Tolomatic
EXCELLENCE *IN MOTION*®

USER GUIDE

Tolomatic Motion Interface (TMI)

NOTE: Throughout this manual information is color coded as it applies to products

Information that ONLY applies to Stepper Drives will be noted in grey box.

ACS Stepper Drive

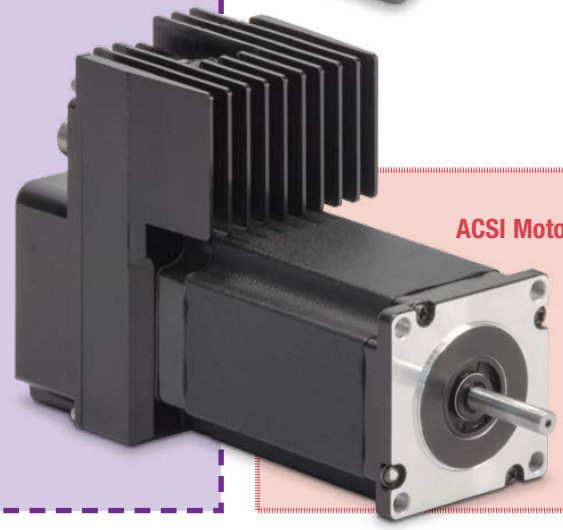
Actuator Control Solutions for:

- **ACS Stepper Drive/Controller/Motors**
  Supported Models: ST1048ED, ST1048MD, ST1048UD,
- **ACS Servo Drive/Controller/Motors**
  Supported Models: SV2048ED, SV2048MD, SV2048UD,
- **ACSI Integrated Motor/Drive/Controller**
  ACSI - Base, ACSI - EIP, ACSI - MBTCP, ACSI - PNET, ACSI - ECAT
- **Tolomatic Electric Linear Actuators**

ACS Servo Drive
Information that ONLY applies to Servo Drives will be noted in light blue box.

ACS Servo Drive/ ACSI

Information that applies to both Servo Drives & ACSI Motor/ Drive will be noted in light purple box.



ACSI Motor/Drive/Controller

Information that ONLY applies to ACSI will be noted in light red box.

3604-4184_07

LINEAR SOLUTIONS MADE EASY

Tolomatic reserves the right to change the design or operation of the equipment described herein and any associated motion products without notice. Information in this document is subject to change without notice.

201811071337

Contents

Product Overview 13
1.1 The Tolomatic ACS Drive/Controller 13
ACS Stepper Drive **ST1048** 13
ACS Servo Drive **SV2048** 13
Servo Drive 13
ACSI Motor/Drive/Contr. **ASCI** 13
Host Computer Requirements 15
2.1 Host Computer and Software System Requirements 15
2.1.1 Hardware Requirements 15
2.1.2 Operating Systems Supported 15
Installing the TMI Software 16
3.1 Installation Instructions 16
3.1.1 Installing from the Tolomatic CD 16
3.1.2 Downloading and Installing from the Tolomatic Web Site 16
Starting the TMI Software 17
4.1 Launching the TMI Software 17
Establishing Communication 18
5.1 Establishing Communication with the Tolomatic ACS Drive 18
5.2 Offline Connection 20
Navigating through the TMI Software 21
6.1 Navigating through the Tolomatic Motion Interface (TMI) 21
6.1.1 Setup Wizard Tabs 21
TMI Setup Wizard Navigation Tabs 21
6.1.2 Tolomatic Logo 21
6.1.3 Tool Bar 22
6.1.4 Tool Tips 23
6.1.5 Parameter Entry 24
6.1.6 File Menu 24
6.1.7 Tools Menu 25
6.1.8 Help Menu 26
The Actuator Tab 27
7.1 Using the Actuator Tab 27
7.1.1 Tolomatic Actuator Selection 27
7.1.2 Rotary Actuator 28
7.1.3 Custom (Other) Actuator Selection 28
The Motor Tab 31
8.1 Using the Motor Tab 31
8.1.1 Tolomatic Motor Selection 31
8.1.2 Other Motor Selection 33
The Mode Select Tab 35

9.1 Using the Mode Select Tab 35
The I/O Tab 39
10.1 Using the I/O Tab 39
10.1.1 Digital Inputs 39
10.1.2 Digital Outputs 39
10.1.3 Brake Output Configuration 40
The Fault Tab 42
11.1 Using the Fault Tab 42
11.2.1 Safety Faults 43
11.2 Fault Descriptions and Recovery 43
11.2.2 Critical Faults 44
The Safety/Limits Tab 45
12.1 Using the Safety/Limits Tab 45
12.1.1 In Position Criteria 45
12.1.2 Following Error 46
12.1.3 Eco Mode (Servo / ACSI Only) 46
12.1.4 Motion Limits 48
12.1.5 Current Limits 48
12.1.6 Positive/Negative Limits 49
The Home Setup Tab 50
13.1 Using the Home Setup Tab 50
13.1.1 Method of Homing 50
13.1.2 Direction of Motion 51
13.1.3 Motion Profile & Offset 51
13.1.4 Controls 51
13.1.5 Additional Settings 52
13.1.6 Stop During Homing 52
The Mode Setup Tab 53
14.1 Index Move Mode 53
14.1.2 Editing, Arranging and Testing Move Commands 56
14.1.3 FORCE Move Type 59
14.2 Basic Indexer (Demonstration Mode) 62
14.3 Pneumatic Mode 67
14.4 Analog Position Mode 69
14.4.1 Configuring Analog Position Mode 69
14.4.2 Simulating the Analog Position Input 71
14.4.3 Analog Input Controlled Position 72
14.4.4 Calibrating Analog Input & Output 72
14.5 Analog Velocity Mode (Rotary Only) 74
14.5.1 Configuring Analog Velocity Mode 74

14.5.2 Simulating Analog Velocity Input....76
14.5.3 Analog Input Controlled Velocity....77
14.5.4 Calibrating Velocity Analog Input & Output....77
14.6 Network Mode....78
14.6.1 Using Network Mode....78
14.6.2 Behavior of network commands and configured digital inputs....79
Motion Manager Tool....81
15.1 Using the Motion Manager....81
15.1.1 Controls....81
15.1.2 Motion Profile....81
15.1.3 Jog....82
15.1.4 Absolute Move....82
15.1.5 Incremental Move....82
15.1.6 Stop....82
Tuning Filter Tool....83
16.1 Tuning Filter Dialog....84
16.1.1 Parameter Adjustment Pane....84
16.1.2 Graphing Pane....85
16.2 Servo Tuning using TMI – Quick Start Guide....87
16.2.1 Initial Tuning for Motor Power-On and First Motion....87
16.2.2 Quick Tuning for 80% of Applications....87
16.2.3 Common Tuning Adjustments....87
16.2.4 Advanced Tuning for Demanding Applications....88
16.2.5 Troubleshooting....89
16.3 Gain Adjustments and Effects....89
16.3.1 Position Proportional....90
16.3.2 Position Integral....91
16.3.3 Velocity Proportional....93
16.3.4 Velocity Integral....94
16.3.5 Velocity Feed Forward....96
16.3.6 Current Proportional....97
16.3.7 Current Integral....98
16.3.8 Current Tuning....99
Digital I/O Tool....102
17.1 Using the Digital I/O Tool....102
Analog I/O Tool....103
18.1 Using the Analog I/O Tool....103
Software Oscilloscope....104
19.1.1 Select Channels....104
19.1.2 Triggering....104

19.1.3 Parameter Trigger (Offline Sampling Only) 105
19.1.4 Sampling Controls....105
19.2 Channel Definition Window....105
19.3 Menu Strip 106
19.3.1 File....106
19.3.2 Profiles....106
19.3.3 Sampling Controls....107
19.3.4 Sampling Parameters Options Window....107
19.4 Context Menu Strip (Right click on graph) 108
19.4.1 Zoom Out: Zooms out of the graph 108
19.4.2 Sampling Controls....108
19.4.3 Copy to Clipboard 108
19.4.4 Export As. 109
19.4.5 Change Sample Series Type 109
19.4.6 Graph....111
Drive Status Tool....112
20.1 Using the Drive Status Tool....112
Ethernet Setup Tool 113
21.1 Using the Ethernet Setup Tool....113
21.1.1 Ethernet Setup Tool for ACS Stepper and ACS Servo Drives....113
21.1.2 Ethernet Setup Tool for ACSI Motor/Drive/Controller Infrastructure Mode....116
Non-Infrastructure Mode 117
Ethernet Advanced Diagnostics....119
22.1 Using Ethernet Advanced Diagnostics (not available for ACSI)....119
22.1.1 Management Information Base (MIB) Counters 119
22.1.2 Advanced Network Counters....121
Using Network Assembly Remapping 124
23.1 Using Network Assembly Remapping 124
Appendix 127
Index Move Mode - Move Select Logic Table 127
Pneumatic Mode - Move Select Logic Table 129
Tolomatic Firmware Upgrade Tool 131
A3.1.1 Saving Current Drive Settings 131
A3.2.1 Launching the Upgrade Tool Software 132
A3.3.1 User Interface Process 132
A3.6.1 TFUT Integrated with TMI....134
A4.1.1 Import / Export Other Motor Catalogs....136

List of Figures

Figure 1-1: ACS Drive Controller part number identification 13
Figure 1-2: Example of Stepper Only information 14
Figure 1-3: Example of Servo Drive & ACSI Motor/Drive/Controller information 14
Figure 4-1: User Unit Dialog Box 17
Figure 4-2: User Unit Tool Icon in menu 17
Figure 5-1: Drive Tab Showing ACS Drive Disconnected 18
Figure 5-2: Drive Tab Showing ACS Drive Connected 19
Figure 5-3: Software Stop 19
Figure 5-4: Bus voltage mismatch 20
Figure 5-5: Offline connection 20
Figure 6-1: Tolomatic Motion Interface (TMI) Tool Bar 22
Figure 6-2: Tool Tips Display 23
Figure 6-3: Parameter Range in Tool Tip Display 23
Figure 6-4: Red Parameter Fields 24
Figure 6-5: File Menu Options 24
Figure 6-6: Tools Menu 25
Figure 6-7: Help Menu Drop Down Options 26
Figure 6-8: About Window 26
Figure 7-1: Configuration string on ERD actuator 27
Figure 7-2: Configuring the Tolomatic Actuator Selection 27
Figure 7-3: Selection of rotary mode for use with ACSI 28
Figure 7-4: Selection of Other Actuators 28
Figure 7-5: New Actuator Window 29
Figure 7-6: New Actuator Window Data Entry Complete 29
Figure 7-6: Other Actuator Window with Multiple Model Drop Down Display 30
Figure 8-1: Motor Tab with Tolomatic Stepper Motor Selected 31
Figure 8-2: Motor Tab with Tolomatic Servo Motor Selected 32
Figure 8-3: Other Motor with no Model Choices Available 33
Figure 8-4: Edit Stepper Motor Window with Data Complete 34
Figure 8-5: Other Motor Window with Model Added to Drop Down Display 34
Figure 9-1: Mode Select Tab Window - Index default 36
Figure 9-2: Mode Select Tab Window - Index drop-down 36
Figure 9-3: Mode Select Tab Window - Analog default 36
Figure 9-4: Mode Select Tab Window - Analog voltage drop-down 36
Figure 9-5: Mode Select Tab Window - Analog position drop-down 37
Figure 9-6: Mode Select Tab Window - Pneumatic drop-down 37

LIST OF FIGURES

Figure 9-7: Mode Select Tab Window - Modbus RTU 37
Figure 9-8: Mode Select Tab Window - EtherNet/IP.....37
Figure 9-9: Mode Select Tab Window - Modbus TCP 38
Figure 9-10: Mode Select Tab Window -PROFINET 38
Figure 9-11: Mode Select Tab Window -EtherCAT.....38
Figure 10-7: Brake Output enabled.....40
Table 10-3: Descriptions of Brake Output Functionality 41
Figure 10-8: Brake Output timing 41
Figure 11-1: Safety Fault - user defined choices 42
Figure 11-2: No associated digital input means Safety Fault cannot be configured and are displayed greyed out on Fault Tab.....44
Figure 12-1: Safety/Limits Tab.....45
Figure 12-2: Position Hunting in a High Mechanical Drag System.....46
Figure 12-3: Eco Mode Enabled on a High Drag Mechanical System 47
Figure 12-4: Eco Mode with Position reaching equilibrium 47
Figure 12-7: Zone Bounds Diagram 49
Figure 13-1: Home Setup Tab.....50
Figure 14-1: Mode Setup– 4 Move Commands, Not Configured.....54
Figure 14-2: Mode Setup– 8 Move Commands, Not Configured.....55
Figure 14-3: Mode Setup– 16 Move Commands, Not Configured.....55
Figure 14-4: Mode Setup– The Home & No Action commands disable several fields. 56
Figure 14-5: Software Controlled User Options 57
Figure 14-6: Digital Input Controlled 58
Figure 14-7: Configured Mode Setup, 16 Move Command Mode 59
Figure 14-8: Entries for Force Move.....60
Figure 14-9: Force Move Settle Time set to 100 msec 60
Figure 14-10: Resulting Motion Profile, 100 msec Settle Time 60
Figure 14-11: Force Move Settle Time set to 1000 msec 61
Figure 14-12: Resulting Motion Profile, 1000 msec Settle Time 61
Figure 14-13: Indexer Configuration.....62
Figure 14-14 Digital Input Entry Points 62
Figure 14-15 Standard Elements.....63
Figure 14-16 Move Definition combobox.....63
Figure 14-17 Click on the view as Sequence Diagram icon.....63
Figure 14-18 Sequence Diagram.....64
Figure 14-19 Sequential Graph 64
Figure 14-20 Sequence Diagram.....65

LIST OF FIGURES

Figure 14-21 Sequential Graph 65
Figure 14-22 Digital Input Control Mode 65
Figure 14-23 Digital Input Entry.....66
Figure 14-24 Sequential Graph 66
Figure 14-25: Pneumatic, Spring.....67
Figure 14-26: 2 Position (2 input).....68
Figure 14-27: 3 Position (2 input).....68
Figure 14-28: 3 Position (3 input).....68
Figure 14-29: Digital Input Controlled 69
Figure 14-30: Default Analog Position Mode for Voltage.....69
Figure 14-31: Settings for Analog Position mode for Voltage 70
Figure 14-32: Simulating Analog Input.....71
Figure 14-33: Confirm motion warning window 72
Figure 14-34: Analog Input Controlled.....72
Figure 14-35: Sample of completed Analog I/O calibration.....73
Figure 14-36: Invalid settings are highlighted in light red.....74
Figure 14-37: Invalid settings are highlighted in light red.....75
Figure 14-38: Simulating Analog Input.....76
Figure 14-39: Confirm motion warning window 77
Figure 14-40: Test with PLC or external Analog source 77
Figure 14-41: Drive Status tool indicates Software (Host) is in control.....78
Figure 14-42 PLC Master in control, last commanded move is highlighted.....79
Figure 15-1: Launching the Motion Manager Tool.....81
Figure 15-2: Motion Manager Panel 82
Figure 16-1: Control Loop 83
Figure 16-2: Tuning Filter Dialog.....84
Figure 16-3: Position PID Loop 86
Figure 16-4: Velocity PID Loop.....86
Figure 16-5: Current PID Loop.....86
Figure 16-6 – Good Position Proportional Gain.....90
Figure 16-7: Position Proportional Gain - Too High: Oscillations.....90
Figure 16-8: Position Proportional Gain - Too Low: Large Position Error 91
Figure 16-9: Good Position Integral Gain.....91
Figure 16-10: Position Integral Gain – Too Low: Slow steady-state response.....92
Figure 16-11: Position Integral Gain - Too High: Overshoot which gets corrected over time 92

Figure 16-12: Good Velocity Proportional Gain 93
Figure 16-13: Velocity Proportional Gain - Too High: Large Oscillations in Velocity 93
Figure 16-14: Velocity Proportional Gain - Too Low: Slow Velocity Response 94
Figure 16-15: Good Velocity Integral Gain 94
Figure 16-16: Velocity Integral Gain - Too High: Oscillations 95
Figure 16-17: Velocity Integral Gain - Too Low: Steady-state velocity error 95
Figure 16-18: Default Velocity Feed Forward Gain (75%) 96
Figure 16-19: Velocity Feed Forward Gain (0%) - Higher Position error, higher velocity error 96
Figure 16-20: Modified Velocity Feed Forward Gain (100%) Low position and velocity error, causes overshoot 97
Figure 16-21 - Good Current Proportional Gain 97
Figure 16-22: Current Proportional - Too High: Visible Oscillations 98
Figure 16-23: Current Proportional - Too Low: Sluggish Response 98
Figure 16-24: Good Current Integral 98
Figure 16-25: Bad Current Integral - Too High: Large Overshoot and oscillations 99
Figure 16-26: Bad Current Integral - Too Low: Actual not reaching commanded 99
Figure 16-27: Current Loop Starting Point 100
Figure 16-28: Current Loop Tuning - Proportional Bandwidth Oscillations 100
Figure 16-29: Current Loop Tuning - Integral Bandwidth @ .01 101
Figure 16-30: Current Loop Tuning - Integral Bandwidth @ 180 101
Figure 17-1: Launching the Digital I/O Tool 102
Figure 17-2: Digital I/O Tool 102
Figure 18-1: Launching the Analog I/O Tool 103
Figure 18-2: Analog I/O Tool 103
Figure 20-1: Launching the Drive Status Tool 112
Figure 20-2: Drive Status Tool 112
Figure 21-1: Launching the Ethernet Setup Tool 113
Figure 21-2: Ethernet setup tool 113
Figure 21-3: Testing verifies a successful Ethernet connection 115
Figure 21-4: Testing indicates a failed attempt for Ethernet connection 115
Figure 21-5: Ping Test failure and success 115
Figure 21-6: Obtaining an IP address automatically 116
Figure 21-7: By default, infrastructure mode is in DHCP mode 116
Figure 21-8: Ethernet (TCP/IP) Properties 117
Figure 21-9: Ethernet connection test 118
Figure 21-10: Drive not accessible 118

Figure 21-11: Drive is accessible....118
Figure 22-1: Advanced Diagnostics pull-down....119
Figure 22-2: Ethernet MIB Counters....119
Figure 22-3: Menu selection of Advanced Network Counters....121
Figure 22-4: Advanced Network Counters Interface....121
Figure 22-5: Result of "Collect Counters" selection....122
Figure 22-6: Save as .csv file for use in software like Excel....122
Figure 22-7: Result of "Collect Counters" graphed in MicroSoft Excel....123
Figure 23-1: Network Assembly Remapping pull-down....124
Figure 23-2 Click Apply to Remap....125
Figure A3-1: Using the Save As backup current ACS drive settings before upgrading firmware....131
Figure A3-2: Select the correct version of the Firmware Upgrade Tool....132
Figure A3-3 Connected to ACS Drive....133
Figure A3-4: Firmware Flashing Progress....133
Figure A3-5: Firmware Flashing Complete....134
Figure A3-6: Upgrade Firmware through TMI....134

List of Tables

Table 2-1: Hardware Requirements 15
Table 6-1: TMI Setup Wizard Navigation Tabs 21
Table 6-2: File Menu Drop Down Descriptions 24
Table 6-3: Tools Menu Drop Down Descriptions 25
Table 10-1: Descriptions of Digital Input Functionality 39
Table 10-2: Descriptions of Digital Output Commands 40
Table 11-1: Safety Fault user defined choices 42
Table 11-2: Safety Faults Descriptions 43
Table 11-3: ACS Drive Critical Faults Descriptions 44
Table 14-1: Descriptions of Setup Table Move Definitions for 4, 8, and 16 Move Commands 54
Table 14-2: Descriptions of Setup Table Move Definitions for Pneumatic Mode 67
Table 14-3: Enable Command modes and actions when digital input is configured to enable 79
Table 14-4: Software Stop Command modes and actions when digital input configured to Software Stop 80
Table 21-1: Ethernet connection troubleshooting tips 114
Table 22-1: ACS Ethernet Drive MIB counters 120
Table 23-1 - ACS and ACSI Servo Remappable Register Variables 125
Table 23-2 - ACS Stepper Remappable Register Variables 126
Table A1-1: 4 Move Commands Mode Logic 127
Table A1-2: 8 Move Commands Mode Logic 127
Table A1-3: 16 Move Commands Mode Logic 128
Table A2-1: 2 Position (1 input) Mode Logic 129
Table A2-2: 2 Position (2 input) Mode Logic 129
Table A2-3: 3 Position (2 input) Mode Logic 129
Table A2-4: 3 Position (3 input) Mode Logic 130

1.1 The Tolomatic ACS Drive/Controller

NOTE:
It is important to identify the motor and corresponding ACS drive system (Stepper or Servo) being used!
Because the TMI software allows an offline connection that does not require the Tolomatic drive. This offline connection allows users to create, edit and save drive configuration files.

NOTE: Throughout this manual information is color coded as it applies to products

Information that ONLY applies to Stepper Drives will be noted in grey box:

ACS Stepper Drive
ST1048

Information that ONLY applies to Servo Driveswill be noted in light blue box:

ACS Servo Drive
SV2048

Information that applies to Servo Drives & ACSI Motor/ Drive will be noted in light purple box:

Servo Drive

Information that ONLY applies to ACSI will be noted in light red box:

ACSI Motor/Drive/Contr.
ASCI

It is important to know which model Tolomatic ACS Drive/Controller you are programming. The stepper and servo units are the same size, color and externally are only different on the left panel. Use the part number on the label to confirm the Tolomatic ACS Drive/Controller before programming.

Figure 1-1: ACS Drive Controller part number identification

ACS Stepper Drive

Currently (beginning 01/21/2015) there are three ACS Stepper Drive/Controller choices:

- #**3604-9665** (ACST1048UD) - ACS Stepper Drive/Controller, Basic firmware 36043183.TOL
- #**3604-9666** (ACST1048ED) - ACS Stepper Drive/Controller, EtherNet/IP firmware 36043183.TOL
- #**3604-9667** (ACST1048MD) - ACS Stepper Drive/Controller, Modbus TCP firmware 36043183.TOL

ACS Servo Drive

Currently there are three ACS Servo Drive/Controller choices:

- #**3604-9661** (ACSV2048UD) - ACS Servo Drive/Controller, Basic firmware 36043177.tol
- #**3604-9662** (ACSV2048ED)- ACS Servo Drive/Controller, EtherNet/IP firmware 36043177.tol
- #**3604-9663** (ACSV2048MD)- ACS Servo Drive/Controller, Modbus TCP firmware 36043177.tol

ACSI Motor / Drive / Controller

Currently (beginning 01/01/2018) there are ten ACSI Motor/Drive/Controller choices:

- Basic #**3604-9740** (ACSI23-1Q1-B) #**3604-9770** (ACSI34-1Q1-B) ACSI Integrated Servo Motor/Drive/Controller, firmware 36043171.TOL
- EtherNet/IP #**3604-9746** (ACSI23-1Q1-E) #**3604-9776** (ACSI34-1Q1-E) ACSI Integrated Servo Motor/Drive/Controller, firmware 36043171.TOL
- Modbus TCP #**3604-9752** (ACSI23-1Q1-M) #**3604-9782** (ACSI34-1Q1-M) ACSI Integrated Servo Motor/Drive/Controller, firmware 36043171.TOL
- EtherCAT #**3604-9856** (ACSI23-1Q1-C) #**3604-9872** (ACSI34-1Q1-C) ACSI Integrated Servo Motor/Drive/Controller, firmware 36043171.TOL
- PROFINET #**3604-9864** (ACSI23-1Q1-P) #**3604-9886** (ACSI34-1Q1-P) ACSI Integrated Servo Motor/Drive/Controller, firmware 36043171.TOL

NOTE: They will collectively be referred to as ACS Drive throughout this guide

The user guide indicates functions that apply to specific Drive/Controllers. If there is no indication, the information applies to all Tolomatic ACS Drive/Controllers.

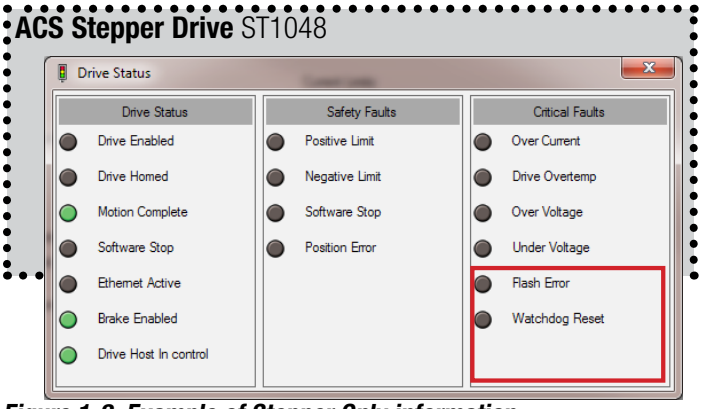


Figure 1-2: Example of Stepper Only information

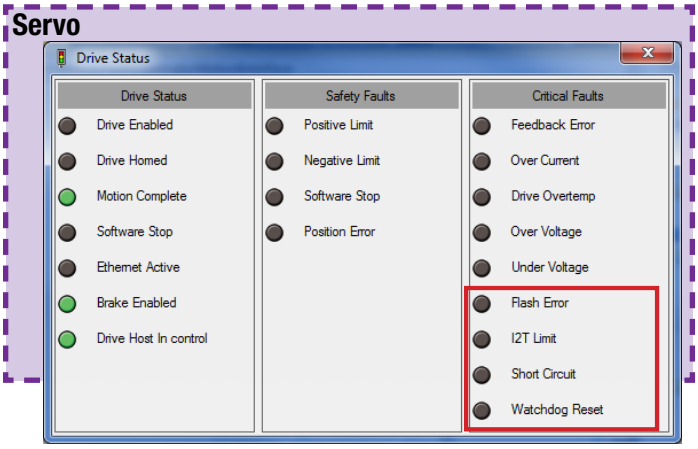


Figure 1-3: Example of Servo Drive & ACSI Motor/Drive/Controller information

FOR EXAMPLE: THE TUNING FILTER TOOL (CHAPTER 16) IS ONLY AVAILABLE FOR SERVO. WHEN THE SERVO DRIVE IS CONNECTED TO THE COMPUTER THE SOFTWARE WILL DETECT THE DRIVE AND THE TUNING FILTER TOOL WILL BE AVAILABLE. CONVERSELY, WHEN CONNECTED TO A STEPPER DRIVE THE TUNING FILTER TOOL WILL NOT BE AVAILABLE.

2.1 Host Computer and Software System Requirements

The Tolomatic Motion Interface (TMI) is designed to work with a host PC with Windows® operating systems. Before installing the TMI software, be sure the host PC has the minimal host requirements indicated below.

2.1.1 Hardware Requirements

NOTE: Tolomatic highly recommends configuration and upgrading using a USB 2.0 port. Slower USB ports may introduce slower response times with TMI and firmware upgrades.

HARDWARE	MINIMUM REQUIREMENT
Processor	1 GHz
RAM	512 MB
Disk Space 32-Bit	600 MB
Disk Space 64-Bit	1.5 GB
USB	1 USB 2.0 Connection

Table 2-1: Hardware Requirements

2.1.2 Operating Systems Supported

The Tolomatic Motion Interface (TMI) is compatible with the following operating systems: Windows® 7, Windows® 8, and Windows® 10.

For all platforms, it is recommended that you upgrade to the latest Windows Service Pack and critical updates from the Windows Update Web Site at http://go.microsoft.com/fwlink/?LinkId=168461 to ensure the best compatibility and security.

The TMI software is not supported on IA-64-based (Itanium) systems.

3.1 Installation Instructions

3.1.1 Installing from the Tolomatic CD

1. Insert the software CD supplied by Tolomatic into the CD-ROM drive in your PC.
2. Double-click the "***TolomaticMotionInterface[version].exe***" file to run the installer.
3. Follow the prompts to install the software.

The software will install a program launch icon in the Windows® Start menu at:
Start > All Programs > Tolomatic > TolomaticMotionInterface

In the Start menu the program will start with a single click.

3.1.2 Downloading and Installing from the Tolomatic Web Site at www.tolomatic.com

The Tolomatic Motion Interface can be downloaded from the Tolomatic web site at www.tolomatic.com

1. To download, click on "***Info Center***" in the navigation bar at top. Select "***Software***" under "Product Support." Select "Software Firmware;" select the: "***Current → Tolomatic Motion Interface***" the current and archive TMI software is available.
2. Select the TMI software and when prompted save the file to the programs folder on your hard drive.
3. Double-click the executable file to run the installer.
4. Follow the prompts to install the software.

The software will install a program launch icon in the Windows® Start menu at:
Start > All Programs > Tolomatic > TolomaticMotionInterface

In the Start menu the program will start with a single click.

4.1 Launching the TMI Software

1. To launch the software in the Windows® Start menu navigate to: ***Start > All Programs > Tolomatic > TolomaticMotionInterface***
2. When the TMI is launched for the first time, the software will automatically display the User Units dialog box (shown below, Figure 4-1) which defines the units displayed in the software. The user has four selections for linear actuator units: US Linear, SI Linear, US Rotary, SI Rotary.

Note: Default Rotary units are Revs. When a rotary actuator is chosen, most applications should use revs. Degrees is avaliable, but has limitations on rollover and limits.

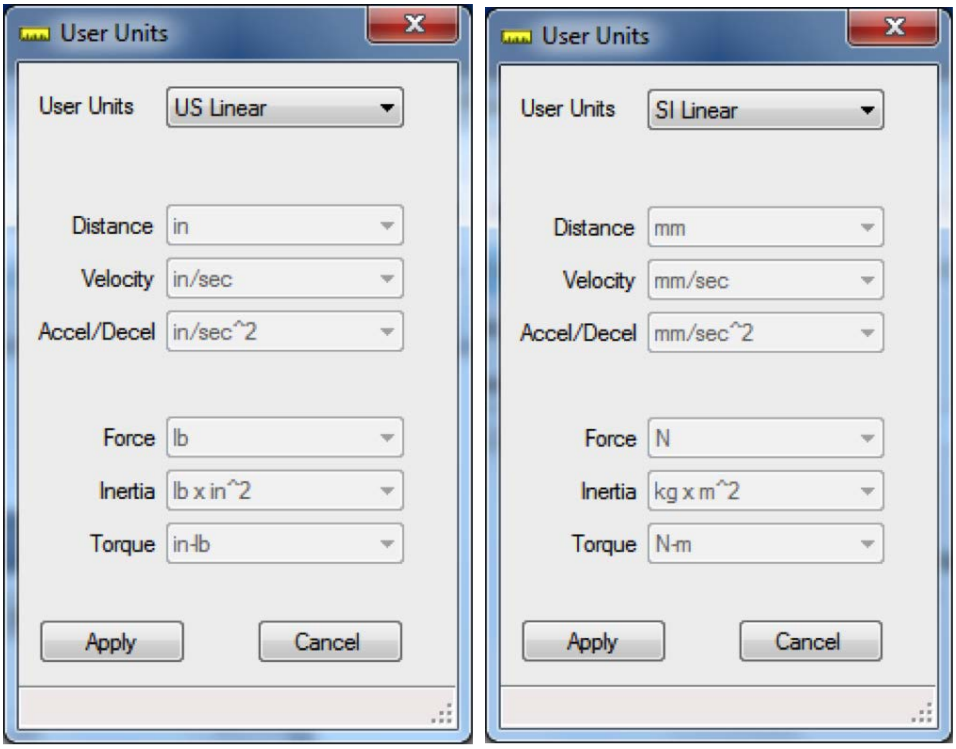


Figure 4-1: User Unit Dialog Box

3. The user must select the desired units and click Apply. Once the apply button is clicked TMI will no longer automatically display the User Units dialog box on application launch. To access the User Units dialog box click on the ruler icon in the tool bar at top. The units can be changed at any time and all displayed parameters in the software will be adjusted accordingly.

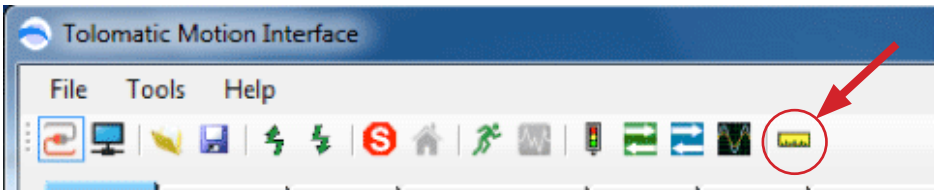


Figure 4-2: User Unit Tool Icon in menu

5.1 Establishing Communication with the Tolomatic ACS Drive

NOTE: The TMI software allows an offline connection that does not require the Tolomatic drive. This offline connection allows users to create, edit and save drive configuration files.

The communications protocol used for configuration uses USB cable.

1. After the User Units have been selected on initial startup, and from then on once the TMI is launched, the software will automatically default to the Drive tab shown in Figure 5-1 below.

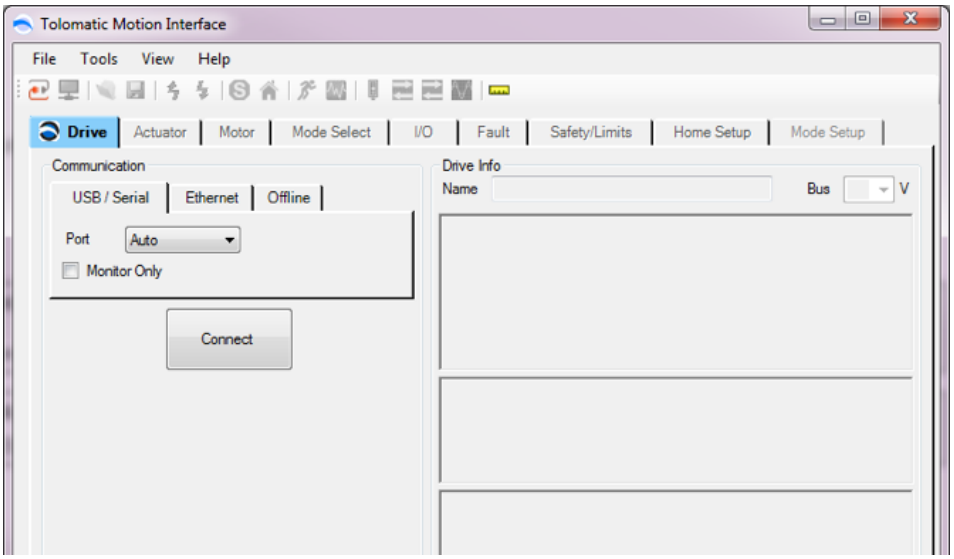


Figure 5-1: Drive Tab Showing ACS Drive Disconnected

TROUBLESHOOTING TIP:

If TMI is prompting you to install drivers and you have already done so, power cycle the drive and try to establish a connection again.

2. When the 'Auto' option is selected for the port, TMI attempts to detect the presence of ACS servo or stepper drive on any of the COM ports available on the computer. When the drive is connected it will show up as a Com-Port in Windows Device Manager. The ACS drive must be powered on for communication with the PC in order for the discovery sequence to be successful. (If no ACS Drive is found, the status bar (at bottom) will display "Disconnected" and the text box will display "Unable to connect to ACS Drive" message.) The user may also select a specific port from the list of available COM ports. **TMI will prompt you to install drivers if drivers are required to connect to the drive.** For proper operation be sure that both the TMI software and associated drivers are up-to-date. Once successful communication is established, the TMI will remember that port for subsequent sessions.

TROUBLESHOOTING TIP:

When Drivers are properly installed, ACS will show up under "Ports" object in Windows Device Manager.

3. Upon establishing communication with the ACS Drive, the TMI software reads all the current settings in the ACS Drive and updates the software interface accordingly. As shown in Figure 5-2, the ACS Drive information is displayed in several fields: Name of ACS Drive given by user; ACS Drive information including Model and Firmware Version; and a Photo of the Tolomatic ACS Drive product being configured (ACS Drive/Controller is pictured). If the ACS Drive has Network hardware the MAC address will also be displayed.

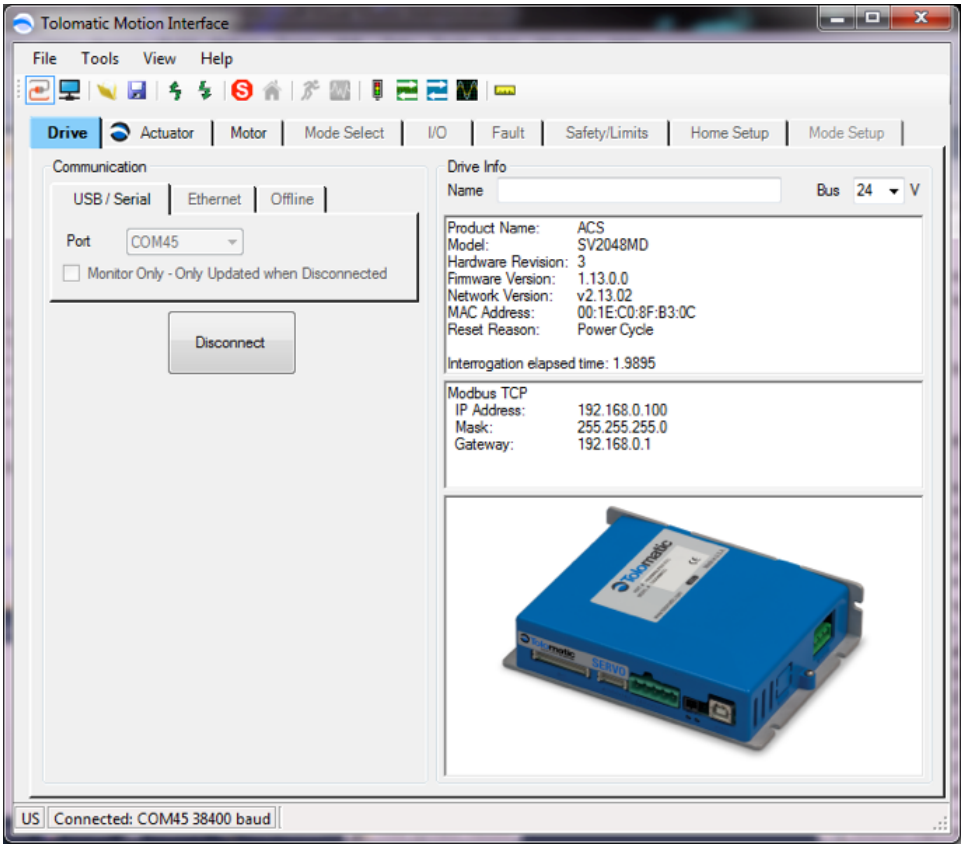


Figure 5-2: Drive Tab Showing ACS Drive Connected

4. The TMI software opens a Software Stop window shown in Figure 5-3. This Software Stop window is intended to be a software motion stop. If the user clicks on the stop button, the actuator will immediately stop. The Tolomatic ACS Drive will be disabled along with the output to the motor. For safety reasons this window is intended to always be on top of other windows.

Figure 5-3: Software Stop

5. The Name text box allows the user to name the drive/axis. This is helpful when configuring multiple drives.

6. When connecting to the drive, the user may experience a Bus Voltage Mismatch warning message. This occurs when the drive is configured for a specific bus

voltage and the drive detects a different supply voltage. When first configuring the drive, make sure to set the Bus Voltage to the correct supply voltage for the application.

TROUBLESHOOTING TIP:

For Servo Drives, Bus Voltage drastically affects tuning. Drive should be configured and tuned at the bus voltage of the application. Faliure to do so will result in excessive vibration and poor motion.

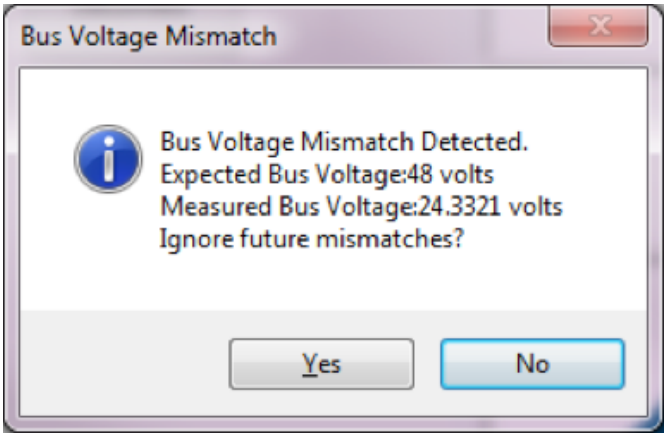


Figure 5-4: Bus voltage mismatch

5.2 Offline Connection

The TMI software supports an offline connection that allows the user to create, edit and save drive configuration files without the Tolomatic ACS Drive being present. This is a useful development and debug tool to create and analyze the drive configuration files.

With the Offline connection, all controls related to motion, tuning and enabling/disabling drive are disabled. The offline connection does not allow the user to simulate motion, debug logic, or tune servo motors.

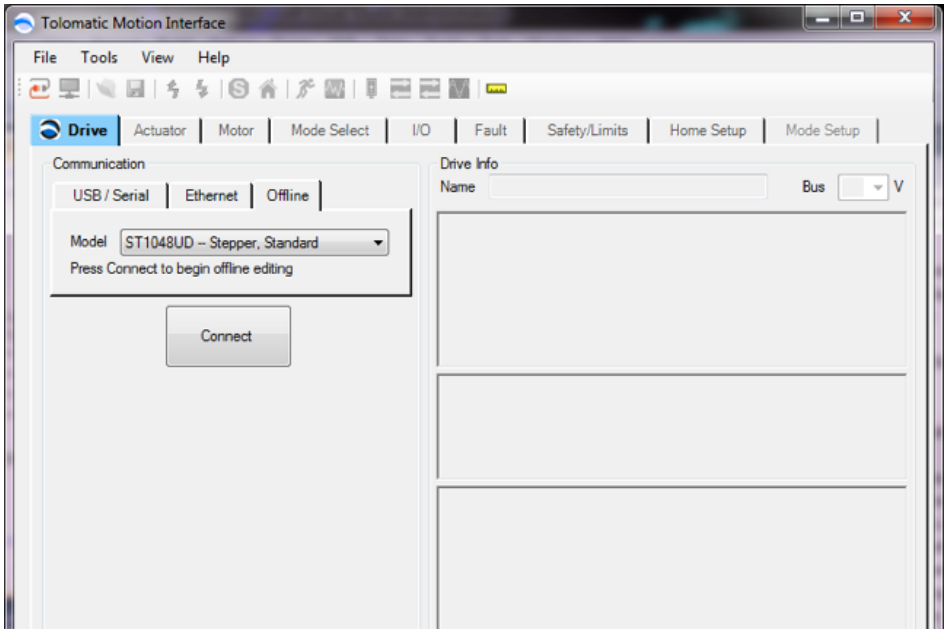


Figure 5-5: Offline connection

6.1 Navigating through the Tolomatic Motion Interface (TMI)

6.1.1 Setup Wizard Tabs

The TMI software for configuring the ACS Drive is designed as a setup wizard. It uses tabs, navigating from left to right through all the steps needed to configure the ACS Drive and create motion. As shown below, there are multiple tabs which are used in the setup process.

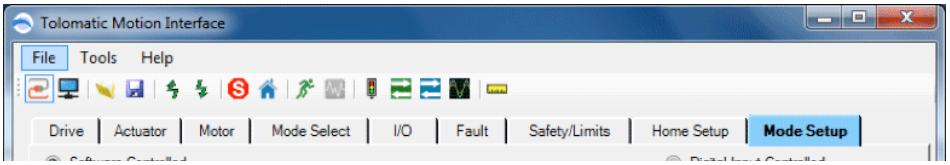
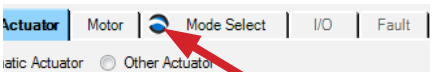
TMI Setup Wizard Navigation Tabs	
	
Drive	Establish communication and verify ACS Drive identification information such as model and firmware version.
Actuator	Configure a Tolomatic actuator or create a custom actuator in the "Other Actuator Catalog."
Motor	Configure or view parameters of a Tolomatic motor or create a 3rd party motor file in the "Other Motor Catalog."
Mode Select	Select the desired operating mode. Tolomatic ACS Drive products were designed to have dedicated operating modes to simplify the configuration and operation of the ACS Drive. Currently, there are four operating modes, depending on model: Index Move, Pneumatic, Analog Position and Network *(EtherNet/IP, ModbusTCP, Modbus RTU)*
I/O	Configure the functionality of the digital inputs and digital outputs of the ACS Drive. The TMI will automatically configure a suggested I/O map based on the selected operating mode.
Fault	Enable/disable faults, and configure the action taken for the displayed faults.
Safety/ Limits	Configure safety parameters and motion limits such as: in position, position error, maximum velocity/accel/decel, current limit, software limits and zone bounds
Home Setup	Configure the homing routine parameters such as type, direction, velocity, force, and home on power-up.
Mode Setup	Setup the operating Mode selected in the Mode Setup tab. For example, in Index Move mode, the user configures move type, position, velocity, acceleration, deceleration and force for all the moves.

Table 6-1: TMI Setup Wizard Navigation Tabs

6.1.2 Tolomatic Logo



The TMI software uses the Tolomatic Logo to guide the user through the software in order to correctly configure all necessary parameters. Notice in the drawing above that the ACS Drive is connected, the Tolomatic logo has moved to the Actuator tab which is the next required step– configuring the actuator. The Drive tab remains highlighted in Blue which gives the user visual indication of the currently selected tab.

6.1.3 Tool Bar

Figure 6-1: Tolomatic Motion Interface (TMI) Tool Bar

The Tool Bar includes the following:

Drive Connect: Connect or disconnect communication to the ACS Drive.

Ethernet Setup (optional): Set up ACS Drive for Ethernet communication.

Open: Open a previously saved drive configuration file to setup all the parameters of the ACS Drive.

Save: Save all parameters to a drive configuration file for later use.

Restore Current Settings from Drive Flash: Read all parameters from drive flash memory into the TMI software.

Write Current Settings to Drive Flash: Write all parameters from the TMI software into the drive flash memory.

Software Stop: Disables ACS Drive and output to the motor

Home: Initiates a home routine

Motion Manager tool: Tool used to create simple moves such as absolute, incremental and jog. All motion profile parameters are adjustable through this tool.

ACS Servo Drive / ACSI

Tuning Filter tool: Tool used to tune servo motors (advanced users)

Drive Status tool: Tool used to notify user of critical drive information such as Enable status, Home status, In Position status and Faults (see Section 20: Drive Status Tool).

Digital I/O tool: Tool used to view the status of the Digital Inputs and Digital Outputs (see Section 17: Digital I/O Tool).

Analog I/O tool: Tool used to view the status of the Analog Inputs and Analog Outputs (see Section 18 Analog I/O Tool).

4 Channel Software Oscilloscope: Tool used to view signals on the drive.

User Units tool: Tool to select application user units. At time of this release, linear units are selected in inches, millimeters and revolutions.

6.1.4 Tool Tips

As the user moves the mouse over Tool Bar items, drive parameters or action buttons, the TMI will display a tool tip providing useful information about that item.

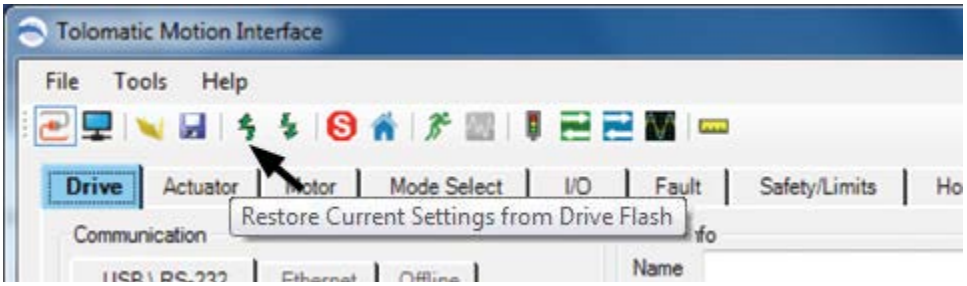


Figure 6-2: Tool Tips Display

Tool Tip Displays: Moving the mouse over a parameter field will activate the Tool Tips display and it will show the allowable range for that parameter. If a user attempts to enter a lower number than is allowed, the TMI software will automatically default to the minimum allowable value. If a user attempts to enter a higher number than is allowed, the TMI will automatically default to the maximum allowable value.

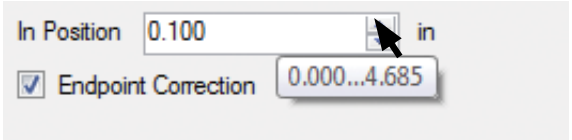


Figure 6-3: Parameter Range in Tool Tip Display

6.1.5 Parameter Entry

Red Parameter Field: The TMI will automatically shade any parameter field a red color if that parameter has not been configured (see Figure 6-4). This is a notice to the user that this parameter must be configured before continuing or creating motion.

