Soft Servo
SYSTEMS, INC

Operator's Manual for WMX Console

Revision 0.9688

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Chapter 1: Welcome to WMX Console

1.1 Overview of WMX

WMX is a soft motion technology that combines simplicity with power, allowing developers to create customized PC-based motion controllers for the EtherCAT interface using an intuitive Windows API library. Motion controllers built using WMX can control up to 64 axes individually in real time. Because WMX is PC-based, developers can take advantage of the processing power of PC processors and the flexibility and familiarity of PC programming languages. WMX software technology runs on Windows XP and Windows Embedded Standard with IntervalZero's RTX technology.

Soft Servo Systems' WMX is available for the following servo platforms:

- EtherCAT Ethernet-based servo network (under development)

1.2 Overview of WMX Console

WMX Console is a simple MDI-style application that demonstrates some of the capabilities of the WMX API. It runs on a standard PC that operates with Microsoft Windows XP, Windows XPe, or Windows 7 with an IntervalZero RTX real-time extension. For additional information regarding the operation of WMX and applications built using the WMX API, refer to the *WMX Installation and Setup Manual* for your interface system. The WMX Console application is intended to be operated using a mouse and a keyboard or keypad.

The WMX Console application provides control for 64 servo drives. Applications built using the WMX API are able to control up to 64 axes simultaneously and independently. The operations included in the WMX Console application are single axis positioning, multiple axis positioning, homing, sync control, I/O control, and parameter configuration.

1.3 Software Requirements

WMX Console requires Microsoft .NET Framework 2.0 Service Pack 2 and Microsoft Visual C++ 2005 Service Pack 1 Runtime to be installed.

Chapter 2: Starting WMX Console

2.1 Starting the WMX Console Application

Make sure that all the software is properly installed and the system hardware is properly set up before running WMX Console. Refer to the *WMX Installation and Setup Manual* for the appropriate interface system for the hardware setup procedure.

Start WMX Console by double clicking on the WMX Console icon on your PC's desktop. Alternatively, double-click the "WMXConsole.exe" file in the "C:\Program Files\SoftServo\WMXConsole" directory.

Upon starting WMX Console, the following initialization procedure is automatically invoked:

- WMX Real-Time Engines are loaded. Communication with the devices in the servo network is initiated.
- Saved parameters from the last run of the WMX Console application are loaded.

The WMX Console is an MDI (multiple document interface) style application. Inside the main WMX Console window, there are several smaller windows, each providing control for a particular operation.

2.2 WMX Console Application Main Window

When WMX Console is started, the following window will be displayed. This is the main window of WMX Console. From this window, several smaller control windows can be accessed. Each of these control windows provides control for a particular operation.

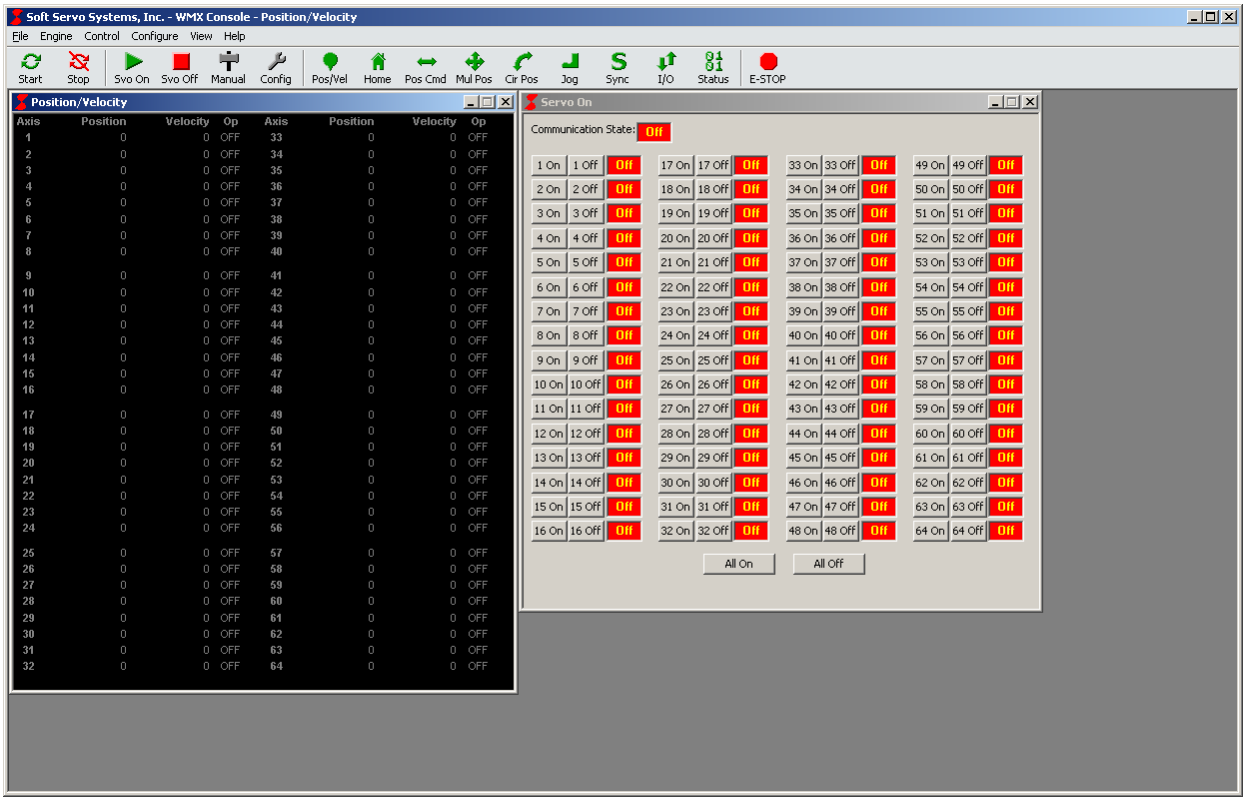


Figure 2-1: WMX Console Main Window

When WMX Console is first started, only the "Position /Velocity" control window and the "Servo On" control window are visible. The "Position/Velocity" control window displays the position and velocity status of each of the up to 64 axes that are controlled by WMX Console. The "Servo On" control window displays the state of each servo in the network. When communication with the network is established, the "Servo On" window also allows the operator to turn individual servos on or off.

All other control windows are accessible through the buttons on the toolbar or through the menu.

2.3 WMX Console Toolbar

The WMX Console toolbar contains the main controls the operator will use. The toolbar is shown in the following figure:

Figure 2-2: WMX Console Toolbar

2.3.1 Start Button

The Start (

) button on the toolbar initiates communication with the network. This button must be pressed to establish communication with the network before most other operations can be performed.

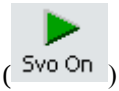
2.3.2 Stop Button

The Stop (

) button on the toolbar finishes communication with the network. To reestablish communication with the network, the Start (

) button must be pressed.

2.3.3 SvoOn Button

The Servo On button (

) opens the "Servo On" control window and attempts to turn on all servos in the network. Servos must be turned on before performing most other operations.

Servos can also be turned on or off individually through the "Servo On" control window. To open the "Servo On" control window without turning on any servos, press the Manual (

) button.

2.3.4 SvoOff Button

The Servo Off button (

) opens the "Servo On" control window and attempts to turn off all servos in the network.

Servos can also be turned on or off individually through the "Servo On" control window. To open the "Servo On" control window without turning off any servos, press the Manual (

) button.

2.3.5 Manual Button

The Manual button (

) opens the "Servo On" control window, from which the operator can turn on or off servos in the network manually.

2.3.6 Config Button

The Config button (

) button opens the "Configure Parameters" control window. This window is used to configure and save parameter settings.

2.3.7 Pos/Vel Button

The Position/Velocity button (

) opens the "Position/Velocity" control window. This window displays the position and velocity status of each axis.

2.3.8 Home Button

The Home button (

) opens the "Home Operation" control window. This window is used to home each axis.

2.3.9 PosCmd Button

The Position Command button (

) opens the "Single Position Operation" control window. This window is used to send position commands to a single axis at a time.

2.3.10 MulPos Button

The Multiple Position button (

) opens the "Multiple Position Operation" control window. This window is used to send position commands to multiple axes at a time.

2.3.11 Cir Pos Button

The Circular Position button (

) opens the "Circular Position Operation" control window. This windows is used to send circular and arc interpolation commands to a pair of axes at a time.

2.3.12 Jog Button

The Jog button (

) opens the "Jog Operation" control window. This window is used to send jog commands to each axis.

2.3.13 Sync Button

The Sync button (

) opens the "Master/Slave Operation" control window. This window is used to establish master/slave sync control for each axis.

2.3.14 I/O Button

The I/O button (

) opens the "I/O Control" control window. This window displays the state of up to 32 I/O bits at a time. This window is also used to turn output bits on or off.

2.3.15 Status Button

The Status button (

) opens the "Status Overview" control window. This window displays the state of status flags.

2.3.15 E-STOP Button

The E-STOP button (

) stops all axes when pressed.

2.4 WMX Console Menu

The WMX Console menu contains many of the functions in the WMX Console toolbar. However, there are some functions that are only available through the menu and some functions that are only available through the toolbar.

2.4.1 File Menu

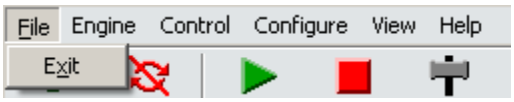


Figure 2-3: WMX Console File Menu

The File menu contains the Exit option. Selecting this option will close WMX Console. Communication with the network will be stopped before exiting.

2.4.2 Engine Menu

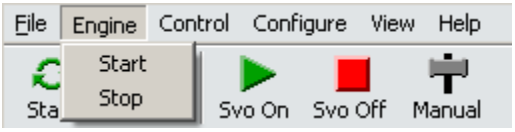


Figure 2-4: WMX Console Engine Menu

The Engine menu contains the Start and Stop options. Selecting the Start option will initiate communication with the network. The Start option has the same function as the Start button on the WMX Console toolbar.

Selecting the Stop option will finish communication with the network. The Stop option has the same function as the Stop button on the WMX Console toolbar.

2.4.3 Control Menu

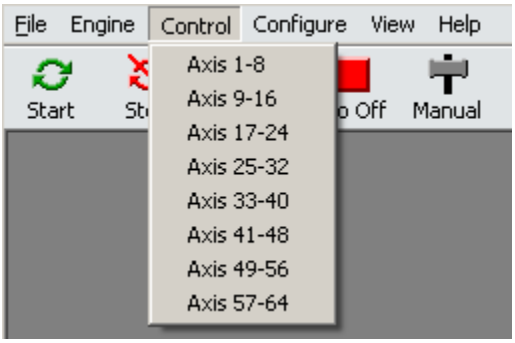


Figure 2-5: WMX Console Control Menu

The Control menu contains options for groups of eight axes. Certain control windows operate axes in groups of eight. By selecting a group under the Control menu, all such control windows will operate on the selected group. The "Axis" captions on such control windows will update to reflect the currently selected group.

2.4.3 Configure Menu

Figure 2-6: WMX Console Configure Menu

The Configure menu contains the Parameters option. Selecting this option will open the "Configure Paramters" control window. This window is used to configure and save parameter settings.

2.4.4 View Menu

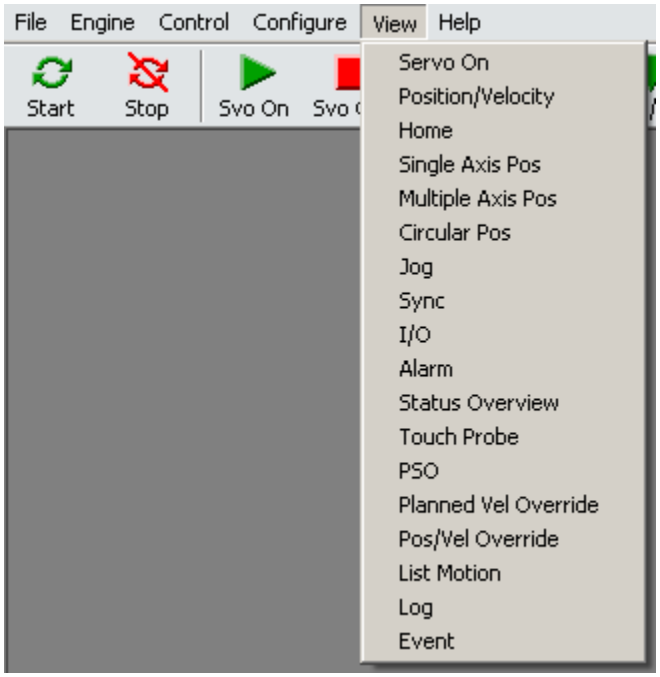


Figure 2-7: WMX Console View Menu

The View menu contains several options, each of which opens a particular control window, as detailed below:

- Servo On – Selecting this option will open the "Servo On" control window.
- Position/Velocity – Selecting this option will open the "Position/Velocity" control window.
- Home – Selecting this option will open the "Home Operation" control window.
- Single Axis Pos – Selecting this option will open the "Single Position Operation" control window.
- Multiple Axis Pos – Selecting this option will open the "Multiple Position Operation" control window.
- Circular Pos – Selecting this option will open the "Circular Position Operation" control window.
- Jog – Selecting this option will open the "Jog Operation" control window.
- Sync – Selecting this option will open the "Sync Operation" control window.
- I/O – Selecting this option will open the "I/O Control" control window.
- Alarm – Selecting this option will open the "Alarm Status" control window.
- Status Overview – Selecting this option will open the "Status Overview" control window.
- Touch Probe – Selecting this option will open the "Touch Probe" control window.
- PSO – Selecting this option will open the "PSO" control window.
- Planned Vel Override – Selecting this option will open the "Planned Vel Override" control window.
- Pos/Vel Override – Selecting this option will open the "Position/Velocity Override Operation" control window.
- List Motion – Selecting this option will open the "List Motion Operation" control window.
- Log – Selecting this option will open the "Log Operation" control window.
- Event – Selecting this option will open the "Event Operation" control window.

For additional information on each control window, see the appropriate section for that control window in this document.

2.4.5 Help Menu

Figure 2-8: WMX Console Help Menu

The Help menu contains the About option, which opens the About dialog shown below, which contains information regarding the WMX Console application.

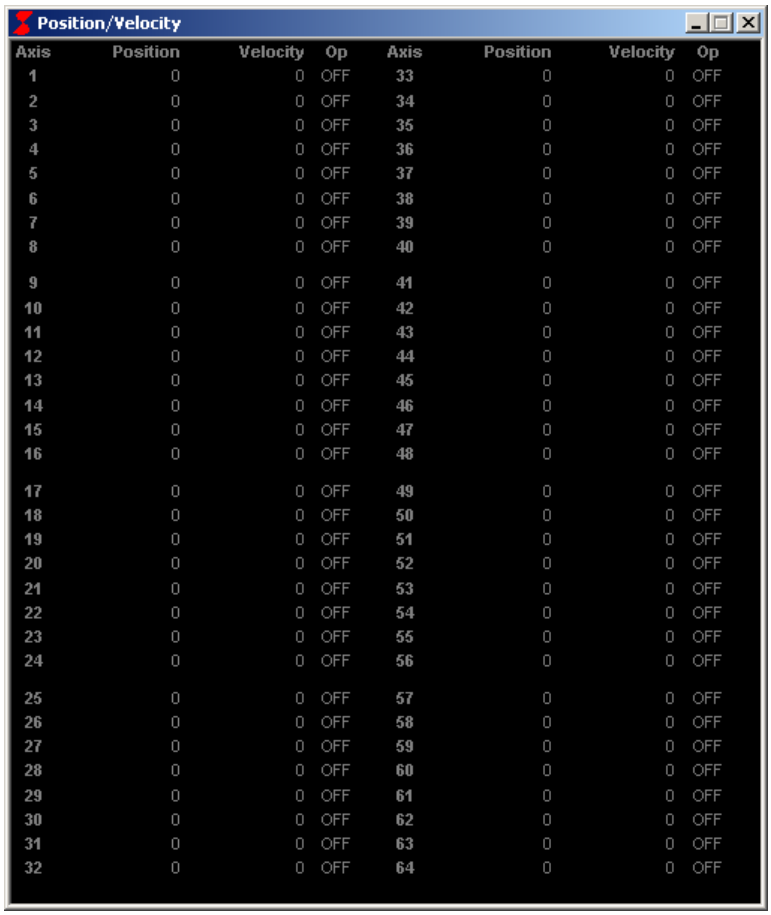
Figure 2-9: WMX Console About Dialog

The "Device ID" value is the identification number of the device that is used to communicate with the WMX engine. Each running instance of WMX Console will have a unique device ID. The instance with a device ID of 0 is the root instance, and must be closed after all other devices are closed. The "Device Count" value is the total number of devices that are currently communicating with the WMX engine.

2.5 Position/Velocity

The "Position/Velocity" control window will be visible when WMX Console is started. The "Position/Velocity" control window will display the position, velocity, and operation state of each of the up to 64 axes controlled by WMX Console.

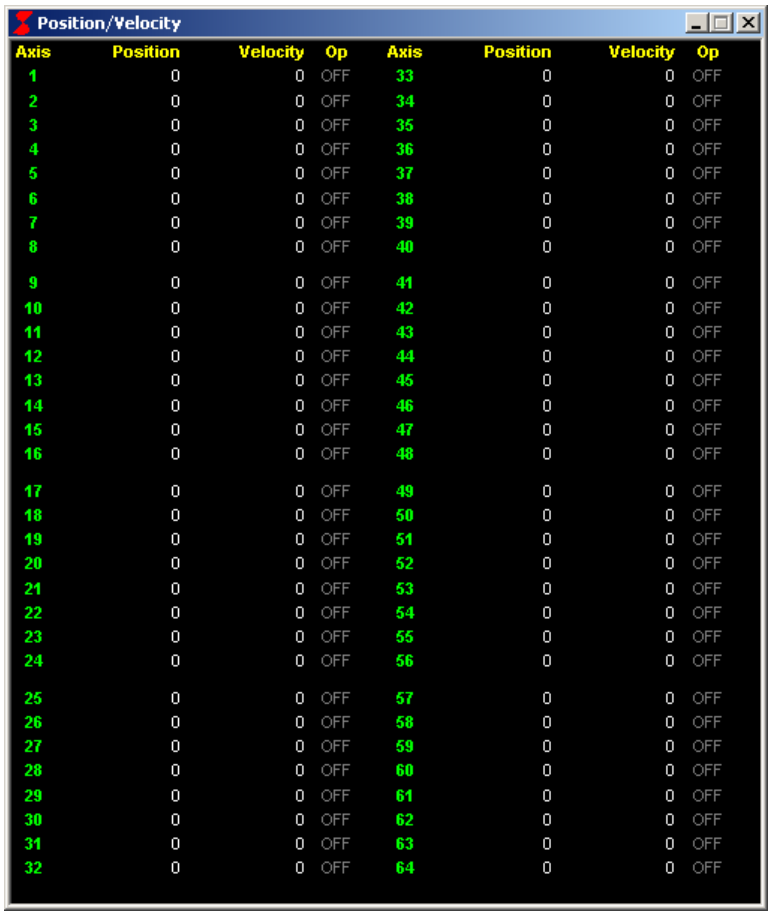
When WMX Console is started, the "Position/Velocity" control window will appear as follows:



Axis	Position	Velocity	Op	Axis	Position	Velocity	Op
1	0	0	OFF	33	0	0	OFF
2	0	0	OFF	34	0	0	OFF
3	0	0	OFF	35	0	0	OFF
4	0	0	OFF	36	0	0	OFF
5	0	0	OFF	37	0	0	OFF
6	0	0	OFF	38	0	0	OFF
7	0	0	OFF	39	0	0	OFF
8	0	0	OFF	40	0	0	OFF
9	0	0	OFF	41	0	0	OFF
10	0	0	OFF	42	0	0	OFF
11	0	0	OFF	43	0	0	OFF
12	0	0	OFF	44	0	0	OFF
13	0	0	OFF	45	0	0	OFF
14	0	0	OFF	46	0	0	OFF
15	0	0	OFF	47	0	0	OFF
16	0	0	OFF	48	0	0	OFF
17	0	0	OFF	49	0	0	OFF
18	0	0	OFF	50	0	0	OFF
19	0	0	OFF	51	0	0	OFF
20	0	0	OFF	52	0	0	OFF
21	0	0	OFF	53	0	0	OFF
22	0	0	OFF	54	0	0	OFF
23	0	0	OFF	55	0	0	OFF
24	0	0	OFF	56	0	0	OFF
25	0	0	OFF	57	0	0	OFF
26	0	0	OFF	58	0	0	OFF
27	0	0	OFF	59	0	0	OFF
28	0	0	OFF	60	0	0	OFF
29	0	0	OFF	61	0	0	OFF
30	0	0	OFF	62	0	0	OFF
31	0	0	OFF	63	0	0	OFF
32	0	0	OFF	64	0	0	OFF

Figure 2-10: WMX Console Position/Velocity Control Window (1 of 4)

At this point, communication has not been established yet, and all captions are gray. Once communication is initiated and established, the "Position/Velocity" control window will change to the following:



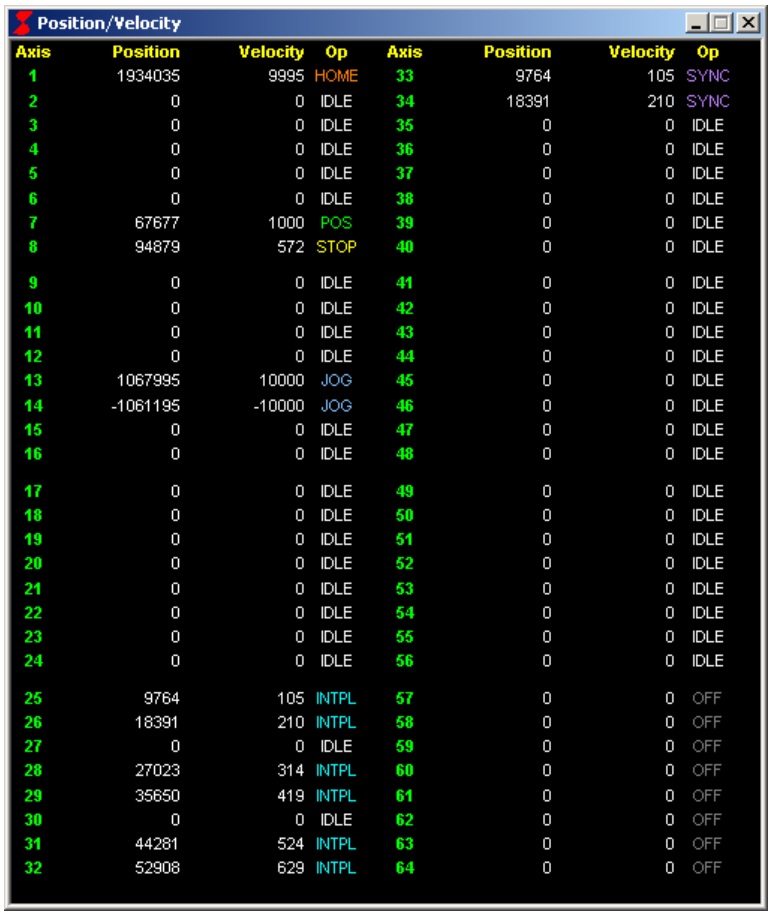
Axis	Position	Velocity	Op	Axis	Position	Velocity	Op
1	0	0	OFF	33	0	0	OFF
2	0	0	OFF	34	0	0	OFF
3	0	0	OFF	35	0	0	OFF
4	0	0	OFF	36	0	0	OFF
5	0	0	OFF	37	0	0	OFF
6	0	0	OFF	38	0	0	OFF
7	0	0	OFF	39	0	0	OFF
8	0	0	OFF	40	0	0	OFF
9	0	0	OFF	41	0	0	OFF
10	0	0	OFF	42	0	0	OFF
11	0	0	OFF	43	0	0	OFF
12	0	0	OFF	44	0	0	OFF
13	0	0	OFF	45	0	0	OFF
14	0	0	OFF	46	0	0	OFF
15	0	0	OFF	47	0	0	OFF
16	0	0	OFF	48	0	0	OFF
17	0	0	OFF	49	0	0	OFF
18	0	0	OFF	50	0	0	OFF
19	0	0	OFF	51	0	0	OFF
20	0	0	OFF	52	0	0	OFF
21	0	0	OFF	53	0	0	OFF
22	0	0	OFF	54	0	0	OFF
23	0	0	OFF	55	0	0	OFF
24	0	0	OFF	56	0	0	OFF
25	0	0	OFF	57	0	0	OFF
26	0	0	OFF	58	0	0	OFF
27	0	0	OFF	59	0	0	OFF
28	0	0	OFF	60	0	0	OFF
29	0	0	OFF	61	0	0	OFF
30	0	0	OFF	62	0	0	OFF
31	0	0	OFF	63	0	0	OFF
32	0	0	OFF	64	0	0	OFF

Figure 2-11: WMX Console Position/Velocity Control Window (2 of 4)

As long as communication remains, the "Position/Velocity" control window will update automatically to display the current position, current velocity, and current operation state of each axis. The possible operation states are listed below:

- OFFLN – The axis' servo either does not exist, or is offline (disconnected).
- OFF – The axis' servo is off.
- IDLE – The axis is idle and is ready to accept commands.
- HOME – The axis is performing a home operation.
- POS – The axis is performing a positioning operation.
- STOP – The axis is decelerating to a stop. Once completely stopped, the axis will switch to the IDLE operation state.
- JOG – The axis is performing a jog operation.
- INTPL – The axis is performing an interpolation operation.
- SYNC – The axis is a sync slave axis and is following another master axis.
- DVC – The axis is a velocity command axis performing a velocity command.

The following figure shows what the "Position/Velocity" control window may look like during use:



Axis	Position	Velocity	Op	Axis	Position	Velocity	Op
1	1934035	9995	HOME	33	9764	105	SYNC
2	0	0	IDLE	34	18391	210	SYNC
3	0	0	IDLE	35	0	0	IDLE
4	0	0	IDLE	36	0	0	IDLE
5	0	0	IDLE	37	0	0	IDLE
6	0	0	IDLE	38	0	0	IDLE
7	67677	1000	POS	39	0	0	IDLE
8	94879	572	STOP	40	0	0	IDLE
9	0	0	IDLE	41	0	0	IDLE
10	0	0	IDLE	42	0	0	IDLE
11	0	0	IDLE	43	0	0	IDLE
12	0	0	IDLE	44	0	0	IDLE
13	1067995	10000	JOG	45	0	0	IDLE
14	-1061195	-10000	JOG	46	0	0	IDLE
15	0	0	IDLE	47	0	0	IDLE
16	0	0	IDLE	48	0	0	IDLE
17	0	0	IDLE	49	0	0	IDLE
18	0	0	IDLE	50	0	0	IDLE
19	0	0	IDLE	51	0	0	IDLE
20	0	0	IDLE	52	0	0	IDLE
21	0	0	IDLE	53	0	0	IDLE
22	0	0	IDLE	54	0	0	IDLE
23	0	0	IDLE	55	0	0	IDLE
24	0	0	IDLE	56	0	0	IDLE
25	9764	105	INTPL	57	0	0	OFF
26	18391	210	INTPL	58	0	0	OFF
27	0	0	IDLE	59	0	0	OFF
28	27023	314	INTPL	60	0	0	OFF
29	35650	419	INTPL	61	0	0	OFF
30	0	0	IDLE	62	0	0	OFF
31	44281	524	INTPL	63	0	0	OFF
32	52908	629	INTPL	64	0	0	OFF

Figure 2-12: WMX Console Position/Velocity Control Window (3 of 4)

In this figure, at least one axis is in each possible operation state.

The "Position Display Large View" parameter can be set to "LARGE" to change the "Position/Velocity" control window to display just the currently selected group of 8 axes in larger font. The following figure shows a screenshot of the "Position/Velocity" control window when "Position Display Large View" is set to "LARGE."

Figure 2-13: WMX Console Position/Velocity Control Window (3 of 4)

2.6 Servo On

Typically, the "Servo On" control window or "Configure Parameters" control window will be the first control window accessed by the operator. The "Servo On" control window allows the operator to turn on and off each of the up to 64 servo drives in the servo network.

Figure 2-14: Servo On Control Window (1 of 4)

Some interface systems take longer to establish communication than other interface systems. When WMX Console is started, the "Servo On" control window will look like the following until communication is established:

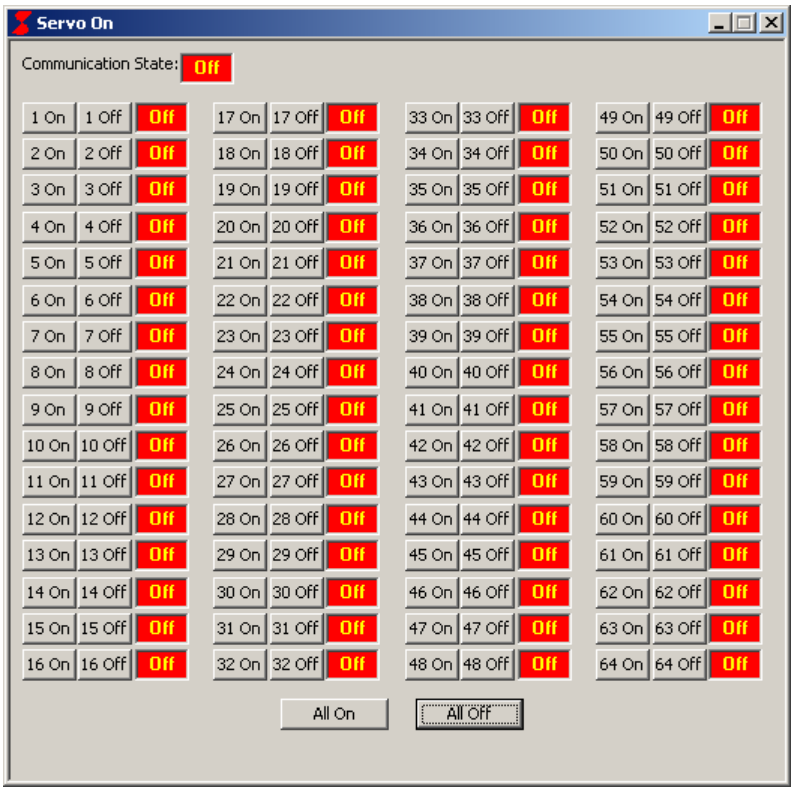


Figure 2-15: Servo On Control Window (2 of 4)

Until communication is established, the operator will be unable to turn any servos on. If the system is unable to establish communication, check all connections and settings, cycle the power for all devices in the servo network and for the PC, and try running WMX Console again. When communication is established, the operator will see the following screen:

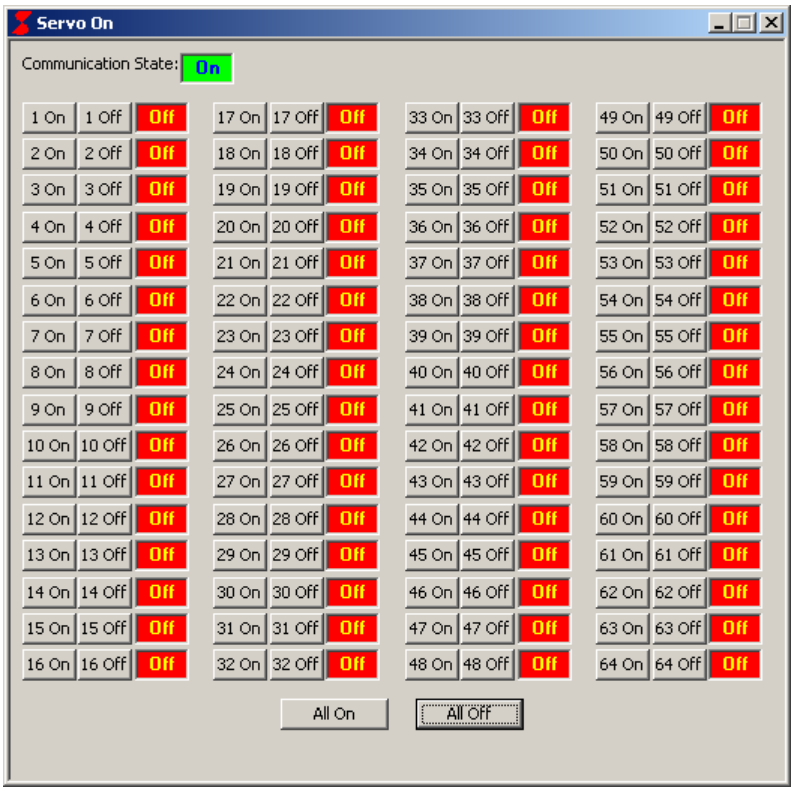


Figure 2-16: Servo On Control Window (3 of 4)

From this screen, the operator will be able to turn on or off each individual servo using the "Axis N On" and "Axis N Off" buttons, where N is the axis number of the servo. When the "All Axis On" button is pressed, WMX Console will attempt to turn on all of the up to 64 axes in the servo network. When the "All Axis Off" button is pressed, WMX Console will turn off all of the servos.

When each servo is turned on, the status display will update to show that information. The following screenshot shows the display when all 64 servos are on.

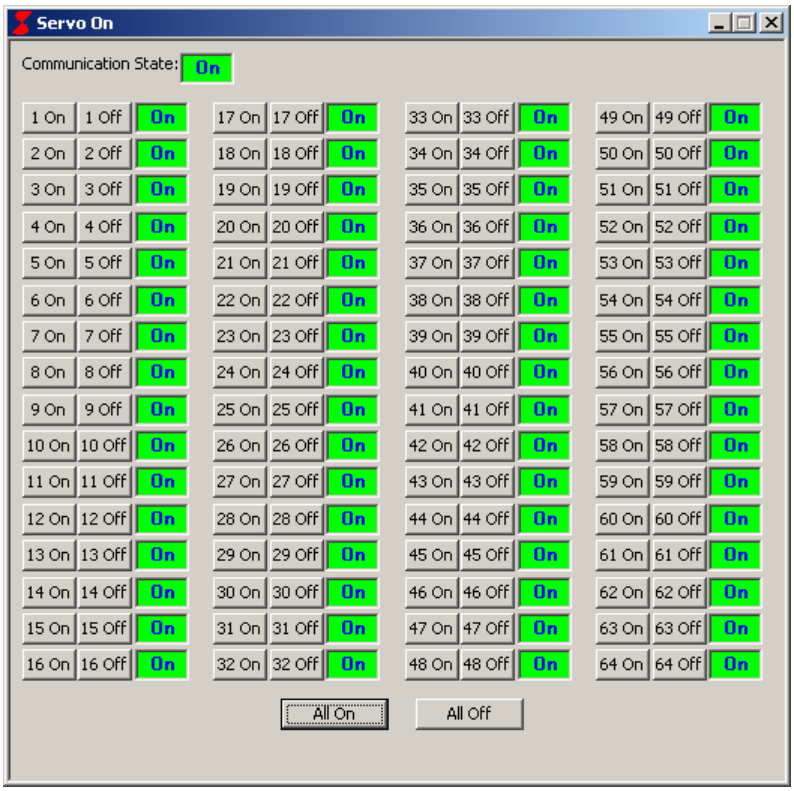


Figure 2-17: Servo On Control Window (4 of 4)

Chapter 3: Setting Up Parameters

3.1Overview of Configure Parameters

The "Configure Parameters" control window is used to configure the parameters available in the WMX system. Parameters are organized into groups, and only one group of parameters is visible at any time. To change the currently displayed parameter group, select a group from the list at the right of the control window. Within each group, parameters are arranged in a table, with each column representing the parameters for the axis number at the top of the column.

The following figures show the "Configure Parameters" control window when each of the possible parameter groups is selected.

