a case-insensitive manner.

This can be used to set the value of enumerated properties from a stream.

For an example, see GetEnumName ([1649](#)).

Errors: If Name is not found in the list of enumerated values, then -1 is returned. No check is done whether TypeInfo points to the type information for an enumerated type.

See also: GetEnumName ([1649](#)), SetOrdProp ([1670](#))

40.7.6 GetFloatProp

Synopsis: Return value of floating point property

Declaration: function GetFloatProp(Instance: TObject; PropInfo: PPropInfo) : Extended
function GetFloatProp(Instance: TObject; const PropName: string)
: Extended

Visibility: default

Description: GetFloatProp returns the value of the float property described by PropInfo or with name Propname for the object Instance. All float types are converted to extended.

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid float property of Instance. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: SetFloatProp ([1668](#)), GetOrdProp ([1657](#)), GetStrProp ([1662](#)), GetInt64Prop ([1652](#)), GetMethodProp ([1653](#)), GetSetProp ([1661](#)), GetObjectProp ([1655](#)), GetEnumProp ([1650](#))

Listing: ./typinfex/ex4.pp

```

program example4;

{ This program demonstrates the GetFloatProp function }

{$mode objfpc}

uses rttiobj, typinfo;

```

```

Var
  O : TMyTestObject;
  PI : PPropInfo;

begin
  O:=TMyTestObject.Create;
  Writeln( 'Real property : ');
  PI:=GetPropInfo(O, 'RealField');
  Writeln( 'Value           : ',O.RealField);
  Writeln( 'Get (name)      : ',GetFloatProp(O, 'RealField'));
  Writeln( 'Get (propinfo)  : ',GetFloatProp(O, PI));
  SetFloatProp(O, 'RealField',system.PI);
  Writeln( 'Set (name, pi)  : ',O.RealField);
  SetFloatProp(O, PI,exp(1));
  Writeln( 'Set (propinfo, e) : ',O.RealField);
  Writeln( 'Extended property : ');
  PI:=GetPropInfo(O, 'ExtendedField');
  Writeln( 'Value           : ',O.ExtendedField);
  Writeln( 'Get (name)      : ',GetFloatProp(O, 'ExtendedField'));
  Writeln( 'Get (propinfo)  : ',GetFloatProp(O, PI));
  SetFloatProp(O, 'ExtendedField',system.PI);
  Writeln( 'Set (name, pi)  : ',O.ExtendedField);
  SetFloatProp(O, PI,exp(1));
  Writeln( 'Set (propinfo, e) : ',O.ExtendedField);
  O.Free;
end.

```

40.7.7 GetInt64Prop

Synopsis: return value of an Int64 property

Declaration: function GetInt64Prop(Instance: TObject; PropInfo: PPropInfo) : Int64
 function GetInt64Prop(Instance: TObject; const PropName: string) : Int64

Visibility: default

Description: Publishing of Int64 properties is not yet supported by Free Pascal. This function is provided for Delphi compatibility only at the moment.

GetInt64Prop returns the value of the property of type Int64 that is described by PropInfo or with name Propname for the object Instance.

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid Int64 property of Instance. Specifying an invalid property name in PropName will result in an EPropertyError exception

See also: SetInt64Prop (1669), GetOrdProp (1657), GetStrProp (1662), GetFloatProp (1651), GetMethodProp (1653), GetSetProp (1661), GetObjectProp (1655), GetEnumProp (1650)

Listing: ./typinfex/ex15.pp

```

program example15;

{ This program demonstrates the GetInt64Prop function }

{$mode objfpc}

uses rttiobj, typinfo;

```

```

Var
  O : TMyTestObject;
  PI : PPropInfo;

begin
  O:=TMyTestObject.Create;
  WriteIn('Int64 property : ');
  PI:=GetPropInfo(O, 'Int64Field');
  WriteIn('Value           : ',O.Int64Field);
  WriteIn('Get (name)      : ',GetInt64Prop(O, 'Int64Field'));
  WriteIn('Get (propinfo)   : ',GetInt64Prop(O, PI));
  SetInt64Prop(O, 'Int64Field',12345);
  WriteIn('Set (name,12345) : ',O.Int64Field);
  SetInt64Prop(O, PI,54321);
  WriteIn('Set (propinfo,54321) : ',O.Int64Field);
  O.Free;
end.

```

40.7.8 GetInterfaceProp

Synopsis: Return interface-typed property

```
Declaration: function GetInterfaceProp(Instance: TObject; const PropName: string)
              : IInterface
    function GetInterfaceProp(Instance: TObject; PropInfo: PPropInfo)
              : IInterface
```

Visibility: default

Description: GetInterfaceProp returns the interface which the property described by PropInfo or with name Propname points to for object Instance.

Errors: No checking is done whether `Instance` is non-nil, or whether `PropInfo` describes a valid method property of `Instance`. Specifying an invalid property name in `PropName` will result in an `EPropertyError` exception.

See also: [SetInterfaceProp \(1669\)](#), [GetOrdProp \(1657\)](#), [GetStrProp \(1662\)](#), [GetFloatProp \(1651\)](#), [GetInt64Prop \(1652\)](#), [GetSetProp \(1661\)](#), [GetObjectProp \(1655\)](#), [GetEnumProp \(1650\)](#)

40.7.9 GetMethodProp

Synopsis: Return value of a method property

```
Declaration: function GetMethodProp(Instance: TObject; PropInfo: PPropInfo) : TMethod  
function GetMethodProp(Instance: TObject; const PropName: string)  
    : TMethod
```

Visibility: default

Description: GetMethodProp returns the method the property described by PropInfo or with name Propname for object Instance. The return type TMethod is defined in the SysUtils unit as:

```
TMethod = packed record  
  Code, Data: Pointer;  
end;
```

Data points to the instance of the class with the method Code.

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid method property of Instance. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: SetMethodProp ([1669](#)), GetOrdProp ([1657](#)), GetStrProp ([1662](#)), GetFloatProp ([1651](#)), GetInt64Prop ([1652](#)), GetSetProp ([1661](#)), GetObjectProp ([1655](#)), GetEnumProp ([1650](#))

Listing: ./typinfex/ex6.pp

```
program example6;

{ This program demonstrates the GetMethodProp function }

{$mode objfpc}

uses rttiobj ,typinfo ,sysutils ;

Type
TNotifyObject = Class(TObject)
  Procedure Notification1(Sender : TObject);
  Procedure Notification2(Sender : TObject);
end;

Procedure TNotifyObject.Notification1(Sender : TObject);
begin
  Write('Received notification 1 of object with class: ');
  Writeln(Sender.ClassName);
end;

Procedure TNotifyObject.Notification2(Sender : TObject);
begin
  Write('Received notification 2 of object with class: ');
  Writeln(Sender.ClassName);
end;

Var
O : TMyTestObject;
PI : PPropInfo;
NO : TNotifyObject;
M : TMethod;

Procedure PrintMethod (Const M : TMethod);
begin
  If (M.Data=Pointer(NO)) Then
    If (M.Code=Pointer(@TNotifyObject.Notification1)) then
      Writeln('Notification1')
    else If (M.Code=Pointer(@TNotifyObject.Notification2)) then
      Writeln('Notification2')
    else
      begin
        Write('Unknown method adress (data:');
        Write(hexStr(Longint(M.data),8));
        Writeln(',code:',hexstr(Longint(M.Code),8),')');
      end;

```

```

end;

begin
  O:= TMyTestObject.Create;
  NO:= TNotifyObject.Create;
  O.NotifyEvent:=@NO.Notification1;
  PI:=GetPropInfo(O, 'NotifyEvent');
  WriteLn( 'Method property : ');
  Write( 'Notifying           : ');
  O.Notify;
  Write( 'Get (name)        : ');
  M:=GetMethodProp(O, 'NotifyEvent');
  PrintMethod(M);
  Write( 'Notifying           : ');
  O.Notify;
  Write( 'Get (propinfo)     : ');
  M:=GetMethodProp(O, PI);
  PrintMethod(M);
  M:=TMethod(@NO.Notification2);
  SetMethodProp(O, 'NotifyEvent',M);
  Write( 'Set (name,Notification2) : ');
  M:=GetMethodProp(O, PI);
  PrintMethod(M);
  Write( 'Notifying           : ');
  O.Notify;
  Write( 'Set (propinfo,Notification1) : ');
  M:=TMethod(@NO.Notification1);
  SetMethodProp(O, PI,M);
  M:=GetMethodProp(O, PI);
  PrintMethod(M);
  Write( 'Notifying           : ');
  O.Notify;
  O.Free;
end.

```

40.7.10 GetObjectProp

Synopsis: Return value of an object-type property.

Declaration: `function GetObjectProp(Instance: TObject; const PropName: string)`
 `: TObject`
`function GetObjectProp(Instance: TObject; const PropName: string;`
 `MinClass: TClass) : TObject`
`function GetObjectProp(Instance: TObject; PropInfo: PPropInfo) : TObject`
`function GetObjectProp(Instance: TObject; PropInfo: PPropInfo;`
 `MinClass: TClass) : TObject`

Visibility: default

Description: `GetObjectProp` returns the object which the property described by `PropInfo` with name `Propname` points to for object `Instance`.

If `MinClass` is specified, then if the object is not descendent of class `MinClass`, then `Nil` is returned.

Errors: No checking is done whether `Instance` is non-nil, or whether `PropInfo` describes a valid

method property of `Instance`. Specifying an invalid property name in `PropName` will result in an `EPropertyError` exception.

See also: `SetMethodProp` (1669), `GetOrdProp` (1657), `GetStrProp` (1662), `GetFloatProp` (1651), `GetInt64Prop` (1652), `GetSetProp` (1661), `GetObjectProp` (1655), `GetEnumProp` (1650)

Listing: ./typinfex/ex5.pp

```
program example5;

{ This program demonstrates the GetObjectProp function }

{$mode objfpc}

uses rttiobj, typinfo;

Var
  O : TMyTestObject;
  PI : PPropInfo;
  NO1,NO2 : TNamedObject;

begin
  O:=TMyTestObject.Create;
  NO1:=TNamedObject.Create;
  NO1.ObjectName:='First named object';
  NO2:=TNamedObject.Create;
  NO2.ObjectName:='Second named object';
  O.ObjField:=NO1;
  Writeln('Object property : ');
  PI:=GetPropInfo(O, 'ObjField');
  Write('Property class : ');
  Writeln(GetObjectPropClass(O, 'ObjField').ClassName);
  Write('Value : ');
  Writeln((O.ObjField as TNamedObject).ObjectName);
  Write('Get (name) : ');
  Writeln((GetObjectProp(O, 'ObjField') As TNamedObject).ObjectName);
  Write('Get (propinfo) : ');
  Writeln((GetObjectProp(O, PI, TObject) as TNamedObject).ObjectName);
  SetObjectProp(O, 'ObjField',NO2);
  Write('Set (name,NO2) : ');
  Writeln((O.ObjField as TNamedObject).ObjectName);
  SetObjectProp(O, PI, NO1);
  Write('Set (propinfo,NO1) : ');
  Writeln((O.ObjField as TNamedObject).ObjectName);
  O.Free;
end.
```

40.7.11 GetObjectPropClass

Synopsis: Return class of property.

Declaration: function GetObjectPropClass(Instance: TObject; const PropName: string)
 : TClass
 function GetObjectPropClass(AClass: TClass; const PropName: string)
 : TClass

Visibility: default

Description: GetObjectPropClass returns the declared class of the property with name PropName. This may not be the actual class of the property value.

For an example, see GetObjectProp ([1655](#)).

Errors: No checking is done whether Instance is non-nil. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: SetMethodProp ([1669](#)), GetOrdProp ([1657](#)), GetStrProp ([1662](#)), GetFloatProp ([1651](#)), GetInt64Prop ([1652](#))

40.7.12 GetOrdProp

Synopsis: Get the value of an ordinal property

Declaration: function GetOrdProp(Instance: TObject; PropInfo: PPropInfo) : Int64
function GetOrdProp(Instance: TObject; const PropName: string) : Int64

Visibility: default

Description: GetOrdProp returns the value of the ordinal property described by PropInfo or with name PropName for the object Instance. The value is returned as a longint, which should be typecasted to the needed type.

Ordinal properties that can be retrieved include:

Integers and subranges of integers The value of the integer will be returned.

Enumerated types and subranges of enumerated types The ordinal value of the enumerated type will be returned.

Sets If the base type of the set has less than 31 possible values. If a bit is set in the return value, then the corresponding element of the base ordinal class of the set type must be included in the set.

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid ordinal property of Instance. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: SetOrdProp ([1670](#)), GetStrProp ([1662](#)), GetFloatProp ([1651](#)), GetInt64Prop ([1652](#)), GetMethodProp ([1653](#)), GetSetProp ([1661](#)), GetObjectProp ([1655](#)), GetEnumProp ([1650](#))

Listing: ./typinfex/ex1.pp

```
program example1;

{ This program demonstrates the GetOrdProp function }

{$mode objfpc}

uses rttiobj ,typinfo;

Var
  O : TMyTestObject;
  PI : PPropInfo;

begin
  O:=TMyTestObject.Create;
  Writeln('Boolean property' : ' ');
  Writeln('Value' : ',O.BooleanField);
  Writeln('Ord(Value)' : ',Ord(O.BooleanField));
```

```

Writeln( 'Get (name) : ',GetOrdProp(O, 'BooleanField' ));
PI:=GetPropInfo(O, 'BooleanField');
Writeln( 'Get (propinfo) : ',GetOrdProp(O, PI));
SetOrdProp(O, 'BooleanField', Ord(False));
Writeln( 'Set (name, false) : ',O.BooleanField);
SetOrdProp(O, PI, Ord(True));
Writeln( 'Set (propinfo, true) : ',O.BooleanField);
O.Free;
end.

```

40.7.13 GetPropInfo

Synopsis: Return property type information, by property name.

Declaration: function GetPropInfo(TypeInfo: PTyepInfo; const PropName: string) : PPropInfo
 function GetPropInfo(TypeInfo: PTyepInfo; const PropName: string; AKinds: TTypeKinds) : PPropInfo
 function GetPropInfo(Instance: TObject; const PropName: string) : PPropInfo
 function GetPropInfo(Instance: TObject; const PropName: string; AKinds: TTypeKinds) : PPropInfo
 function GetPropInfo(AClass: TClass; const PropName: string) : PPropInfo
 function GetPropInfo(AClass: TClass; const PropName: string; AKinds: TTypeKinds) : PPropInfo

Visibility: default

Description: GetPropInfo returns a pointer to the TPropInfo record for a the PropName property of a class. The class to examine can be specified in one of three ways:

InstanceAn instance of the class.

AClassA class pointer to the class.

TypeInfoA pointer to the type information of the class.

In each of these three ways, if AKinds is specified, if the property has TypeKind which is not included in Akinds, Nil will be returned.

For an example, see most of the other functions.

Errors: If the property PropName does not exist, Nil is returned.

See also: GetPropInfos ([1658](#)), GetPropList ([1659](#))

40.7.14 GetPropInfos

Synopsis: Return a list of published properties.

Declaration: procedure GetPropInfos(TypeInfo: PTyepInfo; PropList: PPropList)

Visibility: default

Description: GetPropInfos stores pointers to the property information of all published properties of a class with class info TypeInfo in the list pointed to by Proplist. The PropList pointer must point to a memory location that contains enough space to hold all properties of the class and its parent classes.

Errors: No checks are done to see whether PropList points to a memory area that is big enough to hold all pointers.

See also: [GetPropInfo](#) (1658), [GetPropList](#) (1659)

Listing: ./typinfex/ex12.pp

Program example12;

{ This program demonstrates the GetPropInfos function }

uses
 rttiobj , typinfo ;

Var

```
O : TMyTestObject;  
PT : PTypeData;  
PI : PTypeInfo;  
I, J : Longint;  
PP : PPropList;  
prl : PPropInfo;
```

begin

```

O:=TMyTestObject.Create;
PI:=O.ClassInfo;
PT:=GetTypeData(PI);
WriteLn('Property Count : ',PT^.PropCount);
GetMem(PP,PT^.PropCount*SizeOf(Pointer));
GetPropInfos(PI,PP);
For I:=0 to PT^.PropCount-1 do
begin
  With PP^[i]^ do
    begin
      Write('Property ',i+1:3,' : ',name:30);
      writeln(' Type : ',TypeNames[typinfo^.Type]);
    end;
  end;
FreeMem(PP);
O.Free;
end.

```

40.7.15 GetPropList

Synopsis: Return a list of a certain type of published properties.

```
Declaration: function GetPropList(TypeInfo: PTypeInfo; TypeKinds: TTTypeKinds;
                                 PropList: PPropList; Sorted: Boolean) : LongInt
function GetPropList(TypeInfo: PTypeInfo; out PropList: PPropList)
                     : SizeInt
function GetPropList(AClass: TClass; out PropList: PPropList) : Integer
function GetPropList(Instance: TObject; out PropList: PPropList)
                     : Integer
```

Visibility: default

Description: GetPropList stores pointers to property information of the class with class info TypeInfo for properties of kind TypeKinds in the list pointed to by Proplist. PropList must contain enough space to hold all properties.

The function returns the number of pointers that matched the criteria and were stored in PropList.

Errors: No checks are done to see whether PropList points to a memory area that is big enough to hold all pointers.

See also: GetPropInfos (1658), GetPropInfo (1658)

Listing: ./typinfex/ex13.pp

```

Program example13;

{ This program demonstrates the GetPropList function }

uses
  rttiobj ,typinfo ;

Var
  O : TMyTestObject ;
  PT : PTypeData ;
  PI : PTypeInfo ;
  I,J : Longint ;
  PP : PPropList ;
  prl : PPropInfo ;

begin
  O:=TMyTestObject.Create ;
  PI:=O.ClassInfo ;
  PT:=GetTypeData(PI) ;
  WriteLn( 'Total property Count : ',PT^.PropCount) ;
  GetMem (PP,PT^.PropCount*SizeOf(Pointer)) ;
  J:=GetPropList(PI,OrdinalTypes,PP) ;
  WriteLn( 'Ordinal property Count : ',J) ;
  For I:=0 to J-1 do
    begin
      With PP^[i]^ do
        begin
          Write( 'Property ',i+1:3,' : ',name:30) ;
          writeln( ' Type : ',TypeNames[typinfo.PropType(O,Name)]) ;
        end ;
      end ;
      FreeMem(PP) ;
      O.Free ;
    end .

```

40.7.16 GetPropertyValue

Synopsis: Get property value as a string.

Declaration:

```

function GetPropertyValue(Instance: TObject; const PropName: string)
  : Variant
function GetPropertyValue(Instance: TObject; const PropName: string;
  PreferStrings: Boolean) : Variant

```

Visibility: default

Description: Due to missing Variant support, GetPropValue is not yet implemented. The declaration is provided for compatibility with Delphi.

40.7.17 GetRawInterfaceProp

Synopsis: Get a raw (CORBA) interface property.

Declaration: `function GetRawInterfaceProp(Instance: TObject; const PropName: string)
 : Pointer`
`function GetRawInterfaceProp(Instance: TObject; PropInfo: PPropInfo)
 : Pointer`

Visibility: default

Description: GetRawInterfaceProp can be used to retrieve the value of a published CORBA interface property with name PropName from object Instance. Alternatively, the required property information can be specified by PropInfo instead of the property name. In difference with the GetInterfaceProp (1653) function, no reference counting is done.

Errors: If the property PropName does not exist, an EPropertyError exception is raised.

See also: GetInterfaceProp (1653), SetRawInterfaceProp (1671)

40.7.18 GetSetProp

Synopsis: Return the value of a set property.

Declaration: `function GetSetProp(Instance: TObject; const PropName: string) : string`
`function GetSetProp(Instance: TObject; const PropName: string;
 Brackets: Boolean) : string`
`function GetSetProp(Instance: TObject; const PropInfo: PPropInfo;
 Brackets: Boolean) : string`

Visibility: default

Description: GetSetProp returns the contents of a set property as a string. The property to be returned can be specified by its name in PropName or by its property information in PropInfo.

The returned set is a string representation of the elements in the set as returned by SetToString (1672). The Brackets option can be used to enclose the string representation in square brackets.

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid ordinal property of Instance. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: SetSetProp (1671), GetStrProp (1662), GetFloatProp (1651), GetInt64Prop (1652), GetMethodProp (1653)

Listing: ./typinfex/ex7.pp

```
program example7;

{ This program demonstrates the GetSetProp function }

{$mode objfpc}
```

```

uses rttiobj ,typinfo ;

Var
  O : TMyTestObject;
  PI : PPropInfo;

Function SetAsString (ASet : TMyEnums) : String;

Var
  i : TmyEnum;

begin
  result:= '';
  For i:=mefirst to methird do
    If i in ASet then
      begin
        If (Result<>'') then
          Result:=Result+ ',';
        Result:=Result+MyEnumNames[ i ];
        end;
  end;

Var
  S : TMyEnums;

begin
  O:=TMyTestObject.Create;
  O.SetField:=[mefirst,meSecond,meThird];
  Writeln('Set property      : ');
  Writeln('Value           : ',SetAsString(O.SetField));
  Writeln('Ord(Value)     : ',Longint(O.SetField));
  Writeln('Get (name)     : ',GetSetProp(O,'SetField'));
  PI:=GetPropInfo(O,'SetField');
  Writeln('Get (propinfo) : ',GetSetProp(O,PI,false));
  S:=[meFirst,meThird];
  SetOrdProp(O,'SetField',Integer(S));
  Write('Set (name,[ mefirst ,methird ]) : ');
  Writeln(SetAsString(O.SetField));
  S:=[meSecond];
  SetOrdProp(O,PI,Integer(S));
  Write('Set (propinfo ,[ meSecond]) : ');
  Writeln(SetAsString(O.SetField));
  O.Free;
end.

