EXPERT™ Commissioning Software Tool

CURTISS-WRIGHT

Software Manual for Tritex® Actuators

TRITEX SERIES: TTX, T2X, TDX, R2M/G, RDM/G

EXLAR®

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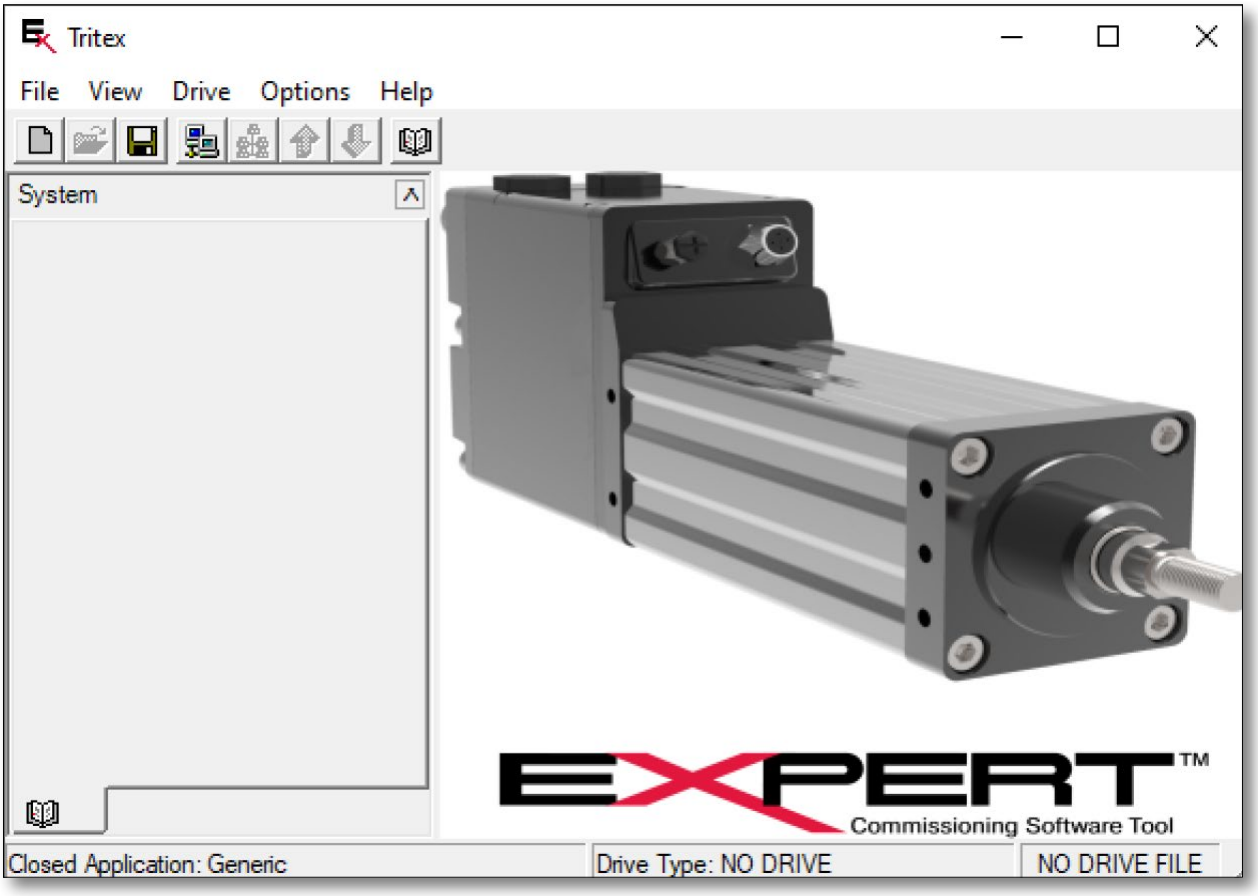

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1. OVERVIEW

The Expert software is the user interface for Tritex actuators, which includes the latest TTX series. It provides a simple way to select all aspects of configuration and control required to set up and operate any member of the Tritex actuator family. Pages provide access to view and change all parameters necessary to configure a motion application. Application folders provide a convenient way to store and organize applications and individual actuator parameter sets.

The Expert software allows for customizable 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 to simplify and customize the operation by only showing the parameters needed for the specific application and allow industry specific names for the drive parameters.

This edition of the Expert Software Instruction Manual applies to Tritex actuators, updated to include features in actuator firmware V4.00 and Expert software release 4.13.9.26. Features new to this version are identified as such. In order to make full use of the latest features, the latest Expert Software release must be installed. For the most part, features introduced in previous firmware versions no longer identify the version in which the feature was introduced.

This manual does not describe detailed operation and use of Tritex actuators with CANopen communications option. These actuators are substantially different in operation, but sections 1 through 5 still apply on connecting and using Expert software.

This latest Expert Software Instruction Manual deletes most references to legacy products Tritex I and EXP, though the software still supports these products. The previous version of this manual will still be available for these products as well.

For the porpose of brevity the T2M and TDM will be referred to as T2X and TDX respectively in this manual as they are electrically the same.

2. INSTALLATION

2.1 GENERAL REQUIREMENTS

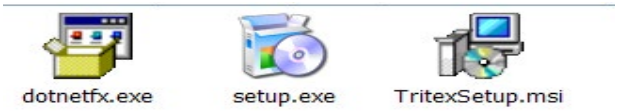
Operating system: Microsoft Windows 7 or Windows 10 operating system.

.NET framework 4.0 (included with installation package)

2.2 INSTALLATION PROCEDURE

The software is also available for download. Curtiss-Wright Actuation Group now has a combined website www.cw-actuationgroup.com. The previous website www.exlar.com redirects here. The current revision software download itself is at https://www.cw-actuationgroup.com/Resources/Exlar-Resources/Expert-Software.

Before installation, note that any previous versions of Expert software are removed. Copy an older version to a different location before installing the new version.

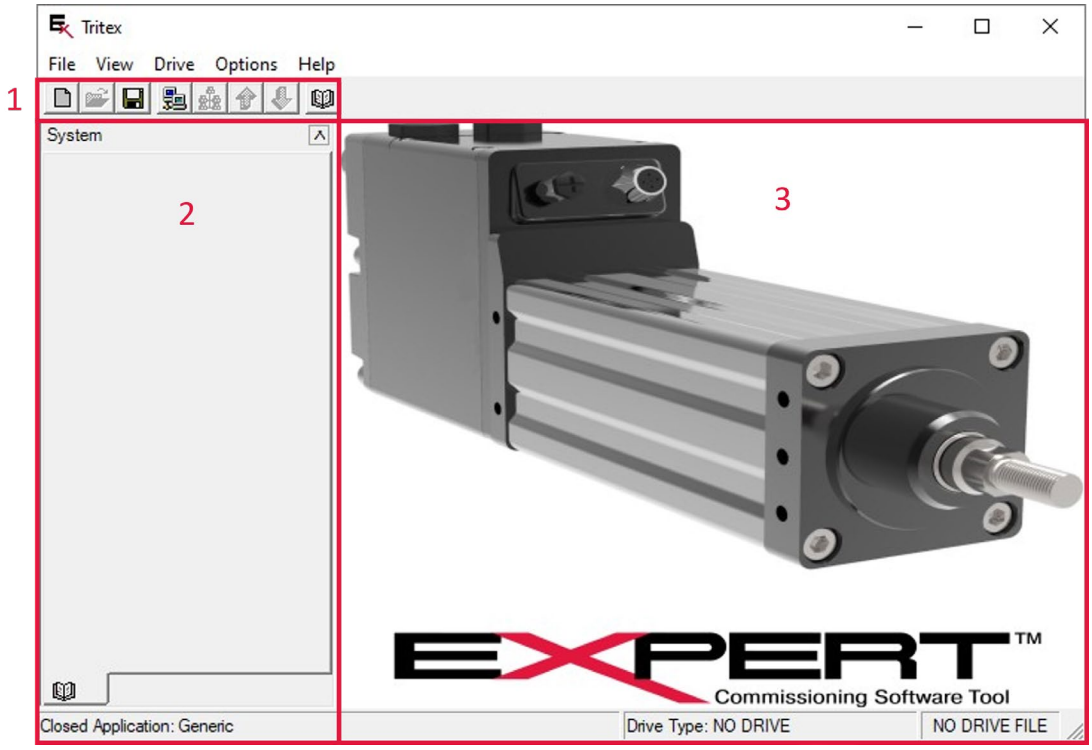


Follow the Windows prompts during installation. By default, it installs in C:\Program Files (x86), creating folders \Exlar\Tritex, but can be installed in other locations, such as C:\Users\Public\Documents.

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

3. WELCOME SCREEN

When the Expert software is opened for the first time, the below screen will be displayed. Subsequent opening of the software will start with the previously used application. The three main sections of the software include: (1) Toolbar section, (2) System Panel and (3) the main body.



3.1 TOOLBAR

Not all of these are active until a connection to a drive is established.


Opens the New Application dialog box to create a new application and drive file.


Opens a navigation window to select a Drive File to open.


Saves the current parameter settings for the Application file and Drive file.


Opens the Network Manager dialog box.

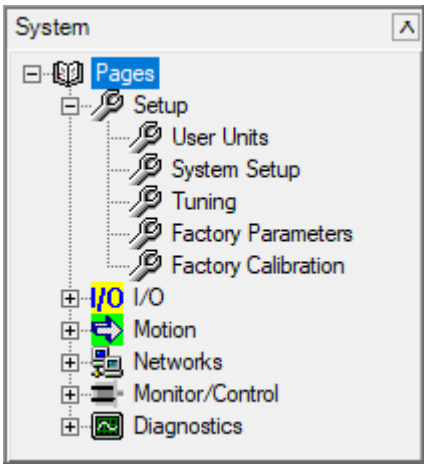

Scans a network for an actuator with type matching the drive file and goes online to it.


Reads all parameter values from the actuator to the open drive file.


Writes most user parameter values from the drive file to the drive.


Display a list of the Application's pages to select which ones are displayed.

3.2 SYSTEM PANEL



The System panel will display the configuration tree for the various pages included in the application. Click on '+' next to the Pages icon to expand the tree into several categories. Each category is a group of related pages that expands to show the included pages. Click on the name of the page to display it. The System Panel is a more organized and convenient way of moving from page to page than the View->Page menu item or Toolbar button, but all select page display.

The page list shown here is an example and may vary based on the application type and actuator type.

3.3 MAIN BODY

The main body is where pages appear. The default page layout displays the Status page docked at the bottom of the main body. If displaying the Input Function Control page or Output Function Status page, they will appear docked at the right side of the main body. The docked pages contain active status or controls often referenced when configuring and checking operation of an actuator. Most other pages appear in the remaining main body space one at a time as selected to configure some part of the application. How each page appears can be changed and saved as part of the application.

4. THE "APPLICATION"

It is best to consider a Tritex application as a complete operating entity. At its core is an actuator to convert electrical energy into motion. Firmware running in the actuator controls the motion according to a set of operating parameters in different functional groups. Factory parameters, sometimes called system parameters, set under-the-hood characteristics unique to an actuator such as calibration values. Users rarely change factory parameters. A lock protects them from accidental change. User parameters configure motion type and characteristics, determine the response to command signals, define the information sent in output signals, and defines blocks of data transferred with advanced communications options. Display parameters convey status information to Expert software or other devices. Factory and User parameters are stored in non-volatile memory in the actuator, while display parameters are not. A PC running Expert software serves as the human-machine interface for configuration and set-up. A set of pages are also part of the application. Pages are used to organize and display operating parameters and provide the ability to change these parameters in the actuator. There are several application templates with pages that provide specialized views of parameters based on how the actuator will be used, such as for general motion control or valve positioning. There are additional or alternate pages that can be included to access advanced features not used in most cases. With different page sets, applications can offer different views of the same set of operating parameters.

⚠ Applications with CANopen communications run on different firmware and have radically different motion profiles and operating parameters. This manual supports actuators with CANopen communications but does not describe the differences in parameters, features, and motion. See the CANopen manuals when using Tritex II with CANopen.

Expert software saves a record of an application into an application folder containing an application file and two sub-folders named *Drive Files* and *Page Files*. An application file ends in *.eapp*. The *Drive Files* folder contains at least one drive file that ends in *.edrv*. The *Page Files* folder contains definitions of all pages used to display and manage the parameters in the drive file, page by page. Although all files are text based xml files and open with a text editor, do not allow any program except Expert software to make changes to these files.

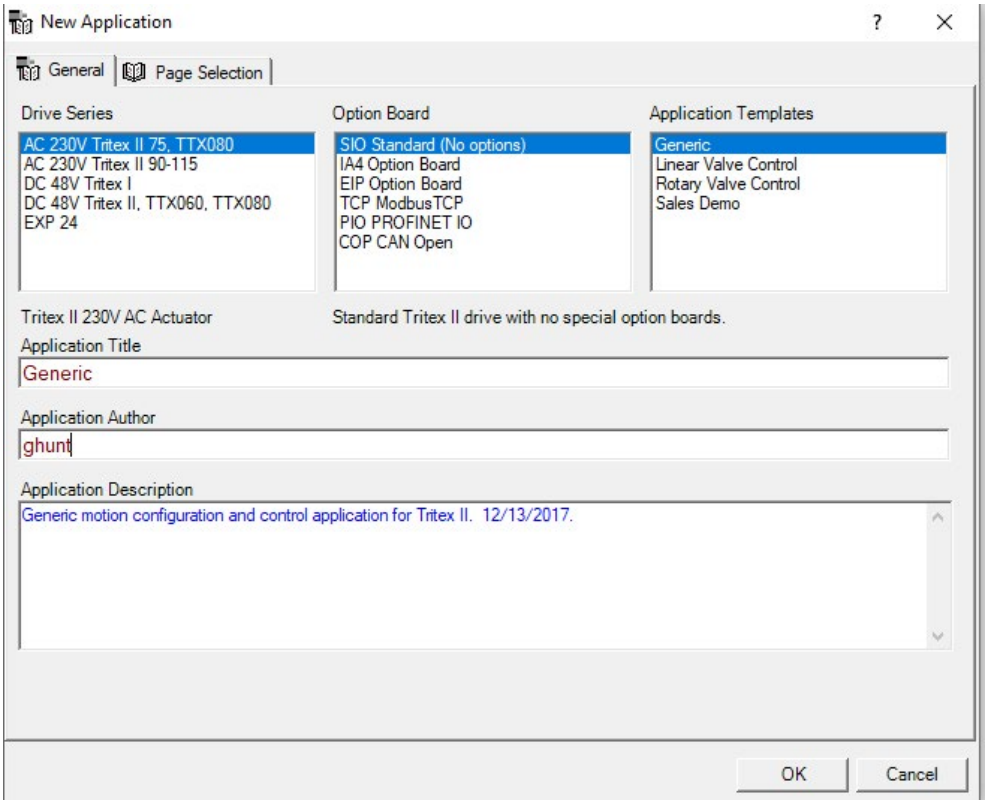
It is best to have an application folder saved for every actuator and available where the actuator is located to aid in local or remote service and troubleshooting. The application file contains the current associated drive file, a list of associated page files, and a few parameters that control properties of page files based on drive type and options.

A drive file contains all the actuator parameter names, addresses, scaling, and most values. Parameter values are data downloaded to and uploaded from a drive and follow Modbus formatting rules. The drive file contains values for all user and factory configuration parameters and some display parameters for one actuator. Other display parameters are not saved in a drive file at all and can be viewed only when connected to the actuator. The *Drive Files* folder is a good place to store copies of previous user configurations during development. Machine builders can keep a drive file for each actuator of the same model doing the same job in application's *Drive Files* folder. Otherwise, there should be one drive file for each application, so that an application is a complete record of a single actuator.

The *Page Files* directory contains a page file ending in *.epag* 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. Page files may be different between applications even if they have the same name, or display parameters differently based on characteristics of the application such as drive type, actuator options, or firmware version. Let Expert software manage the files in this folder.

