EXPERT

Software for TRITEX

Expert Software Manual for Tritex II AC & DC Actuators and EXP-24 Controllers

This document does not contain any export controlled technical data.

Table of Contents:

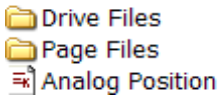
EXPERT SOFTWARE

Overview

Expert software is the user interface for Tritex II actuators, providing a simple way to select all aspects of configuration and control required to set up and operate any member of the Tritex II actuator family. Tabbed pages provide access to input all parameters necessary to successfully configure a motion application. Application folders provide a convenient way to store and organize applications and individual actuator parameter sets.

The Expert software is designed to allow customized views of the Tritex drive features for various industries and applications. For example, a valve application may use different motion features than a clamping application. The concept of different views is intended to simplify and customize the operation by only showing the parameters needed for the specific application and also allow industry specific names for the drive parameters.

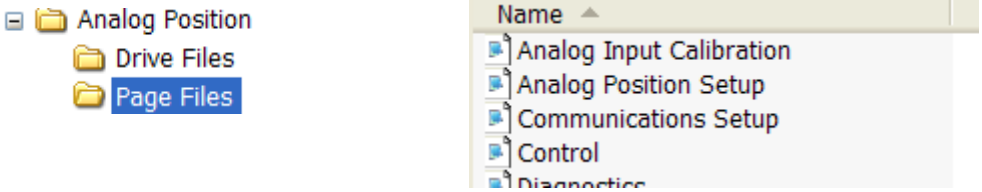
The Expert software uses application folders to organize application files, drive files and page files.



Each application folder contains an application file, a *Drive Files* folder, a *Page Files* folder. In the above example, *Analog Position* is the application file. The application file contains the application title, the file name of the last used drive file and file names of the pages used in the application.

The *Drive Files* directory contains a list of drive files that have been saved for this application. The drive file contains the upload and download parameter values, as well as parameter names, Modbus addresses, scaling and default values. The parameter values in a drive file consist of the data actually downloaded/uploaded from a drive.

The *Page Files* directory contains a page file for each page in an application. The page file contains the information for viewing and controlling the windows screen as viewed in the Expert software.



Important Note: Though Expert software supports actuators with the CANOpen communications option, many drive parameters are different and this manual does not specifically describe the differences. See the CANOpen manuals when using Tritex II with CANOpen.

Installation

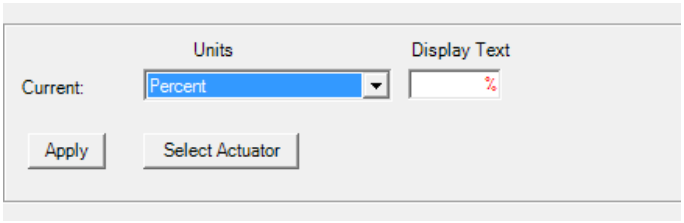
A CD is provided with each actuator and contains the Installation Operation and Maintenance manual as well as the Expert software. The software is also available for download from www.exlar.com.

Using Windows Explorer, open the “TritexX.X.X.X-Release Date” directory from the CD and double-click on “setup.exe”.

Expert software version 3.3.0.2 or later requires .NET Framework version 4.0 to be installed on the PC. If the required version of .NET Framework is not on the PC, a Microsoft message will be displayed suggesting you go to the Microsoft website to download it. This is not necessary, as a distributable version of the required .NET Framework has been included on the CD; it can be installed by double-clicking on the "dotnetfx.exe" file.

Windows 7 64bit Users

Due to the Microsoft Access database setup and protocol in the 64bit operating system, some features, including motor/actuator lookup for percentage based units for current limiting, will not be functional.



Please report any problems you experience as we continue to improve the operation of the Expert Software.

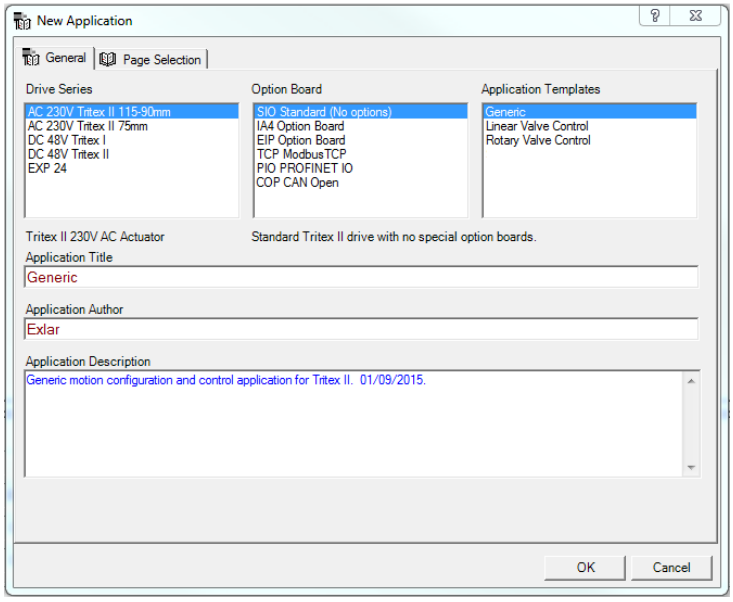
Welcome Screen

When the Expert software is opened for the first time, the below screen will be displayed. Select *File→ New Application* or *Open Application*. Subsequent opening of the software will start with the previously used application.

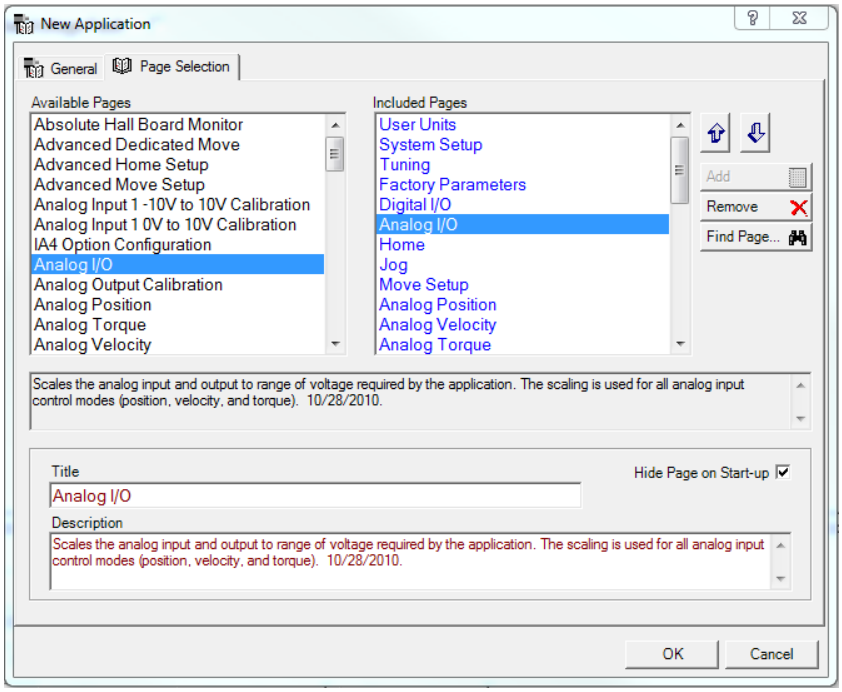
New Application

Selecting *New Application* allows the user to create a new application. First, select the "Drive Series" of the target actuator. Note that for 230VAC actuators, the drive series depends on frame size. Also note that DC 48V Tritex I is a legacy product only. After selecting the Drive Series, a list of possible "Option Boards" for that Drive Series appears. Choose the "Option Board" installed for the target actuator, based on the "Option Board" field in the model number. Use EIP for –EIP and –EIN model fields, and

similar choice for other Option Board fields that end in “N”. Next, select the “Application Template” that best fits the application. “Title”, “Application Author” and “Description” information can be entered at this time.

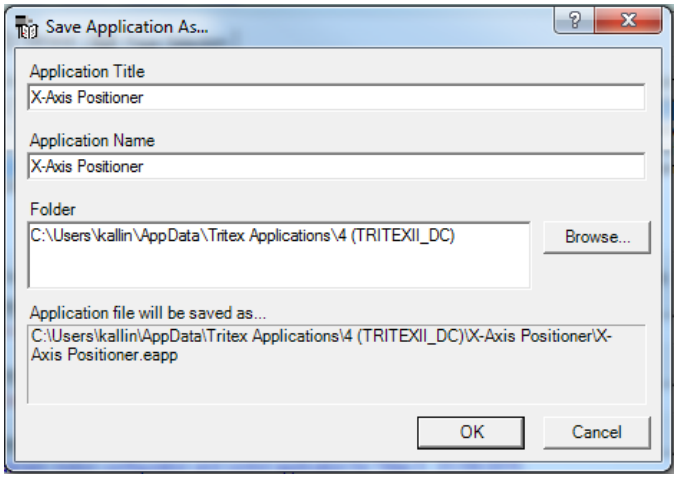


The *Page Selection* tab allows the user to add or remove pages from the chosen application template. A common addition is the Advanced Move Set-up page. The *Find Page* button can be used to add pages from other directories into the application, though this must be done with care to ensure the page is compatible with the drive type.



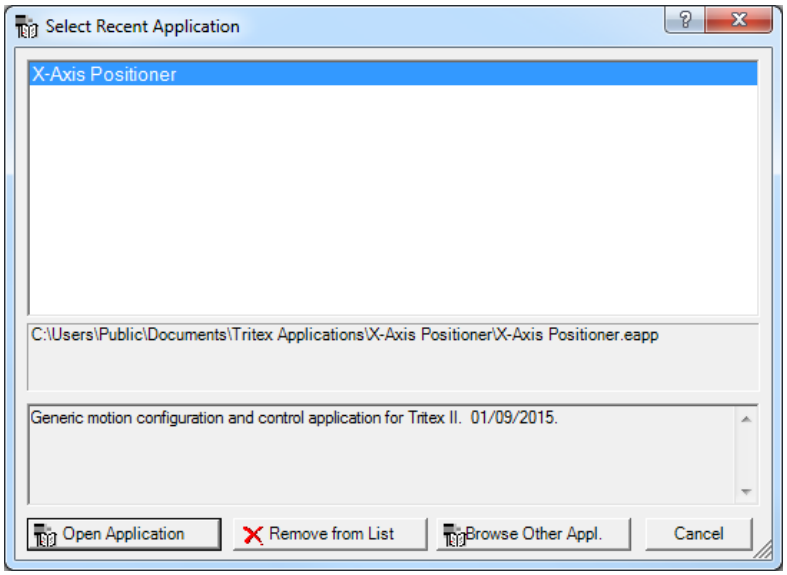
A description of the highlighted page in the “Available Pages” column appears in the center box. The title and description of the highlighted page in the “Included Pages” column are shown in the lower boxes. If the “*Hide Page on Start-up”* checkbox is checked (default for most pages) the page will be hidden when the application opens, however, all pages in the “Included Pages” list are available to the application by selecting *View→Page* later.

After pressing “OK” on the New Application window, a “Save Application As…” window pops up. The default folder for computer user kallin is shown, but in general uses the last save location. It always tries to add an extra folder level based on Drive Series. To save to a different location use the “Browse…” button or type or paste a path directly into the “Folder” area. Application Name starts out matching the Application Title, but may be changed, to differentiate versions for instance. It is the Application Name that determines the folder name and application file name. The final name and location of the application file is shown in the bottom area. It always creates a new folder that contains “Drive Files” and “Page Files” folders as explained in the Overview section above.



Open Application

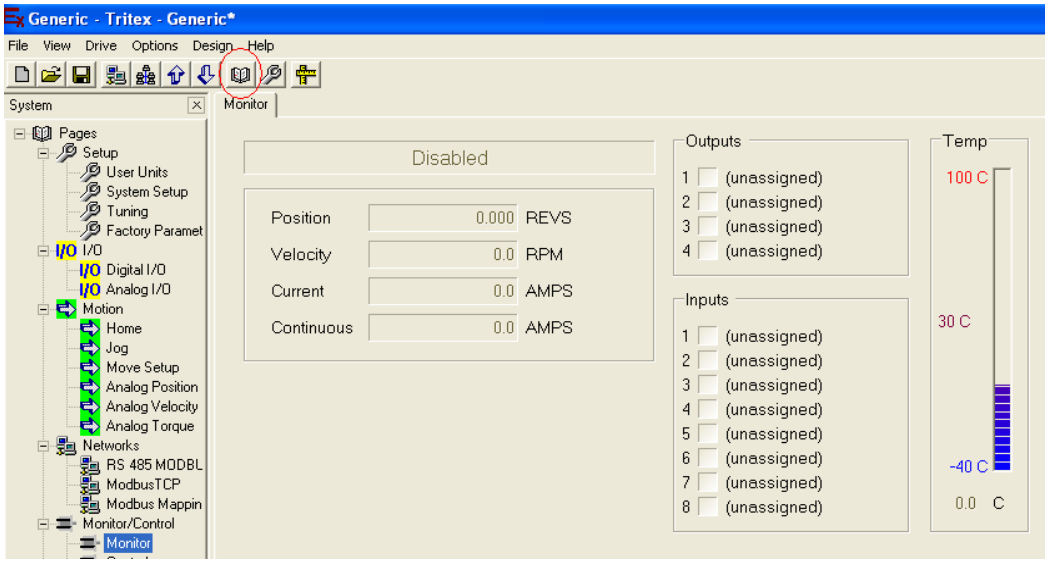
Selecting *Open Application* will provide a list of the last several applications used by the Expert software. (The first time the software is opened the list will be empty. Here there is only one.) If not in the list, use the “Browse Other Appl.” button to navigate to the desired application.



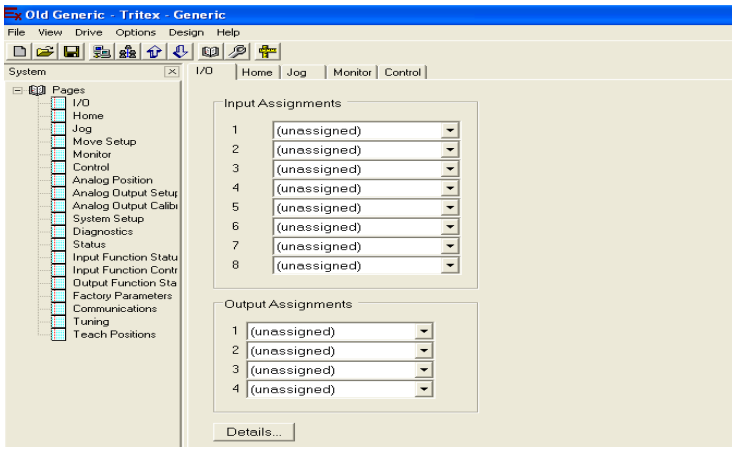
Setting up Application Pages

Viewing Pages in Application

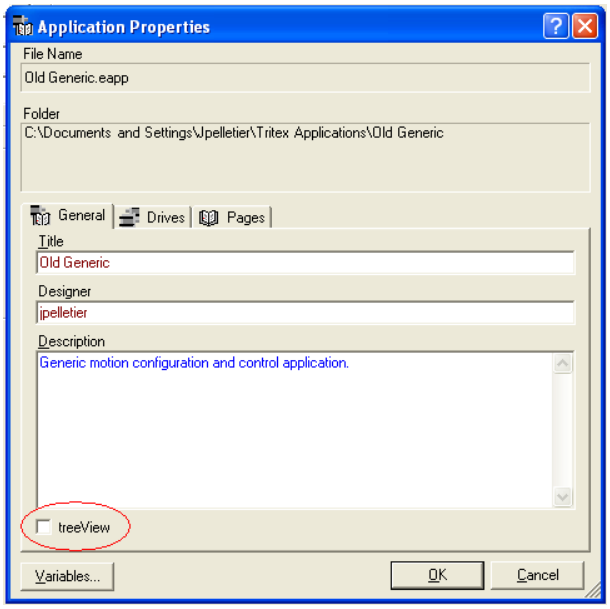
When an application is opened, the pages are shown on the tree to the left, grouped into categories. This tree is organized so that as the actuator is configured; the user will start at the top and work down the list in order.



Note: Older versions of the software had the pages in tabs at the top. The tabs that are displayed are determined either by the template application or during the build of a new application. These applications will most likely have more pages available than initially appear on the tabs. To view other pages, click the *Page* icon or select View→Page from the main menu bar and select the page to be viewed. These will appear in a tree at the left, but will not be grouped into categories.



If the newer version of software is being used, but the old style tabs are preferred, Select *File→Application Properties* and select of deselect the tree view option at the bottom left.



Viewing Pages NOT in an Application

If a page is needed that is not listed in the application, select *File→Open→Page* and browse for pages in other applications. If a page is added, the application should be saved by selecting *File→Save→Application As*…

Pages may also be added, deleted or hidden by selecting *File→Application Properties* and then clicking the *Pages* tab.

Key Application Pages

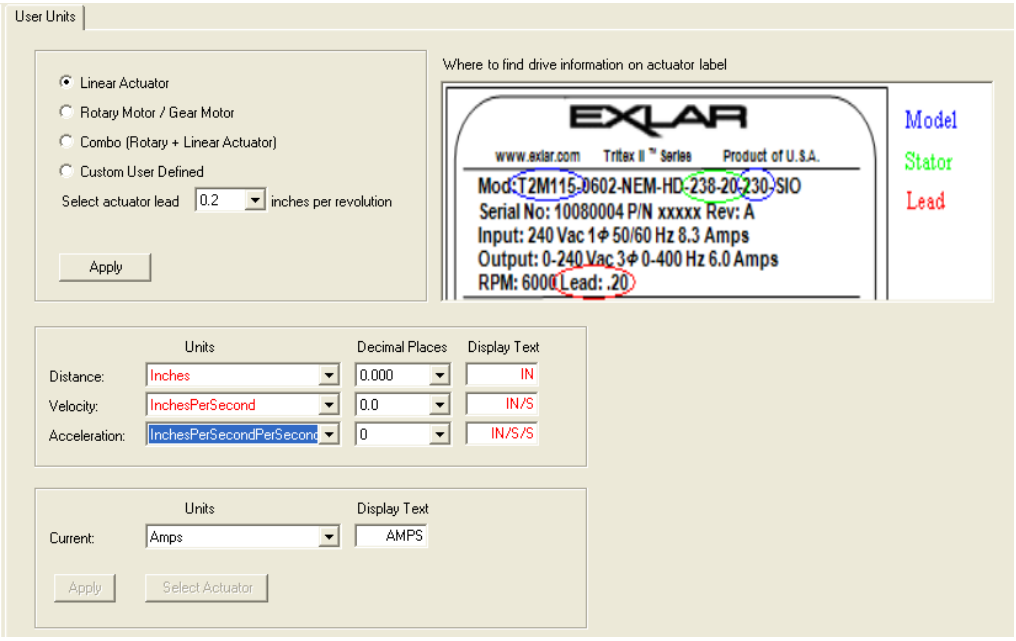
With an open application key pages or tabs that should be addressed for a specific application are:

1. *System Setup*- Start-up options, limits, fault enables, operating modes, *Dedicated Move* and *In Position Window*.
2. *Digital/Analog I/O*- Setup of digital I/O assignments.
3. *Home*- Setup *Home* move.
4. *Move*- Setup of motion controlled by digital I/O.
5. *Jog*- Setup of Jog mode. Even if the Jog function is not used in the final application, it can be used to test initial motion. See Jog section for details.
6. Analog Position/Velocity/Torque- If analog control is desired.

User Units

Configuring User Units

An important step in setting up a new application is to select the user units. In the “Setup” grouping of the pages tree, select *User Units.*



First, choose the type of actuator being configured, and select the lead (for linear actuators) or gear reduction (for rotary actuators) from the drop-down menu. If a custom type is defined, a user unit per motor revolution conversion factor will need to be defined.

Next, select the units, number of decimal places of precision, and display text for distance, velocity and acceleration. These will be the units in which the application will work in. **Table 1** defines which distance scale factor is used for each of the working units conversion.

Finally, choose what units will be used for current. The default is units of Amps with a display test of “AMPS”. However, if it is desired to work in percentage of the actuators rated current, then the specific actuator must be chosen.

Working Unit	Distance Scale factor used for conversion
Distance	
Inches	Inches
User Units	User Units
Revs	Internal, always available
Meters	Meters
Millimeters	Millimeters
OutputRevs	OutputRevs
OutputDegrees	OutputRevs
Velocity	
RevsPerMinute	Internal, always available
InchesPerSecond	Inches
UserUnitsPerSecond	User Units
UserUnitsPerMinute	User Units
MillimetersPerSecond	Millimeters
OutputRevsPerMinute	OutputRevs
OutputRevsPerSecond	OutputRevs
OutputDegreesPerMinute	OutputRevs
OutputDegreesPerSecond	OutputRevs
Acceleration	
RevsPerMinutePerSecond	Internal, always available
RevsPerSecondPerSecond	Internal, always available
InchesPerSecondPerSecond	Inches
UserUnitsPerSecondPerSecond	User Units
MillimetersPerSecondPerSecond	Millimeters
OutputRevsPerSecondPerSecond	OutputRevs
OutputDegreesPerSecondPerSecond	OutputRevs

Table 1: Distance Scale Factor Conversion table

Communication between PC and Tritex Actuator

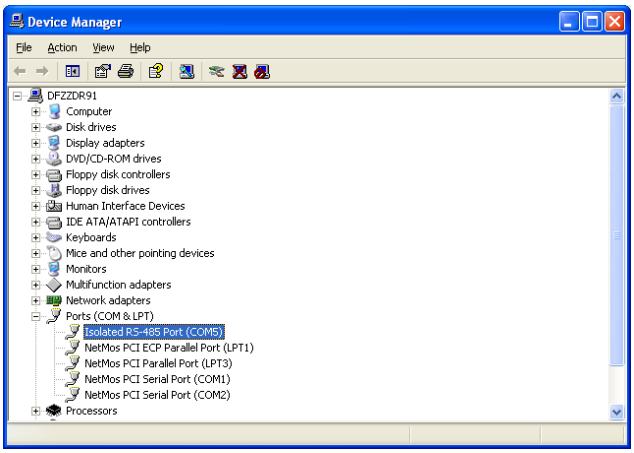
A Tritex actuator uses an RS485 hardware connection with a Modbus RTU protocol for communications with Expert software running on a PC. Therefore, an adapter will be required to interface from an RS232 or USB port on the PC to the RS485 port on the actuator. (See Installation Manual for details on the RS485 port).

Multiple actuators may be multi-dropped on a single Modbus network which requires all devices to have matching parameters for BAUD rate, parity and stop bits and unique Drive ID's. In many cases a PC running Expert software will be connected to only one actuator at a time. In this case it is still convenient to have all devices with matching BAUD rate, parity and stop bits, but all actuators can be left at default Drive ID = 1. Refer to "Changing Drive Parameters" section for setting up actuators.

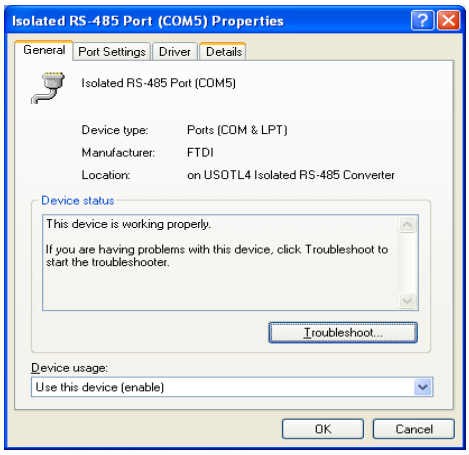
Note: If the PC has an RS232 port, skip the Device Driver section below.

Device Driver

If using a USB to RS485 converter, the device driver must be installed on the PC. To verify the device driver has been installed and the device is recognized, go to the PC Control Panel/System/Hardware/Device Manager and expand the *Port Settings* to a dialog box similar to that below.



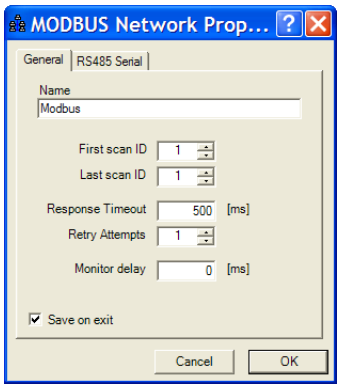
The name of the device driver that has been installed must show under *Ports*. If it does not, the Expert software cannot connect to the PC COM port. COM5 is used in the example above. Use the correct COM port number in the Expert software when setting up PC communication. Double-click on the COM port to see the screen below to verify the converter's device driver is working.



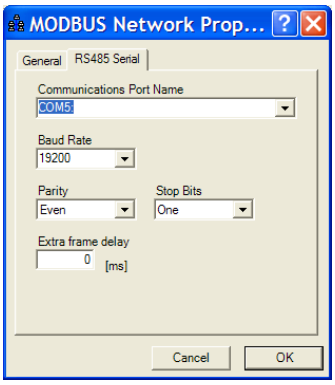
Port Settings

First, set up the Expert software to 'talk to' the pc communication port that is connected. From an open application, select *Options→Network Communication Properties→ModbusRTU…* to view the port settings, or select the  icon on the Toolbar.

Under the *General* Tab



Under the *RS485 Serial* Tab



First and Last scan ID- define the Modbus ID the software will start and stop scanning. Used for multiple actuators on one RS-485 Modbus network. (Default 1 and 1.) In the example above, only ID "1" will be scanned. **IMPORTANT:** The default actuator Modbus ID is "1". These settings will have to be changed to include all ID's assigned to actuators on the Modbus network.

Response Timeout- The Expert software will 'time out' if a response is not received from the actuator within this time. (Default 200ms)

Retry Attempts- If a "time out" or other communications error occurs, the software will attempt to send the same message; this sets the number of retry attempts before declaring a communications failure and going "off line'. (Default 1)

Communications Port Name- This is the serial communication port number. If the PC has an RS232, it is typically COM1 or COM2. If a USB converter is used, it is typically COM3-COM6

Baud Rate- Selects the Modbus network BAUD (or bit) rate. (default 19200.) The default baud rate of Tritex actuators is also 19200. **IMPORTANT:** This setting and the settings for all actuators on the network must be the same. The software does not attempt to make an 'auto' baud rate connection. If the actuator setting is unknown, different baud rates can be tried by changing this parameter.

Parity and Stop Bits - By default these are set to "Even" and "One" respectively to match the default settings in the drive firmware. Even or Odd parity require one stop bit, No parity requires 2 stop bits. **IMPORTANT:** These settings and the settings for all actuators on the network must be the same.

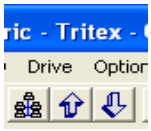
Extra frame delay- Is typically set to 0 ms unless more time is required by a RS485 communication converter. (Default 0 ms)

Note: The Expert software saves the COM port settings. As long as the same communication port is used, this step can be skipped in future online sessions.

Connecting to the Drive

Note: An application must be opened to establish an online session with a drive. As long as the actuator drive type matches the application drive type (Tritex II 230 Volt, Tritex II DC, etc), the data in actuator can be uploaded and viewed by the application. The Network Manager page may be used to scan for all actuators connected to a network and shows the Drive Type by number. This may be used to verify that the actuator is of the correct Drive Type to match the application.

There are three ways to connect to the drive: Scan for Online Drives, Upload, or Download, most conveniently accessed by icons on the Toolbar, but also accessible from the Drive pull-down menu.



Connect using "Scan for Online Drives" 

This method establishes communication, monitors status parameters and conditions, but does NOT upload or download drive parameters. Generally used only when re-connecting to the most recently connected actuator and parameters are known to match.

Important Note*:* The page parameters shown on the screens may not match those in the drive until an upload or download has been performed.

Upload using the up arrow  , or "Read Parameters from Drive".

This method establishes communication and uploads all of the parameters from the drive to the PC, and the drive stays online. Changes to the drive file can be performed and saved now as well.

Note: Since an upload will overwrite existing data in the open drive file, to avoid losing the current drive setup the software will prompt to "Save Drive File?" if there are unsaved changes before proceeding with an upload. The Expert software allows only one drive file per application to be open at any time.

If a parameter changes as the result of an Upload operation, the text will turn RED. This initially indicates the parameter changed but the drive file has not been saved. This is useful to see what parameters differ between the drive file and what is in the actuator. Right after an upload is a good time to perform a "Save Drive File As…" operation to create a drive file that matches a particular actuator including its factory parameters. Any red parameters will return to normal black when the drive file is saved, or in he unusual case of an Upload operation following a Download operation.

Download using the down arrow  , or "Write Parameters to Drive".

This method establishes communication and downloads drive parameters from the PC to the drive and the drive stays online. This is used to load the entire set of operating parameters for an actuator for a particular job. Parameters that are unique to an actuator such as tuning, communications Drive ID, calibration, and all "factory parameters" are not downloaded.

Important Note*:* Communications can sometimes fail to start or re-start with a pop-up saying "Unable to ping connection." It is sometimes necessary to go to the Network Manager window and remove the connection and remove the network, create a new network using the same parameters as before and scanning the network again. If this does not work, it may be necessary to unplug a USB to RS485 connector and plug it back in.

Changing Drive Parameters

Drive parameters may be changed by typing in new values or selecting from a drop-down list or clicking on a checkbox to toggle it.

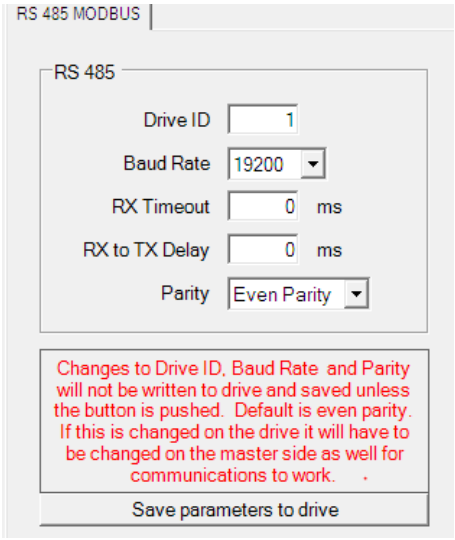
Note: When a numeric or text parameter has been typed to make a change, the change is not accepted until focus is moved by clicking on a different parameter or using <Tab> to move to the next parameter, or pressing <Enter>.

When a parameter on the screen is changed, the text turns RED, but the new value is generally NOT sent down to the actuator immediately. A few are written immediately such as Jog controls, tuning, and analog calibration. When a parameter is changed it can be sent to the actuator by double-clicking on the parameter or right-clicking and selecting "Write current value to connected drive" from the pop-up menu. Many parameters do not continuously update from the actuator either. If ever in doubt about the value in the actuator, right click on the parameter and select "Read value from connected drive.

Important Note: Even though a parameter is entered, downloaded and active in actuator RAM memory, parameters are NOT saved to actuator non-volatile memory (NVM) until a Download operation or "Write Parameters to Drive" command executes, which downloads most parameters and saves to NVM. Parameters sent to the actuator without a Download operation will revert back to the last value stored in NVM when logic power is cycled.

Setting up Tritex RS485 Modbus RTU Communications

The RS485 Modbus page allows the user to set the actuator communication parameters to match the requirements of the communication network. Since these changes are generally being sent over the network that is being reconfigured, critical changes will not take effect right away, but will be delayed until the actuator restarts after power is cycled. Then the PC running Expert software will have to have its communications parameters changed to match in order to re-establish communications.



Drive ID- This is the Modbus node ID. Change delayed until actuator restarted (power cycle).

Baud Rate- This is the baud rate for serial communications. Change delayed until actuator restarted (power cycle).

Rx Timeout- This is the additional time beyond the standard "1.5" character time before a receive command "times out", also called the inter-character gap. Modbus masters should be able to send messages without significant gap and the value can remain 0. Some PC's may occasionally introduce gaps, requiring a non-zero value for reliable communications.

Rx to Tx Delay- This is the delay time between when a command is received and the response is transmitted. Typically set to 0, but some Modbus masters may hold the network for a while at the end of a message, requiring a non-zero value for reliable communications.

Parity- This sets the parity type, Even and Odd Parity require one stop bit, and No Parity requires two stop bits from the master. These settings must match the settings in the Modbus master, usually the PC running Expert software, see the "Port Settings" section for Expert above. Change delayed until actuator restarted (power cycle).

Note: Changes to the critical parameters will not be sent to the drive unless the *Save parameters to drive"* button on this page is pressed. A normal download will not write these parameters to the drive. This allows a drive file prepared for any Drive ID to be downloaded to the connected drive without changing the Drive ID.

Online Status and Control

The *Status*, *Monitor* and *Diagnostics* pages are very useful for observing drive operation. For more information on the *Status* see the Online Diagnostic section towards the end of this manual

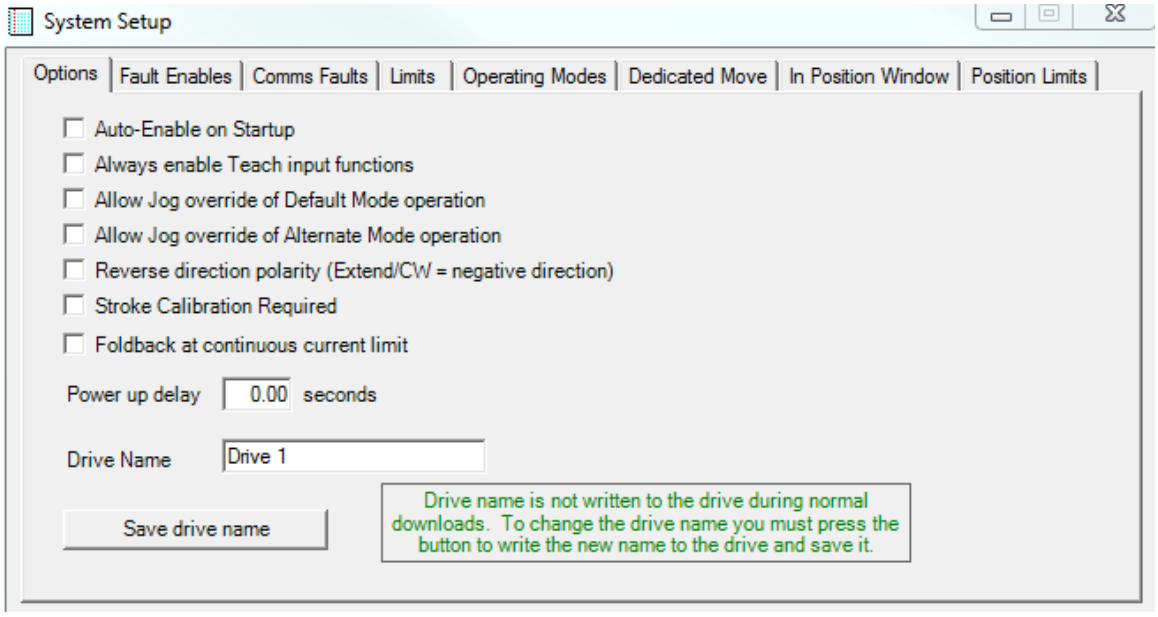
The *Control* page can be used for starting and stopping motion directly from the screen.

