Max Objects from Norm Jaffe

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Contents

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Document History

November 2005	updated the object *rcx* to support Mac OS X
July 2005	corrected a bug with multiple *tcpClient*, *tcpMultiServer* or *tcpServer* objects being loaded at the same time; added the objects *shotgun*, *udpPort* and *Vsplit***??**
May 2005	corrected voice-change bug in *speak*
September 2004	modified the *tcpClient*, *tcpMultiServer* and *tcpServer* objects to support 'raw' mode transfers
July 2004	modified the *rcx* object to support sending messages
January 2004	documented the plugins used with the *fidget* object
December 2003	added support for don't care values in the *map1d*, *map2d* and *map3d* objects
November 2003	added the object *fidget*; removed a potential race condition in the *gvp100*, *ldp1550*, *mtc*, *spaceball* and *x10* objects; restored the *sysLogger* object to the OS X distribution
June 2003	completed conversion to Carbon; dropped the *serialX* object from the OS X distribution, as the functionality is provided in the current *serial* object; dropped the *rcx* and *sysLogger* objects from the OS X distribution due to problems with libraries used by them; added the objects *Vassemble*, *Vdecode*, *Vencode*, *Vltrim*, *Vrtrim*, *Vtokenize*, *Vtrim* and *Vunspell*
March 2003	began conversion to Carbon, for use with Mac OS X
October 2002	converted objects to CodeWarrior 8; corrected logic errors in the objects *map1d*, *map2d*, *map3d*, *tcpClient* and *tcpServer*; added code to support forcing the state of the DTR signal in the *serialX* object
September 2002	modified the objects *tcpClient*, *tcpMultiServer* and *tcpServer* to accept a parameter of the number of receive buffers to use; improved the handling of fast messages for the objects *tcpClient*, *tcpMultiServer* and *tcpServer*
August 2002	added the object *Vcollect*
June 2002	converted objects to CodeWarrior 7, which no longer supports the Motorola MC68xxx processors, so all new objects will be PowerPC-only – the older objects will still be available for both (in a *Max* 3.x archive or a *Max* 4.x archive)
April 2002	added the object *rcx*; improved the handling of non-standard list elements for all objects
March 2002	added the '**kind**' command to the object *x10*; modified the object *x10* to accept a parameter of the kind of X-10 controller attached; modified the objects *listType*, *pfsm*, *serialX*, *speak*, *tcpClient*, *tcpMultiServer* and *tcpServer* to properly handle the *Max* special characters; added the objects *fileLogger* and *sysLogger*
February 2002	began restructuring for *Max* 4.x; modified internal resources so that *Max* collectives and standalone applications can be built

January 2002	added the '**dtr**' command to the object *serialX*; enhanced the output format for the objects *map1d*, *map2d* and *map3d*
October 2001	added an optional argument to the objects *Vceiling*, *Vfloor*, *Vround* and *Vtruncate* indicating the desired output format; modified the object *mtc*'s '**raw**' format to return all the data in a single vector rather than a series of rows; modified the object *serialX* to support external clocking
August 2001	began documenting compatibility with *Max* 4.x
July 2001	added the '**self**' command to the objects *tcpClient*, *tcpMultiServer* and *tcpServer*; added the '**mode**' command to the object *mtc*; added the object *spaceball*
May 2001	extended the format of the input file for the objects *map1d*, *map2d* and *map3d* to return offset/match data; added the objects *Vcos*, *Vexp* and *Vsin*; added the '**add**', '**after**', '**before**', '**clear**', '**count**', '**delete**', '**dump**', '**get**', '**replace**', '**set**' and '**show**' commands to the objects *map1d*, *map2d* and *map3d*; added the '**threshold**' command to the object *mtcTrack*
April 2001	improved the handling of the structural sections, such as the Table of Contents and modified macros that were impacted by generation of PDF; added the objects *listen*, *map3d*, *mtcTrack*, *queue*, *speak*, *Vabs*, *Vdistance*, *Vinvert*, *Vlog*, *Vmean*, *Vnegate*, *Vreverse*, *Vrotate* and *Vsqrt*
March 2001	improved page layout and simplified the use of LaTeX 2ε commands; replaced most of the Adobe Illustrator® graphics with MetaPost versions
February 2001	added cross-references and improved index and graphics inclusion
January 2001	converted this document to LaTeX 2ε
November 2000	made a minor correction to the description of the '**send**' command for the object *tcpMultiServer*; clarified the '**status**' commands for the objects *tcpClient*, *tcpMultiServer* and *tcpServer*; added documentation for the TCP/IP message format to the object *tcpClient*; modified the TCP/IP message format to remove extraneous fields and increase robustness (the resulting TCP/IP objects are not compatible with earlier versions of the same objects); added the objects *map1d*, *map2d*, *tcpLocate*, *Vceiling*, *Vfloor*, *Vreduce*, *Vround*, *Vscan* and *Vtruncate*
October 2000	added the objects *caseShift*, *listType* and *tcpMultiServer*; added the '**float**' command to the object *serialX*; added the '**status**' command to the objects *tcpClient* and *tcpServer*; renamed the objects *drop*, *jet*, *length*, *segment* and *take* to *Vdrop*, *Vjet*, *Vlength*, *Vsegment* and *Vtake*, respectively; added the '**float**' and '**list**' commands to the object *notX*; corrected the description of the arguments to the object *changes*
September 2000	first version of this document

Foreword

This document is a description of the *Max* objects that I've written over the past several years, for myself and my friends, and will be a 'living' document—I intend to update it as new objects join the family. It is intended for *Max* programmers, and assumes a basic understanding of how *Max* works—I've made no attempt to explain standard *Max* objects or how to use my objects with standard *Max* objects, unless there are special considerations for use of my objects with standard *Max* objects. I don't provide examples, except in the form of online help files, as some of the objects are more easily understood from experimentation than exposition. This is not to say that the objects are difficult to use—I consider myself a lazy *Max* programmer and an experienced *C* programmer, so I've attempted to make the objects robust and responsive, with few idiosyncrasies. Some of the objects may show a *LISP* or an *APL* flavour, which is more a reflection on my languages of choice than an indication that *Max* has or doesn't have these elements. The objects were written using Metrowerks CodeWarrior, Apple Macintosh Programmer's Workshop (MPW), Apple ResEdit™ and the *Max* Software Development Kit from Cycling '74. But before I get into the goodies, some preliminaries:

For each object, I present an image of the object, showing its inlets and outlets, along with the following text entries:

1) A description of the object.

2) The year that the object was created.

3) Whether there is an online help file for the object. Wherever possible, the help file provides a comprehensive set of examples of use of the object. For some objects, the help file cannot convey the full complexity of the object—especially for objects with nontrivial state. For some objects, their command language is too complex to be placed in a help file, without making the help file difficult to use.

4) What theme or category the object belongs to. I've defined the following groups of objects:

   a) Device interface (*fidget*, *gvp100*, *ldp1550*, *listen*, *mtc*, *rcx*, *serialX*, *spaceball*, *speak*, *x10*)

   b) Miscellaneous (*caseShift*, *dataType*, *fileLogger*, *gcd*, *listType*, *mtcTrack*, *notX*, *shotgun*, *sysLogger*, *x10units*)

   c) Programming aids (*changes*, *compares*, *map1d*, *map2d*, *map3d*, *memory*, *pfsm*, *queue*, *stack*)

   d) QuickTime™ (*bqt*, *wqt*)

   e) TCP/IP (*tcpClient*, *tcpLocate*, *tcpMultiServer*, *tcpServer*, *udpPort*)

   f) Vector manipulation (*Vabs*, *Vceiling*, *Vcollect*, *Vcos*, *Vdistance*, *Vdrop*, *Vexp*, *Vfloor*, *Vinvert*, *Vjet*, *Vlength*, *Vlog*, *Vmean*, *Vnegate*, *Vreduce*, *Vreverse*, *Vrotate*, *Vround*, *Vscan*, *Vsegment*, *Vsin*, *Vsplit***??**, *Vsqrt*, *Vtake*, *Vtruncate*)

5) Which class list(s) the object appears in within *Max*.

6) A description of the arguments, if any, for the object. Any special values are identified, and default values are identified for optional arguments.

7) A description of each of the inlets for the object. The domain of values for the inlets are identified. If the values have a special format, it is described later.

8) A description of each of the outlets for the object. The range of values for the outlets are identified, where possible.

9) The names of other objects that are normally used with the object. An example is the *serialX* object, which is used with *x10* and *ldp1550* objects.

10) Whether the object is standalone or communicates with other objects. The TCP/IP objects *tcpClient*, *tcpMultiServer* and *tcpServer* work with each other; a *memory* object works with other *memory* objects that have the same tag.

11) Whether the object retains state. An object that doesn't retain state will respond to a given signal presented to an inlet in the same way each time that the signal appears; an object that does retain state, such as a *stack* or *memory* object, may respond differently each time that the same signal appears.

12) Which versions of Max can use the object (*Max* 3.x, *Max* 4.x or *Max* 4.5+) and which operating systems are supported (OS 9 or OS X).

13) Whether the object can be used only on older Macintoshes (68K-only), Power Macintoshes only (PPC-only) or either (Fat). Note that the objects were all built to work with *Max* 3.5 or newer.

14) If the object uses a command language, such as the inputs for the *memory* or *x10* objects, it's described in detail.

15) If the object uses an external file, such as *bqt* or *pfsm* objects, its format is described in detail.

16) Miscellaneous comments or anecdotes. This is whatever I felt needed to be mentioned, that didn't quite fit in one of the other categories.

For those objects, such as *gvp100*, that require specific connections to other objects, a simple diagram of the non-obvious connections is provided. Where it would assist in understanding, I provide a state diagram or a syntax chart.

I'd like to thank the following people for inspiring me to write the objects described here, and for motivating me to actually document them:
My best friend, Thecla Schiphorst, who has helped me find my focus.
My friends Sang Mah, Ken Gregory and Grant Gregson, who've presented *Max* programming challenges to me on many occasions, and who've been my unwitting (but willing) guinea pigs for years.
The students of IA308, 2002, Technical University of British Columbia (now known as the Simon Fraser University Surrey campus), for inspiring me and invigorating me.
My friends Larry Wasik and Glen Taylor, who've helped me learn how to refine my code, and when refining is not necessary.
My friends Jerry Barenholtz, Tom Calvert, Ron Harrop and Doug Seeley for helping me find order and discipline within the chaos of software design and development.
My friends Ron McOuat and Chris Duncombe, who've shown me that a cool head can accomplish great things and overcome obstacles, both from people and computers.
My friends Torsten Belschner, Robb Lovell, Stock and Aadjan van der Helm for providing valuable feedback and ideas about these objects.

The cover page photograph was originally made by Larry Wasik. It's the card deck for the program CONTK, along with a (partial) listing of the source code. CONTK, if you're interested, was a process control program written in *FORTRAN IV* for the IBM 1800 Process Control Computer, to control a Kamyr digester. If those terms aren't familiar to you, don't be surprised—I included the photograph as an attempt at humour, reflecting on my early days of programming.

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November 23, 2005

An OpenDragon production.

Powered by Macintosh! Developed using (over the years) Macintosh II, Macintosh IIci, Power Macintosh 9600, iBook, and Power Mac G4 machines.

Powered by CodeWarrior.

This document was created using CMacTeX 4.3, SubEthaEdit 2.1.1, BBEdit Lite 6.1, AFPL Ghostscript 8.00, GNU Make version 3.79.1, Adobe® Illustrator® 10.0.3, AppleScript 1.9.3, Adobe® Photoshop® 7.0.1, MetaPost 0.641, TeXShop 1.35 and dvips(k) 5.92b on an Apple Power Mac G4.

bqt

[No image—*bqt* is a user interface object]

Description of object: *bqt* provides an interface to QuickTime™ movies, permitting control of playback rate and the section of the movie to be played. It provides more functionality than the standard *movie* player interface object

Object created: October 1998

Current version: 1.0.4

Online help file: yes

Object theme: QuickTime™

Object class(es): n/a

Argument(s): none

Inlet(s):

1 **list**, the command input

Outlet(s):

1 **integer**, the result of a command
2 **integer**, the duration of the current movie
3 **bang**, playing has stopped
4 **bang**, an error was detected

Companion object(s): yes, (optional) the standard *movie* play controller interface object can be attached to a *bqt* object.

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

active [0/1]
Set the current movie active (**1**) or inactive (**0**).

bang
Start the current movie playing.

begin
Move to the beginning of the current movie and make it active.

count
Return the number of movies loaded.

duration
Return the length of the current movie.

end
Move to the end of the current movie and make it active.

getrate
Return the rate at which the current movie will be played.

getvolume
Return the audio level for the current movie.

integer
Move to the given frame number in the current movie.

load [movie-name]
Add the specified movie to the list of movies and make it the current movie. **movie-name** must be a symbol, not a number.

mute [0/1]
Change the audio level of the current movie, silencing it (**0**) or restoring the previous level (**1**).

pause
Stop the current movie.

rate integer [integer]
Set the rate at which the current movie will be played, using the ratio of the first number to the second, and start the movie playing. If only one number is given, or the second number is zero, assume that the second number has the value one.

resume
Continue playing the current movie after a '**pause**' or a '**stop**'.

segment integer [integer]
Set the portion of the current movie that will be played to the section from the first frame number to the second. If the first number is zero and the second number is zero or less, set the portion to be the whole movie. If the second number is negative, set the portion to be from the first frame number to the end of the movie. That is, '0 0' is the whole movie, as is '0 −1', while '15 −1' is the portion from frame 15 to the end.

start
Move to the beginning of the current movie, make it active and start it playing.

stop
Stop the current movie.

time
Return the current frame number of the current movie.

unload [movie-name]
If no movie is specified, remove the current movie from the list of movies. Otherwise, remove the specified movie from the list of movies. **movie-name** must be a symbol, not a number.

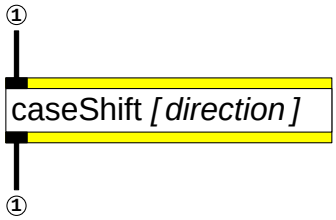
volume [integer]

Set the audio level of the current movie. The maximum level is 255; setting the level negative acts to mute the current movie, but the '**mute**' command can restore the audio level to the corresponding positive value.

File format: QuickTime™ movie

Comments: The *bqt* object was designed to address a critical weakness of the standard *movie* player interface object: there was no way to request only a section of the movie be played, even though QuickTime™ supports this ability. One feature of the standard *movie* player interface object was not retained—mouse motion over the *bqt* object is not detected.

caseShift



Description of object: *caseShift* changes the case of each symbol in a list to either lower case or upper case.

Object created: October 2000

Current version: 1.0.2

Online help file: yes

Object theme: Miscellaneous

Object class(es): Messages

Argument(s):

direction **(optional) symbol**, the direction of the shift, either ‘up’ or ‘down’. The default direction is ‘up’.

Inlet(s):

1 anything, the symbols to be modified

Outlet(s):

1 anything, the symbols after case conversion

Companion object(s): none

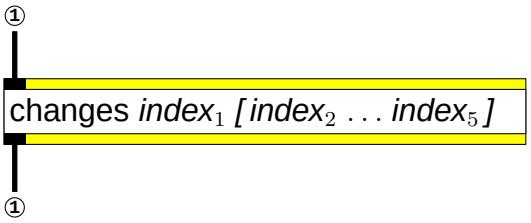
Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

changes



Description of object: *changes* monitors an arbitrary list, watching for a change in specified elements. When a change is detected, the list seen in the inlet is sent to the outlet and it is remembered for comparison with subsequent lists.

Object created: October 1998

Current version: 1.0.4

Online help file: yes

Object theme: Programming aids

Object class(es): Lists

Argument(s):

index1 **integer**, the first list element index to monitor (indices start at 1; negative indices count from the end of the list)

index2 **(optional) integer**, the second list element index to monitor

index3 **(optional) integer**, the third list element index to monitor

index4 **(optional) integer**, the fourth list element index to monitor

index5 **(optional) integer**, the fifth list element index to monitor

Inlet(s):

1 **list**, the list to be monitored

Outlet(s):

1 **list**, the list matching input

Companion object(s): none

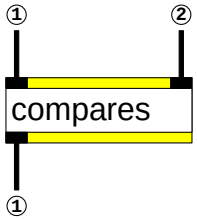
Standalone: yes

Retains state: yes, the elements of the previous input list

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

compares



Description of object: *compares* does a case-sensitive string comparison of two symbols.

Object created: April 1999

Current version: 1.0.3

Online help file: yes

Object theme: Programming aids

Object class(es): Arith/Logic/Bitwise

Argument(s): none

Inlet(s):

1 **symbol**, the first string
2 **symbol**, the second string

Outlet(s):

1 **integer**, the comparison result (−1 = second string greater, 0 = strings match, 1 = first string greater)

Companion object(s): none

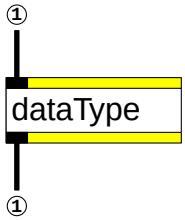
Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

dataType



Description of object: *dataType* returns a numeric code corresponding to the value it receives.

Object created: October 1998

Current version: 1.0.3

Online help file: yes

Object theme: Miscellaneous

Object class(es): Lists

Argument(s): none

Inlet(s):

1 anything, any value

Outlet(s):

1 integer, the code for the input (unknown = 0, bang = 1, float = 2, integer = 3, list = 4, symbol = 5)

Companion object(s): none

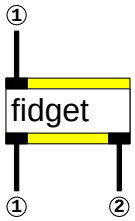
Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

fidget



Description of object: *fidget* provides an interface to *Phidgets*® – physical widgets, available from Phidgets Incorporated. The *fidget* object uses a folder named 'Phidgets', located in the same folder as the *Max* program, to provide a collection of 'plugins' for device-specific behaviours.

Object created: November 2003

Current version: 1.0.1

Online help file: no

Object theme: Device interface

Object class(es): Devices

Argument(s): none

Inlet(s):

1 **list**, the command input

Outlet(s):

1 **list**, the command response
2 **integer**, the error code if an error was detected

Companion object(s): see *Phidgets* for the available 'plugins'

Standalone: yes

Retains state: no

Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

do deviceType serialNumber/* [anything]
Perform a device-specific operation for the specified phidget or all phidgets of the same type (if '*' is specified). The default behaviour is to do nothing.

get deviceType serialNumber/* [anything]
Acquire data from the specified phidget or all phidgets of the same type (if '*' is specified). The default behaviour is to interpret the argument as an element number and to return the value(s) from that element in the form of a list, with the first two elements of the list consisting of the 'deviceType' and the 'serialNumber'.

listen [on/off]
Start reporting phidget insertions and removals ('on') or stop reporting ('off'). If no argument is given, reporting is reversed.

put deviceType serialNumber/* [anything]
Send data to the specified phidget or all phidgets of the same type (if '*' is specified). The default behaviour is to interpret the argument as an element number followed by the value(s) to be sent to the element. There is no expected output from the 'put' command.

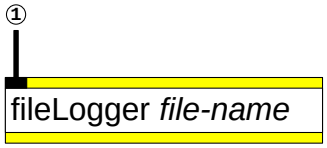
report [deviceType [serialNumber/* [element]]]
If there are no arguments to the 'report' command, return a list of all devices, in the form of the symbol 'devices' followed by each device, as represented by its device type and serial number. If only the 'deviceType' is specified, return a list of all devices with matching device types, in the form of the symbol 'device' followed by the device type and the serial numbers of the matching devices. If the 'deviceType' and 'serialNumber' are specified, the elements of the matching device will be returned, in the form of a list with the symbol 'elements' followed by a triple for each element, consisting of the element 'cookie', the element type ('input-misc', 'input-button', 'input-axis', 'input-scancodes', 'output', 'feature' or 'collection') and the element size in bits. If '*' is specified instead of 'serialNumber', 'element' is ignored and all phidgets of the same type are reported in the form of a series of lists with the symbol 'elements' followed by a triple for each element, consisting of the element 'cookie', the element type ('input-misc', 'input-button', 'input-axis', 'input-scancodes', 'output', 'feature' or 'collection') and the element size in bits. If all three arguments are present, the specified element is returned as a list starting with the symbol 'element' followed by the element type and size. Note that no output is returned if a match fails.

structure deviceType serialNumber/*
Report the hierarchical structure of the specified phidget or all phidgets of the same type (if '*' is specified) to the *Max* window.

Comments:

fidget loads all available files from a folder named 'Phidgets', located in the same folder as the *Max* program, to provide a collection of 'plugins' for device-specific behaviours. Refer to *Phidgets* for a list of the currently available 'plugins'. Device serial numbers are prefixed with an underscore character ("_") to guarantee their interpretation as symbols rather than numbers. Note that at most one *fidget* object can loaded into *Max* due to the way that it interacts with the Macintosh device routines.

fileLogger



Description of object: *fileLogger* writes it's input to a standard file.

Object created: March 2002

Current version: 1.0.2

Online help file: yes

Object theme: Miscellaneous

Object class(es): Miscellaneous

Argument(s):

file-name **symbol**, the file to be written to

Inlet(s):

1 **anything**, the input to be processed

Outlet(s): none

Companion object(s): none

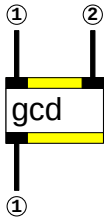
Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

gcd



Description of object: *gcd* calculates the greatest common divisor of two numbers.

Object created: October 1998

Current version: 1.0.3

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise

Argument(s): none

Inlet(s):

1 **bang/integer**, the first number to use
2 **integer**, the second number to use

Outlet(s):

1 **integer**, the greatest common divisor of the two numbers, or the previous result (if a '**bang**' is received)

Companion object(s): none

Standalone: yes

Retains state: yes, the previous number input

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

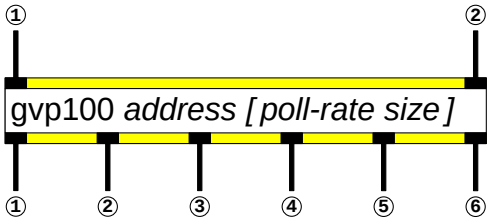
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: In mathematical terms: $y \leftarrow \gcd(x_1, x_2)$, where x_1 and x_2 are the inlet values and y is the outlet result.

gvp100



Description of object: *gvp100* is an interface to an ECHOlab DV7 video switcher, which utilizes the Grass Valley Protocol. It sends commands to a serialX object, which controls the serial port that the video switcher is attached to, and responds to data returned from the video switcher via the *serialX* object.

Object created: June 1998

Current version: 1.0.5

Online help file: no

Object theme: Device interface

Object class(es): Devices

Argument(s):

address **integer**, the select address of the video switcher. The address must be even and less than 256.

poll-rate **(optional) integer**, the rate (in milliseconds) at which the companion *serialX* object is polled via a sample request. The default rate is 100 milliseconds between sample requests.

size **(optional) integer**, the size of the command pool that is used to buffer commands to the video switcher. The default size is 50 and the maximum size is 200.

Inlet(s):

1. **list**, the command channel
2. **anything**, the output of the companion *serialX* object

Outlet(s):

1. **bang**, the sequence has completed
2. **bang**, the command has completed
3. **bang**, the sample request to send to the companion *serialX* object
4. **anything**, the data to send to the companion *serialX* object
5. **bang**, the '**break**' request to send to the companion *serialX* object, via a message object
6. **bang**, an error was detected

Companion object(s): works with *serialX* objects (not *serial*)

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

allstop
Send the 'allstop' command to the video switcher.

breakdone
The '**break**' sent to the *serialX* object has completed. This command shouldn't be sent under other circumstances.

c bus-settings
This is a shortcut for the '**crosspoint bus-settings**' command.

crosspoint bus-settings
The argument **bus-settings** is a series of pairs of symbols and symbols or integers— if the list is of odd length, the value zero is added at the end. The first value is the name of the bus of the video switcher that is to be set ('pgm'/'program', 'preset'/'preview', 'key'/'insert'/'k'/'i') and the second value is the source for the given bus ('black', 'background'/'b' or an integer between 0 and 9, where 'black' is the same as '0' and 'background' is the same as '9'). Each of the resulting pairs is sent to the video switcher to change the program, preset or key busses.

