LZ/LZ64 Programming Manual

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1 Introduction to OPL

OPL is the Organiser Programming Language. It has a set of commands and functions suitable for all kinds of applications - including the manipulation of records in data files.

To enter OPL:

- Select Prog from the main menu, by pressing P.

From the Prog menu you can start new programs or continue with old ones.

Once you have written programs in OPL, you can run them from within Prog or directly from the main menu, or even whilst you are working on the calculator or the Pocket Spreadsheet.

An OPL program consists of one or more **procedures** each of which is typed in separately. A simple program may consist of just one and a more complex program of a main procedure which calls others.

The most efficient way to use OPL is to write short procedures which can be tested individually. Each one should ideally perform just one specific task. That way, programs which have similar requirements can share one common procedure to do the same job.

This chapter shows you how to write. save and run a simple procedure and covers all the options on the Prog menu.

The Prog menu

The Prog menu looks like this:

```
      11:32a
Edit   New    Run
Print  Dir    Copy
Delete
```

The options on the Prog menu are:

Edit	Lets you alter an existing procedure.
New	Lets you type in and save a new procedure.
Run	Executes an existing procedure.
Print	Prints out a procedure on an attached printer or computer.
Dir	Provides a directory list of your procedures.
Copy	Copies procedures to another device.
Delete	Deletes procedures.

Creating, saving and running a procedure

The simple procedure below just clears the screen and displays the date until you press a key. The procedure's name is DATE:

```
DATE:
CLS
PRINT "TODAY IS",DAY;"/";MONTH
GET
```

1 Creating a new procedure

- Select **New** from the menu and the screen shows:

  ```
  New A:_
  ```

The current device is shown after the word New; in this case it is A: (the internal memory). If you want to work on a pack, press **MODE** to change device.

The first thing to type is the procedure name, this can be up to 8 characters long and must start with a letter.

- Type in DATE as the name for your first procedure. **(Don't type the colon.)** Press **EXE**.

The procedure name is shown with a colon at the end. The cursor is flashing at the end of it.

```
DATE:_
```

- Press **EXE** to move the cursor down to the next line and you can begin typing. Typing in the OPL editor is the the same as typing in the notepad.

If you are not used to the keys look at the Keyboard section in Chapter 2 of the operating manual.

Note: in OPL you can use either upper case or lower case letters in any combination.

- Type the first line:
  ```
  CLS
  ```
- This is a **command**. When you run the procedure, CLS is an instruction to OPL to clear the screen.
- Press **EXE** to start a new line, then type:
  ```
  PRINT "TODAY IS",DAY;"/";MONTH
  ```

Check that the line appear on screen exactly as it does here as even the spaces are important. Here is an analysis of the line:

- PRINT, is a **command**. It makes what. follows it print on the display screen. All commands are followed by a space.
- "TODAY IS" is the text to be printed. A piece of text in quotes like this is called a **string**.
- A **comma** makes the next thing to be printed follow on the same line after a space.
- DAY is a **function**. It finds out the date. Here it returns it to the print command, which displays it.
- A **semi-colon** makes the next thing to be printed follow on the same line without a space.
- "/" is another string of just one character and MONTH is another function.
- Now press **EXE** to start a new line, and type: `GET`

The GET function, waits for a keypress before running the rest of the program. So when you run DATE:, the date will remain on the screen until you press a key.

Editing what you've typed

You can correct what you've typed at any time:

- Use **LEFT** , **RIGHT**, **UP** and **DOWN** to move around.
- Use **DEL** to delete the character to the left of the character and hold down **SHIFT** and press **DEL** to delete the character under the cursor.
- To insert a new line between two existing ones, press **EXE** on the first character of the second one.
- To join two lines, press **DEL** on the first character of the second one.
- To delete a line, press **ON/CLEAR**.

You can also press **MODE** and use four of the options on the editor menu to help you:

Find	Takes you to a search-clue you specify (you have to press **ON/CLEAR** to remove the find prompt).
Home	Takes you to the top of the procedure file.
End	Takes you to the bottom of the procedure file.
Zap	Clears all the lines deleting the whole procedure text so that you can start again.

2 Saving and translating procedures

When you have finished typing the procedure, you can:

- Translate it into a form which OPL can run.
- Save it as it is - so you can edit it but not run it.
- Quit and abandon it.
- Press **MODE** to get the editor menu. The first three options are: `Tran Save Quit`

This diagram illustrates the differences between them. The bold path shows the normal process of translating a new procedure:

```
           Type in procedure
           then press MODE

     Tran         Save         Quit

    Saves         Saves       Returns
  translated      text        to Prog
  version        version        menu
```

You would normally select Tran, so that you can run the procedure, but to see what the other two do:

Quit

- Select Quit and you are prompted with the message: `Quit? Y/N`
- Press **N**, and you return to the procedure editor. (If you pressed **Y**, everything you typed during the editing session would be discarded.)

Tran

- Select Tran.

The procedure is translated into a form that OPL can run. When the procedure has been translated, the screen displays this prompt: `Save A:DATE`

You can now save the translated procedure.

- Press **MODE** to change device if you want to save on a pack, then **EXE** to save.

You return to the Prog menu. When you save the translated version, the original text version is saved with it. So you can run it and re-edit it later.

Syntax errors

If you make a typing error, OPL spots it during translation. For example, if you typed PRONT instead of PRINT or omitted one of the pair of quotation round a string, this message is displayed:

```
   ERROR
     SYNTAX ERR
....................
  press SPACE key
```

- Press **SPACE** and you return to the procedure editor, with the cursor near the syntax error.
- Correct it, press **MODE**, and select Tran again.

Save

When you just save a procedure rather than translating it, no error checking is done. The text is simply saved exactly as you typed it.

If you type in part of a procedure and intend to return to it later to complete it you can select Save instead of Tran so as not to waste memory by producing an unnecessary translated version.

Where you should save programs

The best place to save programs is on A: or a Rampak. Then, if a procedure takes a couple of versions before it runs properly, each version will not use up space:

- When an edited version is saved on A: or a Rampak, the old version is deleted completely each time the new version is saved or translated.
- On Datapaks, however, the old versions remain there taking up space, you just can't access them.

When a final version of a procedure has been produced on device A: it is a good idea to copy it to a Datapak.

3 Running a procedure

When you've successfully translated the procedure, you can run it.

- From the Prog menu, select Run. The name of the procedure you just translated is supplied for you:
  ```
  Run A:Date
  ```
- Just press **EXE** to run the procedure.

When DATE: is run, the screen will first clear and then show something like this, depending on the date:

```
TODAY IS 19/8
```

The last line of the procedure was GET. This instruction simply waits until you press a key before continuing. So, when you press a key, the procedure finishes and you return to the Prog menu.

Edit, Print, Dir, Copy, Delete

Like Run, the remaining Prog options all require you to specify an existing procedure file.

If you haven't left Prog, the name of the procedure you worked on last is supplied for Edit and Print. You can press **EXE** to accept it, or **DOWN** to get a list of procedures to select from. For detail on selecting from file lists, see Chapter 12 in the operating manual.

Editing an existing procedure

The Edit option from the Prog menu allows you to return to an old procedure to change it or add to it.

- Select Edit and press **MODE** to change device if necessary, then select a procedure file.

When you've finished editing the procedure, you can either:

- Press **MODE** then **EXE** to translate and save it.

or, if you make a mess of the editing:

- Press **MODE** then 9 to quit and delete this version of the procedure so you can edit the original again.

Printing a procedure

The Print option is used to print out a listing of a procedure on a printer or personal computer.

- Select Print then select a procedure file.

If no printer or computer is connected to the Organiser, this error message is displayed:

```
 DEVICE MISSING
```

For more details on printing, see Chapter 17 in the operating manual.

The procedure directory

The Dir option on the Prog menu shows you the directory of procedures stored on the various devices.

- Select Dir from the Prog menu. The screen shows:

```
Dir A:
```

If necessary, change device with **MODE**, then list the procedures with **DOWN** in the same way as you do in Dir in Utils. See Chapter 15 of the Operating Manual.

Copying a procedure

The Copy option in the Prog menu is used to make copies of procedures from one device to another.

- Select Copy from the Prog menu:

```
    Copy
     Select type
....................
Opl Oplobj Opltxt
```

Opl Copies both the text and translated object code of the procedure.
Oplobj Copies only the translated object code part.
Opltxt Copies only the editable text part.

- If you select Opl you will be able to edit and run the copy.
- If you select Oplobj you won't be able to edit it.
- If you select Opltxt, you won't be able to run it until you have translated it again.

Copy in Prog works just like Copy in Utils.

Warning: If you copy a procedure, and one with the same name already exists on the destination device, the existing one is deleted - even if the existing one is text only and the one you are copying is object only.

Deleting a procedure

The **Delete** option allows you to delete procedures from any of the devices.

- Select Delete to get the prompt: `Delete A:_`

If necessary change device with **MODE**. Select a file or files to be deleted in the same way as you do in the Utils Delete option.

Running a procedure from the main menu

To insert the name of a procedure in the main menu:

- On the main menu, press **MODE** with the cursor where you want the name to be.
- Type in the name of the procedure.
- Select Opl.

When you select the name, the procedure is run.

For example, you could type in, translate and save a procedure like the one below, then enter its name, ID, in the main menu. When the item Id is selected, your Organiser will be identified.

```
ID:
CLS
PRINT "IF FOUND PLEASE RING"
PRINT "PAUL SMITH EXT. 998"
GET
```

Pausing and quitting procedures when running

Sometimes you may want to stop a procedure when it's running. To halt the execution of a procedure:

- Press **ON/CLEAR**.

This will pause it indefinitely. (Unless the procedure was waiting for a key, with a function such as GET.)

- Press **Q** to quit (or any other key to continue).

If the procedure was run from the main menu, the screen shows:

```
   ERROR
ESCAPE IN A:procname
....................
  press SPACE key
```

- Press the **SPACE** key to return to the main menu.

If the procedure was run from the Prog menu, the screen shows:

```
   ERROR
       ESCAPE
....................
Edit A:procname Y/N
```

Press **Y** if you want to enter the procedure text to edit it, or press **N** to return to the Prog menu.

Renaming a procedure

You can't use Copy to rename a procedure you have to re-save it under a different name. For example, to rename A:DATE to A:TODAY.

- Select Edit to edit A:DATE then select Tran.
- When you see the Save A:DATE prompt, press **ON/CLEAR** then enter the new name, TODAY and press **EXE**.

Translating a procedure for an XP or CM

If you are creating a procedure to be run on a two-line Organiser model CM or XP:

- Select Xtran instead of Tran when you've finished editing it

When you run a procedure created on an XP or translated with Xtran, anything printed on the screen has a border like this round it:

```
XXXXXXXXXXXXXXXXXXXX
XX  2-LINE PROC   XX
XX                XX
XXXXXXXXXXXXXXXXXXXX
```

Summary

Entering and running a procedure.

- ❒ Select Prog on the main menu.
- ❒ Select New.
- ❒ Type a name. Press **EXE**.
- ❒ Press **EXE** again to start a new line. Type in the procedure.
- ❒ Press **MODE** and select Tran (Xtran to run on a two-line Organiser XP or CM).
- ❒ Press **MODE** if you need to change device, then **EXE** to save.
- ❒ Select Run to execute the procedure.

Inserting a procedure name in the main menu

- ❒ On the main menu, press **MODE** with the cursor where you want the name to be.

❒ Type in the name of the procedure.
❒ Select Opl.

When you select the name. the procedure is run.

Escaping from a running procedure

❒ Press **ON/CLEAR**.
❒ Press **Q** to quit (or any other key to continue).

2 Procedures and variables

The previous chapter dealt with the mechanics of using the Prog menu. The next five chapters cover the basic concepts of OPL programming. If you are familiar with programming languages just skim through these chapters, or refer instead to the reference sections which follow.

Procedures generally consist of the four steps shown in this simplified example:

1 Name	`SINE50:`
2 Declaration of variables	`LOCAL x`
3 Operations upon variables	`x=SIN(50)`
4 Communication of variables	`PRINT x`

This chapter deals with these four steps.

1 Procedure names

e.g. **print:**, **shares89:**, **TAXCALC:**

- They may be up to 8 characters long and can combine numbers and letters. **The first character must be a letter.**
- They end with a colon, but it is only in certain circumstances that you have to type this in. For example, you don't have to type it in when naming a new procedure but you do when you call a procedure from within another one.
- They may be typed in upper or lower case letters.

2 Declaring variables

If you were adding together two numbers, in algebra you would write 'x+y=z'.
In OPL you would write z=x+y but first you would have to **declare** x,y and z as variables in order to reserve memory space for them. You would do this:

1 Declare the variables in order to reserve 3 spaces in memory, calles x, y and z.

```
LOCAL x,y,z
```

2 Assign values to x and y.

```
x=5
    y=2
```

3 Add x and y together and assign the result to z:

```
z=x+y
```

A variable is therefore a named region of memory which at the very beginning of your procedure you **declare**. This means that you tell the Organiser you are going to use the variable so that it will have space to store the number or text you later assign to it. So in the SINE50 example, the line 'LOCAL x' reserves a memory space named x in which the value given to x in the next line can be stored.

Variable names

There are three kinds of variables identified when you declare them by the format of the variable name. The three kinds are:

Floating point variables e.g. x
Integer variables e.g. x%
String variables e.g. x$

All variables may be up to 8 characters long. The first character must be a letter. The other characters may be letters or numbers but not symbols - except for the identifiers % and $ at the end.

Floating point variables

A floating point number is one which has a decimal point and then any number of digits after that point, e.g. 13.567 or 8. or 0.05319 or 6.0

You should declare a floating point variable when you know that the sort of value you are likely assign to it will be a floating point number.

A floating point variable name does not have any special symbol at the end.

e.g. a, AGE, PROFIT89.

Floating point variables are stored to an accuracy of 12 digits and must be in the range ±9.99999999999E99 to ±1E-99 and 0.

Integer variables

An integer is a whole number, e.g. 6 or 13 or -3 or 11058

You should use integer variables wherever floating point numbers are not necessary and speed or space are important. Integer arithmetic is faster than floating point and it occupies two bytes of memory instead of eight.

An integer variable name ends with a % sign. (The % sign is included in the 8 characters length.)

e.g. a%, AGE%, PROFI89%.

Integer variables must be in the range -32768 to +32767.

String variables

A **string** is a sequence of characters, alphabetic, numeric or symbolic, which is treated literally rather than being evaluated. Examples of strings are: "x + y =" and "01-345-2908" and "profit".

A string variable name ends with a $ sign. (The sign is included in the 8 characters length.)

e.g. a$, NAME$, MAN6$.

When declaring a string variable, you must state the maximum length of the string you expect to assign to it. So if you want to enter names up to 15 characters long as the value of NAME$, you have to declare NAME$(15). The number goes in brackets.

The maximum length of a string is 255 characters.

The LOCAL and GLOBAL commands

You must declare your variables immediately after the procedure name. You may list together all 3 types, in any order; they must be separated by commas like this:

```
LOCAL x,y,a%,NAME$(15),YEAR3%.
```

To declare variables you use either the LOCAL or the GLOBAL command like this:

```
LOCAL x,a%,list$(8)
```

or

```
GLOBAL x,a%,list$(8)
```

LOCAL and GLOBAL define the **range** the variables are to be active in. The basic difference is that:

- Local variables are limited to the procedure in which they are declared.
- Global variables can also be used in any procedures called by the procedure in which they are declared.

Calling procedures

An OPL program can be made up of more than one procedure. However, you have to type, translate and save each procedure separately.

In the example below, the fourth line of proca: calls another procedure, procb:. To do this, you just type the procedure name (with the colon).

```
proca:                 procb:
GLOBAL a%              a%=a%+4
a%=2
procb:
PRINT a%
```

You declare a% as a global variable so that it can be used in the second procedure. In this example the value printed out when proca: is run is 6.

The only danger with global variables is that you may get mistakes occurring if you accidentally use the same variable name twice. So, you should use the LOCAL command unless the GLOBAL one is required.