For advanced online control the *Input Function Control* page can be used to activate all input functions, providing total control from the PC. The *Output Function Status* page can be used to monitor the exact state, mode and motion type.

System Setup

The System Setup page is separated into eight tab groups containing various setup parameters.

Options



Auto-Enable on Start-up- If checked, the drive will automatically enable when bus power is applied and after the *Power-up Delay* has expired (see Fault Enables tab)

Always enable Teach input functions- If checked, the *Teach* function is always enabled.

Allow Jog override of Default Mode operation- If checked, a *Jog* command will override any motion currently commanded from the *Default Mode*. For example, if a *Move* or *Analog* motion is active from the *Default Mode*, and a *Jog* motion is commanded, the *Jog* will take priority and override the *Default Mode* motion. *Jog* will NOT override a *Dedicated Move* or *Home* command.

Allow Jog override of Alternate Mode operation- If checked, a *Jog* command will override any motion currently commanded from the *Alternate Mode*. For example, if a *Move* or *Analog* motion is active from the *Alternate Mode*, and a *Jog* motion is commanded, the *Jog* will take priority and override the *Alternate Mode* motion. *Jog* will NOT override a *Dedicated Move* or *Home* motion.

Reverse direction polarity (Extend/CW = negative direction) - If checked, the polarity of movement for all commands and feedback (position, velocity and current) will be reversed. This is used to change the actuator direction without changing the commanded position, velocity or torque. For example, a NEGATIVE command will move a linear actuator in the extend direction and a rotary actuator in the CW direction.

Note: Changing this flag changes the definition of all absolute positions. Therefore, the *Homed* output function flag is automatically cleared. A *Home* command is required to resume operation.

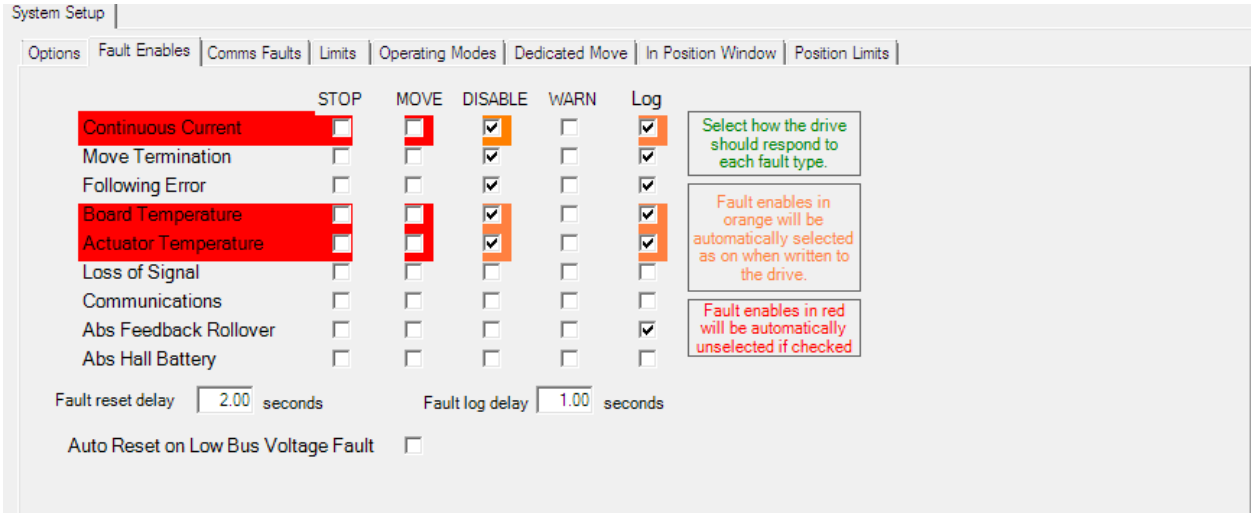
Stroke Calibration Required- If checked, all motion is disabled until a Calibrate Stoke cycle has been completed. For more information on Stroke Calibration see the Valve section of this manual.

Foldback at continuous current limit- If checked, a continuous current fault will not occur. Rather, the current will be limited to the continuous current level until the actual continuous current level drops below 80% of the continuous current setting.

Note: This feature is available in Firmware version 2.37 and higher for the DC and 75 mm AC Tritex and version 2.20 or higher for the 90/115 mm AC Tritex.

Power-up delay- This is a time delay added, before the any of the drives processes start to run following a power-up. This includes, communication, IO processing as well as the motor control.

Fault Enables



CAUTION

Continuous Current, Board Temperature and Actuator faults are there to protect the actuator. Always select Disable and do not select STOP or MOVE for these faults as they may prevent the drive from Disabling. Later versions of firmware do not acknowledge the STOP or MOVE options with these faults. (Ver 2.38 for DC and 75mm AC Tritex, and 2.22 for 90/115 mm AC Tritex and later have this protection)

The following describes the actions taken by the drive when a fault condition occurs, depending on what the user has selected for each fault.

WARN- Causes a warning status and the *Warning* output function to become active. The *Warning* will clear when the fault condition clears.

DISABLE- Causes the drive to disable (removes power from the motor) for the selected fault. The drive must be re-enabled after the fault condition has cleared. Re-enabling after a fault does not happen automatically. The *Fault reset delay* does not apply because an auto-reset is not allowed when *DISABLE* is selected.

MOVE- Causes the *Dedicated Move* to activate, moving the actuator to the pre-defined *Dedicated Move Position.* If the fault condition clears and the *Fault reset delay* expires before the move is complete, normal operation will be continued. (see *Dedicated Move* section for more details)

STOP- Issues a *Stop* command to stop motion. The *Stop* mode will be cleared when the fault is cleared and the *Fault reset delay* has expired.

If more the one action is selected they are executed in following sequence:

1. *WARN* 2. *STOP* 3. *MOVE* 4. *DISABLE*

Example 1: *MOVE* and *DISABLE* are both checked for a *Loss of Signal* fault. First, the move to *Dedicated Position* would take place. When it is completed, the drive will disable.

Example 2: *STOP* and *DISABLE* are both checked for a *Loss of Signal* fault. First, a Stop would take place, (following the *Stop Ramp* Limit, see below). When it is completed, the drive will disable.

Example 3: *STOP* and *MOVE*, checking *STOP* and *MOV*E together isn't helpful because the *STOP* happens first the *MOVE* cannot be executed because of *STOP* condition.

Fault reset delay- This time delay is added before automatically recovering from a fault condition. This feature is only effective when *DISABLE* is NOT selected.

***Note*:** If *DISABLE* is checked, there is no automatic fault recovery; the fault is latched and the drive will remain disabled until a reset occurs or the drive is enabled again and the fault condition is removed. If *DISABLE* is not checked, the drive will automatically recover when the fault condition is cleared and after the *Fault reset delay* time has expired.

Example: The delay is set 3000ms (3 sec). The *Loss of Signal* fault is set to perform a *STOP*. On a *Loss of Signal* condition the Stop mode would immediately be activated, and remain until the *Loss of Signa*l condition is rectified. Then, after a 3 second delay, operation will continue.

Fault Log Delay- This time delay is to avoid logging false faults during a normal power down, such as *Low Bus* voltage. (See *Status Log* page section)

The following describes the different types of faults that can be set to per the above:

Continuous Current- The drive continuously monitors the drive power on an I^2t calculation and compares this value to the factory limit. This fault should be set to both disable the drive and log and not bypassed by the user.

Move Termination- This fault condition can occur if the option is checked on the *Move Setup* page.

Following Error- This fault condition occurs if the Max Following Error and Following Error time limit are exceeded.

Board Temperature- This fault condition occurs when the drive board temperature is over the factory limit. This fault should be set to both disable the drive and log and not bypassed by the user.

Actuator Temperature- This fault condition occurs when the temperature sensor in the stator winding indicates the temperature of the stator is over the factory limit. This fault should be set to both disable the drive and log and not bypassed by the user.

*Loss of Signa*l- This fault condition occurs only when the *Enable Analog Input* box is checked and the *Analog Input* value drops out of range.

Communications- This fault condition occurs when the Tritex loses communication with a given communication protocol, such as Modbus, Ethernet or Profinet.

User Low Bus Voltage- This fault condition occurs in DC drives when the user sets a low bus voltage limit and the bus voltage drops below that limit.

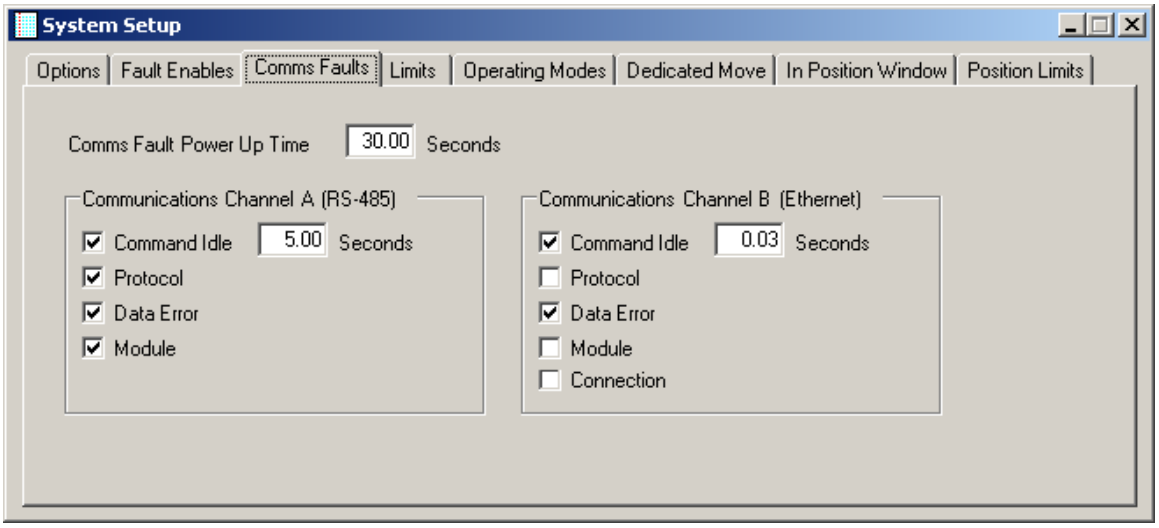
Abs Feedback Rollover- This fault condition occurs on drives that use an absolute feedback device when the drive has gone over the absolute feedback limit of +/-8192 revs. The turns limit was removed in August 2016 on all new units, so this fault will not occur.

Abs Hall Battery- This fault condition occurs on drives that use an absolute feedback device when the absolute feedback battery voltage droops, indicating battery replacement is needed soon.

Auto Reset on Low Bus Voltage Fault- If this checkbox is set, a Low Voltage Fault will be cleared automatically when the voltage rises to 110% of the Low Voltage Trip value. This parameter does not apply to the User Low Bus Voltage fault.

Note: This feature is available in Firmware version 2.37 and higher for the DC and 75 mm AC Tritex and version 2.20 or higher for the 90/115 mm AC Tritex.

Communication Faults



The Comms Faults tab is used to set up the conditions that will be monitored to determine a host communication fault. These conditions will only take action when the Communications fault action is selected on the Fault Enables tab.

Comms Fault Power-up Time- This sets the time delay at power-up before communication faults are monitored. This allows time for the host controller to power-up and establish communications, preventing unnecessary faults at start-up.

Several conditions of the communication ports are monitored. For each communication channel, the conditions desired to generate a fault condition can be selected.

Command Idle- If a valid command from the host has not been received in the time entered, this fault condition will be set.

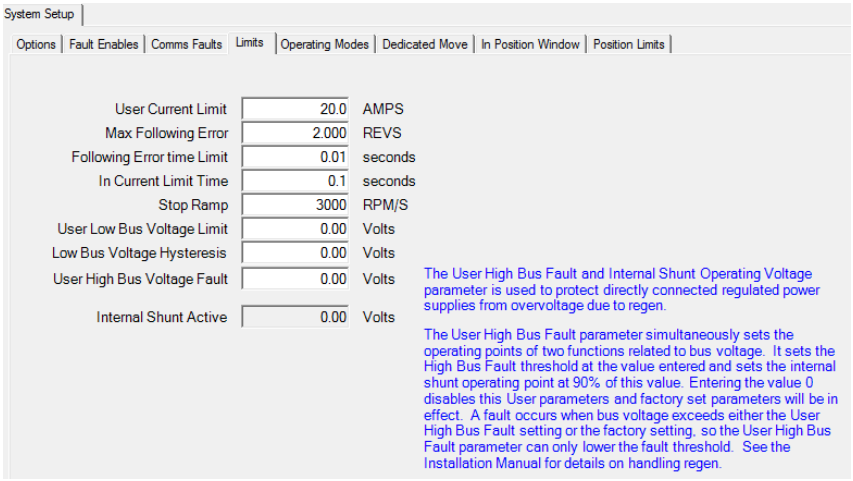
Protocol- If a protocol error, such as incorrect parity, invalid CRC, framing error etc. occurs, this fault condition will be set.

Data Error- If a data error, such as invalid address, invalid range etc. occurs, this fault condition will be set.

Module- If a module error, such as invalid ID address, invalid baud rate etc. occurs, this fault condition will be set.

Connection- This monitors the Ethernet/IP and Profinet I/O connection. If the connection is not present a fault condition will be set.

Limits



The Limits tab on the System Setup page is shown above. Parameters are as follows:

User Current Limit- Sets the maximum current the drive will deliver to the actuator, though the Factory Current Limit will be enforced if lower than the User Current Limit setting.

Max Following Error- Sets the maximum allowable following error (difference between commanded position and actual position). If following error exceeds this value longer than the *Following Error Time Limit*, a fault will occur. This condition is monitored for position and velocity mode only, NOT in current/torque mode. Default value is 0.5 motor revs. ***Note:*** Motion profiles should be designed such that following error is within about .25 motor revs under normal operation so that Following Error faults indicate unusual loads or machine jams.

Following Error Time Limit – This is the allowable time the following error can exceed Max Following Error before fault condition actually occurs.

In Current Limit Time- This sets the amount of time the current limit is active before asserting the current limit output status flag. It also applies to an internal current limit event. For example, if the *Current Limit* box is checked for the *Home* sequence, and is set to 5 amps, the drive will limit the current to 5 amps during the *Homing* sequence. If the *Terminate on Current Limit* box is checked, the drive will have to supply 5 amps for this specified time before the termination is satisfied (also applies to "feed moves").

Stop Ramp- Sets the deceleration that will be used when the *Stop* function is activated.

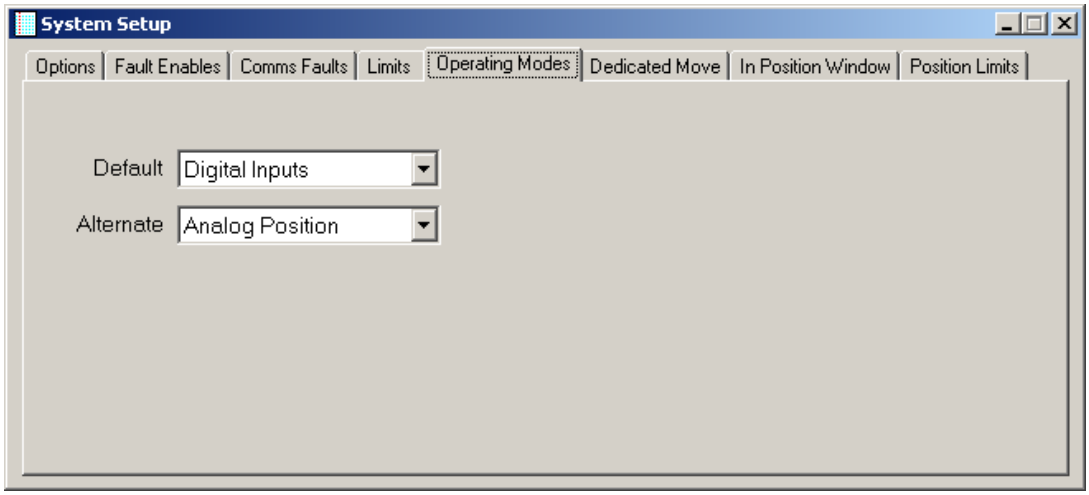
User Low Bus Voltage Limit – Minimum bus voltage without causing a "User Low Bus Voltage" fault. This fault is implemented on DC drives only.

Low Bus Voltage Hysteresis – The voltage level at which the fault User Low Bus Voltage fault will reset. (It is not strictly speaking a hysteresis value.)

User High Bus Voltage Fault- This is only used on the Tritex II DC (TDM,TDX,RDM & RDG models). The *User High Bus Voltage Fault* and *Internal Shunt Active* parameters are used to protect directly connected, regulated power supplies from overvoltage due to regen. The *User High Bus Fault* parameter simultaneously sets the *High Bus Voltage Fault* threshold at the value entered and sets the

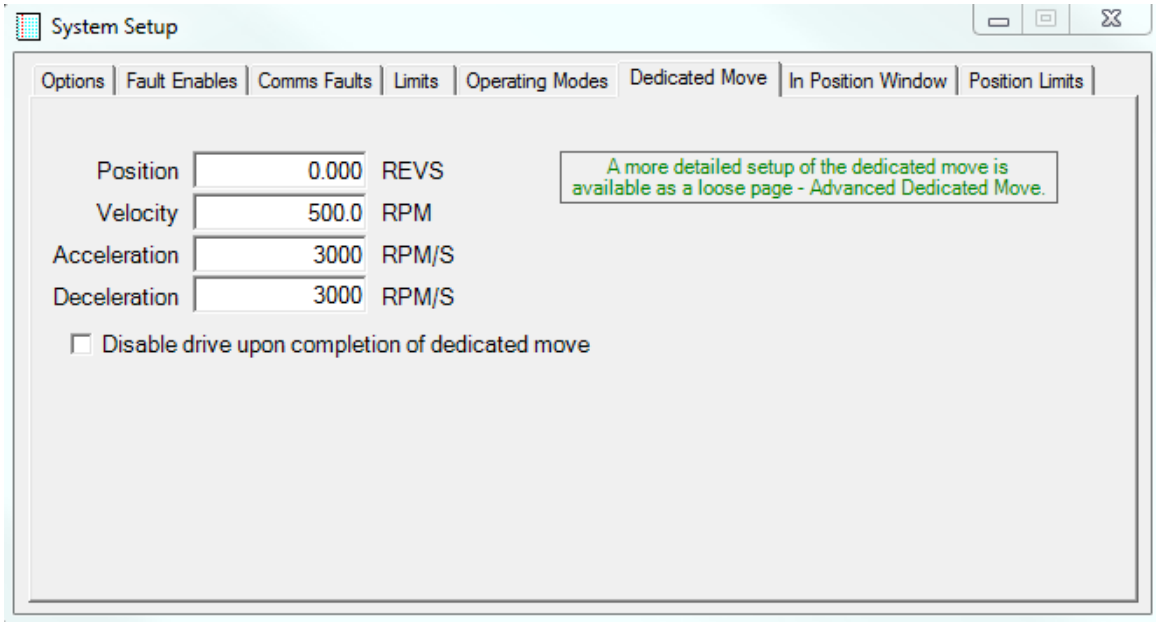
internal shunt operating point at 90% of this value. Entering the value “0” disables this user parameter and factory parameters will be in effect. A fault occurs when bus voltage exceeds either the *User High Bus Voltage Fault* setting or the factory setting. Therefore, the *User High Bus Voltage Fault* parameter can only lower the fault threshold. (See the Installation Manual for details on handling regen). DC drives only.

Operating Modes



This tab allows selection of the source/motion type for *Default* and *Alternate* modes. The possible selections for each mode include: *Inactive*, *Digital Inputs*, *Analog Position*, *Analog Velocity, Analog Current, Host Position, Host Velocity or Host Current.*

Dedicated Move

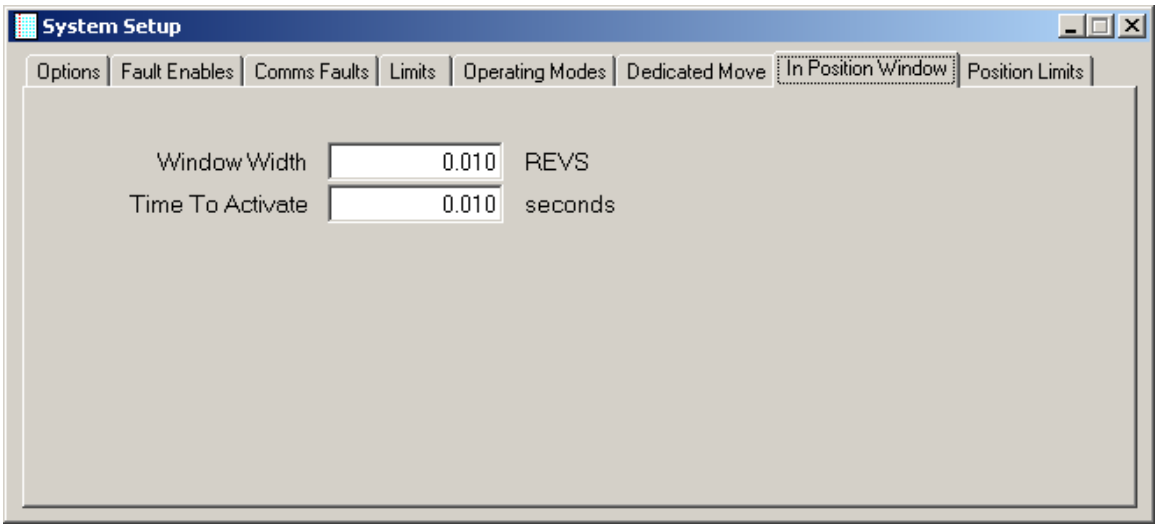


The *Dedicated Move* is designed to provide a method, available from any mode, to move to a specified position. The *Dedicated Move* has priority in all operating modes at all times. If the *MOVE* flag is set

high at any time, during any action, the *Dedicate Move* will be executed. If the *Disable drive upon completion of dedicated move* box is checked, the actuator will be disable at the completion of the *Dedicated Move*. The actuator must be enabled again to resume operation.

Note: The *Dedicated Move Position* is an absolute position, therefore the actuator must be homed (*Homed* output function on), usually by completing a *Home Move*, before a *Dedicated Move* will be allowed to execute.

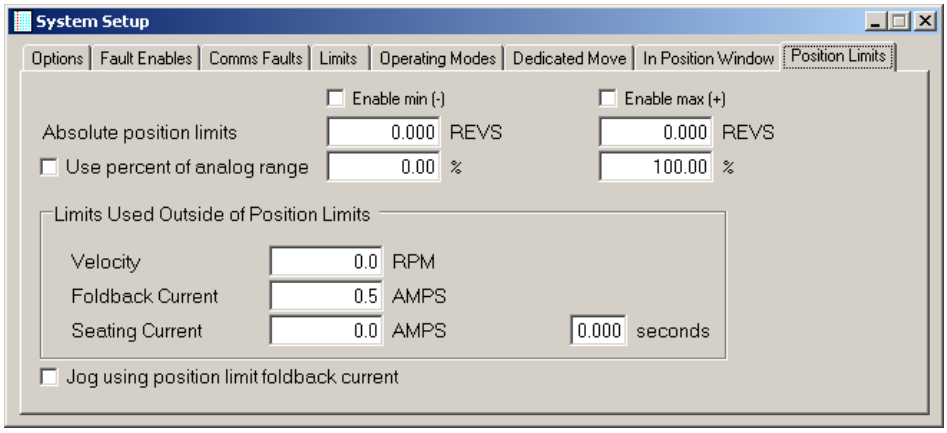
In Position Window



The *In Position Window* defines the window and time delay used by- *Home*, *Dedicated Move*, *Move (x)* and *In Position* output functions-to determine the actuator at the right position. The window width is actually +/- the value entered. For example, if the 0.005 inches is entered the actual position must be within +/– 0.005 inch of the commanded position. The *In Position* condition is satisfied when the commanded position "minus" actual position is within the window AND remains there for the specified *Time To Activate*, AND the commanded velocity is ZERO.

Note: In *Analog Position* mode, the commanded velocity is usually changing continuously, dithering in position. Therefore, the commanded velocity is rarely zero for very long, so the *In Position* output function will continually cycle on and off.

Position Limits

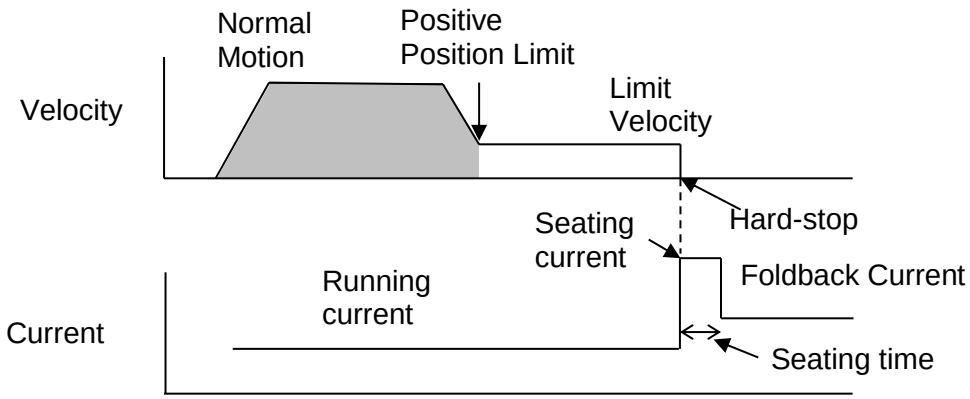


Position Limits are software monitored travel limits, with special features for control outside of these travel limits.

The limits can be enabled individually for each direction during all modes of motion. The controller looks ahead to anticipate when/if the position limit will be hit based on the current velocity at approximately a 2ms scan rate. If it is determined the limit will be reached, the control decelerates using the acceleration/deceleration rate for the active mode. Once the commanded position is outside of the position limit range, the *Velocity*, *Foldback Current* and *Seating Current* parameters take effect. The motion control, while outside of the position limits, operates in a special mode to limit velocity and current. If the velocity is set to zero, motion will stop near the limit position; if it is non-zero, the motor will ramp to the limit velocity, without stopping until it reaches a hard stop. When a hard stop is hit, the *Seating Current* will be produced for the specified time and then the current will be switched to the *Foldback Current* value. During this *Position Limit* mode of operation, the *Following Error* does not build up when a hard stop is reached; instead, the *Following Error* is controlled to maintain the specified current limit. The limits are direction sensitive, meaning that velocity and current are only limited in the direction of the active position limit; any motion commanded in the opposite direction will operate normally.

Exception: If the mode of operation is *Analog Torque* or *Host Current* mode, the *Velocity* limit will not be in effect, however, the *Seating Current* and *Foldback Current* limits are active.

Note*: Position Limits* are only active after a *Home* has been completed (Homed status flag is on).



Position Limits parameters

Enable min (-) and max (+) - Select the direction in which the limit parameters are active.

Absolute Position Limits- Set the position where the limits become effective. Since they are absolute positions, a *Home* must be completed before they will take effect.

Use percent of analog range- This option is normally used if the position mode is *Analog Position* and the user desires to base the position limits on the percent of the analog position min and max settings. If this box is checked, the specified percent of *Analog Input* command will be used instead of the *Absolute position limits.* This is common in valve applications.

Limits Used Outside of Position Limits

These limits take effect when the commanded position is outside of the *Position Limits* parameter values.

Velocity- This is the velocity limit in user units. If set to zero, the motor/actuator will stop near the position limit. If set to a non-zero value, the velocity will be ramped to this velocity at the position limit position.

Foldback Current- The current will be limited to this value when the commanded position is outside of the position limit range and the *Seating Current* limit has been reached and the time has expired.

Seating Current- If a hard stop is hit while outside of the position limit range, the current will built to this value for the specified time. When the time has expired, the *Foldback Current* limit will take effect. If it is not desired to have extra current for seating, this value should be set equal to the *Foldback Current* limit.

Note: If Homing to a current limit is use the *Feedback and Seating Current Limits* must be set to a higher value than the *Home Current Limit* to avoid conflict when trying to perform a home beyond the Position Limits.

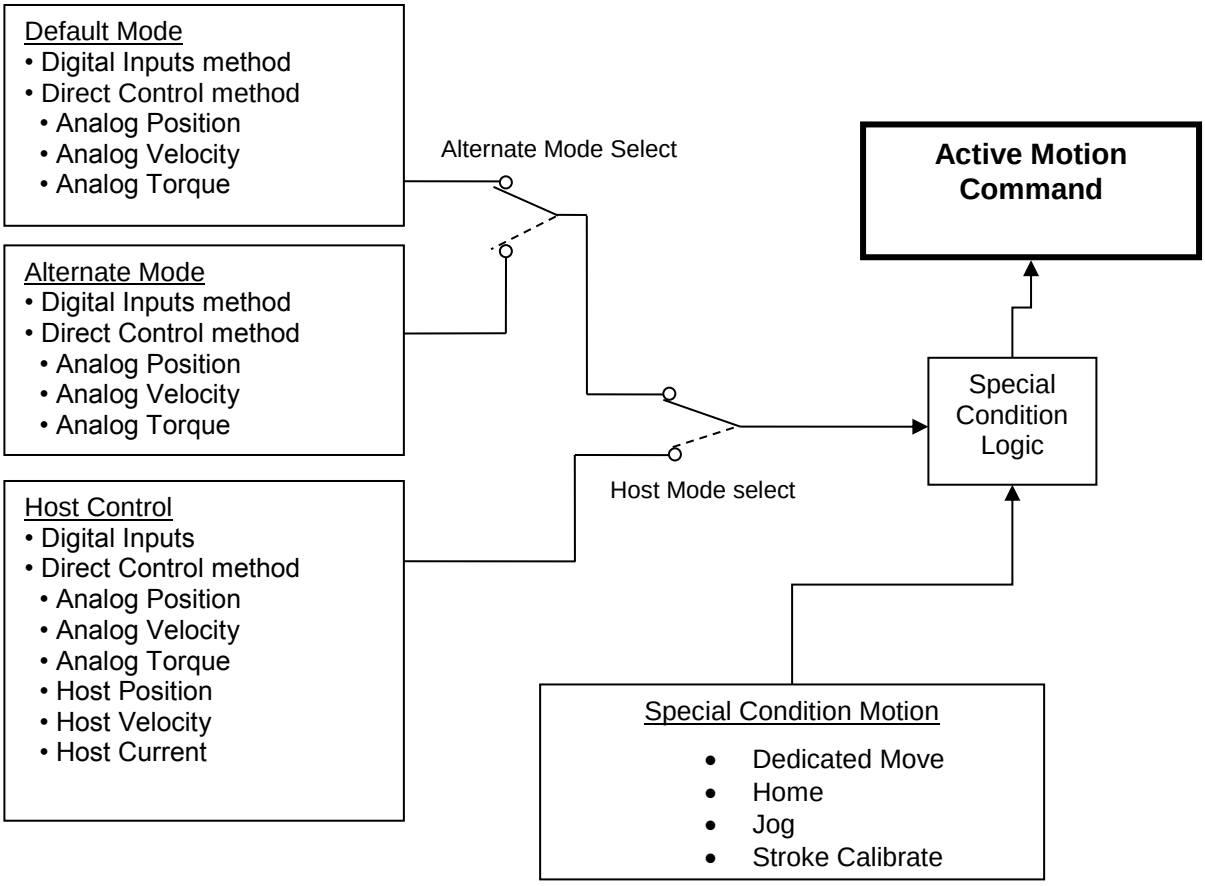
Recovering from a Position Limit Condition

The method of recovery from a Position Limit condition is dependent on the motion mode that was used to enter the position limit range. In the following modes, any velocity or toque mode, Host Position, Analog Position, or Jog; a command in the opposite direction will move out of the Position limit condition. If a Move Maintained input function started a Move that caused the Position Limit condition the Move can be discontinued by removing that input function and any motion mode can be used to move out of the condition. If a Move Momentary input function started a Move that caused the Position Limit condition, the Move remains active until the distance or termination method is satisfied, this prevents other Moves initiated by Move Momentary input functions from operating. To move out the position limit condition move must be terminated, this can be done with a number methods, A Move initiated by Move Maintained Input function ,Stop, Disable, Jog in the opposite direction if Jog Override is selected on the Setup page, Initiating a dedicated Move, or selecting Alternate Mode.

MOTION CONTROL

Motion Control Overview

There are two basic methods to control motion: *Digital Inputs* or direct control of position, velocity or torque. The *Digital Inputs* method can control *Jog*, *Move*, *and Dedicated Move and Home* motion types. The direct method can control position, velocity or torque directly from either an analog command or a host command. These motion control types are available in three modes: *Default* mode*, Alternate* mode and *Host Control*. To provide additional flexibility and ease of use, *Dedicated Move, Home*, *Jog* and Stroke Calibrate motion types are available under certain conditions even if *Digital Inputs* is not the selected control method.



Default & Alternate Mode- Default and *Alternate* can each be assigned a motion type, with only one type active at a time. *Digital Inputs*, *Analog Position*, *Velocity* and *Torque* can be selected for each. *Default* is the normally the active mode and *Alternate* mode can be selected via an input or via Modbus. For example, if *Digital Input* mode is selected as *Default* and *Analog Position* is selected for *Alternate*, indexing can be performed using the *Move* input functions and, as soon as the *Alternate* mode input function is active, the controller will switch to *Analog Position* mode.