!c level
This is a shortcut for the '**!clip level**' command.

!clip level
Set the clipping level to the given value, **level**, which is a floating point number that is between 0 and 100. The command is the equivalent to '**dskanalogcontrol 8 level**'.

d control-values
A shortcut for the '**dskanalogcontrol control-values**' command.

dskanalogcontrol control-values
The argument **control-values** is a series of pairs of floating point numbers—if the list is of odd length, the value zero is added at the end. The first number in each pair is the control to be set and the second number in each pair is the value to set the control to. Each of the resulting pairs is sent to the video switcher to change the DSK analog control settings.

e control-values
This is a shortcut for the '**effectsanalogcontrol control-values**' command.

effectsanalogcontrol control-values
The argument **control-values** is a series of pairs of floating point numbers—if the list is of odd length, the value zero is added at the end. The first number in each pair is the control to be set and the second number in each pair is the value to set the control to. Each of the resulting pairs is sent to the video switcher to change the effects analog control settings.

!e position

This is a shortcut for the '**!effects position**' command.

!effects position

Set the 'effects' control position of the video switcher to the given value, **position**, which is a floating point value between 0 and 100. The command is equivalent to '**effectsanalogcontrol 21 position**'.

endsequence

Add the pseudo-command 'endsequence' to the buffer of commands to be sent to the video switcher. The pseudo-command 'endsequence' is not actually sent to the video switcher, but results in a '**bang**' being sent out the first outlet to signal that a sequence of commands has been completed.

!j horizontal vertical

This is a shortcut for the '**!joystick horizontal vertical**' command.

!joystick horizontal vertical

Set the coordinates of the joystick on the video switcher. The given values, **horizontal** and **vertical**, are floating point numbers between 0 and 100. The command is equivalent to '**effectsanalogcontrol 18 horizontal 17 vertical**'.

learn-emem [**register**]

The video switcher settings will be stored in the given **register** of the video switcher, where **register** is an integer between 0 and 15. If no value for **register** is given, zero is assumed.

m keyOrBackground1 [**keyOrBackground2**]

This is a shortcut for the '**transitionmode keyOrBackground1 [keyOrBackground2]**' command.

off buttons

The argument **buttons** is a list of numbers, which are interpreted as the indices of the buttons and switches of the video switcher. The indices are between 0 and 80, but not all values correspond to actual buttons or switches. Each of the matching buttons and switches on the video switcher will have their state set to 'off'. If an erroneous index appears, the remaining indices will be ignored.

on buttons

The argument **buttons** is a list of numbers, which are interpreted as the indices of the buttons and switches of the video switcher. The indices are between 0 and 80, but not all values correspond to actual buttons or switches. Each of the matching buttons and switches on the video switcher will have their state set to 'on'. If an erroneous index appears, the remaining indices will be ignored.

p buttons

This is a shortcut for the '**push buttons**' command.

push buttons

The argument **buttons** is a list of numbers, which are interpreted as the indices of the buttons and switches of the video switcher. The indices are between 0 and 80, but not all values correspond to actual buttons or switches. Each of the matching buttons and switches on the video switcher will have their state flipped (from 'off' to 'on' or vice-versa). If an erroneous index appears, the remaining indices will be ignored.

r transition [**rate** [**keyOrBackgroundOrDoIt1** [**keyOrBackgroundOrDoIt2** [**keyOrBackgroundOrDoIt3**]]]]

This is a shortcut for the '**transitionrate transition [rate [keyOrBackgroundOrDoIt1 [keyOrBackgroundOrDoIt2 [keyOrBackgroundOrDoIt3]]]]**' command.

recall-emem [**register**]

The previously stored video switcher settings will be retrieved from the given **register** of the video switcher,

where **register** is an integer between 0 and 15. If no value for **register** is given, zero is assumed.

!t position

This is a shortcut for the '**!take position**' command.

!take position

Set the 'take' control position of the video switcher to the given value, **position**, which is a floating point value between 0 and 100. The command is equivalent to '**effectsanalogcontrol 11 position**'.

transitionmode keyOrBackground1 [**keyOrBackground2**]

Set the active transition mode of the video switcher to either key ('key' or 'k') or background ('background' or 'b') or both.

transitionrate transition [**rate** [**keyOrBackgroundOrDoIt1** [**keyOrBackgroundOrDoIt2** [**keyOrBackgroundOrDoIt3**]]]]

Set the transition rate for the given **transition** ('auto'/'a', 'dsk'/'d' or 'f2b'/'f', where 'f2b' represents fade-to-black) to the given value, **rate**, which is an integer between 0 and 1000. The transition rate affects either the key ('key' or 'k') or background ('background' or 'b') transitions. If the symbol 'doit' or 'd' appears, the transition is triggered as well. If no value for **rate** is given, zero is assumed.

v [**on**/**off**]

This is a shortcut for the '**verbose [on/off]**' command.

verbose [**on**/**off**]

Communication tracing to the *Max* window will be enabled ('on'), disabled ('off') or reversed, if no argument is given.

w [**index**]

This is a shortcut for the '**wipepattern [index]**' command.

wipepattern [**index**]

Set the wipe pattern of the video switcher to **index**, which is one of the following integer values: 0, 1, 3, 4, 10, 11, 20, 23, 30 or 33. If no value for **index** is given, zero is assumed.

x

This is a shortcut for the '**xreset**' command.

xreset

Remove any pending commands for the video switcher and send a 'break' to the video switcher to force a device reset.

Comments: Figure 1 shows how to connect a *gvp100* object to a *serialX* object.

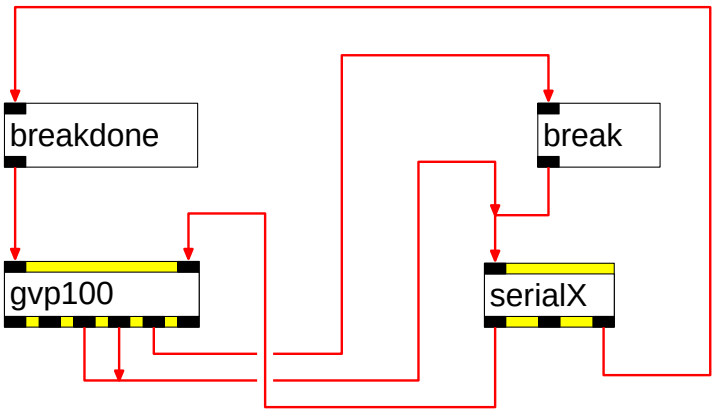
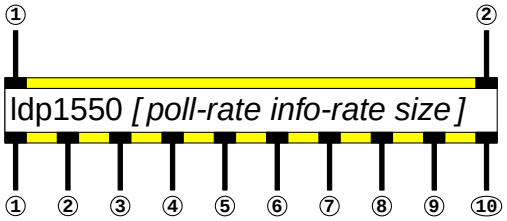


Figure 1: Connecting a *gvp100* object to a *serialX* object

ldp1550



Description of object: *ldp1550* is an interface to the Sony Corporation LDP-1550 Laser Disk Player (LDP). It sends commands to a *serial* or *serialX* object, which controls the serial port that the LDP is attached to, and responds to data returned from the LDP via the *serial* or *serialX* object.

Object created: September 1996

Current version: 1.0.6

Online help file: no

Object theme: Device interface

Object class(es): Devices

Argument(s):

poll-rate **(optional) integer**, the rate (in milliseconds) at which the companion *serial* or *serialX* object is polled via a sample request. The default rate is 100 milliseconds between sample requests.

info-rate **(optional) integer**, the multiples of the poll-rate at which the laser disk player is sent a status request. The default rate is 10 times the poll-rate.

size **(optional) integer**, the size of the deferred command pool, where commands that can't be acted on immediately are held. The default size is 30 elements. Most commands consume several elements.

Inlet(s):

1 **list**, the command channel
2 **integer**, the output of the companion *serial* or *serialX* object

Outlet(s):

1 **integer**, the data to send to the companion *serial* or *serialX* object
2 **bang**, the sample request to send to the companion *serial* or *serialX* object
3 **integer**, the key mode status
4 **integer**, the command status
5 **bang**, a program stop code was detected

6 **bang**, the command has completed
7 **bang**, the command was accepted
8 **integer**, the chapter number
9 **integer**, the frame number
10 **bang**, an error was detected

Companion object(s): works with *serial* or *serialX*

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

allinfo
Send commands to the laser disk player requesting the current chapter, the current frame number, the key mode status and the command status.

chapter
Send a command to the laser disk player requesting the current chapter.

continue
Send a 'continue' command to the laser disk player.

frame
Send a command to the laser disk player requesting the current frame number.

memory
Send a 'memory' command to the laser disk player.

mode new-mode
Send a command to the laser disk player requesting the mode, as given by **new-mode**, be set to 'chapter' or 'frame'.

msearch
Send an 'msearch' command to the laser disk player.

picture on/off
Send a command to the laser disk player, turning the video signal 'on' or 'off'.

play [**speedAndMode** [**stepRate**]]
Send a command to the laser disk player to begin playing the laser disk, at the given speed and mode ('fwd', 'fast', 'slow', 'scan', 'step', 'rev', 'rev-fast', 'rev-slow', 'rev-scan' or 'rev-step', where 'rev' indicates the reverse direction and 'fwd' indicates the forward direction and normal speed) and stepping rate, **stepRate**, which is an integer between 0 and 255. The default speed is forward, the default mode is normal and the default stepping rate is 0.

playtill position [**speed** [**stepRate**]]
Send a command to the laser disk player to begin playing the laser disk, at the given **speed** ('fwd', 'fast', 'slow', 'step', where 'fwd' indicates normal speed) and stepping rate, **stepRate**, which is an integer between

0 and 255. The laser disk player will stop when the given chapter or frame (depending on the mode of the laser disk player), **position**, is reached. The ending position is an integer between 0 and 79 (if the mode is 'chapter') or between 0 and 54000 (if the mode is 'frame'). The default speed is normal and the default stepping rate is 0.

pscenable on/off
Send a command to the laser disk player to enable ('on') or disable ('off') PSC mode.

repeat position [**speed** [**repeatCount** [**stepRate**]]]
Send a command to the laser disk player to begin playing the laser disk, at the given **speed** ('fwd', 'fast', 'slow', 'step', where 'fwd' indicates normal speed) and stepping rate, **stepRate**, which is an integer between 0 and 255. The laser disk player will stop when the given chapter or frame (depending on the mode of the laser disk player), **position**, is reached, and it will then repeat the sequence played for the number of times given by **repeatCount**. The ending position is an integer between 0 and 79 (if the mode is 'chapter') or between 0 and 54000 (if the mode is 'frame'). The number of times is between 0 and 15. The default speed is normal, the default stepping rate is 0 and the default number of times is 1.

reset
Send a 'reset' command to the laser disk player.

search new-position
Send a command to the laser disk player to move the current position to the given chapter or frame (depending on the mode of the laser disk player), **new-position**. The new position is an integer between 0 and 79 (if the mode is 'chapter') or between 0 and 54000 (if the mode is 'frame').

show on/off
Send a command to the laser disk player to enable ('on') or disable ('off') the addition of the display of the current position to the outgoing video signal.

sound theChannel on/off
Send a command to the laser disk player to enable ('on') or disable ('off') the sound signal in the given channel, **theChannel**. The channel is either '1' or '2'.

status
Send a command to the laser disk player requesting the key mode status and the command status.

step&still [**fwdOrRev**]
Send a command to the laser disk player to move the current position one frame forward ('fwd') or reverse ('rev'). The default direction is forward.

still
Send a command to the laser disk player to freeze play.

stop
Send a command to the laser disk player to stop playing.

xreset
Unconditionally send a 'reset' command to the laser disk player. This has the side effect of changing the mode to 'frame'.

Comments: Figure 2 shows how to connect an *ldp1550* object to a *serialX* object.

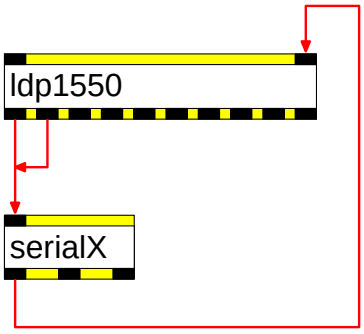


Figure 2: Connecting an *ldp1550* object to a *serialX* object

listen

Description of object: *listen* is an interface to the Macintosh Speech Recognition Manager.

Object created: April 2001

Current version: 1.0.2

Online help file: yes

Object theme: Device interface

Object class(es): Devices

Argument(s):

showFeedback **(optional) symbol**, either ‘yes’, ‘y’, ‘no’ or ’n’ to indicate whether to use the Apple Speech Recognition window for feedback

init-file **(optional) symbol**, the name of the language file to load initially

Inlet(s):

1 **list**/**bang**, the command input

Outlet(s):

1 **list**, the status or response. Status messages (triggered by a ‘**status**’ command) appear as a two element list, starting with the symbol ‘status’; response messages appear as a list, starting with the symbol ‘result’.

2 **bang**, an error was detected

Companion object(s): none

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

load filename
The currently loaded language model will be set to the contents of the named language file.

recognize phrase-list
The currently loaded language model will be replaced by the simplified model, **phrase-list**. **phrase-list** consists of a sequence of alternate phrases, separated by the character '|'. Phrases are a sequence of one or more English words, each followed by an (optional) list of atoms that are output when this word is matched, preceeded by the character '{' and followed by the character '}'. Each word in a phrase can be followed by an optional modifier, which begins with the character '[', followed by one or more 'O', 'o', 'R' or 'r' characters and ending with the character ']'. The characters 'R' and 'r' indicate that the word that they follow can be repeated, and the characters 'O' and 'o' indicate that the word that they follow is optional.

start
If a language model has been loaded, listening will be enabled.

status
The state of the *listen* object (idle, loaded or stopped) will be reported.

stop
Listening will be disabled.

File format:

The language file describes the spoken phrases that the *listen* object will recognize and is composed of two sections:

1) the top-level model—a single symbol
2) the model descriptions—a list of statements describing the elements of the language.

Comments start with the '#' character and end with the ';' character.

The model descriptions have the following form:

a) a linguistic symbol, which is a sequence of non-blank characters, preceeded by the character '<' and followed by the character '>'
b) an (optional) list of atoms that are output when this linguistic symbol is matched, preceeded by the character '{' and followed by the character '}'
c) the symbol '='
d) one or more phrases, separated by the character '|', which indicates that the phrases are alternatives
e) the character ';'

Phrases are a sequence of one or more elements, where an element is:

a) a linguistic symbol or
b) an English word, followed by an (optional) list of atoms that are output when this word is matched, preceeded by the character '{' and followed by the character '}'

Each element in a phrase can be followed by an optional modifier, which begins with the character '[', followed by one or more 'O', 'o', 'R' or 'r' characters and ending with the character ']'. The characters 'R' and 'r' indicate that the element that they follow can be repeated, and the characters 'O' and 'o' indicate that the element that they follow is optional.

Note that the top-level model is represents the most complex sentence that is expected. Each model can only have one description, and each model must be used in at least one other model. When a sentence is recognized, the optional lists of atoms that are associated with the matching words and linguistic symbols will be output as a single list, preceeded by the symbol 'result'.

Comments: Note that there can only be one *listen* object in *Max* at any time. As well, *Max/MSP* by default grabs the Sound Input Manager when it starts up, so that it is necessary to make it release the Sound Input Manager before using an *listen* object.

```
#File:  listen_data_1;
<CallSomeone>
<CallSomeone> { call } = Call <Person> at <Place> ;
<Person> = Matt { MJ } | Jason { JH } | Chris { CD } ;
<Place> = Work { 0 } | Home { 1 } | the office { 2 } ;
# The following spoken phrases result in the indicated output:
#call matt at home -> call MJ 1
#call jason at the office -> call JH 2
#call chris at work -> call CD 0
```

Figure 3: An example language file for a *listen* object

```
#File:  listen_data_2;
# Top-level model:;
<Number>
# Models:;
<Number> = zero { 0 } | <LowNumber> | <Century> and [ o ] <LowNumber> [ o ] ;
<LowNumber> = <LowUnits> | <LowTeens> | <LowDecades> <LowUnits> [ o ] ;
<LowUnits> = one { 1 } | two { 2 } | three { 3 } | four { 4 } | five { 5 } |
      six { 6 } | seven { 7 } | eight { 8 } | nine { 9 } ;
<LowTeens> = ten { 10 } | eleven { 11 } | twelve { 12 } | thirteen { 13 } |
      fourteen { 14 } | fifteen { 15 } | sixteen { 16 } | seventeen { 17 } |
      eighteen { 18 } | nineteen { 19 } ;
<LowDecades> = twenty { 20 } | thirty { 30 } | forty { 40 } | fifty { 50 } |
      sixty { 60 } | seventy { 70 } | eighty { 80 } | ninety { 90 } ;
<Century> = <MidNumber> hundred [ o ] | <HighUnits> thousand ;
<MidNumber> = <MidUnits> | <MidTeens> | <MidDecades> <MidUnits> [ o ] ;
<MidUnits> = one { 100 } | two { 200 } | three { 300 } | four { 400 } |
      five { 500 } | six { 600 } | seven { 700 } | eight { 800 } |
      nine { 900 } ;
<MidTeens> = ten { 1000 } | eleven { 1100 } | twelve { 1200 } | thirteen { 1300 } |
      fourteen { 1400 } | fifteen { 1500 } | sixteen { 1600 } |
      seventeen { 1700 } | eighteen { 1800 } | nineteen { 1900 } ;
<MidDecades> = twenty { 2000 } | thirty { 3000 } | forty { 4000 } |
      fifty { 5000 } | sixty { 6000 } | seventy { 7000 } | eighty { 8000 } |
      ninety { 9000 } ;
<HighUnits> = one { 1000 } | two { 2000 } | three { 3000 } | four { 4000 } |
      five { 5000 } | six { 6000 } | seven { 7000 } | eight { 8000 } |
      nine { 9000 } ;
# This allows for several alternate representations of the same number:;
# 1492 = fourteen ninety two, or one thousand four hundred ninety two, or ;
#      fourteen hundred and ninety two or other variants where the word ;
#      'and' may or may not appear.;
```

Figure 4: Another example language file for a *listen* object

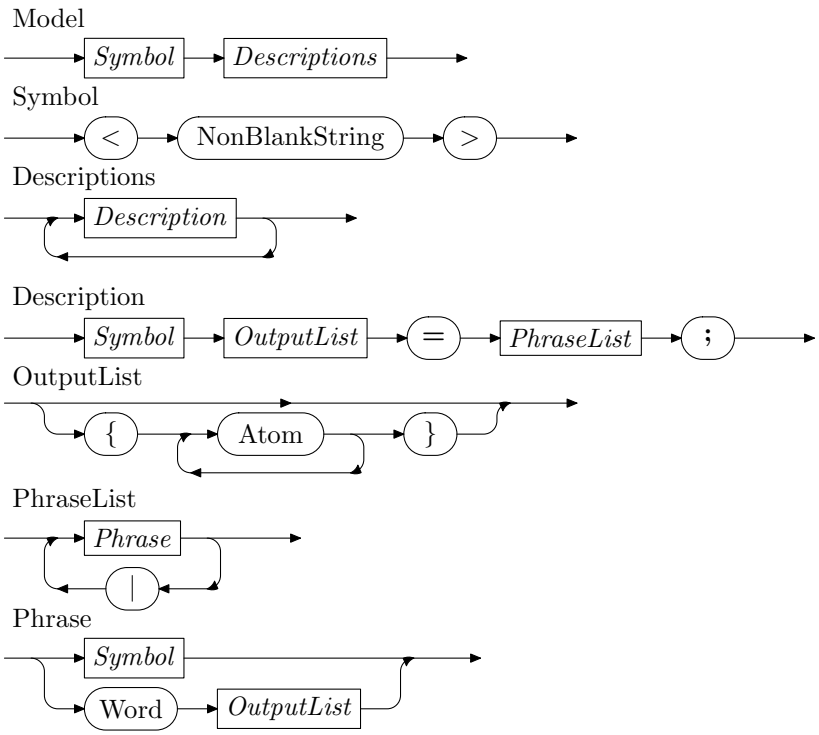
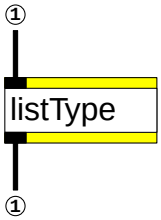


Figure 5: Syntax diagram for language files

listType



Description of object: *listType* returns a numeric code corresponding to the value it receives.

Object created: October 2000

Current version: 1.0.3

Online help file: yes

Object theme: Miscellaneous

Object class(es): Lists

Argument(s): none

Inlet(s):

1 anything, any value

Outlet(s):

1 integer, the code for the input (unknown = 0, non-list = 1, empty list = 2, integer list = 3, float list = 4, numeric list[4] = 5, symbol list = 6, mixed list[5] = 7, list with unknowns[6] = 8)

Companion object(s): none

Standalone: yes

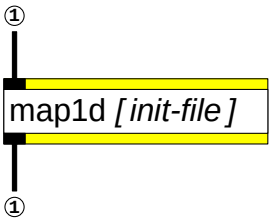
Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

[4] A numeric list contains both integer and float values.
[5] A mixed list contains both numeric values and symbols.
[6] A list with unknowns contains one or more unrecognizable values.

map1d



Description of object: *map1d* maps its input to a one of a sequence of ranges and returns the set of values associated with the range.

Object created: November 2000

Current version: 1.0.6

Online help file: yes

Object theme: Programming aids

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

init-file **(optional) symbol**, the name of the map file to load initially

Inlet(s):

1 **integer**/**float**, the command or data input

Outlet(s):

1 **list**, the retrieved data, the previous result (if a '**bang**' is received), the number of loaded ranges, the description of an individual range or the value of an element of a range. Results or retrieved data appear as a list starting with the symbol 'result'; the number of loaded ranges appear as a two element list, starting with the symbol 'count', range descriptions appear as a list starting with the symbol 'range' and range element values appear as a list starting with the symbol 'value'.