```

40.7.19 GetStrProp

Synopsis: Return the value of a string property.

Declaration: function GetStrProp(Instance: TObject; PropInfo: PPropInfo) : Ansistring
 function GetStrProp(Instance: TObject; const PropName: string) : string

Visibility: default

Description: GetStrProp returns the value of the string property described by PropInfo or with name PropName for object Instance.

Errors: No checking is done whether `Instance` is non-nil, or whether `PropInfo` describes a valid string property of `Instance`. Specifying an invalid property name in `PropertyName` will result in an `EPropertyError` exception.

See also: [SetStrProp \(1672\)](#), [SetWideStrProp \(1674\)](#), [GetOrdProp \(1657\)](#), [GetFloatProp \(1651\)](#), [GetInt64Prop \(1652\)](#), [GetMethodProp \(1653\)](#)

Listing: `./typinfex/ex3.pp`

```
program example3;

{ This program demonstrates the GetStrProp function }

{$mode objfpc}

uses rttiobj, typinfo;

Var
  O : TMyTestObject;
  PI : PPropInfo;

begin
  O:=TMyTestObject.Create;
  PI:=GetPropInfo(O, 'AnsiStringField');
  Writeln('String property : ');
  Writeln('Value           : ',O.AnsiStringField);
  Writeln('Get (name)      : ',GetStrProp(O, 'AnsiStringField'));
  Writeln('Get (propinfo)  : ',GetStrProp(O, PI));
  SetStrProp(O, 'AnsiStringField', 'First');
  Writeln('Set (name, ''First'')   : ',O.AnsiStringField);
  SetStrProp(O, PI, 'Second');
  Writeln('Set (propinfo, ''Second'') : ',O.AnsiStringField);
  O.Free;
end.
```

40.7.20 GetTypeData

Synopsis: Return a pointer to type data, based on type information.

Declaration: `function GetTypeData(TypeInfo: PTyepInfo) : PTyepData`

Visibility: default

Description: `GetTypeData` returns a pointer to the `TTypeData` record that follows after the `TTyepInfo` record pointed to by `TypeInfo`. It essentially skips the `Kind` and `Name` fields in the `TTyepInfo` record.

Errors: None.

40.7.21 GetUnicodeStrProp

Synopsis: Get `UnicodeString`-valued property

Declaration: `function GetUnicodeStrProp(Instance: TObject; PropInfo: PPropInfo)
 : UnicodeString
 function GetUnicodeStrProp(Instance: TObject; const PropName: string)
 : UnicodeString`

Visibility: default

Description: `GetUnicodeStrProp` returns the `UnicodeString` property from `Instance`, where the property is identified by the `PropInfo` pointer or the `PropertyName`.

Errors: If no property of the indicated name exists, or the value is not a unicode string, an exception will occur.

See also: [GetStrProp \(1662\)](#), [SetUnicodeStrProp \(1673\)](#)

40.7.22 GetVariantProp

Synopsis: Return the value of a variant property.

Declaration: `function GetVariantProp(Instance: TObject; PropInfo: PPropInfo) : Variant`
 `function GetVariantProp(Instance: TObject; const PropName: string)`
 `: Variant`

Visibility: default

Description: Due to missing Variant support, the `GetVariantProp` function is not yet implemented. Provided for Delphi compatibility only.

See also: [SetVariantProp \(1674\)](#)

40.7.23 GetWideStrProp

Synopsis: Read a widestring property

Declaration: `function GetWideStrProp(Instance: TObject; PropInfo: PPropInfo)`
 `: WideString`
 `function GetWideStrProp(Instance: TObject; const PropName: string)`
 `: WideString`

Visibility: default

Description: `GetWideStrProp` returns the value of the widestring property described by `PropInfo` or with name `PropName` for object `Instance`.

Errors: No checking is done whether `Instance` is non-nil, or whether `PropInfo` describes a valid widestring property of `Instance`. Specifying an invalid property name in `PropName` will result in an `EPropertyError` exception.

See also: [GetStrProp \(1662\)](#), [SetWideStrProp \(1674\)](#), [GetOrdProp \(1657\)](#), [GetFloatProp \(1651\)](#), [GetInt64Prop \(1652\)](#), [GetMethodProp \(1653\)](#)

40.7.24 IsPublishedProp

Synopsis: Check whether a published property exists.

Declaration: `function IsPublishedProp(Instance: TObject; const PropName: string)`
 `: Boolean`
 `function IsPublishedProp(AClass: TClass; const PropName: string)`
 `: Boolean`

Visibility: default

Description: `IsPublishedProp` returns true if a class has a published property with name `PropName`. The class can be specified in one of two ways:

AClassA class pointer to the class.

InstanceAn instance of the class.

Errors: No checks are done to ensure `Instance` or `AClass` are valid pointers. Specifying an invalid property name in `PropName` will result in an `EPropertyError` exception.

See also: `IsStoredProp` (1665), `PropIsType` (1666)

Listing: ./typinfex/ex10.pp

```
program example10;

{ This program demonstrates the IsPublishedProp function }

{$mode objfpc}

uses rttiobj ,typinfo ;

Var
  O : TMyTestObject ;
  PI : PPropInfo ;

begin
  O:=TMyTestObject.Create ;
  Writeln('Property tests      : ');
  Write('IsPublishedProp(O, BooleanField)      : ');
  Writeln(IsPublishedProp(O, 'BooleanField'));
  Write('IsPublishedProp(Class, BooleanField) : ');
  Writeln(IsPublishedProp(O.ClassType, 'BooleanField'));
  Write('IsPublishedProp(O, SomeField)         : ');
  Writeln(IsPublishedProp(O, 'SomeField'));
  Write('IsPublishedProp(Class, SomeField)    : ');
  Writeln(IsPublishedProp(O.ClassType, 'SomeField'));
  O.Free;
end.
```

40.7.25 IsStoredProp

Synopsis: Check whether a property is stored.

Declaration: `function IsStoredProp(Instance: TObject; PropInfo: PPropInfo) : Boolean`
`function IsStoredProp(Instance: TObject; const PropName: string) : Boolean`

Visibility: default

Description: `IsStoredProp` returns True if the `Stored` modifier evaluates to True for the property described by `PropInfo` or with name `PropName` for object `Instance`. It returns False otherwise. If the function returns True, this indicates that the property should be written when streaming the object `Instance`.

If there was no `stored` modifier in the declaration of the property, `True` will be returned.

Errors: No checking is done whether `Instance` is non-nil, or whether `PropInfo` describes a valid property of `Instance`. Specifying an invalid property name in `PropertyName` will result in an `EPropertyError` exception.

See also: [IsPublishedProp \(1664\)](#), [PropIsType \(1666\)](#)

Listing: `./typinfex/ex11.pp`

```
program example11;

{ This program demonstrates the IsStoredProp function }

{$mode objfpc}

uses rttiobj ,typinfo ;

Var
  O : TMyTestObject ;
  PI : PPropInfo ;

begin
  O:=TMyTestObject.Create ;
  Writeln( 'Stored tests      : ' );
  Write( 'IsStoredProp(O, StoredIntegerConstFalse)    : ' );
  Writeln( IsStoredProp(O, 'StoredIntegerConstFalse' ) );
  Write( 'IsStoredProp(O, StoredIntegerConstTrue)     : ' );
  Writeln( IsStoredProp(O, 'StoredIntegerConstTrue' ) );
  Write( 'IsStoredProp(O, StoredIntegerMethod)        : ' );
  Writeln( IsStoredProp(O, 'StoredIntegerMethod' ) );
  Write( 'IsStoredProp(O, StoredIntegerVirtualMethod) : ' );
  Writeln( IsStoredProp(O, 'StoredIntegerVirtualMethod' ) );
  O.Free ;
end.
```

40.7.26 PropIsType

Synopsis: Check the type of a published property.

Declaration: `function PropIsType(Instance: TObject; const PropName: string;
 TypeKind: TTypeKind) : Boolean`
`function PropIsType(AClass: TClass; const PropName: string;
 TypeKind: TTypeKind) : Boolean`

Visibility: default

Description: `PropIsType` returns `True` if the property with name `PropName` has type `TypeKind`. It returns `False` otherwise. The class to be examined can be specified in one of two ways:

AClass A class pointer.

Instance An instance of the class.

Errors: No checks are done to ensure `Instance` or `AClass` are valid pointers. Specifying an invalid property name in `PropertyName` will result in an `EPropertyError` exception.

See also: [IsPublishedProp \(1664\)](#), [IsStoredProp \(1665\)](#), [PropType \(1667\)](#)

Listing: `./typinfex/ex16.pp`

```

program example16;

{ This program demonstrates the PropIsType function }

{$mode objfpc}

uses rttiobj ,typinfo;

Var
  O : TMyTestObject;

begin
  O:=TMyTestObject.Create;
  WriteLn( 'Property tests      : ' );
  Write( 'PropIsType(O,BooleanField ,tkBool)      : ' );
  WriteLn( PropIsType(O , 'BooleanField ' ,tkBool ) );
  Write( 'PropIsType(Class ,BooleanField ,tkBool) : ' );
  WriteLn( PropIsType(O.ClassType , 'BooleanField ' ,tkBool ) );
  Write( 'PropIsType(O,ByteField ,tkString)      : ' );
  WriteLn( PropIsType(O , 'ByteField ' ,tkString ) );
  Write( 'PropIsType(Class ,ByteField ,tkString) : ' );
  WriteLn( PropIsType(O.ClassType , 'ByteField ' ,tkString ) );
  O.Free;
end.

```

40.7.27 PropType

Synopsis: Return the type of a property

Declaration: `function PropType(Instance: TObject;const PropName: string) : TTypeKind`
`function PropType(AClass: TClass;const PropName: string) : TTypeKind`

Visibility: default

Description: `PropType` returns the type of the property `PropName` for a class. The class to be examined can be specified in one of 2 ways:

AClassA class pointer.

InstanceAn instance of the class.

Errors: No checks are done to ensure `Instance` or `AClass` are valid pointers. Specifying an invalid property name in `PropName` will result in an `EPropertyError` exception.

See also: [IsPublishedProp \(1664\)](#), [IsStoredProp \(1665\)](#), [PropIsType \(1666\)](#)

Listing: ./typinfex/ex17.pp

```

program example17;

{ This program demonstrates the PropType function }

{$mode objfpc}

uses rttiobj ,typinfo;

Var

```

```

O : TMyTestObject;

begin
  O:= TMyTestObject.Create;
  WriteLn('Property tests      : ');
  Write('PropType(O, BooleanField)      : ');
  WriteLn(TypeNames[PropType(O, 'BooleanField')]);
  Write('PropType(Class, BooleanField)   : ');
  WriteLn(TypeNames[PropType(O. ClassType, 'BooleanField')]);
  Write('PropType(O, ByteField)         : ');
  WriteLn(TypeNames[PropType(O, 'ByteField')]);
  Write('PropType(Class, ByteField)     : ');
  WriteLn(TypeNames[PropType(O. ClassType, 'ByteField')]);
  O.Free;
end.

```

40.7.28 SetEnumProp

Synopsis: Set value of an enumerated-type property

Declaration: `procedure SetEnumProp(Instance: TObject; const PropName: string;
 const Value: string);
procedure SetEnumProp(Instance: TObject; const PropInfo: PPropInfo;
 const Value: string);`

Visibility: default

Description: `SetEnumProp` sets the property described by `PropInfo` or with name `PropName` to `Value`. `Value` must be a string with the name of the enumerate value, i.e. it can be used as an argument to `GetEnumValue` ([1651](#)).

For an example, see `GetEnumProp` ([1650](#)).

Errors: No checks are done to ensure `Instance` or `PropInfo` are valid pointers. Specifying an invalid property name in `PropName` will result in an `EPropertyError` exception.

See also: `GetEnumProp` ([1650](#)), `SetStrProp` ([1672](#)), `SetFloatProp` ([1668](#)), `SetInt64Prop` ([1669](#)), `SetMethodProp` ([1669](#))

40.7.29 SetFloatProp

Synopsis: Set value of a float property.

Declaration: `procedure SetFloatProp(Instance: TObject; const PropName: string;
 Value: Extended);
procedure SetFloatProp(Instance: TObject; PropInfo: PPropInfo;
 Value: Extended);`

Visibility: default

Description: `SetFloatProp` assigns `Value` to the property described by `PropInfo` or with name `Propname` for the object `Instance`.

For an example, see `GetFloatProp` ([1651](#)).

Errors: No checking is done whether `Instance` is non-nil, or whether `PropInfo` describes a valid float property of `Instance`. Specifying an invalid property name in `PropName` will result in an `EPropertyError` exception.

See also: [GetFloatProp \(1651\)](#), [SetOrdProp \(1670\)](#), [SetStrProp \(1672\)](#), [SetInt64Prop \(1669\)](#), [SetMethodProp \(1669\)](#)

40.7.30 SetInt64Prop

Synopsis: Set value of a Int64 property

Declaration:

```
procedure SetInt64Prop(Instance: TObject; PropInfo: PPropInfo;
                      const Value: Int64)
procedure SetInt64Prop(Instance: TObject; const PropName: string;
                      const Value: Int64)
```

Visibility: default

Description: SetInt64Prop assigns Value to the property of type Int64 that is described by PropInfo or with name Propname for the object Instance.

For an example, see [GetInt64Prop \(1652\)](#).

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid Int64 property of Instance. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: [GetInt64Prop \(1652\)](#), [GetMethodProp \(1653\)](#), [SetOrdProp \(1670\)](#), [SetStrProp \(1672\)](#), [SetFloatProp \(1668\)](#)

40.7.31 SetInterfaceProp

Synopsis: Set interface-valued property

Declaration:

```
procedure SetInterfaceProp(Instance: TObject; const PropName: string;
                           const Value: IInterface)
procedure SetInterfaceProp(Instance: TObject; PropInfo: PPropInfo;
                           const Value: IInterface)
```

Visibility: default

Description: SetInterfaceProp assigns Value to the the object property described by PropInfo or with name Propname for the object Instance.

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid interface property of Instance. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: [GetInterfaceProp \(1653\)](#), [SetObjectProp \(1670\)](#), [SetOrdProp \(1670\)](#), [SetStrProp \(1672\)](#), [SetFloatProp \(1668\)](#), [SetInt64Prop \(1669\)](#), [SetMethodProp \(1669\)](#)

40.7.32 SetMethodProp

Synopsis: Set the value of a method property

Declaration:

```
procedure SetMethodProp(Instance: TObject; PropInfo: PPropInfo;
                       const Value: TMethod)
procedure SetMethodProp(Instance: TObject; const PropName: string;
                       const Value: TMethod)
```

Visibility: default

Description: SetMethodProp assigns Value to the method the property described by PropInfo or with name Propname for object Instance.

The type TMethod of the Value parameter is defined in the SysUtils unit as:

```
TMethod = packed record
  Code, Data: Pointer;
end;
```

Data should point to the instance of the class with the method Code.

For an example, see GetMethodProp ([1653](#)).

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid method property of Instance. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: GetMethodProp ([1653](#)), SetOrdProp ([1670](#)), SetStrProp ([1672](#)), SetFloatProp ([1668](#)), SetInt64Prop ([1669](#))

40.7.33 SetObjectProp

Synopsis: Set the value of an object-type property.

Declaration:

```
procedure SetObjectProp(Instance: TObject; const PropName: string;
                      Value: TObject)
procedure SetObjectProp(Instance: TObject; PropInfo: PPropInfo;
                      Value: TObject)
```

Visibility: default

Description: SetObjectProp assigns Value to the the object property described by PropInfo or with name Propname for the object Instance.

For an example, see GetObjectProp ([1655](#)).

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid object property of Instance. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: GetObjectProp ([1655](#)), SetOrdProp ([1670](#)), SetStrProp ([1672](#)), SetFloatProp ([1668](#)), SetInt64Prop ([1669](#)), SetMethodProp ([1669](#))

40.7.34 SetOrdProp

Synopsis: Set value of an ordinal property

Declaration:

```
procedure SetOrdProp(Instance: TObject; PropInfo: PPropInfo; Value: Int64)
procedure SetOrdProp(Instance: TObject; const PropName: string;
                    Value: Int64)
```

Visibility: default

Description: SetOrdProp assigns Value to the the ordinal property described by PropInfo or with name Propname for the object Instance.

Ordinal properties that can be set include:

Integers and subranges of integers The actual value of the integer must be passed.

Enumerated types and subranges of enumerated types The ordinal value of the enumerated type must be passed.

Subrange types of integers or enumerated types. Here the ordinal value must be passed.

Sets If the base type of the set has less than 31 possible values. For each possible value; the corresponding bit of Value must be set.

For an example, see GetOrdProp ([1657](#)).

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid ordinal property of Instance. No range checking is performed. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: GetOrdProp ([1657](#)), SetStrProp ([1672](#)), SetFloatProp ([1668](#)), SetInt64Prop ([1669](#)), SetMethodProp ([1669](#))

40.7.35 SetPropValue

Synopsis: Set property value as variant

Declaration: `procedure SetPropValue(Instance: TObject; const PropName: string;
const Value: Variant)`

Visibility: default

Description: Due to missing Variant support, this function is not yet implemented; it is provided for Delphi compatibility only.

40.7.36 SetRawInterfaceProp

Synopsis: Set a raw (CORBA) interface property.

Declaration: `procedure SetRawInterfaceProp(Instance: TObject; const PropName: string;
const Value: Pointer)
procedure SetRawInterfaceProp(Instance: TObject; PropInfo: PPropInfo;
const Value: Pointer)`

Visibility: default

Description: SetRawInterfaceProp can be used to set the value of a published CORBA interface with name PropName from object Instance to Value. Alternatively, the required property information can be specified by PropInfo instead of the property name. In difference with the SetInterfaceProp ([1669](#)) procedure, no reference counting is done.

Errors: If the property PropName does not exist, an EPropertyError exception is raised.

See also: SetInterfaceProp ([1669](#)), GetRawInterfaceProp ([1661](#))

40.7.37 SetSetProp

Synopsis: Set value of set-typed property.

Declaration: `procedure SetSetProp(Instance: TObject; const PropName: string;
const Value: string)
procedure SetSetProp(Instance: TObject; const PropInfo: PPropInfo;
const Value: string)`

Visibility: default

Description: SetSetProp sets the property specified by PropInfo or PropName for object Instance to Value. Value is a string which contains a comma-separated list of values, each value being a string-representation of the enumerated value that should be included in the set. The value should be accepted by the StringToSet (1674) function.

The value can be formed using the SetToString (1672) function.

For an example, see GetSetProp (1661).

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid ordinal property of Instance. No range checking is performed. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: GetSetProp (1661), SetOrdProp (1670), SetStrProp (1672), SetFloatProp (1668), SetInt64Prop (1669), SetMethodProp (1669), SetToString (1672), StringToSet (1674)

40.7.38 SetStrProp

Synopsis: Set value of a string property

```
Declaration: procedure SetStrProp(Instance: TObject; const PropName: string;
                                const Value: AnsiString)
procedure SetStrProp(Instance: TObject; PropInfo: PPropInfo;
                    const Value: Ansistring)
```

Visibility: default

Description: SetStrProp assigns Value to the string property described by PropInfo or with name Propname for object Instance.

For an example, see GetStrProp (1662)

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid string property of Instance. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: GetStrProp (1662), SetWideStrProp (1674), SetOrdProp (1670), SetFloatProp (1668), SetInt64Prop (1669), SetMethodProp (1669)

40.7.39 SetToString

Synopsis: Convert set to a string description

```
Declaration: function SetToString(TypeInfo: PTypeInfo; Value: Integer;
                                 Brackets: Boolean) : string
function SetToString(PropInfo: PPropInfo; Value: Integer;
                     Brackets: Boolean) : string
function SetToString(PropInfo: PPropInfo; Value: Integer) : string
```

Visibility: default

Description: SetToString takes an integer representation of a set (as received e.g. by GetOrdProp) and turns it into a string representing the elements in the set, based on the type information found in the PropInfo property information. By default, the string representation is not surrounded by square brackets. Setting the Brackets parameter to True will surround the string representation with brackets.

The function returns the string representation of the set.

Errors: No checking is done to see whether PropInfo points to valid property information.

See also: GetEnumName (1649), GetEnumValue (1651), StringToSet (1674)

Listing: ./typinfex/ex18.pp

```

program example18;

{ This program demonstrates the SetToString function }

{$mode objfpc}

uses rttiobj ,typinfo ;

Var
  O : TMyTestObject ;
  PI : PPropInfo ;
  I : longint;

begin
  O:=TMyTestObject.Create;
  PI:=GetPropInfo(O, 'SetField');
  O.SetField:=[mefirst,meSecond,meThird];
  I:=GetOrdProp(O,PI);
  WriteLn('Set property to string : ');
  WriteLn('Value : ',SetToString(PI,I,False));
  O.SetField:=[mefirst,meSecond];
  I:=GetOrdProp(O,PI);
  WriteLn('Value : ',SetToString(PI,I,True));
  I:=StringToSet(PI,'mefirst');
  SetOrdProp(O,PI,I);
  I:=GetOrdProp(O,PI);
  WriteLn('Value : ',SetToString(PI,I,False));
  I:=StringToSet(PI,['mesisecond,methird']);
  SetOrdProp(O,PI,I);
  I:=GetOrdProp(O,PI);
  WriteLn('Value : ',SetToString(PI,I,True));
  O.Free;
end.