Host Control- Host Control can only be selected via Modbus commands. *Host Control* allows the same motion types as the other modes, plus *Host Position*, *Velocity* and *Torque.*

Special Condition Motion

The *Special Condition Logic* allows certain motion types to be activated from input functions, even if *Digital Inputs is not the current active* mode.

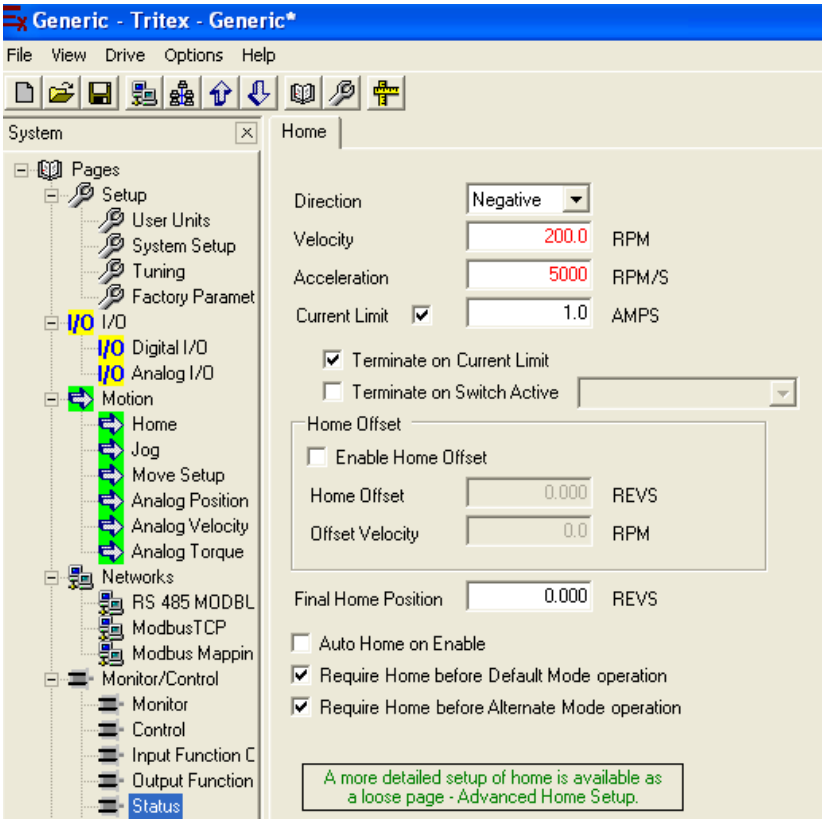
Dedicated Move: If the *Dedicated Move* input function is activated from an input or Modbus command, it will override any active motion from any mode, except a *Home* motion. As soon as the function is deactivated, the motion type will revert to the active mode. A *Home move* must be completed (*Homed* output function on) before a *Dedicated Move* will be allowed.

Home: If a *Home* move has not been completed, a *Home move* can be initiated from an input or Modbus command, even if *Digital Inputs* is not the current active mode. Once the *Homed* output function is active, a subsequent *Home move* can only be executed when *Digital Inputs* mode is the active mode.

Jog: If the *Allow Jog Override on Default Operation Mode* or *Allow Jog Override on Alternate Operation Mode* check box is checked, a *Jog* motion will override the active motion, even when the *Digital Inputs* mode is not the current active mode. (See the *Start-up* tab of the *System Start-up* page for details)

Motion Type – Homing

Home Move Parameters



Direction: Select plus or minus direction; minus is the default.

Velocity: This is the *Home* move maximum velocity. This may or may not be achieved, depending on the distance traveled and acceleration parameter.

Acceleration: The acceleration ramp used during a *Home* move

Current Limit: This sets the current limit for the *Home* move when the box is checked. If the *Terminate on Current Limit* box is checked, the *Home* move will terminate when the motor current is equal to or greater than this value. (The time to satisfy a *Terminate on Current Limit* condition is determined by *In Current Limit Time* parameter on the *System Setup* page). If the *Terminate on Switch Active* box is checked and the *Current Limit* box is checked, and the current value is exceeded before a switch is found, a *Switch is Not Found Fault* will occur. (See Faults & Warning)

Note: If the *Current Limit* box is checked, and the *Terminate on Switch Active* box is checked, do NOT select both *Auto Home on Enable* and *Auto Enable on Start-up* (*System Setup* page). If the actuator is against a stop in the home direction, each time the fault is attempted to be cleared another home against the stop is executed creating another fault.

Terminate on Current Limit/Switch Active: This action will end the searching portion of the *Home* move. A specified current limit AND/OR switch (1-16) input function, can be used to terminate the *Home* move.

Home Offset: The *Home Offset* is a distance moved after a termination condition is satisfied. Typically it is used to move off of a hard-stop when *Terminate on Current Limit* is used. If no offset is desired, enter "0".

Offset Velocity: The velocity used during the offset portion of the move.

Final Home Position: The commanded and actual positions are set to this position at the completion of a *Home* move.

Auto Home on Enable: If this box is checked, a *Home* move will automatically be performed on enable.

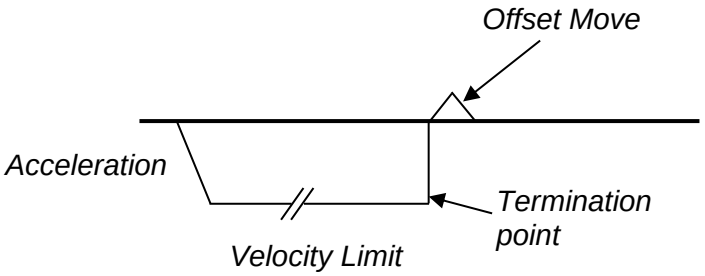
Require Home before Default/Alternate Mode operation: If checked requires a *Home* to be completed before operation from the *Default/Alternate* mode operation.

Home Initiation

The *Home* move can be initiated from the following methods:

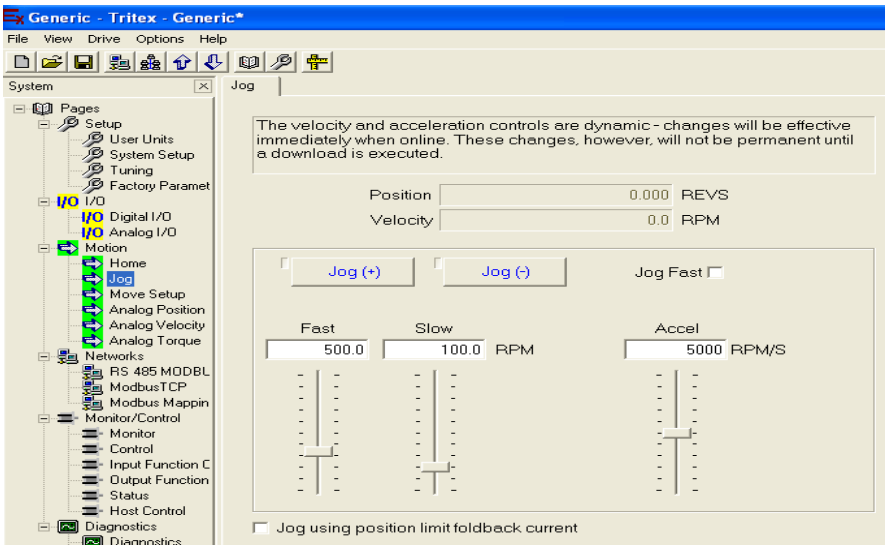
1. The *Home* input function from an assigned digital input
2. Input Function Control page
3. *Home* button on the *Control* page
4. From a host using a Modbus command
5. Automatically *Home* when the actuator is enabled, if the *Homed* status in not active.

Once initiated, the acceleration rate will be followed to achieve the specified velocity. The *Home* termination selection is poled at a 2ms rate looking, for a termination condition to be satisfied. Following the termination, the *Home Offset* move is executed. Then the *Final Home Position* is applied



Home Move Velocity Profile

Motion Type - Jogging



Jog Parameters

Slow: The *Jog* speed when *Jog Fast* is not selected

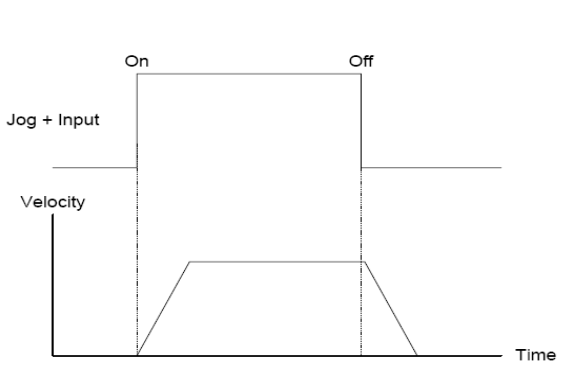
Fast: The *Jog* speed when *Jog Fast* is selected

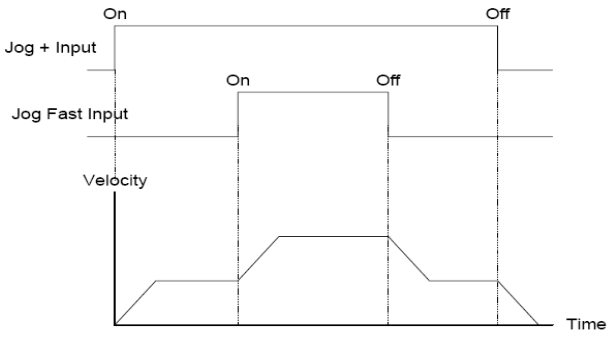
Accel: The acceleration and deceleration ramp used in *Jog* mode

Jog Controls

Jog Fast, *Slow* and *Accel* slider bars provide an easy way to change *Jog* parameters; these changes take effect immediately but are not saved permanently until a download is performed. The *Jog (+)* and *Jog (-)* buttons will activate a *Jog* as long as they are held down with a mouse click. The indicators next to the buttons illuminate when the *Jog* is active. Selecting the *Jog Fast* check box or an input function will toggle the *Jog Fast* velocity.

The *Jog* function can be initiated from the *Jog +/-* input functions, which can be activated from the assigned digital inputs*, Input Function Control* page, *Jog* buttons on the *Jog* page or the *Control* page, or from a Modbus command. *Jog* can be selected to override other motion types as well. (See the *System Setup* page description and *Motion Description section*).

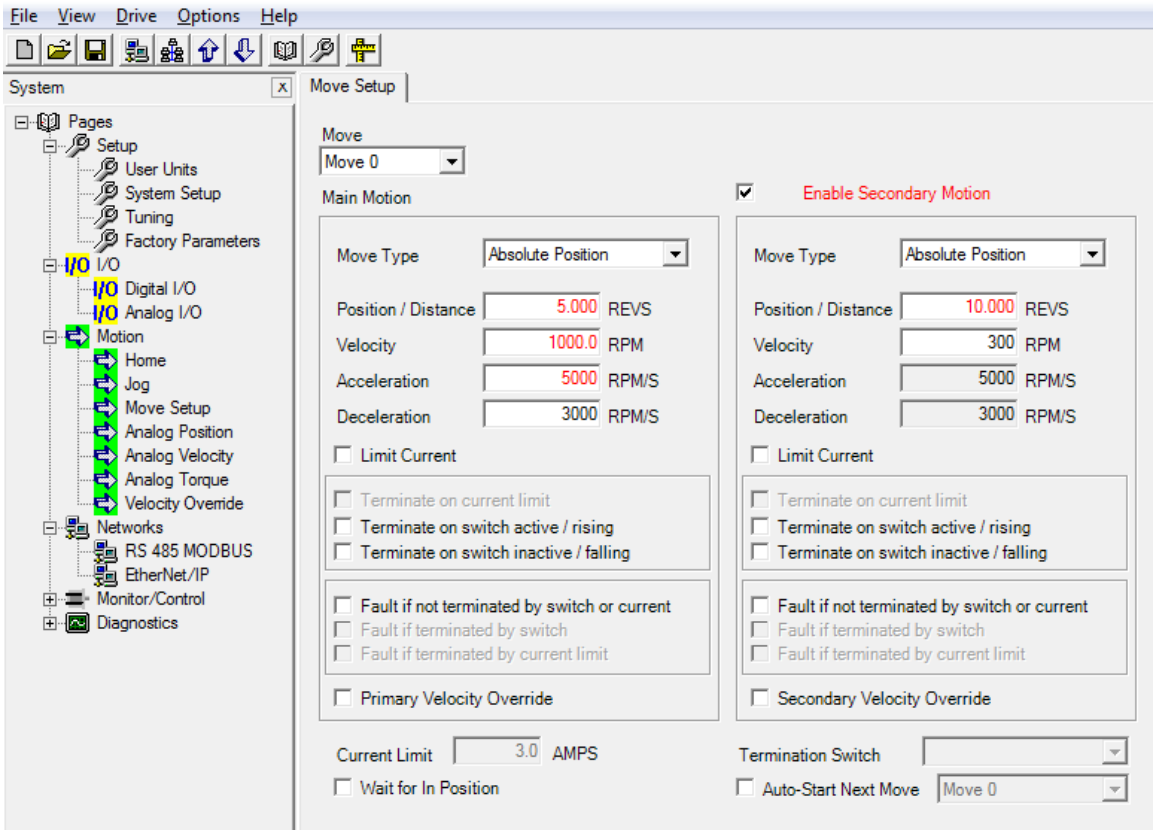


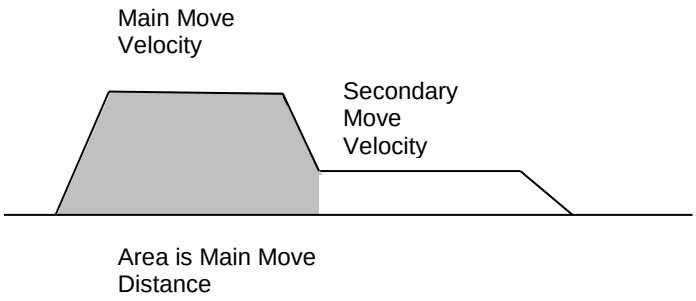


Jog using position limit foldback current- This flag limits the available current when a *Jog* motion is active to the *Foldback Current* value set on the *Position Limit* tab of the *System Setup* page. This can be used to find hard-stop positions or limit available torque/force during manual operation.

Motion Type - Move

Move Setup





The Tritex II drives are capable of storing and controlling up to sixteen move profiles. Each move has two parts: a *Main Motion* and a *Secondary Motion.* The *Main Motion* transitions into the *Secondary Motion* without coming to a stop. If the *Enable Secondary Motion* check box is not selected, the *Secondary Mo*tion is disabled. See examples at the end of the Move Parameters section.

Note: Deceleration parameter is not available on EXP 24, Tritex II AC with firmware revision older than 2.13 or Tritex II DC Tritex with firmware older than 2.29

Move Parameters

Move Type- Select the type of move here. The types are defined below.

Absolute Position- Move to the desired position relative to home.

Absolute (+ dir only) and *Absolute (- dir only)*- Move to the desired position relative to home only if the position is more positive or more negative than the current position respectively.

Incremental Distance- Move a specified distance each time the move is initiated. If Incremental move type is selected, do not use the Move Maintained Input Function because as soon as the move is complete, another one will immediately start. Move Momentary Input Function should be use for Incremental type moves.

Unlimited (+/-) - Move unlimited in the positive or negative direction until a limit is reached, there is a command to stop, pause or disable, or a termination condition is reached.

Position/Distance- Defines the move position or distance specified in user units.

Velocity- Defines the velocity of the move in user units.

Acceleration- Defines the acceleration and deceleration of the move in user units.

Limit Current- Select the check box to limit current for a given move.

Termination on…- These determine which events, if any, will terminate a move. Any combination, including all or none, of the termination types may be used.

Fault if…- These determine whether to trigger faults on the listed events. The action taken from the fault is determined on the *Faults* tab of the *System Setup* page.

Primary/Secondary Velocity Override- Allows for the defined move velocity to be overridden with an external analog input or Modbus value. (See Velocity Override Page for more information) (Not available with all firmware versions)

Current Limit- Defines the current limit for a given move.

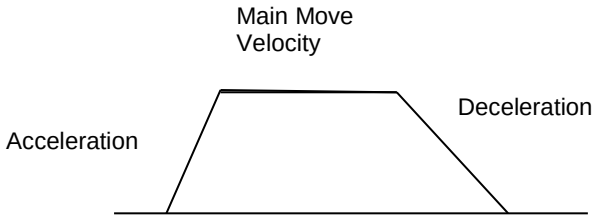
Termination Switch- Defines which switch to terminate the move on if a *Terminate on Switch* option is checked.

Enable Secondary Motion- An optional *Secondary Motion* can be used to perform a move after the *Main Motion* move is completed. The *Secondary Motion* has the same options as the *Main Motion* move.

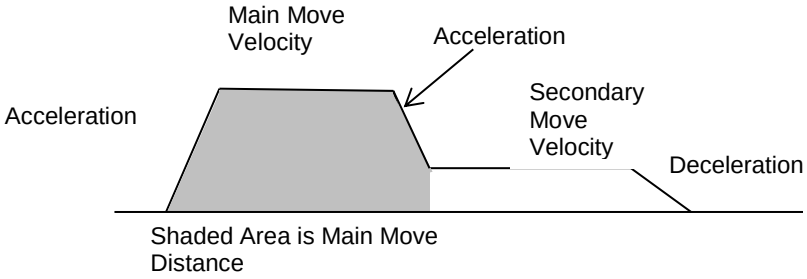
Auto-Start Next Move- Check this box to “string” moves together and select from the drop down menu which move to proceed to after the current move is completed. If a *Secondary Motion* is enabled, it will need to be completed before moving onto the selected next move.

Wait for In-Position-Check this to wait for the In-Position Window (Setup Page) to be satisfied before Auto Starting Next Move (above).

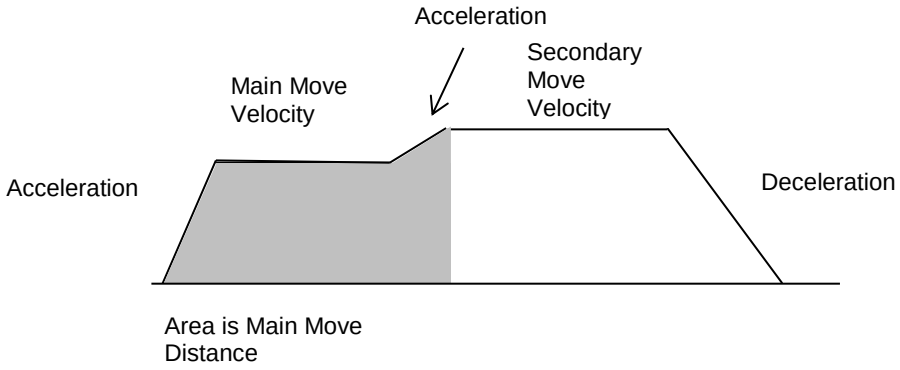
Move Examples:



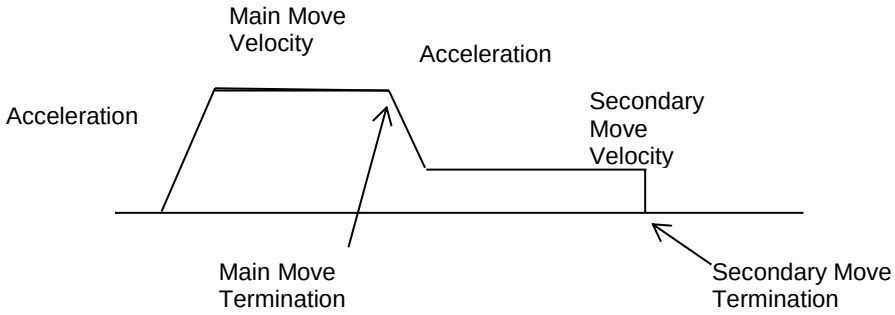
Main Move Only



Main Move and Secondary Move,
Note: Ramp from Main to Secondary always uses the Acceleration ramp



Main Move and Secondary Move,
Note: Ramp from Main to Secondary always uses the Acceleration ramp



Moves ended with a termination of switch or current limit

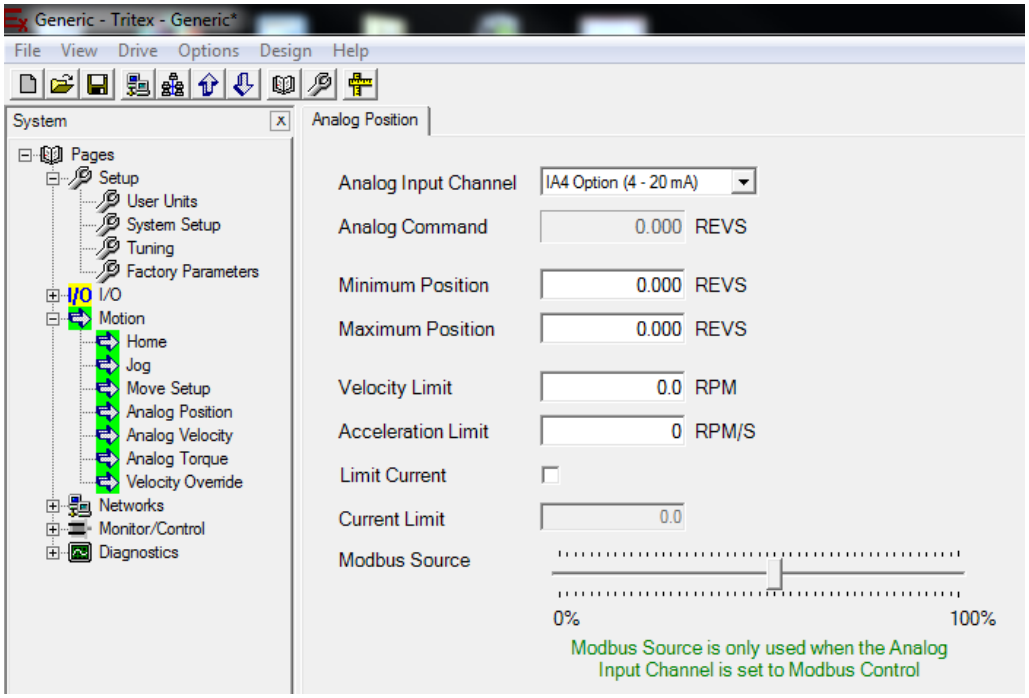
Motion Type - Analog Motion Control

The Analog Input can be setup as a position command, a velocity command or a current command. The Expert software provides a page for each, with the specific parameters needed for each type of analog motion control.

Note: The *Analog Input* is calibrated at the factory; if there a need to change this calibration, see the *Analog I/O* section.

Analog Position Control

Analog Position control provides position control proportional to the *Analog Input* value. The input is continuously updated and scaled to provide an analog command position. If the *Analog Position* control is active from *Default, Alternate* or *Host* mode, the drive will move to the commanded position, while following the *Velocity Limit* and *Acceleration Limit* specified on the page. The *Acceleration Limit* is also used as the deceleration limit.



Analog Position Parameters

Analog Input Channel- Select the type of analog signal to be used; options are- *Analog Input Voltage*, *IA4 Option (4-20mA*)(if the IA4 Option board is installed) or *Modbus Control*.

Note: The Modbus Control feature is available in Firmware version 2.27 and higher for the DC and 75 mm AC Tritex and version 2.20 or higher for the 90/115 mm AC Tritex

Analog Command- This displays the commanded position, in user units, based on the *Analog Input* value and the scaling.

Maximum/Minimum Position- These should be set to the desired motor/actuator positions, in user units, when the *Analog Input* is at the maximum/minimum value respectively. (See *Analog Input Scaling* section).

Velocity Limit- This is the maximum velocity during an *Analog Position* move.

Acceleration Limit- This is the maximum acceleration/deceleration during an *Analog Position* move.

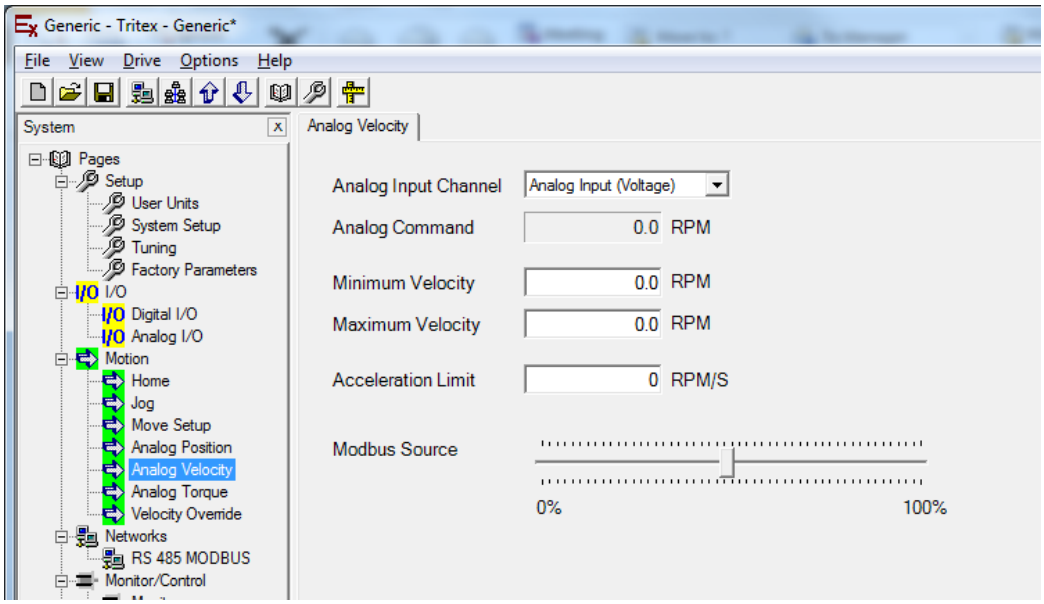
Limit Current- If this checkbox is checked, the current for analog positioning will be limited to the value displayed below in the *Current Limit* parameter.

Modbus Source - The position is controlled be the slider bar or a value sent to the Modbus register. This will apply the corresponding percentage of the minimum and maximum limits. *Modbus Control* must be selected in the *Analog Input Channel* menu.

Note: Modbus Source control is not available on EXP 24, Tritex II AC with firmware revision older than 2.12 or Tritex II DC Tritex with firmware older than 2.27

Analog Velocity Control

Analog Velocity control provides velocity control proportional to the *Analog Input* value. The input is continuously updated and scaled to provide an analog command velocity. If the *Analog Velocity* control is active from *Default*, *Alternate* or *Host* modes, the drive will operate in velocity control, following the *Acceleration Limit* as specified on the page. The *Acceleration Limit* is also used as the deceleration limit. In *Analog Velocity* mode, position control is the responsibility of the user's control system.



Analog Velocity Parameters

Analog Input Channel- Select the type of analog signal to be used; options are- *Analog Input Voltage*, *IA4 Option (4-20mA*)(if the IA4 Option board is installed) or *Modbus Control*.

Note: The Modbus Control feature is available in Firmware version 2.27 and higher for the DC and 75 mm AC Tritex and version 2.20 or higher for the 90/115 mm AC Tritex

Analog Command- This displays the commanded velocity, in user units, based on the *Analog Input* value and the scaling.

Maximum/Minimum Velocity- These should be set to the desired motor/actuator velocities, in user units, when the *Analog Input* is at the maximum/minimum value respectively. (See *Analog Input Scaling* section.)

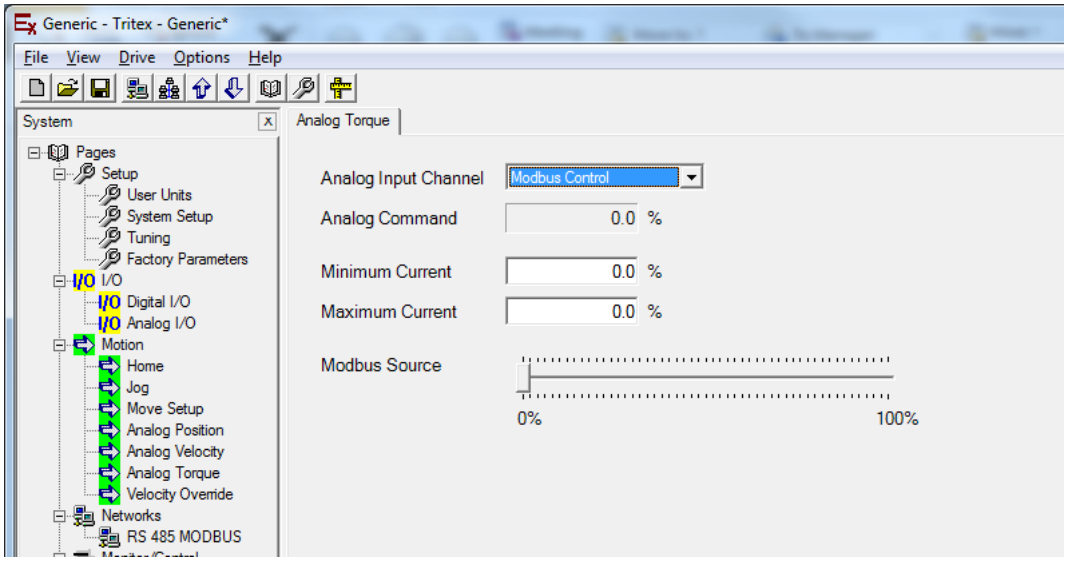
Acceleration Limit- The maximum acceleration/deceleration during an *Analog Velocity* move.

Modbus Source- The velocity is controlled be the slider bar or a value sent to the Modbus register. This will apply the corresponding percentage of the minimum and maximum limits. *Modbus Control* must be selected in the *Analog Input Channel* menu.

Note: Modbus Source control is not available on EXP 24, Tritex II AC with firmware revision older than 2.12 or Tritex II DC Tritex with firmware older than 2.27

Analog Torque Control

Analog Torque control provides current control based on the *Analog Input* value. The input is continuously updated and scaled to provide an analog command torque. If the *Analog Torque* control is active from *Default, Alternate* or *Host* modes, the drive will operate in torque/force control. In *Analog Current* control, velocity and position control are the responsibility of the user's control system.



Analog Torque Parameters

Analog Input Channel- Select the type of analog signal to be used; options are- *Analog Input Voltage*, *IA4 Option (4-20mA*)(if the IA4 Option board is installed) or *Modbus Control* (not available with all firmware versions).

Note: The Modbus Control feature is available in Firmware version 2.27 and higher for the DC and 75 mm AC Tritex and version 2.20 or higher for the 90/115 mm AC Tritex

Maximum/Minimum Current- This should be set to the desired motor/actuator currents, in Amps, when the *Analog Input* is at the maximum/minimum value, respectively. (See *Analog Input Scaling* section.)

Modbus Source- The torque is controlled be the slider bar or a value sent to the Modbus register. This will apply the corresponding percentage of the minimum and maximum limits. *Modbus Control* must be selected in the *Analog Input Channel* menu.

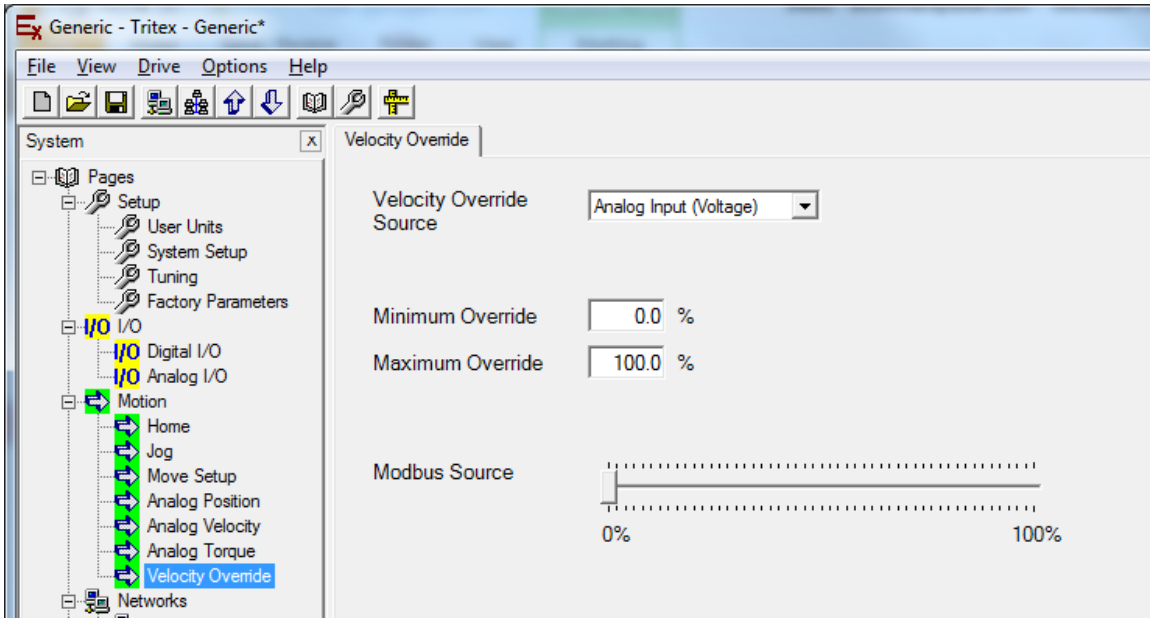
Note: Modbus Source control is not available on EXP 24, Tritex II AC with firmware revision older than 2.12 or Tritex II DC Tritex with firmware older than 2.27

Velocity Override

Velocity Override provides a real-time method to change the Velocity of a Move. The Velocity Override will take effect immediately, even during a move. The Acceleration and Deceleration ramps of the active move will be honored even if the Override value changes instantaneously.

Note: Velocity Override control is not available on EXP 24, Tritex II AC with firmware revision older than 2.11 or Tritex II DC Tritex with firmware older than 2.27

When *Primary or Secondary Velocity* Override boxes are checked on the Move Setup page, this page determines the source and range of the Override value to be applied.