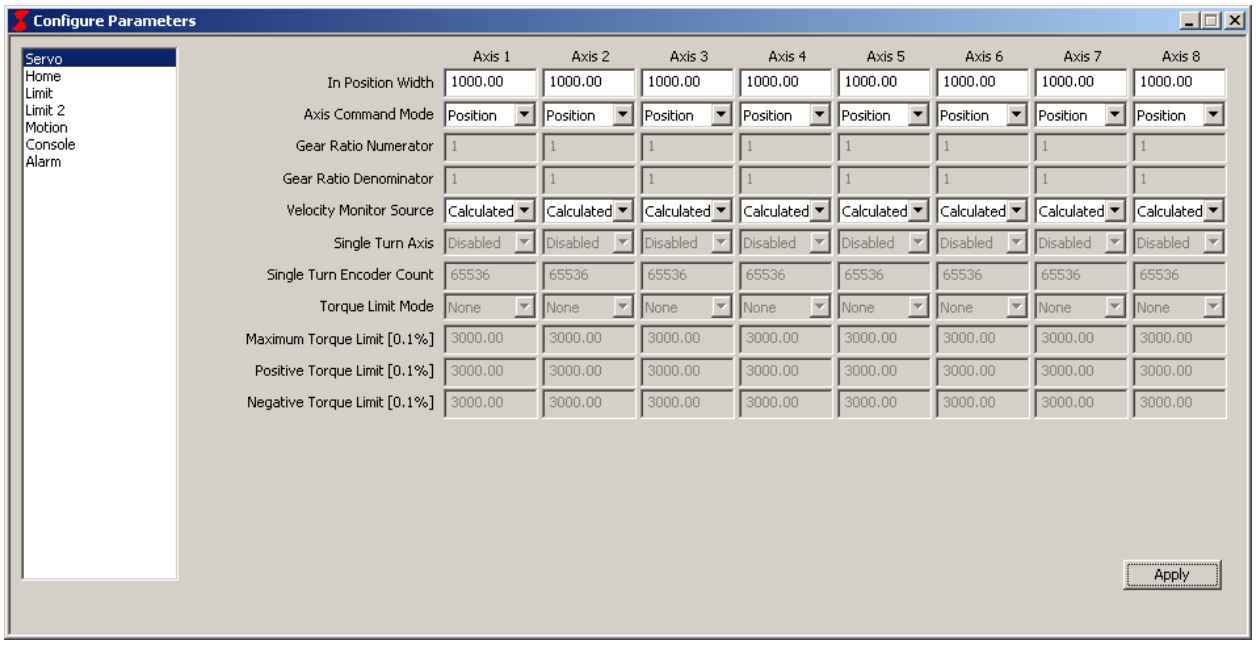


Figure 3-1: Configure Parameters Control Window (1 of 7)

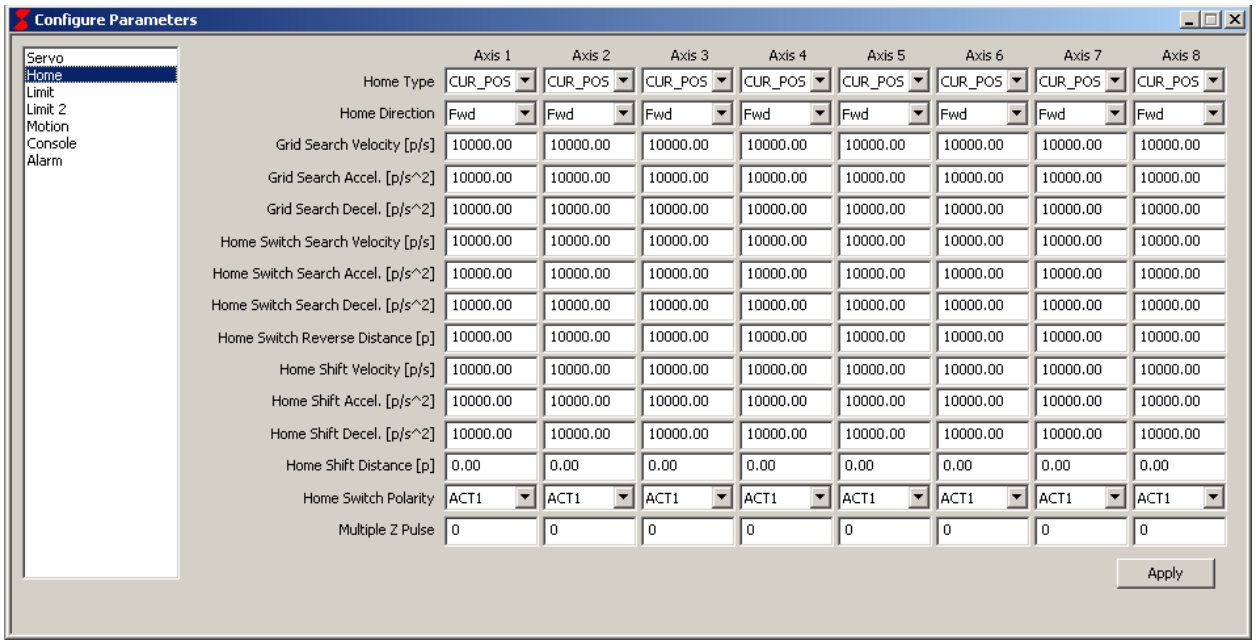


Figure 3-2: Configure Parameters Control Window (2 of 7)

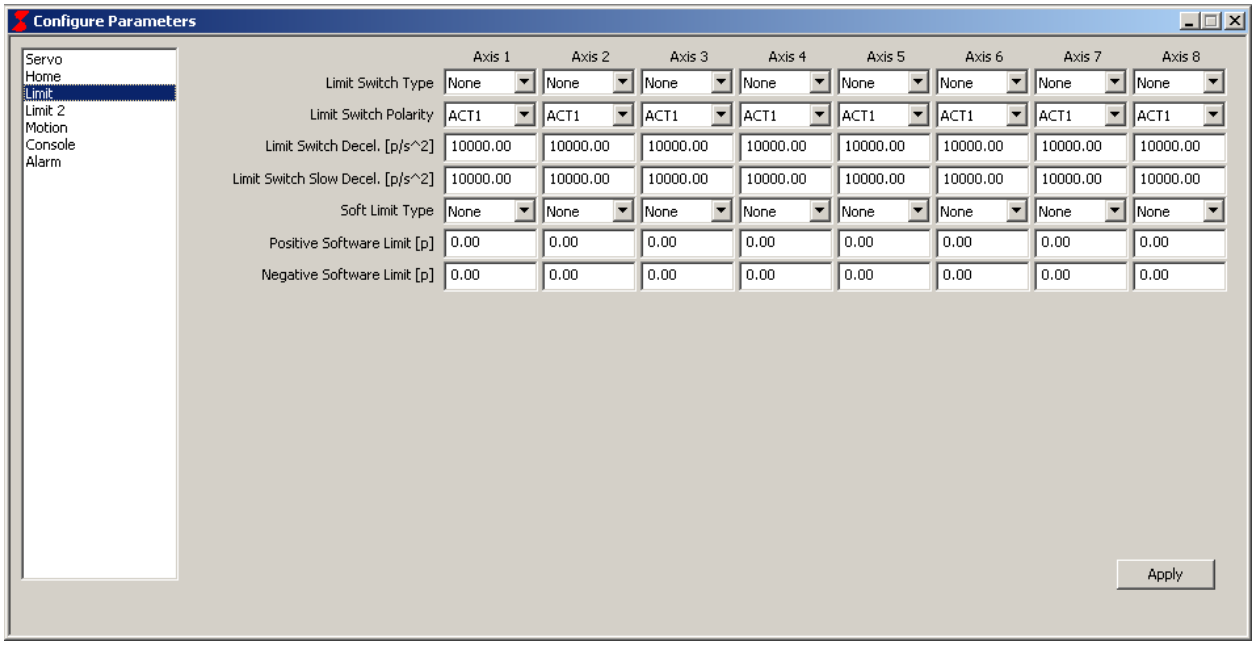


Figure 3-3: Configure Parameters Control Window (3 of 7)

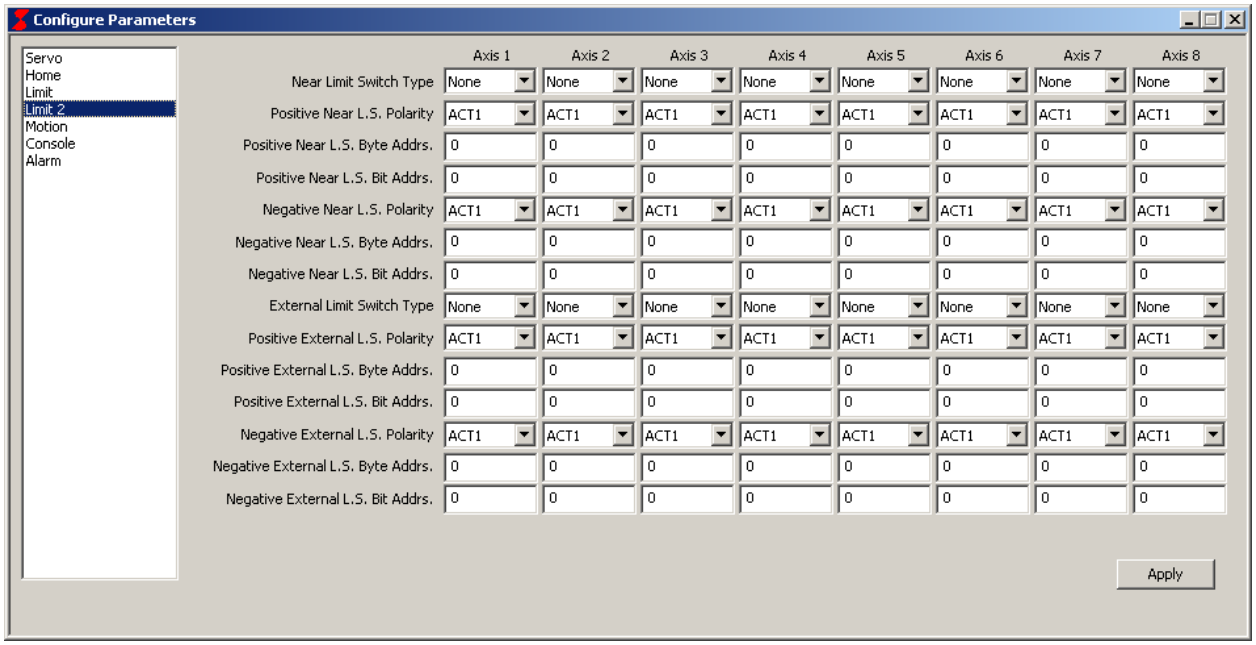


Figure 3-4: Configure Parameters Control Window (4 of 7)

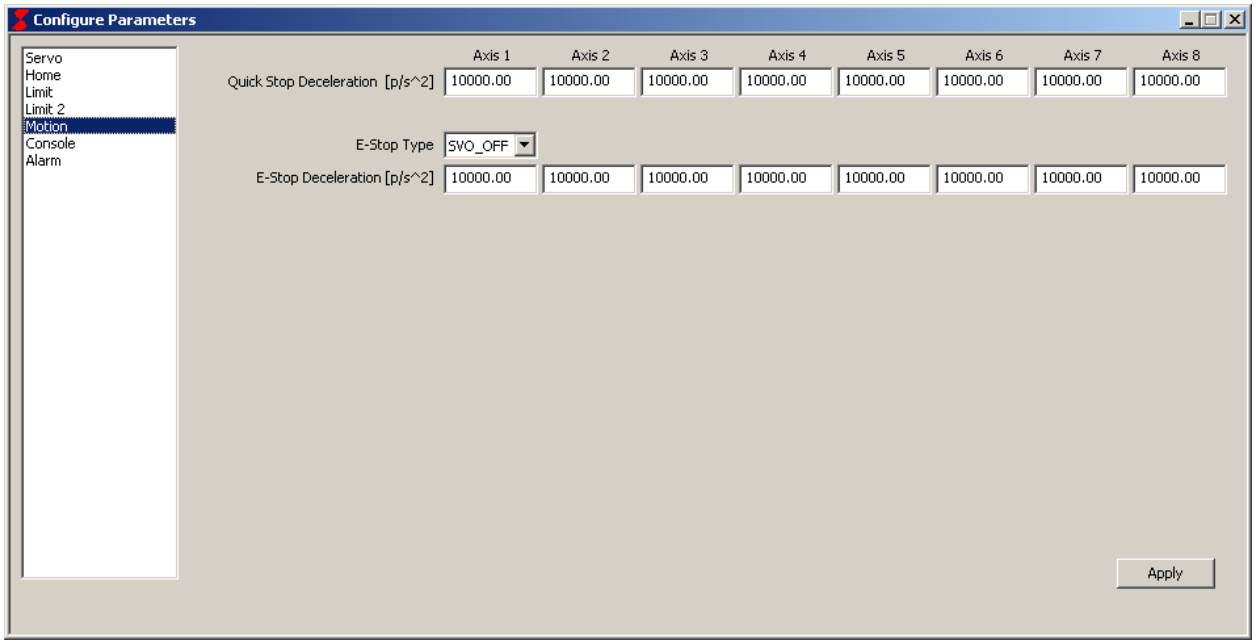


Figure 3-5: Configure Parameters Control Window (5 of 7)

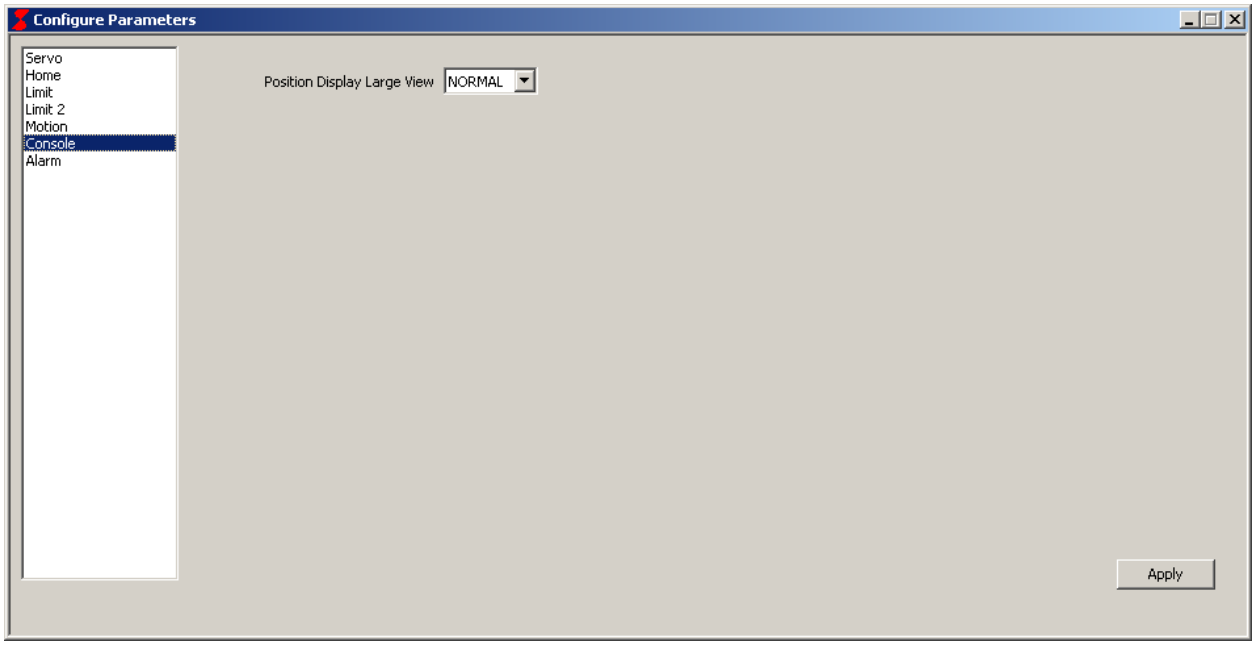


Figure 3-6: Configure Parameters Control Window (6 of 7)

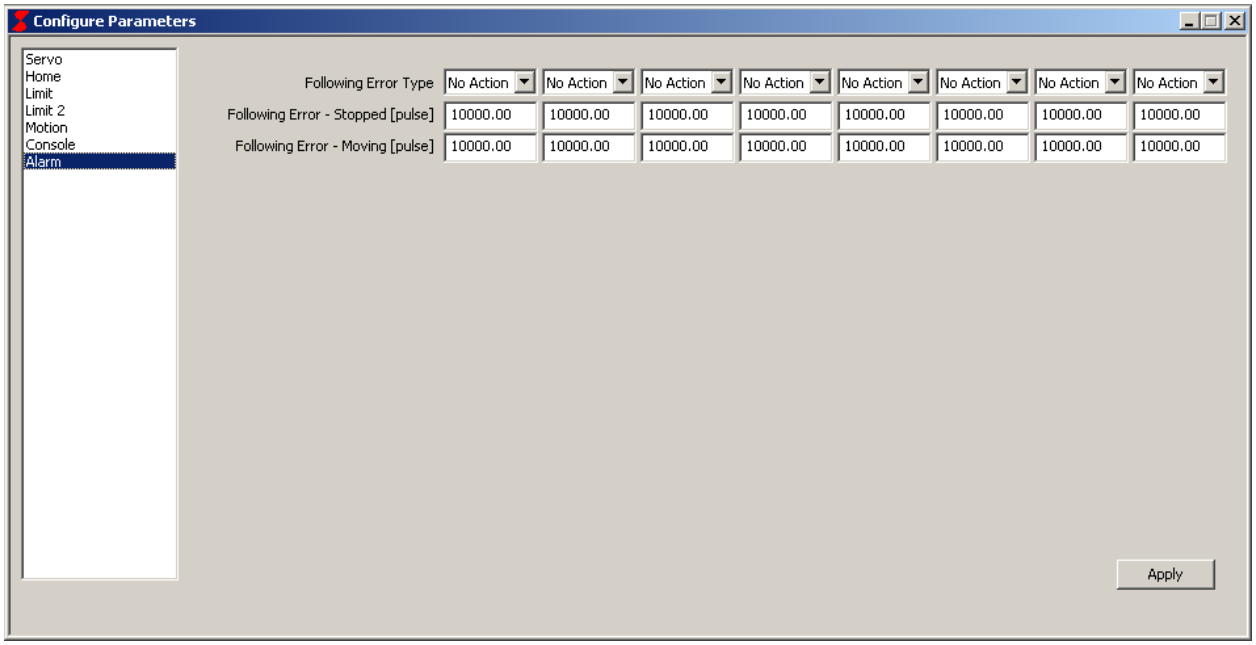


Figure 3-7: Configure Parameters Control Window (7 of 7)

Selecting a different parameter group will not discard changes to the current parameter group. However, selecting a different axis group will discard changes to the current axis group.

After configuring the parameters, the operator can click on the "Apply" button to apply the specified parameters from all parameter groups to the WMX system. Note that parameters from all parameter groups are applied, regardless of the currently selected parameter group.

The available parameters are described below:

3.2 Servo Parameters

These parameters are found in the "Servo" group in the "Configure Parameters" control window.

3.2.1 In Position Width Parameter

The width of the window centered at the command position. When the actual position falls into this window, the axis is considered to be in position. The units are encoder counts.

3.2.2 Axis Command Mode

The command mode of the axis. The available options are "Position" and "Velocity." The command mode determines the types of commands that the axis can perform.

The command mode may only be changed while communication with the servo network has not been established. Once communication is established, the "Axis Command Mode" parameter selection will be unable to be changed until communication is resolved.

The "Jog Operation" control window will automatically switch between sending jog commands and velocity commands depending on the command mode of the axis. The "Jog Operation" control window also displays the current command mode of each axis.

Axes in "Velocity" command mode are commanded by velocity only, and hence do not display their positions in the "Position/Velocity" control window.

3.2.3 Gear Ratio Numerator

The numerator of the gear ratio of the axis. The pulses sent to the axis servo will be multiplied by the gear ratio of the axis.

The gear ratio may only be changed while communication with the servo network has not been established. Once communication is established, the "Gear Ratio Numerator" parameter selection will be unable to be changed until communication is resolved.

3.2.4 Gear Ratio Denominator

The denominator of the gear ratio of the axis. The pulses sent to the axis servo will be multiplied by the gear ratio of the axis.

The gear ratio may only be changed while communication with the servo network has not been established. Once communication is established, the "Gear Ratio Denominator" parameter selection will be unable to be changed until communication is resolved.

3.2.5 Velocity Monitor Source

This parameter determines whether the velocity status is calculated from the position feedback, or is obtained directly from the servo as velocity feedback. If "Calculated" is selected, the velocity status will be calculated from position feedback. If "Actual" is selected, the velocity status will be obtained directly from the servo.

For most servos, the "Actual" status is more accurate and is more responsive to changes in velocity. However, some servos are unable to report velocity feedback.

3.2.6 Single Turn Axis

This parameter determines whether the axis is a single turn axis or a normal axis. If this parameter is set to "Enabled," this axis will be a single turn axis, and if this parameter is set to "Disabled," this axis will be a normal axis. A single turn axis only retains position information within a certain range, and if the axis position would move out of this range, the axis position loops around to the other end of the range. A single turn axis is suitable for axes for which its position is cyclical instead of linear, such as rotary axes.

This parameter may only be changed while communication with the servo network has not been established. Once communication is established, the "Single Turn Axis" parameter selection will be unable to be changed until communication is resolved.

3.2.7 Single Turn Encoder Count

This parameter determines the range of positions that the axis could occupy, if the axis' "Single Turn Axis" parameter is set to "Enabled." If the axis position would move out of this range, the axis position loops around to the other end of the range.

This parameter may only be changed while communication with the servo network has not been established. Once communication is established, the "Single Turn Encoder Count" parameter selection will be unable to be changed until communication is resolved.

3.2.8 Torque Limit Mode

This parameter determines the torque limit that will be applied to the commanded axis. Selecting "None" will cause the axis to use the default maximum torque limit, selecting "Max" will cause the axis to use the torque specified in the "Max Torque Limit" parameter selection, and selecting "Pos/Neg Max" will cause the axis to use the torques specified in the "Positive Torque Limit" and "Negative Torque Limit" parameters, with a different torque being used for each direction. The torque limit is the maximum amount of torque that will be applied by the servo motor.

3.2.9 Maximum Torque Limit

The maximum torque that will be applied by the servo motor in either direction, in units of %. This parameter is only used when the "Torque Limit Mode" parameter is set to "Max."

3.2.10 Positive Torque Limit

The maximum torque that will be applied by the servo motor in the positive direction, in units of %. This parameter is only used when the "Torque Limit Mode" parameter is set to "Pos/Neg Max."

3.2.11 Negative Torque Limit

The maximum torque that will be applied by the servo motor in the negative direction, in units of %. This parameter is only used when the "Torque Limit Mode" parameter is set to "Pos/Neg Max."

3.3 Home Parameters

These parameters are found in the "Home" group in the "Configure Parameters" control window.

3.3.1 Home Type Parameter

The method of homing during a home operation. The available choices are as follows:

- CUR_POS – Set the current position as the home position.
- ZP – Search for the Z pulse.
- HS – Search for the home switch.
- HS_REV_ZP – Search for the home switch. When the home switch is detected, search for the Z-pulse in the direction opposite to the home switch.
- HS_HS – Search for the home switch at the rapid feedrate. When the home switch is detected, move back the home switch reverse distance, then search for the home switch at the grid search feedrate.
- HS_ZP – Search for the home switch. When the home switch is detected, search for the Z pulse.
- LS_REV_ZP – Search for the on-servohard limit switch in the direction of the Home Direction parameter. When the Home Direction is forward (Fwd), the positive on-servo hard limit switch is searched. When the Home Direction is backward (Bwd), the negative on-servo hard limit switch is searched. When the appropriate limit switch is detected, search for the Z pulse in the direction opposite to the limit switch.
- LS_REV_ZP_NEAR –Search for the near limit switch in the direction of the Home Direction parameter. When the Home Direction is forward (Fwd), the positive near limit switch is searched. When the Home Direction is backward (Bwd), the negative near limit switch is searched. When the appropriate limit switch is detected, search for the Z pulse in the direction opposite to the limit switch.
- LS_REV_ZP_EXT –Search for the external limit switch in the direction of the Home Direction parameter. When the Home Direction is forward (Fwd), the positive external limit switch is searched. When the Home Direction is backward (Bwd), the negative external limit switch is searched. When the appropriate limit switch is detected, search for the Z pulse in the direction opposite to the limit switch.

For additional information regarding the different home types, refer to *Section 4.3: Home Operation*.

The following choices are currently unavailable. Their specifications may change at any time.

- LS – Search for the limit switch. *(Currently unavailable.)*

3.3.2 Home Direction Parameter

The direction to search for home during a home operation. The choices are forward (Fwd) and backward (Bwd).

3.3.3 Grid Search Velocity Parameter

The velocity to use while searching for the home switch, in units of pulses per second.

3.3.4 Grid Search Acceleration Parameter

The acceleration to use while searching for the home switch, in units of pulses per second squared.

3.3.5 Grid Search Deceleration Parameter

The deceleration to use while searching for the home switch, in units of pulses per second squared.

3.3.6 Home Switch Search Velocity Parameter

The velocity to use while rapidly searching for the home switch, in units of pulses per second.

3.3.7 Home Switch Search Acceleration Parameter

The acceleration to use while rapidly searching for the home switch, in units of pulses per second squared.

3.3.8 Home Switch Search Deceleration Parameter

The deceleration to use while rapidly searching for the home switch, in units of pulses per second squared.

3.3.9 Home Switch Reverse Distance Parameter

The distance to reverse when the home switch is found, in units of pulses.

3.3.10 Home Shift Velocity Parameter

The velocity to use while moving the home shift distance after the home position is found, in units of pulses per second.

3.3.11 Home Shift Acceleration Parameter

The acceleration to use while moving the home shift distance after the home position is found, in units of pulses per second squared.

3.3.12 Home Shift Deceleration Parameter

The deceleration to use while moving the home shift distance after the home position is found, in units of pulses per second squared.

3.3.13 Home Shift Distance

The distance to move after the home position is found, in pulses. The shifted position becomes the actual home position.

3.3.14 Home Shift Polarity

Whether the home switch is active when high (ACT1) or active when low (ACT0).

3.3.15 Multiple Z-Pulse

For home types that search for the Z-pulse, the number of Z-pulses to search for before setting the home position. If set to 0 or 1, the home position will be set at the position of the first Z-pulse.

3.4 Limit Switch Parameters

These parameters are found in the "Limit" and "Limit 2" groups in the "Configure Parameters" control window.

⚠ CAUTION

Limit switches will not trigger if the axis is traveling in the direction opposite to the limit switch. Any positive limit switch will trigger only if the axis is traveling in the positive direction or is not moving. Any negative limit switch will trigger only if the axis is traveling in the negative direction or is not moving.

3.4.1 Limit Switch Type

The behavior of the positive and negative limit switches when triggered. The available choices are as follows:

- None – Do nothing. Select this setting if the servo handles the limit switch.
- Servo Off – Immediately turn the servo off.
- Decelerate, Servo Off – Decelerate to a stop using the Limit Switch Deceleration, then turn the servo off.
- Decelerate – Decelerate to a stop using the Limit Switch Deceleration.
- Slow Decelerate, Servo Off – Decelerate to a stop using the Limit Switch Slow Deceleration, then turn the servo off.
- Slow Decelerate – Decelerate to a stop using the Limit Switch Slow Deceleration.

Except for the "None" limit switch type, when a limit switch is triggered, further motion in the direction of the limit switch will be canceled. If a positive limit switch is triggered, motion in the positive direction will be canceled. If a negative limit switch is triggered, motion in the negative direction will be canceled.

The limit switch type will be ignored and a special procedure will be performed instead while searching for the home switch in homing mode. For additional information, refer to *Section 4.3: Home Operation*.

3.4.2 Limit Switch Polarity

Whether the positive and negative limit switches are active when high (ACT1) or active when low (ACT0).

3.4.3 Limit Switch Deceleration

The deceleration to stop the axis at when the limit switch is triggered for the "Decelerate, Servo Off" and "Decelerate" limit switch types.

3.4.4 Limit Switch Slow Deceleration

The deceleration to stop the axis at when the limit switch is triggered for the "Slow Decelerate, Servo Off" and "Slow Decelerate" limit switch types.

3.4.5 Soft Limit Type

The behavior of the software limits when triggered. Software limits are triggered when an axis reaches the"Positive Software Limit" or "Negative Software Limit" positions. See *Section 3.4.1: Limit Switch Type* for information regarding the available choices.

3.4.6 Positive Software Limit

The positive position at which the software limit will be triggered. This value must be a positive value or zero.

3.4.7 Negative Software Limit

The negative position at which the software limit will be triggered. This value must be a negative value or zero.

3.4.8 Near Limit Switch Type

The behavior of the positive and negative near limit switches when triggered. Near limit switches are general purpose limit switches that may be mapped to any I/O input Functionally, they are identical to external limit switches. See *Section 3.4.1: Limit Switch Type* for information regarding the available choices.

3.4.9 Positive Near Limit Switch Polarity

Whether the positive near limit switch is active when high (ACT1) or active when low (ACT0).

3.4.10 Positive Near Limit Switch Byte Address

The byte address of the positive near limit switch I/O input.

3.4.11 Positive Near Limit Switch Bit Address

The bit address of the positive near limit switch I/O input.

3.4.12 Negative Near Limit Switch Polarity

Whether the negative near limit switch is active when high (ACT1) or active when low (ACT0).

3.4.13 Negative Near Limit Switch Byte Address

The byte address of the negative near limit switch I/O input.

3.4.14 Negative Near Limit Switch Bit Address

The bit address of the negative near limit switch I/O input.

3.4.15 External Limit Switch Type

The behavior of the positive and negative external limit switches when triggered. External limit switches are general purpose limit switches that may be mapped to any I/O input Functionally, they are identical to near limit switches. See *Section 3.4.1: Limit Switch Type* for information regarding the available choices.

3.4.16 Positive External Limit Switch Polarity

Whether the positive external limit switch is active when high (ACT1) or active when low (ACT0).

3.4.17 Positve External Limit Switch Byte Address

The byte address of the positiveexternallimit switch I/O input.

3.4.18 Positive External Limit Switch Bit Address

The bit address of the positive externallimit switch I/O input.

3.4.19 Negative External Limit Switch Polarity

Whether the negativeexternal limit switch is active when high (ACT1) or active when low (ACT0).

3.4.20 Negative External Limit Switch Byte Address

The byte address of the negative externallimit switch I/O input.

3.4.21 Negative External Limit Switch Bit Address

The bit address of the negative externallimit switch I/O input.

3.5 Motion Parameters

These parameters are found in the "Motion" group in the "Configure Parameters" control window.

3.5.1 Quick Stop Deceleration

The deceleration to stop the axis at when the axis is stopped using quick stop. The difference between quick stop and regular stop are:

- Quick stop uses the "Quick Stop Deceleration" parameter as the deceleration rate. Regular stop uses the deceleration parameter that was specified for the command (when stopping position commands, jog commands, or interpolation commands) or the "Grid Search Deceleration" parameter (when stopping home commands).
- Quick stop always uses a trapezoidal motion profile. Regular stop uses either a trapezoidal motion profile or an S-curve motion profile depending on the profile that was specified for the command (when stopping position commands, jog commands, or interpolation commands) (when stopping home commands, a trapezoidal profile is used).
- A regular stop can be overridden by a quick stop, but a quick stop cannot be overridden by a regular stop.

3.5.2 E-STOP Type

The type of emergency stop to execute when the E-STOP button on the WMX Console toolbar is pressed. The available choices are as follows:

- SVO_OFF – Immediately turn off all servos.
- DEC_STOP – Decelerate to a stop using the "E-Stop Deceleration" parameter as the deceleration rate. The servos are not turned off after stopping.

3.5.3 E-Stop Deceleration

The deceleration to stop the axis at when the axis is stopped using E-Stop (emergency stop) while the "E-Stop Type" parameter is set to "DEC_STOP."

3.6 Console Parameters

These parameters are found in the "Console" group in the "Configure Parameters" control window.

3.6.1 Position Display Large View

The size of the "Position/Velocity" control window's text. The available choices are as follows:

- NORMAL – The text is displayed in normal size. The state of all 64 axes are displayed at once.
- LARGE – The text is displayed in large size. The state of the currently selected group of 8 axes are displayed at once

3.7 Alarm Parameters

These parameters are found in the "Alarm" group in the "Configure Parameters" control window.

3.7.1 Following Error Type

This parameter determines the action that is performed when the following error alarm is triggered. A following error alarm is triggered whenever the difference between the command position and the feedback position of an axis exceeds a certain value. Once triggered, the following error alarm will not be triggered again until the axis alarm is cleared from the Alarm Status control window. If this parameter is set to "No Action," no action will be performed when the following error alarm is triggered. If this parameter is set to "Quick Stop," the axis will decelerate to a stop at the "Quick Stop Deceleration" rate.

3.7.2 Following Error – Stopped

The maximum difference between the command position and feedback position that can be tolerated while the axis is idle before a following error alarm is triggered. A following error alarm will never be triggered while the axis is idle if this value is set to 0.

3.7.3 Following Error – Moving

The maximum difference between the command position and feedback position that can be tolerated while the axis is executing a command before a following error alarm is triggered. A following error alarm will never be triggered while the axis is executing a command if this value is set to 0.

Chapter 4: Operation

4.1Single Position Operation

The "Single Position Operation" control window allows the operator to execute single-axis positioning commands for each of the up to 64 axes. Because each axis in a WMX system can be individually controlled, positioning commands may be sent to several axes asynchronously.

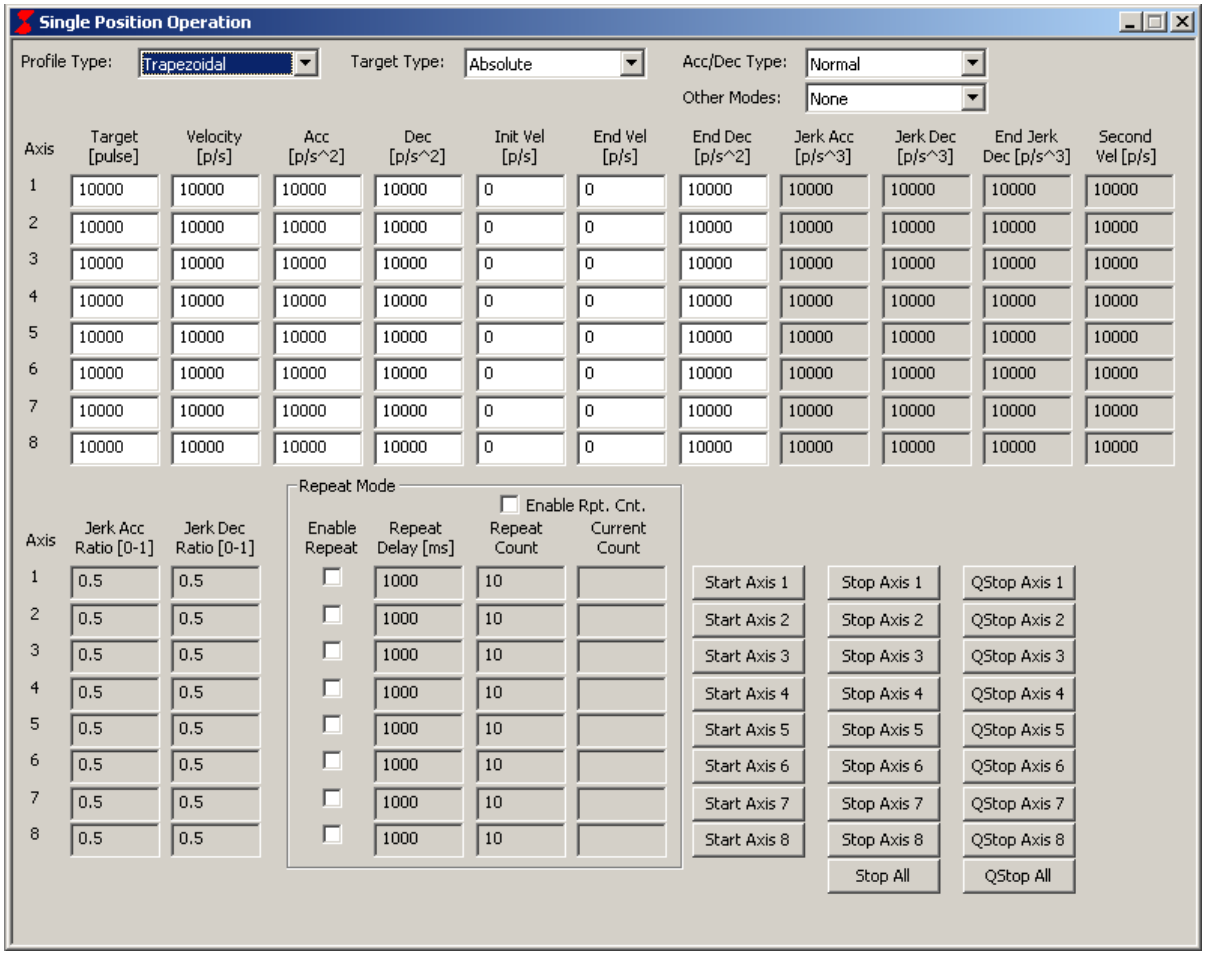


Figure 4-1: Single Position Operation Control Window

To initiate a positioning command, click on the "Start" button for the axis to command. To stop a positioning command, click on the "Stop" button for the axis. Clicking on the "Stop All" button will stop the entire up to 64 axes. The "QStop" and "QStop All" buttons can be used likewise to quick stop one axis or all axes. Quick stop operations use the "Quick Stop Deceleration" parameter.