Companion object(s): none

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

add list
Add a range to the end of the loaded set of ranges. The range is in the form: '*' or *left-bracket lower-value upper-value right-bracket output*, where *left-bracket* is either '[' or '(' and *right-bracket* is either ']' or ')'; *lower-value* is a floating-point number, an integer or one of the symbols '−inf' or '−∞', which indicate an unbounded value; *upper-value* is a floating-point number, an integer or one of the symbols 'inf', '+inf', '∞' or '+∞', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol '$' to indicate the input or the symbol '$$' to indicate the offset of the input from the *lower-value* of the matching range. If the *lower-value* is unbounded, the input is returned rather than the offset.

after index list
Add a range after the range with the given index. The range is in the form: '*' or *left-bracket lower-value upper-value right-bracket output*, where *left-bracket* is either '[' or '(' and *right-bracket* is either ']' or ')'; *lower-value* is a floating-point number, an integer or one of the symbols '−inf' or '−∞', which indicate an unbounded value; *upper-value* is a floating-point number, an integer or one of the symbols 'inf', '+inf', '∞' or '+∞', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol '$' to indicate the input or the symbol '$$' to indicate the offset of the input from the *lower-value* of the matching range. If the *lower-value* is unbounded, the input is returned rather than the offset.

bang
Return the previous result, if any, as a list starting with the symbol 'result'.

before index list
Add a range before the range with the given index. The range is in the form: '*' or *left-bracket lower-value upper-value right-bracket output*, where *left-bracket* is either '[' or '(' and *right-bracket* is either ']' or ')'; *lower-value* is a floating-point number, an integer or one of the symbols '−inf' or '−∞', which indicate an unbounded value; *upper-value* is a floating-point number, an integer or one of the symbols 'inf', '+inf', '∞' or '+∞', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol '$' to indicate the input or the symbol '$$' to indicate the offset of the input from the *lower-value* of the matching range. If the *lower-value* is unbounded, the input is returned rather than the offset.

clear
The currently loaded set of ranges is removed.

count
The number of currently loaded ranges is returned as a two element list, starting with the symbol 'count'.

delete index
Removes the range with the given index from the loaded set of ranges.

dump
Retrieves all the ranges as a sequence of lists starting with the symbol 'range'. The second element of each list is the index, and the remainder of the list is in the form '*' or *left-bracket lower-value upper-value right-bracket output*, where *left-bracket* is either '[' or '(' and *right-bracket* is either ']' or ')'; *lower-value* is a floating-point number or the symbol '−inf', which indicates an unbounded value; *upper-value*, is a floating-point number or the symbol 'inf', which indicates an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is the list of values which will be returned on a successful match.

float

The given value is compared to the loaded ranges. When a match is found, the output portion of the matching range is returned, prefixed with the symbol 'result'.

get index edge

Returns the given edge ('upper' or 'lower') of the given index as a two element list, starting with the symbol 'value'. A "don't care" value is returned as the symbol '*'.

integer

The given value is compared to the loaded ranges. When a match is found, the output portion of the matching range is returned, prefixed with the symbol 'result'.

load filename

The currently loaded set of ranges will be set to the contents of the named map file.

replace index list

Replace the range with the given index. The range is in the form: '*' or *left-bracket lower-value upper-value right-bracket output*, where *left-bracket* is either '[' or '(' and *right-bracket* is either ']' or ')'; *lower-value* is a floating-point number, an integer or one of the symbols '$-$inf' or '$-\infty$', which indicate an unbounded value; *upper-value* is a floating-point number, an integer or one of the symbols 'inf', '$+$inf', '∞' or '$+\infty$', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol '$' to indicate the input or the symbol '$$' to indicate the offset of the input from the *lower-value* of the matching range. If the *lower-value* is unbounded, the input is returned rather than the offset.

set index edge value

Replace the given edge ('lower' or 'upper') of the range with the given index. *value* is a floating-point number, an integer, or one of the symbols 'inf', '$+$inf', '∞' or '$+\infty$', '$-$inf' or '$-\infty$', which indicate an unbounded value. If *edge* is 'lower', the symbol '$-$inf' or '$-\infty$' can appear; if *edge* is 'upper', the symbol 'inf', '$+$inf', '∞' or '$+\infty$' can appear. Note that a "don't care" value cannot be replaced using this command.

show index

Retrieves the range with the given index, as a list starting with the symbol 'range'. The second element of the list is the index, and the remainder of the list is in the form '*' or *left-bracket lower-value upper-value right-bracket output*, where *left-bracket* is either '[' or '(' and *right-bracket* is either ']' or ')'; *lower-value* is a floating-point number or the symbol '$-$inf', which indicates an unbounded value; *upper-value*, is a floating-point number or the symbol 'inf', which indicates an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is the list of values which will be returned on a successful match.

verbose [**on**/**off**]

Range check tracing to the *Max* window will be enabled ('on'), disabled ('off') or reversed, if no argument is given.

File format:

The map file is composed of a set of ranges. Comments start with the '#' character and end with the ';' character. Ranges are either open (don't include the boundary value) or closed (the boundary value is included), and have boundary values that are integers, floating-point numbers, or infinities. An open range is indicated by a parenthesis, or round bracket, and a closed range by a square bracket. A range declaration is in the following form:

'*' or *left-bracket lower-value upper-value right-bracket output*

left-bracket is either '[' or '(' and *right-bracket* is either ']' or ')'; *lower-value* is a floating-point number, an integer or one of the symbols '−inf' or '−∞', which indicate an unbounded value; *upper-value* is a floating-point number, an integer or one of the symbols 'inf', '+inf', '∞' or '+∞', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbols '$' or '$x' to indicate the input or the symbol '$$' or '$$x' to indicate the offset of the input from the *lower-value* of the matching range. If the *lower-value* is unbounded, the input is returned rather than the offset. Note that the order of the range declarations is critical—the first range that matches the input is used, and overlaps between range declarations are ignored.

```
#File:  map_file_1d;
# Each line is terminated with a semicolon;
# A comment starts with a '#' character;
# Note that white space is critical around symbols and operators;
# Mappings;
# The format is:  <open> <lower> <upper> <close> <output> ;
# where <open> is either '[' or '(' and <close> is either ']' or ')';
# <lower> is a number or the symbol '−∞' (option-5) or '−inf';
# <upper> is a number or the symbol '∞' (option-5) or '+∞' or;
# 'inf' or '+inf';
# The bracketed pair can be replaced by the symbol * to indicate;
# a don't care value;
# <output> is what to return on a match;
# <output> can contain the symbol '$' which is replaced by the input;
# value or the symbol '$$' which is replaced by the offset of the input;
# value from <lower> - the input value is returned instead of the;
# offset if <lower> is unbounded;
[ -20 20 ] alpha $ ;
( 20 30 ] beta ;
( −∞ -20 ) gamma ;
( 30 inf ) delta $$ ;
```

Figure 6: An example map file for a *map1d* object

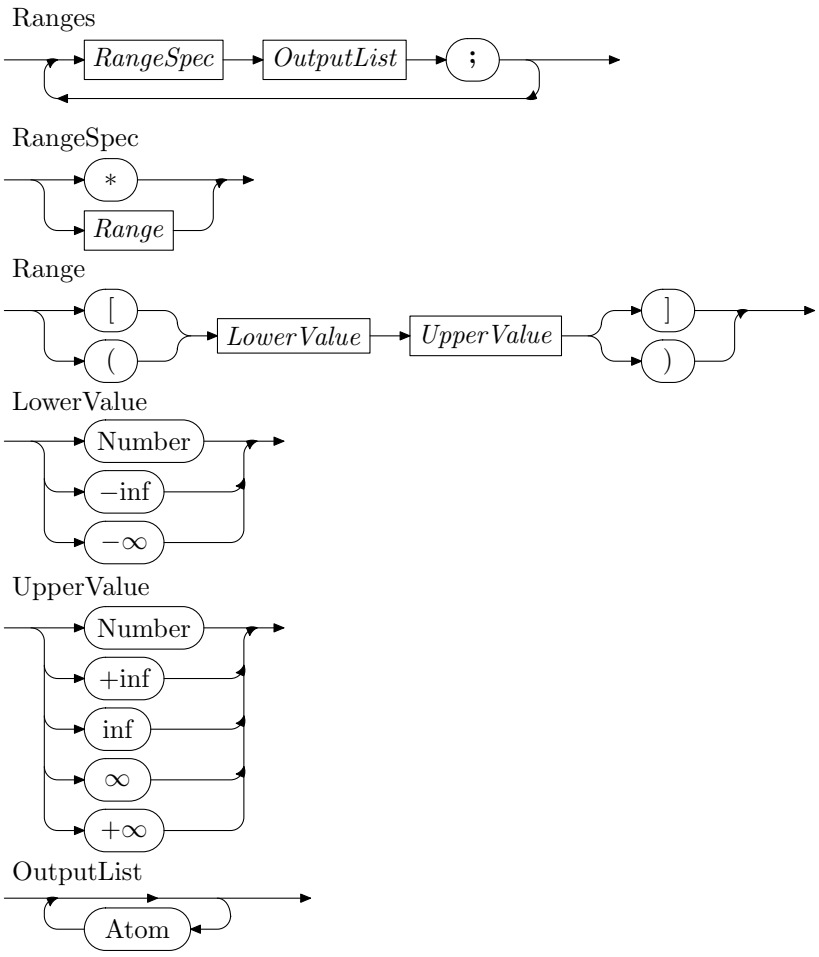
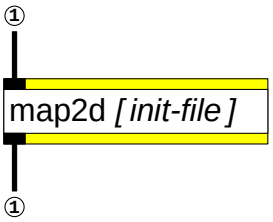


Figure 7: Syntax diagram for 1-D map files

map2d



Description of object: *map2d* maps its input to a one of a sequence of ranges and returns the set of values associated with the range.

Object created: November 2000

Current version: 1.0.6

Online help file: yes

Object theme: Programming aids

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

init-file **(optional) symbol**, the name of the map file to load initially

Inlet(s):

1 **list**, the command or data input

Outlet(s):

1 **list**, the retrieved data, the previous result (if a '**bang**' is received), the number of loaded ranges, the description of an individual range or the value of an element of a range. Results or retrieved data appear as a list starting with the symbol 'result'; the number of loaded ranges appear as a two element list, starting with the symbol 'count', range descriptions appear as a list starting with the symbol 'range' and range element values appear as a list starting with the symbol 'value'.

Companion object(s): none

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

add list
Add a range to the end of the loaded set of ranges. The range is in the form: '*' or *bracket1 left right bracket2* '*' or *bracket3 bottom top bracket4 output*, where *bracket1* and *bracket3* are either '[' or '(' and *bracket2* and *bracket4* are either ']' or ')'; *left* and *bottom* are floating-point numbers, integers or one of the symbols '−inf' or '−∞', which indicate an unbounded value; *right* and *top* are floating-point numbers, integers or one of the symbols 'inf', '+inf', '∞' or '+∞', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol '$' to indicate the input values or the symbol '$$' to indicate the offset of the input values from the vector (*left bottom*) of the matching range. If *left* or *bottom* is unbounded, the corresponding input value is returned rather than the offset.

after index list
Add a range after the range with the given index. The range is in the form: '*' or *bracket1 left right bracket2* '*' or *bracket3 bottom top bracket4 output*, where *bracket1* and *bracket3* are either '[' or '(' and *bracket2* and *bracket4* are either ']' or ')'; *left* and *bottom* are floating-point numbers, integers or one of the symbols '−inf' or '−∞', which indicate an unbounded value; *right* and *top* are floating-point numbers, integers or one of the symbols 'inf', '+inf', '∞' or '+∞', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol '$' to indicate the input values or the symbol '$$' to indicate the offset of the input values from the vector (*left bottom*) of the matching range. If *left* or *bottom* is unbounded, the corresponding input value is returned rather than the offset.

bang
Return the previous result, if any, as a list starting with the symbol 'result'.

before index list
Add a range before the range with the given index. The range is in the form: '*' or *bracket1 left right bracket2* '*' or *bracket3 bottom top bracket4 output*, where *bracket1* and *bracket3* are either '[' or '(' and *bracket2* and *bracket4* are either ']' or ')'; *left* and *bottom* are floating-point numbers, integers or one of the symbols '−inf' or '−∞', which indicate an unbounded value; *right* and *top* are floating-point numbers, integers or one of the symbols 'inf', '+inf', '∞' or '+∞', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol '$' to indicate the input values or the symbol '$$' to indicate the offset of the input values from the vector (*left bottom*) of the matching range. If *left* or *bottom* is unbounded, the corresponding input value is returned rather than the offset.

clear
The currently loaded set of ranges is removed.

count
The number of currently loaded ranges is returned as a two element list, starting with the symbol 'count'.

delete index
Removes the range with the given index from the loaded set of ranges.

dump
Retrieves all the ranges as a sequence of lists starting with the symbol 'range'. The second element of each list is the index, and the remainder of the list is in the form '*' or *bracket1 left right bracket2* '*' or *bracket3 bottom top bracket4 output*, where *bracket1* and *bracket3* are either '[' or '(' and *bracket2* and *bracket4* are either ']' or ')'; *left* and *bottom* are floating-point numbers or the symbol '−inf', which indicates an

unbounded value; *right* and *top* are floating-point numbers or the symbol 'inf', which indicates an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is the list of values which will be returned on a successful match.

float*/*integer float*/*integer
The given pair of values (either floating-point or integer) is compared to the loaded ranges. When a match is found, the output portion of the matching range is returned, prefixed with the symbol 'result'.

get index edge
Returns the given edge ('left', 'right', 'top' or 'bottom') of the given index as a two element list, starting with the symbol 'value'. A "don't care" value is returned as the symbol '*'.

load filename
The currently loaded set of ranges will be set to the contents of the named map file.

replace index list
Replace the range with the given index. The range is in the form: '*' or *bracket1 left right bracket2* '*' or *bracket3 bottom top bracket4 output*, where *bracket1* and *bracket3* are either '[' or '(' and *bracket2* and *bracket4* are either ']' or ')'; *left* and *bottom* are floating-point numbers, integers or one of the symbols '−inf' or '$-\infty$', which indicate an unbounded value; *right* and *top* are floating-point numbers, integers or one of the symbols 'inf', '+inf', '∞' or '$+\infty$', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol '$' to indicate the input values or the symbol '$$' to indicate the offset of the input values from the vector (*left bottom*) of the matching range. If *left* or *bottom* is unbounded, the corresponding input value is returned rather than the offset.

set index edge value
Replace the given edge ('left', 'right', 'top' or 'bottom') of the range with the given index. *value* is a floating-point number, an integer, or one of the symbols 'inf', '+inf', '∞' or '$+\infty$', '−inf' or '$-\infty$', which indicate an unbounded value. If *edge* is 'left' or 'bottom', the symbol '−inf' or '$-\infty$' can appear; if *edge* is 'right' or 'top', the symbol 'inf', '+inf', '∞' or '$+\infty$' can appear. Note that a "don't care" value cannot be replaced using this command.

show index
Retrieves the range with the given index, as a list starting with the symbol 'range'. The second element of the list is the index, and the remainder of the list is in the form '*' or *bracket1 left right bracket2* '*' or *bracket3 bottom top bracket4 output*, where *bracket1* and *bracket3* are either '[' or '(' and *bracket2* and *bracket4* are either ']' or ')'; *left* and *bottom* are floating-point numbers or the symbol '−inf', which indicates an unbounded value; *right* and *top* are floating-point numbers or the symbol 'inf', which indicates an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is the list of values which will be returned on a successful match.

verbose [**on**/**off**]
Range check tracing to the *Max* window will be enabled ('on'), disabled ('off') or reversed, if no argument is given.

File format:

The map file is composed of a set of ranges. Comments start with the '#' character and end with the ';' character. Ranges are either open (don't include the boundary value) or closed (the boundary value is included), and have boundary values that are integers, floating-point numbers, or infinities. An open range is indicated by a parenthesis, or round bracket, and a closed range by a square bracket. A range

declaration is in the following form:

‘*’ or *bracket1 left right bracket2* ‘*’ or *bracket3 bottom top bracket4 output*

bracket1 and *bracket3* are either ‘[’ or ‘(’ and *bracket2* and *bracket4* are either ‘]’ or ‘)’; *left* and *bottom* are floating-point numbers, integers or one of the symbols ‘−inf’ or ‘−∞’, which indicate an unbounded value; *right* and *top* are floating-point numbers, integers or one of the symbols ‘inf’, ‘+inf’, ‘∞’ or ‘+∞’, which indicate an unbounded value. The symbol ‘*’ indicates a “don’t care” value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol ‘$’ to indicate the input values or the symbol ‘$$’ to indicate the offset of the input values from the vector (*left bottom*) of the matching range. The output list can also contain the symbols ‘$x’ or ‘$y’ to indicate the first or second input value, or the symbols ‘$$x’ or ‘$$y’ to indicate the offset of the first input value from the *left* value of the matching range or the offset of the second input value from the *bottom* value of the matching range. If *left* or *bottom* is unbounded, the corresponding input value is returned rather than the offset. Note that the order of the range declarations is critical—the first range that matches the input is used, and overlaps between range declarations are ignored.

```
#File:  map_file_2d;
# Each line is terminated with a semicolon;
# A comment starts with a '#' character;
# Note that white space is critical around symbols and operators;
# Mappings;
# Format:  <op> <left> <right> <cl> <op> <bottom> <top> <cl> <output> ;
# where <op> is either '[' or '(' and <cl> is either ']' or ')';
# <left>, <bottom> are numbers or the symbol '−∞' (option-5) or '−inf';
# <right>, <top> are numbers or the symbol '∞' (option-5) or '+∞' or;
# 'inf' or '+inf';
# Any of the bracketed pairs can be replaced by the symbol * to indicate;
# a don't care value;
# <output> is what to return on a match;
# <output> can contain the symbol '$' which is replaced by the input vector;
# or the symbol '$$' which is replaced by the offset of the input vector from;
# the vector (<left> <bottom>) - the input value is returned instead of the;
# offset for any elements of the vector that are unbounded;
[ -20 20 ] [ -20 20 ] alpha $ ;
( 20 30 ) ( 20 30 ) beta ;
[ 20 30 ] [ 20 30 ] beta-shadow $$ ;
( -40 40 ) ( −∞ 0 ) gamma ;
```

Figure 8: An example map file for a *map2d* object

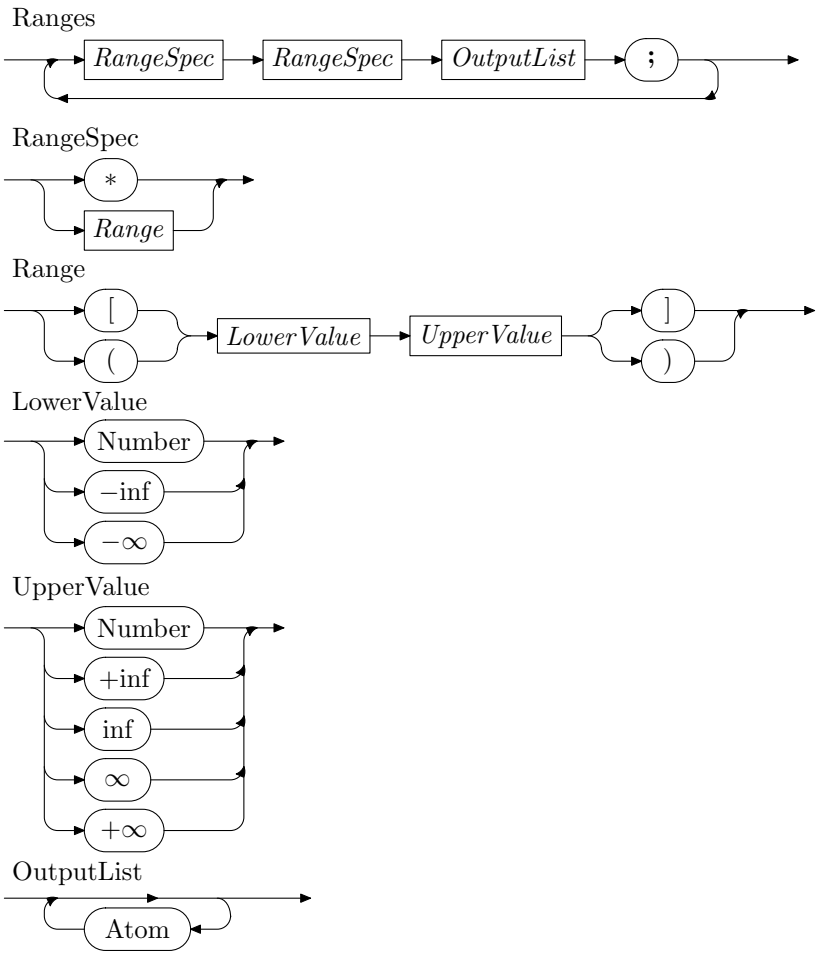
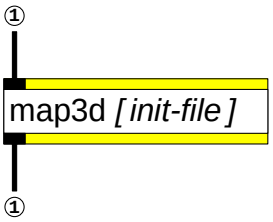


Figure 9: Syntax diagram for 2-D map files

map3d



Description of object: *map3d* maps its input to a one of a sequence of ranges and returns the set of values associated with the range.

Object created: April 2001

Current version: 1.0.6

Online help file: yes

Object theme: Programming aids

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

init-file **(optional) symbol**, the name of the map file to load initially

Inlet(s):

1 **list**, the command or data input

Outlet(s):

1 **list**, the retrieved data, the previous result (if a '**bang**' is received), the number of loaded ranges, the description of an individual range or the value of an element of a range. Results or retrieved data appear as a list starting with the symbol 'result'; the number of loaded ranges appear as a two element list, starting with the symbol 'count', range descriptions appear as a list starting with the symbol 'range' and range element values appear as a list starting with the symbol 'value'.

Companion object(s): none

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

add list
Add a range to the end of the loaded set of ranges. The range is in the form: '*' or *b1 left right b2* '*' or *b3 bottom top b4* '*' or *b5 forward back b6 output*, where *b1*, *b3* and *b5* are either '[' or '(' and *b2*, *b4* and *b6* are either ']' or ')'; *left*, *bottom* and *forward* are floating-point numbers, integers or one of the symbols '−inf' or '−∞', which indicate an unbounded value; *right*, *top* and *back* are floating-point numbers, integers or one of the symbols 'inf', '+inf', '∞' or '+∞', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol '$' to indicate the input values or the symbol '$$' to indicate the offset of the input values from the vector (*left bottom forward*) of the matching range.

after index list
Add a range after the range with the given index. The range is in the form: '*' or *b1 left right b2* '*' or *b3 bottom top b4* '*' or *b5 forward back b6 output*, where *b1*, *b3* and *b5* are either '[' or '(' and *b2*, *b4* and *b6* are either ']' or ')'; *left*, *bottom* and *forward* are floating-point numbers, integers or one of the symbols '−inf' or '−∞', which indicate an unbounded value; *right*, *top* and *back* are floating-point numbers, integers or one of the symbols 'inf', '+inf', '∞' or '+∞', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol '$' to indicate the input values or the symbol '$$' to indicate the offset of the input values from the vector (*left bottom forward*) of the matching range.

bang
Return the previous result, if any, as a list starting with the symbol 'result'.

before index list
Add a range before the range with the given index. The range is in the form: '*' or *b1 left right b2* '*' or *b3 bottom top b4* '*' or *b5 forward back b6 output*, where *b1*, *b3* and *b5* are either '[' or '(' and *b2*, *b4* and *b6* are either ']' or ')'; *left*, *bottom* and *forward* are floating-point numbers, integers or one of the symbols '−inf' or '−∞', which indicate an unbounded value; *right*, *top* and *back* are floating-point numbers, integers or one of the symbols 'inf', '+inf', '∞' or '+∞', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol '$' to indicate the input values or the symbol '$$' to indicate the offset of the input values from the vector (*left bottom forward*) of the matching range.

clear
The currently loaded set of ranges is removed.

count
The number of currently loaded ranges is returned as a two element list, starting with the symbol 'count'.

delete index
Removes the range with the given index from the loaded set of ranges.

dump
Retrieves all the ranges as a sequence of lists starting with the symbol 'range'. The second element of each list is the index, and the remainder of the list is in the form '*' or *b1 left right b2* '*' or *b3 bottom top b4* '*' or *b5 forward back b6 output*, where *b1*, *b3* and *b5* are either '[' or '(' and *b2*, *b4* and *b6* are either ']' or ')'; *left*, *bottom* and *forward* are floating-point numbers or the symbol '−inf', which indicates an unbounded value; *right*, *top* and *back* are floating-point numbers or the symbol 'inf', which indicates an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is the list of values which will be returned on a successful match.

float*/*integer* *float*/*integer* *float*/*integer

The given triple of values (either floating-point or integer) is compared to the loaded ranges. When a match is found, the output portion of the matching range is returned, prefixed with the symbol 'result'.

get index edge

Returns the given edge ('left', 'right', 'top', 'bottom', 'forward' or 'back') of the given index as a two element list, starting with the symbol 'value'. A "don't care" value is returned as the symbol '*'.

load filename

The currently loaded set of ranges will be set to the contents of the named map file.

replace index list

Replace the range with the given index. The range is in the form: *'*'* or *b1 left right b2 '*'* or *b3 bottom top b4 '*'* or *b5 forward back b6 output*, where *b1, b3* and *b5* are either '[' or '(' and *b2, b4* and *b6* are either ']' or ')'; *left, bottom* and *forward* are floating-point numbers, integers or one of the symbols '−inf' or '$-\infty$', which indicate an unbounded value; *right, top* and *back* are floating-point numbers, integers or one of the symbols 'inf', '+inf', '∞' or '$+\infty$', which indicate an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol '$' to indicate the input values or the symbol '$$' to indicate the offset of the input values from the vector (*left bottom forward*) of the matching range.

set index edge value

Replace the given edge ('left', 'right', 'top', 'bottom', 'forward' or 'back') of the range with the given index. *value* is a floating-point number, an integer, or one of the symbols 'inf', '+inf', '∞' or '$+\infty$', '−inf' or '$-\infty$', which indicate an unbounded value. If *edge* is 'left', 'bottom', or 'forward', the symbol '−inf' or '$-\infty$' can appear; if *edge* is 'right', 'top' or 'back', the symbol 'inf', '+inf', '∞' or '$+\infty$' can appear. Note that a "don't care" value cannot be replaced using this command.

show index

Retrieves the range with the given index, as a list starting with the symbol 'range'. The second element of the list is the index, and the remainder of the list is in the form *'*'* or *b1 left right b2 '*'* or *b3 bottom top b4 '*'* or *b5 forward back b6 output*, where *b1, b3* and *b5* are either '[' or '(' and *b2, b4* and *b6* are either ']' or ')'; *left, bottom* and *forward* are floating-point numbers or the symbol '−inf', which indicates an unbounded value; *right, top* and *back* are floating-point numbers or the symbol 'inf', which indicates an unbounded value. The symbol '*' indicates a "don't care" value, which will match anything. *output* is the list of values which will be returned on a successful match.

verbose [**on**/**off**]

Range check tracing to the *Max* window will be enabled ('on'), disabled ('off') or reversed, if no argument is given.