Velocity Override Parameters

Velocity Override Source- Select the type of analog signal to be used; options are- *Analog Input Voltage*, *IA4 Option (4-20mA*)(if the IA4 Option board is installed) or *Modbus Control.*

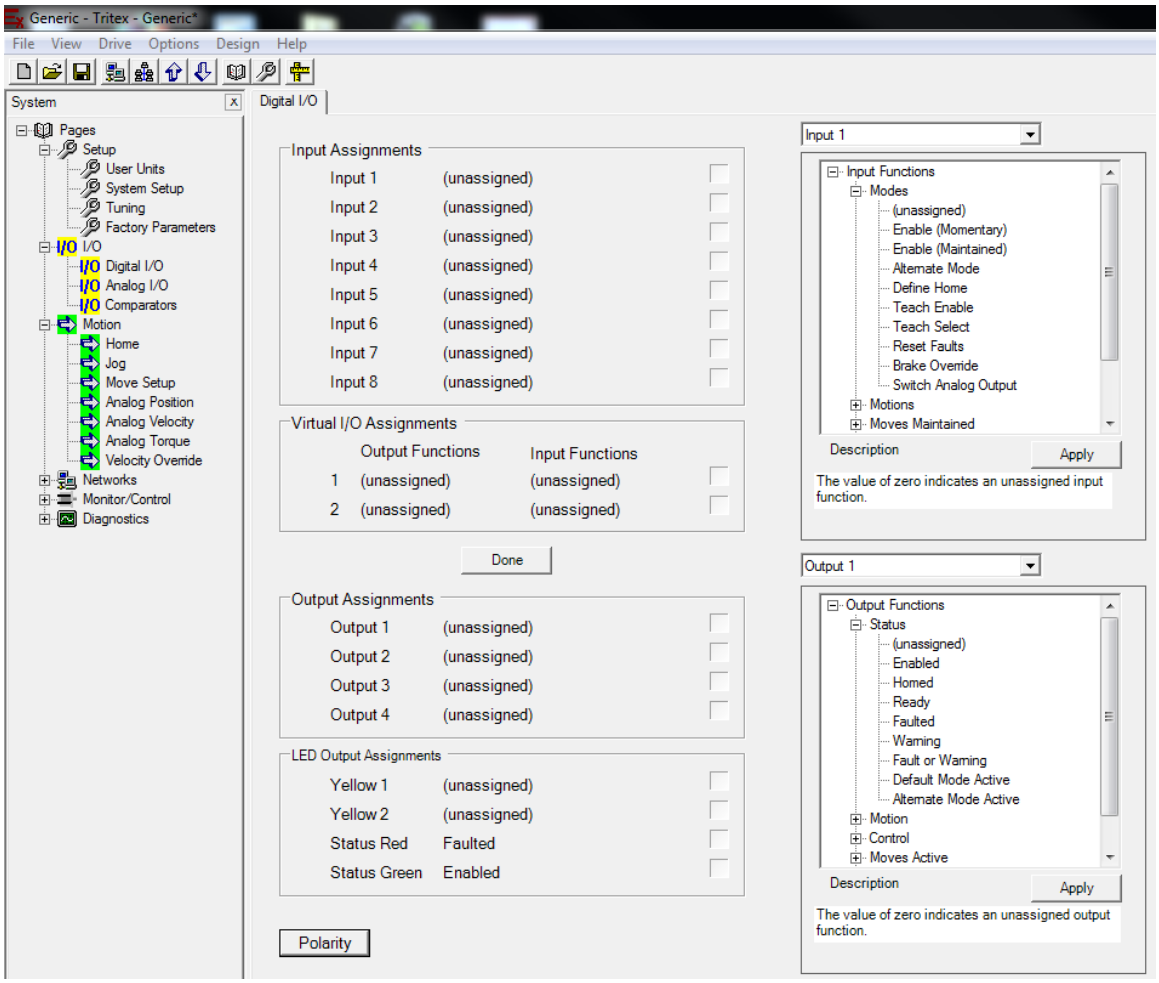
Note: The Velocity Override feature is available in Firmware version 2.27 and higher for the DC and 75 mm AC Tritex and version 2.20 or higher for the 90/115 mm AC Tritex

Maximum/Minimum Override- This should be set to the desired percentage limits of the defined move velocity. The *Modbus Source* slider will also be limited by these values.

Modbus Source- This slider bar can be controlled with a mouse drag or a Modbus value being entered into the correct register. *Modbus Control* must be selected in the *Analog Input Channel* menu and the percentage limits are limited to the minimum and maximum values entered above.

INPUTS AND OUTPUTS

Digital I/O

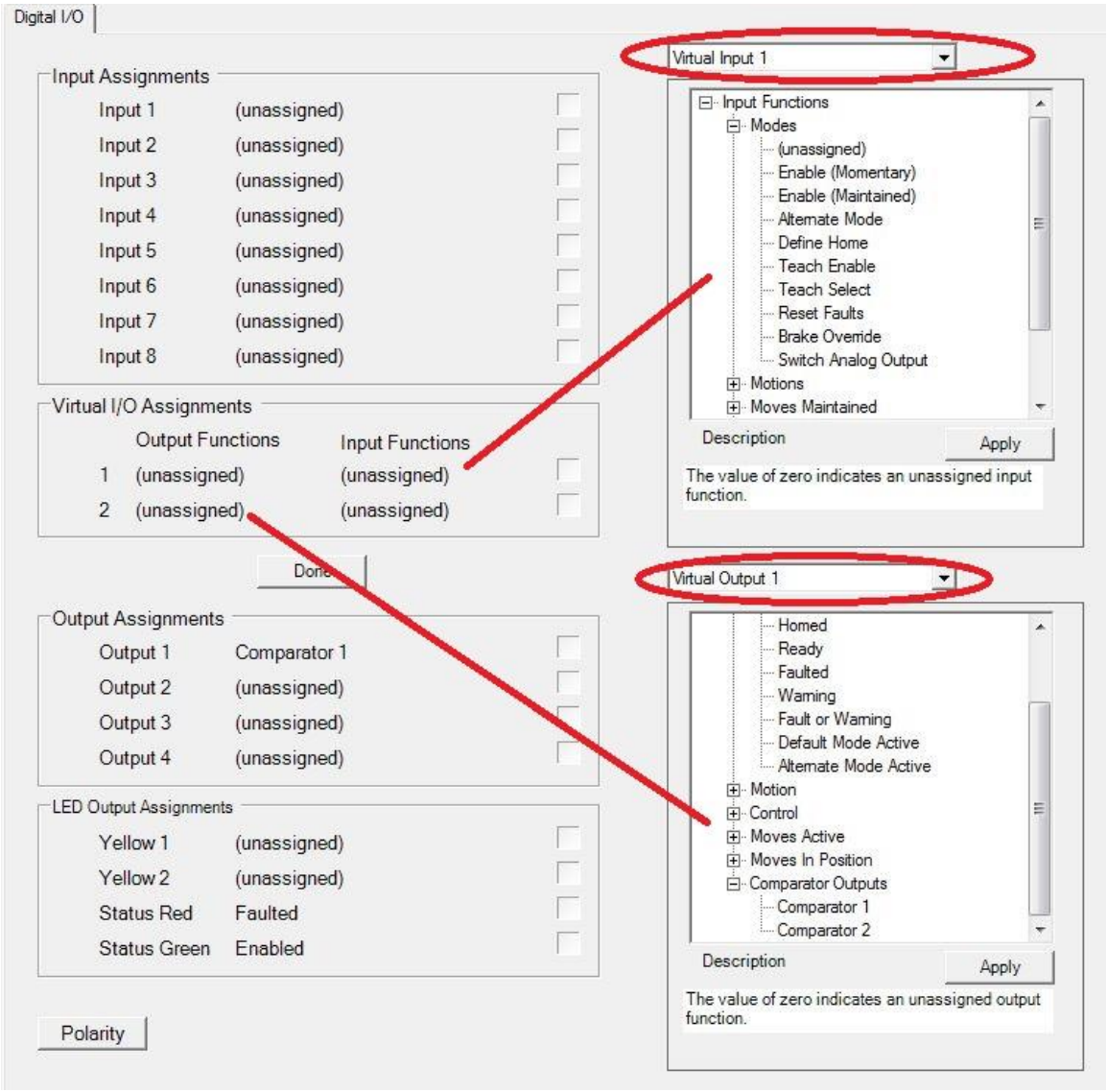


Input/Output Assignments

The *Digital I/O* screen is used to assign hardware digital input lines to logical input functions and logical output functions to hardware digital output lines and LED's. Not all models have LED's that can be assigned to output functions and the number of digital inputs and digital outputs varies by model and options. See the Installation Manual for the appropriate model for hardware details. The Digital I/O page shows the correct number of I/O for the attached drive. Clicking on the *Edit* button opens the *Input Functions* and *Output Functions* trees. From the drop down menus, select the input or output you would like to set. Next, select the action to be performed (for inputs only) when the bit is set, or select what action will cause a bit to be set (outputs and LED's only). A download must be performed for the I/O assignments to take effect.

Clicking the *Polarity* button will show polarity switches ("P" or "N"). Each input or output line can be assigned a positive "P" or negative "N" polarity. Clicking on the polarity buttons will toggle the polarity. An 'N' on an input means the selected function will be active when the input is off and inactive when the input is on. An 'N' on an output line means the output will be off when the function is active and on when the function is inactive. *Note*: This does not change the electrical characteristics of the I/O line.

Virtual I/O Assignments



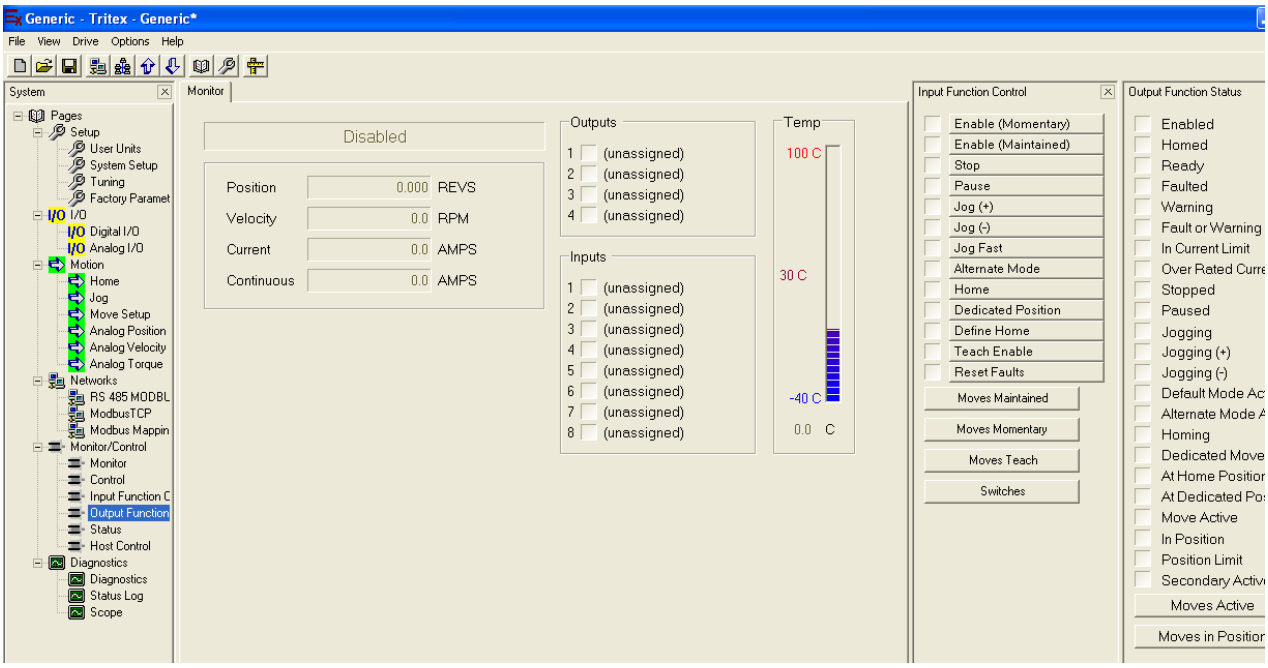
The *Virtual I/O Assignments* section allows an output event to set or clear and input event. By selecting either Virtual Output 1 or 2 from the Output Assignments tab, a given output event can be selected. Likewise, by selecting either Virtual Input 1 or 2, from the Input Assignments tab, a given input event can be selected. Feature added with Tritex II AC 90/115mm v2.21 and Tritex II DC and AC 75mm v2.37. Not available on EXP-24.

Monitoring Input/Output Status

Digital input and output line status can be viewed on the *Monitor* tab. Output lines can be set (forced active) and overridden (forced inactive) on the *Diagnostics* Tab to test digital output hardware.

The *Input Function Control* page allows the user to monitor and control all input functions.

The *Output Function Status* indicates the status of all of the output functions. Both the *Input Function Control* and *Output Function Status* pages can be opened by going to the menu bar and clicking View/Page and select the desired page, or from the System Panel, if that is visible.



Input Function Definitions

Unassigned- No function is assigned to the I/O line, so the input channel does nothing.

Enable Momentary- The drive will try to enable on the rising edge. If a fault prevents the enable from occurring, another rising edge is required. On start-up or power cycle, a rising edge of the *Enable Momentary* is required to re-enable.

Enable Maintained- The drive will enable if bus power is applied and there are no active faults. If there is a fault, toggling the *Enable Maintained* function will clear the fault. If the fault condition still exists, the drive with fault again. On start-up or power cycle with no active faults, the drive will automatically re-enable after the *Power-up Delay* expires.

Alternate Mode- A Tritex Actuator has several operating modes. The *Alternate Mode* input function when active sets the actuator into the operating mode defined on the *System Setup* page *Operating Modes* tab in the ”Alternate” Select Box If the *Alternate Mode* function goes inactive, the actuator goes into the operating mode defined by the ”Default” Select Box. Default and Alternate mode selections may be one of the following*: Inactive, Digital Inputs, Analog Position, Analog Velocity,* or *Analog Torque*. For example*: Default* mode set to *Digital Inputs* and *Alternate* mode set to *Analog Position*. When the *Alternate* mode is disabled, the *Digital Inputs* could be used to control the *Home* move, *Jog* and *Move*s, as required. When the *Alternate Mode* input function is active, the position is controlled from the *Analog Input*. There are “Host” operating modes that can take precedence over this mode selection.

Define Home- Defines the current position as the *Final Home Position* parameter and sets the *Homed* output function. This function is always available, so should be used with caution. When activated, even during motion, a new *Home* position will be defined. If a *Maintained Move* is being executed or *Analog Position* mode or *Host Position* mode is active, the motor/actuator will move to the commanded position relative to the new *Home* position.

Teach Enable- Enables the *Teach* function.

Teach Select- Performs a *Teach* function.

Reset Faults- The rising edge of this input function resets all fault flags if the fault condition is not currently active. If there is an active fault condition, the active fault flag will not be reset.

Note: Toggling the *Enable* input function performs this same action.

Brake Override- Overrides Tritex actuator control of an internal brake when so equipped. When active, the brake will release when the drive is not enabled.

Stop- Activating the *Stop* function will stop all motion using the defined *Stop Ramp* deceleration value. When the *Stop* function is removed, motion is allowed to resume. The Stop function is available in all modes of operation.

Pause- When not in *Host* mode, all motion except a *Jog* will decelerate to a stop using the ramp of the active motion. When the *Pause* function is removed the motion will continue using acceleration ramp of the active motion. The *Pause* input function does NOT pause *Jog* motion and does not affect motion while in *Host* mode.

Jog (+) and Jog(-) - Activates the *Jog* motion, (see *Jog* page section). *Jog* can be selected to have a higher priority and, therefore, override other motion types. (See the *Options* tab of the *System Setup* page). Only one direction of *Jog* is allowed to be active at time. If both *Jog* directions are selected at once, the operating status will report that it is trying to Jog, but it will not move either direction.

Jog Fast- When active selects the "Fast" velocity defined on the *Jog* page when jogging. Otherwise the "Slow" velocity will be used.

Home- Initiates a *Home* move. (See the *Home* page section for *Home* parameters setup). The *Home* move will start on the edge of the *Home* input Function. The function does not need to remain active to complete the *Home* move sequence.

Dedicated Position - Activates the *Dedicated Move* function, (See *Dedicate Move* section for parameters & operation). This is a maintained type input function; if the input is turned off the dedicated move will stop and, if other motion is being commanded, it will resume. *Dedicated Move* has high priority and will override all motion types except motion commanded from *Host* mode. *Dedicated Move* is only available if the *Homed* output function is set, after a *Home* move has completed or the *Define Home* input function goes active.

Move Maintained Select- Input functions Select 3, Select 2, Select 1, and Select 0 form a binary number in that bit order to select Move 0 to Move 15. *Move Maintained Select* activates the move determined by the binary number as a maintained move. See *Move x (Maintained)* input function description below. Changing the binary number during the move will switch to the move defined by the new binary number immediately. Move Maintained Select has precedence over a Move x (Maintained) move, or any Move Momentary.

Move Momentary Select- Input functions Select 3, Select 2, Select 1, and Select 0 form a binary number in that bit order to select Move 0 to Move 15. *Move Momentary Select* activates the move determined by the binary number as a maintained move. See *Move x (Momentary)* input function description below. Changing the binary number or toggling *Move Momentary Select* or toggling a *Move x (momentary)* during the move will have no effect until the move completes.

Move x (maintained) - The *Move x Maintained* input functions with x = 0 to 15 are designed to be used with absolute move types. Once activated, the specified move will be executed. If the function is deactivated during the move, motion will decelerate to a stop and resume when the function is re-activated. If more than one Move Maintained move is active, the lowest number move has priority. *Move Maintained* has priority over *Move Momentary*.

Note: If the *Move Maintained* input function is used with *Incremental* move types, all subsequent incremental moves will be started immediately after each one is completed. Therefore, for *Incremental* moves, Exlar suggests using the *Move x (Momentary)* input functions.

Move x (momentary) - The *Move* x *Momentary* input functions with x = 0 to 15 can be used with any move type. The rising edge of the input function will start the specified move as long as no other move is currently active. If the input function is left “on”, a subsequent move will start on the next rising edge after the previous move is completed. Turning the input function “off” during a move will have no affect on the motion.

Move x (teach) – The rising edge of a *Move x (teach)* input function with x = 0 to 15 loads the current position into the respective Move x positions. They work only when the *Teach Enable* input function is active. *Teach Enable* can be activated from a digital input or automatically by selecting the *Always Enable Teach input functions* check box (see *System Setup* page section). These positions are automatically saved into non-volatile memory.

Select x – The *Select x* input functions with x = 0 to 3 are used with *Move Maintained Select* and *Move Momentary Select* input functions to select any of the 16 Moves using fewer *Digital Inputs*. *Select 3*, *Select 2*, *Select 1*, and *Select 0* form a binary number in that bit order to select Move 0 to Move 15. Assign *Select x* input functions to up to four of digital inputs. For instance turning on the inputs assigned to *Select 3* and *Select 0* and turning off the inputs assigned to *Select 1* and *Select 2*, will select Move 9. If another input is then assigned to *Move Maintained Select* or *Move Momentary Select* and turned “on”, it will execute Move 9 accordingly. , Unused *Select x* input functions may be left unassigned and the values will remain “off” or 0. For instance, if only Move 0 to Move 7 are used, *Select 3* need not be assigned to a digital input.

Switch 1 - 8 Maintained/Switch 9 - 16 Momentary– These input functions are designed to terminate the feed portion of a move. If a move is set to terminate on a switch being active or inactive, and one or more of *Switch 1-8* has been assigned to a *Digital Input*, the *Move* will terminate at any point when it sees the appropriate active or inactive condition. However, if *Switch 9-16 are* assigned, the *Move* will only terminate when an edge is seen, ie, a switch being set active or inactive.

Switch Analog Output– When active applies the alternate analog signal to the analog output channel. Available on 4-20mA Output only.

Calibrate Stroke– When this input function goes active, the Stroke Calibration sequence launches..

Output Function Definitions

Unassigned- No function is assigned to the I/O line and the channel remains in the inactive "OFF" state

Enabled– Indicates the power stage of the drive is active. Requires that no faults are active, bus voltage is present and an *Enable* input function is active or Auto-enable on start-up is selected.

Homed- Indicates that a Home move has been completed or the *Define Home* input function had a rising edge so that absolute position is established. *Homed* goes inactive if a *Home* move is initiated, a *Position Tracking Fault* occurs or logic power is cycled. If the unit has the absolute feedback option, *Homed* will be set on power-up if the absolute feedback system has preserved absolute position.

Ready- Indicates the drive is *Enabled* and *Homed*.

Faulted- Indicates the drive is in a fault condition. The active fault is displayed in the *Status* window. The user has control over some fault conditions. (See *System Setup* page).

Warning- Indicates a *Warning* condition. The active *Warning* is displayed in the *Status* window. The user may select which conditions indicate a warning. (See System Setup page section).

Fault or Warning- This is the logical "OR" of the *Faulted* and *Warning* output functions.

Default Mode Active- Indicates when an actuator is in Default mode and Enabled.

Alternate Mode Active- Indicates when an actuator is in Alternate mode and Enabled.

Stop- Indicates motion has been inhibited by an active *Stop* input function or fault action.

Pause- Indicates motion is suspended by an active *Pause* input function.

Jogging (+)/(-)- Indicates when *Jog* + or *Jog* - is active.

Homing- Indicates when a Home move is active.

Dedicated Move- Indicates when the Dedicated Move function is active.

Move Active- Indicates when any of the Moves *(0-15)* or Main Motion or Secondary Motion are active. This will also remain active if the *Move Maintained* input function is active, even if the specified *Move* is complete.

Secondary Active- Indicates when any of the Moves *(0-15)* Secondary Motion are active. This will also remain active if the *Move Maintained* input function is active, even if the specified Move is complete.

In Position- Indicates a target position has been reached within the window and for the necessary time defined by *the In Position Window* parameters.

At Home Position- Indicates when the actual position is within the window, defined by the *In Position Window* parameters, of the defined *Final Home Position*.

At Dedicated Position- Indicates when the actual position is within the window, defined by the *In Position Window* parameters, of the defined *Dedicated Position.*

At Home 2 Position- Indicates when the actual position is within the window, defined by the *In Position Window* parameters, of the defined *Final Home 2 Position*.

Note: The standard Expert software does NOT have an "on screen" parameter for setting a *Final Home 2 Position*, however, this can be set using Modbus protocols. (See *Tritex II Parameters* manual for more information on additional parameters that can be accessed by Modbus commands.)

Shunt Active- Indicates when the shunt control circuit is active. It occurs when regeneration energy from deceleration or lowering a vertical load has raised the bus voltage above the shunt turn-on threshold. For the Tritex II DC actuators, it means that energy is being sent to a small internal shunt resistor. For Tritex II AC actuators, it means voltage is applied at the shunt resistor terminals.

Brake Release- Indicates when the brake is released and the motor/actuator is free to move. This logic is active even if the unit has no brake, and could be used to control an external brake.

Over Rated Current- Active when operating at more than the *Continuous Current* setting for the actuator. If it operates in this state too long, a Contiuous Current fault will occur, but the time to fault is shorter if the current is higher so is hard to predict and can vary from a few seconds to several minutes.

In Voltage Limit- Active when the drive needs more voltage than is available from the DC Bus, basically meaning it can't go the speed being requested and will build following error.

In Current Limit- Active when any current limit is active. There is a *Factory Current Limit* (set at the factory by actuator model) that is always in force. At no time will commanded current exceed this value, chosen to prevent damage to the actuator. The *User Current Limit* (set by the user in the *System Setup* page) has second highest priority, allowing the user to set a limit lower than the *Factory Current Limit* to prevent damage to linkage and loads. However, some limits are move/motion specific. For example. during a *Home* move, the *Home Current Limit* is active and during the feed portion of a *Move* the feed *Current Limit* is active. This is not a fault condition, only an indication that the controller is limiting the current to the motor/actuator. This condition will clear when the demand for the current is lowered.

In Current Limit (+)/ (-) – Same as *In Current Limit* output function but active for only one direction.

Position Limit- Indicates the commanded position is outside of the position limit range. (See *Position Limits* tab in the *System Setup* page section.)

Position Limit (+) / (-) - Active when the commanded position is outside of the position limit range in the positive or negative limit, respectively.

Host Mode Active- Indicates when Host Mode is active.

Seating Current Limit- Active when the Seating Current Limit is active.

Stroke Calibration Active- Active during the stroke calibration process..

Stroke Calibration Complete- Active after the stroke calibration process. Resets on power-up if stroke calibration is needed again.

Brake Delay Active- Indicates that the brake release or engage delay is active. These delays allow time for the brake to apply or release with a slight overlap between motor holding and brake holding to prevent droop.

PWM Bridge Active- Indicates that the PWM bridge power is active. Generally use *Enabled* instead.

Move Active- Indicates when ANY of the *Moves (0-15)* are active. This will also remain active if the *Move Maintained* input function is active, even if the specified *Move* is complete.

Move 0-15 Active- Indicates when the SPECIFIC *Move (0-15)* is active.

At Move 0-15 Position- Meaning of these output functions depends on context as follows:

For Absolute Move Types: Indicates when the actual position is within the window, defined by the *In Position Window* parameters, of the commanded *Move.*

For Move Type Unlimited (+) or (–)- Indicates the commanded and actual position are past the *Position/Distance* value of the move.

Note: The standard Expert software does NOT allow this value to be changed “on screen”, however, this can be set using Modbus protocols. (See *Tritex II Parameters* manual for more information on additional parameters that can be accessed by Modbus commands)

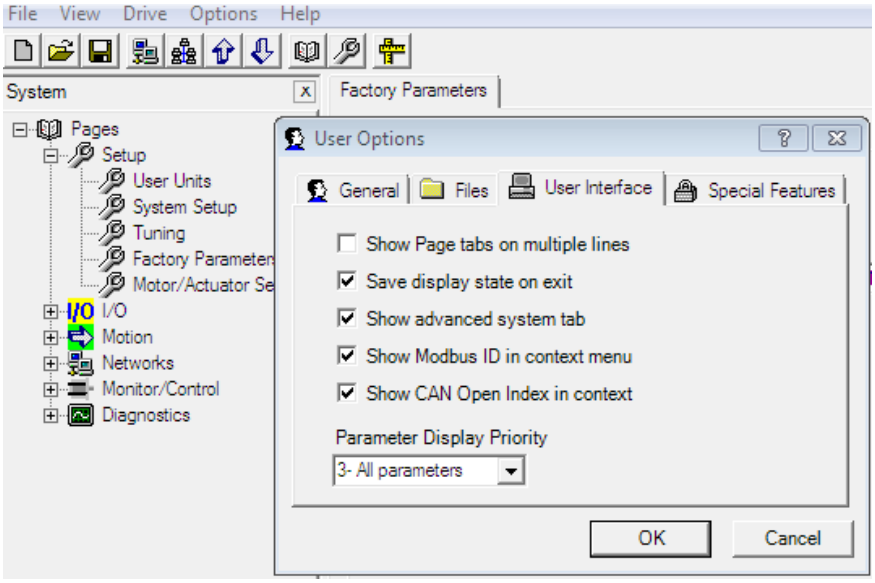
For Incremental Move Types: The At Move Position is NOT activated.

Comparator Outputs (Comparator 1 and 2) - Indicates when a Comparator output is active. Comparators were added in Tritex II AC 90/115mm at v2.21 firmware and Tritex II DC and AC 75 firmware at v2.37.

There are a few other output functions that are not intended for general use not defined here

Advanced I/O Assignment Options

To view addional (advanced) IO assignment parameters, from main menu bars select *Options*/*User Options* then click the User Interface tab, under the Parameter Display Priority box select ”3-All parameters” and all of the Input and Output fucntions will be available.

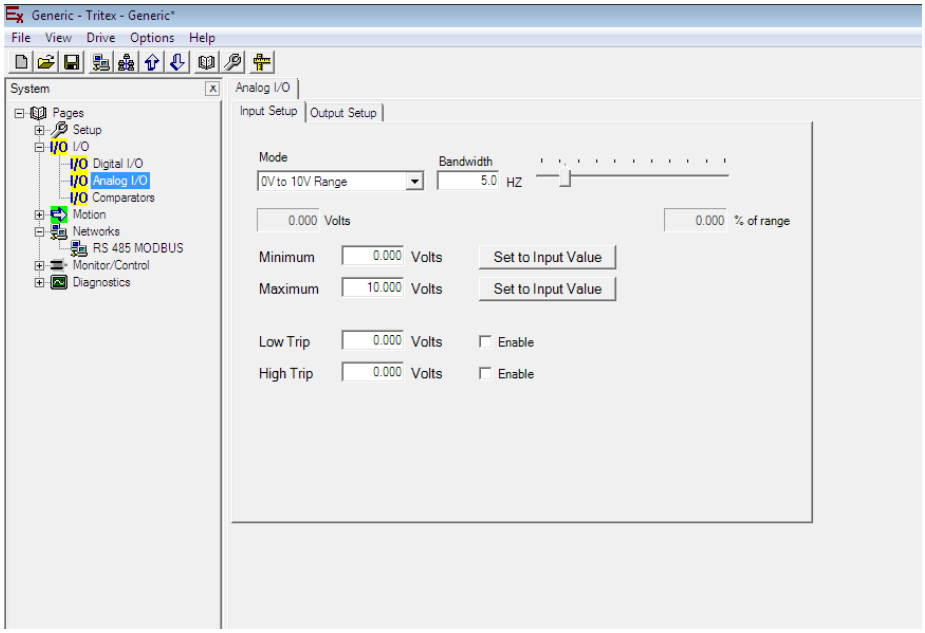


Analog I/O

This section covers the Voltage Analog I/O. (See the specific actuator *Installation* manual for detailed specifications). These Voltage Analog I/O are available on 230 V AC Tritex II 90-115 mm with the SIO, EIP, PIO, TCP and IA4 options and the 230 VAC Tritex II 75mm and 48V DC Tritex II with SIO, EIP, PIO and TCP options.

Analog Input

The Analog input has a maximum range of +10 to -10 Volts and can be mapped as the command source for Analog Position, Analog Velocity, or Analog Torque motion modes or as a Velocity Override value for Move Velocities.



Enable Analog Input- This box should always be checked. It may not appear on all pages.

Mode- Only displayed for 230 Volt Tritex II 115-90mm actuators. This selection must be set to 0-10 Volt Range or -10 to +10 Volt Range to match the range of the analog signal that will be used. For other actuators this selection is not needed because the hardware always handles the full -10 to +10V range.

Bandwidth- Is the break frequency in Hertz of a digital low-pass filter on the Analog Input. The value is essentially the maximum frequency the filter will allow. This filter is used to eliminate higher frequency interference on the analog signal. Typical values for Analog Position Mode are 1-5 Hz, for Analog Velocity or Torque Mode they can be set higher if needed for stability by the host control loop. Do not enter 0, though it is allowed in present firmware and software, because this will freeze the input.

Minimum and Maximum- Values are set to the desired range of the actual Analog Input Voltage. These minimum and maximum Voltages will be scaled to correspond with the minimum and maximum command values on the Analog Position, Analog Velocity Analog Torque and Velocity Override pages.

Set to Input Value Buttons- These buttons can only be used when actively On Line with the actuator. The purpose of these buttons is to provide an easy method of matching the min and max analog value from a host controller to the exact *Minimum and Maximum* Voltages used by the Tritex. For example: If there is a slight discrepancy between the value displayed in the Tritex Software and the host control of the 0V and/or 10 Volt values, set the host controller to apply 0 Volts and click the Minimum Set to Input Value button, the set the host controller to apply 10 Volts and then click the Maximum Set to Input Value button. The Actual Voltages, as measured by Tritex, will show in Minimum and Maximum windows. A download must be performed to permanently save the values.

Low and High Trip- Low and High Trip Voltage limits can be set, if the enable check box is selected and the Analog Input Voltage is outside of the range, a Loss of Signal Fault condition will occur. The action taken when the fault occurs is set on the Fault Enables tab of the System Setup page

Analog Input Calibration

The analog input circuit is factory calibrated and does not typically need periodic calibration. The purpose of calibration is to represent accurately the voltage applied at the channel as a digital value. Converting that value to a position value for instance is called scaling and is done elsewhere. Calibration should only be done if a calibration check by applying known voltages and comparing them with the values appearing in the “Volts” monitor box on the Input Setup tab of the Analog I/O page indicate calibration is required.

To access the Input Calibration page, click on the red “Calibrate” button on the Analog I/O page, Input Setup tab. If such a button is not visible, right click in the area just outside of the border of the Input Setup tab. Then click on the “Show Page Details” line in the menu that pops up. The “Calibrate” button will then appear. The Tritex II DC and AC 75mm input calibration page is shown below. The one for Tritex II AC 90/115mm is similar but does not have the “Calibrate Zero” button. Follow the instructions below, or on the screen and click the “Save Calibration points” button when complete.

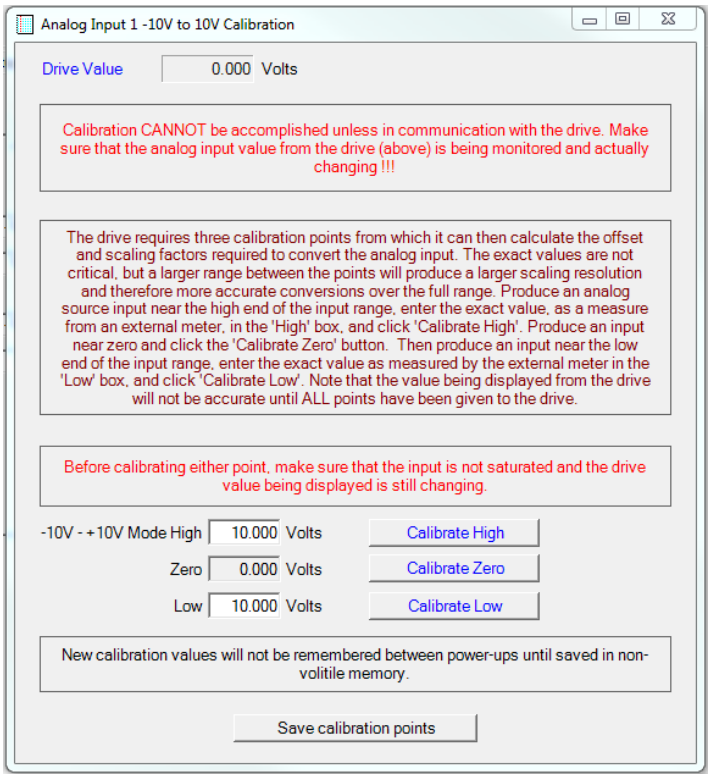
Make sure the actuator is “ON-LINE” and communicating with Expert software. Then make sure the actuator is disabled or otherwise not commanding motion based on the analog input.