The available parameters are described below:

- Profile Type – The profile type of the positioning command. The available profile types are:

Trapezoidal – A profile in which the velocity curve follows a trapezoidal shape. Typical position, velocity, and acceleration plots for a trapezoidal profile positioning command are as follows:

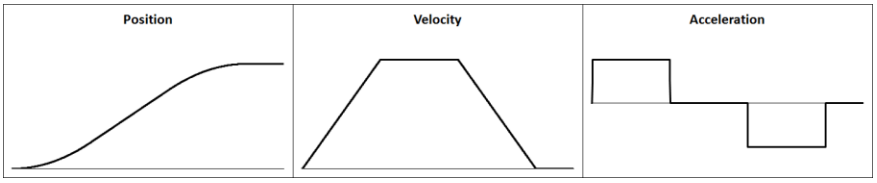


Figure 4-2: Trapezoidal Motion Profile

Jerk-Free – Also called an S-curve profile. The velocity curve follows an S-shape when accelerating and decelerating. The acceleration curve follows a triangular shape when accelerating and decelerating. Typical position, velocity, acceleration, and jerk plots for a jerk-free profile positioning command are as follows:

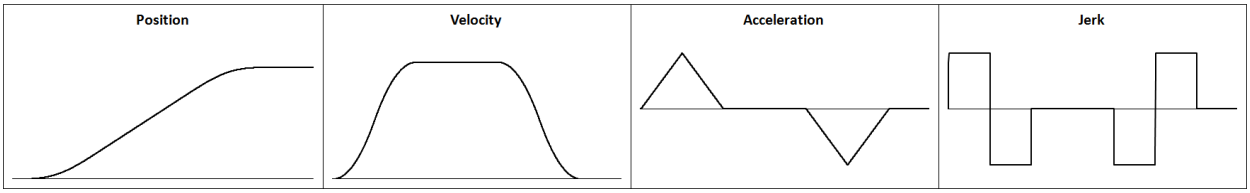


Figure 4-3: Jerk-Free (S-Curve) Motion Profile

Jerk-Limited – A profile in which the velocity follows an S-shape when accelerating and decelerating, with a region of linear acceleration at the middle of the S-shape. The acceleration curve follows a trapezoidal shape. Typical position, velocity, acceleration, and jerk plots for a jerk-limited profile positioning command are as follows:

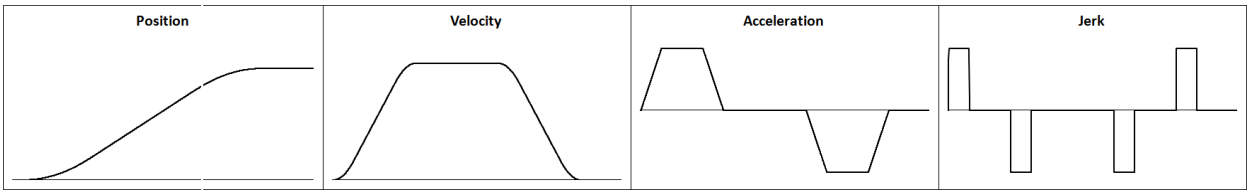


Figure 4-4: Jerk-Limited Motion Profile

The Jerk-Limited profile is currently not compatible with the end deceleration feature. The Jerk-Limited profile is currently limited to the "Trapezoidal" Acc/Dec Type.

- Target Type – The mode in which the target position is specified. Select "Absolute" to specify an absolute target position, or "Distance" to specify a relative distance to move the axis. When Target Type is set to "Distance," the "Target" column will be replaced by the "Distance" column.
- Target – The target position to move to, in units of pulses.
- Distance – The distance to move, in units of pulses.
- Velocity – The velocity to move at, in units of pulses per second.
- Acc/Dec Type – The mode in which the acceleration and deceleration are specified. Select "Normal" to specify the acceleration and deceleration normally, in units of pulses per second squared. Select "Time" to

specify the acceleration time and deceleration time, in units of seconds. When Acc/Dec Type is set to "Time," the "Acc" and "Dec" columns will be replaced by the "Acc Time" and "Dec Time" columns.

Select "Trapezoidal" to specify the acceleration and deceleration as follows. If Profile Type is "Trapezoidal," the acceleration and deceleration are specified in the same manner as when Acc/Dec Type is "Normal." If Profile Type is "Jerk-Free" or "Jerk-Limited," the acceleration and deceleration are modified so that the time taken to accelerate or decelerate is the same as when Profile Type is "Trapezoidal."

- Acc – The acceleration at which to accelerate to the specified velocity, in units of pulses per second squared.

- Dec – The deceleration at which the axis should decelerate to a stop at the end of the position command, or when the "Stop" button is pressed. The units are in pulses per second squared.

- InitVel– The initial velocity of the position command, in units of pulses per second. If the position command is an override command, the initial velocity is added to the current velocity instead. In either case, the initial velocity will not raise the velocity to a value above the command velocity.

- End Velocity – The velocity at which the deceleration rate changes from the command deceleration to the end deceleration, in pulses per second. If this value is not 0, at the end of the position command, the axis will decelerate from its current velocity to the end velocity at the command deceleration rate, and then decelerate from the end velocity to rest at the end deceleration rate. If Profile Type is "Jerk-Free," the deceleration from the end velocity to rest will also be affected by the end jerk deceleration rate.

- End Deceleration – The deceleration at which the axis decelerates from the end velocity to rest, in pulses per second squared. If this value is less than the command deceleration, then it will be ignored and the axis will decelerate at the command deceleration rate instead.

- Jerk Acc – The acceleration jerk used when the Profile Type is "Jerk-Free," in units of pulses per second cubed. When accelerating to the specified velocity, the rate at which acceleration changes will be limited by this value.

- Jerk Dec – The deceleration jerk used when the Profile Type is "Jerk-Free," in units of pulses per second cubed. When decelerating to a stop, the rate at which deceleration changes will be limited by this value.

- End Jerk Dec – If the Profile Type is "Jerk-Free," this value will determine the deceleration jerk of the end deceleration. This value is in units of pulses per second cubed.

- Jerk Acc Ratio – The jerk ratio to be used for the acceleration segment if the Profile Type is "Jerk-Limited." This value is defined as the ratio of the time for which the jerk is nonzero to the time where the acceleration is nonzero. This value must be between 0 and 1, inclusive. When jerk acceleration ratio is 0, the profile during acceleration will be identical to when the Profile Type is "Trapezoidal." However, the acceleration jerk will not exceed the maximum of 2^31-1 (if the acceleration jerk would exceed this value, the acceleration jerk will be clamped to this value). When jerk acceleration ratio is 1, the profile during acceleration will be identical to when the Profile Type is "Jerk-Free."

- Jerk Dec Ratio – The jerk ratio to be used for the deceleration segment if the Profile Type is "Jerk-Limited." This value is defined as the ratio of the time for which the jerk is nonzero to the time where the deceleration is nonzero. This value must be between 0 and 1, inclusive. When jerk deceleration ratio is 0, the profile during deceleration will be identical to when the Profile Type is "Trapezoidal." However, the deceleration jerk will not exceed the maximum of 2^31-1 (if the deceleration jerk would exceed this value, the deceleration jerk will be clamped to this value). When jerk deceleration ratio is 1, the profile during deceleration will be identical to when the Profile Type is "Jerk-Free."

- Other Modes – Additional modes may be selected using this parameter. This parameter may only be changed when the Profile Type is "Trapezoidal." The currently available other modes are:

  Two Velocity - The axis will first accelerate to the specified velocity at the specified acceleration rate. Upon reaching the specified velocity, the axis will immediately accelerate to the specified second velocity at an intermediate acceleration rate. Upon reaching the specified second velocity, the axis will immediately start decelerating to rest. The axis will have traveled to the target position upon reaching zero velocity. The intermediate acceleration rate is dependent on the specified target position.

- Second Velocity – The second velocity when two-velocity mode is selected for Other Modes. This parameter is specified in units of pulses per second.

- Repeat Mode – When this check box is checked, repeat mode will be enabled for that axis. When an axis in repeat mode receives a positioning command, that axis will repeat movement to and from the target position and the starting position.

- Repeat Delay – The delay before an axis in repeat mode reverses direction, in milliseconds.

- Enable Repeat Count – When this check box is checked, a new command will be repeated Repeat Count times instead of indefinitely in repeat mode.

- Repeat Count – The number of times to repeat a new command in repeat mode. Only applicable when Enable Repeat Count is checked.

- Current Count – A countdown display showing how many more times the current command will be repeated. Only applicable when Enable Repeat Count is checked.

4.2 Multiple Position Operation

The "Multiple Position Operation" control window allows the operator to execute multiple-axis positioning commands for each of the up to 64 axes. Multiple position operation allows multiple axes to initiate positioning commands simultaneously.

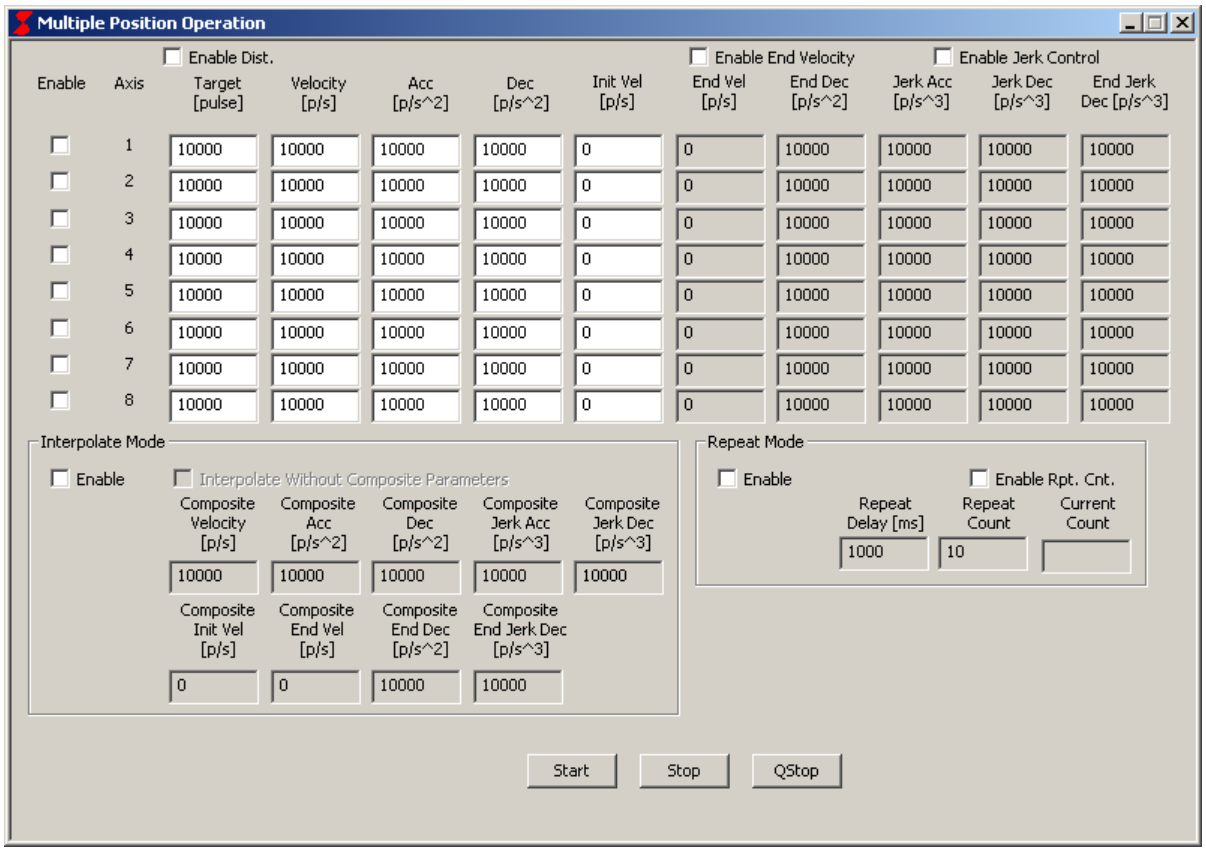


Figure 4-5: Multiple Position Operation Control Window (1 of 2)

To initiate a multiple axis positioning command, check the "Enabled" check boxes next to the axes to command. When the "Start" button is pressed, the axes with the "Enabled" check box checked will simultaneously start executing the positioning command. When the "Stop" button is pressed, all axes will be stopped. Likewise, when the "QStop" button is pressed, all axes will be quick stopped.

The available parameters are described below:

- Target – The target position to move to, in units of pulses.
- Enable Distance – When this check box is checked, the distance to move the axis can be specified instead of a target position. The "Target" column will be replaced by the "Distance" column.
- Distance – The distance to move when the "Enable Distance"check box is checked, in units of pulses.
- Velocity – The velocity to move at, in units of pulses per second.
- Acc – The acceleration at which to accelerate to the specified velocity, in units of pulses per second squared.
- Dec – The deceleration at which the axis should decelerate to a stop at the end of the position command, or when the "Stop" button is pressed. The units are in pulses per second squared.
- Enable Acc./Dec. Time – When this check box is checked, the acceleration rate and deceleration rate can be specified in units of time. The "Acc" and "Dec" columns will be replaced by the "Acc Time" and "Dec Time" columns.

- InitVel– The initial velocity of the position command, in units of pulses per second. If the position command is an override command, the initial velocity is added to the current velocity instead. In either case, the initial velocity will not raise the velocity to a value above the command velocity.

- Enable End Velocity – When this check box is checked, end velocity will be enabled. When end velocity is enabled, at the end of the position command, the axis will decelerate from its current velocity to the end velocity at the command deceleration rate, and then decelerate from the end velocity to rest at the end deceleration rate. If jerk control is enabled, the deceleration from the end velocity to rest will also be affected by the end jerk deceleration rate.

- End Velocity – The velocity at which the deceleration rate changes from the command deceleration to the end deceleration, in pulses per second.

- End Deceleration – The deceleration at which the axis decelerates from the end velocity to rest, in pulses per second squared. If this value is less than the command deceleration, then it will be ignored and the axis will decelerate at the command deceleration rate instead.

- Enable Jerk Control – When this check box is checked, jerk control will be enabled and the position commands will follow an S-curve motion profile instead of a trapezoidal motion profile. The operator will be able to specify a jerk initial velocity, a jerk acceleration, and a jerk deceleration.

- Jerk Acc – The acceleration jerk used when jerk control is enabled, in units of pulses per second cubed. When accelerating to the specified velocity, the rate at which acceleration changes will be limited by this value. (See *2.8.2 Motion Profile for Single Position Operation with Jerk Control* for additional information).

- Jerk Dec – The deceleartion jerk used when jerk control is enabled, in units of pulses per second cubed. When decelerating to a stop, the rate at which deceleration changes will be limited by this value. (See *2.8.2 Motion Profile for Single Position Operation with Jerk Control* for additional information).

- End Jerk Dec – If end velocity and jerk control are both enabled, this value will determine the deceleration jerk of the end deceleration. This value is in units of pulses per second cubed.

- Interpolate Mode – When this check box is checked, the multiple axis positioning command will interpolate the axes using the specified composite velocity, composite acceleration, and composite deceleration.

  Note that when interpolating axes, velocity, acceleration, deceleration, jerk acceleration, and jerk deceleration parameters will change to velocity limit, acceleration limit, deceleration limit, jerk acceleration limit, and jerk deceleration limit, as shown below. Each of the interpolated axes will stay within these specified limits during the interpolation operation.

  Also note that when interpolating axes, all interpolating axes must be at rest at the start of the position command. If any interpolating axes are not idle, the position command will not be executed.

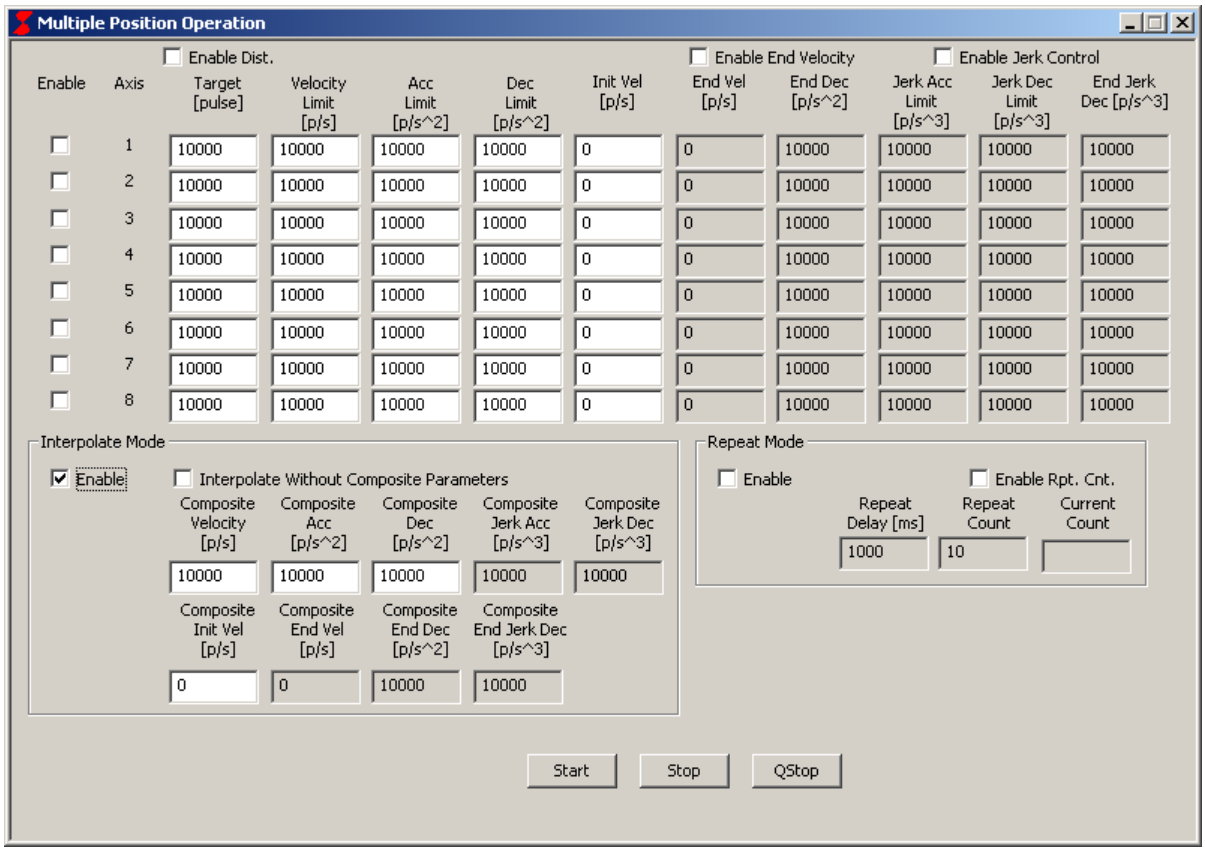


Figure 4-6: Multiple Position Operation Control Window (2 of 2)

- Composite Velocity – The composite velocity to interpolate at when performing an interpolation command, in units of pulses per second.

- Composite Acceleration – The composite acceleration used when performing an interpolation command, in units of pulses per second squared.

- Composite Deceleration – The composite deceleration used when performing a deceleration command, in units of pulses per second squared.

- Composite Jerk Acceleration – The composite accceleration jerk used when performing an interpolation command, in units of pulses per second cubed. When accelerating to the specified composite velocity, the rate at which composite acceleration changes will be limited by this value. (Also see *2.8.2 Motion Profile for Single Position Operation with Jerk Control*). This value is only applied when jerk control is enabled.

- Composite Jerk Deceleration – The composite deceleration jerk used when performing an interpolation command, in units of pulses per second cubed. When decelerating to a stop, the rate at which composite deceleration changes will be limited by this value. (Also see *2.8.2 Motion Profile for Single Position Operation with Jerk Control*). This value is only applied when jerk control is enabled.

- Composite InitVel– The composite initial velocity used when performing an interpolation command, in units of pulses per second.

- Composite End Vel– The composite end velocity used when performing an interpolation command, in units of pulses per second. While the composite vector is decelerating to a stop, the composite end deceleration

and composite end jerk deceleration will be applied when the composite velocity drops below this value. This value is only applied when end velocity is enabled.

- Composite End Dec – The composite end deceleration used when performing an interpolation command, in units of pulses per second squared.

- Composite End Jerk Dec – The composite deceleration jerk used when performing an interpolation command, in units of pulses per second cubed.

- Interpolate Without Composite Parameters – When this check box is checked, interpolation will be performed without specifying composite parameters. The composite parameters are instead calculated from the parameters specified for each interpolating axis. The composite parameters will be set to the largest values possible without exceeding the parameters specified for any of the interpolated axes.

- Repeat Mode – When this check box is checked, repeat mode will be enabled. In repeat mode, when a multiple axis positioning command is started, all enabled axes will repeat movement to and from their target positions and their starting positions.

- Repeat Delay – The delay before the axes in repeat mode reverse direction, in milliseconds. Note that all the axes will reverse direction together. This occurs when all axes reach their target positions and the repeat delay time has elapsed.

- Enable Repeat Count – When this check box is checked, a new command will be repeated Repeat Count times instead of indefinitely in repeat mode.

- Repeat Count – The number of times to repeat a new command in repeat mode. Only applicable when Enable Repeat Count is checked.

- Current Count – A countdown display showing how many more times the current command will be repeated. Only applicable when Enable Repeat Count is checked.

4.3 Home Operation

The "Home Operation" control window allows the operator to home each axis, using the homing parameters that may have been set using the "Configure Parameters" control window.

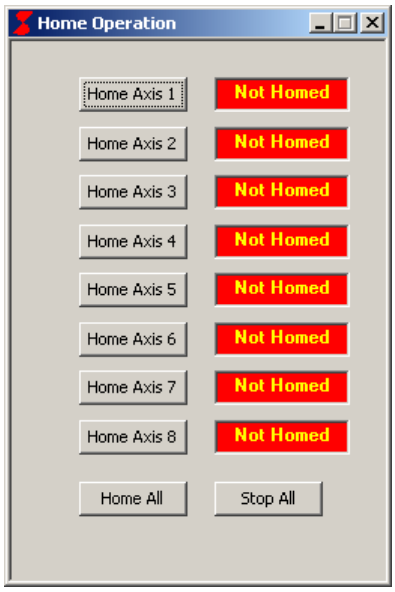


Figure 4-7: Home Operation Control Window (1 of 2)

When the operator clicks the "Home Axis N" button for a particular axis, where N is the axis number, that axis will initiate homing. When the "Home All" button is pressed, WMX Console will attempt to home all up to 64 axes. When the "Stop All" button is pressed, all axes will stop homing.

When each axis has finished homing, the status display will update to show that information. The following screenshot shows the display when all 64 axes have been homed.

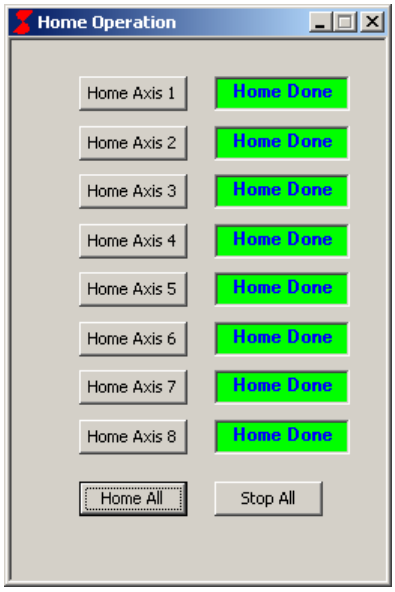


Figure 4-8: Home Operation Control Window (2 of 2)

The homing procedure depends on the specified Home Type parameter for that axis. Refer to *Section 3.3.1 Home Type Parameter* for additional information. The following sections illustrate the available homing procedures.

4.3.1 Home Type = CUR_POS

When the home type is "CUR_POS", the home position will be set to the axis position when homing is initiated.

4.3.2 Home Type = ZP

When the home type is "ZP", the homing procedure is as follows:

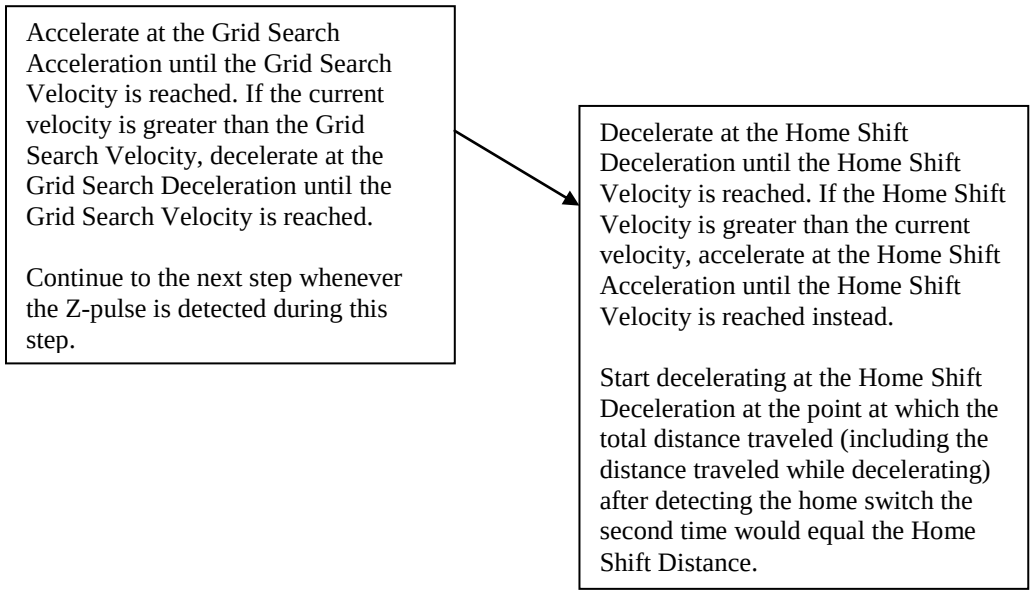


Figure 4-9: ZP Homing Procedure

Example 1: Grid SearchVelocity > Home Shift Velocity

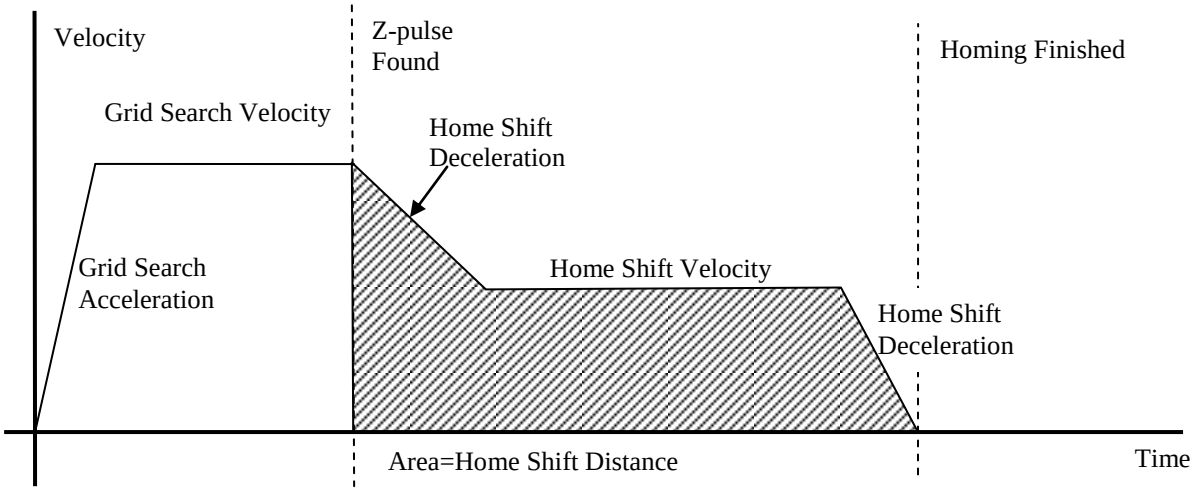


Figure 4-10: ZP Home Operation Example 1

Example 2: Grid Search Velocity > Home Shift Velocity

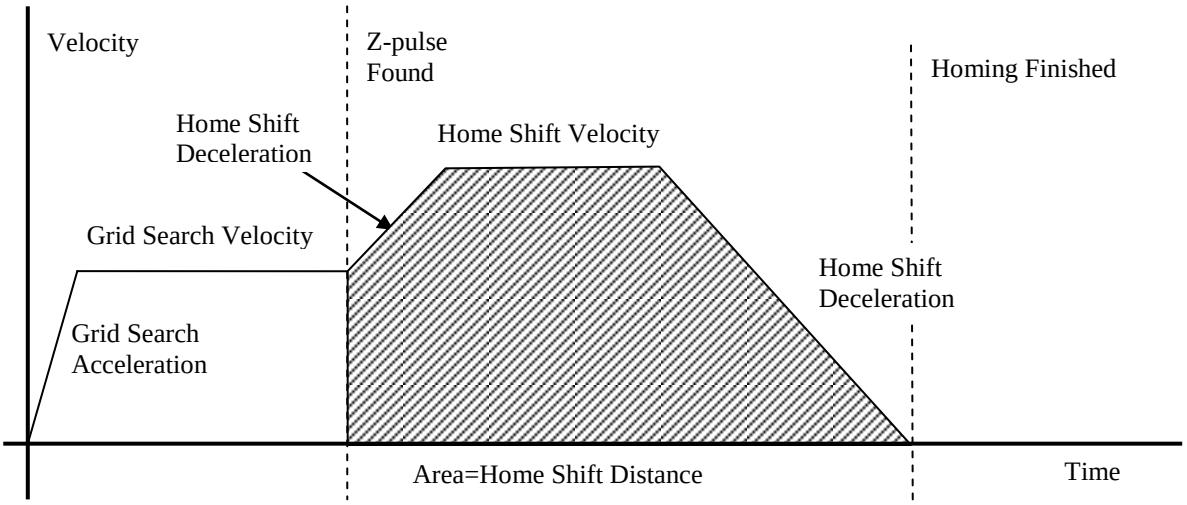


Figure 4-11: ZP Home Operation Example 2

The following diagram shows the path of ZP Home Operation.

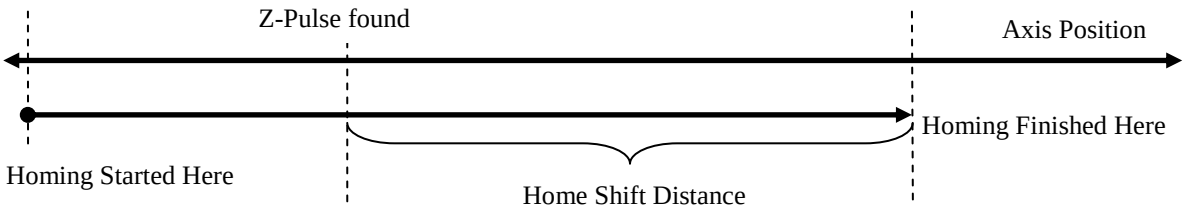


Figure 4-12: ZP Home Operation Path

4.3.3 Home Type = HS

When the home type is "HS", the homing procedure is as follows:

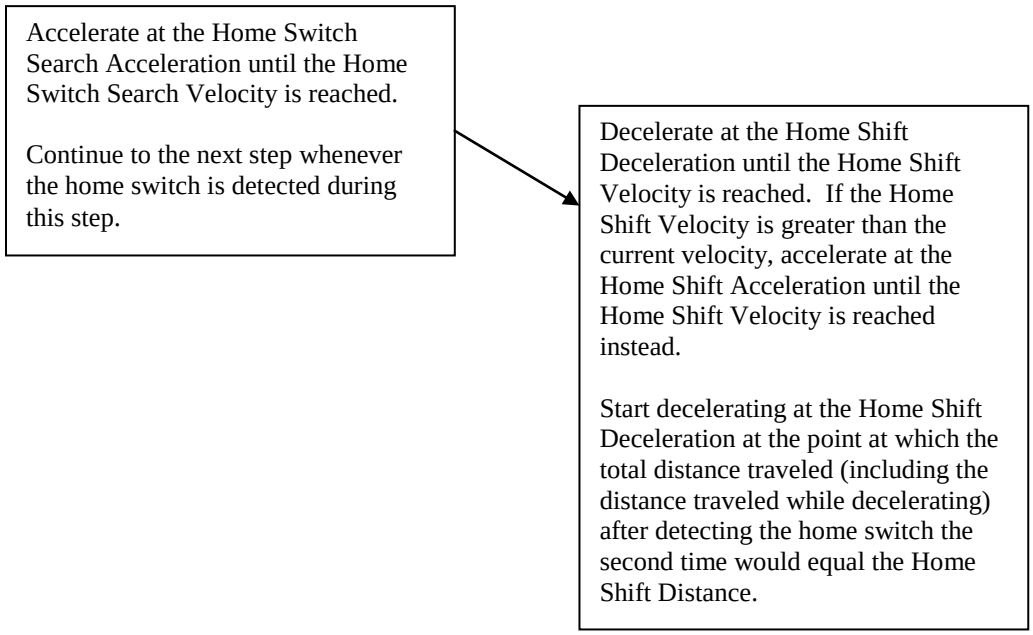


Figure 4-13: HS Homing Procedure

Example 1: Home Switch Velocity > Home Shift Velocity

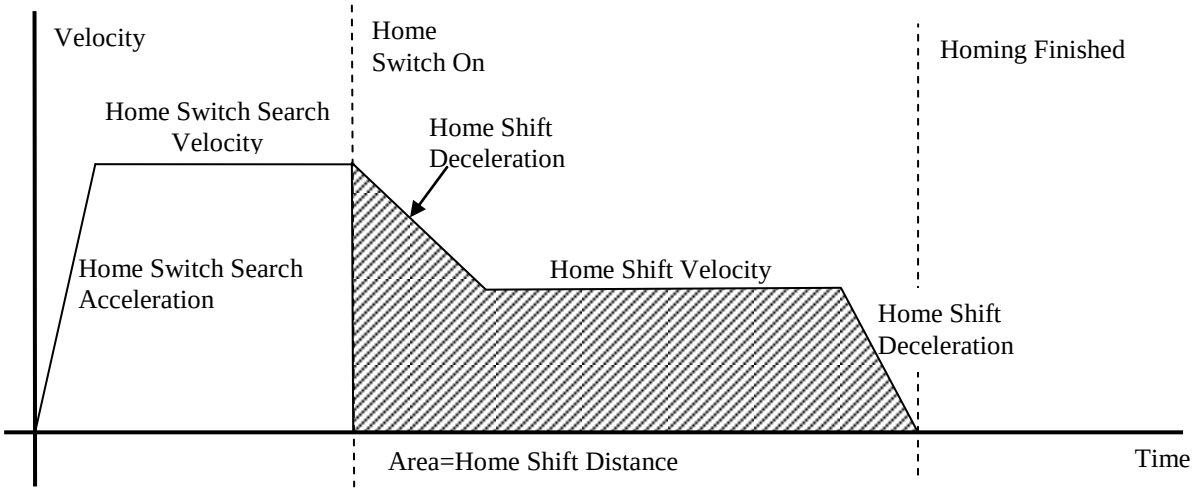


Figure 4-14: HS Home Operation Example 1

Example 2: Home Switch Velocity > Home Shift Velocity

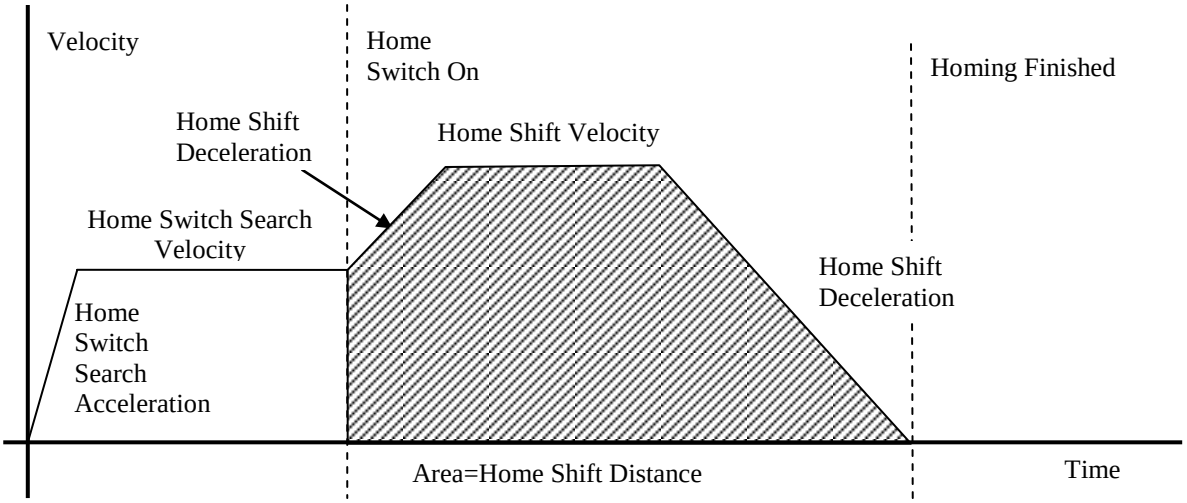


Figure 4-15: HS Home Operation Example 2

The following diagram shows the path of HS Home Operation.

