

LEXIUM GMT

Graphical Motion Task
for Unilink Software

February 2005



Lexium Drive

Graphical Motion Tasking

Graphical Motion Tasking is an advanced feature of Unilink that enables you to program the Lexium drive as a single-axis positioner. You can control multiple motions, process I/O, make decisions, add time delays, and modify drive process variables. It offers a simple, user-friendly environment, enabling you to program an intuitive flow chart.

In its original form, Motion Tasking supported only chained moves in sequences executed once or in infinite loops. Graphical Motion Tasking extends the capabilities of Motion Tasking by adding looping, comparing (<, =, >, etc.) and calling functions, as well as setting process variables.



Graphical Motion Tasking is not available in Lexium drive firmware versions prior to version 5.80

Option card installation

Graphical Motion Tasking requires one of the following option cards to be installed:

- Extended I/O
- SERCOS
- Profibus
- FipIO
- MB+

If the appropriate option card is not installed, attempting to execute programs with non-motion blocks will generate an n08 error.

Since the release of drive firmware version 6.3 and with Unilink versions later than 3.0, an option card no longer needs to be installed.

Extended I/O card

If the Extended I/O card is installed, configure this card to increase the number of general purpose digital I/O available to your program. This card is available in addition to the standard digital I/O (IN1, IN2, IN3, IN4, O1 and O2).



Graphical Motion Tasking can also control and make decisions based on analog I/O.

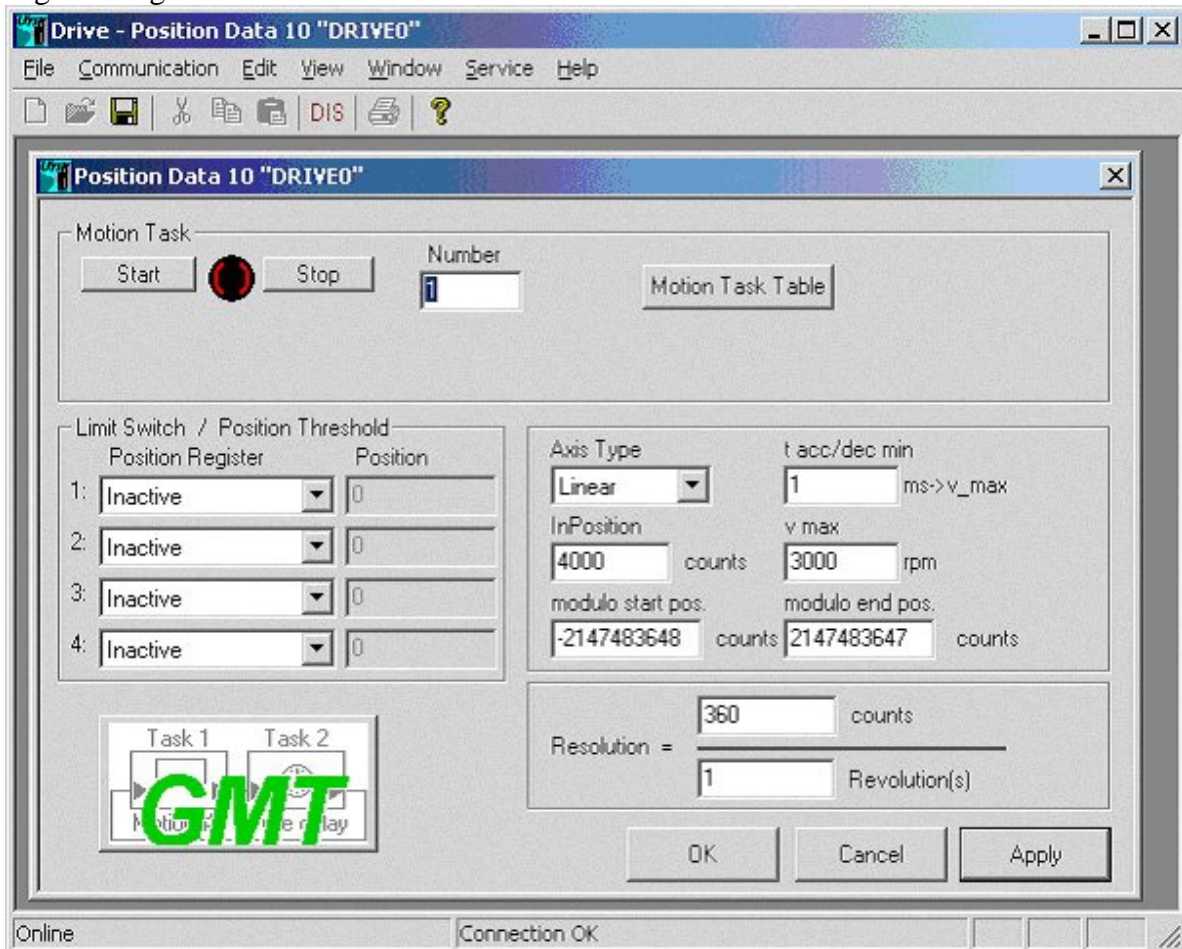
To be able to use four or nine inputs on the Extended I/O card as general purpose inputs, set IO11IN as follows:

	General purpose inputs available from the EI card	Inputs available to automatically start tasks from the EI card
IO11IN = 0 (default)	None	A0-A7 START_MT
IO11IN = 1	INS4-INS7 (A4-A7 on the EI card)	A0-A3 START_MT
IO11IN = 2	INS0-INS7 (A0-A7 on the EI card) INS8 (START_MT)	None

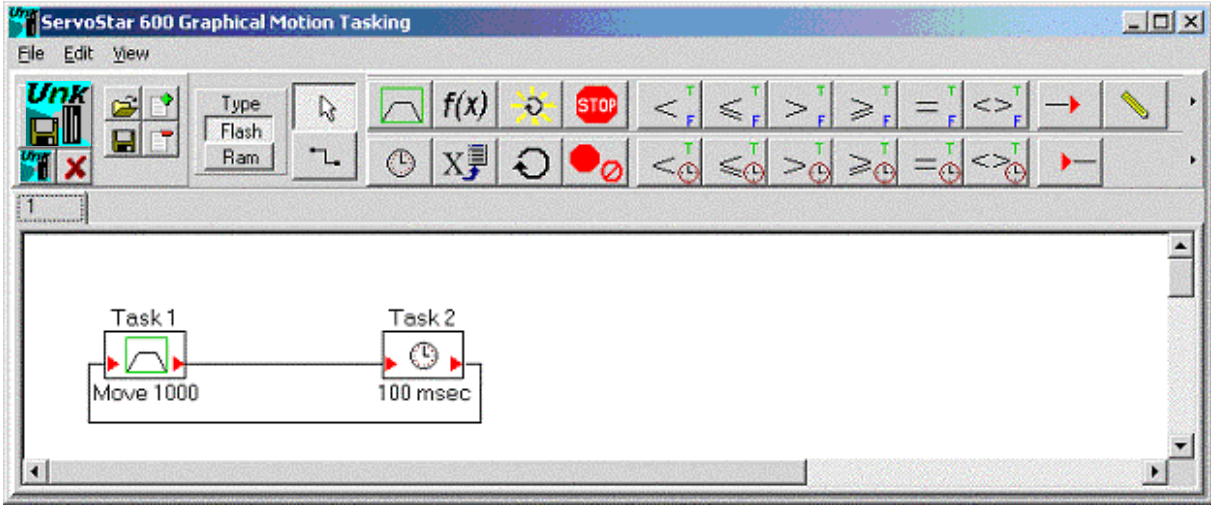
Up to five of the outputs on the Extended I/O can be configured for general purposes. Four of these outputs are called OS1, OS2, OS3 and OS4 and are shared with PosReg1-4 on the Extended I/O card. The fifth one is called OS5 and is shared with PosReg5 (X11B-10). Configure these lines using SWCNFG to configure SWE1 – SWE4 and SWCNFG2 to configure SWE5. For every SWEx line configured to be disabled, the corresponding output on the Extended I/O card can be controlled with the O_{sx} variable.

GMT programming environment

After installation, start Unilink. Click on the *Position* button from the main screen. At the top right, click on the *Position Data* button to display the *Position Data* dialog box, as shown below. In this screen, click on the *GMT* button at the bottom left to open the GMT programming environment.



The Graphical Motion Tasking programming environment, shown below, has several controls at the top left, motion tasking blocks at the top right, and the GMT canvas at the bottom of the screen. The figure below shows a simple GMT program, which indefinitely repeats a 1000-count move followed by a 100 msec time delay.