For a Tritex 2 AC 90/115mm actuator:
Apply a voltage between +9 V and +10 V from Analog In + to Analog In – terminals. Measure this voltage with a DVM. Enter the actual voltage in the “High” box and with the voltage still applied click on the “Calibrate High” button.

Then if the actuator is in 0V to +10V mode as determined in checkbox on Input Setup tab, apply a voltage of about + 0.2 V from Analog In + to Analog In – terminals, enter the voltage from the DVM in the "Low" box and with the voltage still applied, click on the "Calibrate Low" button.
Or if the actuator is in -10V to +10V mode as determined in checkbox on Input Setup tab, apply a voltage of between -9 V to -10 V from Analog In + to Analog In – terminals, enter the voltage from the DVM in the "Low" box including the negative sign, and click on the "Calibrate Low" button.

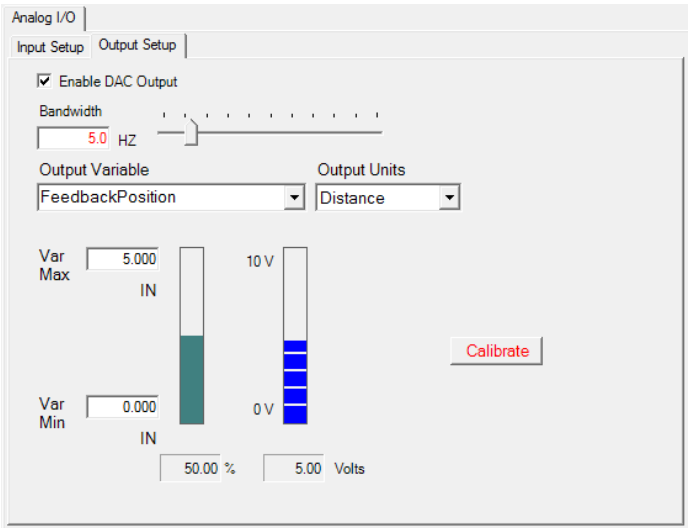
For a Tritex 2 DC or AC 75mm actuator:
Apply a voltage between +9 V and +10 V from Analog In + to Analog In – terminals. Measure this voltage with a DVM. Enter the actual voltage in the "High" box and with the voltage still applied click on the "Calibrate High" button.
Then remove the voltage and directly short the Analog In + to Analog In – terminals for a known 0 V signal. Click on the "Calibrate Zero" button.
Then remove the short and apply a voltage between -9 V and -10 V from Analog In + to Analog In – terminals, enter the voltage from the DVM in the "Low" box including the negative sign, and with the voltage still applied click on the "Calibrate Low" button.

Then click on the "Save calibration points" button. Apply voltages to confirm that the calibration was successful.



Analog Output

The Voltage Analog output has a maximum range of 0 to +10 Volts and can be mapped to any of several actuator variables such as Position, Current, Temperature, etc. The Voltage Analog Output is replaced by the 4-20mA analog output on Tritex 2 DC and AC 75mm actuators, so is not available on those models. It is available on all Tritex 2 AC 90/115mm models.



Enable DAC Output- This box should always be checked. It may not appear on all pages.

Bandwidth- Is the break frequency in Hertz of a digital low-pass filter on the Analog Output. This filter is used to smooth out sharp steps, spikes or dithering on the measured signal on the way to the output signal. The lower the number the more damping is applied. Do not enter 0, though it may be allowed in present firmware and software, because this will freeze the output.

Output Variable- Select from the drop down menu a drive variable to be mapped to the *Analog Output*.

Output Units- In order to scale the output correctly using *Var Min* and *Var Max* values, *Output Units* must be set to correspond to the *Output Variable* selected. For example if Feedback Position is the Output Variable choose Distance as the Output Units.

Var Min, Var Max- These are the minimum and maximum values of the selected variable in units selected. The *Var Min* value will produce 0V on the Analog Output and the *Var Max* value will produce 10.0V on the Analog Output.

% and Volts Display- These displays are only active while on line. The % display will show the % value of the selected variable over range of Var Min to Var Max. In the above example the Output Variable is Feedback Position and the Range is 0.000 to 5.000 IN, the actual Feedback Position is 2.500 IN so 50% is the displayed value. The Volts display is an approximation that does not include the effects of calibration, so is for reference only. It is <u>not</u> the actual output signal.

Analog Output Calibration

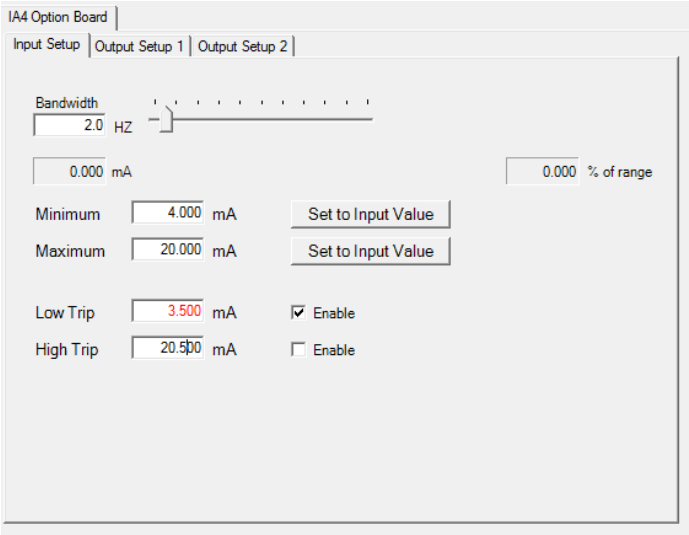
The *Analog Output* has been calibrated at the factory so 0-100% covers a span of 0 V to +10.0V. Re-calibration of the analog output is not recommended. Contact the Tech Support group for Exlar Tritex actuators for more information.

IA4 Option Board

This section covers the 4-20mA Analog I/O. (See the specific actuator *Installation* manual for detailed specifications). These 4-20mA I/O are only available on actuators with the IA4 option.

4-20 mA Input

The input can be mapped as the command source for Analog Position, Analog Velocity, or Analog Torque motion modes or as a Velocity Override value for Move Velocities.



Enable Analog Input- This box should always be checked. It may not appear on all pages.

Bandwidth- Is the break frequency in Hertz of a digital low-pass filter on the Analog Input. The value is essentially the maximum frequency the filter will allow. This filter is used to eliminate higher frequency interference on the analog signal. Typical values for Analog Position Mode are 1-5 Hz, for Analog Velocity or Torque Mode they can be set higher if needed for stability by the host control loop. Do not enter 0, though it is allowed in present firmware and software, because this will freeze the input.

Minimum and Maximum- These values assign input signal values to the desired 0-100% of range of the 4-20mA Input. Typically 4mA is assigned as the 0% value and 20mA is assigned as the 100% value. The 0 and 100% percent of range values will be scaled to correspond with the minimum and maximum command values on the Analog Position, Analog Velocity Analog Torque and Velocity Override pages. For Valve applications, these values are renamed *Closed* and *Open*, respectively.

Set to Input Value Buttons- <u>These buttons can be used only when actively On Line with the actuator</u>. The purpose of these buttons is to provide an easy method of matching the min and max 4-20mA value from a host controller to the exact *Minimum and Maximum* values used by the Tritex. For example, if there is a slight discrepancy between the value displayed by the Tritex Software and the host control for the 4 mA and/or 20mA values, set the host controller to apply 4mA and click the Minimum Set to Input Value button, then set the host controller to apply 20mA and click the Maximum Set to Input Value button. The Actual mA values, as measured by Tritex, will show in Minimum and Maximum windows. <u>A download must be performed to permanently save the values.</u>

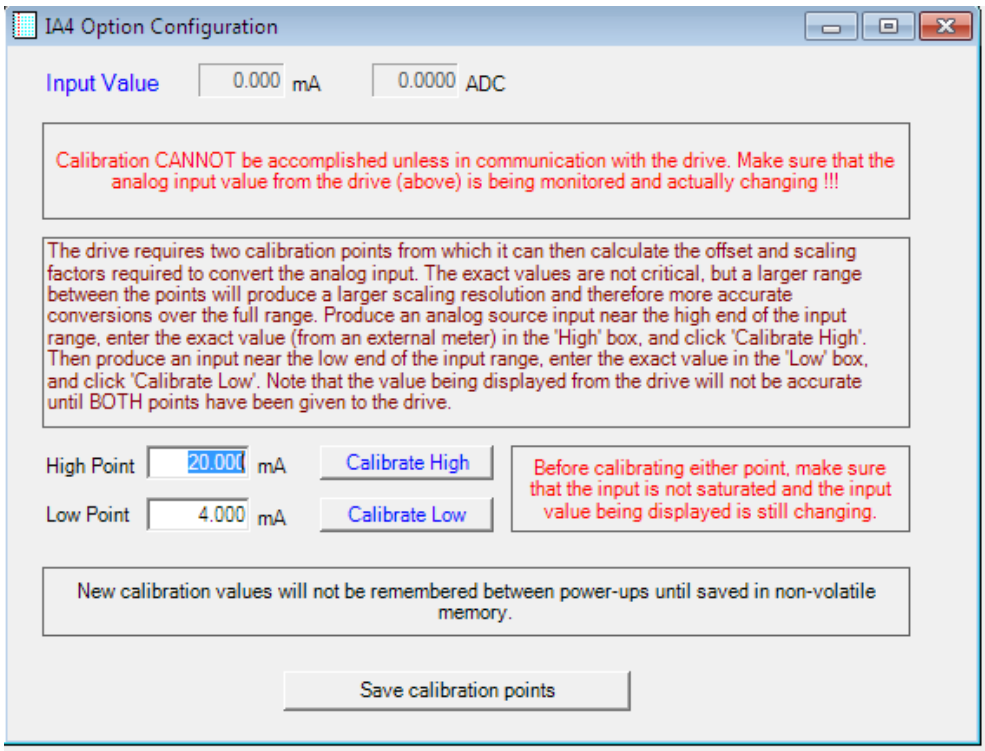
Low and High Trip- Low and High Trip mA limits can be set, if the enable check box is selected and the 4-20mA Input is outside of the range a Loss of Signal Fault condition will occur. The action taken when

the fault occurs is dependent on the setting on the Fault Enables tab of the System Setup page. In the example above, if the input drops below 3.5mA, an fault condition will occur because it is enabled.

4-20mA Input Calibration:

The analog input circuit is factory calibrated and does not typically need periodic calibration. The purpose of calibration is to represent accurately the current applied at the channel as a digital value. Converting that value to a position value for instance is called scaling and is done elsewhere. Calibration should only be done if a calibration check by applying known currents and comparing them with the values appearing in the “mA” monitor box on the Input Setup tab of the IA4 Option Board page indicate calibration is required.

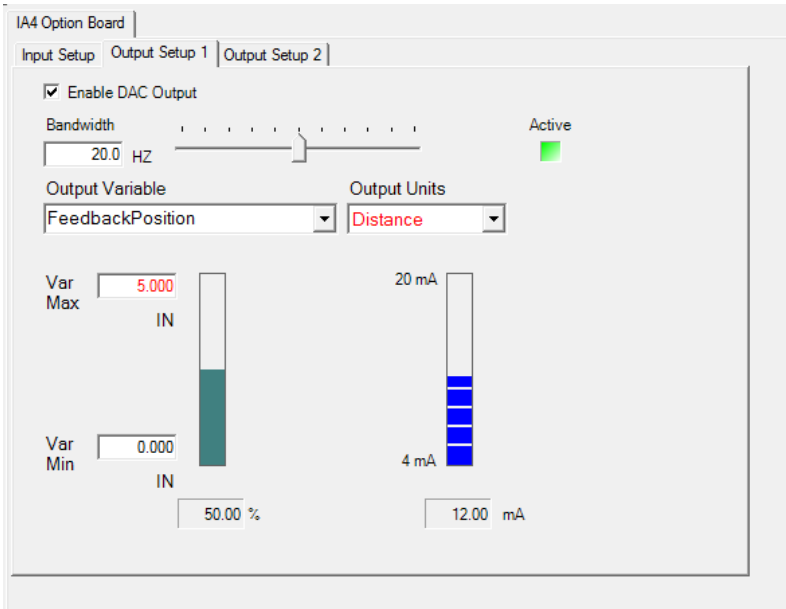
To access the calibration page, click on the red “Calibrate” button on the IA4 Option Board page, Input Setup tab. If such a button is not visible, right click in the area just outside of the border of the Input Setup tab. Then click on the “Show Page Details” line in the menu that pops up. The “Calibrate” button will then appear. The IA4 Option Configuration page is shown below. The one for Tritex II AC 90/115mm is similar but does not have the “Calibrate Zero” button. Follow the instructions below, or on the screen and click the “Save Calibration points” button when complete.



A Loop Calibrator instrument that provides loop power and an accurate current is very useful for calibrating a 4-20mA input. The input is best calibrated at 4mA and 20mA.

4-20 mA Output

The Tritex II actuator with –IA4 option has one physical analog 4-20mA output, but there are two independent setups for the output that can be switched dynamically onto the output channel. Each setup can be mapped from any of several internal parameters and scaled to produce the desired output over a specified range. The variable in Output Setup 1 is applied to the 4-20mA output channel unless input function *Switch Analog Output* is active when the variable in Output Setup 2 is applied.



Output 1, Output 2 tabs: Each of the two setups has a tab to configure and scale a variable to be applied to the 4-20mA output channel. The *Active* LED box indicates which channel is currently applied to the 4-20mA output channel.

Enable DAC Output- This box should always be checked. It may not appear on all pages.

Bandwidth- Is the break frequency in Hertz of a digital low-pass filter on the Analog Output. This filter is used to smooth out sharp steps, spikes or dithering on the measured signal on the way to the output signal. The lower the number the more damping is applied. Do not enter 0, though it may be allowed in present firmware and software, because this will freeze the output.

Output Variable- Select from the drop down menu the variable to be assigned to the *Analog Output*.

Output Units- In order to scale the output correctly using *Var Min* and *Var Max* values, *Output Units* must be set to correspond to the *Output Variable* selected. For example if Feedback Position is the Output Variable choose Distance as the Output Units.

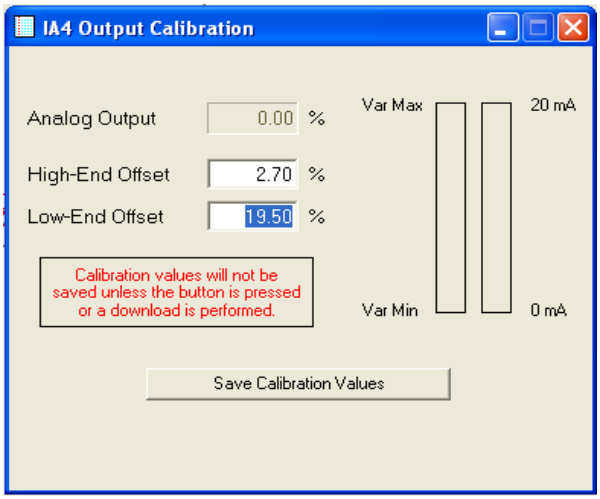
Var Min, Var Max- These are the minimum and maximum values of the selected variable in units selected. The *Var Min* value will produce 4mA on the Analog Output and the *Var Max* value will produce 20mA on the Analog Output.

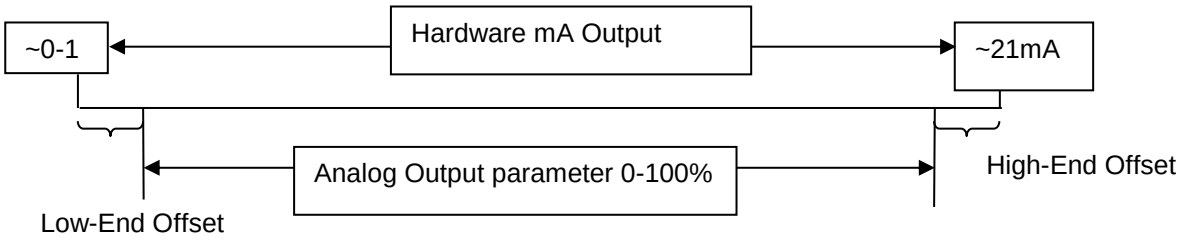
% and mA Display- These displays are only active while on line. The % display will show the % value of the selected variable over range of Var Min to Var Max. In the above example the Output Variable is Feedback Position and the Range is 0.000 to 5.000 IN, the actual Feedback Position is 2.500 IN so 50% is the displayed value. The mA display is an approximation that does not include the effects of calibration, so is for reference only. It is <u>not</u> the actual mA output.

4-20mA Output Calibration:

The *4-20mA Output* has been calibrated at the factory so 0-100% covers a span of 4mA to 20mA. Typically calibration is is not required unless a different range is desired or if re-calibration is required to match the *4-20mA Output* to the device that is measuring it, such as another controller's analog input or a ammeter.

To access the Output Calibration page right click in the area just outside of the Output Setup tab and then select (left click) the *Show Page Details* line in the menu. Then click on the Calibrate button that appears near the 4-20mA bar. The following page will appear.





The actual hardware output is designed to allow an output span that is greater than 4mA to 20 mA, this assures that 4- 20mA can always be delivered to the Host considering all component tolerances and other losses before the signal gets to the host controller.

Note: Make sure all configuration changes are saved by downloading to the actuator and saving the drive file before calibrating.

To calibrate the 4-20mA analog output:

1) Connect a Loop Calibrator or loop power supply and DVM in mA mode to the Analog Output terminals of the actuator. Meter must be able to read to at least 20mA with 2uA resolution.
2) With the actuator disabled, record the correct values of the following parameters on the Output Setup that is Active and then temporarily reconfigure them to these values:
   Output Variable = Positional Following Error
   Output Units = Distance
   Var Max = 0
   Var Min = -1000
   This will create an output target of 100.00%

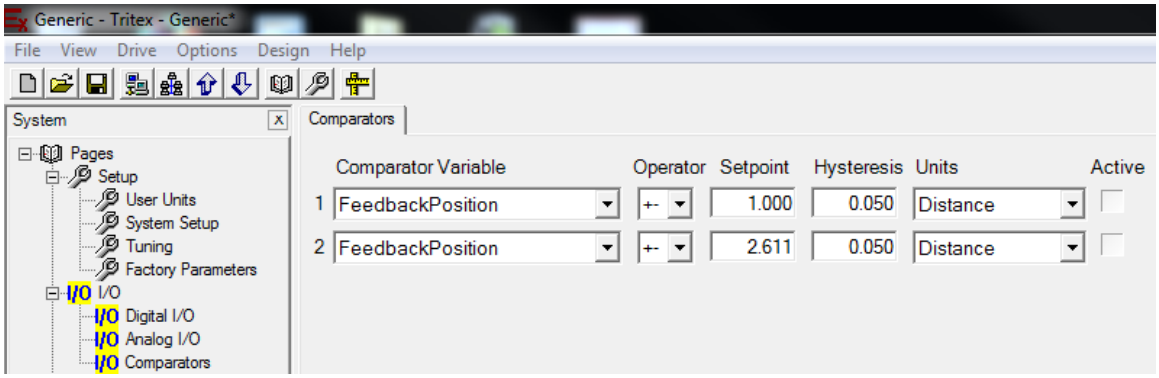
3) Enter 3.30 for a Tritex 2 AC 90/115mm actuator or 6.5 for a Tritex 2 DC or AC 75mm actuator in the High End Offset entry box as a starting point. Measure the current on the output which should be close to 20mA.
4) Iteratively enter slightly higher or lower values into High End Offset until the current measures 20.000+/-.002 mA.
5) Temporarily change the following values in the Output Setup that is Active:
   Var Max = 1000
   Var Min = 0
   This will create an output target of 0.00%
6) Enter 19.30 for a Tritex 2 AC 90/115mm actuator or 6.5 for a Tritex 2 DC or AC 75mm actuator in the Low End Offset entry box as a starting point. Measure the current on the output which should be close to 4mA.
7) Iteratively enter slightly higher or lower values into High End Offset until the current measures 4.000+/-.002 mA.
8) Restore the Output Setup page to its original setting, making sure the values are sent to the drive by right clicking on the box and selecting (left clicking) the *Write current value to connected drive* entry.
9) Click on the *Save Calibration Values* button to store the new values to NVM.
10) Check operation of the output to make sure it was correctly calibrated and then disconnect the loop power supply and meter.

Important Note: The newly calibrated numbers are not saved in the drive's non-volatile memory until the *Save calibration points* button is pressed.

Comparators

Note: This feature is available in Firmware version 2.37 and higher for the DC and 75 mm AC Tritex and version 2.20 or higher for the 90/115 mm AC Tritex.

Two comparators allow output events to be set based on the state of the comparator outputs. The Comparator output events are Comparator 1 and Comparator 2.



Comparator Variable- Selected the desired Comparator Variable from the drop-down list of possible variables. Appropriate Units must be selected. The state of the Comparator Output is determined by the variable's value with respected to the selected Operator, Setpoint, and Hysteresis values.

Operator- The three possible operators are:

+- - Output will be active if Variable is within the range Setpoint +/- Hysteresis.

> - Output will be active if Variable is greater than Setpoint. The Output will go inactive once the value drops below the value Setpoint – Hysteresis.

< - Output will be active if Variable is less than Setpoint. The Output will go inactive once the value goes above the value Setpoint + Hysteresis.

Setpoint- The value that is compared to the present value of the Comparator Variable to determine the state of the comparator output. Both values will have the same units.

Hysteresis- For > or < operators, this is a true hysteresis, modifying the effective setpoint by the hysteresis in order to turn the output from active to inactive. This value is designed to prevent the output from repeatedly changing state due to normal fluctuation or dither on the comparator variable. For the +- operator, the hysteresis value sets a range on either side of the setpoint and the output will be active if within this range.

User Units- It is important that the correct Units are selected for the comparator variable for the Setpoint and Hysteresis values to be interpreted correctly.

When the Output is Active, the Active LED on the screen will turn on and the output event shown on the Digital I/O screen will be active. The Output function can be used externally or assigned through virtual I/O to an input function.

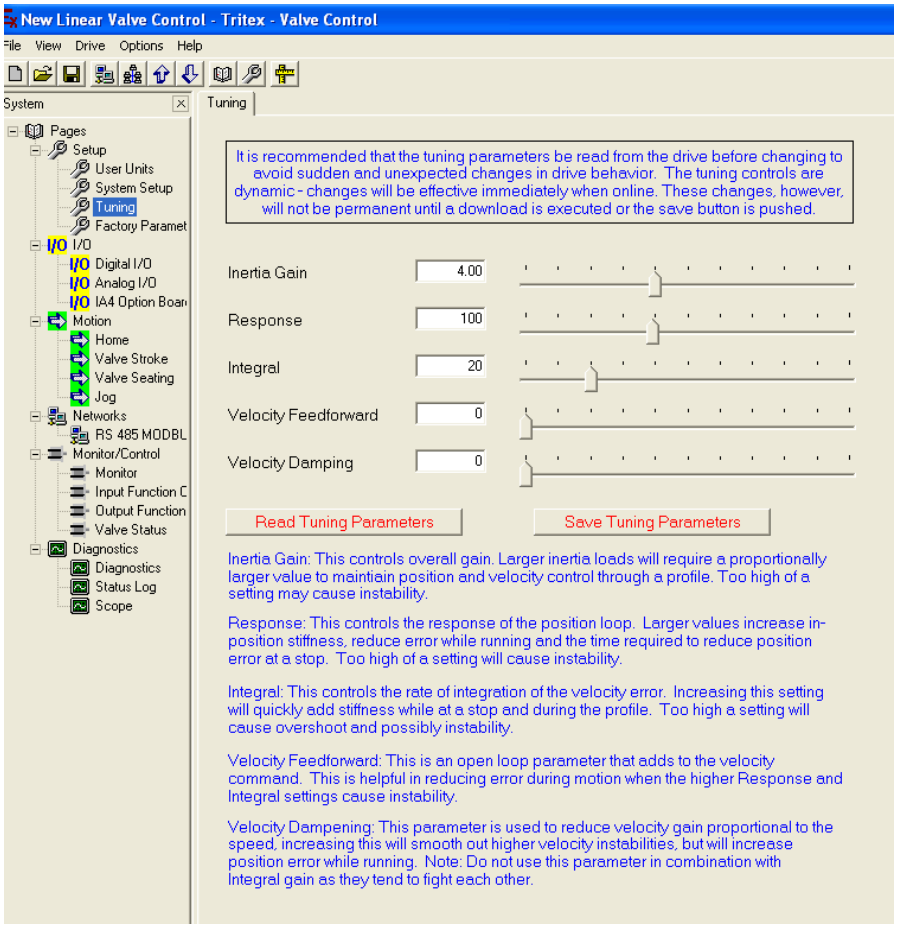
ONLINE DIAGNOSTICS

Tuning

Tritex default gains are set to work out of the box for many applications, for those applications that require tuning four parameters are provided on the Tuning page.

The drive's proprietary motion control algorithms have been designed to reduce the number of tuning parameters for the customer. There are five parameters: *Inertia Gain*, *Response*, *Integral*, *Velocity Feedforward* and *Velocity Damping. Only Inertia Gain* and *Response* are visible by default. The others are not normally necessary to change; however, they can be made available when by right-clicking on the page and selecting *Show Page Details*.

Important Note: If the actuator is online changes to the gain parameters take effect immediately, however they will not be saved in nonvolatile memory until "Save Tuning Parameters" is performed.



Inertia Gain- This controls overall gain. Larger inertia loads will require a proportionally larger value *Inertia Gain* to maintain position and velocity control through a profile. Too high of a setting may cause instability.

Response- This controls the response of the position loop. Larger values increase in-position stiffness, reduce error while running and the time required to reduce position error at a stop. Too high of a setting will cause instability.

Integral- This controls the rate of integration of the velocity error. Increasing this setting will quickly add stiffness while at a stop and during the profile. Too high a setting will cause overshoot and possibly instability.

Velocity Feedforward- This is an open loop parameter that adds to the velocity command. This is helpful in reducing error during motion when the higher *Response* and *Integral* settings cause instability.

Velocity Dampening- This parameter is used to reduce velocity gain proportional to the speed. Increasing this will smooth out higher velocity instabilities, but will increase position error while running.

Note: Do not use this parameter in combination with a high *Integral* value as they tend to fight each other.

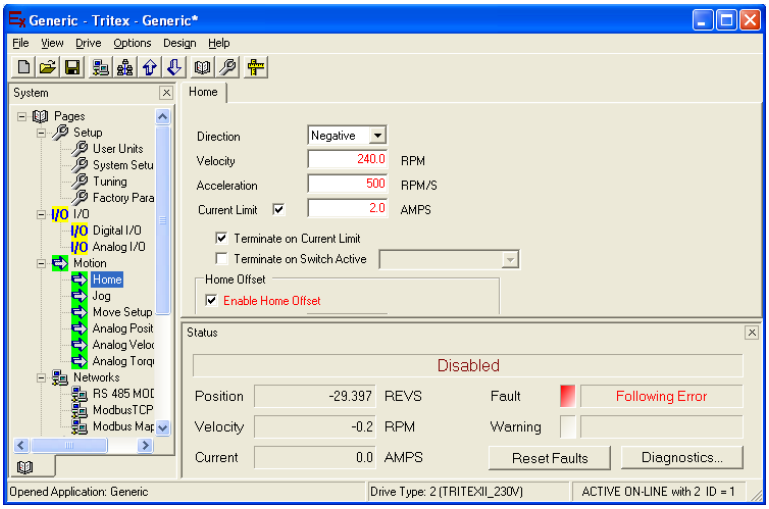
Status, Faults & Warnings

Several pages are available to display status and fault and event history.

Status Page

Operating state, key conditions, faults and warnings can viewed most easily with the Status page. This page is normally part of all applications and is docked at the bottom of the screen. This page can be found under the *Monitor/*Control section of the page tree.

The action taken by certain fault conditions is selectable by the user. (See the *System Setup* section for details on user selection of faults and warnings).



Referring to the image above, “Disabled” is the current operating state of the actuator.

Faults & Warnings are also displayed on the *Status* page. A *Following Error* is displayed as the current fault condition for the example above. If the fault condition no longer exists, clicking the *Reset Fault* button will clear this fault. If the condition still exists, the drive will fault again.

Position, velocity and motor current are displayed on this page as well.

Status Log

The *Status Log* page can be found under the *Diagnostics* category of the page tree. Though not easily interpreted, it contains fault histories that are very useful in determining whether faults could be avoided by adjusting control parameters or if an actuator is in need of repairs. Unexplained faults should not be ignored, because some fault conditions can result in cumulative damage. Please contact our Tech Support group for help in determining underlying causes of faults.

Total power-up time and power-up count are displayed at the top. Power-up time is actually the time the actuator is enabled, not just the time all power is applied. If logic power is applied to keep the electronics running even when main bus power is off, a power-up is counted only after both main and logic power have been removed.

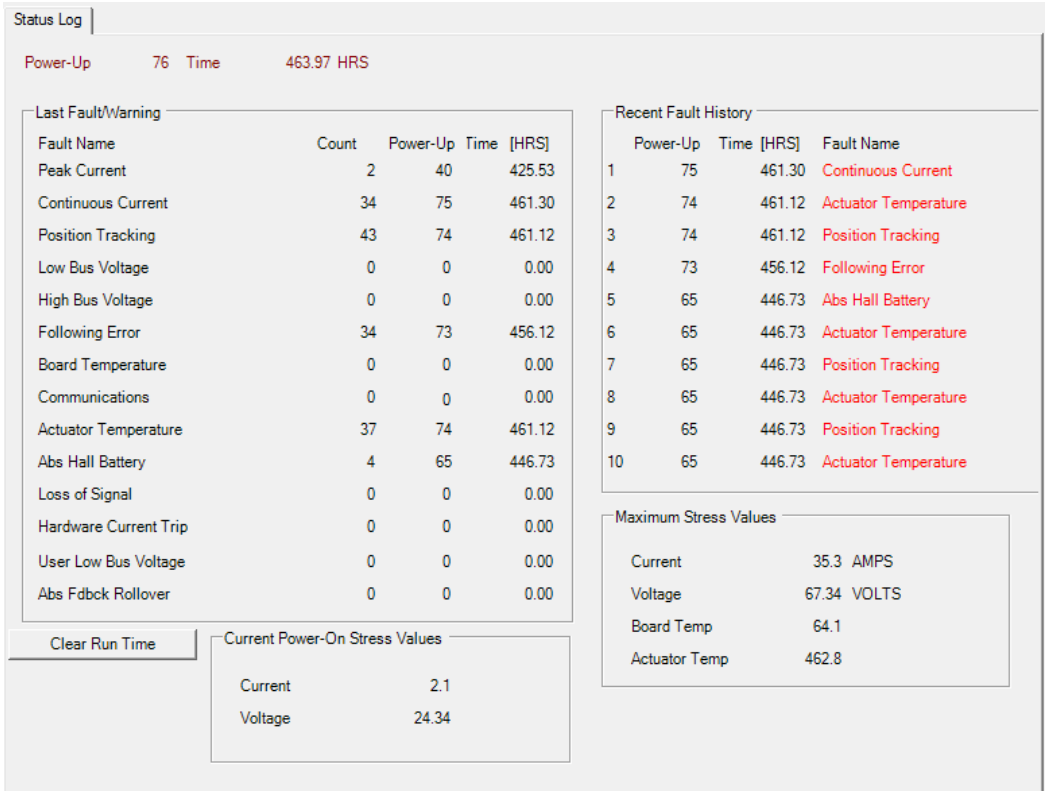
The *Status Log* page shows the number of fault occurrences and the power-up count and run time of the most recent occurrence for each fault condition in the Last Fault/Warning section.

The *Recent Fault History* section displays the last ten faults that have been logged with #1 the most recent. The *Power-up* count and *Time* for each fault are also saved here.

Maximum Stress Values indicate the maximum values for *Current*, *Voltage* and *Board Temp* seen by the drive since being shipped from the factory. On models equipped with an actuator temperature sensor rather than an overtemperature switch, the highest *Actuator Temp* will also be recorded here. *Current Power-On Stress Values* indicate the maximum current and voltage seen since the actuator was last restarted from a complete power down. These values can be reset for diagnostic purposes by clicking the *Clear Run Time* button.

Note: The power up time, count and stress values will only be stored to non-volatile memory every SIX minutes. Faults are saved to non-volatile memory immediately.

The data is uploaded for viewing but is not saved with the drive file.



Faults: Possible Causes and Solutions

The next paragraphs describe the meaning of faults that may occur and be recorded in the Fault Log. There are a few that are not recorded in the fault log as well, also described here.

Peak Current - The *Peak Current* fault threshold is set at the factory and is above the *Factory Current* limit, meaning the actuator will never command enough current for a *Peak Current* fault. This fault can only occur under serious upset to the control loops operating in the actuator, possibly from a hard stop or severe supply voltage upset. The Oscilloscope function can be used to monitor the current to find upsets if there are nuisance *Peak Current* faults. They should not be ignored.

Continuous Current- The actuator continuously monitors motor current using an I^2t calculation and compares the actual value to a factory limit. On reaching this limit, the actuator will limit current to not exceed the limit if the *Foldback on continuous current* box is checked on the *Option tab of the System Setup page.* Otherwise the actuator will fault and immediately disable. The *Continuous Current* fault is one of the most important protections against overload for the. *Continuous Current* can be monitored on the *Monitor* page.

*Tracking Erro*r- This is an internal fault that can only occur if the drive senses invalid position feedback signals. This condition cannot be resolved in the field; the unit must be sent to the factory for repair, with an important exception. For units with the absolute feedback option (-AF) running on older firmware, an Absolute Feedback Rollover fault was mapped into a *Tracking Erro*r fault and this condition is field re-settable. Contact Tech Support for advice on occasional faults that can be reset.