File format:

The map file is composed of a set of ranges. Comments start with the '#' character and end with the ';' character. Ranges are either open (don't include the boundary value) or closed (the boundary value is included), and have boundary values that are integers, floating-point numbers, or infinities. An open range is indicated by a parenthesis, or round bracket, and a closed range by a square bracket. A range declaration is in the following form:

''* or *b1 left right b2 '*'* or *b3 bottom top b4 '*'* or *b5 forward back b6 output*

b1, b3 and *b5* are either '[' or '(' and *b2, b4* and *b6* are either ']' or ')'; *left, bottom* and *forward* are floating-point numbers, integers or one of the symbols '−inf' or '$-\infty$', which indicate an unbounded

value; *right*, *top* and *back* are floating-point numbers, integers or one of the symbols ‘inf’, ‘+inf’, ‘∞’ or ‘+∞’, which indicate an unbounded value. The symbol ‘*’ indicates a “don’t care” value, which will match anything. *output* is a list of values to return on a successful match. The output list can contain the symbol ‘$’ to indicate the input values or the symbol ‘$$’ to indicate the offset of the input values from the vector (*left bottom forward*) of the matching range. The output list can also contain the symbols ‘$x’, ‘$y’ or ‘$z’ to indicate the first, second or third input value, or the symbols ‘$$x’, ‘$$y’ or ‘$$z’ to indicate the offset of the first input value from the *left* value of the matching range, the offset of the second input value from the *bottom* value of the matching range or the offset of the third input value from the *forward* value of the matching range. If *left*, *bottom* or *forward* is unbounded, the corresponding input value is returned rather than the offset. Note that the order of the range declarations is critical—the first range that matches the input is used, and overlaps between range declarations are ignored.

```
#File:  map_file_3d;
# Each line is terminated with a semicolon;
# A comment starts with a '#' character;
# Note that white space is critical around symbols and operators;

# Mappings;
# Format:  <o> <lft> <rht> <c> <o> <bot> <top> <c> <o> <for> <bck> <c> <out> ;
# where <o> is either '[' or '(' and <c> is either ']' or ')';
# <lft>, <bot>, <for> are numbers or the symbol '−∞' (option-5) or '−inf';
# <rht>, <top>, <bck> are numbers or the symbol '∞' (option-5) or '+∞' or;
# 'inf' or '+inf';
# Any of the bracketed pairs can be replaced by the symbol * to indicate;
# a don't care value;
# <out> is what to return on a match;
# <out> can contain the symbol '$' which is replaced by the input vector or;
# the symbol '$$' which is replaced by the offset of the input vector from the vector;
# (<lft> <bot> <for>) - the input value is returned instead of the offset for any;
# elements of the vector that are unbounded;
[ -20 20 ] [ -20 20 ] ( 20 +inf ] alpha $ ;
( 20 30 ) ( 20 30 ) ( −inf 10 ] beta ;
[ 20 30 ] [ 20 30 ] [ 15 30 ] beta-shadow $$ ;
( -40 40 ) ( −∞ 0 ) ( 12 100 ) gamma ;
```

Figure 10: An example map file for a *map3d* object

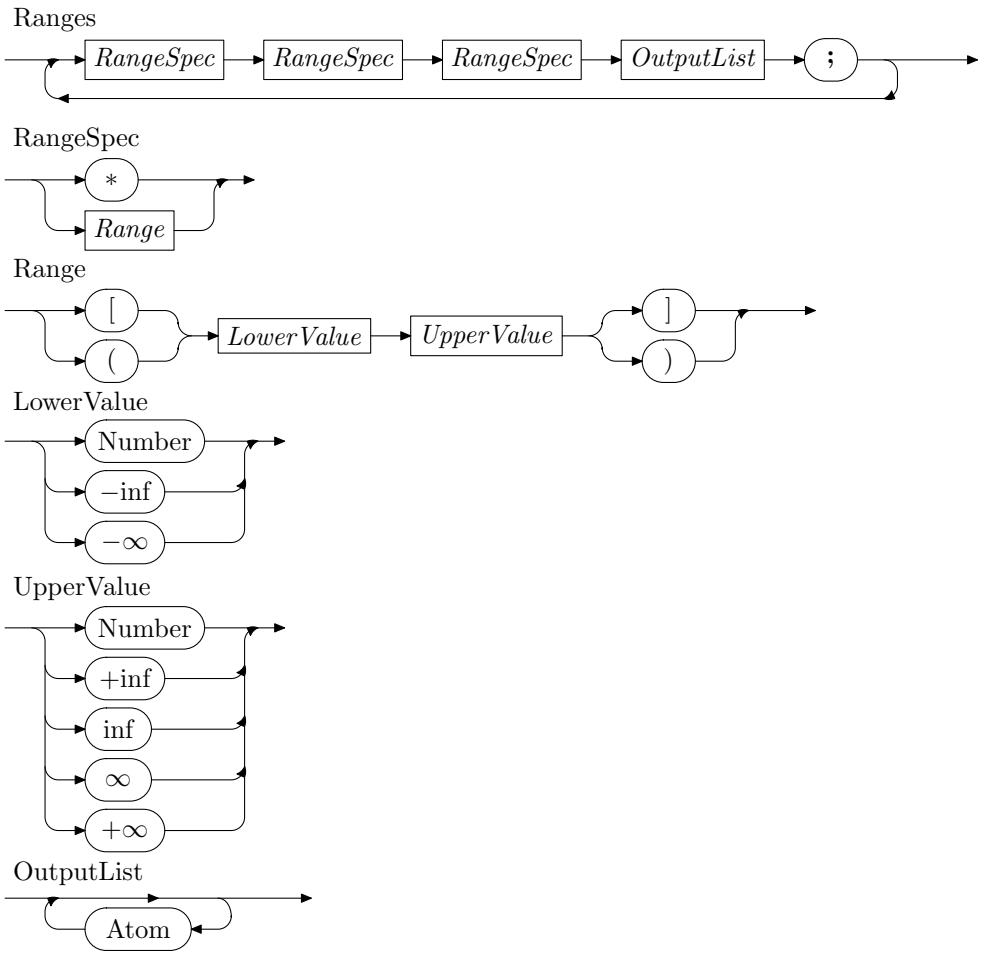
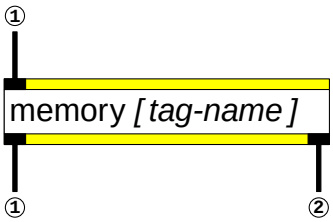


Figure 11: Syntax diagram for 3-D map files

memory



Description of object: *memory* provides a repository for values, using an associative table to give fast access to the retained data.

Object created: June 2000

Current version: 1.0.2

Online help file: yes

Object theme: Programming aids

Object class(es): Data

Argument(s):

tag-name **(optional) symbol**, shares the associative table with all other *memory* objects having the same *tag-name*

Inlet(s):

1 **list**, the command input

Outlet(s):

1 **anything**, the retrieved data
2 **bang**, an error was detected

Companion object(s): none

Standalone: no, the object works with other *memory* objects with the same *tag-name*

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

clear
Empties the associative table of all retained values.

forget **symbol**
Removes the symbol from the associative table, along with its data.

load **filename**
Clears the associative table and reads the given file into it. The file must have been created by a '**store**' command.

recall **symbol**
Retrieves the data stored with the given symbol from the associative table.

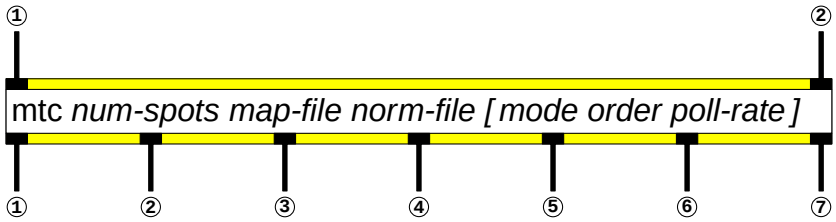
remember **symbol** [**data**]
Stores the data with the given symbol in the associative table, forgetting any previous data associated with the symbol.

store **filename**
Write the associative table to the given file.

trace [**on**/**off**]
Associative table update tracing to the *Max* window will be enabled ('on'), disabled ('off') or reversed, if no argument is given.

Comments: The *memory* object was designed to address some problems that were found in attempting to use *table* objects to perform complex state sequencing.

mtc



Description of object: *mtc* is an interface to the Tactex Controls multi-touch controller (MTC). It sends commands to a *serialX* object, which controls the serial port that the MTC is attached to, and responds to data returned from the MTC via the *serialX* object.

Object created: December 1999

Current version: 1.0.7

Online help file: no

Object theme: Device interface

Object class(es): Devices

Argument(s):

num-spots **integer**, the maximum number of hot spots to return

map-file **symbol**, the map file that contains the coordinates of the sensor points for the MTC device

norm-file **symbol**, the normalization file for the pressure values for the MTC device

mode **(optional) symbol**, the initial processing mode (raw or cooked) that is to be used. By default, the mode is cooked.

order **(optional) symbol**, the initial sort order (pressure, x, or y) that is to be used to prioritize the hot spots. By default, the hot spots are unordered.

poll-rate **(optional) integer**, the rate (in milliseconds) at which the companion *serialX* object is polled via a sample request. The default rate is 100 milliseconds between sample requests.

Inlet(s):

1 **list**, the command channel

2 **anything**, the output of the companion *serialX* object

Outlet(s):

1 **list**, the detected hot spots in the form of floating point triples (x coordinate, y coordinate, pressure)

2 **integer**, the data has started (‘0’) or ended (‘1’). The ‘0’ to ‘1’ transition preceeds the data from the MTC and the ‘1’ to ‘0’ transition follows the data from the MTC.

3 **bang**, the command has completed
4 **bang**, the sample request to send to the companion *serialX* object
5 **anything**, the data to send to the companion *serialX* object
6 **bang**, the '**chunk**' request to send to the companion *serialX* object, via a message object
7 **bang**, an error was detected

Companion object(s): works with *serialX* objects (not *serial*) and can be connected to *mtcTrack* objects

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

describe
Read the MTC descriptor string from the device (if it hasn't already been read) and send the string to the *Max* window.

mode symbol
Change the processing mode (where **symbol** is 'raw' or 'cooked') that is to be used.

order symbol
Change the sort order (where **symbol** is 'pressure', 'x', or 'y') that is to be used to prioritize the hot spots.

ping
Perform a 'ping' of the MTC device to verify connectivity.

start [**normal**/**compressed**]
Start sampling the MTC device for data (hot spots or raw pressures). If 'compressed' is requested, the compressed form of data communication is used with the MTC device; if 'normal' is specified, or no argument is given, then the uncompressed form of data communication is used with the MTC device.

stop
Stop sampling the MTC device for data (hot spots or raw pressures).

threshold new-level
Set the pressure threshold for hot spots to **new-level**. Sensors with values above the pressure threshold are candidates for the hot spot list.

train [**start**/**stop**]
Start or stop the 'training' mode of the *mtc* object, where the high and low pressure levels for each sensor are determined to establish the dynamic range of the sensor.

verbose [**on**/**off**]
Tracing to the *Max* window of the messages sent will be enabled ('on'), disabled ('off') or reversed, if no argument is given.

Comments: Figure 12 shows how to connect an *mtc* object to a *serialX* object. Figure 13 is a state diagram for *mtc* objects.

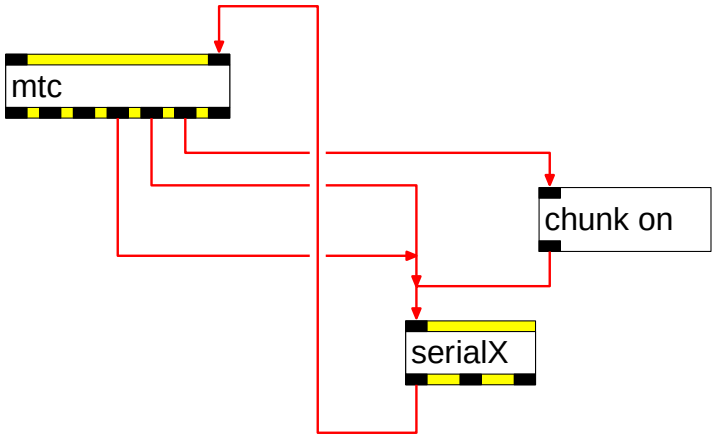


Figure 12: Connecting an *mtc* object to a *serialX* object

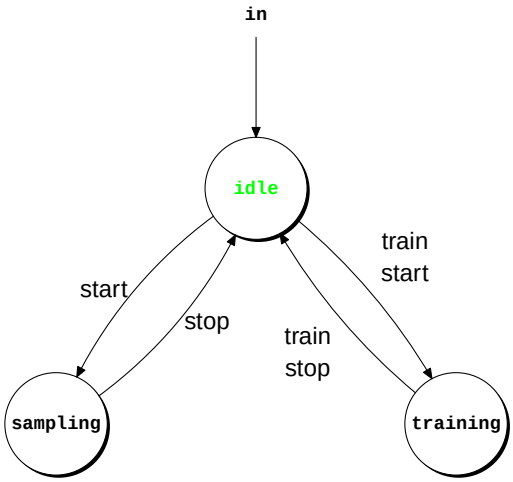
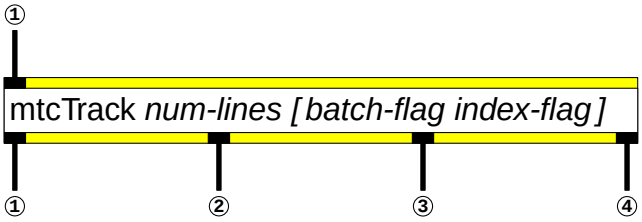


Figure 13: State diagram for *mtc* objects

mtcTrack



Description of object: *mtcTrack* is an auxiliary object to be used with *mtc* objects. Its purpose is to convert the raw list of coordinate and pressure data into a series of lines.

Object created: April 2001

Current version: 1.0.2

Online help file: no

Object theme: Miscellaneous

Object class(es): Lists

Argument(s):

num-lines **integer**, the maximum number of lines to return

batch-flag **(optional) symbol**, whether to output the batch number. If the word 'batch' appears, the batch number is prepended to each output line. By default, the batch number is not output. Batch numbers start at zero and are incremented with each set of lines returned, regardless of whether the batch number is output.

index-flag **(optional) symbol**, whether to output the index of the line, relative to the other lines in the batch. If the word 'index' appears, the index is prepended to each output line, after the batch number, if it's present. By default, the index is not output. Indices start at zero.

Inlet(s):

1 **list**, the values to be converted, from the companion *mtc* object

Outlet(s):

1 **list**, the recognized lines, in the form of a six, seven or eight element list of numbers, consisting of the (optional) batch number, the (optional) line index (which starts at zero), the starting x coordinate, the starting y coordinate, the ending x coordinate, the ending y coordinate, the "velocity" and the "force". The last two elements are estimates of the line's characteristics.

2 **bang**, the last recognized line has been sent

3 **integer**, the number of lines recognized. This value is output before the lines are output, so that the lines can be collected and processed in a batch.

4 bang, an error was detected

Companion object(s): works with *mtc* objects

Standalone: yes

Retains state: yes, the previously identified points

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

batch [**on**/**off**]
Output of the batch number with each line will be enabled ('on'), disabled ('off') or reversed, if no argument is given.

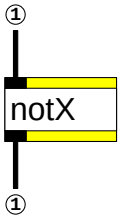
clear
Reset the number of previously identified points, so that the next set of points received will be considered the start of a set of new lines.

index [**on**/**off**]
Output of the line number index with each line will be enabled ('on'), disabled ('off') or reversed, if no argument is given.

threshold distance
Set the maximum distance that can separate the starting and ending points of a recognized line. If **distance** is negative, there is no maximum. Use of this command reduces the thrashing that occurs when the matching points of lines are not sufficiently separated to permit unambiguous determination of the recognized lines.

Comments: The *mtcTrack* object was designed to assist in working with the *mtc* object. The maximum number of lines to return should be close in value to the the maximum number of hot spots specified for the companion *mtc* object.

notX



Description of object: *notX* provides the logical complement of a number or a list of numbers, returning '0' for each non-zero number and '1' for each zero number. Non-numeric values are returned without modification.

Object created: September 1998

Current version: 1.0.4

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s): none

Inlet(s):

1 anything, the input to be processed

Outlet(s):

1 anything, the input after complementation, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

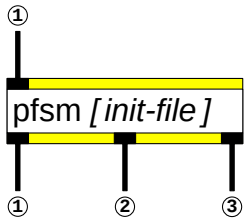
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: The *notX* object was created because there was a *not* object that wasn't Fat, when a Fat object was needed. It was extended to handle lists and floating point values.

pfsm



Description of object: *pfsm* is an implementation of a Finite State Machine, with probabilistic transitions. Hence, Probabilistic Finite State Machine, or PFSM. It processes a sequence of messages against a state file, generating output as guided by the state transitions triggered by the input.

Object created: May 2000

Current version: 1.0.4

Online help file: yes

Object theme: Programming aids

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

init-file **(optional) symbol**, the name of the state file to load initially

Inlet(s):

1 **integer**/**list**, the command input

Outlet(s):

1 **list**, the retrieved data
2 **bang**, a stop state was reached
3 **bang**, an error state was reached or an error was detected

Companion object(s): none

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

autorestart [**on**/**off**]
Enable (‘on’) or disable (‘off’) autorestart. If autorestart is enabled, when the *pfsm* object reaches a ‘stop’ state it will automatically advance to the ‘start’ state. In either case, a ‘bang’ will always be sent to the stop state outlet.

clear
The current state will be cleared. This is not the same as going to the ‘start’ state.

describe
The currently loaded set of transitions will be reported to the *Max* window.

do list
The first element in the given list is matched against the transitions available for the current state. If a match is found, the current state is set to the destination of the transition and the output portion of the transition is processed using the remainder of the given list.

goto new-state
The current state will be set to **new-state**, if it is in the currently loaded set of transitions.

integer
The given value is matched against the transitions available for the current state. If a match is found, the current state is set to the destination of the transition and the output portion of the transition is processed using an empty list as the remainder of the input.

list anything
The first element in the given list is matched against the transitions available for the current state. If a match is found, the current state is set to the destination of the transition and the output portion of the transition is processed using the remainder of the given list.

load filename
The currently loaded set of transitions will be set to the contents of the named state file.

start
The current state will be set to the start state for the currently loaded set of transitions and the *pfsm* object will be set to ‘running’.

status
The state of the *pfsm* object (running or stopped, the current state, the start state and whether autorestart is enabled) will be reported to the *Max* window.

stop
The *pfsm* object will be stopped and the current state will be cleared.

trace [**on**/**off**]
State transition tracing to the *Max* window will be enabled (‘on’), disabled (‘off’) or reversed, if no argument is given.

File format:

The state file describes the legal transitions that the *pfsm* object will perform and is composed of five sections:

1) the state symbols—a list of symbols enclosed in square brackets (‘[‘ and ‘]’)
2) the starting state—a single symbol

3) the stop states—a list of symbols enclosed in square brackets
4) the error states—a list of symbols enclosed in square brackets
5) the transitions—a list of statements describing the transitions.

The order of the transitions is critical—for each state, the first transition matching the input provided (and meeting the probability criteria, if it is a probabilistic transition) will be processed and the remaining transitions will be ignored. For this reason, transitions with specific matching values should precede transitions with wild card matching criteria.

Comments start with the '#' character and end with the ';' character.

The transitions are in one of two forms, and are terminated with the ';' character:

5a) current-state input -> new-state output
5b) current-state input -? probability new-state output

The output list can contain the symbol '$' to indicate the matching input or the symbol '$$' to indicate the overflow values (any values in the input list, after the matching element) or the symbol '$*' to indicate the new name of the new state. The value 'input' can be any of the following special symbols:

a) @s represents any valid symbol
b) @n represents any valid number
c) @r, followed by two numbers, represents a range of values
d) '?, where ? is any printable character, represents the numeric equivalent to the character, and can appear wherever a number could appear
e) anything else represents the value that will be matched literally

The probability is in the form of a fraction between 0.0 and 1.0

Comments:

The *pfsm* object was designed to address some problems that were found in attempting to use *table* objects to perform complex state sequencing. I realized that a better approach was to represent the actions as the output of an FSM, and added the probabilistic transition mechanism as a useful extension. Figure 15 is a state transition diagram for the example state file, Figure 14.

```
#File:  state-file;
# Each line is terminated with a semicolon;
# A comment starts with a '#' character;
# Note that white space is critical around symbols and operators;
# State symbols;
[ alpha omega beta test-state theta gamma ]
# Starting state;
alpha
# Stop states;
[ theta ]
# Error states;
[ omega ]
# Transitions;
# The format is:  current-state input -> new-state output ;
# or current-state input -?  probability new-state output ;
# where output can contain the symbol $ to indicate the matching input;
# the symbol $$ to indicate the overflow values or the symbol;
# $* to indicate the new state;
# The special symbol @s represents any valid symbol on input;
# The special symbol @n represents any valid number on input;
# The special symbol @r represents a range of values (the next two numbers;
# in the input);
# The special form '?  represents the numeric equivalent to the character ?;
# for input;
# The probability is in the form of a fraction between 0 and 1;
alpha 42 -> beta $ ;
alpha 'a -> beta $;
alpha @r 'b 'g -> theta $;
test garbage -> test ;
beta blorg -> alpha ;
beta blirg -> theta $ ;
alpha @s -> gamma $$ $;
gamma @n -> beta chuck you $ times;
theta @s -> theta symbol;
theta @n -> theta number;
gamma @s -?  0.30 beta whoo hoo; #probabilistic transition to beta;
gamma @s -> gamma; #handle non-branch to beta;
```

Figure 14: An example state file for a *pfsm* object

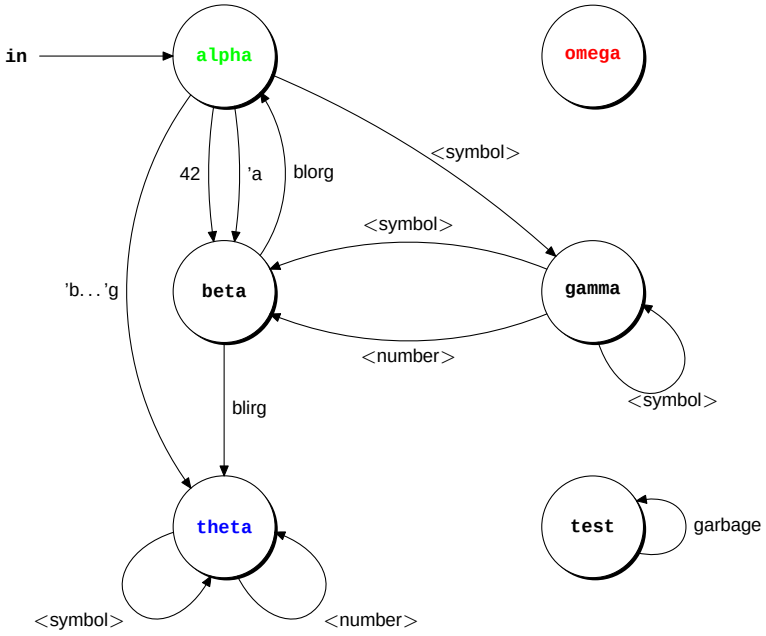


Figure 15: State transition diagram for the example state file

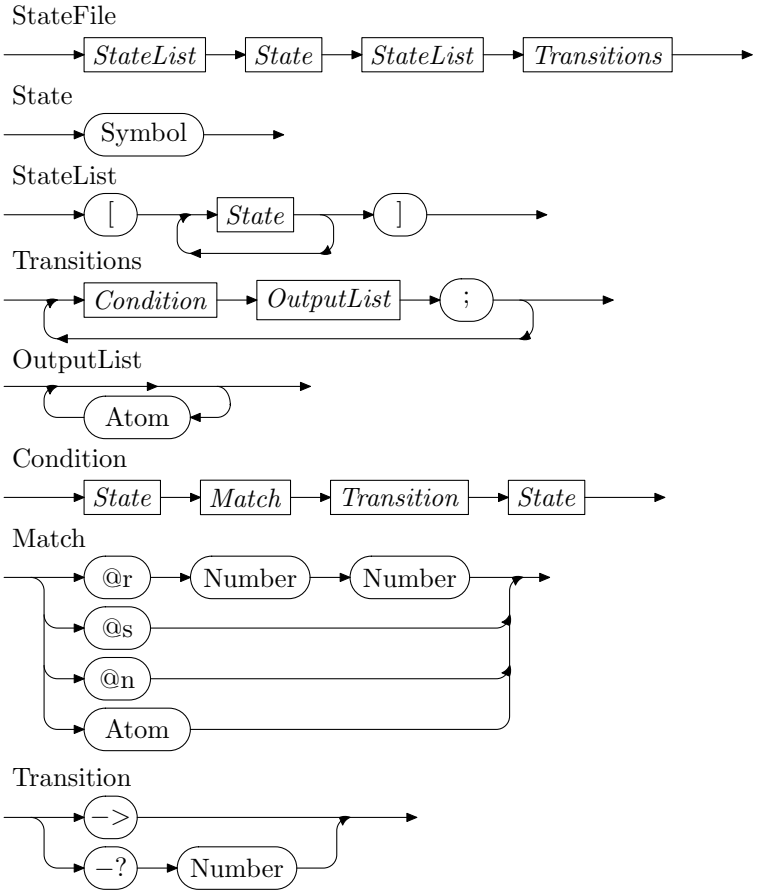
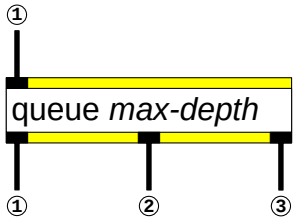


Figure 16: Syntax diagram for state files

queue



Description of object: *queue* is an implementation of first-in-first-out queues. Unlike conventional queues, the *queue* object can store lists as well as single values on each level.