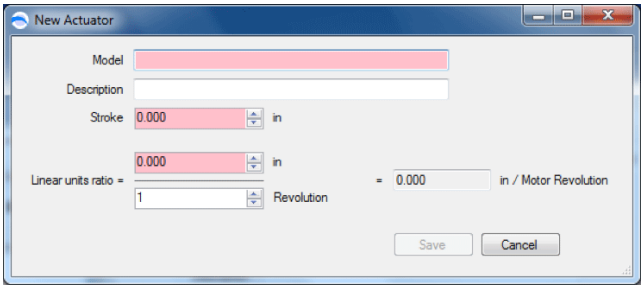


Figure 6-4: Red Parameter Fields

6.1.6 File Menu

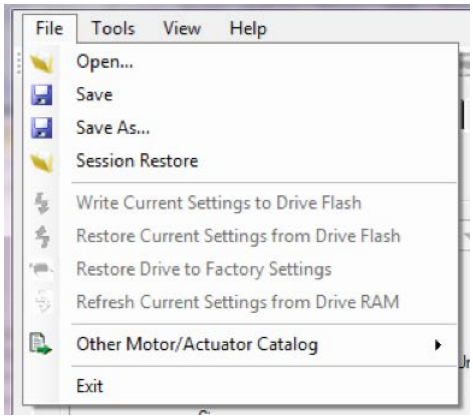


Figure 6-5: File Menu Options

File Menu Drop Down Descriptions	
Open	Open a drive configuration file to setup all the parameters of the ACS Drive.
Save	Saves all parameters to a drive configuration file. If user hasn't given a name to the file yet, a File Save window will be opened.
Save As	Opens a File Save window to allow user to select location and name of drive configuration file.
Session Restore	Restore a previous waypoint. While drive is being configured, waypoints are automatically saved in the session.
Write Current Settings to Drive Flash	Write all parameters from the TMI software into the drive flash memory.
Read Current Settings from Drive Flash	Read all parameters from drive flash memory into the drive's RAM and into the TMI software.
Restore Drive to Factory Settings	Restores all parameters in the ACS Drive flash and RAM memory to factory defaults.
Read Current Settings from Drive RAM	Reads all parameters in ACS Drive RAM into the TMI software (Performed automatically when communication is established)
Exit	Exits the application

Table 6-2: File Menu Drop Down Descriptions

NOTE: Executing any Open, Restore or Read operation will result in the TMI software automatically navigating to the Drive Tab and updating all parameters in TMI to the current drive settings.

6.1.7 Tools Menu

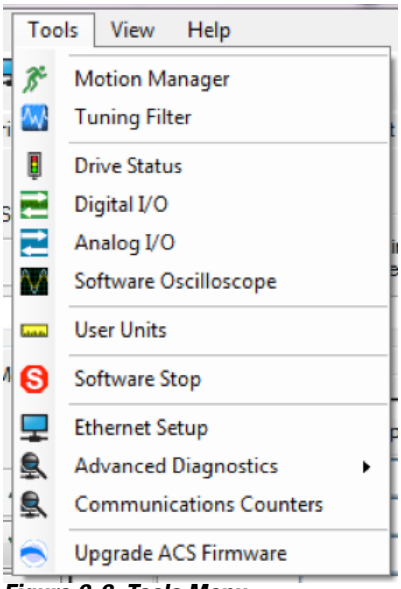


Figure 6-6: Tools Menu

ACS Servo Drive / ACSI

Tools Menu Drop Down Descriptions	
Motion Manager	Used to create simple moves such as absolute, incremental and jog. All motion profile parameters are adjustable through the Motion Manager tool.
Tuning Filter	Used to tune servo motors
Drive Status	Used to notify user of critical drive information such as Enable status, Home status, In Position status and Faults
Digital I/O	Used to view the status of the Digital Inputs and Digital Outputs.
Analog I/O	Used to view the status of the Analog Inputs and Analog Outputs.
4 Channel Software Oscilloscope	Software tool used to analyze drive parameters
User Units	Used to select application user units. At time of this release, units are selected in inches or millimeters.
Software Stop	Used to disable ACS Drive and output to the motor. This tool is automatically launched when the TMI software connects to the ACS Drive.
Ethernet Setup (optional)	Set up ACS Drive for Ethernet communication.
Advanced Diagnostics	Used for advanced diagnostics and troubleshooting.
Communications Counters	Used to diagnose USB communications issues.
Upgrade ACS Firmware	Used to upgrade the firmware for the ACS.

Table 6-3: Tools Menu Drop Down Descriptions

6.1.8 Help Menu

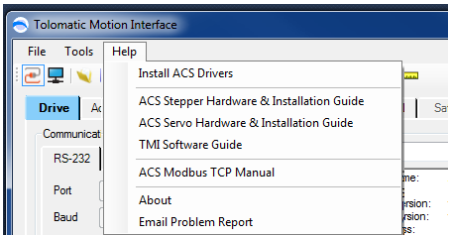


Figure 6-7: Help Menu Drop Down Options

Install ACS Drivers: Installs the drivers for the USB enabled ACS Drives.

ACS Stepper Hardware & Installation Guide: Launches a PDF of the manual with ACS Stepper Drive specifications, wiring diagrams, connector and cable information.

ACS Servo Hardware & Installation Guide: Launches a PDF of the manual with ACS Servo Drive specifications, wiring diagrams, connector and cable information.

Tolomatic Motion Interface (TMI) Software Guide: Launches a PDF of this manual.

ACS [Network Mode] Manual: Launches a drive specific PDF of the manual for supported network mode.

About: Indicates the current software version of the Tolomatic Motion Interface and the build date.

Email Problem Report: Launches local email application with log file attachments that can be sent to Tolomatic in the event of an issue.

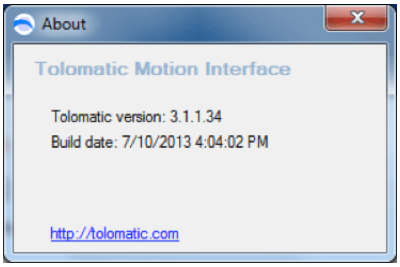


Figure 6-8: About Window

7.1 Using the Actuator Tab

NOTE: ALL standard Tolomatic electric actuators can be selected from the model drop down menu. Some custom actuators may require use of "Other Actuator" to configure.

The Actuator tab is used to configure a Tolomatic actuator or define a new actuator. The default selection of the radio button is Tolomatic Actuator.

7.1.1 Tolomatic Actuator Selection

1. Identify the actuator configuration string on the actuator. Enter Model, Size, Screw/Nut Lead, Stroke Units (either SM for mm, or SK for inches), length of Stroke in units specified, Motor Mount, and Motor option.

Figure 7-1: Configuration string on ERD actuator

2. When Model is configured, a photo of the actuator will be shown.

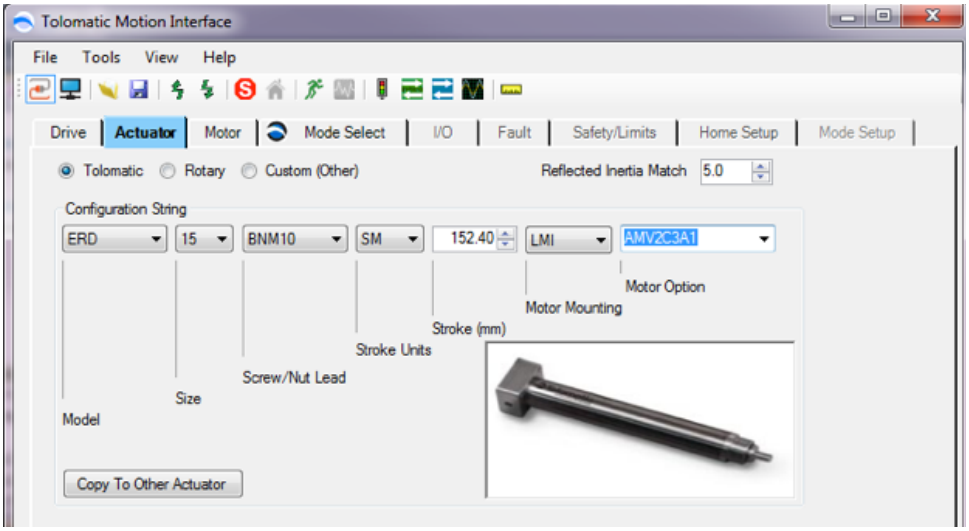


Figure 7-2: Configuring the Tolomatic Actuator Selection

TROUBLESHOOTING TIP:

If Servo motor vibrates on enable, lower reflected inertia match to "1," then increase as applicable. Inertia is a base tuning for servo motors. More advance tuning can be done using Tuning Filter too.

NOTE: When complete configuration string is entered the Tolomatic logo will move to the next tab requiring attention.

3. Copy to Other Actuator: Creates a new actuator in the Other Actuator Selection based on the defined Tolomatic Actuator.
4. Reflected Inertia Match: Set initial inertia of the system.

7.1.2 Rotary Actuator

The Rotary Actuator selection allows a user to configure the drive for Rotary operation.

NOTE: Tolomatic recommends "Revs" for rotary units. Degrees support is limited to single revolution applications.

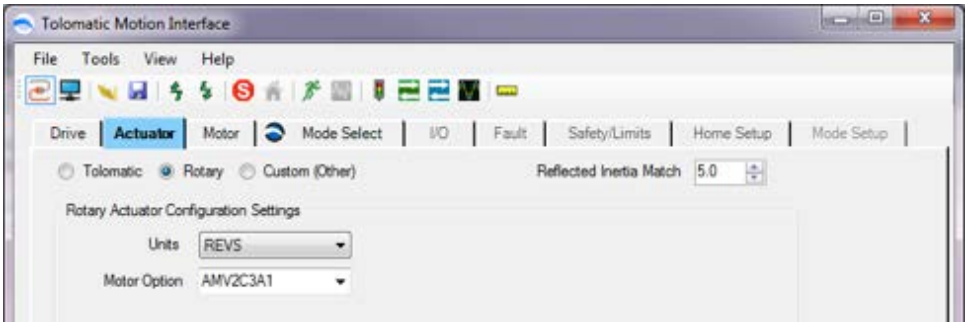


Figure 7-3: Selection of rotary mode for use with ACSI

1. Selecting the Units will map the System Units to the User Units which means that in network modes, the user can use the rotary units for distance, velocity, acceleration, and deceleration values.
2. Motor Option allows the user to select the motor to use
3. Reflected Inertia Match allows the user to change the inertia values for tuning

7.1.3 Custom (Other) Actuator Selection

The Custom (Other) Actuator Catalog allows a user to keep any number of Other Actuator models in the file for convenience and later reference.

1. If no Other Actuators have been created there will be no selections under the Models drop down. In this case, the user must click the New button at the bottom of the screen (see Figure 7-4).

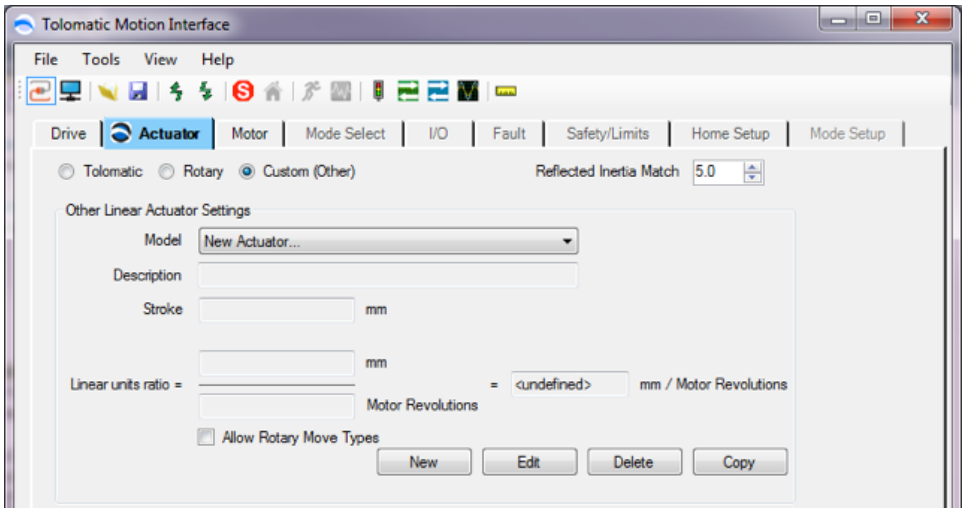


Figure 7-4: Selection of Other Actuators

2. Clicking the New button, will bring up a New Actuator dialog in which the user must enter critical information about the actuator (see figure 7-5)

3. Model field: Enter the name selected for the Other Actuator. It will remain red until the user enters a unique name that has not already been saved into the Other Actuator Catalog.
4. Description field: Enter a unique description of the Other Actuator, up to a 28 alpha-numeric character entry that is all uppercase. This field is optional.
5. Stroke field: Enter the stroke in the selected user units.

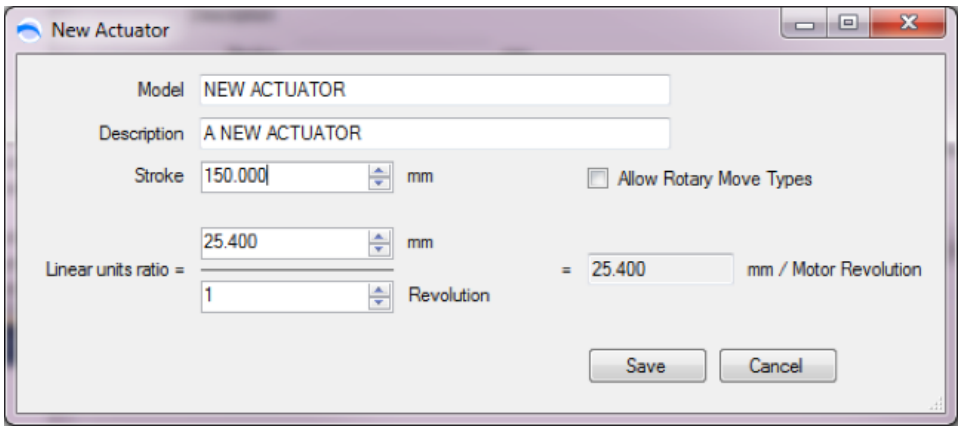


Figure 7-5: New Actuator Window

6. Linear Units Ratio field: These numerator and denominator entries are used to setup the ratio of rotary motor revolutions to linear distance in selected user units per motor revolution. If there is a gearbox inline with the motor, this ratio must be taken into account and entered accordingly.

   For example, if there is an Other Actuator with an 0.5" (two turns per inch) lead screw, then the Linear Units Ratio would look as in Figure 7-6 below. All the required fields have been entered properly and the parameters have been validated. This activates the Save button.

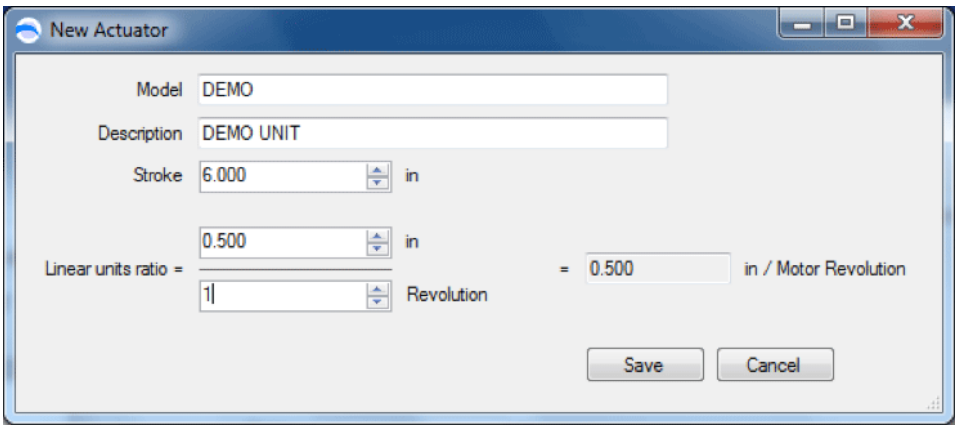


Figure 7-6: New Actuator Window Data Entry Complete

7. Allow Rotary Moves Types allows velocity and other rotary moves to be accessible. If this motor is connected to a linear actuator it is recommended that this remain unchecked. Linear units ratio must also be set to 1:1.

8. Clicking the save button adds the New Actuator information to the Other Actuator catalog. The name of the new actuator is automatically added to the Model drop down for later reference.

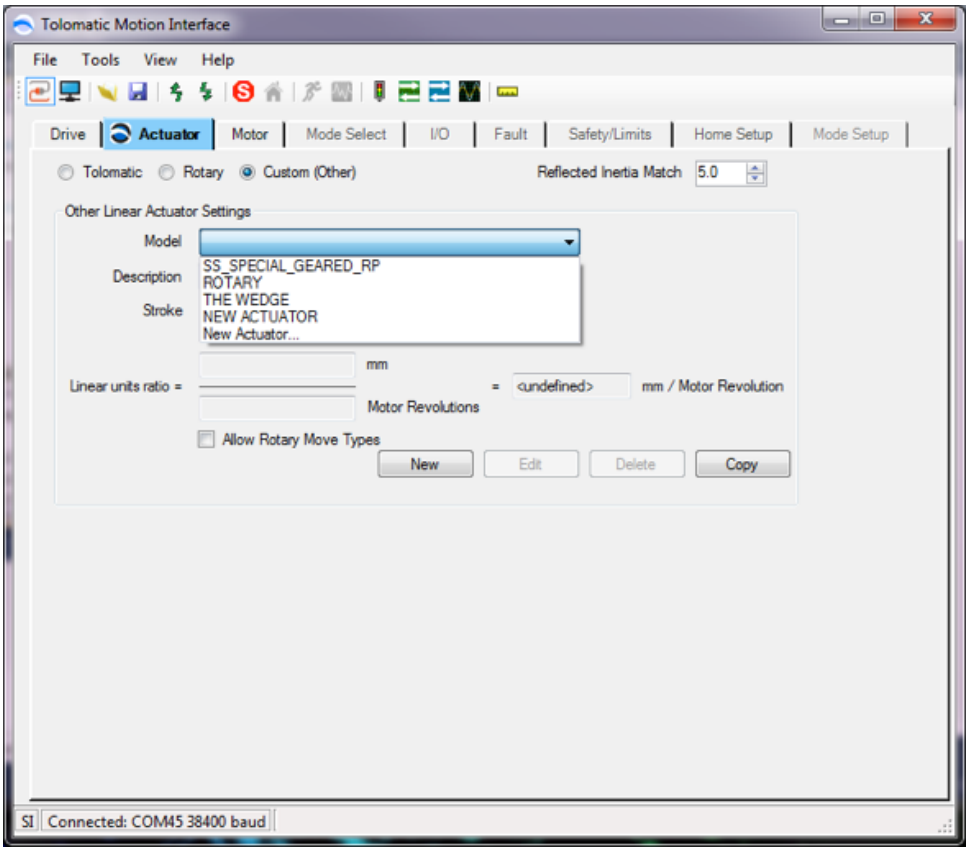


Figure 7-6: Other Actuator Window with Multiple Model Drop Down Display

9. Button descriptions:
   New: Create new actuator
   Edit: Edit existing actuator previously saved
   Delete: Delete selected actuator
   Copy: Create a new actuator based on selected existing actuator

8.1 Using the Motor Tab

NOTE: At the time of this release, servo drives do NOT support "Other Motor" configuration.

The Motor tab is used to configure a Tolomatic motor or create a different motor in the Other Motor Catalog. The default selection of the radio button is Tolomatic Motor.

8.1.1 Tolomatic Motor Selection

1. Verify the correct Motor selection and settings are displayed.
2. All parameters except the Reverse Direction check box are automatically populated with those of the selected motor and are disabled from entry.

   If the user wishes to select a different motor Model that is acceptable for the actuator chosen, then simply select a new motor from the Model drop down.
3. Depending on the actuator configuration or the actuator installation in the machine, the user may wish to reverse the direction of the motor's positive direction. Default positive motion direction is CW (clockwise) when viewed toward output shaft of motor. To change it to CCW (counter-clockwise), the Reverse Direction check box must be checked.

ACS Stepper Drive

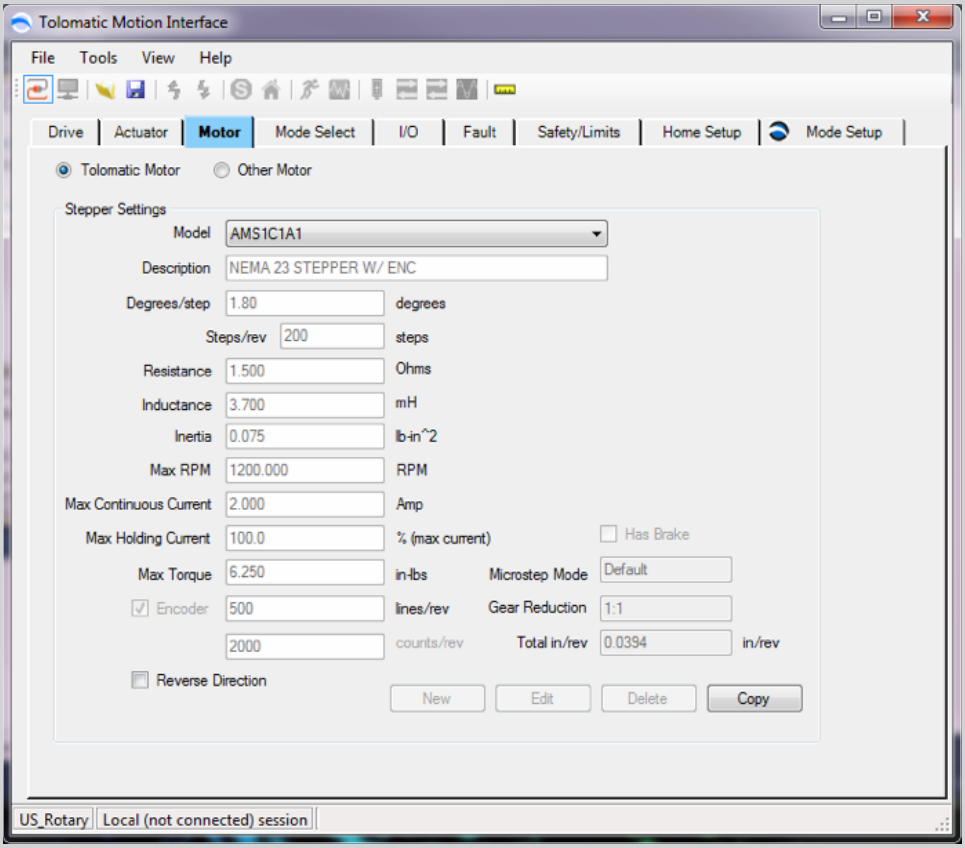


Figure 8-1: Motor Tab with Tolomatic Stepper Motor Selected

ACS Servo Drive / ACSI

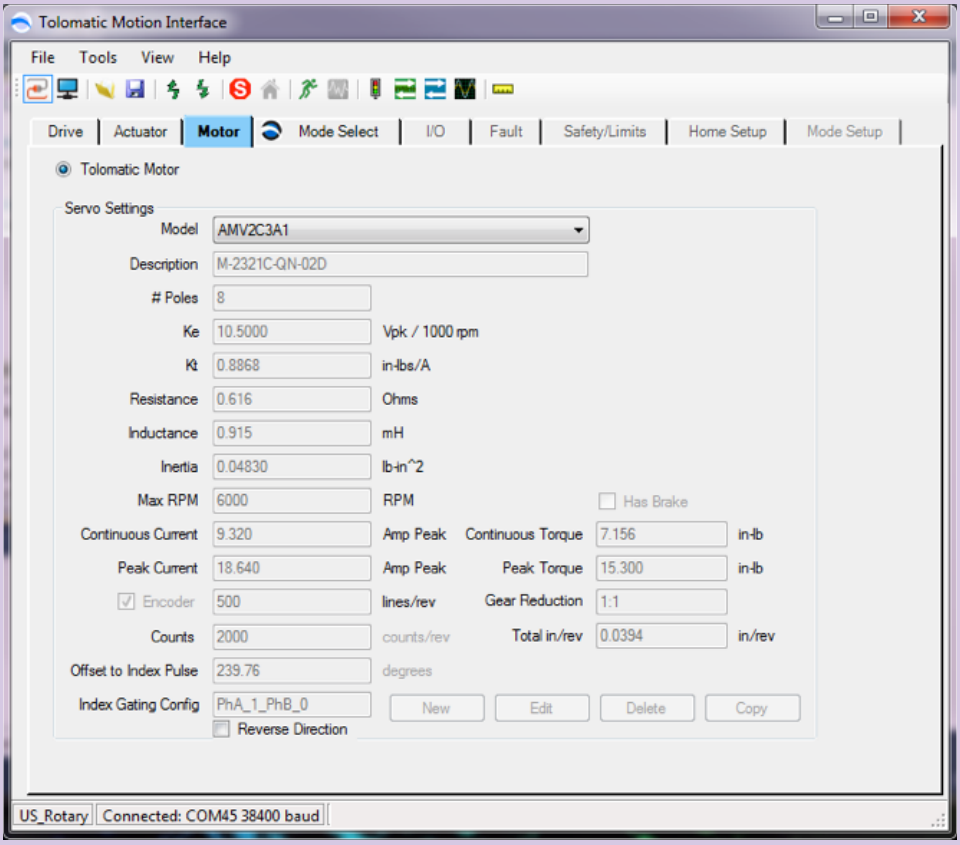


Figure 8-2: Motor Tab with Tolomatic Servo Motor Selected

NOTE: Servo does not currently support "Other Motor".

ACS Stepper Drive

8.1.2 Other Motor Selection

The Other Motor catalog allows a user to keep any number of motor models compatible with the ACS Drive in the file for convenience and later use. Selection of a motor other than one supplied by Tolomatic is done in a similar procedure as selecting an Other Actuator.

1. If no Other Motors have been created there will be no selections under the Models drop down (see Figure 8-3). In this case, the user must click the New button at the bottom of the screen.

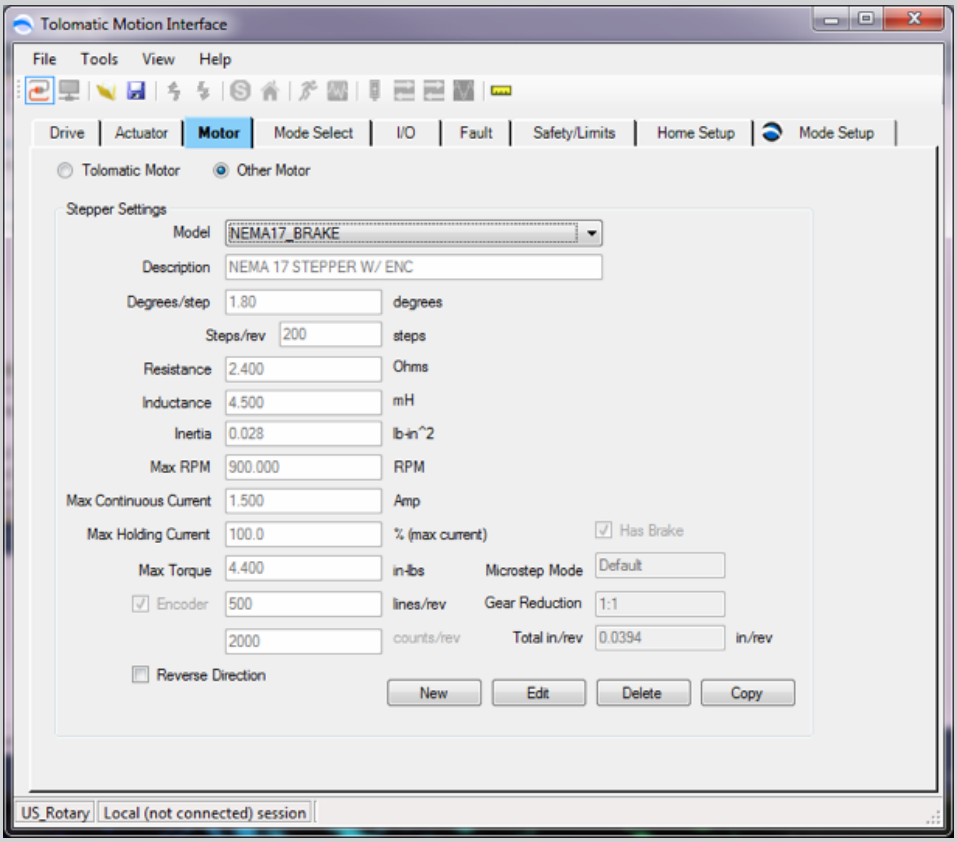


Figure 8-3: Other Motor with no Model Choices Available

2. Clicking the New button, will bring up a New Stepper Motor dialog box in which the user must enter the motor name, description (28 alpha-numeric characters in uppercase), and specifications. Once the information entered has been validated, the light red fields will disappear and the save button will become active.
3. Clicking the save button adds the New Motor information to the Other Motor catalog. The name of the new motor is automatically added to the Model drop down for later reference.
4. Depending on the actuator configuration or the actuator installation in the machine, the user may wish to reverse the direction of the motor's positive direction. When facing motor mounting end, default positive motion direction is CW (clockwise). To change it to CCW (counter-clockwise), the Reverse Direction check box must be checked.

ACS Stepper Drive

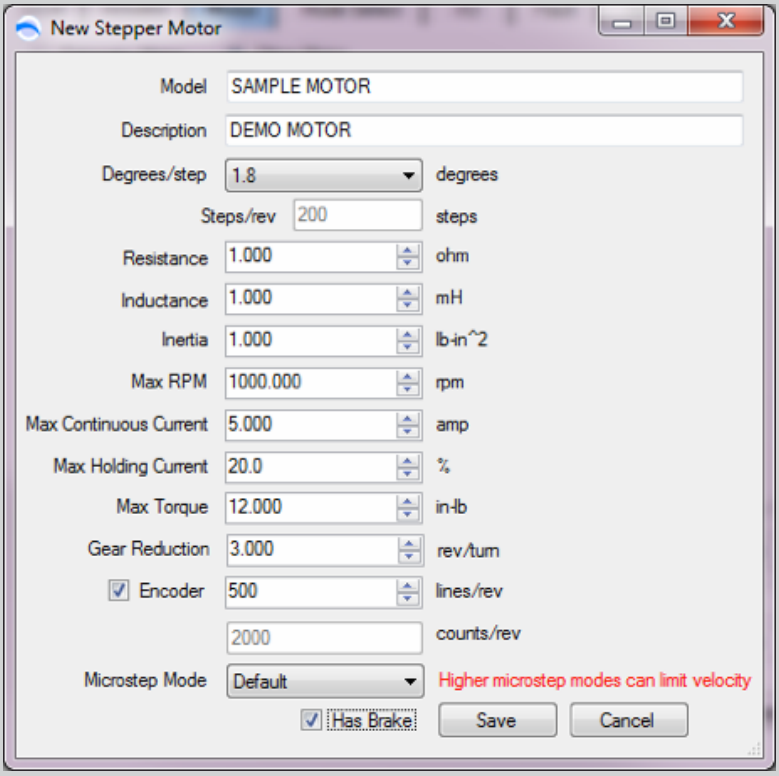


Figure 8-4: Edit Stepper Motor Window with Data Complete

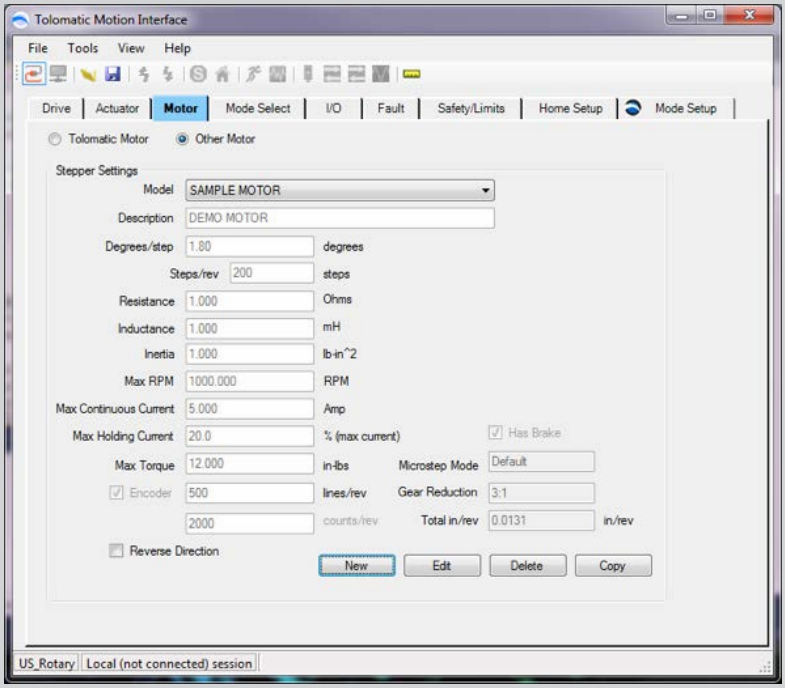


Figure 8-5: Other Motor Window with Model Added to Drop Down Display

5. Button descriptions: New: Create new actuator Edit: Edit existing actuator previously saved Delete: Delete selected actuator Copy: Create a new actuator based on selected existing actuator

9.1 Using the Mode Select Tab

ACS Stepper Drive

NOTE: The ACS stepper drive models and modes are as follows:

	ACS Model	Part Number	Operating Mode
10 - 52 VDC Stepper	ST1048**UD**	3604-9665	Index Move Analog Position Pneumatic **Modbus RTU**
	ST1048**ED**	3604-9666	Index Move Analog Position Pneumatic **EtherNet/IP**
	ST1048**MD**	3604-9667	Index Move Analog Position Pneumatic **Modbus TCP**

ACS Servo Drive

NOTE: The ACS servo drive models and modes are as follows:

	ACS Model	Part Number	Operating Mode
10 - 60 VDC Servo	SV2048**U**D	3604-9661	Index Move Analog Position / Velocity Pneumatic **Modbus RTU**
	SV2048**E**D	3604-9662	Index Move Analog Position / Velocity Pneumatic **EtherNet/IP**
	SV2048**M**D	3604-9663	Index Move Analog Position Pneumatic **Modbus TCP**

ACSI Integrated

NOTE: The ACSI motor / drive / controller models and modes are as follows:

	ACSI Model	AM Code (Used to order ACSI on a Tolomatic actuator)	Part Number	Operating Mode
10 - 60 VDC Integrated Servo	ACSI23-1Q1-**B**	AMI2C1A1	3604-9740	Index Move, Analog Position/ Velocity, Pneumatic, Basic Indexer
	ACSI23-1Q1-**E**	AMI3C1A1	3604-9746	Index Move, Analog Position/ Velocity, Pneumatic, Basic Indexer, EtherNet/IP
	ACSI23-1Q1-**M**	AMI4C1A1	3604-9752	Index Move, Analog Position/ Velocity, Pneumatic, Basic Indexer, Modbus TCP
	ACSI23-1Q1-**C**	AMI5C1A1	3604-9856	Index Move, Analog Position/ Velocity, Pneumatic, Basic Indexer, EtherCAT
	ACSI23-1Q1-**P**	AMI6C1A1	3604-9864	Index Move, Analog Position/ Velocity, Pneumatic, Basic Indexer, PROFINET I/O
	ACSI34-1Q1-**B**	AMI2D1A1	3604-9770	Index Move, Analog Position/ Velocity, Pneumatic
	ACSI34-1Q1-**E**	AMI3D1A1	3604-9776	Index Move, Analog Position/ Velocity, Pneumatic, Basic Indexer, EtherNet/IP
	ACSI34-1Q1-**M**	AMI4D1A1	3604-9782	Index Move, Analog Position/ Velocity, Pneumatic, Basic Indexer, Modbus TCP
	ACSI34-1Q1-**C**	AMI5D1A1	3604-9872	Index Move, Analog Position/ Velocity, Pneumatic, Basic Indexer, EtherCAT
	ACSI34-1Q1-**P**	AMI6D1A1	3604-9886	Index Move, Analog Position/ Velocity, Pneumatic, Basic Indexer, PROFINET I/O

The software supports four different operating modes: Index Move, Analog Position, Pneumatic and Network. Network mode supports one of the following protocols: *Modbus RTU, EtherNet/IP*, *Modbus TCP or EtherCAT*.

The **Index Move** mode supports 4, 8, and 16 move commands. These move commands can be configured to be Absolute, Incremental, Jog, Home, Force or No Action moves. Also supports velocity and rotary moves. The motion profile can be independently set for each move. The motion profile includes velocity, acceleration, deceleration and force which is setup in the Mode Setup tab (see Section 14: Mode Setup Tab). Index mode also contains the Basic Indexer.

The **Analog Control** mode supports both voltage (0 to 10 VDC) and current (4 to 20 mA) on the analog input and analog output. The ACS Drive follows the analog input signal and commands the actuator position to a scaled position as distance/volt or scaled velocity as speed / volt.

The **Pneumatic** mode is used to replace or mimic pneumatic cylinder/valve operation logic. With pneumatic mode there are four different selections: Spring, 2 Position (2 input), 3 Position (2 input) &, 3 Position (3 input). These four pneumatic mode operations allow just about any pneumatic valve logic to be replaced with the ACS drive. Additionally, in pneumatic mode, the drive will automatically home the actuator upon power up based on the home setup configuration.

NOTE: The TMI software will determine if ModBus RTU, EtherNet/IP, PROFINET. Modbus TCP, or EtherCAT is appropriate based on the connected ACS Drive.

The **Network** mode accepts commands to change motion profile, command infinite positions, monitor status and provide diagnostics, using network control.

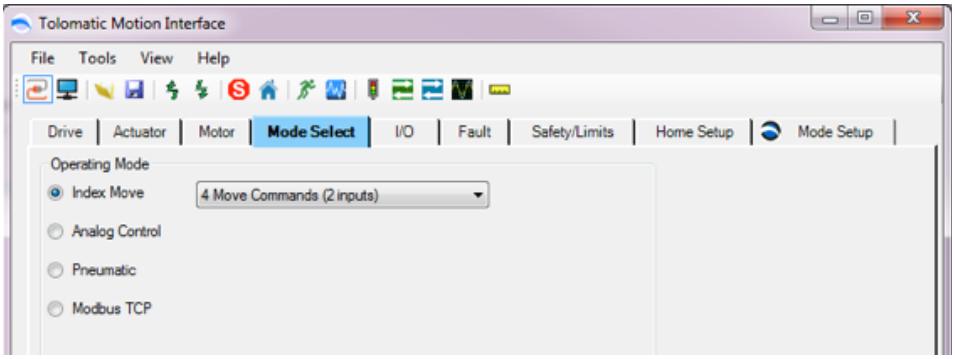


Figure 9-1: Mode Select Tab Window - Index default

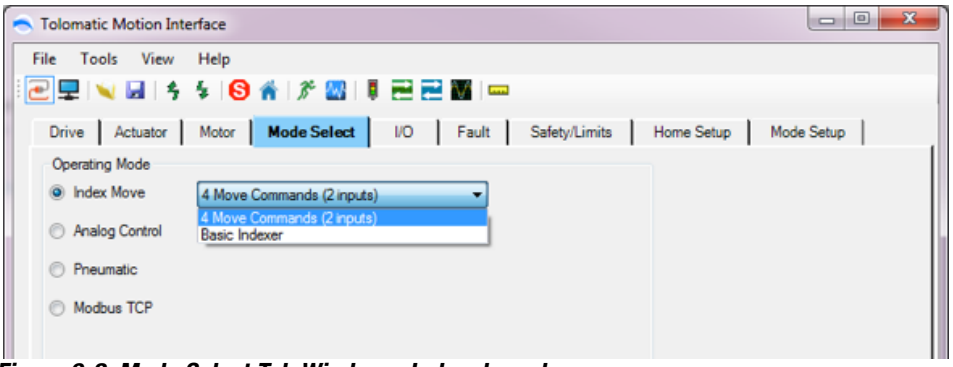


Figure 9-2: Mode Select Tab Window - Index drop-down

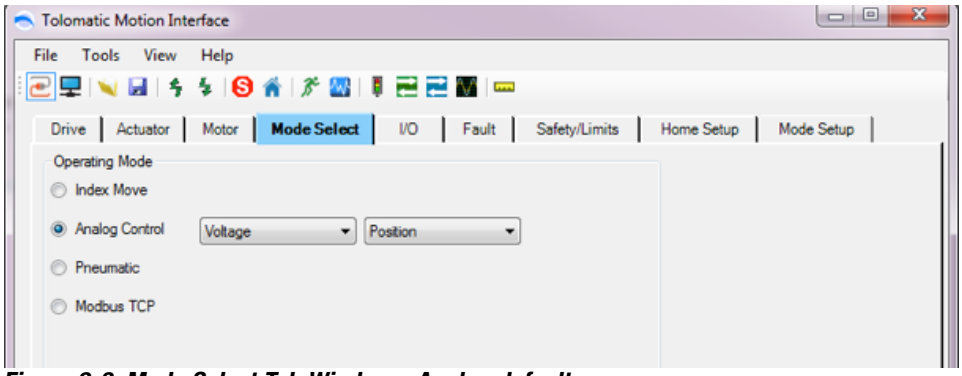


Figure 9-3: Mode Select Tab Window - Analog default

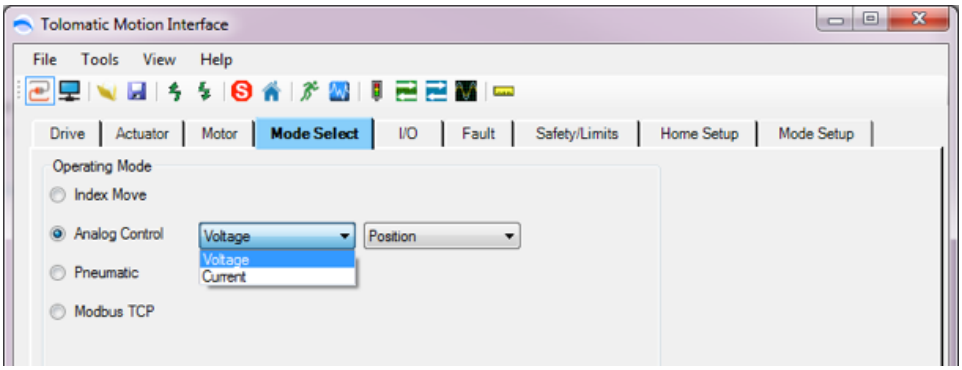


Figure 9-4: Mode Select Tab Window - Analog voltage drop-down

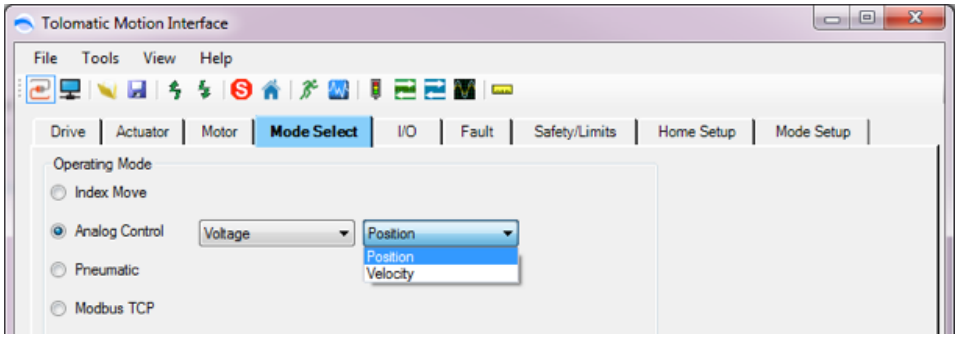


Figure 9-5: Mode Select Tab Window - Analog position drop-down

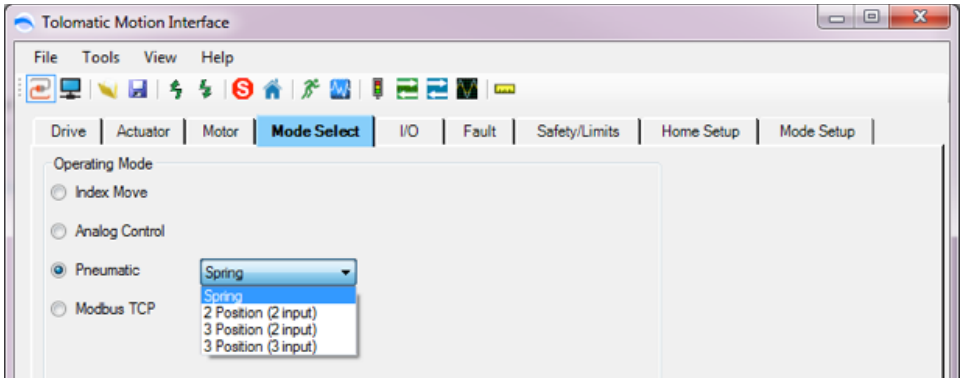


Figure 9-6: Mode Select Tab Window - Pneumatic drop-down

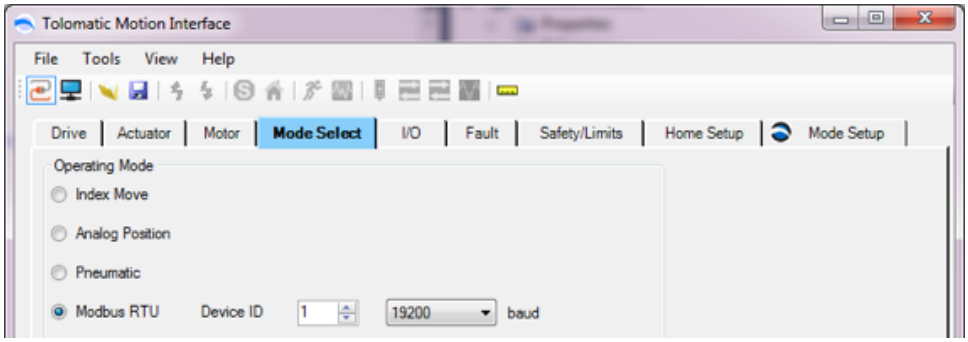


Figure 9-7: Mode Select Tab Window - Modbus RTU

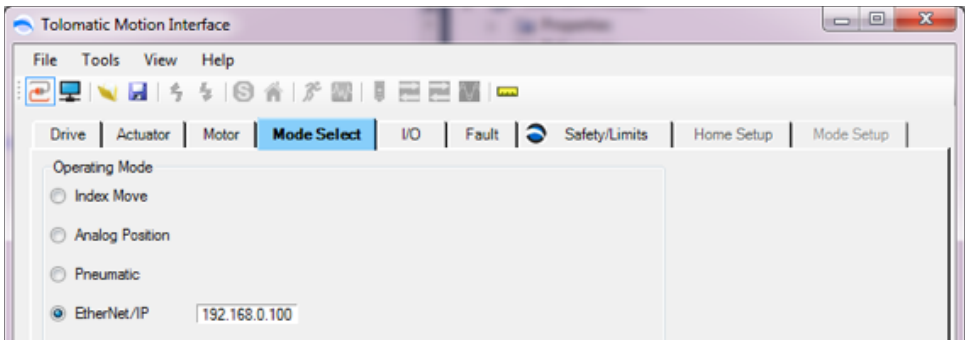


Figure 9-8: Mode Select Tab Window - EtherNet/IP

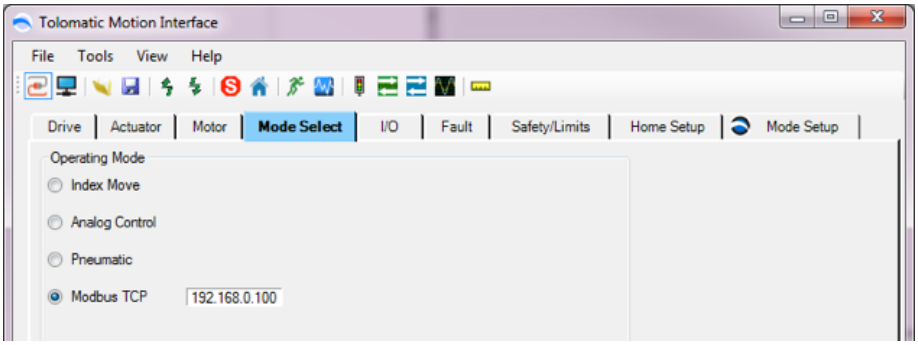


Figure 9-9: Mode Select Tab Window - Modbus TCP

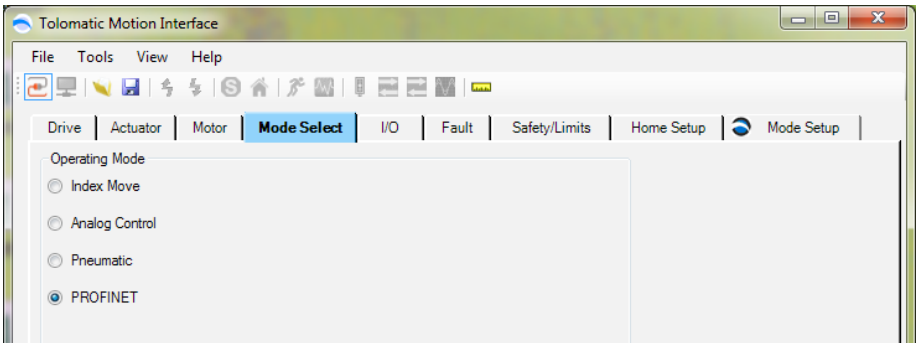


Figure 9-10: Mode Select Tab Window -PROFINET

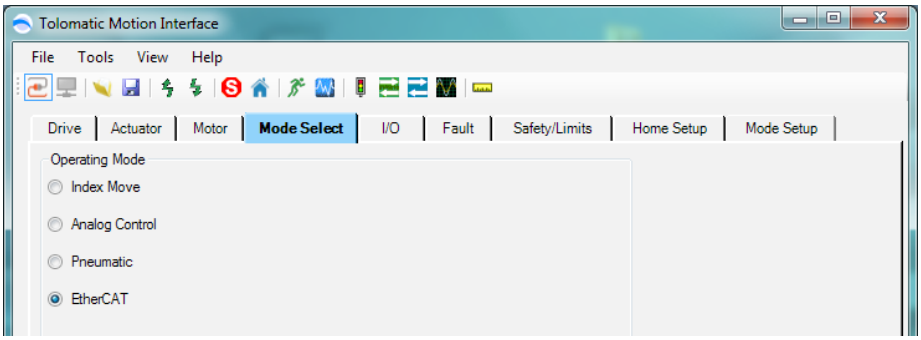


Figure 9-11: Mode Select Tab Window -EtherCAT

10.1 Using the I/O Tab

The digital input and digital output functionality are configured using the I/O tab. Default I/O configurations are set up for the selected mode and are shown after the Digital Input and Output Command Tables in Figures 10-1 through 10-4.