```

40.7.40 SetUnicodeStrProp

Synopsis: Set UnicodeString-valued property

Declaration: `procedure SetUnicodeStrProp(Instance: TObject; const PropName: string;
const Value: UnicodeString);
procedure SetUnicodeStrProp(Instance: TObject; PropInfo: PPropInfo;
const Value: UnicodeString);`

Visibility: default

Description: SetUnicodeStrProp sets the UnicodeString property from Instance to Value, where the property is identified by the PropInfo pointer or the PropName.

Errors: If no property of the indicated name exists, or it is not of type unicodestring, an exception will occur.

See also: SetStrProp (1672), GetUnicodeStrProp (1663)

40.7.41 SetVariantProp

Synopsis: Set value of a variant property

Declaration:

```
procedure SetVariantProp(Instance: TObject; const PropName: string;
                        const Value: Variant)
procedure SetVariantProp(Instance: TObject; PropInfo: PPropInfo;
                        const Value: Variant)
```

Visibility: default

Description: Due to missing Variant support, this function is not yet implemented. Provided for Delphi compatibility only.

40.7.42 SetWideStrProp

Synopsis: Set a widestring property

Declaration:

```
procedure SetWideStrProp(Instance: TObject; const PropName: string;
                        const Value: WideString)
procedure SetWideStrProp(Instance: TObject; PropInfo: PPropInfo;
                        const Value: WideString)
```

Visibility: default

Description: SetWideStrProp assigns Value to the widestring property described by PropInfo or with name Propname for object Instance.

Errors: No checking is done whether Instance is non-nil, or whether PropInfo describes a valid widestring property of Instance. Specifying an invalid property name in PropName will result in an EPropertyError exception.

See also: GetWideStrProp (1664), SetStrProp (1672), SetOrdProp (1670), SetFloatProp (1668), SetInt64Prop (1669), SetMethodProp (1669)

40.7.43 StringToSet

Synopsis: Convert string description to a set.

Declaration:

```
function StringToSet(PropInfo: PPropInfo; const Value: string) : Integer
function StringToSet(TypeInfo: PTyepInfo; const Value: string) : Integer
```

Visibility: default

Description: StringToSet converts the string representation of a set in Value to a integer representation of the set, using the property information found in PropInfo. This property information should point to the property information of a set property. The function returns the integer representation of the set. (i.e, the set value, typecast to an integer)

The string representation can be surrounded with square brackets, and must consist of the names of the elements of the base type of the set. The base type of the set should be an enumerated type. The elements should be separated by commas, and may be surrounded by spaces. each of the names will be fed to the GetEnumValue (1651) function.

For an example, see SetToString (1672).

Errors: No checking is done to see whether PropInfo points to valid property information. If a wrong name is given for an enumerated value, then an EPropertyError will be raised.

See also: GetEnumName (1649), GetEnumValue (1651), SetToString (1672)

40.8 EPropertyConvertError

40.8.1 Description

`EPropertyConvertError` is not used in the Free Pascal implementation of the typinfo unit, but is declared for Delphi compatibility.

40.9 EPropertyError

40.9.1 Description

Exception raised in case of an error in one of the functions.

Chapter 41

Reference for unit 'Unix'

41.1 Used units

Table 41.1: Used units by unit 'Unix'

Name	Page
BaseUnix	102
System	1229
unixtype	1713

41.2 Constants, types and variables

41.2.1 Constants

`ARG_MAX = UnixType . ARG_MAX`

Maximum number of arguments to a program.

`fs_ext = $137d`

File system type (StatFS (1710)): (ext) Extended

`fs_ext2 = $ef53`

File system type (StatFS (1710)): (ext2) Second extended

`fs_iso = $9660`

File system type (StatFS (1710)): ISO 9660

`fs_minix = $137f`

File system type (StatFS (1710)): Minix

`fs_minix_30 = $138f`

File system type (StatFS ([1710](#))): Minix 3.0

`fs_minux_V2 = $2468`

File system type (StatFS ([1710](#))): Minix V2

`fs_msdos = $4d44`

File system type (StatFS ([1710](#))): MSDOS (FAT)

`fs_nfs = $6969`

File system type (StatFS ([1710](#))): NFS

`fs_old_ext2 = $ef51`

File system type (StatFS ([1710](#))): (ext2) Old second extended

`fs_proc = $9fa0`

File system type (StatFS ([1710](#))): PROC fs

`fs_xia = $012FD16D`

File system type (StatFS ([1710](#))): XIA

`IOCtl_TCGETS = $5401`

IOCTL call number: get Terminal Control settings

`LOCK_EX = 2`

FpFLock ([1700](#)) Exclusive lock

`LOCK_NB = 4`

FpFLock ([1700](#)) Non-blocking operation

`LOCK_SH = 1`

FpFLock ([1700](#)) Shared lock

`LOCK_UN = 8`

FpFLock ([1700](#)) unlock

`MAP_FAILED = baseunix . MAP_FAILED`

Error return value for mmap: mmap operation failed.

`MAP_FIXED = baseunix . MAP_FIXED`

#rtl.baseunix.FpMMap (165) map type: Interpret addr exactly

MAP_PRIVATE = baseunix . MAP_PRIVATE

#rtl.baseunix.FpMMap (165) map type: Changes are private

MAP_SHARED = baseunix . MAP_SHARED

#rtl.baseunix.FpMMap (165) map type: Share changes

MAP_TYPE = baseunix . MAP_TYPE

#rtl.baseunix.FpMMap (165) map type: Bitmask for type of mapping

MS_ASYNC = 1deprecated

Asynchronous operation flag for msync call

MS_INVALIDATE = 2deprecated

Invalidate other mappings of file flag for msync call

MS_SYNC = 4deprecated

Synchronous operation flag for msync call

NAME_MAX = UnixType . NAME_MAX

Maximum filename length.

Open_Accmode = 3

Bitmask to determine access mode in open flags.

Open_Append = 2 shl 9

File open mode: Append to file

Open_Creat = 1 shl 6

File open mode: Create if file does not yet exist.

Open_Direct = 4 shl 12

File open mode: Minimize caching effects

Open_Directory = 2 shl 15

File open mode: File must be directory.

Open_Excl = 2 shl 6

File open mode: Open exclusively

`Open_LargeFile = 1 shl 15`

File open mode: Open for 64-bit I/O

`Open_NDelay = Open_NonBlock`

File open mode: Alias for `Open_NonBlock` ([1679](#))

`Open_NoCtty = 4 shl 6`

File open mode: No TTY control.

`Open_NoFollow = 4 shl 15`

File open mode: Fail if file is symbolic link.

`Open_NonBlock = 4 shl 9`

File open mode: Open in non-blocking mode

`Open_RdOnly = 0`

File open mode: Read only

`Open_RdWr = 2`

File open mode: Read/Write

`Open_Sync = 1 shl 12`

File open mode: Write to disc at once

`Open_Trunc = 1 shl 9`

File open mode: Truncate file to length 0

`Open_WrOnly = 1`

File open mode: Write only

`PATH_MAX = UnixType . PATH_MAX`

Maximum pathname length.

`PRIOPGRP = UnixType . PRIOPGRP`

#rtl.baseunix.fpGetPriority ([159](#)) option: Get process group priority.

`PRIOPPROCESS = UnixType . PRIOPPROCESS`

#rtl.baseunix.fpGetPriority (159) option: Get process priority.

PRI0_USER = UnixType . PRI0_USER

#rtl.baseunix.fpGetPriority (159) option: Get user priority.

PROT_EXEC = baseunix . PROT_EXEC

#rtl.baseunix.FpMMap (165) memory access: page can be executed

PROT_NONE = baseunix . PROT_NONE

#rtl.baseunix.FpMMap (165) memory access: page can not be accessed

PROT_READ = baseunix . PROT_READ

#rtl.baseunix.FpMMap (165) memory access: page can be read

PROT_WRITE = baseunix . PROT_WRITE

#rtl.baseunix.FpMMap (165) memory access: page can be written

P_IN = 1

Input file descriptor of pipe pair.

P_OUT = 2

Output file descriptor of pipe pair.

SIG_MAXSIG = UnixType . SIG_MAXSIG

Maximum system signal number.

STAT_IFBLK = \$6000

File (#rtl.baseunix.stat (137) record) mode: Block device

STAT_IFCHR = \$2000

File (#rtl.baseunix.stat (137) record) mode: Character device

STAT_IFDIR = \$4000

File (#rtl.baseunix.stat (137) record) mode: Directory

STAT_IFIFO = \$1000

File (#rtl.baseunix.stat (137) record) mode: FIFO

STAT_IFLNK = \$a000

File (#rtl.baseunix.stat (137) record) mode: Link

```
STAT_IFMT = $f000
```

File (#rtl.baseunix.stat (137) record) mode: File type bit mask

```
STAT_IFREG = $8000
```

File (#rtl.baseunix.stat (137) record) mode: Regular file

```
STAT_IFSOCK = $c000
```

File (#rtl.baseunix.stat (137) record) mode: Socket

```
STAT_IRGRP = STAT_IROTH shl 3
```

File (#rtl.baseunix.stat (137) record) mode: Group read permission

```
STAT_IROTH = $4
```

File (#rtl.baseunix.stat (137) record) mode: Other read permission

```
STAT_IRUSR = STAT_IROTH shl 6
```

File (#rtl.baseunix.stat (137) record) mode: Owner read permission

```
STAT_IRWXG = STAT_IRWXO shl 3
```

File (#rtl.baseunix.stat (137) record) mode: Group permission bits mask

```
STAT_IRWXO = $7
```

File (#rtl.baseunix.stat (137) record) mode: Other permission bits mask

```
STAT_IRWXU = STAT_IRWXO shl 6
```

File (#rtl.baseunix.stat (137) record) mode: Owner permission bits mask

```
STAT_ISGID = $0400
```

File (#rtl.baseunix.stat (137) record) mode: GID bit set

```
STAT_ISUID = $0800
```

File (#rtl.baseunix.stat (137) record) mode: UID bit set

```
STAT_ISVTX = $0200
```

File (#rtl.baseunix.stat (137) record) mode: Sticky bit set

```
STAT_IWGRP = STAT_IWOTH shl 3
```

File (#rtl.baseunix.stat (137) record) mode: Group write permission

```
STAT_IWOTH = $2
```

File (#rtl.baseunix.stat (137) record) mode: Other write permission

```
STAT_IWUSR = STAT_IWOTH shl 6
```

File (#rtl.baseunix.stat (137) record) mode: Owner write permission

```
STAT_IXGRP = STAT_IXOTH shl 3
```

File (#rtl.baseunix.stat (137) record) mode: Others execute permission

```
STAT_IXOTH = $1
```

File (#rtl.baseunix.stat (137) record) mode: Others execute permission

```
STAT_IXUSR = STAT_IXOTH shl 6
```

File (#rtl.baseunix.stat (137) record) mode: Others execute permission

```
SYS_NMLN = UnixType . SYS_NMLN
```

Max system name length.

```
Wait_Any = -1
```

#rtl.baseunix.fpWaitPID (194): Wait on any process

```
Wait_Clone = $80000000
```

#rtl.baseunix.fpWaitPID (194): Wait on clone processes only.

```
Wait_MyPGRP = 0
```

#rtl.baseunix.fpWaitPID (194): Wait processes from current process group

```
Wait_NoHang = 1
```

#rtl.baseunix.fpWaitPID (194): Do not wait

```
Wait_UnTraced = 2
```

#rtl.baseunix.fpWaitPID (194): Also report stopped but untraced processes

41.2.2 Types

cbool = UnixType.cbool

Boolean type

cchar = UnixType.cchar

Alias for #rtl.UnixType.cchar ([1715](#))

cdouble = UnixType.cdouble

Double precision real format.

cfloat = UnixType.cfloat

Floating-point real format

cint = UnixType.cint

C type: integer (natural size)

cint16 = UnixType.cint16

C type: 16 bits sized, signed integer.

cint32 = UnixType.cint32

C type: 32 bits sized, signed integer.

cint64 = UnixType.cint64

C type: 64 bits sized, signed integer.

cint8 = UnixType.cint8

C type: 8 bits sized, signed integer.

clock_t = UnixType.clock_t

Clock ticks type

clong = UnixType.clong

C type: long signed integer (double sized)

clonglong = UnixType.clonglong

C type: 64-bit (double long) signed integer.

coff_t = UnixType.TOff

character offset type.

`cschar = UnixType.cschar`

Signed character type

`cshort = UnixType.cshort`

C type: short signed integer (half sized)

`csigned = UnixType.csigned`

`csigned` is an alias for `cint` ([1683](#)).

`csint = UnixType.csint`

Signed integer

`csize_t = UnixType.size_t`

Character size type.

`cslong = UnixType.cslong`

The size is CPU dependent.

`cslonglong = UnixType.cslonglong`

`cslonglong` is an alias for `clonglong` ([1683](#)).

`csshort = UnixType.csshort`

Short signed integer type

`cuchar = UnixType.cuchar`

Alias for `#rtl.UnixType.cuchar` ([1716](#))

`cuint = UnixType.cuint`

C type: unsigned integer (natural size)

`cuint16 = UnixType.cuint16`

C type: 16 bits sized, unsigned integer.

`cuint32 = UnixType.cuint32`

C type: 32 bits sized, unsigned integer.

`cuint64 = UnixType.cuint64`

C type: 64 bits sized, unsigned integer.

```
cuint8 = UnixType.cuint8
```

C type: 8 bits sized, unsigned integer.

```
culong = UnixType.culong
```

C type: long unsigned integer (double sized)

```
culonglong = UnixType.culonglong
```

C type: 64-bit (double long) unsigned integer.

```
cunsigned = UnixType.cunsigned
```

Alias for #rtl.unixtype.cunsigned ([1717](#))

```
cushort = UnixType.cushort
```

C type: short unsigned integer (half sized)

```
dev_t = UnixType.dev_t
```

Device descriptor type.

```
gid_t = UnixType.gid_t
```

Group ID type.

```
ino_t = UnixType.ino_t
```

Inode type.

```
mode_t = UnixType.mode_t
```

Inode mode type.

```
nlink_t = UnixType.nlink_t
```

Number of links type.

```
off_t = UnixType.off_t
```

Offset type.

```
pcbool = UnixType.pcbool
```

Pointer to boolean type cbool ([1683](#))

```
pcchar = UnixType.pcchar
```

Alias for #rtl.UnixType.pcchar (1718)

```
pcdouble = UnixType.pcdouble
```

Pointer to cdouble (126) type.

```
pcffloat = UnixType.pcffloat
```

Pointer to cfloating-point type.

```
pclint = UnixTypepclint
```

Pointer to cInt (1683) type.

```
pclint16 = UnixTypepclint16
```

Pointer to 16-bit signed integer type

```
pclint32 = UnixTypepclint32
```

Pointer to signed 32-bit integer type

```
pclint64 = UnixTypepclint64
```

Pointer to signed 64-bit integer type

```
pclint8 = UnixTypepclint8
```

Pointer to 8-bits signed integer type

```
pClock = UnixType.pClock
```

Pointer to TClock (1690) type.

```
pclong = UnixTypepclong
```

Pointer to cLong (1683) type.

```
pclonglong = UnixTypepclonglong
```

Pointer to longlong type.

```
pcschar = UnixTypepcschar
```

Pointer to character type cschar (1684).

```
pcshort = UnixType.pcshort
```

Pointer to cShort (1684) type.

```
pcsigned = UnixType.pcsigned
```

Pointer to signed integer type csigned ([1684](#)).

```
pcrint = UnixType.pcrint
```

Pointer to signed integer type csint ([1684](#))

```
pcsize_t = UnixType.pcsize_t
```

Pointer to character size type pcsize_t.

```
pcslong = UnixType.pcslong
```

Pointer of the signed long cslong ([1684](#))

```
pcslonglong = UnixType.pcslonglong
```

Pointer to Signed longlong type cslonglong ([1684](#))

```
pcsshort = UnixType.pcsshort
```

Pointer to short signed integer type csshort ([1684](#))

```
pcuchar = UnixType.pcuchar
```

Alias for #rtl.UnixType.pcuchar ([1720](#))

```
pcuint = UnixType.pcuint
```

Pointer to cUInt ([1684](#)) type.

```
pcuint16 = UnixType.pcuint16
```

Pointer to 16-bit unsigned integer type

```
pcuint32 = UnixType.pcuint32
```

Pointer to unsigned 32-bit integer type

```
pcuint64 = UnixType.pcuint64
```

Pointer to unsigned 64-bit integer type

```
pcuint8 = UnixType.pcuint8
```

Pointer to 8-bits unsigned integer type

```
pculong = UnixType.pculong
```

Pointer to cuLong ([1685](#)) type.

```
pculonglong = UnixType.pculonglong
```

Unsigned longlong type

```
pcunsigned = UnixType.pcunsigned
```

Alias for #rtl.unixtype.pcunsigned ([1720](#))

```
pcushort = UnixType.pcushort
```

Pointer to cuShort ([1685](#)) type.

```
pDev = UnixType.pDev
```

Pointer to TDev ([1690](#)) type.

```
pGid = UnixType.pGid
```

Pointer to TGid ([1690](#)) type.

```
pid_t = UnixType.pid_t
```

Process ID type.

```
pIno = UnixType.pIno
```

Pointer to TIino ([1690](#)) type.

```
pMode = UnixType.pMode
```

Pointer to TMode ([1691](#)) type.

```
pnLink = UnixType.pnLink
```

Pointer to TnLink ([1691](#)) type.

```
pOff = UnixType.pOff
```

Pointer to TOff ([1691](#)) type.

```
pPid = UnixType.pPid
```

Pointer to TPid ([1691](#)) type.

```
pSize = UnixType.pSize
```

Pointer to TSize ([1691](#)) type.

```
pSize_t = UnixType.pSize_t
```

Pointer to type Size_t.

```
pSocklen = UnixType.pSocklen
```

Pointer to TSockLen (1691) type.

```
psSize = UnixType.psSize
```

Pointer to TsSize (1691) type

```
pstatfs = UnixType.PStatFs
```

Pointer to statfs type

```
pthread_cond_t = UnixType(pthread_cond_t
```

Thread conditional variable type.

```
pthread_mutex_t = UnixType(pthread_mutex_t
```

Thread mutex type.

```
pthread_t = UnixType(pthread_t
```

Posix thread type.

```
pTime = UnixType.pTime
```

Pointer to TTime (1691) type.

```
ptimespec = UnixType.ptimespec
```

Pointer to timespec (1690) type.

```
ptimeval = UnixType.ptimeval
```

Pointer to timeval (1690) type.

```
ptime_t = UnixType.ptime_t
```

Pointer to time_t (1690) type.

```
pUid = UnixType.pUid
```

Pointer to TUid (1691) type.

```
size_t = UnixType.size_t
```

Size specification type.

```
socklen_t = UnixType.socklen_t
```

Socket address length type.

```
ssize_t = UnixType.ssize_t
```

Small size type.

```
TClock = UnixType.TClock
```

Alias for `clock_t` ([1683](#)) type.

```
TDev = UnixType.TDev
```

Alias for `dev_t` ([1685](#)) type.

```
TFSearchOption = (NoCurrentDirectory, CurrentDirectoryFirst,
                  CurrentDirectoryLast)
```

Table 41.2: Enumeration values for type `TFSearchOption`

Value	Explanation
<code>CurrentDirectoryFirst</code>	Search the current directory first, before all directories in the search path.
<code>CurrentDirectoryLast</code>	Search the current directory last, after all directories in the search path
<code>NoCurrentDirectory</code>	Do not search the current directory unless it is specified in the search path.

Describes the search strategy used by `FSearch` ([1702](#))

```
TGid = UnixType.TGid
```

Alias for `gid_t` ([1685](#)) type.

```
timespec = UnixType.timespec
```

Short time specification type.

```
timeval = UnixType.timeval
```

Time specification type.

```
time_t = UnixType.time_t
```

Time span type

```
TIino = UnixType.TIino
```

Alias for `ino_t` ([1685](#)) type.

```
TIOCtlRequest = UnixType.TIOCtlRequest
```

Alias for the `TIOCtlRequest` ([1725](#)) type in `unixtypes`

```
TMode = UnixType.TMode
```

Alias for mode_t ([1685](#)) type.

```
TnLink = UnixType.TnLink
```

Alias for nlink_t ([1685](#)) type.

```
TOff = UnixType.TOff
```

Alias for off_t ([1685](#)) type.

```
TPid = UnixType.TPid
```

Alias for pid_t ([1688](#)) type.

```
Tpipe = baseunix.tfdlides deprecated
```

Array describing a pipe pair of filedescriptors.

```
TSize = UnixType.TSize
```

Alias for size_t ([1689](#)) type

```
TSocklen = UnixType.TSocklen
```

Alias for socklen_t ([1689](#)) type.

```
TsSize = UnixType.TsSize
```

Alias for ssize_t ([1690](#)) type

```
tstatfs = UnixType.TStatFs
```

Record describing a file system in the fpstatfs ([1701](#)) call.

```
TTime = UnixType.TTime
```

Alias for TTime ([1691](#)) type.

```
Ttimespec = UnixType.Ttimespec
```

Alias for TimeSpec ([1690](#)) type.

```
TTimeVal = UnixType.TTimeVal
```

Alias for timeval ([1690](#)) type.

```
TUid = UnixType.TUid
```

Alias for uid_t ([1691](#)) type.

```
uid_t = UnixType.uid_t
```

User ID type

41.2.3 Variables

`tzdaylight : Boolean`

Indicates whether daylight savings time is active.