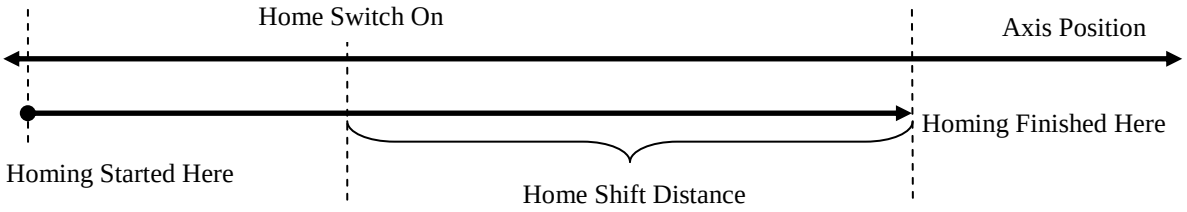


Figure 4-16: HS Home Operation Path

4.3.4 Home Type = HS_ZP

When the home type is "HS_ZP", the homing procedure is as follows:

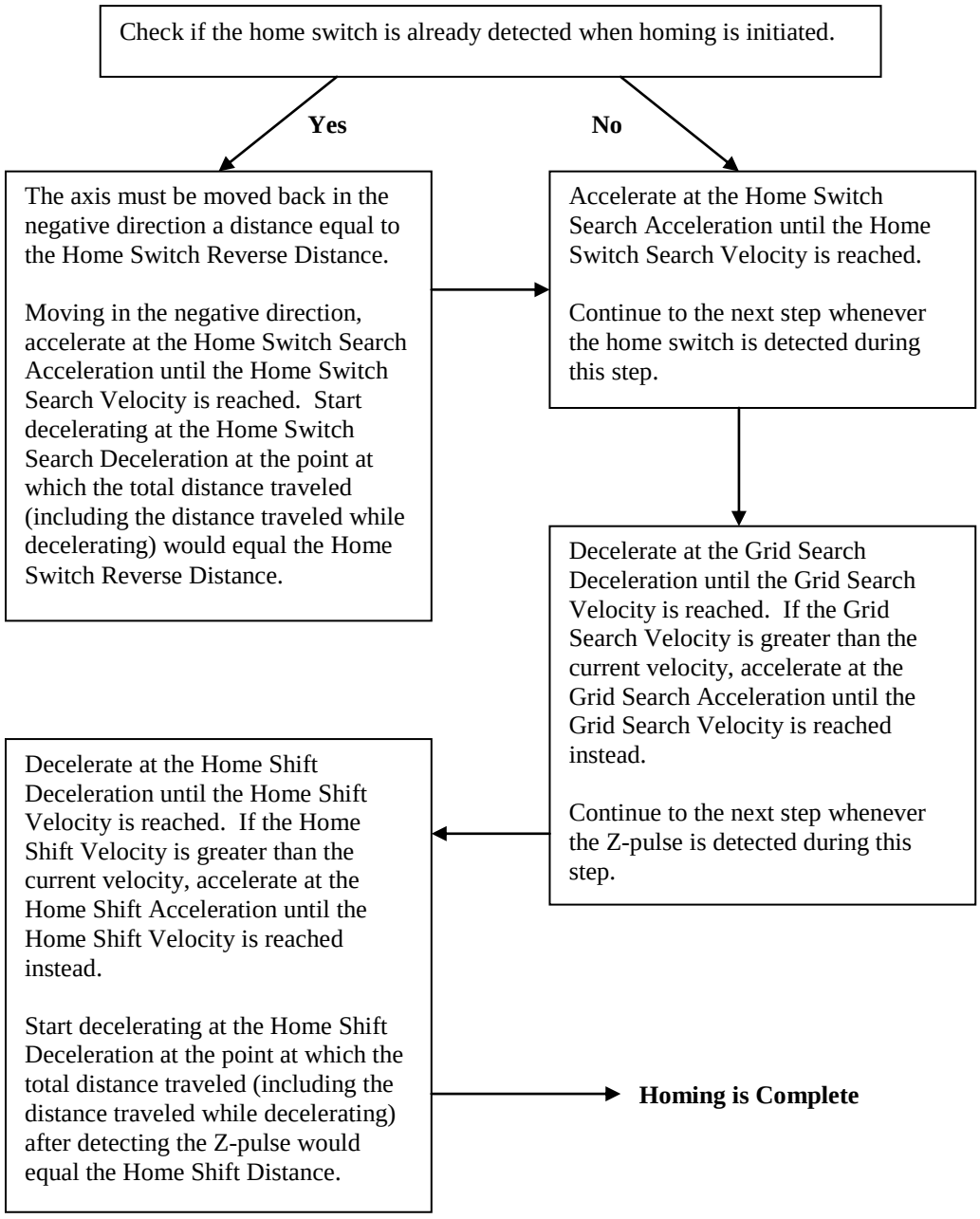


Figure 4-17: HS_ZP Homing Procedure

The following figures show examples of the HS_ZP homing procedure.

Example 1: Home Switch Search Velocity > Grid Search Velocity > Home Shift Velocity

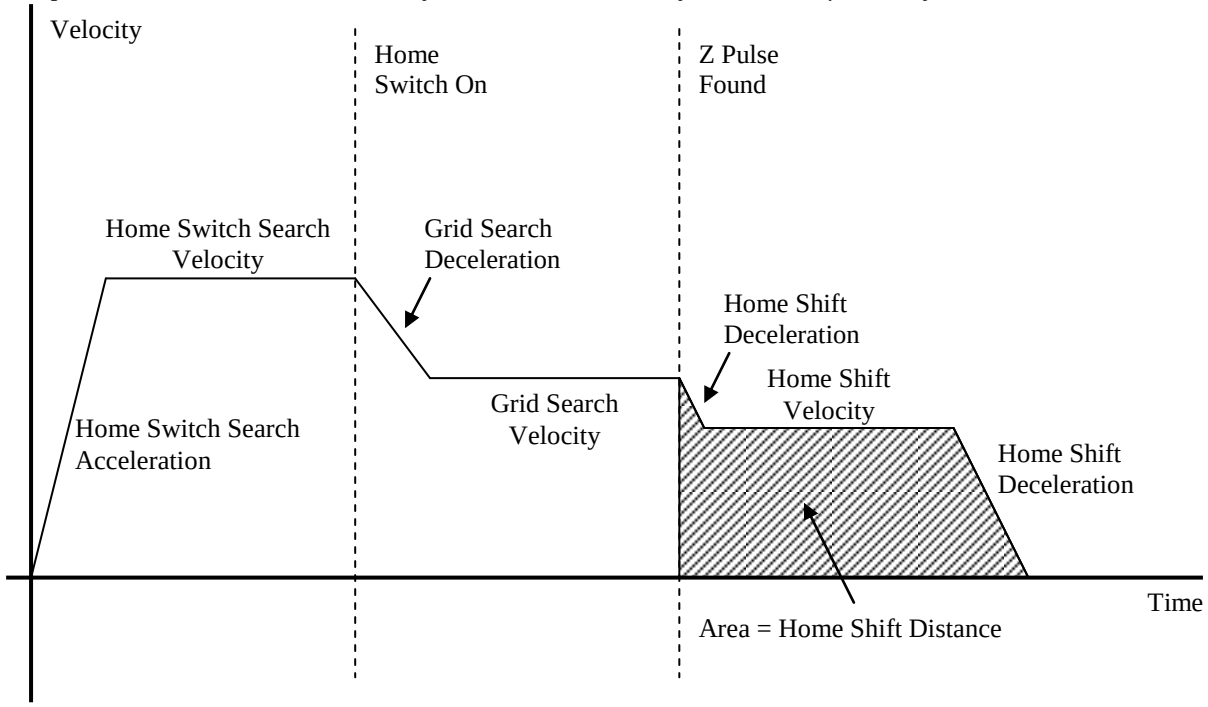


Figure 4-18: HS_ZP Home Operation Example 1

Example 2: Home Switch Search Velocity < Grid Search Velocity < Home Shift Velocity

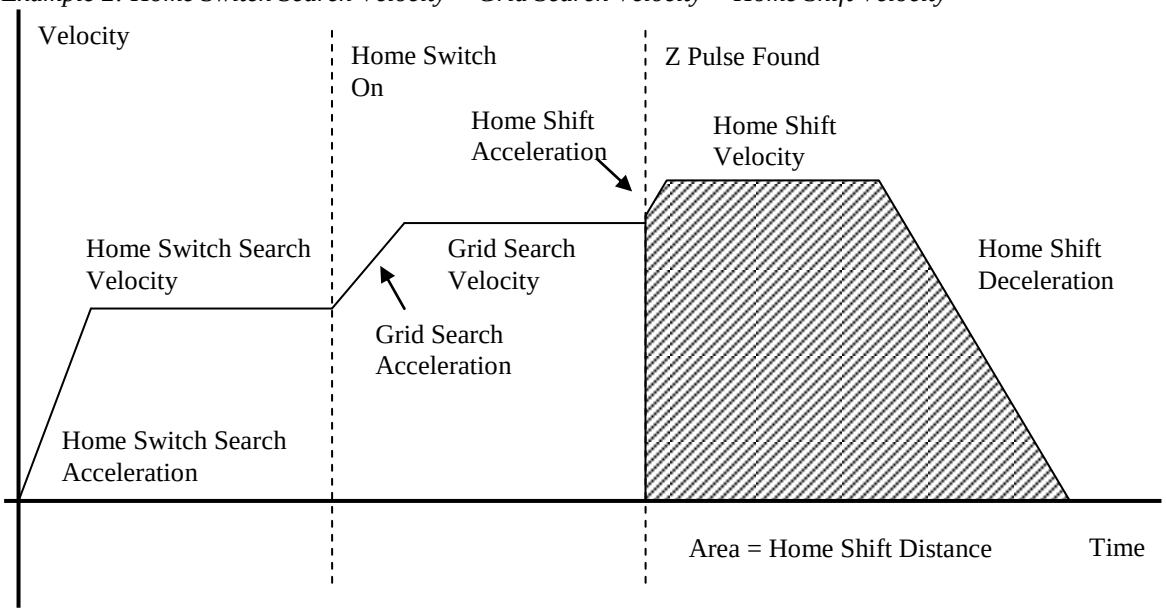


Figure 4-19: HS_ZP Home Operation Example 2

Example 3: Home Shift Deceleration Point Occurs Before Reaching Full Home Shift Velocity

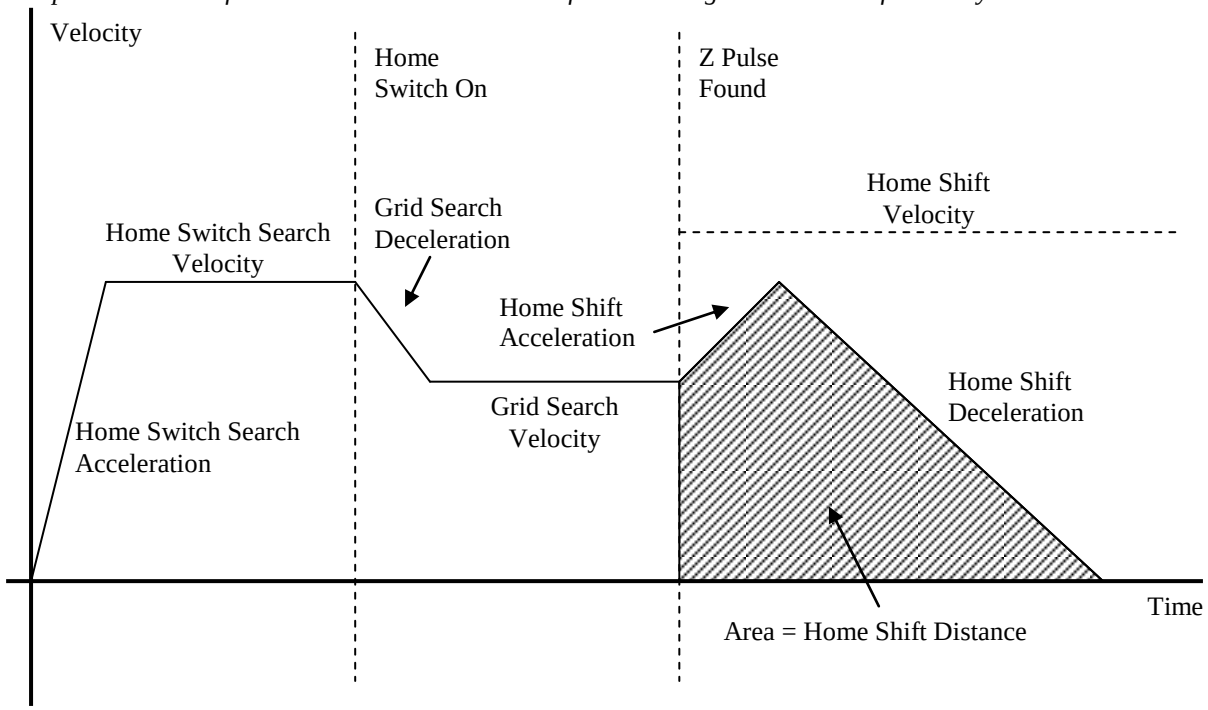


Figure 4-20: HS_ZP Home Operation Example 3

The following diagram shows the axis path of Example 1,2, and 3.

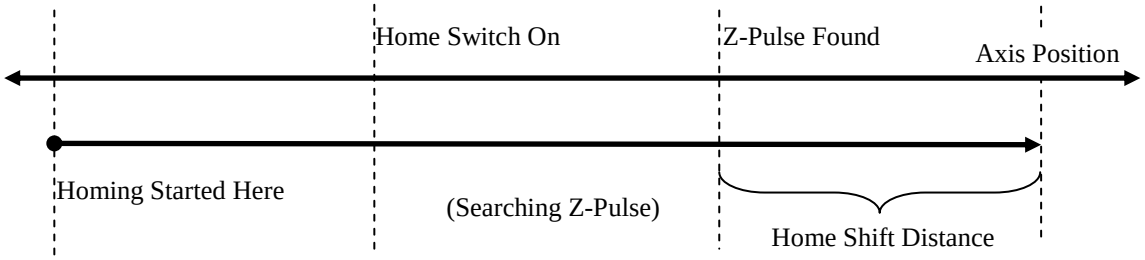


Figure 4-21: HS_ZP Home Operation Example 1,2, and 3 Path

Example 4 : Home Switch Search Velocity > Home Shift Velocity and the home switch is already On when homing is initiated.

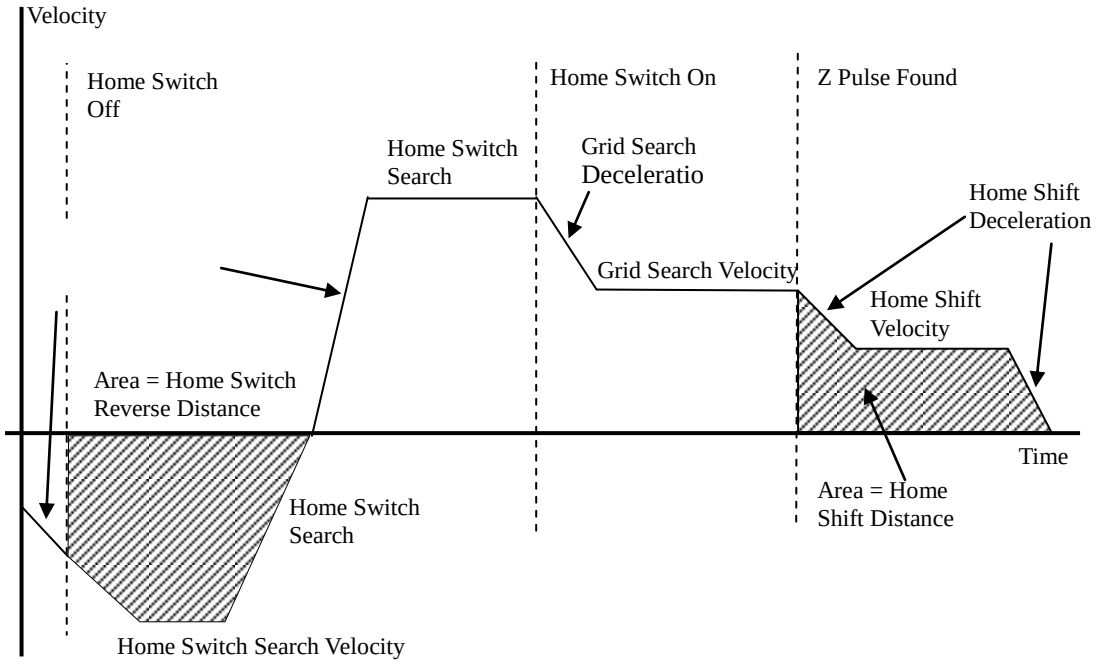


Figure 4-22: HS_ZP Home Operation Example 4

The following diagram shows the path of HS_ZP type homing procedure that the axis already detected the home switch when homing is initiated.

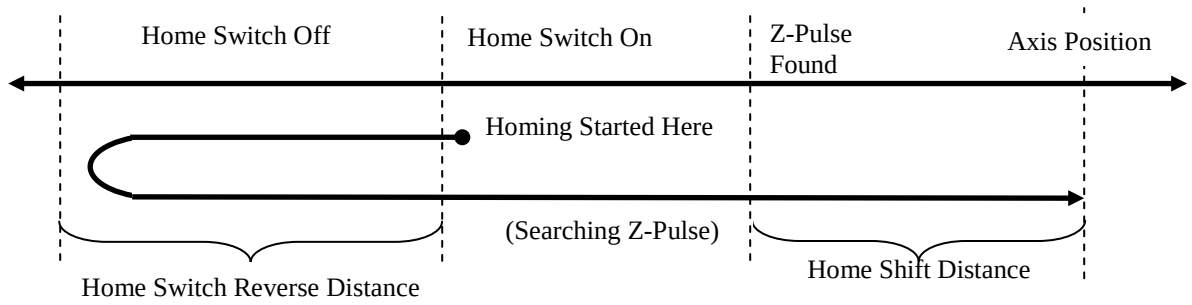


Figure 4-23: HS_ZP Home Operation Example 4 Path

4.3.5 Home Type = HS_REV_ZP

When the home type is "HS_REV_ZP," the homing procedure changes depending on whether the Home Direction parameter is "forward" or "backward."
Case 1: The Home Direction parameter is "forward."
In this case, the homing procedure will involve searching for the positive home switch.

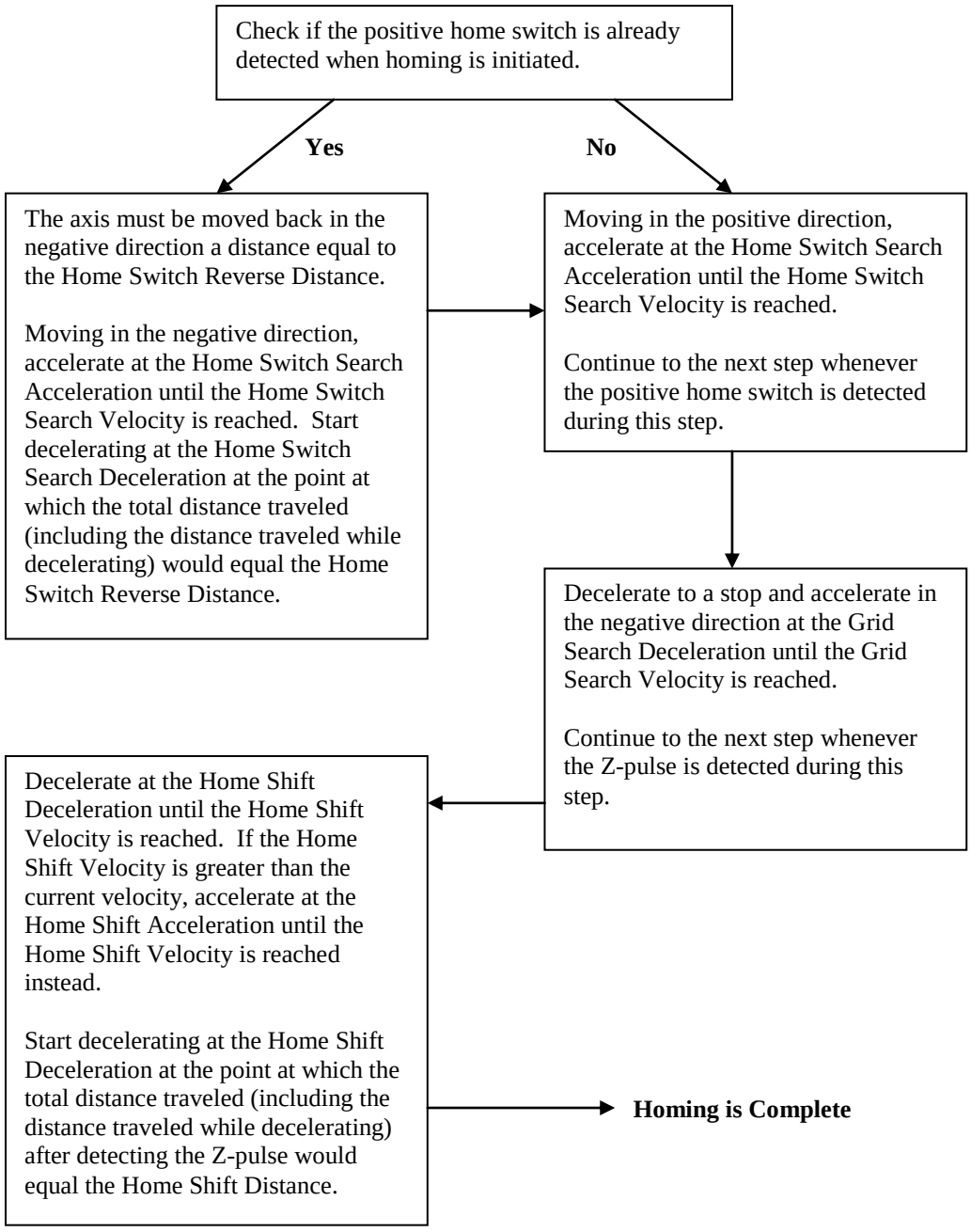


Figure 4-24: HS_REV_ZP Homing Procedure, Home Direction is "Forward"

The following figure show examples of the HS_REV_ZP homing procedure.
Example 1: Home Direction is "forward"

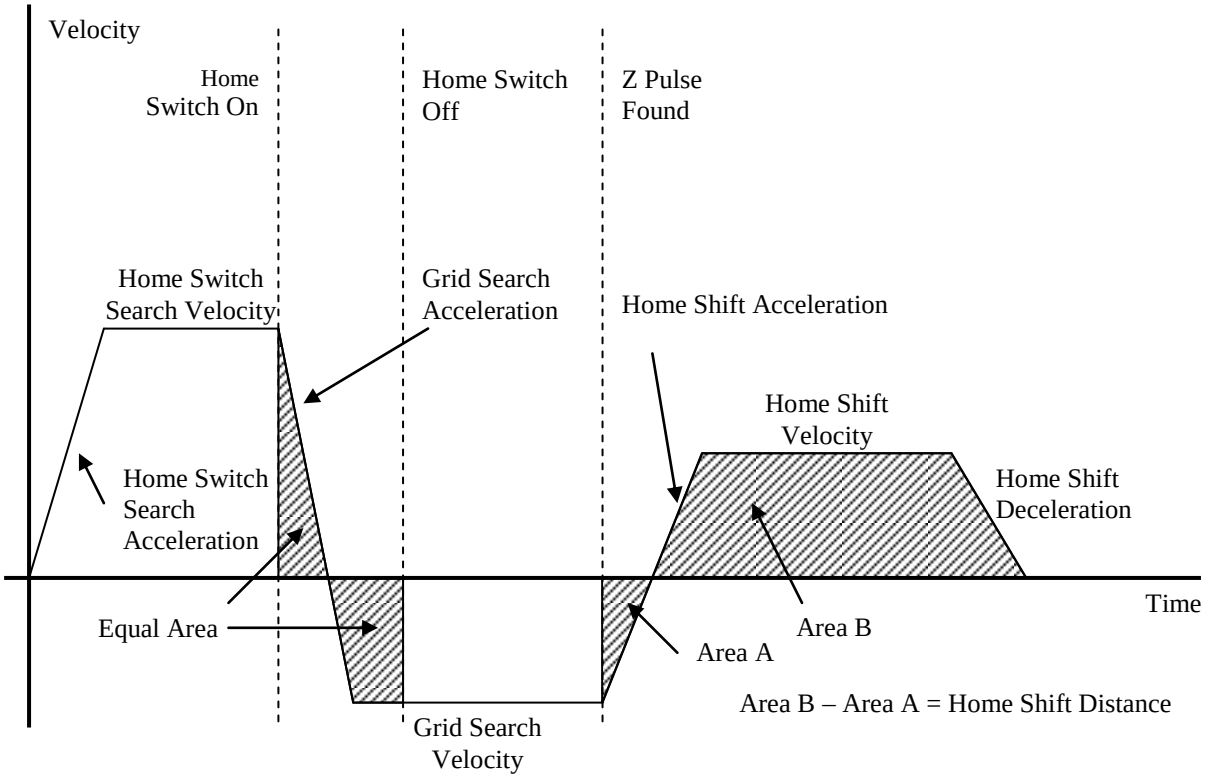


Figure 4-25: HS_REV_ZP Home Operation Example 1

The axis path.

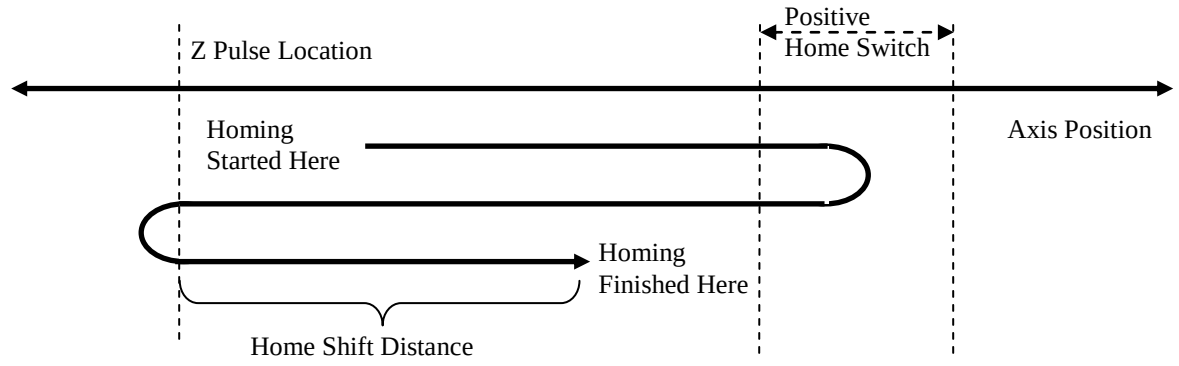


Figure 4-26: HS_REV_ZP Home Operation Example 1 Path

Case 2: The Home Direction parameter is "backward."

In this case, the homing procedure will involve searching for the negative home switch.

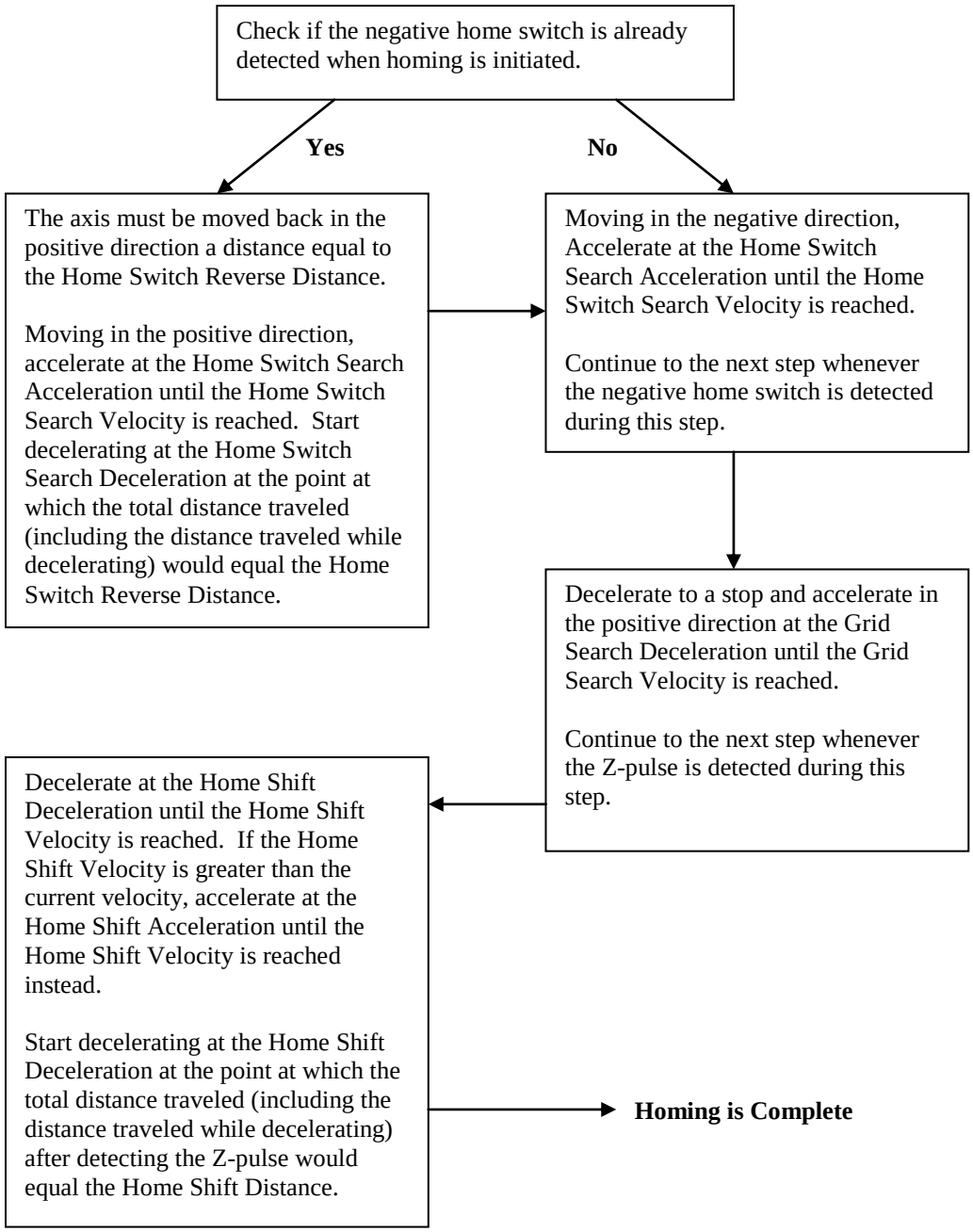


Figure 4-27: HS_REV_ZP Homing Procedure, Home Direction is "Backward"

Example 2: Home Direction is "backward"

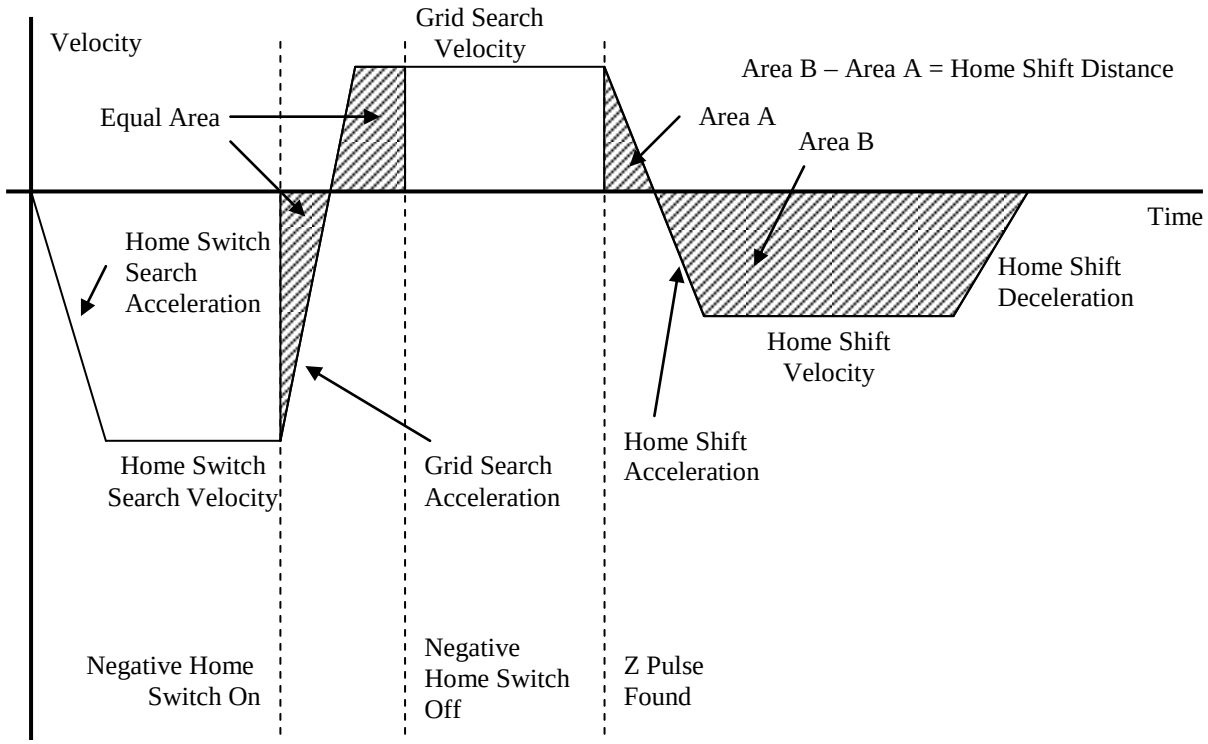


Figure 4-28: HS_REV_ZP Home Operation Example 2

The axis path of Example 2.

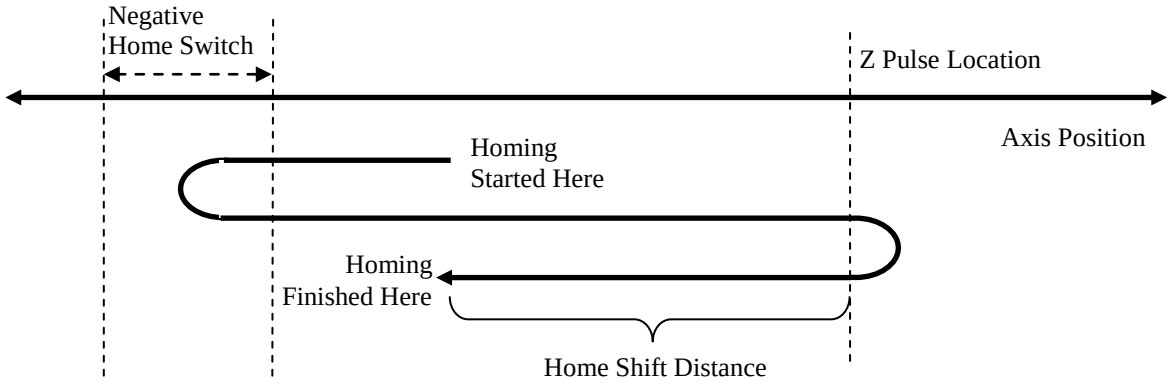


Figure 4-29: HS_REV_ZP Home Operation Example 2 Path

4.3.6 Home Type = HS_HS

When the home type is "HS_HS", the homing procedure is as follows:

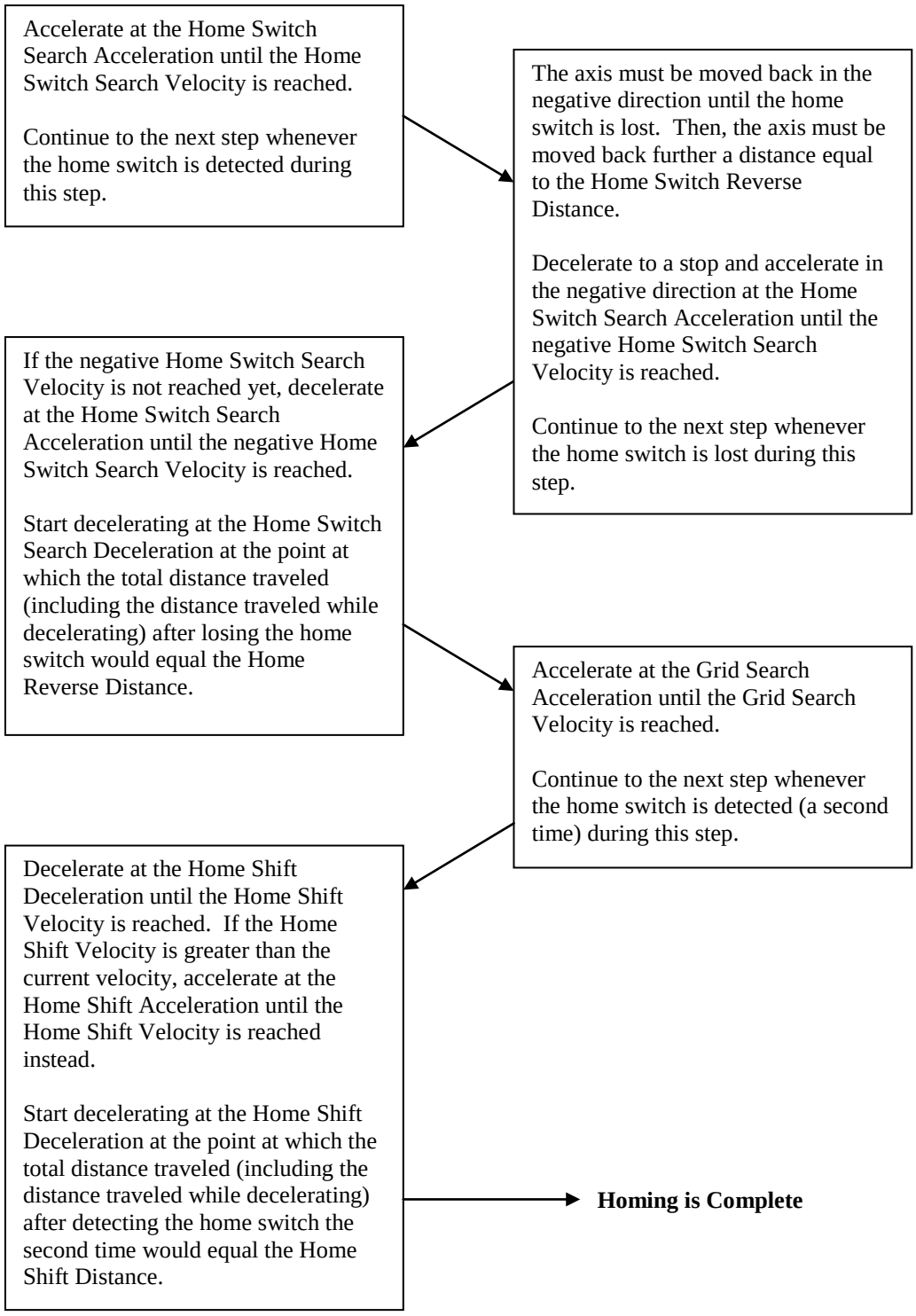


Figure 4-30: HS_HS Homing Procedure

The following figure shows an example of the HS_HS homing procedure.