Low Bus Voltage: A *Low Bus Voltage* limit is set at the factory. Anytime the voltage goes below this preset value while the actuator is enabled, the drive immediately faults. A Low Bus Voltage condition is only considered a fault if the drive is enabled, that is, trying to operate when there is insufficient power to do anything. The *Bus Voltage* can be monitored on the *Diagnostics* page.

High Bus Voltage: A *High Bus Voltage* limit is set at the factory, and on DC actuators a lower *User High Bus* fault may be set. Anytime the voltage goes above this preset value, the drive immediately faults. A *High Bus Voltage* fault can occur from overvoltage on the main power supply, but more likely from the bus voltage rising due to motor regeneration energy. For an AC powered actuator, the solution is generally to connect an external braking resister, though occasionally slower deceleration or better position loop performance (less overshoot) is enough. For DC actuators regenerated energy handling can be more complicated and involve an RSR and blocking diodes to protect power supplies. (See the *Installation Manuals* for more details). The *Bus Voltage* can be monitored on the *Diagnostics* page, or with the Scope.

Following Error- This fault occurs if the *Following Error* (difference between target position and actual position) is beyond the *Following Error* limit and the *Time in Following Error* limit is exceeded. This will typically occur if the actuator cannot provide enough force/torque to get to the desired position, either because the active current limit is set too low or a there is a machine jam or hard stop or end travel has been reached. Another cause could be attempting to accelerate a high inertia load too quickly. *Following Error* should be kept low by good motion control practice; asking for motion within the limits of the actuator at all times and having good tuning.

Board Temperature- This condition occurs when a temperature sensor near the processor in the control electronics is over the factory set limit. This can occur if the actuator is continuously used above its power rating, or at high ambient temperatures.

Note: Power de-ratings apply to units operated at an elevated ambient.

Communications- This fault occurs if there is no activity on a communications channel for a configurable timeout interval. See the *System Setup* page *Comms Faults* tab for settings. This condition should be ignored – not even logged – unless continuous communications is required for operation, such as commands via Modbus or other fieldbus.

Actuator Temperature- This condition occurs when the temperature sensor in the stator winding reports a temperature higher than the factory set limit.

Important Note: If the actuator has the hand wheel (–HW) or side drive (-SD) option, a switch to indicate manual operation is wired in series with the Actuator Temperature sensor to disable the actuator. Therefore, engaging the manual drive is recorded as an Actuator Temperature fault.

Absolute Hall Battery- This condition should generally be set as a warning rather than a fault. It indicates that the battery that maintains multi-turn absolute position is running low. If it gets too low, position will not be retained and a home sequence will have to be performed after a power-down.

Loss of Signal- This fault condition occurs only when the *Enable High Trip* or *Enable Low Trip* box is checked and the *Analog Input* value drops out of range that is entered. See analog input page.

Hardware Current Trip- This fault indicates an abnormal current has been detected by high speed short-circuit detection electronics. It usually indicates an insulation breakdown, though can occur due to a severe transient voltage. If this fault recurs immediately on attempting to re-enable the actuator, do not keep trying to reset the fault. Secondary failures will eventually occur, causing supply fuses to open. This fault must not be ignored. Contact our tech support.

User Low Bus Voltage: A *User Low Bus Voltage* limit is set by the user; anytime the voltage goes below this value, the fault condition occurs. The *Bus Voltage* can be monitored on the *Diagnostics* page.

Absolute Feedback Rollover: With the absolute feedback (-AF) option the travel limit is 8192 motor revolutions, if the motor goes past 8192 revolutions the position will track properly until the next power cycle, at that time this fault will occur. The only recovery from this fault condition is to unplug the backup battery connector when all power (main bus and logic) is removed. Leave the connection off for about 1 minute then re-connect and power up. A home cycle will be required. This fault is only shown on firmware version 2.19 and higher for the Tritex 2 AC 90/115m or version 2.35 and higher for other drive types and with Expert Software version 4.5.2.6 and higher. In older firmware or software this fault condition is reported as a Tracking Error. The recovery is the same. Latest firmware and absolute feedback hardware eliminates the turns limit so this fault will not occur.

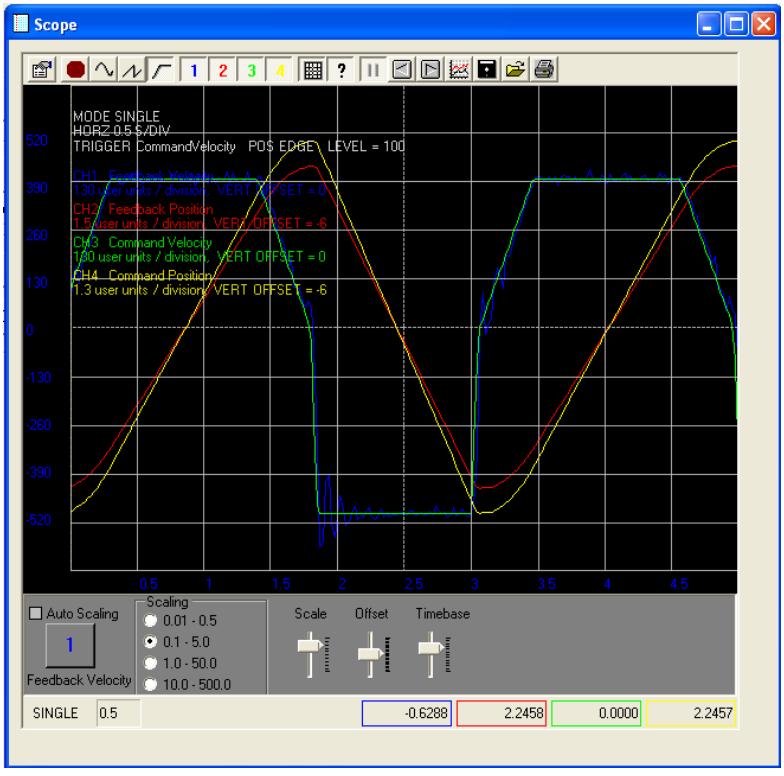
Move Termination- This condition can occur in any motion type with three different possible causes: (See the *Move* page).

1. If the *Fault if not terminated by switch or current limit* box is checked and the move is terminated by reaching the designated position without having activated a switch or reached the *Current Limit* value.
2. If either *Terminate on switch* (*active or inactive*) is selected or Fault *if terminated by switch* is selected and the motion is terminated by the *Switch Input* rather than by *Current Limit* or reaching the designated position.
3. If the *Terminate on current limit* and the *Fault if terminated by current limit* boxes are checked and the *Current Limit* for the motion is hit before the *Switch Input* is sensed or before the designated position is reached.

Invalid Parameters or *System Parameters*- These faults involve parameter images in non-volatile memory. It is recommended that a drive file for each actuator is saved at all times, though having a drive file for each actuator is more likely to be used to install a spare actuator for other maintenance or repair purposes. Contact the Tech Support group for recovery.

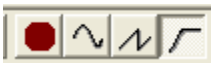
Scope

The Tritex software has a *Scope* page that is a virtual oscilloscope that can plot up to four channels with either high speed or continuous data capture mode. It is vital for understanding the dynamics of servo motion control when optimum performance is required.



Button Controls

 This button opens the *Control Panel* for configuration and precise setup. Details on this page are found later in this section.

 These four buttons set the capture method as follows:

 This button stops data collection and plotting.

 This button is for continuous capture/plotting where the *Scope* plots new data points as each channel variable changes value.

 This button is for continuous re-trigger mode, where every time the trigger condition exists, the scope starts a new capture.

 This button is a single capture where the scope will gather and plot one buffer full of data and then hold.

 These six buttons toggle the capture and display of the four channels, the  grid lines and the  legend.

 These three buttons are helpful for zooming left or right on a plot segment. The pause button freezes the screen and enables the left and right buttons for scrolling through the entire buffer of data, half a screen at a time.

 This button toggles between the default plotting method of data over time and the secondary method of plotting channel 1 over channel 2.

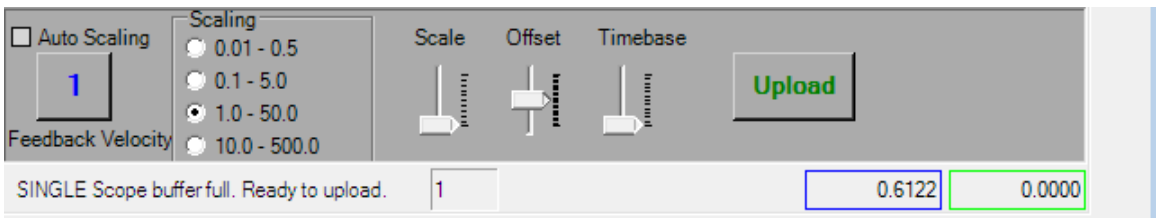
 These three buttons are for saving, recalling and printing a plot.

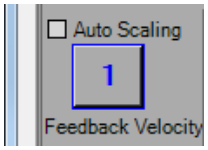
 Save the data to a CSV file.

 Recall data from a previously saved file.

 Send the plot image to a printer.

The lower controls offer methods of tuning the display such as scaling, offset and time base.





This button, whose number changes as it is toggled, selects which channel will be affected when the *Scale* or *Offset* slide bars are used. This is also the channel that the values displayed on the vertical grid line will represent.

Auto Scaling- The displayed channel will be scaled vertically by percentage of the grid it takes up from its highest point to its lowest from 1% to 300%.

Scaling- This selects the "coarseness" for the *Scale* slide bar

Scale- Moving this slide bar up or down changes the scale of the selected channel in the vertical direction. For fine adjustments click on the slider arrow and use the keyboard up/down arrows.

Offset- This applies a -50% to 50%

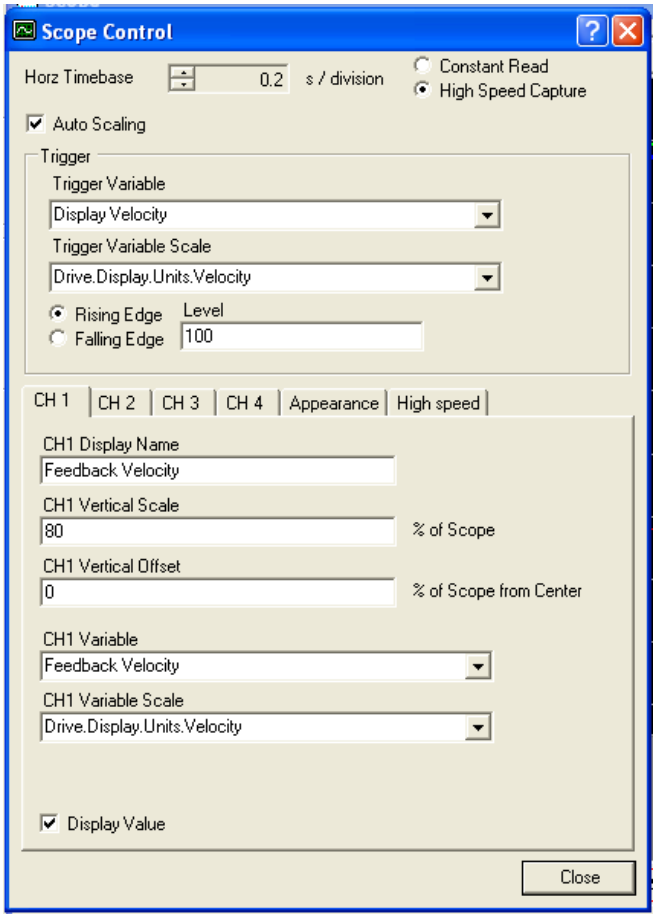
Timebase- This adjusts the scaling horizontally. It allows the user to select how much time passes from one vertical grid line to the next. Time increments from .001 seconds per line to 10.0 seconds per line are available.

Upload- When data buffer is full and is ready for Upload the Upload button text will turn green.

The bottom row displays the capture mode, time base and current value of each channel variable.

Scope Controls

The *Scope Control* page is opened by using the *Control Panel* button  .



Capture and Trigger Settings

Horz Timebase- The horizontal time base of the *Scope* plot.

Auto Scaling- An automatic scaling vertically by percentage of the grid it takes up from its highest point to its lowest from 1% to 300%.

Capture Method- Constant Read takes in the channel and trigger data from conventional variable monitors and is not as precise as the high speed capture method due to delays from communications.*High Speed Capture* fills a data buffer on the drive and then uploads all data points at once when it is full.

Trigger- This tells the scope to start capturing data to plot. The *Trigger Variable* and *Trigger Variable Scale* can be selected from the drop-down lists. *Level* is the value at which the trigger will occur and *Rising*/*Falling Edge* selection dictates if the capture is triggered as the value crosses the level from lower to higher or higher to lower.

Channel Setup

Each of the four channels is set up on their own tab on this page.

CH# Display Name- The name to be displayed by the *Legend* of the *Scope*.

CH# Vertical Scale- The scaling of the vertical axis to be used if not using *Auto Scaling*.

CH# Vertical Offset- The position vertically on the scope of the “zero” point of a set of data.

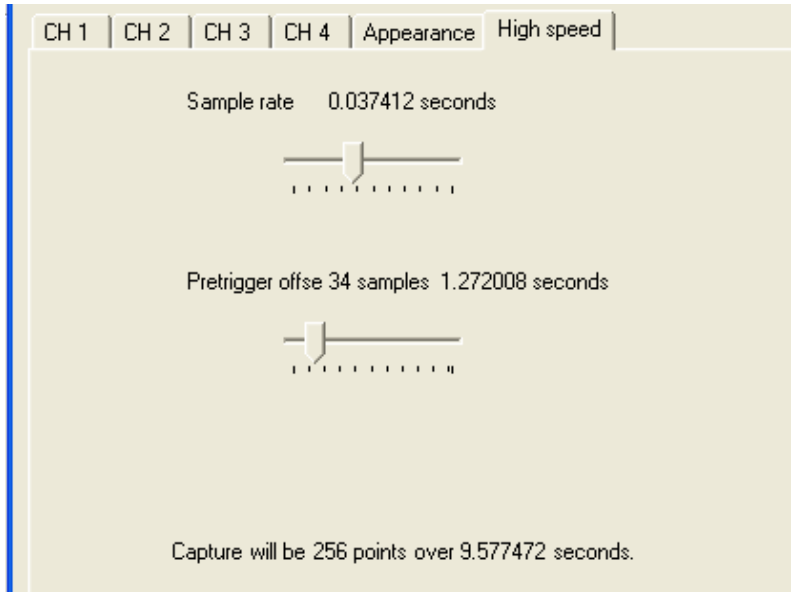
CH# Variable- Select the variable for which this channel will capture data.

CH# Variable Scale- Select the units appropriate for the data being captured.

Scope Appearance

The *Appearanc*e tab allows the user to select the colors and line widths for the background, grid, individual channels when plotted and displayed on the *Scope.*

High Speed Capture



The *High Speed* tab lets the user set how much time passes between data points collected and how many data points will be displayed from before the trigger occurred. If insufficient time passes between enabling the scope to capture and when the trigger occurs, all the pre-trigger data may not be valid.

FIELDBUS OPTIONS

EtherNet/IP Option

Functionality

Note: *For detailed information on Tritex Ethernet IP setup see the Tritex II Ethernet IP Option Manual*

The Tritex II EtherNet/IP option board supports the following features:

- Device IP Address assignment through BOOTP or through Tritex Expert software
- Drive commissioning through standard RS485 communication to Tritex Expert software
- EtherNet/IP device capable of Implicit I/O messaging
- Exlar supplied EDS file if required by client device
- Up to 100 input registers(INT16) and 100 output registers(INT16) are available to be user mapped to Tritex parameters through the Tritex Expert software
- Full functional control of Tritex parameters

Assignment of Tritex IP address

As with any Ethernet device, the Tritex contains a MAC-ID that is unique to this device. When assigning an IP address, this MAC-ID is useful for verifying device identity, so a printed label is applied to the actuator. Each device receives an IP address to identify itself to the Ethernet network. In addition, it also holds a default subnet mask and gateway for the network.

There are two ways of assigning the IP address to the Tritex:

-BOOTP Server

-Tritex Expert software

The default IP address settings loaded into the unit at the factory:

IP Address – 192.168.0.254
Subnet – 255.255.255.0
Gateway – 0.0.0.0

Setting the IP address is more conveniently accomplished through Tritex Expert software, so BOOTP must be disabled. This is done using a BOOTP server, if not already disabled.

Note: For more information on IP addresses with BOOTP, refer to the EthernNet/IP Option Manual.

Tritex Expert Software IP Address Configuration

Note: BOOTP must be disabled to set the IP address through the Tritex software.

When communications are online with the Tritex software, opening the *EtherNet/IP* page under the *Networks* category of the pages tree, you will see the TCP/IP parameters. The displayed values, under *Current TCP/IP Properties-IP Address*, *Subnet Mask* and *Dflt Gateway*-are the parameters set in the EtherNet/IP module. The fields under *Edit TCP/IP Properties* are for entering an *IP Address*, *Subnet Mask* and *Dflt Gateway* for using BOOTP or changing the default parameters.

Note: Be sure to select *Save Addresses to Drive* if modifying the TCP/IP properties.

Changes to Ethernet prarmeters will not take effect until power to the drive is cycled. Upon power-up the new IP Address will be assigned and will show up in the current MAC-ID parameter container.

EtherNet/IP Implicit I/O Messaging

Implicit I/O Messages are transmitted via UDP/IP. I/O Message connections are often established as One-to-Many relationships in the producer-consumer multicast model of EtherNet/IP. The data fields of I/O Messages contain no protocol information, only time-critical I/O data. These messages are used to send and receive application-specific data over the network at regular intervals. The meaning of the data is pre-defined at the time the connection is established. I/O Messages contain *Assemblies* of several parameters that can be transmitted with a single message.

The Tritex has a set number of 101 input and/or 101 output 16 bit registers that are transferred with each update. These registers are mapped to specific parameter definitions in the Tritex Expert software. Unmapped registers will carry data across with the messages, but will not be associated to affect any functionality of the Tritex. Outputs are sent from the Tritex consistently while the Inputs only updates when a value is changed.

A *Host* is the device capable of initiating an EtherNet/IP Implicit connection with the Tritex, such as a PLC or other plant control system. The *Assemblies* used to setup the *Host* and transmit I/O Messaging data are:

Assembly 101 is defined for Host Inputs(Tritex Outputs) with a data size of 101 16 bit registers.

Assembly 102 is defined for Host Outputs(Tritex Inputs) with a data size of 101 16 bit registers.

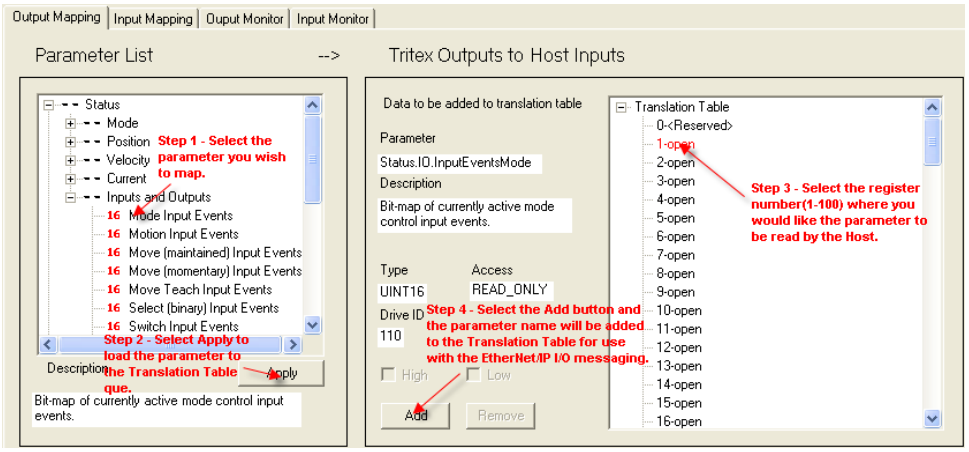
Assembly 128 is defined for Configuration with a data size of 0 registers.

Note: There are 100 usable input and output registers. Register 0 is reserved for the Tritex both on the Inputs and the Outputs. The *Host* must set register 0 to a value of 1 to enable writing data to the Tritex on the 100 registers.

Tritex Data Mapping to I/O Registers

All Tritex functionality is parameter based. This means there is a listing of parameters associated with every functional capability of the Tritex. When setting up the EtherNet/IP mapping to the 101 Inputs and 101 Outputs, first a list of the parameters must be defined and determined whether they are *Read Parameters* from the EtherNet/IP *Host* or *Write Parameters* to the EtherNet/IP *Host*. Once this list is created, mapping the parameters to the *Translation Table* of registers is done as shown in the Figure below. The *Output Mapping* tab is used to map the parameters that are output by the Tritex and read into the *Host*. The *Input Mapping* tab is used to map the parameters that are input to the Tritex and written from the *Host*. The *Input Monitor* and *Output Monitor* tabs work in the same manner.

Note: Not all parameters in the list are compatible with all versions of firmware. If an EIP error occurs check the compatibility of the parameters in the table with the firmware version on the Tritex drive.

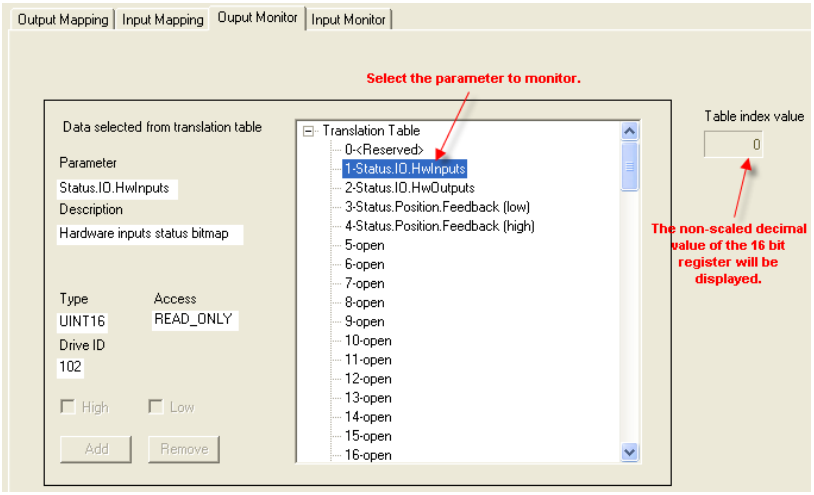


Selecting parameters to be mapped to the Translation Table.

After *Step #2* in the Figure above, the information about the parameter is displayed. 32 bit or double word parameters can only be assigned to tables starting with odd numbers. If a 32 bit parameter is selected and even table number is selected the *Add* button will be gray. If, for example, only half of a 32 bit parameter is needed (all velocities are 32 bit parameters their data format is 8.24 revs/sec and rarely would 24 bits of precision be needed to the right of the decimal point), the user could select only the *High* word of the parameter, by un-checking the *Low* box, resulting in a 16 bit velocity parameter in the format of 8.8 revs/sec , 8 bits on each side of the decimal point.

Assigning the parameters to be transferred between the Tritex and PLC is simple; the hard part is understanding the Tritex parameters and their format so they can be controlled from the PLC. The *Tritex II Parameters Manual* describes the function of every parameter, in some cases even the interaction with other parameters, and most importantly the format of data for each parameter. Parameters such as *Move* distances and *Velocity* are straight forward, however, many of the parameters used for control are 16 bit registers represented by bit maps or Enumeration tables; the common bit maps are covered in *Appendix A* of the *Tritex II Parameters Manual*.

To assist with validating the data sent/received, the *Input/Output Monitor* tabs allow the user to view the non-scaled decimal value of the 16 bit register. This value will match the value observed from the *Host*. See Figure below to identify its use.



Monitoring parameters to validate data sent/received by the host.

PROFINET I/O Option

Functionality

Note: For detailed information on Tritex PROFINET IO setup see the *Tritex II PROFINET IO Option Manual*

The Tritex II PROFINET IO option board supports the following features:

- Device IP Address assignment through DCP.
- Drive commissioning through standard RS485 communication to Tritex Expert software.
- PROFINET IO device capable of Implicit I/O messaging.
- Exlar supplied GSD file is required.
- Up to 100 input registers (INT16) and 100 output registers(INT16) are available to be user mapped to Tritex parameters through the Tritex Expert software.
- Full functional control of Tritex parameters.

Assignment of Tritex IP address

As with any Ethernet device, the Tritex has a MAC-ID that is unique to this device (located on the actuator label). PROFINET I/O identifies nodes by the device name, but also assigns and uses IP addresses. When assigning an IP address and device name this MAC-ID is useful for identifying the device. Each device receives an IP address and device name to specifically identify itself to the PROFINET network. In addition, it also holds a default subnet mask and gateway for the network.

The IP address and device name to the Tritex is set through DCP (Discovery and Configuration) software.

The default IP address settings loaded into the unit at the factory:

Device Name – “”
IP Address – 0.0.0.0
Subnet – 255.255.255.0
Gateway – 0.0.0.0
IP Address assignment using DCP

A network scan run by the Engineering Tool for PROFINET IO setup software, such as Siemens Step 7 or NCM PC, detects and displays all PROFINET IO nodes that can be reached online along with MAC address, IP address, device name and device type. This application permits processing of the nodes, e.g. assigning the device name and changing the IP address.

Tritex Expert Software IP Address configuration

When communications are online with the Tritex software, opening the *PROFINET IO* page under the *Networks* category of the pages tree, you will see the TCP/IP parameters. The displayed values, under *Current TCP/IP Properties-IP Address*, *Subnet Mask* and *Dflt Gateway*-are the parameters set in the PROFINET IO module. These addresses are overwritten by the PROFINET setup tools (Step 7) or PLC, so they are not edited in the Tritex software.

PROFINET IO Messaging

I/O Messages are transmitted via UDP/IP. I/O Message connections are often established as One-to-Many relationships in the model of distributed PROFINET IO. The data fields of I/O Messages contain no protocol information, only time-critical I/O data. These messages are used to send and receive

application-specific data over the network at regular intervals. The meaning of the data is pre-defined at the time the connection is established. I/O Messages contain Assemblies of several parameters that can be transmitted with a single message.

The Tritex has a set number of 101 input and/or 101 output 16 bit registers that are transferred with each update. These registers are mapped to specific parameter definitions in the Tritex Expert software. Unmapped registers will carry data across with the messages, but will not be associated to affect any functionality of the Tritex. Outputs are sent from the Tritex consistently while the Inputs only updates when a value is changed.

A Host is the device capable of initiating a PROFINET IO connection with the Tritex, such as a PLC or other plant control system. The Assemblies used to setup the Host and transmit I/O Messaging data are:

Assembly 101 is defined for Host Inputs(Tritex Outputs) with a data size of 101 16 bit registers.

Assembly 102 is defined for Host Outputs(Tritex Inputs) with a data size of 101 16 bit registers.

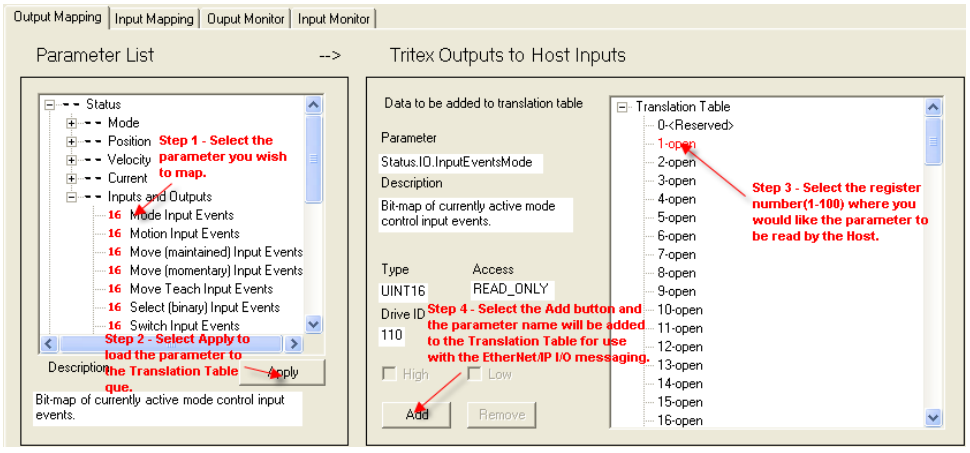
Assembly 128 is defined for Configuration with a data size of 0 registers.

Note: There are 100 usable input and output registers. Register 0 is reserved for the Tritex both on the Inputs and the Outputs. The Host must set register 0 to a value of 1 to enable writing data to the Tritex on the 100 registers.

Tritex data mapping to I/O registers

All Tritex functionality is parameter based. This means there is a listing of parameters associated with every functional capability of the Tritex. When setting up the PROFINET IO mapping to the 101 Inputs and 101 Outputs, first a list of the parameters must be defined and determined whether they are *Read Parameters* from the PROFINET IO *Host* or *Write Parameters* to the PROFINET IO *Host*. Once this list is created, mapping the parameters to the *Translation Table* of registers is done as shown in the Figure below. The *Output Mapping* tab is used to map the parameters that are output by the Tritex and read into the *Host*. The *Input Mapping* tab is used to map the parameters that are input to the Tritex and written from the *Host*. The *Input Monitor* and *Output Monitor* tabs work in the same manner.

NOTE: Not all parameters in the list are compatible with all versions of firmware. If a PNIO error occurs check the compatibility of the parameters in the table with the firmware version on the Tritex drive.



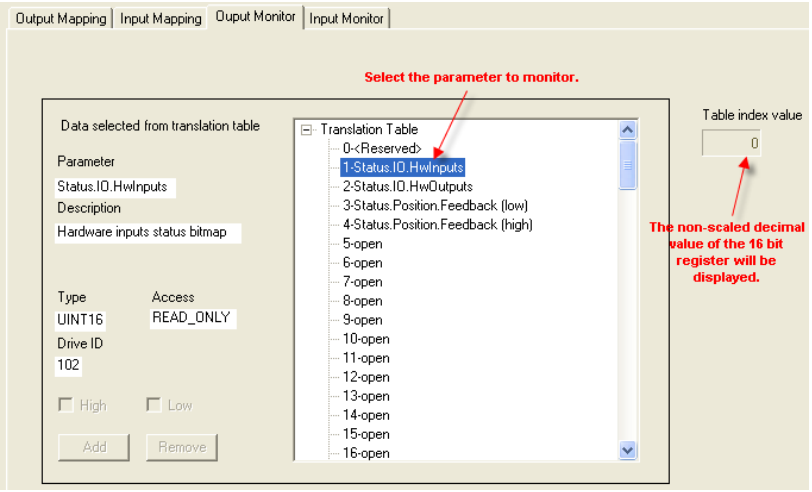
Selecting parameters to be mapped to the Translation Table.

Note: Tritex works with 16 bit words where PROFINET IO uses 8 bit bytes or “octets”. There will be two PROFINET IO octets for each Tritex word.

After *Step #2* in the Figure above, the information about the parameter is displayed. 32 bit or double word parameters can only be assigned to tables starting with odd numbers. If a 32 bit parameter is selected and even table number is selected the *Add* button will be gray. If, for example, only half of a 32 bit parameter is needed (all velocities are 32 bit parameters their data format is 8.24 revs/sec and rarely would 24 bits of precision be needed to the right of the decimal point), the user could select only the *High* word of the parameter, by un-checking the *Low* box, resulting in a 16 bit velocity parameter in the format of 8.8 revs/sec, 8 bits on each side of the decimal point.

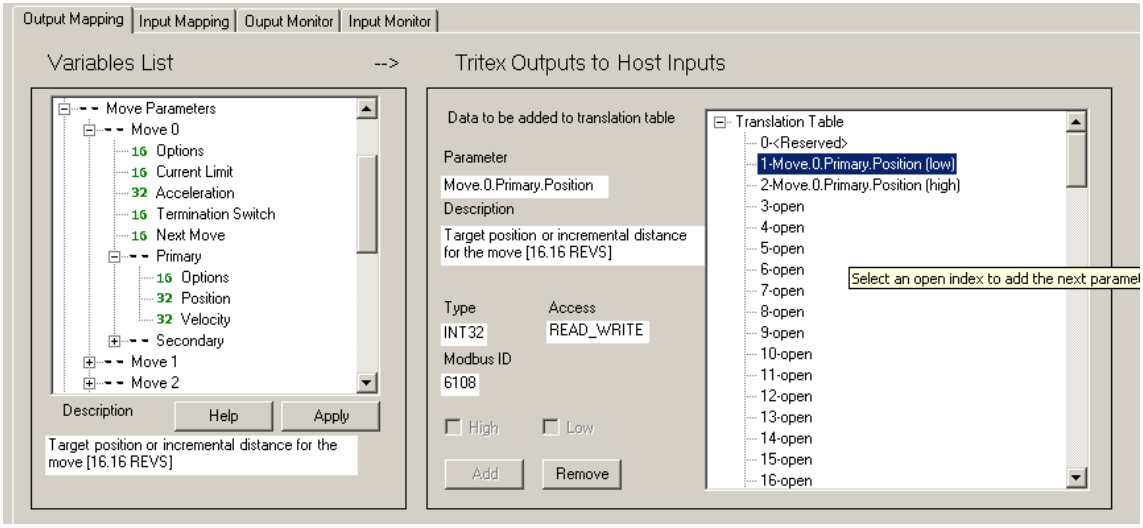
Assigning the parameters to be transferred between the Tritex and PLC is simple; the hard part is understanding the Tritex parameters and their format so they can be controlled from the PLC. The *Tritex II Parameters Manual* describes the function of every parameter, in some cases even the interaction with other parameters, and most importantly the format of data for each parameter. Parameters such as *Move* distances and *Velocity* are straight forward, however, many of the parameters used for control are 16 bit registers represented by bit maps or Enumeration tables; the common bit maps are covered in *Appendix A* of the *Tritex II Parameters Manual*.

To assist with validating the data sent/received, the *Input/Output Monitor* tabs allow the user to view the non-scaled decimal value of the 16 bit register. This value will match the value observed from the *Host*. See Figure below to identify its use.