If OPL comes across a variable which isn't declared in that procedure, it assumes it has been declared in a previous procedure. OPL will then report a MISSING EXTERNAL error if it can't find the global variable in a calling procedure.

Other variables

Calculator memories

There are ten floating point variables which are always available. These are the calculator memories m0 to m9. You do not declare these as variables, as they are always in existence.

Values may be assigned to these at any time in any procedure. You can then access them in the calculator.

Array variables

You may want to declare a large number of similar variables at the beginning of a program. For this reason. OPL has **array variables**.

The idea is simply that, instead of having to declare variables a, b, c, d and e, you can declare variables a1 to a5 in one go like this:

LOCAL a%(5)	(integer variable array)
LOCAL a(5)	(floating point variable array)
LOCAL a$(5,8)	(string variable array)

Numeric array variables may be thought of as a list of numbers, each with the same name, but with an index number to differentiate them.

When the array is declared, the number in brackets is the number of elements in it. Here is a simple example assigning values to the elements of in integer array:

```
procname:
GLOBAL num%(4)
num%(1)=1
num%(2)=3
num%(3)=5
num%(4)=7
PRINT num%(1)+num%(2)+num%(3)+num%(4)
```

This example just prints the sum of the four elements of the array num%.

With strings, you must declare the number of elements in the array **and** the maximum length of the strings.

For example GLOBAL ARRAY$(5,10) allocates memory space for five strings, each up to ten characters in length, under the names ARRAY$(1) to ARRAY$(5). As yet, each of the variables is empty (is a **null string**), but enough memory still has to be set aside to contain all of the five strings when full.

3 Operations upon variables

Once you have declared your variables you can perform any number of operations on them. This might be a combination of arithmetic operations, or you might pass the variables to other procedures for them to operate upon them, or use one of the OPL functions. Whatever you do, however, you need to understand how your variables will react according to what type they are and how you combine them.

For example, you cannot divide a string variable by an integer variable. And if you mix integers and floating point variables in the same sum one may convert the other into its own type of variable. The following sections give details of what problems may arise and how to avoid them.

Mixing integers and floating point variables: automatic type conversion

In the procedure below there is a potential mistake in the third line after the name, where the integer variable y% is assigned a floating point value:

```
procname:
GLOBAL x%,y%
x%=7
y%=3.7+x%
PRINT y%
GET
```

OPL deals with this in the following way: instead of reporting an error, OPL carries out an **automatic type conversion** internally on the value assigned to the mismatched variable.

The right hand side of y%=3.7+x% is evaluated to 10.7. However, the fractional part of the number is dropped before the result is assigned to the left hand side, y%. So, the PRINT statement will display the value 10.

Since OPL does not report this as an error, the onus is on you to ensure that it does not happen - unless you want it to! You must always take care when mixing variable types that the answer produced is the one which you expect.

In the procedure below where only floating point variables are used, you can see that another type conversion is made, but does not cause the value to change:

```
procname:
GLOBAL a,b,c
a=1.2
b=2.7
c=3
PRINT a+b+c
```

In this procedure, the floating point variable c is given the integer value 3. An automatic type conversion is carried out in such cases. Here the result is converted to 3.0, so the real value of the variable remains the same.

If you assign a floating point number to an integer variable, then the automatic type conversion will generate an integer rounded **down**. So if you say a%=2.3 then the value of a% will be 2; but a%=2.9 would also give a% the value 2. And if you assign a negative floating point number to an integer variable, then the number is still rounded down - rather than toward zero. So if you say a%=-2.3 then a% will take the value -3. This may not be desirable..

If you expect an expression to return a floating point number, you must ensure that the correct types of number are used within that expression.

It is possible to control how floating point numbers are rounded when converted. For example, if you wanted to round floating point numbers to the nearest half (so 2.4 would round to 2.5 and 2.2 to 2) then you might try the following statement:

```
r=INT(2*n+0.5)/2
```

where n is the number to be rounded.

This would produce the wrong result, though. To see why substitute a trial value, say 3.4, instead of n:

```
INT(2*3.4+0.5) i.e. INT(7.3).
```

returns the integer 7. But 7/2, **when rounded down** gives the integer 3, not 3.5.

To obtain 3.5 you must force the division to give a floating point result. In this case the simplest way to do this is to divide by the floating point value of 2.0, instead of the integer 2. So the expression:

```
r=INT(2*n+0.5)/2.0
```

will give the required result.

There is more about integers and floating point variables in the chapter on Operators.

Mixing strings and numbers

If you try to allocate a number to a string variable, an error will be reported. There is no automatic type conversion between string and numeric variables. However, OPL does have facilities for forcing conversion of numbers to strings and vice versa. These are the SCI$, FIX$, GEN$, NUM$ and VAL functions.

Concatenating strings

Adding strings together is as easy as adding numeric variables:

- If a$ is "DOWN" and b$ is "WIND", then the statement c$=a$+b$ means c$ is "DOWNWIND".

Alternatively, you could give c$ the same value with the statement c$="DOWN"+"WIND".

When concatenating strings, the result cannot be longer than the maximum length you declared.

Slicing strings

You can also split strings up. This process is known as **string slicing**.

There are three functions which allow you to do this. They are LEFT$, RIGHT$ and MID$. These allow you to access the left, right or middle portions of a string respectively. For example:

- If a$="01-234-5782", then b$=LEFT$(a$,2) assigns the variable b$ the string 01.

String slicing operations leave the original string unchanged - i.e. a$ would still have the value 01-234-5782 after b$ had gained the value 01. The exception would be when the left hand side of the expression is the same string as appears in the right hand side. Eg a$=LEFT$(a$,4) would return a string containing the leftmost four characters of a$ and assign it to a$, thus overwriting the original value.

Note: If you need to define a string which includes the quotation mark character (ASCII character 34) then this character must be included twice in the string. So, if you say a$="x""y""z", then the resulting value of a$ will be x"y"z.

4 Communication of variables

In the first example procedure at the beginning of this chapter, the statement PRINT x simply takes the value found in the memory space of variable x and prints it on the screen.

Values can also be passed between procedures. In the example on page 2-5 [See Calling procedures], the procedure proca: called another procedure, procb: which returned the adjusted value of a% back to proca:. The variable a% was declared global to allow this.

The rest of this chapter deals with two other ways of communicating values: entering values from the keyboard using the INPUT command, and passing values between procedures using parameters.

The INPUT command

Values can be entered from the keyboard using the INPUT command, as in the example below.

This simple procedure just asks you to enter a number. The number you enter is assigned to the variable x and is then printed out to the screen with a message:

```
INPUT:
LOCAL x
CLS
PRINT "ENTER NUMBER"
INPUT x
CLS
PRINT "YOU ENTERED",x
GET
```

For full details of the INPUT command, see Chapter 9.

Procedure parameters

Values can be passed between procedures using parameters. In the VAT example below, the second procedure VAT1: is followed by a parameter name (p).

The last line of the first procedure PROC1: calls VAT1 with the value of x. The value of x is copied to the parameter p. VAT1: then prints out this value plus VAT at 15%.

```
PROC1:
LOCAL x
CLS
PRINT "ENTER PRICE"
```

```
INPUT x
VAT1:(x)

VAT1:(p)
CLS
PRINT "PRICE INCLUDING VAT = ",p*1.15
GET
```

- Calling a procedure which has parameters means that your first procedure can use local rather than global variables which is sometimes neater.
- Parameters differ from variables in that you cannot assign values to them. They have an external value passed to them from the calling procedure and it is then illegal to assign another value by saying, in the above example, p=p+1.
- Parameter names are typed in brackets immediately after the colon of the procedure name. Their type is specified as with variables e.g. p for a floating point value, p% for an integer and p$ for a string.

Multiple parameters

In this similar VAT example the second procedure VAT2: has two parameters.

The value of the price variable, x, is passed to the parameter p1 and the rate of VAT is also a variable, r, which is passed to the parameter p2. VAT2 then prints out the price plus VAT at the rate specified.

```
PROC2:
LOCAL x, r
CLS
PRINT "ENTER PRICE"
INPUT x
CLS
PRINT "ENTER VAT RATE"
INPUT r
VAT2:(x,r)

VAT2: (p1,p2)
CLS
PRINT p1+p2/100*p1
GET
```

- You can pass variable names, strings in quotes, or actual values to parameters.
- When you pass multiple values to multiple parameters you must make sure that the order of the values when the procedure is called corresponds to the order of parameters after the procedure name. For example:
  Procedure call - PROC:("a string",9,3.7)
  Procedure name - PROC:(p$,p%,p)

The RETURN command

This VAT example differs from the previous two in that control does not end with the second procedure but returns instead to the first.

The RETURN command is used to return the value of X plus VAT at r percent - to be printed out in PROC3:. VAT3: is now just doing the calculation and not printing. This means it can be called by other procedures which need this calculation but do not necessarily need to print it.

```
PROC3:
LOCAL x,r
CLS
PRINT "ENTER PRICE"
INPUT x
CLS
PRINT "ENTER VAT RATE"
INPUT r
CLS
PRINT "PRICE INCLUDING VAT =",VAT3:(x,r)
GET

VAT3:(p1,p2)
RETURN p1+p2/100*p1
```

- Only one value may be returned by the RETURN command.
- The name of a procedure which RETURNs a value must end with the correct identifier eg. PROC$: for one which returns a string; PROC% for one which returns an integer; PROC: for one which returns a floating point value (as in this example).
- The RETURN command returns to the point where the procedure was called.

3 Loops and branches

So far we have only considered programs which run in a straight line from start to finish. They consist of a number of instructions which are executed in the order they appear in the program; if you want to carry out an instruction more than once you must repeat it.

That is clearly very inefficient. A far more efficient method is for the program to be able to loop around a particular part as many times as you require, or until a certain condition is met.

There are a number of ways of doing this in OPL.

The first two are the **DO/UNTIL** and the **WHILE/ENDWH** loops. These are known as structures. They operate in a similar way to each other, with one difference.

- The DO/UNTIL structure tests for a condition being fulfilled at the end of the loop.
- The WHILE/ENDWH structure tests the condition at the start of the loop.

You can have up to eight loops nested within each other.

The DO/UNTIL loop

Here is an example of a DO/UNTIL loop:

```
a%=10
DO
PRINT "A=";a%
a%=a%-1
UNTIL a%=0
```

First 10 is assigned to a%. The loop starts on the next line, with the instruction DO. This says to OPL:

"Execute all the following instructions until an UNTIL is reached. If the condition following UNTIL is not met, repeat the same set of instructions until it is."

The next line displays "A=", followed by the value of a%. The first time through the loop, this is 10.

Next, the value of a% has 1 subtracted from it so that a% is 9. Now comes UNTIL, followed by a condition. The condition is that a% is equal to zero. It isn't yet, so the program returns to DO and the loop is repeated. Now a% decrements to 8, and again the condition fails. This process continues until a% does equal zero.

When a% equals zero the loop finishes and the program continues with the instructions after UNTIL.

The WHILE/ENDWH loop

The WHILE/ENDWH loop is similar, except that the test condition is at the beginning. For example:

```
a=4.1
b=2.7
WHILE a>b
PRINT "a is greater than b"
b=b+1.04
ENDWH
```

BREAK

BREAK can be used in conjunction with an IF statement, see below, to break out of a DO or WHILE loop. It jumps to the instruction after the end of the loop.

Labels and jumps

Another command which can direct the program out of a straight sequence is **GOTO**. This jumps to a **label**.

In this example, when the program reaches the GOTO, it jumps to the line beginning with the label exit::.

```
GOTO exit::
PRINT "MISS THIS LINE"
PRINT "AND THIS ONE"
exit::
```

Labels end in a double colon.

The label must be in the same procedure as the GOTO, and the jump is not conditional, it always happens.

Branches

GOTO is a way of **branching**, but it is a fairly crude tool and can make procedures difficult to read.

Better is the **IF/ELSEIF/ELSE/ENDIF** structure. This structure is used to perform one or more instructions IF a condition is met. If the condition is not met, you can use an ELSEIF instruction, to test for another condition. You can have any number of ELSEIF instructions within an IF/ENDIF structure.

After all likely things are catered for by the ELSEIF instructions, other possibilities can be catered for by an ELSE statement, followed at the end by the ENDIF statement. Here is an example:

```
whatkey:
LOCAL g%
g%=GET
PRINT "THAT KEY IS"
IF g%>64 AND g%<91
PRINT "UPPER CASE"
ELSEIF g%>96 AND g%<123
PRINT "lower case"
ELSE
PRINT "NOT A LETTER."
ENDIF
GET
```

This just waits for a key to be pressed, and then prints that it is either a lower or upper case letter. (If you don't realise the significance of the numbers 64 and 91, see Appendix A.) If it is not a letter at all, then that is printed, as allowed for by the ELSE statement.

ELSEIF and ELSE statements are optional, but for every IF there must be a corresponding ENDIF.

Endless Loops

ESCAPE OFF, GET, KEY and INPUT must be used with caution in loops for the following reasons:

To halt the execution of a procedure, you normally press **ON/CLEAR** then **Q**:

- If you've used an ESCAPE OFF command, you can't do this, as this disables **ON/CLEAR**. So you can only escape by removing the battery and thus losing data.

- If you've used a function such as GET or KEY to read a keypress, you have to press **ON/CLEAR** quickly followed by **Q** and repeat this very quickly a few times. This may be very difficult to do.

4 Operators

Arithmetic operators

+	add
-	subtract
*****	multiply
/	divide
******	raise to a power
-	unary minus (make negative)
%	percent

Comparison operators

>	greater than
>=	greater than or equal to
<	less than
<=	less than or equal to
=	equal to
<>	not equal to

Logical operators

AND
OR
NOT

Operator precedence

Highest:	**
	- (Unary minus) NOT
	* /
	+ -
	= > < <> >= <=
Lowest:	AND OR

The percent operator % is rather different as its effect depends on the operator it is combined with. The way % works is described in the calculator chapter of the operating manual.

Using Brackets

An expression such as a+b+c presents no problems, as the result is the same whichever addition is done first. However, you may want to enforce precedence with brackets. For example:
a+b*c/d

is evaluated in the order: b multiplied by c, then divided by d, then added to a. To perform the addition and the division before the multiplication, use brackets:
(a+b)*(c/d)

- In an expression where all operators have equal precedence, they are evaluated from left to right
- Powers, however, are evaluated right to left. So for example, in the expression:
  a%**b%**c%

b% will first be raised to the power of c% and the resulting value will be used as the power of a%.

When in doubt, simply use brackets.

Precedence of integer and floating point values

You are free to mix floating point and integer values, in expressions, but be aware how OPL handles the mix:

- Floating point variables take priority over integers. So, in an expression linked by an operator to a floating point number, integers will be converted to floating point. **but then**
- The result of the right hand side of an expression is converted to whatever type the left hand side is.

For example, your procedure might include the expression:
a%=b%+c

This is handled like this: b% is converted to floating point and added to c. The resulting floating point value is then automatically converted to an integer in order to be assigned to the integer variable a%.

These conversions may produce odd results, so be careful. For example, a%=3.0*(7/2) assigns 9 to a%, but a%=(3.0*7)/2 assigns 10 to a%.

Logical expressions

The comparison operators and logical operators are based on the idea that a certain situation can be evaluated as either true or false. For example, if a%=6 and b%=8, a%>b% would be false. They are useful for setting up alternative paths in your procedures. For example you could say:

```
IF salary<expenses
PRINT "bad"
ELSEIF salary>expenses
PRINT "good"
ENDIF
```

You can also make use of the fact that the result of these logical expressions is represented by an integer:

- True is represented by the integer -1
- False is represented by the integer 0 (zero)

These integers can be returned to a variable or printed out to the screen to tell you whether a particular condition is true or false, or used in an IF statement.

For example, in a procedure you might arrive at two sub-totals, a and b. You want to find out which is the greater. So include the statement, PRINT a>b. If zero is displayed, a and b are equal or b is the larger number but if - 1 is displayed, 'a>b' is true - a is the larger.