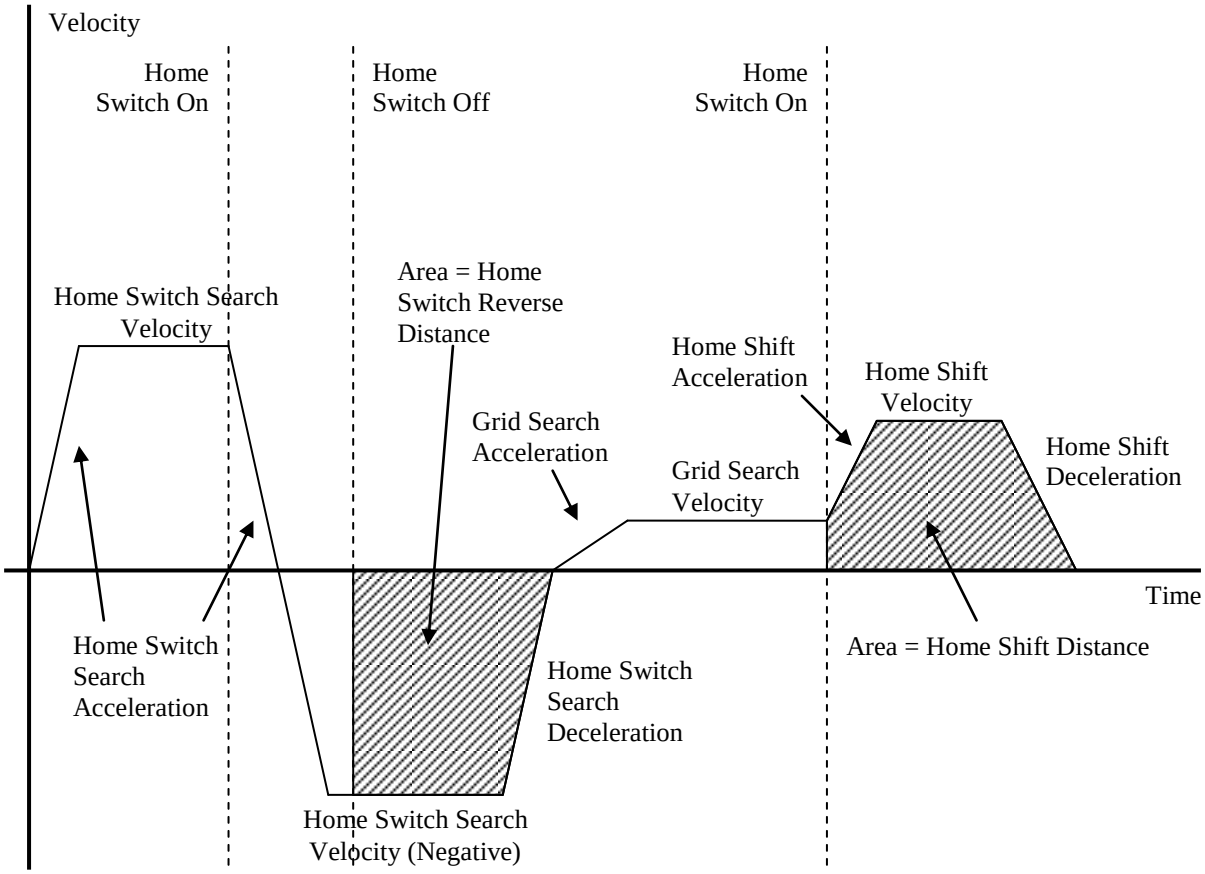


Figure 4-31: HS_HS Home Operation Example

The following diagram shows the axis path of HS_HS homing type.

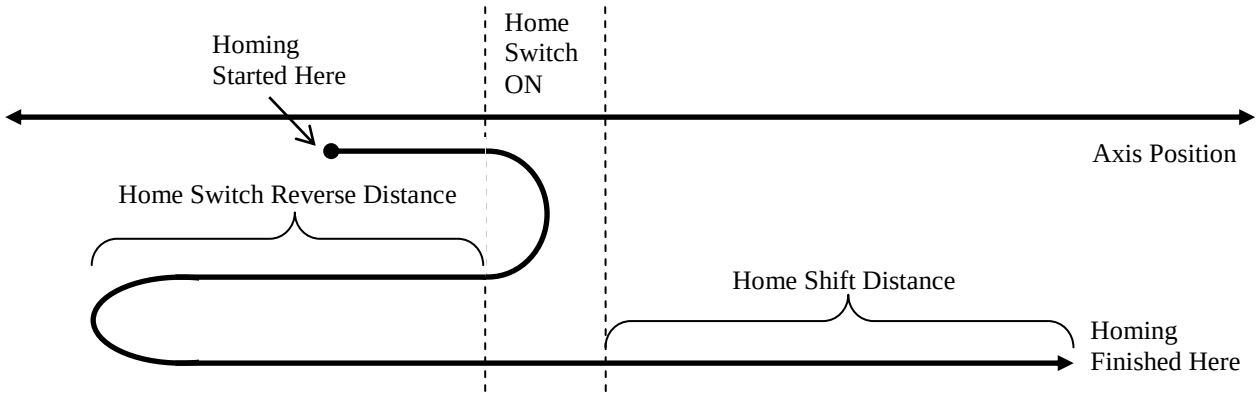


Figure 4-32: HS_HS Home Operation Example Path

4.3.7 Home Type = LS_REV_ZP

When the home type is "LS_REV_ZP," the homing procedure changes depending on whether the Home Direction parameter is "forward" or "backward."

Case 1: The Home Direction parameter is "forward."

In this case, the homing procedure will involve searching for the positive on-servo hard limit switch. Note that the negative limit switch still operates normally during this procedure.

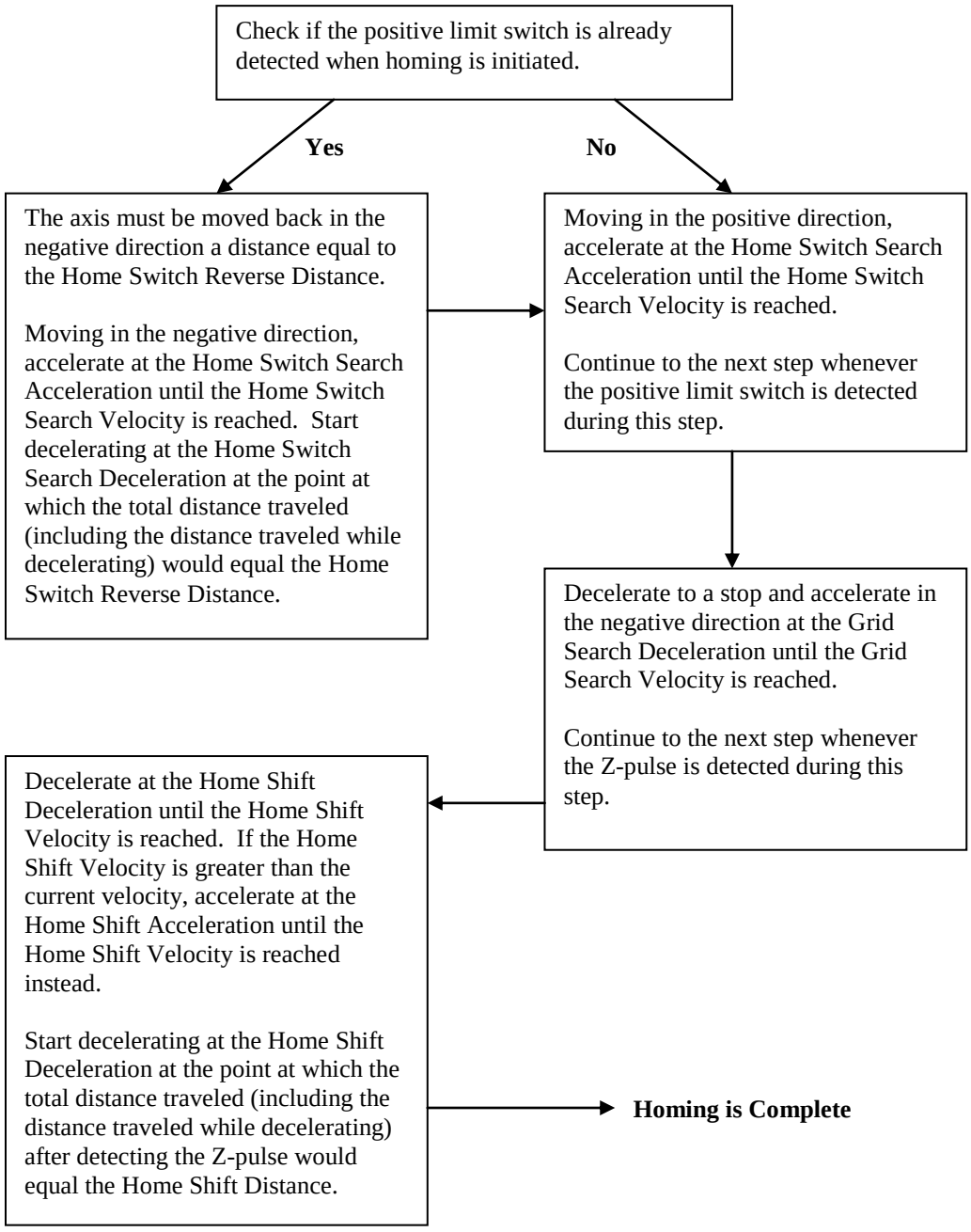


Figure 4-33: LS_REV_ZP Homing Procedure, Home Direction is "Forward"

Case 2: The Home Direction parameter is "backward."

In this case, the homing procedure will involve searching for the negative on-servo hard limit switch. Note that the positive limit switch still operates normally during this procedure.

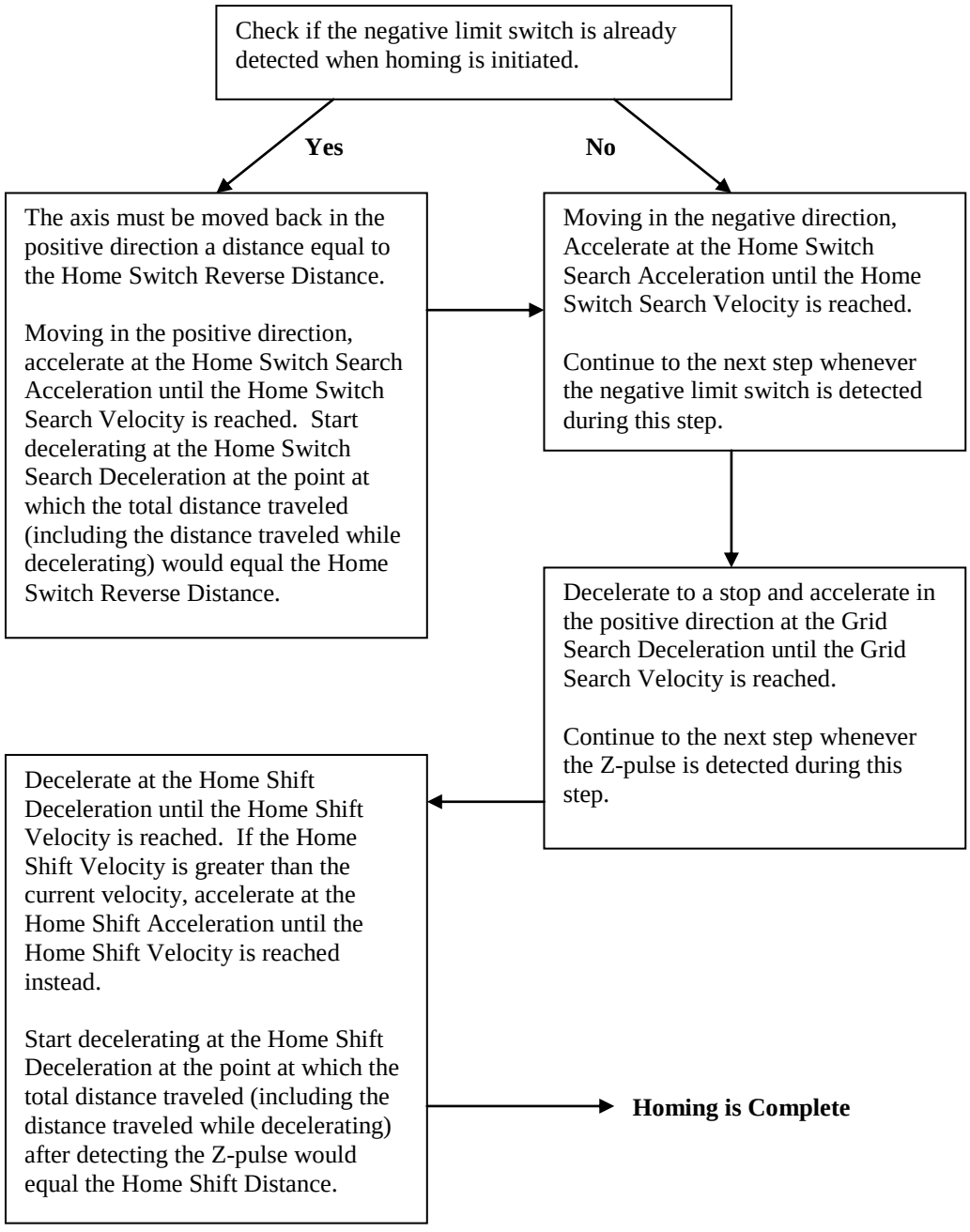


Figure 4-34: LS_REV_ZP Homing Procedure, Home Direction is "Backward"

The following figure show examples of the LS_REV_ZP homing procedure.

Example 1: Home Direction is "forward"

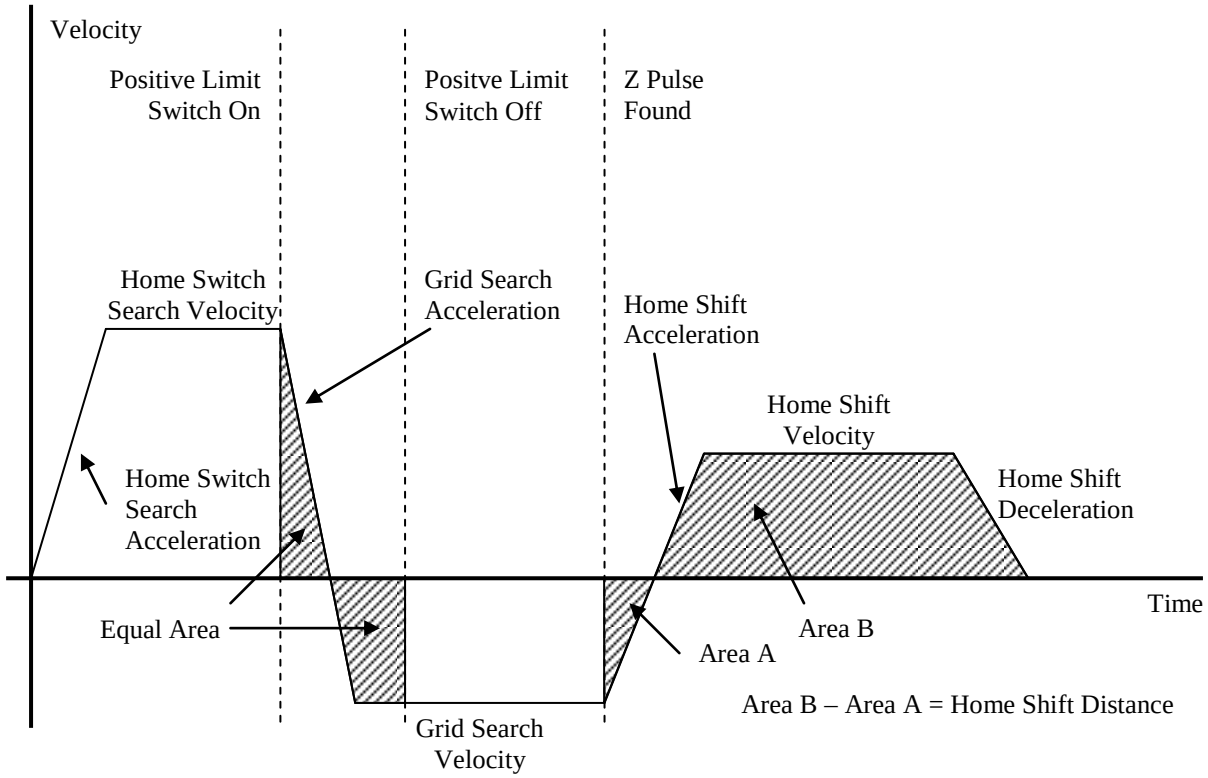


Figure 4-35: LS_REV_ZP Home Operation Example 1

The axis path of Example 1.

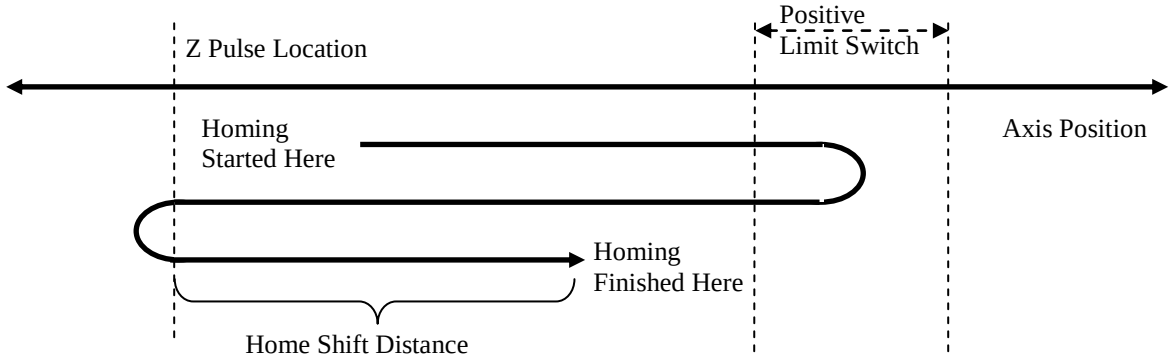


Figure 4-36 : LS_REV_ZP Home Operation Example 1 Path

Example 2: Home Direction is "backward"

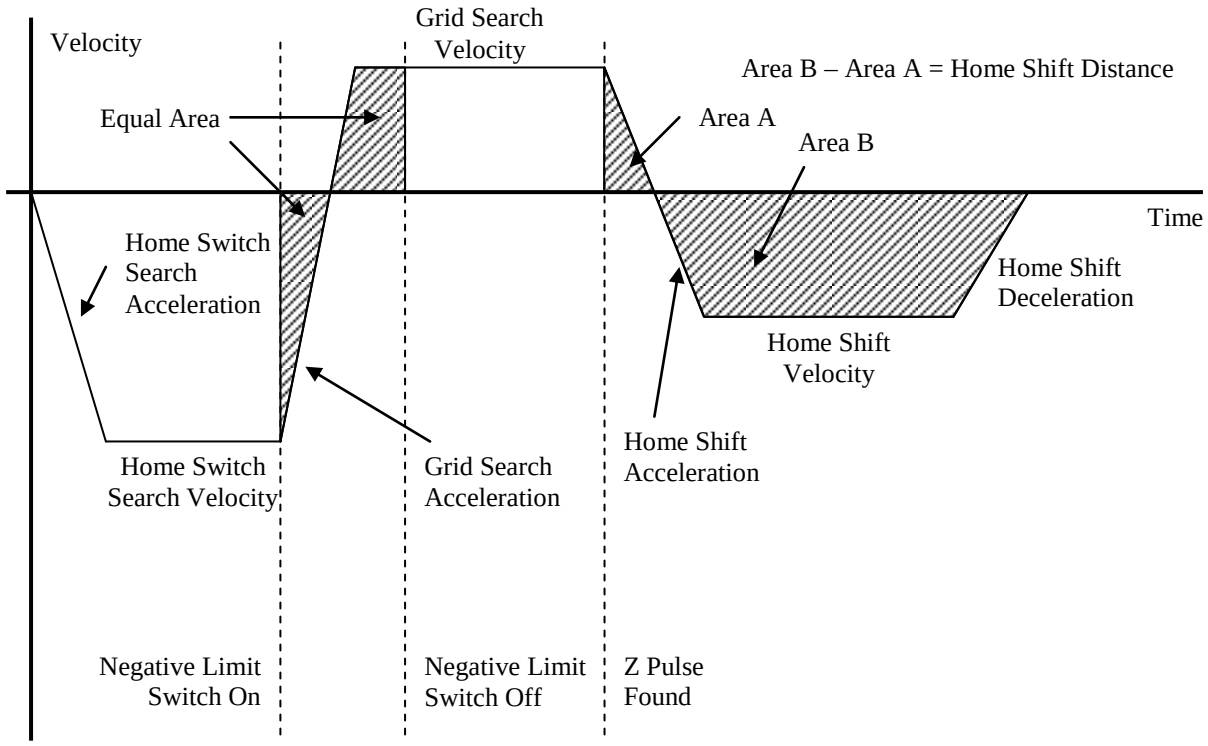


Figure 4-37: LS_REV_ZP Home Operation Example 2

The axis path of Example 2.

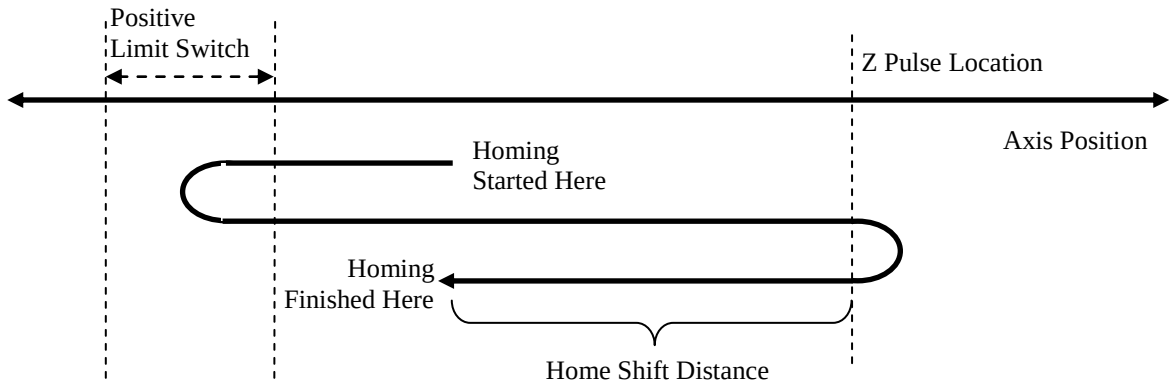


Figure 4-38: LS_REV_ZP Home Operation Example 2 Path

Example 3: Home Direction is "forward," and the limit switch is already on when homing is initiated

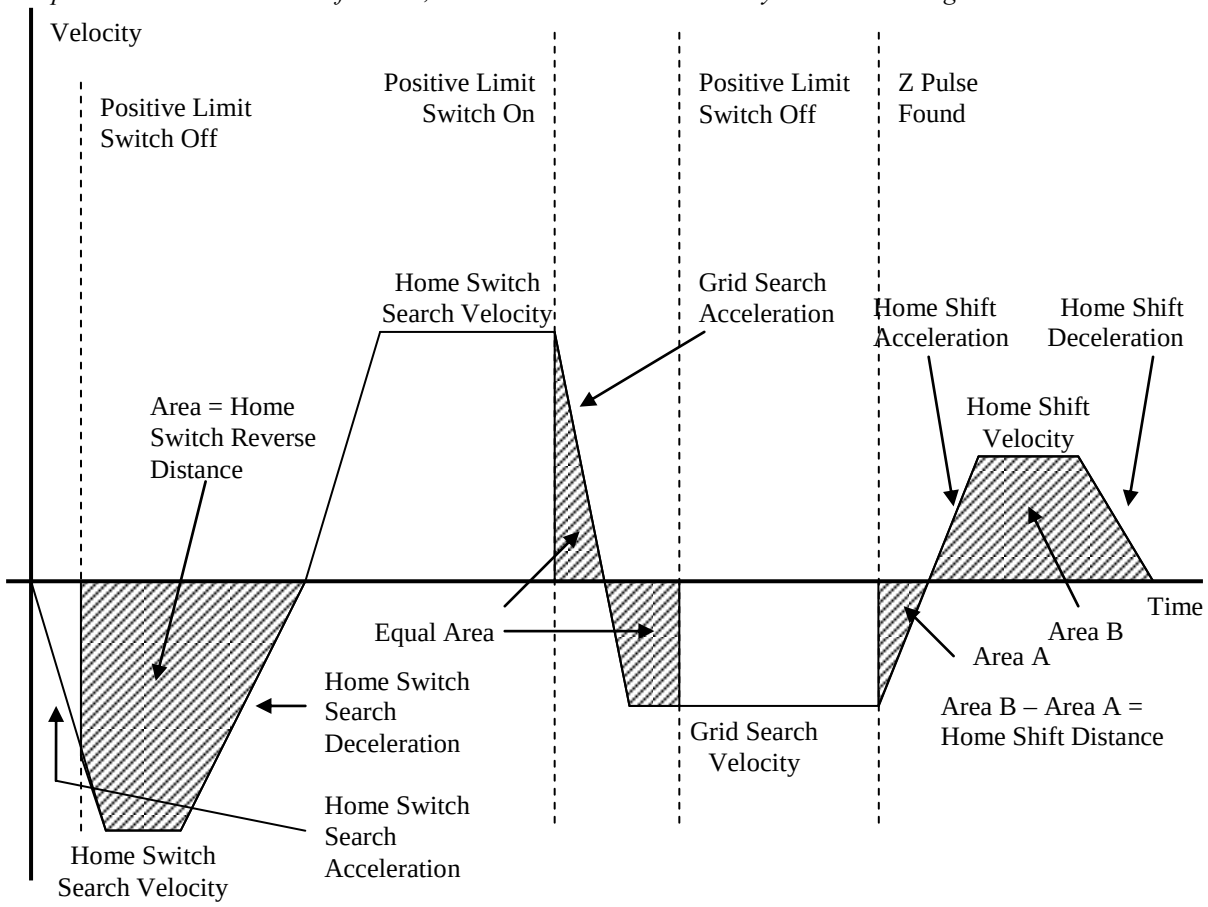


Figure 4-39: LS_REV_ZP Home Operation Example 3

The following diagram shows the path that the axis follows during the homing procedure of Example 3.

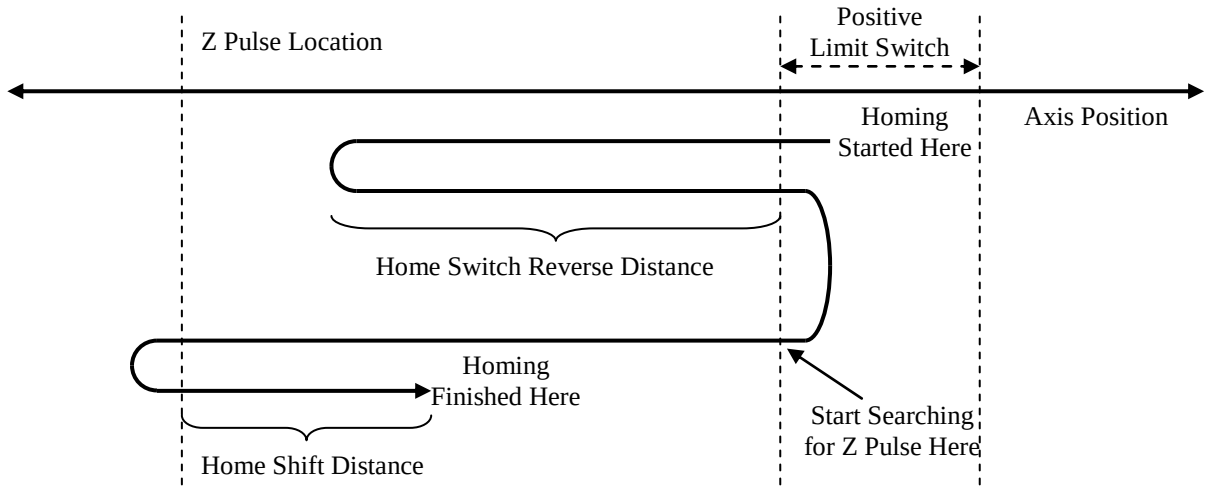


Figure 4-40: LS_REV_ZP Home Operation Example 3 Path

4.3.8 Home Type = LS_REV_ZP_NEAR

This home type is identical to the LS_REV_ZP home type, except the positive and negative near limit switches are searched instead.

4.3.9 Home Type = LS_REV_ZP_EXT

This home type is identical to the LS_REV_ZP home type, except the positive and negative external limit switches are searched instead.

4.3.10 Limit Switches During Home Operation

Hardware limit switches (on-servo hard limit, near limit, and external limit) behave differently during home mode when the home type is one of the following: HS, HS_ZP, HS_REV_ZP, HS_HS, LS_REV_ZP, LS_REV_ZP_NEAR, LS_REV_ZP_EXT. The behavior of the limit switches for each of these home types is listed below:

- HS, HS_ZP, HS_REV_ZP, HS_HS – When the limit switch in the direction of homing is tripped, the limit switch will not perform the action dictated by its limit switch type. Instead, the procedure in the following two figures is executed.
- LS_REV_ZP – The on-servo hard limit switch in the direction of homing is used during the homing procedure. The near and external limit switches in the direction of homing are ignored. All hardware limit switches opposite to the direction of homing behave normally.
- LS_REV_ZP_NEAR – The near limit switch in the direction of homing is used during the homing procedure. The external limit switch in the direction of homing is ignored. All hardware limit switches opposite to the direction of homing and the on-servo hard limit switch in the direction of homing behave normally.
- LS_REV_ZP_EXT – The external limit switch in the direction of homing is used during the homing procedure. The near limit switch in the direction of homing is ignored. All hardware limit switches opposite to the direction of homing and the on-servo hard limit switch in the direction of homing behave normally.

The following procedure is performed when a limit switch in the direction of homing is tripped for the home types that search for the home switch:

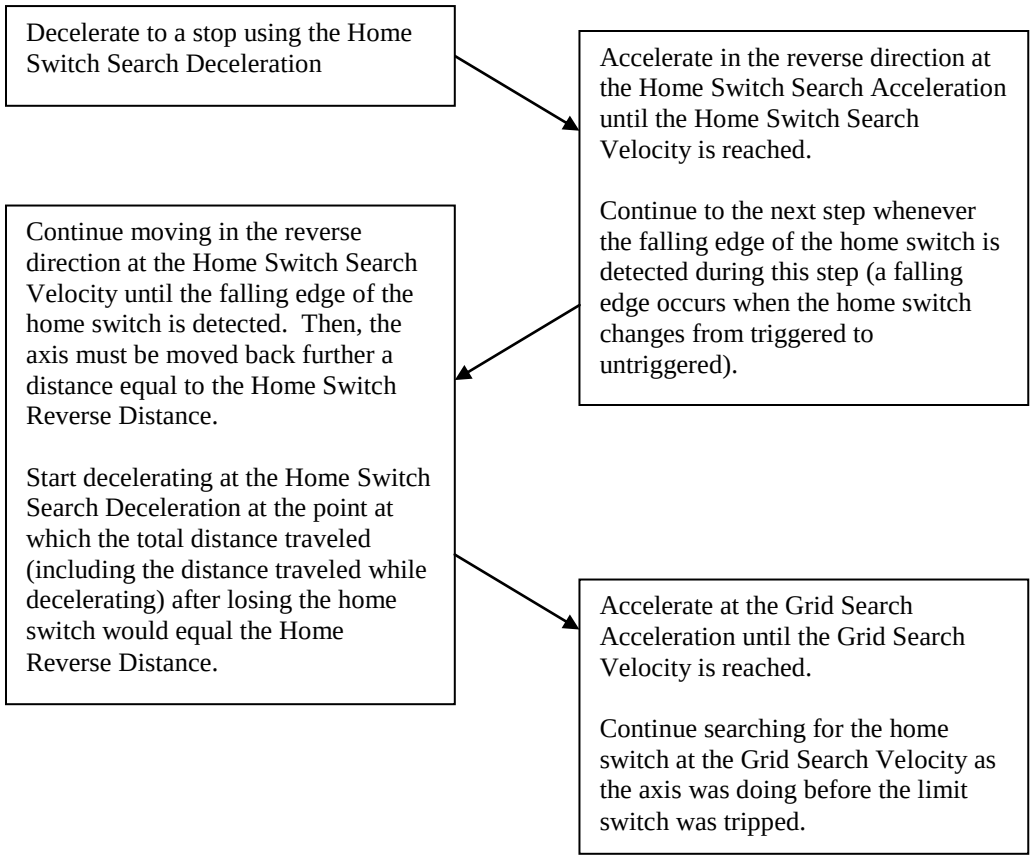


Figure 4-41: Limit SwichesDuring Home Operation

This procedure is illustrated in the following diagram, which shows the path that the axis follows when a limit switch is tripped.

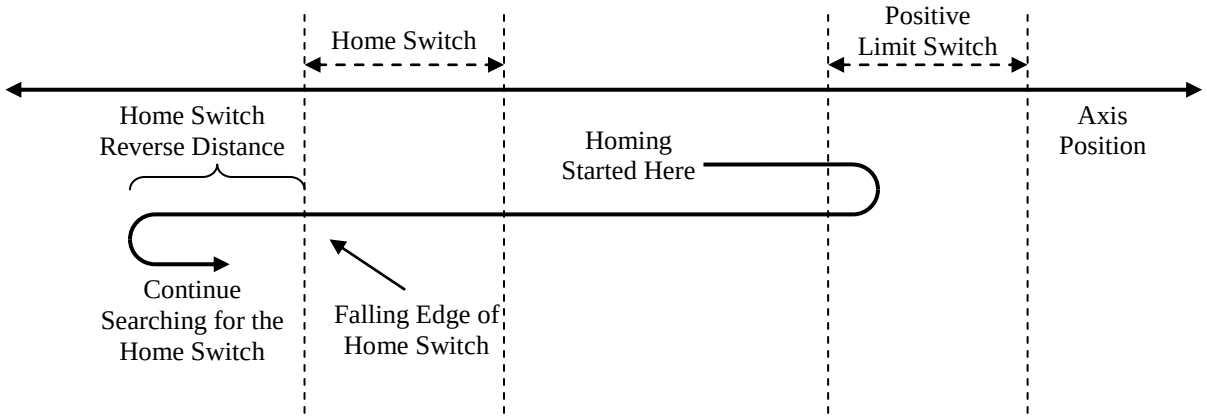


Figure 4-42: Limit SwichesDuring Home Operation Example Path

Note that this procedure will only occur when a limit switch in the direction of homing is tripped. When a limit switch in the direction opposite to the direction of homing is tripped, the limit switch will behave normally.