Controls

Return to Drive

Click on either of the *Return to Drive* icons to return and download your motion task program to the drive. Clicking on the icon with the diskette automatically saves the file; the other icon provides an option for saving it. Usually, you should save your program before exiting, as GMT requires the original GMT file to produce the block diagram. GMT cannot produce a diagram from the data stored in the drive.

Cancel

Click on the *Cancel* icon to discard the program changes and return to the Lexium Drive user interface.

File Open

The *File Open* icon allows you to open a GMT program. GMT programs must be read from GMT files rather than from the Lexium drive program memory.

File Save

The *File Save* icon allows you to save the current GMT programs in a GMT file.

Add Page

The *Add Page* icon allows you to add pages for programs that are too large to fit on one page. Pages are automatically numbered, but you can rename them. Double-click on the “Page” tab. A dialog box appears for you to enter the relevant name. The figure below shows the tabs in a program comprising two pages called “Main Page” and “Aux Page”. You can interconnect GMT diagrams between different pages using extenders, which will be discussed later on.



Delete Page

The *Delete Page* icon allows you to delete pages in programs.

Flash/Ram

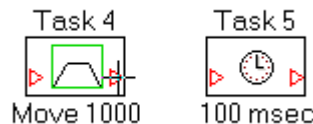
Motion blocks can be transferred to the Lexium drive to be saved either to flash memory or RAM. Flash memory is non-volatile. When the drive is powered down, it retains flash blocks. However, the drive must be disabled when downloading blocks to the flash memory. RAM is volatile, but does not require the drive to be disabled. Downloading to RAM is a faster procedure. Flash blocks occupy order blocks 1 to 180, while RAM blocks occupy 181 to 255. Order numbers for new blocks are chosen according to the position of the *Flash/Ram* button. If you want to transfer an existing block to flash memory or RAM, place the cursor over the relevant block and right-click to display a pop-up menu. Select "Convert to Flash Block" or "Convert to RAM Block" from the menu.

Select

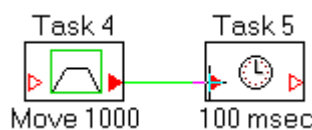
The *Select* icon allows you to use the mouse to select new blocks that you want to place on the GMT canvas. It also allows you to use the mouse to select blocks on the canvas that you want to delete or move, or for initializing a process variable. In the last instance, double-click on a block to set its parameters.

Flow Path

The *Flow Path* icon supports flow interconnection between blocks. When this icon is enabled, you can start a flow path by clicking on a *flow source* or *flow destination* (red triangle).



Then move the mouse to the connection point and click on it again to end the flow path.



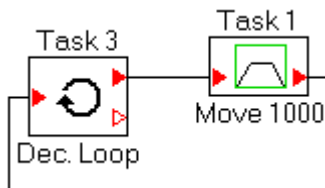
Click on the *Select* icon or Esc key to terminate the path.



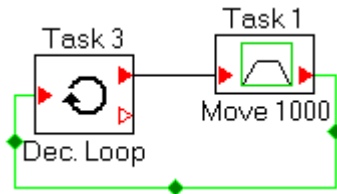
The most common flow path involves connecting a flow source from one block to a flow destination of another. Multiple sources can be connected together; however, multiple destinations cannot be interconnected. Their operation is not affected by the connection order.

Flow path routing

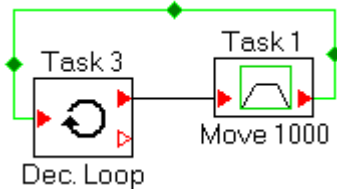
GMT automatically routes the flow path. You can modify routes where there are two or more bends. To do this, deselect the flow path. Start with an existing flow path connection, like the one shown below, then click on the *Select* icon.



Click on the flow path icon to display the green diamond "handles".



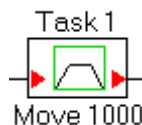
Click on the new flow path and move it by dragging, as shown below:



Even if you move the two blocks connected by the flow path, the routing remains unchanged. However, if you move either one of the blocks, the routing reverts to its default setup.