`tzname : Array[boolean] of PChar`

Timezone name.

41.3 Procedures and functions

41.3.1 AssignPipe

Synopsis: Create a set of pipe file handlers

Declaration: `function AssignPipe(var pipe_in: cint;var pipe_out: cint) : cint`
`function AssignPipe(var pipe_in: text;var pipe_out: text) : cint`
`function AssignPipe(var pipe_in: File;var pipe_out: File) : cint`

Visibility: default

Description: `AssignPipe` creates a pipe, i.e. two file objects, one for input, one for output. What is written to `Pipe_out`, can be read from `Pipe_in`.

This call is overloaded. The in and out pipe can take three forms: an typed or untyped file, a text file or a file descriptor.

If a text file is passed then reading and writing from/to the pipe can be done through the usual `ReadLn(Pipe_in,...)` and `WriteLn(Pipe_out,...)` procedures.

The function returns `True` if everything went successfully, `False` otherwise.

Errors: In case the function fails and returns `False`, extended error information is returned by the `FpGetErrno` ([156](#)) function:

`sys_emfile`Too many file descriptors for this process.

`sys_enfile`The system file table is full.

See also: `POpen` ([1706](#)), `#rtl.baseunix.FpMkFifo` ([165](#))

Listing: `./unixex/ex36.pp`

Program Example36;

{ Program to demonstrate the `AssignPipe` function. }

Uses BaseUnix, Unix;

Var pipi, pipo : Text;
`s : String;`

begin

```
  WriteLn ('Assigning Pipes.');
  If assignpipe(pipi,pipo)<>0 then
    WriteLn('Error assigning pipes !',fpgeterrno);
  WriteLn ('Writing to pipe, and flushing.');
  WriteLn (pipo,'This is a textstring');close(pipo);
```

```

Writeln ('Reading from pipe.');
While not eof(pipi) do
  begin
    Readln (pipi,s);
    Writeln ('Read from pipe : ',s);
    end;
  close (pipi);
  writeln ('Closed pipes.');
  writeln
end.

```

41.3.2 AssignStream

Synopsis: Assign stream for in and output to a program

Declaration: function AssignStream(var StreamIn: text;var Streamout: text;
 const Prog: ansiString;
 const args: Array of ansistring) : cint
 function AssignStream(var StreamIn: text;var Streamout: text;
 var streamerr: text;const Prog: ansiString;
 const args: Array of ansistring) : cint

Visibility: default

Description: AssignStream creates a 2 or 3 pipes, i.e. two (or three) file objects, one for input, one for output,(and one for standard error) the other ends of these pipes are connected to standard input and output (and standard error) of Prog. Prog is the path of a program (including path). The options for the program can be specified in Args.

What is written to StreamOut, will go to the standard input of Prog. Whatever is written by Prog to its standard output can be read from StreamIn. Whatever is written by Prog to its standard error read from StreamErr, if present.

Reading and writing happens through the usual Readln (StreamIn,...) and Writeln (StreamOut,...) procedures.

Remark: You should *not* use Reset or Rewrite on a file opened with POpen. This will close the file before re-opening it again, thereby closing the connection with the program.

The function returns the process ID of the spawned process, or -1 in case of error.

Errors: Extended error information is returned by the FpGetErrno ([156](#)) function.

sys_emfileToo many file descriptors for this process.

sys_enfileThe system file table is full.

Other errors include the ones by the fork and exec programs

See also: AssignPipe ([1692](#)), POpen ([1706](#))

Listing: ./unixex/ex38.pp

Program Example38;

{ Program to demonstrate the AssignStream function. }

Uses BaseUnix , Unix ;

Var Si,So : Text;

```

S : String;
i : longint;

begin
  if not (paramstr(1)='–son') then
    begin
      Writeln ('Calling son');
      Assignstream (Si,So,'./ex38',[ '–son']);
      if fpgeterrno <>0 then
        begin
          writeln ('AssignStream failed !');
          halt(1);
        end;
      Writeln ('Speaking to son');
      For i:=1 to 10 do
        begin
          writeln (so,'Hello son !');
          if ioreturn <>0 then writeln ('Can''t speak to son... ');
        end;
      For i:=1 to 3 do writeln (so,'Hello chap !');
      close (so);
      while not eof(si) do
        begin
          readln (si,s);
          writeln ('Father: Son said : ',S);
        end;
      Writeln ('Stopped conversation');
      Close (Si);
      Writeln ('Put down phone');
    end
  Else
    begin
      Writeln ('This is the son ');
      While not eof (input) do
        begin
          readln (s);
          if pos ('Hello son !',S)<>0 then
            Writeln ('Hello Dad !')
          else
            writeln ('Who are you ?');
        end;
      close (output);
    end
  end.

```

41.3.3 FpExecL

Synopsis: Execute process (using argument list, environment)

Declaration: function FpExecL(const PathName: AnsiString;
 const S: Array of AnsiString) : cint

Visibility: default

Description: FpExecL replaces the currently running program with the program, specified in PathName. S is an array of command options. The executable in PathName must be an absolute pathname. The current process' environment is passed to the program. On success, FpExecL does not return.

Errors: Extended error information is returned by the FpGetErrno (156) function:

sys_eaccesFile is not a regular file, or has no execute permission. A component of the path has no search permission.
sys_epermThe file system is mounted *noexec*.
sys_e2bigArgument list too big.
sys_enoexecThe magic number in the file is incorrect.
sys_enoentThe file does not exist.
sys_enomemNot enough memory for kernel, or to split command line.
sys_enotdirA component of the path is not a directory.
sys_eloopThe path contains a circular reference (via symlinks).

See also: FpExecve (150), FpExecv (1697), FpExecvp (1698), FpExecle (1695), FpExeclp (1696), FpFork (153)

Listing: ./unixex/ex77.pp

```
Program Example77;

{ Program to demonstrate the FPExecL function. }

Uses Unix, strings;

begin
  { Execute 'ls -l', with current environment. }
  { 'ls' is NOT looked for in PATH environment variable.}
  FpExecL ('/bin/ls',[ '-l']);
end.
```

41.3.4 FpExecLE

Synopsis: Execute process (using argument list, environment)

Declaration: function FpExecLE(const PathName: AnsiString;
 const S: Array of AnsiString; MyEnv: PPChar) : cint

Visibility: default

Description: FpExecLE replaces the currently running program with the program, specified in PathName. S is an array of command options. The executable in PathName must be an absolute pathname. The environment in MyEnv is passed to the program. On success, FpExecLE does not return.

Errors: Extended error information is returned by the FpGetErrno (156) function:

sys_eaccesFile is not a regular file, or has no execute permission. A component of the path has no search permission.
sys_epermThe file system is mounted *noexec*.
sys_e2bigArgument list too big.
sys_enoexecThe magic number in the file is incorrect.
sys_enoentThe file does not exist.
sys_enomemNot enough memory for kernel, or to split command line.
sys_enotdirA component of the path is not a directory.

sys_eloopThe path contains a circular reference (via symlinks).

See also: [FpExecve \(150\)](#), [FpExecv \(1697\)](#), [FpExecvp \(1698\)](#), [FpExecl \(1694\)](#), [FpExeclp \(1696\)](#), [FpFork \(153\)](#)

Listing: ./unixex/ex11.pp

Program Example11;

```
{ Program to demonstrate the Execle function. }
```

Uses Unix, strings;

begin

```
{ Execute 'ls -l', with current environment. }
{ 'ls' is NOT looked for in PATH environment variable.}
{ envp is defined in the system unit.}
  Execle ('/bin/ls -l',envp);
```

end.

41.3.5 FpExecLP

Synopsis: Execute process (using argument list, environment; search path)

Declaration: `function FpExecLP(const PathName: AnsiString;
 const S: Array of AnsiString) : cint`

Visibility: default

Description: `FpExecLP` replaces the currently running program with the program, specified in `PathName`. `S` is an array of command options. The executable in `PathName` is searched in the path, if it isn't an absolute filename. The current environment is passed to the program. On success, `FpExecLP` does not return.

Errors: Extended error information is returned by the `FpGetErrno (156)` function:

- sys_eacces**File is not a regular file, or has no execute permission. A component of the path has no search permission.
- sys_eperm**The file system is mounted *noexec*.
- sys_e2big**Argument list too big.
- sys_enoexec**The magic number in the file is incorrect.
- sys_enoent**The file does not exist.
- sys_enomem**Not enough memory for kernel, or to split command line.
- sys_enotdir**A component of the path is not a directory.
- sys_eloop**The path contains a circular reference (via symlinks).

See also: [FpExecve \(150\)](#), [FpExecv \(1697\)](#), [FpExecvp \(1698\)](#), [FpExecl \(1695\)](#), [FpExecl \(1694\)](#), [FpFork \(153\)](#)

Listing: ./unixex/ex76.pp

```
Program Example76;

{ Program to demonstrate the FpExeclp function. }

Uses Unix, strings;

begin
  { Execute 'ls -l', with current environment. }
  { 'ls' is looked for in PATH environment variable.}
  { envp is defined in the system unit.}
  FpExeclp ('ls',[ '-l']);
end.
```

41.3.6 FpExecLPE

Synopsis: Execute a program in the path, and pass it an environment

Declaration: function FpExecLPE(const PathName: AnsiString;
 const S: Array of AnsiString;env: PPChar) : cint

Visibility: default

Description: FpExecLPE does the same as FpExecLP (1696), but additionally it specifies the environment for the new process in env, a pointer to a null-terminated array of null-terminated strings.

Errors: On success, this function does not return.

See also: FpExecLP (1696), FpExecLE (1695)

41.3.7 FpExecV

Synopsis: Execute process

Declaration: function FpExecV(const PathName: AnsiString;args: PPChar) : cint

Visibility: default

Description: FpExecV replaces the currently running program with the program, specified in PathName. It gives the program the options in args. This is a pointer to an array of pointers to null-terminated strings. The last pointer in this array should be nil. The current environment is passed to the program. On success, FpExecV does not return.

Errors: Extended error information is returned by the FpGetErrno (156) function:

- sys_eacces**File is not a regular file, or has no execute permission. A component of the path has no search permission.
- sys_eperm**The file system is mounted *noexec*.
- sys_e2big**Argument list too big.
- sys_enoexec**The magic number in the file is incorrect.
- sys_enoent**The file does not exist.
- sys_enomem**Not enough memory for kernel.
- sys_enotdir**A component of the path is not a directory.
- sys_eloop**The path contains a circular reference (via symlinks).

See also: [FpExecve](#) (150), [FpExecvp](#) (1698), [FpExecle](#) (1695), [FpExecl](#) (1694), [FpExeclp](#) (1696), [FpFork](#) (153)

Listing: ./unixex/ex8.pp

```

Program Example8;

{ Program to demonstrate the Execv function. }

Uses Unix, strings;

Const Arg0 : PChar = '/bin/ls';
        Arg1 : Pchar = '-l';

Var PP : PPchar;

begin
  GetMem (PP,3*SizeOf(Pchar));
  PP[0]:=Arg0;
  PP[1]:=Arg1;
  PP[3]:=Nil;
  { Execute '/bin/ls -l', with current environment }
  fpExecv ('/bin/ls',pp);
end.

```

41.3.8 FpExecVP

Synopsis: Execute process, search path

Declaration: function FpExecVP(const PathName: AnsiString; args: PPChar) : cint

Visibility: default

Description: FpExecVP replaces the currently running program with the program, specified in PathName. The executable in path is searched in the path, if it isn't an absolute filename. It gives the program the options in args. This is a pointer to an array of pointers to null-terminated strings. The last pointer in this array should be nil. The current environment is passed to the program. On success, execvp does not return.

Errors: Extended error information is returned by the FpGetErrno (156) function:

sys_eaccesFile is not a regular file, or has no execute permission. A component of the path has no search permission.
sys_epermThe file system is mounted *noexec*.
sys_e2bigArgument list too big.
sys_enoexecThe magic number in the file is incorrect.
sys_enoentThe file does not exist.
sys_enomemNot enough memory for kernel.
sys_enotdirA component of the path is not a directory.
sys_eloopThe path contains a circular reference (via symlinks).

See also: [FpExecve](#) (150), [FpExecv](#) (1697), [FpExecle](#) (1695), [FpExecl](#) (1694), [FpExeclp](#) (1696), [FpFork](#) (153)

Listing: ./unixex/ex79.pp

Program Example79;

{ Program to demonstrate the FpExecVP function. }

Uses Unix, strings;

Const Arg0 : PChar = 'ls';
Arg1 : PChar = '-l';

Var PP : PPChar;

```
begin
  GetMem (PP,3*SizeOf(PChar));
  PP[0]:=Arg0;
  PP[1]:=Arg1;
  PP[2]:=Nil;
  { Execute 'ls -l', with current environment. }
  { 'ls' is looked for in PATH environment variable. }
  fpExecvp ('ls',pp);
end.
```

41.3.9 FpExecVPE

Synopsis: Execute process, search path using environment

Declaration: function FpExecVPE(const PathName: AnsiString; args: PPChar; env: PPChar)
: cint

Visibility: default

Description: FpExecVP replaces the currently running program with the program, specified in PathName. The executable in path is searched in the path, if it isn't an absolute filename. It gives the program the options in args. This is a pointer to an array of pointers to null-terminated strings. The last pointer in this array should be nil. The environment in Env is passed to the program. On success, execvp does not return.

Errors: Extended error information is returned by the FpGetErrno ([156](#)) function:

sys_eaccesFile is not a regular file, or has no execute permission. A component of the path has no search permission.
sys_epermThe file system is mounted *noexec*.
sys_e2bigArgument list too big.
sys_enoexecThe magic number in the file is incorrect.
sys_enoentThe file does not exist.
sys_enomemNot enough memory for kernel.
sys_enotdirA component of the path is not a directory.
sys_eloopThe path contains a circular reference (via symlinks).

See also: FpExecve ([150](#)), FpExecv ([1697](#)), FpExecle ([1695](#)), FpExecl ([1694](#)), FpExeclp ([1696](#)), FpFork ([153](#))

Listing: ./unixex/ex79.pp

```

Program Example79;

{ Program to demonstrate the FpExecVP function. }

Uses Unix, strings;

Const Arg0 : PChar = 'ls';
        Arg1 : Pchar = '-l';

Var PP : PPchar;

begin
  GetMem (PP,3*SizeOf(Pchar));
  PP[0]:=Arg0;
  PP[1]:=Arg1;
  PP[2]:=Nil;
  { Execute 'ls -l', with current environment. }
  { 'ls' is looked for in PATH environment variable. }
  fpExecvp ('ls',pp);
end.

```

41.3.10 fpFlock

Synopsis: Lock a file (advisory lock)

Declaration: function fpFlock(var T: text;mode: cint) : cint
 function fpFlock(var F: File;mode: cint) : cint
 function fpFlock(fd: cint;mode: cint) : cint

Visibility: default

Description: FpFlock implements file locking. it sets or removes a lock on the file F. F can be of type Text or File, or it can be a linux filedescriptor (a longint) Mode can be one of the following constants :

LOCK_SHsets a shared lock.

LOCK_EXsets an exclusive lock.

LOCK_UNunlocks the file.

LOCK_NBThis can be OR-ed together with the other. If this is done the application doesn't block when locking.

The function returns zero if successful, a nonzero return value indicates an error.

Errors: Extended error information is returned by the FpGetErrno ([156](#)) function:

See also: #rtl.baseunix.FpFcntl ([151](#)), FSync ([1704](#))

41.3.11 fpfStatFS

Synopsis: Retrieve filesystem information.

Declaration: function fpfStatFS(Fd: cint;Info: pstatfs) : cint

Visibility: default

Description: fpStatFS returns in Info information about the filesystem on which the open file descriptor fd resides. Info is of type tstatfs. The function returns 0 if the call was successful, or an error code if the call failed.

Errors: On error, a non-zero error code is returned

See also: fpStatFS (1701), #rtl.baseunix.fpStat (154)

41.3.12 fpfsync

Synopsis: Flush cached data to disk

Declaration: function fpfsync(fd: cint) : cint

Visibility: default

Description: fpfsync forces the system to write all paged (in-memory) changes to file descriptor fd to disk. If the call was successful, 0 is returned.

Errors: On error, a nonzero error-code is returned.

41.3.13 fpgettimeofday

Synopsis: Return kernel time of day in GMT

Declaration: function fp gettimeofday(tp: ptimerval;tzp: ptimzone) : cint

Visibility: default

Description: FpGetTimeOfDay returns the number of seconds since 00:00, January 1 1970, GMT in a timerval record. This time NOT corrected any way, not taking into account timezones, daylight savings time and so on.

It is simply a wrapper to the kernel system call.

Errors: None.

41.3.14 fpStatFS

Synopsis: Retrieve filesystem information.

Declaration: function fpStatFS(Path: PChar;Info: pstatfs) : cint

Visibility: default

Description: fpStatFS returns in Info information about the filesystem on which the file or path Path resides. Info is of type tstatfs. The function returns 0 if the call was successful, or an error code if the call failed.

Errors: On error, a non-zero error code is returned

See also: fpFStatFS (1700), #rtl.baseunix.fpStat (186)

41.3.15 fpSystem

Synopsis: Execute and feed command to system shell

Declaration: function fpSystem(const Command: string) : cint
 function fpSystem(const Command: AnsiString) : cint

Visibility: default

Description: Shell invokes the bash shell (/bin/sh), and feeds it the command Command (using the -c option). The function then waits for the command to complete, and then returns the exit status of the command, or 127 if it could not complete the FpFork (153) or FpExecve (150) calls.

Errors: Errors are reported in (fpget)ErrNo (156)

See also: POpen (1706), Shell (1708), FpFork (153), FpExecve (150)

Listing: ./unixex/ex80.pp

```
program example56;

uses Unix;

{ Program to demonstrate the Shell function }

Var S : Longint;

begin
  Writeln ('Output of ls -l *.pp');
  S:=fpSystem('ls -l *.pp');
  Writeln ('Command exited wwith status : ',S);
end.
```

41.3.16 FSearch

Synopsis: Search for file in search path.

Declaration: function FSearch(const path: AnsiString; dirlist: AnsiString;
 CurrentDirStrategy: TFSearchOption) : AnsiString
 function FSearch(const path: AnsiString; dirlist: AnsiString)
 : AnsiString

Visibility: default

Description: FSearch searches in DirList, a colon separated list of directories, for a file named Path. It then returns a path to the found file.

The CurrentDirStrategy determines how the current directory is treated when searching:

NoCurrentDirectoryDo not search the current directory unless it is specified in the search path.

CurrentDirectoryFirstSearch the current directory first, before all directories in the search path.

CurrentDirectoryLastSearch the current directory last, after all directories in the search path

It is mainly provided to mimic DOS search path behaviour. Default behaviour is to search the current directory first.

Errors: An empty string if no such file was found.

See also: #rtl.unixutil.FNMatch (1731)

Listing: ./unixex/ex46.pp

```
Program Example46;

{ Program to demonstrate the FSearch function. }

Uses BaseUnix, Unix, Strings;

begin
  Writeln ('Is is in : ',FSearch ('Is',strpas(fpGetenv('PATH'))));
end.
```

41.3.17 fStatFS

Synopsis: Retrieve filesystem information from a file descriptor.

Declaration: function fStatFS(Fd: cint; var Info: tstatfs) : cint

Visibility: default

Description: fStatFS returns in Info information about the filesystem on which the file with file descriptor fd resides. Info is of type TStatFS (1726).

The function returns zero if the call was successful, a nonzero value is returned if the call failed.

Errors: Extended error information is returned by the FpGetErrno (156) function:

- sys_enotdir**A component of Path is not a directory.
- sys_einval**Invalid character in Path.
- sys_enoent**Path does not exist.
- sys_eaccess**Search permission is denied for component inPath.
- sys_eloop**A circular symbolic link was encountered in Path.
- sys_eio**An error occurred while reading from the filesystem.