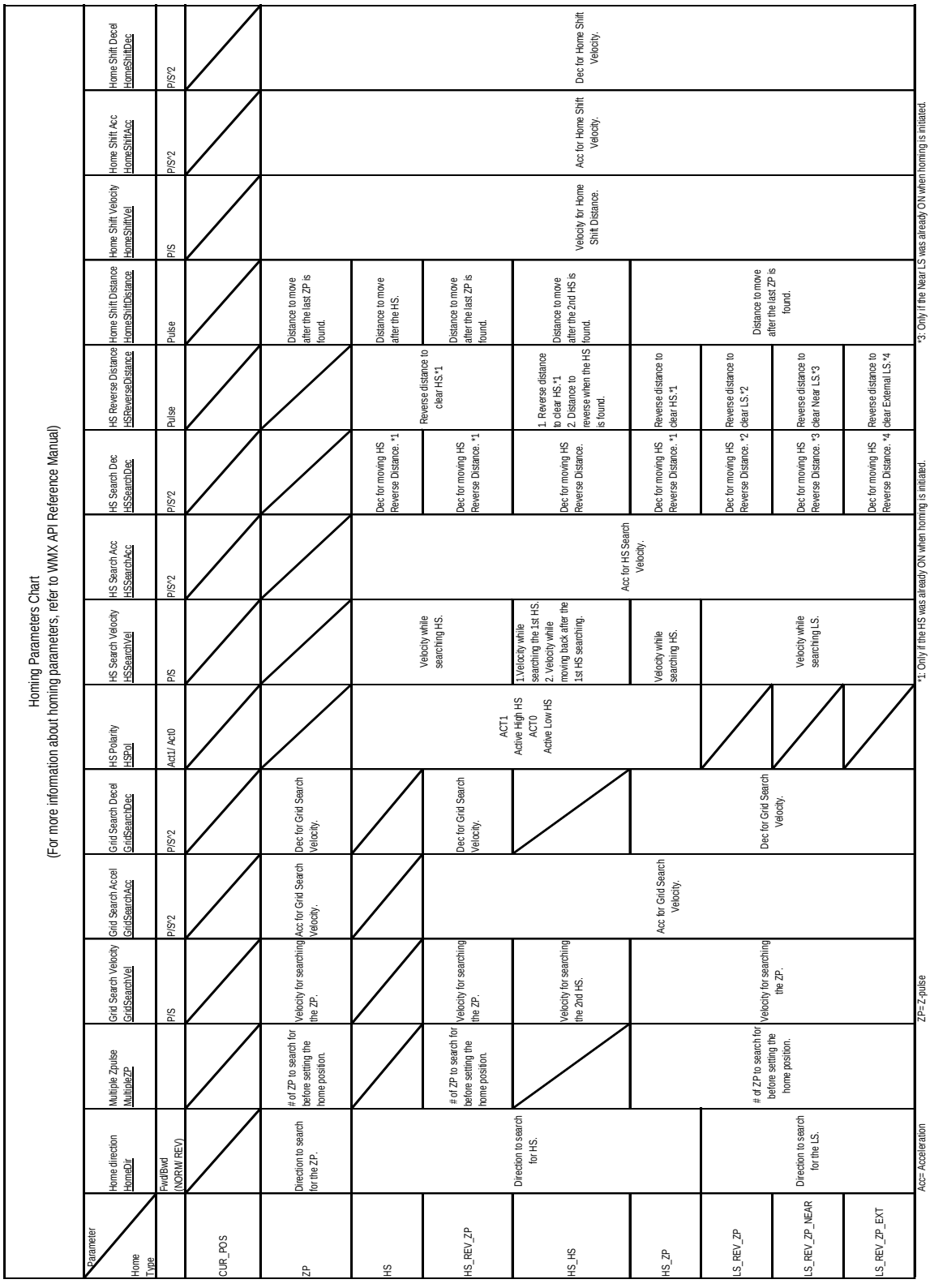


Figure 4-43 : Homing Parameter Chart

4.4 Master/Slave Operation

The "Master/Slave Operation" control window allows the operator to set and resolve master-slave synchronization control between any of the up to 64 axes that are controlled. When sync control is enabled for an axis, that axis will follow the movements of its master axis until sync control is resolved.

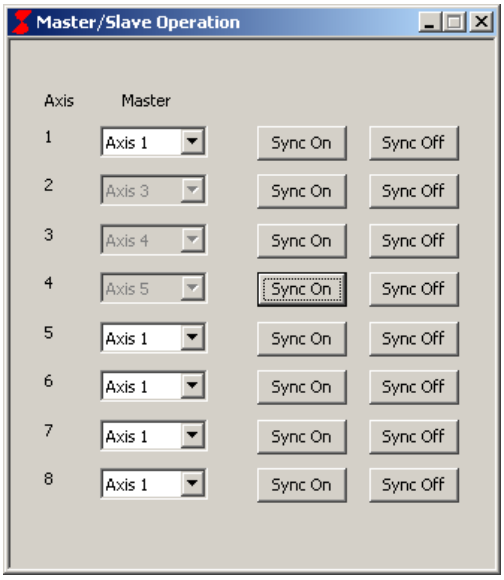


Figure 4-45: Sync Operation Control Window

To enable sync control for an axis, specify the master axis using the drop down menu, then click on "Sync On." If successful, the drop down menu will become grayed out to signify that sync control has been established. To resolve sync control for an axis, click on the "Sync Off" button for that axis.

Sync control can be chained so that one axis has a master axis, which in turn has another master axis, and so on. In the above screenshot, Axis 3 is Axis 2's master, Axis 4 is Axis 3's master, and Axis 5 is Axis 4's master.

There are some restrictions for establishing sync control:

- Each axis can only have one master axis.
- *You cannot select Axis A to be the master of Axis B if Axis A already has a master axis*. To chain sync control, you must start establishing sync control from the "bottom up." For example, to establish the sync control chain shown in the screenshot above, you must first set Axis 3 to be Axis 2's master, then set Axis 4 to be Axis 3's master, then set Axis 5 to be Axis 4's master. If you first set Axis 5 to be Axis 4's master, you will be unable to set Axis 4 to be Axis 3's master.
- For more information, refer to the *WMX API Reference Manual.*

4.5 I/O Operation

The "I/O Control" control window allows the operator to view the state of up to 4 bytes of inputs and 4 bytes of outputs at a time. In addition, the operator is able to set the state of any output bits.

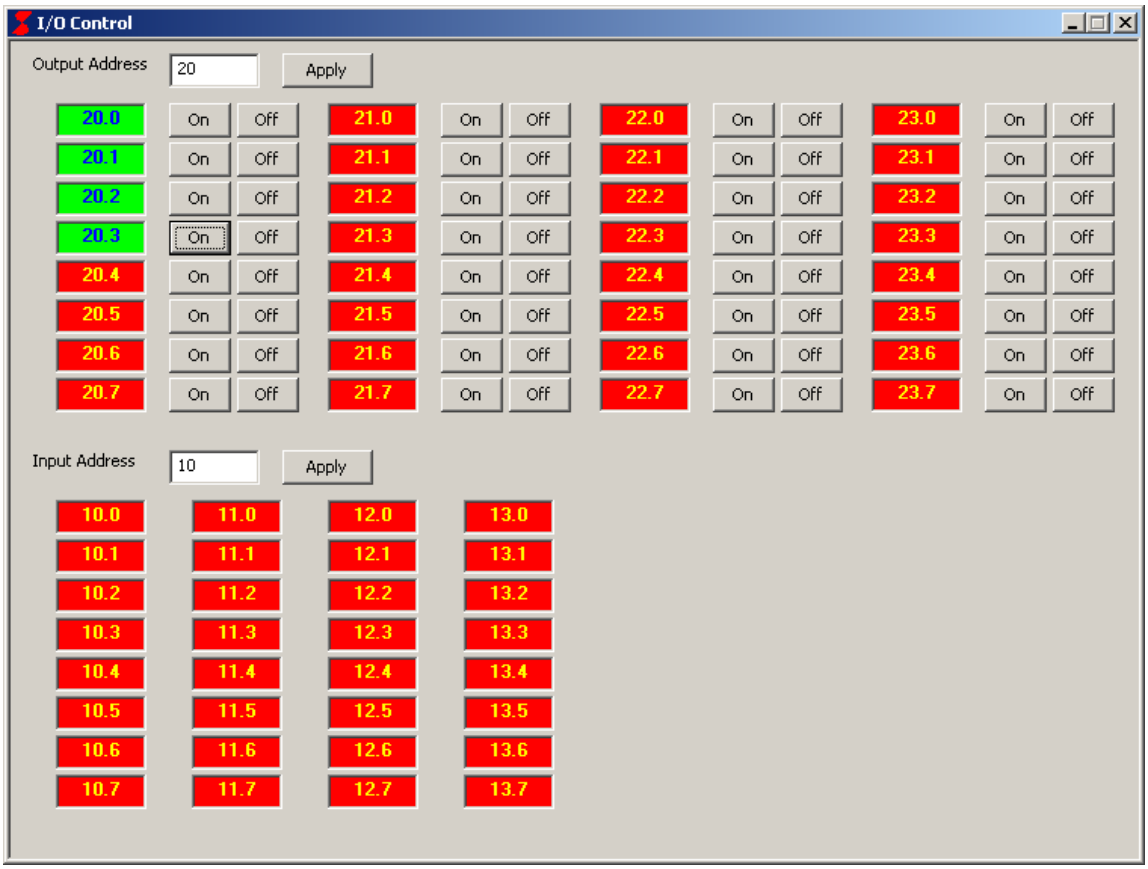


Figure 4-46: I/O Control Control Window

To view the output of a particular address, enter the byte address of that output into the text box labeled "Output Address," then click on "Apply." The 4 bytes of outputs starting from that byte address will be displayed in the format "[byte address].[bit address]".

An output address with a green background signifies that the output bit is high. An output address with a red background signifies that the output bit is low. By clicking the "On" or "Off" buttons next to each output address, the operator is able to turn that output bit on or off.

To view the input of a particular address, enter the byte address of that input into the text box labeled "Input Address," then click on "Apply." The 4 bytes of inputs starting from that byte address will be displayed in the format "[byte address].[bit address]".

An input address with a green background signifies that the input bit is high. An input address with a red background signifies that the input bit is low.

4.6 Jog Operation

The "Jog Operation" control window allows the operator to jog each axis. The axis will continue moving at the specified velocity until stopped.

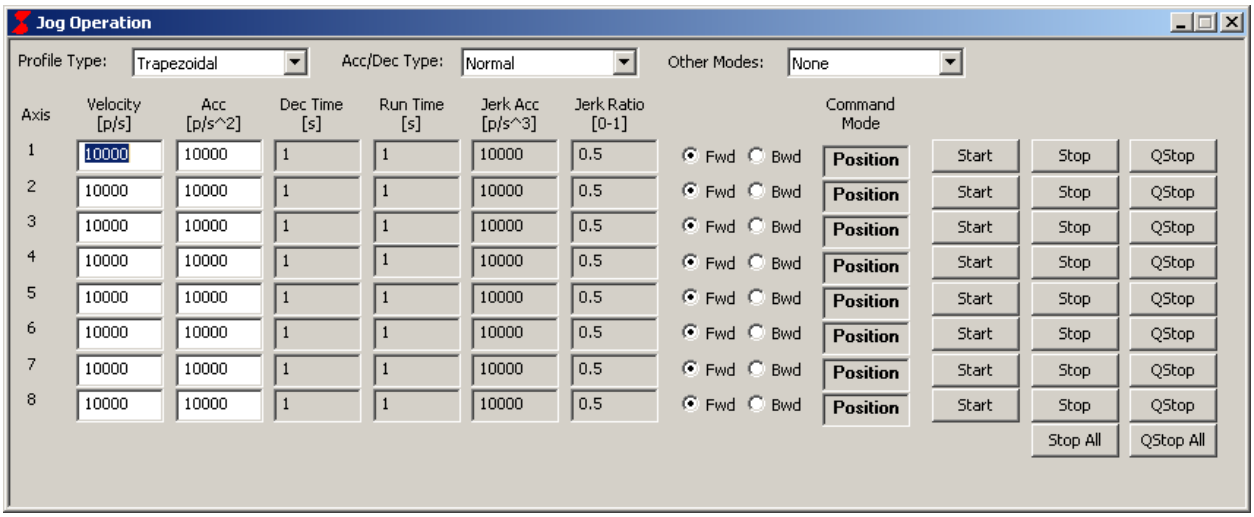


Figure 4-47: Jog Operation Control Window (1 of 3)

To initiate jogging for an axis, click on the "Start" button for the axis to jog. To stop an axis that is jogging, click on the "Stop" button for the axis. Clicking on the "Stop All" button will stop all axes that are jogging.

The available parameters are described below:

- Profile Type – The profile type of the positioning command. See *Section 4.1: Single Position Operation* for additional information regarding the available profile types.

- Acc/Dec Type – The mode in which the acceleration is specified. Select "Normal" to specify the acceleration normally, in units of pulses per second squared. Select "Time" to specify the acceleration time, in units of seconds. "Time" is incompatible with the "Timed Run" Other Mode. When Acc/Dec Type is set to "Time," the "Acc" column will be replaced by the "Acc Time" column.

  Select "Trapezoidal" to specify the acceleration as follows. If Profile Type is "Trapezoidal," the acceleration is specified in the same manner as when Acc/Dec Type is "Normal." If Profile Type is "Jerk-Free" or "Jerk-Limited," the acceleration is modified so that the time taken to accelerate is the same as when Profile Type is "Trapezoidal."

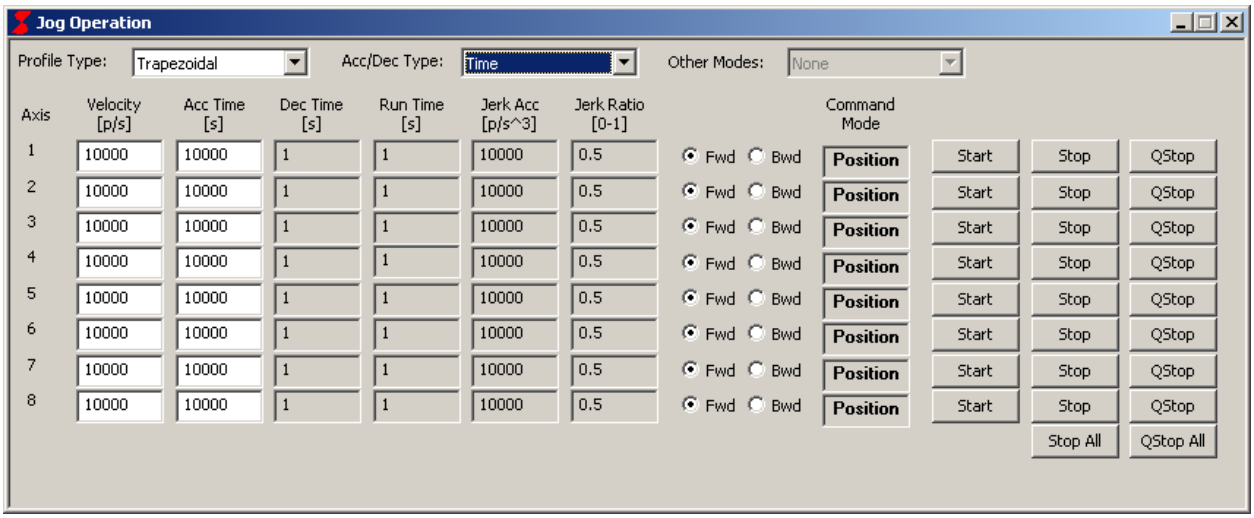


Figure 4-48: Jog Operation Control Window (2 of 3)

- Other Modes – Additional modes may be selected using this parameter. The currently available other modes are:

  Timed Run - The axis will jog only for a specified period of time. After the period of time elapses, the axis will automatically decelerate to a stop. The period of time has a resolution of one communication cycle (commonly 1ms).

  The "Timed Run" option is incompatible with the "Acc Time" option. The "Acc" parameter will change to "Acc Time," and the "Dec Time" and "Run Time" parameters will be enabled, as shown below:

  The "Acc Time" parameter specifies the number of seconds to spend accelerating to the specified velocity. The "Dec Time" parameter specifies the number of seconds to spend decelerating to rest at the end of the timed run. The "Run Time" parameter specifies the number of seconds to spend running at the specified velocity. The total time that the timed run takes is "Acc Time" + "Dec Time" + "Run Time."

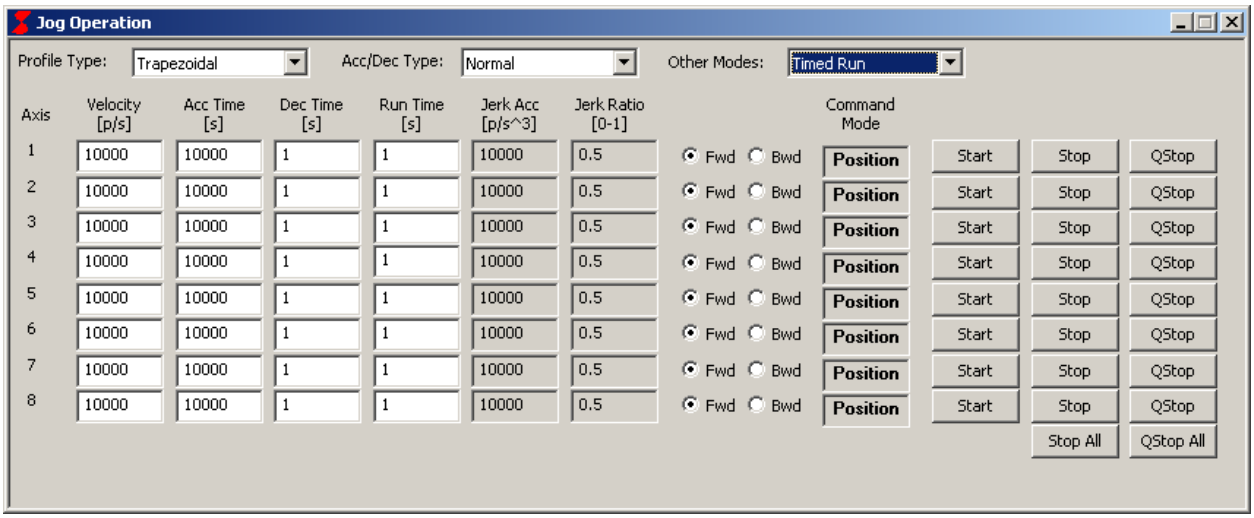


Figure 4-49: Jog Operation Control Window (3 of 3)

- Velocity – The velocity to jog the axis at, in units of pulses per second.

- Acc – The acceleration at which to accelerate to the specified velocity, in units of pulses per second squared. This value will also be used as the deceleration rate when an axis that is jogging is stopped.

- Acc Time – The time to spend accelerating to the specified velocity, in seconds. This parameter is only used if the "Acc/Dec Type" is "Acc Time," or if "Other Modes" is "Timed Run."

- Dec Time –The parameter specifies the number of seconds to spend decelerating to rest at the end of the timed run. (This parameter is applied only if "Timed Run" option is enabled.)

- Run Time - The parameter specifies the number of seconds to spend running at the specified velocity.

- Jerk Acc – The acceleration jerk used when jerk control is enabled, in units of pulses per second cubed. When accelerating to the specified velocity, the rate at which acceleration changes will be limited by this value. (See 4.1 Single Position Operation). This value will also be used as the deceleration jerk rate when an axis that is jogging is stopped.

- Jerk Ratio - The jerk ratio to be used for the acceleration/deceleration segment if the Profile Type is "Jerk-Limited." This value is defined as the ratio of the time for which the jerk is nonzero to the time where the acceleration/deceleration is nonzero. This value must be between 0 and 1, inclusive. When jerk ratio is 0,

the profile during acceleration will be identical to when the Profile Type is "Trapezoidal." However, the jerk will not exceed the maximum of 2^31-1 (if the jerk ratio would exceed this value, the acceleration/deceleration jerk will be clamped to this value). When jerk ratio is 1, the profile during acceleration/deceleration will be identical to when the Profile Type is "Jerk-Free."

- Fwd / Bwd – The direction that the axis jogs in. The possible options are forward and backward.

The "Jog Operation" control window shows the command mode of each axis in the column labeled "Command Mode." In addition, the "Start" buttons in the control window automatically send jog commands to axes with the "Position" command mode and velocity commands to axes with the "Velocity" command mode.

4.7 Circular Position Operation

The "Circular Position Operation" control window allows the operator to execute circular and arc interpolation commands for any pair of axes.

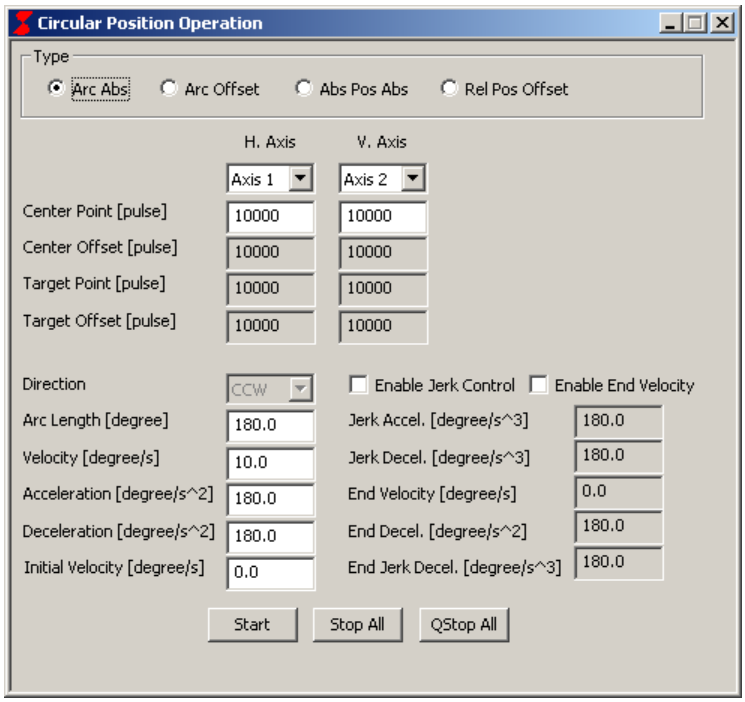


Figure 4-50: Circular Position Operation Control Window

To initiate a circular or arc interpolation command, first select the type of the interpolation command. The available types are listed below:

- Arc Abs – The commanded arc is described by the center point, the arc length, the interpolation velocity, the interpolation acceleration, and the interpolation deceleration.

- Arc Offset – The commanded arc is described by the center offset, the arc length, the interpolation velocity, the interpolation acceleration, and the interpolation deceleration.

- Abs Pos Abs – The commanded arc is described by the center point, the target point, the direction of travel, the interpolation velocity, the interpolation acceleration, and the interpolation deceleration.

- RelPos Offset – The commanded arc is described by the center offset, the target offset, the direction of travel, the interpolation velocity, the interpolation acceleration, and the interpolation deceleration.

When one of the four interpolation command types is selected, the text boxes and pull down menus for parameters that are pertinent to the selected command type are enabled. All other text boxes and pull down menus will be disabled.

Each of the available parameters is described below:

- H.Axis/V.Axis – Specifies the axis number of the horizontal and vertical axes to interpolate.
- Center Point [pulse] – Specifies the absolute coordinates of the center point of the arc, in units of pulses. This parameter is used in "Arc Abs" and "Abs Pos Abs" type interpolation commands.
- Center Offset [pulse] – Specifies the relative coordiantes of the center point of the arc, relative to the starting point, in units of pulses. This parameter is used in "Arc Offset" and "RelPos Offset" type interpolation commands.
- Target Point [pulse] – Specifies the absolute coordinates of the target point to travel to, in units of pulses. This is the end point of the arc. This parameter is used in "Abs Pos Abs" type interpolation commands.
- Target Offset [pulse] – Specifies the relative coordinates of the target point to travel to, relative to the starting point, in units of pulses. This is the relative position of the end point of the arc. This parameter is used in "RelPos Offset" type interpolation commands.
- Direction – Specifies whether the commanded arc is in the clockwise direction or the counterclockwise direction. The default direction is counterclockwise. This parameter is used in "Abs Pos Abs" and "RelPos Offset" type interpolation commands.
- Arc Length [degree] – Specifies the length of the commanded arc, in degrees. Positive values are interpreted as counterclockwise arcs and negative values are interpreted as clockwise arcs. This parameter is used in "Arc Abs" and "Arc Offset" type interpolation commands.
- Velocity [degree/s] – Specifies the interpolation velocity, in units of degrees per second. This parameter is used in all four types of interpolation commands.
- Acceleration [degree/s^2] – Specifies the acceleration velocity, in units of degrees per second squared. This parameter is used in all four types of interpolation commands.
- Deceleration [degree/s^2] – Specifies the deceleration velocity, in units of degrees per second squared. This parameter is used in all four types of interpolation commands.
- Initial Velocity [degree/s] – Specifies the initial velocity of the interpolation vector, in degrees per second.
- Enable Jerk Control – Check this box to enable jerk control. The interpolation vector will follow an S-curve profile instead of a trapezoidal profile.
- Jerk Acceleration [degree/s^3] – Specifies the acceleration jerk in units of degrees per seconds cubed. This parameter is relevant only when jerk control is enabled.
- Jerk Deceleration [degree/s^3] – Specifies the deceleration jerk in units of degrees per second cubed. This parameter is relevant only when jerk control is enabled.

- Enable End Velocity – Check this box to enable the end velocity. While decelerating, the end deceleration and end deceleration jerk parameters will be applied when the velocity drops below the end velocity.
- End Velocity [degree/s] – Specifies the end velocity in units of degrees per second.
- End Dec [degree/s^2] – Specifies the end deceleration in units of degrees per second squared.
- End Jerk Dec [degree/s^3] – Specifies the end deceleration jerk in units of degrees per second cubed.

After entering in values for all relevant parameters, press the "Start" button to initiate the circular or arc interpolation command. To abort all ongoing positioning and interpolation commands, press the "Stop All" button.

The four types of circular interpolation commands are described in additional detail below.

4.7.1 Arc Abs Type Circular Interpolation

In the "Arc Abs" type circular interpolation, the arc is specified by the center point and the arc length, as shown in the following figure. In this figure, (S1, S2) represents the absolute position of the arc start point, (C1, C2) represents the absolute position of the center point, and d represents the arc length. Positive arc lengths indicate motion in the counterclockwise direction, while negative arc lengths indicate motion in the clockwise direction.

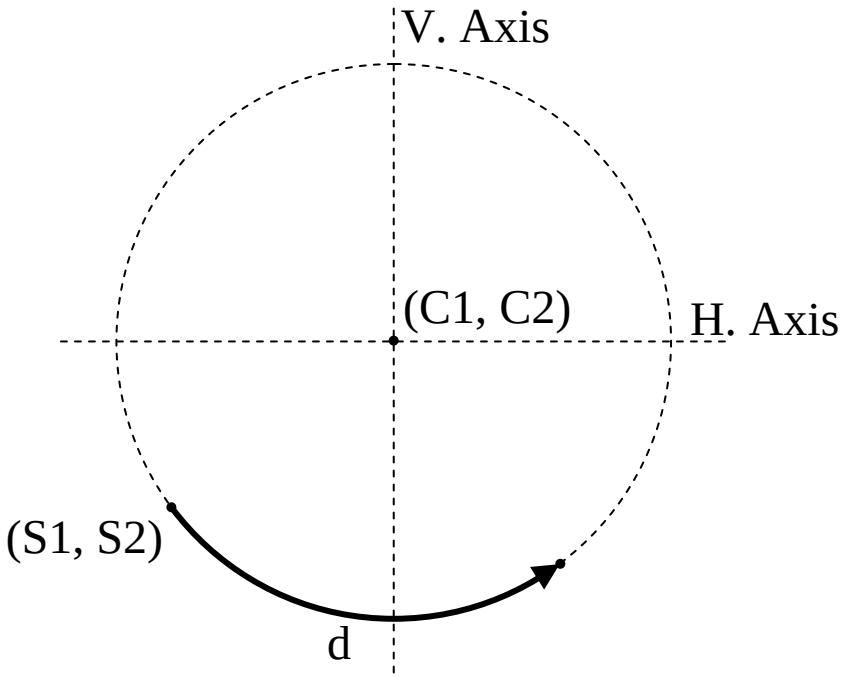


Figure 4-51: Arc Abs Type Circular Interpolation

4.7.2 Arc Offset Type Circular Interpolation

In the "Arc Offset" type circular interpolation, the arc is specified by the center offset and the arc length, as shown in the following figure. In this figure, (S1, S2) represents the absolute position of the arc start point, c1 and c2 represent the offsets from the arc start point to the center point in the horizontal and vertical axes, and d represents the arc length.

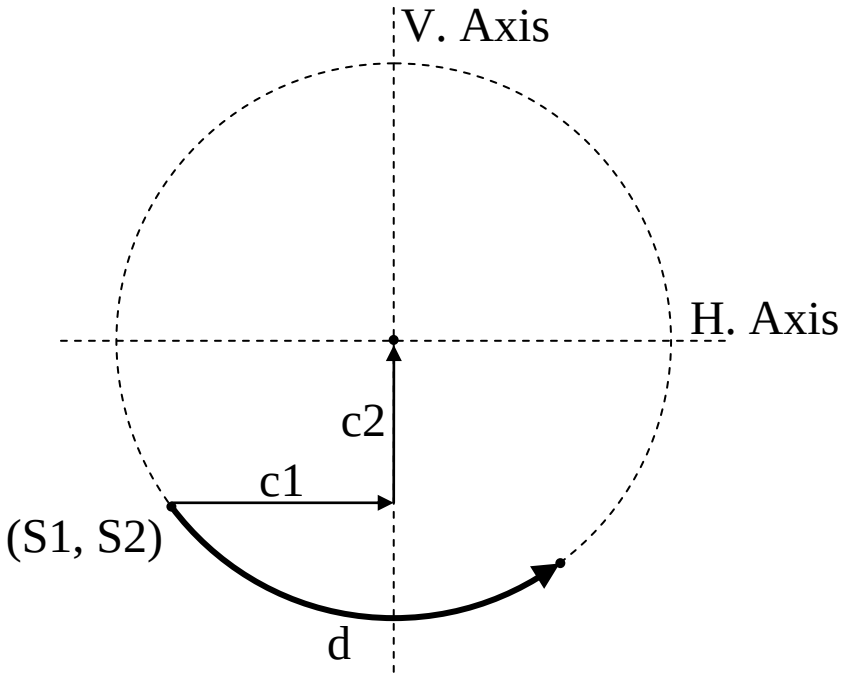


Figure 4-52: Arc Offset Type Circular Interpolation

4.7.3 Abs Pos Abs Type Circular Interpolation

In the "Abs Pos Abs" type circular interpolation, the arc is specified by the center point, the target point, and the direction of travel, as shown in the following figure. In this figure, (S1, S2) represents the absolute position of the arc start point, (C1, C2) represents the absolute position of the center point, and (E1, E2) represents the absolute position of the arc end point.

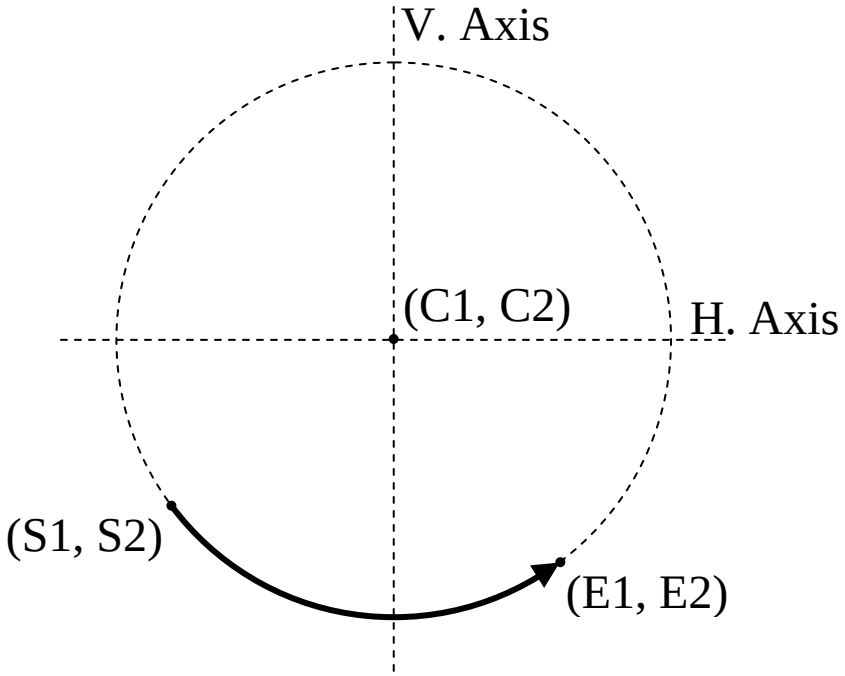


Figure 4-53: Abs Pos Abs Type Circular Interpolation

Note that depending on the specified parameters, the center point may not be equidistant from the start point and the end point. In such cases, the center point is adjusted so that the center point is equidistant from the start point and the end point. The new center point is the point that is closest to the original center point that is also equidistant from the start point and the end point. This is illustrated in the following figure.

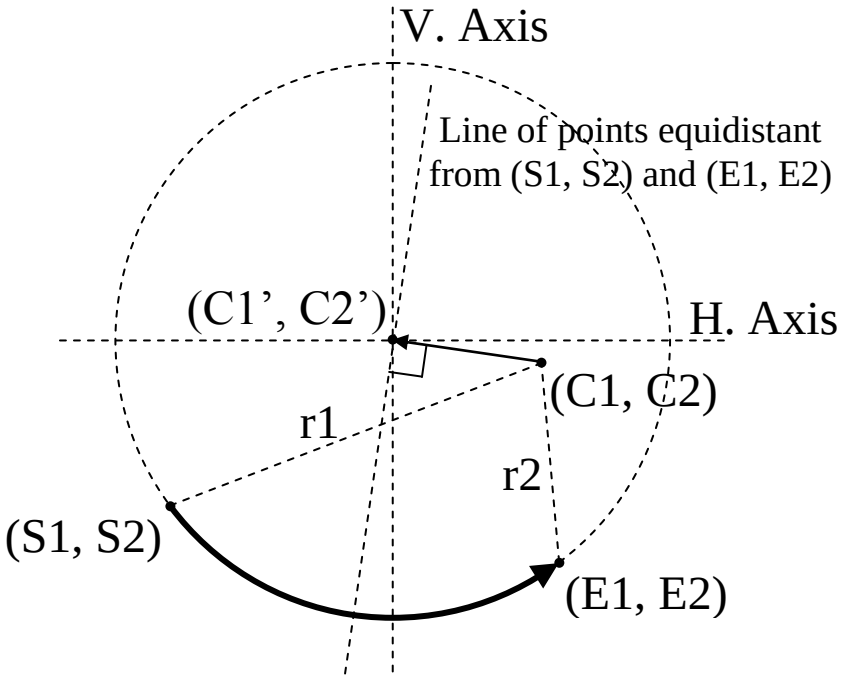


Figure 4-54: Adjustment of the Center Point During Circular Interpolation

In the above figure, an "Abs Pos Abs" type circular interpolation was commanded with (S1, S2) as the arc start point, (C1, C2) as the center point, and (E1, E2) as the arc end point. r1 is the distance from the arc start point to the specified center point. r2 is the distance from the arc end point to the specified center point. Since r1 is not equal to r2, there are no arcs that start from (S1, S2) and end at (E1, E2) with the center point at (C1, C2). The center point is adjusted to the point (C1', C2'). Note that (C1', C2') is the point closest to (C1, C2) on the line of points equidistant from (S1, S2) and (E1, E2). With the new center point, an arc can be traced from (S1, S2) to (E1, E2).