Task order numbers

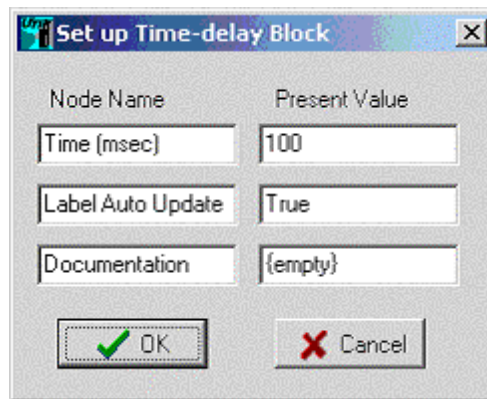
The task order number is automatically displayed above the blocks that represent the relevant tasks. The task order number can be modified by placing the cursor on the block and right-clicking; a pop-up menu will appear from which you can select "Set Order Number". You can select any unused order number as the new order number.



Block labels and documentation

Block labels are printed below most blocks. A label is a brief description of the relevant block's function. For example, the figure above shows a motion block with the label "Move 1000", indicating that this is a 1000-count move. Labels are automatically updated when a block's parameters are changed. If you want to modify a label, double-click on it and a dialog box appears that allows you to change the label. When a label is modified, this disables its automatic update feature. It should be noted that labels are only for convenience and do not change the blocks' function. The only exceptions to this are extender blocks, which use the block label to indicate which extenders should be connected.

If you want to re-enable "Label Auto Update", double-click on the block and change the "Present Value" of the "Label Auto Update" node to "True".



Most blocks support user documentation. You can write documentation by clicking in the edit box to the right of the "Documentation" edit box (bottom right of the dialog box shown above). Documentation has no effect on the normal operation of motion tasks.

OPMODE 8

The Lexium drive must be configured in OPMODE 8 (Position Motion Tasks) to execute motion tasks. This mode can be selected from the main user interface software screen.

Running your Motion Task program

Use the Motion Task *Start* and *Stop* buttons at the top left of the *Position Data* dialog box to start and stop your motion tasks (this dialog box will appear when you close the GMT programming environment).



Specify the starting task order number in the *Number* edit box to the right of the Motion Task *Stop* button. The order number is shown above each block that represents a motion task.

Initial homing

You must provide initial homing before you can run a motion task. The Lexium drive supports a wide variety of homing methods. Consult the product documentation for further details. The simplest homing sequence involves accessing the homing screen (from the *Position* screen) and selecting home mode 0 (Set Reference Point Immediately). Then click on the Home *Start* button. This sets the current position to home and generates no motion. Homing can be executed during operation by configuring the Lexium drive process variables NREF and MH using the Set Process variable blocks. If you try to execute motion tasking without homing the drive, an n09 error is generated.

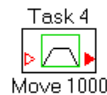
Tasknum

During execution, the Lexium variable TASKNUM retains the current task number. You can use the terminal screen in the user interface software to view the TASKNUM value. If TASKNUM equals -1, motion tasking is not performed.

Graphical motion task blocks

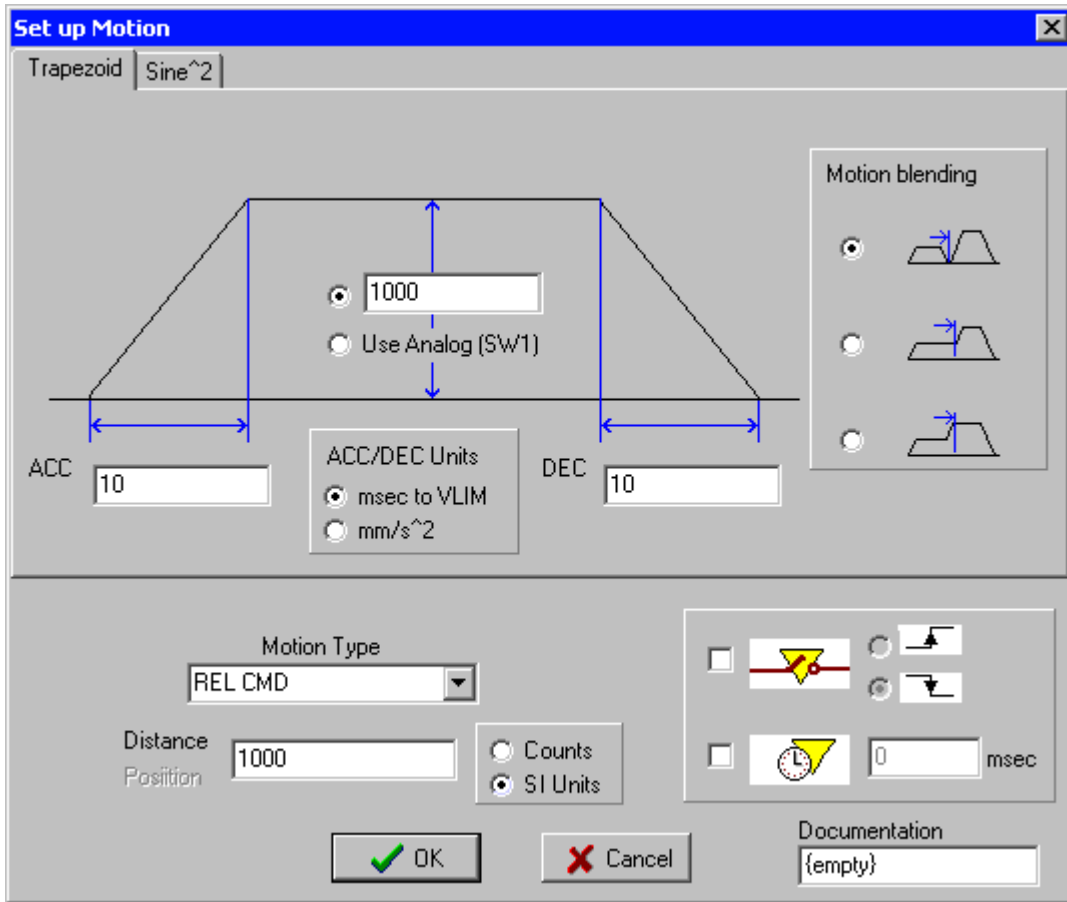
Motion tasks comprise motion blocks interconnected by flow paths. Each motion block occupies one motion task.