See also: StatFS (1710), #rtl.baseunix.FpLStat (163)

Listing: ./unixex/ex91.pp

```
program Example30;

{ Program to demonstrate the FSStat function. }

uses BaseUnix, Unix, UnixType;

var s : string;
    fd : cint;
    info : tstatfs;

begin
  writeln ('Info about current partition : ');
  s:='.';
  while s<>'q' do
    begin
      Fd:=fpOpen(S,O_RDONLY);
```

```

if (fd >=0) then
  begin
    if fpfstatfs (fd ,@info)<>0 then
      begin
        writeln('Fstat failed. Errno : ',fpgeterrno);
        halt (1);
      end;
    FpClose(fd );
    writeln;
    writeln ('Result of fsstat on file ''',s,'''.');
  {$if defined(Linux) or defined(sunos)}
    // SysV like .
    writeln ('fstype : ',info.fstype);
  {$else}
    // BSD like , incl Mac OS X.
    writeln ('fstype : ',info.ftype);
  {$endif}
    writeln ('bsize : ',info.bsize);
    writeln ('bfree : ',info.bfree);
    writeln ('bavail : ',info.bavail);
    writeln ('files : ',info.files);
    writeln ('ffree : ',info.ffree);
  {$ifdef FreeBSD}
    writeln ('fsid : ',info.fsid[0]);
  {$else}
    writeln ('fsid : ',info.fsid[0]);
    writeln ('Namelen : ',info.namelen);
  {$endif}
    write ('Type name of file to do fsstat. (q quits) : ');
    readln (s)

    end;
  end;
end.

```

41.3.18 fsync

Synopsis: Synchronize file's kernel data with disk.

Declaration: function fsync(fd: cint) : cint

Visibility: default

Description: Fsync synchronizes the kernel data for file fd (the cache) with the disk. The call will not return till all file data was written to disk.

If the call was succesfull, 0 is returned. On failure, a nonzero value is returned.

Errors: Extended error information is returned by the FpGetErrno ([156](#)) function:

See also: FpFLock ([1700](#))

41.3.19 GetDomainName

Synopsis: Return current domain name

Declaration: function GetDomainName : string

Visibility: default

Description: Get the domain name of the machine on which the process is running. An empty string is returned if the domain is not set.

Errors: None.

See also: [GetHostName \(1705\)](#)

Listing: ./unixex/ex39.pp

```
Program Example39;  
  
{ Program to demonstrate the GetDomainName function. }  
  
Uses Unix;  
  
begin  
  Writeln ('Domain name of this machine is : ',GetDomainName);  
end.
```

41.3.20 GetHostName

Synopsis: Return host name

Declaration: function GetHostName : string

Visibility: default

Description: Get the hostname of the machine on which the process is running. An empty string is returned if hostname is not set.

Errors: None.

See also: [GetDomainName \(1704\)](#)

Listing: ./unixex/ex40.pp

```
Program Example40;  
  
{ Program to demonstrate the GetHostName function. }  
  
Uses unix;  
  
begin  
  Writeln ('Name of this machine is : ',GetHostName);  
end.
```

41.3.21 GetLocalTimezone

Synopsis: Return local timzeone information

Declaration: procedure GetLocalTimezone(timer: cint; var leap_correct: cint;
 var leap_hit: cint)
procedure GetLocalTimezone(timer: cint)

Visibility: default

Description: GetLocalTimeZone returns the local timezone information. It also initializes the TZSeconds variable, which is used to correct the epoch time to local time.

There should never be any need to call this function directly. It is called by the initialization routines of the Linux unit.

See also: [GetTimezoneFile \(1706\)](#), [ReadTimezoneFile \(1707\)](#)

41.3.22 GetTimezoneFile

Synopsis: Return name of timezone information file

Declaration: function GetTimezoneFile : string

Visibility: default

Description: GetTimezoneFile returns the location of the current timezone file. The location of file is determined as follows:

- 1.If /etc/timezone exists, it is read, and the contents of this file is returned. This should work on Debian systems.
- 2.If /usr/lib/zoneinfo/localtime exists, then it is returned. (this file is a symlink to the timezone file on SuSE systems)
- 3.If /etc/localtime exists, then it is returned. (this file is a symlink to the timezone file on RedHat systems)

Errors: If no file was found, an empty string is returned.

See also: [ReadTimezoneFile \(1707\)](#)

41.3.23 PClose

Synopsis: Close file opened with POpen ([1706](#))

Declaration: function PClose(var F: File) : cint
function PClose(var F: text) : cint

Visibility: default

Description: PClose closes a file opened with POpen ([1706](#)). It waits for the command to complete, and then returns the exit status of the command.

For an example, see [POpen \(1706\)](#)

Errors: Extended error information is returned by the FpGetErrno ([156](#)) function.

See also: [POpen \(1706\)](#)

41.3.24 POpen

Synopsis: Pipe file to standard input/output of program

Declaration: function POpen(var F: text;const Prog: Ansistring;rw: Char) : cint
function POpen(var F: File;const Prog: Ansistring;rw: Char) : cint

Visibility: default

Description: POpen runs the command specified in Prog, and redirects the standard in or output of the command to the other end of the pipe F. The parameter rw indicates the direction of the pipe. If it is set to 'W', then F can be used to write data, which will then be read by the command from stdinput. If it is set to 'R', then the standard output of the command can be read from F. F should be reset or rewritten prior to using it. F can be of type Text or File. A file opened with POpen can be closed with Close, but also with PClose (1706). The result is the same, but PClose returns the exit status of the command Prog.

Errors: Extended error information is returned by the FpGetErrno (156) function. Errors are essentially those of the Execve, Dup and AssignPipe commands.

See also: AssignPipe (1692), PClose (1706)

Listing: ./unixex/ex37.pp

```
Program Example37;

{ Program to demonstrate the Popen function. }

uses BaseUnix, Unix;

var f : text;
    i : longint;

begin
    writeln ('Creating a shell script to which echoes its arguments');
    writeln ('and input back to stdout');
    assign (f, 'test21a');
    rewrite (f);
    writeln (f, '#!/bin/sh');
    writeln (f, 'echo this is the child speaking.... ');
    writeln (f, 'echo got arguments $*');
    writeln (f, 'cat');
    writeln (f, 'exit 2');
    writeln (f);
    close (f);
    fpchmod ('test21a', &755);
    popen (f, './test21a arg1 arg2', 'W');
    if fpgeterrno<>0 then
        writeln ('error from POpen : errno : ', fpgeterrno);
    for i:=1 to 10 do
        writeln (f, 'This is written to the pipe, and should appear on stdout.');
    Flush(f);
    Writeln ('The script exited with status : ', PClose (f));
    writeln;
    writeln ('Press <return> to remove shell script.');
    readln;
    assign (f, 'test21a');
    erase (f)
end.
```

41.3.25 ReadTimezoneFile

Synopsis: Read the timezone file and initialize time routines

Declaration: procedure ReadTimezoneFile(fn: string)

Visibility: default

Description: `ReadTimeZoneFile` reads the timezone file `fn` and initializes the local time routines based on the information found there.

There should be no need to call this function. The initialization routines of the `linux` unit call this routine at unit startup.

Errors: None.

See also: `GetTimezoneFile` (1706), `GetLocalTimezone` (1705)

41.3.26 SeekDir

Synopsis: Seek to position in directory

Declaration: `procedure SeekDir(p: pDir; loc: clong)`

Visibility: default

Description: `SeekDir` sets the directory pointer to the `loc`-th entry in the directory structure pointed to by `p`.

For an example, see `#rtl.baseunix.fpOpenDir` (170).

Errors: Extended error information is returned by the `FpGetErrno` (156) function:

See also: `#rtl.baseunix.fpCloseDir` (147), `#rtl.baseunix.fpReadDir` (174), `#rtl.baseunix.fpOpenDir` (170), `TellDir` (1711)

41.3.27 SelectText

Synopsis: Wait for event on text file.

Declaration: `function SelectText(var T: Text; TimeOut: ptimeval) : cint`
`function SelectText(var T: Text; TimeOut: cint) : cint`

Visibility: default

Description: `SelectText` executes the `FpSelect` (177) call on a file of type `Text`. You can specify a timeout in `TimeOut`. The `SelectText` call determines itself whether it should check for read or write, depending on how the file was opened : With `Reset` it is checked for reading, with `Rewrite` and `Append` it is checked for writing.

Errors: See `#rtl.baseunix.FpSelect` (177). `SYS_EBADF` can also mean that the file wasn't opened.

See also: `#rtl.baseunix.FpSelect` (177)

41.3.28 Shell

Synopsis: Execute and feed command to system shell

Declaration: `function Shell(const Command: string) : cint`
`function Shell(const Command: AnsiString) : cint`

Visibility: default

Description: `Shell` invokes the bash shell (`/bin/sh`), and feeds it the command `Command` (using the `-c` option). The function then waits for the command to complete, and then returns the exit status of the command, or 127 if it could not complete the `FpFork` (153) or `FpExecve` (150) calls.

Errors: Extended error information is returned by the FpGetErrno (156) function:

See also: POpen (1706), FpSystem (1702), FpFork (153), FpExecve (150)

Listing: ./unixex/ex56.pp

```
program example56;
uses Unix;
{ Program to demonstrate the Shell function }

Var S : Longint;

begin
  Writeln ('Output of ls -l *.pp');
  S:=Shell ('ls -l *.pp');
  Writeln ('Command exited wwith status : ',S);
end.
```

41.3.29 SigRaise

Synopsis: Raise a signal (send to current process)

Declaration: procedure SigRaise(sig: Integer)

Visibility: default

Description: SigRaise sends a Sig signal to the current process.

Errors: None.

See also: #rtl.baseunix.FpKill (161), #rtl.baseunix.FpGetPid (158)

Listing: ./unixex/ex65.pp

```
Program example64;
{ Program to demonstrate the SigRaise function.}

uses Unix, BaseUnix;

Var
  oa,na : PSigActionrec;

Procedure DoSig(sig : Longint);cdecl;
begin
  writeln ('Receiving signal: ',sig);
end;

begin
  new(na);
  new(oa);
  na^.sa_handler:=SigActionHandler(@DoSig);
  fillchar(na^.Sa_Mask, sizeof(na^.Sa_Mask),#0);
  na^.Sa_Flags:=0;
  {$ifdef Linux}
```

```
// this member is linux only, and afaik even there arcane
na^.Sa_Restorer:=Nil;
{$endif}
if fpSigAction(SigUsr1,na,oa)<>0 then
begin
writeln('Error: ',fpgeterrno);
halt(1);
end;
writeln('Sending USR1 (',sigusr1,) signal to self.');
SigRaise(sigusr1);
end.
```

41.3.30 StatFS

Synopsis: Retrieve filesystem information from a path.

Declaration: function StatFS(Path: PChar;var Info: tstatfs) : cint
function StatFS(Path: ansistring;var Info: tstatfs) : cint

Visibility: default

Description: StatFS returns in Info information about the filesystem on which the file Path resides. Info is of type TStatFS ([1726](#)).

The function returns zero if the call was succesful, a nonzero value is returned if the call failed.

Errors: Extended error information is returned by the FpGetErrno ([156](#)) function:

sys_enotdirA component of Path is not a directory.
sys_einvalInvalid character in Path.
sys_enoentPath does not exist.
sys_eaccessSearch permission is denied for component inPath.
sys_eloopA circular symbolic link was encountered in Path.
sys_eioAn error occurred while reading from the filesystem.

See also: #rtl.baseunix.FpStat ([186](#)), #rtl.baseunix.FpLStat ([163](#))

Listing: ./unixex/ex91.pp

```
program Example30;

{ Program to demonstrate the FSStat function. }

uses BaseUnix, Unix, UnixType;

var s : string;
    fd : cint;
    info : tstatfs;

begin
  writeln ('Info about current partition : ');
  s:='.';
  while s<>'q' do
    begin
      Fd:=fpOpen(S,O_RDONLY);
      if (fd >= 0) then
```

```

begin
  if fpfstatfs (fd ,@info)<>0 then
    begin
      writeln( 'Fstat failed. Errno : ',fpgeterrno );
      halt (1);
      end;
      FpClose(fd );
      writeln ;
      writeln ( 'Result of fsstat on file ''',s,'''.' );
{ $if defined(Linux) or defined(sunos) }
  // SysV like .
  writeln ( 'fstype : ',info.fstype );
{ $else }
  // BSD like , incl Mac OS X.
  writeln ( 'fstype : ',info.ftype );
{$endif}

  writeln ( 'bsize : ',info.bsize );
  writeln ( 'bfree : ',info.bfree );
  writeln ( 'bavail : ',info.bavail );
  writeln ( 'files : ',info.files );
  writeln ( 'ffree : ',info.ffree );
{ $ifdef FreeBSD }
  writeln ( 'fsid : ',info.fsid[0]);
{ $else }
  writeln ( 'fsid : ',info.fsid[0]);
  writeln ( 'Namelen : ',info.namelen );
{ $endif}
  write ('Type name of file to do fsstat. (q quits) : ');
  readIn (s)

  end;
  end;
end.

```

41.3.31 TellDir

Synopsis: Return current location in a directory

Declaration: function TellDir(p: pDir) : TOff

Visibility: default

Description: TellDir returns the current location in the directory structure pointed to by p. It returns -1 on failure.

For an example, see #rtl.baseunix.fpOpenDir (170).

See also: #rtl.baseunix.fpCloseDir (147), #rtl.baseunix.fpReadDir (174), #rtl.baseunix.fpOpenDir (170), SeekDir (1708)

41.3.32 WaitProcess

Synopsis: Wait for process to terminate.

Declaration: function WaitProcess(Pid: cint) : cint

Visibility: default

Description: WaitProcess waits for process PID to exit. WaitProcess is equivalent to the #rtl.baseunix.FpWaitPID (194) call:

```
FpWaitPid(PID, @result, 0)
```

Handles of Signal interrupts (errno=EINTR), and returns the Exitcode of Process PID (>=0) or -Status if it was terminated

Errors: None.

See also: #rtl.baseunix.FpWaitPID (194), #rtl.baseunix.WTERMSIG (196), #rtl.baseunix.WSTOPSIG (196), #rtl.baseunix.WIFEXITED (195), WIFSTOPPED (1712), #rtl.baseunix.WIFSIGNALLED (196), W_EXITCODE (1712), W_STOPCODE (1712), #rtl.baseunix.WEXITSTATUS (195)

41.3.33 WIFSTOPPED

Synopsis: Check whether the process is currently stopped.

Declaration: function WIFSTOPPED(Status: Integer) : Boolean

Visibility: default

Description: WIFSTOPPED checks Status and returns true if the process is currently stopped. This is only possible if WUNTRACED was specified in the options of FpWaitPID (194).

See also: #rtl.baseunix.FpWaitPID (194), WaitProcess (1711), #rtl.baseunix.WTERMSIG (196), #rtl.baseunix.WSTOPSIG (196), #rtl.baseunix.WIFEXITED (195), #rtl.baseunix.WIFSIGNALLED (196), W_EXITCODE (1712), W_STOPCODE (1712), #rtl.baseunix.WEXITSTATUS (195)

41.3.34 W_EXITCODE

Synopsis: Construct an exit status based on an return code and signal.

Declaration: function W_EXITCODE(ReturnCode: Integer; Signal: Integer) : Integer

Visibility: default

Description: W_EXITCODE combines ReturnCode and Signal to a status code fit for WaitPid.

See also: #rtl.baseunix.FpWaitPID (194), WaitProcess (1711), #rtl.baseunix.WTERMSIG (196), #rtl.baseunix.WSTOPSIG (196), #rtl.baseunix.WIFEXITED (195), WIFSTOPPED (1712), #rtl.baseunix.WIFSIGNALLED (196), W_EXITCODE (1712), W_STOPCODE (1712), #rtl.baseunix.WEXITSTATUS (195)

41.3.35 W_STOPCODE

Synopsis: Construct an exit status based on a signal.

Declaration: function W_STOPCODE(Signal: Integer) : Integer

Visibility: default

Description: W_STOPCODE constructs an exit status based on Signal, which will cause WIFSIGNALLED (196) to return True

See also: #rtl.baseunix.FpWaitPID (194), WaitProcess (1711), #rtl.baseunix.WTERMSIG (196), #rtl.baseunix.WSTOPSIG (196), #rtl.baseunix.WIFEXITED (195), WIFSTOPPED (1712), #rtl.baseunix.WIFSIGNALLED (196), W_EXITCODE (1712), #rtl.baseunix.WEXITSTATUS (195)

Chapter 42

Reference for unit 'unixtype'

42.1 Overview

The `unixtype` unit contains the definitions of basic unix types. It was initially implemented by Marco van de Voort.

When porting to a new unix platform, this unit should be adapted to the sizes and conventions of the platform to which the compiler is ported.

42.2 Constants, types and variables

42.2.1 Constants

`ARG_MAX` = 131072

Max number of command-line arguments.

`NAME_MAX` = 255

Max length (in bytes) of filename

`PATH_MAX` = 4095

Max length (in bytes) of pathname

`Prio_PGrp` = 1

#rtl.baseunix.fpGetPriority (159) option: Get process group priority.

`Prio_Process` = 0

#rtl.baseunix.fpGetPriority (159) option: Get process priority.

`Prio_User` = 2

#rtl.baseunix.fpGetPriority (159) option: Get user priority.

`pthreadrwlocksize = 32`

`SIG_MAXSIG = 128`

Maximum signal number.

`SYS_NMLN = 65`

Max system namelength

`_PTHREAD_MUTEX_ADAPTIVE_NP = 3`

Mutex options:

`_PTHREAD_MUTEX_DEFAULT = _PTHREAD_MUTEX_NORMAL`

Mutex options:

`_PTHREAD_MUTEX_ERRORCHECK = _PTHREAD_MUTEX_ERRORCHECK_NP`

Mutex options:

`_PTHREAD_MUTEX_ERRORCHECK_NP = 2`

Mutex options: double lock returns an error code.

`_PTHREAD_MUTEX_FAST_NP = _PTHREAD_MUTEX_ADAPTIVE_NP`

Mutex options: Fast mutex

`_PTHREAD_MUTEX_NORMAL = _PTHREAD_MUTEX_TIMED_NP`

Mutex options:

`_PTHREAD_MUTEX_RECURSIVE = _PTHREAD_MUTEX_RECURSIVE_NP`

Mutex options:

`_PTHREAD_MUTEX_RECURSIVE_NP = 1`

Mutex options: recursive mutex

`_PTHREAD_MUTEX_TIMED_NP = 0`

Mutex options: ?

42.2.2 Types

cbool = longbool

Boolean type

cchar = cint8

C type: 8-bit signed integer

cdouble = Double

Double precision real format.

cfloat = single

Floating-point real format

cint = cint32

C type: integer (natural size)

cint16 = SmallInt

C type: 16 bits sized, signed integer.

cint32 = LongInt

C type: 32 bits sized, signed integer.

cint64 = Int64

C type: 64 bits sized, signed integer.

cint8 = ShortInt

C type: 8 bits sized, signed integer.

clock_t = culong

Clock ticks type

clong = LongInt

C type: long signed integer (double sized)

clongdouble = extended

Usually translates to an extended, but is CPU dependent.

clonglong = cint64

C type: 64-bit (double long) signed integer.

`cschar = cint8`

Signed character type

`cshort = cint16`

C type: short signed integer (half sized)

`csigned = cint`

`csigned` is an alias for `cint` ([1715](#)).

`csint = cint32`

Signed integer

`cslong = LongInt`

The size is CPU dependent.

`cslonglong = cint64`

`cslonglong` is an alias for `clonglong` ([1716](#)).

`csshort = cint16`

Short signed integer type

`cuchar = cuint8`

C type: 8-bit unsigned integer

`cuint = cuint32`

C type: unsigned integer (natural size)

`cuint16 = Word`

C type: 16 bits sized, unsigned integer.

`cuint32 = LongWord`

C type: 32 bits sized, unsigned integer.

`cuint64 = QWord`

C type: 64 bits sized, unsigned integer.