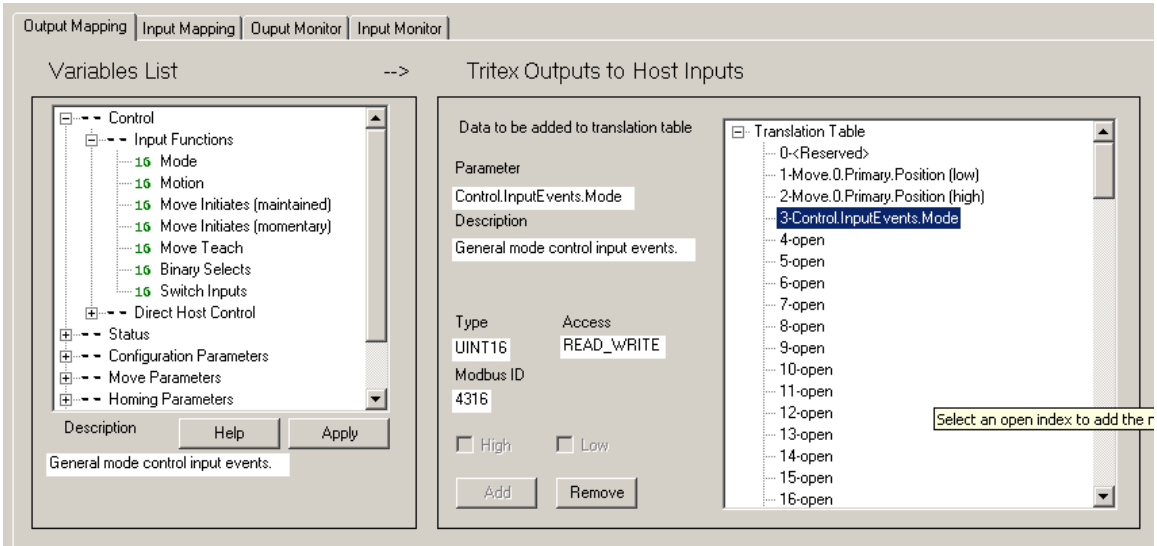
Monitoring parameters to validate data sent/received by the host.

Example 1: Writing Move 0 Position from the PLC to the Tritex



1. Select the *Input Mapping* tab (Input to the Tritex from the PLC)
2. Select Move 0, Primary, Position
3. Click *Apply*: information about the parameter is displayed.
4. Since this is a 32 bit parameter select an odd number in the *Translation Table* and Click the *Add* button.
5. After a download the Tritex is now ready to receive this data and write it directly to the *Move 0* position register.
6. Click on the *Help* button and a PDF file will open explaining the *Move* parameter details. *Move Position* has a variable type of POS 32; the data table details the format is 16.16, (16 digits on each side of the decimal point), and the units are in Revs (motor revolutions).

Example 2: Enabling the Tritex from a PLC



1. Select the *Input Mapping* tab (Input to the Tritex from the PLC)
2. Enable bit is found in the *Mode* sub group of *Control*/*Input Functions*. Click the *Help* button for details on the *Input Function Events* bit map.
3. Select *Control*, *Mode* and Click *Apply*
4. Select the desired register number from the translation table. Since it is a 16 bit parameter either an odd or even number can be selected.
5. From the information in found in the *Help* PDF, the bit map of the *Mode* word is shown as:

IEG_MODE

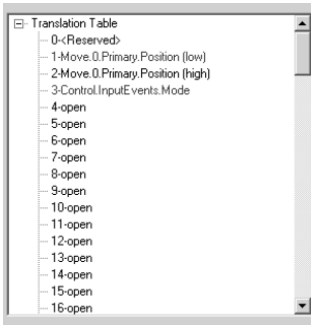
RESET	BKOV	TSEL	TENA	H2	H1			ALT						EL	EE
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

As described bit "1", EL is *Enable Maintained*

6. After a download, writing a "1" or "0" to bit "1" of word "3" from the PLC will control the Tritex *Enable*.

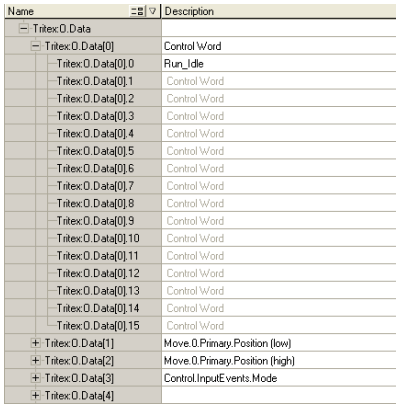
The below figure shows the relationship between Tritex *Input Translation Table* to RSLogix Output controller tags

Tritex Expert Software



Inputs

RSLogix (I/O Connection)



Outputs

Tritex Input vs. RSLogix Output Tags

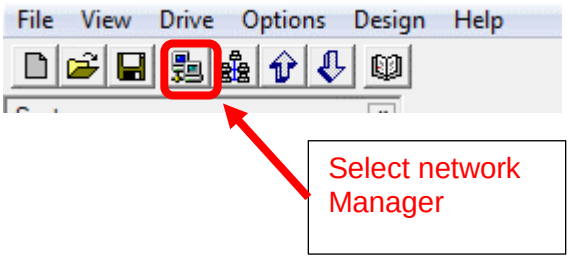
Modbus TCP Option

Modbus TCP works with the Expert software much the same as Modbus RTU, and once the Network Manager has been configured for the drive it should be transparent as to which protocol is being used.

In fact, it is necessary to connect Expert Software with an actuator over Modbus TCP in order to change the Ethernet parameters such as the IP address for the intended application. The following procedure shows how to establish a connection.

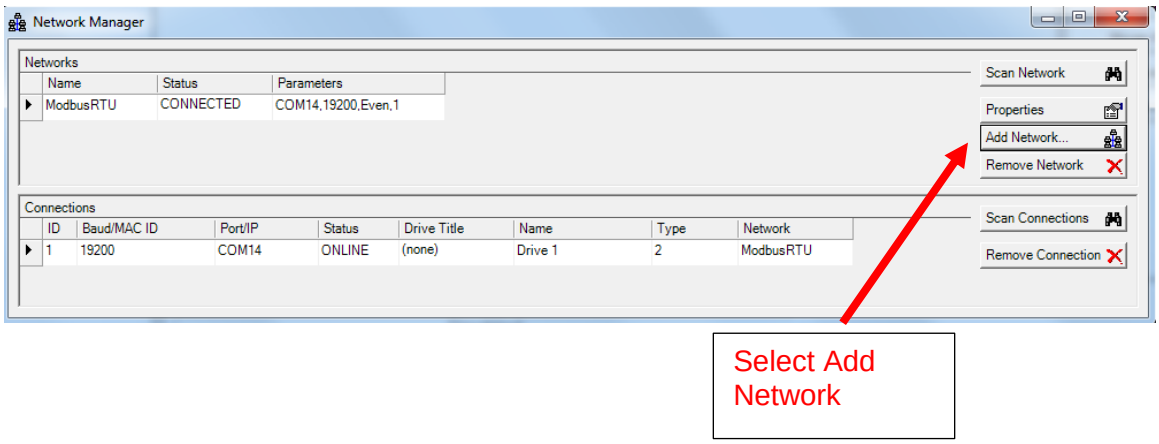
STEP 1 - Add TCP network Connection

- To add a Network select the 'Network Manager':



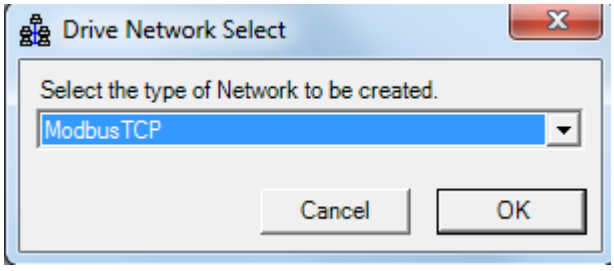
STEP 2 – Add TCP Network

- From the Network Manager click Add Network:



STEP 2.1 – select Network

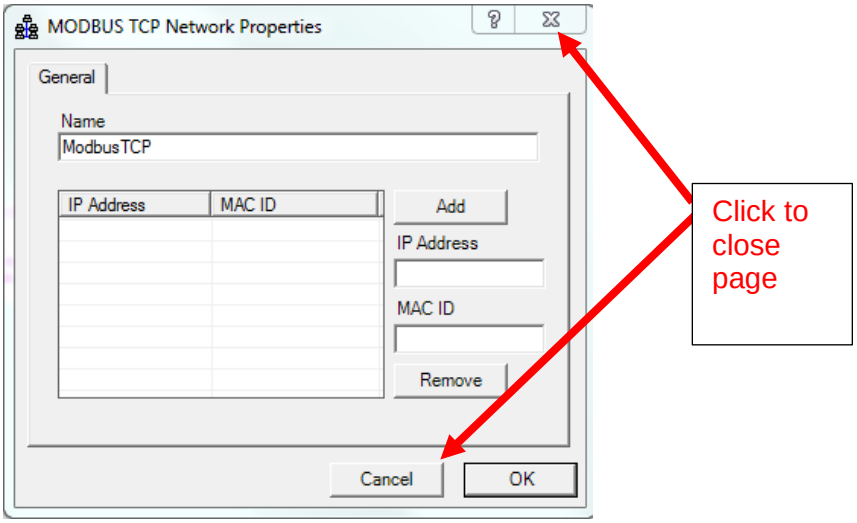
- Add Network:

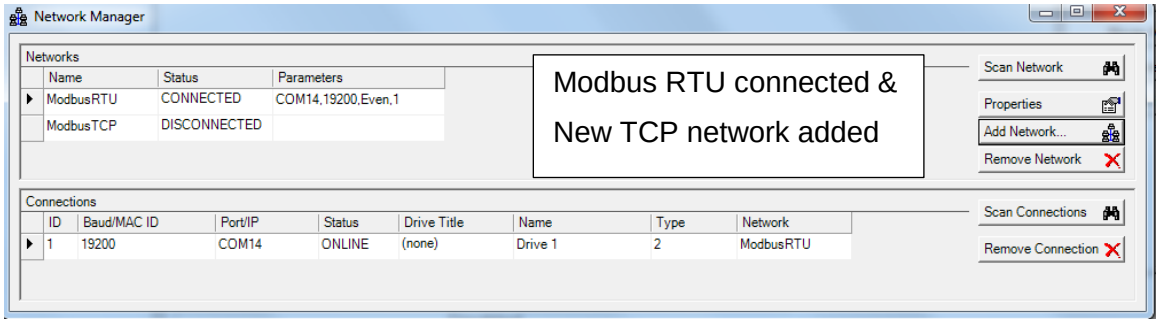


Select ModbusTCP and click 'OK'

STEP 3

- After adding ModbusTCP, this Page will appear - IGNORE – click Cancel to close





After Canceling 'Modbus TCP Network Properties' the above Page will appear, showing available networks.

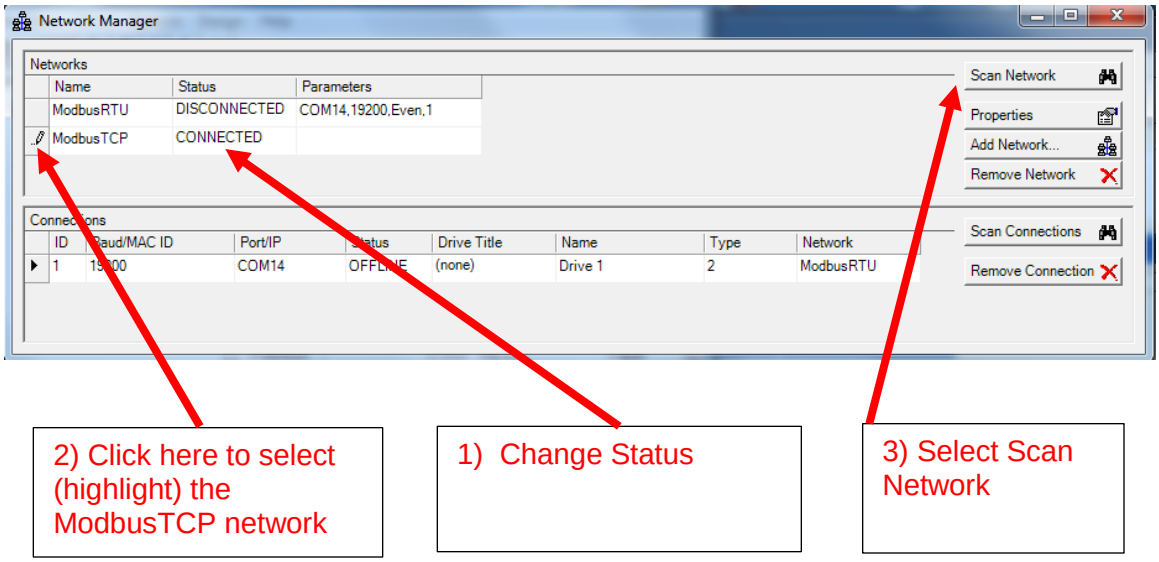
STEP 4 – Scan for network

- Scan for Drive by following the outline steps 1 through 3

  (1) Change Status of ModbusTCP network to Connected and any other networks to Disconnected by clicking on the box and the ▼ for a pulldown menu and then selecting from the menu

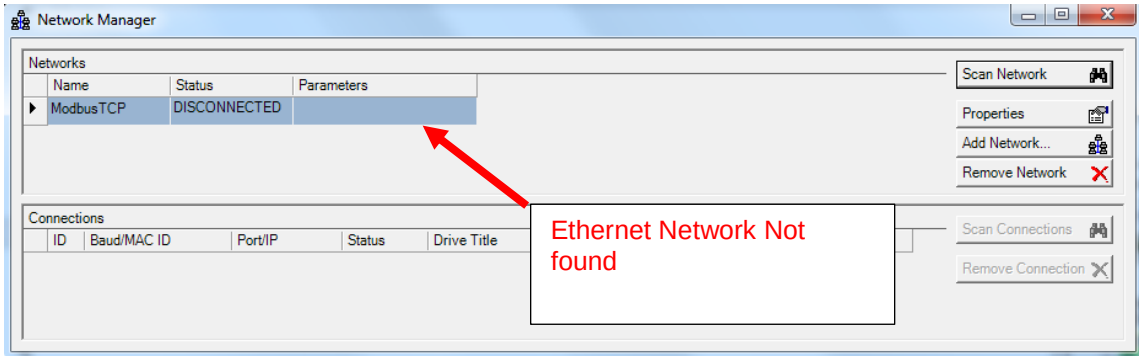
  (2) Select the ModbusTCP Network

  (3) Scan network



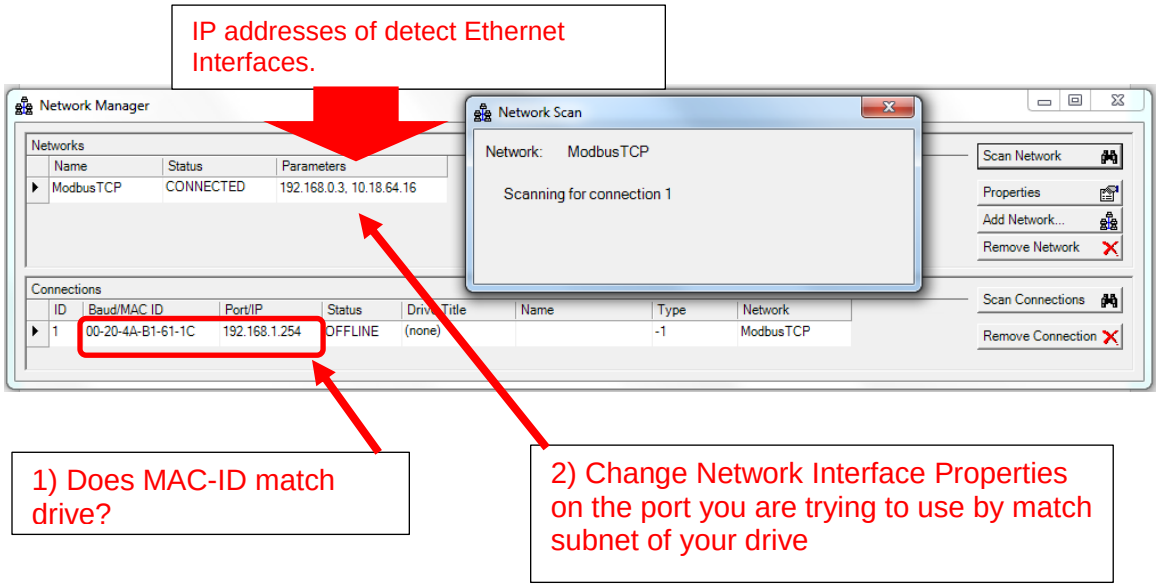
Above image shows ModbusRTU and ModbusTCP networks installed; and ModbusTCP enabled.

Step 4.1 – No Ethernet Network



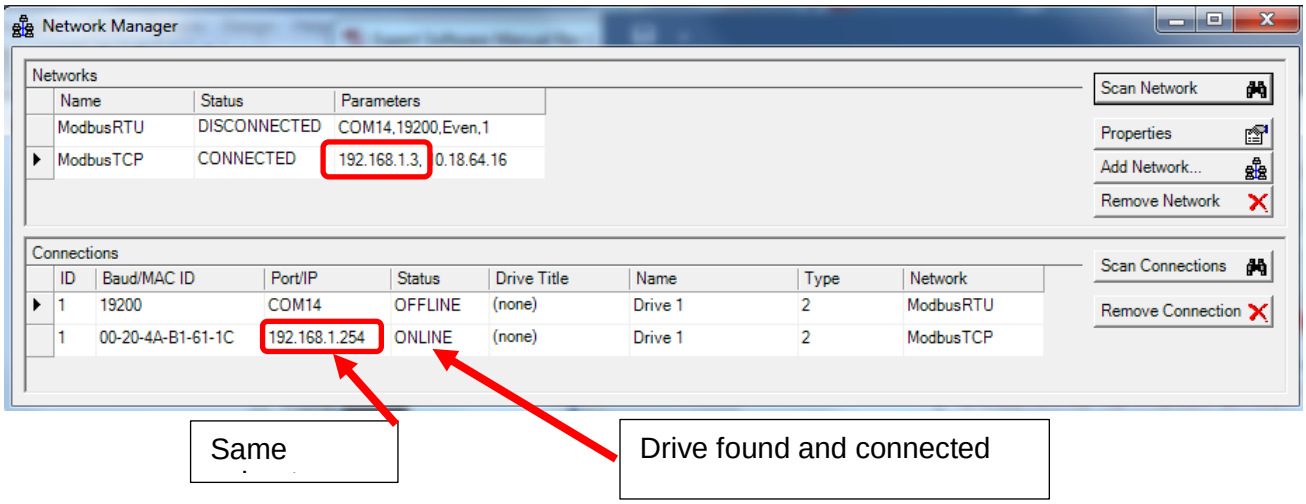
Above image is after 'Scan Network' and Ethernet Network interface not detected. This is not a likely result, but needs to be fixed in the PC first. More likely there will be one or more IP addresses as seen in the image under Step 4.2. However if nothing shows up in the Connections area as shown above, there is a problem with the Ethernet link between PC and actuator. Make sure network status LED's are green and the PC Network Interface Status is OK. Make corrections as needed and scan again.

Step 4.2 – Different subnet



The above images show a device was found but it was on a different subnet, so could not connect. Check that the MAC ID is the actuator to be connected. Change PC Ethernet network properties to match found actuator subnet, meaning the first three numbers match. Then scan Connection again.

Step 4.3 –valid subnet



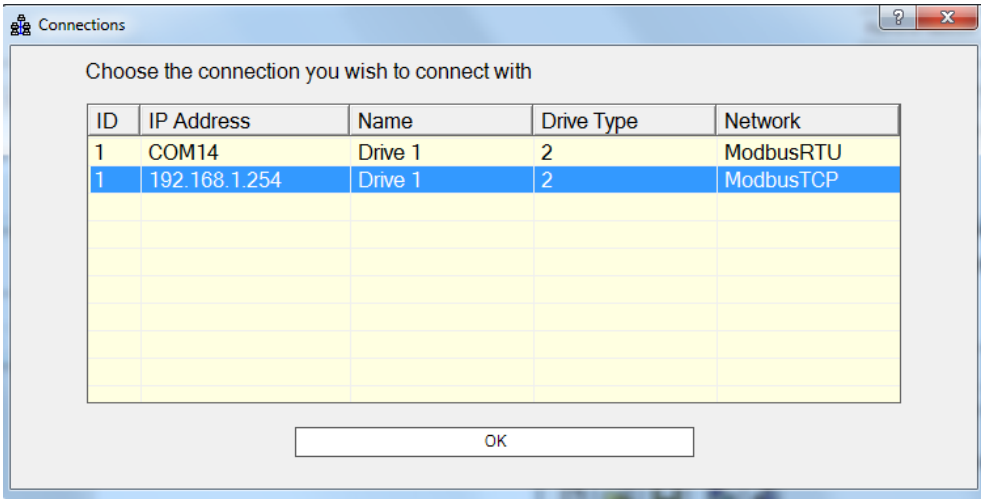
If more than, one TCP drive is found, select the drive that matches MAC ID by highlighting drive in ‘Connections’. This will become the active drive. If all that was desired was to find the IP address, the task is done. If the IP address needs to be changed, go on o Step 5.

STEP 5 - Read Drive Parameters and Change IP Address

Read parameters from drive by selecting upload

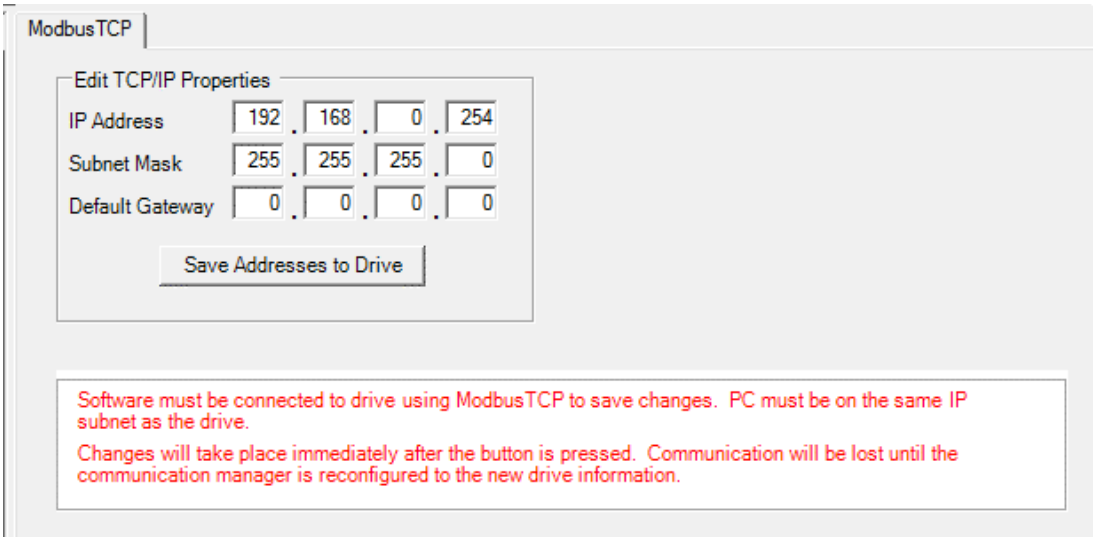
Read parameters value from connected drive.

If more than one connection is available, a Connection page appears and user must select the connection for the drive, which is the ModbusTCP connection in this case. (This would happen only if an RS-485 connection is also available.)



If the IP address is to be changed to connect into the end use network, open the ModbusTCP page from the Networks group. Type in the new IP address and other parameters as needed and click on the Save Addresses to Drive button.

Important Note: The values on this page are NEVER read from the actuator. The only place the actual IP address is displayed is on the Network Manager window.



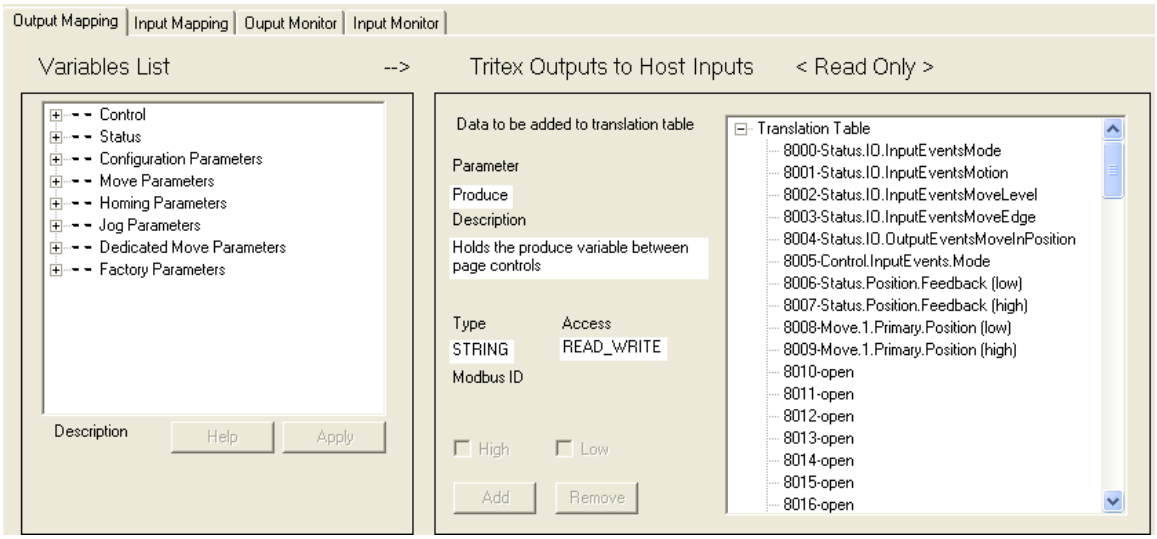
After saving to drive, the connection will be lost immediately. Many times there is no further reason to connect to the drive via the ModbusTCP network from Expert Software. The connection can be over the ModbusRTU network. Reconnection is possible over ModbusTCP but the Network Interface may have to be changed to the new subnet, and the network will need to be scanned again.

It is a good idea to enter the actual IP Address and Subnet Mask on the ModbusTCP page and save the drive file for this actuator, just as a place to put them.

***Important Note*:** Expert Software must be connected to the actuator using Modbus/TCP to change IP Properties.

Tritex Data Mapping to I/O Modbus Registers

This works with the same data mapping tables that are used for Ethernet/IP. The differences are that it is a “0” based table instead of “1” based table and the numbers displayed in the table are the Modbus addresses, rather than Ethernet/IP addresses. When used with Modbus, these tables can be used to group together into one location parameters that are used frequently. These parameters can then be written to or read in one block through Modbus RTU or Modbus TCP.

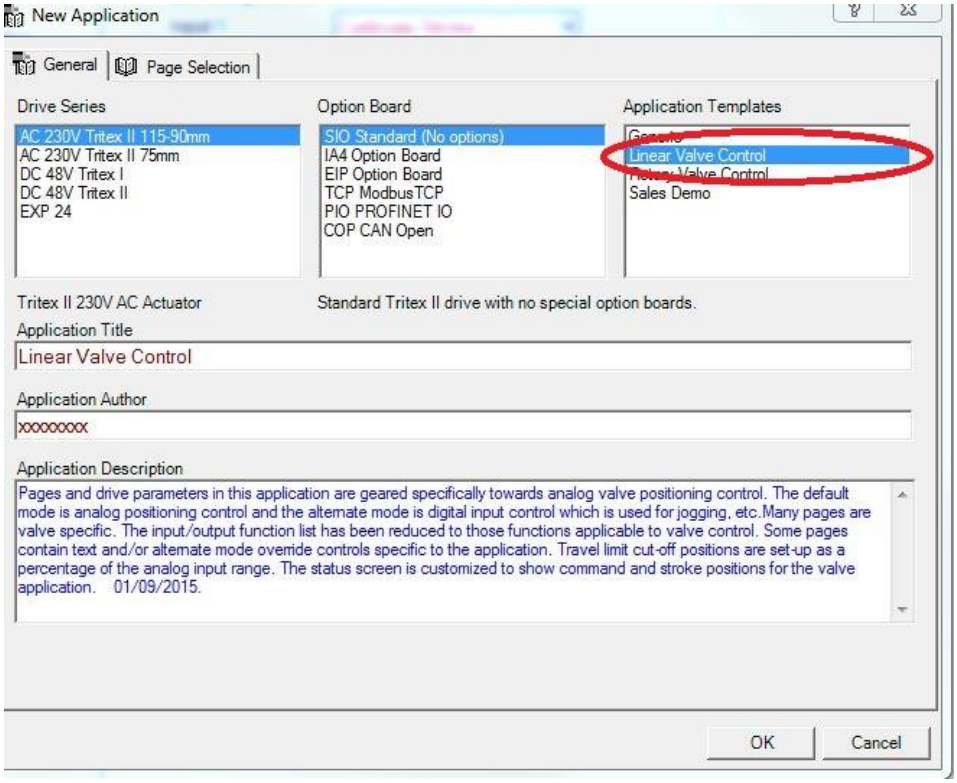


(See the *Tritex Data Mapping to I/O Registers* in *Ethernet/IP Options* section for detailed instructions on how to setup and edit these tables.)

VALVE CONFIGURATION

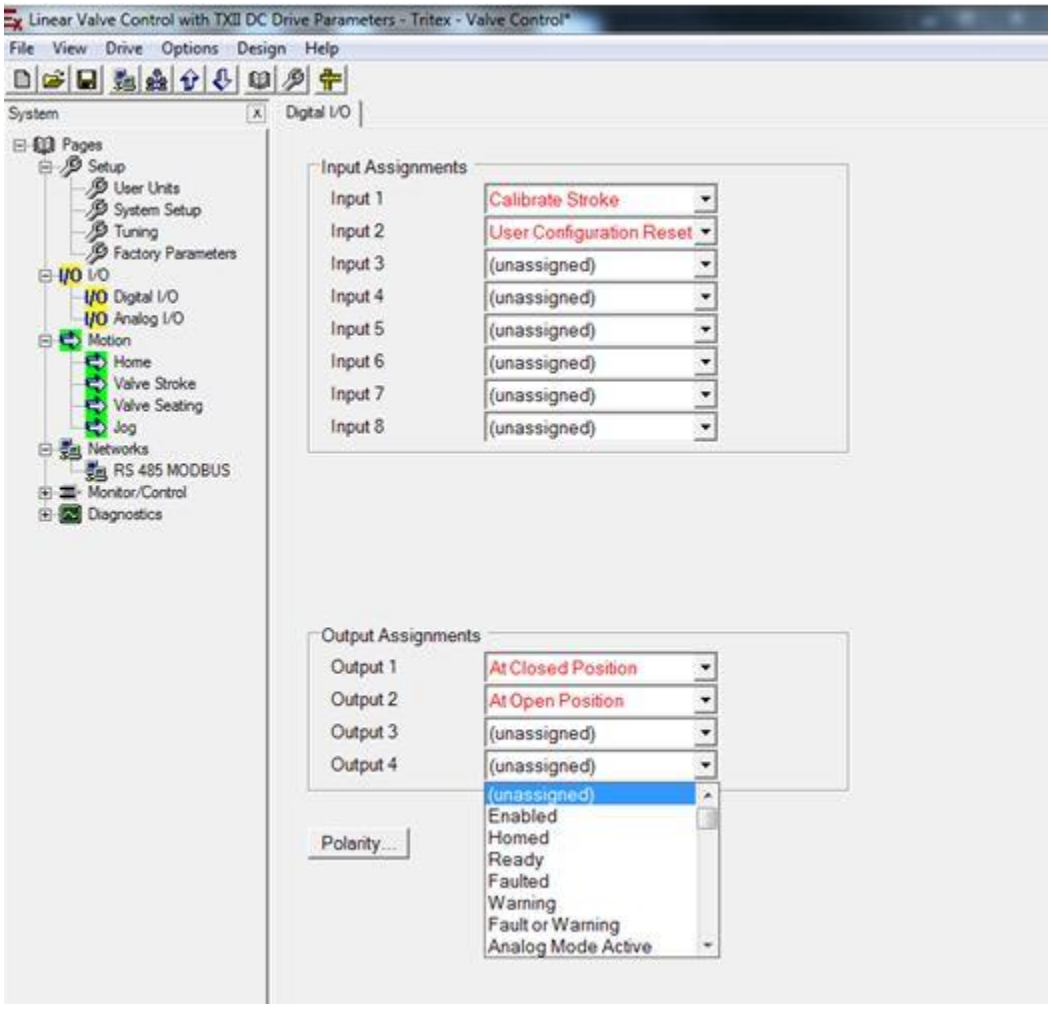
Starting a new Valve Application

In order to create a Valve application, go to “File” on the menu bar and press “New”. The following pop-up will appear:



Select the appropriate drive and then select “Linear Valve Control” from the Application Templates.

Valve Digital I/O



The Valve Digital I/O screen allows a pull down which shows what the possible input and output events are available.