Motion



Motion blocks support multiple motion types, including trapezoidal and Sine² profiles, motion blending, time delays and I/O time delays. They support all Lexium drive motion types. Program flow enters from the input flow connection (normally on the left) and remains within the block until the move is complete. The flow then proceeds to the output flow path.

The motion block set up screen for trapezoidal moves is shown below.



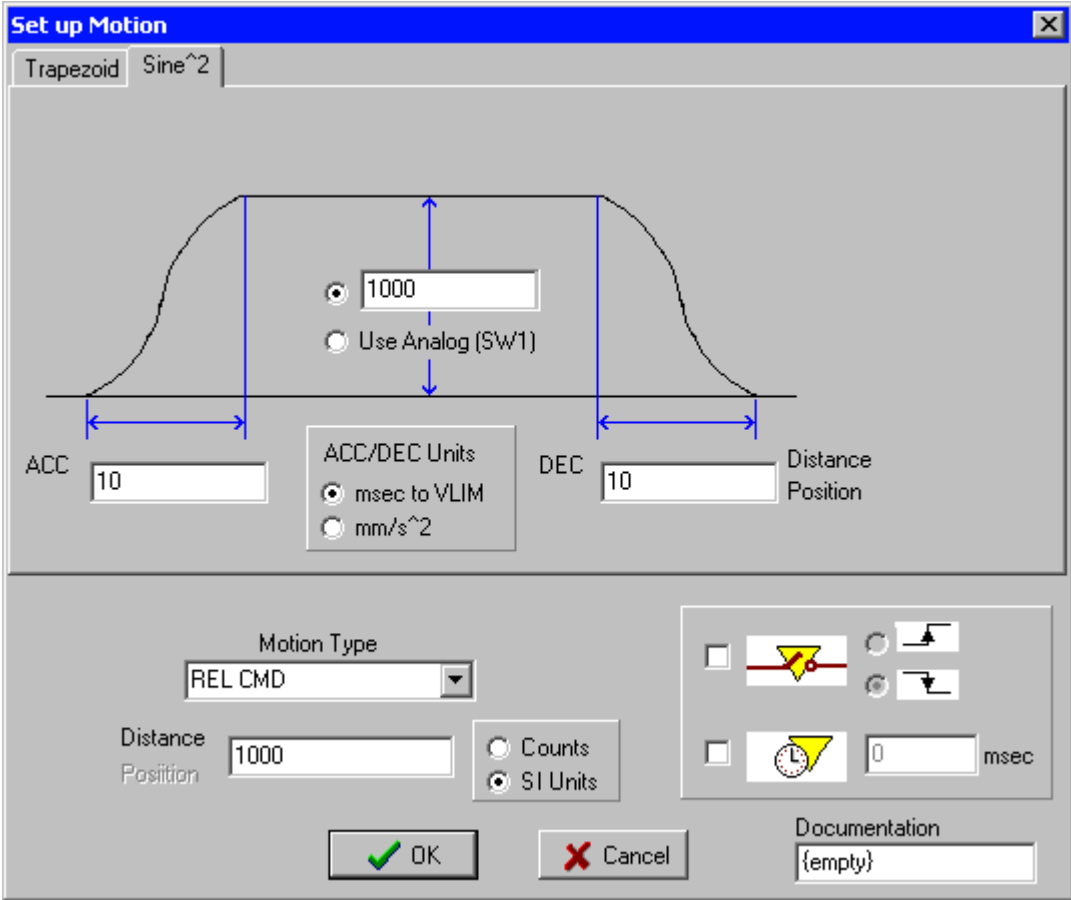
In this screen you can set acceleration and velocity variables in the top left area. The motion type (relative, absolute, etc.) and the target position/distance can be set at the bottom left of the screen.