`cuint8 = Byte`

C type: 8 bits sized, unsigned integer.

```
culong = Cardinal
```

C type: long unsigned integer (double sized)

```
culonglong = cuint64
```

C type: 64-bit (double long) unsigned integer.

```
cunsigned = cuint
```

Alias for #rtl.unixtype.cuint ([1716](#))

```
cushort = cuint16
```

C type: short unsigned integer (half sized)

```
dev_t = cuint64
```

Device descriptor type.

```
gid_t = cuint32
```

Group ID type.

```
ino64_t = cuint64
```

ino64_t is an inode type capable of containing 64-bit inodes.

```
ino_t = clong
```

Inode type.

```
ipc_pid_t = cushort
```

Process ID

```
kDev_t = cushort
```

Kernel device type

```
mbstate_t = record
  __count : cint;
  __value : mbstate_value_t;
end
```

This type should never be used directly.

```
mbstate_value_t = record
end
```

This type should never be used directly. It is part of the mbstate_t ([1717](#)) type.

```
mode_t = cuint32
```

Inode mode type.

```
nlink_t = cuint32
```

Number of links type.

```
off64_t = cint64
```

64-bit offset type.

```
off_t = cint
```

Offset type.

```
pcbool = ^cbool
```

Pointer to boolean type cbool ([1715](#))

```
pcchar = ^cchar
```

Pointer to #rtl.UnixType.cchar ([1715](#))

```
pcdouble = ^cdouble
```

Pointer to cdouble ([1715](#)) type.

```
pcffloat = ^cfloat
```

Pointer to cfloat ([1715](#)) type.

```
pcint = ^cint
```

Pointer to cInt ([1715](#)) type.

```
pcint16 = ^cint16
```

Pointer to 16-bit signed integer type

```
pcint32 = ^cint32
```

Pointer to signed 32-bit integer type

```
pcint64 = ^cint64
```

Pointer to signed 64-bit integer type

```
pcint8 = ^cint8
```

Pointer to 8-bits signed integer type

```
pClock = ^clock_t
```

Pointer to TClock ([1724](#)) type.

```
pclong = ^clong
```

Pointer to cLong ([1715](#)) type.

```
pclongdouble = ^clongdouble
```

Pointer to the long double type clongdouble ([1715](#))

```
pclonglong = ^clonglong
```

Pointer to longlong type.

```
pcschar = ^cschar
```

Pointer to character type cschar ([1716](#)).

```
pcshort = ^cshort
```

Pointer to cShort ([1716](#)) type.

```
pcsigned = ^csigned
```

Pointer to signed integer type csined ([1716](#)).

```
pcsin = ^csint
```

Pointer to signed integer type csint ([1716](#))

```
pcslong = ^cslong
```

Pointer ot the signed long long cslong ([1716](#))

```
pcslonglong = ^cslonglong
```

Pointer to Signed longlong type cslonglong ([1716](#))

```
pcsshort = ^csshort
```

Pointer to short signed integer type csshort ([1716](#))

```
pcuchar = ^cuchar
```

Pointer to #rtl.UnixType.cuchar ([1716](#))

```
pcuint = ^cuint
```

Pointer to cUInt ([1716](#)) type.

```
pcuint16 = ^cuint16
```

Pointer to 16-bit unsigned integer type

```
pcuint32 = ^cuint32
```

Pointer to unsigned 32-bit integer type

```
pcuint64 = ^cuint64
```

Pointer to unsigned 64-bit integer type

```
pcuint8 = ^cuint8
```

Pointer to 8-bits unsigned integer type

```
pculong = ^culong
```

Pointer to cuLong ([1717](#)) type.

```
pculonglong = ^culonglong
```

Unsigned longlong type

```
pcunsigned = ^cunsigned
```

Pointer to #rtl.unixtype.cunsigned ([1717](#))

```
pcushort = ^cushort
```

Pointer to cuShort ([1717](#)) type.

```
pDev = ^dev_t
```

Pointer to TDev ([1724](#)) type.

```
pGid = ^gid_t
```

Pointer to TGid ([1724](#)) type.

```
pid_t = cint
```

Process ID type.

```
pIno = ^ino_t
```

Pointer to TIno (1725) type.

```
pIno64 = ^ino64_t
```

Pointer to ino64_t (1717)

```
pkDev = ^kDev_t
```

Pointer to TkDev (1725) type.

```
pmbstate_t = ^mbstate_t
```

Pointer to mbstate_t (1717) type

```
pMode = ^mode_t
```

Pointer to TMode (1725) type.

```
pnLink = ^nlink_t
```

Pointer to TnLink (1725) type.

```
pOff = ^off_t
```

Pointer to TOff (1725) type.

```
pOff64 = ^off64_t
```

Pointer to off64_t type

```
pPid = ^pid_t
```

Pointer to TPid (1725) type.

```
pSize = ^size_t
```

Pointer to TSize (1725) type.

```
psize_t = pSize
```

Pointer to size_t (1724) type.

```
pSockLen = ^socklen_t
```

Pointer to TSockLen (1726) type.

```
pSSize = ^ssize_t
```

Pointer to TsSize (1726) type

```
PStatFS = ^TStatfs
```

Pointer to TStatFS (1726) type.

```
pthread_attr_t = record
    __detachstate : cint;
    __schedpolicy : cint;
    __schedparam : sched_param;
    __inheritsched : cint;
    __scope : cint;
    __guardsize : size_t;
    __stackaddr_set : cint;
    __stackaddr : pointer;
    __stacksize : size_t;
end
```

`pthread_attr_t` describes the thread attributes. It should be considered an opaque record, the names of the fields can change anytime. Use the appropriate functions to set the thread attributes.

```
pthread_condattr_t = record
    __dummy : cint;
end
```

`pthread_condattr_t` describes the attributes of a thread mutex. It should be considered an opaque record, the names of the fields can change anytime.

```
pthread_cond_t = record
    __c_lock : _pthread_fastlock;
    __c_waiting : pointer;
    __padding : Array[0..48-1-sizeof(_pthread_fastlock)-sizeof(pointer)-sizeof(clonglong)];
    __align : clonglong;
end
```

`pthread_cond_t` describes a thread conditional variable. It should be considered an opaque record, the names of the fields can change anytime.

`pthread_key_t` = cuint

Thread local storage key (opaque)

```
pthread_mutexattr_t = record
    __mutexkind : cint;
end
```

`pthread_mutexattr_t` describes the attributes of a thread mutex. It should be considered an opaque record, the names of the fields can change anytime.

```
pthread_mutex_t = record
    __m_reserved : cint;
    __m_count : cint;
```

```
__m_owner : pointer;
__m_kind : cint;
__m_lock : _pthread_fastlock;
end
```

`_pthread_mutex_t` describes a thread mutex. It should be considered an opaque record, the names of the fields can change anytime.

```
pthread_rwlockattr_t = record
  __lockkind : cint;
  __pshared : cint;
end
```

`pthread_rwlockattr_t` describes the attributes of a lock. It should be considered an opaque record, the names of the fields can change anytime.

```
pthread_rwlock_t = record
end
```

`pthread_rwlock_t` describes a lock. It should be considered an opaque record, the names of the fields can change anytime.

`pthread_t` = culong

Thread description record

`pTime` = `^time_t`

Pointer to TTime ([1726](#)) type.

`ptimespec` = `^timespec`

Pointer to timespec ([1724](#)) record.

`ptimeval` = `^timeval`

Pointer to timeval ([1725](#)) record.

`ptime_t` = `^time_t`

Pointer to time_t ([1725](#)) type.

`pUid` = `^uid_t`

Pointer to TUid ([1726](#)) type.

`pwchar_t` = `^wchar_t`

Pointer to wchar_t ([1726](#)) type.

```
sched_param = record
    __sched_priority : cint;
end
```

Scheduling parameter description record.

```
sem_t = record
    __sem_lock : _pthread_fastlock;
    __sem_value : cint;
    __sem_waiting : pointer;
end
```

sem_t describes a thread semaphore. It should be considered an opaque record, the names of the fields can change anytime.

```
size_t = cuint32
```

Size specification type.

```
socklen_t = cuint32
```

Socket address length type.

```
ssize_t = cint32
```

Small size type.

```
TClock = clock_t
```

Alias for clock_t ([1715](#)) type.

```
TDev = dev_t
```

Alias for dev_t ([1717](#)) type.

```
TGid = gid_t
```

Alias for gid_t ([1717](#)) type.

```
timespec = record
    tv_sec : time_t;
    tv_nsec : clong;
end
```

Record specifying time interval.

```
timeval = record
    tv_sec : time_t;
    tv_usec : clong;
end
```

Time specification type.

```
time_t = clong
```

Time span type

```
TIno = ino_t
```

Alias for ino_t ([1717](#)) type.

```
TIno64 = ino64_t
```

Alias for ino64_t ([1717](#))

```
TIOCtlRequest = cint
```

Opaque type used in FpIOCtl ([161](#))

```
TkDev = kDev_t
```

Alias for kDev_t ([1717](#)) type.

```
TMode = mode_t
```

Alias for mode_t ([1718](#)) type.

```
TnLink = nlink_t
```

Alias for nlink_t ([1718](#)) type.

```
TOff = off_t
```

Alias for off_t ([1718](#)) type.

```
TOff64 = off64_t
```

Alias for off64_t type.

```
TPid = pid_t
```

Alias for pid_t ([1720](#)) type.

```
TSize = size_t
```

Alias for size_t ([1724](#)) type

TSockLen = socklen_t

Alias for socklen_t ([1724](#)) type.

TSSize = ssize_t

Alias for ssize_t ([1724](#)) type

```
TStatfs = record
  fstype : cint;
  bsize : cint;
  blocks : culong;
  bfree : culong;
  bavail : culong;
  files : culong;
  ffree : culong;
  fsid : Array[0..1] of cint;
  namelen : cint;
  frsize : cint;
  spare : Array[0..4] of cint;
end
```

Record describing a file system in the baseunix.fpstatafs ([102](#)) call.

TTime = time_t

Alias for TTime ([1726](#)) type.

TTimeType = timespec

Alias for TimeSpec ([1724](#)) type.

TTimeVal = timeval

Alias for TimeVal ([1725](#)) record.

TUid = uid_t

Alias for uid_t ([1726](#)) type.

uid_t = cuint32

User ID type

wchar_t = cint32

Wide character type.

wint_t = cint32

Wide character size type.

```
_pthread_fastlock = record
    __status : clong;
    __spinlock : cint;
end
```

`_pthread_fastlock` describes a thread mutex. It should be considered an opaque record, the names of the fields can change anytime.

Chapter 43

Reference for unit 'unixutil'

43.1 Overview

The UnixUtil unit contains some of the routines that were present in the old Linux unit, but which do not really belong in the unix ([1676](#)) or baseunix ([102](#)) units.

Most of the functions described here have cross-platform counterparts in the SysUtils ([1449](#)) unit. It is therefore recommended to use that unit.

43.2 Constants, types and variables

43.2.1 Types

ComStr = string deprecated

Command-line string type.

DirStr = string deprecated

Filename directory part string type.

ExtStr = string deprecated

Filename extension part string type.

NameStr = string deprecated

Filename name part string type.

PathStr = string deprecated

Filename full path string type.

43.2.2 Variables

Tzseconds : LongInt

Seconds west of GMT

43.3 Procedures and functions

43.3.1 ArrayStringToPPchar

Synopsis: Convert an array of string to an array of null-terminated strings

Declaration: function ArrayStringToPPchar(const S: Array of AnsiString;
reserveentries: LongInt) : ppchar

Visibility: default

Description: `ArrayStringToPPchar` creates an array of null-terminated strings that point to strings which are the same as the strings in the array `S`. The function returns a pointer to this array. The array and the strings it contains must be disposed of after being used, because it they are allocated on the heap. The `ReserveEntries` parameter tells `ArrayStringToPPchar` to allocate room at the end of the array for another `ReserveEntries` entries.

Errors: If not enough memory is available, an error may occur.

See also: [StringToPPChar \(1734\)](#)

43.3.2 Basename

Synopsis: Return basename of a file

Declaration: function Basename(const path: PathStr; const suf: PathStr) : PathStr

Visibility: default

Description: Returns the filename part of `Path`, stripping off `Suf` if it exists. The filename part is the whole name if `Path` contains no slash, or the part of `Path` after the last slash. The last character of the result is not a slash, unless the directory is the root directory.

Errors: None.

See also: [DirName \(1730\)](#)

Listing: ./unutilex/ex48.pp

```
Program Example48;

{ Program to demonstrate the BaseName function. }

Uses Dos, Unix, UnixUtil;

Var S : String;

begin
  S:=FExpand(Paramstr(0));
  Writeln ('This program is called : ',Basename(S,''));
end.
```

43.3.3 Dirname

Synopsis: Extract directory part from filename

Declaration: function Dirname(const path: PathStr) : PathStr

Visibility: default

Description: Returns the directory part of Path. The directory is the part of Path before the last slash, or empty if there is no slash. The last character of the result is not a slash, unless the directory is the root directory.

Errors: None.

See also: [BaseName \(1729\)](#)

Listing: ./unutilex/ex47.pp

```
Program Example47;

{ Program to demonstrate the DirName function. }

Uses Dos, Unix, UnixUtil;

Var S : String;

begin
  S:=FExpand(Paramstr(0));
  WriteLn ('This program is in directory : ',Dirname(S));
end.
```

43.3.4 EpochToLocal

Synopsis: Convert epoch time to local time

Declaration: procedure EpochToLocal(epoch: LongInt; var year: Word; var month: Word;
var day: Word; var hour: Word; var minute: Word;
var second: Word)

Visibility: default

Description: Converts the epoch time (=Number of seconds since 00:00:00 , January 1, 1970, corrected for your time zone) to local date and time.

This function takes into account the timzeone settings of your system.

Errors: None

See also: [LocalToEpoch \(1733\)](#)

Listing: ./unutilex/ex3.pp

```
Program Example3;

{ Program to demonstrate the EpochToLocal function. }

Uses BaseUnix, Unix, UnixUtil;

Var Year,month,day,hour,minute,seconds : Word;
```

```
begin
  EpochToLocal (FPTime,Year,month,day,hour,minute,seconds);
  Writeln ('Current date : ',Day:2,'/',Month:2,'/',Year:4);
  Writeln ('Current time : ',Hour:2,':',minute:2,':',seconds:2);
end.
```

43.3.5 FNMatch

Synopsis: Check whether filename matches wildcard specification

Declaration: function FNMatch(const Pattern: string;const Name: string) : Boolean

Visibility: default

Description: FNMatch returns True if the filename in Name matches the wildcard pattern in Pattern, False otherwise.

Pattern can contain the wildcards * (match zero or more arbitrary characters) or ? (match a single character).

Errors: None.

See also: #rtl.unix.FSearch ([1702](#))

Listing: ./unutilex/ex69.pp

Program Example69;

{ Program to demonstrate the FNMatch function. }

Uses unixutil;

Procedure TestMatch(Pattern,Name : String);

begin

```
  Write ('"',Name,'"');
  If FNMatch (Pattern,Name) then
    Write ('matches')
  else
    Write ('does not match');
  Writeln ('"',Pattern,'"');
end;
```

begin

```
  TestMatch ('*', 'FileName');
  TestMatch ('.*', 'FileName');
  TestMatch ('*a*', 'FileName');
  TestMatch ('?ile*', 'FileName');
  TestMatch ('?', 'FileName');
  TestMatch ('.? ', 'FileName');
  TestMatch ('?a*', 'FileName');
  TestMatch ('??*me?', 'FileName');
end.
```

43.3.6 FSplit

Synopsis: Split filename into path, name and extension

Declaration: procedure FSplit(const Path: PathStr; var Dir: DirStr; var Name: NameStr; var Ext: ExtStr)

Visibility: default

Description: FSplit splits a full file name into 3 parts : A Path, a Name and an extension (in ext). The extension is taken to be all letters after the last dot (.).

Errors: None.

See also: #rtl.unix.FSearch ([1702](#))

Listing: ./unutilex/ex67.pp

```
Program Example67;

uses UnixUtil;

{ Program to demonstrate the FSplit function. }

var
  Path,Name,Ext : string;

begin
  FSplit(ParamStr(1),Path,Name,Ext);
  WriteLn('Split ',ParamStr(1),' in :');
  WriteLn('Path      : ',Path);
  WriteLn('Name      : ',Name);
  WriteLn('Extension : ',Ext);
end.
```

43.3.7 GetFS

Synopsis: Return file selector

Declaration: function GetFS(var T: Text) : LongInt
function GetFS(var F: File) : LongInt

Visibility: default

Description: GetFS returns the file selector that the kernel provided for your file. In principle you don' need this file selector. Only for some calls it is needed, such as the #rtl.baseunix.fpSelect ([177](#)) call or so.

Errors: In case the file was not opened, then -1 is returned.

See also: #rtl.baseunix.fpSelect ([177](#))

Listing: ./unutilex/ex34.pp

```
Program Example33;

{ Program to demonstrate the SelectText function. }

Uses Unix;
```

```

Var tv : TimeVal;

begin
  Writeln ('Press the <ENTER> to continue the program.');
  { Wait until File descriptor 0 (=Input) changes }
  SelectText (Input, nil);
  { Get rid of <ENTER> in buffer }
  readIn;
  Writeln ('Press <ENTER> key in less than 2 seconds... ');
  tv.tv_sec:=2;
  tv.tv_usec:=0;
  if SelectText (Input, @tv)>0 then
    Writeln ('Thank you !')
  else
    Writeln ('Too late !');
end.

```

43.3.8 GregorianToJulian

Synopsis: Converts a gregorian date to a julian date

Visibility: default

Description: GregorianToJulian takes a gregorian date and converts it to a Julian day.

Errors: None.

See also: JulianToGregorian (1733)

43.3.9 JulianToGregorian

Synopsis: Converts a julian date to a gregorian date

Declaration: procedure JulianToGregorian(JulianDN: LongInt; var Year: Word;
var Month: Word; var Day: Word)

Visibility: default

Description: JulianToGregorian takes a julian day and converts it to a gregorian date. (Start of the Julian Date count is from 0 at 12 noon 1 JAN -4712 (4713 BC),

Errors: None.

See also: GregorianToJulian (1733)

43.3.10 LocalToEpoch

Synopsis: Convert local time to epoch (unix) time

Declaration: function LocalToEpoch(year: Word; month: Word; day: Word; hour: Word;
minute: Word; second: Word) : LongInt

Visibility: default

Description: Converts the Local time to epoch time (=Number of seconds since 00:00:00 , January 1, 1970).

Errors: None

See also: EpochToLocal ([1730](#))

Listing: ./unutillex/ex4.pp

```
Program Example4;

{ Program to demonstrate the LocalToEpoch function. }

Uses UnixUtil;

Var year,month,day,hour,minute,second : Word;

begin
  Write ('Year    : ');readIn(Year);
  Write ('Month   : ');readIn(Month);
  Write ('Day     : ');readIn(Day);
  Write ('Hour    : ');readIn(Hour);
  Write ('Minute  : ');readIn(Minute);
  Write ('Seconds : ');readIn(Second);
  Write ('This is : ');
  Write (LocalToEpoch(year,month,day,hour,minute,second));
  Writeln (' seconds past 00:00 1/1/1980');
end.
```

43.3.11 StringToPPChar

Synopsis: Split string in list of null-terminated strings

Declaration: function StringToPPChar(S: PChar;ReserveEntries: Integer) : ppchar
 function StringToPPChar(var S: string;ReserveEntries: Integer) : ppchar
 function StringToPPChar(var S: AnsiString;ReserveEntries: Integer)
 : ppchar

Visibility: default

Description: StringToPPChar splits the string S in words, replacing any whitespace with zero characters. It returns a pointer to an array of pchars that point to the first letters of the words in S. This array is terminated by a Nil pointer.

The function does *not* add a zero character to the end of the string unless it ends on whitespace.

The function reserves memory on the heap to store the array of PChar; The caller is responsible for freeing this memory.

This function can be called to create arguments for the various Exec calls.

Errors: None.

See also: ArrayStringToPPchar ([1729](#)), #rtl.baseunix.FpExecve ([150](#))

Listing: ./unutillex/ex70.pp

```
Program Example70;
```

{ Program to demonstrate the StringToPPchar function. }

```
Uses UnixUtil;

Var S : String;
    P : PPChar;
    I : longint;

begin
    // remark whitespace at end.
    S:= 'This is a string with words. ';
    P:=StringToPPChar(S,0);
    I:=0;
    While P[i]<>Nil do
        begin
            WriteLn( 'Word ',i,' : ',P[i]);
            Inc(I);
        end;
    FreeMem(P, i*SizeOf(Pchar));
end.
```

Chapter 44

Reference for unit 'video'

44.1 Overview

The Video unit implements a screen access layer which is system independent. It can be used to write on the screen in a system-independent way, which should be optimal on all platforms for which the unit is implemented.

The working of the Video is simple: After calling `InitVideo` (1754), the array `VideoBuf` contains a representation of the video screen of size `ScreenWidth*ScreenHeight`, going from left to right and top to bottom when walking the array elements: `VideoBuf[0]` contains the character and color code of the top-left character on the screen. `VideoBuf[ScreenWidth]` contains the data for the character in the first column of the second row on the screen, and so on.

To write to the 'screen', the text to be written should be written to the `VideoBuf` array. Calling `UpdateScreen` (1757) will then cp the text to the screen in the most optimal way. (an example can be found further on).

The color attribute is a combination of the foreground and background color, plus the blink bit. The bits describe the various color combinations:

bits 0-3 The foreground color. Can be set using all color constants.

bits 4-6 The background color. Can be set using a subset of the color constants.

bit 7 The blinking bit. If this bit is set, the character will appear blinking.

Each possible color has a constant associated with it, see the constants section for a list of constants.

The foreground and background color can be combined to a color attribute with the following code:

```
Attr:=ForeGroundColor + (BackGroundColor shl 4);
```

The color attribute can be logically or-ed with the blink attribute to produce a blinking character:

```
Attr:=Attr or blink;
```

But not all drivers may support this.

The contents of the `VideoBuf` array may be modified: This is 'writing' to the screen. As soon as everything that needs to be written in the array is in the `VideoBuf` array, calling `UpdateScreen` will copy the contents of the array screen to the screen, in a manner that is as efficient as possible.

The updating of the screen can be prohibited to optimize performance; To this end, the LockScreenUpdate (1754) function can be used: This will increment an internal counter. As long as the counter differs from zero, calling UpdateScreen (1757) will not do anything. The counter can be lowered with UnlockScreenUpdate (1757). When it reaches zero, the next call to UpdateScreen (1757) will actually update the screen. This is useful when having nested procedures that do a lot of screen writing.

The video unit also presents an interface for custom screen drivers, thus it is possible to override the default screen driver with a custom screen driver, see the SetVideoDriver (1756) call. The current video driver can be retrieved using the GetVideoDriver (1752) call.

Remark: The video unit should *not* be used together with the crt unit. Doing so will result in very strange behaviour, possibly program crashes.