	Example	Result	Integer Returned
<	a<b	True if a less than b	-1
		False if a greater than or equal to b	0
>	a>b	True if a greater than b	-1
		False if a less than or equal to b	0
<=	a<=b	True if a less than or equal b	-1
		False if a greater than b	0
>=	a>=b	True if a greater than or equal to b	-1
		False if a less than b	0
<>	a<>b	True if a not equal to b	-1
		False if a equal to b	0
=	a=b	True if a equal to b	-1
		False if a not equal to b	0

You can use these-operators with a mixture of floating point or integer values. However, if one side of the comparison is floating point, and the other is an integer, the integer is converted to a floating point. So if a %=1 and b=1.2, b>a% is true. You can't use a mix of string and numeric values, so a$<b is invalid.

Few programmers need the following information, so skip the rest of the chapter if it seems daunting.

The **logical operators** AND, OR and NOT have different effects depending on whether they are used with floating point numbers or integers:

1 When used with floating point numbers only, the logical operators have the following effects:

Example	Result	Integer Returned
a AND b	True if both a and b are non-zero	-1
	False if either a or b are zero	0
a OR b	True if either a or b are non-zero	-1
	False if both a and b are zero	0
NOT a	True if a is zero	-1
	False if a is non-zero	0

2 When used with integer values only, AND, OR and NOT are bitwise logical operators.

The way the Organiser holds integer numbers internally is as a 16-bit binary code. So, 7 looks like this: 0000000000000111 The Organiser's numerical range is +32767 to -32768. 32767 is the largest number that can be represented with 15 binary bits. The 16th bit is used for the + or -.

As the operators are bitwise they perform the operation on first the 1st bit, then the 2nd, up to the 16th bit.

AND The statement PRINT 12 AND 10 prints 8. To understand this, write 12 and 10 in binary:

```
12    0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0
10    0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0
```

AND acts on each pair of bits. Thus, working from left to right - discounting the first 12 bits:
1 AND 1 --> 1
1 AND 0 --> 0
0 AND 1 --> 0
0 AND 0 --> 0

The result is therefore the binary number 1000, or 8.

OR What result would the statement PRINT 12 OR 10 give? Again, write down the numbers in binary and apply the operator to each pair of digits:
1 OR 1 --> 1
1 OR 0 --> 1
0 OR 1 --> 1
0 OR 0 --> 0

The result is the binary number 1110, or 14 in decimal.

NOT NOT works on only one number. It returns the one's complement, i.e. it replaces 0s with 1s and 1s with 0s.

So if 7 looks like this: 0000000000000111
NOT 7 will look like this: 1111111111111000

This is the binary representation of -8.

Hint. A quick way of calculating NOT for integers is to add 1 to the original number and reverse its sign. Thus, NOT 23 is -24, NOT 0 is -1 and NOT -1 is 0. The last two results are the same for floating points.

5 Handling data files

When you use the SAVE option from the main menu your records are saved in a file called MAIN. You can also create extra data files in the Xfiles option. You can access these files and the records in them from OPL. You can also create new files and then manipulate them. This chapter explains how to do this.

```
Record    Dr John Wood
          0982 23456
          44 Broughton Rd
          Broughton
```

[image]

There are also three examples of data file handling programs at the end of the example procedures chapter. It may be a good idea to refer to those programs while you read this chapter.

Files, records and fields

The data file MAIN and any extra ones you create contain **records** which are divided into **fields**. When you save a record from the main menu with the SAVE option, you start a new field every time you start a new line by pressing **DOWN**.

In a name and address file, in each record, there might be a name field, a telephone number field, and separate fields for each line of the address.

[image]

```
Records     Dr John Wood
            0982 23456
            44 Broughton Rd
            Broughton

              Dr John Wood      --> Field 1
Fields        098223456         --> Field 2
              44 Broughton Rd   --> Field 3
              Broughton         --> Field 4
```

Creating a data file

Before you can start to enter data into a new data file, you must create the file on one of the devices using New in Xfiles or the CREATE command in OPL.

With CREATE in OPL you have more control, as you specify how many fields there can be in each record, and what type of data can go in each field. The CREATE command has this syntax:
`CREATE "<dev>fname",logname,fldnm1,fldnm2`

"<dev>fname", is the device (A:, B: or C:) which the file is to be on, and then the file name. This all goes in quotes as a string, e.g. "a:clients". You can also assign this device and file name string to a string variable (e.g. cl$="a:clients") and then use the variable name (cl$) as the parameter. The file name may be up to 8 characters long.

logname is the **logical file name**. This may be A, B, C or D. You use this logical file name to refer to the file from within the program.

fldnm1, fldnm2 are the field names. There may be up to 16 fields in any record, and these may be given a qualifier, either % or $, to signify integer data or string data respectively. Fields containing floating point data need no qualifier. Field names may be up to 8 characters long including any qualifier used.

An example of a CREATE command might be:

CREATE "a:clients",B,nm$,tel$,ad1$,ad2$,ad3$

When a file has been created, it is automatically open. This means records can be saved to it immediately. It also becomes the current file which means that when you use one of the commands for manipulating records, they operate on this file.

Adding records to a file

You add records to a data file field by field. First you assign some values to the current field names, then you use the APPEND command to add them to the file.

Assigning values to field names

The field names act in a similar way to variables, and can be assigned values and used in INPUT statements. The field name must be used with the logical file name like this:

```
INPUT B.name$
```

or this

```
B.name$="MR Bruno"
```

where B is the logical file name and name$ is the name of the field. These are separated by a full stop.

Appending the fields

When you have assigned values to the fields, you add them to the open file with the **APPEND** command. They are always added as the last record in the data file. If the file is a new one, this will be the first record.

The APPEND command has no parameters - the field values are automatically added to the file in the correct order and format.

If you try to assign a text string to a numeric field name, an error will be reported.

See the second procedure (insert:) in program no. 6 of Chapter 8 for an example of adding records to a data file.

At any time while a data file is open, the field names currently in use can be used like any other variable - for example, in a PRINT statement, or a string or numeric expression. However, in order to operate on a particular field, you must make the record containing it the current one.

Changing the current record

Before you can erase a record or operate on the fields in it you must make it current. You can change the current record by using any of the six commands and functions below.

FIRST moves to the first record in a file.

NEXT moves to the following record in a file. If the end of the file is passed, **NEXT** does not report an error. The current record will then be null. This condition can be tested for with the EOF function.

BACK moves to the previous record in the file. If the current record is the first record in the file then the current record does not change.

LAST moves to the last record in the file.

POSITION moves to a particular record. For example, the instruction POSITION 3 makes record 3 (the first record is record 1) the current record. You can find the current record number by using the POS function which returns the number of the current record.

FIND moves to the record which contains a search string you specify.

Finding a record

The FIND function acts like the main menu Find, but without wild cards. The difference is that whereas the main menu Find prints the record on the screen, this function makes it the current record so that you can operate on it: editing it, erasing it, or just displaying it.

For example, the line

```
r%=FIND("HOLMES")
```

would make the first record. containing the string "HOLMES" the current record and return the number of that record to the variable r%. If the number returned is zero, the string was not found.

There is another function, FINDW, which is the same as FIND but does allow wild cards. So, to find the first record containing ORDER and 89 use this instruction:

```
r%=FINDW("*ORDER*89*")
```

+ Matches any character.
* Matches any group of characters.

The procedure called search: in program no. 6 in Chapter 8 is an example of how to find and edit records.

Erasing a record

To erase a record, make that record current by use of one of the commands FIRST, NEXT, BACK, LAST, POSITION or FIND and then use the ERASE command. This removes the current record from the file and renumbers the ones that follow.

The final procedure (erase:) in program no. 6 in Chapter 8 is an example of how to find and erase records.

Opening a file

When you first CREATE a data file it is automatically open but it closes again when the program ends. To open the file again in another program, you use the OPEN command.

The syntax of the OPEN command is the same as for the CREATE command. You must use the same device and file name as when you first created it, but when opening it in a different program, you can give it a different logical file name and give the fields different names. For example, a file which was created in one program with the command:

```
CREATE "c:address",D,name$,num$,add$,add2$
```

can be opened in another program by the command:

```
OPEN "c:address",A,a$,b$,c$,d$
```

Up to four files may be open at any one time, and these may be spread over any of the three devices. Each must be referred to in the program by a different logical name. So, if you have 4 files open. one is A one is B one is C and the other is D.

If you are going to edit or erase records in the file. you need to include all the fields you are going to operate on in the OPEN command. However, if you are just going to search for strings and display records. you only need to include the first field in the OPEN command, like this:

```
OPEN "c:address",A,a$
```

Changing the current file

When a file is created or opened, that file is then automatically the current file and all access is to that file until you say you want to USE a different one. The **USE** command makes a file current. You refer to the file by its logical file name. For example:

```
USE B
```

In this example the file with the logical file name B (as specified in the OPEN or CREATE command which opened it) becomes the current file. All access is now to this file until you change the current file with another USE command or OPEN or CREATE another file. If you attempt to use a file which has not previously been opened, an error is reported.

Closing and deleting a file

Data files close automatically when programs end. However, when you have finished accessing a particular file, you can close it with the CLOSE command which closes the current file.

You might want to close a file if you already have 4 files open in a program, and you want to open another, or if you want to delete the file. There is a command **DELETE** for deleting data files, but the file to be deleted must be closed first.

More information on data file handling

See the beginning of Chapter 9 for a summary of all the data file handling commands and functions. Then look up each one for more detail.

Look at programs 6, 7 and 8 in Chapter 8 for examples of data file handling programs.

6 Handling any type of file

Most of the file handling commands and functions are only for data files.

However there are three, COPYW, DELETEW and DIRW$, which operate on any type of file. You indicate the type of file with these extensions:

Data file and diary file (ODB stands for Organiser Data Base.)	**.ODB**
OPL procedure	**.OPL**
Notepad file	**.NTS**
Comms Link setup file	**.COM**
Spreadsheet file	**.PLN**
Pager setup file	**.PAG**
Diary file from XP or CM	**.DIA**

There are also two extra extensions for COPYW only. Use these to copy only one part of an OPL procedure.

OPL procedure (text only)	**.OPT**
OPL procedure (object only)	**.OPO**

You can also use wild cards with COPYW, DELETEW and DIRW$. The wild cards are the normal ones: + is any character, * is any group of characters.

Examples

```
COPYW "A:*88.OPL","B:"
```

Copies all the OPL procedures whose names end in 88 from A: to B:

```
DELETEW "C:*.NTS"
```

Deletes an the notepad files on C:

```
DIRW$ ("A: R*")
```

Returns the name of the first file of any type on A: which starts with the letter R.

Diary files

Diary files are saved as data files. Each entry is a record with this two field format:

```
198904271200010O
JAMES BIRTHDAY
```

in this example, the first field carries this information:

1989	The year
04	The month
27	The date
1200	The start time
01	The duration - one 15 minute interval
00	The alarm pre-warning time. In this case there is no alarm so it's zero.

You can open a saved diary file in Xfiles, and then find and update records in it. For example, you could find all your annual entries such as birthdays and change 1989 to 1990. If you then restored the diary and merged it with the current one you wouldn't need to put in all the birthday entries again at the end of the year. However, be careful to use the right format, or you won't be able to restore the diary.

You could also do this in OPL using the data file handling and string handling commands. There is a program in Chapter 8 which does this.

7 Error handling

This chapter covers commonly made errors, then error trapping. There is a list of the OPL error messages in Appendix D.

Common errors

All programming languages are very particular about the way commands and functions are used, especially in the way program statements are laid out.

Below are a number of errors which are easy to make in OPL. The incorrect statements are in bold and the correct versions are on the right.

Punctuation errors

Omitting the colon between statements on a multi-statement line:

Incorrect	Correct
`a$="text" PRINT a$`	`a$="text" :PRINT a$`

Omitting the colon after a called procedure name:

```
Incorrect         Correct
proc1:            proc1:
GLOBAL a,b,c      GLOBAL a,b,c
.                 .
.                 .
proc2             proc2:
```

Omitting one or more of the colons after a label:

```
Incorrect         Correct
proc1:            proc1:
GOTO below:       GOTO below::
.                 .
.                .
below::          below::
```

Omitting the space before the colon between statements on a multi-statement line:

```
Incorrect           Correct
proc1:              proc1:
a$=b$:PRINT a$      a$=b$: PRINT a$
```

Parameter errors Passing a floating point value to a procedure which requires an integer - here the procedure proc2:(x%).

```
Incorrect           Correct
2*6+proc2:(PI)      2*6+proc2:(INT(PI))
```

This may also happen when a procedure is called from the calculator. The calculator converts all numbers to floating point, so:

```
Incorrect           Correct
Calc:proc2:(3)      Calc:proc2:(INT(3))
```

Passing an integer to a procedure which requires a floating point value - here the procedure proc3:(x)

```
Incorrect        Correct
proc1:           proc1:
.                .
.                .
proc3:(2/3)      proc3:(2.0/3)
```

Passing the wrong number of parameters to a procedure - here, the procedure proc4:(x,y)

```
Incorrect        Correct
proc1:           proc1:
.                .
.                .
proc4:(3.7)      proc4:(3.7,2.5)
```

Integer size error

OPL only allows numbers between minus 32768 and plus 32767 to be assigned to integer variables, so any expression which exceeds these limits will cause an error:

```
Incorrect        Correct
proc1:           proc1:
LOCAL a%         LOCAL a
a%=100*2468      a=100.0*2468
```

Structure errors

The structures allowed within OPL are DO/UNTIL, WHILE/ENDWH and IF/ELSEIF/ELSE/ENDIF. These may all be nested within one another to up to eight structures deep. Attempting to nest to a greater depth than this will cause an error. Mixing up the three structures e.g. by matching up DO with WHILE, will also cause an error:

```
Incorrect     Correct
proc1:        proc1:
.             .
DO            DO
.             .
WHILE a<2     UNTIL a>=2
```

Run-time errors

If an error occurs when you run a program, the program stops and an error message is displayed.

If you are running the procedure from the main menu, just press **SPACE** to return to the menu.

However if you are running it from the Prog menu, you get a chance to edit it. Here a call has been made to a procedure called subproc: which does not exist:

```
 MISSING PROC
      SUBPROC
....................
Edit A:MAINPROC Y/N
```

Press **Y** if you want to edit the procedure. If the source code is available, you are returned to the OPL editor to correct the offending line. Press **N** or **ON/CLEAR** if you don't want to edit it.

When you have done this, press MODE to get the editor menu, and either translate, save or quit the procedure. If you quit, the edits you have made this session are abandoned.

Error trapping

In the case of the run time errors described above, the program stops to display the error message. There are ways of avoiding this by trapping errors and dealing with them yourself within the program - but they put you in full control and **must be used carefully**. The tools used to control errors are **ONERR**, **TRAP**, **ERR**, **ERR$** and **RAISE**:

- ONERR traps any errors which occur and redirects the program to your own error handler.
- TRAP traps only errors on a particular command.
- ERR and ERR$ identify which error has occurred.
- RAISE generates an error. (often used for testing)

ONERR label:: and ONERR OFF

ONERR, is used to redirect program control to a label if an error occurs. This is useful if you want to provide your own error handling routine, such as printing out a message for an error you anticipate. ONERR is followed by the label name which ends in two colons. The label itself can be either in the same procedure or in a procedure before it in the same program.

In the example below, LPRINT is being used to print to an attached printer. Normally, when no printer is connected, the message DEVICE MISSING is displayed. Here a more precise message, CONNECT PRINTER, is supplied by the programmer:

```
ONERR noprint::
LPRINT "Dear Sir"
RETURN
noprint::
ONERR OFF :IF ERR=194 :RAISE ERR :ENDIF
PRINT "CONNECT PRINTER"
GET
```

The first line causes a jump to the label noprint:: if an error occurs. If no printer is connected, the LPRINT command causes such a jump and the message "CONNECT PRINTER" is displayed. If there is one connected, "Dear Sir" is printed and the lines after the label are never run, because of the RETURN before it.