When this motion block is connected so that it flows to another motion block, several options are enabled. First, you set the Motion blending parameter at the top right of the window. You can choose between non-blended moves (top radio button), blending where the speed change to the next move begins at the target position of this move (middle radio button), or even blending where the speed change to the next move is completed at the target position of this move (bottom radio button). For non-blended moves, you can add delays for I/O and a time at the bottom right of the screen.



Blending can be used only when the next block is another motion block. Otherwise, blending is disabled.

The motion block set up screen for Sine^2 moves is shown below. The Sine^2 screen is similar to the trapezoidal move screen, except that Sine^2 moves cannot be blended. You should note that if you load special profiles using the UPDATE LOOKUP command, selecting Sine^2 will select your special profile.

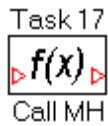


The *Stop* block stops the motor and ends motion tasking. The drive is still enabled after the motion has stopped. This block has the same function as the Set Process Variable block with the STOP command. This block has a single input flow connection. There is no output flow because motion tasking ends upon execution of this command.



In this current version, the *Stop/Disable* block performs the same action as the previous *Stop* block.

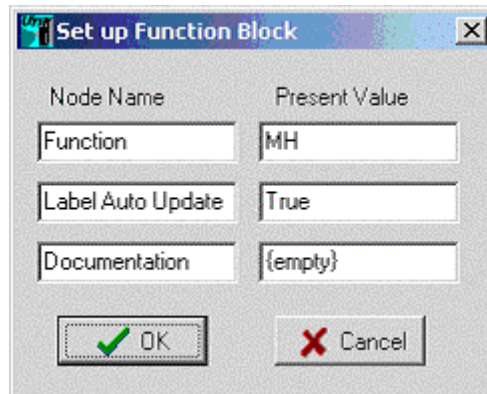
Call Function



The *Call Function* block allows you to call the following functions at any time:

- MH
- S
- SETREF
- STOP

To select the function to be called, place the Set Call Function block on the canvas and double-click on it. The Set up dialog box below appears.



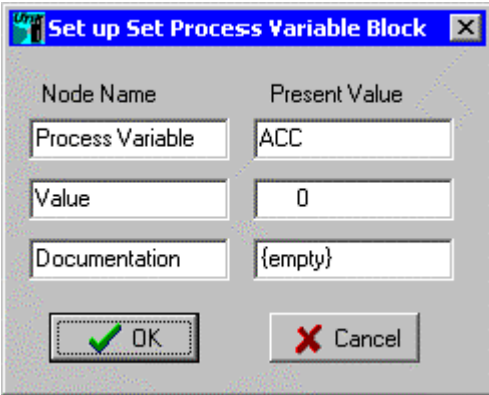
Click in the edit box to the right of the Function option and a drop-down list appears from which you can select the function to call.

Set Process Variable

The Set Process Variable block allows you to set the value of the following drive process variables at any time (non-exhaustive list):

- | | | | |
|---------|---------|---------|---------|
| ACC | DEC | DECDIS | DECSTOP |
| DOVRIDE | DREF | ENCMODE | ENCZERO |
| ERND | GEARI | GEARO | GV |
| IN1TRIG | IN2TRIG | IN3TRIG | IN4TRIG |
| NREF | O1 | O1TRIG | O2 |
| O2TRIG | OS1 | OS2 | OS3 |
| OS4 | OS5 | PEMAX | PVMAX |
| PVMAXN | REFIP | SWEO | SWEON |
| SPSET | VLIM | VLIMN | VREF |

To select the value that the process variables will be set to, place the Set Process Variable block on the canvas and double-click on it. The Set up dialog box below appears. Click in the edit box to the right of the Process Variable option and a drop-down list appears from which you can select the variable. Click in the edit box to the right of the Value box to set the value.