44.2 Examples utility unit

The examples in this section make use of the unit vidutil, which contains the TextOut function. This function writes a text to the screen at a given location. It looks as follows:

Listing: ./videoex/vidutil.pp

```

unit vidutil;

Interface

uses
  video;

Procedure TextOut(X,Y : Word;Const S : String);

Implementation

Procedure TextOut(X,Y : Word;Const S : String);

Var
  W,P,I,M : Word;

begin
  P:=((X-1)+(Y-1)*ScreenWidth);
  M:=Length(S);
  If P+M>ScreenWidth*ScreenHeight then
    M:=ScreenWidth*ScreenHeight-P;
  For I:=1 to M do
    VideoBuf^[P+I-1]:=Ord(S[i])+($07 shl 8);
  end;
end.

```

44.3 Writing a custom video driver

Writing a custom video driver is not difficult, and generally means implementing a couple of functions, which would be registered with the SetVideoDriver (1756) function. The various functions that can be implemented are located in the TVideoDriver (1746) record:

```
TVideoDriver = Record
```

```

InitDriver      : Procedure;
DoneDriver      : Procedure;
UpdateScreen   : Procedure(Force : Boolean);
ClearScreen    : Procedure;
SetVideoMode    : Function (Const Mode : TVideoMode) : Boolean;
GetVideoModeCount : Function : Word;
GetVideoModeData : Function(Index : Word; Var Data : TVideoMode) : Boolean;
SetCursorPos    : procedure (NewCursorX, NewCursorY: Word);
GetCursorType   : function : Word;
SetCursorType   : procedure (NewType: Word);
GetCapabilities : Function : Word;
end;

```

Not all of these functions must be implemented. In fact, the only absolutely necessary function to write a functioning driver is the `UpdateScreen` function. The general calls in the `Video` unit will check which functionality is implemented by the driver.

The functionality of these calls is the same as the functionality of the calls in the video unit, so the expected behaviour can be found in the previous section. Some of the calls, however, need some additional remarks.

InitDriver Called by `InitVideo`, this function should initialize any data structures needed for the functionality of the driver, maybe do some screen initializations. The function is guaranteed to be called only once; It can only be called again after a call to `DoneVideo`. The variables `ScreenWidth` and `ScreenHeight` should be initialized correctly after a call to this function, as the `InitVideo` call will initialize the `VideoBuf` and `OldVideoBuf` arrays based on their values.

DoneDriver This should clean up any structures that have been initialized in the `InitDriver` function. It should possibly also restore the screen as it was before the driver was initialized. The `VideoBuf` and `OldVideoBuf` arrays will be disposed of by the general `DoneVideo` call.

UpdateScreen This is the only required function of the driver. It should update the screen based on the `VideoBuf` array's contents. It can optimize this process by comparing the values with values in the `OldVideoBuf` array. After updating the screen, the `UpdateScreen` procedure should update the `OldVideoBuf` by itself. If the `Force` parameter is `True`, the whole screen should be updated, not just the changed values.

ClearScreen If there is a faster way to clear the screen than to write spaces in all character cells, then it can be implemented here. If the driver does not implement this function, then the general routines will write spaces in all video cells, and will call `UpdateScreen` (`True`).

SetVideoMode Should set the desired video mode, if available. It should return `True` if the mode was set, `False` if not.

GetVideoModeCount Should return the number of supported video modes. If no modes are supported, this function should not be implemented; the general routines will return 1. (for the current mode)

GetVideoModeData Should return the data for the `Index`-th mode; `Index` is zero based. The function should return true if the data was returned correctly, false if `Index` contains an invalid index. If this is not implemented, then the general routine will return the current video mode when `Index` equals 0.

GetCapabilities If this function is not implemented, zero (i.e. no capabilities) will be returned by the general function.

The following unit shows how to override a video driver, with a driver that writes debug information to a file. The unit can be used in any of the demonstration programs, by simply including it in the uses clause. Setting DetailedVideoLogging to True will create a more detailed log (but will also slow down functioning)

Listing: ./videoex/viddbg.pp

```

unit viddbg;

Interface

uses video;

Procedure StartVideoLogging;
Procedure StopVideoLogging;
Function IsVideoLogging : Boolean;
Procedure SetVideoLogFileName(FileName : String);

Const
  DetailedVideoLogging : Boolean = False;

Implementation

uses sysutils, keyboard;

var
  NewVideoDriver,
  OldVideoDriver : TVideoDriver;
  Active, Logging : Boolean;
  LogFileName : String;
  VideoLog : Text;

Function TimeStamp : String;

begin
  TimeStamp:=FormatDateTime( 'hh:nn:ss' ,Time() );
end ;

Procedure StartVideoLogging;

begin
  Logging:=True;
  WriteLn(VideoLog , 'Start logging video operations at: ' ,TimeStamp);
end ;

Procedure StopVideoLogging;

begin
  WriteLn(VideoLog , 'Stop logging video operations at: ' ,TimeStamp);
  Logging:=False;
end ;

Function IsVideoLogging : Boolean;

begin
  IsVideoLogging:=Logging;
end ;

```

```

Var
  ColUpd,RowUpd : Array[0..1024] of Integer;

Procedure DumpScreenStatistics(Force : Boolean);

Var
  I,Count : Integer;

begin
  If Force then
    Write(VideoLog,'forced ');
    Writeln(VideoLog,'video update at ',TimeStamp,' : ');
    FillChar(Colupd,SizeOf(ColUpd),#0);
    FillChar(Rowupd,SizeOf(RowUpd),#0);
    Count:=0;
    For I:=0 to VideoBufSize div SizeOf(TVideoCell) do
      begin
        If VideoBuf^[i]<>OldVideoBuf^[i] then
          begin
            Inc(Count);
            Inc(ColUpd[I mod ScreenWidth]);
            Inc(RowUpd[I div ScreenHeight]);
          end;
      end;
      Write(VideoLog,Count,' video cells differed divided over ');
      Count:=0;
    For I:=0 to ScreenWidth-1 do
      If ColUpd[I]<>0 then
        Inc(Count);
      Write(VideoLog,Count,' columns and ');
      Count:=0;
    For I:=0 to ScreenHeight-1 do
      If RowUpd[I]<>0 then
        Inc(Count);
      Writeln(VideoLog,Count,' rows.');
    If DetailedVideoLogging Then
      begin
        For I:=0 to ScreenWidth-1 do
          If (ColUpd[I]<>0) then
            Writeln(VideoLog,'Col ',i,' : ',ColUpd[I]:3,' rows changed');
        For I:=0 to ScreenHeight-1 do
          If (RowUpd[I]<>0) then
            Writeln(VideoLog,'Row ',i,' : ',RowUpd[I]:3,' columns changed');
      end;
    end;
  end;

Procedure LogUpdateScreen(Force : Boolean);

begin
  If Logging then
    DumpScreenStatistics(Force);
    OldVideoDriver.UpdateScreen(Force);
end;

Procedure LogInitVideo;

begin
  OldVideoDriver.InitDriver();

```

```

Assign(VideoLog, logFileName);
Rewrite(VideoLog);
Active := True;
StartVideoLogging;
end;

Procedure LogDoneVideo;

begin
  StopVideoLogging;
  Close(VideoLog);
  Active := False;
  OldVideoDriver.DoneDriver();
end;

Procedure SetVideoLogFileName(FileName : String);

begin
  If Not Active then
    LogFileName := FileName;
end;

Initialization
  GetVideoDriver(OldVideoDriver);
  NewVideoDriver := OldVideoDriver;
  NewVideoDriver.UpdateScreen := @LogUpdateScreen;
  NewVideoDriver.InitDriver := @LogInitVideo;
  NewVideoDriver.DoneDriver := @LogDoneVideo;
  LogFileName := 'Video.log';
  Logging := False;
  SetVideoDriver(NewVideoDriver);
end.

```

44.4 Constants, types and variables

44.4.1 Constants

Black = 0

Black color attribute

Blink = 128

Blink attribute

Blue = 1

Blue color attribute

Brown = 6

Brown color attribute

cpBlink = \$0002

Video driver supports blink attribute

cpChangeCursor = \$0020

Video driver supports changing cursor shape.

cpChangeFont = \$0008

Video driver supports changing screen font.

cpChangeMode = \$0010

Video driver supports changing mode

cpColor = \$0004

Video driver supports color

cpUnderLine = \$0001

Video driver supports underline attribute

crBlock = 2

Block cursor

crHalfBlock = 3

Half block cursor

crHidden = 0

Hide cursor

crUnderLine = 1

Underline cursor

Cyan = 3

Cyan color attribute

DarkGray = 8

Dark gray color attribute

errOk = 0

No error

ErrorCode : LongInt = ErrOK

Error code returned by the last operation.

```
ErrorHandler : TErrorHandler = @DefaultErrorHandler
```

The `ErrorHandler` variable can be set to a custom-error handling function. It is set by default to the `DefaultErrorHandler` ([1748](#)) function.

```
ErrorInfo : Pointer = Nil
```

Pointer to extended error information.

```
errVioBase = 1000
```

Base value for video errors

```
errVioInit = errVioBase + 1
```

Video driver initialization error.

```
errVioNoSuchMode = errVioBase + 3
```

Invalid video mode

```
errVioNotSupported = errVioBase + 2
```

Unsupported video function

```
FVMaxWidth = 240
```

Maximum screen buffer width.

```
Green = 2
```

Green color attribute

```
iso_codepages = [iso01, iso02, iso03, iso04, iso05, iso06, iso07, iso08, iso09, iso10]
```

`iso_codepages` is a set containing all code pages that use an ISO encoding.

```
LightBlue = 9
```

Light Blue color attribute

```
LightCyan = 11
```

Light cyan color attribute

```
LightGray = 7
```

Light gray color attribute

```
LightGreen = 10  
Light green color attribute  
LightMagenta = 13  
Light magenta color attribute  
LightRed = 12  
Light red color attribute  
LowAscii = True
```

On some systems, the low 32 values of the DOS code page are necessary for the ASCII control codes and cannot be displayed by programs. If LowAscii is true, you can use the low 32 ASCII values. If it is false, you must avoid using them.

LowAscii can be implemented either through a constant, variable or property. You should under no circumstances assume that you can write to LowAscii, or take its address.

```
Magenta = 5  
Magenta color attribute  
NoExtendedFrame = False
```

The VT100 character set only has line drawing characters consisting of a single line. If this value is true, the line drawing characters with two lines will be automatically converted to single lines.

NoExtendedFrame can be implemented either through a constant, variable or property. You should under no circumstances assume that you can write to NoExtendedFrame, or take its address.

```
Red = 4  
Red color attribute  
ScreenHeight : Word = 0  
Current screen height  
ScreenWidth : Word = 0  
Current screen Width  
vga_codepages = [cp437, cp850, cp852, cp866]
```

vga_codepages is a set containing all code pages that can be considered a normal vga font (as in use on early VGA cards) Note that KOI8-R has line drawing characters in wrong place.

```
vioOK = 0  
No errors occurred  
White = 15  
White color attribute  
Yellow = 14  
Yellow color attribute
```

44.4.2 Types

PVideoBuf = ^TVideoBuf

Pointer type to TVideoBuf ([1746](#))

PVideoCell = ^TVideoCell

Pointer type to TVideoCell ([1746](#))

PVideoMode = ^TVideoMode

Pointer to TVideoMode ([1746](#)) record.

```
Tencoding = (cp437, cp850, cp852, cp866, koi8r, iso01, iso02, iso03, iso04,
             iso05, iso06, iso07, iso08, iso09, iso10, iso13, iso14, iso15, utf8)
```

Table 44.1: Enumeration values for type Tencoding

Value	Explanation
cp437	Codepage 437
cp850	Codepage 850
cp852	Codepage 852
cp866	Codepage 866
iso01	ISO 8859-1
iso02	ISO 8859-2
iso03	ISO 8859-3
iso04	ISO 8859-4
iso05	ISO 8859-5
iso06	ISO 8859-6
iso07	ISO 8859-7
iso08	ISO 8859-8
iso09	ISO 8859-9
iso10	ISO 8859-10
iso13	ISO 8859-13
iso14	ISO 8859-14
iso15	ISO 8859-15
koi8r	KOI8-R codepage
utf8	UTF-8 encoding

This type is available under Unix-like operating systems only.

```
TErrorHandler = function(Code: LongInt; Info: Pointer)
                  : TErrorHandlerReturnValue
```

The `TErrorHandler` function is used to register an own error handling function. It should be used when installing a custom error handling function, and must return one of the above values.

`Code` should contain the error code for the error condition, and the `Info` parameter may contain any data type specific to the error code passed to the function.

```
TErrorHandlerReturnValue = (errRetry, errAbort, errContinue)
```

Table 44.2: Enumeration values for type TErrorHandlerReturnValue

Value	Explanation
errAbort	abort and return error code
errContinue	abort without returning an errorcode.
errRetry	retry the operation

Type used to report and respond to error conditions

```
TVideoBuf = Array[0..32759] of TVideoCell
```

The TVideoBuf type represents the screen.

```
TVideoCell = Word
```

TVideoCell describes one character on the screen. One of the bytes contains the color attribute with which the character is drawn on the screen, and the other byte contains the ASCII code of the character to be drawn. The exact position of the different bytes in the record is operating system specific. On most little-endian systems, the high byte represents the color attribute, while the low-byte represents the ASCII code of the character to be drawn.

```
TVideoDriver = record
  InitDriver : procedure;
  DoneDriver : procedure;
  UpdateScreen : procedure(Force: Boolean);
  ClearScreen : procedure;
  SetVideoMode : function(const Mode: TVideoMode) : Boolean;
  GetVideoModeCount : function : Word;
  GetVideoModeData : function(Index: Word; var Data: TVideoMode) : Boolean;
  SetCursorPos : procedure(NewCursorX: Word; NewCursorY: Word);
  GetCursorType : function : Word;
  SetCursorType : procedure(NewType: Word);
  GetCapabilities : function : Word;
end
```

TVideoDriver record can be used to install a custom video driver, with the SetVideoDriver ([1756](#)) call.

An explanation of all fields can be found there.

```
TVideoMode = record
  Col : Word;
  Row : Word;
  Color : Boolean;
end
```

The TVideoMode record describes a videomode. Its fields are self-explaining: Col, Row describe the number of columns and rows on the screen for this mode. Color is True if this mode supports colors, or False if not.

```
TVideoModeSelector = function(const VideoMode: TVideoMode;
                               Params: LongInt) : Boolean
```

Video mode selection callback prototype.

44.4.3 Variables

```
CursorLines : Byte
```

`CursorLines` is a bitmask which determines which cursor lines are visible and which are not. Each set bit corresponds to a cursorline being shown.

This variable is not supported on all platforms, so it should be used sparingly.

```
CursorX : Word
```

Current horizontal position in the screen where items will be written.

```
CursorY : Word
```

Current vertical position in the screen where items will be written.

```
external_codepage : Tencoding
```

This variable is for internal use only and should not be used.

```
internal_codepage : Tencoding
```

This variable is for internal use only and should not be used.

```
OldVideoBuf : PVideoBuf
```

The `OldVideoBuf` contains the state of the video screen after the last screen update. The `UpdateScreen` ([1757](#)) function uses this array to decide which characters on screen should be updated, and which not.

Note that the `OldVideoBuf` array may be ignored by some drivers, so it should not be used. The Array is in the interface section of the video unit mainly so drivers that need it can make use of it.

```
ScreenColor : Boolean
```

`ScreenColor` indicates whether the current screen supports colors.

```
VideoBuf : PVideoBuf
```

`VideoBuf` forms the heart of the `Video` unit: This variable represents the physical screen. Writing to this array and calling `UpdateScreen` ([1757](#)) will write the actual characters to the screen.

```
VideoBufSize : LongInt
```

Current size of the video buffer pointed to by `VideoBuf` ([1747](#))

44.5 Procedures and functions

44.5.1 ClearScreen

Synopsis: Clear the video screen.

Declaration: procedure ClearScreen

Visibility: default

Description: ClearScreen clears the entire screen, and calls UpdateScreen (1757) after that. This is done by writing spaces to all character cells of the video buffer in the default color (lightgray on black, color attribute \\$07).

Errors: None.

See also: InitVideo (1754), UpdateScreen (1757)

Listing: ./videoex/ex3.pp

```
program testvideo;

uses video, keyboard, vidutil;

Var
  i : longint;
  k : TKeyEvent;

begin
  InitVideo;
  InitKeyboard;
  For I:=1 to 10 do
    TextOut(i,i, 'Press any key to clear screen');
    UpdateScreen(false);
    K:=GetKeyEvent;
    ClearScreen;
    TextOut(1,1, 'Cleared screen. Press any key to end');
    UpdateScreen(true);
    K:=GetKeyEvent;
    DoneKeyBoard;
    DoneVideo;
end.
```

44.5.2 DefaultErrorHandler

Synopsis: Default error handling routine.

Declaration: function DefaultErrorHandler(AErrorCode: LongInt; AErrorInfo: Pointer)
 : TErrorHandlerReturnValue

Visibility: default

Description: DefaultErrorHandler is the default error handler used by the video driver. It simply sets the error code AErrorCode and AErrorInfo in the global variables ErrorCode and ErrorInfo and returns errContinue.

Errors: None.

44.5.3 DoneVideo

Synopsis: Disable video driver.

Declaration: procedure DoneVideo

Visibility: default

Description: DoneVideo disables the Video driver if the video driver is active. If the videodriver was already disabled or not yet initialized, it does nothing. Disabling the driver means it will clean up any allocated resources, possibly restore the screen in the state it was before InitVideo was called. Particularly, the VideoBuf and OldVideoBuf arrays are no longer valid after a call to DoneVideo.

The DoneVideo should always be called if InitVideo was called. Failing to do so may leave the screen in an unusable state after the program exits.

For an example, see most other functions.

Errors: Normally none. If the driver reports an error, this is done through the ErrorCode variable.

See also: InitVideo ([1754](#))

44.5.4 GetCapabilities

Synopsis: Get current driver capabilities.

Declaration: function GetCapabilities : Word

Visibility: default

Description: GetCapabilities returns the capabilities of the current driver. It is an or-ed combination of the following constants:

- cpUnderLine** Video driver supports underline attribute
- cpBlink** Video driver supports blink attribute
- cpColor** Video driver supports color
- cpChangeFont** Video driver supports changing screen font.
- cpChangeMode** Video driver supports changing mode
- cpChangeCursor** Video driver supports changing cursor shape.

Note that the video driver should not yet be initialized to use this function. It is a property of the driver.

Errors: None.

See also: GetCursorType ([1750](#)), GetVideoDriver ([1752](#))

Listing: ./videoex/ex4.pp

Program Example4;

{ Program to demonstrate the GetCapabilities function. }

Uses video;

Var

W: Word;

Procedure TestCap(Cap: Word; Msg : String);

```

begin
  Write(Msg, ' : ');
  If (W and Cap=Cap) then
    WriteIn('Yes')
  else
    WriteIn('No');
end;

begin
  W:=GetCapabilities;
  WriteIn('Video driver supports following functionality');
  TestCap(cpUnderLine,'Underlined characters');
  TestCap(cpBlink,'Blinking characters');
  TestCap(cpColor,'Color characters');
  TestCap(cpChangeFont,'Changing font');
  TestCap(cpChangeMode,'Changing video mode');
  TestCap(cpChangeCursor,'Changing cursor shape');
end.

```

44.5.5 GetCursorType

Synopsis: Get screen cursor type

Declaration: function GetCursorType : Word

Visibility: default

Description: GetCursorType returns the current cursor type. It is one of the following values:

- crHidden** Hide cursor
- crUnderLine** Underline cursor
- crBlock** Block cursor
- crHalfBlock** Half block cursor

Note that not all drivers support all types of cursors.

Errors: None.

See also: SetCursorType (1756), GetCapabilities (1749)

Listing: ./videoex/ex5.pp

Program Example5;

{ Program to demonstrate the GetCursorType function. }

Uses video, keyboard, vidutil;

Const

Cursortypes : **Array**[crHidden..crHalfBlock] **of** **string** =
 ('Hidden', 'UnderLine', 'Block', 'HalfBlock');

begin

InitVideo;

InitKeyboard;

TextOut(1,1,'Cursor type: '+CursorTypes[GetCursorType]);

```

TextOut(1,2,'Press any key to exit.');
UpdateScreen(False);
GetKeyEvent;
DoneKeyboard;
DoneVideo;
end.

```

44.5.6 GetLockScreenCount

Synopsis: Get the screen lock update count.

Declaration: function GetLockScreenCount : Integer

Visibility: default

Description: GetLockScreenCount returns the current lock level. When the lock level is zero, a call to UpdateScreen ([1757](#)) will actually update the screen.

Errors: None.

See also: LockScreenUpdate ([1754](#)), UnlockScreenUpdate ([1757](#)), UpdateScreen ([1757](#))

Listing: ./videoex/ex6.pp

Program Example6;

{ Program to demonstrate the GetLockScreenCount function. }

Uses video, keyboard, vidutil;

Var

 I : Longint;
 S : String;

begin

 InitVideo;
 InitKeyboard;
 TextOut(1,1,'Press key till new text appears.');//
 UpdateScreen(False);

Randomize;

For I:=0 **to** Random(10)+1 **do**
 LockScreenUpdate;

 I:=0;

While GetLockScreenCount<>0 **do**

begin

 Inc(I);

 Str(I,S);

 UnlockScreenUpdate;

 GetKeyEvent;

 TextOut(1,1,'UnLockScreenUpdate had to be called '+S+' times');//

 UpdateScreen(False);

end;

 TextOut(1,2,'Press any key to end.');//

 UpdateScreen(False);

 GetKeyEvent;

 DoneKeyboard;

 DoneVideo;

end.