- **You should always cancel ONERR with ONERR OFF as soon as an error has been detected.**
- **You should always deal with the LOW BATTERY error explicitly as it is so important.**

ONERR OFF

Notice that the first instruction after the label noprint:: is ONERR OFF. This is very important because if you don't do this after the ONERR label:: command is used, all subsequent program errors - even in other procedures called - result in the program being directed to the same label. This diagram illustrates how two completely different errors cause a jump to the same label, and cause the same explanatory message to be printed out:

```
proc1:
onerr label::
....
a=log(- 1)
....
label::
PRINT "Explanation of log error"
....
```

proc2:
....

proc3:
PRINT 2/0

Risks of ONERR label::

As all errors go back to the same label unless you switch ONERR OFF, it is very easy to create an endless loop by mistake. If this happens, you cannot press **ON/CLEAR** and **Q** to break out, as this just makes control go to the label as any other error would - so, you have to take the battery out of the Organiser, and lose everything in the internal memory. To avoid this:

- **You should always include the command ONERR OFF immediately after the label.**

TRAP

TRAP traps errors on a specified command only, so it doesn't need to be cancelled like ONERR does. It can be used with any of the commands listed below:

APPEND BACK CLOSE COPY COPYW CREATE DELETE DELETEW ERASE EDIT FIRST INPUT LAST NEXT OPEN POSITION RENAME UPDATE USE

The trap command immediately precedes any of these commands, separated from it by a space - e.g:
`TRAP INPUT a%`

When INPUT is used without TRAP and a text string is entered when a number is required, the display just scrolls up and a question mark is shown, prompting for another - valid - entry. When you put TRAP in front of INPUT, the command is executed in the usual way, but if an error occurs the next line of the program is executed as if there had been no error. The next line in the example below is a helpful message.

```
proc:
LOCAL a%
start::
PRINT "ENTER AGE",
TRAP INPUT a%
IF ERR=252
PRINT "NUMBER NOT WORD"
GOTO start::
ENDIF
```

The example above also uses the ERR function.

The ERR function

When errors occur in a program, the number of the error is accessible by using the **ERR** function. This means that you can be absolutely sure which error you are dealing with.

The anticipated error in the lines below is 246 (NO PACK). If 246 occurs when trying to open the MAIN file on pack B: a helpful error message is printed out. However, just in case a different error occurs, the next lines make sure that the standard error message for that error is printed.

```
TRAP OPEN "B:MAIN",A,a$
IF ERR=246
PRINT "NO PACK IN B:"
ELSEIF ERR
PRINT ERR$(ERR)
ENDIF
```

The OPL error messages are listed in Appendix D.

RAISE

If you are using commands to trap errors and handle them yourself, then at some during the development stage of your program you need to test your error handling routines. An easy way to do this is with the RAISE command. You can generate an error that you think might occur when the program is in use, and see if the error handling routine takes care of it in the way you anticipate. For example, this statement causes the NO PACK error to be generated:

```
RAISE 246
```

8 Example programs

This chapter contains example programs written in OPL. The programs are not intended to demonstrate all the features of OPL, but they should give you a few hints. To find out more about a particular command or function, refer to Chapter 9. Each of the procedures must be entered separately, you can't enter two procedures in one block. Chapter 1 explains how to type in, translate, save and run a procedure.

Uppercase, lowercase

In the listings here, variables are shown in lowercase and commands and functions in uppercase. However, it doesn't matter which you use when you enter procedures into the Organiser:

- **You can type procedures in an uppercase, all lowercase or any mixture of the two.**

Spaces

Be careful to type in the necessary spaces:

- When there is more than one command or function on a line, you need to separate each one with a space. Also each command or function except for the first must have a colon before it - for example:
  `CLS :PRINT "hello" :GET`
- Put a space between a command and the arguments which follow it - for example:
  `LOCAL a$`
- Don't put a space between a function and the arguments in brackets - for example:
  `CHR$(16)`

- It doesn't matter how many spaces you have at the beginning of a line.

Remarks

Lines beginning with the command REM are remarks; they are there to explain things. They do not affect the way a procedure runs and you don't have to type them in if you don't want to.

1 Days (Version 1)

This procedure works out the number of days you've been alive. Substitute your own date of birth for the one supplied here.

```
days1:
LOCAL birth%,now%,answer%
birth%=DAYS(14,6,1957)
now%=DAYS(DAY,MONTH,YEAR)
answer%=now%-birth%
PRINT answer% :GET
```

Variables
birth% is your date of birth.
now% is the current date.
answer% is the current date minus your date of birth.

Date functions
All the OPL date functions return values accessed from the Organiser clock and calendar. The function DAYS returns the number of days since the beginning of the calendar on a particular date.

2 Days (Version 2)

This procedure is a more flexible one which works out the number of days between boy two dates that you input. When you run the procedure you are prompted to enter the day, month and year of the first date then the second date.

```
days2:
LOCAL d1%, m1%, y1%, d2%, m2% y2%
PRINT "ENTER FIRST DAY"
INPUT d1%
PRINT "ENTER FIRST MONTH"
INPUT m1%
PRINT "ENTER FIRST YEAR"
INPUT y1%
PRINT "ENTER SECOND DAY"
INPUT d2%
PRINT "ENTER SECOND MONTH"
INPUT m2%
PRINT "ENTER SECOND YEAR"
INPUT y2%
PRINT DAYS(d2%,m2%,y2%)-DAYS(d1%,m1%,y1%)
GET
```

Variables
d1%, **m1%** and **y1%** are the day month and year of the first date.
d2%, **m2%** and **y2%** are the day month and year of the second date.

3 Dice

This procedure turns the Organiser into a dice. When the program is run, a message is displayed saying that the dice is rolling. You then press S to stop it. A random number from one to six is displayed and you choose whether to roll again or not.

```
dice:
LOCAL dice%,key%
```

```
KSTAT 1
top::
CLS :PRINT "****DICE ROLLING****"
PRINT "PRESS S TO STOP"
DO
 dice%=(RND*6+1)
UNTIL KEY$="S"
CLS
PRINT "********* ";dice%;" ********"
BEEP 50,100
AT 1,4 :PRINT "ROLL AGAIN Y/N"
label::
key%=GET
IF key%=%Y
 GOTO top::
ELSEIF key%=%N
 RETURN
ELSE
 GOTO label::
ENDIF
```

Variables
dice% is a random number from 1 to 6.
key% is the ASCII value of the keypress read by the GET function.

Random numbers
This is how dice: displays 1, 2, 3, 4, 5 or 6 randomly. The RND function returns a random floating point number, between 0 and 1 (not including 1). It is then multiplied by 6 and 1 is added (so that you get numbers from 1 to 6 instead of from 0 to 5). It is rounded down to a whole number by assigning to the integer dice%.

Identifying keypresses of Y and N
The ASCII value of the character on the key you press is returned by the GET function and assigned to key%. In OPL you get the ASCII value of any character by putting % in front of it, so %Y is the ASCII value of Y and %N is the ASCII value of N. In case you had the keyboard set to lowercase, KSTAT 1 is used at the start of the procedure to set it to uppercase, so that you are not pressing y and n.

4 Mortgage calculator

This program calculates monthly mortgage payments. When you run it, you have to enter the amount of the loan, the interest rate and the term in years. Then you specify the source of the loan by selecting from a menu. The program does not allow for tax relief.

The program is made up to two procedures - mortgage: and q: - a general input routine. You must type each one in separately. The input routine could be called by any procedure which needs to prompt the user to enter a floating point number.

```
mortgage:
LOCAL num%,loan,x,term,rate,pay,ques$(2)
CLS
PRINT "EVALUATE MONTHLY"
PRINT "MORTGAGE PAYMENT"
PAUSE 30
ques$=CHR$(63)+" "
REM CHR$(63) is a "?" - See Appendix A
loan=q:("ENTER LOAN"+ques$)
DO
 rate=q:("INTEREST RATE % "+ques$)
UNTIL rate>0 AND rate<99
DO
 term=q:("ENTER TERM (YRS)"+ques$)
UNTIL term>.5 AND term<100
num%=MENU("BUILDING-SOCIETY,BANK,OTHER")
```

```
IF num%=0 :RETURN :ENDIF
rate=rate/100 :x=1+11*(num%/2)
pay=loan*rate/12/(1-((1+rate/x)**(-x*term)))
CLS :PRINT "MONTHLY PAYMENT"
PRINT FIX$(pay, 2, -8)
GET
RETURN

q:(a$)
LOCAL z
CLS :PRINT a$,CHR$(16);
INPUT z
CLS
RETURN(z)
```

Variables

loan, **term**, **rate** and **pay** are the amounts of the loan, the term in years, the interest rate and the monthly payments.

ques$ is "? ".

num% is the number of the menu item you choose.

x is a variable used in the calculation at the end.

z is the variable used for the values you input when q: is running.

Calling q:

The main procedure mortgage: calls q: three times, passing it a string to be printed out as a prompt. The text string is passed to q: as a parameter. The values returned are assigned to the variables loan, rate, and term.

How "?" is printed

The CHR$ function converts the ASCII value 63 to the question mark character.

How the input routine beeps

The CHR$ function converts the value 16 to the beep control character. This is then "printed" out.

5 Chase Game

The next two procedures make up a game which demonstrates the use of user defined graphics (UDG's). Each procedure must be typed in separately.

The object of the game is to avoid being caught by the pursuers. Your movable man can jump up and down: press the **X** key to jump down and the **S** key to jump up. At the end of the game your score will be displayed on the screen.

To pause the game, press **ON/CLEAR** and to restart press it again. To quit out of the game press **ON/CLEAR** then **Q**.

```
game:
LOCAL e$ (2)
LOCAL a%,b%,b1%,c%,c1%,x%,y%,i%,sc%
graphic: :CURSOR OFF
e$=CHR$(4)+CHR$(6)
b%=20 :c%=12 :x%=3 :y%=1
DO
 CLS :PRINT REPT$(CHR$(158),80)
 AT x%,y% :PRINT CHR$(7)
 a%=1 :c%=1+RND*4
 DO :c1%=1+RND*4 :UNTIL c%<>c1%
 DO
  AT a%,c% :PRINT CHR$(0)
  AT a%,c1% :PRINT CHR$(0) :BEEP b%,10*b%
  AT a%,c% :PRINT CHR$(1)
  AT a%,c1% :PRINT CHR$(1) :BEEP b%,10*b%
  AT a%,c% :PRINT CHR$(2)
  AT a%,c1% :PRINT CHR$(2) :BEEP b%,10*b%
  AT a%,c% :PRINT CHR$(3)
  AT a%,c1% :PRINT CHR$(3) :BEEP b%,10*b%
  AT a%,c% :PRINT e$
  AT a%,c1% :PRINT e$ :BEEP b%,10*b%
  AT a%,c% :PRINT CHR$(5)
  AT a%,c1% :PRINT CHR$(5) :BEEP b%,10*b%
  AT a%,c% :PRINT " " :AT a%,c1% :PRINT " "
  i%=KEY
  IF i%
   IF i%=%S AND y%>1
    AT x%,y% :PRINT CHR$(158)
    y%=y%-1 :AT x%,y% :PRINT CHR$(7)
   ENDIF
   IF i%=%X AND y%<4
    AT x%,y% :PRINT CHR$(158)
    y%=y%+1 :AT x%,y% :PRINT CHR$(7)
   ENDIF
  ENDIF
  a%=a%+1
  IF a%=x% AND (c%=y% OR c1%=y%) :REM Hit
   i%=0
   DO
    AT x%,y% :PRINT CHR$(170+i%)
    BEEP 10,100+i%
    i%=i%+1
    BEEP 10,100-i%
   UNTIL i%=30
   b%=b%+5 :a%=20 :x%=x%+2
   IF x%>20
    CLS :PRINT "GAME OVER"
    PRINT "SCORE:",sc% :PAUSE 40
    WHILE KEY :ENDWH :REM Drain buffer
    GET :RETURN
   ENDIF
  ENDIF
 UNTIL a%=20
 sc%=sc%+1
 IF b%>12
  b%=b%-2
 ELSEIF b%<6
  IF b1%
   b%=b%-1 :b1%=0
  ELSE
   b1%=1
  ENDIF
 ELSE
  b%=b%-1
 ENDIF
UNTIL 0

graphic:
UDG 0,0,0,28,30,30,30,28,0
UDG 1,0,0,14,31,30,31,14,0
UDG 2,0,0,7,14,12,14,7,0
UDG 3,0,0,3,7,6,7,3,0
UDG 4,0,0,1,3,3,1,0,0
UDG 5,0,0,0,1,1,1,0,0
UDG 6,0,0,24,16,4,16,24,0
UDG 7,30,14,4,14,30,14,11,25
```

User defined graphics

The main procedure, game:, calls graphic: which then uses the UDG command 8 times to set up the graphics characters used in the game. The last UDG command is the one which sets up the little man. User defined characters are explained in Appendix A.

6 Data file handling procedures

The main procedure below creates a data file called addr on device A, to contain names, addresses, post codes and telephone numbers. It is followed by 4 other procedures which allow you to insert. search for, alter and erase records in the file. When you run files:, a menu giving you a choice of these options is displayed.

Each of these 5 procedures must be typed in separately.

```
files:
LOCAL m%
IF NOT EXIST("A:addr")
 CREATE "A:ADDR",A,n$,ad1$,ad2$,ad3$,pc$,tel$
ELSE
 OPEN " A:ADDR",A,n$,ad1$,ad2$,ad3$,pc$,tel$
ENDIF
DO
 m%=MENU("INSERT,SEARCH,ALTER,ERASE,QUIT")
 IF m%=0 or m%=5 :STOP
 ELSEIF m%=1 :insert:
 ELSEIF m%=2 :search:
 ELSEIF m%=3 :alter:
 ELSEIF m%=4 :erase:
 ENDIF
UNTIL 0 :REM do loop forever

insert:
PRINT "ENTER NAME" :INPUT A.n$
CLS :PRINT "ENTER STREET" :INPUT A.adl$
CLS :PRINT "ENTER TOWN" :INPUT A.ad2$
CLS :PRINT "ENTER COUNTY" :INPUT A.ad3$
CLS :PRINT "ENTER PCODE" :INPUT A.pc$
CLS :PRINT "ENTER TELNUM" :INPUT A.tel$
APPEND

search:
LOCAL recnum%,search$(30)
top::
FIRST :CLS :PRINT "FIND:";
TRAP INPUT search$
IF ERR=206
 RETURN
ENDIF
recnum%=FIND(search$)
IF recnum%=0
 CLS :PRINT "NOT FOUND" :PAUSE 20
 GOTO top::
ENDIF
DO
 DISP(-1,"") :NEXT :recnum%=FIND(search$)
 IF recnum%=0 :CLS
  PRINT " NO MORE ENTRIES"
  PAUSE 20 :RETURN
 ENDIF
UNTIL 0

alter:
LOCAL recnum%,search$(30),k%
DO
 FIRST :CLS
 PRINT "ALTER:"; :TRAP INPUT search$
 IF ERR=206 :RETURN :ENDIF
 recnum%=FIND(search$)
 IF recnum%=0
  CLS :PRINT "NOT FOUND"
  PAUSE 20 :CONTINUE
 ENDIF
 DO
  KSTAT 1 :CLS :AT 1,2 :PRINT "EDIT Y/N"
  k%=VIEW(1,A.n$)
  IF k%=%Y :CLS
   EDIT A.n$ :EDIT A.ad1$
   EDIT A.ad2$ :EDIT A.ad3$
   EDIT A.pc$ :EDIT A.tel$ :UPDATE :RETURN
  ELSEIF k%=%N :NEXT :recnum%=FIND(search$)
   IF recnum%=0
    CLS :PRINT "NOT FOUND" :PAUSE 20 :BREAK
   ENDIF
  ENDIF
 UNTIL 0
UNTIL 0

erase:
LOCAL recnum%,search$(30),k%
FIRST :CLS :PRINT "ERASE:";
TRAP INPUT search$
IF ERR=206 :RETURN :ENDIF
recnum%=FIND(search$)
DO
 IF recnum%=0
  CLS :PRINT "NOT FOUND" :PAUSE 20 :RETURN
 ENDIF
 ask::
 KSTAT 1 :AT 1,2 :PRINT "ERASE Y/N"
 k%=VIEW(1,A.n$)
 IF k%<>%Y AND k%<>%N
  GOTO ask::
 ELSEIF k%=%Y
  ERASE
 ELSEIF k%=%N
  NEXT :recnum%=FIND(search$)
 ENDIF
UNTIL EOF
```

Variables

m% is the number of the menu item you select

recnum% is the record number returned by FIND.

search$ is the search clue you enter.

k% is the ASCII value of the key you press whilst the found record is displayed. (%Y is the ASCII value of Y, %N is the ASCII value of N.)