10.1.1 Digital Inputs

Digital Input Functionality	
Enable	Enables or Disables the ACS Drive and power to the motor. NOTE: Faults configured to Disable Motor (see Section 11: Fault Tab) will require PLC or logic device to cycle level of Enable input to re-enable the ACS Drive. Cycling this input when there is no feedback device will clear the Home output.
Start Motion	Initiates the selected move command from the Move Select inputs. While input is on it prevents further motion.
Stop Motion	Stops move in progress with controlled deceleration. If executed during a home, will declare home at current position.
Home	Initiates the homing routine setup in the Home Setup tab (see Section 13: Home Setup Tab).
Software-stop (E-Stop)	Executes an immediate stop which either stops motion or disables ACS Drive depending on the fault configuration in the Fault tab (see Section 11: Fault Tab). While asserted it prevents further motion.
Move Select 1-4 Inputs (MS1, MS2, MS3, MS4)	Selects move for execution based on Index Move mode (see Appendix 1 for Move Select Logic) or Pneumatic mode (see Appendix 2 for Move Select Logic)
Positive Limit Switch	Stops motion or disables the ACS Drive depending on the fault configuration in the Fault tab (see Section 11: Fault Tab).
Negative Limit Switch	Stops motion or disables the ACS Drive depending on the fault configuration in the Fault tab (see Section 11: Fault Tab).
Pause Indexer (Basic Indexer)	Pauses the currently running basic sequencer index. (Demo Mode)
Enable/Start Motion (Basic Indexer)	Enables and initiates the selected move command from the Move Select inputs. (Demo Mode)

Table 10-1: Descriptions of Digital Input Functionality

Refer to Hardware Manual for I/O Timing Diagrams.

10.1.2 Digital Outputs

Digital Output Functionality	
Move Complete	Signal to PLC or logic device indicating whether motion is in progress (off) or motion is complete (on).
Home Complete	Signal to PLC or logic device indicating whether ACS Drive/motor combination is homed (on) or not homed (off). NOTE: When homing is in progress, the Home Complete output will be off.

	Digital Output Functionality	
	Fault	Signal to PLC or logic device indicating that a fault has occurred. The steps to reset the fault are different depending on the fault category (see section 11: Fault Tab) for a complete description of faults and recovery.
	Zone (Optional)	Signal to PLC or logic device indicating that the position of the actuator is within the Zone Positive Bound and Zone Negative Bound setup in the Safety/Limits tab (see Section 12: Safety/ Limits Tab).
ACSI	**Brake (ACSI Specific)**	Logical output to control brake relay.
	Indexer Complete	Indicates basic indexer sequence in progress or complete. Demo mode only.
	In Position	Drive is at Commanded Position

Table 10-2: Descriptions of Digital Output Commands

Refer to Appendix 1: I/O Timing Diagrams for Input Requirement, System Startup Timing, Jog Move Timing, Absolute and Incremental Moves, Timing and Move Timing Rules.

Digital Input Control

TMI allows the user to adjust the digital debounce time from 0 to 500 milliseconds. (This control is not pictured)

"Tru-Pneu" Mode check-box executes pneumatic commanded position on power-up. (By default, drive waits for change in digital input before commencing motion)

10.1.3 Brake Output Configuration

For drives that support brake output, control of the output is configured on the I/O tab.

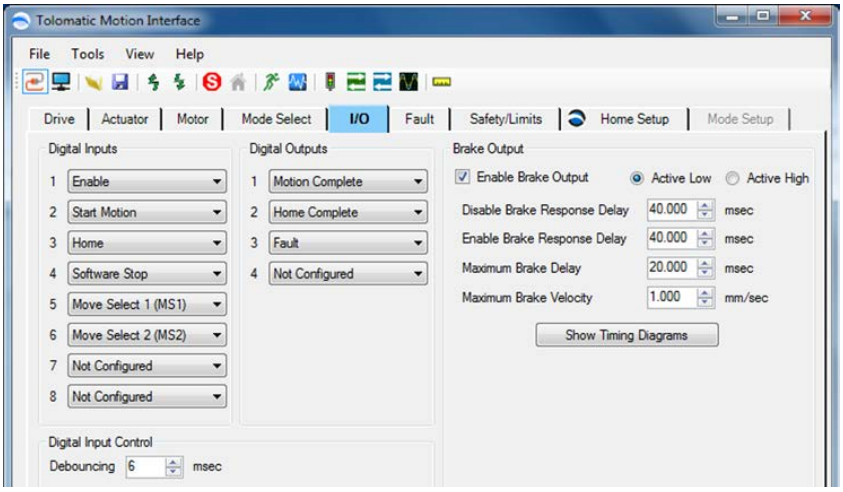


Figure 10-7: Brake Output enabled

Brake Output Functionality	
Enable Brake Output	Enables or disables the brake output subsystem
Active Low	Brake is applied when current is removed
Active High	Brake is applied when current is applied

Brake Output Functionality	
Disable Brake Response Delay	Number between 0 and 1,000 milliseconds
Enable Brake Response Delay	Number between 0 and 1,000 milliseconds
Maximum Brake Delay	Number between 0 and 1,000 milliseconds
Maximum Brake Velocity	Number between 0 and 5 mm/sec.

Table 10-3: Descriptions of Brake Output Functionality

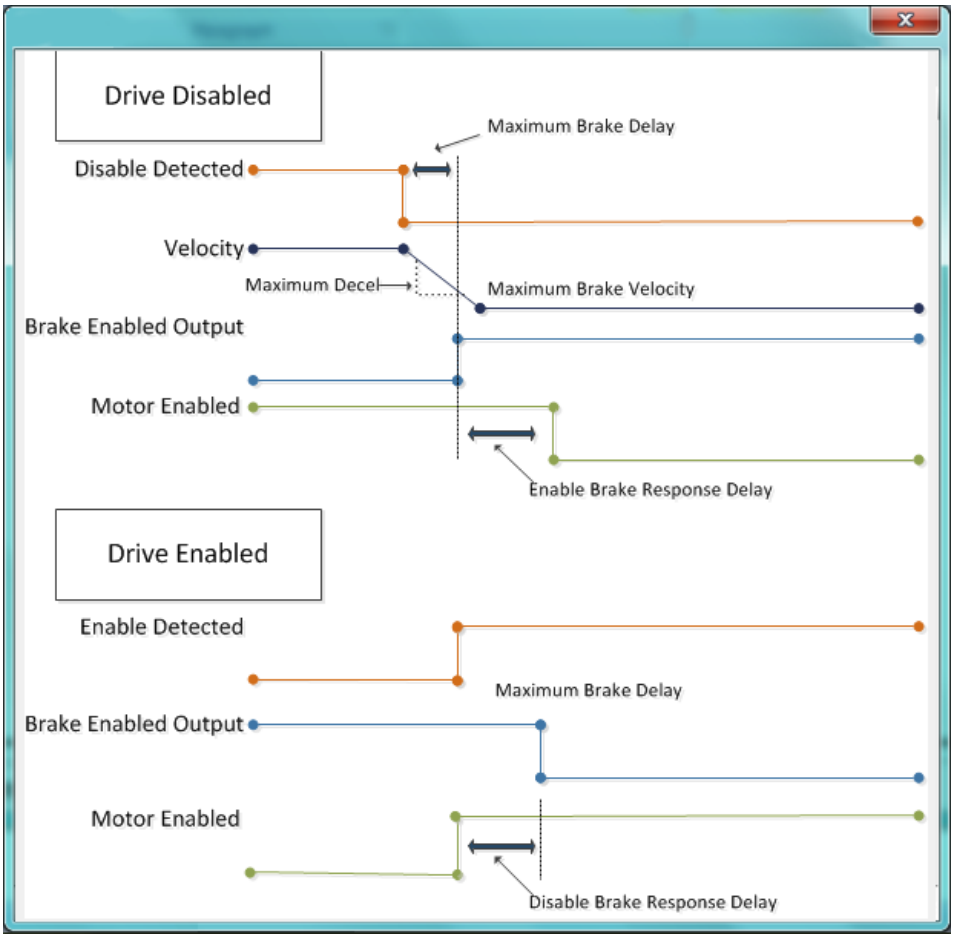


Figure 10-8: Brake Output timing

NOTE:

The ACSI requires external switching to handle the high amp brake. See ACSI hardware manual for details.

11.1 Using the Fault Tab

The Fault tab allows the user to configure how the drive responds to Safety Faults. The Critical Faults are always enabled and the configured response is to disable the motor. Critical Faults are listed for information only.

Each of the Safety Fault types has a check-box and a combobox (drop-down).

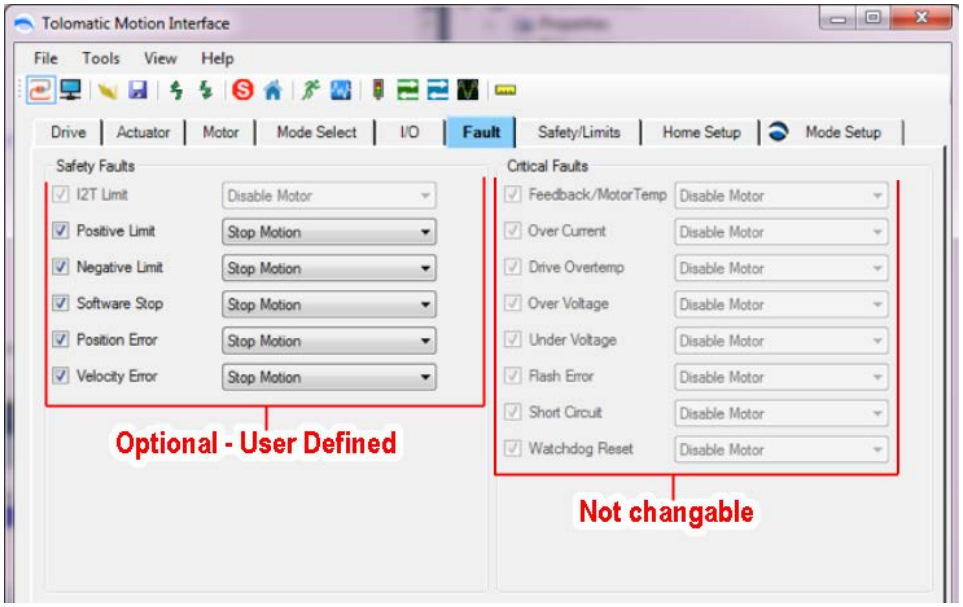


Figure 11-1: Safety Fault - user defined choices

Each available Safety Fault has 4 different user defined choices. (If greyed out no input is configured for that safety fault.) Safety Faults are assigned to physical digital inputs in the I/O tab. If that digital input is High, then the assigned Fault condition will occur.

NOTE: Maximum Decel is used in Safety Faults when either Stop Motion & Stop Motion (without Fault Output) is chosen. This allows a faster motion stop than Disable Motor. (See Chapter 12 Safety/Limits Tab)

Unchecked	Input will not cause a safety fault.
Checked, *Stop Motion*	Fault will result in current motion to stop at Maximum Decel value configured on the Safety/Limits tab, and the Fault digital output will be turned on. A subsequent motion command may automatically clear this fault.
Checked, *Disable Motor*	Fault will result in drive power to be cut. If a move is in progress, coasting may result. For a vertical application, the load may fall. The motor will **remain disabled until the fault is cleared** by an ACS Drive Disable/Enable cycle, or power cycle.
Checked, *Stop Motion (without Fault Output)*	Same as "Checked, *Stop Motion*" except the Fault digital output will not be turned on.

Table 11-1: Safety Fault user defined choices

11.2 Fault Descriptions and Recovery

NOTE: To clear faults that disable the motor; PLC needs to lower/raise the enable digital input, toggle the enable bit using Network or TMI user must press the Enable button on the motion manager.

11.2.1 Safety Faults

Safety Faults Table		
Positive Limit Switch		Fault indicates positive limit has been reached. If **Stop Motion** is configured, the fault will clear on motion in the opposite direction. If **Disable Motor** is configured, the fault is cleared with **Disable/Enable** cycle.
Negative Limit Switch		Fault indicates negative limit has been reached. If **Stop Motion** is configured, the fault will clear on motion in the opposite direction. If **Disable Motor** is configured, the fault is cleared with **Disable/Enable** cycle.
Position Error		Requires motor with an encoder. Fault indicates current position is not within the specified Position Error distance (configured on the Safety/Limits tab) of the commanded position. If **Stop Motion** is configured, this fault will be automatically cleared on the next move. If **Disable Motor** is configured, the fault is cleared with **Disable/Enable** cycle.
ACS Stepper Drive		Stepper Only: If move force < 100% position error reporting on digital fault output and fault status is silenced.
ACS Servo Drive / ACSI	**Velocity Error**	Velocity is above velocity error max defined in safety limits.
	I2T	Drive power usage above max allowed.
Software Stop		Fault indicates the signal level on the digital input is high. If **Stop Motion** is configured it will be cleared once the software stop input is lowered. Motion will not be allowed until software stop has been cleared. If **Disable Motor** is configured the fault must be cleared by lowering software stop input, and cycle enable signal.

Table 11-2: Safety Faults Descriptions

Any Stop Motion commanded by a Safety Fault decelerates the current move at max. deceleration (as configured in the Safety/Limits tab).

FAULT NOTE

There is no priority in fault actions. **The last fault to occur will perform the action associated with it.** This is important to understand for troubleshooting faults. For example, if a Software Stop safety fault occurs with the action set to "Stop Motion", this will turn on the fault output. And then if a Position Error fault occurs shortly afterward with the action set to "Stop Motion without fault output", the fault output will be turned off. Another example is if a fault occurs with action set to "Disable Motor", and then a fault occurs with action set to "Stop Motion without fault output", the result will be the motor stays disabled and the fault output is turned off.

NOTE: To clear faults; PLC needs to lower/raise the enable digital input, enable command over network control or TMI user must press the Enable button on the motion manager.

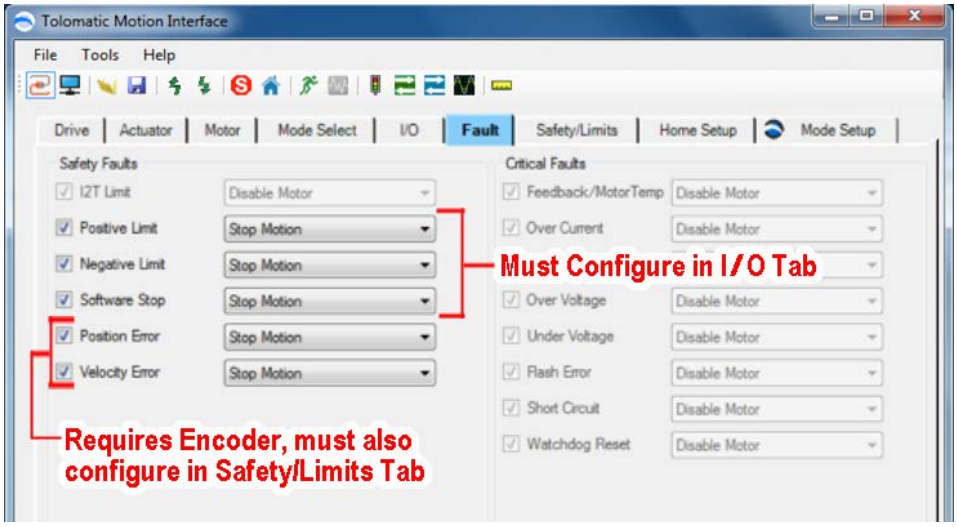


Figure 11-2: No associated digital input means Safety Fault cannot be configured and are displayed greyed out on Fault Tab

11.2.2 Critical Faults

All Critical Faults will disable the motor when they occur. To clear these faults, the fault condition cannot be present and the enable input line must be lowered and then raised to proceed with motion. Watchdog timeout must be cleared by power cycle only.

NOTE: Critical Faults are drive specific. Check the hardware manual for more information on fault triggers.

Drive Critical Faults Table		
ACS Servo Drive / ACSI	**Feedback Error / motor overtemp**	Feedback device is malfunctioning OR disconnected when drive is enabled. (Power Cycle to Clear) or motor is overTemp
	Over Current	Drive current is above safe level for the Drive hardware.
	Drive Over Temperature	Drive temperature is greater than the maximum allowed temperature.
	Drive Over Voltage	Main power voltage exceeds threshold (defined in the hardware manual, Input Power Section).
	Drive Under Voltage	Main power voltage below threshold (defined as 0.6 times configured bus voltage).
	Flash Error	Flash write failed. Flash version doesn't match. • During Startup: Invalid flash version • During Save: Flash write failed • During Motion: Communications error with driver
ACS Servo Drive / ACSI	**Short Circuit**	Motor phase shorted to ground. Internal motor short or phase short to ground.
	Watchdog Timeout	Firmware stall, drive reset or drive power-cycled but voltage did not reach ØV. (Power Cycle to Clear) Intermittent power upon startup or while running can trigger a watchdog timeout fault. Power brownouts may also trigger the watchdog timeout fault.

Table 11-3: ACS Drive Critical Faults Descriptions

TROUBLESHOOTING TIP:
Short circuit can false trigger if Drive power is cut while keep alive power is active and the motor is enabled and in motion. To prevent this, before power is cut, software-stop (Estop) can be commanded over I/O or network control.

12.1 Using the Safety/Limits Tab

The Safety/Limits tab is used to configure Safety parameters, Motion Limits and setup such features as Endpoint Correction or Zone Output.

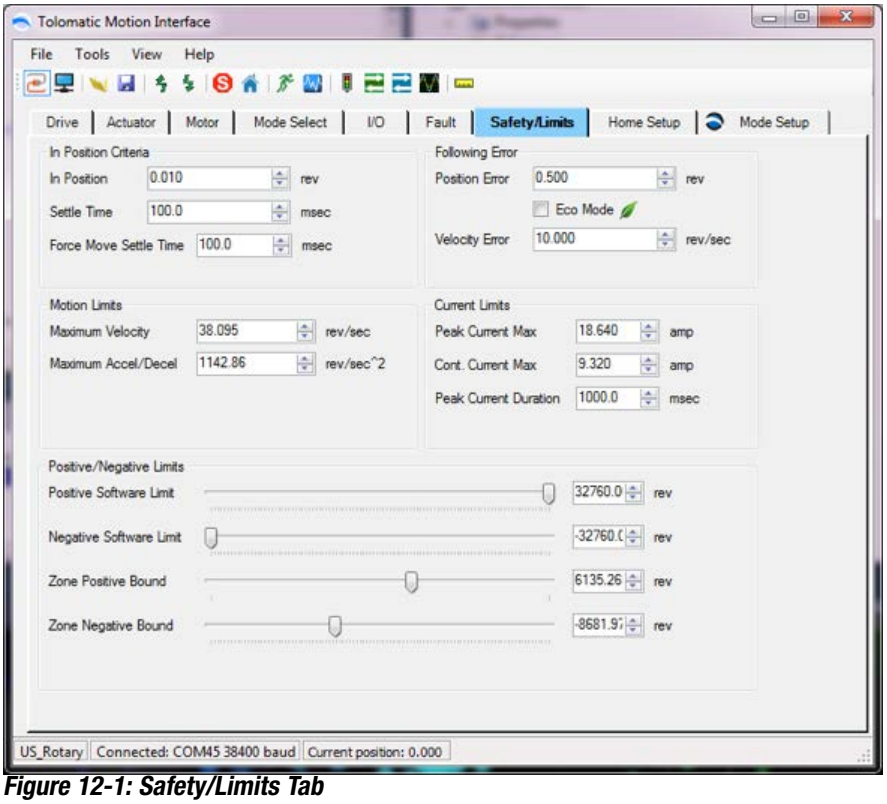


Figure 12-1: Safety/Limits Tab

NOTE: Throughout this manual information that ONLY applies to Stepper Drives will be noted in grey box:

ACS Stepper Drive

Information that applies to Servo Drives & ACSI Motor/ Drive will be noted in light purple box:

ACS Servo Drive / ACSI

12.1.1 In Position Criteria

In Position: This value defines the +/- window around the desired target position that is considered within position.

Settle Time: The amount of time the position is within the In Position Band before declaring Motion Complete.

ACS Stepper Drive

Endpoint Correction: When enabled, Endpoint Correction initiates one correcting move at the end of the initial move to correct any position error that is greater than the In Position value. At the end of the initial move, the distance of the corrected move will be the difference between Target Position and Actual Position. This correcting move will use the same motion profile parameters (velocity, accel, decel, force) as the initial move. Endpoint Correction is only available with stepper motors with encoders.

ACS Servo Drive / ACSI

Force Move Settle Time: The amount of time after a specified force is reached before declaring Motion Complete.

12.1.2 Following Error

Position Error: This value defines the +/- window around the commanded position that the actual position must be within or a Position Error fault will occur.

Position Error = Commanded Position – Actual Position.

The Position Error is continuously calculated throughout the entire move. Position Error is only available with motors with encoders. The Position Error setting must always be larger than the setting for the In Position parameter. If the Position Error setting is smaller than the In Position setting, the In Position parameter will turn red, indicating an invalid setting.

Velocity Error: This value defines the +/- window around commanded velocity that the actual velocity must be within or a Velocity Error fault will occur.

Velocity Error = Commanded Velocity – Actual Velocity

Velocity Error is continuously calculated throughout the entire move. Velocity Error is only available with motors with encoders. By default, Velocity Error output is disabled.

ACS Servo Drive / ACSI

12.1.3 Eco Mode (Servo / ACSI Only)

Eco mode is intended to reduce motor current in the motion complete interval (dwell) by allowing a slight increase of position error. It is suggested to enable this feature when an I2T Fault occurs when the drive is not in motion, or if there is high drag in the mechanical system and the drive is near the I2T Limit.

Eco mode is a mode specially designed for instance where the dynamic loads on the actuator are lower than the stiction or drag of the mechanical system itself. In other words, if the drive is disabled, the load does not move from its current position.

In these high drag mechanical configurations, frictional drag may prevent position error from ever reaching 0. As the control loop error increases over time, it eventually breaks through the frictional drag and overshoots the target position. This process repeats and a scenario called “Position Hunting” occurs.

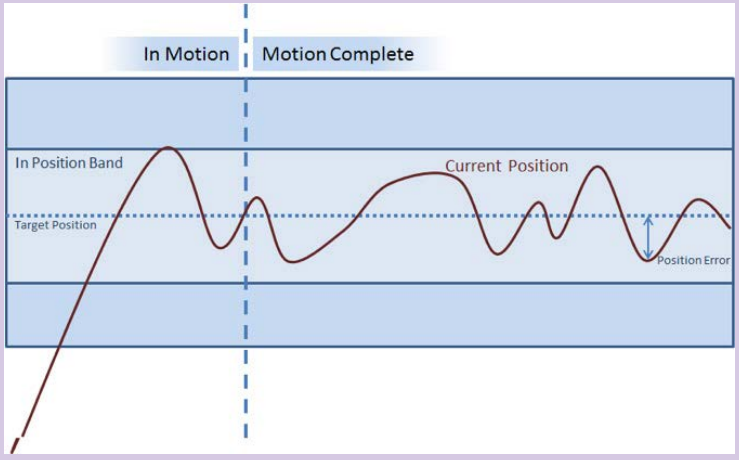


Figure 12-2: Position Hunting in a High Mechanical Drag System

While this hunting is occurring, current is increasing and, depending on the strength of the mechanical stiction of the system, integral error could be spooling up over the continuous current limits of the drive or motor. When the actual current is higher than the continuous

ACS Servo Drive / ACSI

current of the motor, an I2T fault can occur, which protects your motor and drive from overheating. If this is occurring, your actual output currents could well be approaching the peak limits of the drive or motor.

When Eco mode is enabled, motion is complete and the current position is within the In Position Band, the control loop does not attempt to correct position error. This allows the mechanical advantage of the system to hold the load while the drive monitors the position and intercedes when the current position falls outside of the In Position Band. This mode conserves power by stopping the Position Hunt.

TROUBLESHOOTING TIP:

In some Applications, if position is pushed or forced out of the in position band once motion completes, the position could enter an oscillating or waiting mode. If this occurs, the application is not suitable for eco-mode.

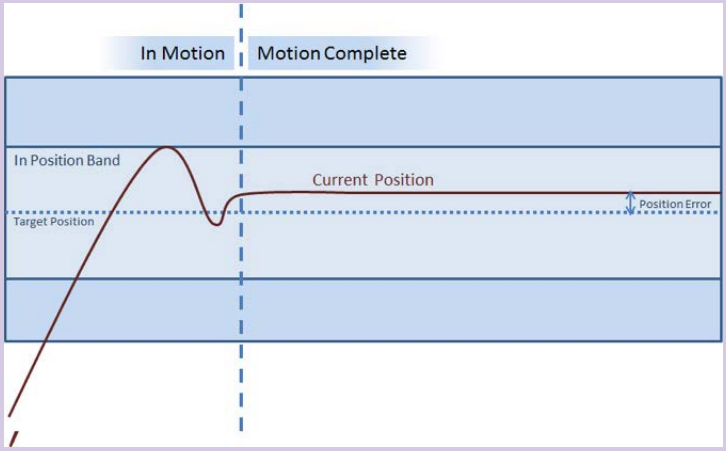


Figure 12-3: Eco Mode Enabled on a High Drag Mechanical System

While Eco mode is primarily used in systems with mechanical high drag, it also can be used in systems that do not have high drag, but wish to conserve power – at a cost of a slight position adjustment on motion complete. In these systems, the load pushes the Current Position outside of the In Position Band. The Control Loop then corrects the position using a scaling based on target position and the position error limit. As the current position approaches the position error limit the control gains increase. This negotiation results in a rapid equilibrium that conserves power.

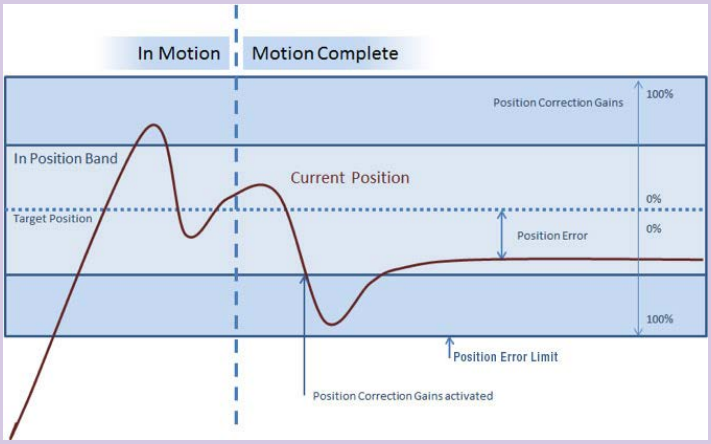


Figure 12-4: Eco Mode with Position reaching equilibrium

TIPS: 1) The smaller IN Position Band is the less effective ECO Mode, it will be reducing power during the motion complete interval.

2) Control gains are scaled at maximum 100% at the position error limit. To reduce position error when in motion complete interval, reduce position error limit value.

NOTE: Maximum Decel is used in Safety Faults when either Stop Motion & Stop Motion (without Fault Output) is chosen. This allows a faster motion stop than Disable Motor. (See Chapter 11 Fault Tab)

TROUBLESHOOTING TIP:
Choose valid motion limits to watch the application. Max velocity, Accel/Decel values that are too high for an application can cause motion issues including possible damage to drives in high inertia systems.

12.1.4 Motion Limits

Maximum Velocity: This value defines the maximum velocity that is allowed to be configured by the software and commanded by the ACS Drive. The TMI software will automatically cap any entered velocity value to the max setting. When the actuator & motor information is entered, the TMI software will automatically calculate the Maximum Velocity setting using the actuator max speed and motor max RPM. The ACS Drive ensures that no moves can be commanded with a velocity value higher than the max setting. This calculation does not include inertia or load. As such, your system may not be able to reach maximum velocity.

Maximum Accel/Decel: This value defines the maximum accelerations and decelerations that are allowed to be configured by the software and commanded by the ACS Drive. The TMI software will automatically cap any entered value to the maximum Accel/Decel setting. The maximum allowable Accel/Decel is 40 times the maximum allowable velocity. The ACS Drive ensures that no moves can be commanded with an acceleration or deceleration value higher than the value of the Maximum Accel/Decel parameter.

Note: If zero (Ø) velocity or accel/decel is entered, these parameters will turn red and the Tolomatic logo will appear on the Safety/Limits tab.

12.1.5 Current Limits

Peak Current Max: Instantaneous current the drive is allowed to supply to the motor. This corresponds to 100% force in a move.

ACS Servo Drive / ACSI

Continuous Current Max: Maximum continuous current the drive is allowed to supply the motor.

Peak Current Duration: Maximum length of time the drive is allowed to supply Peak Current to the motor. This is used for the I2T Fault calculation.

ACS Stepper Drive

Holding Current: This value defines the current level (in percentage) to which the ACS Drive sets the output current to the motor when any move is complete. The ACS Drive maintains this current level to the motor until the next Move Command is executed. The default value for this parameter is 100%. This parameter can be used to conserve energy or lower motor temperature while the motor is at rest.

Peak Current Max: This value defines the maximum current applied to the motor for all moves. Force % for a move is scaled to this value for any defined Move Command in the Mode Setup Tab. The limits are automatically set by the motor selection and definition in the Motor Tab. The value cannot be set higher than the maximum rating of the motor/drive combination, but it can be reduced.

12.1.6 Positive/Negative Limits

Software Limits: There are two software limits, a *positive* and a *negative.* These software limits create a virtual position boundary for the motor/actuator system which the ACS Drive can not be commanded to exceed. The exception to this rule is for homing. A home command will ignore both software limits and will ignore limit switches if move to hard stop is selected. The TMI software will automatically cap any move to the positive software limit if the entered value is larger, or to the negative software limit if the entered value is smaller. The default values of the software limits are dependent upon the following homing sequences:

1. *Home to Hard-stop*
   Negative home direction: Positive Software Limit = Stroke – Home Offset; Negative Software Limit = - Home Offset

   Positive home direction: Positive Software Limit = + Home Offset; Negative Software Limit = - Stroke + Home Offset
2. *Home to Limit Switch*
   Negative Software Limit = - Stroke; Positive Software Limit = + Stroke
   Note: The software limits must be changed to restrict motion bounds.

ACS Servo Drive / ACSI

3. *Home to Index Pulse (Servo / ACSI Only)*
   Motor is configured for rotary mode
   Negative software limit = - Drive max.
   Positive software limit = + Drive max.

Zone Bounds: This feature is only visible if the Zone output is enabled on the I/O tab (see Section 10: I/O Tab). There are two zone bounds, a *positive* and a *negative*. These zone bounds define a virtual position window that is monitored at all times by the ACS Drive. When the actual position is greater than or equal to the Negative Bound Zone and less than the Positive Bound Zone, the Zone Output will be on. The TMI software has rules regarding these zones. The Zone Positive Bound is always smaller than the Positive Software Limit but larger than the Negative Software Limit. The Zone Negative Bound is always larger than the Negative Software Limit but smaller than the Positive Software Limit. The Zone Output feature does not interfere with motion. This feature can be used in a variety of applications to prevent a collision with another axis of motion or to initiate a process during a specific position range.

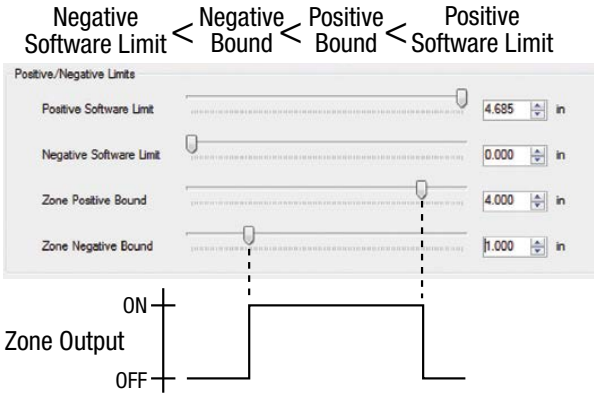


Figure 12-7: Zone Bounds Diagram

13.1 Using the Home Setup Tab

The Home Setup tab is used to configure the homing routine. Every home routine has a configurable motion profile (velocity, accel/decel, force), a choice of direction, and an option to home on power-up.

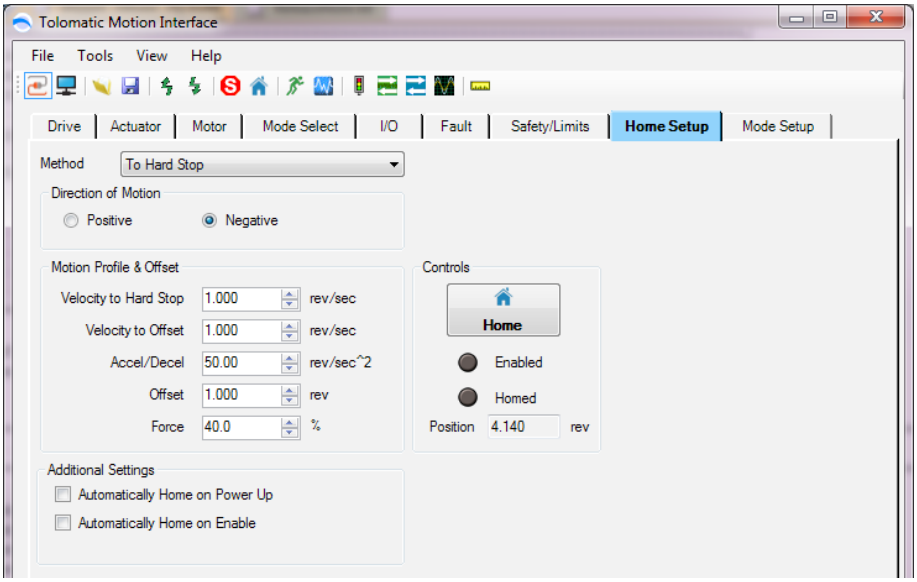


Figure 13-1: Home Setup Tab

Status Bar Indicators have been added to the status bar to indicate when a Fault condition exists (red light on the ACS drive flashing) or when the current actuator position is within the In Position criteria of the currently programmed software limit.

- Double-clicking on the Yellow indicator will navigate to the Safety/Limits tab so you can review the currently programmed Software Limits and In Position Criteria.
- Double-clicking on the Red indicator will display the Drive Status window.

13.1.1 Method of Homing

There are two different types of homing routines:

Homing To Hard Stop

1. **With encoder:** This home routine uses the encoder to detect position error to find the hard stop during home.

WARNING:
Depending on where the actuator is positioned when homing begins, this routine may cause the motor/actuator to push against the hard stop for several seconds. This is not ideal for the mechanical system and may cause audible noise.

ACS Stepper Drive

2. **Without encoder:** This home routine initiates an incremental move the size of one stroke length. This ensures that the actuator will find the hard stop since there is no encoder to help detect it.

NOTE: To ensure repeatability it is best to home with relatively slow velocity (<=1"/sec or 25 mm/sec) and relatively high accel/decel (>40"/sec^2 or 1000mm/sec^2).

Homing to Limit Switch

The To Limit Switch homing routine is only available if the Positive or Negative Limit Switch is configured in the I/O tab (see Section 10: I/O Tab). This home routine uses either the positive or negative limit switch to find home position. The ACS Drive initiates an incremental move the size of one stroke length and stops motion when the limit switch input is activated.

ACS Servo Drive / ACSI

Homing to Index Pulse

The To Index Pulse homing routine is only available if drive is configured for rotary operation.

NOTE: For all homing moves: To ensure repeatability it is best to home with relatively slow velocity (<=1"/sec or 25 mm/sec) and relatively high accel/decel (>40"/sec^2 or 1000mm/sec^2).

TROUBLESHOOTING TIP:

The motor tab has a "reverse direction" check box that changes the positive direction of a motor. Use this if home direction is changed to avoid the requirement to use negative positions.

13.1.2 Direction of Motion

Positive or Negative: Depending on the setup of the motor in the Motor tab (see Section 8: Motor Tab), this selection will define the direction the motor/actuator system homes.

13.1.3 Motion Profile & Offset

Velocity to Hard Stop / Limit Switch: Velocity used in the initial move towards the hard stop or limit switch.

Velocity to Offset: Velocity used when reversing direction to the Offset.

Accel / Decel: Acceleration and Deceleration setting for all moves in the homing routine.

NOTE: Tolomatic recommends a slow smooth homing Velocity/Accel. Fast homing to hard-stop can damage your actuator.

Offset: Distance to move away from either hard stop or limit switch in the opposite direction selected by Direction of Motion.

Force: Force % setting for all moves in the homing routine.

13.1.4 Controls

Home: Initiates the Home sequence.

Enabled and Homed: Status LEDs.

Position: Indicates current position in user units.

13.1.5 Additional Settings

Automatically Home on Power Up: This feature homes the system automatically when the ACS Drive unit is powered up.

Automatically Home on Enable: Start homing routine when drive is enabled. The drive un-homes when the drive is disabled.

NOTE: The Enable input, if configured, must be activated for the home routine to start.

NOTE: This feature will not work when the ACS Drive is in Network mode unless the digital IO enable line is configured and high on power up.

13.1.6 Stop During Homing

STOP Motion Input: if during homing motion the STOP input is set, it will act like a 'home here'. It will decelerate at the homing deceleration value and then reset the position to 0.0 and show 'homed' status.

Software STOP input: if during homing the Software STOP input is set, it will stop the homing motion and declared 'unhomed' status. The same action will be taken if a fault occurs during homing.

NOTE: Position is cleared to 0.0 at the hard-stop/limit switch, and again when finished the offset move.

The Mode Setup tab is used for configuring the selected mode in the Mode Select tab (see Section 9: Mode Select Tab).

14.1 Index Move Mode

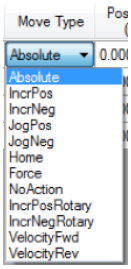
ACSI Motor/Drive/Controller

NOTE:

8 & 16 Move Commands are not available with ACSI Motor/ Drive /Controller

With the Index Move mode, there are three different selections: 4, 8 & 16 Move Commands. If the ACS Drive has not been previously configured or it has been restored to factory defaults, the Move Commands will be configured with zero velocity, accel & decel to prevent any motion. The velocity, accel and decel fields will be highlighted in light indicating they are invalid settings (see table below).

The setup table used for the 4, 8 & 16 Move Commands mode has the following columns: Label, Move Type, Position, Velocity, Accel, Decel and Force. Each individual Move Command (rows) can have different, independent settings for each column.

Setup Table Move Definitions	
Label	Descriptive alpha-numeric "name" for each Move Command. Limited to 28 characters, all uppercase. (Optional, but recommended)
Move Type 	Drop down selection for the type of move for each Move Command. Valid selections are Absolute (default), IncrPos, IncrNeg, JogPos, JogNeg, Home and No Action. If an encoder is present, all moves are validated with the encoder feedback. If no encoder is present, the move is operated in open loop with no feedback. **Absolute:** Initiates an absolute move upon the Start Motion Input. **IncrPos:** Initiates an incremental move in the positive direction upon the Start Motion Input. **IncrNeg:** Initiates an incremental move in the negative direction upon the Start Motion Input. **JogPos:** Initiates a jog move in the positive direction when the Start Motion Input is active. When the Start Motion Input is not-active motion is stopped. **JogNeg:** Initiates a jog move in the negative direction when the Start Motion input is active. When the Start Motion input is not-active motion is stopped. **Home:** Initiates the homing sequence that is defined in the Home Setup tab. The position, velocity, accel/decel and force settings in that row will be disabled (not used) for this move type. **No Action:** Allows user to configure an unused move in the table in order to prevent unintended motion. If this move is executed, the ACS Drive will do nothing. The position, velocity, accel/decel and force settings in that row will be disabled (not used) for this move type. **ACS Servo Drive / ACSI Motor/Drive/Controller** **Force:** Allows user to configure a push to force move upon start motion input. (see Force Move Settle Time, 12.1.1) ***IncPosRotary:** Initiates an incremental move in the positive direction. If the end of stroke will be reached before the move completes its trajectory, the position is reset and the drive is un-homed. This allows for infinite incremental moves in the same direction. ***IncNegRotary:** Initiates an incremental move in the negative direction. If the end of stroke will be reached before the move completes its trajectory, the position is reset and the drive is un-homed. This allows for infinite incremental moves in the same direction.

***NOTE:**

When position is reset, a slight loss in precision occurs. Over time, this could manifest itself in positional drift. It is recommended to periodically reset position using a home to Index Pulse or home to Limit Switch to prevent this from causing issues.

Setup Table Move Definitions	
Move Type (cont.)	**VelocityFwd:** Initiated a velocity move in the forward direction with no positional control. At the end of the move, the actual position will be reset and the drive is un-homed. **If Servo drives are used, configure Velocity Feed Forward to 100% (Tuning Filter)** **VelocityRev:** Initiated a velocity move in the reverse direction with no positional control. At the end of the move, the actual position will be reset and the drive is un-homed. **If Servo drives are used, configure Velocity Feed Forward to 100% (Tuning Filter)** **NOTE:** See Start Motion Input (see Appendix 1: Timing Diagrams)
Position	Move position value for either absolute or incremental moves. This field is not used in Jog, Home, or Velocity move types.
Velocity	Velocity value for all move types
Accel/Decel	Acceleration and Deceleration value for all move types
Force %	Force % value from 10 to 100% for all move types. **ACS Stepper Drive** If force <100% and a position error condition occurs (motors with encoders), the fault action will be executed but the fault will not be reported.

Table 14-1: Descriptions of Setup Table Move Definitions for 4, 8, and 16 Move Commands

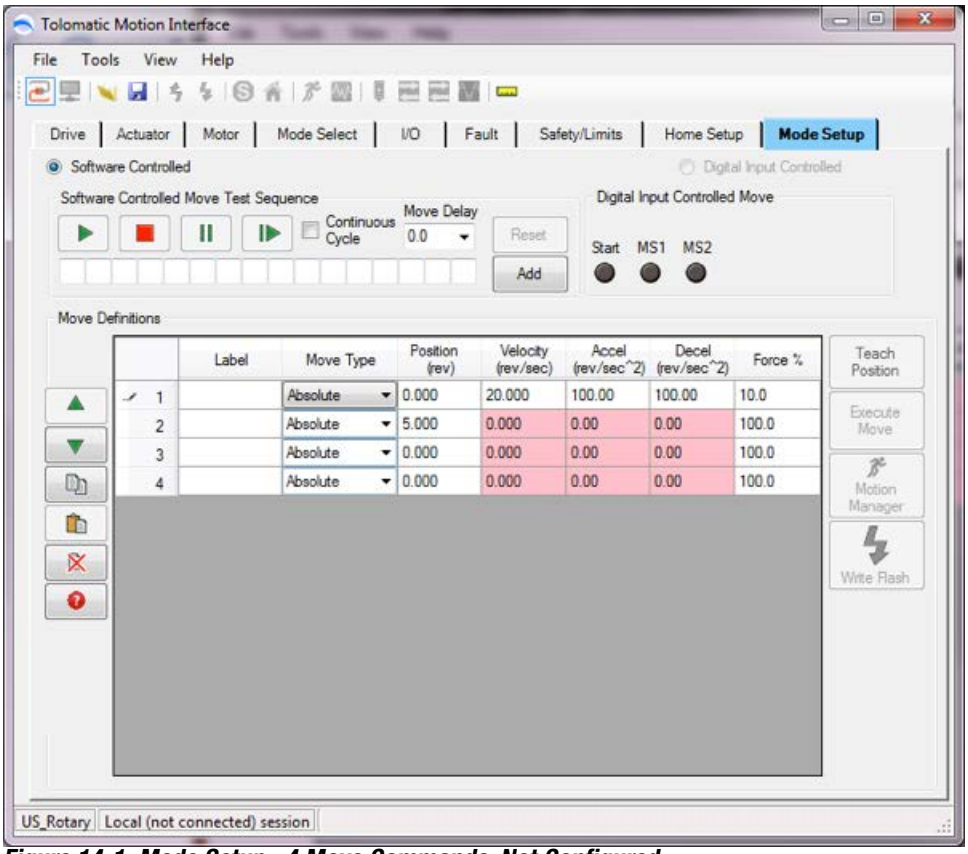


Figure 14-1: Mode Setup– 4 Move Commands, Not Configured

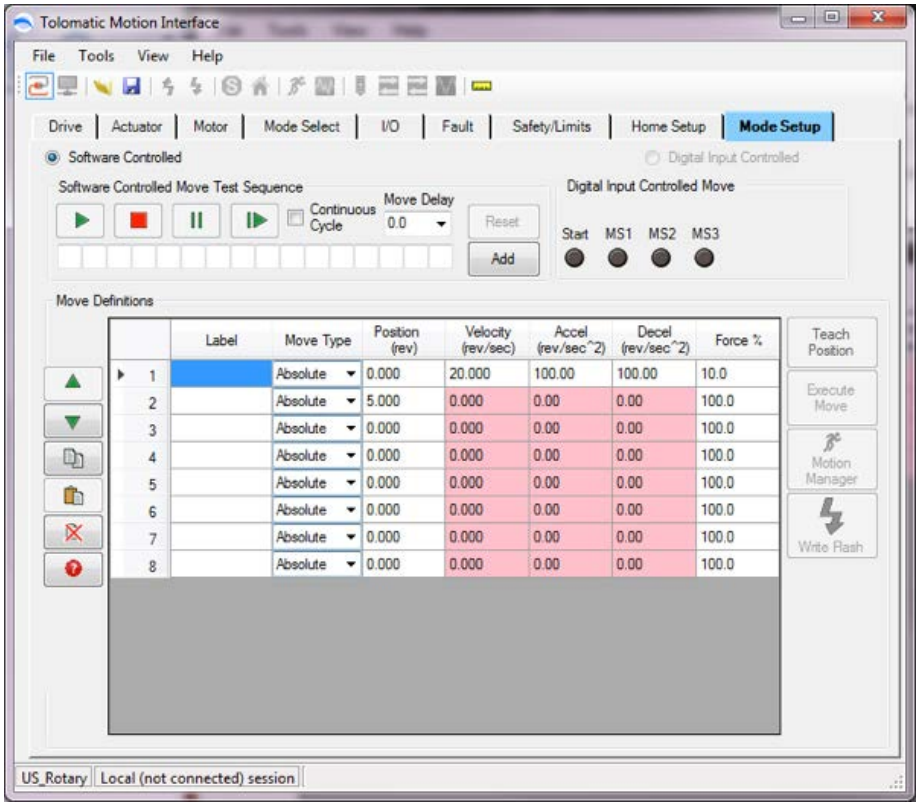


Figure 14-2: Mode Setup– 8 Move Commands, Not Configured

NOTE: The software controlled MS# LEDs will light to indicate what digital input pattern corresponds to that row. Similarly, you can use the mouse to click and toggle the MS# LEDs On/Off and the row corresponding to that binary code will be selected.