4.1 CREATE NEW APPLICATION

Unless an application folder is already available for the actuator, the user must create a new application. Refer to the actuator model designation to select Drive Series according to the following table:



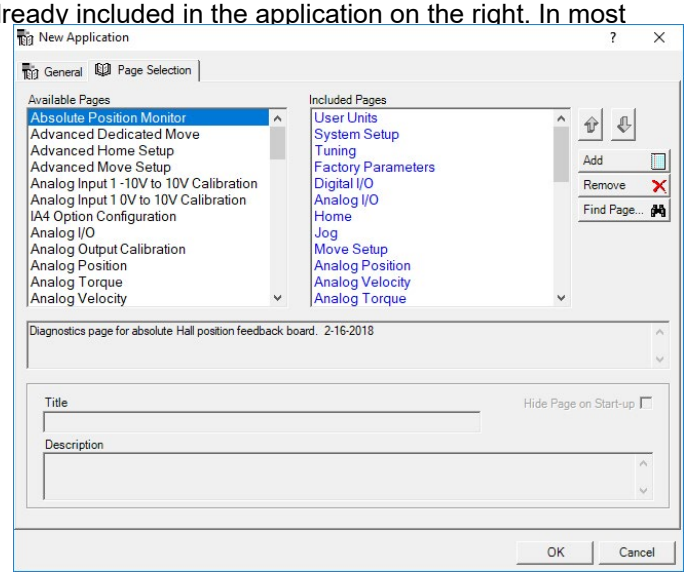
Select *File* → *New* → *Application* or click on the button.

1. Select the General Tab
2. Select the *Drive Series* of the target actuator. This step must be done before *Option* or *Template* selections.

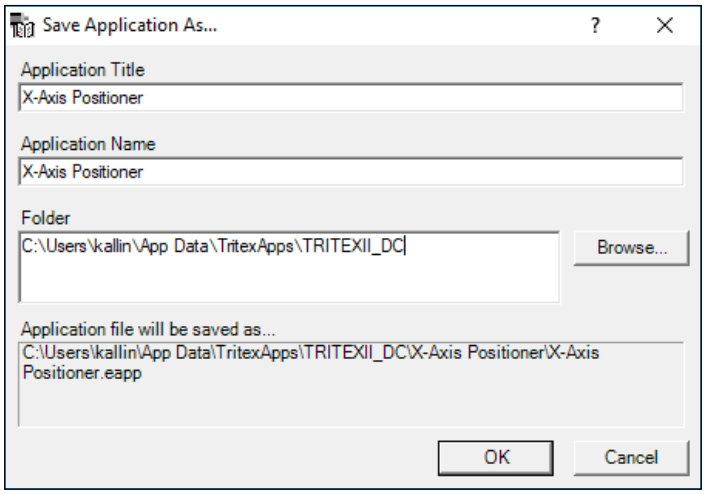
⚠ For most actuators, the drive series depends on frame size and input power AC or DC. See table above.

⚠ DC 48 V Tritex I (TLM, RTM, RTG) and EXP 24 are legacy products with limited support.

3. Select the *Option Board* installed in the target actuator as it appears in model designation. For –EIP or –EIN in model select EIP. For –TCP or –TCN in model use TCP. For -PIO or PIN use PIO. For –COP or –CON in model use COP.
4. Select the desired *Application Template,* usually *Generic* unless the application is a proportional valve positioner.
5. Enter the *Application Title*. It shows up in the upper left corner of the main Expert window.
6. Enter the *Application Author* and *Description* (optional).
7. Click on the *Page Selection* tab to see the list of pages already included in the application on the right. In most cases, all the pages needed will already be included.



8. Select any additional page desired from the *Available Pages*. Sometimes an *Advanced..* page is needed and the standard page can be highlighted and removed. The description of a highlighted page appears below the lists. With an available page highlighted, click the *Add* button on the right side. The page will appear at the bottom of the *Included Pages* list. The arrow buttons above the Add button move a selected page up or down in the list, affecting the order in which pages appear in lists.
9. Use the *Find Page* button to add pages from a directory other than the ones installed with Expert.
10. 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 default 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.



⚠ The application file must be saved to view pages and connect to an actuator. Pressing the Cancel button in the Save Application As… window, returns to the New Application window.

At this point, there will be an application folder with one drive file in the “Drive Files” folder named for the Application Template, usually “Generic.edrv.” This drive file knows nothing about the parameter set in a real actuator. Immediately after connecting to an actuator, the parameters in the actuator must be uploaded from the actuator to Expert and then the application or drive file saved again. Using the *File-> Save-> Drive File As*… command allows giving the drive file a better name. This creates a drive file that matches the parameters in the actuator, including factory parameters, and puts it in the Drive Files folder in the current application. The parameters can then be edited and saved to actuator with a *Download* and to the computer with a *File-> Save->* command.

4.2 OPEN EXISTING APPLICATION

Select *File → Open → Application*. This will provide a list of the last several applications used by Expert software. If not in the list, use the *Browse Other Appl.* button to navigate to the desired application. This is used to open an application and drive file already developed on one actuator for download to a different actuator. The user must always be aware of that parameters saved in a drive file may not match what is running in an actuator unless they are matched with an Upload or Download and the drive file saved to the computer again.

5. COMMUNICATION SETUP

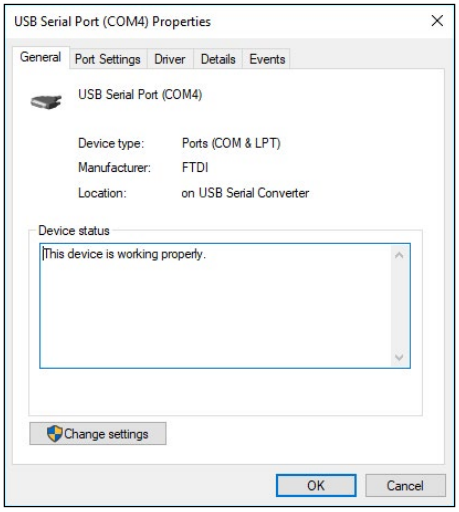
All Tritex actuators use an RS485 wired connection with a Modbus RTU protocol for communications with Expert software running on a PC. Therefore, an adapter will be required to interface from an RS232 or USB port on the PC to the RS485 port on the actuator. Our model CBL-USB485-M8-xxx cables provide USB port to the M8 connector provided on all standard Tritex II actuators (See Installation Manual for details on the RS485 port and alternative wiring). Expert software may connect through a Modbus TCP connection, but only if the Tritex actuator has the –TCP or –TCN option.

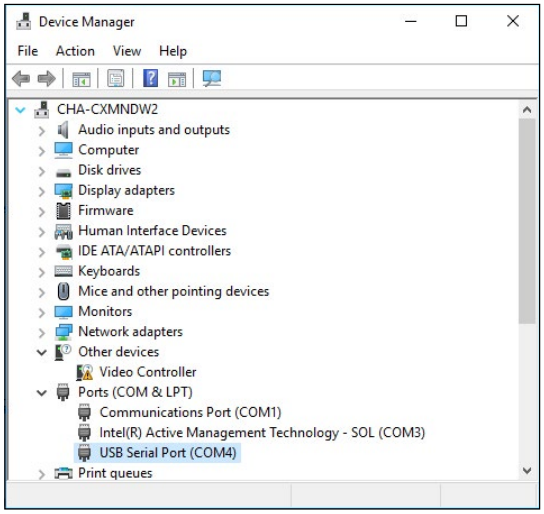
Multiple actuators may be multi-dropped on a single Modbus network, though this is generally only done with a permanently connected Modbus-RTU master. Multi-drop requires all devices to have matching parameters for BAUD rate, parity and stop bits and unique Drive ID's. It is best to reserve Drive ID = 1 for network maintenance use when using a multi-drop network.

In most cases a PC running Expert software will be connected temporarily 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.

5.1 DEVICE DRIVER

If using a USB to RS485 (Modbus RTU) converter, the device driver must be installed on the PC. On most PC's, the necessary driver is already available, and the device is plug-and-play. 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. See the image below on the left.

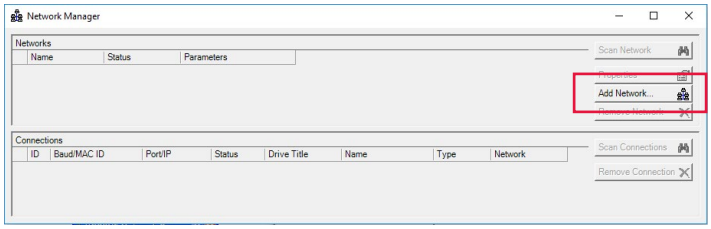




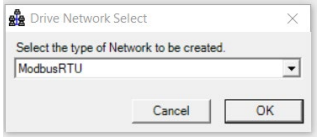
The name of the device driver installed must show under Ports. If it does not, the Expert software cannot connect to the PC COM port. COM4 is used in the example above. Use the correct COM port number in the Expert software when setting up PC communication. Double-click on the COM port to see the screen above on the right to verify the converter's device driver is working.

5.2 ADD NETWORK

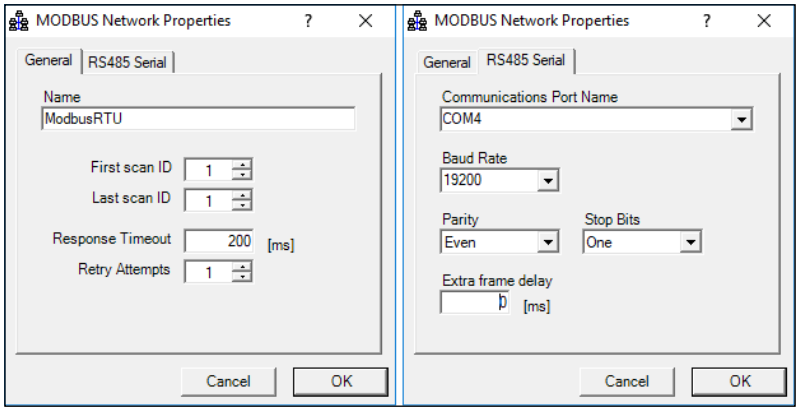
Select *View → Network Communications Manager* or click on the  button.



Click on the *Add Network* button. The window shown on the right pops up. Select *ModbusRTU* from the drop-down and *OK*.



The *MODBUS Network Properties* window appears with each of the two tabs shown below. Field descriptions follow.



First scan ID / Last scan ID	[1] Define the Modbus ID the software will start and stop scanning. Used for multiple actuators on one RS485 Modbus network. (Default 1 and 1.) In the example above, only ID "1" will be scanned.
Response Timeout	The Expert software will 'time out' if a response is not received from the actuator within this time. (Default 200ms) Only a highly unusual network with repeaters would take longer.
Retry Attempts	If a "time out" or other communications error occurs, the software will try again this many times before giving up and going "offline". (Default 1) There is little practical reason to select any other value. This has nothing to do with actuator communications faults.

[1]

⚠ 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.

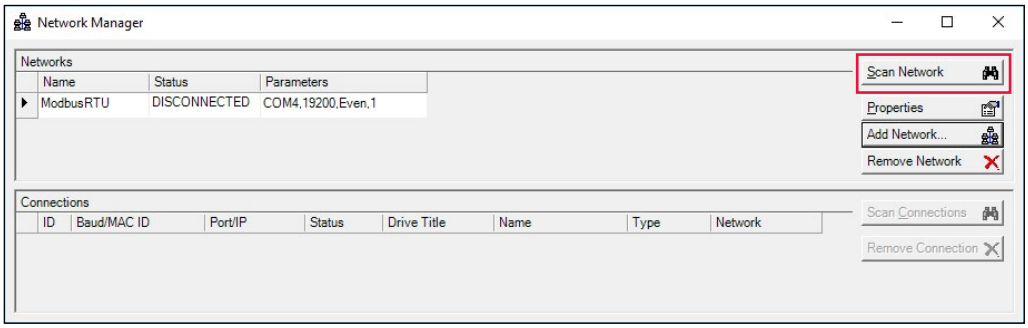
Communications Port Name	This is the serial communication port number. If the PC has an RS232 port, it is typically COM1 or COM2. If a USB converter is used, it is typically COM3-COM6 or higher. If multiple ports are shown in the drop-down menu, it is sometimes necessary to simply use trial and error to find the right one. Red (transmit) and green (receive) LEDs on the USB to RS485 converter cable can be useful to see activity.
Baud Rate	[2] Selects the Modbus network BAUD (or bit) rate (default 19200). The default baud rate of Tritex actuators is also 19200. Unless 38400 speed is required for throughput when using a Modbus master for control, it is best to leave all devices at 19200.
Parity and Stop Bits	[2] Selects the Modbus network Parity and Stop Bit settings (default Even parity with 1 stop bit). This is generally not changed unless required for some other master device.
Extra frame delay	Set to 0 ms unless more time is required by a RS485 communication converter or repeaters or some other device on a network. (Default 0 ms)

[2]

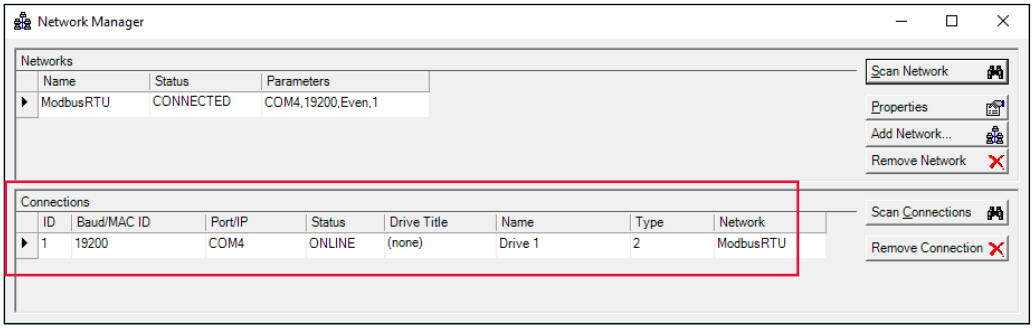
⚠ BAUD Rate and Parity and Stop Bits settings for master (Expert or controller) and all actuators on a network must be the same. The software does not attempt to make an 'auto' baud rate connection. If the actuator setting is unknown, different settings can be tried by changing the parameters.
When making changes to all devices on a network, change the actuators first. Changes do not become effective until the actuators are restarted, usually with a power cycle. Then change the master settings.

The Expert software saves the COM port settings. If the same communication port is used, this step can be skipped in future sessions, and Expert can go online with an actuator by connecting as described in the next section. This is another reason is convenient to keep all actuators with the same communications settings except Drive ID on multidrop networks.

Click on the *Scan Network* button.



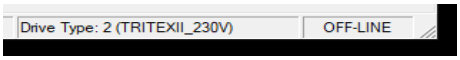
When Expert finds a device or devices connected to the configured COM port, the connections will appear in the Connections section with Status = ONLINE. This does not mean it is Connected and actively communicating to the actuator; only that the connection is available.

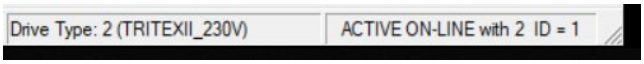


⚠ If no device is found, a line appears temporarily with Status = OFFLINE and Type = -1 and a pop-up window will say “Unable to ping connection” or “Unable to access port”. With the first message, make sure the actuator is powered up and the communications cable is connected. It is possible the port parameters do not match. With the second message verify that the port is not being used by a different program and that the Device Driver is working properly. Sometimes the port connection drops out and it may be necessary to click on *Remove Network* and start over with *Add Network…* Rarely the USB to RS485 converter gets hung up and it may be necessary to unplug the USB connector and plug it back in.

5.3 CONNECTING TO DRIVE

In order to make the connection and be actively online, an application and drive file must be open in Expert. Furthermore, the drive type in the drive file and the drive type of the actuator must match or an error pop-up will appear announcing “Wrong Drive Type”. Drive Type in the open drive file shows up in the Status Bar at the bottom right corner of the main Expert window while the next box indicates the connection status as shown below with drive type and Modbus ID appearing when connected.

Not connected: 

Connected: 

The drive types of available actuators appear under *Type* in the *Connections* table of the *Network Manager* and appears as above when connected. Drive type is not the same as Drive Series when creating an application, but if the correct Drive Series and I/O option is selected, the drive Type will be correct. CANopen is not currently offered with Tritex TTX actuators.