4.7.4 RelPos Offset Type Circular Interpolation

In the "RelPos Offset" type circular interpolation, the arc is specified by the center offset, the target offset, and the direction of travel, as shown in the following figure. In this figure, (S1, S2) represents the absolute position of the arc start point, c1 and c2 represent the offsets from the arc start point to the center point in the horizontal and vertical axes, and e1 and e2 represent the offsets from the arc start point to the arc end point in the horizontal and vertical axes

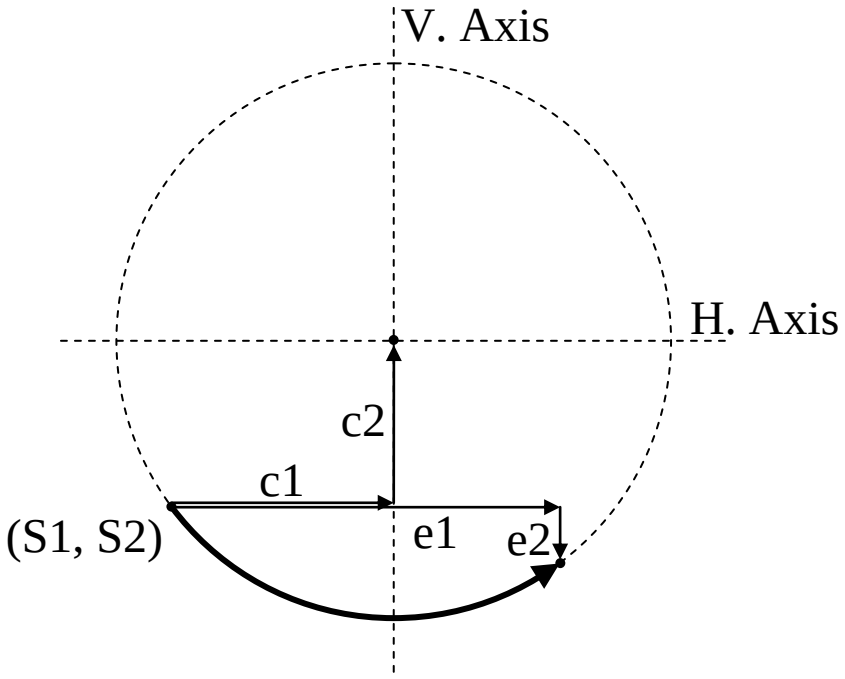


Figure 4-55: RelPos Offset Type Circular Interpolation

As with the "Abs Pos Abs" type circular interpolation, the center point may not be equidistant from the start point and the end point. In such cases, the center point is adjusted so that the center point is equidistant from the start point and the end point. The new center point is the point that is closest to the original center point that is also equidistant from the start point and the end point. See the discussion on the "Abs Pos Abs" type circular interpolation for more details.

Chapter 5: Monitoring

5.1 Alarm Status

The "Alarm Status" control window allows the operator to view the alarm state of any devices in the network and clear any existing alarms.

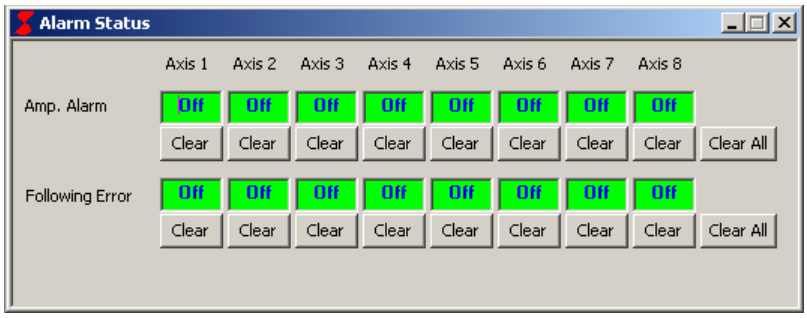


Figure 5-1: Alarm Status Control Window

The display under each axis next to "Amp. Alarm" will show "On" if the device corresponding to that axis is generating an amp. alarm and "Off" if not.

Pressing the "Clear" button under each axis next to "Amp. Alarm" will clear any amp. alarms that exist on that axis. Pressing the "Clear All" button next to "Amp. Alarm" will clear any alarms that exist on the eight displayed axes.

The display under each axis next to "Following Error" will show "On" if a following error alarm is triggered for that axis, and "Off" if not.

Pressing the "Clear" button under each axis next to "Following Error" will clear any following error alarms that exist on that axis. Pressing the "Clear All" button next to "Following Error" will clear all alarms that exist on the eight displayed axes.

5.2 Status Overview

The "Status Overview" control window allows the operator to view the overall status of all axes in the network.

Figure 5-2: Status Overview Control Window

The axis statuses displayed in the "Status Overview" control window are listed below:

- Servo On – Whether the servo of that axis is on or off. This status is identical to the status displayed in the "Servo On" control window.
- Alarm Status – Whether the alarm of the device of that axis is on or off. This status is identical to the status displayed in the "Alarm Status" control window.
- Limit Switch + - Whether any of the three positive limit switches is on or off.
- Limit Switch - - Whether any of the three negative limit switches is on or off.
- Hard Limit Switch + - Whether the positive hard limit switch is on or off.
- Hard Limit Switch - - Whether the negative hard limit switch is on or off.
- Near Limit Switch + - Whether the positive near limit switch is on or off.
- Near Limit Switch - - Whether the negative near limit switch is on or off.
- External Limit Switch + - Whether the positive external limit switch is on or off.
- External Limit Switch - - Whether the negative external limit switch is on or off.
- Soft Limit + - Whether the positive software limit switch is on or off.

- Soft Limit - - Whether the negative software limit switch is on or off.
- Home Switch – Whether the home switch is on or off.
- In Position – Whether the axis is "in position" or not. The axis is considered to be "in position" if it is idle or if it is executing a motion command and is within the "In Position Width" of the destination. The "In Position Width" can be specified in the "Configure Parameters" control window.
- Axis Acc. Flag – Whether the axis is accelerating or not. This value is applicable only for certain motion commands.
- Axis Dec. Flag – Whether the axis is decelerating or not. This value is applicable only for certain motion commands.
- Intpl. Acc. Flag – Whether the axis is accelerating along the interpolated path. This value is applicable only for certain motion commands.
- Intpl. Dec. Flag – Whether the axis is decelerating along the interpolated path. This value is applicable only for certain motion commands.

5.3 Log Operation

The "Log Operation" control window allows the operator to log the position command, position feedback, velocity command, velocity feedback, torque command, and torque feedback of one or more axes over a period of time. During this period, the aforementioned data are collected and written to file at a frequency of up to every communication cycle. This data may then be analyzed to gain an understanding of the performance of the machine.

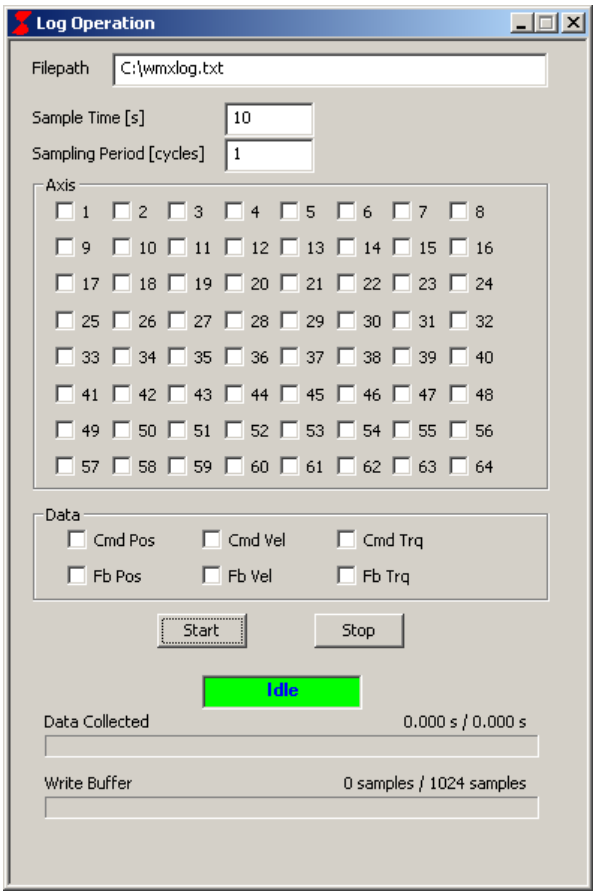


Figure 5-3: Log Operation Control Window (1 of 2)

To start a log operation, set the following parameters as appropriate:

- Filepath– The file path that will contain the log file. ***If there already is a file in the specified path, it will be overwritten during this operation.***

- Sample Time – The total period of time to log the data, in units of seconds. The maximum allowable value is 120 seconds.

- Sample Period – The frequency at which to log the data, in units of communication cycles. For example, if this parameter is set to 1, data will be logged every communication cycle, and if this parameter is set to 5, data will be logged every five communication cycles.

- Axis – The axes to log the data of. Any combination of axes may be selected.

- Data – The data to log. The available options are as follows:

    - CmdPos– The position command of the axis. This is the position that the controller commands the servo to move to each cycle.
    - FbPos– The position feedback of the axis. This is the current position of the axis read from the servo.
    - CmdVel– The velocity command of the axis. This is the velocity that the controller commands the servo to move at each cycle. This value is only nonzero for axes with the "Axis Command Mode" parameter set to "Velocity."

- FbVel– The velocity feedback of the axis. For axes that support velocity feedback and have "Velocity Monitor Source" set to "Actual," this is the current velocity of the axis read from the servo. For axes that do not support velocity feedback or have "Velocity Monitor Source" set to "Calculated," this is the filtered velocity of the axis calculated from the positions read from the servo.
- CmdTrq– The torque command of the axis. ***This option is currently unavailable.***
- FbTrq– The torque feedback of the axis. ***This option is currently unavailable.***

After setting the parameters, click on the "Start" button to start logging data. The system will continue to log data until the time specified in "Sample Time" elapses or an error is encountered. The data logging may also be aborted by clicking on the "Stop" button. This will cease further logging of data, but data already logged will remain in the log file.

The bottom of the control window shows the following status information:

- The state of the log operation. The possible states are as follows:
  - Idle – The log function is in idle state.
  - Running – Data is currently being logged.
  - Finished – Data logging is finished.
  - Write Fail – Data logging failed because of file write failure.
  - Buffer Overflow – Data logging failed because of buffer overflow.
- The number of seconds of data logged as a fraction of the sample time and as a progress bar.
- The number of samples in the write buffer as a fraction of the buffer size and as a progress bar.

The following figure shows the log operation screen while logging data:

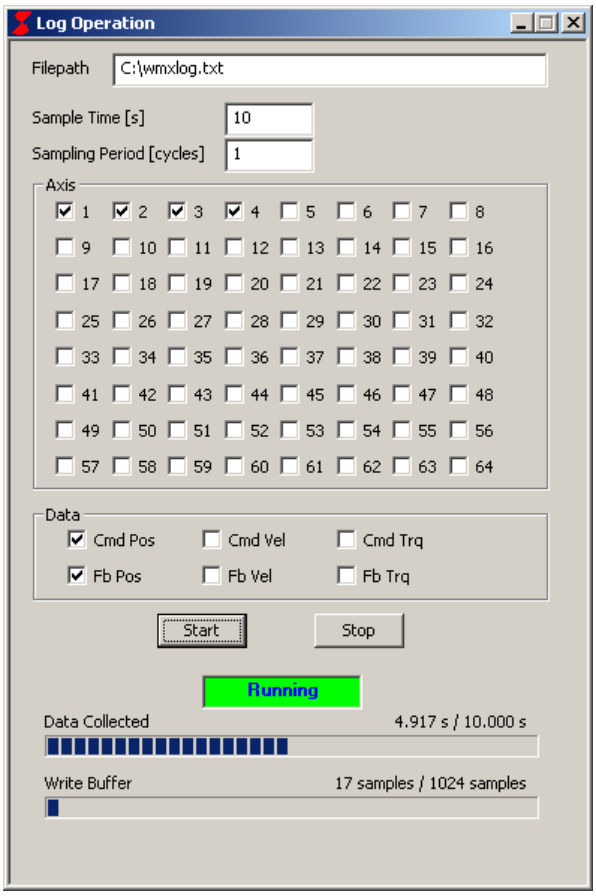


Figure 5-4: Log Operation Control Window (2 of 2)

Chapter 6: Advanced Operations

6.1 Touch Probe

The "Touch Probe" control window allows the operator to use the touch probe functions of WMX. This window includes controls for the software touch probe and the hardware touch probe, which operate independently.

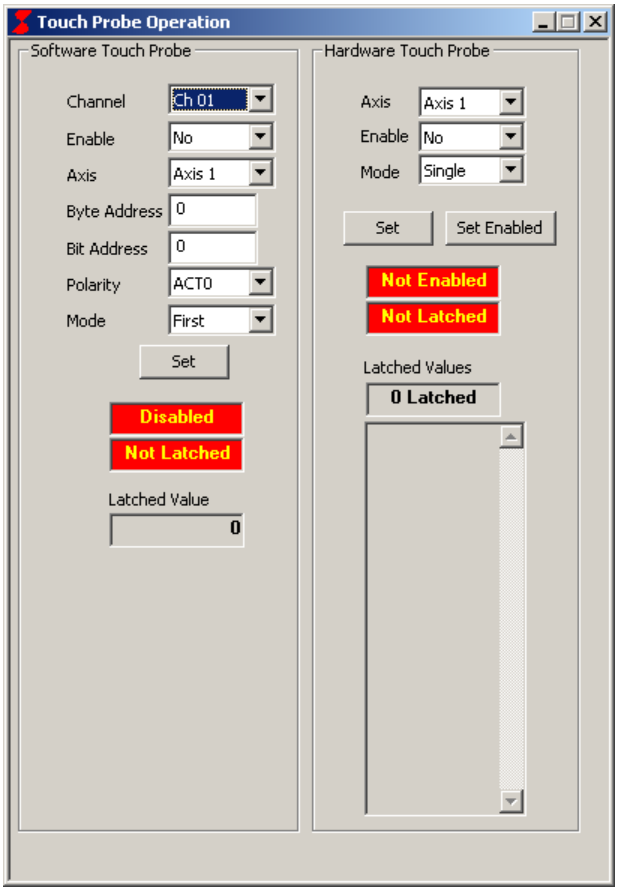


Figure 6-1: Touch Probe Control Window

6.1.1 Software Touch Probe

Touch probe functions are used to latch onto the encoder data of an axis at the exact cycle that an input signal is detected.

The available parameters are listed below:

- Channel – The channel of the touch probe. Up to 64 channels may be used at one time.
- Enable – Whether the selected channel is enabled.
- Axis – The axis to latch the encoder data.

- Byte Address – The byte address of the input signal that triggers latching the encoder data.

- Bit Address – The bit address of the input signal that triggers latching the encoder data.

- Polarity – The polarity of the input signal. ACT0 (0) indicates that the encoder data will be latched when the input signal changes from 1 to 0. ACT1 (1) indicates that the encoder data will be latched when the input signal changes from 0 to 1.

- Mode – The mode of the touch probe. First (0) indicates that the latched encoder data will not be overwritten until the latched encoder data is read when there are subsequent input signals. Last (1) indicates that the latched encoder data will be overwritten when there are subsequent input signals. *(Note that WMX Console reads the latched encoder data of the channel currently selected in the Touch Probe control window every refresh cycle (typically 50 milliseconds). Thus, when the Mode is set to First, when there are multiple input signals within the timespan between refresh cycles, the encoder data when the first input signal was detected will be displayed. When Mode is set to Last, the encoder data when the last input signal was detected will be displayed.)*

The touch probe will latch onto the encoder data only when an edge is detected on the input signal. Thus, the input signal must change from 0 to 1 if polarity is ACT1 or from 1 to 0 if polarity is ACT0 in order to latch the encoder data.

Once appropriate parameters are selected for a channel, press the "Set" button to apply the parameters. The display at the bottom of the Touch Probe control window shows whether the currently selected touch probe channel is enabled, whether it has latched encoder data, and the value of the last latched encoder data.

6.1.2 Touch Probe Example

The following example demonstrates the difference in the latched data when different polarity and mode settings are used with the same axis and input signal address settings. Channel 1 uses Polarity = 1 and Mode = 0, Channel 2 uses Polarity = 1 and Mode = 1, Channel 3 uses Polarity = 0 and Mode = 0, and Channel 4 uses Polarity = 0 and Mode = 1. All four channels observe the same input signal at 10.0 and latch the axis 5 encoder data. Note that when the latched encoder data is read during the next refresh cycle, all four channels report encoder data latched at different timings.

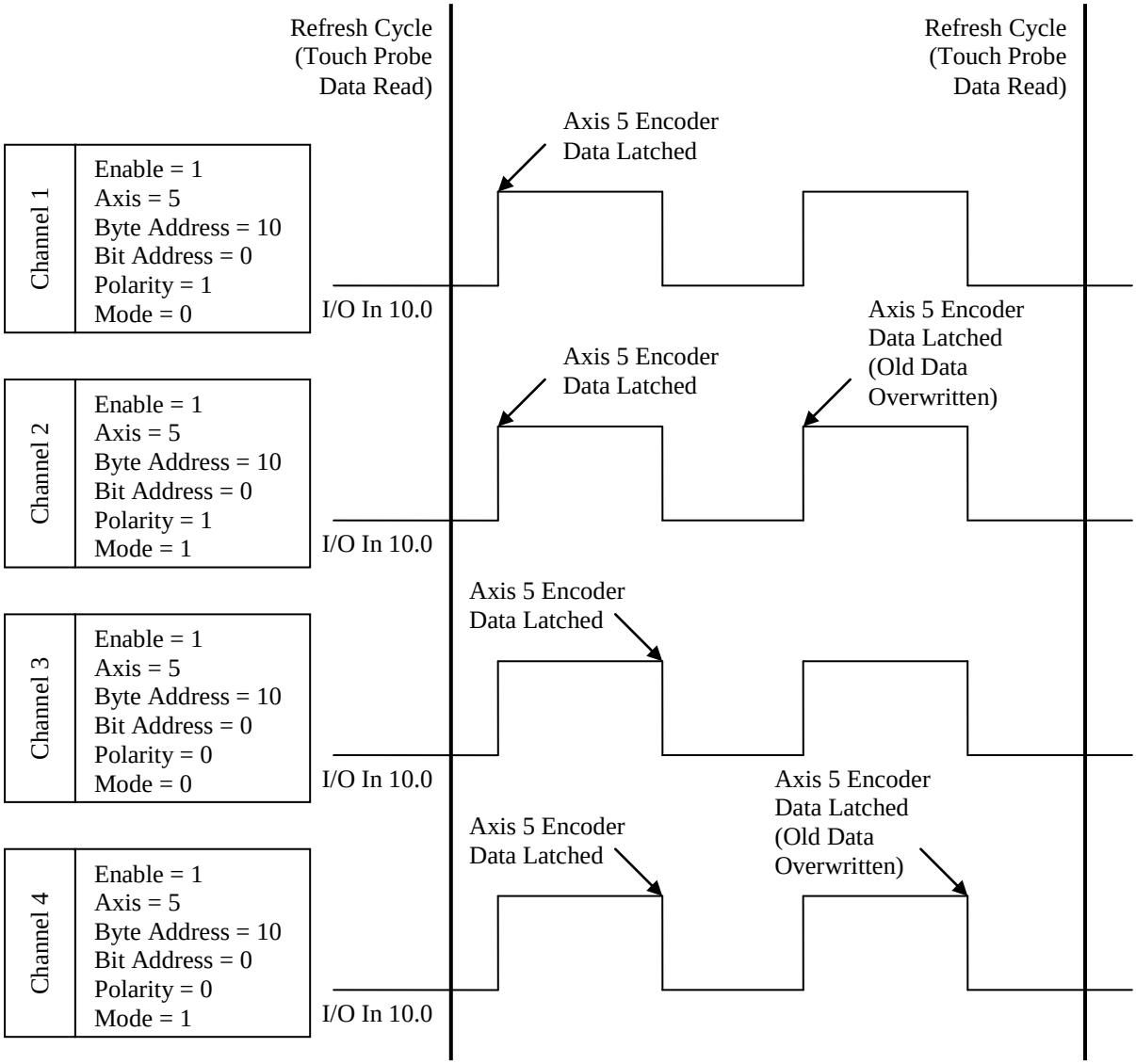


Figure 6-2: Touch Probe Example

6.1.3 Hardware Touch Probe

Some servo drives contain built in hardware touch probes. These touch probes record the encoder data when the appropriate input signals are sent to the servo drives. Hardware touch probes are processed within the processing cycles of the servo drive, and typically have faster response times and greater accuracy compared to software touch probes. The hardware touch probe controls allow the operator to use hardware touch probes.

The available parameters are listed below:

- Axis – The axis of the servo that contains the hardware touch probe.
- Enable – Whether the selected axis' hardware touch probe is enabled.
- Mode – The mode of the touch probe. Single (0) indicates that the hardware touch probe should latch the encoder data when the next touch probe input signal is detected, but not latch the encoder data for any

subsequent touch probe input signals Multiple (1) indicates that the hardware touch probe should latch the encoder data each time the touch probe input signal is detectd.

Once appropriate parameters have been selected, click on the "Set" button to apply the parameters. Click the "Set Enable" button to apply the "Enable" parameter without changing the "Mode" parameter. In addition, when the "Mode" is set to Single (0), clicking the "Set Enable" button will re-enable the hardware touch probe to latch encoder data again, even if the touch probe has already latched encoder data.

The bottom of the control window contains several status displays. These status displays show whether the selected axis' hardware touch probe is enabled, whether it has latched encoder data, the number of latched encoder data, and the values of the latched encoder data.

6.2 PSO (Position Synchronous Output)

The "PSO" (position synchronous output) control window allows the operator to use the PSO functions of WMX.

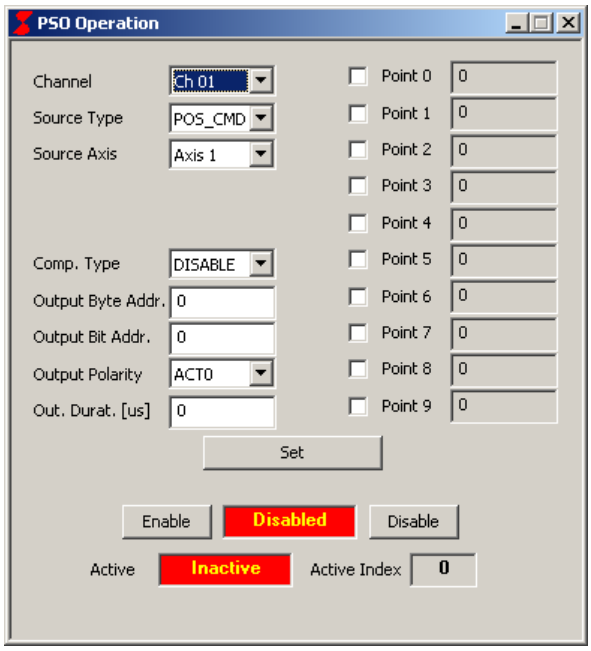


Figure 6-3: PSO Control Window

PSO functions are used to trigger an output signal when a particular condition is satisfied.

A PSO channel consists of four components: the source, the comparator, the data points, and the output. The relation between these components is expressed in the following diagram:

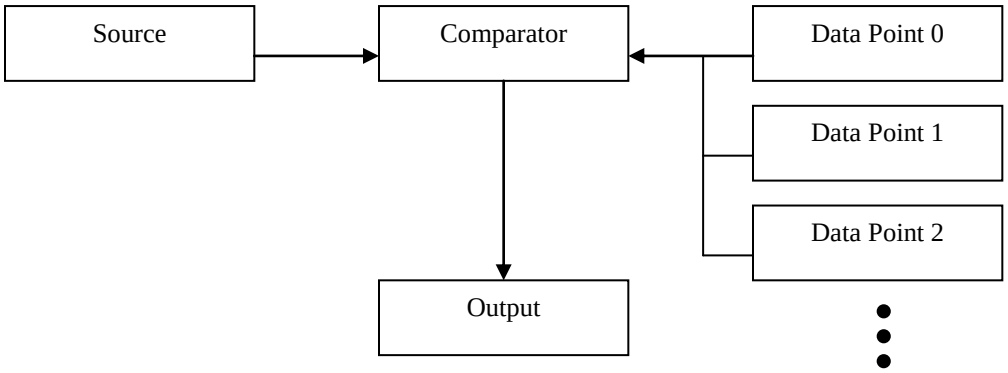


Figure 6-4: PSO Component Relation

The source, which may change every cycle, is compared against one or more data points, using the comparator. If any of the comparisons yield true, the output is enabled. Otherwise, the output is disabled. The output can be set to any I/O output bit.

In addition, if the comparison yields true, the index of the data point that causes the comparison to yield true is displayed as the active index. If multiple data points cause the comparison to yield true, the data point with the smallest index is displayed as the active index. Note that all entered data points are internally sorted from smallest to largest so that a data point with a smaller value would always have an index smaller than a data point with a larger value. To have the PSO control window display the internal indexing of the data points, refresh the display by selecting a different channel then selecting back the original channel.

The available parameters are listed below:

- Channel – The channel of the PSO. Up to 64 channels may be used at one time.

- Source Type – The source type of the PSO. The source determines what value to compare the data points to. The available options are POS_CMD (position command of an axis),POS_FB (position feedback of an axis), and FOL_ERR (the following error of an axis).

- Source Axis – The source axis of the PSO. This axis is used in the comparison when the source type is POS_CMD, POS_FB, or FOL_ERR.

- Comparison Type – The type of comparison to perform between the source and the data points. The available options are DISABLE, EQUAL (equals), EQUAL_PDIR (equal positive direction), EQUAL_NDIR (equal negative direction), MORE_THAN (more than), or LESS_THAN (less than).

  For the POS_CMD source type, the source is considered to equal a data point if the data point lies in between the current cycle's position command and the last cycle's position command. The same is true for the POS_FB and FOL_ERR source types, except the comparison uses their respective sources.

  Equals positive direction is the same as the equals comparison type, except that for the POS_CMD source type, the comparison yields true only if the current cycle's position command is greater than the last cycle's position command. The same is true for the POS_FB and FOL_ERR source types, except the comparison uses their respective sources.

  Equals negative direction is the same as the equals comparison type, except that for the POS_CMD source type, the comparison yields true only if the current cycle's position command is less than the last cycle's position command. The same is true for the POS_FB and FOL_ERR source types, except the comparison uses their respective sources.

- Output Byte Address – The byte address of the output signal that is turned on when the condition is satisfied.

- Output Bit Address – The bit address of the output signal that is turned on when the condition is satisfied.

- Output Polarity – Whether to set the output signal high or low when the condition is satisfied. When the condition is not satisified, the output signal will be set to the opposite of polarity.

- Output Duration – The duration to keep the output active when the condition is satisfied, in units of microseconds. This value will be automatically rounded down to the nearest multiple of the cycle time. The minimum allowable value is one cycle, and the maximum allowable value is 60 seconds (60000000).

- Point 0 through Point 9 – Up to ten points can be specified. These points are compared against the source specified by the source type and using the comparison specified by the comparison type. When the comparison yields true, the specified output signal is set to a value determined by the polarity.

Once appropriate parameters are selected for a channel, press the "Set" button to apply the parameters. Then, the channel must be enabled by pressing the "Enable" button. A channel can be disabled at any time by pressing the "Disable" button.

The display at the bottom of the PSO control window shows whether the currently selected PSO channel is enabled, whether its condition is satisifed, and the point whose condition was last satisifed. If multiple points satisfy the condition, the point with the smallest value will be shown. *(Note that points are automatically sorted from smallest value to largest value internally. If the displayed point values are not sorted from smallest to largest, it may help to refresh the control window by selecting a different channel then selecting the original channel.)*

6.2.1 PSO Example 1

The following example demonstrates a typical usage of the position synchronous output function. In this example, one channel is used, with the parameters set as follows:

Source Type = POS_CMD
Source Axis = Axis 1
Comparison Type = LESS_THAN
Output Byte Address = 12
Output Bit Address = 0
Output Polarity = 1
Point 0 = 2000
Point 1 = 3000
Point 2 = 1000

Note that the point data will be sorted internally in order from smallest to largest. Hence, the data internally will be:

Point 0 = 1000
Point 1 = 2000
Point 2 = 3000

To verify the internal ordering of the data, refresh the PSO control window by briefly selecting another channel and then selecting the original channel.

With the above parameter set, Axis 1 is moved from position 0 to position 4000. The output and the displayed active index along this path is shown in the following figure:

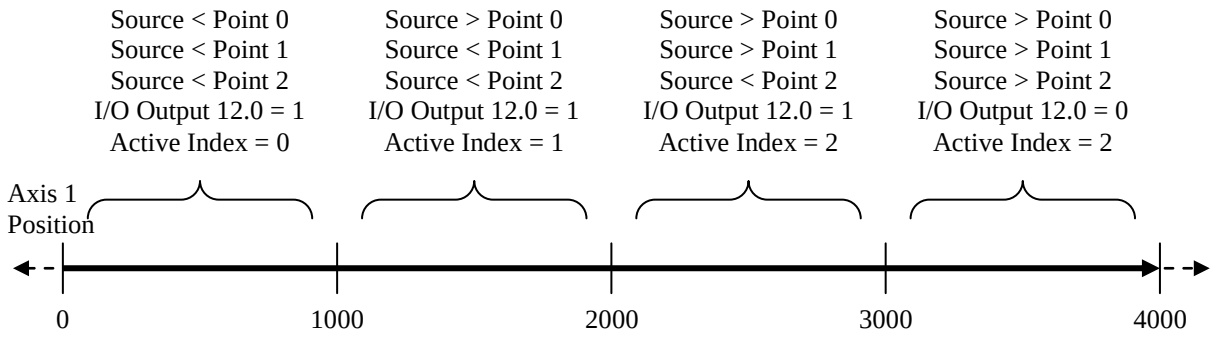


Figure 6-5: PSO Example 1

Note that the Active Index remains 2 during the segment from 3000 to 4000, when the output is inactive. This is because when the comparison yields false for all data points, Active Index displays the index of the data point that last yielded true for the comparison. This behavior is helpful when tracing the state of comparison types that typically stay active for one cycle, such as the "equals" comparison type.

6.2.2 PSO Example 2

The following example demonstrates the difference between the equals, equals positive direction, and equals negative direction comparison types. In this example, three channels are used, each with identical parameter settings except for the comparison type and output address. The parameter settings for the three channels are listed below:

All three channels

Source Type = POS_CMD
Source Axis = Axis 1
Output Polarity = 1
Point 0 = 2000
Point 1 = 4000
Point 2 = 6000

Channel 1
Comparison Type = EQUAL
Output Byte Address = 4
Output Bit Address = 0

Channel 2
Comparison Type = EQUAL_PDIR
Output Byte Address = 4
Output Bit Address = 1

Channel 3
Comparison Type = EQUAL_NDIR
Output Byte Address = 4
Output Bit Address = 2

With the above parameters set, Axis 1 is moved from position 0 to position 8000. The output for each channel along this path is shown in the following figure:

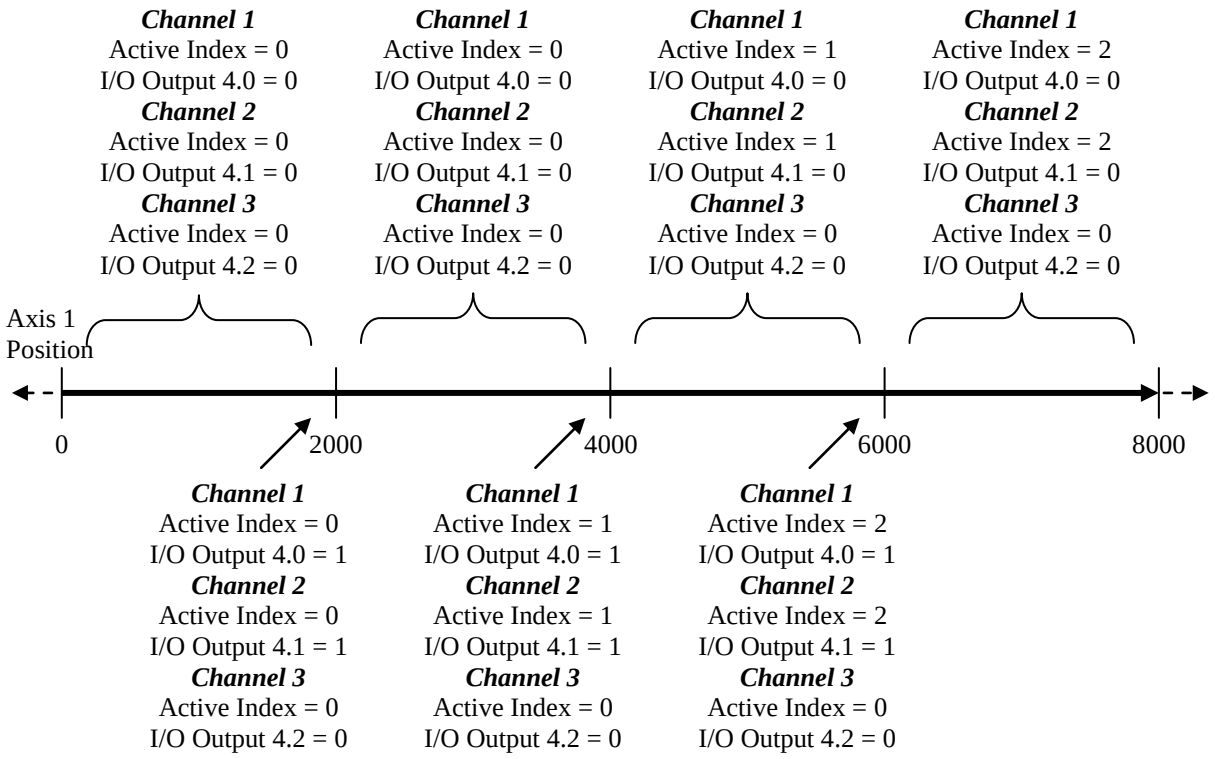


Figure 6-6: PSO Example 2 (1 of 2)

Note that the Channel 3 output is never active. Also note that for Channel 1 and Channel 2, the output is active for only the exact Axis 1 positions where the Axis 1 position equals one of the data points. The duration that the output is active is exactly one cycle.

Had Axis 1 started at position 8000 and was moved from position 8000 to position 0 instead, the following would have been the output of each channel.

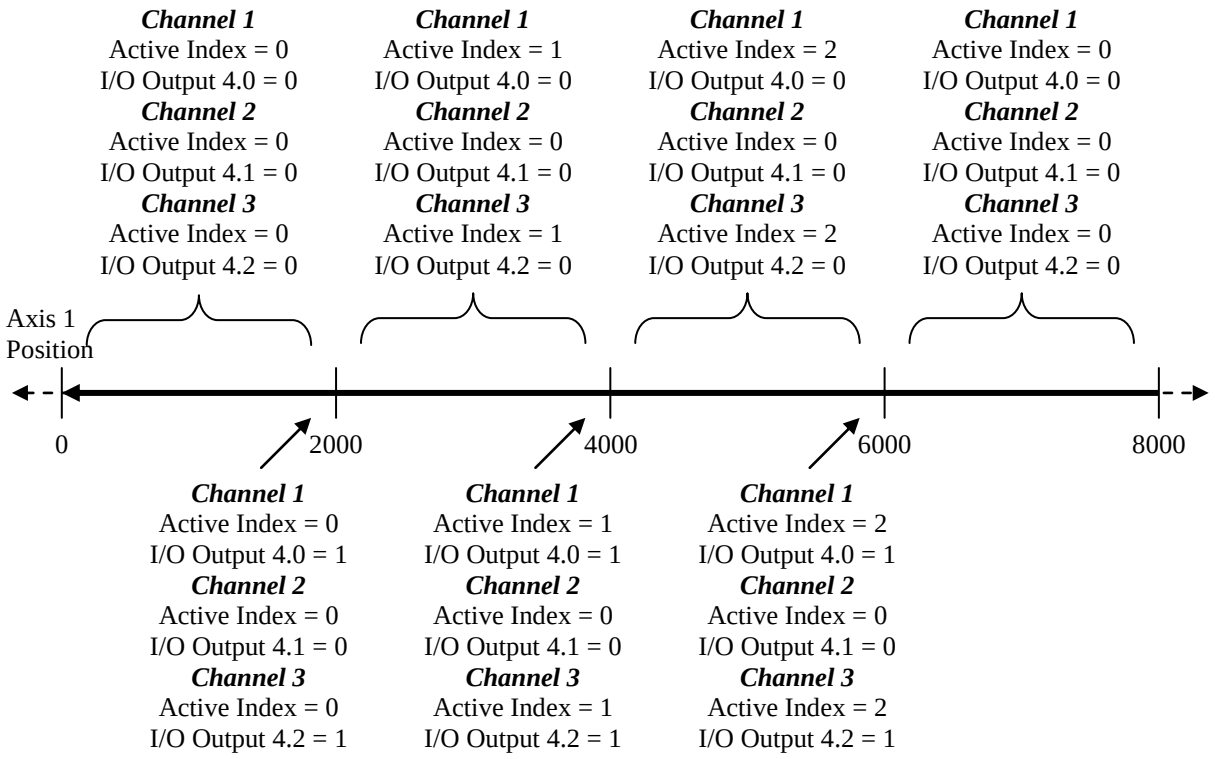


Figure 6-7: PSO Example 2 (2 of 2)

Note that the Channel 2 output is never active.