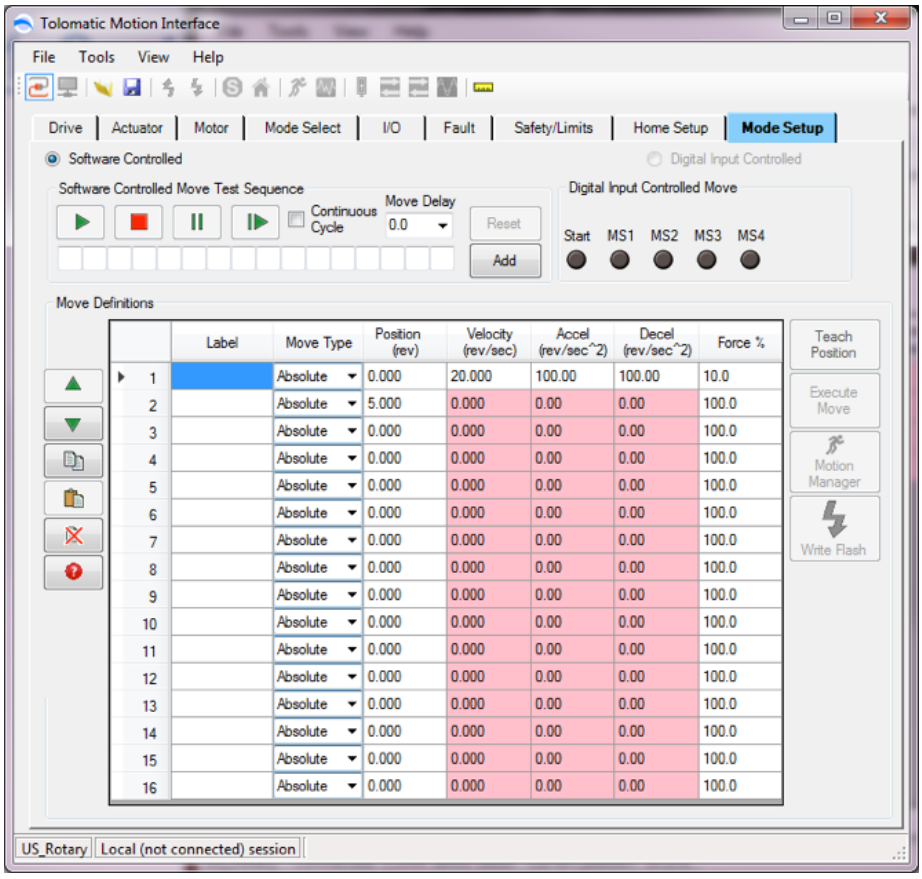


Figure 14-3: Mode Setup– 16 Move Commands, Not Configured

NOTE: Default Move Command velocities, acceleration, and deceleration are 0. If user does not configure a valid value for all motion parameters the TMI software and the ACS Drive will not allow that move to be executed.

For the move types of Home and No Action the fields for Position, Velocity, Accel, Decel and Force do not apply. They appear grey and are disabled for these move types.

With Home move type the parameters used in the homing routine are from the Home Setup tab. Using a Home move type in the Index Move table allows the user to free up an additional digital input.

The No Action move type is used to prevent unwanted moves from being commanded. If this type is configured, the controller will simply do nothing when it is commanded to move to that move number.

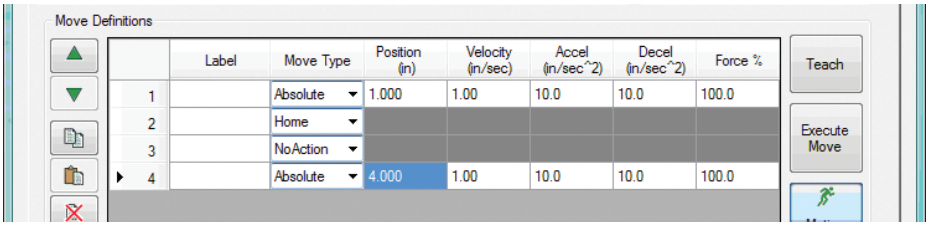


Figure 14-4: Mode Setup– The Home & No Action commands disable several fields.

14.1.2 Editing, Arranging and Testing Move Commands

Once all the Move Commands have been configured, there are several features in the Mode Setup screen for editing, arranging, or testing the configured Move Commands.

Move Row Up / Down: Move the Move Commands up and down one row at a time in the table.

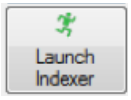
Copy / Paste / Cut Row: Copy, Paste & Cut functionality for each row. Select the row and click button for desired functionality.

Teach: Teach all motion profile parameters (position, velocity, accel/decel, force) from the Motion Manager (see Section 15: Motion Manager Tool) into the selected row in the table. If the selected row already has valid data, the TMI will prompt the user whether they want to overwrite it or not. If the ACS Drive is disabled (See Motion Manager) pressing teach will only update the position (not Velocity/Accel/Decel or Force). This is useful for manually positioning the actuator then teaching that position.

Execute Move: Clicking this button will execute or start the selected move in the table. The selected move is denoted by the move highlighted in blue with the black arrow on the left hand side. For Jog moves, the move is initiated while the Execute Move button is pressed and will stop when the Execute Move button is released.

Motion Manager: Opens and closes the Motion Manager tool (see Section 15: Motion Manager Tool)

Write Flash: Write Current Settings to Drive Flash: Write all parameters from the TMI software into the drive flash memory.



Launch Indexer: Opens the Basic Indexer Configuration Tool window (Demo Mode Only)

Software Controlled: When the TMI is in Software Control, all motion commands (Start Motion and Home inputs) from the I/O interface (PLC or logic controller) are ignored. In order to test the I/O logic with the PLC or logic controller, the user must select Digital Input Controlled.

NOTE: Jog and No Action moves as well as empty boxes will be skipped when playing the sequence.

While in Software Control, the user can test the moves by using the Software Controlled Move Test Sequence. This feature allows up to 16 Move Commands to be tested in any order. When in Software Controlled mode, the Move Select (MS#) LEDs in the Digital Input Controlled group box will echo the logic of the selected Move Command in the table. The Software Controlled mode feature has the following controls:

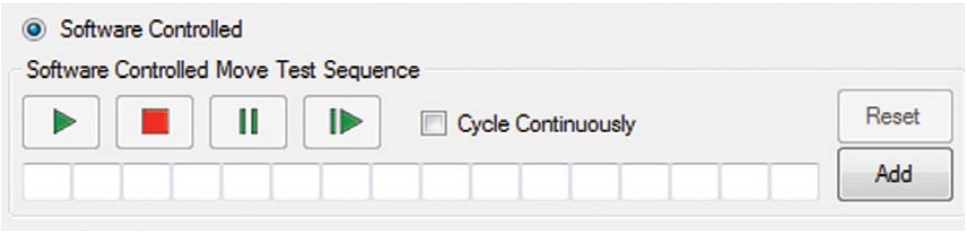


Figure 14-5: Software Controlled User Options

Add: Click Add to add a Move Command to the next available position.

Reset: Removes all Move Commands from the test sequence

Play: Initiates the test sequence. All Move Commands in sequence will be executed once.

Stop: Stops the test sequence.

Pause: Pauses the test sequence on the highlighted move.

Step: Steps through the test sequence one Move Command at a time.

Cycle Continuously: When this feature is checked, the test sequence cycles continuously in an endless loop until the Stop or Pause button is clicked, the user switches to the Digital Input Controller, navigates to another tab, or communication is disconnected.

When the test sequence is in progress:

1. All other move controls in Mode Setup and Motion Manager will be disabled.
2. The currently executed move will be highlighted in blue in the table.

Move Delay: User settable dwell between test sequence moves. (Not Pictured)

Digital Input Controlled:

In order to test the I/O logic with the PLC or logic controller, the user must select Digital Input Controlled. When in this mode, all move buttons in the software are disabled and motion can only be initiated from the logic controller (PLC). The selected move from the Move Select inputs (see Section 10: I/O Tab) will be highlighted in blue in the table below. The Move Select (MS#) LEDs in the Digital Input Controlled group box will echo the logic of the Move Select inputs from the physical I/O interface. In this mode, the PLC or logic controller can select the desired move using the Move Select inputs and initiate motion using the Start Motion input (see Appendix 1: Timing Diagrams).

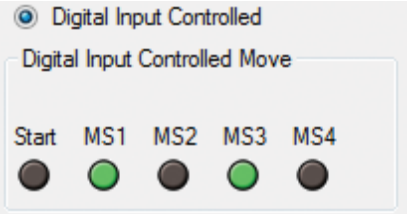


Figure 14-6: Digital Input Controlled

NOTE: When Software Controlled is selected the MS1 to MS4 “LEDs” will track the selected line in the Move Definitions table.

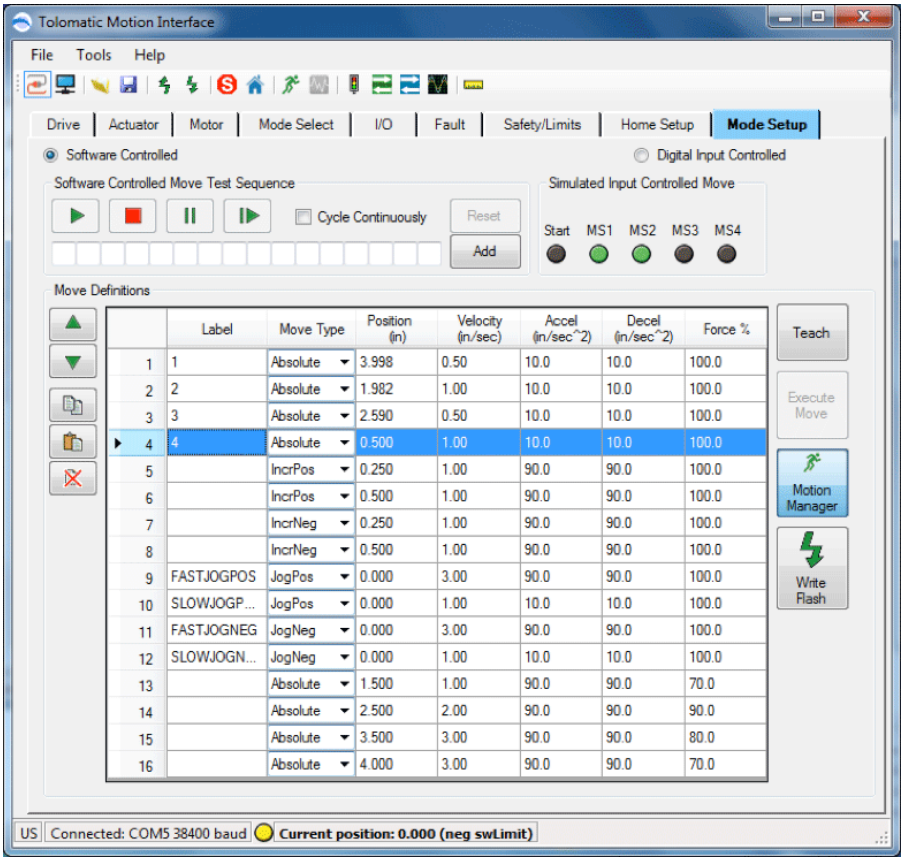


Figure 14-7: Configured Mode Setup, 16 Move Command Mode

ACS Servo Drive / ACSI

14.1.3 FORCE Move Type

The FORCE move type is similar to the ABSOLUTE position move but with additional logic added to help with press at force applications. For safety of the user and equipment, the FORCE move is run as a position move in the way that it uses the position, velocity, and current control loops as opposed to other servo drives that only use the current loop for a force move. The advantage to using all three loops is to have control over the actuator speed; speed is not controllable with current loop only implementations. The current loop has a limiter at the input to limit the maximum current to the value of the move FORCE % as setup in each move's profile. A position command past the point of press may be desired to reach this desired force.

Important notes about the Force move behavior:

- The Force Move Settle Time is a timer that starts counting when the Force % has been reached, and ends when the Force Move Settle Time in milliseconds has passed. This timeout will set the motion complete output to ON and another move may be commanded. If the Force % has not been reached then the Force Move Settle Time starts when the move trajectory completes.
- It is recommended that the next move after a FORCE move that releases the press also be a Force move with the same Force %. This will ensure smooth force transitions and prevent unwanted jumps or spikes in force as well as

ACS Servo Drive / ACSI

prevent position error fault from triggering.

- Position error Fault is disabled during Force moves.
- ⚠ **WARNING: If a press move has reached its Force % and the load is suddenly removed, the actuator may accelerate quickly toward the commanded position at an un-regulated speed.** This is due to the large position error and the proportional integral gains trying to compensate for the error.

The following examples shows a force move where an actuator presses into a spring fixture until a force is achieved. The only difference between the two scope captures is the Force Move Settle Time.

	Label	Move Type	Position (mm)	Velocity (mm/sec)	Accel (mm/sec^2)	Decel (mm/sec^2)	Force %
1	PRESS	Force	100.000	100.00	500.0	500.0	40.0
2	RELEASE	Force	0.000	100.00	500.0	500.0	40.0

Figure 14-8: Entries for Force Move

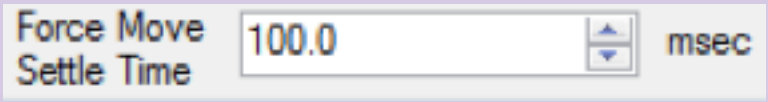


Figure 14-9: Force Move Settle Time set to 100 msec

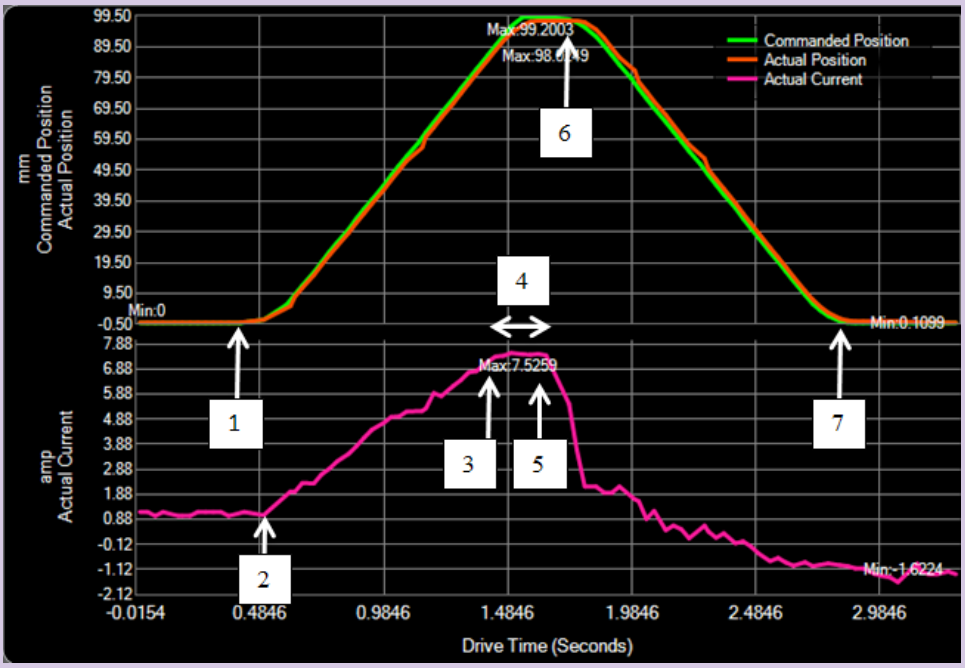


Figure 14-10: Resulting Motion Profile, 100 msec Settle Time

1. Force move begins (Press move)
2. Actuator begins compressing a spring

ACS Servo Drive / ACSI

3. Actuator reaches Force % value, Force Move Settle Time timer begins
4. Force Move Settle Time
5. Motion Complete signaled
6. Start new Force move (Release move) to back off of the spring.
7. Move complete, motion complete will be signaled after Force Move Settle Time.

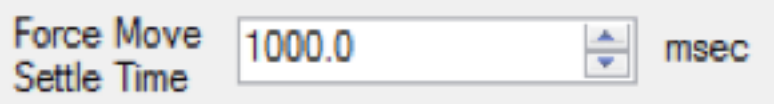


Figure 14-11: Force Move Settle Time set to 1000 msec

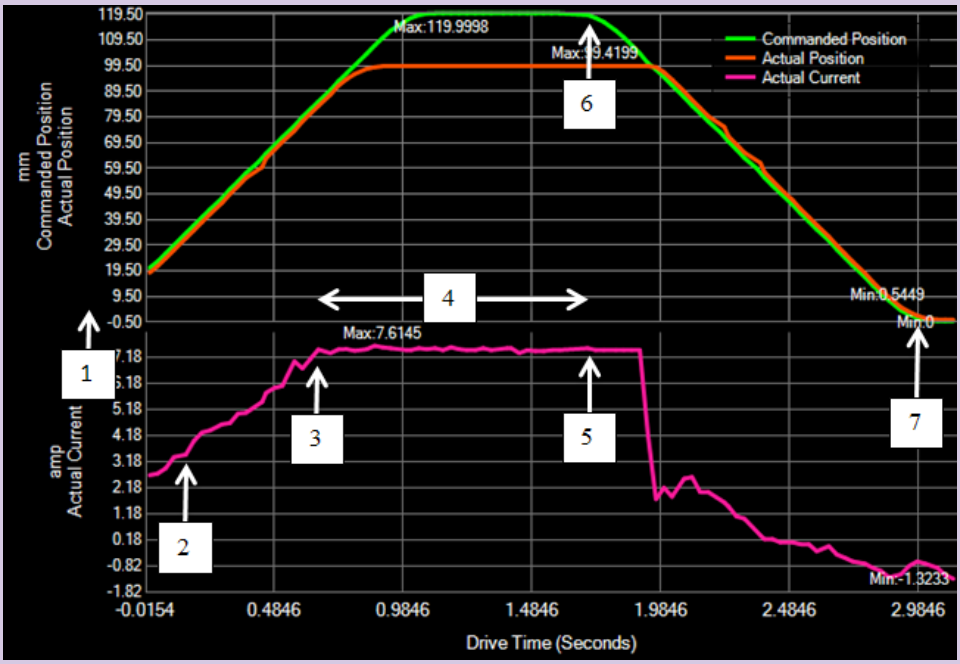


Figure 14-12: Resulting Motion Profile, 1000 msec Settle Time

1. Force move begins (Press move)
2. Actuator begins compressing a spring
3. Actuator reaches Force % value, Force Move Settle Time timer begins
4. Force Move Settle Time
5. Motion Complete signaled
6. Start New Force move (Release move) to back off of the spring.
7. Move complete, motion complete will be signaled after Force Move Settle Time.

14.2 Basic Indexer (Demonstration Mode)

The Basic Indexer is an onboard sequencer used for demonstrations that allows users to set up a series of moves that be initiated by a digital input. It is an Index Move operating mode. It uses the existing Move Definitions table to store motion profiles as well as a sequence definitions table that stores the configured sequences. To configure a sequence, the user must use both tables in tandem. To launch the Basic Indexer, click the "Launch Indexer" button on the Mode Setup tab.

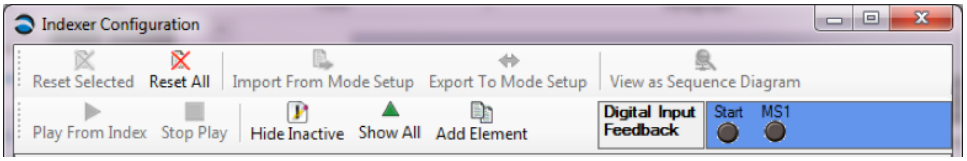


Figure 14-13: Indexer Configuration

Tool Name	Description
Reset Selected	Resets and removes the currently selected sequence
Reset All	Resets all sequences in the table
Import From Mode Setup	Imports a sequence from the Software Controlled Move Test Sequence tool on the Mode Setup Tab into the currently selected element (overwriting the existing element definition)
Export To Mode Setup	Exports a sequence starting at the currently selected element to the Software Controlled Move Test Sequence Tool on the Mode Setup Tab.
View as Sequence Diagram	Launches a Sequence Diagram window that starts at the selected element and displays the progression of the sequence. If the sequence is currently being run on the drive, it will also indicate the running element
Play From Index	Starts a visual sequence that slowly plays through the selected sequence (Not this does not command motion. For commanding motion, use the Test Sequence Tool on the Mode Setup tab)
Stop Play	Stops the Play From Index function
Hide Inactive	Hides all undefined elements in the Sequence Definitions table
Show All	Un-hides all undefined elements in the Sequence Definitions table
Add Element	Adds an undefined element to the Sequence Definitions table
Digital Input Feedback	In software control, selecting a MSX LED will select the defined entry point for the given combination of Move Selects. Move Select (MS) inputs are configured on the I/O tab. In Digital Input Control, these LEDs will turn on and off based on Move Select Input status. In Software Control, the LEDs can be pressed to show which Digital Input Entry Point is valid for the Move Select inputs

Elements

There are 2 types of elements – Digital Input Entry Points and standard elements.

Digital Input Entry Points occupy the first two (2) or more elements in the sequence definitions table (based on the number of configured Move Select lines in the I/O configuration. Each Entry Point corresponds to a Move Select combination.

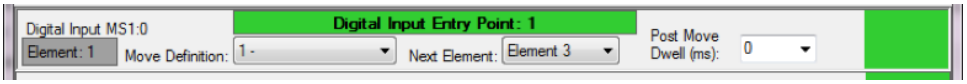


Figure 14-14 Digital Input Entry Points

Digital Input Entry Points each have a unique color associated with them that allows

users to quickly identify which elements belong to which sequences. Elements can belong to multiple sequences.

A **standard element** does not have a unique color associated with it and can be assigned to multiple sequences. On the right side of each element, the Element Flag indicates the Digital Inputs the element is assigned to. The element 3 ion the following example is part of both Digital Input Entry Point 1's and DIEP 2's sequences.

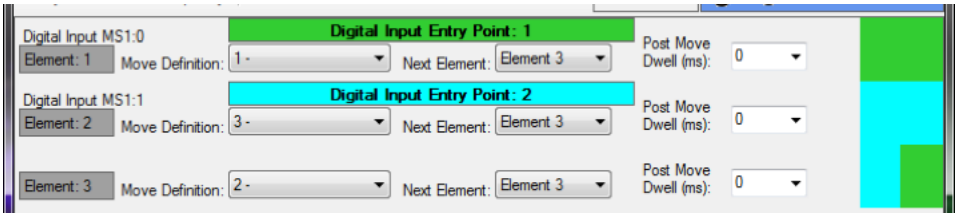


Figure 14-15 Standard Elements

The Move Definition combobox allows the user to select which Move Definition (defined in the Mode Setup tab) the element executes when active. For ease of use, label each move definition uniquely to help designate the definition in the Indexer Configuration tool.

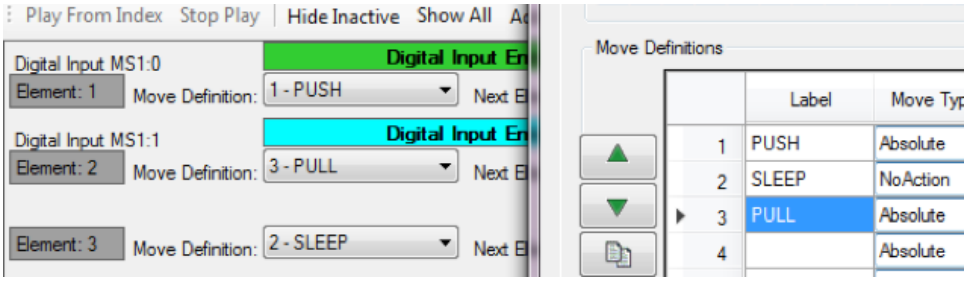


Figure 14-16 Move Definition combobox

Sequence Diagram

The Sequence Diagram is a tool that allows one to visualize a Basic Indexer sequence. The user clicks on the starting element of the sequence to visualize and then clicks on the "View as Sequence Diagram" icon.

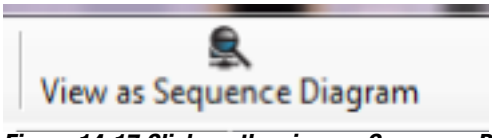


Figure 14-17 Click on the view as Sequence Diagram icon

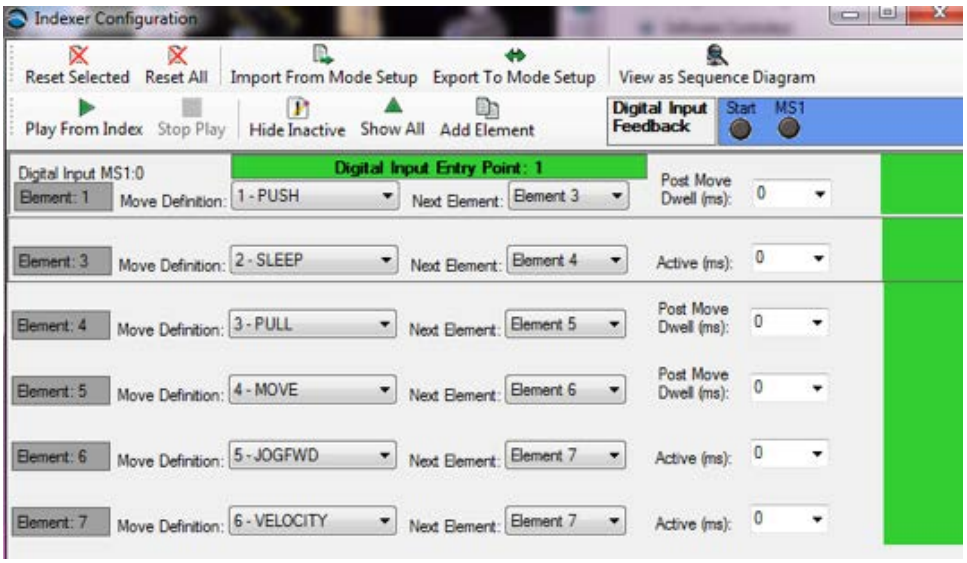


Figure 14-18 Sequence Diagram

In this example, the sequence is linear, starting at Element 1 and finishing at Element 7. Once Element 7 is complete, the Indexer is complete.

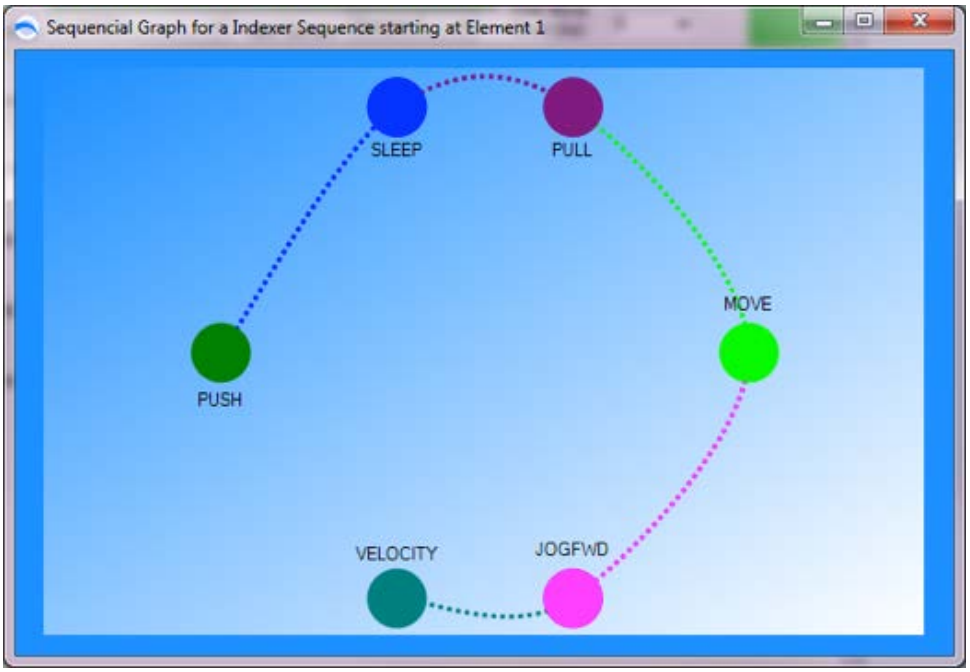


Figure 14-19 Sequential Graph

The way to indicate the end of a sequence is to set the Next Element equal to the current element. In this case Element 7's next element is Element 7. If instead the user would like this sequence to continue indefinitely (while the Digital Inputs are valid), the user can change Element 7's Next Element to another element in the sequence.

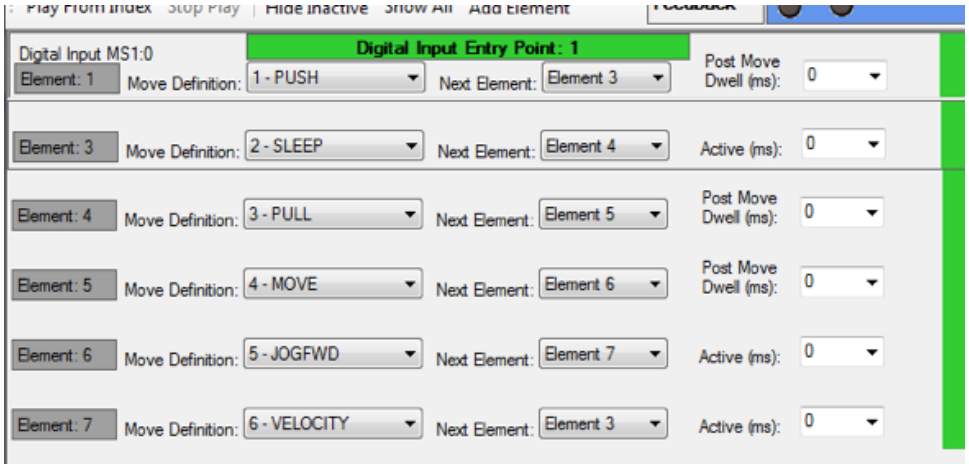


Figure 14-20 Sequence Diagram

In this example, Element 7's Next Element is Element 3. To visualize this, the user executes the "View Sequence Diagram" tool. From this, it is apparent that Element 1 is the starting point and is executed once, but the rest of the elements form a circular queue that is continuously executed while the Digital Inputs are valid for Entry Point 1.

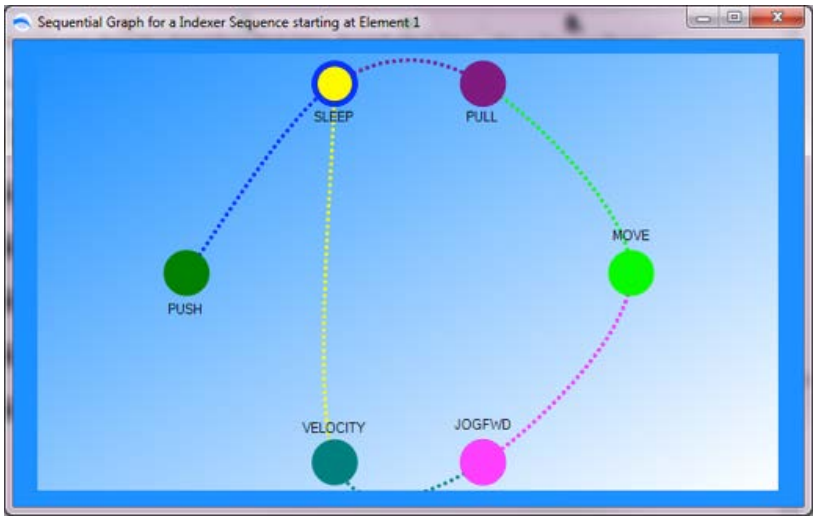


Figure 14-21 Sequential Graph

With the Sequence Diagram open, selecting an Element in the Indexer Configuration will highlight the corresponding Element in the Sequential Graph.

Running Indexer in Digital Input Control

When running the Basic Indexer in Digital Input Controlled mode

Figure 14-22 Digital Input Control Mode

The Indexer Configuration tool will provide feedback about the current running sequence. The Digital Input Entry Point that is currently being executed (by the configured Move Select lines) will be highlighted blue. The currently executed Element will be selected, and the Next Element in the sequence will have a black box around the Element. See below

Figure 14-23 Digital Input Entry

NOTE: For demos, the Indexer can be configured to start on power up without digital input control. A check-box for this is on the I/O Tab.

Digital Input Entry Point 1 is being executed (Move Select 1 digital input is low). The Element that is currently being executed is Element 3, and the next element that will be executed is Element 4.

The Sequence Diagram tool will also provide feedback during Digital Input Control. The Element currently being executed will be highlighted with a white circle. As the sequence progresses, each element will be highlighted as it is executed.

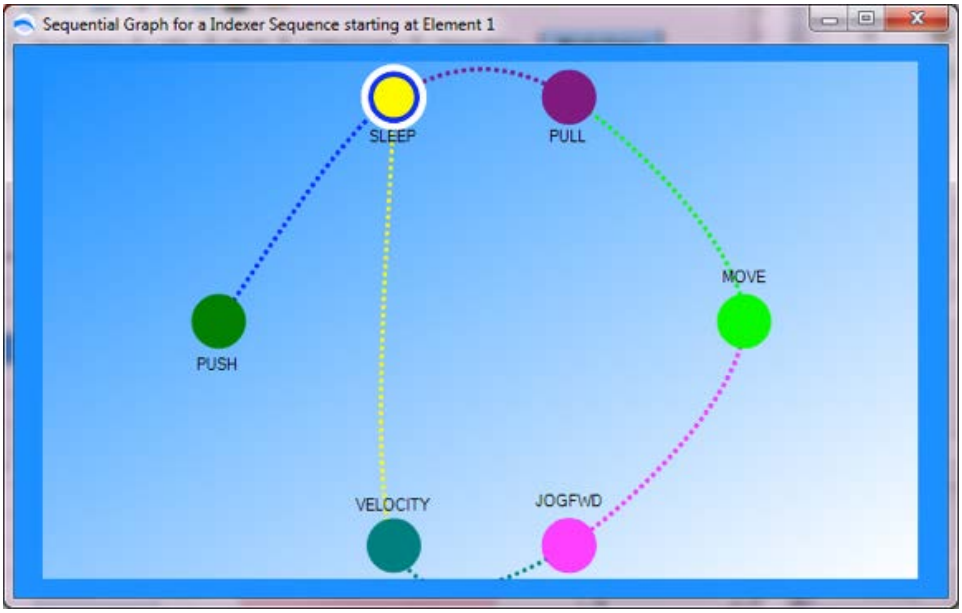


Figure 14-24 Sequential Graph

14.3 Pneumatic Mode

TROUBLESHOOTING TIP:

Pneumatic Mode by default is edge triggered. This means the motion will only occur when a change in digital input is detected. If user requires the drive to command move immediately on power up, check the "Tru-Pneu" mode check-box on the I/O Tab.

Pneumatic mode is used to replace or replicate pneumatic cylinder/valve operation logic. With pneumatic mode, there are four different selections: Spring, 2 Position (2 input), 3 Position (2 input) & 3 Position (3 input). These four pneumatic mode operations allow almost any pneumatic valve logic to be replaced with the ACS drive. Additionally, in pneumatic mode, the drive will automatically home the actuator upon power up based on the home setup configuration.

NOTE: The default configuration for Pneumatic Mode automatically enables drive upon power up. Because of this, the only way to clear a fault is to cycle power unless the enable input is configured to a digital input in the I/O tab.

The setup table used for pneumatic mode has the following columns:

Setup Table Move Definitions		
	Label	Descriptive alpha-numeric "name" for each Move Command. Limited to 28 characters, all uppercase.
ACS Stepper Drive	**Move Type**	**Absolute:** Initiates an absolute move upon change of Move Select bits. (STEPPER DRIVE: Pneumatic Mode only supports Absolute Moves)
ACS Servo Drive / ASCI		**Absolute:** Initiates an absolute move upon change of Move Select bits. (SERVO DRIVE: Pneumatic Mode supports Absolute and Force Moves)
	Position	Move position value for absolute moves. This field is not used in JogPos or JogNeg move types.
	Velocity	Velocity value for all move types
	Accel/Decel	Acceleration and Deceleration value for all move types
	Force %	Force % value from 10 to 100% for all move types.

Table 14-2: Descriptions of Setup Table Move Definitions for Pneumatic Mode

NOTE: Default Move Command velocities, acceleration, and deceleration are 0. If user does not configure a valid value for all motion parameters the TMI software and the ACS Drive will not allow that move to be executed.

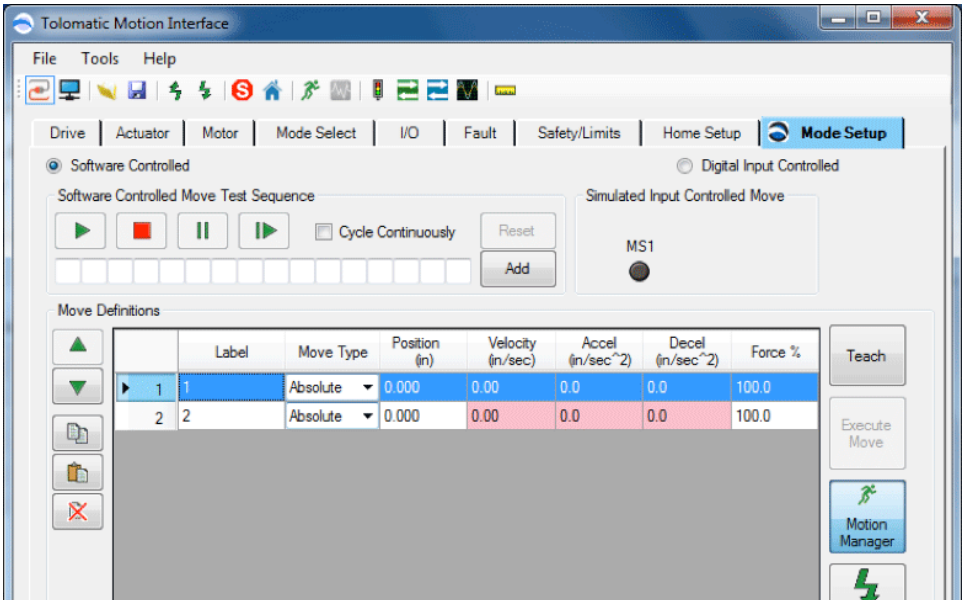


Figure 14-25: Pneumatic, Spring

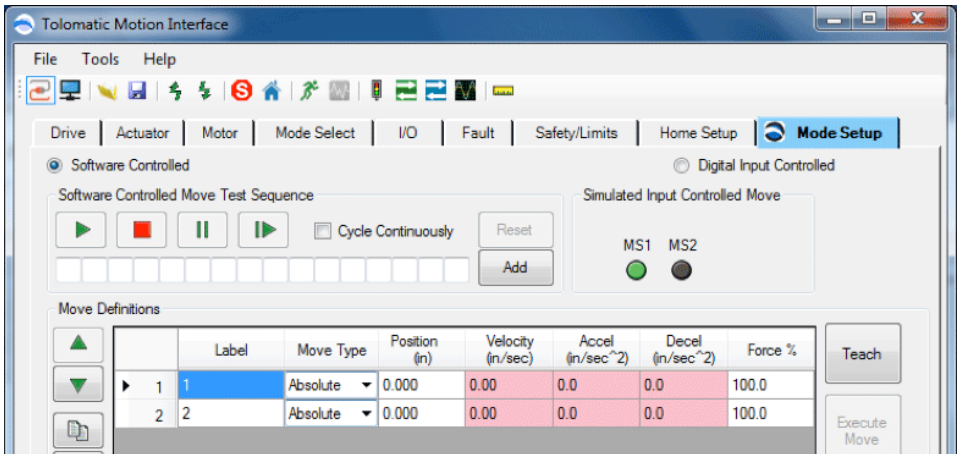


Figure 14-26: 2 Position (2 input)

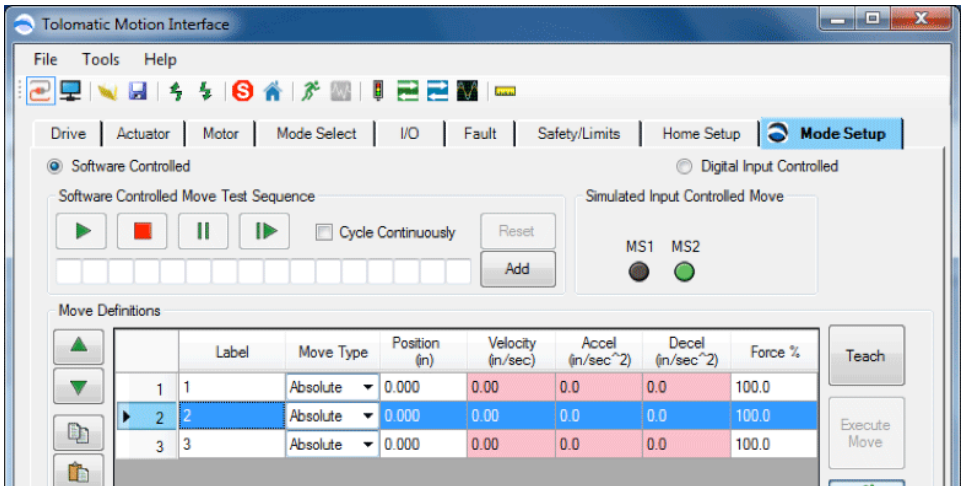


Figure 14-27: 3 Position (2 input)

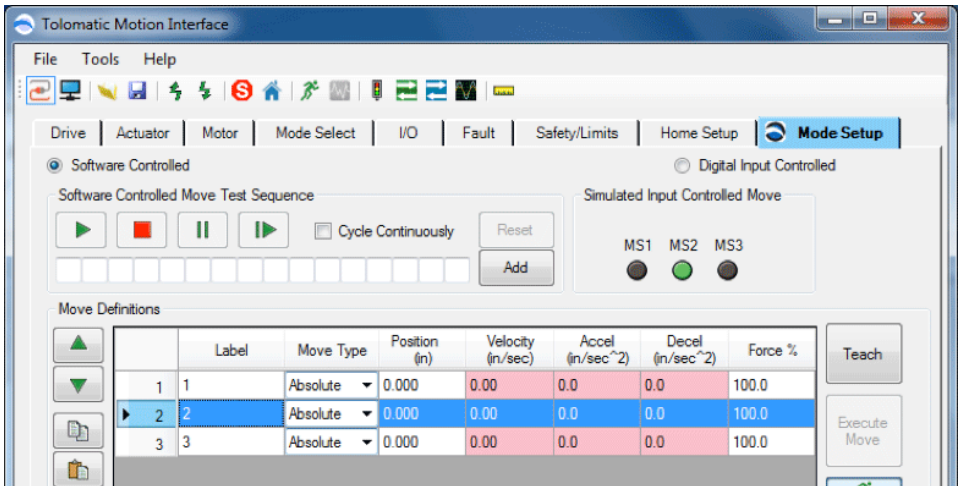


Figure 14-28: 3 Position (3 input)

Digital Input Controlled:

In order to test the I/O logic with the PLC or logic controller, the user must select Digital Input Controlled. When in this mode, all move buttons in the software are disabled and motion can only be initiated from the logic controller (PLC). The selected move from the Move Select inputs (see Section 10: I/O Tab) will be highlighted in blue in the table below. The Move Select (MS#) LEDs in the Digital Input Controlled group box will echo the logic of the Move Select inputs from the physical I/O interface. In this mode, the PLC or logic controller can select the desired move using the Move Select inputs and initiate motion using the Start Motion input (see Appendix 2: Pneumatic Mode - Move Select Logic Table).

NOTE: When Software Controlled is selected the MS1 to MS3 "LEDs" will track the selected line in the Move Definitions table.

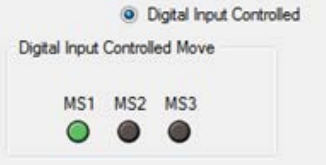


Figure 14-29: Digital Input Controlled

14.4 Analog Position Mode

14.4.1 Configuring Analog Position Mode

Analog Position mode is used to equate an analog input voltage or current to position. The ACS Drive will convert the analog input to a scaled position range. If the ACS Drive has an analog output installed, the position of the encoder will be scaled to the analog output. If the ACS Drive has not been previously configured for Analog Position mode or has been restored to factory defaults, the Analog Position mode will be configured with zero Min/Max Position, Velocity, Accel/Decel to prevent any motion. The Min/Max Position, Velocity, Accel/Decel fields will be highlighted in light red indicating they are invalid settings (see Figure 14-18 below).

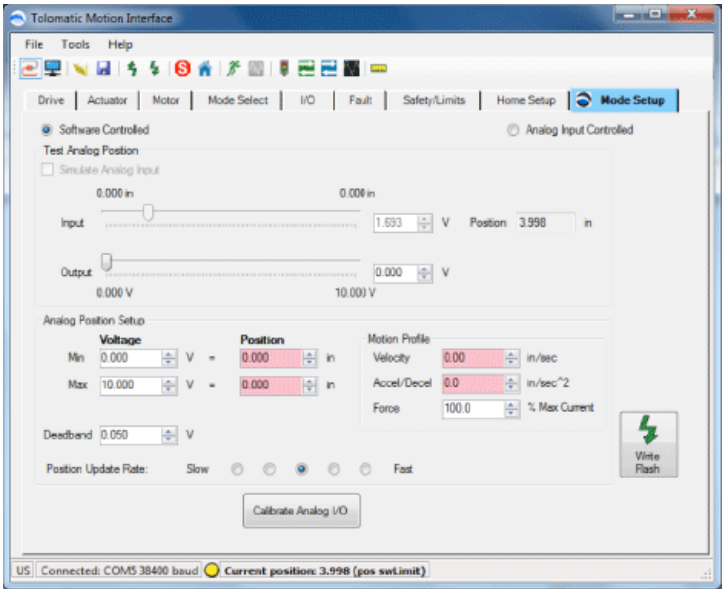
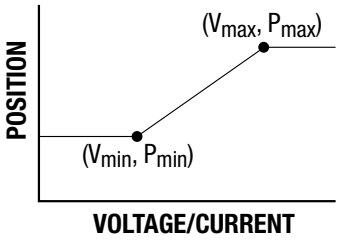


Figure 14-30: Default Analog Position Mode for Voltage



The mode setup for Analog Position mode has the following parameters that must be configured for proper operation.

Min/Max Voltage or Current: The range of Voltage is 0 to 10VDC and the range of Current is 4 to 20mA.

Min/Max Position: The configured positions that are equated to the Min/Max Voltage or Current setting. The ACS Drive will then linear interpolate the Analog Input and equate it to position based on the Min/Max Voltage or Current settings along with the Min/Max Position settings.

Velocity: Velocity value for any Analog Position move

Accel/Decel: Acceleration and deceleration value for any Analog Position move

Force: Force % value from 10 to 100% for any Analog Position move

Deadband: Plus / Minus window for Analog Input that is ignored or not used to create motion.

Position Update Rate: This setting adjusts the rate at which position commands are updated based on the changing Analog Input. A slower setting means the response of the system will not be as dynamic. A faster setting means the system will respond more quickly

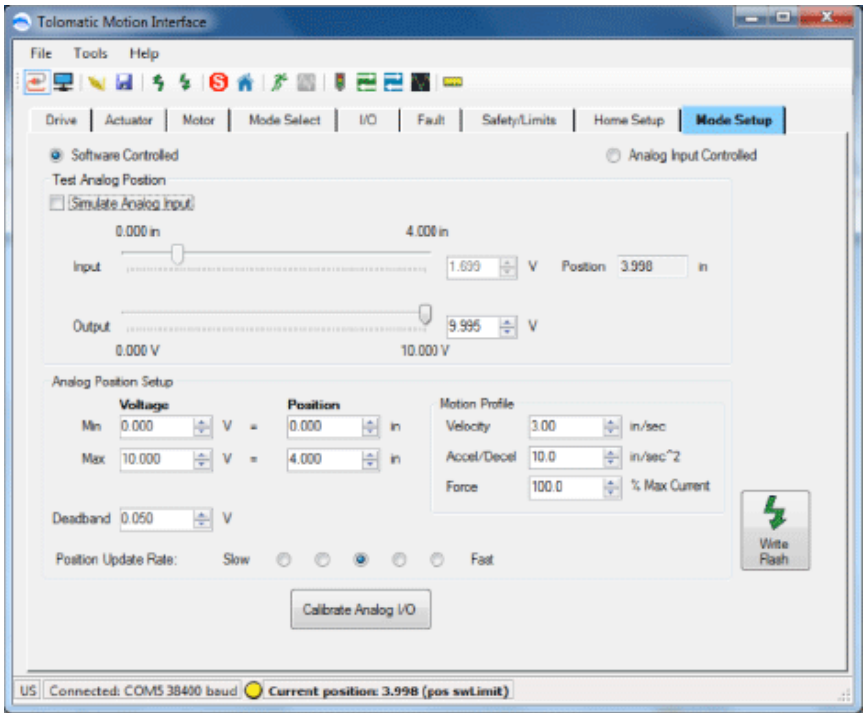


Figure 14-31: Settings for Analog Position mode for Voltage

Relationship between Analog Mode & Start Motion Input:

1. If Start Motion Input is configured in I/O Tab then user must set the Start Motion input ON to get motion. If Start Motion is configured and is set to OFF, user will not get motion after adjusting analog input.