Drive Series	*Drive Type except CANopen*	*Drive Type with CANopen*
AC 230V Tritex II 75mm, TTX80-100mm	7	8
DC 48V Tritex II, TTX060, TTX080	4	6
AC 230V Tritex II 90-115mm	2	5
DC 48V Tritex I	1	N/A
EXP	3	N/A

There are three ways to connect to the drive: Scan for Active Drive Connections, Read Parameters from Drive, or Write Parameters to Drive from the Drive pull-down menu. These have Toolbar icons  (Scan),  (Upload), or  (Download) respectively. If multiple actuators are available on a network, a pop-up will list them and ask which one to connect. The Network Manager window is generally not needed after making a connection and may be closed. The three ways to connect differ only in how parameter data transfers at the start the connection.

⚠ An application and drive file must be opened to establish an online session with a drive. If the actuator drive type matches the application drive type, the data in the actuator can be uploaded and viewed. The Network Manager page allows scanning 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.

5.3.1 Using Parameter Set in Actuator

For most general maintenance or status check purposes, any application with a matching drive type may be used.

⚠ An application and drive file created under a previous version of Expert will not be able to support any firmware features added since the Expert software release. It is therefore important to install the latest Expert software package and to upload from the actuator into a new application created with the latest Expert.

After opening or creating an application and connecting to the actuator, click on the  button or select *Drive → Read Parameters from Drive*. If there are unsaved changes in the drive file, which is not likely in this scenario, Expert will prompt the user to save the drive file before uploading the new parameters. Be aware this prompt refers to the parameters in the drive file *before* bringing up the parameters from the actuator. Then Expert transfers Factory (System) parameters from the actuator into the open drive file followed by all the User parameters, overwriting anything that had been in the drive file. The actuator remain active online. If this was an existing application, it is wise to save the new parameters under a different name using the *File-> Save-> Application As…* command to avoid overwriting the source. Whether a new or existing drive file, it is also wise to save the drive file under a new name specific to the actuator using the *File-> Save-> Drive File As…* command.

At this point, the user has visibility to all display parameters and most Factory (System) parameters and full control of all User parameters to configure operation. Most display parameters update continuously to show the status of the drive.

If a parameter changes as the result of an Upload operation, the value will turn 'red', which indicates the parameter changed but the drive file has not been saved. This can be very useful to see what parameters differ between the parameters in the drive file and those in the actuator. Open a drive file that should closely match the actuator. Do an upload and look for red parameters. Close the drive file *without saving* to preserve it, or do a "*Save As…"* operation to save both. Any red parameters will return to normal 'black' when the drive file is saved, or in the unusual case of an Upload operation following a Download operation. Display parameters generally do not turn red because the values are "live" and not saved anywhere.

5.3.2 Using Parameter Set from an Existing Drive Application and Drive File

This method downloads User parameters from Expert to the actuator and remains active online. Use this 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 and name, calibration, and all *factory parameters* do not transfer to the actuator.

The most common use of this is to clone actuators from a master application and drive file, or to start with an existing application to make modifications for a new use. If a master file, both the application file (ending in .eapp) and drive file (ending in .edrv) should have Windows file attribute set to Read Only to prevent accidental modification.

After opening the desired application and drive file, select *Drive → Write Parameters to Drive* or click on the  button. At the end of the download, the actuator saves the User parameters to NVM so they may be reloaded on each actuator power cycle.

After downloading the User parameters to a particular actuator, it is best to upload from the actuator, which brings up all the factory parameters and other parameters that do not change with a download. Save this application as a complete record of the parameters in this unique actuator, with a unique name, such as including the serial number in the name. Alternatively, if there are many actuators that do the same job, multiple drive files with unique names may be saved with a single application.

5.3.3 Connecting Without Transferring Parameters

This method establishes communication with the actuator only (goes active online). Its primary function is to quickly go active online to view the fault status. It is important to note that this can cause confusion because it is possible that the remaining parameters may be mismatched.

Select *Drive → Scan for active Drive Connections* or click on the  button.

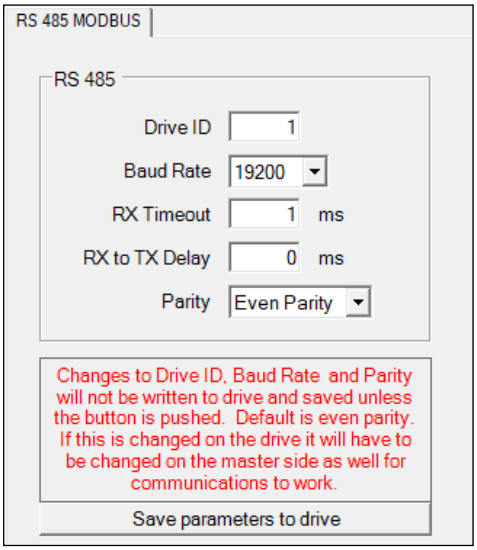
⚠ No configuration parameter data transfers when this connection is established. The parameters shown on Expert pages may not match those in the drive until an upload or download has been performed.

5.3.4 Changing RS485 Modbus RTU Communications

A final note on connections and communications is that the RS485 Modbus page allows the user to set the actuator communication parameters to match the requirements of the communication network, usually to set the network for proper connection to a PLC or other control device. Expert has to meet the actuator where it is, so this has to be done while operating on the set of parameters currently in the actuator. Since these changes are generally 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. Make the desired changes and click on *Save parameters to drive* for one or more actuators. Then use the *Network Manger* to change the Expert communications settings to match. Then power cycle the actuators to restart them.

Any of the following will work to bring up the RS485 MODBUS page shown below:

1. Select the RS485 MODBUS entry in the *Networks* group of the System tree
2. Use the main View → Page → RS485 MODBUS menu
3. Click on the  button and select RS485 MODBUS



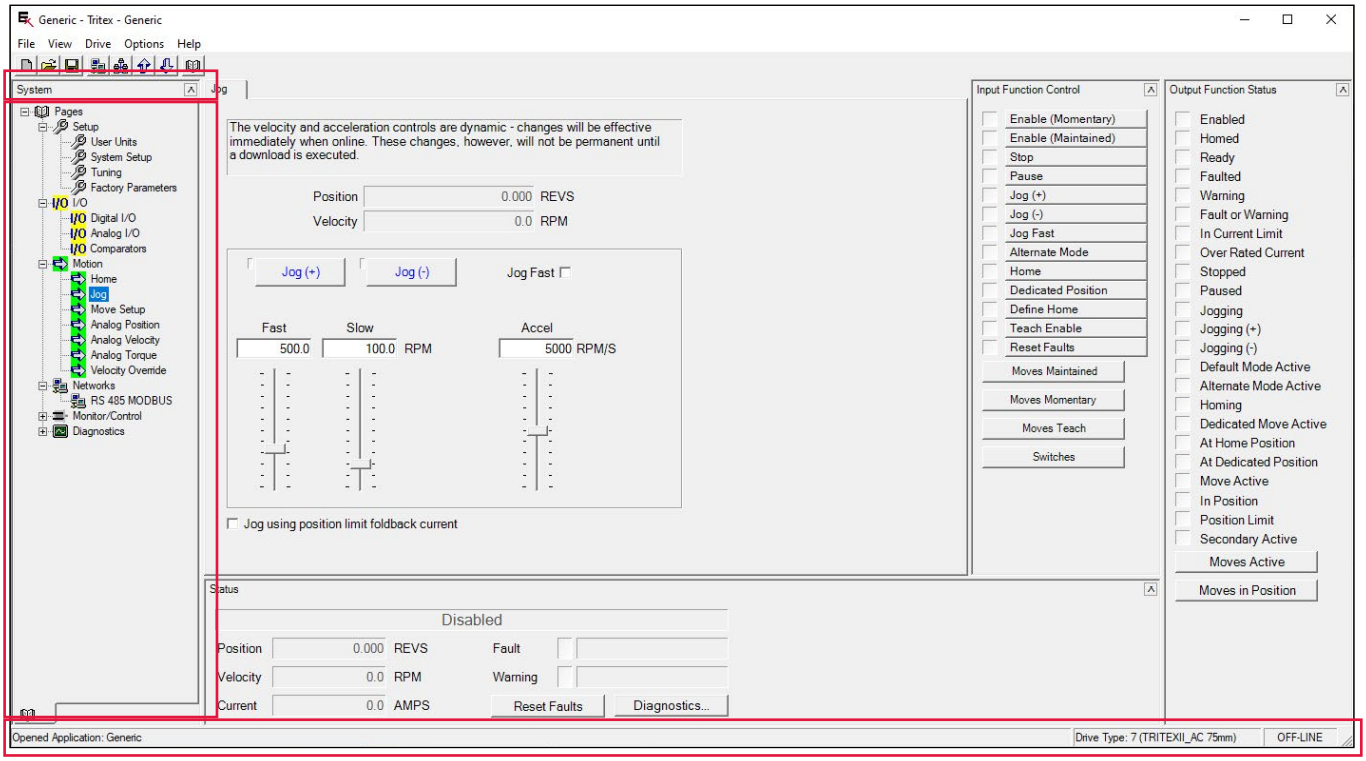
Drive ID	This is the Modbus node ID. Change delayed until actuator restarted (power cycle).
Baud Rate	This is the baud rate for serial communications. Change delayed until actuator restarted (power cycle).
RX Timeout	This is the additional time beyond the standard “1.5” character time before a receive 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).

⚠ 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.

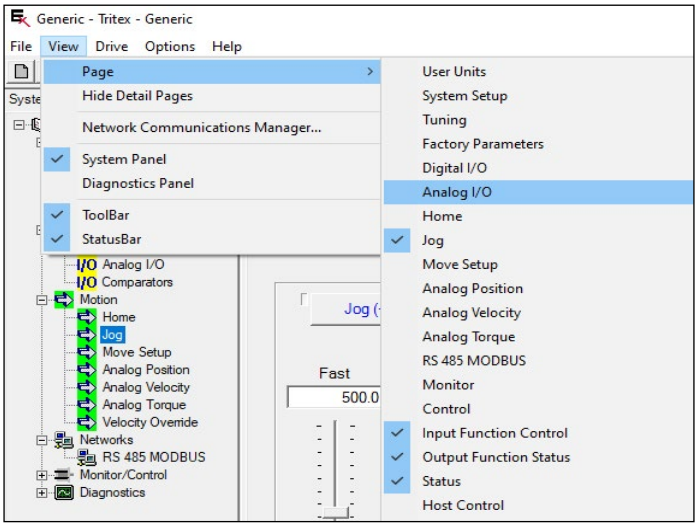
6. SETTING UP APPLICATION PAGES

6.1 CONFIGURING THE USER INTERFACE

Expert software has different views, called pages, to configure motion, control operation, view status, and see diagnostics. Pages may be displayed in countless arrangements, so the following is one found to be very useful in developing and configuring motion. The start-up default shows the Toolbar at the top, System Panel docked on the left edge, Status page docked bottom center, and Status Bar along the bottom with those elements highlighted. This example also shows the *Input Function Control* and *Output Function Status* pages docked on the right and the *Jog* page in the main body.



Use the *View* drop-down menu to show or hide the special bars and panels by clicking on the name. Pages may also be shown from the available pages sub-menu shown expanded here, though these are generally selected from the *System Panel*.



Clicking on in the top right of docked page or the System Panel will dismiss the page or panel. It only appears on panels or docked pages. Most pages appear one at a time in the main body of the window, where the Jog page is shown in the example above.

6.1.1 Toolbar

The Toolbar contains icons for commonly used actions. These were presented in section 3.1.

6.1.2 System Panel

Most pages are shown on the *System Panel* to the left, grouped into categories, organized so that as the actuator is configured; the user will start at the top and work down the list. The system panel will be the most common way to view and dismiss pages.

Most pages in the *System Panel* appear in the main body area one at a time. Clicking on a page name will show the page, or if already showing will dismiss it. If a page already appears in the main body and the user clicks on a different page that also shows up in the main body, the first page will be dismissed and the new page will replace it.

Not all available pages show up in the *System Panel.* Some ordinarily appear only from other pages such as the *Moves Maintained* page accessed from a button on the *Input Function Control* page. Others are seldom used, such as I/O calibration. These pages generally appear as floating windows rather than in the main body area.

6.1.3 Status Bar

This will show the application file name, the type of drive connected and the status of the drive.

6.1.4 Displaying Other Available Pages

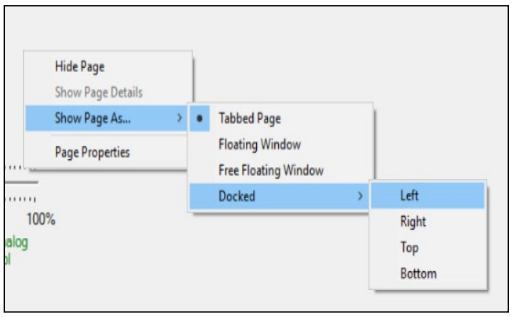
For viewing any available page, select *View* → *Page* → drop-down menu or click on the  button. An available page is one that is in a list in the application file and has a page file in the *Page Files* folder in the application folder. When creating a new application, the list and the page files are aligned.

Though possible to view any additional page through the *File* → *Open* → *Page…,* menu and navigating to the page, ***this is only temporary*** and not integrated into the application. It is best to either include all pages when creating a new application or adding the page to the application as explained later.

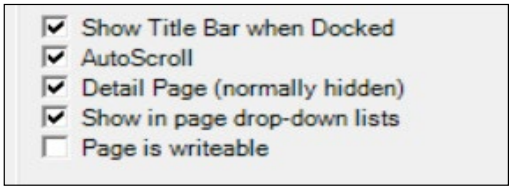
6.1.5 Controlling Page Display

For viewing any available page, select *View* → *Page* → drop-down menu or click on the  button. An available page is one that is in a list in the application file and has a page file in the *Page Files* folder in the application folder. When creating a new application, the list and the page files are aligned.

If a user right clicks in the base area of a display, a menu appears as with *Hide Page* as first entry. If something else appears, try right clicking close to the page border. The view at right follows the *Show Page As…* entry and choices for the *Docked* selection. A *Tabbed Page* appears in the main body area which is how most pages appear. A *Floating Window* and *Free Floating Window* appear as completely separate windows on top of the main window and can be moved around. A *Docked* page will appear on the selected edge of the main window and stay there until dismissed. These properties are saved with the page when the application is saved.



Also pertinent to page appearance is the bottom of the *Page Properties* window that appears when clicking on that entry. *AutoScroll* allows a page larger than the main body area to scroll as needed to see the entire page. *Detail Page* simply means it does not appear until requested. *Show in page drop-down lists* means it appears in the System Panel.



The default settings were considered carefully to provide easy use and navigation around the Expert user interface, so this section provides information on why pages appear as they do and where to access controls for customization.

It is possible to create custom pages with custom displays and buttons with scripted actions accessing any of the parameters in the drive file. However, this is beyond the scope of this instruction manual.

6.2 ADDING PAGES TO AN APPLICATION

As mentioned in 6.1.4, the best way to assemble the correct set of pages is when creating a new application. This can be done at any time and can be used to update an application to the latest pages and drive file and uploading parameters from a connected actuator.

Pages may also be added, deleted or hidden by selecting *File→Application Properties* and then clicking the *Pages* tab. What appears is a smaller version of the *Pages* tab for creating a new application. It only shows the available pages. The arrows can be used to re-order how they appear in the System Panel and lists, and the *Remove* button deletes a highlighted page in the list. Clicking the *Add* button brings up a navigation window to find a page to add. Pages differ based on Drive Type and firmware version supported, which is why creating a new application from the latest Expert installation is recommended. A page added this way is copied into the *Pages* folder and added to the list in the application file so becomes fully integrated into the application. The application must be saved to keep the changes.

6.3 MAKING CHANGES TO ACTUATOR PARAMETERS

How a Tritex actuator controls motion through specific commands is through a carefully constructed set of configurable parameters. Many of the pages in the Expert user interface provide enterable fields to make changes to parameters. The user changes actuator parameters by typing in new values in an “EditBox” or selecting from a list of options in a “SelectBox”or clicking on a “CheckBox” to toggle it. Fields that can be changed have a white background. “Monitor” values are read-only so are not white, and Factory parameters are normally not white to prevent user changes to this critical set of parameters.

⚠ 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>.