Object created: April 2001

Current version: 1.0.2

Online help file: yes

Object theme: Programming aids

Object class(es): Data

Argument(s):

tag-name **integer**, the maximum number of elements that can be held in the queue. This is also known as its depth. A depth of zero is interpreted as a queue that can hold an unlimited number of elements.

Inlet(s):

1 **list**, the command input

Outlet(s):

1 **anything**, the retrieved data
2 **integer**, the depth of the queue (the number of elements held in the queue)
3 **bang**, an error was detected

Companion object(s): none

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

add anything
Place the given data at the end of the queue. If the queue was already full, output the first element in the queue (the oldest) before adding the new data.

bang
Output all data held in the queue in the order in which it was received.

clear
Remove all data from the queue.

depth
Return the depth of the queue.

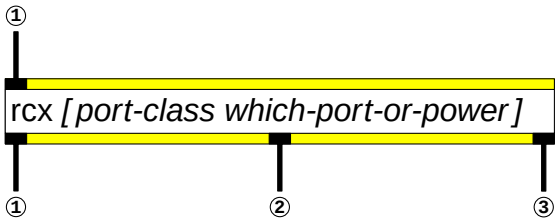
fetch
Return the first element of the queue, without removing it.

pull
Return the first element of the queue and remove it from the queue.

setdepth new-depth
Set the maximum depth of the queue to new-depth. If the new maximum depth is zero, the contents of the queue are left alone. If the new maximum depth is less than the current depth, all the data is removed from the queue.

trace [**on**/**off**]
Queue update tracing to the *Max* window will be enabled (‘on’), disabled (‘off’) or reversed, if no argument is given.

rcx



Description of object: *rcx* is an interface to the LEGO MINDSTORMS RCX device. For Mac OS X, it uses direct operations with a LEGO USB Tower to connect to the device; for Mac OS 9, it uses the Ghost API from LEGO to connect to the device, using either a USB or serial port. Note that it does not use the *serialX* or *serial* objects for this communication.

Object created: April 2002

Current version: 1.0.5

Online help file: no

Object theme: Device interface

Object class(es): Devices

Argument(s):

port-class **(optional) symbol**, the kind of Ghost port ('usb' or 'serial') that is to be used. By default, the port-class is USB. For Mac OS X, only USB is supported.

which-port **(optional) symbol**, the name of the port within the port-class that is to be used, or the power-level for USB (for Mac OS X). By default, the first available port is used (for Mac OS 9) and low power is used (for Mac OS X).

Inlet(s):

1 **list**, the command channel

Outlet(s):

1 **list**, the data requested from the RCX device. The individual commands indicate the format of their results.

2 **bang**, the command has completed

3 **bang**, an error was detected

Companion object(s): none

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

clearmemory
Clears all programs out of the RCX.

clearsensor index
Clear the value of the given sensor, where **index** is between 1 and 3.

clearsound
Clear the sound buffer. See also the '**mute**' command.

continuetask index
Resume the execution of the given task, where **index** is between 1 and 10.

floatoutput set
Set the given set of outputs to "coast", where **set** is between 1 and 7 (the individual outputs are encoded as 1, 2 and 4, which are then added together to get the set of outputs to change).

getallsensors
Read the values, types and modes of all three sensors of the RCX and return them as a ten element list, starting with the symbol 'allsensors', followed by triples (value as an integer, type as one of 'nosensor', 'switch', 'temperature', 'reflection', 'angle' or 'unknown' and mode as one of 'raw', 'boolean', 'transition', 'periodcount', 'percent', 'celsius', 'fahrenheit', 'anglestep' or 'unknown') for each of the sensors, in order of the sensor number.

getallvariables
Read the values of all thirty-two variables of the RCX and return them as a list, startimg with the symbol 'allvariables' and followed by the value of each of the variables.

getbattery
Read the battery level from the RCX and return it as a two element list, starting with the symbol 'battery', followed by a floating-point value representing the voltage.

getsensormode index
Read the mode of the given sensor, where **index** is between 1 and 3, and return it as a two element list, starting with the symbol 'sensormode', followed by the current value of the sensor as one of 'raw', 'boolean', 'transition', 'periodcount', 'percent', 'celsius', 'fahrenheit', 'anglestep' or 'unknown'.

getsensortype index
Read the type of the given sensor, where **index** is between 1 and 3, and return it as a two element list, starting with the symbol 'sensortype', followed by the current type of the sensor as one of 'nosensor', 'switch', 'temperature', 'reflection', 'angle' or 'unknown'.

getsensorvalue index
Read the value of the given sensor, where **index** is between 1 and 3, and return it as a two element list, starting with the symbol 'sensor', followed by the current value of the sensor as an integer.

getslot
Read the index of the active program and return it as a two element list, starting with the symbol 'slot', followed by the index as an integer between 1 and 5.

getvariable index
Read the value of the given variable, where **index** is between 1 and 32, and return it as a two element list, starting with the symbol ‘variable’, followed by the current value of the variable as an integer.

getversion
Read the version number of the ROM and the firmware from the RCX and return it as a three element list, starting with the symbol ‘version’, followed by the ROM version number and the firmware version number, represented as integers.

mute
Clear the sound buffer of the RCX and ignore future sound requests. See also the ‘**clearsound**’ command.

playsound sound
Play the given system sound, which is either ‘keyclick’, ‘beep’, ‘sweepdown’, ‘sweepup’, ‘error’ or ‘fast-sweep’.

playtone frequency duration
Play the given tone, where **frequency** is in Hertz and **duration** is in 100ths of a second.

setoutputdirection set direction
Set the direction of the given set of outputs, where **set** is between 1 and 7 (the individual outputs are encoded as 1, 2 and 4, which are then added together to get the set of outputs to change) and **direction** is either ‘backward’, ‘reverse’ or ‘forward’.

setmessage message
Set the message buffer to the given value, where **message** is between 1 and 255.

setoutputpower set level
Set the power level for the given set of outputs, where **set** is between 1 and 7 (the individual outputs are encoded as 1, 2 and 4, which are then added together to get the set of outputs to change) and **level** is between 1 and 8.

setsensormode index mode
Set the mode of the given sensor, where **index** is between 1 and 3 and **mode** is one of ‘raw’, ‘boolean’, ‘transition’, ‘periodcount’, ‘percent’, ‘celsius’, ‘fahrenheit’ or ‘anglestep’.

setsensortype index type
Set the type of the given sensor, where **index** is between 1 and 3 and **type** is one of ‘nosensor’, ‘switch’, ‘temperature’, ‘reflection’ or ‘angle’.

setslot index
Select the given program slot as the active program, where **index** is between 1 and 5.

setwatch hour minute
Set the displayed time on the RCX to the given values.

run
Start the active program’s execution.

setvariable index value
Set the value of the given variable, where **index** is between 1 and 32.

startoutput set
Set the given set of outputs on, where **set** is between 1 and 7 (the individual outputs are encoded as 1, 2 and 4, which are then added together to get the set of outputs to change).

starttask index
Start the execution of the given task, where **index** is between 1 and 10.

stopalltasks
Stop the execution of all tasks for the active program on the RCX device.

stopoutput **set**
Set the given set of outputs off, where **set** is between 1 and 7 (the individual outputs are encoded as 1, 2 and 4, which are then added together to get the set of outputs to change).

stoptask **index**
Stop the execution of the given task, where **index** is between 1 and 10.

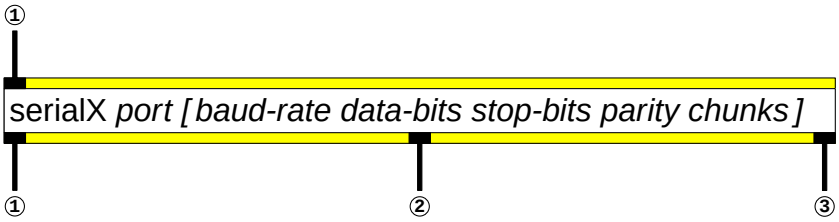
turnoff
Turn off the RCX device.

unmute
Re-enable the processing of sound requests.

verbose [**on**/**off**]
Tracing to the *Max* window of the messages sent will be enabled (‘on’), disabled (‘off’) or reversed, if no argument is given.

Comments: The MacNQC development environment is recommended for developing code to be downloaded into the RCX device.

serialX



Description of object: *serialX* is an interface to the serial ports on a Macintosh. It provides functionality over and above that of the standard *serial* object.

Object created: June 1998

Current version: 1.1.4

Online help file: yes

Object theme: Device interface

Object class(es): Devices

Argument(s):

port **symbol**, either ‘modem’, ‘printer’, or a single letter from ‘a’ to ‘z’ which represents the port to be connected to

baud-rate **(optional) integer/symbol**, the baud rate to set the port to. The acceptable values are: 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 115200 and 230400. Some of the baud rates can also be expressed in terms of ‘kilobaud’: 0.3k (or .3k), 0.6k (or .6k), 1.2k, 1.8k, 2.4k, 3.6k, 4.8k, 7.2k, 9.6k, 14.4k, 19.2k, 28.8k, 38.4k, 57.6k, 115.2k or 230.4k. The following special externally clocked rates may be available, if the serial port supports them: MIDI_1, MIDI_16, MIDI_32 and MIDI_64. These correspond to rate multipliers of 1, 16, 32 and 64, respectively. Use of these special rates forces the data bits to 8 and the stop bits to 1. Note that the character ‘k’ is lower case. The default baud rate is 4800.

data-bits **(optional) integer**, the number of data bits to set the port to. The value is between 5 and 9, inclusive. The default number of data bits is 8.

stop-bits **(optional) float**, the number of stop bits to set the port to. The acceptable values are: 1, 1.5 or 2. The default number of stop bits is 1.

parity **(optional) symbol**, the parity mode to set the port to. The acceptable values are: ‘off’/’no’/’none’, ‘even’ or ‘odd’. The default parity mode is ‘off’.

chunks **(optional) integer**, the number of characters in each chunk that will be sent when ‘chunk’ mode is active. The default chunk size is 10 and the maximum is 80.

Inlet(s):

1 **integer**/**list**/**bang**, the command input

Outlet(s):

1 **integer**/**list**, returned characters (as single characters, if ‘chunk’ mode is inactive, or as lists of characters, if ‘chunk’ mode is active) from the port of the serial device
2 **bang**, a break signal was seen on the port of the serial device
3 **bang**, the break operation has completed

Companion object(s): none

Standalone: yes

Retains state: yes, the serial port settings

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 only}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return any characters received from the port of the serial device (since the last time a ‘**bang**’ command was received), in the form of one or more lists of characters, if ‘chunk’ mode is active, or as single characters, if ‘chunk’ mode is inactive. Any detected ‘break’ signals from the port of the serial device will also be reported.

baud integer/**symbol**
Change the baud rate of the port to the given value. The acceptable values are: 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 115200 and 230400. Some of the baud rates can also be expressed in terms of ‘kilobaud’: 0.3k (or .3k), 0.6k (or .6k), 1.2k, 1.8k, 2.4k, 3.6k, 4.8k, 7.2k, 9.6k, 14.4k, 19.2k, 28.8k, 38.4k, 57.6k, 115.2k or 230.4k. The following special externally clocked rates may be available, if the serial port supports them: MIDI_1, MIDI_16, MIDI_32 and MIDI_64. These correspond to rate multipliers of 1, 16, 32 and 64, respectively. Use of these special rates forces the data bits to 8 and the stop bits to 1. Note that the character ‘k’ is lower case.

break
Send a ‘break’ signal out the port of the serial device.

chunk [**on**/**off**]
Chunking of received data will be enabled (‘on’), disabled (‘off’) or reversed, if no argument is given. The chunk size is established when the *serialX* object is created.

dtr [**assert**/**negate**/**on**/**off**]
The DTR signal will asserted (‘assert’), negated (‘negate’) or used for handshaking (‘off’ or ‘on’ or no argument). When no argument is given, the use of the DTR signal for handshaking will be toggled. The DTR handshake is set active when the *serialX* object is created.

float
Send the single character that is the ASCII equivalent to the given value, out the port of the serial device.

integer
Send the single character that is the ASCII equivalent to the given value, out the port of the serial device.

list anything

Send the contents of the list out the port of the serial device. Integer and float values are sent as the equivalent ASCII character and symbols are sent as a string of ASCII characters. Note that no white space is introduced between values, so the command '**1 2 3 alpha 4**' results in the characters '123alpha4' being sent out the port of the serial device.

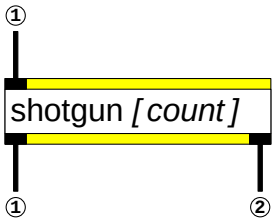
text anything

Send the characters corresponding to the arguments to the command out the port of the serial device. Note that no white space is introduced between values, so the command '**text 1 2 3 4**' results in the characters '1234' being sent out the port of the serial device.

Comments:

The *serialX* object was designed to address some weaknesses of the standard *serial* object–the 'break' signal was neither reported nor generated, the maximum baud rate was well below what most serial ports can handle, and output was always in the form of single characters. *serialX* was originally developed as a companion for the *gvp100* object (which needed to be able to send a 'break' signal), and was extended to support higher baud rates and 'chunking' for the *mtc* object.

shotgun



Description of object: *shotgun* redirects a bang to a randomly selected outlet.

Object created: July 2005

Current version: 1.0.0

Online help file: yes

Object theme: Programming aids

Object class(es): Arith/Logic/Bitwise

Argument(s):

num-outlets **(optional) integer**, the number of outlets to select from

Inlet(s):

1 **bang**, the ‘bang’ to be sent out the selected outlet

Outlet(s):

1 **bang**, the first outlet
2 **bang**, the second outlet
⋮
n **bang**, the nth outlet

Companion object(s): none

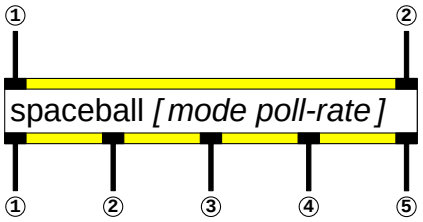
Standalone: yes

Retains state: no

Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

spaceball



Description of object: *spaceball* is an interface to the Labtec six-degrees-of-freedom trackball, the Spaceball. It sends commands to a *serialX* object, which controls the serial port that the Spaceball is attached to, and responds to data returned from the Spaceball via the *serialX* object.

Object created: July 2001

Current version: 1.0.3

Online help file: no

Object theme: Device interface

Object class(es): Devices

Argument(s):

mode **(optional) symbol**, the initial processing mode (additive ('add') or differential ('delta')) that is to be used. The default mode is additive.

poll-rate **(optional) integer**, the rate (in milliseconds) at which the companion *serialX* object is polled via a sample request. The default rate is 100 milliseconds between sample requests.

Inlet(s):

1. **list**, the command channel
2. **anything**, the output of the companion *serialX* object

Outlet(s):

1. **list**, result data from the Spaceball, in the form of a button list (a three element list, starting with the symbol 'button', followed by the button number and the button state, where '0' is up and '1' is down, for each button transition), a rotation list (a four element list, starting with the symbol 'rotate', with the cumulative rotation factors as three floating point numbers, in the order 'X', 'Y', 'Z') or a translation list (a four element list, starting with the symbol 'translate', with the cumulative translation terms as three floating point numbers, in the order 'X', 'Y', 'Z'). Moving the sensor ball results in both a rotation list and a translation list; pressing a button results in two button lists, the first when the button is pressed and the second when it is released
2. **bang**, the sample request to send to the companion *serialX* object

3 **anything**, the data to send to the companion *serialX* object
4 **bang**, the '**chunk**' request to send to the companion *serialX* object, via a message object
5 **bang**, an error was detected

Companion object(s): works with *serialX* objects (not *serial*)

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

mode symbol
Change the processing mode (where **symbol** is 'add' or 'delta') that is to be used.

reset
Send a device reset sequence to the Spaceball and reset the rotation and translation vectors.

verbose [**on**/**off**]
Tracing to the *Max* window of the messages sent will be enabled ('on'), disabled ('off') or reversed, if no argument is given.

zero
Reset the rotation and translation vectors.

Comments: Figure 17 shows how to connect an *spaceball* object to a *serialX* object.

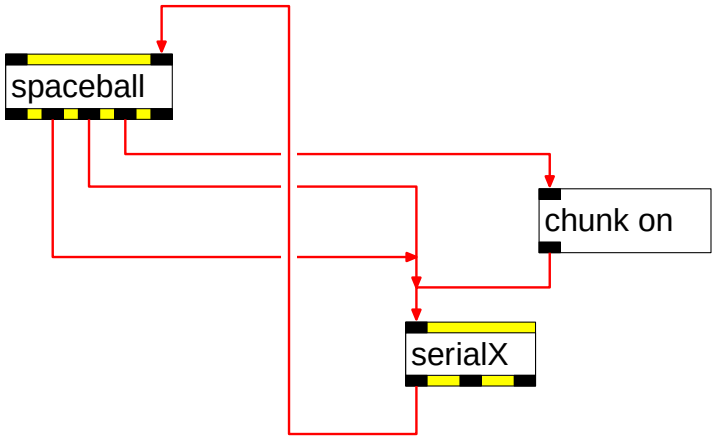
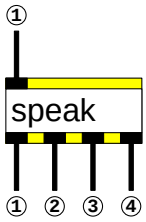


Figure 17: Connecting a *spaceball* object to a *serialX* object

speak



Description of object: *speak* is an interface to the Macintosh Speech Synthesis Manager, providing control over pitch, rate, volume and voice.

Object created: April 2001

Current version: 1.0.4

Online help file: yes

Object theme: Device interface

Object class(es): Devices

Argument(s): none

Inlet(s):

1 **integer**/**float**/**list**, the command input

Outlet(s):

1 **bang**, speaking has stopped
2 **bang**, speaking has paused
3 **list**, the response to the '**pitch?**', '**rate?**', '**voice?**', '**voiceMax**' or '**volume?**' commands. Response messages appear as a two element list, starting with one of the symbols 'pitch', 'rate', 'voice', 'voicemax', 'volume' and followed by the appropriate value–an integer value for 'voice' and 'voicemax' and a floating-point value for 'pitch', 'rate' and 'volume'.
4 **bang**, an error was detected

Companion object(s): none

Standalone: yes

Retains state: yes, the Speech Manager settings

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

continue
Cause the Speech Manager to resume speaking if it's paused.

float
Send the given number to the Speech Manager to be spoken immediately.

integer
Send the given number to the Speech Manager to be spoken immediately.

list anything
Send the given list to the Speech Manager to be spoken immediately.

pause
Cause the Speech Manager to pause speaking immediately.

pitch float
Select a new pitch for speaking. Higher values correspond to higher frequencies.

pitch?
Report the speech pitch as a two element list, with the symbol 'pitch' as its first element and the pitch as a floating-point number as its second element.

rate float
Select a new rate for speaking. The given value is measured (approximately) in terms of words-per-minute. Use the '**rate?**' command to get the current rate in a form that can be sent back to a *speak* object.

rate?
Report the speech rate as a two element list, with the symbol 'rate' as its first element and the rate as a floating-point number as its second element.

say anything
Send the given list to the Speech Manager to be spoken immediately. This message permits the speaking of an arbitrary list; in particular any list that could be confused with a command to the *speak* object.

spell [**on**/**off**]
Spelling of the following messages will be enabled ('on'), disabled ('off') or reversed, if no argument is given.

stop
Cause the Speech Manager to immediately stop speaking.

voice integer
Select a new voice to be used for speaking. Use the '**voice?**' command to get the current voice in a form that can be sent back to a *speak* object.

voice?
Report the active voice number as a two element list, with the symbol 'voice' as its first element and the voice number as an integer as its second element.

voicemax?
Report the maximum voice number as a two element list, with the symbol 'voicemax' as its first element and the maximum voice number as an integer as its second element.

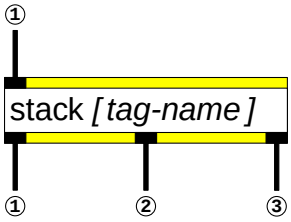
volume float
Select a new volume for speaking. The given value is between zero (silence) and one (maximum possible volume). Use the '**volume?**' command to get the current volume in a form that can be sent back to a *speak*

object.

volume?

Report the speech volume as a two element list, with the symbol ‘volume’ as its first element and the volume as a floating-point number as its second element.

stack



Description of object: *stack* is an implementation of push-down stacks, also known as LIFO (last-in, first-out) queues. Unlike conventional stacks, the *stack* object can store lists as well as single values on each level.

Object created: June 2000

Current version: 1.0.2

Online help file: yes

Object theme: Programming aids

Object class(es): Data

Argument(s):

tag-name **(optional) symbol**, share the internal stack with all other *stack* objects having the same **tag-name**

Inlet(s):

1 **list**, the command input

Outlet(s):

1 **anything**, the retrieved data
2 **integer**, the depth of the internal stack (the number of elements in the internal stack)
3 **bang**, an error was detected

Companion object(s): none

Standalone: no, the object works with other *stack* objects with the same **tag-name**

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

clear
Remove all data from the internal stack.

depth
Return the depth of the internal stack.

dup
Duplicate the top element of the internal stack.

pop
Remove the top element of the internal stack.

push anything
Place the given data on the top of the internal stack.