6.3 Planned Velocity Override

The "Planned Velocity Override" control window allows the operator to use the Planned Velocity Override functions of WMX.

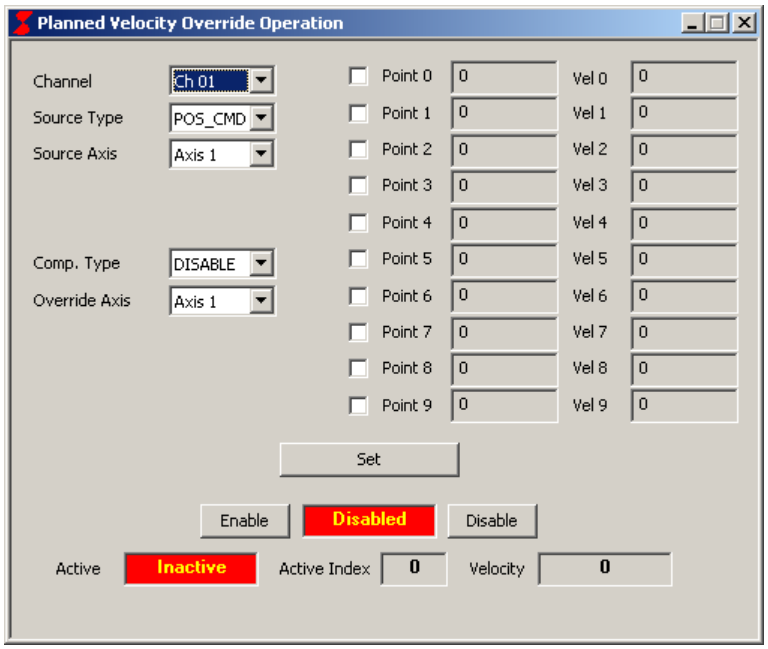


Figure 6-8: Planned Velocity Override Control Window

Planned velocity override functions are used to override the velocity of an axis that is currently performing a position when a particular condition is satisfied. If the override axis is not performing a position command when the condition is satisfied, nothing happens.

A planned velocity override channel consists of four components: the source, the comparator, the data points, and the output. The relation between these components is expressed in the following diagram:

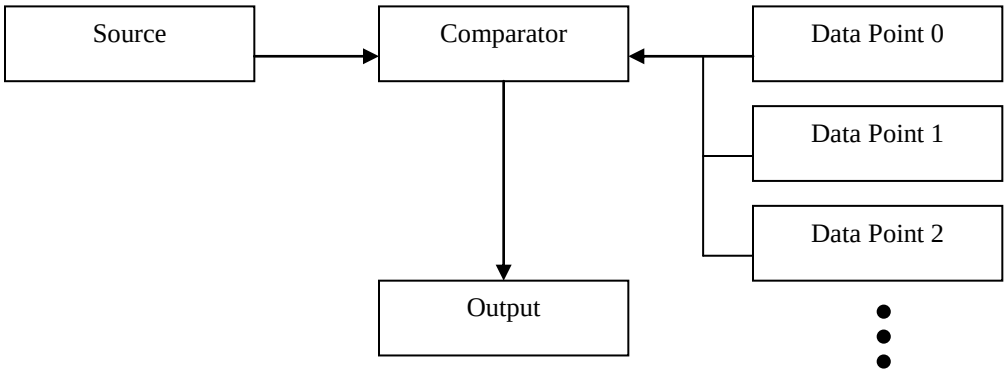


Figure 6-9: Planned Velocity Override Component Relation

The source, which may change every cycle, is compared against one or more data points, using the comparator. If any of the comparisons yield true, the output is enabled (the override axis' velocity is overridden). Otherwise, the output is disabled (the override axis' velocity is unchanged).

In addition, if the comparison yields true, the index of the data point that causes the comparison to yield true is displayed as the active index and the override velocity associated with that data point is displayed as the active velocity. If multiple data points cause the comparison to yield true, the data point with the smallest index is displayed as the active index. Note that all entered data points are internally sorted from smallest to largest so that a data point with a smaller value would always have an index smaller than a data point with a larger value. To have

the planned velocity override control window display the internal indexing of the data points, refresh the display by selecting a different channel then selecting back the original channel.

The available parameters are listed below:

- Channel – The channel of the planned velocity override. Up to 64 channels may be used at one time.
- Source Type – The source type of the planned velocity override. The source determines what value to compare the data points to. The available options are POS_CMD (position command of an axis), POS_FB (position feedback of an axis), and FOL_ERR (the following error of an axis).
- Source Axis – The source axis of the planned velocity override. This axis is used in the comparison when the source type is POS_CMD, POS_FB, or FOL_ERR.
- Comparison Type – The type of comparison to perform between the source and the data points. The available options are DISABLE, EQUAL, EQUAL_PDIR, EQUAL_NDIR, MORE_THAN, or LESS_THAN. For the POS_CMD source type the source is considered to equal a data point if the data point lies in between the current cycle's position command and the last cycle's position command. The same is true for the POS_FB and FOL_ERR source types, except the comparison uses their respective sources.
- Override Axis – The axis to override the velocity when the condition is satisfied. Note that the override axis may be different from the source axis.
- Point 0 through Point 9 – Up to ten points can be specified. These points are compared against the source specified by the source type and using the comparison specified by the comparison type. When the comparison yields true, the specified output signal is set to a value determined by the polarity.
- Vel 0 through Vel 9 – The velocity to override to. A velocity can be specified for each point.

Once appropriate parameters are selected for a channel, press the "Set" button to apply the parameters. Then, the channel must be enabled by pressing the "Enable" button. A channel can be disabled at any time by pressing the "Disable" button.

The display at the bottom of the Planned Velocity Override control window shows whether the currently selected planned velocity override channel is enabled, whether its condition is satisifed, the point whose condition was last satisifed, and the velocity associated with the point whose condition was last satisfied. If multiple points satisfy the condition, the point with the smallest value will be shown. *(Note that points are automatically sorted from smallest value to largest value internally. If the displayed point values are not sorted from smallest to largest, it may help to refresh the control window by selecting a different channel then selecting the original channel.)*

6.3.1 Planned Velocity Override Example

The following example demonstrates a typical usage of the planned velocity override function. In this example, one channel is used, with the parameters set as follows:

Source Type = POS_CMD
Source Axis = Axis 1
Comparison Type = EQUAL
Override Axis = Axis 1
Point 0 = 10000, Velocity 0 = 5000
Point 1 = 20000, Velocity 1 = 10000
Point 2 = 40000, Velocity 2 = 15000

With the above parameters set, Axis 1 is moved from position 0 to position 60000 with a velocity of 2000 and a reasonably high acceleration and deceleration. The following figure shows the velocity of Axis 1 as it moves from position 0 to position 60000.

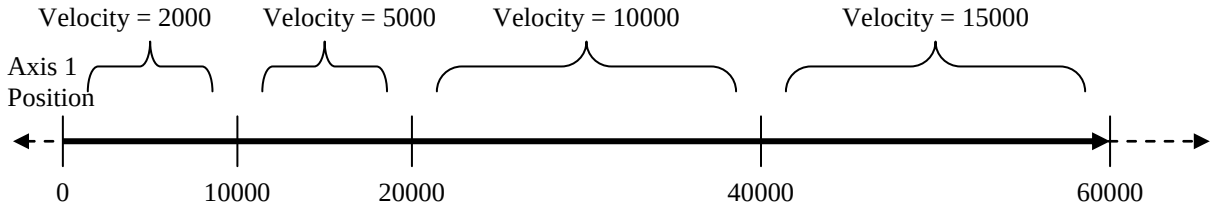


Figure 6-10: Planned Velocity Override Example

6.4Position/Velocity Override

The "Position/Velocity Override Operation" control window allows the operator to override the target position of a position command, the target velocity of a position or jog command, or all command parameters excluding the target position of a position or jog command.

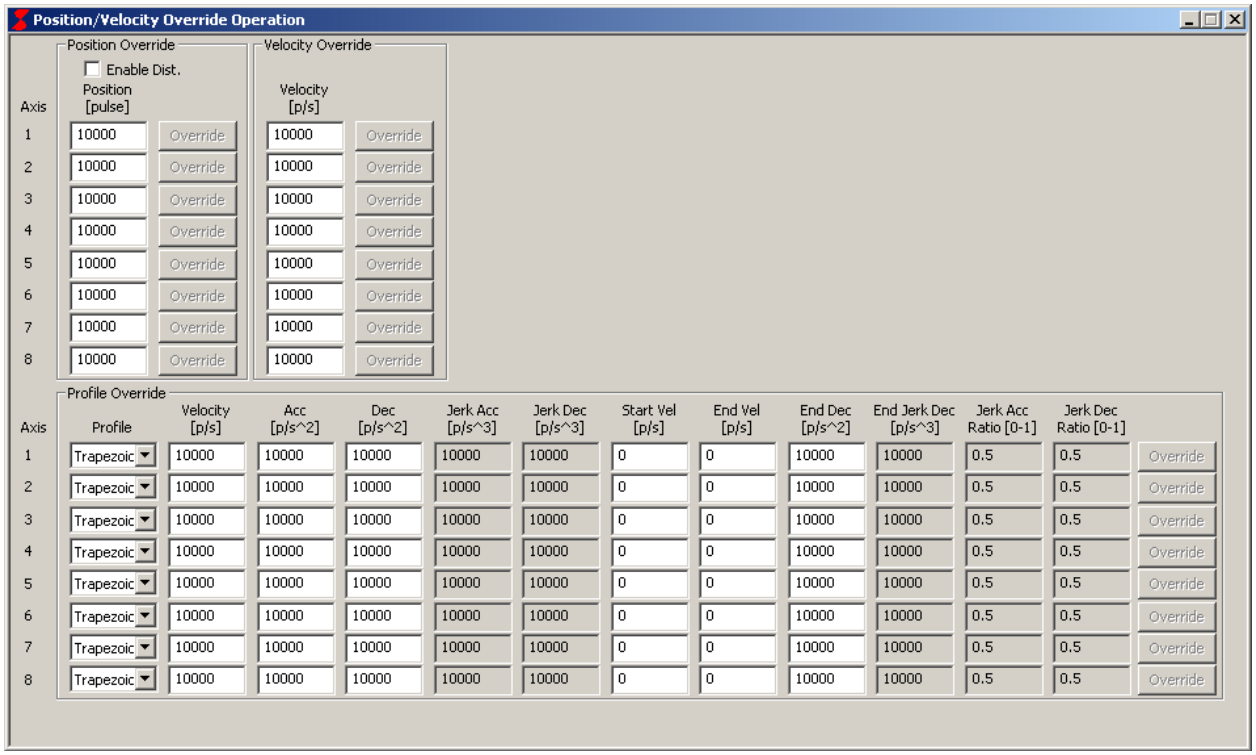


Figure 6-11: Position/Velocity Override Operation Control Window (1 of 2)

The buttons in the "Position/Velocity Override Operation" control window are disabled for axes that are not performing position or jog commands. When an axis is performing a position command, the position override button, the velocity override button, and the profile override button for that axis will be enabled. Similarly, when an axis is performing a jog command, the velocity override button and the profile override button for that axis will be enabled. The following figure shows the "Position/Velocity Override Operation" window when all axes are performing position commands.

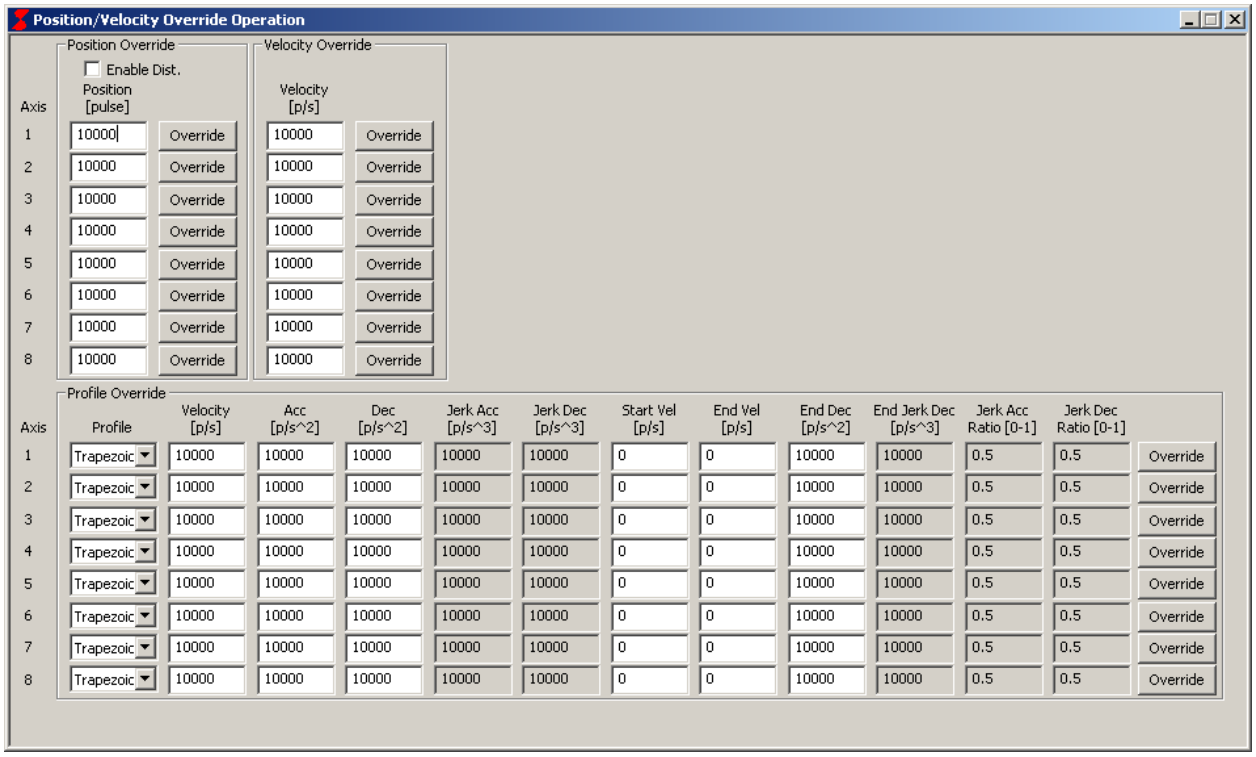


Figure 6-12: Position/Velocity Override Operation Control Window (2 of 2)

To override the target position of an axis, enter the new target position under "Position Override," then press the "Override" button next to that axis.

To override the target velocity of an axis, enter the new target velocity under "Velocity Override," then press the "Override" button next to that axis.

To override all command parameters except for the target position, enter the parameters under "Profile Override," then press the "Override" button next to that axis. Note that certain parameters are available only when certain values are selected under "Profile."

6.5 List Motion Operation

The "List Motion Operation" control window allows the operator to record a list of motion commands, and then execute the recorded list at a later time.

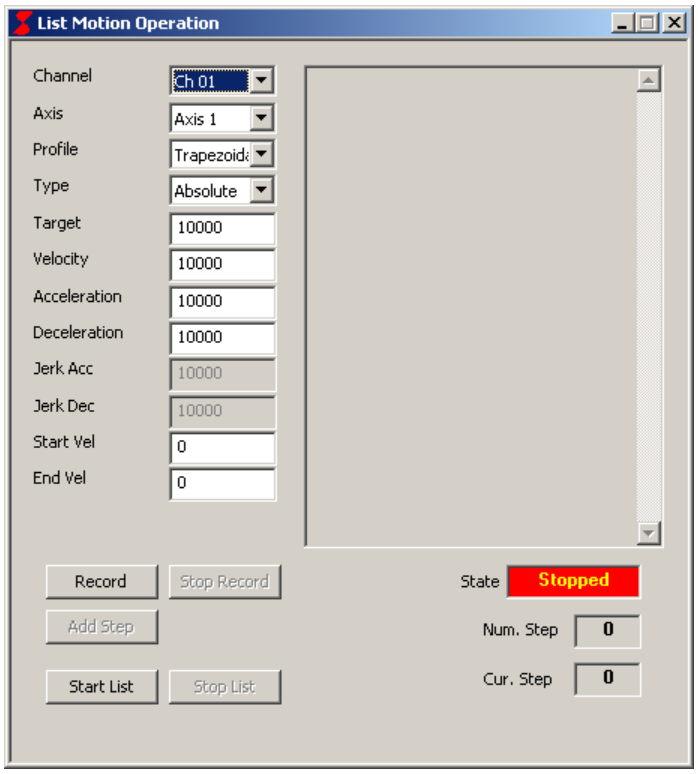


Figure 6-13: List Motion Operation Control Window (1 of 3)

When first started, the list motion operation window appears as shown above. The available parameters are listed below:

- Channel – The channel of the list motion. Each channel may record one list.
- Axis – The axis of the motion command to add to the list.
- Profile – The motion profile of the motion command to add to the list.
- Type – Whether the target position of the motion command to add to the list is absolute or relative.
- Target – The target position of the motion command to add to the list.
- Velocity – The velocity of the motion command to add to thelist.
- Acceleration – The acceleration of the motion command to add to the list.
- Deceleration – The deceleration of the motion command to add to the list.
- Jerk Acc – The jerk acceleration of the motion command to add to the list.
- Jerk Dec – The jerk deceleration of the motion command to add to the list.
- Start Vel – The starting velocity of the motion command to add to the list.
- End Vel – The end velocity of the motion command to add to the list.

Note that the starting velocity and ending velocity are interpreted differently in list motion operation compared to normal position commands. For additional information, refer to the *WMX API Reference Manual*.

To start recording a list, select a channel, and then press the "Record" button. If successful, the "State" will show "Recording," as seen in the following figure. Note that communication must be established before recording.

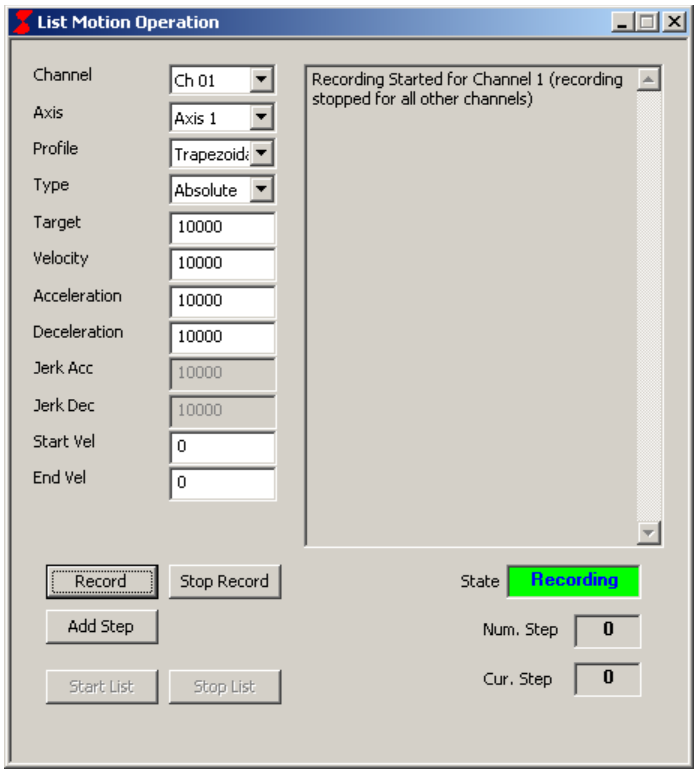


Figure 6-14: List Motion Operation Control Window (2 of 3)

Then, for each command in the list, enter the command parameters and press the "Add Step" button. The following figure shows the control window after adding two steps.

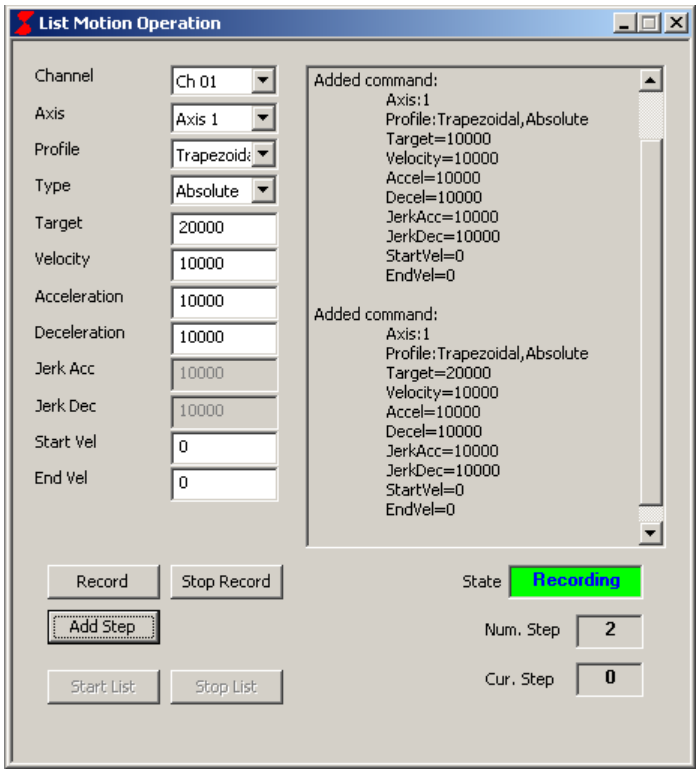


Figure 6-15: List Motion Operation Control Window (3 of 3)

After all commands have been added to the list, press the "Stop Record" button to stop recording. Then, the list may be executed by pressing the "Start List" button.

To erase the recorded list of a list motion channel, simply press the "Record" button. When a new recording is started, the old recording is erased.

The recorded list can be executed for multiple channels concurrently. For instance, to execute the list for two channels, select the first channel, press "Start List", then select the second channel, and then press "Start List" again.

To stop the execution of the list, select the channel to stop the execution of, and then press the "Stop List" button.

The status displays at the bottom right of the control window show the following information:

- State – Whether the selected channel is currently "Idle," "Recording" a list, or "Running" a list.
- Num. Steps – The number of steps (motion commands) that are in the selected channel's list.
- Cur. Step – If the channel is executing a list, the step that is currently being executed.

6.6 Event Operation

The "Event Operation" control window allows the operator to set events that automatically execute an action whenever a certain condition is met. An event in WMX consists of two parts – the input and the output. The input is the condition for triggering the event, and the output is the action that is executed when the event is triggered. WMX also classifies events into two types – regular events and motion events. Regular events are synchronized with the command cycle and are deterministic. Motion events concern moving and stopping axes, and are not synchronized with the command cycle.

The following figure shows the "Event Operation" control window:

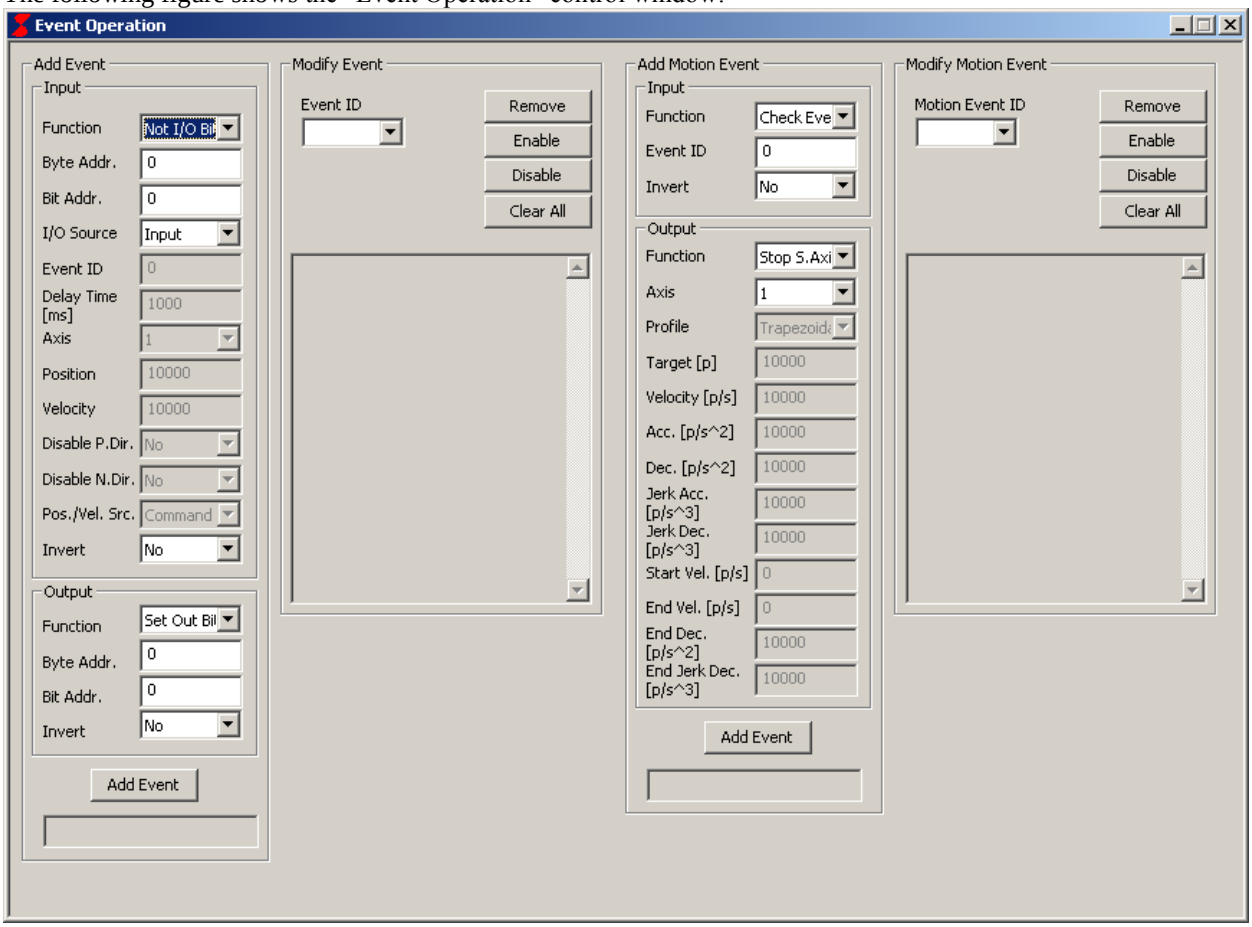


Figure 6-16: Event Operation Control Window (1 of 2)

The "Event Operation" control window is divided into four sections. The "Add Event" section allows the operator to define a new event. The "Modify Event" section allows the operator to view the parameters of any previously defined event, enable or disable a previously defined event, or remove a previously defined event. The "Add Motion Event" and "Modify Motion Event" sections are identical to the "Add Event" and "Modify Event" sections, except they concern motion events instead of regular events.

The following figure shows the "Event Operation" control window after adding a regular event and a motion event and displaying the parameters of these events.

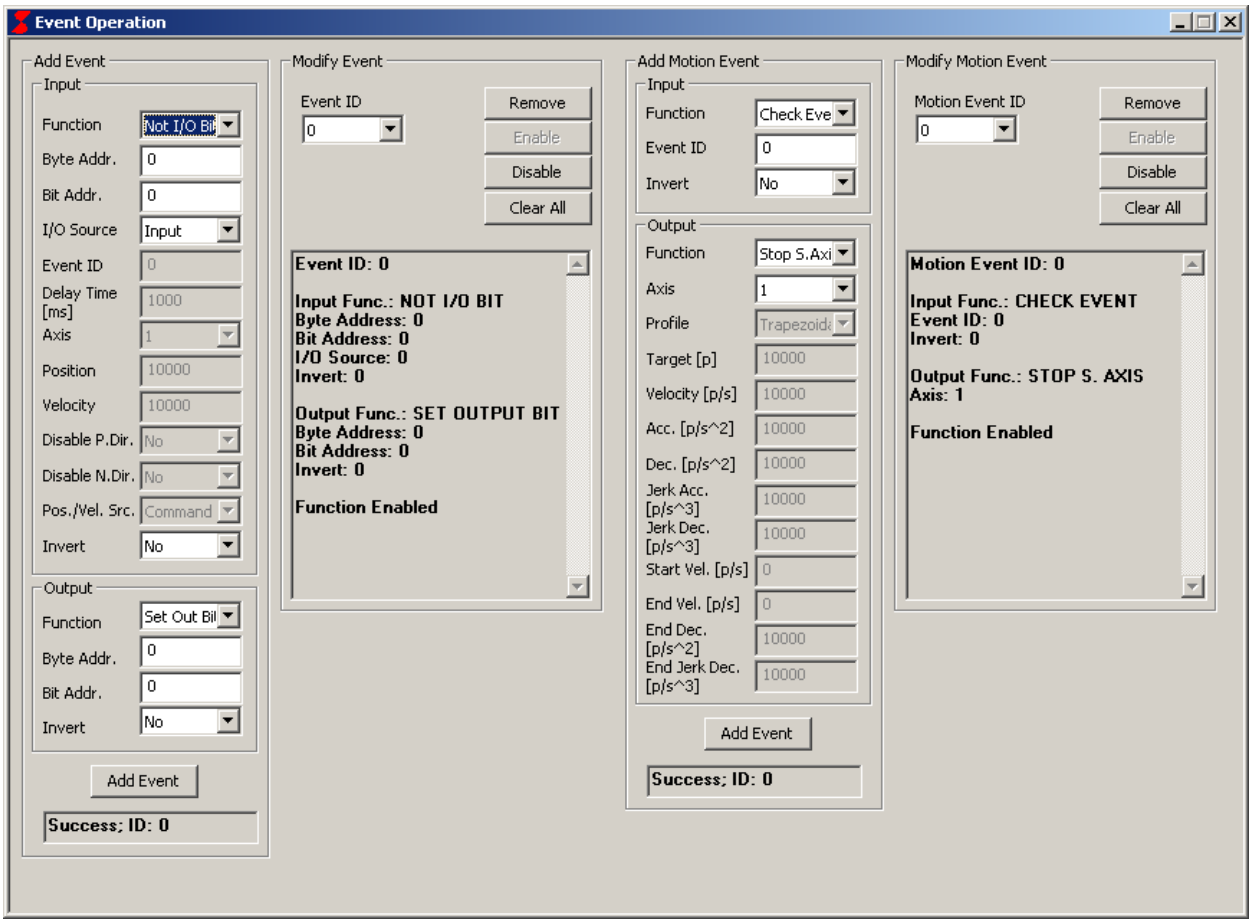


Figure 6-17: Event Operation Control Window (2 of 2)

6.6.1 Add Event

To define a new event, specify the parameters for the event and click on the "Add Event" button. The text box below the "Add Event" button will display whether the event was successfully added or not. If successful, an event ID number will be assigned to the event.

The parameters available for the "Add Event" section are as follows:

Inputs:

- Function – The type of input condition. The available types are:
  - Not I/O Bit – The input condition becomes true when the specified I/O bit is 0.
  - Not Event – The input condition becomes true when another event's input condition is false.
  - Delay I/O Bit – The same as "Not I/O Bit," except a delay is added before the input condition becomes true. If the I/O bit changes to 1 before the delay expires, the input condition will stay false.
  - Delay Event – The same as "Not Event" except a delay is added before the input condition becomes true. If the other event's input condition changes to true before the delay expires, the input condition will false.
  - Position – The input condition becomes true when the axis passes the specified position.
  - Velocity – The input condition becomes true when the axis is at the specified velocity.
- Byte Address – The byte address of the I/O bit for certain input condition functions.
- Bit Address – The bit address of the I/O bit for certain input condition functions.

- I/O Source – Whether the I/O bit is an input bit or an output bit, for certain input condition functions.
- Event ID – The event id for certain input condition functions.
- Delay Time – The delay time in milliseconds, for certain input condition functions.
- Axis – The axis to monitor for certain input condition functions.
- Position – The position to monitor for certain input condition functions.
- Velocity – The velocity to monitor for certain input condition functions.
- Disable P. Direction – Used for the Position input condition. If set to "Yes", the input condition will not become true when the axis passes the specified position while traveling in the positive direction.
- Disable N. Direction – Used for the Position input condition. If set to "Yes" the input condition will not become true when the axis passes the specified position while traveling in the negative direction.
- Position/Velocity Source – Whether to monitor the position (or velocity) command or the feedback.
- Invert – If set to "Yes," the input condition logic will be inverted. The input condition will become true when previously it would have been false, and false when previously it would have been true.

Outputs

- Function – The type of output action. The available types are:
  - Set Out Bit – The specified I/O bit will be set to 1 when the input condition is true, and 0 when the input condition is false.
- Byte Address – The byte address of the I/O bit for certain output action functions.
- Bit Address – The bit address of the I/O bit for certain output action functions.
- Invert – If set to "Yes," the output action will be inverted. For the "Set Out Bit" function, the specified I/O bit will be set to 0 when the input condition is true, and 1 when the input condition is false.

6.6.2 Modify Event

To see the definition of an existing event, select the event's event ID number from the "Event ID" drop down menu. The event's definition will be displayed in the text box.

To enable or disable an existing event, select the event's event ID number from the "Event ID" drop down menu, then click on the "Enable" or "Disable" buttons, respectively. An event that is disabled will not trigger.

To remove an existing event, select the event's event ID number from the "Event ID" drop down menu, then click on the "Remove" button. The selected event will be permanently removed, and its event ID number will become available to be assigned to new events.

To remove all existing events, click on the "Clear All" button. A confirmation dialog will appear. Click on "Yes" to permanently remove all defined events.

6.6.3 Add Motion Event

To define a new motion event, specify the parameters for the motion event and click on the "Add Event" button. The text box below the "Add Event" button will display whether the motion event was successfully added or not. If successful, a motion event ID number will be assigned to the motion event.

The parameters available for the "Add Event" section are as follows:

Inputs:

- Function – The type of input condition. The available types are:
  - Check Event – The input condition becomes true when another event's input condition is true. Note that this checks another regular event and not another motion event.
- Event ID – The event id for certain input condition functions.

- Invert – If set to "Yes," the input condition logic will be inverted. The input condition will become true when previously it would have been false, and false when previously it would have been true.

Outputs

- Function – The type of output action. The available types are:
  - Stop S. Axis – Stops the motion of a single axis whenever the input condition changes from false to true.
  - Start S. Pos – Starts an absolute position command for a single axis whenever the input condition changes from false to true.
  - Start S. Mov – Starts a relative position command for a single axis whenever the input condition changes from false to true.
- Axis – The axis to command for certain output functions.
- Profile – The motion profile to use for certain output functions.
- Target – The absolute or relative target position in pulses, for certain output functions.
- Velocity – The velocity in pulses per second, for certain output functions.
- Acceleration – The acceleration in pulses per second squared, for certain output functions.
- Deceleration – The deceleration in pulses per second squared, for certain output functions.
- Jerk Acceleration – The acceleration jerk in pulses per second cubed, for certain output functions. This value is only relevant for the S. Curve profile.
- Jerk Deceleration – The deceleration jerk in pulses per second cubed, for certain output functions. This value is only relevant for the S. Curve profile.
- Start Velocity – The starting velocity in pulses per second, for certain output functions.
- End Velocity – The end velocity in pulses per second, for certain output functions.
- End Deceleration – The end deceleration in pulses per second squared, for certain output functions.
- End Jerk Deceleration – The end deceleration jerk in pulses per second cubed, for certain output functions. This value is only relevant for the S. Curve profile.

Also see *Section 4.1: Single Position Operation* for additional information regarding these parameters.

6.6.4 Modify Motion Event

To see the definition of an existing motion event, select the motion event's motion event ID number from the "Motion Event ID" drop down menu. The motion event's definition will be displayed in the text box.

To enable or disable an existing motion event, select the motion event's motion event ID number from the "Motion Event ID" drop down menu, then click on the "Enable" or "Disable" buttons, respectively. A motion event that is disabled will not trigger.

To remove an existing motion event, select the motion event's motion event ID number from the "Motion Event ID" drop down menu, then click on the "Remove" button. The selected motion event will be permanently removed, and its motion event ID number will become available to be assigned to new motion events.

To remove all existing motion events, click on the "Clear All" button. A confirmation dialog will appear. Click on "Yes" to permanently remove all defined motion events.

Chapter 7: Exiting the WMX Console

7.1 Closing WMX Console

To close WMX Console, click on the "Exit" option under the "File" menu, as shown below. Alternatively, click on the close button on the top right corner of the main screen.

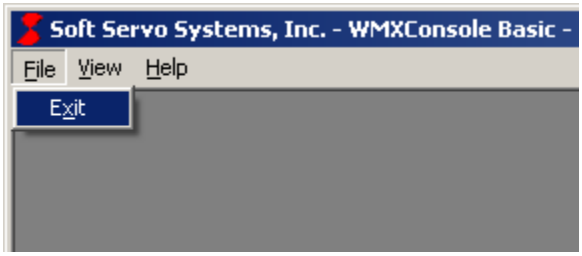


Figure 7-1: Exit Menu

When WMX Console is closed, communication with the servo network will be ended automatically.