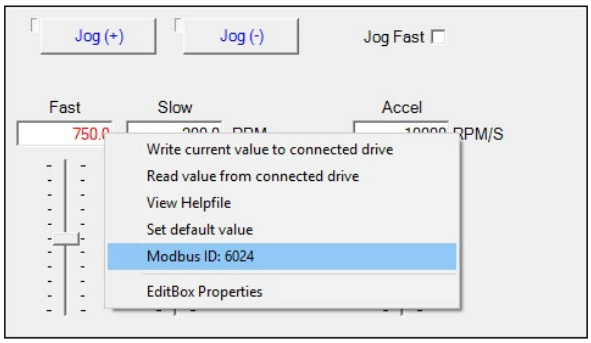
When a parameter on the screen is changed, the text turns ‘red’, but the new value is generally NOT sent down to the actuator until a download. Often the user enters multiple parameters and sends and saves all changes at once with a download. A few take immediate effect such as Jog controls and tuning. To force a parameter change immediately, right click on the entry field and choose *Write current value to connected drive* from the pop-up menu. Most 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.* Most parameter changes take effect when sent, but a few only take effect when the actuator is restarted. One final note on changing parameters is that most CheckBox parameters are single flags (or bits) within a 16-bit or 32-bit parameter. All 16 or 32 bits are read or written at the same time even when it is not obvious how flags are grouped.

⚠ 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 to the last value stored in NVM when logic power is cycled.

To save changes in the drive file select *File → Save → Drive File* or click on the  button. After this the parameter values will return to the ‘black’ color. Often the user concentrates on saving parameters in the actuator and forgets to also save the drive file. There is a prompt on exit.

6.4 MOUSE RIGHT CLICK FEATURE

Right-click on an entry field or control button to bring up a menu with features that depend on the parameter or control. The right-click menu for the *Fast* jog speed EditBox is shown on the right, while the one for the Jog(-) button is on the left.



The *Write…* and *Read…* commands were mentioned in the previous paragraphs.

The menu on control buttons has an option for latched or momentary operation. The *Latch…* and *Don't latch…*lines operate as a pair of radio buttons where clicking on a line sets that option and unsets the other.

Some menus have a *View Helpfile* feature to provide more information. Clicking on this opens a .pdf of the relevant page from the Tritex II Parameters Manual.

The *Modbus ID* is also commonly present. It simply shows the Modbus number for the parameter and has no function when selected. It is a simple way to find the Modbus number for a parameter when setting up a PLC.

The *EditBox Properties* or *CheckBox Properties* selection brings up additional windows into the inner workings of the Expert User Interface. These details are beyond the scope of this manual.

⚠ It is highly recommended to NOT attempt to edit properties.

6.5 HELP DOCUMENTS

Click on the *Help → Documents* to view various manuals that are included with the software, including the installation manuals for all the actuator models and information on Ethernet based communications.

7. SETUP PAGES

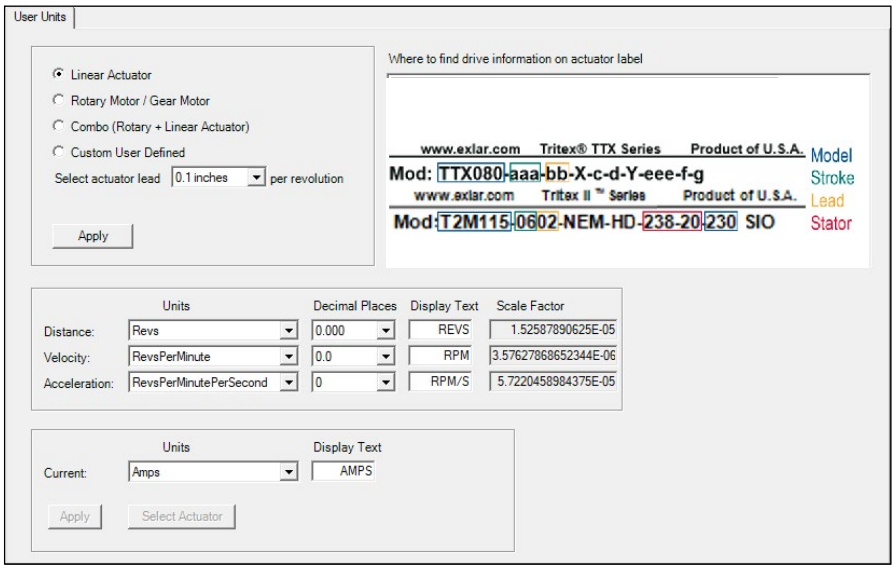
An important step in setting up a new application is to understand and address all pages and parameters in the Setup group of pages. These pages provide the framework for viewing motion, limits of various types, exception handling, and operating mode selection.

7.1 USER UNITS

User units provide a way to show motion in a way that makes sense. Internally, Tritex uses fixed point math with scaling to make numeric ranges fit in 16-bit or 32-bit integer values for efficient storage, calculation, and transfer in Modbus registers. Obviously this has little meaning outside the little world of the microprocessor in the actuator. For instance the internal unit of distance is 1/65536 of a revolution, which means that a 32-bit value representing position uses the top 16 bits as the integer number of revolutions (revs) of the internal motor relative to a reference position and the lower 16 bits as a fractional part of a rev. The default user unit for position is revs and the scale factor for displaying position in revs is 1.52587890625E-5 as shown in the Scale Factor column, which is 1/65536. The important concept is that all parameters that represent a number are scaled to fit into Modbus registers but are displayed in Expert in a way that makes much more sense to the user.

Internal revs for a linear actuator is still not the most sensible way to display position, so it is possible to select main rod position in linear units (inches, meters, millimeters) or geared rotary position in revs of the output shaft, or even main rod position when driven by a geared rotary Tritex. If someone wants to see a valve actuator display in % open, or a geared shaft with ¼ turn range display in degrees, that can be done using the Custom User Defined units. The only requirement is that the displayed value will be proportional to the internal units of revs, so the final angular position of a shaft turned by a clevis mounted linear actuator through a crank can't be accurately displayed, but it may be close enough. The point is that there is great flexibility in choosing User Units.

In the *Setup* grouping of the pages tree, select *User Units.*



First, choose the type of actuator by clicking on one of the four radio buttons:

Linear Actuator

Then select the actuator lead from the label. This is the distance the main rod moves for each revolution of the internal motor.

Rotary Motor / Gear Motor

Then select the gear reduction ratio. 1:1 for a non-geared rotary, and the reduction from the model number for geared.

Combo (Rotary + Linear Actuator)

This is usually an FT or K series actuator driven by a rotary or geared rotary Tritex. Then select both the lead for the linear actuator and the gear reduction ratio for the rotary part. If there is some other gearbox or non-1:1 belt between them, it may be necessary to use the Custom User Defined option.

Custom User Defined

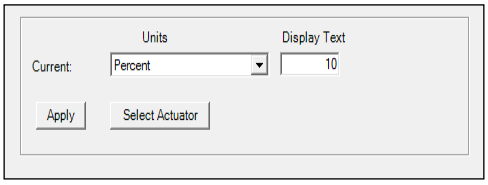
If starting at 0 for the value to display for position in whatever units desired, imagine the internal motor turning 1 rev. Calculate what value should now display for position in those units as the motion transfers through whatever gears, belts and pulleys and roller screws there may be between the motor and the final motion. Enter this value in the User Units per 1 motor revolution

When this section is done, click on *Apply*.

Next, select the units from the available selections and number of decimal places of precision from available selections for distance, velocity, and acceleration. The available selections differ based on actuator type. Note that revs, rpm, and rpm/sec are available even with linear motion in case the perspective of internal motor revs is useful. Display Text will appear when units are selected, but can be modified if desired. For the *Custom User Defined* option, the only selection for position units is “User Units”. Make that selection and then type in the desired *Display Text*. Velocity units are frequently available as “per second” or “per minute”. Choose whichever makes the most sense.

As the choices are defined, the values in the *Scale Factor* column change. The value for a Modbus parameter that represents position or distance is multiplied by the scale factor for distance to appear in the desired units. Similarly, parameters that represent velocity and acceleration use the corresponding scale factors. The value for the Modbus parameter does not change when units and hence scale factors change. These are display factors only and the actuator knows nothing about them. They are saved in the *Drive File* but never sent to the actuator. As an unfortunate consequence, if you create a new application the User Units are lost, reverting to defaults, and have to be set up again. It is always a good idea to keep a copy of the drive file for each actuator handy.

Finally, choose whether to display motor current in Amps or Percent of rated current. The default is units of Amps with a display text of “AMPS”. When using percent of rated current the relevant area of the User Units appears below.



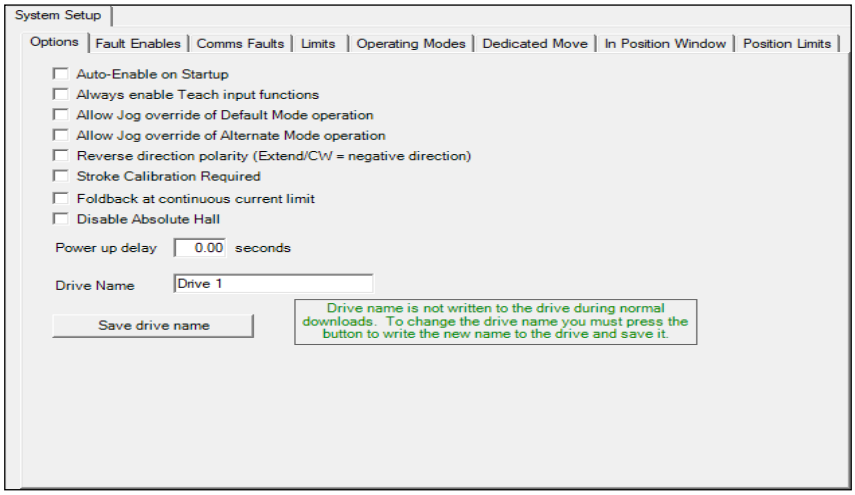
The recommended value is the real rated current for the actuator in use found on the Factory Parameters page, Limits tab as Continuous Current. The real rated current value determines the current for a Continuous Current fault and the Over Rated Output Status flag, so displaying this value as 100% has significance to actuator operation. When using Percent for current display and Current for 100% is not the Continuous Current limit value, a pop-up will appear offering to fix it each time the user connects and goes online with the actuator. This is handy if the intent is to use this value because it may not be known before going online. If choosing Yes, the Current for 100% value will be changed to match the actuator with immediate effect, and will be saved when the Drive File is next saved.

However, any value may be used here, if some other value has more meaning in the application. For instance, a value based on your User Current Limit may be preferred. Keep in mind that this does not change the actual motor current used to determine the Continuous Current fault. The user will have to put up with the pop-up request to change the display value on each occasion to go online.

7.2 SYSTEM SETUP PAGE

The System Setup page has eight tabs to group the large number of parameters into functional groups. The following sections describe each tab.

7.2.1 Options Tab



Quick Reference for Options Check Boxes

Option	Checked	Not Checked
Auto-Enable on Start-up	On power-up, the drive will automatically enable after *Power-up Delay* if no disabling faults are active. After that normal state is enabled.	Additional Enable signal or command required to enable drive.
Always enable Teach input functions	*Teach* inputs are always active. For more information see *Valve Application* section.	*Teach* inputs are inactive unless *Teach Enable* input function is active.
Allow Jog override of Default Mode operation	A *Jog* command will take precedence over most other *Default Mode* motion commands. *Jog* will NOT override a *Dedicated Move* or *Home* command.	A *Jog* command will not be honored while another motion command is active in *Default Mode.*
Allow Jog override of Alternate Mode operation	A *Jog* command will take precedence over most other *Alternate Mode* motion commands. *Jog* will NOT override a *Dedicated Move* or *Home* command.	A *Jog* command will not be honored while another motion command is active in *Alternate Mode.*
Reverse direction polarity (Extend/CW = negative direction)	Reference direction is positive motion retracts main rod for a linear actuator or turns shaft CCW (looking at shaft) for a rotary actuator.	Reference direction is positive motion extends main rod for a linear actuator or turns shaft CW for a rotary actuator.
Stroke Calibration Required	Motion other than Stroke Calibration is inhibited unless Stroke Calibration Complete flag is set. For more information on Stroke Calibration see the Valve section of this manual.	Stroke Calibration Complete is ignored, allowing normal motion.
Foldback at continuous current limit	If the value of the Continuous Current parameter exceeds the Continuous Current Limit value, the current will be limited to the Continuous Current Limit value until Continuous Current drops below 80% of the continuous current setting. A continuous current fault will not occur.	If the value of the Continuous Current parameter exceeds the Continuous Current Limit value, a Continuous Current fault will occur, disabling the drive.
Disable Absolute Hall	Multi-turn absolute feedback (if present on the actuator) will be turned off, and the actuator will generally have to be homed after each power-up.	Multi-turn absolute feedback, which is on all TTX series actuators and any others with –AF in the model designation, will be active.

The following paragraphs provide additional information on some options above.

Auto-Enable on Start-up -

With this option checked, the drive will generally be enabled unless faulted or a *Disable* command is active. It is equivalent to applying the *Enable (Maintained)* command all the time. If an option to disable at the end of a move is configured and that event occurs, the drive will disable and require a new edge on *Enable Momentary* to re-enable. Without a logic supply to keep the processor active, applying main power causes the actuator to go through its power-up sequence and with this option checked will enable the drive when the *Power up delay* time has elapsed.

⚠ Overall machine safety must be considered in determining whether to use the *Auto-Enable on Start-up* option or to require a separate enable signal or command.

Reverse direction polarity

The entire direction reference for the actuator reverses by changing this option. The definition of any absolute position is lost with a change. Therefore, the *Homed* output function flag is automatically cleared. A *Home* command is required to resume operation. It is best to determine and set the reference direction before configuring motion.

⚠ Changing this option is disruptive. Change it only when actuator is disabled. After making and saving the change to NVM, usually with a Download, you must restart (cycle power) to the actuator, to complete the change. Do not dynamically change this parameter, treat it as a one-time part of initial set-up.

Foldback at continuous current limit

Many applications should fault when the average current exceeds the rated value for the actuator to prevent overheating. It usually indicates something is not running properly and needs maintenance. Some applications should continue trying to operate but at reduced motor current. This will generally reduce the speed it can move but will prevent damage to the actuator due to overheating. Valve actuators are examples where continued operation may be best.

Disable Absolute Hall

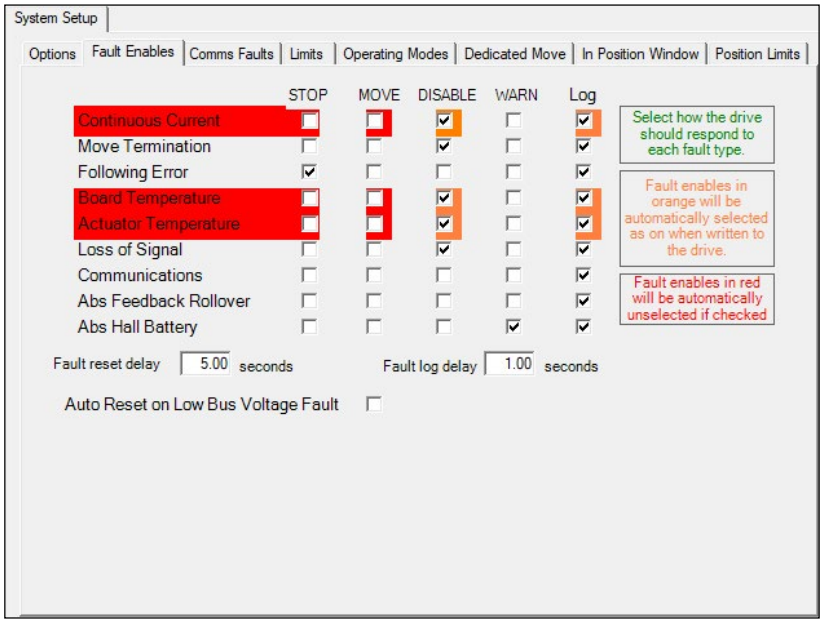
NEW! If a user prefers not to use the multi-turn absolute feedback feature but it was installed on an actuator, there was no easy way to turn it off. Now that the Tritex TTX series comes standard with the feature, the option was added. When disabled, the battery is not needed and may be removed, however, the battery monitor remains active. The Abs Hall Battery condition should be configured on the *Fault Enables* tab to ignore the low battery condition. Of course after disabling multi-turn absolute feedback, the actuator will need to be homed on each power-up.