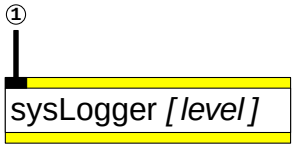
swap
Exchange the top two elements of the internal stack.

top
Return the top element of the internal stack.

top+pop
Return the top element of the internal stack and remove it from the internal stack.

trace [**on**/**off**]
Internal stack update tracing to the *Max* window will be enabled (‘on’), disabled (‘off’) or reversed, if no argument is given.

sysLogger



Description of object: *sysLogger* writes it's input to the syslogd facility for Mac OS 9, available from Brian Bergstrand or to the native Mac OS X facility.

Object created: March 2002

Current version: 1.0.3

Online help file: yes

Object theme: Miscellaneous

Object class(es): Miscellaneous

Argument(s):

level **(optional) symbol**, the logging level to be used. The acceptable values are: 'emergency', 'alert', 'critical', 'error', 'warning', 'notice', 'info' and 'debug'. The default level is 'info'.

Inlet(s):

1 **anything**, the input to be processed

Outlet(s): none

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x

Fat, PPC-only or 68k-only: Fat

Comments: Use of the *sysLogger* object in Mac OS X environment may require additions to the file /etc/syslog.conf; the output can be viewed using the standard Console application.

tcpClient

Description of object: *tcpClient* is an interface to the TCP/IP stack on a Macintosh, providing an end-point client to communicate with a *tcpServer* or a *tcpMultiServer* object.

Object created: August 1998

Current version: 1.1.7

Online help file: yes

Object theme: TCP/IP

Object class(es): Devices

Argument(s):

ip-address **(optional) symbol**, the address of the machine running the *tcpServer* or *tcpMultiServer* object to communicate with, in 'dotted' notation. The default address is '10.11.12.13'.

port **(optional) integer**, the number of the port to communicate on. The default port is 65535, which is also the maximum acceptable port number.

buffers **(optional) integer**, the number of receive buffers to use. The default number of buffers is 25

Inlet(s):

1 **list**, the command input

Outlet(s):

1 **list**, the status or response. Status messages (triggered by a '**bang**' or '**status**' command) appear as a two or four element list, starting with the symbol 'status'; response messages appear as a list, starting with the symbol 'reply' and 'self' messages appear as a two element list, starting with the symbol 'self'

2 **bang**, an error was detected

Companion object(s): none

Standalone: no, works with a *tcpServer* or a *tcpMultiServer* object on the same computer or another computer that is reachable via a TCP/IP network

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

bang
Report the state of the communication ('unbound', 'bound', 'listening', 'connecting', 'connected', 'disconnecting' or 'unknown') as a two or five element list, with the symbol 'status' as its first element. If the state is not 'connected', the list will contain two elements. If the state is 'connected', the third element is the IP address of the server, expressed as a symbol in 'dotted' notation, the fourth element is the port of the server and the fifth element is either 'raw' or 'max'.

connect
Connect to the *tcpServer* or *tcpMultiServer* object on the machine at the specified address and port.

disconnect
Close any existing connection to a *tcpServer* or a *tcpMultiServer* object.

float
Send the given floating point value to the *tcpServer* or *tcpMultiServer* object.

integer
Send the given integer value to the *tcpServer* or *tcpMultiServer* object.

list anything
Send the given list to the *tcpServer* or *tcpMultiServer* object.

mode symbol
Set the operating mode of the communication to either 'raw' or 'max'. In 'raw' mode, data is transferred without any structure; in 'max' mode it is as described below. Both ends of the communication must agree on the mode.

port integer
Set the number of the port to communicate on.

self
Returns the IP address of this object as a two element list, with the symbol 'self' as its first element.

send anything
Send the arguments to the *tcpServer* or *tcpMultiServer* object. This message permits the transmission of an arbitrary list; in particular any list that could be confused with a command to the *tcpClient* object.

server symbol
Specify the address of the machine running the *tcpServer* or *tcpMultiServer* object to communicate with, in 'dotted' notation.

status
Report the state of the communication ('unbound', 'bound', 'listening', 'connecting', 'connected', 'disconnecting' or 'unknown') as a two- or five element list, with the symbol 'status' as its first element. If the state is not 'connected', the list will contain two elements. If the state is 'connected', the third element is the IP address of the server, expressed as a symbol in 'dotted' notation, the fourth element is the port of the server and the fifth element is either 'raw' or 'max'.

verbose [**on**/**off**]
Communication tracing to the *Max* window will be enabled (‘on’), disabled (‘off’) or reversed, if no argument is given.

Message format:

The data sent through the TCP/IP objects is structured as follows:

1) A fixed header containing the following fields:
   a) The number of Atoms which follow, as a two byte number,
   b) A sanity check field as a two byte number and
   c) The type of Atoms to follow, as a single byte
2) Zero or more Atoms, represented via the following fields:
   a) (optional) The type of the Atom, as a single byte,
   b) The Atom, represented as described next.

All multi-byte values are sent most-significant-byte first (network byte order, which is big-endian). The sanity check field is the negative of the sum of the total number of bytes in the data and the number of Atoms sent. Floating-point values are represented using IEEE 32-bit floating point. Integers are represented as signed four byte quantities. Symbols are represented as strings, with a leading length (a two byte number) and a trailing null character. Note that the length includes the trailing null character, so it is always non-zero.

If all the Atoms are the same type, the type is placed in the header and the individual Atom type fields are not transmitted. If there is more than one type of Atom present, the Atom type field is transmitted for each Atom, and the type in the fixed header is set to eight (8). If the number of Atoms is zero, the type in the fixed header is also set to zero.

The type of the Atom is one of the following values:

1: Integer,
2: Floating point,
3: String,
10: Semicolon,
11: Comma or
12: Dollar

The following sequence of values represent the list ‘123 14.7, Chuck’:

```
04    The number of Atoms which follow
-27   The sanity check field (3 Atoms, 24 bytes)
8     The type of Atoms (eight indicates a mixture of Atoms)
1     An integer value follows
0123  The value ‘123’ as a 32-bit integer
2     A floating-point value follows
14.70 The value ’14.7’ as a 32-bit floating-point number
```

```
11    A comma follows (no associated data)
3     A string value follows
06    The length of the string
Chuck The characters of the string
0     The trailing null character of the string
```

The largest message that can be processed is 24,000 bytes, which could contain 6,000 integers or floating-point values or a single string of 23,997 characters.

Comments:

Once a communication path is established between a *tcpClient* object and a *tcpServer* or *tcpMultiServer* object, either object can send messages—the path is full-duplex. Figure 18 is a state diagram for *tcpClient* objects.

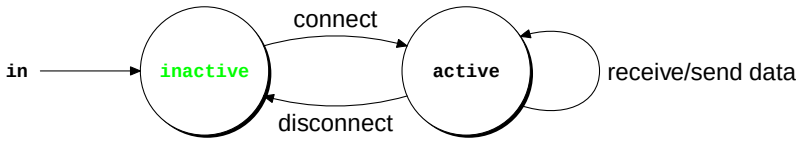
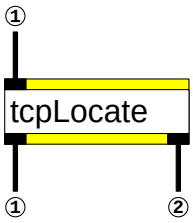


Figure 18: State diagram for *tcpClient* objects

tcpLocate



Description of object: *tcpLocate* is an interface to the TCP/IP stack on a Macintosh, providing a client to identify the IP address corresponding to an Internet address.

Object created: November 2000

Current version: 1.0.2

Online help file: yes

Object theme: TCP/IP

Object class(es): Devices

Argument(s): None

Inlet(s):

1 list, the command input

Outlet(s):

1 list, the response as a symbol
2 bang, an error was detected

Companion object(s): none

Standalone: no, works with a *tcpClient*, *tcpServer* or *tcpMultiServer* object

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

symbol
Interpret the given value as an Internet address and return the IP address if found.

verbose [**on**/**off**]
Communication tracing to the *Max* window will be enabled ('on'), disabled ('off') or reversed, if no argument is given.

tcpMultiServer

Description of object: *tcpMultiServer* is an interface to the TCP/IP stack on a Macintosh, providing an endpoint server to communicate with one or more *tcpClient* objects.

Object created: October 2000

Current version: 1.1.0

Online help file: yes

Object theme: TCP/IP

Object class(es): Devices

Argument(s):

port **(optional) integer**, the number of the port to communicate on. The default port is 65535, which is also the maximum acceptable port number

clients **(optional) integer**, the maximum number of clients that will be supported. The maximum that can be specified is 100 and the default is 5.

buffers **(optional) integer**, the total number of receive buffers to use. The default number of buffers is 25 times the maximum number of clients

Inlet(s):

1 **list**, the command input

Outlet(s):

1 **list**, the status or response. Status messages (triggered by a '**bang**' or '**status**' command) appear as a five element list, starting with the symbol 'status'; response messages appear as a list, starting with the symbol 'reply' and 'self' messages appear as a two element list, starting with the symbol 'self'. The second element of the status or response message is the identifier of the client connection involved.

Companion object(s): none

Standalone: no, works with multiple *tcpClient* objects on the same computer or other computers that are reachable via a TCP/IP network

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

bang
Report the general state of the communication as a five element list, with the symbol 'status' as its first element. The second element of the list is the value '0', the third element is the general state of the communication ('unbound', 'bound', 'listening' or 'unknown'), the fourth element is the number of active client connections and the fifth element is the port number that is being listened to.

disconnect client
Close any existing connection to the *tcpClient* object with the given identifier, if **client** is non-zero, or close all existing connections if **client** is zero.

listen on/off
Start listening on the communication port ('on') or stop listening ('off'). The command is only accepted if the *tcpMultiServer* object is in an appropriate state— 'listening' if 'off' and 'bound' if 'on'.

mode client symbol
Set the operating mode of the communication to either 'raw' or 'max'. In 'raw' mode, data is transferred without any structure; in 'max' mode it is as described below. Both ends of the communication must agree on the mode.

port integer
Set the number of the port to communicate on.

self
Returns the IP address of this object as a two element list, with the symbol 'self' as its first element.

send client anything
Send the arguments to the connected *tcpClient* objects with the given identifier, if **client** is non-zero, or send the arguments to all existing connections if **client** is zero (a broadcast). This message permits the transmission of an arbitrary list.

status [**client**]
Report either the state of a specific client communication, if **client** is non-zero (a valid identifier), or the general state of the communication, if **client** is zero, as a five or six element list, with the symbol 'status' as its first element. The second element of the list is **client**, the third element is the general state of the communication ('unbound', 'bound', 'listening' or 'unknown') or the specific client communication ('connecting', 'connected', 'disconnecting' or 'unknown'). If **client** is zero, the fourth element is the number of active client connections and the fifth element is the port number that is being listened to. If **client** is non-zero and the state is 'connected', the fourth element is the IP address of the client, expressed as a symbol in 'dotted' notation, the fifth element is the port of the client and the fifth element is either 'raw' or 'max'. The default for **client** is 0, which requests the general state of the communication.

verbose [**on**/**off**]
Communication tracing to the *Max* window will be enabled ('on'), disabled ('off') or reversed, if no argument is given.

Message format: see *tcpClient*

Comments:

Once a communication path is established between a *tcpClient* object and a *tcpMultiServer* object, either object can send messages—the path is full-duplex. The client identifier used with the commands '**disconnect**', '**send**' and '**status**' and returned as part of the 'reply' and 'status' messages is a positive integer between 1 and the maximum number of clients specified when the *tcpMultiServer* object was created. Note that the identifier exists until the connection is closed with a '**disconnect**' command (sent to the *tcpMultiServer* object or the connected *tcpClient* object) and the identifier may be reassigned to a subsequent connection. Note as well that only there can only be one *tcpMultiServer*, *tcpServer* or *udpPort* object for any given port. Figure 19 is a state diagram for *tcpMultiServer* objects.

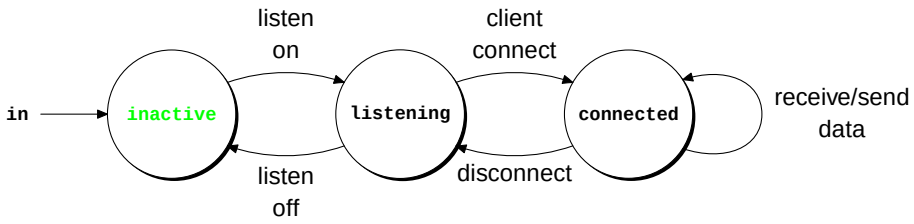
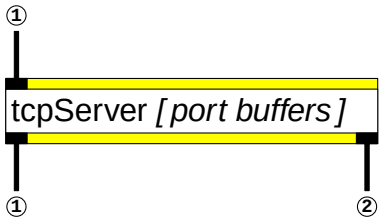


Figure 19: State diagram for *tcpMultiServer* objects

tcpServer



Description of object: *tcpServer* is an interface to the TCP/IP stack on a Macintosh, providing an end-point server to communicate with a single *tcpClient* object.

Object created: August 1998

Current version: 1.1.7

Online help file: yes

Object theme: TCP/IP

Object class(es): Devices

Argument(s):

port **(optional) integer**, the number of the port to communicate on. The default port is 65535, which is also the maximum acceptable port number

buffers **(optional) integer**, the number of receive buffers to use. The default number of buffers is 25

Inlet(s):

1 **list**, the command input

Outlet(s):

1 **list**, the status or response. Status messages (triggered by a '**bang**' or '**status**' command) appear as a three or four element list, starting with the symbol 'status'; response messages appear as a list, starting with the symbol 'reply' and 'self' messages appear as a two element list, starting with the symbol 'self'.

2 **bang**, an error was detected

Companion object(s): none

Standalone: no, works with a *tcpClient* object on the same computer or another computer that is reachable via a TCP/IP network

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

bang
Report the state of the communication (‘unbound’, ‘bound’, ‘listening’, ‘connecting’, ‘connected’, ‘disconnecting’ or ‘unknown’) as a three or five element list, with the symbol ‘status’ as its first element. If the state is not ‘connected’, the third element of the list is the port number that is being listened on. If the state is ‘connected’, the third element is the IP address of the client, expressed as a symbol in ‘dotted’ notation, the fourth element is the port of the server and the fifth element is either ‘raw’ or ‘max’.

disconnect
Close any existing connection to a *tcpClient* object.

float
Send the given floating point value to the *tcpClient* object.

integer
Send the given integer value to the *tcpClient* object.

list anything
Send the given list to the *tcpClient* object.

listen on/off
Start listening on the communication port (‘on’) or stop listening (‘off’). The command is only accepted if the *tcpServer* object is in an appropriate state— ‘listening’ if ‘off’ and ‘bound’ if ‘on’.

mode symbol
Set the operating mode of the communication to either ‘raw’ or ‘max’. In ‘raw’ mode, data is transferred without any structure; in ‘max’ mode it is as described below. Both ends of the communication must agree on the mode.

port integer
Set the number of the port to communicate on.

self
Returns the IP address of this object as a two element list, with the symbol ‘self’ as its first element.

send anything
Send the arguments to the *tcpClient* object. This message permits the transmission of an arbitrary list; in particular any list that could be confused with a command to the *tcpServer* object.

status
Report the state of the communication (‘unbound’, ‘bound’, ‘listening’, ‘connecting’, ‘connected’, ‘disconnecting’ or ‘unknown’) as a two or five element list, with the symbol ‘status’ as its first element. If the state is not ‘connected’, the list will contain two elements. If the state is ‘connected’, the third element is the IP address of the client, expressed as a symbol in ‘dotted’ notation, the fourth element is the port of the client and the fifth element is either ‘raw’ or ‘max’.

verbose [**on/off**]
Communication tracing to the *Max* window will be enabled (‘on’), disabled (‘off’) or reversed, if no argument is given.

Message format: see *tcpClient*

Comments:

Once a communication path is established between a *tcpClient* object and a *tcpServer* object, either object can send messages—the path is full-duplex. Note as well that only there can only be one *tcpMultiServer*, *tcpServer* or *udpPort* object for any given port. Figure 20 is a state diagram for *tcpServer* objects.

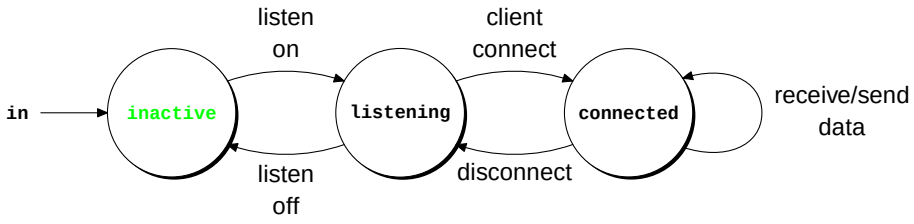


Figure 20: State diagram for *tcpServer* objects

udpPort

Description of object: *udpPort* is an interface to the UDP/IP stack on a Macintosh, providing an endpoint to communicate with another *udpPort* object.

Object created: July 2005

Current version: 1.0.0

Online help file: yes

Object theme: TCP/IP

Object class(es): Devices

Argument(s):

port **(optional) integer**, the number of the port to communicate on. The default port is 65535, which is also the maximum acceptable port number

buffers **(optional) integer**, the number of receive buffers to use. The default number of buffers is 25

Inlet(s):

1 **list**, the command input

Outlet(s):

1 **list**, the status or response. Status messages (triggered by a '**bang**' or '**status**' command) appear as a three or four element list, starting with the symbol 'status'; response messages appear as a list, starting with the symbol 'reply' and 'self' messages appear as a two element list, starting with the symbol 'self'.

2 **bang**, an error was detected

Companion object(s): none

Standalone: no, works with another *udpPort* object on the same computer or another computer that is reachable via a TCP/IP network

Retains state: yes

Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

bang
Report the state of the communication (‘unbound’, ‘bound’ or ‘unknown’) as a three element list, with the symbol ‘status’ as its first element. The third element is either ‘raw’ or ‘max’.

float
Send the given floating point value to the other *udpPort* object.

integer
Send the given integer value to the other *udpPort* object.

list anything
Send the given list to the other *udpPort* object.

mode symbol
Set the operating mode of the communication to either ‘raw’ or ‘max’. In ‘raw’ mode, data is transferred without any structure; in ‘max’ mode it is as described below. Both ends of the communication must agree on the mode.

port integer
Set the number of the port to communicate on.

self
Returns the IP address of this object as a two element list, with the symbol ‘self’ as its first element.

send anything
Send the arguments to the other *udpPortX* object. This message permits the transmission of an arbitrary list; in particular any list that could be confused with a command to the *udpPort* object.

sendTo symbol integer
Specify the address of the machine running the other *udpPort* object to communicate with, in ‘dotted’ notation, along with the port to communicate on.

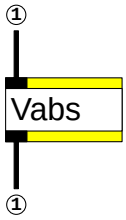
status
Report the state of the communication (‘unbound’, ‘bound’ or ‘unknown’) as a three element list, with the symbol ‘status’ as its first element. The third element is either ‘raw’ or ‘max’.

verbose [**on**/**off**]
Communication tracing to the *Max* window will be enabled (‘on’), disabled (‘off’) or reversed, if no argument is given.

Message format: see *tcpClient*

Comments: Once a communication path is established between a *udpPort* object and another *udpPort* object, either object can send messages—the path is full-duplex. Note as well that only there can only be one *tcpMultiServer*, *tcpServer* or *udpPort* object for any given port.

Vabs



Description of object: *Vabs* calculates the absolute value of the input (either a list or a single number).

Object created: April 2001

Current version: 1.0.2

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s): none

Inlet(s):

1 anything, the input to be processed

Outlet(s):

1 anything, the input after calculating the absolute value, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

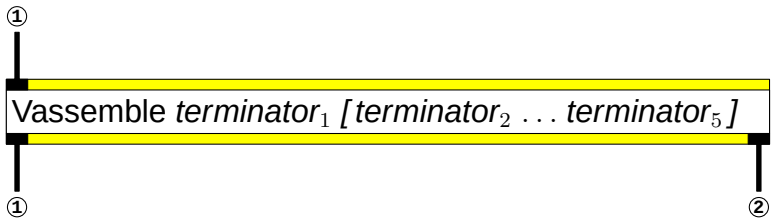
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: In mathematical terms: $y_i \leftarrow |x_i|$, where $x = x_1, x_2, \ldots, x_n$ is the inlet value and $y = y_1, y_2, \ldots, y_n$ is the outlet result.

Vassemble



Description of object: *Vassemble* is used to collect a sequence of numbers that are terminated by one of a set of numbers. The 'terminator' numbers are removed from the sequence.

Object created: June 2003

Current version: 1.0.0

Online help file: yes

Object theme: Vector manipulation

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

terminator1 **integer**, a number that marks the end-of-list. Only non-zero numbers will be recognized.
terminator2 **(optional) integer**, another number that marks the end-of-list.
terminator3 **(optional) integer**, another number that marks the end-of-list.
terminator4 **(optional) integer**, another number that marks the end-of-list.
terminator5 **(optional) integer**, another number that marks the end-of-list.

Inlet(s):

1 **integer**/**list**/**bang**, the list to be processed. A single number is treated as a single element list.

Outlet(s):

1 **list**, the accumulated list
2 **bang**, an empty list was generated

Companion object(s): none

Standalone: yes

Retains state: yes, the terminator numbers and the numbers accumulated so far

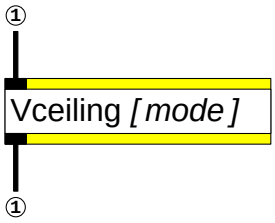
Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

bang
Return the previous result, if any.

Vceiling



Description of object: *Vceiling* calculates the smallest integer greater than the value given (either a list or a single number).

Object created: November 2000

Current version: 1.0.5

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

mode **(optional) symbol**, either 'f', 'i' or 'm' to indicate whether the output is to be floating-point values only, integer values only, or mixed values. Mixed values are floating-point if the input is floating-point and integer if the input is integer. The default is 'm'.

Inlet(s):

1 **anything**, the input to be processed

Outlet(s):

1 **anything**, the input after calculating the ceiling, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

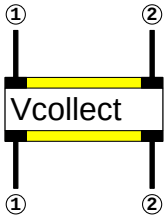
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: In mathematical terms: $y_i \leftarrow \lceil x_i \rceil$, where $x_1, x_2, \ldots, x_n$ is the inlet value and $y_1, y_2, \ldots, y_n$ is the outlet result.

Vcollect



Description of object: *Vcollect* collects all the data arriving at its left inlet into a list.

Object created: August 2002

Current version: 1.0.1

Online help file: yes

Object theme: Vector manipulation

Object class(es): Lists

Argument(s): none

Inlet(s):

1 **anything**, the data to be collected
2 **symbol**, the command input

Outlet(s):

1 **list**, the collected data
2 **integer**, the count of the atoms collected

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Output the collected data.

clear
Remove all the collected data.

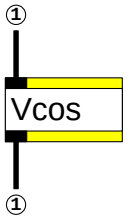
count
Return the number of atoms collected so far.

start
Start collecting data.

stop
Stop collecting data.

Comments: The *Vcollect* object was designed to address some problems that were found in attempting to use *coll* objects to gather arbitrary sequential streams of data.

Vcos



Description of object: *Vcos* calculates the cosine of the input (either a list or a single number).

Object created: May 2001

Current version: 1.0.2

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s): none

Inlet(s):

1 anything, the input to be processed

Outlet(s):

1 anything, the input after calculating the cosine, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

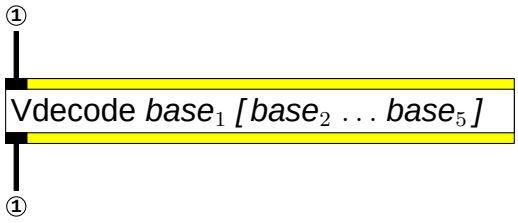
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: In mathematical terms: $y_i \leftarrow \cos x_i$, where $x = x_1, x_2, \ldots, x_n$ is the inlet value and $y = y_1, y_2, \ldots, y_n$ is the outlet result.