Creating the data file

The first procedure, files:, creates or opens a file called addr on device A: with 6 fields for each record. The six field names are n$ for the name, ad1$, ad2$, and ad$3 for each line of the address, pc$ for the post code and tel$ for the phone number. The file is given the logical name A.

Inserting records

Notice how in insert: the 6 fields of the record are input one by one. The field names are used like variables and preceded by the logical file name (A) and a full stop. Then the APPEND command is used; this is necessary to actually add the record to the end of the file.

Displaying the current record

When a record containing a particular string has been found by FIND it becomes the current record. DISP with -1 as the first parameter, displays it.

In the procedure alter:, VIEW is used to display just the first field of the record, while you decide whether to edit it. If you choose to, each field is then displayed by the EDIT function, which allows you to alter what is on the screen.

7 Telephone logging (data file handling)

These 3 procedures make up a program which allows you to log telephone calls. It stores their duration with your comments in a data file. It could easily be adapted to record the duration of any other activity.

The first procedure displays a menu like this with a phone UDG and the clock. Because the clock uses UDGs 3, 4, 5, 6, 7 and 1, UDGs 0 and 2 been used for the phone and the underline:

```
X               11:19a
Logcall   Viewcalls
```

```
logger:
LOCAL m%
UDG 0,31,21,14,10,31,31,0,31
UDG 2,0,0,0,0,0,0,0,31
PRINT CHR$(0);REPT$(CHR$(2),14)
CLOCK(1)
m%=MENUN(2,"Logcall,Viewcalls")
IF m%=0
  RETURN
ELSEIF m%=1
  logcall:
ELSE m%=2
  viewcall:
ENDIF

logcall:
LOCAL k%,h%,m%,s%,sec%,start$(8),swof%
ESCAPE OFF
IF NOT EXIST("A:LOG")
 CREATE "A:LOG",B,date$,t$,comment$
ELSE
 OPEN "A:LOG",B,date$,t$,comment$
ENDIF
swof%=PEEKB($7C)
POKEB $007C,0 :REM no auto turn off
B.t$="00:00:00"
B.date$=DATIM$
start$=RIGHT$(DATIM$,8)
h%=0 :m%=0 :s%=0 :sec%=SECOND
DO
 IF sec%<>SECOND
  BEEP 1,100
  sec%=SECOND :s%=s%+1
  IF s%=60 :s%=0 :m%=m%+1
   IF m%=60 :m%=0 :h%=h%+1
   ENDIF
  ENDIF
  B.t$=REPT$("0",-(h%<10))+NUM$(h%,2)+":"
  B.t$=B.t$+REPT$("0",-(M%<10))+NUM$(m%,2)+
  B.t$=B.t$+REPT$("0",-(s%<10))+NUM$(s%,2)
 ENDIF
 AT 1,1 :PRINT "Started:";start$
 PRINT "Time:";B.t$
 PAUSE -1 :REM save battery
 k%=KEY
 IF k%=1
  GOTO exit::
 ENDIF
UNTIL k%=13
PRINT "Comments "+CHR$(63)
TRAP INPUT B.comment$
IF ERR=206
 GOTO exit::
ENDIF
CLS :PRINT "Saving" :APPEND
```

```
exit::
CLOSE
POKEB $007C,swof% :REM restore auto turn off
ESCAPE ON

viewcall:
LOCAL k%
TRAP OPEN "A:LOG",B,date$,t$,comment$
IF ERR :RETURN :ENDIF
DO
 k%=DISP (-1,"")
 NEXT
 IF k%=1
  RETURN
 ENDIF
UNTIL EOF
AT 1,4 :PRINT "  NO MORE ENTRIES"
PAUSE 25
RETURN
```

Variables

k% is used for the keypresses read by KEY.
sec% is the actual number of seconds past the minute at the start of the procedure.
s% is the seconds shown counting up.
m% is the minutes shown counting up.
h% is the minutes shown counting up.
start$ is the time the call started.
swof$ is the initial setting of auto-switch off.

The data file

A data file called LOG is created on device A: with three fields in each record: one for the date, one for the time which the call took, and one for your comments. When you run the program and log a call the date, time and comment are appended to the data file as a record. Select Viewcalls to look through all the appended records.
You could also open the file A LOG in Xfiles, and search for the records using Find.

How the stopwatch counts up the elapsed time

The actual number of seconds past the minute is read from the system clock by the SECOND function and assigned to sec% at the start. Then the SECOND function is used again, and if it is no longer equal to sec% - i.e. when a second has elapsed - 1 is added to s% and sec% is assigned the actual number of seconds again. Whenever s% is 60, it is reset to 0 and 1 is added to m% and so on.

ESCAPE OFF

Normally **ON/CLEAR** pauses the execution of a procedure so that **Q** can be pressed to quit. At the start of this procedure ESCAPE OFF is used. This means that **ON/CLEAR** does not pause the program, and can thus be read by the KEY and DISP functions and cause a RETURN to the PROG menu instead of an ESCAPE error.

Displaying the records

When A:LOG is opened in viewcall, the first record is made current then displayed by DISP with - 1 as the first parameter. Then NEXT is used to make each record current in turn.

8 Diary file handling procedure

If you save your diary to a file, you can use this program to copy all the birthdays from one year to the next year. It could easily be adapted to deal with other annual entries too.

A saved diary file called "olddia" is opened. All the records containing 1989 and birthday have the 1989 changed to 1990 and are put into a file called "newdia". You can then restore "newdia" into your current diary and merge the two.

Remember to substitute the name of your saved diary for "olddia" when you type the procedure in.

```
birthday:
CREATE "a:newdia",B,date$,text$
OPEN "a:olddia",A,date$,text$
WHILE FINDW("1989*birthday")
 PRINT a.text$
 b.date$="1990"+mid$(a.date$,5,255)
 b.text$=a.text$
 USE B :APPEND
 USE A :NEXT
ENDWH
GET
```

Diary files

A saved diary file is just like any other data file. However, for more information about the format of records in diary files, see Chapter 6.

9 OPL commands and functions

Summary

Here is a summary of the OPL commands and functions to give you an idea of what is available. This is followed by an alphabetic list which deals with each command and function in detail.

A * indicates that the instruction can only be used on a model LZ or LZ64 and not on an XP or CM.

Structures

DO/UNTIL Loops until a condition is met
GOTO label:: Branches to a label
IF/ELSEIF/ELSE/ENDIF Acts conditionally
WHILE/ENDWH Loops while a condition is met
BREAK Exits from a loop
CONTINUE Goes to the test condition of a loop

General commands

LOCATE Positions the cursor
BEEP Sounds the buzzer
CLS Clears the display
CURSOR ON/OFF Sets the cursor
EDIT Allows a string to be edited on the screen
ESCAPE ON/OFF Allows user to break out of program
GLOBAL Declares variables for all procedures called
INPUT Allows data to be input
KSTAT Sets the keyboard status
LOCAL Declares variables for current procedure only
OFF Turns the Organiser off
OFF x% Turns the Organiser off for a limited time only*
PAUSE Pauses the program
PRINT Prints to the screen
PRINT Prints to an attached printer or computer,
RANDOMIZE Sets a new sequence of random numbers
REM Precedes a programmer's remark
RETURN Returns to the calling procedure
STOP Exits from OPL
UDG Defines a display character (user-defined graphic)*

Error handling commands

ONERR label:: Goes to label on error
ONERR OFF Cancels ONERR label::
RAISE Generates an error
TRAP Traps errors on a specified command

File handling commands

APPEND Adds current field values to current data file
CLOSE Closes a data file
COPY Copies a data file

COPYW Copies any type of file*
CREATE Creates a data file
DELETE Deletes a data file
DELETEW Deletes any type of file*
ERASE Erases a record
FIRST/LAST/NEXT/BACK Select first/last/next/previous record
OPEN Opens a data file
POSITION Selects a record by number
RENAME Renames a data file
UPDATE Updates a record
USE Changes current data file

Memory address commands

POKEB Writes a byte to an address
POKEW Writes an integer to two successive addresses

General functions

CHR$ Returns a character with a specified. ASCII code
CLOCK Displays the clock.*
FIX$ Returns a number as a fixed point decimal
FREE Returns the amount of free internal memory
GEN$ Returns a number as a string
GET Waits for a keypress. Returns ASCII value of key
GET$ Waits for a keypress. Returns the key as a string
KEY Returns the ASCII value of the key pressed
KEY$ Returns the key pressed as a string
NUM$ Returns a number as an integer
MENU Displays a menu
MENUN Displays a multi-line menu*
SPACE Returns free memory space on a device
VIEW Displays a scrolling string on the screen

Error handling functions

ERR Returns error number
ERR$ Returns error message

File handling functions

COUNT Returns the number of records in a data file
DIR$ Returns name of data file
DIRW$ Returns name of any type of file*
DISP Displays a record
EOF Tests for end of data file
EXIST Checks to see if a data file name exists
FIND Finds a record containing a string
FINDW Like FIND but allows the use of wild cards*
POS Returns the current record number
RECSIZE Returns bytes occupied by the current record

Numeric functions

ABS Returns the absolute (unsigned) value of a floating point number
ACOS Returns the arc cosine of a number*
ASIN Returns the arc sine of a number*
ATAN Returns the arc tangent of a number
COS Returns the cosine of a number
DEG Converts from radians to degrees
EXP Returns e raised to the power you specify
FLT Converts an integer into a floating point number
IABS Returns the absolute (unsigned) value of an integer
INT Returns a rounded down integer number
INTF As above, but returns a floating point number
LN Returns the natural log of a number
LOG Returns the base 10 log of a number
PI Returns pi (3.1415926535 ...)
RAD Converts from degrees to radians
RND Returns a random floating point number
SIN Returns the sine of a number.
SQR Returns the square root of a number
TAN Returns the tangent of a number
HEX$ Converts an integer into a hexadecimal string

Numeric list functions*

MAX Returns the greatest item
MIN Returns the smallest item
MEAN Returns the mean
STD Returns the standard variation
SUM Returns the sum
VAR Returns the variance

Date functions

DAYS Returns the number of days since 0 1/ 0 1 1900 - used to fInd out the number of days between two dates*
DATIM$ Returns the date and time as a string
DAYNAME$ Converts 1-7 to the day of the week*
DOW Returns the day a date falls on as a number 1-7*
MONTH$ Converts 1- 12 to the month*
SECOND/MINUTE/HOUR/DAY/MONTH/YEAR Return Information about the current time and date.

WEEK Returns the week number a date falls in*

String handling functions

ASC Returns the ASCII value of the first character of a string
LEFT$/MID$/RIGHT$ Select characters from strings according to their position
LEN Returns the length of a string
LOC Returns the location of a string within a string
LOWER$/UPPER$ Convert a string to lower/upper case
REPT$ Returns repetitions of a specified string
VAL Converts a numeric string to a floating point value

Memory address functions
ADDR Returns the address of a variable
PEEKB Returns the value stored at an address
PEEKW Returns the value store at two consecutive addresses

Microprocessor functions
USR Passes values to the microprocessor and returns an integer
USR$ Passes values to the microprocessor and returns a string

Command syntax

Most OPL commands require one or more arguments after them. The arguments may be either literal values or variables.

The following method of specifying the syntax of a command is used:

x	Numeric expression, variable or literal. E.g price or 49.99
x%	Integer expression in the range -32768 to +32767, variable or literal. E.g. price% or 50
a$	String expression, variable or literal. E.g. price$ or "49.99"
dev:	Device (A:, B: or C:)
log	Logical file name (A, B, C or D).

- The arguments follow the command after a space and are separated by commas.
- So an example of the AT command - which has the syntax:
  AT x%,y%
  might be
  AT 15,2
- If you want more than one command or function on one line, you must separate them by a space followed by a colon - for example:
  CLS :PRINT "hello"

Function syntax

Functions are used to produce values which can then be assigned to a variable or combined with commands such as PRINT. For example:

> The instruction y%=YEAR assigns the integer value 1990 (or whatever the current year is) to the variable y%
>
> The instruction PRINT YEAR displays the number 1990 on the screen

The method of specifying the syntax is the same as for commands.

You can tell what the return type of the function is by the type of the receiving variable shown in the syntax:

> Numeric functions which return a floating point value look like this: f=FUNCTION.
>
> Numeric functions which return an Integer look like this: f%=FUNCTION.
>
> String functions look like this: f$=FUNCTION$.

- The arguments follow the function with no space, separated by commas and enclosed in round brackets ().
- So an example of an instruction including the ABS function which has the syntax:
  a=ABS(x)
  might be
  PRINT ABS(-10) or x=ABS(y)
- Commands, functions and arguments can be typed in upper or lower case.

List of commands and functions

ABS
Syntax: **a=ABS(x)**
Returns the absolute value. Ie. without any sign, of a floating point number. E.g. `ABS(-10)` is 10.
See also IABS.

ACOS
Syntax: **a=ACOS(x)**
Returns the arc cosine of the expression inside the brackets.

ADDR
Syntax: **a%=ADDR(var)**
Returns the address at which the variable inside the brackets is stored in memory. You can use an array as the variable, e.g. `A%=ADDR(ARRAY())`, but you can't specify individual elements of an array.

APPEND
Syntax: **APPEND**
Appends the current field values to the end of the current file as a new record.
See also UPDATE.

ASC
Syntax: **a%=ASC(a$)**
Returns the ASCII value of the first character of a string expression. E.g. `A%=ASC("hello")` returns 104.
See Appendix A for the ASCII codes.

If you just need the ASCII code for one particular character you can use the % sign. For example, `A%=%G` returns the ASCII code for the letter G to the variable A%.
See also CHR$.

ASIN
Syntax: **a=ASIN(x)**
Returns the arc sine of the expression inside the brackets.

AT
Syntax: **AT x%,y%**
Positions the cursor at the screen position you specify. x% is the number of characters across the screen in the range 1 to 20, and y% (1, 2, 3 or 4) indicates the top, second, third or bottom line.

ATAN
Syntax: **a=ATAN(x)**
Returns the arc tangent of the expression inside the brackets.

BACK
Syntax: **BACK**
Makes the previous record in the current data file the current record. If the current record is the first record in the file then the current record does not change.

BEEP
Syntax: **BEEP x%,y%**
Sounds the internal buzzer of the Organiser. The sound duration is k% milliseconds. The frequency of the sound is determined by the equation Frequency = 921600/(78+2*y%)Hz.

Alternatively, the control character 16 can be used in conjunction with the PRINT command and the CHR$ function to sound the buzzer, i.e: `PRINT CHR$(16)`

BREAK
Syntax: **BREAK**
Allows program control to break out of a DO/UNTIL or a WHILE/ENDWH loop, and to continue the execution of the program at the instruction following the terminator of the loop (UNTIL or ENDWH).

CHR$
Syntax: **a$=CHR$(x%)**
Returns the ASCII character with the value of the expression inside the brackets. You can use it to print characters unavailable from the keyboard - for example, the instruction `PRINT CHR$(63)` prints the question mark character. See Appendix A for more information.