The remaining parameter on this tab is the Power-up delay. The purpose of this parameter is to allow other components of a system that power up at the same time, such as a PLC or other controller, to get up and running before the Tritex is operational. This time is in addition to the approximately 1 second time to start up the processor on power-up. Enter the additional power-up delay time in seconds. All functions are inhibited during this time including communications, though an Ethernet connection may establish but not have new data.

7.2.2 Fault Enables Tab

The Fault Enables tab of the System Setup page is used to configure the reaction to some exception conditions detected by the fault handling system. Not all conditions appear in the list since several conditions like high bus voltage or peak current are not configurable. Those conditions always disable the drive and by default enter the occurrence in the status log. The exception conditions in red remain in the list but are no longer configurable to better protect the actuator.

For a more complete description of the fault handling system, refer to the section on the Diagnostics page. The system detects exception conditions and initiates actions based on the condition. If the action disables the drive, it is called a “fault” and also sets the *Faulted* Output Function Status flag. Conditions configured with a check in the *WARN* column will generate a “warning” and set the *Warning* Output Function Status flag. When a condition with a check in the *Log* column occurs, it is entered in the Status Log. Refer to the section on the Status Log page for more information about that diagnostic tool.



⚠ Continuous Current, Board Temperature and Actuator Temperature faults are there to protect the actuator. Until 2017 these conditions could be configured to take action other than a fault that disabled the drive, assuming the action would reduce the temperature or current. For a variety of reasons, the only action that fully protects the actuator is immediate fault on these three conditions. Both Expert software and the drive firmware enforce this change.

The following table describes the configurable actions for exception conditions, which can be combined in some cases.

STOP	Issues a *Stop* command to stop motion, decelerating using the *Stop Ramp* parameter on the *Limits* tab. The *Stop* command is removed by first clearing the fault condition and then waiting for the *Fault reset delay* to expire or issuing a *Reset Faults* command.
MOVE	Causes the *Dedicated Move* to activate, moving the actuator to the configured *Dedicated Move Position.* If the fault condition clears and then the *Fault reset delay* expires, normal operation will resume even if this occurs before the move is complete. (See *Dedicated Move* section for more details.)
DISABLE	Causes the drive to disable on the selected exception condition. The drive must be re-enabled after the fault condition has cleared by re-applying an enable signal or sending a *Reset Faults* command while holding an enable signal active. 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.
WARN	Causes a warning status and the *Warning* output function to become active. The *Warning* will clear when the fault condition clears.

With more than one action selected, they are executed in the following sequence:

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

Example 1: *MOVE* and *DISABLE* are both checked for a *Loss of Signal* fault. First, the *Dedicated Move* would take place. When it is completed, the drive will disable. Fault status indications are active during the move and while the condition persists and until re-enabled or reset. Dedicated Move Active status flag is active during the move.

Example 2: *STOP* and *DISABLE* are both checked for a *Loss of Signal* fault. First, a Stop would take place. When it is completed, the drive will disable. Fault status indications are active during the stop and while the condition persists and until re-enabled or reset. Stopped status flag is active until the drive disables.

Example 3: *MOVE, DISABLE* and *WARN* are checked for a *Loss of Signal* fault. Action is like Example 1 except Warn status indications are active while the exception condition persists. Making both Warn and Fault status available can provide a more complete picture of the state of the actuator.

It is not useful to configure both *STOP* and *MOVE* for one condition. *STOP* takes precedence, so the *MOVE* will not execute.

The following table describes the different exception conditions.

Continuous Current	The drive continuously monitors motor current using a modified I^2t calculation to model power dissipation in the drive and motor. The result is filtered and compared to the Continuous Current value shown on the *Factory Parameters* page and generates a fault if it exceeds the trip point. The value appears on the *Monitor* page as *Continuous.* The trip point is set for each model and represents the maximum allowable time averaged operating point for the actuator. It must be set to Disable and should be logged. The cause of repetitive occurrences should be investigated and corrected.
Move Termination	A Move can be configured on the *Move Setup* page to generate this exception condition if a move terminates in an unintended way. For example, if a move goes into current limit before getting to the end position, or the other way around.
Following Error	This exception condition occurs if following error exceeds the *Max Following Error* for more than the *Following Error Time Limit* configured on the *Limits* tab. This frequently indicates a machine jam, or attempting to operate beyond speed or acceleration, or “loose” tuning on quick moves.
Board Temperature	This fault condition occurs when the drive electronics temperature exceeds the trip point on the *Factory Parameters* page. It must be set to Disable and should be logged. The cause of repetitive occurrences should be investigated and corrected.
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. Some older actuators had thermal switches, but all units in production now have temperature sensors. The cause of repetitive occurrences should be investigated and corrected.
Loss of Signal	This exception condition occurs when the *Analog Input* value is out of range. It is set up on the *Analog I/O* or *IA4 Option Board* page, *Input Setup* tab. The relevant parameters are the *Low Trip* and *High Trip* values and associated *Enable* check boxes.
Communications	This exception condition occurs when the Tritex loses communication on one of the communications ports. .
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. (Not shown in example above.)

Abs Feedback Rollover	This fault condition occurred on actuators with an old absolute feedback design when the turned more than +/-8192 revs. The turns limit was removed in August 2016 on all new units, so this fault will no longer 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. It is generally set to WARN since it is an early warning fault.

The following table describes the remaining parameters on the *Fault Enables* tab.

Fault reset delay	[1] This time delay is added before automatically recovering from a fault condition. This feature is only effective when *DISABLE* is NOT selected.
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)
Auto Reset on Low Bus Voltage Fault	[2] If this checkbox is set, a Low Voltage Fault will clear 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.

[1] 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 clears and after the *Fault reset delay* time has expired.

There are many details in how the exception handling system works. It is best to thoroughly test out the configuration to make sure it provides acceptable responses to foreseeable events. Here are some additional notes on configuring faults and warnings.

There are no general provisions to create a warning when a temperature or continuous current approaches the trip point. A Comparator can be configured for this purpose and may be used to initiate a Dedicated Move. The underlying parameter can also be monitored over a communications link to alert a PLC or similar controller.

Though a Continuous Current fault will always disable the drive immediately, the *Foldback at Continuous Current limit* option may provide a way to avoid a fault while still protecting the actuator.

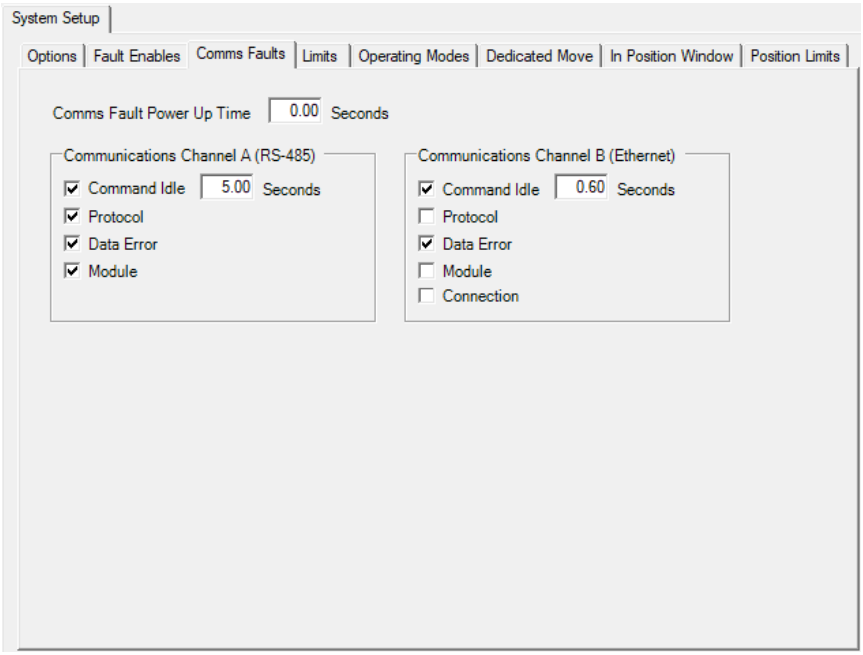
A *Dedicated Move* or (rarely) a *Stop* must be able to finish the trajectory calculated for it at its onset or the actuator could hang up and not go on to the *Disable* stage. If a jam prevents the *Dedicated Move* from getting to the end position or a *Stop* from completing a decal ramp, the action will not complete and could remain in a high current state indefinitely. The solution was to prohibit use of Continuous Current, or overtemperature conditions with STOP or MOVE actions.

Please see the section on the Status Log and Diagnostics page for additional information on faults.

7.2.3 Comms Faults Tab

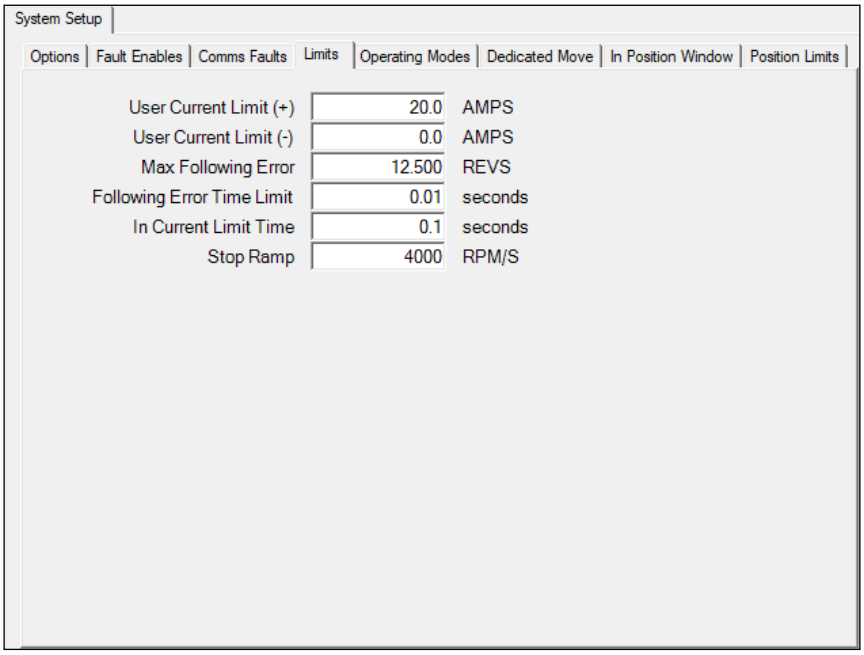
The *Comms Faults* tab is used to set up the conditions that will be monitored to determine a host communication exception condition. The *Fault Enables* tab settings control the action taken on occurrence.

Channel A is dedicated as the RS-485 port included on all models. Channel B is used with the Ethernet based advanced communications protocols, including EtherNet/IP, PROFINET, and Modbus TCP/IP. The Channel B communication fault identifies if there is an issue with the communication interface, but does not indicate associated protocol errors.



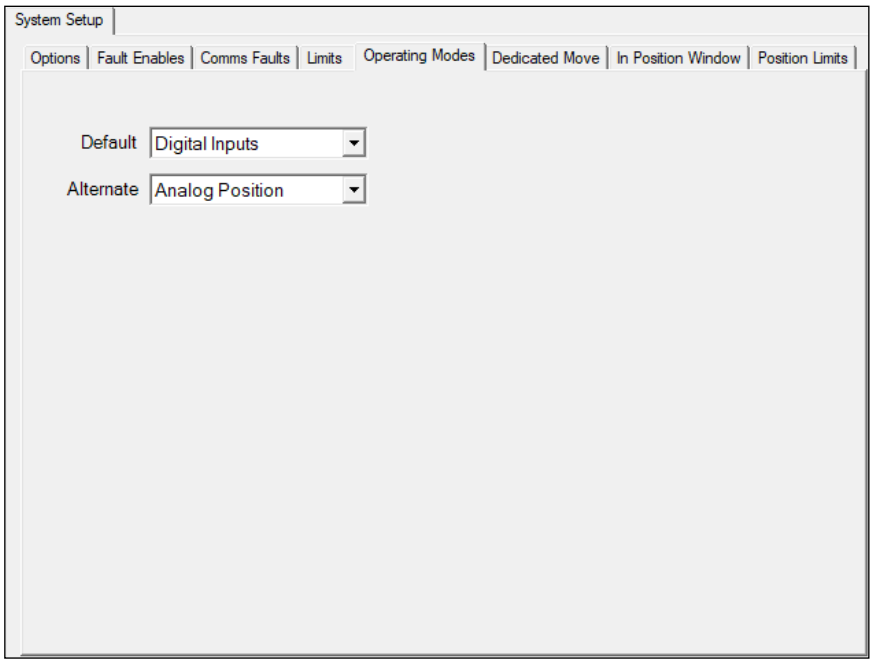
Comms Fault Power-up Time	This sets the time delay at start-up before communication faults are monitored. This allows time for the host controller to power-up and establish communications, preventing unnecessary faults at start-up. The *Power up delay* parameter on the *Options* tab also provides delay, but sometimes this parameter alone or in combination provides best start-up sequencing depending on the system.
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. It indicates a bit error in a message, which could result in a NACK or an ignored message, whereupon the master may attempt a retry. It is usually better to ignore occasional occurrences if the master attempts a retry than to take aggressive action. It may be useful for temporary diagnostic purposes.
Data Error	If a data error, such as invalid address, invalid range etc. occurs, this fault condition will be set. This is due to an improperly formed request from the master, so is ultimately a programming error that should not have to be monitored past check-out.
Module	If a module error occurs, such as invalid ID address, invalid baud rate etc. occurs, this fault condition will be set.
Connection	This monitors the connection when one or more of the following Modbus errors occur: • Command timeout • Protocol error • Data error • Network error • Module error

7.2.4 Limits



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. Actuators with firmware 3.00 and newer will have separate Current Limits for positive and negative directions. If the negative current limit is set to 0.0, the positive current limit will be used for both directions.
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 0.25 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 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 A 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.

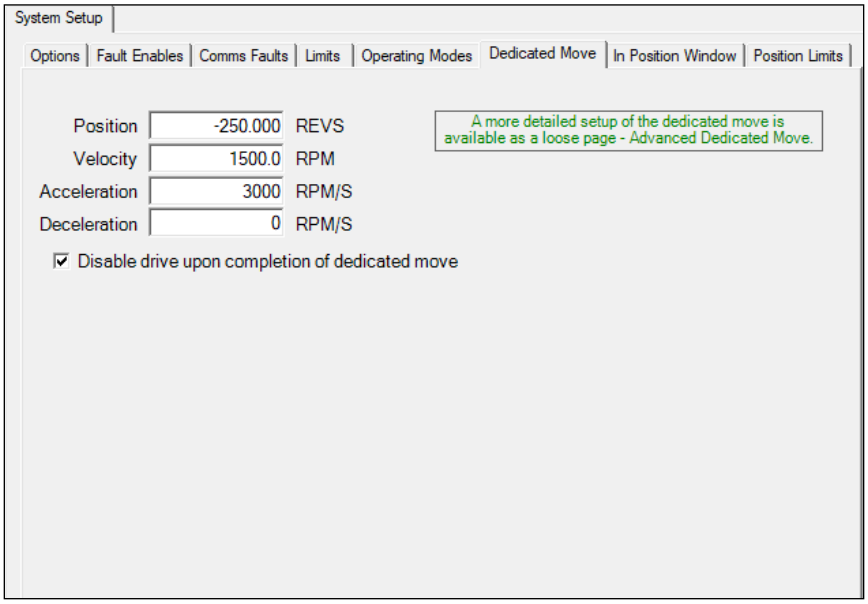
7.2.5 Operating Modes



This tab allows selection of the source/motion type for *Default* and *Alternate* modes. The description of these modes of operation are available by right clicking on the drop box and selecting the View Helpfile. The possible selections for each mode include:

- Inactive
- Digital Inputs
- Analog Position
- Analog Velocity
- Analog Current
- Host Position
- Host Velocity
- Host Current

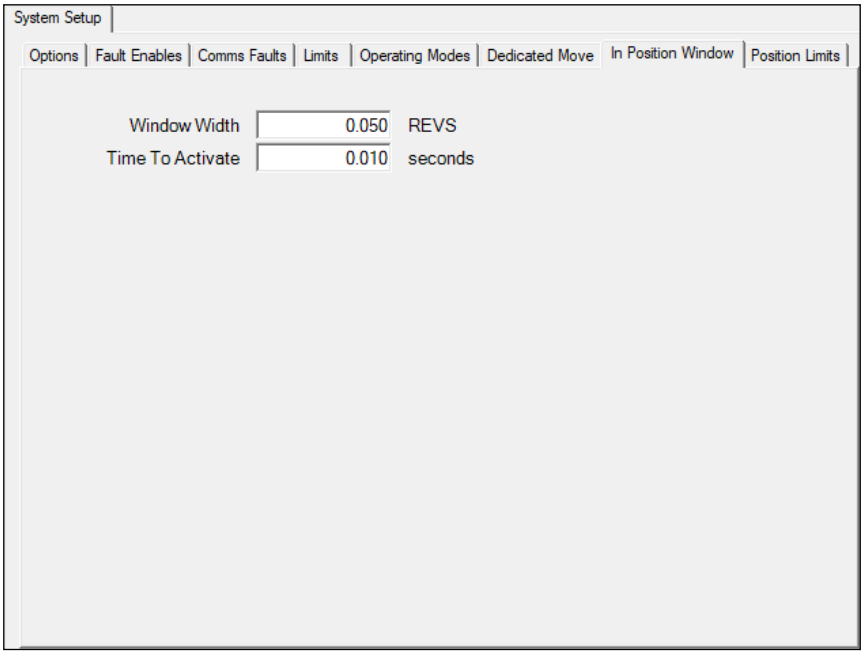
7.2.6 Dedicated Move



The *Dedicated Move* is designed to provide a method, available from any mode, to move to a specified position. The *Dedicated Move* always has priority in all operating modes. 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.