2. In I/O Tab unmapping Start Motion input relieves the responsibility of setting Start Motion input to get motion using Analog input.

NOTE: If the Analog Output option is not installed, the Output slider will not be visible.

NOTE: If the motor doesn't have an encoder, the analog output will be forced to 0 (volts or mA) and not used.

In the example above:

0 volts = 0 inch position

10 volts = 4 inch position

All moves will move with 3 inch/sec velocity, 10 inch/sec^2 accel/decel and 100% force.

14.4.2 Simulating the Analog Position Input

NOTE:
When simulating Analog Input, the Motion Manager tool is disabled.

To simulate the analog input and test the logic setup for Analog Position mode, click on the Simulate Analog Input check-box. This will disable all the Analog Position Setup variables and the calibrate Analog I/O button because changes are not allowed when attempting motion. There are two sliders in the Test Analog Position box: one for an Input and one for the Output. The Input is enabled and the user can change the values of the simulated analog input to create motion. The output slider should mimic the value of the analog output based on the actual position, if the motor has an encoder.

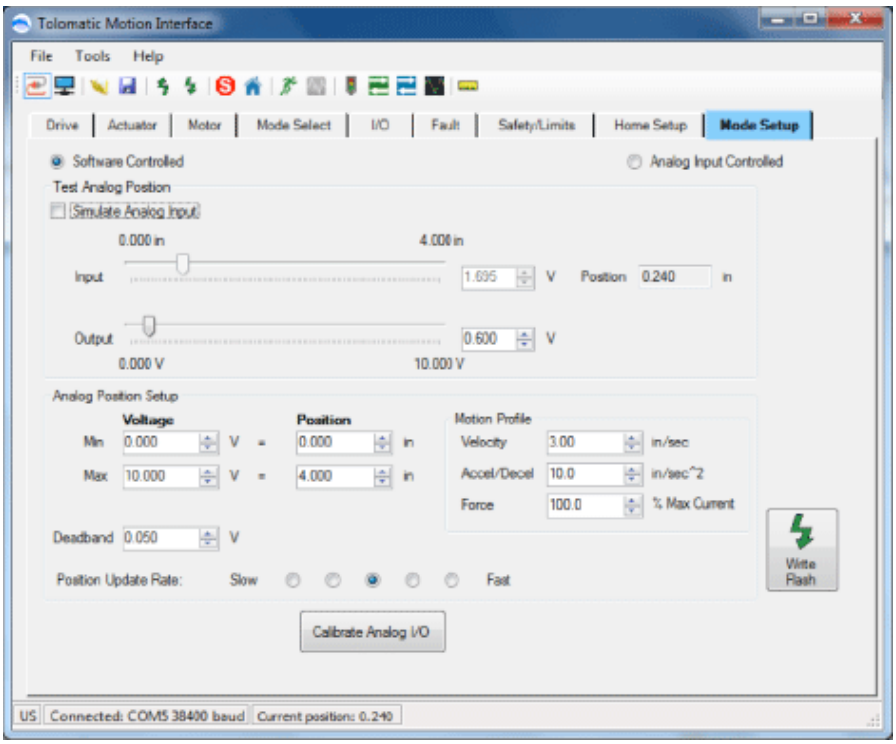


Figure 14-32: Simulating Analog Input

NOTE: When Simulate Analog Input is not checked, the output slider may be moved to manually change the analog output of the ACS drive.

14.4.3 Analog Input Controlled Position

Analog Input Controlled is used to test the logic of the Analog Position mode setup with actual external hardware such as a PLC. When the Analog Input Controlled button is pressed, the message below will be displayed.

WARNING: If "Yes" is selected, the user should expect motion as the ACS Drive will attempt to move in accordance with the Analog Position Setup.

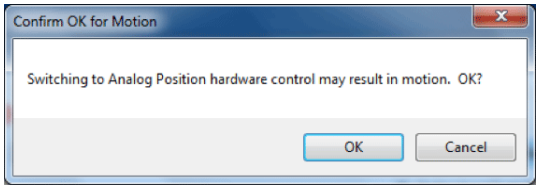


Figure 14-33: Confirm motion warning window

Once in this mode, the PLC or external Analog source can be used to test the system.

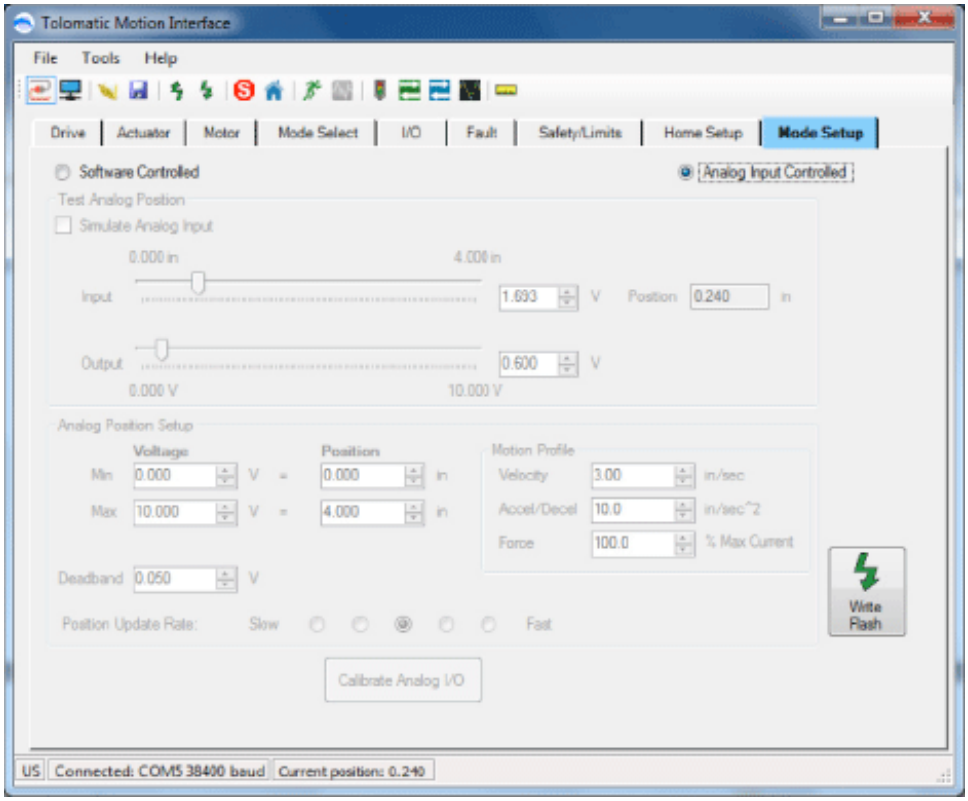


Figure 14-34: Analog Input Controlled

14.4.4 Calibrating Analog Input & Output

For advanced applications where positional accuracy is extremely important, the Analog I/O Calibration tool can be used to calibrate both the Analog Input and Output. Press the Calibrate Analog I/O tool from the Mode Setup screen to launch the tool. Once in Analog I/O Calibration, the user cannot navigate to any other screens in the Tolomatic Motion Interface (TMI). The user must click the Calibrate

Analog I/O check box to enable the calibration process.

For analog input calibration, a voltage or current source and a multimeter will be required. Input a voltage or current to the ACS Drive and measure with the meter. Enter that value into the Measured Input field and press the associated Calibrate Min or Max button. For voltage, the recommended ranges are 1-4 volts for the Min voltage and 6-10 volts for the Max voltage. For current, the recommended ranges are 2-8 mA for the Min current and 12-20 mA for the Max current.

The analog input also has a software filter that is adjustable to give flexibility to the user on how dynamic the Analog Position control should be. With a filter setting more towards Min, the analog filter will do less filtering and the controller will follow closer to the actual analog signal including signal noise. With a filter setting more towards Max, the analog filter will do more filtering causing the analog input signal to the controller to be smoother (less noisy).

For analog output calibration, a multimeter will be required. Enter a Min voltage or current (1 - 4 volts or 2 - 8mA) into the Test Output field press Test Min and then measure with the meter. Enter the measured value into the Measured Output field and press Calibrate Min button. Repeat procedure for Max voltage or current (6 - 10 volts or 12 - 20mA) and press the Calibrate Max button. Click OK button to send the calibrations to the ACS drive.

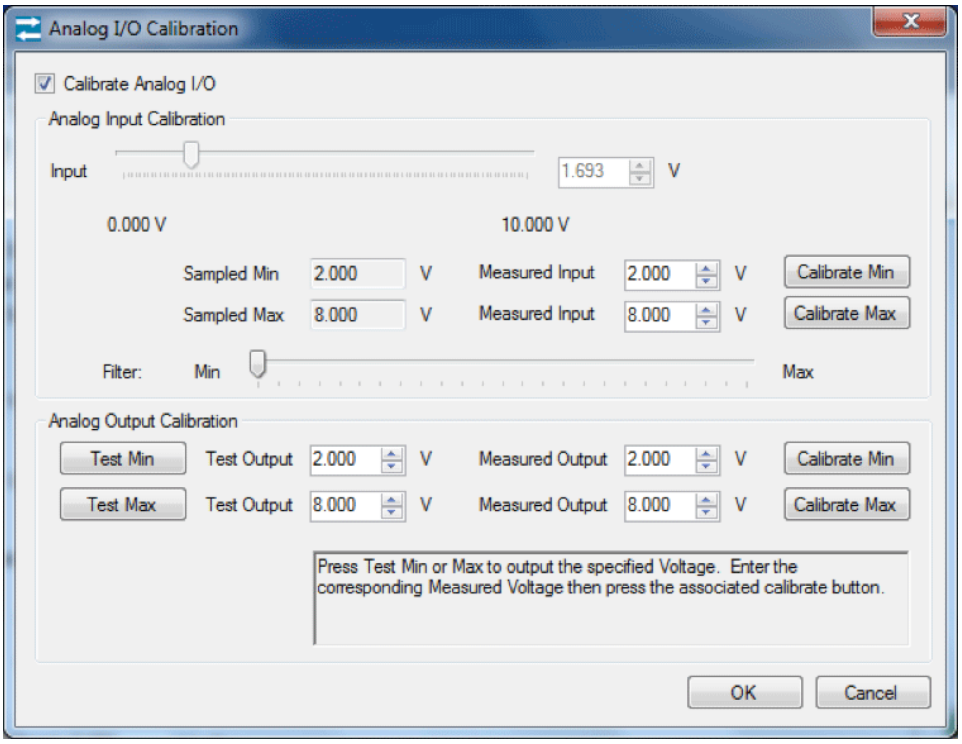


Figure 14-35: Sample of completed Analog I/O calibration

14.5 Analog Velocity Mode (Rotary Only)

14.5.1 Configuring Analog Velocity Mode

Analog Velocity mode is used to equate an analog input voltage or current to velocity. The ACS Drive will convert the analog input to a scaled velocity rate. If the ACS Drive has an analog output installed, the velocity of the encoder will be scaled to the analog output. If the ACS Drive has not been previously configured for Analog Velocity mode or has been restored to factory defaults, the Analog Velocity mode will be configured with zero Min / Max Velocity, and Accel / Decel to prevent any motion. The fields will be highlighted in light red indicating they are invalid settings. (See Figure 14-36 below).

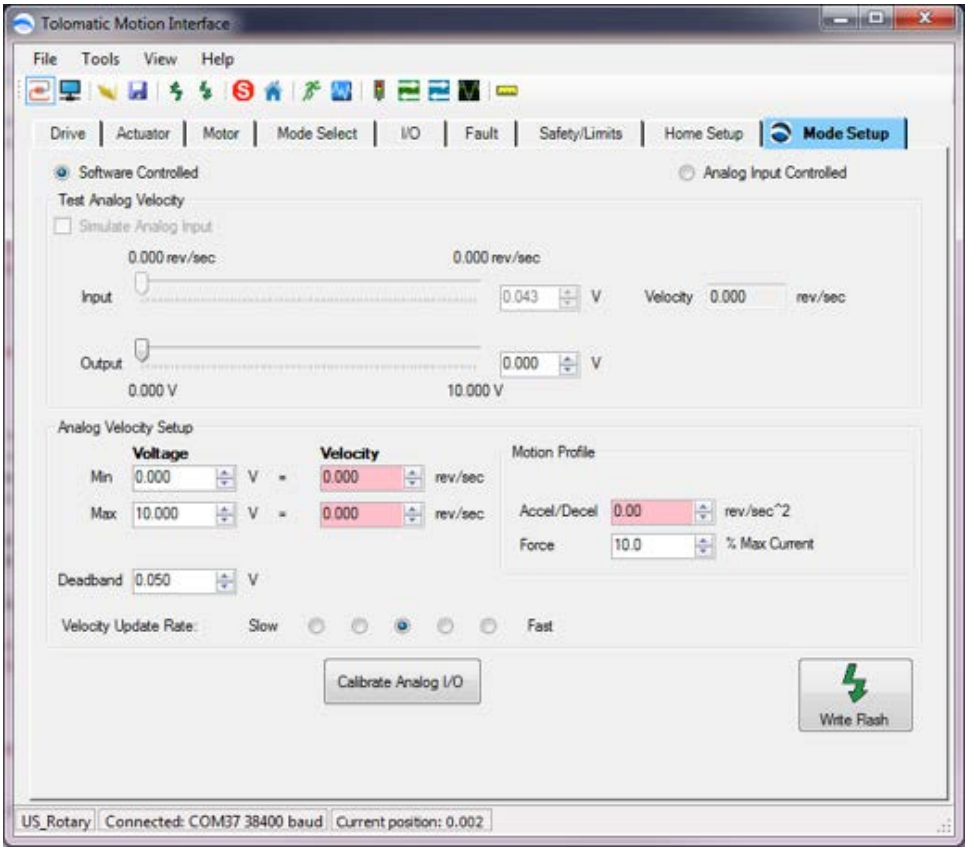


Figure 14-36: Invalid settings are highlighted in light red

The Mode Setup tab for Analog Velocity mode has the following parameters that must be configured for proper operation.

Min/Max Voltage or Current: The range of Voltage is 0 to 10VDC and the range of Current is 4 to 20mA.

Min/Max Velocity: The configured velocities that are equated to the Min/Max Voltage or Current setting. The ACS Drive will then linear interpolate the Analog Input and equate it to velocity based on the Min/Max Voltage or Current settings along with the Min/Max Velocity settings.

Accel/Decel: Acceleration and deceleration value for any Analog Velocity move

Force: Force % value from 10 to 100% for any Analog Velocity move

Deadband: Plus / Minus window for Analog Input that is ignored or not used to create motion

Velocity Update Rate: Adjusts the rate at which velocity commands are updated based on the changing Analog Input. A slower setting means the response of the system will be buffered. A faster setting means the system will respond more quickly

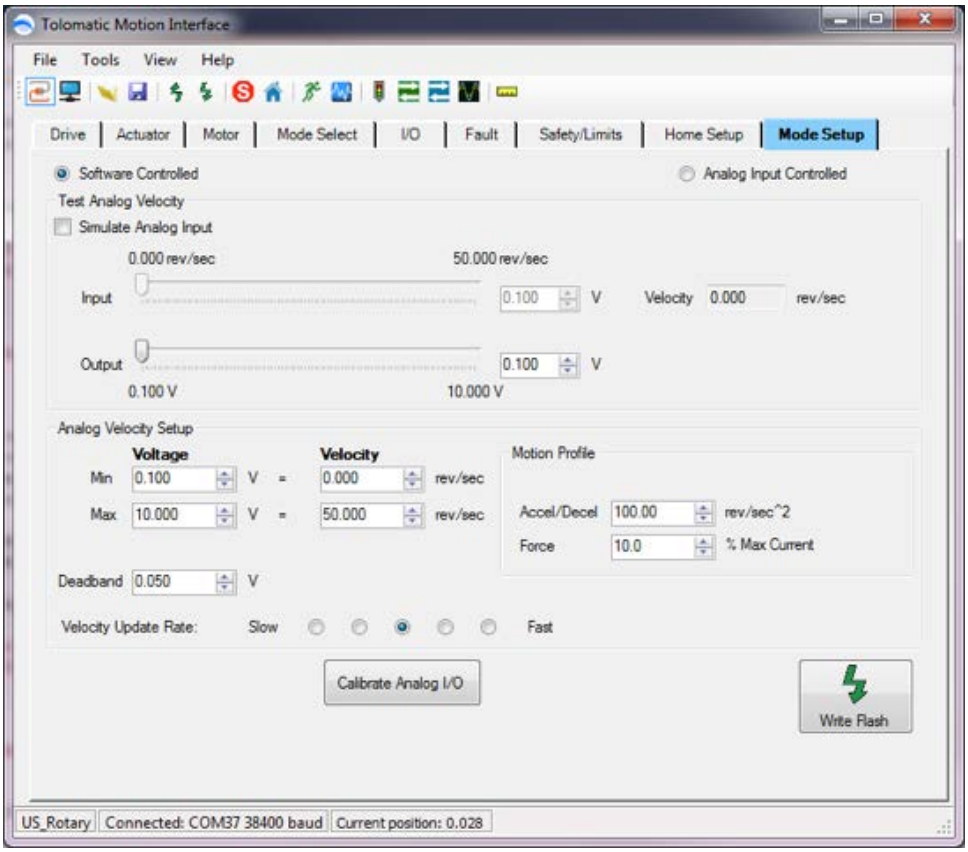


Figure 14-37: Invalid settings are highlighted in light red

Settings for Analog Velocity mode for Voltage

Relationship between Analog Mode & Start Motion
1. If Start Motion Input is configured for I/O Tab, then user must set Start Motion input HIGH to initiate motion. If Start Motion is configured and is set LOW, user will not get motion after adjusting analog input.
2. In I/O Tab, unmapping Start Motion input relieves the responsibility of setting Start Motion input to initiate motion using analog input.

Note: If the Analog Output option is not installed, the Output slider will not be visible

Note: If the motor does not have an encoder, the analog output will be forces to 0 (volts or mA) and not used

14.5.2 Simulating Analog Velocity Input

To simulate the analog input and test the logic setup for Analog Velocity mode, click on the Simulate Analog Input checkbox. This will disable all the Analog Velocity Setup variables and the calibrate Analog I/O button as changes are not allowed when making motion. There are two sliders in the Test Analog Velocity box: one for Input and one for Output. The Input is enabled and the user can change the values of the simulated analog input to create motion. The output slider should simulate the value of the analog output based on the actual velocity, if the motor has an encoder.

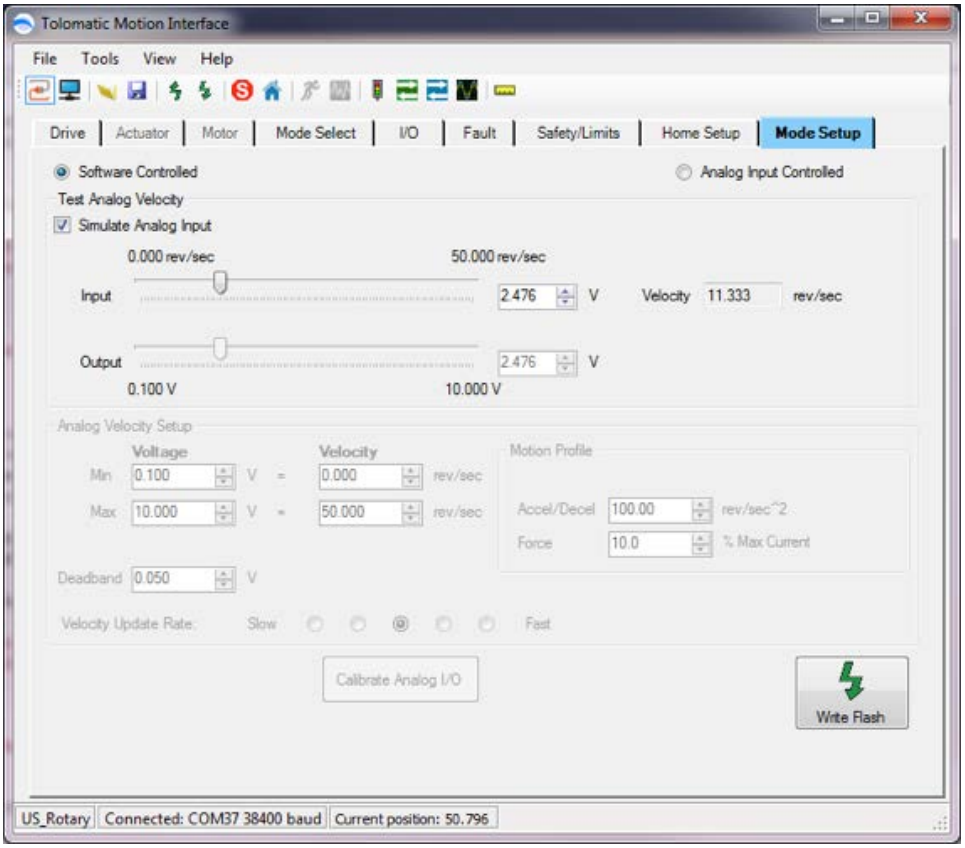


Figure 14-38: Simulating Analog Input

Note: When Simulate Analog Input is not checked, the output slider may be moved to manually change the analog output of the ACS Drive

14.5.3 Analog Input Controlled Velocity

Analog Input Controlled is used to test the logic of the Analog Velocity mode setup with actual external hardware such as a PLC. When the Analog Input Controlled button is pressed, the message below will be displayed

WARNING: If "Yes" is selected, the user should expect motion as the ACS Drive will attempt to move in accordance with the Analog Velocity setup.

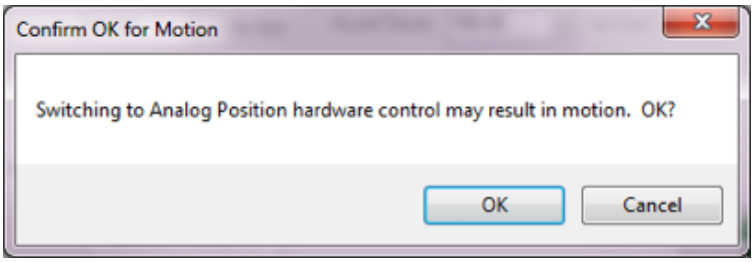


Figure 14-39: Confirm motion warning window

Once in this mode, the PLC or external Analog source can be used to test the system

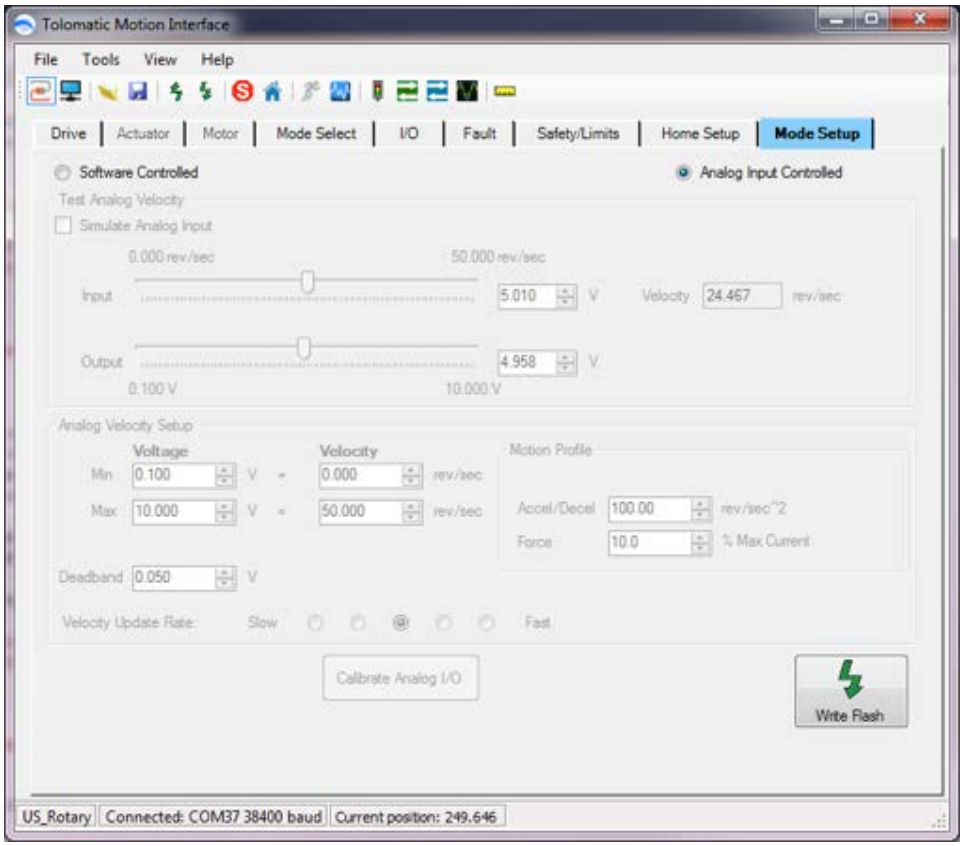


Figure 14-40: Test with PLC or external Analog source

14.5.4 Calibrating Velocity Analog Input & Output

See Section 14.3.4 Calibrating Input & Output

14.6 Network Mode

NOTE: The TMI software will determine which protocol is appropriated based on the ACS unit connected.

NOTE: To setup ACS drive for Network communication, the Ethernet port must be configured using the Ethernet Setup Tool. See Section 21 for details. Some protocols require configuration over network control. This is called "Infrastructure Mode".

NOTE: Details about communications with drive over Network Mode can be found in the protocol specific document, accessible via the Help menu.

14.6.1 Using Network Mode

Once the ACS Drive has been configured for the desired Actuator and Motor, Network mode can be configured for control with drive specific protocols. Depending on the model ordered, the TMI software will only show its configured protocol. In this section Network refers to all protocols

When Mode Select is configured for Network operation, the Mode Setup tab will allow setup of up to 16 moves. The Network Move GroupBox displays the most recently commanded move. Please note that the Current Position is displayed instead of the Position from the move table or the position sent over the network. The reason for this is to be able to track the absolute position at all times. Move number 0 indicates a move commanded by the TMI Motion Manager or the Network connection.

When the TMI user presses the Network Controlled radio button, control indicator (as seen on the Drive Status Tool) will turn off and the TMI controls will be disabled. This keeps the TMI user from changing parameter values while the network controller is commanding movement.

When Network is in control, the controls in the Mode Setup tab's Network Move GroupBox show the most recent move commanded by the PLC master. Note that rather than displaying the commanded position, the Current Position is displayed.

To return control to the TMI host, either press the Software Controlled radio button, or select one of the tabs other than Mode Setup.

The Host in control indicator on the Drive Status tool indicates whether TMI (the Host in this case) is in control.

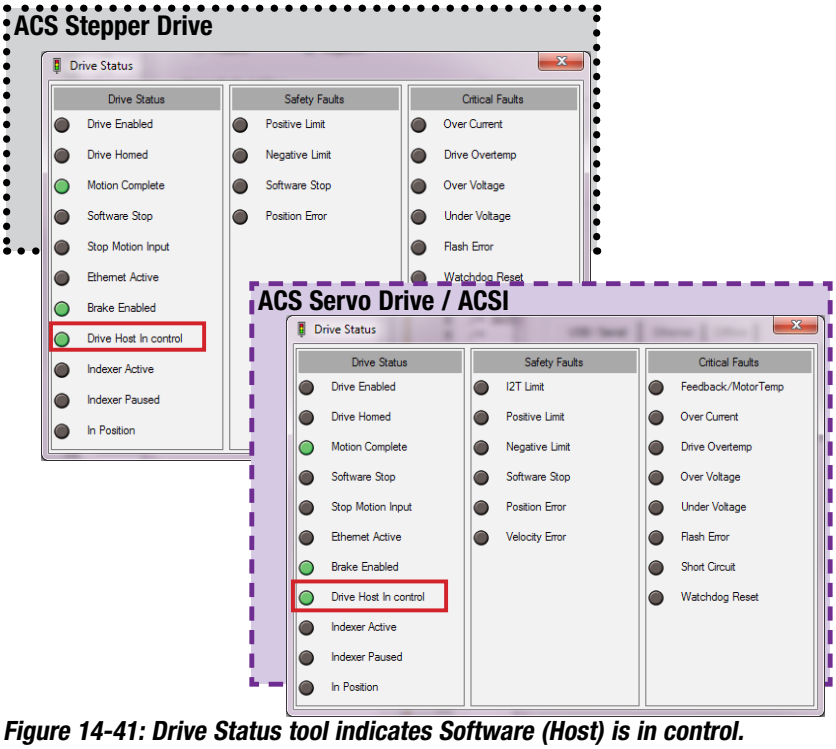


Figure 14-41: Drive Status tool indicates Software (Host) is in control.

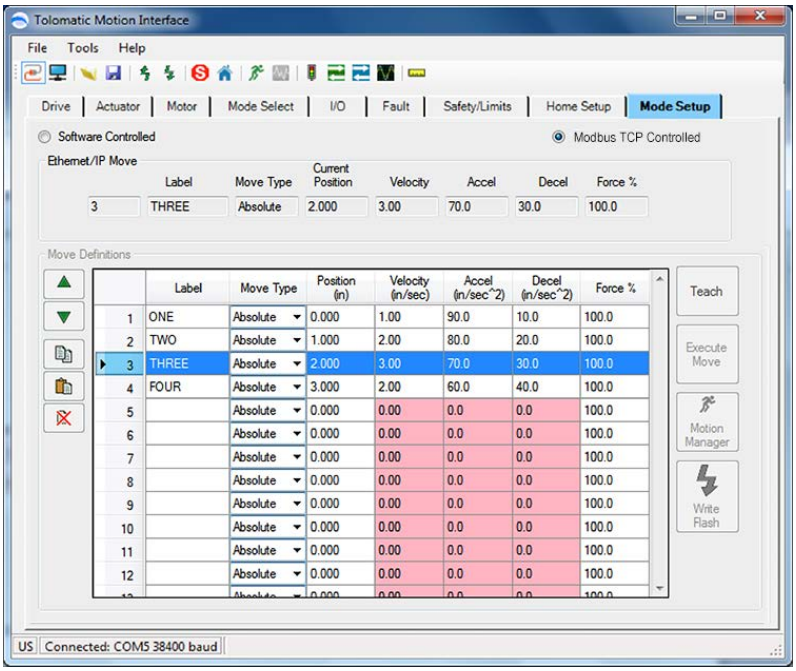


Figure 14-42 PLC Master in control, last commanded move is highlighted.

14.6.2 Behavior of network commands and configured digital inputs

ENABLE COMMAND			
MODE SELECT	**DIGITAL INPUT STATE**	**NETWORK COMMAND STATE**	**ACTION**
"Network"	0	0	DISABLE
"Network"	0	1	DISABLE
"Network"	1	0	DISABLE
"Network"	1	1	ENABLE
INDEX	0	X	DISABLE
INDEX	1	X	ENABLE
ANALOG	0	X	DISABLE
ANALOG	1	X	ENABLE
PNEUMATIC	0	X	NOT AVAILABLE
PNEUMATIC	1	X	NOT AVAILABLE
SOFTWARE CONTROLLED (HOST IN CONTROL)	X	X	ONLY TMI CONTROLS ENABLE

Table 14-3: Enable Command modes and actions when digital input is configured to enable.

SOFTWARE STOP COMMAND (E Stop)			
MODE SELECT	**DIGITAL IN-PUT STATE**	**NETWORK COMMAND STATE**	**ACTION**
"Network"	0	0	SOFTWARE STOP OFF
"Network"	0	1	SOFTWARE STOP ON
"Network"	1	0	SOFTWARE STOP ON
"Network"	1	1	SOFTWARE STOP ON
INDEX	0	X	SOFTWARE STOP OFF
INDEX	1	X	SOFTWARE STOP ON
ANALOG	0	X	SOFTWARE STOP OFF
ANALOG	1	X	SOFTWARE STOP ON
PNEUMATIC	0	X	SOFTWARE STOP OFF
PNEUMATIC	1	X	SOFTWARE STOP ON
SOFTWARE CONTROLLED (HOST IN CONTROL)	0	X	SOFTWARE STOP OFF
SOFTWARE CONTROLLED (HOST IN CONTROL)	1	X	SOFTWARE STOP ON

Table 14-4: Software Stop Command modes and actions when digital input configured to Software Stop.

15.1 Using the Motion Manager

⚠ WARNING: Before making a move with the Motion Manager verify Velocity, Accel, Decel, Force, Bus Voltage (Servo), and Inertia (Servo).

The Motion Manager allows the user to enable/disable the motor, home, and create simple motion commands (Absolute, Incremental, Jog). The Motion Manager is a can also be used for positioning in order to teach Moves into the Mode Setup table (see Section 14: Mode Setup Tab).

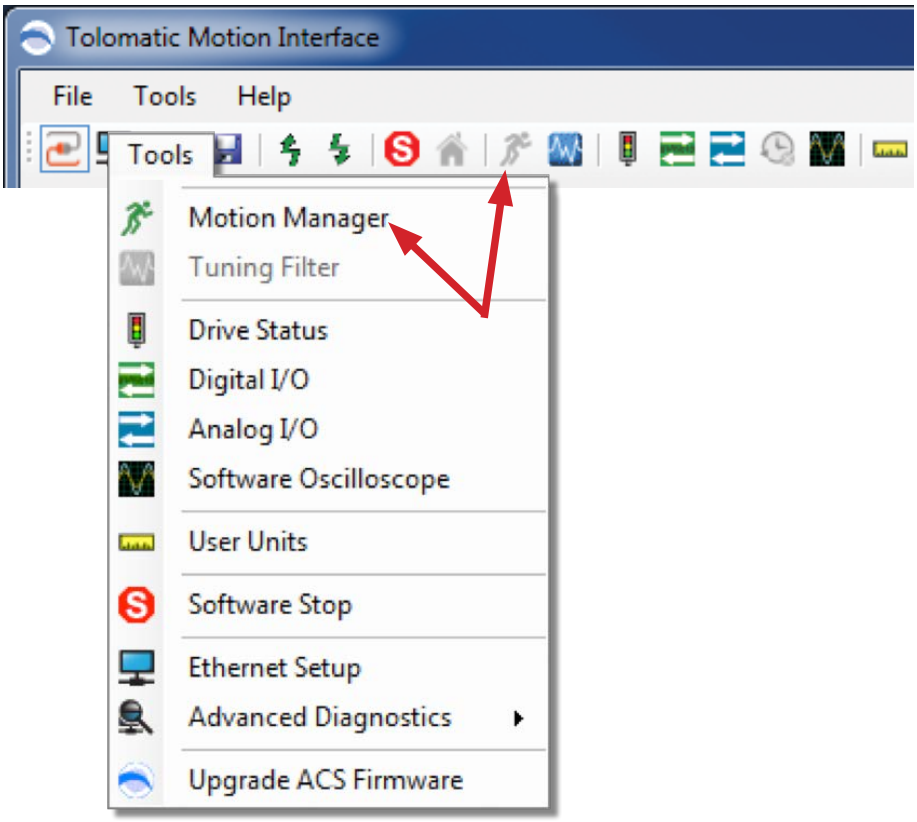


Figure 15-1: Launching the Motion Manager Tool

15.1.1 Controls

Enable/Disable: Enables or Disables drive and output to motor.

Home: Initiates Home sequence configured in Home Setup Tab.

Enabled, Homed, Motion Complete LEDs: Status LEDs.

15.1.2 Motion Profile

Position: Displays actual position from encoder or commanded position without encoder. Motion profile (Velocity, Accel, Decel, Force) per Jog, Absolute and Incremental moves in Motion Manager.

Velocity: Profile Velocity to execute

Accel: Profile Acceleration to execute

Decel: Profile Deceleration

Force: Profile Force

15.1.3 Jog

Jog Neg: Initiates a Jog Move with motion profile settings in a negative direction.

Jog Pos: Initiates a Jog Move with motion profile settings in a positive direction.

NOTE: Jog move will be initiated while Jog Neg or Jog Pos button is held down by mouse click. The jog move will stop when the mouse click is released.

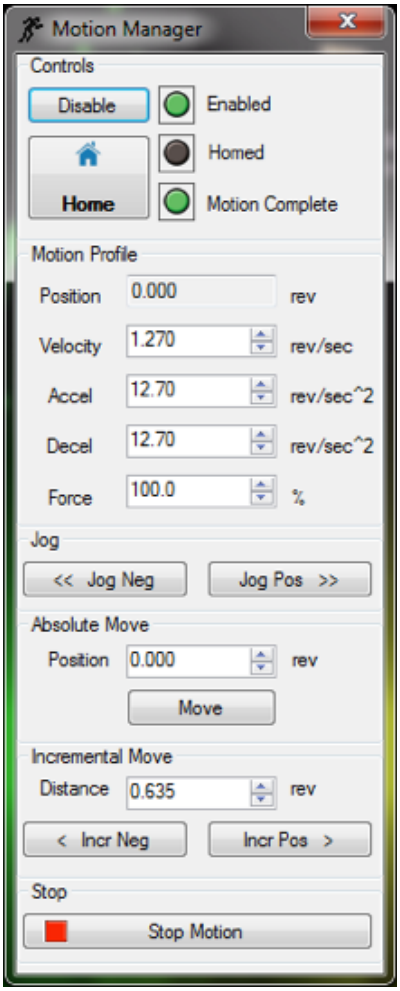


Figure 15-2: Motion Manager Panel

NOTE: Executing a "Stop Motion" during homing will stop motion and declare current postion "Home".

15.1.4 Absolute Move

Initiates an absolute move to entered position parameter with motion profile settings.

15.1.5 Incremental Move

Incr Neg: Initiates an incremental move the size of the entered distance parameter in a negative direction.

Incr Pos: Initiates an incremental move the size of the entered distance parameter in a positive direction.

15.1.6 Stop

Stops currently executing motion at profile deceleration.

Tuning Filter Tool

Tuning a servo motor is an advanced procedure. Tolomatic standard motors have predetermined tuning values that should work for most applications. Tuning should be performed when more performance is required for the application or when a new motor is added. A basic understanding of PI (Proportional Integral) Control Loops is required for tuning.

The Servo Control Loop for Position Control is made up of three separate PI loops: Position, Velocity, and Current loops. These three control loops are cascaded, meaning that the output of one loop feeds into the input of the next loop. The position loop uses profile position from the trajectory generator and actual position from the feedback device to commanded velocity. The velocity loop uses the sum of commanded velocity from the position loop and profile velocity and compares it to actual velocity to generate a commanded current. This commanded current, along with the actual current, is used to control the PWM to the bridge circuit which in turns drives the servo motor.

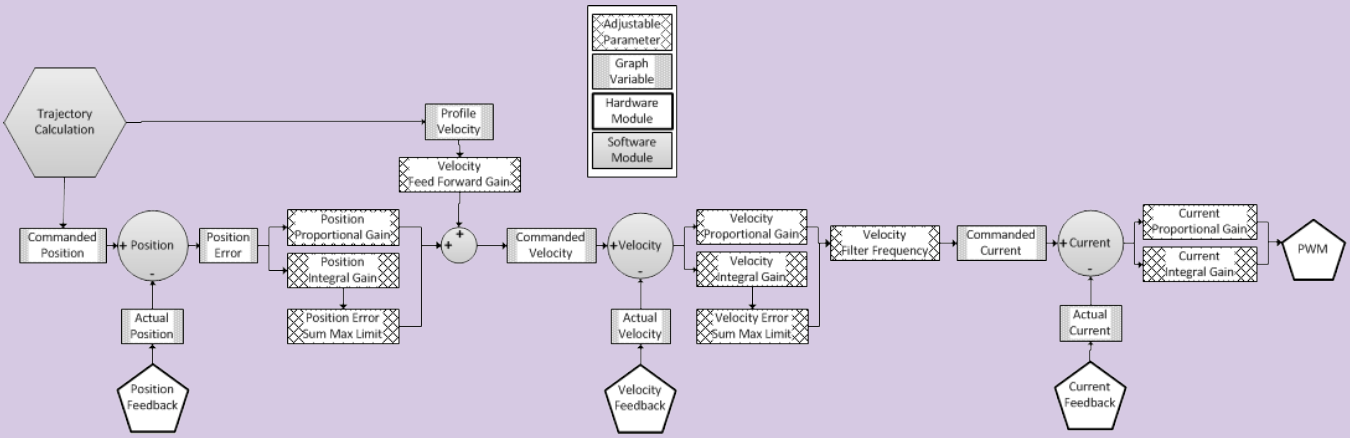


Figure 16-1: Control Loop

Each control loop corresponds to a set of tunable parameters in the Tuning Filter.

16.1 Tuning Filter Dialog

The Tuning Filter tool is broken into two distinct parts – the Parameter Adjustment pane, and the Graphing Pane. The parameters are adjusted in the left hand side of the window, and the effects can be observed on the right hand side of the window.

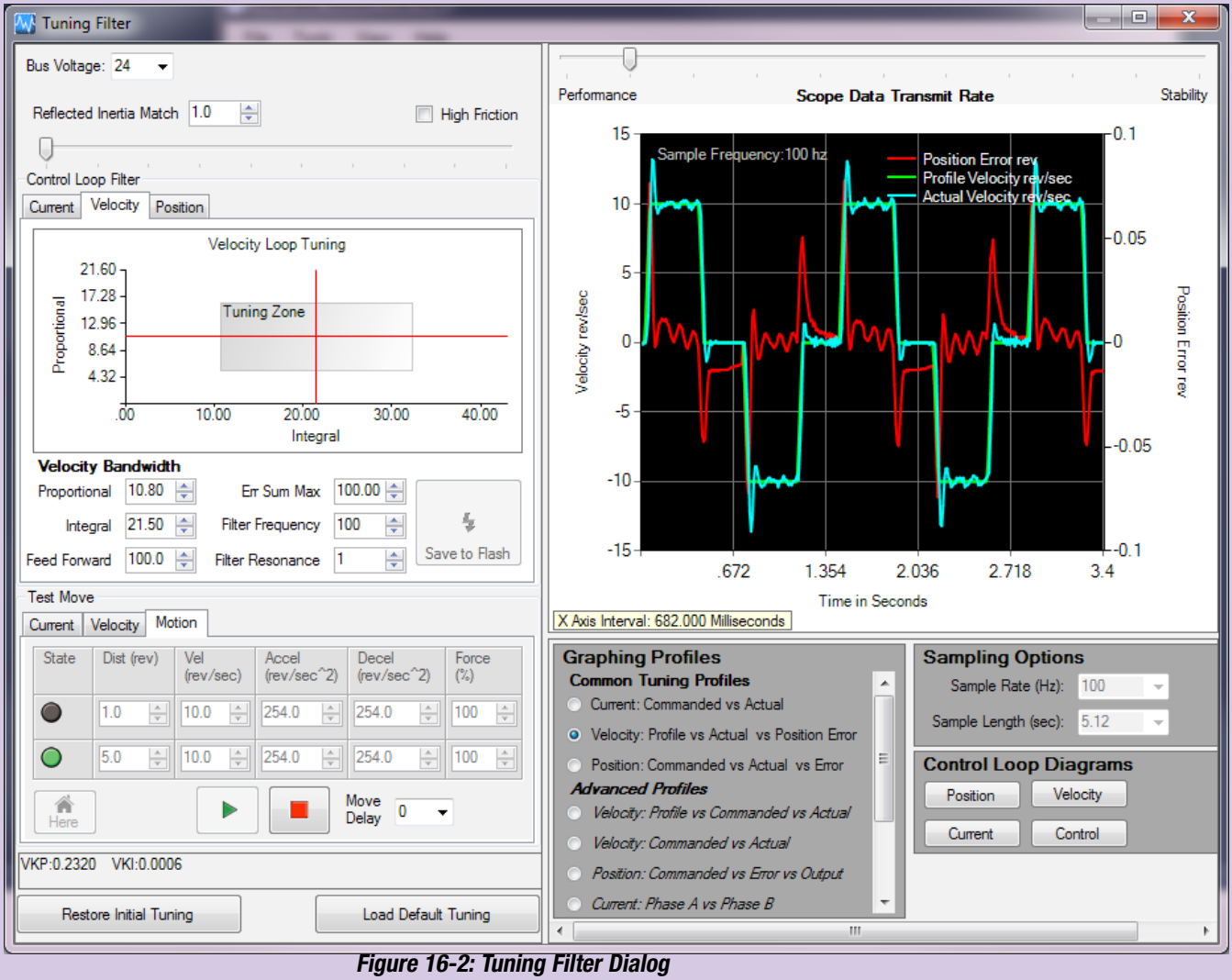


Figure 16-2: Tuning Filter Dialog

NOTE: Feed forward should be set to 100% for velocity moves.

16.1.1 Parameter Adjustment Pane

- Bus Voltage: Bus voltage of the system, typically 24V or 48V. Note: This setting affects the calculation of current loop gains.
- Reflected Inertia Match: Inertia match of the system. Note: This setting affects the calculation of velocity loop gains.
- High Friction: Gains Amplifier to be enabled for systems with high friction or drag forces that affect motion.
- Proportional Bandwidth: Proportional bandwidth value for the given PI loop (Position, Velocity, Current) used to calculate proportional gain. The value can be changed using the numeric up/down box or by clicking on the graph.
- Integral Bandwidth: Integral bandwidth value for the given PI loop(Position, Velocity, Current) used to calculate integral gain. The value can be changed

using the numeric up/down box or by clicking on the graph.

- Feed Forward: Percentage value that enables the profile velocity command to help drive the velocity loop in addition to position error.
- Err Sum Max: Percentage value that can be used to limit the amount of error calculated in the loop. Useful in limiting runaways and over corrections.
- Filter Frequency: Used to control velocity output filter (Hz), a smaller value will smooth the output.
- Filter Resonance: Used as input to velocity output filter (Hz).
- Save to Flash: Saves the tuning settings of the specific loop to internal storage on the drive so that it can be maintained when the system power cycles
- Test Move: Configures the drive for a continuous sequenced position move between two points using the user defined settings. Current tuning inputs a square wave of specified force amplitude into the current loop instead of performing a position move. NOTE: Tuning uses relative positioning. Make sure that you are aware of your actuators position with relation to its stroke length before performing any moves to prevent a crash.
- Home Here: Declares home position value of 0.0 at the current position
- Restore Initial Values: Restores to the drive the initial tuning values saved when the tool was opened. Note that is not a restore to factory defaults. In order to do this, you should run the File->Restore Drive to Factory Settings command from the TMI menu

NOTE: For the majority of setups, the user will only need to adjust the Bus Voltage and the Reflected Inertia Match slider. It is recommended that users do not modify the Current PI loop tuning parameters if using Tolomatic standard motors.

Advanced Option - Adjusting the Tuning Range Min/Max: If more range is desired, each bandwidth's combo box min/max can be adjusted by right clicking on that parameter's combo box, and selecting "Adjust Min/Max".

16.1.2 Graphing Pane

The graphing pane can display variables recorded during motion so the effects of changing tuning parameters can be seen. The drive supports a limited sized internal buffer for onboard sampling. The data is transferred after a move has completed.

- Graphing Profiles: Selectable outputs that can be graphed for analysis
- Sample Rate: Rate in Hertz at which parameters are sampled
- Sample Length: The total length of the sampling period, in seconds
- Control Loop Diagrams: Helpful diagrams that display the input and outputs of each PI loop
- Scope Data Transmit Rate: Controls speed at which scope data is transmitted from drive. In high gain systems, data transmission can cause instability.

NOTE: The linear units are always in drive default (mm), even if the user units are in inches or revolutions. This is solely for graphing speed purposes.