CLOCK
Syntax: **c%=CLOCK(x%)**
This function displays the continuously updating clock in the top right-hand corner of the screen. x% can be 0 or 1:

0	Clock not displayed or if CLOCK(1) has been used already, not updated.
1	Clock displayed.

Returns the previous status of the clock (0 or 1).

CLOSE
Syntax: **CLOSE**
Closes the current file.
See also OPEN, CREATE, DELETE, USE.

CLS
Syntax: **CLS**
Clears the screen. and returns the cursor to the first character space on the top line.

CONTINUE
Syntax: **CONTINUE**
Returns program control to the test expression of either a DO/UNTIL or a WHILE/ENDWH loop. E.g:

```
DO
  <statement list>
  IF x=y
    CONTINUE
  ENDIF
  <statement list>
UNTIL a=b
```

In the example. the CONTINUE command will be executed if the expression following the IF statement is true. If this happens, program control will then be transferred to the UNTIL test.

COPY
Syntax: **COPY "dev1:fname1","dev2:fname2"**
COPY "dev1:fname1","dev2:"
COPY "dev1:","dev2:"
Copies data files from one device to another. There are three variations:

1 In the first example, a data file on one device is copied to a file on another device with a different filename. An example might be:

```
COPY "A:CLIENTS","B:CLIENT88"
```

If there is already a file on the destination device with the name fname2, then the records in the file being copied over are appended to it. Otherwise a new file is created with that name and the records written to it.

2 In the second example. the file name on the destination device is taken to be the same as that on the source device.

3 In the third example. all files on the source device are copied onto the destination device. and are given the same names on the destination device as they had on the source device.

COPYW

Syntax: **COPYW "dev1:fname1.ext","dev2:fname2"**
COPYW "dev1:fname1.ext","dev2:"
COPYW "dev1:*.*","dev2:"

Copies any type of file from one device to another. The three variations are the same as for COPY except that you use file extensions to indicate the type of file. You can also use wild cards. If the first name contains wild cards, the second name must only be the device. E.g. to copy all the notepads from B: to C: `COPYW "B:*.NTS","C:"` You must either specify an extension or .* on the first name, so to copy all files of any type whose names end in 8 from A: to B: `COPYW "A:*8.*","B:"` Extensions are in Chapter 6.

COS

Syntax: **c=COS(x)**

Returns the cosine of the expression inside the brackets. The expression represents an angle expressed in radians.

COUNT

Syntax: **c%=COUNT**

Returns the number of records in the current file.
See also POS, POSITION.

CREATE

Syntax: **CREATE "dev:fname",log,fld1,fld2**

Creates a data file on device dev:, with the name fname, the logical file name log, and up to 16 fields as specified by fld1, fld2 etc. The logical file name (A, B, C or D) is used to refer to this file within the program. Each new file is automatically OPEN, and up to four may be open at once. An example of the command might be:

```
CREATE "A: CLIENTS", B, NAME$, PHONE$, ADDRESS$
```

In this example a data file is created on device A: with the name clients and the logical name B. Each record In this data file can have up to three fields.
See also OPEN, CLOSE, DELETE, USE.

CURSOR ON/OFF

Syntax: **CURSOR ON** or **CURSOR OFF**

Switches the cursor on or off. The default is CURSOR OFF.

DATIM$

Syntax: **d$=DATIM$**

Returns the current date and time fro m the system clock in string format; e.g: "MON 16 OCT 1989 16:25:30"
See also SECOND, MINUTE, HOUR, DAY, MONTH, YEAR.

DAY

Syntax: **d%=DAY**

Returns the current day of the month,$ to 3 1).
See also SECOND, MINUTE, HOUR, MONTH YEAR, DATIM$.

DAYNAME$
Syntax: **d$=DAYNAME$(X%)**
Converts x%, a number from 1 to 7, to the day of the week. E.g.: `d$=DAYNAME$(1)` returns Mon.
See also DOW.

DAYS
Syntax: **d%=DAYS(day%,month%,year%)**
Returns the number of days since 01/01/1900. You can use this to find out the number of days between two dates by subtracting one result from another. E.g:
```
x%=DAYS(1,1,1989)
y%=DAYS(DAY,MONTH,YEAR)
z%=y%-x%
```

DEG
Syntax: **d=DEG(x)**
Converts from radians to degrees. Returns the value of the expression in the brackets, an angle measured in radians, as a number of degrees.
See also RAD.

DELETE
Syntax: **DELETE "dev:fname"**
Deletes a data file with the name fname from device dev:. For example, `DELETE "B:CLIENTS"` The file must be closed before this command is given.
See also CREATE, OPEN, CLOSE, USE.

DELETEW
Syntax: **DELETEW "dev:fname.ext"**
Deletes any type of file with the name fname from device dev:. The syntax is the same as for DELETE except that you must use a file extension to indicate the type of file. You can also use wild cards. E.g. to delete all the notepad files on C:
```
DELETEW "C:*.NTS"
```
For details of the file extensions, see Chapter 6.

Because DELETEW is such a powerful command. all files should be closed when it is used. If they are not, the command will close them automatically.

DIR$
Syntax: **d$=DIR$("dev")**
d$=DIR$("")
Returns the name of a data file:

1 DIR$(dev:) returns the name of the first data file on the device specified. The device name (A, B or C) must be in quotation marks and brackets. E.g: `D$=DIR$ ("A")`

2 Subsequent uses of this function with a null string in the brackets return the names of the following files on the device. When there are no more, a null string is returned.

DIRW$
Syntax: **d$=DIRW$("dev:fname.ext")**
d$=DIRW$("")
Returns the name of any type of file. It works in the same way as DIR$, except that you must specify a filename and extension as well as the device. You can also use wild cards. E.g: To return the name of the

first notepad on B: `D$=DIRW$ ("B: *.NTS")`
See Chapter 6 for file extensions.

DISP
Syntax: **d%=DISP(x%,a$)**
Displays a string or a record according to the value of x%. The value of x% may be - 1, 0 or 1:

-1 a$ is ignored and the current record is displayed with one field on each line of the display. The cursor keys may be used to scroll around the record.

1 a$ is displayed as above. If a$ contains tab characters (ASCII character 9), these divide the string into different fields so the string is displayed on different lines.

0 a$ is ignored and the last displayed string or record is continued. If any key other than the arrow keys is pressed, the number of that key is returned.

No other commands or functions should be used between using DISP with x% equal to 1 or -1 and DISP with x% equal to 0. For example:

```
A%=DISP(1,A$)
WHILE A%<>13
  A%=DISP(0,"")
ENDWH
```

This displays A$ until **EXE** is pressed. Clearly there can be no reason to use any other command or function which accesses the screen in between the two uses of DISP. Doing so may have unpredictable results. (13 is the code for the **EXE** key. see Appendix A for more details.)
See also VIEW and EDIT.

DO/UNTIL

Syntax: **DO**
<statement list>
UNTIL x=y

The DO command is used to indicate the start of a list of one or more statements which terminate with the UNTIL command. The list of statements will be repeated until the expression after the UNTIL command returns logical true.

DOW
Syntax: **d%=DOW(day%,month%,year%)**
Returns the day of the week of the date you specify as a number from 1 to 7. (Monday is 1.) E.g. `D%=DOW(25,12,1990)` returns 2, Tuesday.

EDIT
Syntax: **EDIT var$**
Displays a string which you can edit on the screen using the cursor keys and DEL. var$ can be a string variable name or a field name. When you have finished editing, press **EXE** to return the edited string. If you press **EXE** before you have made any changes, then the same string will be returned as was included inside the brackets. If you press ON/CLEAR during editing, the string will be cleared and new text may be typed. However, if the TRAP command is used with this command and ON/CLEAR is pressed twice. the string will be cleared and then control will pass on to the next line of the procedure with the ESCAPE error condition being set.
See also DISP and VIEW.

ELSE See IF.

ENDIF See IF.

ENDWH See WHILE.

EOF
Syntax: **e%=EOF**
Tests for the End Of File. Any program instruction which tries to read past the last record in a data file will result in the end of file (EOF) being reached. This can be tested for like this:

```
DO
  <statement list>
UNTIL EOF
```

The EOF function returns -1 (True) if the end of file condition has been reached, or 0 (False).

ERASE
Syntax: **ERASE**
Erases the current record in the current file. Following this command, the current record will be the record after the one just deleted. If the erased record was the last record in a file. then following this command, the current record will be null and EOF will return true.

ERR
Syntax: **e%=ERR**
Returns the number of the last error which occured. Appendix D has a list of all the error messages in numeric order. The number returned will be in the range 0 to 255. If 0 is returned, there is no error.
See also ERR$, RAISE, ONERR.

ERR$
Syntax: **e$=ERR$(x%)**
Returns an error message as a string. x% can either be a number - e.g. `E$=ERR$(240)`, to return the message for error number 240, or ERR - i.e. `PRINT ERR$(ERR)`, to print the message for the last error which occurred. If the number is outside the range 192 to 255, "UNKNOWN ERR" is returned.
Appendix D is a list of error messages.
See also ERR, ONERR, RAISE.

ESCAPE OFF/ESCAPE ON
Syntax: **ESCAPE OFF** or **ESCAPE ON**
Disables and enables the **ON/CLEAR** key. You can normally press **ON/CLEAR** to pause a running program, and then **Q** to quit. ESCAPE OFF cancels the use of the **ON/CLEAR** key to pause. ESCAPE ON lets the **ON/CLEAR** key pause the program again. This is the normal state.

Warning: If your program enters a loop which has no logical exit, and ESCAPE OFF has been used, you won't be able to quit the program unless you remove the battery from the Organiser. All data in the RAM of the machine will then be lost.

EXIST
Syntax: **c%=EXIST("dev:fname")**
Tests for the existence of a data file called fname on device dev:. Returns logical true if the file exists and logical false otherwise - so EXIST can be used on an IF statement. for example:

```
IF EXIST ("a:clients")
  <statement list>
ENDIF
```

See also DIR$.

EXP
Syntax: **e=EXP(x)**
Returns the value of the arithmetic constant e (2.71828... raised to the power of x.

FIND
Syntax: **f%=FIND(a$)**
Searches the current data file for the string Inside the brackets. If found, it returns the record number where the string occurs, and makes the record the current record. If the string is not found, zero is returned.
See also NEXT.

FINDW
Syntax: **f%=FINDW(a$)**
Searches the current data file for the string inside the brackets in the same way as FIND. The difference is that you can include wild cards in the string expression. For example. to find a record containing both "Dr" and either "BROWN" or "BRAUN", the instruction is:

```
F%=FINDW("*DR*BR++N")
```

FIRST
Syntax: **FIRST**
Makes the first record in a data file the current record.
See also ERASE, NEXT. POSITION, LAST, BACK, POS.

FIX$
Syntax: **f$=FIX$(x,y%,z%)**
Returns a string representation of x, with y% decimal places in a field which is z% characters wide. If z% Is negative then the string is right justified. So:

```
FIX$(123456.127,2,9)               ="123456.13"
FIX$(1,2,-5)                       =" 1.00"
```

If the number will not fit in the field width specified then the returned string will contain asterisks.
See also GEN$, NUM$, SCI$.

FLT
Syntax: **f=FLT(x%)**
Converts the integer expression inside the brackets into a floating point number.

FREE
Syntax: **f%=FREE**
Returns the number of free bytes in the work area.
See also SPACE.

GEN$
Syntax: **g$=gen$(x,y%)**
Returns a string representation of x in a field of width y% characters. GEN$ tries to represent the number as integer, decimal or scientific, in that order. If the value of y% is negative then the result will be right justified. If the number will not fit in the field width specified then the returned string will contain asterisks.
See also FIX$. NUM$, SCI$.

GET
Syntax: **g%=GET**
Waits for a key to be pressed and returns the ASCII value or special code for that key. For example, if the A key is pressed in lower case mode, the integer returned is 97. If the **EXE** key is pressed, the integer

returned is 13. See Appendix A for tables of ASCII values and special key codes.
See also GET$. KEY. KEY$, PAUSE.

GET$
Syntax: **g$=GET$**
Waits for a key to be pressed and returns that key as a string. For example, if the A key is pressed in lower case mode, the string returned is "a".
See also GET, KEY, KEY$.

GLOBAL
Syntax: **GLOBAL var1,var2%.var3$(length),var4(n)**
Used to declare variables which will be available in the current procedure and any procedures below it in the program.

Variable names not ending with a special sign are floating point variables. those ending with a percent sign (%) are integers; those ending with a dollar sign ($) are string variables. String variable names must be followed by the maximum length of the string in brackets.

The last variable in the example above is a floating point array. The number following it in brackets is the number of elements in the array. Array variables may be of any of the three types.

Variable names may be up to 8 alphanumeric characters long, the first of which must be a letter. This length includes the % or $. More than one GLOBAL or LOCAL statement may be used but they must be the first lines in the procedure. See the chapter on variables for more information.
See also LOCAL.

GOTO
Syntax: **GOTO label::**
Sends program control to the line containing the label name label:: The label must be in the current procedure, and must end with a double colon. Labels may be up to 8 characters long excluding the colons.

HEX$
Syntax: **h$=HEX$(x%)**
Returns the hexadecimal (base 16) version of the integer expression inside the brackets. For example: `HEX$(255)` will return "FF".

(Hex numbers may be entered by preceding them by a $. So `PRINT $FF` gives 255.)

HOUR
Syntax: **h%=HOUR**
Returns the number of the current hour from the system clock (0 to 23).
See also SECOND, MINUTE, DAY, MONTH, YEAR, DATIM$.

IABS Syntax i%=IABS(x%) Returns the absolute value. i.e. without any sign. of an integer. E.g. `IABS(-10)` is 10.
See also ABS.

IF/ELSEIF/ELSE/ENDIF
```
Syntax:  IF x=y
         <statement list>
         ELSEIF x=z
         <statement list>
         ELSE
         <statement list>
         ENDIF
```

IF statements are immediately followed by an expression. If the result of that expression returns logical true, (non-zero) then the statements following are executed. If the expression returns logical false (zero) then those statements are ignored. The statement list must be followed by an ENDIF.

The ELSEIF statement is optional, but if it is included, and the following expression returns logical true - while none of the previous ones have, then the next list of statements are executed. There may be more than one ELSEIF, each with its own list of statements.

The ELSE statement is optional. If none of the preceding expressions have returned logical true, then the list of statements after the ELSE statement and before the ENDIF statement are executed.

INPUT

Syntax: **INPUT var%**
INPUT var
INPUT var$
INPUT log.field

Allows data to be input from the keyboard during program execution. There are four variations.

The variable supplied must have been declared previously with a GLOBAL or LOCAL command, or be a field variable of the current file. If inputting to a string variable, you cannot exceed its maximum length.

If inappropriate input is entered, e.g. a string when the variable specified was an integer, a "?" is displayed and you can try again. However, if the TRAP command is used with INPUT, control passes on to the next line of the procedure with the ESCAPE error condition (no. 206) being set.

INT
Syntax: **i%=INT(x)**
Returns the integer (ie the whole number part) of x. Negative numbers are rounded down, so INT(-5.3) returns -6. Used when the returned value will be within the Organiser's integer range.
See also INTF.

INTF
Syntax: **i=INTF(x)**
Used in the same way as the INT function, but the value returned is a floating point number. You may need this when an integer calculation may exceed the Organiser's integer range, for example: `PRINT INTF(320000/3)*100`

KEY
Syntax: **k%=KEY**
Returns the ASCII value of any key pressed. If no key has been pressed, zero is returned. This command doesn't wait for a key to be pressed.
See also PAUSE, GET, GET$, KEY$.

KEY$
Syntax: **k$=KEY$**
Returns a string containing the key pressed. If no key has been pressed, a null string is returned. KEY$ does not wait for a key to be pressed.
See also KEY, GET, GET$.

KSTAT
Syntax: **KSTAT x%**
Sets the state of the keyboard to SHIFT mode. CAPS mode etc. x% is a number from 1 to 4:

1	Alphabetic - upper case
2	Alphabetic - lower case

3 Numeric - upper case
4 Numeric - lower case

LAST
Syntax: **LAST**
Makes the last record in a data file the current record.
See also ERASE, FIRST, NEXT, POSITION, BACK, POS.