⚠ 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.

7.2.7 In Position Window

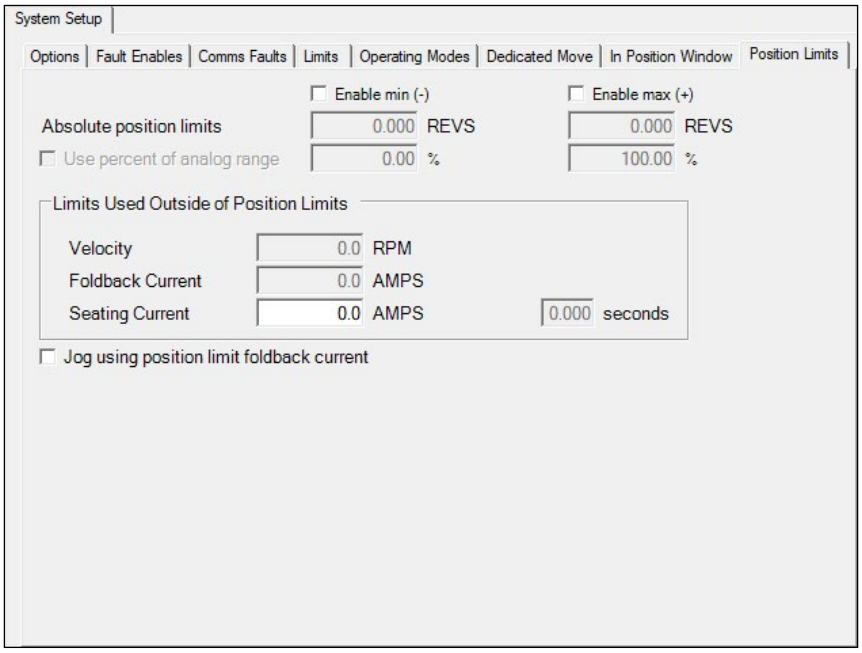


The In Position Window defines the window and time delay used by- Home, Dedicated Move, Move (x) and In Position output functions-to determine the actuator at the right position. The window width is +/- the value entered. For example, if the 0.005 inches

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.

⚠ 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.

7.2.8 Position Limits

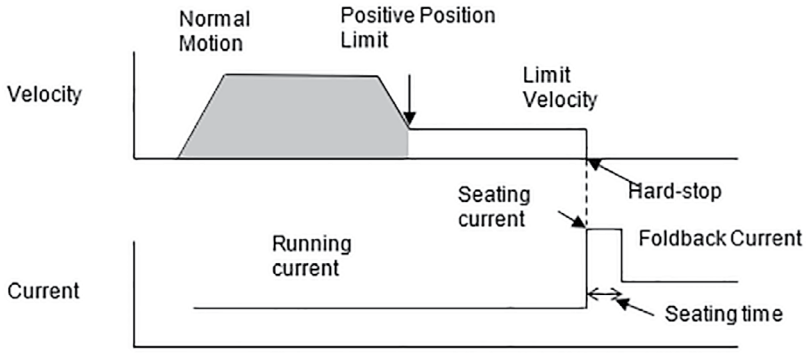


Position Limits are software monitored travel limits, with special features for control outside of these travel limits.

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 2 ms 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.

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



Position Limits parameters

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

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 build 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.

⚠ If Homing to a current limit is used, 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.

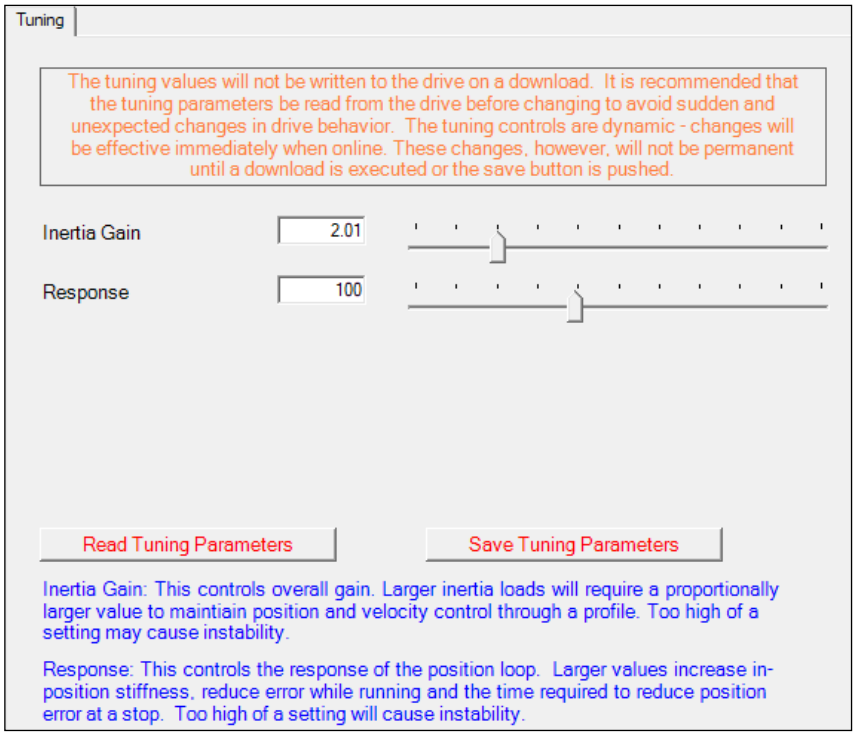
The method of recovery from a Position Limit condition is dependent on the motion mode that was used to enter the position limit range. In the following modes, any velocity or toque mode, Host Position, Analog Position, or Jog; a command in the opposite direction will move out of the Position limit condition. 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 of 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.

7.3 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*.

⚠ 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.



⚠ Do not use these parameters in combination with a high *Integral* value as they tend to fight each other.

7.4 FACTORY PARAMETERS

This is where factory parameters can be viewed. There are multiple tabbed windows sorting factory information.

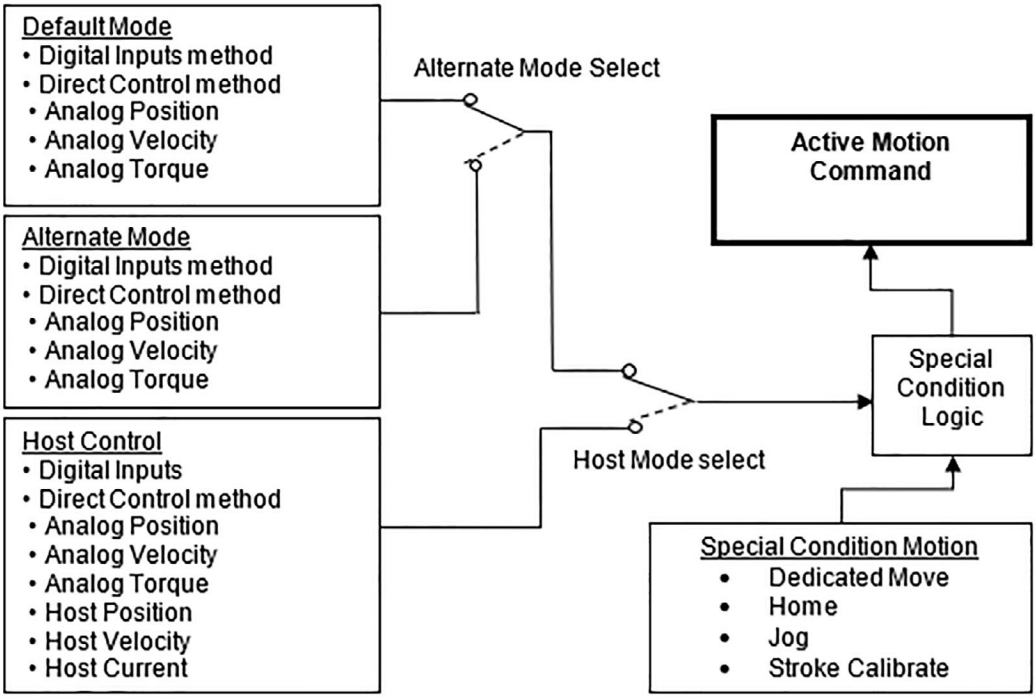
7.5 FACTORY CALIBRATION

This is where factory calibration can be viewed. There are multiple tabbed windows sorting factory information.

8. MOTION CONTROL

8.1 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.*

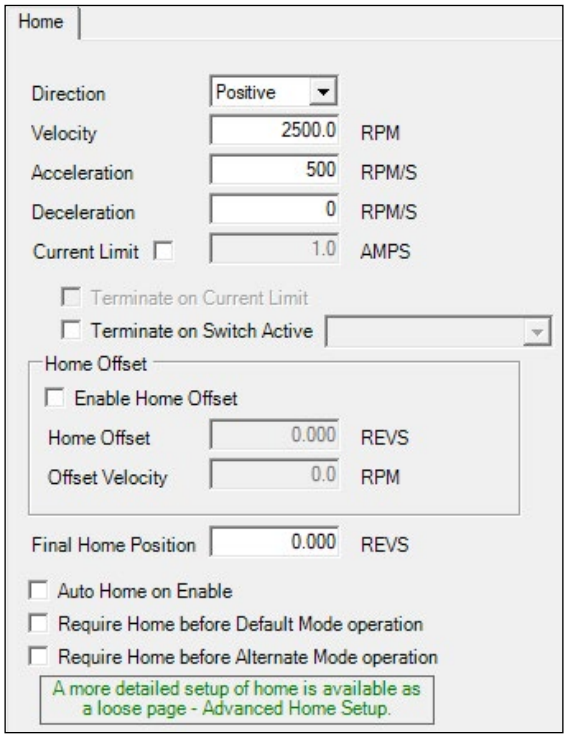
8.1.1 Special Condition Motion

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* is 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)

8.2 HOME PAGE



8.2.1 Home Parameters

Direction	Select Positive or Negative direction; Positive 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.
Deceleration	The deceleration ramp used during a *Home* move.
Current Limit	[1] 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)
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 from 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.

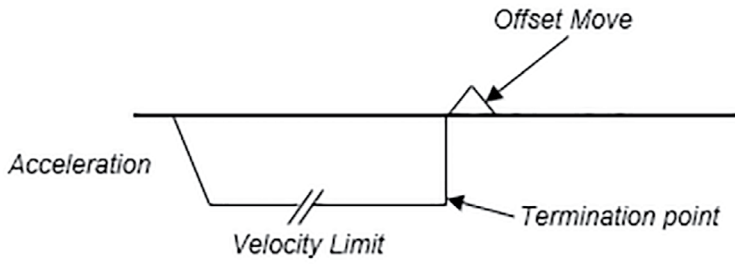
[1] ⚠ If the *Current Limit* box is checked, and the *Terminate on Switch Active* box is checked, do NOT select both *Auto Home on Enable* and *Auto Enable on Start-up* (*System Setup* page). If the actuator is against a stop in the home direction, each time the fault is attempted to be cleared another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

8.2.2 Home Initiation

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

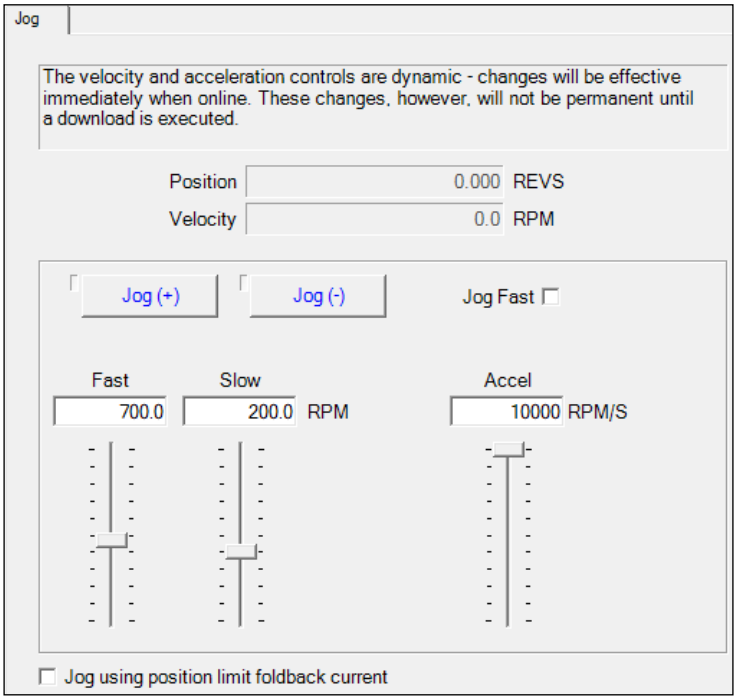
1. The Home input function from an assigned digital input
2. Input Function Control page
3. Home button on the Control page
4. From a host using a Modbus command
5. Automatically Home when the actuator is enabled if the Homed status in not active.

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

8.3 JOG PAGE



8.3.1 Jog Parameters

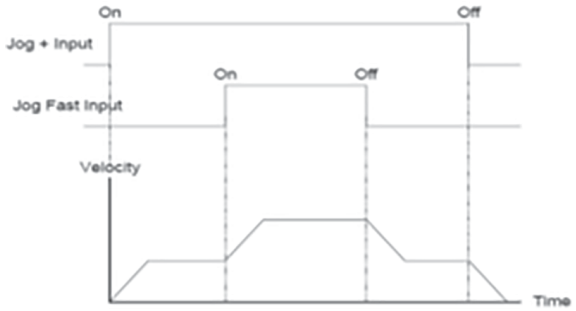
Fast	[1] The *Jog* velocity when *Jog Fast* is selected.
Slow	[1] The *Jog* velocity when *Jog Fast* is not selected.
Accel	[1] The acceleration and deceleration ramp used in *Jog* mode.
Jog Fast checkbox	When checked the *Fast* velocity is used, unchecked uses the *Slow* velocity.
Jog using position 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.

[1] *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.

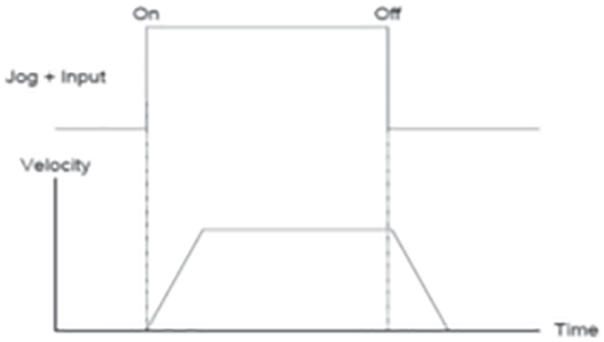
The slider bars provide an easy way to change *Jog* parameters; these changes take effect immediately but are not saved permanently until a download is performed. The *Jog (+)* and *Jog (-)* buttons will activate a *Jog* if they are held down with a mouse click. The indicators next to the buttons illuminate when the *Jog* is active.