44.5.7 GetVideoDriver

Synopsis: Get a copy of the current video driver.

Declaration: procedure GetVideoDriver(var Driver: TVideoDriver)

Visibility: default

Description: GetVideoDriver returns the currently active video driver record in Driver. It can be used to clone the current video driver, or to override certain parts of it using the SetVideoDriver ([1756](#)) call.

Errors: None.

See also: SetVideoDriver ([1756](#))

44.5.8 GetVideoMode

Synopsis: Return current video mode

Declaration: procedure GetVideoMode(var Mode: TVideoMode)

Visibility: default

Description: GetVideoMode returns the settings of the currently active video mode. The row, col fields indicate the dimensions of the current video mode, and Color is true if the current video supports colors.

See also: SetVideoMode ([1757](#)), GetVideoModeData ([1754](#))

Listing: ./videoex/ex7.pp

Program Example7;

{ Program to demonstrate the GetVideoMode function. }

Uses video, keyboard, vidutil;

Var

 M : TVideoMode;
 S : String;

begin

 InitVideo;
 InitKeyboard;
 GetVideoMode(M);
 if M.Color **then**
 TextOut(1,1,'Current mode has color')
 else
 TextOut(1,1,'Current mode does not have color');
 Str(M.Row,S);
 TextOut(1,2,'Number of rows : '+S);
 Str(M.Col,S);
 TextOut(1,3,'Number of columns : '+S);
 Textout(1,4,'Press any key to exit.');//
 UpdateScreen(False);
 GetKeyEvent;
 DoneKeyboard;
 DoneVideo;

end.

44.5.9 GetVideoModeCount

Synopsis: Get the number of video modes supported by the driver.

Declaration: function GetVideoModeCount : Word

Visibility: default

Description: GetVideoModeCount returns the number of video modes that the current driver supports. If the driver does not support switching of modes, then 1 is returned.

This function can be used in conjunction with the GetVideoModeData (1754) function to retrieve data for the supported video modes.

Errors: None.

See also: GetVideoModeData (1754), GetVideoMode (1752)

Listing: ./videoex/ex8.pp

Program Example8;

{ Program to demonstrate the GetVideoModeCount function. }

Uses video, keyboard, vidutil;

Procedure DumpMode (M : TVideoMode; Index : Integer);

Var

S : String;

begin

```
Str(Index:2,S);
inc(Index);
TextOut(1,Index,'Data for mode '+S+:');
if M.Color then
  TextOut(19,Index,' color ,')
else
  TextOut(19,Index,'No color ,');
Str(M.Row:3,S);
TextOut(28,Index,S+' rows ');
Str(M.Col:3,S);
TextOut(36,Index,S+' columns ');
end;
```

Var

```
i,Count : Integer;
m : TVideoMode;
```

begin

```
InitVideo;
InitKeyboard;
Count:=GetVideoModeCount;
For I:=1 to Count do
  begin
    GetVideoModeData(I-1,M);
    DumpMode(M,I-1);
  end;
TextOut(1,Count+1,'Press any key to exit');
UpdateScreen(False);
```

```

GetKeyEvent;
DoneKeyboard;
DoneVideo;
end.

```

44.5.10 GetVideoModeData

Synopsis: Get the specifications for a video mode

Declaration: function GetVideoModeData(Index: Word; var Data: TVideoMode) : Boolean

Visibility: default

Description: GetVideoModeData returns the characteristics of the Index-th video mode in Data. Index is zero based, and has a maximum value of GetVideoModeCount-1. If the current driver does not support setting of modes (GetVideoModeCount=1) and Index is zero, the current mode is returned.

The function returns True if the mode data was retrieved successfully, False otherwise.

For an example, see GetVideoModeCount ([1753](#)).

Errors: In case Index has a wrong value, False is returned.

See also: GetVideoModeCount ([1753](#)), SetVideoMode ([1757](#)), GetVideoMode ([1752](#))

44.5.11 InitVideo

Synopsis: Initialize video driver.

Declaration: procedure InitVideo

Visibility: default

Description: InitVideo initializes the video subsystem. If the video system was already initialized, it does nothing. After the driver has been initialized, the VideoBuf and OldVideoBuf pointers are initialized, based on the ScreenWidth and ScreenHeight variables. When this is done, the screen is cleared.

For an example, see most other functions.

Errors: if the driver fails to initialize, the ErrorCode variable is set.

See also: DoneVideo ([1749](#))

44.5.12 LockScreenUpdate

Synopsis: Prevent further screen updates.

Declaration: procedure LockScreenUpdate

Visibility: default

Description: LockScreenUpdate increments the screen update lock count with one. As long as the screen update lock count is not zero, UpdateScreen ([1757](#)) will not actually update the screen.

This function can be used to optimize screen updating: If a lot of writing on the screen needs to be done (by possibly unknown functions), calling LockScreenUpdate before the drawing, and

UnlockScreenUpdate (1757) after the drawing, followed by a UpdateScreen (1757) call, all writing will be shown on screen at once.

For an example, see GetLockScreenCount (1751).

Errors: None.

See also: UpdateScreen (1757), UnlockScreenUpdate (1757), GetLockScreenCount (1751)

44.5.13 SetCursorPos

Synopsis: Set write cursor position.

Declaration: procedure SetCursorPos (NewCursorX: Word; NewCursorY: Word)

Visibility: default

Description: SetCursorPos positions the cursor on the given position: Column NewCursorX and row NewCursorY.

The origin of the screen is the upper left corner, and has coordinates (0, 0).

The current position is stored in the CursorX and CursorY variables.

Errors: None.

See also: SetCursorType (1756)

Listing: ./videoex/ex2.pp

```
program example2;

uses video, keyboard;

Var
  P, PP, D : Integer;
  K: TKeyEvent;

Procedure PutSquare (P : INteger; C : Char);

begin
  VideoBuf^[P]:=Ord(C)+($07 shl 8);
  VideoBuf^[P+ScreenWidth]:=Ord(c)+($07 shl 8);
  VideoBuf^[P+1]:=Ord(c)+($07 shl 8);
  VideoBuf^[P+ScreenWidth+1]:=Ord(c)+($07 shl 8);
end;

begin
  InitVideo;
  InitKeyBoard;
  P:=0;
  PP:=-1;
  Repeat
    If PP<>-1 then
      PutSquare(PP, ' ');
      PutSquare(P, '#');
      SetCursorPos(P Mod ScreenWidth, P div ScreenWidth);
      UpdateScreen(False);
    PP:=P;
    Repeat
      D:=0;
      K:=TranslateKeyEvent(GetKeyEvent);
```

```

Case GetKeyEventCode(K) of
  kbdLeft : If (P Mod ScreenWidth)<>0 then
    D:=-1;
  kbdUp : If P>=ScreenWidth then
    D:=-ScreenWidth;
  kbdRight : If ((P+2) Mod ScreenWidth)<>0 then
    D:=1;
  kbdDown : if (P<(VideoBufSize div 2)-(ScreenWidth*2)) then
    D:=ScreenWidth;
  end;
  Until (D<>0) or (GetKeyEventChar(K)= 'q');
  P:=P+D;
until GetKeyEventChar(K)= 'q';
DoneKeyBoard;
DoneVideo;
end.

```

44.5.14 SetCursorType

Synopsis: Set cursor type

Declaration: procedure SetCursorType (NewType: Word)

Visibility: default

Description: SetCursorType sets the cursor to the type specified in NewType.

crHidden Hide cursor
crUnderLine Underline cursor
crBlock Block cursor
crHalfBlock Half block cursor

Errors: None.

See also: SetCursorPos ([1755](#))

44.5.15 SetVideoDriver

Synopsis: Install a new video driver.

Declaration: function SetVideoDriver(const Driver: TVideoDriver) : Boolean

Visibility: default

Description: SetVideoDriver sets the videodriver to be used to Driver. If the current videodriver is initialized (after a call to InitVideo) then it does nothing and returns False.

A new driver can only be installed if the previous driver was not yet activated (i.e. before a call to InitVideo ([1754](#))) or after it was deactivated (i.e after a call to DoneVideo).

For more information about installing a videodriver, see viddriver ([1737](#)).

For an example, see the section on writing a custom video driver.

Errors: If the current driver is initialized, then False is returned.

See also: viddriver ([1737](#))

44.5.16 SetVideoMode

Synopsis: Set current video mode.

Declaration: function SetVideoMode (const Mode: TVideoMode) : Boolean

Visibility: default

Description: SetVideoMode sets the video mode to the mode specified in Mode:

If the call was successful, then the screen will have Col columns and Row rows, and will be displaying in color if Color is True.

The function returns True if the mode was set successfully, False otherwise.

Note that the video mode may not always be set. E.g. a console on Linux or a telnet session cannot always set the mode. It is important to check the error value returned by this function if it was not successful.

The mode can be set when the video driver has not yet been initialized (i.e. before InitVideo ([1754](#)) was called) In that case, the video mode will be stored, and after the driver was initialized, an attempt will be made to set the requested mode. Changing the video driver before the call to InitVideo will clear the stored video mode.

To know which modes are valid, use the GetVideoModeCount ([1753](#)) and GetVideoModeData ([1754](#)) functions. To retrieve the current video mode, use the GetVideoMode ([1752](#)) procedure.

Errors: If the specified mode cannot be set, then errVioNoSuchMode may be set in ErrorCode

See also: GetVideoModeCount ([1753](#)), GetVideoModeData ([1754](#)), GetVideoMode ([1752](#))

44.5.17 UnlockScreenUpdate

Synopsis: Unlock screen update.

Declaration: procedure UnlockScreenUpdate

Visibility: default

Description: UnlockScreenUpdate decrements the screen update lock count with one if it is larger than zero.

When the lock count reaches zero, the UpdateScreen ([1757](#)) will actually update the screen. No screen update will be performed as long as the screen update lock count is nonzero. This mechanism can be used to increase screen performance in case a lot of writing is done.

It is important to make sure that each call to LockScreenUpdate ([1754](#)) is matched by exactly one call to UnlockScreenUpdate

For an example, see GetLockScreenCount ([1751](#)).

Errors: None.

See also: LockScreenUpdate ([1754](#)), GetLockScreenCount ([1751](#)), UpdateScreen ([1757](#))

44.5.18 UpdateScreen

Synopsis: Update physical screen with internal screen image.

Declaration: procedure UpdateScreen (Force: Boolean)

Visibility: default

Description: UpdateScreen synchronizes the actual screen with the contents of the VideoBuf internal buffer.

The parameter Force specifies whether the whole screen has to be redrawn (Force=True) or only parts that have changed since the last update of the screen.

The Video unit keeps an internal copy of the screen as it last wrote it to the screen (in the OldVideoBuf array). The current contents of VideoBuf are examined to see what locations on the screen need to be updated. On slow terminals (e.g. a linux telnet session) this mechanism can speed up the screen redraw considerably.

On platforms where mouse cursor visibility is not guaranteed to be preserved during screen updates this routine has to restore the mouse cursor after the update (usually by calling HideMouse from unit Mouse before the real update and ShowMouse afterwards).

For an example, see most other functions.

Errors: None.

See also: ClearScreen ([1748](#))

Chapter 45

Reference for unit 'wincrt'

45.1 Overview

The wincrt unit provides some auxiliary routines for use with the graph (634) unit, namely keyboard support. It has no connection with the crt (421) unit, nor with the Turbo-Pascal for Windows WinCrt unit. As such, it should not be used by end users. Refer to the crt (421) unit instead.

45.2 Constants, types and variables

45.2.1 Variables

directvideo : Boolean

On windows, this variable is ignored.

lastmode : Word

Is supposed to contain the last used video mode, but is actually unused.

45.3 Procedures and functions

45.3.1 delay

Synopsis: Pause program execution

Declaration: procedure delay(ms: Word)

Visibility: default

Description: Delay stops program execution for the indicated number ms of milliseconds.

See also: sound (1760), nosound (1760)

45.3.2 keypressed

Synopsis: Check if a key was pressed.

Declaration: function keypressed : Boolean

Visibility: default

Description: KeyPressed returns True if the user pressed a key, or False if not. It does not wait for the user to press a key.

See also: [readkey \(1760\)](#)

45.3.3 nosound

Synopsis: Stop the speaker

Declaration: procedure nosound

Visibility: default

Description: NoSound does nothing, windows does not support this.

See also: [sound \(1760\)](#)

45.3.4 readkey

Synopsis: Read a key from the keyboard

Declaration: function readkey : Char

Visibility: default

Description: ReadKey reads a key from the keyboard, and returns the ASCII value of the key, or the scancode of the key in case it is a special key.

The function waits until a key is pressed.

See also: [KeyPressed \(1759\)](#)

45.3.5 sound

Synopsis: Sound PC speaker

Declaration: procedure sound (hz : Word)

Visibility: default

Description: Sound sounds the PC speaker. It emits a tone with frequency Hz for 500 milliseconds. (the time argument is required by the windows API)

See also: [nosound \(1760\)](#)

45.3.6 textmode

Synopsis: Set indicated text mode

Declaration: procedure textmode (mode : Integer)

Visibility: default

Description: TextMode does nothing.

Chapter 46

Reference for unit 'x86'

46.1 Used units

Table 46.1: Used units by unit 'x86'

Name	Page
BaseUnix	102
System	1229

46.2 Overview

The x86 unit contains some of the routines that were present in the 1.0.X Linux unit, and which were Intel (PC) architecture specific.

These calls have been preserved for compatibility, but should be considered deprecated: they are not portable and may not even work on future linux versions.

46.3 Procedures and functions

46.3.1 fpIOperm

Synopsis: Set permission on IO ports

Declaration: `function fpIOperm(From: Cardinal; Num: Cardinal; Value: cint) : cint`

Visibility: default

Description: `FpIOperm` sets permissions on `Num` ports starting with port `From` to `Value`. The function returns zero if the call was successfull, a nonzero value otherwise.

Note:

- This works ONLY as root.
- Only the first 0x03ff ports can be set.
- When doing a `FpFork` ([153](#)), the permissions are reset. When doing a `FpExecVE` ([150](#)) they are kept.

Errors: Extended error information can be retrieved with FpGetErrno ([156](#))

46.3.2 fpIoPL

Synopsis: Set I/O privilege level

Declaration: function fpIoPL(Level: cint) : cint

Visibility: default

Description: FpIoPL sets the I/O privilege level. It is intended for completeness only, one should normally not use it.

46.3.3 ReadPort

Synopsis: Read data from a PC port

Declaration: procedure ReadPort (Port: LongInt; var Value: Byte)
 procedure ReadPort (Port: LongInt; var Value: LongInt)
 procedure ReadPort (Port: LongInt; var Value: Word)

Visibility: default

Description: ReadPort reads one Byte, Word or Longint from port Port into Value.

Note that you need permission to read a port. This permission can be set by the root user with the FpIOPerm ([1761](#)) call.

Errors: In case of an error (not enough permissions read this port), runtime 216 (*Access Violation*) will occur.

See also: FpIOPerm ([1761](#)), ReadPortB ([1762](#)), ReadPortW ([1763](#)), ReadPortL ([1763](#)), WritePort ([1763](#)), WritePortB ([1764](#)), WritePortL ([1764](#)), WritePortW ([1764](#))

46.3.4 ReadPortB

Synopsis: Read bytes from a PC port

Declaration: function ReadPortB (Port: LongInt) : Byte
 procedure ReadPortB (Port: LongInt; var Buf; Count: LongInt)

Visibility: default

Description: The procedural form of ReadPortB reads Count bytes from port Port and stores them in Buf. There must be enough memory allocated at Buf to store Count bytes.

The functional form of ReadPortB reads 1 byte from port B and returns the byte that was read.

Note that you need permission to read a port. This permission can be set by the root user with the FpIOPerm ([1761](#)) call.

Errors: In case of an error (not enough permissions read this port), runtime 216 (*Access Violation*) will occur.

See also: FpIOPerm ([1761](#)), ReadPort ([1762](#)), ReadPortW ([1763](#)), ReadPortL ([1763](#)), WritePort ([1763](#)), WritePortB ([1764](#)), WritePortL ([1764](#)), WritePortW ([1764](#))

46.3.5 ReadPortL

Synopsis: Read longints from a PC port

Declaration: function ReadPortL(*Port*: LongInt) : LongInt
procedure ReadPortL(*Port*: LongInt; var *Buf*; *Count*: LongInt)

Visibility: default

Description: The procedural form of ReadPortL reads *Count* longints from port *Port* and stores them in *Buf*. There must be enough memory allocated at *Buf* to store *Count* Longints.

The functional form of ReadPortL reads 1 longint from port B and returns the longint that was read.

Note that you need permission to read a port. This permission can be set by the root user with the FpIOPerm ([1761](#)) call.

Errors: In case of an error (not enough permissions read this port), runtime 216 (*Access Violation*) will occur.

See also: FpIOPerm ([1761](#)), ReadPort ([1762](#)), ReadPortW ([1763](#)), ReadPortB ([1762](#)), WritePort ([1763](#)), WritePortB ([1764](#)), WritePortL ([1764](#)), WritePortW ([1764](#))

46.3.6 ReadPortW

Synopsis: Read Words from a PC port

Declaration: function ReadPortW(*Port*: LongInt) : Word
procedure ReadPortW(*Port*: LongInt; var *Buf*; *Count*: LongInt)

Visibility: default

Description: The procedural form of ReadPortW reads *Count* words from port *Port* and stores them in *Buf*. There must be enough memory allocated at *Buf* to store *Count* words.

The functional form of ReadPortW reads 1 word from port B and returns the word that was read.

Note that you need permission to read a port. This permission can be set by the root user with the FpIOPerm ([1761](#)) call.

Errors: In case of an error (not enough permissions read this port), runtime 216 (*Access Violation*) will occur.

See also: FpIOPerm ([1761](#)), ReadPort ([1762](#)), ReadPortB ([1762](#)), ReadPortL ([1763](#)), WritePort ([1763](#)), WritePortB ([1764](#)), WritePortL ([1764](#)), WritePortW ([1764](#))

46.3.7 WritePort

Synopsis: Write data to PC port

Declaration: procedure WritePort(*Port*: LongInt; *Value*: Byte)
procedure WritePort(*Port*: LongInt; *Value*: LongInt)
procedure WritePort(*Port*: LongInt; *Value*: Word)

Visibility: default

Description: WritePort writes *Value* – 1 byte, Word or longint – to port *Port*.

Remark: You need permission to write to a port. This permission can be set with root permission with the FpIOPerm ([1761](#)) call.

Errors: In case of an error (not enough permissions to write to this port), runtime 216 (*Access Violation*) will occur.

See also: FpIOPerm (1761), WritePortB (1764), WritePortL (1764), WritePortW (1764), ReadPortB (1762), ReadPortL (1763), ReadPortW (1763)

46.3.8 WritePortB

Synopsis: Write byte to PC port

Declaration: `procedure WritePortB(Port: LongInt; Value: Byte)`
`procedure WritePortB(Port: LongInt; var Buf; Count: LongInt)`

Visibility: default

Description: The first form of `WritePortB` writes 1 byte to port `Port`. The second form writes `Count` bytes from `Buf` to port `Port`.

Remark: You need permission to write to a port. This permission can be set with root permission with the `FpIOPerm` (1761) call.

Errors: In case of an error (not enough permissions to write to this port), runtime 216 (*Access Violation*) will occur.

See also: FpIOPerm (1761), WritePort (1763), WritePortL (1764), WritePortW (1764), ReadPortB (1762), ReadPortL (1763), ReadPortW (1763)

46.3.9 WritePortI

Synopsis: Write longint to PC port.

Declaration: `procedure WritePortL(Port: LongInt; Value: LongInt)`
`procedure WritePortl(Port: LongInt; var Buf; Count: LongInt)`

Visibility: default

Description: The first form of `WritePortB` writes 1 byte to port `Port`. The second form writes `Count` bytes from `Buf` to port `Port`.

Remark: You need permission to write to a port. This permission can be set with root permission with the `FpIOPerm` (1761) call.

Errors: In case of an error (not enough permissions to write to this port), runtime 216 (*Access Violation*) will occur.

See also: FpIOPerm (1761), WritePort (1763), WritePortB (1764), WritePortW (1764), ReadPortB (1762), ReadPortL (1763), ReadPortW (1763)

46.3.10 WritePortW

Synopsis: Write Word to PC port

Declaration: `procedure WritePortW(Port: LongInt; Value: Word)`
`procedure WritePortW(Port: LongInt; var Buf; Count: LongInt)`

Visibility: default

Description: The first form of WritePortB writes 1 byte to port Port. The second form writes Count bytes from Buf to port Port.

Remark: You need permission to write to a port. This permission can be set with root permission with the FpIOPerm ([1761](#)) call.

Errors: In case of an error (not enough permissions to write to this port), runtime 216 (*Access Violation*) will occur.

See also: FpIOPerm ([1761](#)), WritePort ([1763](#)), WritePortL ([1764](#)), WritePortB ([1764](#)), ReadPortB ([1762](#)), ReadPortL ([1763](#)), ReadPortW ([1763](#))