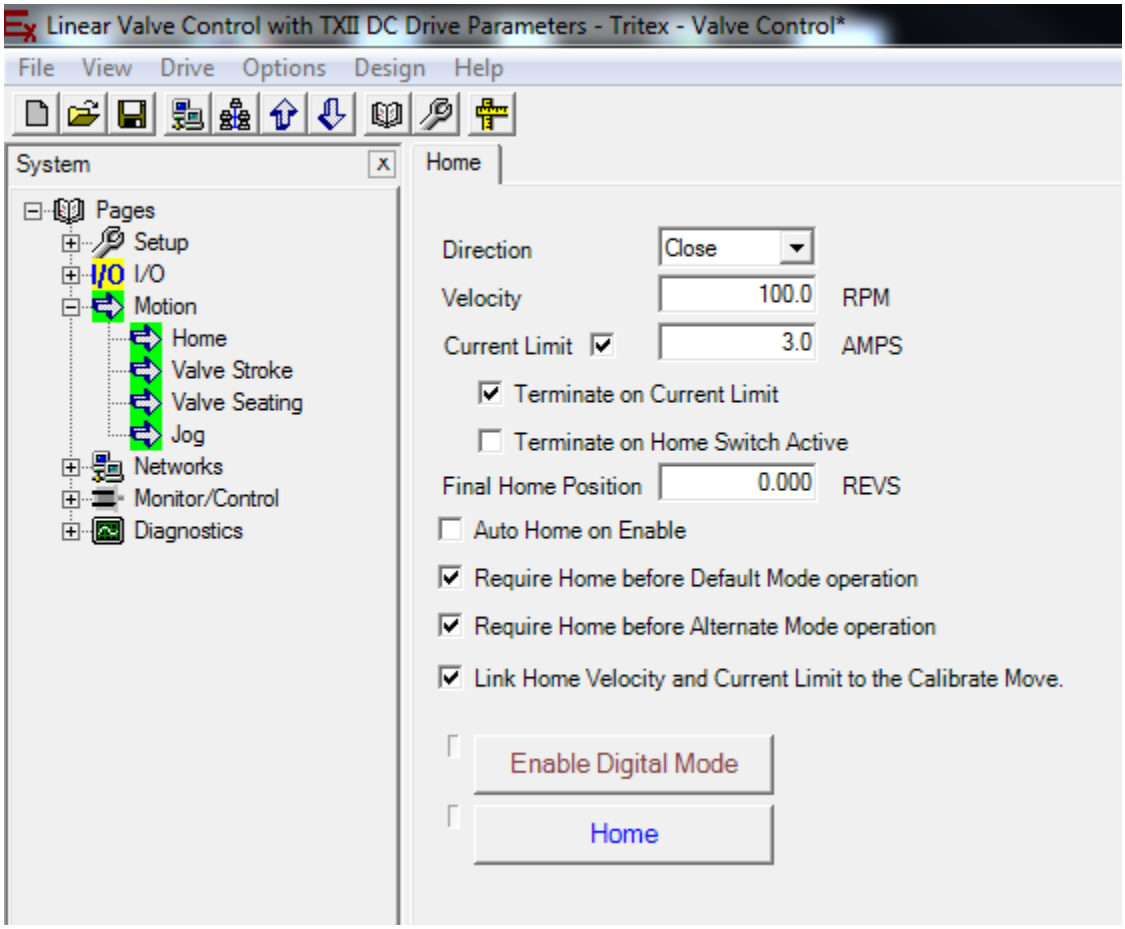
Calibrate Stroke is an input event which will initiate the stroke calibration.

User Configuration Reset is an input event which will clear the stroke calibration completed flag.

At Closed Position is an output event which will be active when the actuator is at the closed position.

At Open Position is an output event which will be active when the actuator is at the Open position.

Valve App Home



Direction: Select plus or minus direction; minus is the default.

Velocity: This is the *Home* move maximum velocity. This may or may not be achieved, depending on the distance traveled and acceleration parameter.

Acceleration: The acceleration ramp used during a *Home* move.

Current Limit: This sets the current limit for the *Home* move when the box is checked. If the *Terminate on Current Limit* box is checked, the *Home* move will terminate when the motor current is equal to or greater than this value. (The time to satisfy a *Terminate on Current Limit* condition is determined by *In Current Limit Time* parameter on the *System Setup* page). If the *Terminate on Switch Active* box is checked and the *Current Limit* box is checked, and the value is exceeded before a switch is found, a *Switch is Not Found Fault* will occur. (See Faults & Warning)

Note: If the *Current Limit* box is checked, and the *Terminate on Switch Active* box is checked, do NOT select both *Auto Home on Enable* and *Auto Enable on Start-up* (*System Setup* page). If the actuator is against a stop in the home direction, each time the fault is attempted to be cleared another home against the stop is executed creating another fault.

Terminate on Current Limit/Switch Active: This action will end the searching portion of the *Home* move. A specified current limit AND/OR switch (1-16) input function, can be used to terminate the *Home* move.

Home Offset: The *Home Offset* is a distance moved after a termination condition is satisfied. Typically it is used to move off of a hard-stop when *Terminate on Current Limit* is used. If no offset is desired, enter "0".

Offset Velocity: The velocity used during the offset portion of the move.

Final Home Position: The commanded and actual positions are set to this position at the completion of a *Home* move.

Auto Home on Enable: If this box is checked, a *Home* move will automatically be performed on enable.

Require Home before Default/Alternate Mode operation: If checked requires a *Home* to be completed before operation from the *Default/Alternate* mode operation.

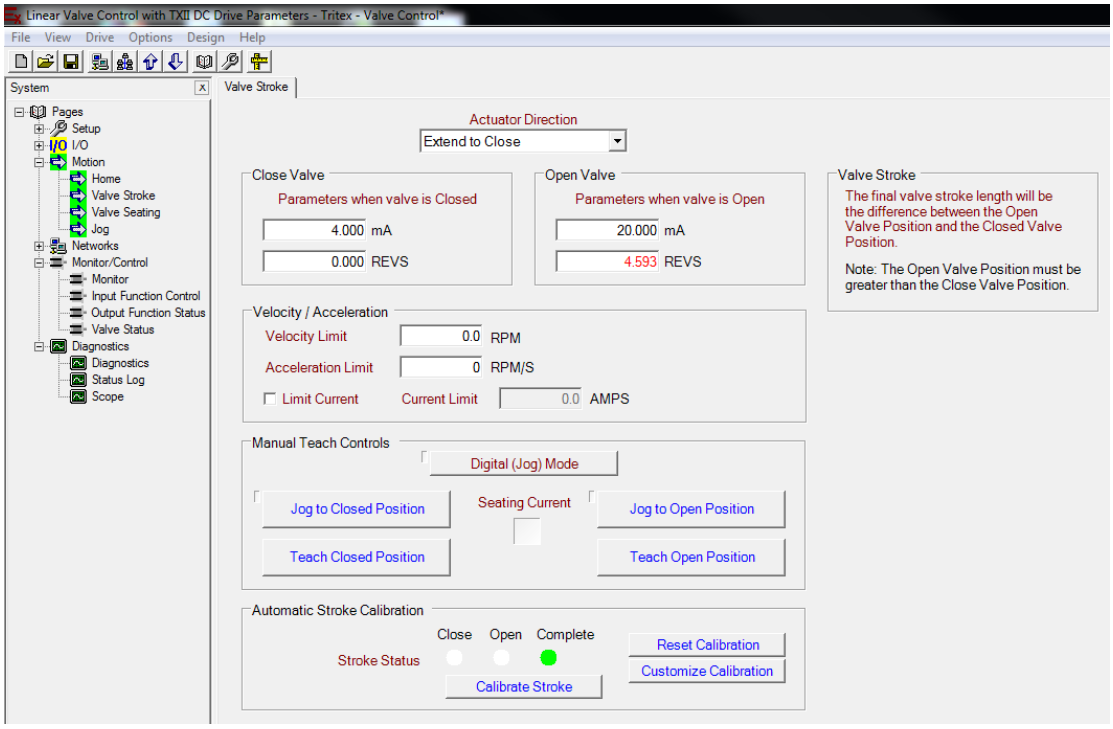
Link Home Velocity and Current Limit to the Calibrate Move: If checked the Velocity and Current Limit for the Stroke Calibration will be set to the same values as the home move.

Note: This feature is available in Firmware version 2.37 and higher for the DC and 75 mm AC Tritex and version 2.20 or higher for the 90/115 mm AC Trite.

Enable Digital Mode: If pressed selects alternate (digital) control mode to allow home and jog functions.

Home: If pressed initiates home motion.

Valve Stroke



Actuator Direction- Retract to Close/Extend to Close changes the polarity of movement for all commands and feedback (position, velocity and current). This is used to change the actuator direction without changing the commanded positions, velocities or torques.

Note: Changing this flag changes the definition of all absolute position and therefore automatically clears the *Homed* output function. A Home is required to resume operation.

There are three methods of determining the stroke or span of the valve: The desired positions corresponding to 4mA and 20 mA can be entered directly. The positions can be manually taught using jog mode or the can be automatically learned using the automatic stroke calibration function.

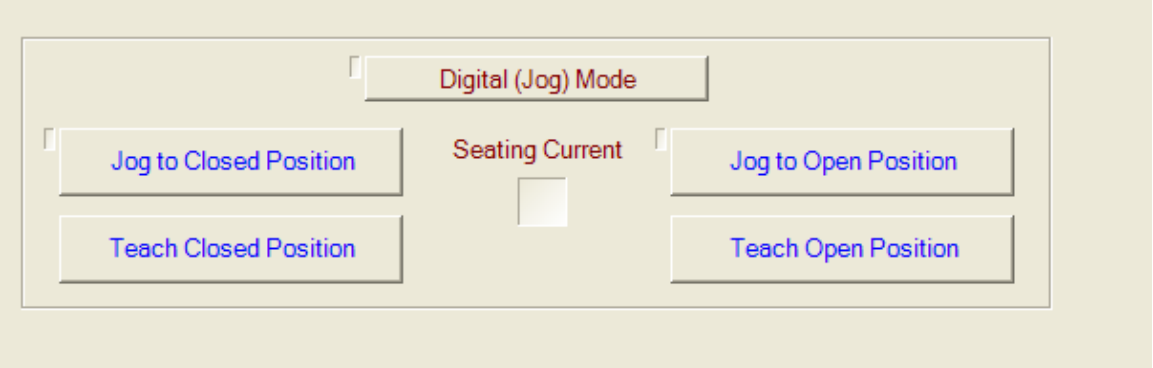
Close Valve/Open Valve Parameters- Enter the mA position you need for the closed and open positions. This can be either 4mA or 20 mA, depending on your control loop configuration.

Note: To change the command signal to voltage, go to the *System Setup* section of this manual.

Note: The final valve stroke length is the difference between the open valve position and the closed valve position. The open valve position must be greater that the closed valve position. If you are unsure of the valve stroke, you can also set these parameters by using the jog mode.

Velocity/Acceleration- Set the Velocity and Acceleration Limits for the valve stroke.

Digital Jog Mode



Selecting *Digital Jog Mode* allows the valve to be manually jogged to its closed and open positions. Click on the *Digital Jog Mode* button to enable this feature.

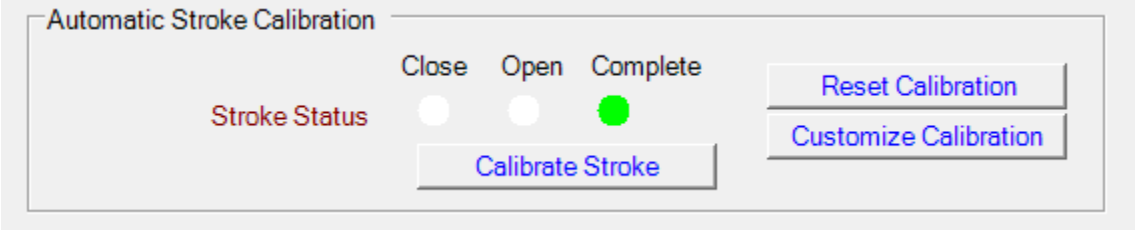
Note: The analog signal will be disabled while in digital mode

To close the valve, select the *Jog to Closed Position* button and hold it down with your mouse until the desired position is reached. You may then select *Teach Closed Position* to automatically fill in the closed valve position parameter. To open the valve, hold down the *Jog to Open Position* button until you have reached the desired position. Select the *Teach Open Position* to automatically fill in the open valve position parameter.

Note: Unselect *Digital Jog Mode* to re-enable the analog signal.

Automatic Stroke Calibration

Note: This feature is available in Firmware version 2.37 and higher for the DC and 75 mm AC Tritex and version 2.20 or higher for the 90/115 mm AC Trite.

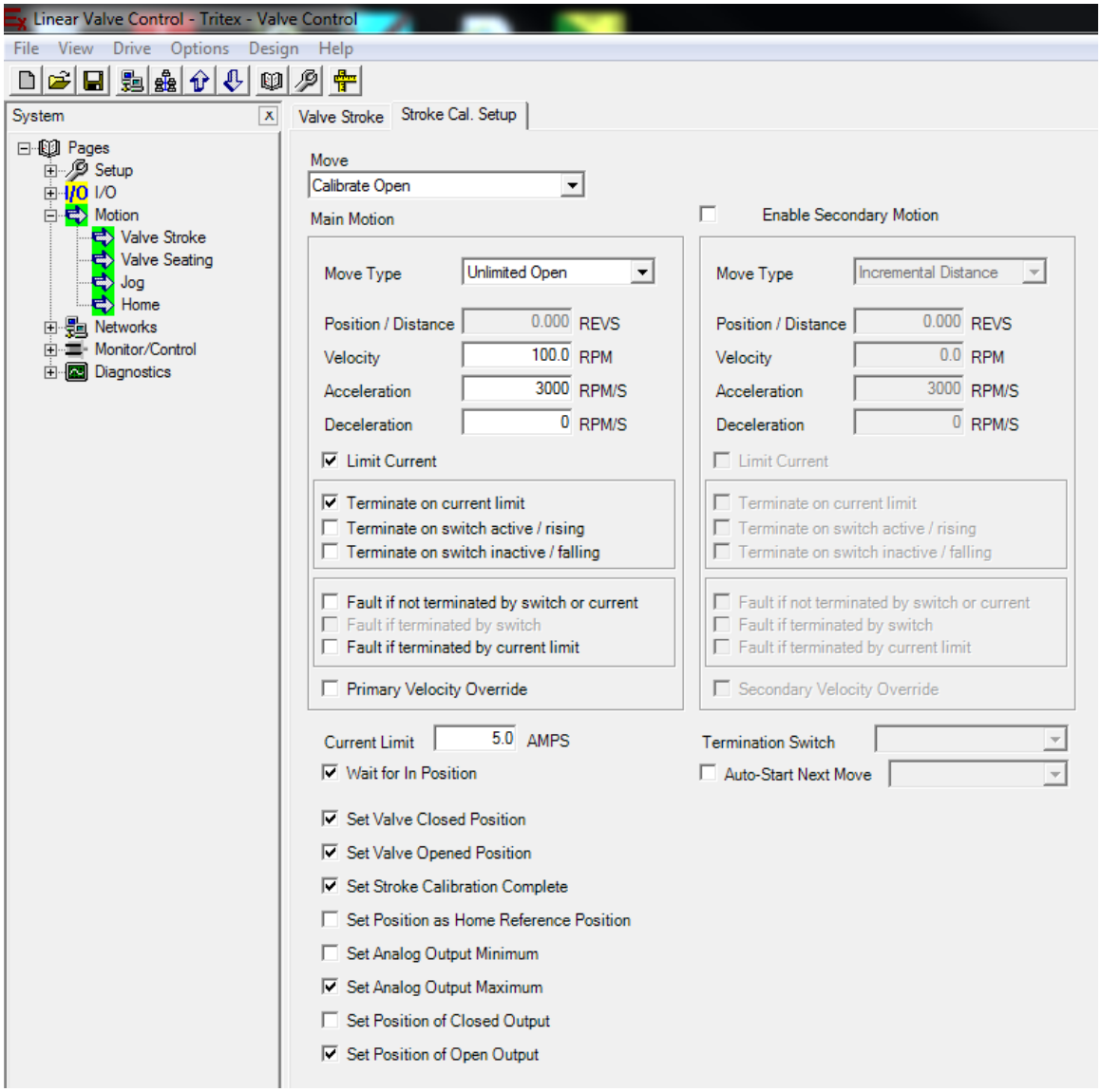


Automatic Stroke Calibration calibrates the stroke by moving to the in the retract direction until the current limit is reached and then doing the same in the extend direction. This function can occur either by pressing the *Calibrate Stroke* button shown above or by setting an Input Assignment to “Calibrate Stroke” and activating the assigned input.

Calibrate Stroke calibrates the span by finding the minimum and maximum positions. The LED’s will display the current status by turning on when the Close and Open positions have been set. Once Calibration has been set, it will survive a power down / power up cycle.

Reset Calibration clears the calibration complete flag.

Customize Stroke Calibration



Customize Calibration allows the user to customize the complete calibration process. Except for the select boxes on the bottom, the page is just like the Move Setup page used in the Generic Application and described earlier in this document except instead of Move 0 – Move 15, the moves are “Calibrate Open” and “Calibrate Close”. Note that “Calibrate Close” is the move that is initiated when the *Calibrate Stroke* button is pushed. The “Calibrate Open” move occurs because the “Auto-Start Next Move” check box is set and the selection is set to “Calibrate Open”.

Below the move setup information are check boxes allowing specific events to occur at the completion of the select move (Calibrate Open or Calibrate Close).

Set Valve Closed Position sets the valve close position to the current position.

Set Valve Open Position sets the valve open position to the current position.

Set Stroke Calibration Complete sets the Calibration Complete event.

Set Position as Home Reference makes the completion of the move cause a redefinition of the home position.

Set Analog Output Minimum sets the Var Min on the Analog I/O page. This setting assumes that Output Variable is set to either FeedbackPosition or CommandPosition.

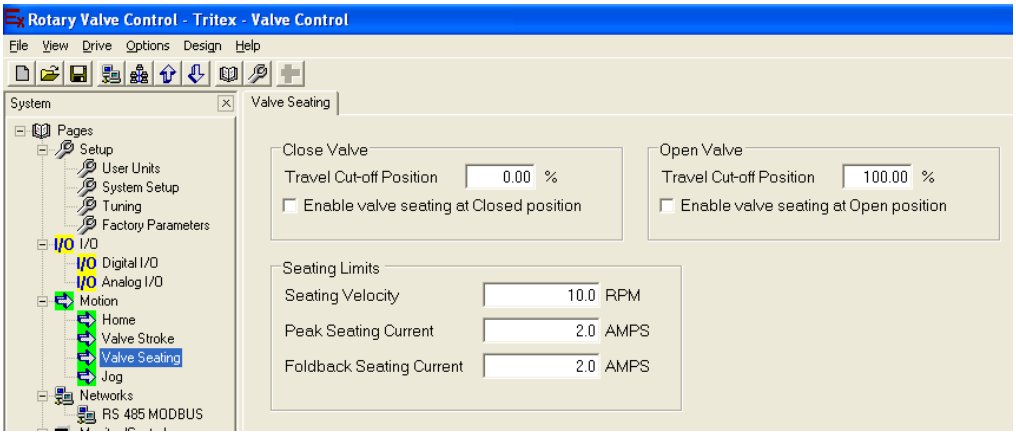
Set Analog Output Maximum sets the Var Max on the Analog I/O page. This setting assumes that Output Variable is set to either FeedbackPosition or CommandPosition.

Set Position of Closed Output sets the position at which the "At Closed Position" output function will turn on.

Set Position of Open Output sets the position at which the "At Open Position" output function will turn on.

Stroke calibration process will use the Home velocity and current limit. If it is not set, it will be up to the user to set those values for the open and close moves found on the Stroke Cal. Setup page described above.

Valve Seating



Close Valve/Open Valve

Travel Cut-off Position-The Tritex software has a valve seat algorithm that allows the actuator to switch from position mode to torque mode at a pre-determined position based on the milliamp signal; selecting the respective check box with enable this feature. The control is switched to torque mode when the *Position Command* exceeds the set closed or open travel cutoff. This causes the actuator to apply a force without concern for actual position. The user can determine how fast and how much force should be applied to properly seat the valve without damage.

Note: Valve Cut-off position limits are only active after a *Home* or an Auto Calibrate has been completed.

Seating Limits

Seating Velocity- The maximum velocity for the seating move, after reaching the cutoff position has been reached.

Peak Seating Current- This determines the force that the actuator will use to seat a valve in position. *Peak Seating Current* should be set to provide the desired level of force to fully close (or open) the valve.

Foldback Seating Current- This determines the force that the actuator will use to hold a valve in position once seated. When calculating the *Foldback Seating Current*, use the following equation to calculate the force applied:

Seating force (Lbf) ~= Foldback Seating Current (Amps) x Kt (lb-in/Amp) x 5.34 / Screw Lead

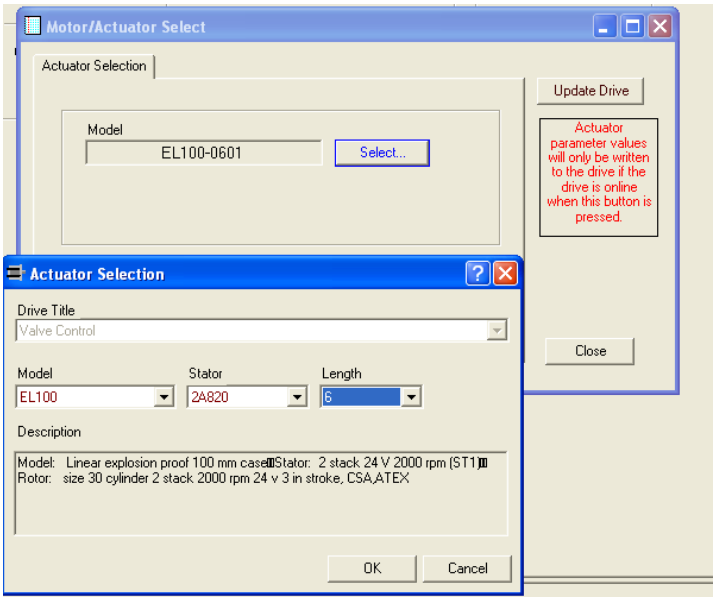
Note: If Homing to a current limit is used the *Foldback and Seating Current Limits* must be set to a higher value than the *Home Current Limit* to avoid conflict when trying to perform a home beyond the Position Limits.

EXP-24 CONTROLLERS

The EXP-24 software interface is very similar to the Tritex II series valve applications with a few key differences because of hardware differences. These differences include having only 2 digital inputs and 2 digital outputs; having 2 analog outputs.

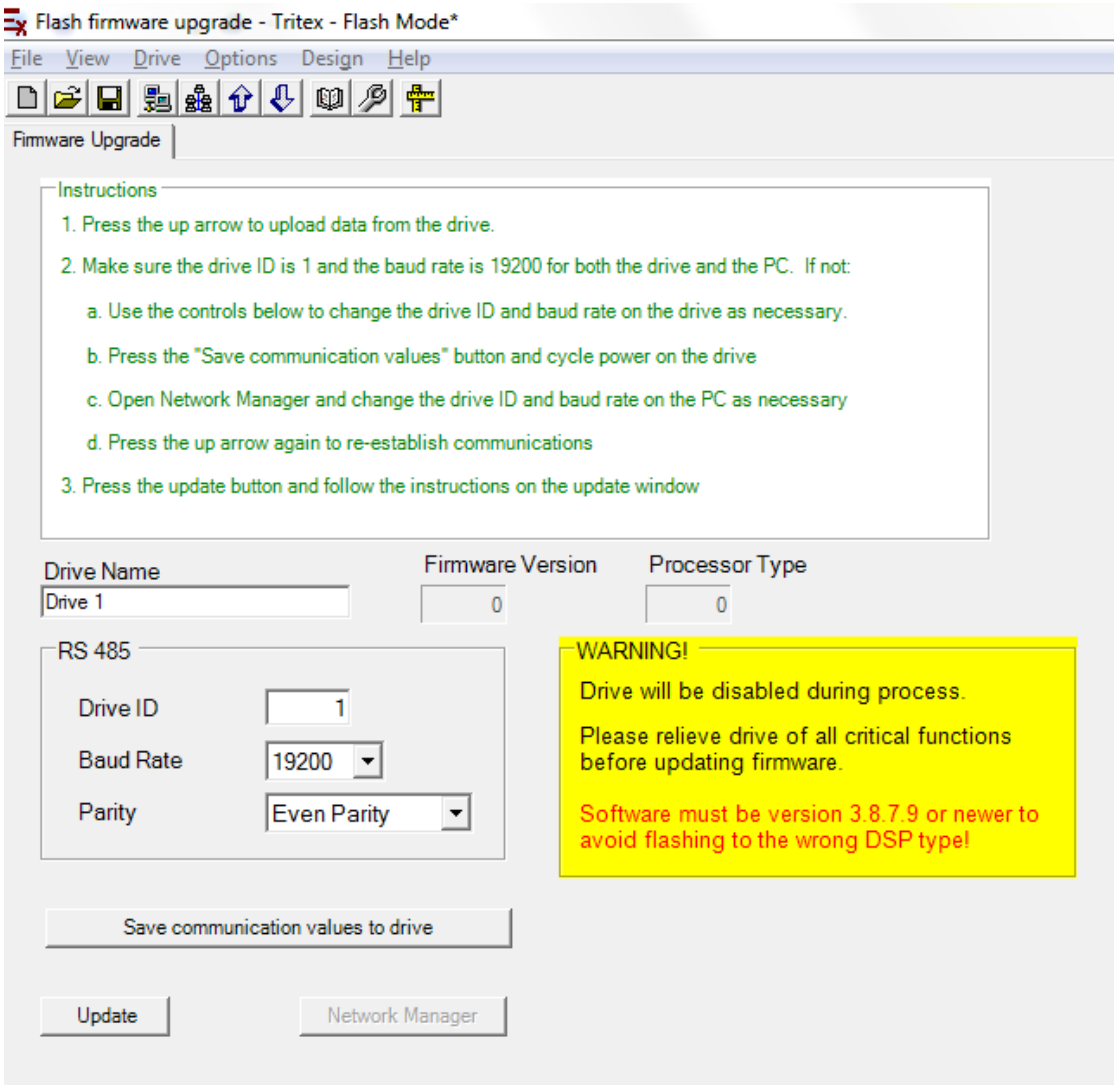
Motor/Actuator Select

One major difference between Tritex and EXP-24 is that Tritex has the drive and actuator integrated into one unit, where EXP-24 can be connected to different motors and actuators. Therefore, many of the motor and actuator specific parameters that are loaded into a Tritex at the Factory and never changed must be configured in the field for an EXP-24. The *Motor/Actuator Select* page allows the user to select the model, stator and actuator type (linear or rotary) and the length if it is linear. The relevant parameters are found in a database and can then be downloaded to the drive at the press of a button.



UPDATING THE FIRMWARE

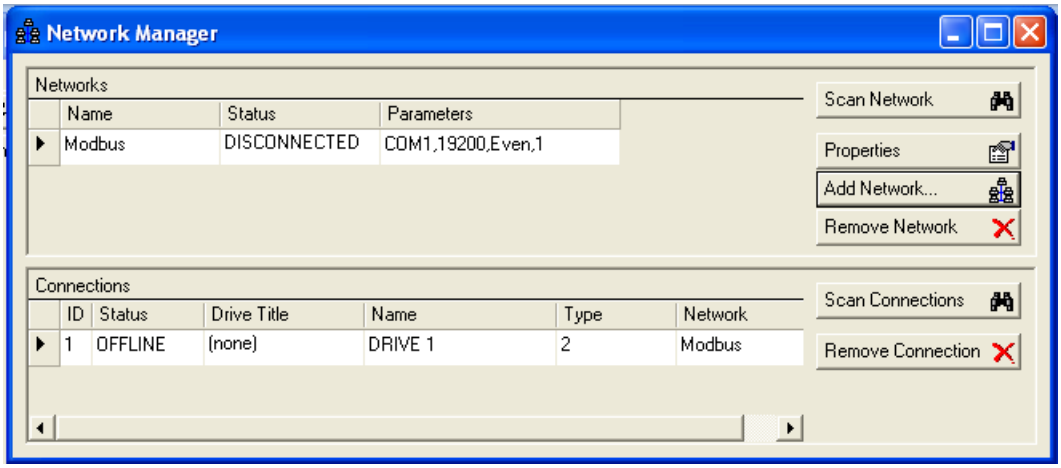
As updates and improvements are made to the Tritex firmware it may be advantageous to load the updates into the actuators that are in use in the field. A method to load the new firmware through the serial line and using the Tritex software has been developed. The latest firmware file and update application will need to be acquired from Exlar to ensure that it will be compatible with that particular drive. Contact Exlar Application Engineering for the application and firmware files.



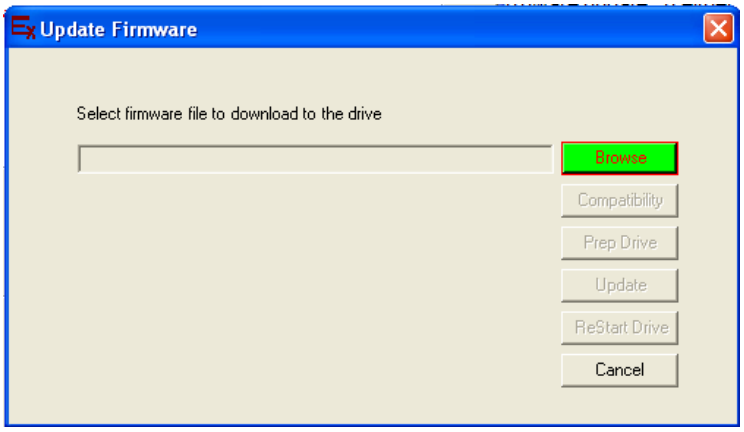
CAUTION! Disable drive before updating firmware. During the flash process the drive will disable. If the load is vertical, be sure the brake is applied before flashing.

After the drive data has been uploaded to the software, the software will display the *Drive Name*, the Modbus *Drive ID* and the communications *Baud Rate*. The *Drive ID* must be set to “1” and the *Baud Rate* must be set to “19200” to run the firmware update. If either is not set to the required value the Network Manager button will be activated and the instructions must be followed to set the *Drive ID* and

Baud Rate to the correct values on both the actuator and the software. It is recommended to save the drive file to a new file name after the upload.

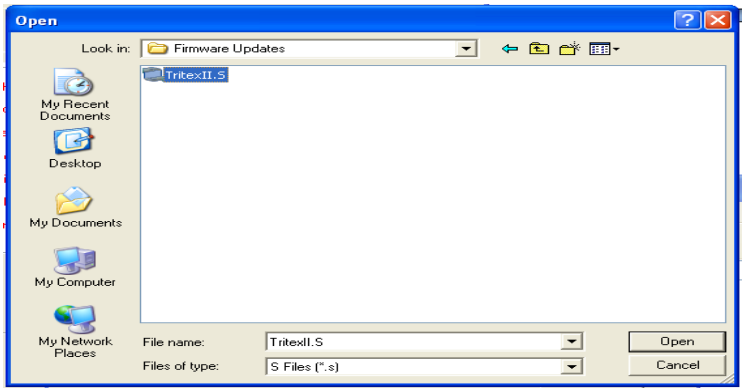


Update Firmware Window

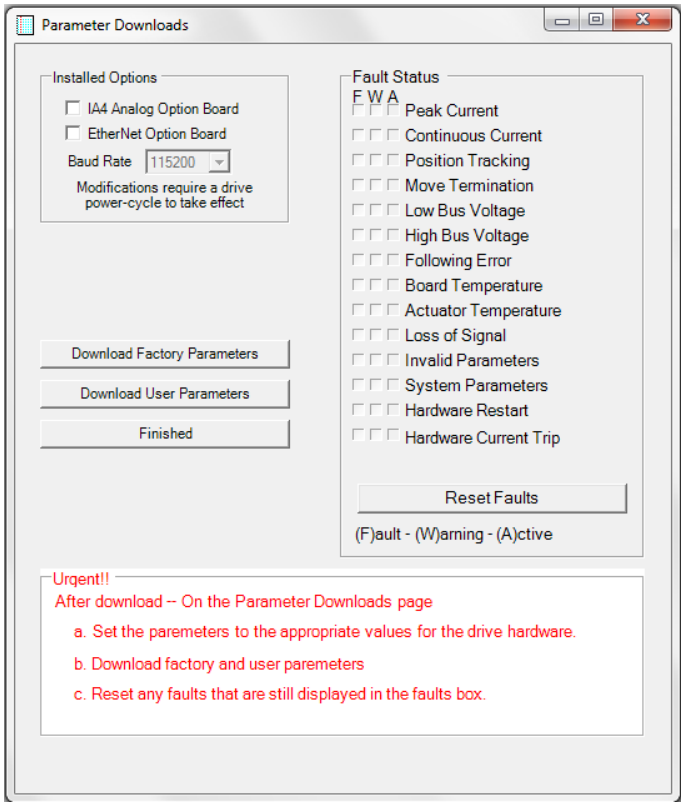


The *Update Firmware* window will walk the user through the update procedure. The proper button to press to start the next phase of the update will be highlighted in green and red.

Browse- The *Browse* button will pull up a screen that will let you choose the ".S" record file to update the drive with.

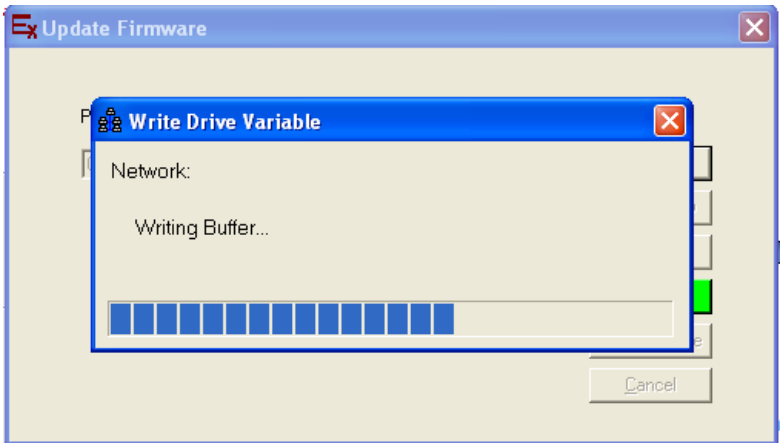


Compatibility- This button will check the selected update file with the drive to verify that they are compatible with each other. There are several levels of compatibility. If the firmware file is for a different processor type than the drive has it cannot be used to upgrade the drive. If parameters have changed from the old firmware version to the next it can still be considered compatible, but the parameters will have to be downloaded to the new locations. The Download Parameters page will open at the end of the upgrade to allow the user to write the user and factory parameters and to make some changes to select factory parameters if the option boards have been changed. If compatibility has been determined the process will move on to the *Prep Drive* button.



Prep Drive- This button signals the drive to run in the boot mode which is only capable of communication and firmware upgrades. The drive must be in boot mode when the file is being downloaded to the drive.

Update- The next step is the actual update. Pressing this button will send the firmware file to the drive where it will be saved to the correct location in the flash memory. A series of progress bars will be displayed showing the progress of the update.



Restart Drive- This button starts the normal part of the firmware that runs the drive. It will then automatically check the drive to determine if the upgrade was successful. When it was successful a message saying so will display on the bottom of the window and the *Cancel* button will change to *Finish* and when that is pressed, the update is completed for that drive.