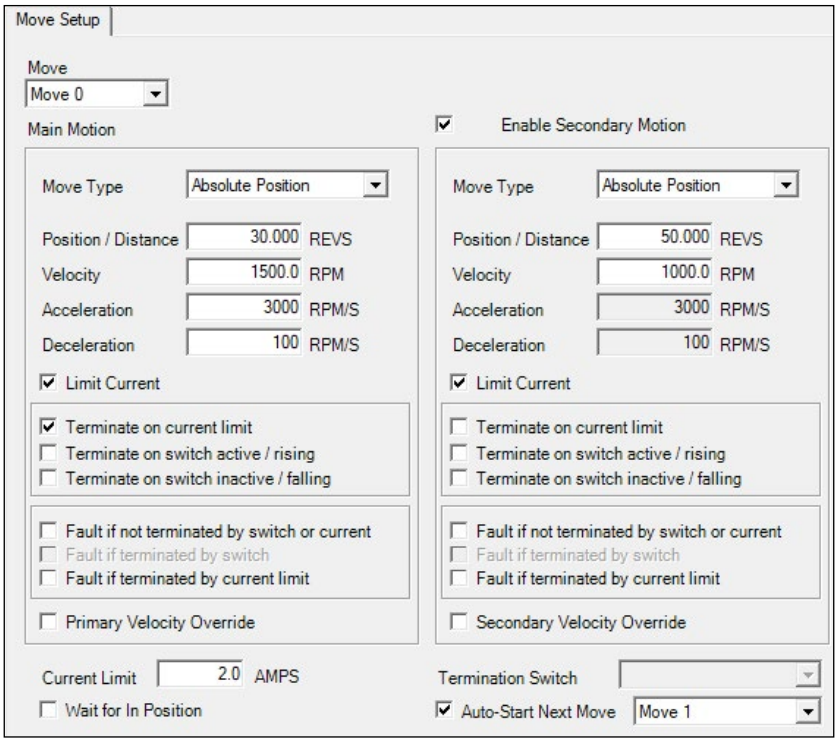
8.3.2 Jog Controls

The *Jog (+)* and *Jog (-)* buttons will activate a *Jog* if 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.



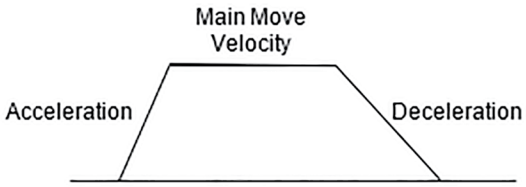
The *Jog* function can be initiated from the *Jog +/-* input functions, which can be activated from the assigned digital inputs*, Input Function Control* page, *Jog* buttons on the *Jog* page or the *Contro*l page, or from a Modbus command. *Jog* can be selected to override other motion types as well.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





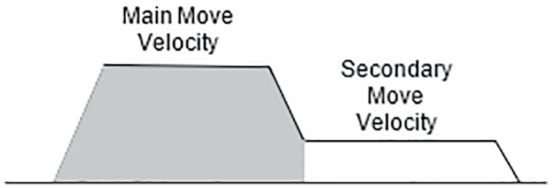
8.4 MOVE SETUP PAGE

The Tritex II drives can store and control up to sixteen move profiles referenced by Move (0-15). 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.

Main move with secondary motion disabled.



Main move with secondary motion enabled.

⚠ The secondary move Acceleration and Deceleration velocities will be the same as the main move velocities.

⚠ 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

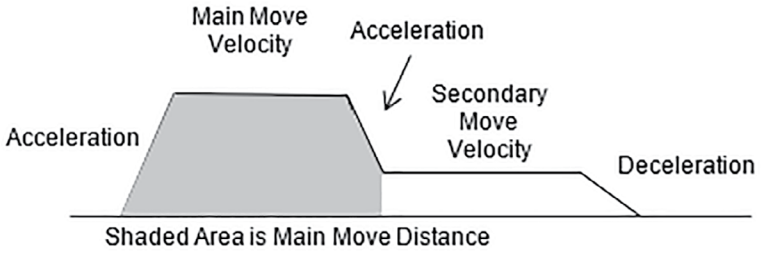
8.4.1 Move Setup Parameters

Move	Select the Move (0-15) for defining the below parameters.
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.
Move Type	Select the type of move here. The types are defined below.
Absolute Position	Move to the desired position relative to home.
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.
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.
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 of the move in user units.
Deceleration	Defines the deceleration of the move in user units.
Limit Current	Select the check box to limit current for a given move.
Terminate on current limit	[1] Terminate the move when the current limit is reached.
Terminate on switch active / rising	[1] Terminate the move when the *Termination Switch* switches to active / rising state.
Terminate on switch inactive / falling	[1] Terminate the move when the *Termination Switch* switches to inactive / falling state.
Fault if not terminated by switch or current	[2] Issue fault if not terminated by switch or current
Fault if terminated by switch	[2] Only selectable when *Terminated on switch* is selected. Issue fault if terminated by switch.
Fault if terminated by current limit	Issue fault if terminated by current limit
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 value for a given 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).
Termination Switch	Defines which switch to terminate the move on if a *Terminate on Switch* option is checked.
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.

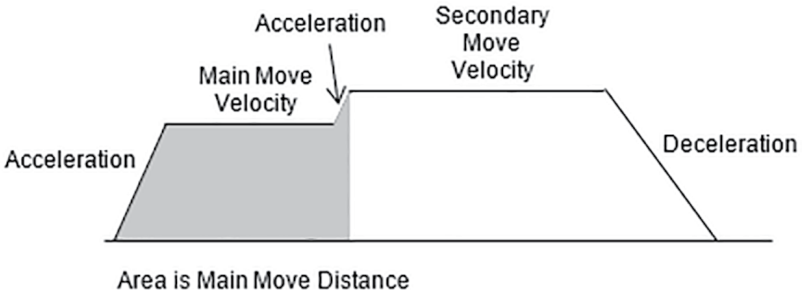
[1] These determine which events, if any, will terminate a move. Any combination, including all or none, of the termination types may be used. However, if current limit AND switch termination options are both used, both must be fulfilled before the motion segment terminates.

[2] 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.

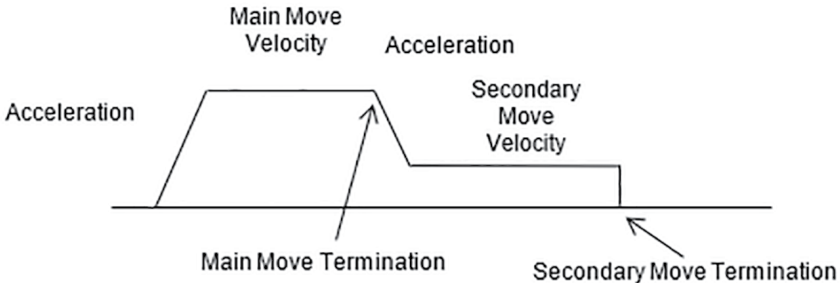
8.4.2 Move Examples



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

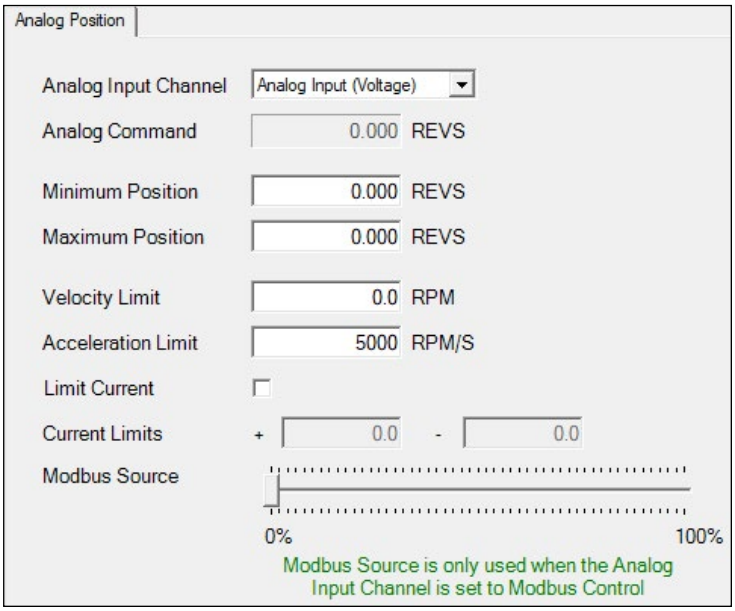
8.5 ANALOG MOTION PAGES

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.

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

8.5.1 Analog Position Page

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.



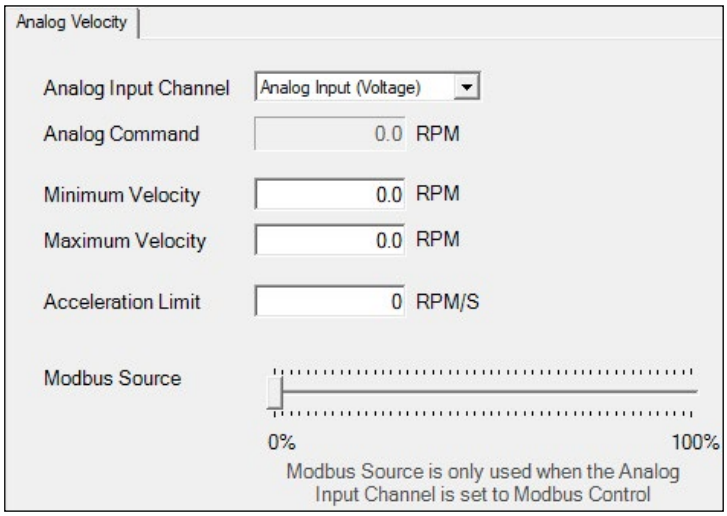
Analog Input Channel	[1] Select the type of analog signal to be used; options are- *Analog Input Voltage*, *IA4 Option (4-20 mA*)(if the IA4 Option board is installed) or *Modbus Control*.
Analog Command	This displays the commanded position, in user units, based on the *Analog Input* value and the scaling.
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* parameters. For actuators with newer firmware there is now a separate current limit for travel in the negative direction. If the negative current limit is set to 0, the setting for the positive current limit is used in both directions.
Modbus Source	[2] 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.

[1] 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

[2] 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. Negative Current Limit is not available with firmware older than 3.00.

8.5.2 Analog Velocity Page

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.



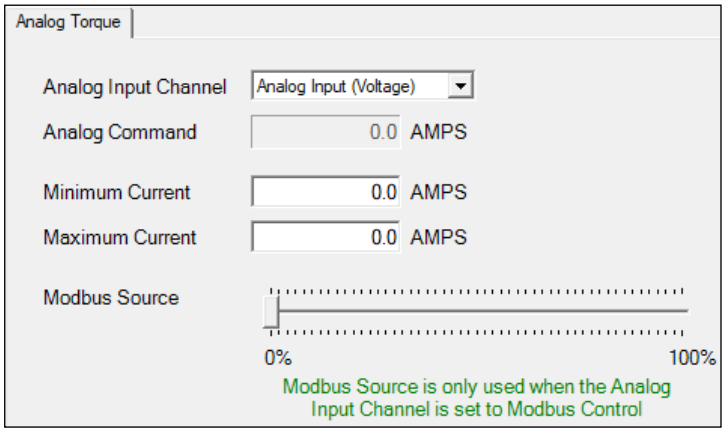
Analog Input Channel	[1] Select the type of analog signal to be used; options are- *Analog Input Voltage*, *IA4 Option (4-20 mA)*(if the IA4 Option board is installed) or *Modbus Control*.
Analog Command	This displays the commanded position, in user units, based on the *Analog Input* value and the scaling.
Maximum/Minimum Velocity	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 Velocity* move.
Acceleration Limit	This is the maximum acceleration/deceleration during an *Analog Velocity* move
Modbus Source	[2] 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.

[1] 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.

[2] Modbus Source control is not available on EXP 24, Tritex II AC with firmware revision older than 2.12 or Tritex II DC with firmware older than 2.27. Negative Current Limit is not available with firmware older than 3.00.

8.5.3 Analog Torque Page

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 Input Channel	[1] Select the type of analog signal to be used; options are- *Analog Input Voltage*, *IA4 Option (4-20 mA*)(if the IA4 Option board is installed) or *Modbus Control*.
Analog Command	This displays the commanded position, in user units, based on the *Analog Input* value and the scaling.
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	[2] 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.

[1] 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.

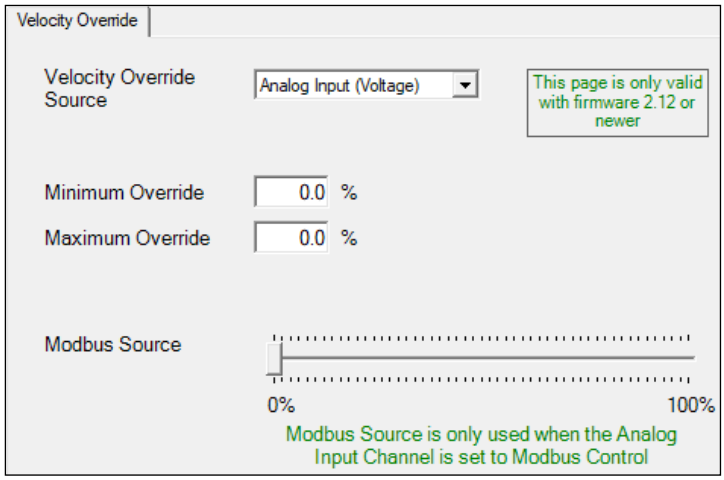
[2] Modbus Source control is not available on EXP 24, Tritex II AC with firmware revision older than 2.12 or Tritex II DC with firmware older than 2.27. Negative Current Limit is not available with firmware older than 3.00.

8.6 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.

⚠ 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.



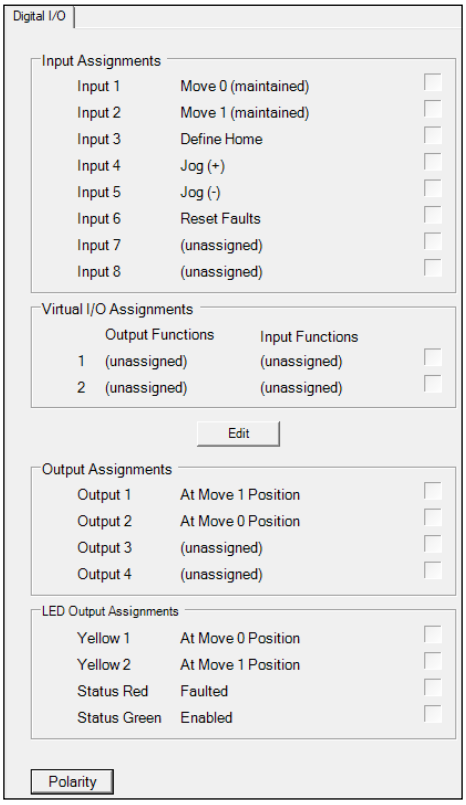
Velocity Override Source	[1] Select the type of analog signal to be used; options are- *Analog Input Voltage*, *IA4 Option (4-20mA*)(if the IA4 Option board is installed) or *Modbus Control*.
Maximum/Minimum Override	This should be set to the desired percentage limits of the defined move velocity. The *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.

[1] ⚠ 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.