LEFT$
Syntax: **b$=LEFT$(a$.x%)**
Returns the leftmost x% characters from the string specified by a$.
See also RIGHT$. MID$, LEN, LOC.

LEN
Syntax: **a%=LEN(a$)**
Returns the length of the string expression a$.

LN
Syntax: **a=LN(x)**
Returns the natural (base e) logarithm of the expression inside the brackets.
See also LOG.

LOC
Syntax: **a%=LOC(a$,b$)**
Returns the position in a$ where b$ occurs. E.g. `LOC("Standing","AND")` would return the value 3 because the substring "AND" starts at the third character of the main string. If b$ does not occur in a$, zero is returned.
See also LEFT$, RIGHT$, MID$, LEN.

LOCAL
Syntax: **LOCAL var1%,var2.var3$(length),var4(n)**
Used to declare variables which will only be available in the current procedure. Other procedures may use the same variable names for other uses.
See GLOBAL for more details on declaring variables.

LOG
Syntax: **a=LOG(x)**
Returns the base 10 logarithm of the expression inside the brackets.
See also LN.

LOWER$
Syntax: **b$=LOWER$(a$)**
Converts any upper case characters in the string expression inside the brackets to lower case and returns the completely lower case string.
See also UPPER$.

LPRINT
Syntax: **LPRINT x,y%;a$**
Prints out to a printer. If there is no printer attached, a DEVICE MISSING error is reported. If the Psion Printer II is attached and you get this message, try pressing **ON/CLEAR** on the main menu to load the printer software.

If items to be printed are separated by commas, there is a space between them when printed. If they are separated by semi-colons, there are no spaces.
A final semi-colon makes the next items printed with an LPRINT command start immediately after these.

A final comma has the same effect but inserts a space. Otherwise the next line is used. For example, the instruction:

```
LPRINT "The year is", YEAR
```

prints

```
The year is 1989
```

The PRINT command operates like LPRINT, but displays on the screen rather than listing to a printer.

MAX

Syntax: **m=MAX(Item1,item2,item3)**
m=MAX(array(),n)

Returns the greatest of the items in the list. The list can either be a list of items separated by commas, or the elements of a floating point array. For more details of the format of list functions, see MEAN.

MEAN

Syntax: **m=MEAN(item1,item2,item3)**
m=MEAN(array(),n)

Returns the mean (average) of the items in the list. The list can either be a list of items separated by commas, or the elements of a floating point array.

1 The items in the list can be any mixture of real values and integer and floating point variables. E.g:
`m=MEAN(12,x,y%,3.6)`

2 When operating on an array, the two arguments in brackets are the array name, and the number of array elements you wish to operate on. E.g: to return the mean of the first 3 elements of an array called arr, `m=MEAN(arr(),3)` In the example below, 12.5 would be displayed:

```
LOCAL a(3)
a(1)=10
a(2)=15
a(3)=20
PRINT MEAN(a(),2)
```

MENU

Syntax: **m%=MENU(menuitem1,menuitem2...)**

Displays a menu of items and allows a selection to be made from the menu in the usual way. Returns the number of the item selected (1 to ...). If **ON/CLEAR** is pressed, 0 is returned.

The menu items are displayed starting on the top line of the screen.

MENUN

Syntax: **m%=MENUN(n%,menuitem1,menuitem2...)**

Displays a menu of items in the same way as MENU. However, the items are displayed differently according to the value of n%:

n%=0 Exactly the same as MENU
n%=1 Displays a one-line menu
n%=2 Displays a multi-line menu starting on the line with the current cursor position. Any text already display on the line above the cursor remains on the screen.

MID$

Syntax: **m$=MID$(a$,x%,y%)**

Returns a string comprising y% characters of a$, starting at the character at position x%.
See also LEFT$, RIGHT$, LEN, LOC.

MIN

Syntax: **m=MIN(array(),n)**

Returns the smallest of the items in the list. The list can either be a list of items separated by commas, or the elements of a floating point array.
For more details of the format of list functions, see MEAN.

MINUTE
Syntax: **m%=MINUTE**
Returns the current minute number from the system clock (0 to 59).
See also SECOND, HOUR, DAY, MONTH, YEAR, DATIM$.

MONTH
Syntax: **m%=MONTH**
Returns the current month from the system clock (1 to 12).
See also SECOND, MINUTE, HOUR, DAY. YEAR, DATIM$.

MONTH$
Syntax: **m$=MONTH$(x%)**
Converts x% a number from 1 to 12. to the month. E.g.: `M$=MONTH$(1)` returns Jan.

NEXT
Syntax: **NEXT**
Makes the next record the current record in the current file. If use of NEXT is continued beyond the end of a file, no error is reported but the current record is a null and the EOF function returns true.
See also FIRST, LAST, BACK, POSITION, POS.

NUM$
Syntax: **n$=NUM$(x,y%)**
Returns a string representation of the floating point number x as an integer in a field y% characters wide. If y% is negative then the string is right justified. If the number will not fit in the field width specified then the returned string will contain asterisks.
See also FIX$, GEN$, SCI$.

OFF
Syntax: **OFF or OFF x%**
Switches off the Organiser. If the ON/CLEAR key is pressed, program execution will start again at the program line following the OFF command. x% is a number from 1 to 1800. If you include this number the machine switches off for that number of seconds only.

OPEN
Syntax: **OPEN "dev:fname".log,fld1,fld2**
Opens an existing data file on device dev:, with the logical file name log, with the field names as specified by fld1, fld2 etc. That file may then be referred to within the program by the logical file name (A, B, C or D). Up to 4 files can be open at once. For more details see the section on opening a file in the data file handling chapter.
See also CREATE, CLOSE, DELETE, USE.

ONERR
Syntax: **ONERR label:: and ONERR OFF**
If an error occurs during program execution, the ONERR label:: instruction transfers program control to the line containing the label.

ONERR OFF cancels the ONERR label:: statement, so that any errors occuring below the ONERR OFF statement are no longer referred to the label:: **It is advisable to put the command ONERR OFF immediately after the label and to test for LOW BATTERY explicitly.**

PAUSE
Syntax: **PAUSE x%**

Pauses the program according to the value of x%:

0	Waits for a key to be pressed.
<0	Pauses for x% (made positive) twentieths of a second or until a key is pressed.
>0	Pauses for x% twentieths of a second.

So PAUSE 100 would cause the program to pause for five seconds. In the first two cases, the key pressed is stored in a buffer and it is wise to remove it with the KEY function:

```
<statement list>
PAUSE 0
KEY
<statement list>
```

The keypress stored in the buffer from the PAUSE 0 command is taken as the input for KEY.

PEEKB
Syntax: **P%=PEEKB(x%)**
Returns the value (0 to 255) stored at the address specified by the expression inside the brackets.

PEEKW
Syntax: **p%=PEEKW(x%)**
Returns the value of the two byte integer stored at addresses x% and x%+1.

PI
Syntax: **p=PI**
Returns the value of Pi (3.14...).

POKEB
Syntax: **POKEB x%,y%**
Writes the number y% which must be in the range 0 to 255, into the memory address x%, which must be an integer. Addresses above 32767 are addressed by negative values or hexadecimal numbers. E.g. $FFFF=-1, which corresponds to address 65535.
Warning: Casual use of this command can result in the loss of an data in the Organiser.

POKEW
Syntax: **POKEW x%,y%**
Writes the integer y% into two successive memory addresses, starting with the address x%, with the most significant byte in the lower address.
Warning: Casual use of this command can result In the loss of an data in the Organiser.

POS
Syntax: **p%=POS**
Returns the number of the current record in the current data file.

POSITION
Syntax: **POSITION x%**
Makes record number x% the current record in the current data file. If x% is greater than the number of records in the file then the EOF function will return true.
See also FIRST, NEXT, LAST, BACK, POS.

PRINT
Syntax: **PRINT x.y%;a$**
Prints numbers or text to the screen.

If items to be printed are separated by commas, there is a space between them when displayed. If they are separated by semi-colons, there are no spaces.
A final semi-colon makes the next items displayed with a PRINT command start immediately after these. A final comma has the same effect but inserts a space. Otherwise the next line is used. For example, the instruction:

```
PRINT "The year is", YEAR
```

displays

```
The year is 1989
```

The LPRINT command operates in the same way as the PRINT command except that it prints on a printer.

RAD
Syntax: **n=RAD(x)**
Converts x from degrees to radians.
See also DEG.

RAISE
Syntax: **RAISE x%**
Artificially generates an error, even though no such error has occurred. If no ONERR statement has been issued previously then the appropriate message for that error number Is displayed. The range of possible internal errors to use as x% is 192 to 255. Refer to the chapter on error handling for more explanation. A full list of error messages is in Appendix D.
See also ONERR, ERR, ERR$.

RANDOMIZE
Syntax: **RANDOMIZE x**
Gives a new seed value to the random number generator. so that a new sequence of random numbers will be initiated. So use RANDOMIZE if you wish to use the same sequence of random numbers more than once.
See also RND.

RECSIZE
Syntax: **r%=RECSIZE**
Returns the number of bytes occupied by the current record. No record may contain more than 254 characters, so this function may be used to check that a record may have data added to It without overstepping this limit.

REM
Syntax: **REM text**
The REM statement precedes a remark you include to explain how a program works. The Organiser ignores all text after the REM statement up to the end of that line.

RENAME
Syntax: **RENAME "dev:fname1","fname2"**
Renames a file on device dev: called fname1 as the file fname2. E.g: `RENAME "B:ADDR", "OLDADDR"`

REPT$
Syntax: **r$=REPT$(a$,x%)**
Returns a string comprising x% repetitions of a$.
See also LEFT$ RIGHT$. MID$, UPPER$, LOWER$, LEN, LOC.

RETURN
Syntax: **RETURN** or **RETURN x**
Used on its own, the RETURN command terminates the execution of a procedure and returns control to the point where that procedure was called. Use of this command at the end of a procedure is optional.

The RETURN command may also be used to pass a value back to the level from which the procedure was called. The value must be supplied after the RETURN command thus: `RETURN X% or RETURN X or RETURN A$`

A procedure may only return one type of value as indicated by the identifier which is the last character of the procedure name. So proc$: can only return a string.

RIGHT$
Syntax: **r$=RIGHT$(a$,x%)**
Returns the rightmost x% characters of a$.
See also left$ MID$, REPT$ LEN, LOC.

RND
Syntax: **r=RND**
Returns a random floating point number in the range 0 (inclusive) to 1 (exclusive).
See also RANDOMIZE.

SCI$
Syntax: **s$=SCI$(x,y%,z%)**
Returns a string representation of x In scientlfic format, to y% decimal places in a field of width of z% characters. For example:

```
SCI$ (123456, 2, 8)         = "1.23E+05"
SCI$(1,2,8)                 = "1.00E+00"
SCI$(123456789,2,-9)        = "1.23E+08"
```

If the number does not fit in the field width specified then the returned string contains asterisks.
See also FIX$. GEN$, NUM$.

SECOND
Syntax: **SECOND**
Returns the current number of seconds from the system clock (0 to 59).
See also MINUTE, HOUR. DAY, MONTH, YEAR.

SIN
Syntax: **s=SIN(x).**
Returns the sine of the expression inside the brackets. The expression represents an angle expressed in radians.

SPACE
Syntax: **s=SPACE**
Returns the number of free bytes on the current device. There must be a file open on the device first.
See also FREE.

SQR
Syntax: **s=SQR(x)**
Returns the square root of the expression inside the brackets.

STD
Syntax: **s=STD(item1,item2,item3)**
s=STD(array(),n)

Returns the standard deviation of the items in the list. The list can either be a list of items separated by commas, or the elements of a floating point array. For more details of the format of list functions, see MEAN.

STOP
Syntax: **STOP**
Halts execution of the language and returns the Organiser to the point where that program was started. e.g. the main menu or the calculator.

SUM
Syntax: **s=SUM(item1,item2.item3)**
s=SUM(array(),n)
Returns the sum of the items in the list. The list can ither be a list of items separated by commas, or the elements of a floating point array. For more details of the format of list functions, see MEAN.

TAN
Syntax: **t=TAN(x)**
Returns the tangent of the expression inside the brackets. The expression represents an angle expressed in radians.

TRAP
Syntax: **TRAP command**
TRAP may precede any of these commands:
APPEND/BACK/CLOSE/COPY/COPYW/CREATE/DELETE/DELETEW/ER
ASE/EDIT/FIRST/INPUT/ LAST/NEXT/OPEN/POSITION/RENAME/UPDATE/USE
For example, `TRAP FIRST`. Any error resulting from the execution of the command will be trapped - the next program line will be executed regardless of whether the error would normally have caused an error message to be displayed.

UDG
Syntax: **UDG x%,a%,b%,c%,d%,e%,f%,g%,h%**
Defines a display character. x% is the number of the character (0-7) and the integers a% to h% define each line of the character. For example, the instruction:
```
UDG 7,0,0,0,0,0,0,0,31
```
Defines UDG 7 as an underline character.
See Appendix A for a full explanation of this command.

UNTIL See DO.

UPDATE
Syntax: **UPDATE**
The current record in the current file is deleted and the current field values are appended as a new record at the end of the file.
See also APPEND.

UPPER$
Syntax: **u$=UPPER$(a$)**
Converts any lower case characters in the string expression inside the brackets to upper case. Returns the completely upper case string.
See also LOWER$.

USE
Syntax: **USE log**
Selects for use the data file with the logical file name log (A, B, C or D), which must previously have

been opened with OPEN or CREATE command.
See also OPEN, CLOSE, CREATE, DELETE.

USR
Syntax: **u%=USR(x%,y%)**
The value of y% is passed to the D register and the value of x% is passed to the PC register of the HD6303X microprocessor. The microprocessor then executes the machine language program starting at the address x%. At the end of the routine, the value in the X register is passed back to the language as an integer.
Warning: Casual use of this function can result in the loss of all data in the Organiser.
See also USR$, ADDR.

USR$
Syntax: **u$=USR$(x%.y%)**
The value of y% is passed to the D register and the value of x% is passed to the PC register of the HD6303X microprocessor. The microprocessor then executes the machine language program starting at the address x%. At the end of the routine, the value in the X register must point to a length-byte preceded string. This string is then returned.
Warning: Casual use of this function can result in the loss of all data in the Organiser.
See also USR, ADDR.

VAL
Syntax: **v=VAL(a$)**
Returns a floating point number which is the value of the string expression inside the brackets. E.g. `VAL ("470.0")` would return the value 470.0. The string cannot contain any non-numeric characters. ScientifIc notation is allowed, so `VAL("1.3E10")` would return the value 1.3E10.

VAR
Syntax: **v=VAR(item1.item2,item3)**
v=VAR(array().n)
Returns the variance of the items in the list. The list can either be a list of items separated by commas. or the elements of a floating point array.
For more details of the format of list functions, see MEAN.

VIEW
Syntax: **v%=VIEW(x%,a$)**

Displays a$ on line number x% (1, 2, 3 or 4) on the screen. a$ can be a string, a string variable, or a field name.

If the text Is longer than 20 characters, the display auto-scrolls to the left, and pressing the left or right cursor keys allows you to change the direction of the scroll. Pressing any other key halts the scrolling of the text and returns the ASCII value of the key pressed. If VIEW is used again with a$ being a null string then viewing is continued at the point it was interrupted by a key press.
See also DISP.

WEEK
Syntax: **w%=WEEK(day%,month%,year%)**
Returns the week number of the date you specify. The weeks begin on Mondays, so the 1st Monday in January is the beginning of week 1.

WHILE/ENDWH
Syntax: **WHILE x<>y**
<statement list>
ENDWH

This structure is started by the WHILE command which precedes a numeric expression.

The subsequent list of statements, which must end with the ENDWH statement, is executed while the expression returns logical true (non-zero).
See also DO/UNTIL.