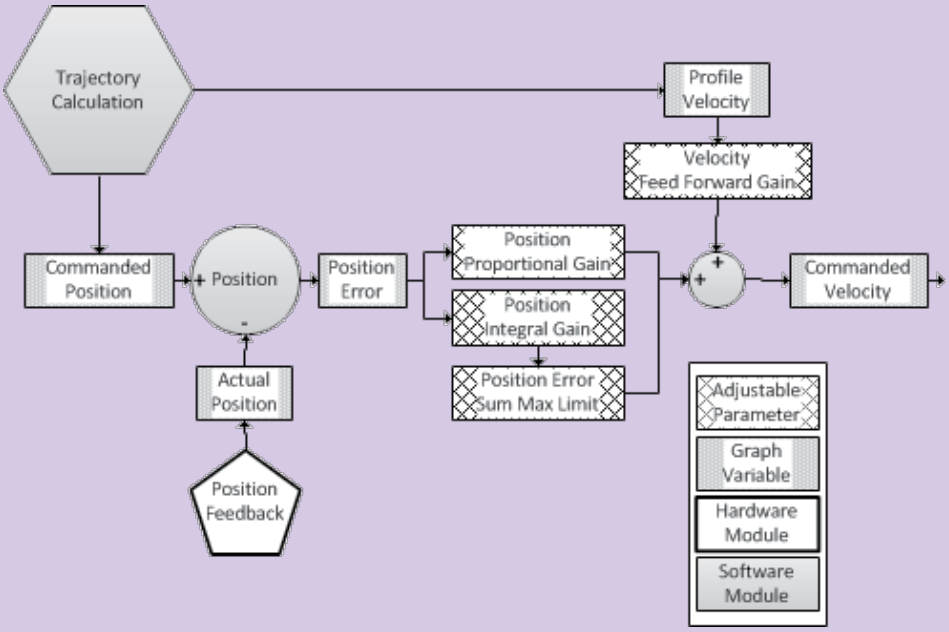


Figure 16-3: Position PID Loop

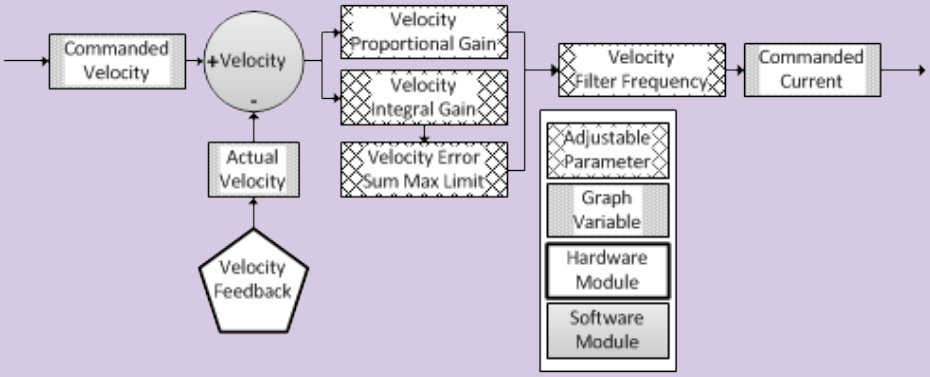


Figure 16-4: Velocity PID Loop

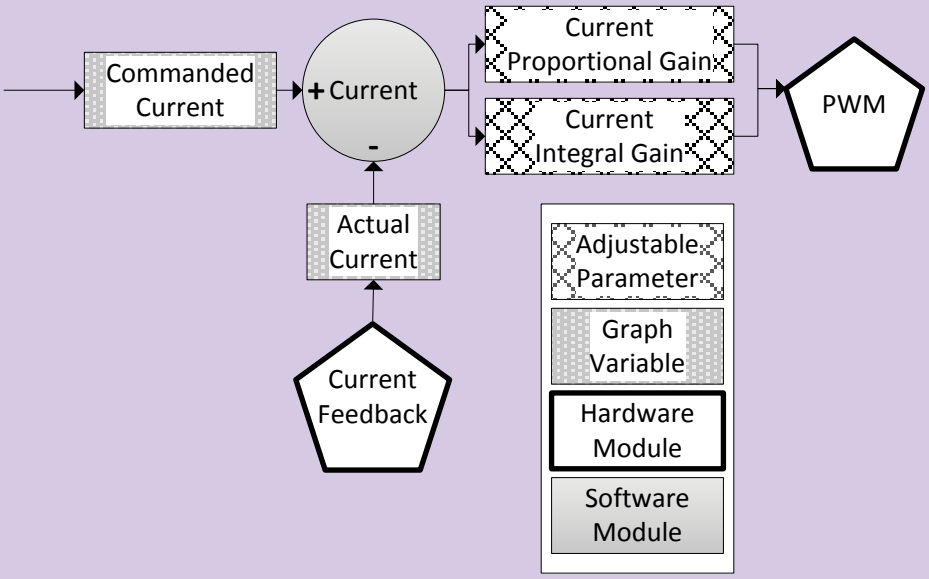


Figure 16-5: Current PID Loop

16.2 Servo Tuning using TMI – Quick Start Guide

16.2.1 Initial Tuning for Motor Power-On and First Motion

Tolomatic Motion Interface (TMI) references a motor catalog containing default tuning values for each motor option. TMI has controls that allow simple or complex tuning adjustment. During startup, use the simple adjustments. Before enabling the motor using the Motion Manager, open the Tuning window and set the bus voltage to match the drive's power supply. Note that the Reflected Inertia slider bar is set to 5. Enable the motor, if it vibrates loudly, quickly disable the motor, lower the inertia setting by 1.0 and try again. When the motor doesn't vibrate perform a simple position move to check responsiveness and stability. The Homing move can now be performed to set the actuator's zero position.

16.2.2 Quick Tuning for 80% of Applications

When the motor has been enabled, holds position, and homed, then fine tuning can be performed. In the Tuning window setup two position move profiles in the Test Move area at about one third of the applications peak velocity or try 10 Revs/Sec. Do not begin with a high speed move. Click the play button to run the two moves continuously. Now the inertia slider bar and other settings can be adjusted. The updates take effect at the beginning of the next move. If a fault such as Position Error occurs then temporarily set the fault limit to a larger value in the Safety/Limits Tab until the unit is tuned.

Next, select Velocity radio button under Common Tuning Profiles. When the motion sequence is running begin adjusting the Reflected Inertia Match left or right. Try to make the Actual Velocity follow tightly to Profile Velocity. Keep any overshoot to less than 10%. Also, try adjusting velocity feed forward gain between 75 and 100%. Lastly, click on the Position tab and adjust position proportional gain up or down (try going from 12 to 6 or 20). A higher position gain will reduce position error but may lead to vibration. To reduce vibration either slightly decrease the Inertia or reduce the position gain. Lowering position gain may provide smoother motion but also may require increasing the Inertia to regain stiffness.

Now run the motion profile desired in your application. Run through the above adjustments again until motion is acceptable. Save setting to Flash memory and continue with drive setup. The scope's auto-zoom may make motion look worse than it is at times. Check the axis units if in doubt. Look visually for smoothness and listen for audible characteristics.

16.2.3 Common Tuning Adjustments

Slow move with small position error – turn up the position proportional gain. If it becomes unstable reduce the Reflected Inertia value. Adding mechanical inertia can help reduce the velocity ripple. If the position error does not trend toward zero during the motion then increase position integral gain.

Fast smooth move – the velocity loop should be tuned stiff (turn up Reflected

Inertia to just before it vibrates or all the way to 10 if it never vibrates) and reduce position proportional gain, try around 6. Try 100% on Velocity Feed Forward gain.

High friction system – this usually requires more velocity integral gain. First try selecting the checkbox for High Friction. This amplifies both proportional and integral gains automatically to drive harder through the friction. Adjust the Inertia slider.

High inertial load – this is difficult and can sometimes respond opposite as expected. First try adjusting the Inertia slider up and down to get controlled motion. Be careful, a large load can begin to oscillate out of control. Find your upper and lower limits in the Inertia, and set somewhere in the center. Next adjust position proportional gain up and down based on how the motion reacts. Start with lower accel/decel values. High inertia combined with high accel/decel can cause back-emf which can fault the power supply. If this occurs, either a voltage clamp or an adjustment to the motion profile is required.

Low inertia, low friction load – the Inertia setting should be set around 1-3 such as the case for driving the motor with no load attached. High friction checkbox should be unchecked. This is a difficult to tune scenario because there is not much inertia to keep the motion smooth and motor torque ripple can be noticeable. For smoothness at mid to higher speeds, reduce position proportional gain (try 2-4), set velocity feed forward to 100% to drive more with the velocity profile signal. Test various Inertia settings. For tight position control and/or lower speeds, try increasing the position gain to drive more with the position profile signal.

Motor sounds crunchy when holding position – this is from stiff tuning and updates in velocity feedback signal are amplified through the control loops, try reducing the Filter Frequency on the Velocity tuning tab to 50-200 range.

Motor is chirping or whining – soften the current gains, try the lower left corner of the Tuning Zone. Make sure the bus voltage setting is correct for your power supply. Also try softening the current loop (lowering the current proportional and integral gains). Enabling Eco-Mode (Safety/Limits Tab) can also help with this scenario.

Gearbox reduction – Start with a low Inertia setting of 1-3. A gearbox reduces the reflected inertia by the square of the gear ratio. With light loads this acts like a motor with no load attached and needs low gains. Any amount of backlash would also require low gains.

16.2.4 Advanced Tuning for Demanding Applications

The proportional and integral loop gains can be adjusted independently beyond default values to obtain tuning that the Inertia slider bar and High Friction checkbox cannot achieve.

Note: To reset tuning values to factory settings, click the Load Default Tuning or Restore Initial Tuning buttons and the bottom of the screen.

Tuning Order: Always tune current loop first (usually this is not necessary as it is already pre-tuned at the factory) followed by the velocity loop, and last the position loop.

Effect of Gains: Generally, an increase in proportional gain makes the motor react faster to a change in the trajectory signal, adjusting too high will cause overshoot and fast oscillations. An increase in integral gain reduces steady-state error (constant trajectories), too much will cause large sinusoidal oscillations.

Repeatable Method: For the loop being tuned, turn integral gain off or almost off, then while running the motion sequencer, turn up proportional until the motion starts to oscillate hard and become unstable. Then take that value multiply it by 0.4 and use that value. Then begin turning up integral gain until the desired steady-state error is reached.

Velocity motion for Fine-Tuning the Velocity Loop

The velocity loop and velocity feed forward signal typically has the greatest effect to drive the motor when under high load; so it's important that this loop is tuned well. To tune velocity loop with the above Repeatable Method, it is often useful to run the velocity move type that generates an ideal velocity command using a square wave and monitors position to keep it in actuator's stroke range. It removes the position loop output from driving the velocity. This option is only available when actuator type is set to rotary (Actuator Tab). If you are tuning a linear actuator then temporarily set the actuator type to rotary and setting the stroke limit in the Safety Limits tab. **Caution: this motion has fast deceleration and can cause significant voltage spike on some power supplies, a voltage clamp is recommended.**

Attach the application load and set the Inertia value to 10. Slowly jog actuator to center position of the stroke before starting this velocity tuning method. Set the velocity to 15-20% of the motor's max RPM or lower if your system is speed sensitive. Set the distance to stay within the stroke limit. Set the Velocity Feed Forward and Force to 100% so the speed will reach profile values. Click Play button and tune using the Repeatable Method above. When finished, test a position move. A position move may be very stiff at this point, just decrease the Inertia setting a bit. Click Save to Flash button and File->Save As to save a drive setup .xml file that can be loaded onto other drives.

16.2.5 Troubleshooting

Motor makes chirping sound - Check the Bus Voltage setting. If set to 24V and the supply is 48V the motor will have a chirping sound.

Vibrating – The motor is tuned too stiff or there is excessive backlash in the system between the motor and the load. An attached gearbox may require a lower Inertia setting.

Sluggish – The system may have high friction or drag or heavy load. Turn the Reflected Inertia setting up. If still sluggish at 10 setting then check box for High Friction. If still sluggish, start moving the velocity gain up and to the right on the graph in the Tuning Zone area.

16.3 Gain Adjustments and Effects

The following section describes generally what each gain adjustment does with relation to motion using the Tuning Filter dialog.

16.3.1 Position Proportional

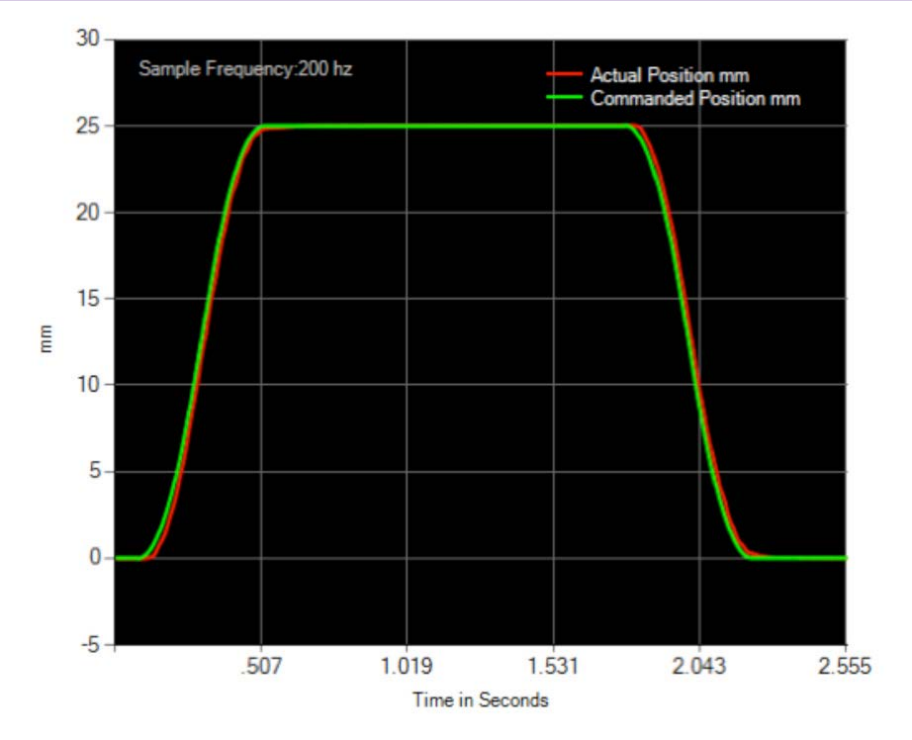


Figure 16-6 – Good Position Proportional Gain

A good position proportional gain setting should follow the position profile closely without much overshoot. This gain affects how quickly the control loop can follow a fast change in commanded position.

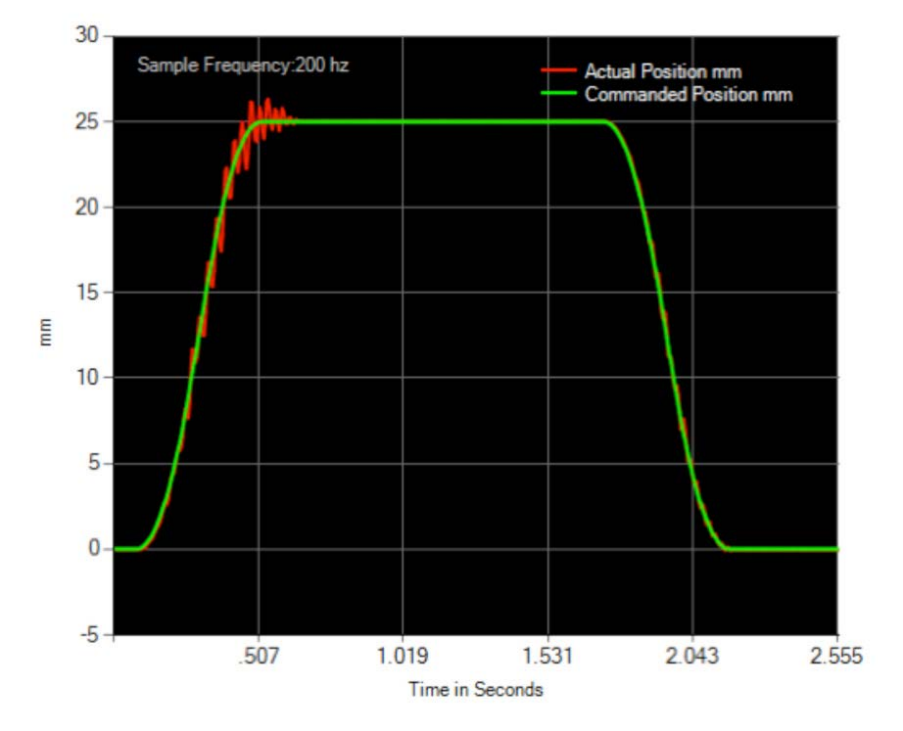


Figure 16-7: Position Proportional Gain - Too High: Oscillations

Figure 16-7: Generally the higher the proportional gain the faster the control loop

can follow a fast change in the position command. A Position proportional gain too high can create oscillations and rough motion.

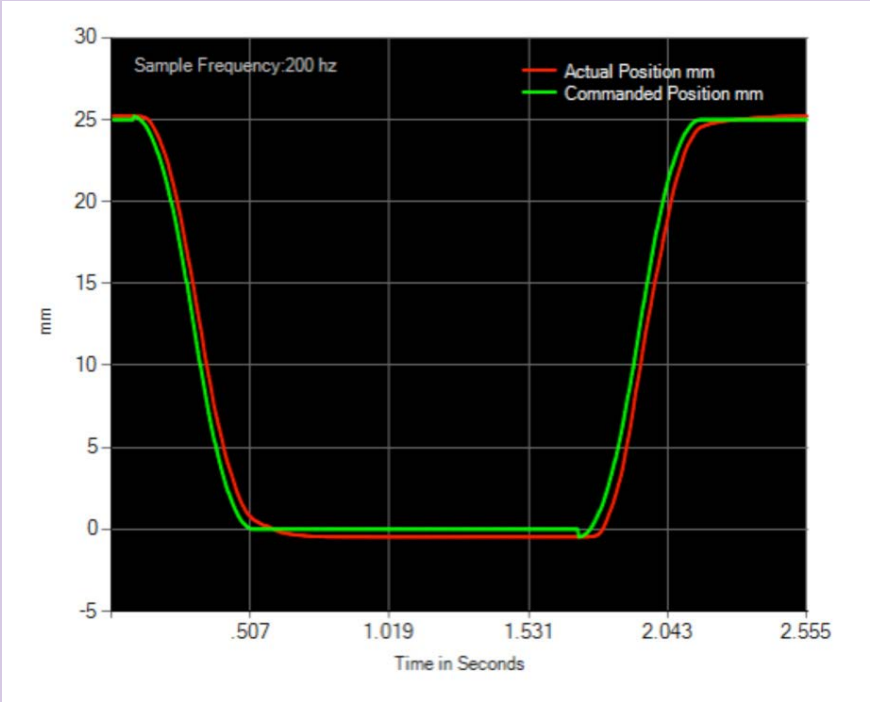


Figure 16-8: Position Proportional Gain - Too Low: Large Position Error

Figure 16-8: Position proportional gain too low can be sluggish and fall behind the desired motion profile. Falling behind creates position error that can accumulate during the move and then take a while to wind down causing an overshoot of the desired position.

16.3.2 Position Integral

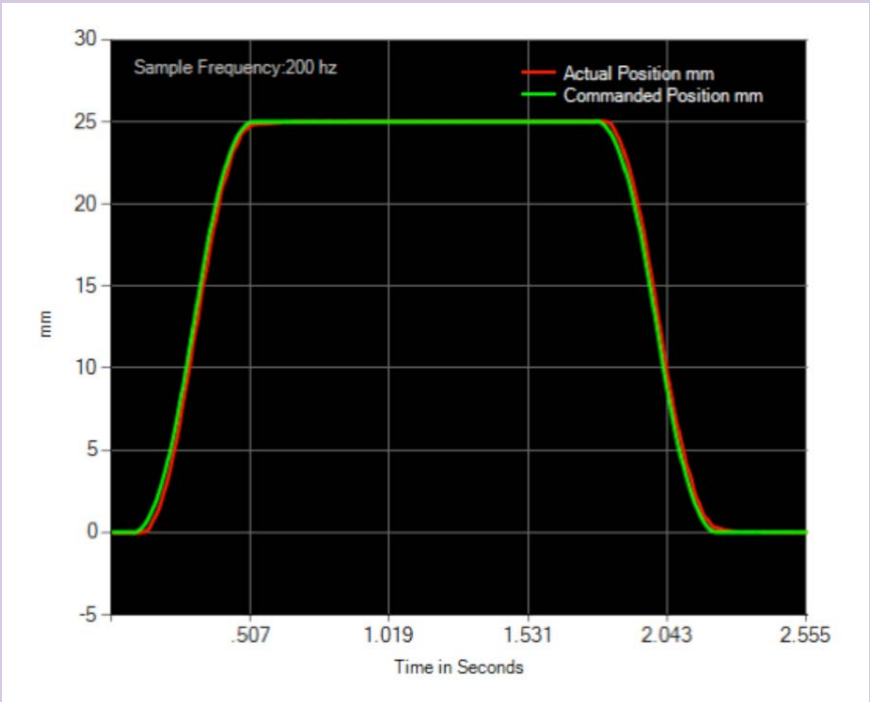


Figure 16-9: Good Position Integral Gain

Figure 16-9: A good position integral gain setting should follow the position profile closely without much overshoot and it should settle to a steady state position equal to the commanded position.

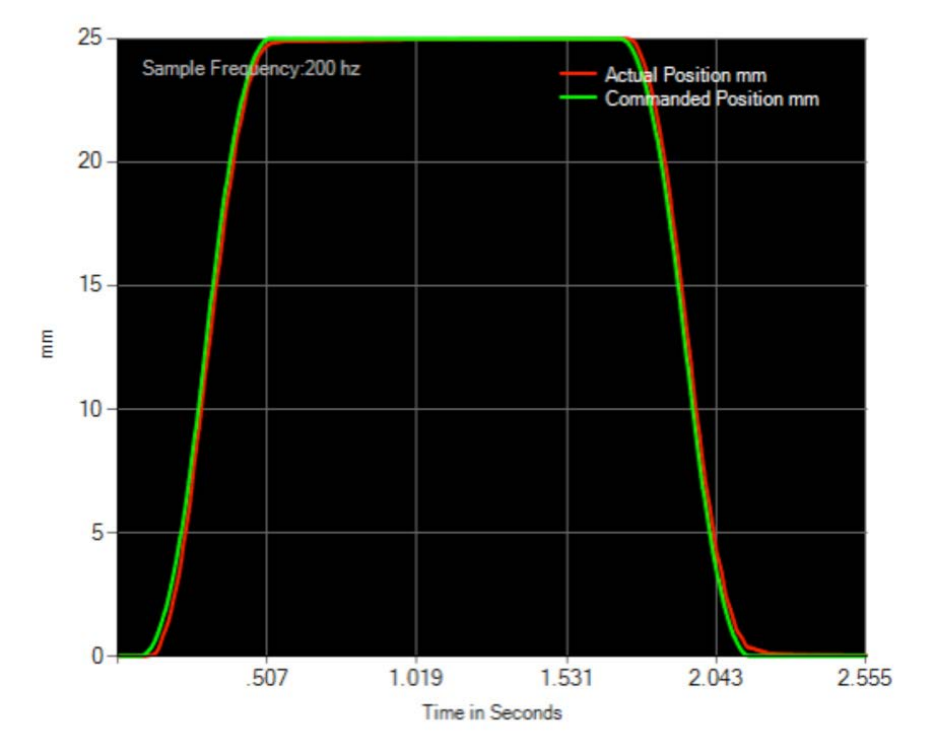


Figure 16-10: Position Integral Gain – Too Low: Slow steady-state response

Figure 16-10: A position integral gain set too low can increase position error during motion and slow the steady-state response of seeking the final position value.

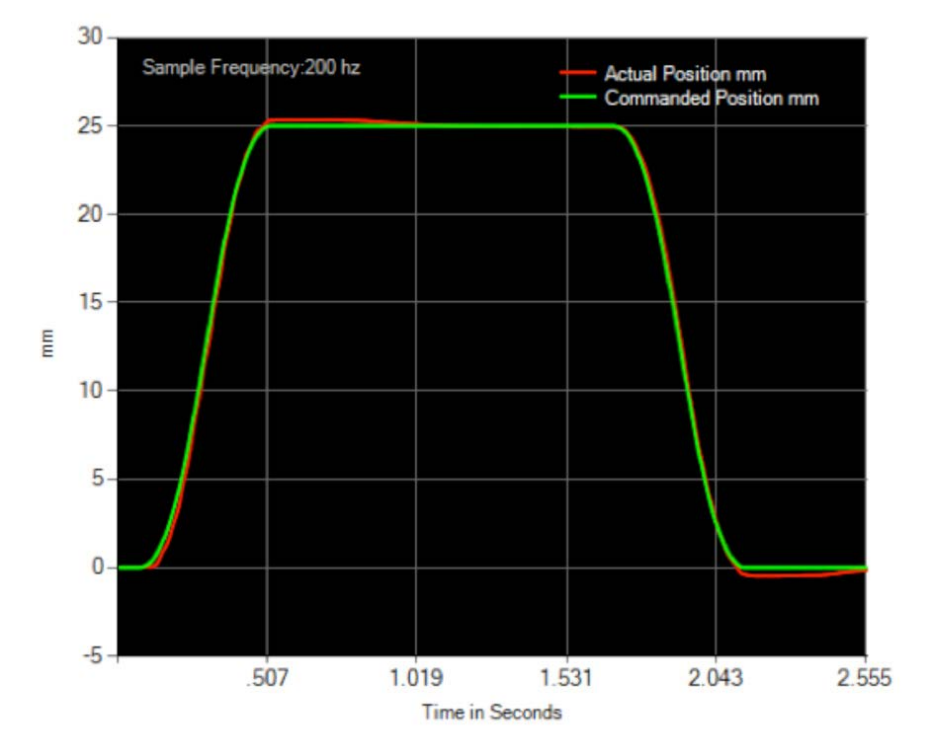


Figure 16-11: Position Integral Gain - Too High: Overshoot which gets corrected over time

Figure 16-11: A high position integral setting can accumulate error during the move and cause too much overshoot of the final position. Some overshoot oscillation can occur also.

16.3.3 Velocity Proportional

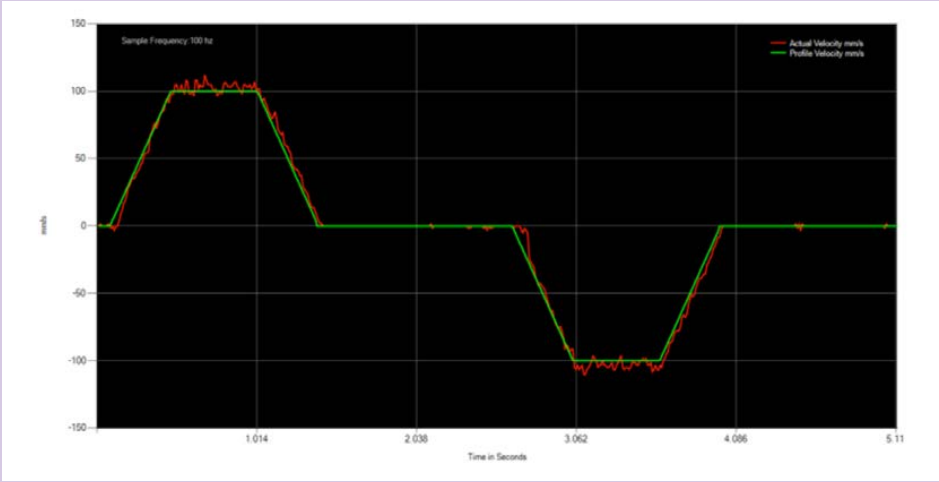


Figure 16-12: Good Velocity Proportional Gain

Figure 16-12: A good velocity proportional gain should create quick loop response to a fast change in velocity. Proportional gain will affect mainly the rising and falling slopes of the velocity profile.

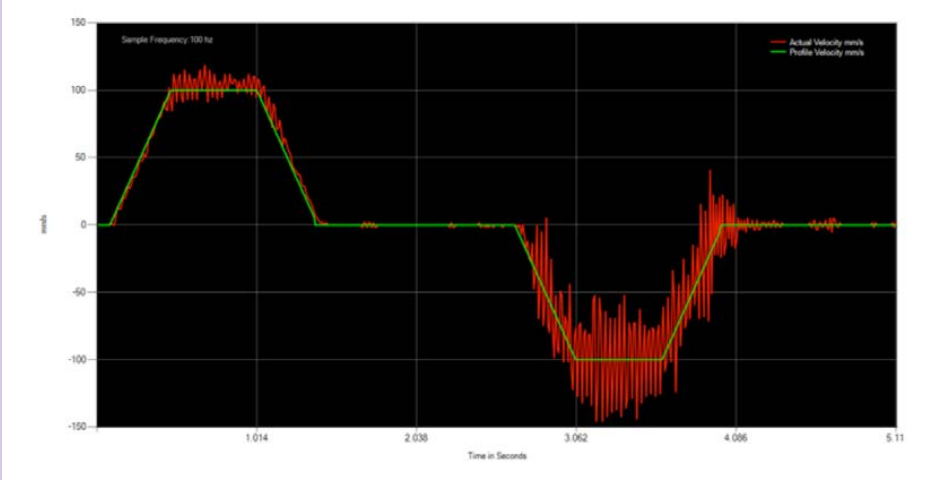


Figure 16-13: Velocity Proportional Gain - Too High: Large Oscillations in Velocity

Figure 16-13: Setting velocity proportional gain too high can result in large oscillations in velocity during a move.

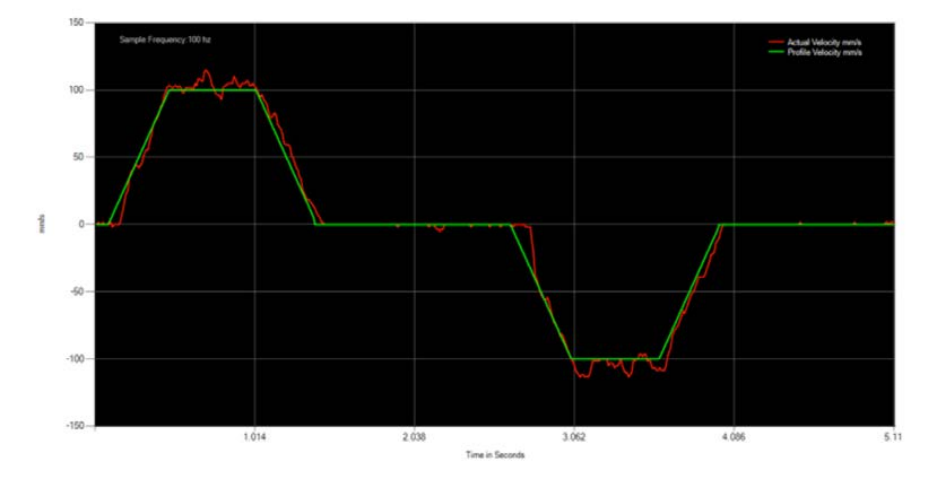


Figure 16-14: Velocity Proportional Gain - Too Low: Slow Velocity Response

Figure 16-14: Setting a velocity proportional gain too low can result in sluggish response to changes in velocity. It may not even reach the commanded velocity value.

16.3.4 Velocity Integral

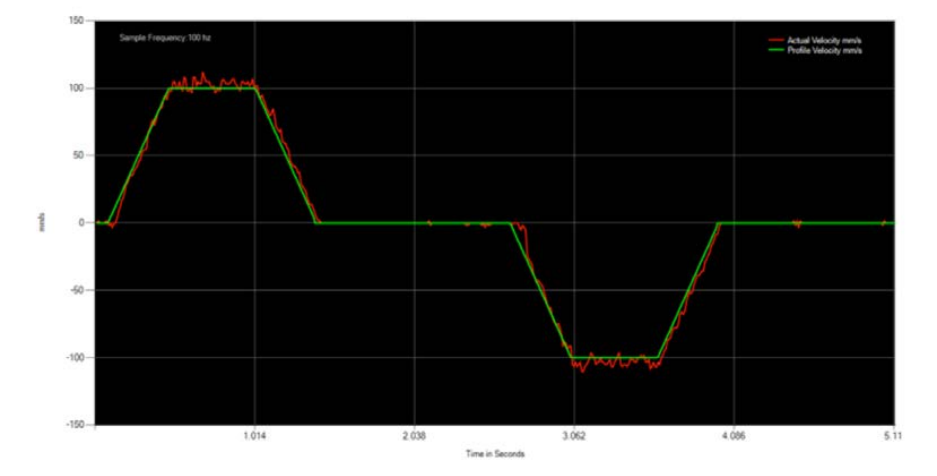


Figure 16-15: Good Velocity Integral Gain

Figure 16-15: A good velocity integral setting will help reduce the error in the constant velocity section of the velocity profile.

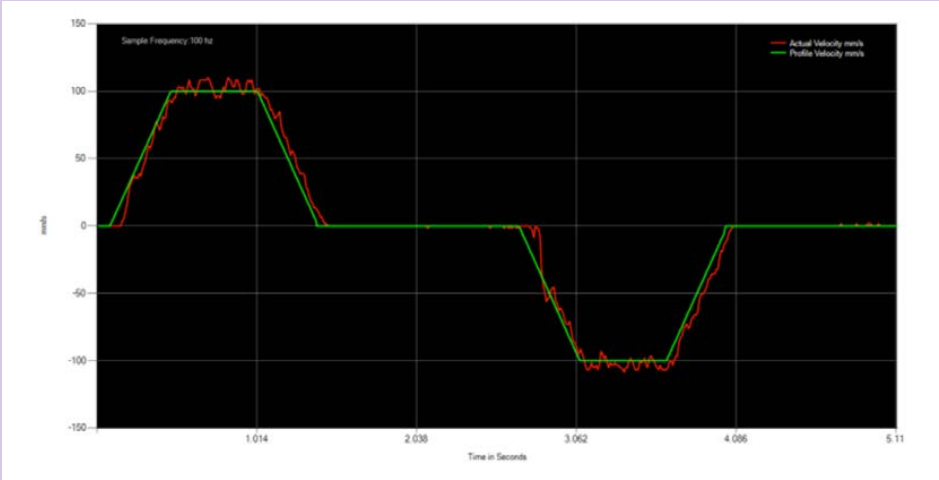


Figure 16-16: Velocity Integral Gain - Too High: Oscillations

Figure 16-16: Setting the velocity integral gain too high can cause oscillations in the constant velocity section of the velocity profile. It can increase the velocity overshoot.

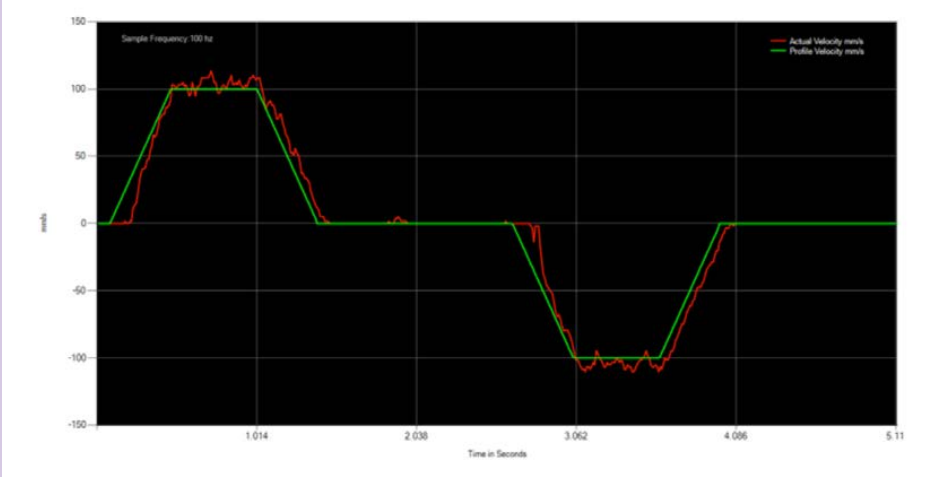


Figure 16-17: Velocity Integral Gain - Too Low: Steady-state velocity error

Figure 16-17: Too low of velocity integral gain will result in the loop not tracking to desired velocity resulting in steady-state velocity error.

16.3.5 Velocity Feed Forward

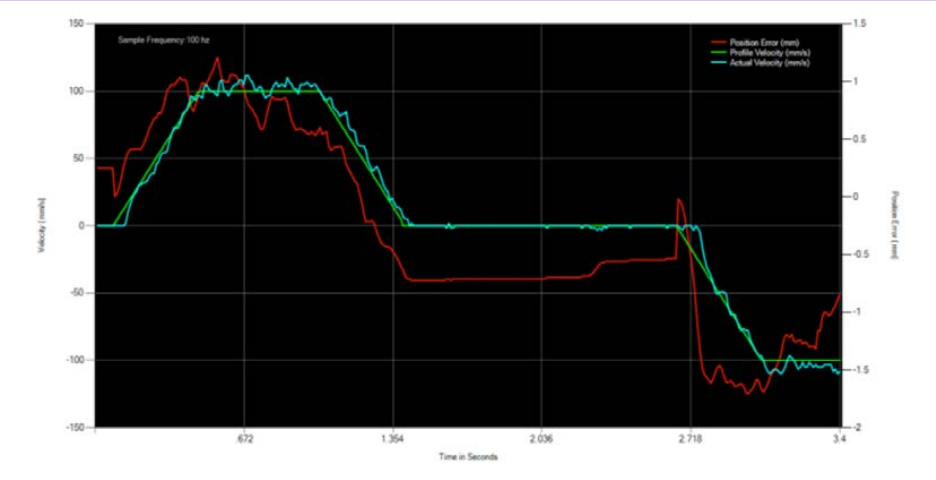


Figure 16-18: Default Velocity Feed Forward Gain (75%)

Figure 16-18: To increase performance and lessen the burden of control on the position loop, a velocity feed-forward (VFF) gain as an input to the velocity loop. Generally this value should not need to be adjusted much from the factory default setting.

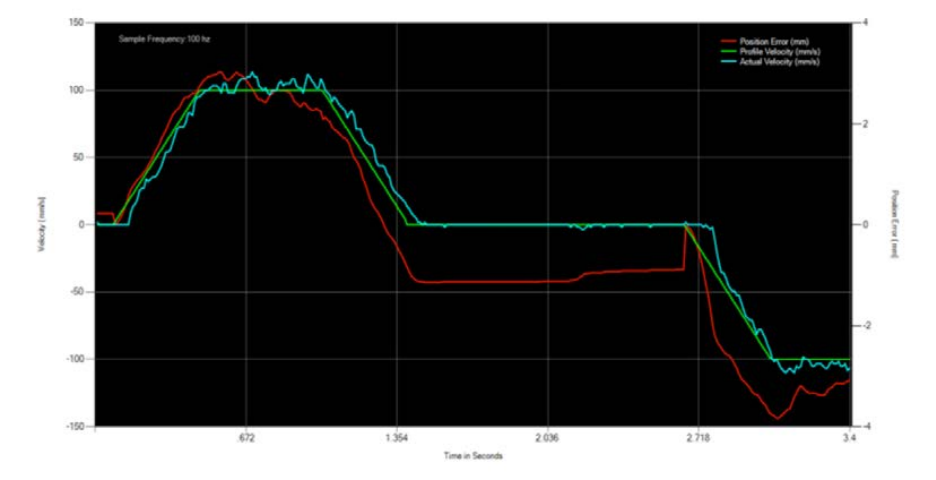


Figure 16-19: Velocity Feed Forward Gain (0%) - Higher Position error, higher velocity error

Figure 16-19: Decreasing the VFF gain or setting it to zero will cause the control response to be very sluggish. A higher position loop gain may be needed to get acceptable motion. The maximum velocity achievable may be reduced based on the position loop gains. Position and velocity error will increase.

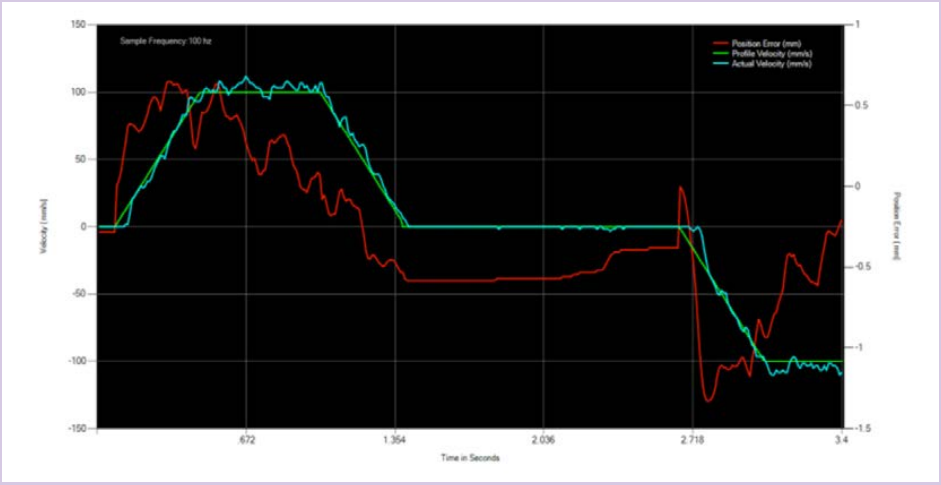


Figure 16-20: Modified Velocity Feed Forward Gain (100%) Low position and velocity error, causes overshoot

Figure 16-20: Too much VFF gain will cause velocity overshoot and possibly position overshoot.

16.3.6 Current Proportional

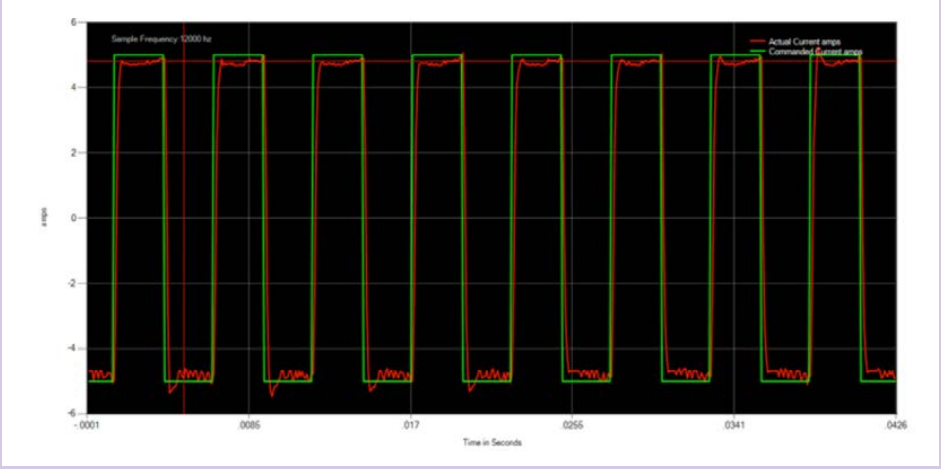


Figure 16-21 - Good Current Proportional Gain

Figure 16-21: A good current proportional gain setting will have a fast response to changes in current command.

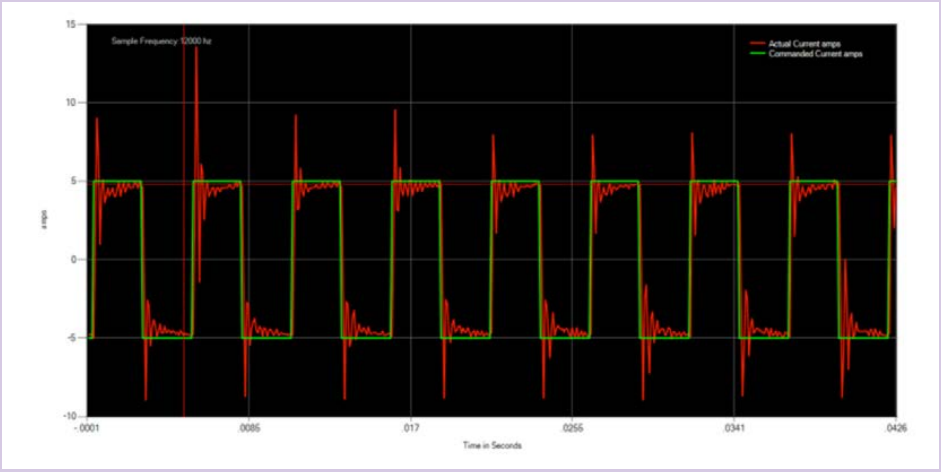


Figure 16-22: Current Proportional - Too High: Visible Oscillations

Figure 16-22: Setting the current proportional gain too high will cause high overshoot and oscillations in response to fast changes in current command.

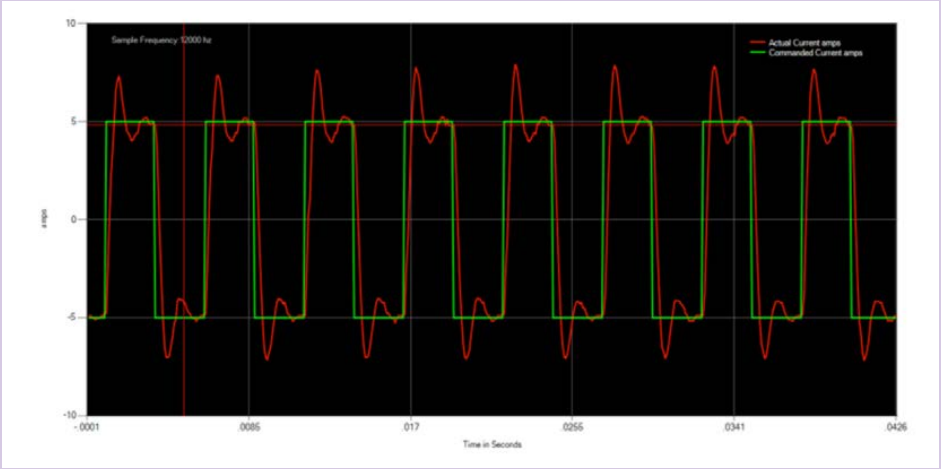


Figure 16-23: Current Proportional - Too Low: Sluggish Response

Figure 16-23: Setting current proportional gain too low will cause sluggish response to changes in current command.

16.3.7 Current Integral

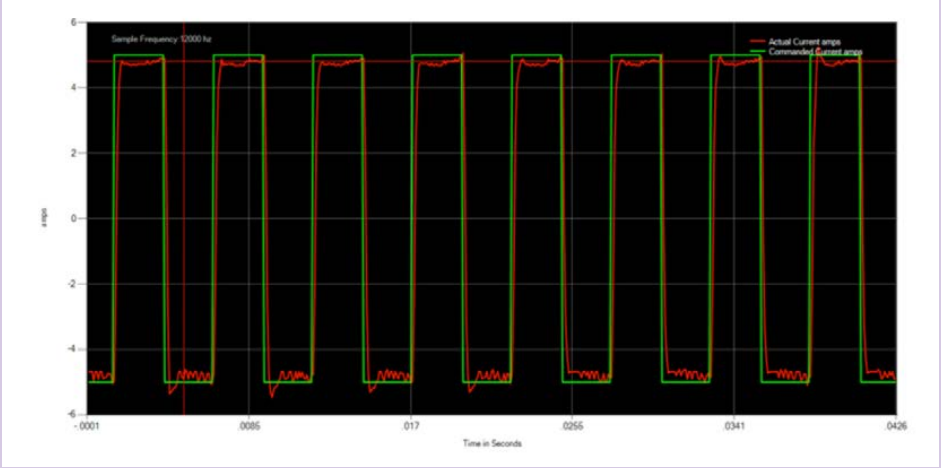


Figure 16-24: Good Current Integral

Figure 16-24: Good current integral gain should reduce steady state current error.