GMT process variables can only support integer values. You should note that many variables are weighted, which allows them to be entered as floating point numbers from the serial interface used by the Lexium drive user interface. However, these variables are stored in the drive as integers after being scaled by 1000. These variables include: GV, IPEAK, IPEAKN, REFIP, VLIM and VLIMN. For example, setting the process variable GV to 2200 in GMT is equivalent to setting the variable GV to 2.2 in the user interface.

Initialize Loop

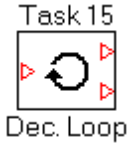


The *Initialize Loop* block initializes the Lexium drive loop counter. The number of counts is its only parameter. Place the *Initialize Loop* on the canvas and double-click on it to open the Set up dialog box. Specify the number of loops using the *Initial Value* parameter. You should note that the number of loops executed is one more than the initial value.



Only a single loop can be executed at a time as there is only one counter.

Decrement Loop



The *Decrement Loop* decrements the loop counter. There is one input flow connection to decrement the loop counter and two output flow connections: one for when the loop is being counted and the other for when the loop is complete. If the loop counter is greater than 0 when entering the loop, the flow continues through the loop output (top right) after the decrement. Otherwise, the flow continues through the loop's complete output (bottom right).

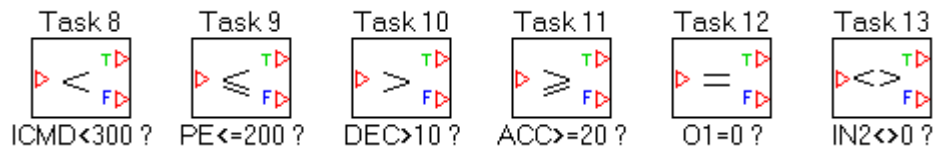
Input Extender Ext

Extenders are provided to support connections between two points that are very far apart (where the wiring is confusing or impractical) or on different pages. Extenders are eliminated when the motion task program is compiled so that extenders do not affect normal operation. When two extenders have identical names, they are treated as being connected together.

Output Extender Ext

Output extenders behave in a similar manner to input extenders, the difference being that they are drawn with the arrow facing the opposite direction. It is useful for the user to have input and output extenders and this does not affect the motion task's normal operation.

Comparison blocks (LT, LE, GT, GE, EQ, NE)



Comparison blocks compare a parameter to a value and the flow continues according to the comparison. There is a single input flow path and two output flow paths, True (T) and False (F).



The T output must be connected to a block. The F block can be left unconnected. If the flow follows an unconnected F path, motion tasking stops.

To select the variable, place the block on the canvas and double-click on it to open the Set up dialog box below.

Node Name	Present Value
Process Variable	ICMD
Compare Value	300
Label Auto Update	True
Documentation	{empty}

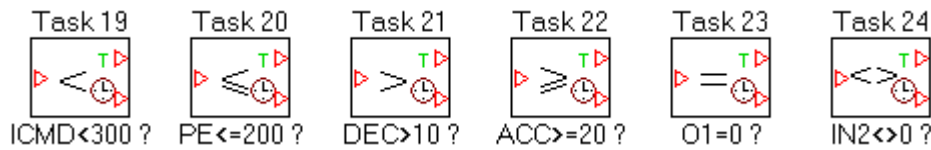
OK Cancel

The following parameters can be used for comparison (non-exhaustive list):

ACC	DEC	DECDIS	DECSTOP
DOVRIDE	DREF	ENCMODE	ENCZERO
ERND	GEARI	GEARO	GV
I	ICMD	IN1	IN1TRIG
IN2	IN2TRIG	IN3	IN3TRIG
IN4	IN4TRIG	INS0	INS1
INS2	INS3	INS4	INS5
INS6	INS7	INS8	LATCH16
LATCH16N	LATCH32	LATCH32N	LATCHX32
LATCHX32N	MONITOR1	MONITOR2	NREF
O1	O1TRIG	O2	O2TRIG
OS1	OS2	OS3	OS4
OS5	PEMAX	PE	PFB
PFB0	PRD	PVMAX	PVMAXN
REFIP	SWEO	SWEON	SPSET
VLIM	VLIMN	VREF	

GMT process variables can only support integer values. You should note that many variables are weighted, which allows them to be entered as floating point numbers from the serial interface used by the Lexium drive user interface. However, these variables are stored in the drive as integers after being scaled by 1000. These variables include: GV, I, ICMD, IPEAK, IPEAKN, REFIP, VLIM and VLIMN. For example, comparing the process variable ICMD to 3500 in GMT is equivalent to setting the variable ICMD to 3.5 using the serial port.