YEAR
Syntax: **y%=YEAR**
Returns the current year from the system date (1900 to 2155).
See also SECOND, MINUTE, HOUR, DAY, MONTH.

Appendix A
Organiser character set

The full character set of the Organiser is shown in the table overleaf. The more common characters can obviously just be typed from the keyboard. However, there are others which do not appear on the keys. These are accessed via the OPL CHR$ function.

Printing non-keyboard characters

By supplying the CHR$ function with the appropriate number from the table overleaf, you can print out to the screen or the printer, or assign to string variables, any of the characters shown. For example, to display a question mark the instruction is:

```
PRINT CHR$(63)
```

To display a pound sign the instruction is:

```
PRINT CHR$(156)
```

Finding out the ASCII code of a keyboard character

You can find out the ASCII value of any of the characters on the keyboard at any time without looking at the table. You do this by typing the % sign followed by the character in the calculator. For example if you type %P in the calculator, the number 80 is returned.

The table on these two pages shows the characters which have the ASCII codes 32 to 255. 32 is the space character.

The codes 0 to 7 are for user-defined characters. (page A-6)

The codes 8 to 31 are for control characters. (page A-5)

Accessing ASCII values within procedures

It is often useful to access the ASCII value of a character in a procedure - for example if you want to know whether a user has typed in Y or N.

To do this you can use the % sign and the character, e.g. %Y. The example below is part of a procedure in which you are asked whether or not you want to erase something. If you type N the program stops. If you type Y another procedure called erase: is called. If you type a key other than Y or N the procedure goes to a label in order to give you another chance.

```
PRINT "ERASE Y/N"
label::
g%=GET
IF g%=%N OR g%=%n :STOP
ELSEIF g%=%Y OR g%=%y :erase:
ELSE GOTO label::
ENDIF
```

Codes for special keys

When functions such as the GET and KEY functions are used, the ASCII code for the character on the key is normally returned. The keys not in the ASCII set return these numbers:

ON/CLEAR	1
MODE	2
UP	3
DOWN	4
LEFT	5
RIGHT	6
SHIFT and DEL	7
DEL	8
EXE	13

Control characters

For the screen. the numbers 8 to 26 have special uses. They do not produce a visible character, but may be used in conjunction with the PRINT command produce the effects listed below. For example, the instruction PRINT CHR$(22) clears the 3rd line of the screen.

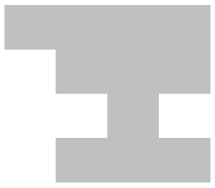
CHR$(8) Moves the cursor 1 character to the left.
CHR$(9) Moves the cursor to the next tab position. (Position 0 and 10 on the screen.)
CHR$(10) Moves the cursor to the next line.
CHR$(11) Moves the cursor to the top left "home" position of the display.
CHR$(12) Clears the display (equivalent to CLS).
CHR$(13) Moves the cursor to the left of the current line.
CHR$(14) Clears the top line of the display, and moves cursor to start of line.
CHR$(15) Clears the second line of the display, and moves cursor to start of line.
CHR$(16) Sounds the Organiser's buzzer.
CHR$(17) Refreshes the 1st and 2nd line.
CHR$(18) Refreshes the lst line.
CHR$(19) Refreshes the 2nd line.
CHR$(20) Refreshes the 3rd line.
CHR$(21) Refreshes the 4th line.
CHR$(22) Clears the 3rd line of the display, and moves cursor to start of line.
CHR$(23) Clears the 4th line of the display, and moves cursor to start of line.
CHR$(24) Prints dashes, like the ones above a multi-line menu, on the 2nd line. (uses UDG 2.)
CHR$(25) Prints dots, like the ones above a one-line menu, on the 3rd line. (uses UDG 2.)
CHR$(26) Clears to the end of line.

CHR$(27) to CHR$(31) are reserved.

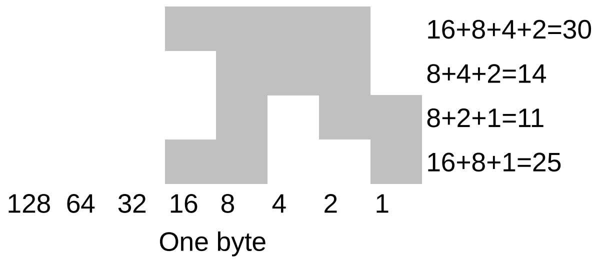
User-defined characters

For the screen, the numbers 0 to 7 are reserved for user-defined characters. You use the UDG command to define the pattern of dots which appears when you print one of these characters with the CHR$ function.

You define each character line-by-line by a series of eight bytes, starting with the top line of the character. (From each of the eight bytes which make up the characters, only the last five bits 16 to 1 are used because the characters are only five dots across.)



16+8+4+2=30
8+4+2=14
4
8+4+2=14



To define the running man as character number 1, you would use the instruction below. The first number is the character number and the 8 numbers after represent each line of the character.

```
UDG 1,30,14,4,14,30,14,11,25
```

Then you can use this instruction to display the man:

```
PRINT CHR$(1)
```

The screen clock, the symbols in the top left-hand corner, and the dotted lines under and over menus, all use UDGs. So, each time they are displayed, they overwrite any UDGs you have defined. You therefore have to redefine your UDGs each time you wish to display them. This shows the UDG numbers taken up by the clock, the symbol and the underline graphics.

```
02          &nbs; p;345671
X               12:45a
Edit    New    Run
Print   Dir    Copy
Delete
```

If you wish to display an underlined menu with a symbol and the clock, you have to use UDGs 0 and 2 for your symbol and the underline. The telephone logging program in Chapter 8 is an example of how to do this.

Appendix B
Technical Data

Dimensions (with protective case closed)

Length	142.0 mm
Width	78.0 mm
Depth	29.3 mm
Weight	250 grams.

Display
Four line by twenty character alphanumeric dot-matrix liquid crystal display.

Keyboard
A total of thirty six keys including editing, cursor, alphabetic, numeric, **MODE** and **ON/CLEAR**.

Microprocessor
HD6303X Crystal frequency 3.6864 Mhz.

Memory
ROM: 64K
RAM: 32K LZ, 64K LZ64
Extra EPROM 8/16/32/64/128K - from Datapaks.
Extra RAM 32K - from Rampak.

Clock

Real time clock with 32768 Hz crystal frequency source.

Datapaks

Storage medium

EPROM (Erasable, Programmable. Read Only Memory)

Data retention

'Mean time to failure' 50 years at temperatures up to 100'C

Formatting

30 minutes in Psion Formatter clears Datapak. Can be re-formatted up to 100 times

Memory capacity

8K Datapak	8192 bytes
16K Datapak	16384 bytes
32K Datapak	32768 bytes
64K Datapak	65536 bytes
128K Datapak	131072 bytes

Datapaks

Storage medium

Battery backed-up RAM.

Formatting

Format option in Utils clears Rampak.

Memory capacity

32768 bytes.

Power

Standard alkaline 9 volt long-life battery. Mains adaptor available.

Psion has a policy of continuous product development Small modifications arising from this are not necessarily reflected in this manual.

Appendix C
Technical programming

Memory addresses

These addresses are used for certain system variables. You access them with PEEKB, PEEKW, POKEB and POKEW. You should only use these commands if you you know what you are doing.

Address	Default	Use
$0069,$006A	($04)	Horizontal scroll delay counter
$006B,$006C	($0A)	Vertical scroll delay counter
$0077	($0E)	Delay before keyboard auto-repeat
$0078	($00)	Keyboard auto-repeat counter
$007C	non-zero	Auto-switch off flag, 0 disables
$20CB,$20CC		Frame counter, increments every 50ms
$20CD,$20CE	($012C)	Default number of seconds to auto-switch off
$00A4	($00)	Buzzer mute. non-zero mutes
$2099	($F5)	Border character round 2-line mode procedure.

$20C0	($01)	Length of key click. 0 is silent
$20A7	($1F)	Sets bits for workday alarms. The default is $1F - Monday to Friday:

```
MSB                           LSB
       1       |        F
 0   0   0   1 | 1   1   1   1
    Sun Sat Fri Thu Wed Tue Mon
```

Memory Map

The Organiser Model LZ has 64K of ROM and 32K of RAM in the following arrangement. Model LZ64 has two extra 16K RAM banks as indicated.

$FFFF			
	16K ROM		
$C000			
	16K ROM Bank 1	16K ROM Bank 2	16K ROM Bank 3
$8000			
	Language Stack 16K RAM	16K extra RAM LZ64 only	16K extra RAM LZ64 only
$4000			
	System variables Machine Stack System variables		
$2000			
	7K RAM for devices		
$0400			
	Machine registers		
$0100			
	System variables		
$0040			
	Machine registers		
$0000			

Hexadecimal numbers

To get a hexadecimal number in OPL, prefix it with a $ identifier - for example $FF is 255.

Machine language programming

The Organiser's CPU (Central Processor Unit) is the HD6303X microprocessor. This advanced processor can be programmed directly, in its own language called machine language or machine code.

Machine language programs run far faster than OPL programs and take up less memory, but they are much more difficult to write and debug. Also, a simple mistake in a machine language program can easily wipe out all of the information stored in the internal memory of the Organiser, as these programstake over full control of the chip at the heart of the machine.

To avoid this, it is wise to save all important data to a pack before testing machine language programs, so that all will not be lost if the machine loses all its data, or 'crashes'.

Appendix D

Error messages

The error messages are listed in numeric order. If you find it difficult to locate a message because you do not know the number, find what page it's on by looking it up in the index. Error trapping is covered in Chapter 7.

192 DEVICE WRITE FAIL
Usually occurs when a pack is faulty or when an attempt is made to write to a write-protected program pack. Also occurs when an attempt is made to format a Datapak rather than a Rampak in the Utils Format option or when Comms Link fails.

193 DEVICE READ FAIL
Usually occurs when a pack is faulty or when trying to copy from a copy-protected pack or when Comms Link fails.

194 BATTERY TOO LOW
The battery is low. Switch off and see Chapter 1 of the operating manual on how to change the battery.

195 INTEGER OVERFLOW
The range of numbers allowed for integer variables (-32768 to +32767) has been exceeded.

196 FILE NOT OPEN
An attempt has been made to write to or read from a file which is not open.

197 BAD PROC NAME
Occurs when an invalid procedure name is given. For instance, in New in Prog or inserted in the main menu.

198 RECORD TOO BIG
No record may exceed a total of 254 characters.

199 FILE IN USE
An attempt has been made to open a file which is already open, or to delete a file which is open.

200 READ PACK ERROR
The data in a Datapak cannot be read and the pack needs re-formatting.

201 FIELD MISMATCH
Occurs when a field variable used does not match any of those in the current file.

202 MENU TOO BIG
The string supplied to the MENU function is too large and must be shortened.

203 MISSING PROC
A procedure has been called which does not exist on any device.

204 MISSING EXTERNAL
A variable has been encountered which has not been declared in a calling procedure as a global variable and has not been declared in the current procedure as a local or global variable.

205 ARG COUNT ERR
An incorrect number of arguments has been supplied to a procedure.

206 ESCAPE
The ON/CLEAR key followed by Q has been pressed during program execution, halting that program.

207 BAD FIELD LIST
Any file must contain at least one and not more than sixteen fields. Occurs when an attempt is made to exceed these limits.

208 BAD ASSIGNMENT
An attempt has been made to assign a value to the wrong type of variable - for example by the statement a$=4.3

209 BAD LOGICAL NAME
An illegal logical name has been used: ie, not A B, C or D.

210 MISSING COMMA
A comma has been omitted from a list of items which should be delimited by commas throughout.

211 MISSING LABEL
An attempt been made to GOTO a label which does not exist in the current procedure.

212 TOO COMPLEX
Structures within a procedure have been nested too deeply. The limit is 8.

213 STRUCTURE ERR
An IF/ENDIF. WHILE/ENDWH or DO/UNTIL structure has been incorrectly nested.

214 DUPLICATE NAME
The file, procedure or variable name given is already in existence on the current device.

215 BAD ARRAY SIZE
An array has been declared with an illegal number of elements. eg GLOBAL name$(0,15)

216 BAD DECLARATION
A variable has been declared incorrectly - eg GLOBAL name$(300) - where the length of the string exceeds the maximum allowed.

217 NO PROC NAME
An externally created program file has been introduced which does not have a valid procedure name as its first line.

218 BAD NUMBER
A number which cannot be evaluated properly has been used. eg 2.3.4

219 BAD CHARACTER
A non-valid character such as ? or @ has been included in a calculation string or an expression.

220 STRING TOO LONG
A string has been produced which exceeds the space allocated with the GLOBAL or LOCAL commands. eg:

```
LOCAL a$(10)
A$="123456789ABCDEF"
```

221 MISMATCHED "
Occurs when quotation marks are not paired up correctly.

222 BAD IDENTIFIER
An incorrectly formed variable name has been used. eg name$$.

223 NAME TOO LONG
The specified file, procedure or variable name exceeds the maximum number of characters allowed: eight characters including the $ or % qualifier.

224 TYPE MISMATCH
A value has been assigned to variable of the wrong type. eg a$= 12 or a="text", or a procedure parameter has been given a value of the wrong type.

225 SUBSCRIPT ERR
An out of range subscript has been specified for an array variable eg a(0) or a(10) when the array a() has been declared as having 9 elements.

226 BAD FN ARGS
An illegal number or type of arguments has been supplied to a function. eg LOG(-1).

227 MISMATCHED ()'s
Brackets have not been paired up correctly.

228 SYNTAX ERR
A syntax error has been detected during the translation of a procedure.

229 DEVICE LOAD ERR
A program or peripheral pack has been removed during its verification by the Organiser or the pack has become corrupted.

230 DEVICE MISSING
An attempt has been made to access a device which is not present, eg a printer. When no printer is connected. the LPRINT command will produce this error.

231 BAD DEVICE CALL
Occurs if an illegal operation is requested of a device.

232 PAK NOT COPYABLE
An attempt has been made to copy a pack which is copy-protected.

233 DIRECTORY FULL
Only 110 data files are allowed on each device. An attempt has been made to create a file which exceeds this limit.

234 FILE NOT FOUND
An attempt has been made to access a file which does not exist on the specified device.

235 FILE EXISTS
An attempt has been made to create a file or procedure under a name which already exists on that device.

236 BAD FILE NAME
A file name has been specified which does not conform to the rules. (Max 8 characters, alphanumeric starting with a letter.)

237 BAD RECORD TYPE
Occurs only when running machine language programs.

238 END OF FILE
Occurs when an attempt is made to read past the end of a data file.

239 PACK FULL
An attempt has been made to write to a full Datapak.

240 UNKNOWN PACK
A pack not supported by the Organiser II has been fitted to one of the devices.

241 PACK NOT BLANK
Datapak needs formatting as data remnants are still present.

242 PACK CHANGED
Occurs when calling operating system machine language routines or when a pack is changed in the middle of a COPY.

243 BAD DEVICE NAME
A device name other than A, B or C has been used.

244 READ ONLY PACK
An attempt has been made to write to a program pack. These may be read from, but not written to.

245 WRITE PACK ERR
The Organiser cannot write data to one of the Datapaks. Try re-fitting it.

246 NO PACK
There is no Datapak fitted to the device named in an instruction such as CREATE, OPEN etc. or a pack has been removed during pack access.

247 FN ARGUMENT ERR
The wrong type of argument has been passed to a function or a user's procedure.

248 STACK UNDERFLOW
Will only occur when users machine language program destroys the Organiser's stack.

249 STACK OVERFLOW
As above.

250 NUM TO STR ERR
Only occurs when calling operating system machine language routines.

251 DIVIDE BY ZERO
An attempt has been made to divide by zero.

252 STR TO NUM ERR
A non-numeric string has been passed to the VAL function.

253 EXPONENT RANGE
A number has exceeded the exponent limit of + or -99.

254 OUT OF MEMORY
Either the internal memory of the machine is fully occupied by programs, diary entries and data files, or the current program has used up all available memory.

255 NO ALLOC CELLS
Seen only when running machine language routines which access internal buffer space.

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