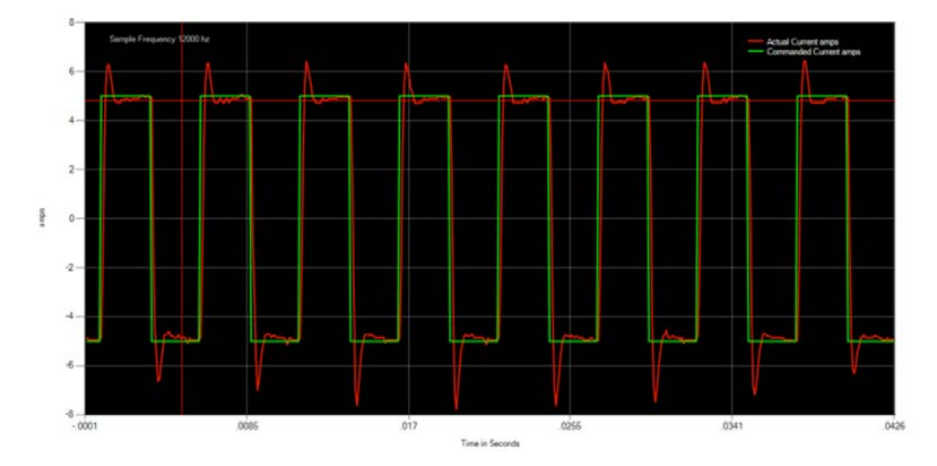


Figure 16-25: Bad Current Integral - Too High: Large Overshoot and oscillations

Figure 16-25: Too much current integral gain will cause large overshoot spikes in current and oscillations to occur

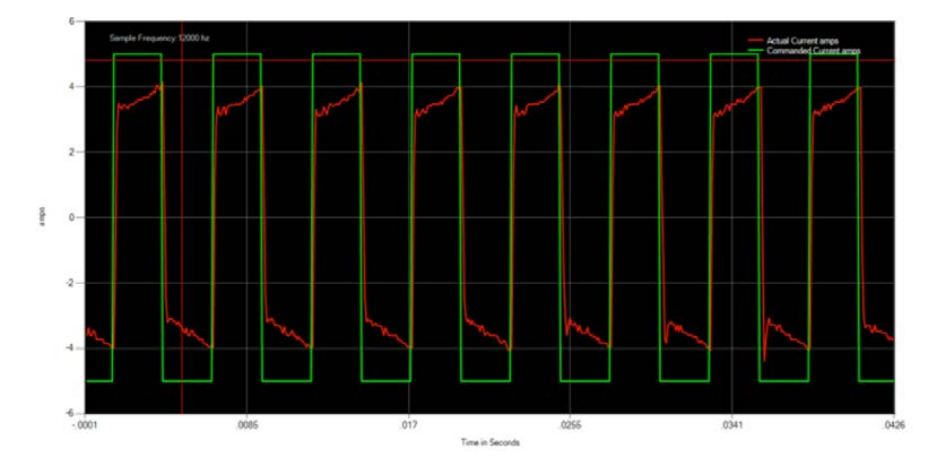


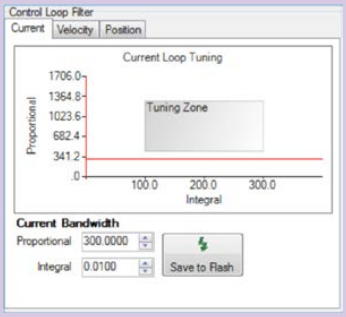
Figure 16-26: Bad Current Integral - Too Low: Actual not reaching commanded

Figure 16-26: Too little current integral gain will have large steady state current error.

16.3.8 Current Tuning

The user should not need to touch the current tuning gains for Tolomatic motors. However, if the need should arise, the following method can be used to tune the current loop.

Step 1: Set Integral Gain to 0, and set proportional gain to about 300



Step 2: Set Step force to 30% and start the Test Move

This will inject a 100 Hz commanded current square wave directly into the current loop to see how the control loop response to an ideal step input signal. The gains should be adjusted to make the actual current fit closely to the commanded current with little overshoot and steady-state error.

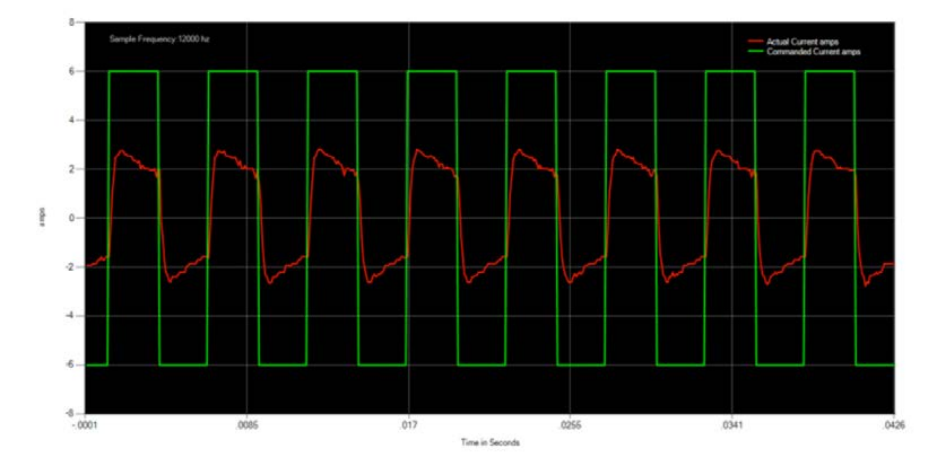


Figure 16-27: Current Loop Starting Point

Step 3: Increase Proportional Bandwidth until visible oscillations appear.

About 3-4 oscillation periods should be visible after the edge of the step input signal.

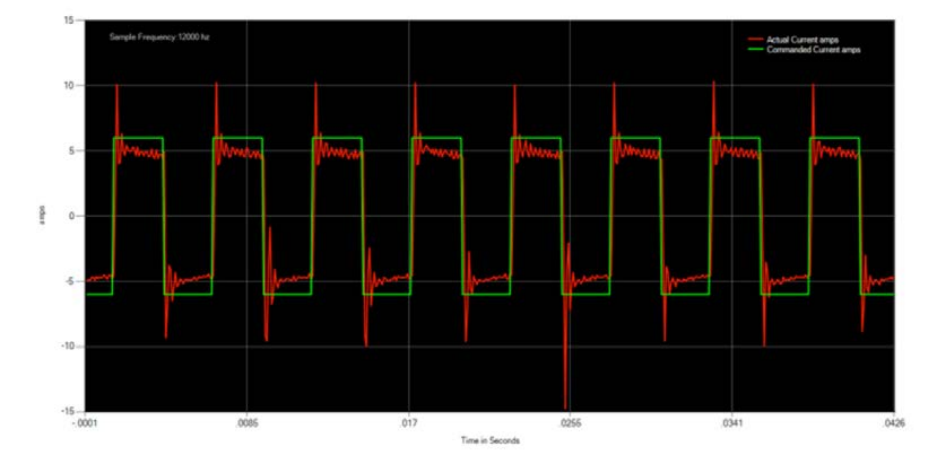


Figure 16-28: Current Loop Tuning - Proportional Bandwidth Oscillations

Step 4: Set Proportional Bandwidth to 40% of the oscillation bandwidth.

In our example, we saw oscillations at a bandwidth of 1931.18. 1931.18 x .40 = 772.472

Step 5: Increase Integral Bandwidth slowly until desired response is reached.

This starting point is as follows, with integral set at .01:

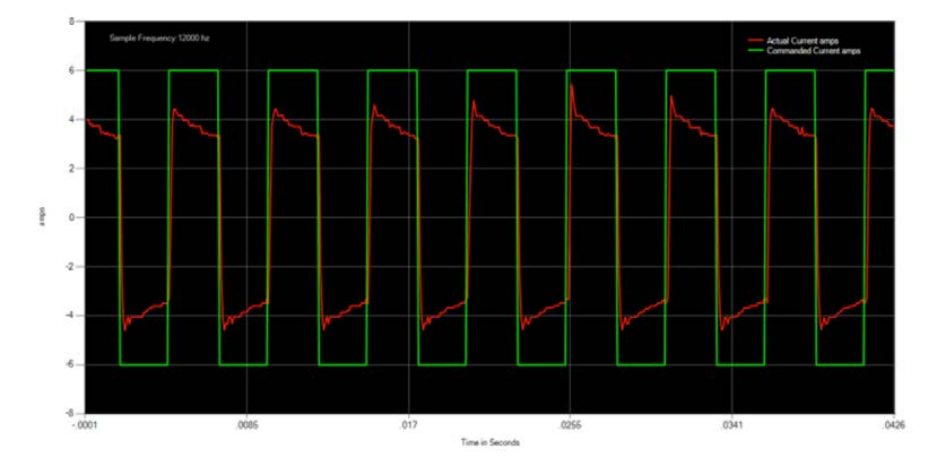


Figure 16-29: Current Loop Tuning - Integral Bandwidth @ .01

As you increase, the level of the signal will rise. Try to keep the overshoot under 10%.

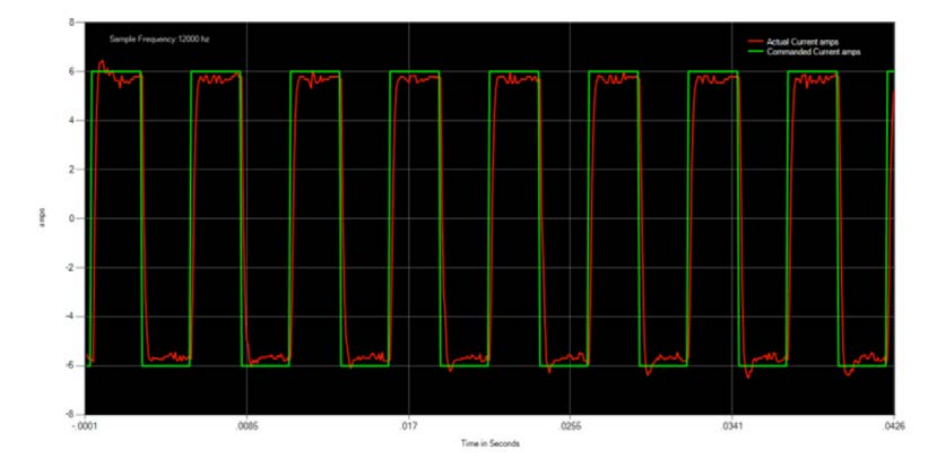


Figure 16-30: Current Loop Tuning - Integral Bandwidth @ 180

17.1 Using the Digital I/O Tool

The Digital I/O tool is launched from the Tools Menu in the TMI interface menu bar or the Tool Bar. This tool shows the current status of the physical I/O interface. The description of each input and output is dependent on the I/O configuration from the I/O Tab (see Section 10: I/O Tab)

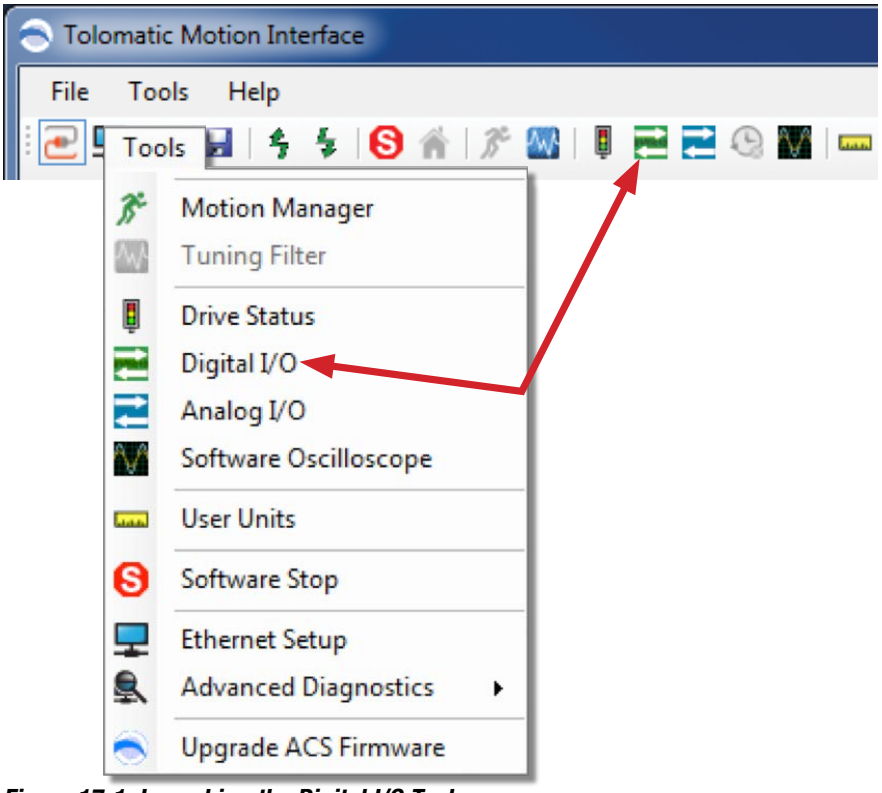


Figure 17-1: Launching the Digital I/O Tool

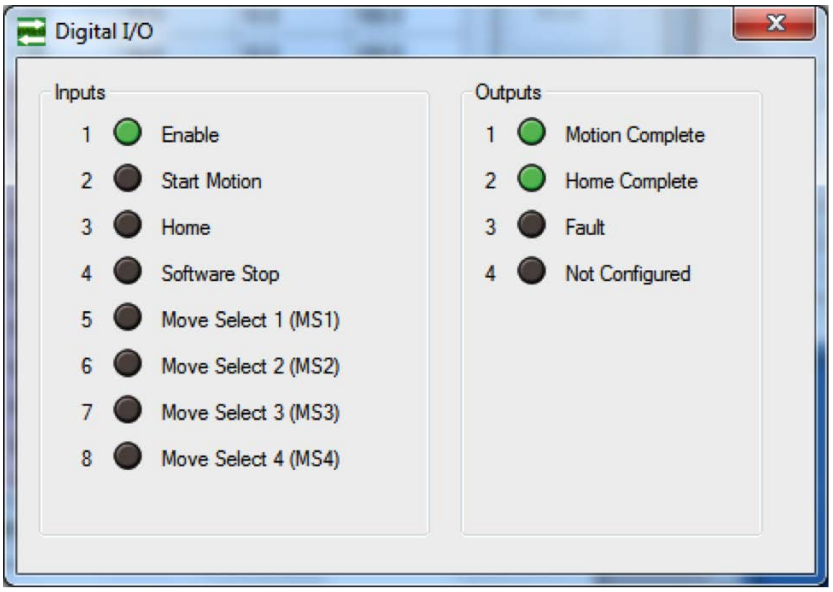


Figure 17-2: Digital I/O Tool

18.1 Using the Analog I/O Tool

The Analog I/O tool is launched from the Tools Menu in the TMI interface menu bar or the Tool Bar. This tool shows the current status of the physical Analog I/O interface. The units will be Volts or mAmps as determined by the Analog Position Settings (see Mode Select tab Section 9.1)

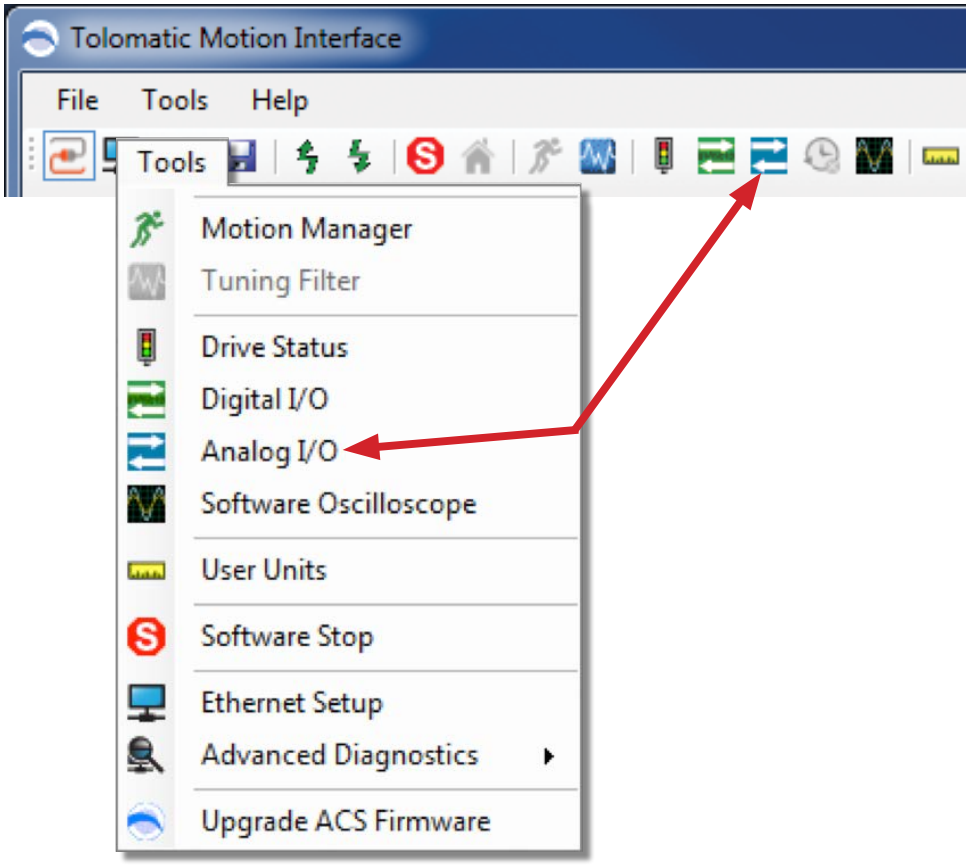


Figure 18-1: Launching the Analog I/O Tool

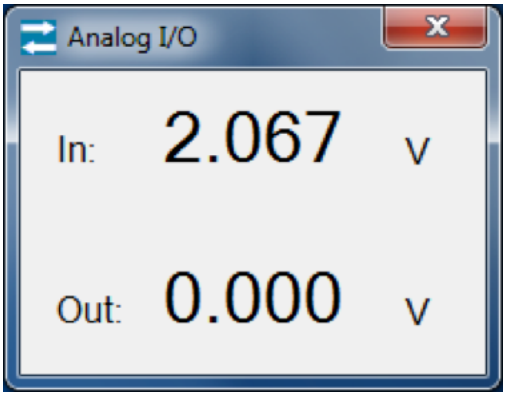
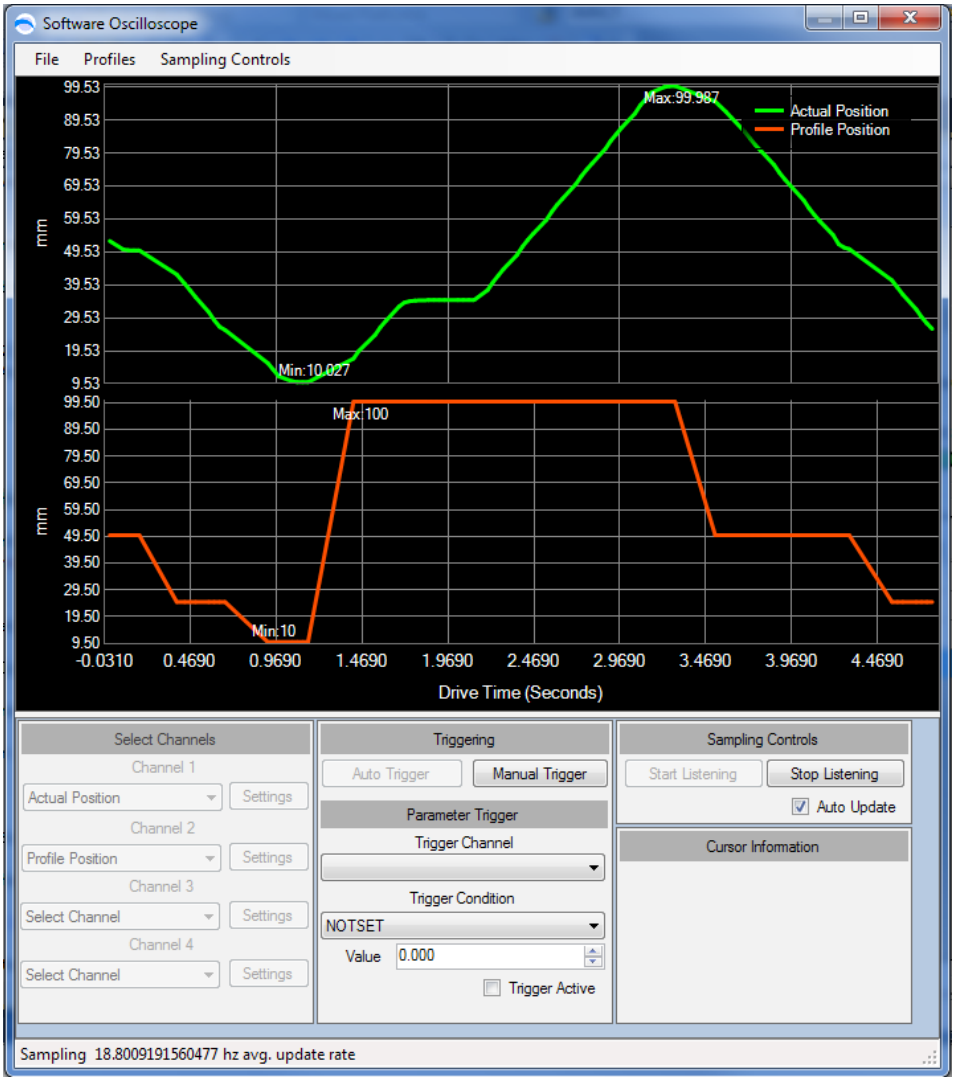


Figure 18-2: Analog I/O Tool

The Software Oscilloscope uses the USB communications interface to continuously poll user selected parameters. This tool is useful for live system debugging where a lower update rate is acceptable (~15-25ms).



19.1.1 Select Channels

- Channel 1-4: User selectable parameters (up to four) to display
- Channel Settings: Channel specific configuration items

19.1.2 Triggering

- Auto Trigger: Continuously polls the drive and automatically updates the graph as data arrives. Performs the same function as Auto Update + Start Listening
- Manual Trigger: When Listening, Manual Trigger triggers the start of a sample, and will display the data after the sampling has completed

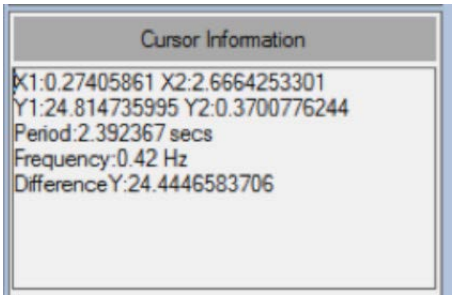
19.1.3 Parameter Trigger (Offline Sampling Only)

- Trigger Channel: The user selected channel to use as a trigger input
- Trigger Condition: A conditional statement to be used in conjunction with Trigger Channel and Trigger Condition Value. For instance if the Trigger Condition is “LESSTHAN”, sampling would occur when Trigger Channel is less than the Condition Value.
- Trigger Active: Activate the triggering condition

19.1.4 Sampling Controls

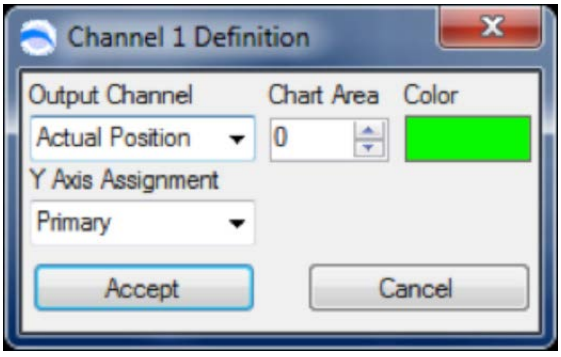
- Start Listening: Start polling the drive for the selected channels. Used in conjunction with Triggering. When a trigger is detected, the sampling queue fills and is displayed when the queue is filled
- Stop Listening: Stops the drive polling and prevents the currently displayed data from being overwritten
- Auto Update: When listening, the trigger condition will be constantly true, forcing the queue to be updated and graphed continuously

Cursor Information displays data to the user when the user clicks on two different places in a graph. This will display X and Y values as well as distance and time between the two mouse clicks.



19.2 Channel Definition Window

Accessible from the Channel Settings button

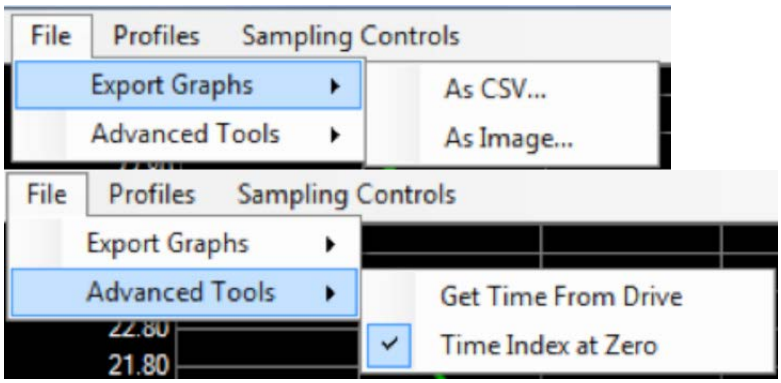


- Output Channel: Selected parameter for the channel
- Chart Area: Assignable to a specified chart area (0-3). It is possible to have multiple channels graphing to the same chart area

- Color: User definable channel color
- Y Axis Assignment: Useful for graphing multiple parameters that require different scaling
  - o Primary: Left Y Axis
  - o Secondary: Right Y Axis

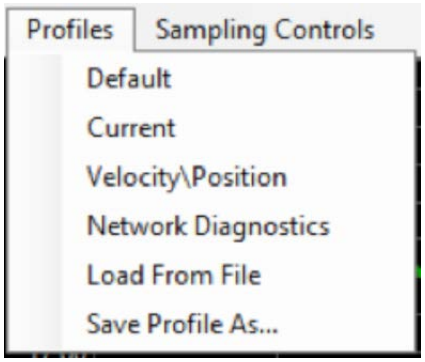
19.3 Menu Strip

19.3.1 File



- Export Graphs
  - As CSV: Exports the data displayed in a CSV format
  - As Image: Saves the graph as an image
- Advanced Tools
  - Get Time From Drive: Uses drive time instead of arrival time for sample timestamps
  - Time Index at Zero: Uses a zero based relative time index for graphing of the data instead of actual time

19.3.2 Profiles

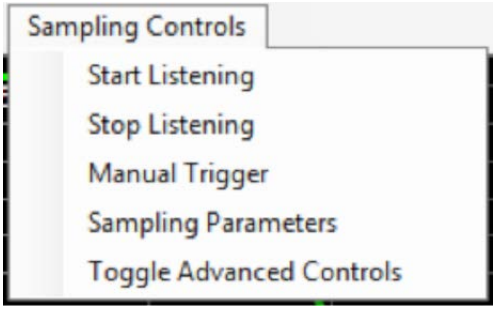


- Default: All available configured signals
- Current: Only Current related signals
- Velocity\Position: Only Velocity and Position signals
- *Network Diagnostics: Special network specific signals (ACS Stepper & Servo)

NOTE: *Network Diagnostics: Special network specific signals is not available for ACSI

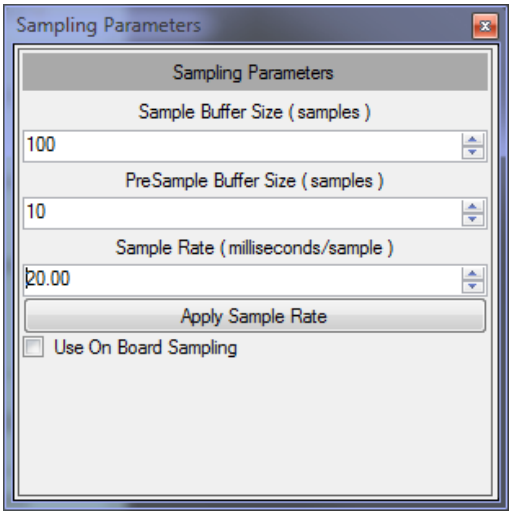
- Load From File: Load saved signals from a file
- Save Profile As…: Saves the currently loaded signal profile to disk

19.3.3 Sampling Controls



- Start Listening: Start polling the drive for the selected channels. Used in conjunction with Triggering. When a trigger is detected, the sampling queue fills and is displayed when the queue is filled
- Stop Listening: Stops the drive polling and prevents the currently displayed data from being overwritten
- Manual Trigger: When Listening, Manual Trigger triggers the start of a sample, and will display the data after the sampling has completed
- Sampling Parameters: Launch Sampling Parameters options window
- Toggle Advanced Controls: Hides/Shows the Controls frame at the bottom of the graph (enabling a larger graphing area)

19.3.4 Sampling Parameters Options Window

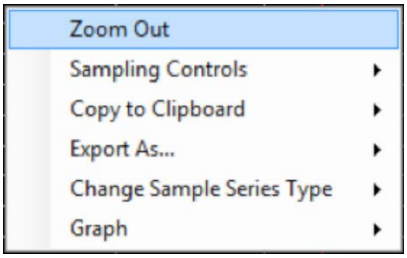


- Sample Buffer Size: Sample Size of the circular sampling buffer for each channel
- PreSample Buffer Size: Number of samples to save before a trigger occurs. In auto trigger mode, this is automatically set to 0

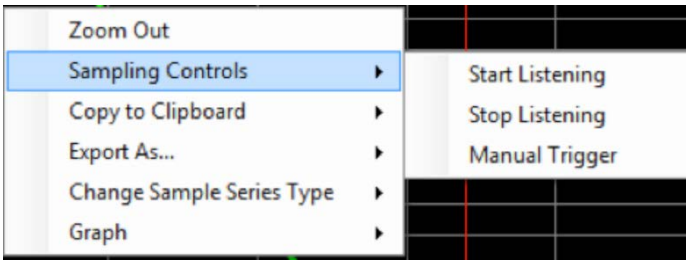
- Sample Rate: Best effort sampling poll rate from TMI to the drive. The sample rate may be slower based on transfer rates, number of channels being sampled, etc
- Apply Sample Rate: Applies the changes made to the Sampling Parameters
- Use On Board Sampling: Some drives provide on board sampling for higher sample rates. When available, this option will allow on board sampling and off board viewing. This option is only available if TMI is in control of motion.

19.4 Context Menu Strip (Right click on graph)

19.4.1 Zoom Out: Zooms out of the graph

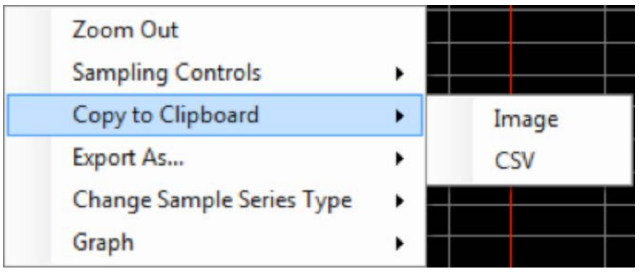


19.4.2 Sampling Controls



- Start Listening: : Start polling the drive for the selected channels. Used in conjunction with Triggering. When a trigger is detected, the sampling queue fills and is displayed when the queue is filled
- Stop Listening: Stops the drive polling and prevents the currently displayed data from being overwritten
- Manual Trigger: When Listening, Manual Trigger triggers the start of a sample, and will display the data after the sampling has completed

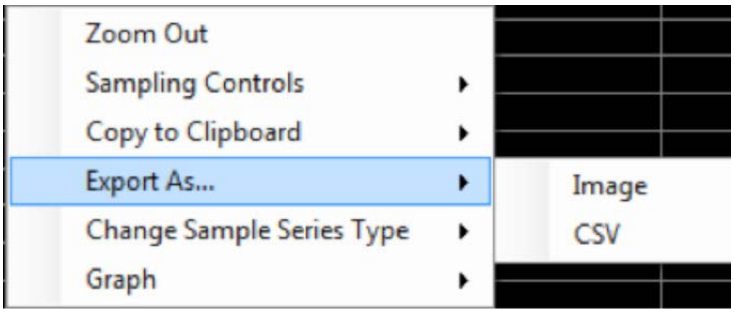
19.4.3 Copy to Clipboard



- Image: Copies the graph as an image to the clipboard so it can be pasted into external applications

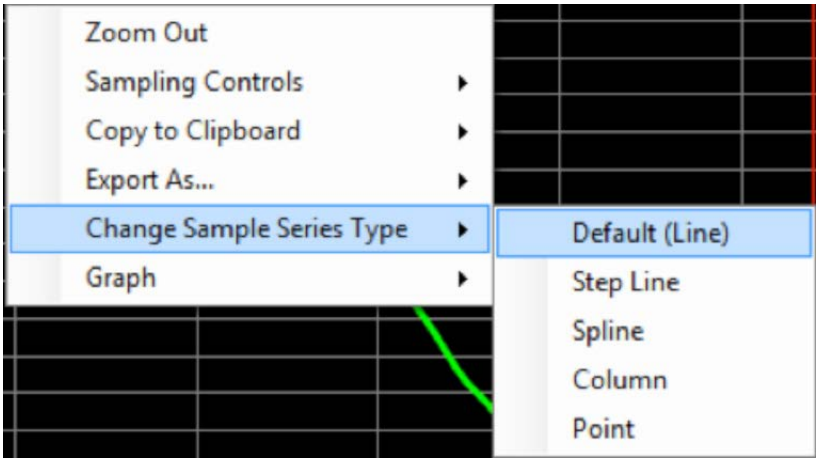
- CSV: Copies the data as CSV text into the clipboard so it can be pasted into external applications

19.4.4 Export As…

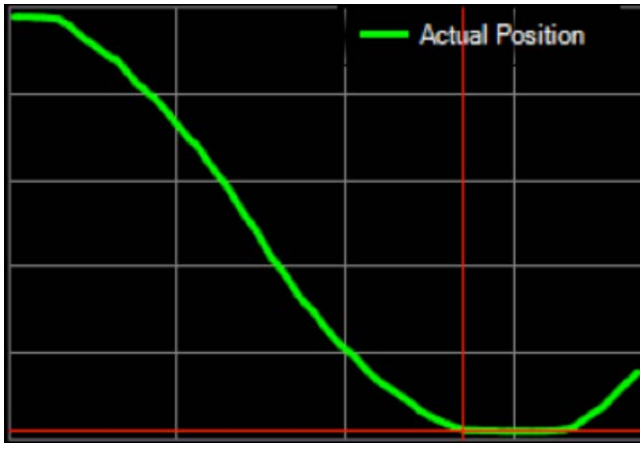


- Image: Saves the graph as an image
- CSV: Exports the data displayed in a CSV format

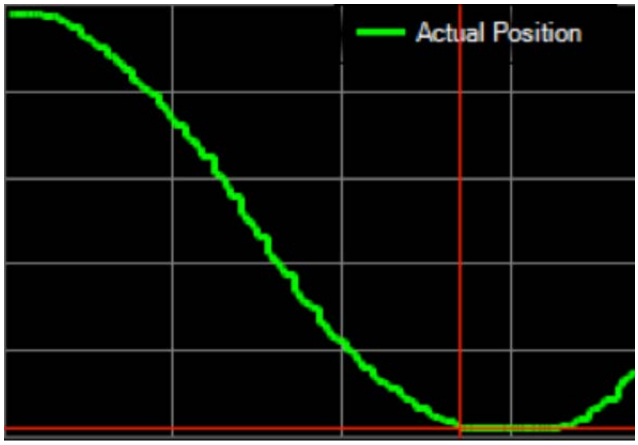
19.4.5 Change Sample Series Type



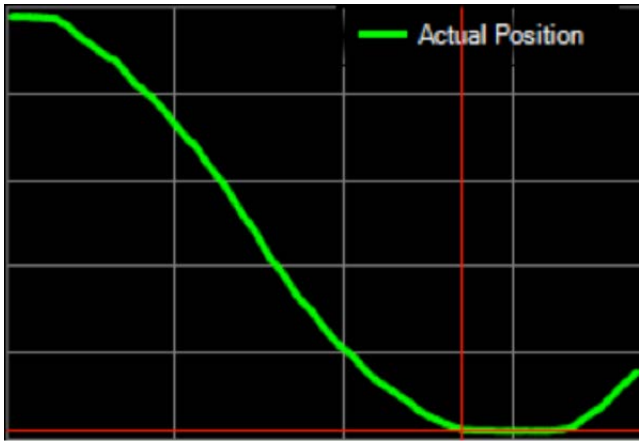
- Default (Line): Straight Line connecting sample to sample



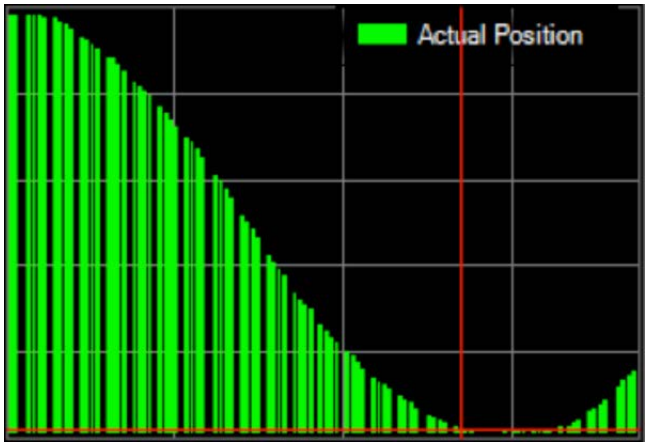
- Step Line: Step function between samples (Digital)



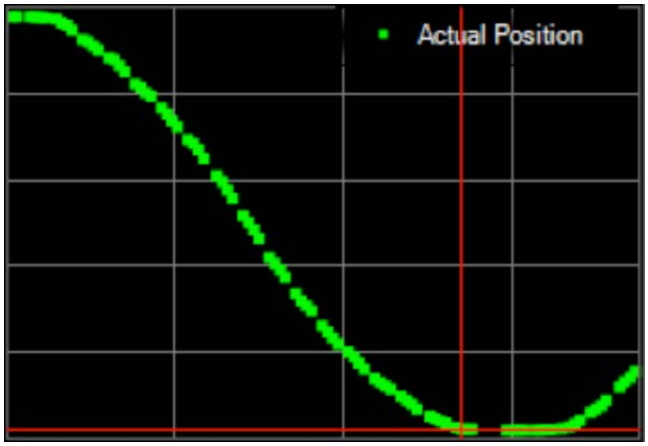
- Spline: Smoothing transitions between samples



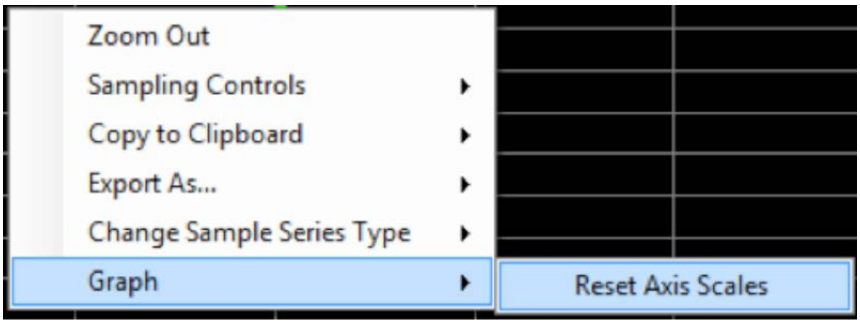
- Column: Each sample is represented by a column



- Point: Each sample is represented by a point



19.4.6 Graph



- Reset Axis Scales: Forces the redrawing and auto-scaling of the axis scales for all of the graphs

20.1 Using the Drive Status Tool

The Drive Status Tool is launched from the Tools Menu in the TMI interface menu bar or the Tool Bar. This tool shows the current status of critical information about the drive.

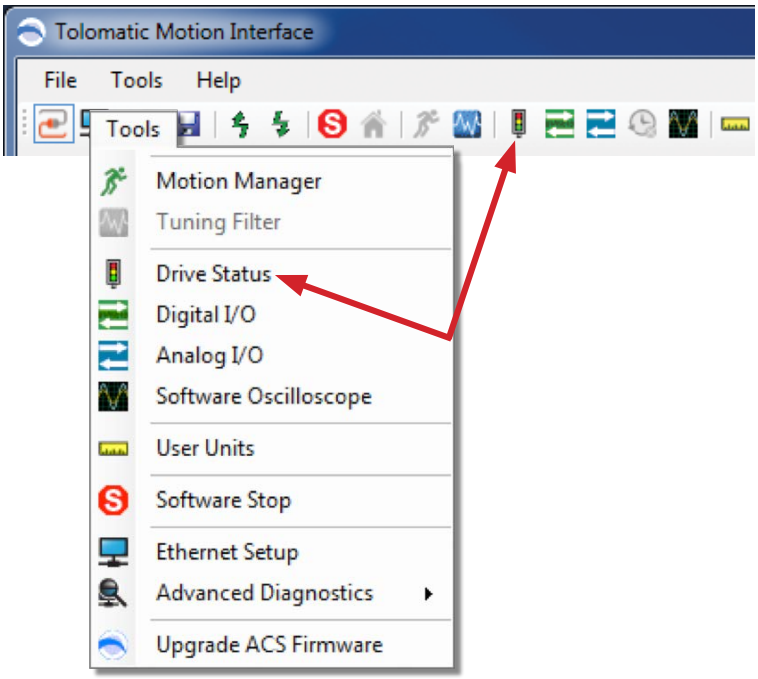


Figure 20-1: Launching the Drive Status Tool

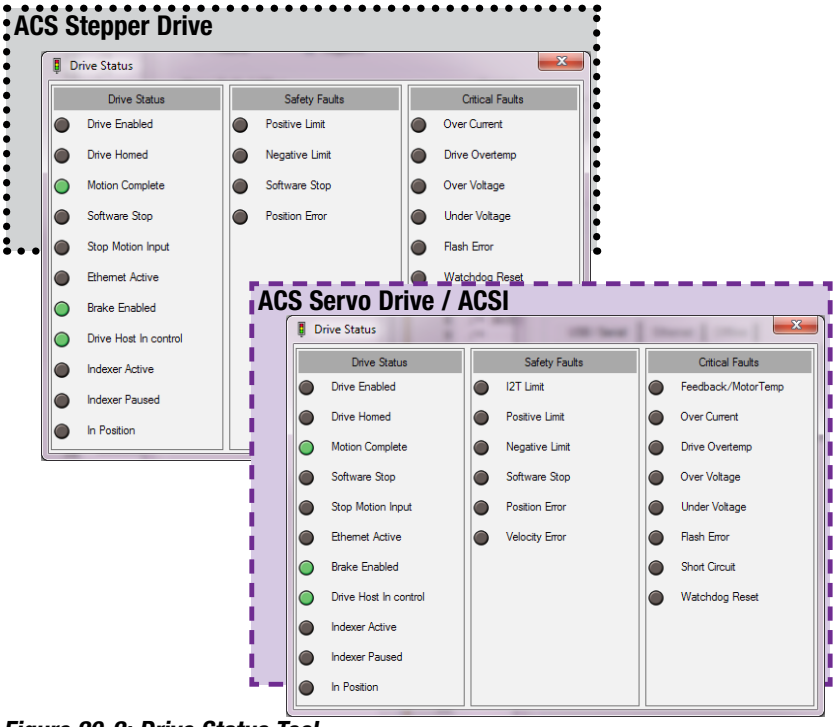


Figure 20-2: Drive Status Tool

21.1 Using the Ethernet Setup Tool

Choose the Tools -> Ethernet menu selection or press the Configure Ethernet button in the toolstrip.

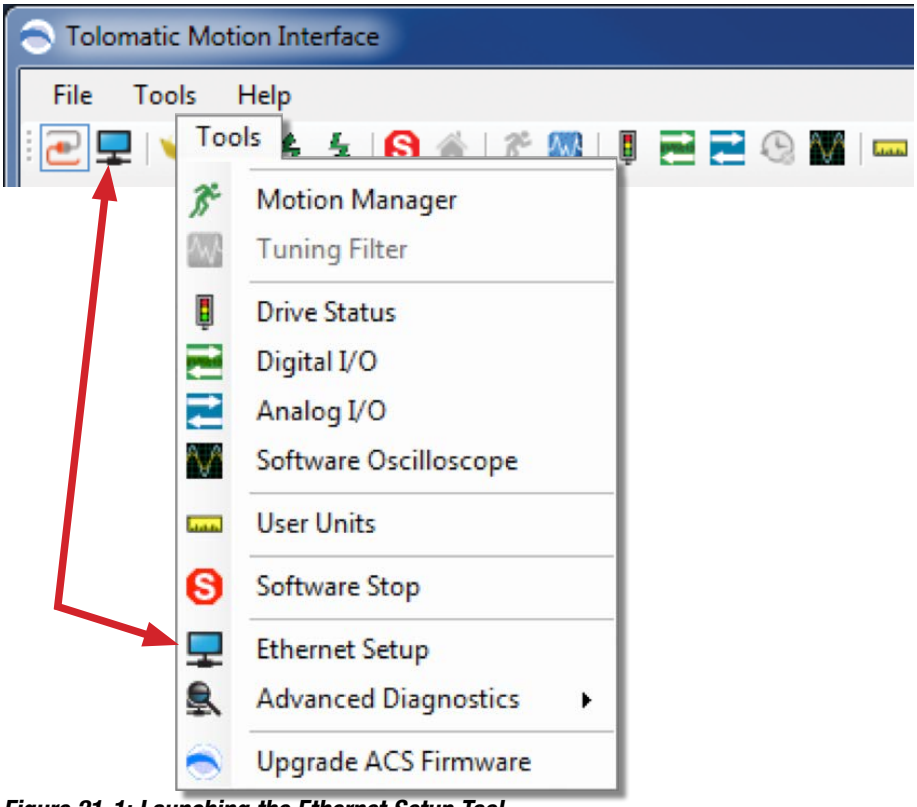


Figure 21-1: Launching the Ethernet Setup Tool

21.1.1 Ethernet Setup Tool for ACS Stepper and ACS Servo Drives

TROUBLESHOOTING NOTE: For proper, timely communications the drive should be **Full Duplex, 100.00 mbps.** If the drive negotiates Half Duplex, 10 mbps, a network device has forced the drive into this mode and should be removed.

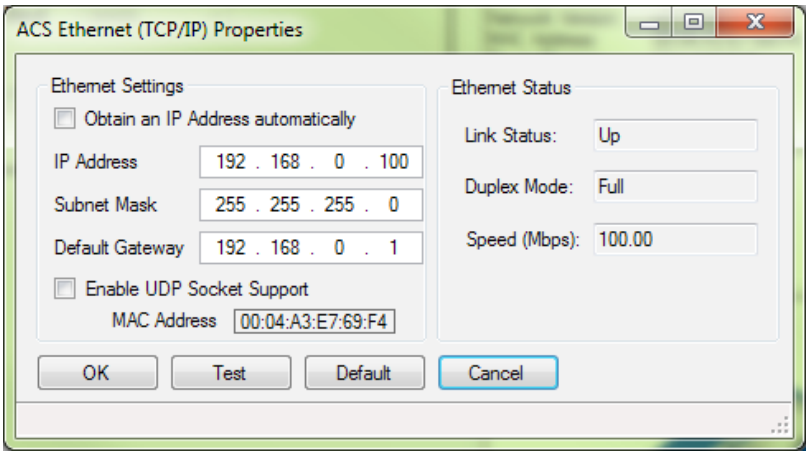


Figure 21-2: Ethernet setup tool

Enter the IP address, Subnet Mask and Default Gateway parameters for the network. (The values shown above are the factory default values for the ACS drive.

Typically, at least the IP address and Default Gateway will need to be changed for the network.) Settings are downloaded when OK is pressed.

Feature	Description	Troubleshooting Tips
Obtain an IP Address automatically	Enables DHCP support on the drive, allowing a server to assign an IP address to the drive	
IP Address	IP Address of the drive	The ACS Drive supports Ping. Pinging the drive is a great way to verify that the drive is on the network.
Subnet Mask	Subnet Mask of the drive	
Default Gateway	Default Gateway of the drive	
Enable UDP Socket Support	Enables TMI to connect to drive over the network using port 7023	Firewalls may automatically block Port 7023. Check with your network administrator if you are not able to connect over this port, but are able to ping the drive.
MAC Address	MAC Address of the drive	
Link Status	Current connection status of the drive (Up / Down)	If the Link Status reports Down, Ethernet communications will not function. Check physical connections, and verify lights on Ethernet ports are on.
Duplex Mode	Communications Duplex Mode (Full / Half)	**For the Network Controlled modes (EIP and Modbus TCP), the drive is required to be in Full Duplex mode. If the drive is reporting Half duplex, errors are dropped connections are expected.**
Speed	Communications Speed of the connection (10 Mbps or 100 Mbps)	
OK	Applies the settings and exits the tool	
Test	Initiates a Ping connection test to the drive	The PC and the drive must be configured and connected to the same network.
Default	Resets the Ethernet settings to the factory defaults	
Cancel	Exits the configuration tool	

Table 21-1: Ethernet connection troubleshooting tips

The test button can be used to initiate a ping test to the drive. The PC and the drive must be connected to the same network.

NOTE: An Ethernet cable must be connected from the PC to the ACS drive.

If the Test worked, a screen will pop-up showing similar results to the following.

TROUBLESHOOTING TIP:

The drive may need to be reset in order for other network devices to recognize the new network settings..

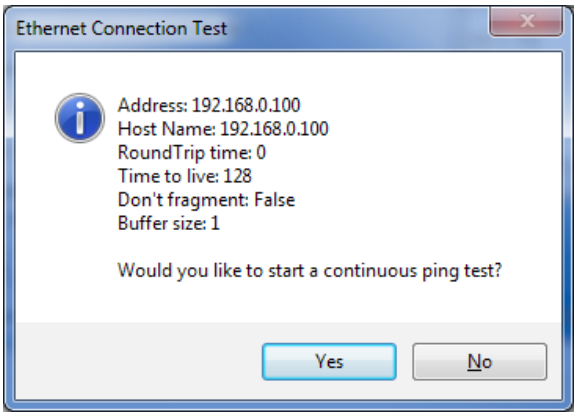


Figure 21-3: Testing verifies a successful Ethernet connection

If the Test didn't work (in this example, the Ethernet cable was unplugged from the ACS drive) an error dialog will be shown.