Vdecode



Description of object: *Vdecode* is an implementation of the *APL* 'decode' operator (⊥), which is used to convert a coded representation of a number into the number itself.

Object created: June 2003

Current version: 1.0.0

Online help file: yes

Object theme: Vector manipulation

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

base1 **integer**, the leftmost base to be applied. If this is the only base it will be repeated as often as needed to do the conversion. If there are more bases and this base is negative, it will be repeated (as it's absolute value) as often as needed to do the conversion, after the other bases have been applied. Bases must be greater than 1.

base2 **(optional) integer**, the next-to-last base to apply.

base3 **(optional) integer**, the next-to-next-to-last base to apply.

base4 **(optional) integer**, the next-to-. . .-last base to apply.

base5 **(optional) integer**, the last base to apply. The elements of the input list are multiplied by each base, in sequence, and the results are summed into the output number.

Inlet(s):

1 **list/number**, the list to be decoded. A single number is treated as a single element list.

Outlet(s):

1 **number**, the decoded result

Companion object(s): none

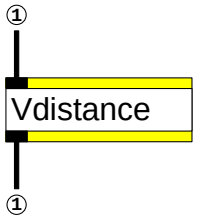
Standalone: yes

Retains state: no

Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Vdistance



Description of object: *Vdistance* calculates the length of its input list, considered as an n-dimensional vector.

Object created: April 2001

Current version: 1.0.2

Online help file: yes

Object theme: Vector manipulation

Object class(es): Lists

Argument(s): none

Inlet(s):

1 anything, the input to be processed

Outlet(s):

1 anything, the input after calculating the length, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

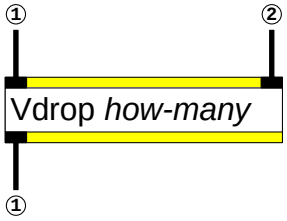
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: In mathematical terms: $y \leftarrow |x|$ or $y \leftarrow \sqrt{(\sum_{i=1}^{n} x_i^2)}$, where $x = x_1, x_2, \ldots, x_n$ is the inlet value and $y = y_1, y_2, \ldots, y_n$ is the outlet result.

Vdrop



Description of object: *Vdrop* is an implementation of the *APL* 'drop' operator (↓), which is used to return the remainder of a vector (in *Max*, a list) with leading or trailing elements removed.

Object created: July 2000

Current version: 1.0.4

Online help file: yes

Object theme: Vector manipulation

Object class(es): Lists

Argument(s):

how-many **integer**, the number of elements to drop. A positive number indicates that the elements are removed from the beginning of the input list, while a negative number indicates that the elements are to be removed from the end of the list.

Inlet(s):

1 **bang/list**, the list to be reduced

2 **integer**, the number of elements to drop. This replaces the initial argument.

Outlet(s):

1 **list**, the reduced list, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: yes, the number of elements to drop

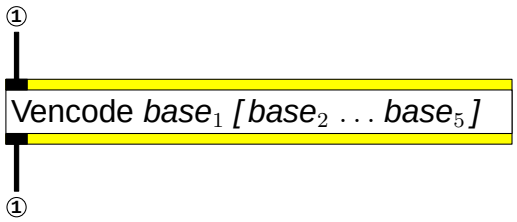
Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Vencode



Description of object: *Vencode* is an implementation of the *APL* 'encode' operator ($\top$), which is used to convert a number into an encoded representation according to a coding scheme or base.

Object created: June 2003

Current version: 1.0.0

Online help file: yes

Object theme: Vector manipulation

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

base1 **integer**, the leftmost base to be applied. If this is the only base it will be repeated as often as needed to do the conversion. If there are more bases and this base is negative, it will be repeated (as it's absolute value) as often as needed to do the conversion, after the other bases have been applied. Bases must be greater than 1.

base2 **(optional) integer**, the next-to-last base to apply.

base3 **(optional) integer**, the next-to-next-to-last base to apply.

base4 **(optional) integer**, the next-to-. . .-last base to apply.

base5 **(optional) integer**, the last base to apply. The input number is divided by each base, in sequence, and the remainders are collected into the output list.

Inlet(s):

1 **list**/**number**, the number to be encoded. A list results in a sequence of lists being generated.

Outlet(s):

1 **list**, the encoded result

Companion object(s): none

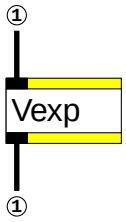
Standalone: yes

Retains state: no

Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Vexp



Description of object: *Vexp* calculates the natural exponential of the input (either a list or a single number).

Object created: May 2001

Current version: 1.0.2

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s): none

Inlet(s):

1 anything, the input to be processed

Outlet(s):

1 anything, the input after calculating the natural exponential, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

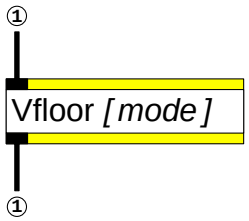
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: In mathematical terms: $y_i \leftarrow \mathrm{e}^{x_i}$, where $x = x_1, x_2, \ldots, x_n$ is the inlet value and $y = y_1, y_2, \ldots, y_n$ is the outlet result.

Vfloor



Description of object: *Vfloor* calculates the largest integer less than the value given (either a list or a single number).

Object created: November 2000

Current version: 1.0.5

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

mode **(optional) symbol**, either 'f', 'i' or 'm' to indicate whether the output is to be floating-point values only, integer values only, or mixed values. Mixed values are floating-point if the input is floating-point and integer if the input is integer. The default is 'm'.

Inlet(s):

1 **anything**, the input to be processed

Outlet(s):

1 **anything**, the input after calculating the floor, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

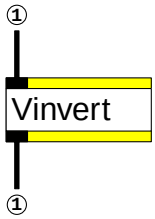
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: In mathematical terms: $y_i \leftarrow \lfloor x_i \rfloor$, where $x_1, x_2, \ldots, x_n$ is the inlet value and $y_1, y_2, \ldots, y_n$ is the outlet result.

Vinvert



Description of object: *Vinvert* calculates the multiplicative inverse of the input (either a list or a single number).

Object created: April 2001

Current version: 1.0.2

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s): none

Inlet(s):

1 anything, the input to be processed

Outlet(s):

1 anything, the input after calculating the multiplicative, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

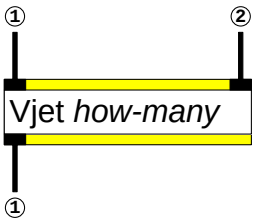
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: In mathematical terms: $y_i \leftarrow \frac{1}{x_i}$, where $x = x_1, x_2, \ldots, x_n$ is the inlet value and $y = y_1, y_2, \ldots, y_n$ is the outlet result.

Vjet



Description of object: *Vjet* takes as input a list and divides it into a series of fixed-size, shorter, lists. It is similar to the *APL* 'reshape' operator (ρ).

Object created: July 2000

Current version: 1.0.2

Online help file: yes

Object theme: Vector manipulation

Object class(es): Lists

Argument(s):

how-many **integer**, the size of the output fragments

Inlet(s):

1 **bang/list**, the input to be processed

2 **integer**, the size of the output fragments. This replaces the initial argument.

Outlet(s):

1 **list**, the input after segmentation, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: yes, the size of the output fragments

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

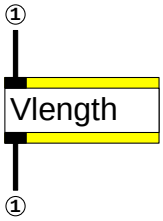
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: The *Vjet* object was designed to assist in working with the *mtc* object, which returns triples of values in the form of a long list. If the input list is not exactly divisible by the size of the output fragments, the last fragment will be shorter than all the earlier fragments.

Vlength



Description of object: *Vlength* returns the number of elements in the list that it receives.

Object created: July 2000

Current version: 1.0.2

Online help file: yes

Object theme: Vector manipulation

Object class(es): Lists

Argument(s): none

Inlet(s):

1 list, the list to measure

Outlet(s):

1 integer, the size of the input

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Vlog

Description of object: *Vlog* calculates the natural logarithm of the input (either a list or a single number).

Object created: April 2001

Current version: 1.0.2

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s): none

Inlet(s):

1 anything, the input to be processed

Outlet(s):

1 anything, the input after calculating the natural logarithm, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

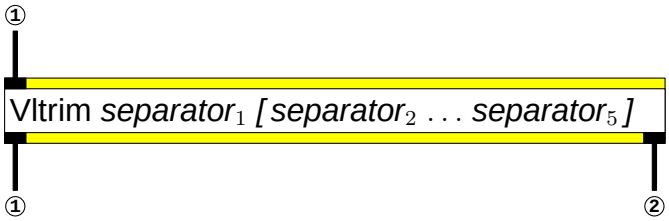
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: In mathematical terms: $y_i \leftarrow \log_e x_i$, where $x = x_1, x_2, \ldots, x_n$ is the inlet value and $y = y_1, y_2, \ldots, y_n$ is the outlet result.

Vltrim



Description of object: *Vltrim* is used to remove 'noise' numbers from the beginning of a list.

Object created: June 2003

Current version: 1.0.0

Online help file: yes

Object theme: Vector manipulation

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

separator1 **integer**, a 'noise' number to remove. Only non-zero numbers will be recognized.
separator2 **(optional) integer**, another 'noise' number to remove.
separator3 **(optional) integer**, another 'noise' number to remove.
separator4 **(optional) integer**, another 'noise' number to remove.
separator5 **(optional) integer**, another 'noise' number to remove.

Inlet(s):

1 **integer/list/bang**, the list to be processed. A single number is treated as a single element list.

Outlet(s):

1 **list**, the reduced list
2 **bang**, an empty list was generated

Companion object(s): none

Standalone: yes

Retains state: yes, the separator numbers

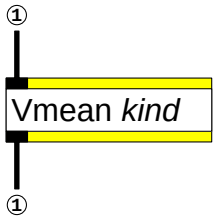
Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

bang
Return the previous result, if any.

Vmean



Description of object: *Vmean* calculates an arithmetic, geometric, or harmonic mean of the elements of a vector (in *Max*, a list).

Object created: April 2001

Current version: 1.0.2

Online help file: yes

Object theme: Vector manipulation

Object class(es): Lists

Argument(s):

kind **symbol**, the kind of mean to be calculated. Recognized kinds are arithetic (‘a’ or ‘arith’), geometric (‘g’ or ‘geom’) and harmonic (‘h’ or ‘harm’).

Inlet(s):

1 **list**, the list to be reduced

Outlet(s):

1 **number**, the result of the calculation

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Comments: Figure 21 is the definition of the output of the *Vmean* object in mathematical terms

$$y = \frac{\sum_{i=1}^{n} x_i}{n} \quad \text{arithmetic mean}$$

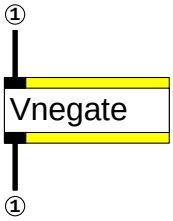
$$y = \sqrt[n]{\prod_{i=1}^{n} x_i} \quad \text{geometric mean}$$

$$y = \frac{n}{\sum_{i=1}^{n} \frac{1}{x_i}} \quad \text{harmonic mean}$$

Where $x = x_1, x_2, \ldots, x_n$ is the inlet value and y is the outlet result.

Figure 21: Definition of the output of *Vmean*

Vnegate



Description of object: *Vnegate* calculates the negative value of the input (either a list or a single number).

Object created: April 2001

Current version: 1.0.2

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s): none

Inlet(s):

1 anything, the input to be processed

Outlet(s):

1 anything, the input after calculating the negative value, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

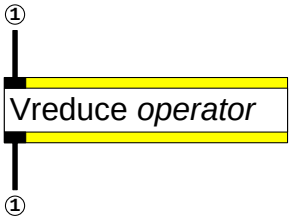
Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Vreduce



Description of object: *Vreduce* is an implementation of the *APL* 'reduction' operator ($f/$), which is used to apply an operator (f) over the elements of a vector (in *Max*, a list).

Object created: November 2000

Current version: 1.0.2

Online help file: yes

Object theme: Vector manipulation

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

operator **symbol**, the operator to be applied. Recognized operators are sum ('+'), logical AND ('&&'), bit-wise AND ('&'), bit-wise OR ('|'), divide ('/'), exclusive-OR ('∧'), maximum ('max'), minimum ('min'), modulus ('%'), product ('*'), logical OR ('||'), or subtract ('−'). The result of applying the operator to each element in order (with the previous result being used as the left operand and the new element being used as the right operand) is returned. For an empty list, the identity element (if defined for the operator), or zero, is returned.

Inlet(s):

1 **list/number**, the list to be reduced. A single number is treated as a single element list.

Outlet(s):

1 **number**, the reduction result

Companion object(s): none

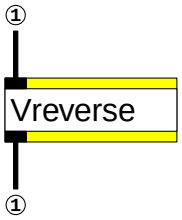
Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Vreverse



Description of object: *Vreverse* is an implementation of the *APL* 'reverse' operator (monadic Φ), which is used to reverse the order of the elements of a vector (in *Max*, a list).

Object created: April 2001

Current version: 1.0.2

Online help file: yes

Object theme: Vector manipulation

Object class(es): Lists

Argument(s): none

Inlet(s):

1 bang/list, the list to be reversed

Outlet(s):

1 list, the reversed list, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

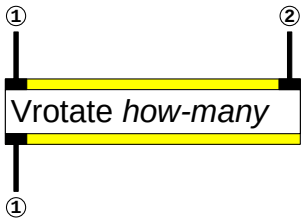
Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Vrotate



Description of object: *Vrotate* is an implementation of the *APL* 'rotate' operator (dyadic Φ), which is used to rotate the elements of a vector (in *Max*, a list).

Object created: April 2001

Current version: 1.0.2

Online help file: yes

Object theme: Vector manipulation

Object class(es): Lists

Argument(s):

how-many **integer**, the number of elements to rotate. A positive number indicates that the beginning of the input list is moved towards the end of th input list by the number of elements given, while a negative number indicates that the end of the input list is moved towards the beginning of the input list by (the absolute value of) the number of elements given.

Inlet(s):

1 **bang/list**, the list to be rotated

2 **integer**, the number of elements to rotate. This replaces the initial argument.

Outlet(s):

1 **list**, the rotated list, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: yes, the number of elements to rotate

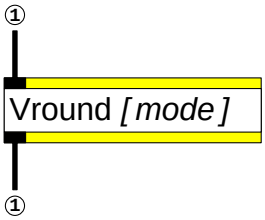
Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Vround



Description of object: *Vround* calculates the integer nearest to the value given (either a list or a single number).

Object created: November 2000

Current version: 1.0.5

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

mode **(optional) symbol**, either 'f', 'i' or 'm' to indicate whether the output is to be floating-point values only, integer values only, or mixed values. Mixed values are floating-point if the input is floating-point and integer if the input is integer. The default is 'm'.

Inlet(s):

1 **anything**, the input to be processed

Outlet(s):

1 **anything**, the input after calculating the nearest integer, or the previous result (if a 'bang' is received)

Companion object(s): none

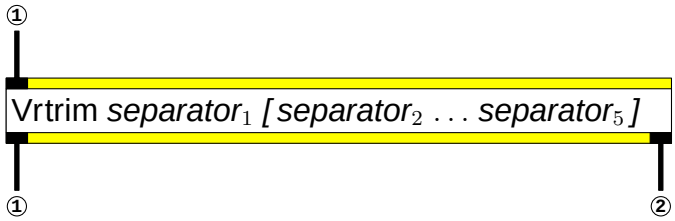
Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Vrtrim



Description of object: *Vrtrim* is used to remove 'noise' numbers from the end of a list.

Object created: June 2003

Current version: 1.0.0

Online help file: yes

Object theme: Vector manipulation

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

separator1 **integer**, a 'noise' number to remove. Only non-zero numbers will be recognized.
separator2 **(optional) integer**, another 'noise' number to remove.
separator3 **(optional) integer**, another 'noise' number to remove.
separator4 **(optional) integer**, another 'noise' number to remove.
separator5 **(optional) integer**, another 'noise' number to remove.

Inlet(s):

1 **integer/list/bang**, the list to be processed. A single number is treated as a single element list.

Outlet(s):

1 **list**, the reduced list
2 **bang**, an empty list was generated

Companion object(s): none

Standalone: yes

Retains state: yes, the separator numbers

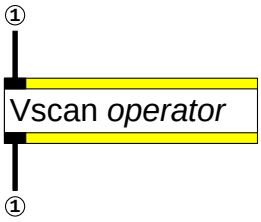
Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

bang
Return the previous result, if any.

Vscan



Description of object: *Vscan* is an implementation of the *APL* 'scan' operator (*f*\), which is used to apply an operator (*f*) over the elements of a vector (in *Max*, a list).

Object created: November 2000

Current version: 1.0.2

Online help file: yes

Object theme: Vector manipulation

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

operator **symbol**, the operator to be applied. Recognized operators are sum ('+'), logical AND ('&&'), bit-wise AND ('&'), bit-wise OR ('|'), divide ('/'), exclusive-OR ('^'), maximum ('max'), minimum ('min'), modulus ('%'), product ('*'), logical OR ('||'), or subtract ('−'). The result of applying the operator to each element in order (with the previous result being used as the left operand and the new element being used as the right operand) are collected and returned as a new list. For an empty list, the identity element (if defined for the operator), or zero, is returned.

Inlet(s):

1 **list**/**number**, the list to be scanned. A single number is treated as a single element list.

Outlet(s):

1 **list**, the scan result

Companion object(s): none

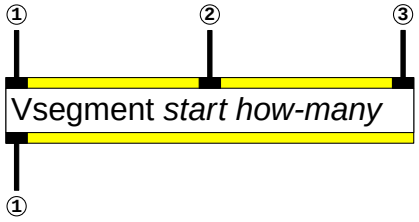
Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Vsegment



Description of object: *Vsegment* is used to extract a portion of a list.

Object created: July 2000

Current version: 1.0.4

Online help file: yes

Object theme: Vector manipulation

Object class(es): Lists

Argument(s):

start **integer**, the starting element to select from the list. A positive number indicates that the selection starts from the beginning of the list, while a negative number indicates that the selection starts from the end of the list, with the last element having the position of '−1'.

how-many **integer**, the number of elements to select from the list. A positive number indicates that the selection extends from the starting element towards the end of the list, while a negative number indicates that the selection extends from the starting element towards the beginning of the list.

Inlet(s):

1 **bang**/**list**, the list to be reduced

2 **integer**, the starting element to select from the list. This replaces the initial argument **start**.

3 **integer**, the number of elements to select from the list. This replaces the initial argument **how-many**.

Outlet(s):

1 **list**, the reduced list, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: yes, the starting element and the number of elements

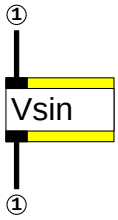
Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Vsin



Description of object: *Vsin* calculates the sine of the input (either a list or a single number).

Object created: May 2001

Current version: 1.0.2

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s): none

Inlet(s):

1 anything, the input to be processed

Outlet(s):

1 anything, the input after calculating the sine, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

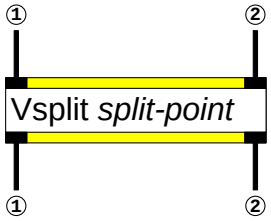
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: In mathematical terms: $y_i \leftarrow \sin x_i$, where $x = x_1, x_2, \ldots, x_n$ is the inlet value and $y = y_1, y_2, \ldots, y_n$ is the outlet result.

Vsplit



Description of object: *Vdrop* is a combination of a *Vtake* and *Vdrop*.

Object created: July 2005

Current version: 1.0.0

Online help file: yes

Object theme: Vector manipulation

Object class(es): Lists

Argument(s):

how-many **integer**, the number of elements to split by. A positive number indicates that the split point is counted from the beginning of the input list, while a negative number indicates that the split point is counted from the end of the list.

Inlet(s):

1 **bang/list**, the list to be split

2 **integer**, the number of elements to split. This replaces the initial argument.

Outlet(s):

1 **list**, the left part of the list, or the previous result (if a 'bang' is received)

1 **list**, the right part of the list, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: yes, the number of elements to split

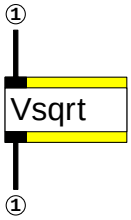
Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

bang
Return the previous result, if any.

Vsqrt



Description of object: *Vsqrt* calculates the square root of the input (either a list or a single number).

Object created: April 2001

Current version: 1.0.2

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s): none

Inlet(s):

1 anything, the input to be processed

Outlet(s):

1 anything, the input after calculating the square root, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

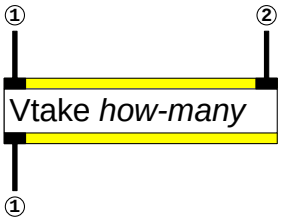
Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Comments: In mathematical terms: $y_i \leftarrow \sqrt{x_i}$, where $x = x_1, x_2, \ldots, x_n$ is the inlet value and $y = y_1, y_2, \ldots, y_n$ is the outlet result.

Vtake



Description of object: *Vtake* is an implementation of the *APL* 'take' operator (↑), which is used to return leading or trailing elements of a vector (in *Max* terms, a list).

Object created: July 2000

Current version: 1.0.4

Online help file: yes

Object theme: Vector manipulation

Object class(es): Lists

Argument(s):

how-many **integer**, the number of elements to take. A positive number indicates that the elements are taken from the beginning of the input list, while a negative number indicates that the elements are to be taken from the end of the list.

Inlet(s):

1 **bang/list**, the list to reduce

2 **integer**, the number of elements to take. This replaces the initial argument.

Outlet(s):

1 **list**, the reduced list, or the previous result (if a 'bang' is received)

Companion object(s): none

Standalone: yes

Retains state: yes, the number of elements to take

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Vtokenize

Description of object: *Vtokenize* is used to partition a list of numbers into a sequence of sublists, separated by 'noise' numbers in the original list.

Object created: June 2003

Current version: 1.0.0

Online help file: yes

Object theme: Vector manipulation

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

separator1 **integer**, a number that indicates the end of a sublist. Only non-zero numbers will be recognized.
separator2 **(optional) integer**, another number that indicates the end of a sublist.
separator3 **(optional) integer**, another number that indicates the end of a sublist.
separator4 **(optional) integer**, another number that indicates the end of a sublist.
separator5 **(optional) integer**, another number that indicates the end of a sublist.

Inlet(s):

1 **integer/list/bang**, the list to be processed. A single number is treated as a single element list.

Outlet(s):

1 **list**, the generated sublists
2 **bang**, the last sublist was generated

Companion object(s): none

Standalone: yes

Retains state: yes, the separator numbers

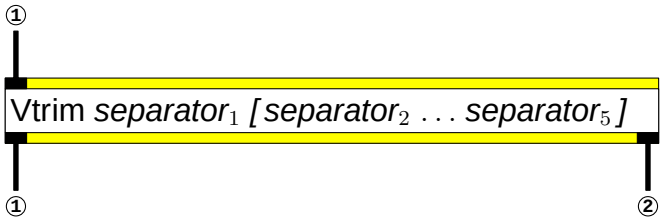
Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

bang
Return the previous sequence of sublists, if any.

Vtrim



Description of object: *Vtrim* is used to remove 'noise' numbers from the beginning and end of a list.

Object created: June 2003

Current version: 1.0.0

Online help file: yes

Object theme: Vector manipulation

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

separator1 **integer**, a 'noise' number to remove. Only non-zero numbers will be recognized.
separator2 **(optional) integer**, another 'noise' number to remove.
separator3 **(optional) integer**, another 'noise' number to remove.
separator4 **(optional) integer**, another 'noise' number to remove.
separator5 **(optional) integer**, another 'noise' number to remove.

Inlet(s):

1 **integer/list/bang**, the list to be processed. A single number is treated as a single element list.

Outlet(s):

1 **list**, the reduced list
2 **bang**, an empty list was generated

Companion object(s): none

Standalone: yes

Retains state: yes, the separator numbers

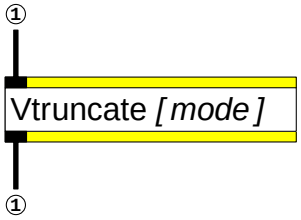
Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

bang
Return the previous result, if any.