Timed comparison blocks (LT, LE, GT, GE, EQ, NE)



Comparison blocks compare a parameter to a value and the flow continues according to the comparison. The flow path comes through the T output as soon as the comparison result is true. Otherwise, an adjustable time delay is enabled. Once the time delay has expired and if the comparison is still false, the flow path comes through the F output.



The T output must be connected to a block. The F block can be left unconnected. If the flow follows an unconnected F path, motion tasking stops.

To select the variable, place the block on the canvas and double-click on it to open the Set up dialog box below.

The same variables are available for timed and standard comparison blocks, and the compare value is set in the same way. Set "Max Time" as the F output timeout period. If "Max Time" is set to 0, these blocks behave like standard (non timed) comparison blocks.

Delay for Time



The *Delay for Time* block allows you to set a delay in the motion tasks. The flow remains in the block during the delay period.

Note



Note

The *Note* block is provided for user documentation. *Note* blocks do not affect the normal operation of motion tasks.

Execution Time

The following table lists the execution times by command name:

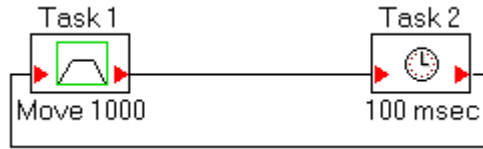
Command name		Execution time
Call	MH	Length of homing command
	S	Ends motion tasking
	SETREF	1 ms
	STOP	Ends motion tasking
Comparison		1 ms
Extenders		0 ms
Initialize Loop		1 ms
Decrement Loop		2 ms
Motion		Length of motion control
Note		0 ms
Stop		Ends motion tasking
Stop and Disable		Ends motion tasking
Set Process Variable		1 ms
Timed comparison		1 ms if True; delay time + 1 ms if False
Delay for time		Delay time +1 ms

*In this current version, the *Stop/Disable* block performs the same action as the previous *Stop* block.

Examples

Infinite loop: move followed by a delay

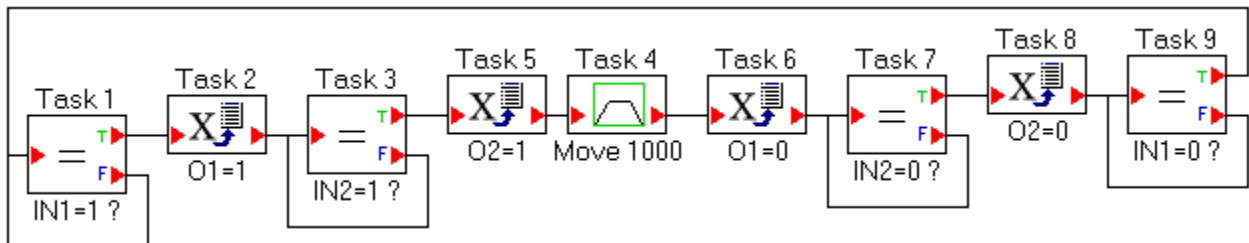
An infinite loop followed by a delay is shown below.



Blending I/O control and motion

In this example, an auxiliary device with digital I/O is being controlled. The sequence is as follows:

1. IN1 is used to start the process.
2. Turn on the auxiliary device with O1.
3. Wait for the auxiliary device to come on, as shown by IN2.
4. Start the move.
5. Indicate to the external device with O2 that motion is in progress.
6. Turn the auxiliary device off with O1.
7. Wait for the auxiliary device to go off, as shown by IN2.
8. Indicate to the external device with O2 that the move has been completed.
9. Wait for the sequence start (IN1) to resume.
10. Restart the sequence.



Looping and motion

This example shows a 1000-count move being performed, followed by a 500 ms delay twice each time IN1 is cycled.