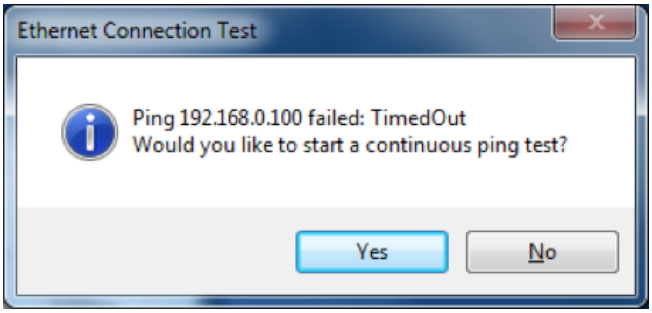


Figure 21-4: Testing indicates a failed attempt for Ethernet connection

A "Yes" response will open the Ping Test window that will continually ping the address and give you a visual online/comment state.

Figure 21-5: Ping Test failure and success

To configure the ACS drive for DHCP server in order to dynamically assign an IP Address:

- check the “Obtain an IP address automatically” check-box
- click OK on the ACS Internet Protocol (TCP/IP) Properties dialog
- click the Disconnect button on the TMI Drive tab (or press the Disconnect from Drive button on the toolstrip)
- click Yes when asked “Update drive flash memory?”.
- cycle ACS drive power (turn off then turn on)
- press the Connect button on the TMI Drive tab (or press the Connect to Drive button on the toolstrip)

When the Ethernet configuration tool is opened, the status bar informs the status of the DHCP address configuration process. This is not dynamically updated. To see the current status, press Cancel (or OK), wait a bit, then open this tool again.

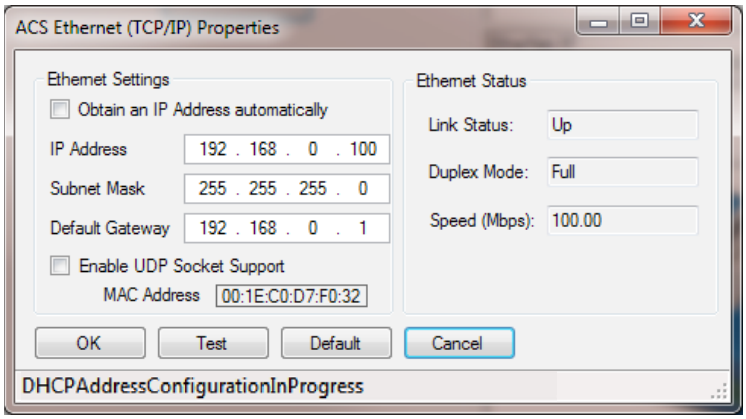


Figure 21-6: Obtaining an IP address automatically

If there is a problem and the ACS drive is unable to get an IP address from the DHCP server, the status bar will display the error message in the status bar.

When Ethernet configuration is complete, press OK.

ACSI Integrated

21.1.2 Ethernet Setup Tool for ACSI Motor/Drive/Controller Infrastructure Mode

NOTE: PROFINET and EtherCAT only support Infrastructure Mode.

For drives that support Infrastructure Mode, this mode allows all network configuration of the drive to be done using the users existing Network Infrastructure. By default, infrastructure mode is in DHCP mode. However, the users network infrastructure can assign a static IP address using existing protocol objects (such as Ethernet/IP connection object).

While in this mode, the user cannot access the network settings through TMI, but is able to use the ping support tool.

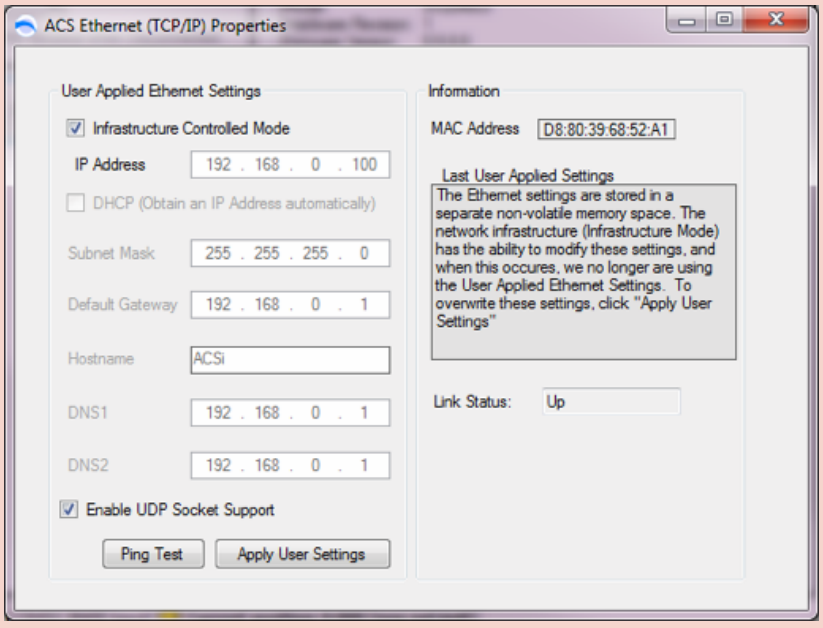


Figure 21-7: By default, infrastructure mode is in DHCP mode

ACSI Integrated

Infrastructure mode can be disabled, and the user can specify network settings using this tool.

Non-Infrastructure Mode

Drives that use protocols that do not support infrastructure mode (such as Modbus TCP) will have a subset of the functions available in Infrastructure Mode.

Feature	Description	Troubleshoot Tips
IP Address	IP Address of drive	Pinging the drive is a great way to verify that the drive is on the network
DHCP	Obtain an IP Address Automatically from DHCP server	
Subnet Mask	Subnet Mask of the drive	
Default Gateway	Default Gateway of the drive	
Hostname	Hostname of the drive	
DNS1	DNS Server for the drive	
DNS2	Alternate DNS server for the drive	
Enable UDP Support	Enables Network access through TMI	
Ping Test	Initiates a ping connection test to the drive	PC and drive must be configured and connected to the same network
Apply User Settings	Applies new configuration settings to the drive and resets ethernet module	

TROUBLESHOOTING TIP:

Drive may need to be power cycled after new network settings are applied for other network devices to be able to "see" the drive.

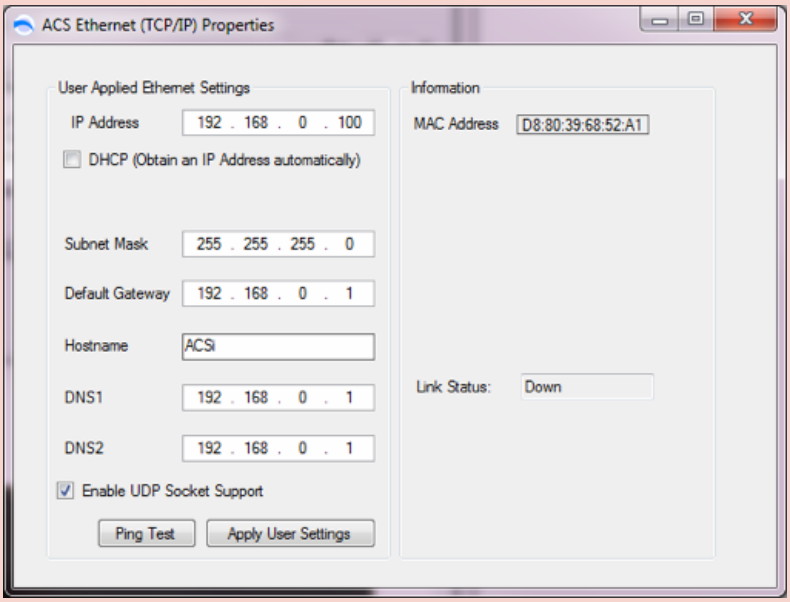


Figure 21-8: Ethernet (TCP/IP) Properties

ACSI Integrated

The Ping Test button can be used to initiate a ping test to the drive. The PC and drive must be connected to the same network. If successful, a screen will pop up showing the results of the ping.

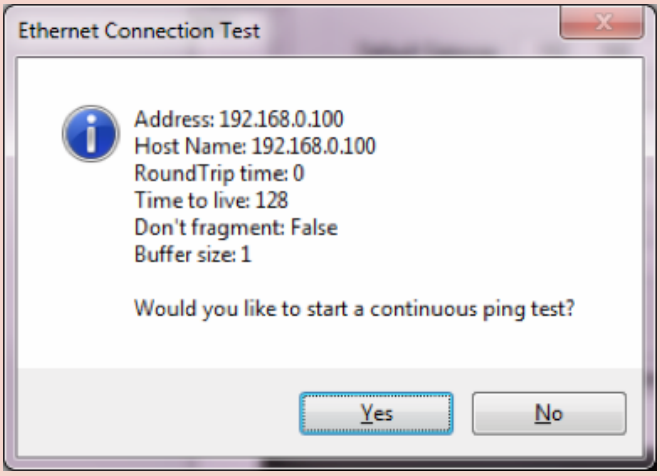


Figure 21-9: Ethernet connection test

A continuous ping test will continuously ping a drive, noting when the drive is accessible and when it is not.

Figure 21-10: Drive not accessible

Figure 21-11: Drive is accessible

22.1 Using Ethernet Advanced Diagnostics (not available for ACSI)

⚠ WARNING: Ethernet Advanced Diagnostics is not supported for ACSI Motor/ Drive/Controller.

ACS Stepper
&
ACS Servo

When connected to Ethernet enabled ACS drives TMI will display Ethernet MIB Counters in Tools > Advanced Diagnostics Menu.

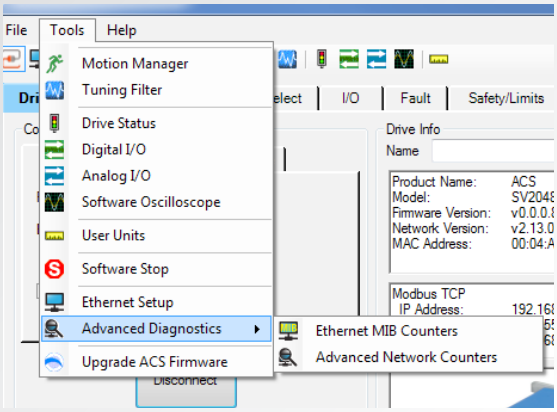


Figure 22-1: Advanced Diagnostics pull-down

22.1.1 Management Information Base (MIB) Counters

The ACS Drive provides 30 MIB counters per port. These counters are used to monitor the port activity for network management. Counters are polled every 10 seconds while the dialog box in Figure 22-2 is visible. When closed, polling stops. Pink highlighted text box indicates a problem reading the counter (this should rarely occur). Bold numbers indicate a change since previous poll. Use the box in the lower left corner to choose either Port 1 or Port 2: this corresponds to ACS Ethernet Port 1 and Port 2.

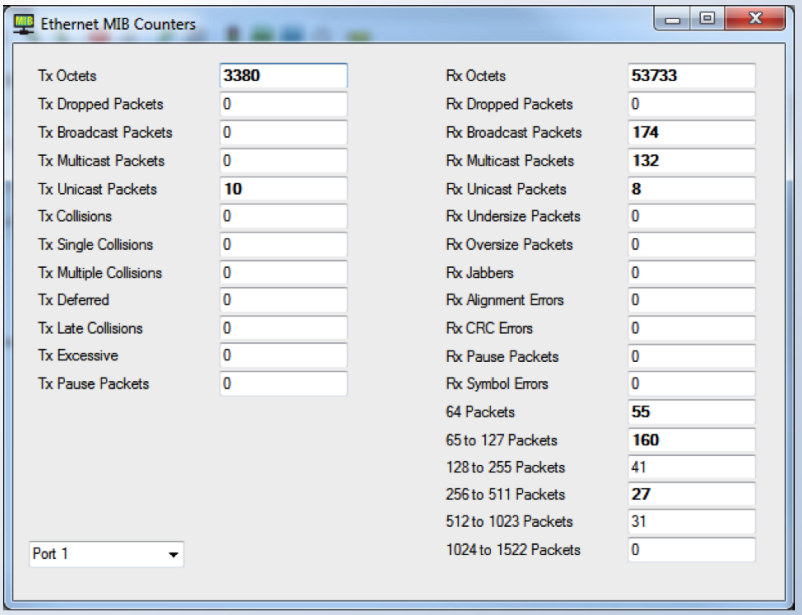


Figure 22-2: Ethernet MIB Counters

TMI LABEL	DESCRIPTION
TxOctets	Tx lo-priority good octet count including PAUSE packets
Tx Dropped Packets	TX packets dropped due to lack of resources
TxBroadcastPackets	Tx good broadcast packets (not including error broadcast or valid multicast packets)
TxMulticastPackets	Tx good multicast packets (not including error multicast or valid broadcast packets)
TxUnicastPackets	Tx good unicast packets
TxCollisions	Tx total collision, half duplex only
TxSingleCollisions	Successfully Tx frames on a port for which Tx is inhibited by exactly one collision
TxMultipleCollisions	Successfully Tx frames on a port for which Tx is inhibited by more than one collision
TxDeferred	Tx packets by a port for which the 1st Tx attempt is delayed due to the busy medium
TxLateCollisions	The number of times a collision is detected later than 512 bit-times into the Tx of a packet
TxExcessive	A count of frames for which Tx fails due to excessive collisions
TxPausePackets	Number of PAUSE frames transmitted by a port
RxOctets	Rx lo-priority (default) octet count including bad packets
Rx Dropped Packets	RX packets dropped due to lack of resources
RxBroadcastPackets	Rx good broadcast packets (not including error broadcast packets or valid multicast packets)
RxMulticastPackets	Rx good multicast packets (not including MAC control frames, error multicast packets or valid broadcast packets)
RxUnicastPackets	Rx good unicast packets
RxUndersizePackets	Rx undersize packets with good CRC
RxOversizePackets	Rx oversize packets with good CRC (max: 1536 or 1522 bytes)
RxJabbers	Rx packets longer than 1522 bytes with either CRC errors, alignment errors or symbol errors (depends on max packet size setting)
RxAlignmentErrors	Rx packets within (64, 1522) bytes with a non-integral number of bytes and a bad CRC (upper limit depends on max packet size setting)
RxCRCErrors	Rx packets within (64, 1522) bytes with an integral number of bytes and a bad CRC (upper limit depends on max packet size setting)
RxPausePackets	Number of PAUSE frames received by a port. Pause frame is qualified with EtherType (88-0xh), DA, control opcode (00-01), data length (64B min), and a valid CRC
RxSymbolErrors	Rx packets with invalid data symbol and legal packet size.
64Packets	Total Rx packets (bad packets included) that were 64 octets in length
65to127Packets	Total Rx packets (bad packets included) that were between 65 and 127 octets in length
128to255Packets	Total Rx packets (bad packets included) that were between 128 and 255 octets in length
256to511Packets	Total Rx packets (bad packets included) that were between 256 and 511 octets in length
512to1023Packets	Total Rx packets (bad packets included) that were between 512 and 1023 octets in length
1024to1522Packets	Total Rx packets (bad packets included) that were between 1024 and 1522 octets in length (upper limit depends on max packet size setting)

Table 22-1: ACS Ethernet Drive MIB counters

22.1.2 Advanced Network Counters

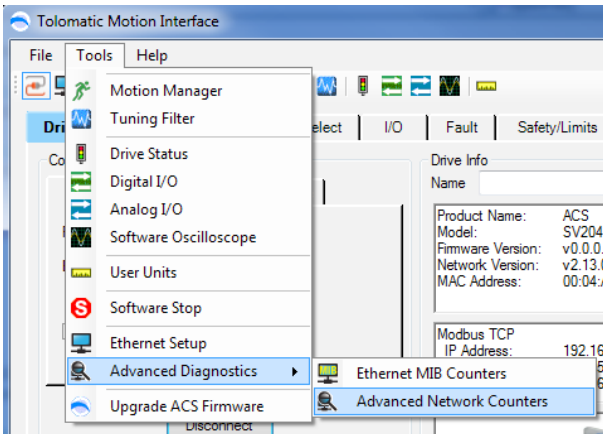


Figure 22-3: Menu selection of Advanced Network Counters

The ACS Drive provides extremely low level access to the network counters used by the network stack implemented in firmware. The Advanced Network Counters tool is an expert level tool designed specifically for deployment engineers troubleshooting network related issues. While the MIB Counters provide access to registers on the Ethernet Hardware directly, the Network Counters are maintained by the ACS Firmware.

Launching the tool from the Tools->Advanced Diagnostics->Advanced Network Counters will bring up the tool's interface.

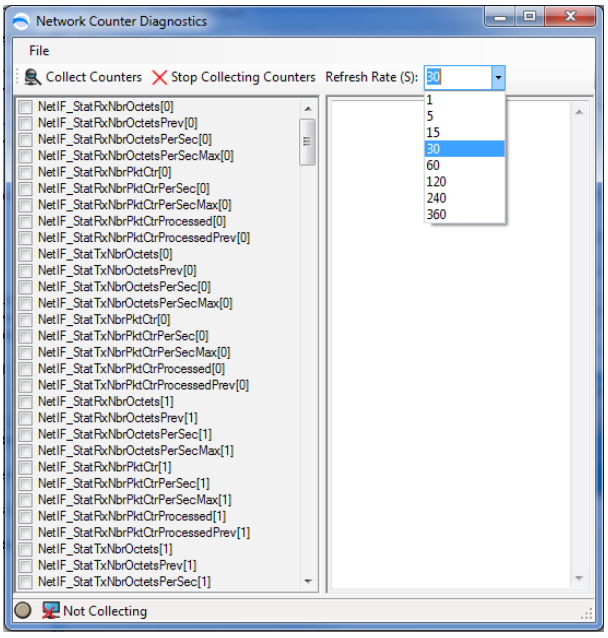


Figure 22-4: Advanced Network Counters Interface

The user can select an appropriate refresh rate based on the number of counters selected. If only a few counters are selected, 1-5 second intervals can be maintained. However, the flexibility of the tool allows for an extremely high number of counters to be selected. Choose a slower refresh rate to increase the performance of the interface. Once the refresh rate (in seconds) is selected, click the "Collect Counters" button.

The counters will be polled at the Refresh Rate interval. As the values are collected, they will be displayed in a CSV format in the output window.

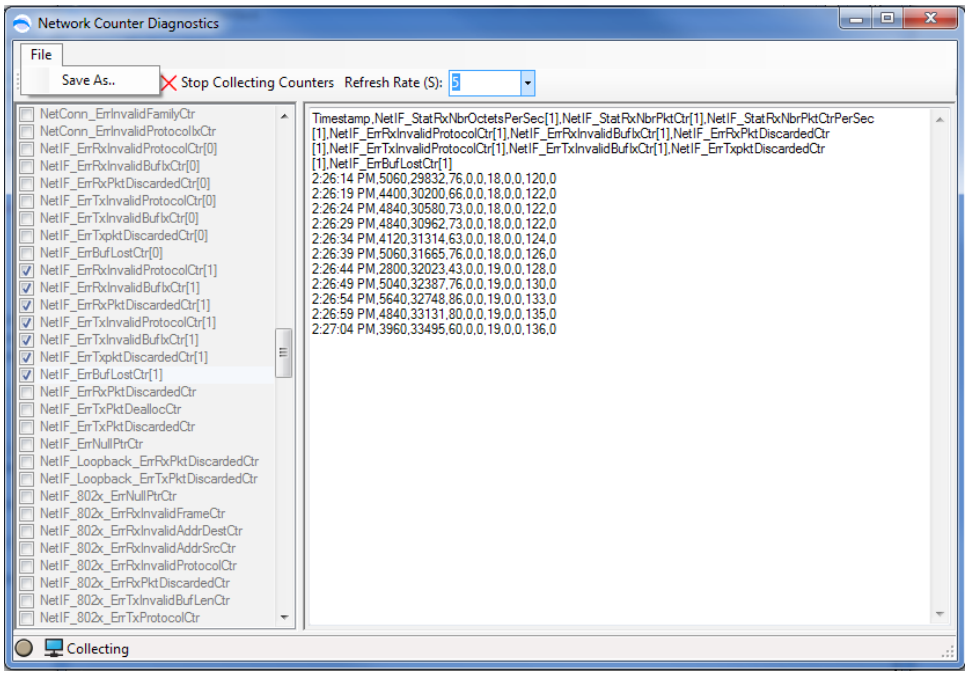


Figure 22-5: Result of "Collect Counters" selection

The user can then save the CSV output to a file using the File->Save As... option

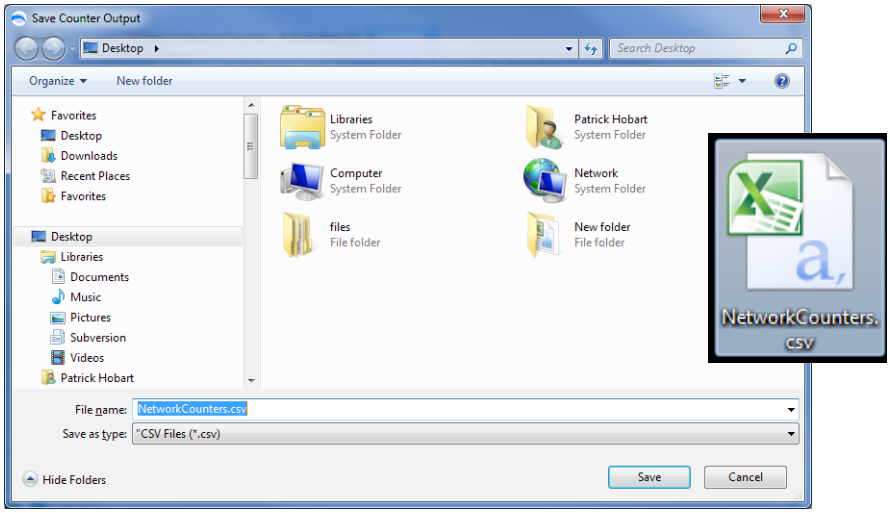


Figure 22-6: Save as .csv file for use in software like Excel

The user can now import this file into a data analysis application (like Excel) and process the data.

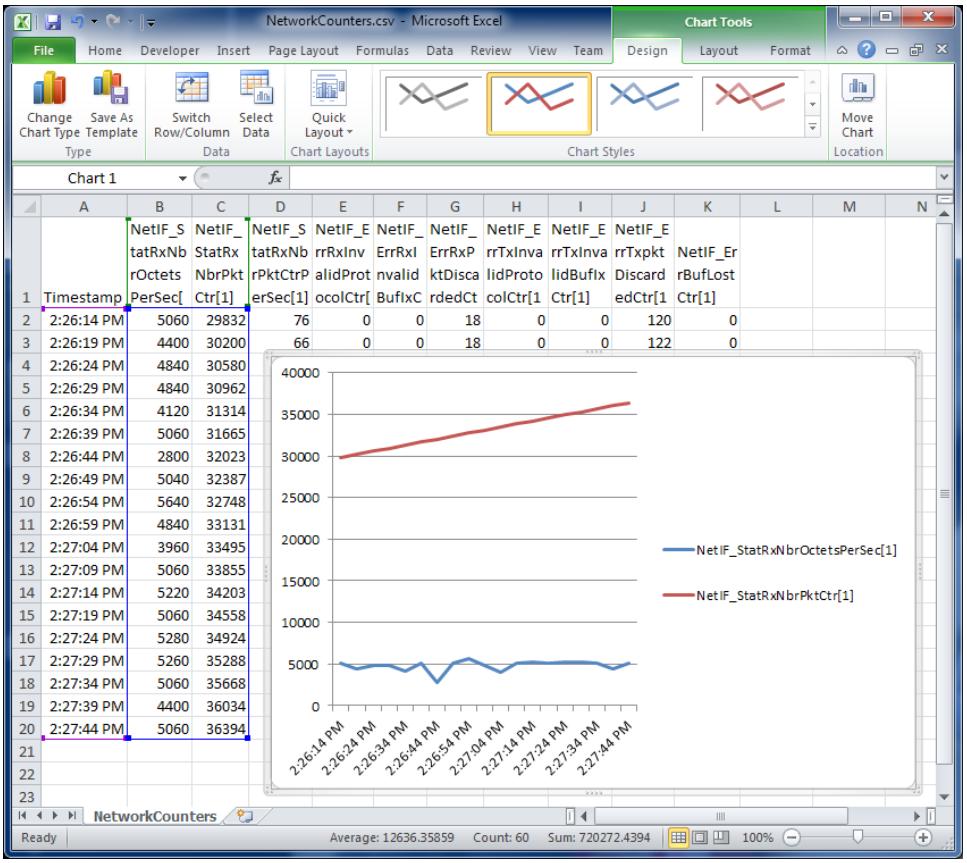


Figure 22-7: Result of "Collect Counters" graphed in MicroSoft Excel

23.1 Using Network Assembly Remapping

The Network Assembly Remapping Tool allows users to remap a subset of the Network Input registers to a number of different read-only drive parameters.

The feature to remap network input assemblies was introduced in the following versions of firmware:

- ACS Servo Firmware Ver. 1.20+
- ACS Stepper Firmware Ver. 1.8+
- ACSI Servo Firmware Ver. 1.7+

When connected to a drive that supports Network Assembly Remapping, the Tool will appear under the Tools>Network Assembly Remapping menu.

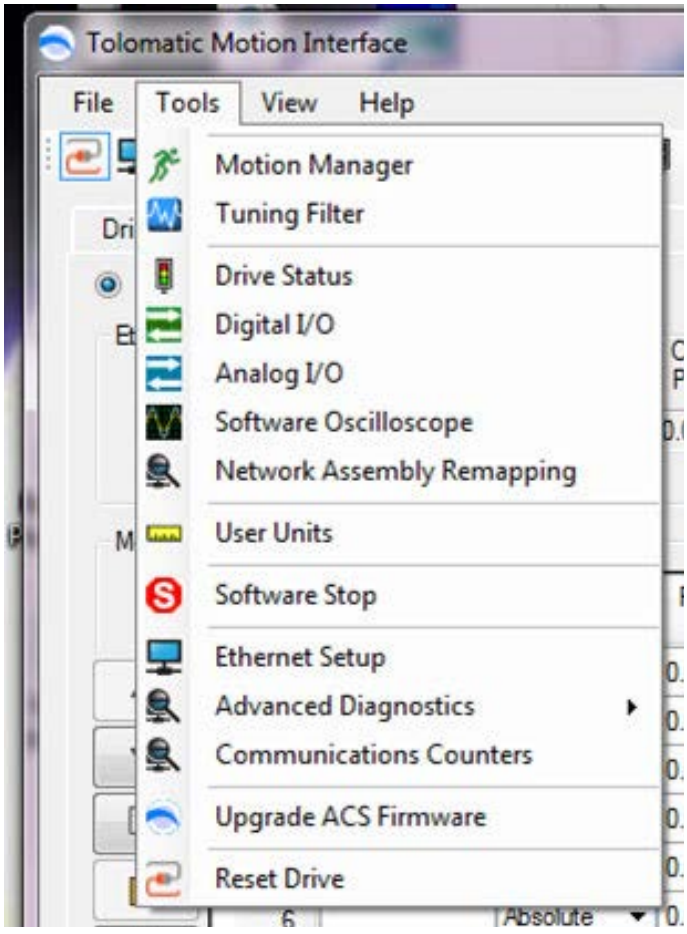


Figure 23-1: Network Assembly Remapping pull-down

By default, Remappable Register 1 is set to Analog Input, and Remappable Register 2 is set to Analog Output. In all supporting programs and tools, the registers may be labeled by these default names.

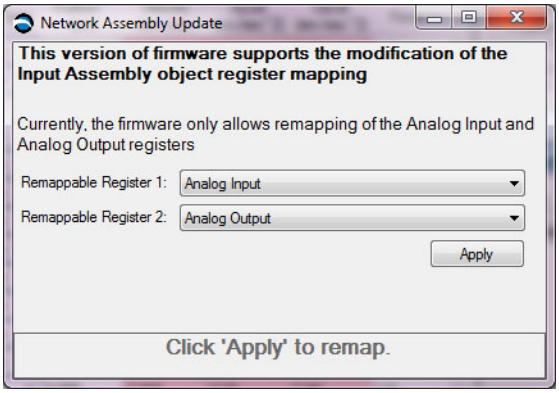


Figure 23-2 Click Apply to Remap

Clicking Apply will force the mapping to occur on the drive. If the input assemblies are being monitored externally (via PLC or HMI) this should have an immediate effect.

Servo and Stepper drives support different drive variables. See the following tables for details.

ACS AND ACSI SERVO REMAPPABLE REGISTERS
Analog Input (Default Register 1)
Analog Output (Default Register 2)
Actual Position (mm or revs)
Actual Position Error (mm or revs)
Actual Velocity (mm/s or revs/s)
Actual Velocity Error (mm/s or revs/s)
Actual Current (Amps) (Fast Signal)
Commanded Position (mm or revs)
Commanded Velocity (Trajectory) (mm/s or revs/s)
I2T Accumulation Value*
I2T Limit*
Bus Voltage (Volts)
Board Temperature (Drive) (Degrees C)
Digital Inputs
Digital Outputs
* When I2T Accumulation value exceeds limit, I2T fault occurs. Accumulation happens any time motor is running

Table 23-1 - ACS and ACSI Servo Remappable Register Variables

ACS STEPPER REMAPPABLE REGISTERS
Analog Input (Default Register 1)
Analog Output (Default Register 2)
Actual Position (mm or revs)
Actual Position Error (With Encoder) (mm or revs)
Actual Velocity (mm/s or revs/s)
Profile Position
Profile Velocity
Profile Acceleration
Profile Deceleration
Bus Voltage (Volts)
Board Temperature (Drive) (Degrees C)
Digital Inputs
Digital Outputs

Table 23-2 - ACS Stepper Remappable Register Variables

Index Move Mode - Move Select Logic Table

The three operating modes, 4/8/16 move commands, require digital inputs to select the desired move for execution. The digital inputs are called Move Select 1 through 4 (MS1-MS4) in the digital input map. To select the desired move command refer to the three logic tables below.

NOTE 1: MS# stands for Move Select #

NOTE 2: 1 = On; 0 = Off

4 Move Commands Mode Logic Table		
MOVE	**MS1**	**MS2**
1	0	0
2	1	0
3	0	1
4	1	1

Table A1-1: 4 Move Commands Mode Logic

8 Move Commands Mode Logic Table			
MOVE	**MS1**	**MS2**	**MS3**
1	0	0	0
2	1	0	0
3	0	1	0
4	1	1	0
5	0	0	1
6	1	0	1
7	0	1	1
8	1	1	1

Table A1-2: 8 Move Commands Mode Logic

16 Move Commands Mode Logic Table				
MOVE	MS1	MS2	MS3	MS4
1	0	0	0	0
2	1	0	0	0
3	0	1	0	0
4	1	1	0	0
5	0	0	1	0
6	1	0	1	0
7	0	1	1	0
8	1	1	1	0
9	0	0	0	1
10	1	0	0	1
11	0	1	0	1
12	1	1	0	1
13	0	0	1	1
14	1	0	1	1
15	0	1	1	1
16	1	1	1	1

Table A1-3: 16 Move Commands Mode Logic

Pneumatic Mode - Move Select Logic Table

The pneumatic mode requires digital inputs to select the desired move for execution. The digital inputs are called Move Select 1 through Move Select 3 (MS1-MS3) in the digital input map. To select the desired move refer to the four logic tables below.

NOTE 1: MS# stands for Move Select #

NOTE 2: 1 = On; 0 = Off

2 Position (1 input) Table	
ACTION	**MS1**
Pos 1	0
Pos 2	1

Table A2-1: 2 Position (1 input) Mode Logic

2 Position (2 input) Table		
ACTION	**MS1**	**MS2**
Stop	0	0
Pos 1	1	0
Pos 2	0	1
Current Pos Command	1	1

Table A2-2: 2 Position (2 input) Mode Logic

3 Position (2 input) Table		
ACTION	**MS1**	**MS2**
Stop	0	0
Pos 1	1	0
Pos 2	0	1
Pos 3	1	1

Table A2-3: 3 Position (2 input) Mode Logic

3 Position (3 input) Table			
ACTION	**MS1**	**MS2**	**MS3**
Stop	0	0	0

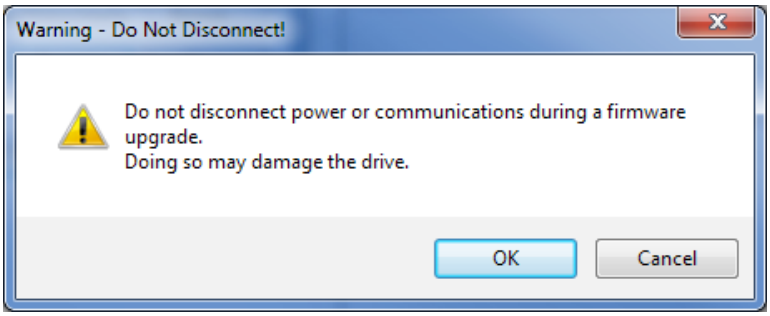
3 Position (3 input) Table			
ACTION	MS1	MS2	MS3
Pos 1	1	0	0
Pos 2	0	1	0
Pos 3	0	0	1
Current Pos Command	1	1	1
Current Pos Command	1	1	0
Current Pos Command	0	1	1
Current Pos Command	1	0	1

Table A2-4: 3 Position (3 input) Mode Logic

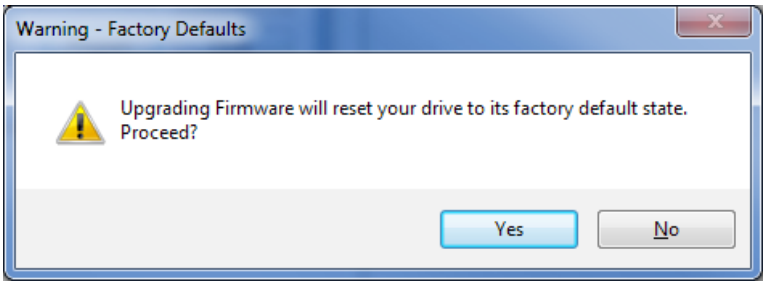
NOTE: If logic selects Current Pos Command, then the controller will continue to current commanded position. If already in position, no motion will occur.

Tolomatic Firmware Upgrade Tool

SAFETY WARNING: Disconnect the drive from Ethernet, RS485, actuator, motor, encoder & brake before upgrading firmware. You should only have power and communications line (serial or USB) connected. Only use Tolomatic authorized firmware to upgrade your ACS drive. Running unauthorized firmware on the ACS drive will result in unexpected behavior.



WARNING: Do not disconnect the drive during the firmware upgrade upload. Doing so may damage the drive.



NOTE: Because upgrading firmware will reset your drive to factory default state it is recommended that you backup your current ACS drive settings before upgrade.

A3.1.1 Saving Current Drive Settings

After successful firmware upgrade, the Tolomatic Firmware Upgrade Tool (TFUT) will restore the drive to factory settings appropriate to the new version of firmware, overwriting any user defined settings.

NOTE: This step is most useful if you want to BACKUP current ACS Drive settings before upgrading firmware. (Upgrading will force the ACS Drive to factory defaults) After upgrading firmware open TMI software and restore ACS Drive settings using the procedure outlined at right.

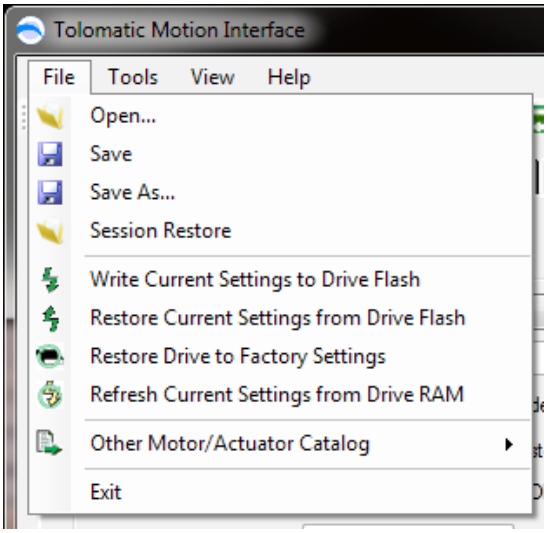


Figure A3-1: Using the Save As backup current ACS drive settings before upgrading firmware

If you run the Tolomatic Motion Interface, connect to the drive and select the ***File->Save As*** menu item, you can save the current drive settings to a file. The next time you run Tolomatic Motion Interface after upgrading the drive firmware, you can select ***File->Open*** and open this file. The parameter settings in the file will automatically be programmed into the Tolomatic drive.

A3.2.1 Launching the Upgrade Tool Software

1. Double-click the program icon on the desktop or in the Windows® Start menu at: ***Start > All Programs > Tolomatic > TolomaticMotionInterface > TolomaticFirmwareUpgrade Tool*** to launch the software.

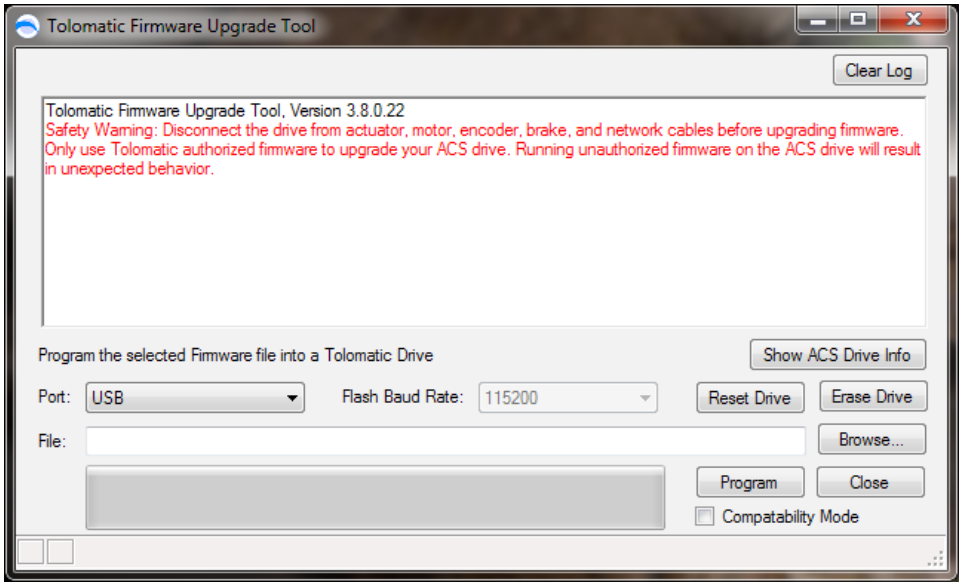


Figure A3-2: Select the correct version of the Firmware Upgrade Tool

Note: If user experiences a permissions error, try running TFUT as Administrator.

Product	Firmware File
ACS Stepper	36043183.TOL
ACS Servo	36043177.TOL
ACSI Integrated	36043171.TOL

A3.3.1 User Interface Process

- As in TMI, setting COM Port to Auto will request TFUT to scan available ports looking for an ACS drive and automatically select that COM port. If the ACS drive does not have valid ACS firmware, the COM port must be selected manually.
- Status and progress messages are displayed in the read-only text box.
- A Show ACS Drive Info button is provided to query the Product Name, Model,

Firmware Version, and Drive Name. This is useful in conjunction with COM Port: Auto.

- Compatibility Mode is available for systems with USB upgrade issues.

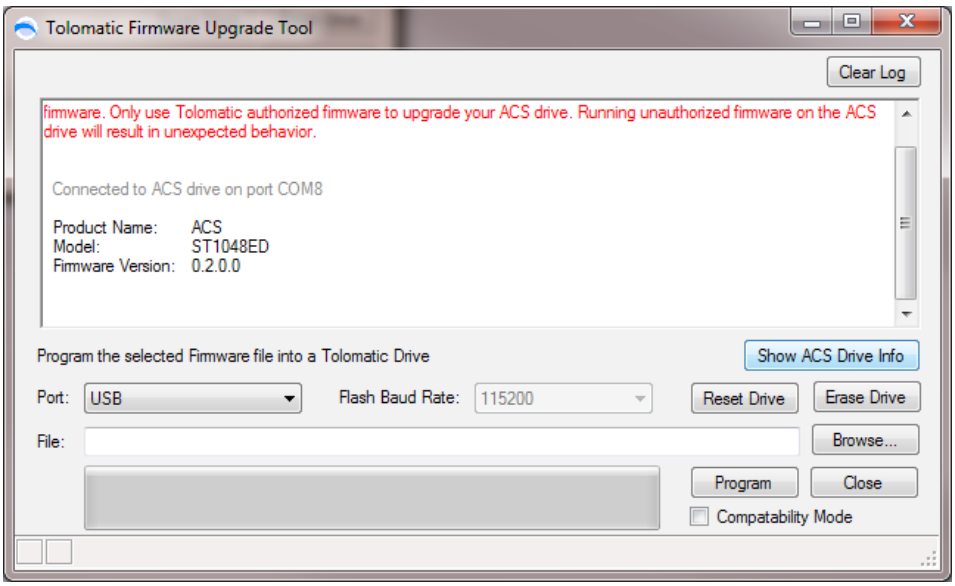


Figure A3-3 Connected to ACS Drive

- A Reset Drive button allows the ACS drive to be reset.
- If no ***".tol"*** is specified, pressing Program will run a connection test (useful for troubleshooting only)

- A progress bar shows how the firmware flashing process is progressing

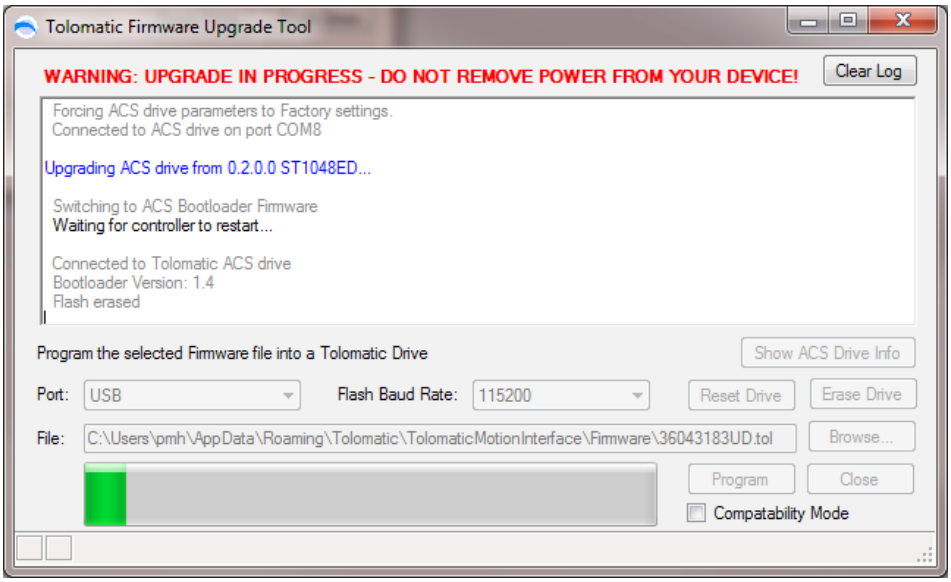


Figure A3-4: Firmware Flashing Progress

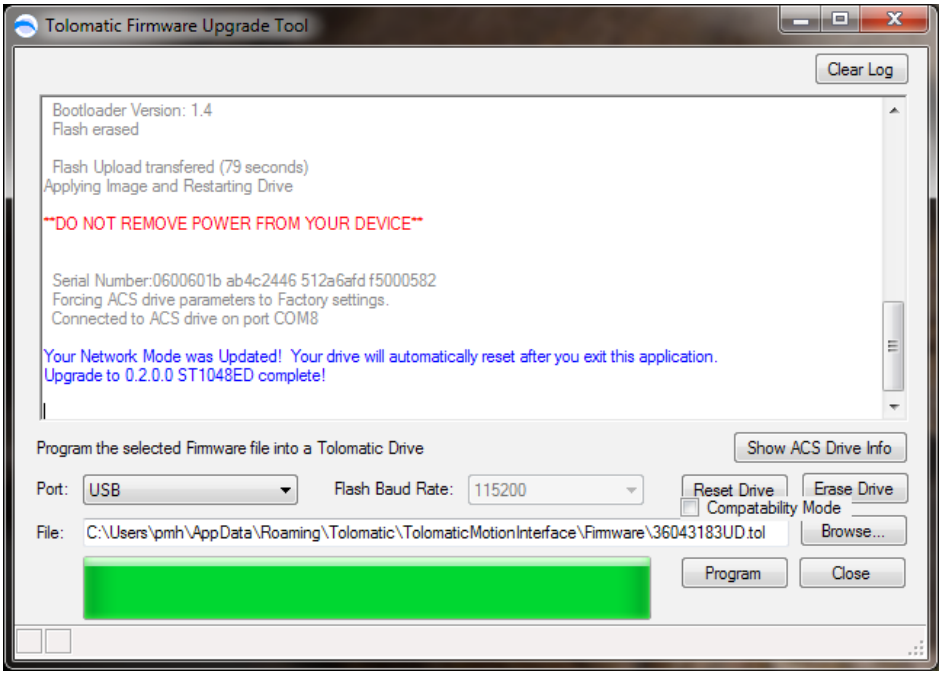


Figure A3-5: Firmware Flashing Complete

A3.6.1 TFUT Integrated with TMI

In addition to being available as a stand-alone tool, the Tolomatic Firmware Upgrade Tool (TFUT) is now available from TMI. Selecting this menu item will cause TMI to disconnect from the ACS drive (discarding any changes) and open a modal TFUT dialog.

TROUBLESHOOTING NOTE: If the upgrade process fails, check the "Compatability Mode" check-box and retry the upgrade process.

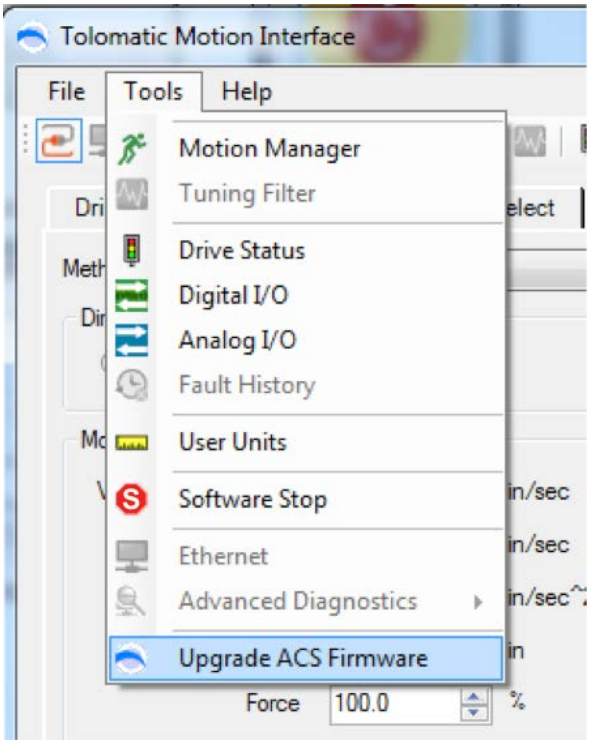


Figure A3-6: Upgrade Firmware through TMI

NOTE: Timing Diagrams and Troubleshooting Help are found in each Hardware & Installation Guide

ACS Servo Hardware & Installation Guide #3604-4181

ACS Stepper Hardware & Installation Guide #3604-4183

ACSI Servo Hardware & Installation Guide #3604-4185

A4.1.1 Import / Export Other Motor Catalogs

1. Launch Tolomatic Motion Interface (v 3.17.0.0 or above)
2. Select File –> Other Motor / Actuator Catalog –> Import / Export
3. In Other Motor / Actuator Catalog Editor, File –> Open
4. Browse to Custom Catalog Definitions File (*.acs), Click "Open"
5. Right click on selection and select "Import to TMI"
6. Verify item now exists in TMI Definitions Catalog
7. Exit Import / Export Tool

NOTE: Custom motors require custom actuators.

3604-4184_07
201811071337

Tolomatic
EXCELLENCE *IN MOTION*®

COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL = ISO 9001 =
Certified site: Hamel, MN

USA
3800 County Road 116
Hamel, MN 55340, USA
Phone: (763) 478-8000
Fax: (763) 478-8080
Toll-Free: **1-800-328-2174**
sales@tolomatic.com
www.tolomatic.com

CHINA
Tolomatic Automation Products (Suzhou) Co. Ltd.
(ServoWeld® inquiries only)
No. 60 Chuangye Street, Building 2
Huqiu District, SND Suzhou
Jiangsu 215011 - P.R. China
Phone: +86 (512) 6750-8506
Fax: +86 (512) 6750-8507
ServoWeldChina@tolomatic.com

EUROPE
Tolomatic Europe GmbH
Elisabethenstr. 4 & 8
D-65428 Rüsselsheim
Germany
Phone: +49 6142 17604-0
EuropeSales@tolomatic.com

Visit www.tolomatic.com for the most up-to-date technical information