Vtruncate



Description of object: *Vtruncate* calculates the integer part of the value given (either a list or a single number).

Object created: November 2000

Current version: 1.0.5

Online help file: yes

Object theme: Miscellaneous

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

mode **(optional) symbol**, either ‘f’, ‘i’ or ‘m’ to indicate whether the output is to be floating-point values only, integer values only, or mixed values. Mixed values are floating-point if the input is floating-point and integer if the input is integer. The default is ‘m’.

Inlet(s):

1 **anything**, the input to be processed

Outlet(s):

1 **anything**, the input after removing the fractional part, or the previous result (if a ‘bang’ is received)

Companion object(s): none

Standalone: yes

Retains state: no

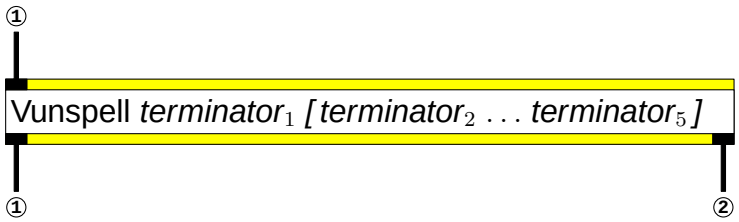
Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Vunspell



Description of object: *Vunspell* is used to convert a sequence of numbers, representing ASCII characters, into the *Max* objects that they represent.

Object created: June 2003

Current version: 1.0.0

Online help file: yes

Object theme: Vector manipulation

Object class(es): Arith/Logic/Bitwise, Lists

Argument(s):

terminator1 **integer**, a number that marks the end-of-list. Only non-zero numbers will be recognized.
terminator2 **(optional) integer**, another number that marks the end-of-list.
terminator3 **(optional) integer**, another number that marks the end-of-list.
terminator4 **(optional) integer**, another number that marks the end-of-list.
terminator5 **(optional) integer**, another number that marks the end-of-list.

Inlet(s):

1 **integer**/**list**/**bang**, the list to be processed. A single number is treated as a single element list.

Outlet(s):

1 **list**, the generated list of atoms
2 **bang**, an empty list was generated

Companion object(s): none

Standalone: yes

Retains state: yes, the terminator numbers and the numbers accumulated so far

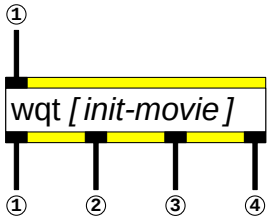
Compatibility: *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: PPC-only

Command language syntax:

bang
Return the previous result, if any.

wqt



Description of object: *wqt* provides a windowed interface to QuickTime™ movies, permitting control of playback rate and the section of the movie to be played. It provides more functionality than the standard *movie* object.

Object created: October 1998

Current version: 1.0.4

Online help file: yes

Object theme: QuickTime™

Object class(es): Graphics

Argument(s):

init-movie **(optional) symbol**, the initial movie to be loaded

Inlet(s):

1 **list**, the command input

Outlet(s):

1 **integer**, the result of a command
2 **integer**, the duration of the current movie
3 **bang**, playing has stopped
4 **bang**, an error was detected

Companion object(s): yes, (optional) the standard *movie* play controller interface object can be attached to a *wqt* object

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

active [**0**/**1**]
Set the current movie active (‘1’) or inactive (‘0’).

bang
Start the current movie playing.

begin
Move to the beginning of the current movie and make it active.

count
Return the number of movies loaded.

duration
Return the length of the current movie.

end
Move to the end of the current movie and make it active.

getrate
Return the rate at which the current movie will be played.

getvolume
Return the audio level for the current movie.

integer
Move to the given frame number in the current movie.

load [**movie-name**]
Add the specified movie to the list of movies and make it the current movie. **movie-name** must be a symbol, not a number.

mute [**0**/**1**]
Change the audio level of the current movie, silencing it (‘0’) or restoring the previous level (‘1’).

pause
Stop the current movie.

rate integer [**integer**]
Set the rate at which the current movie will be played, using the ratio of the first number to the second, and start the movie playing. If only one number is given, or the second number is zero, assume that the second number has the value one.

resume
Continue playing the current movie after a ‘**pause**’ or a ‘**stop**’ command.

segment integer [**integer**]
Set the portion of the current movie that will be played to the section from the first frame number to the second. If the first number is zero and the second number is zero or less, set the portion to be the whole movie. If the second number is negative, set the portion to be from the first frame number to the end of the movie. That is, ‘0 0’ is the whole movie, as is ‘0 −1’, while ‘15 −1’ is the portion from frame 15 to the end.

start
Move to the beginning of the current movie, make it active and start it playing.

stop
Stop the current movie.

time
Return the current frame number of the current movie.

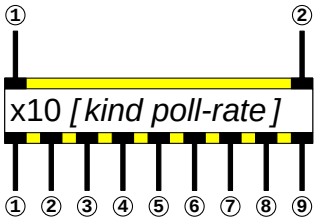
unload [**movie-name**]
If no movie is specified, remove the current movie from the list of movies. Otherwise, remove the specified movie from the list of movies. **movie-name** must be a symbol, not a number.

volume [**integer**]
Set the audio level of the current movie. The maximum level is 255; setting the level negative acts to mute the current movie, but the '**mute**' command can restore the audio level to the corresponding positive value.

File format: QuickTime™ movie

Comments: The *wqt* object was designed to address a critical weakness of the standard *movie* object: there was no way to request only a section of the movie be played, even though QuickTime™ supports this ability. One feature of the standard *movie* object was not retained—mouse motion over the *wqt* object is not detected.

x10



Description of object: *x10* is an interface to the X-10 controller originally from X-10 Incorporated. It sends commands to a *serialX* object, which controls the serial port that the X-10 is attached to, and responds to data returned from the X-10 via the *serialX* object.

Object created: September 1996

Current version: 1.0.8

Online help file: no

Object theme: Device interface

Object class(es): Devices

Argument(s):

kind **(optional) symbol**, the type of X-10 controller to communicate with. The acceptable values are 'cm11' and 'cp290'. The default kind is 'cm11'.

poll-rate **(optional) integer**, the rate (in milliseconds) at which the companion *serialX* object is polled via a sample request. The default rate is 100 milliseconds between sample requests.

Inlet(s):

1. **list**, the command channel
2. **integer**, the feedback from the *serialX* object

Outlet(s):

1. **integer**, the commands to the *serialX* object
2. **bang**, the sample request to the *serialX* object
3. **integer**, the base house-code
4. **bang**, the command has completed
5. **integer**, the device status (sent as a result of each command)
6. **integer**, the day number
7. **integer**, the hour number
8. **integer**, the minute number

9 bang, an error was detected

Companion object(s): works with *serialX* objects, can be attached to *x10units* objects

Standalone: yes

Retains state: yes

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

clear! eventNumber
Remove the given event, **eventNumber**, where **eventNumber** is an integer between 0 and 127.

clock!
Set the clock of the X-10 device to match the Macintosh time-of-day clock.

dim house-code map [**level**]
Given a set of unit codes for the devices controlled by the X-10 device, **map**, and the name of the X-10 device, **house-code**, immediately dim the specified devices to the value of **level**, which is an integer between 0 and 15. The set of unit codes is obtained by passing the list of device numbers through the *x10units* object. The name of the X-10 device is a single character symbol between 'A' and 'P'. If **level** is not given, it is assumed to be zero.

events?
Interrogates the X-10 device for its event data, but does nothing with the results.

everyday! house-code map eventNumber hourMinute function [**level**]
Given a set of unit codes for the devices controlled by the X-10 device, **map**, and the name of the X-10 device, **house-code**, an event number, **eventNumber**, the encoded time, **hourMinute**, the operation to perform, **function** (either 'on', 'off' or 'dim') and the dimming level, **level**, record the event in the X-10 device as a 'normal' event for activation at the given time, every day of the week. The set of unit codes is obtained by passing the list of device numbers through the *x10units* object. The name of the X-10 device is a single character symbol between 'A' and 'P'. The event number is an integer between 0 and 127. The time is encoded by multiplying the desired hour by 60 and adding the minutes; it is effectively the number of minutes after midnight. The dimming level is an integer between 0 and 15.

graphics! object-number [**object-data**]
Set the graphics data of the X-10 device to the two given integer values. There is no current use for this information. If **object-data** is not given, it is assumed to be zero.

graphics?
Interrogates the X-10 device for its icon data, but does nothing with the results.

housecode! letter
Set the name of the X-10 device to the given value, **letter**, where the value is a single character symbol between 'A' and 'P'.

housecode?
Return the current time (day, hour and minute) and the X-10 house-code via the corresponding outlets.

off house-code map

Given a set of unit codes for the devices controlled by the X-10 device, **map**, and the name of the X-10 device, **house-code**, immediately turn off the specified devices. The set of unit codes is obtained by passing the list of device numbers through the *x10units* object. The name of the X-10 device is a single character symbol between ‘A’ and ‘P’.

on house-code map

Given a set of unit codes for the devices controlled by the X-10 device, **map**, and the name of the X-10 device, **house-code**, immediately turn on the specified devices. The set of unit codes is obtained by passing the list of device numbers through the *x10units* object. The name of the X-10 device is a single character symbol between ‘A’ and ‘P’.

kind device-type

Change the protocol to match the given **device-type**. The **device-type** is either ‘cm11’ or ‘cp290’.

normal! house-code map eventNumber dayMap hourMinute function [**level**]

Given a set of unit codes for the devices controlled by the X-10 device, **map**, and the name of the X-10 device, **house-code**, an event number, **eventNumber**, a set of days, **dayMap**, the encoded time, **hourMinute**, the operation to perform, **function** (either ‘on’, ‘off’ or ‘dim’) and the dimming level, **level**, record the event in the X-10 device as a ‘normal’ event for activation at the given time on the given days. The set of unit codes is obtained by passing the list of device numbers through the *x10units* object. The name of the X-10 device is a single character symbol between ‘A’ and ‘P’. The event number is an integer between 0 and 127. The set of days is an integer between 0 and 127, representing which days the event is to occur on, with a single bit corresponding to each day of the week. The time is encoded by multiplying the desired hour by 60 and adding the minutes; it is effectively the number of minutes after midnight. The dimming level is an integer between 0 and 15.

reset

Send a diagnostic command to the X-10 device, forcing a reset of the device.

security! house-code map eventNumber dayMap hourMinute function [**level**]

Given a set of unit codes for the devices controlled by the X-10 device, **map**, and the name of the X-10 device, **house-code**, an event number, **eventNumber**, a set of days, **dayMap**, the encoded time, **hourMinute**, the operation to perform, **function** (either ‘on’, ‘off’ or ‘dim’) and the dimming level, **level**, record the event in the X-10 device as a ‘secure’ event for activation at the given time on the given days. The set of unit codes is obtained by passing the list of device numbers through the *x10units* object. The name of the X-10 device is a single character symbol between ‘A’ and ‘P’. The event number is an integer between 0 and 127. The set of days is an integer between 0 and 127, representing which days the event is to occur on, with a single bit corresponding to each day of the week. The time is encoded by multiplying the desired hour by 60 and adding the minutes; it is effectively the number of minutes after midnight. The dimming level is an integer between 0 and 15.

today! house-code map eventNumber hourMinute function [**level**]

Given a set of unit codes for the devices controlled by the X-10 device, **map**, and the name of the X-10 device, **house-code**, an event number, **eventNumber**, the encoded time, **hourMinute**, the operation to perform, **function** (either ‘on’, ‘off’ or ‘dim’) and the dimming level, **level**, record the event in the X-10 device as a ‘normal’ event for activation at the given time today. The set of unit codes is obtained by passing the list of device numbers through the *x10units* object. The name of the X-10 device is a single character symbol between ‘A’ and ‘P’. The event number is an integer between 0 and 127. The time is encoded by multiplying the desired hour by 60 and adding the minutes; it is effectively the number of minutes after midnight. The

dimming level is an integer between 0 and 15.

tomorrow! house-code map eventNumber hourMinute function [**level**]

Given a set of unit codes for the devices controlled by the X-10 device, **map**, and the name of the X-10 device, **house-code**, an event number, **eventNumber**, the encoded time, **hourMinute**, the operation to perform, **function** (either 'on', 'off' or 'dim') and the dimming level, **level**, record the event in the X-10 device as a 'normal' event for activation at the given time tomorrow. The set of unit codes is obtained by passing the list of device numbers through the *x10units* object. The name of the X-10 device is a single character symbol between 'A' and 'P'. The event number is an integer between 0 and 127. The time is encoded by multiplying the desired hour by 60 and adding the minutes; it is effectively the number of minutes after midnight. The dimming level is an integer between 0 and 15.

xreset

Clear the internal state of the *x10* object, without waiting for completion of pending commands.

Comments: Figure 22 shows how to connect an *x10* object to a *serialX* object.

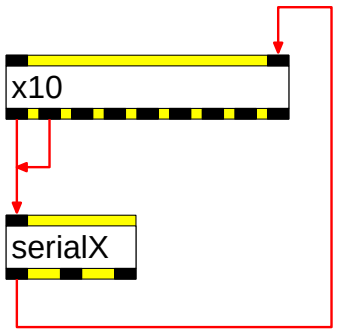
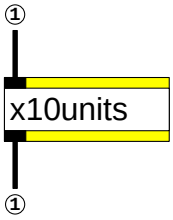


Figure 22: Connecting an *x10* object to a *serialX* object

x10units



Description of object: *x10units* is an auxiliary object to be used with *x10* objects. Its purpose is to permit the use of simple numbers to represent the unit codes used with the *x10* object, by mapping small integers into the bit patterns needed.

Object created: September 1996

Current version: 1.0.6

Online help file: no

Object theme: Miscellaneous

Object class(es): Lists

Argument(s): none

Inlet(s):

1 **integer**/**list**/**bang**, the value to be mapped

Outlet(s):

1 **integer**, the mapped output of the inlet value, or the previous result (if a 'bang' is received). If the inlet value is a list, the outlet value will be the bit-wise 'OR' of the result of mapping each list element.

Companion object(s): works with *x10* objects

Standalone: yes

Retains state: no

Compatibility: *Max* 3.x and *Max* 4.x {OS 9 and OS X}

Fat, PPC-only or 68k-only: Fat

Command language syntax:

bang
Return the previous result, if any.

Appendix *Phidgets*

Phidgets are 'plugins' for use with the *fidget* object. They must be placed in a folder named 'Phidgets', located in the same folder as the *Max* program. Each plugin corresponds to a device and is named to match the device. In the descriptions of the commands for each plugin, the following abbreviations are used: '***standard-do***' is the list '**do deviceType serialNumber/***', '***standard-get***' is the list '**get deviceType serialNumber/***', '***standard-put***' is the list '**put deviceType serialNumber/***' and '***standard-response***' is the list '**deviceType serialNumber**'. Device serial numbers are prefixed with an underscore character ("_") to guarantee their interpretation as symbols rather than numbers.
The following plugins are available: *InterfaceKit004*, *InterfaceKit888*, *QuadServo*, *RFID*, *TextLCD*, *TextLCD088* and *UnitServo*.

InterfaceKit004

Description of plugin: *InterfaceKit004* corresponds to the PhidgetInterfaceKit 0/0/4 device, which has four relay outputs.

Plugin created: December 2003

Current version: 1.0.1

Command language syntax:

standard-do flip/off/on port
Set the state of the specified digital output port to '1' ('on'), '0' ('off') or the reverse of its current state ('flip'). The port is limited to between 1 and 4.

standard-get
Sends the current digital output value out the report output of the *fidget* object, as the list '***standard-response*** value $bit_1 \ldots bit_4$'. The value is limited to between 0 and 15.

standard-put bits
Sets the digital output to the given value. The argument **bits** is limited to between 0 and 15. Each of the digital output ports is set to the corresponding bit of the value.

InterfaceKit888

Description of plugin: *InterfaceKit888* corresponds to the PhidgetInterfaceKit 8/8/8 device, which has eight analog inputs, eight digital inputs and eight digitial outputs.

Plugin created: December 2003

Current version: 1.0.1

Command language syntax:

standard-do flip/on/off port
Set the state of the specified digital output port to '1' ('on'), '0' ('off') or the reverse of its current state ('flip'). The port is limited to between 1 and 8.

standard-do trigger on/off
Enables or disables the digital input triggering mechanism. If the mechanism is enabled, a change to one of the digital inputs results in the transmission of the current digital input through the report output of the *fidget* object. The digital input is sent as the list '***standard-response*** di value bit_1 ... bit_8'. The digital values are limited to between 0 and 255.

standard-get ai/di/do
Sends the current analog input ('ai'), digital input ('di') or digital output ('do') out the report output of the *fidget* object. The analog input is sent as the list '***standard-response*** ai $analog_1$ ... $analog_8$', the digital input is sent as the list '***standard-response*** di value bit_1 ... bit_8' and the digital output is sent as the list '***standard-response*** do value bit_1 ... bit_8'. The digital values are limited to between 0 and 255; the analog values are between zero and one.

standard-put bits
Sets the digital output to the given value. The argument **bits** is limited to between 0 and 255. Each of the digital output ports is set to the corresponding bit of the value.

QuadServo

Description of plugin: *QuadServo* corresponds to the 4-Motor PhidgetServo device, which controls four servo motors.

Plugin created: December 2003

Current version: 1.0.1

Command language syntax:

standard-get All
Sends the current position of all the servoes (as a percentage) out the report output of the *fidget* object, as the list '***standard-response*** $position_1$ $position_2$ $position_3$ $position_4$'.

standard-get Si servo
Sends the current position of the specified servo (as a percentage) out the report output of the *fidget* object, as the list '***standard-response*** position'. The argument **servo** is limited to between 1 and 4.

standard-put All $position_1$ $position_2$ $position_3$ $position_4$
Sets the position of all the servoes to the given values, expressed as percentages of a circle.

standard-put So servo position
Sets the position of the specified servo to the given value, expressed as a percentage of a circle. The argument **servo** is limited to between 1 and 4.

RFID

Description of plugin: *RFID* corresponds to the PhidgetRFID device, which reads RFID (*R*adio *F*requency *ID*entification) tags. Note that the RFID plugin will generate messages asynchronously, when an RFID tag is brought in to close proximity of the device.

Plugin created: December 2003

Current version: 1.0.1

Command language syntax:

standard-do on/off
Asynchronous notification of RFID tags will be enabled ('on') or disabled ('off'). If asynchronous notification is enabled, when a tag is placed close to the RFID device, the list '***standard-response*** RFIDtag' will be sent out the report output of the *fidget* object. The value 'RFIDtag' is a symbol composed from the hexadecimal representation of the RFID tag, prefixed with an underscore character ("_"). Note that the list is only sent when the tag approaches the device, and a new list is output when a different tag appears.

standard-get
Sends the current RFID tag out the report output of the *fidget* object, as the list '***standard-response*** RFIDtag'. The value 'RFIDtag' is a symbol composed from the hexadecimal representation of the RFID tag, prefixed with an underscore character ("_").

Comments: Note that *RFID* can be polled (using the '**get**' command) or configured to asynchronously report the presence of RFID tags (using the '**do**' command).

TextLCD

Description of plugin: *TextLCD* corresponds to the PhidgetTextLCD 20X2 device, which displays text on an LCD screen with two rows of twenty characters.

Plugin created: December 2003

Current version: 1.0.1

Command language syntax:

standard-do backlight on/off
Turns the LCD screen backlight on or off.

standard-do clear [**1**/**2**]
Clears the top row of the LCD screen ('1'), the bottom row ('2') or both rows, if no argument is given.

standard-do cursor left/right
Move the cursor of the LCD screen left or right.

standard-do display left/right
Shift the text shown on the LCD screen either left or right.

standard-do entrymode [**reverse**] [**shift**]
Specify the text entry mode of the LCD screen. If ‘reverse’ is specified, the text entry position decreases after each character is added to the screen. If ‘reverse’ is not specified, the text entry position increases after each character is added to the screen. If ‘shift’ is specified, the screen is shifted after each character is added to the screen, in the direction opposite to the text entry. The entered text appears to stay still while the rest of the screen moves. If ‘shift’ is not specified, the screen is not shifted.

standard-do go row [**column**]
Move the text entry point for the LCD screen to the given row (either ‘1’ or ‘2’) and the given column (between 1 and 20). If the argument **column** is not present, it is assumed to be one.

standard-do off
Turn off the LCD screen.

standard-do on [**blink**] [**cursor**]
Turn on the LCD screen. The cursor format is indicated by the keywords ‘blink’ and ‘cursor’. If ‘blink’ is specified, a block cursor will be used (the whole text cell at the cursor location will blink off and on). If ‘cursor’ is specified, an underline cursor will be used. Both ‘blink’ and ‘cursor’ can be specified.

standard-do write anything
Display the given values as text on the LCD screen.

TextLCD088

Description of plugin: *TextLCD088* corresponds to the PhidgetTextLCD 20X2 with 0/8/8 InterfaceKit device, which displays text on an LCD screen with two rows of twenty characters, as well as providing eight digital inputs and eight digital outputs.

Plugin created: December 2003

Current version: 1.0.1

Command language syntax:

standard-do flip/on/off port
Set the state of the specified digital output port to ‘1’ (‘on’), ‘0’ (‘off’) or the reverse of its current state (‘flip’). The port is limited to between 1 and 8.

standard-do to backlight on/off
Turns the LCD screen backlight on or off.

standard-do to clear [**1/2**]
Clears the top row of the LCD screen (‘1’), the bottom row (‘2’) or both rows, if no argument is given.

standard-do to cursor left/right
Move the cursor of the LCD screen left or right.

standard-do to display left/right
Shift the text displayed on the LCD screen either left or right.

standard-do to entrymode [**reverse**] [**shift**]
Specify the text entry mode of the LCD screen. If ‘reverse’ is specified, the text entry position decreases after

each character is added to the screen. If ‘reverse’ is not specified, the text entry position increases after each character is added to the screen. If ‘shift’ is specified, the screen is shifted after each character is added to the screen, in the direction opposite to the text entry. The entered text appears to stay still while the rest of the screen moves. If ‘shift’ is not specified, the screen is not shifted.

standard-do to go row [**column**]
Move the text entry point for the LCD screen to the given row (either ‘1’ or ‘2’) and the given column (between 1 and 20). If the argument **column** is not present, it is assumed to be one.

standard-do to off
Turn off the LCD screen.

standard-do to on [**blink**] [**cursor**]
Turn on the LCD screen. The cursor format is indicated by the keywords ‘blink’ and ‘cursor’. If ‘blink’ is specified, a block cursor will be used (the whole text cell at the cursor location will blink off and on). If ‘cursor’ is specified, an underline cursor will be used. Both ‘blink’ and ‘cursor’ can be specified.

standard-do trigger on/off
Enables or disables the digital input triggering mechanism. If the mechanism is enabled, a change to one of the digital inputs results in the transmission of the current digital input through the report output of the *fidget* object. The digital input is sent as the list ‘***standard-response*** di value bit_1 . . . bit_8’. The digital values are limited to between 0 and 255.

standard-do to write anything
Display the given values as text on the LCD screen.

standard-get di/do
Sends the current digital input (‘di’) or digital output (‘do’) out the report output of the *fidget* object. The digital input is sent as the list ‘***standard-response*** di value bit_1 . . . bit_8’ and the digital output is sent as the list ‘***standard-response*** do value bit_1 . . . bit_8’. The digital values are limited to between 0 and 255.

standard-put bits
Sets the digital output to the given value. The argument **bits** is limited to between 0 and 255. Each of the digital output ports is set to the corresponding bit of the value.

UnitServo

Description of plugin: *UnitServo* corresponds to the 1-Motor PhidgetServo device, which controls a single servo motor.

Plugin created: December 2003

Current version: 1.0.1

Command language syntax:

standard-get
Sends the current position of the servo (as a percentage) out the report output of the *fidget* object, as the list ‘***standard-response*** **position**’.

standard-put position
Sets the position of the servo to the given value, expressed as a percentage of a circle.

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