9. DIGITAL I/O

9.1 DIGITAL I/O PAGE

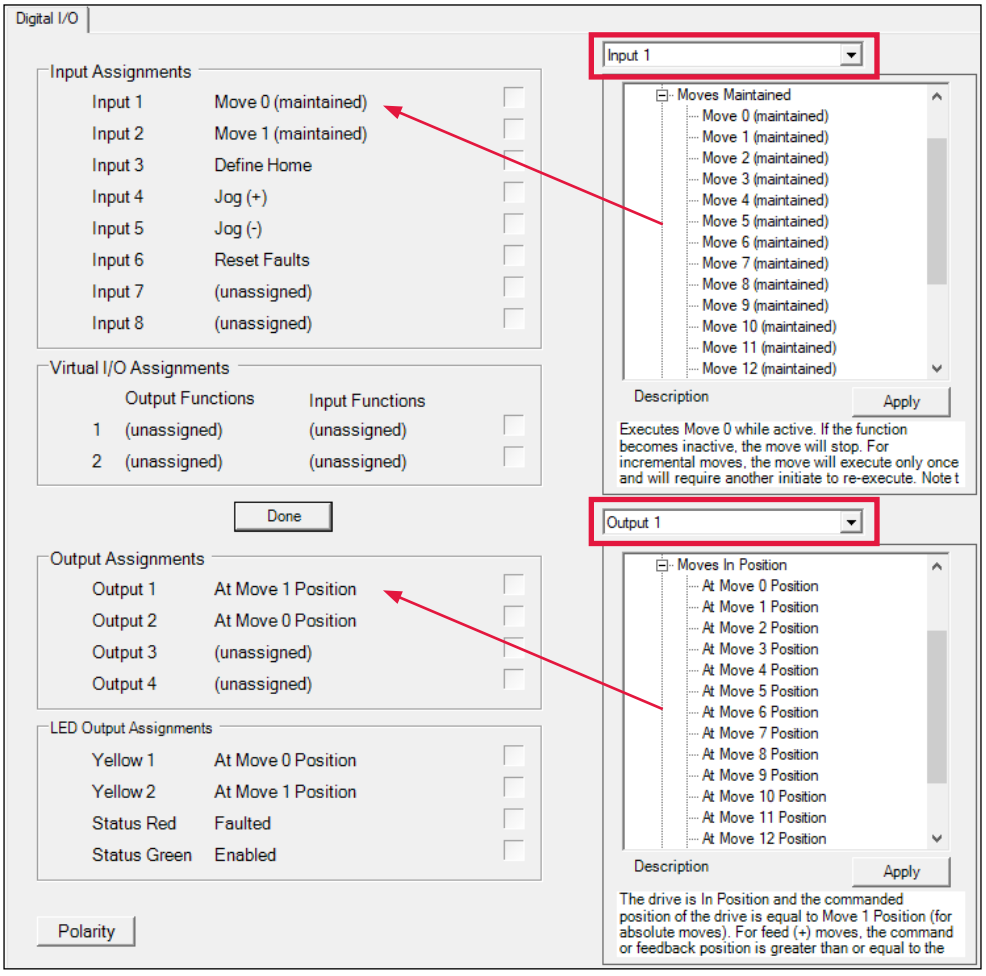
The *Digital I/O* screen is used to assign hardware digital input lines to logical input functions and logical output functions to hardware digital output lines and LED's. Not all models have LED's that can be assigned to output functions and the number of digital inputs and digital outputs varies by 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.



9.1.1 Input/Output Polarity Assignments

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.

9.1.2 Input/Output Assignments

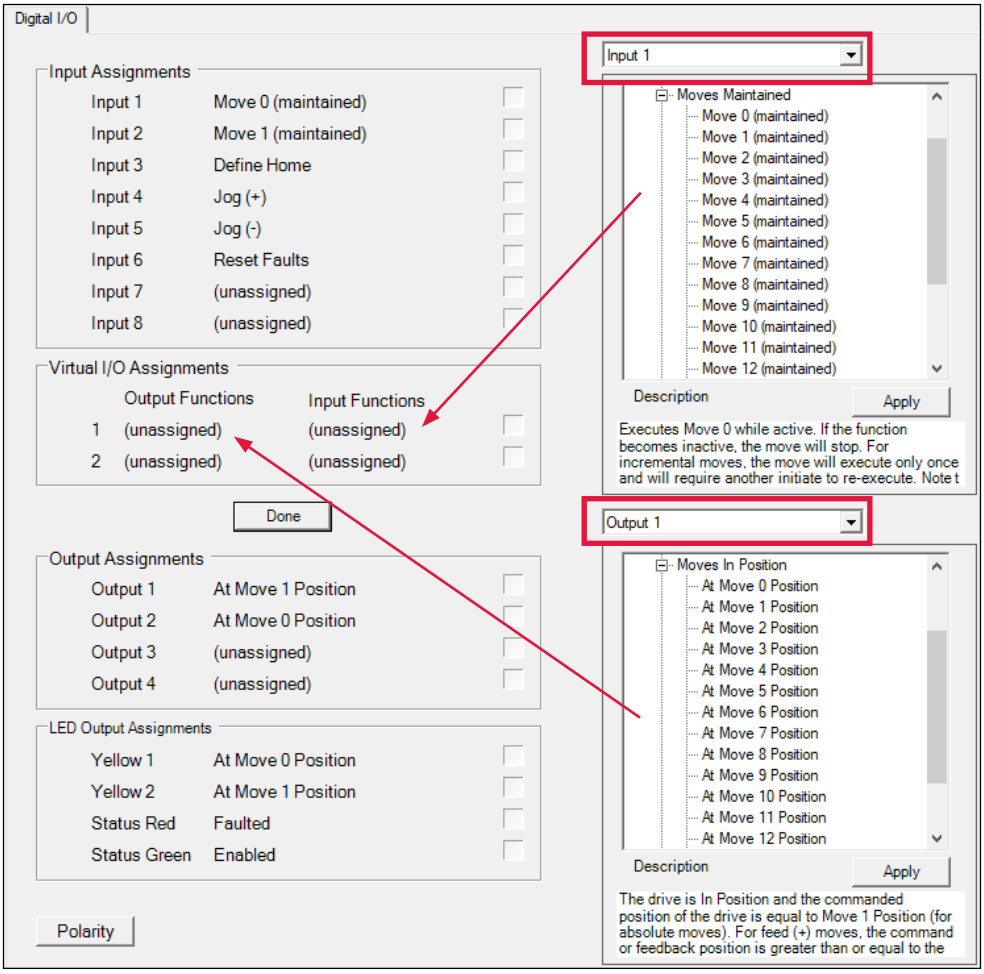


Click on the *Edit* button to show the *Input / Output* selection screens.

Select the *Input/Output* from the drop box.

Select the desired function from the Functions tree. A description of the function will appear for the action that will be taken. Click the *Apply* button to assign the function to the selected Input/Output.

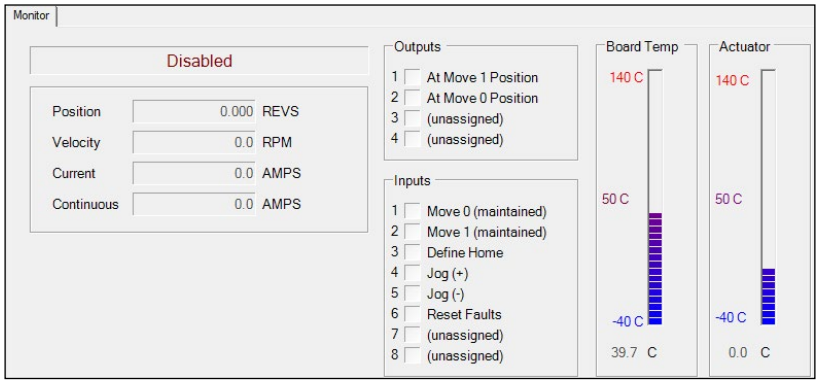
9.1.3 Virtual I/O Assignments



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 90/115 mm v2.21 and Tritex II DC and AC 75 mm v2.37. Not available on EXP-24.

9.2 MONITOR PAGE

Found in the Monitor/Control section of the System Panel tree.

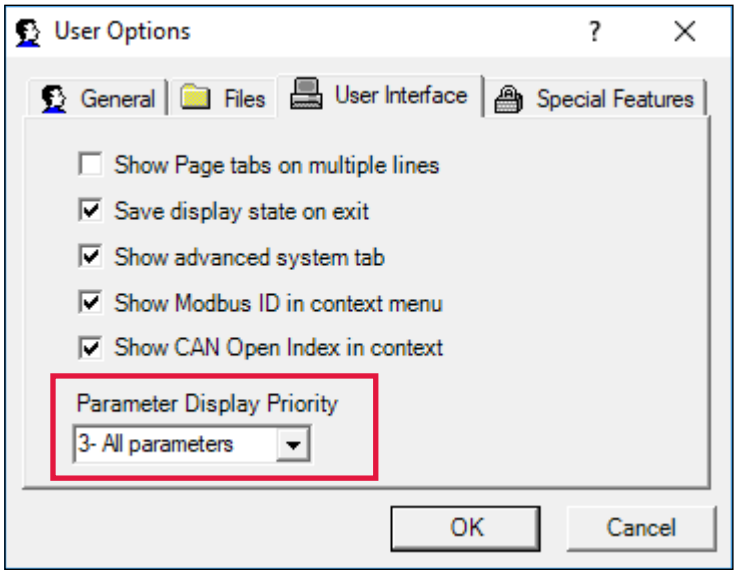


This screen shows actuator status along with position / velocity / current information. The digital input/output line statuses may also be viewed along with the board and actuator temperatures.

⚠ Output lines can be set (forced active) and overridden (forced inactive) on the *Diagnostics* Tab to test digital output hardware.

9.3 ADVANCED I/O ASSIGNMENT OPTIONS

To view addional (advanced) I/O 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.

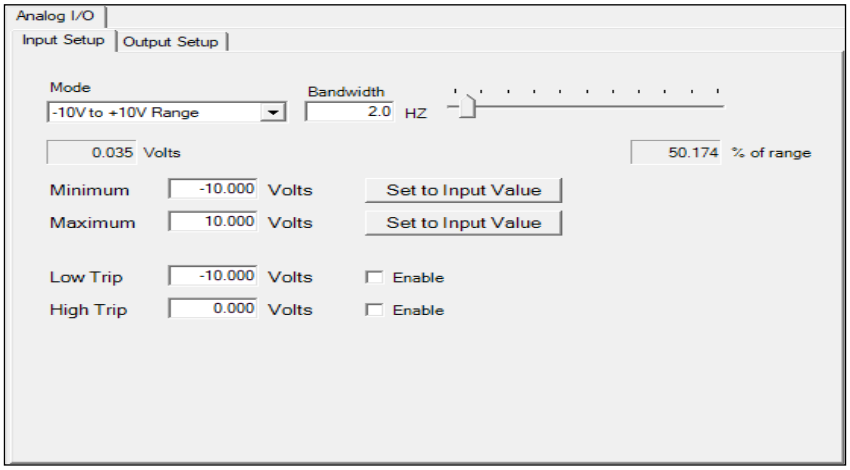


10. ANALOG I/O

This section covers the Analog I/O for the following Tritex products; T2X, TDX, TTX, R2M/G, RDM/G. (See the specific actuator *Installation* manual for detailed specifications).

10.1 ANALOG VOLTAGE 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. The IA4 option replaces the analog voltage I/O with analog 4-20 mA I/O.



Enable Analog Input	This was a user option prior to firmware version 2.02. In all releases version 2.02 and later it is automatically enabled, and the option bit is ignored. The checkbox should not show up unless the software connects to an actuator with firmware version 2.01 or earlier.
Mode	Only displayed for T2X090, T2X115, R2M/G090, R2M/G115 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 +10 V 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 Online 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 0 V and/or 10 V values, set the host controller to apply 0 V and click the Minimum Set to Input Value button, the set the host controller to apply 10 V 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

10.2 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 TTX, TDX, RDM/G and T2X075, input calibration page is shown below. The process for Tritex T2X090/115 and R2M/G090/115 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 T2X090/115 and R2M/G090/115:

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 0 V to +10 V 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.

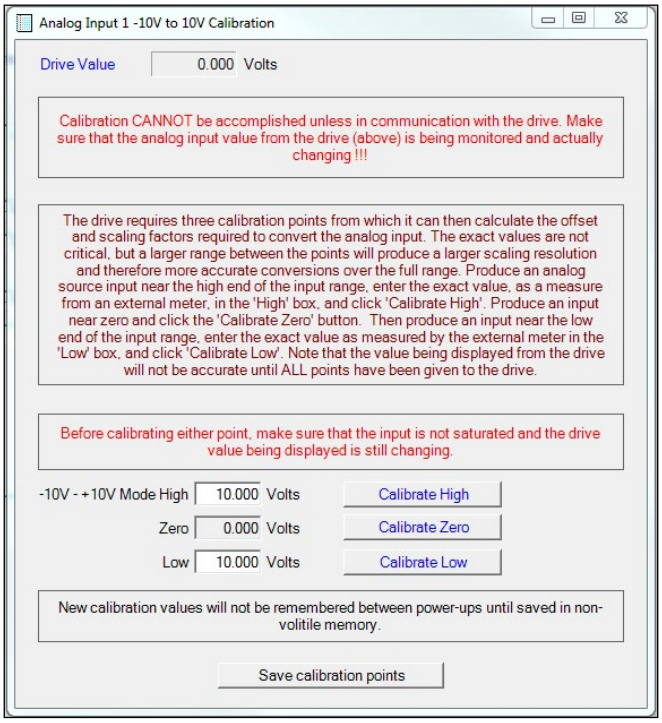
Or if the actuator is in -10 V to +10 V mode as determined in checkbox on Input Setup tab, apply a voltage of between -9 V to -10 V from Analog In + to Analog In – terminals, enter the voltage from the DVM in the *Low* box including the negative sign, and click on the *Calibrate Low* button.

For a Tritex TTX, TDX, RDM/G and T2X075:

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.

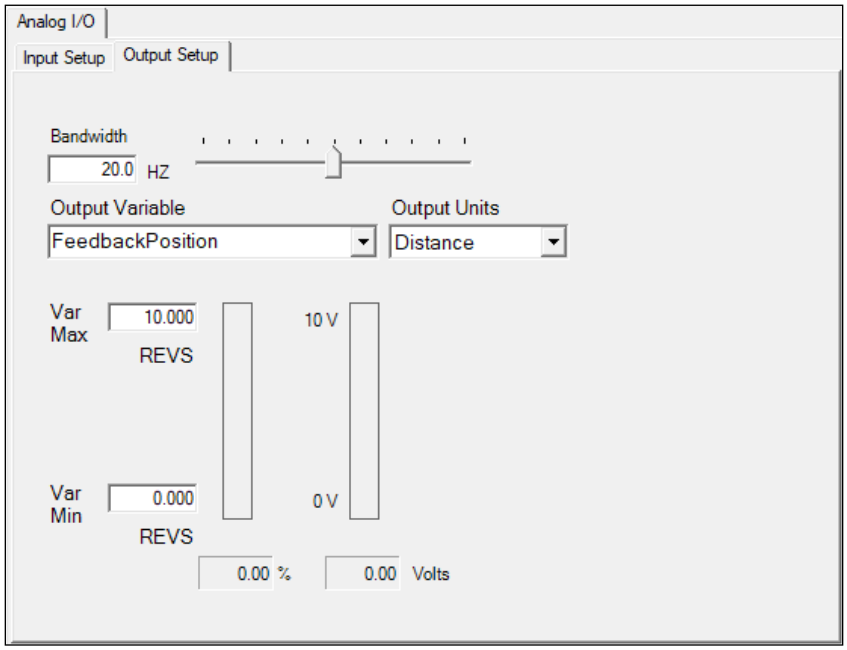
Then remove the short and apply a voltage between -9 V and -10 V from Analog In + to Analog In – terminals, enter the voltage from the DVM in the *Low* box including the negative sign, and with the voltage still applied click on the *Calibrate Low* button.

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



10.3 ANALOG OUTPUT

The Voltage Analog output has a maximum range of 0 to +10 V and can be mapped to any of several actuator variables such as Position, Current, Temperature, etc. The Voltage Analog Output is replaced by the 4-20 mA analog output on Tritex Tritex TTX, TDX, RDM/G and T2X075 actuators, so is not available on those models. It is available on all Tritex T2X090/115 and RDM/G090/115 models.



Enable DAC Output	This box should always be checked. It may not appear on all pages.
Bandwidth	Is the break frequency in Hz 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	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 0 V on the Analog Output and the *Var Max* value will produce 10.0 V on the Analog Output.
% and Volts Display	These displays are only active while online. 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 not the actual output signal.

10.4 ANALOG OUTPUT CALIBRATION

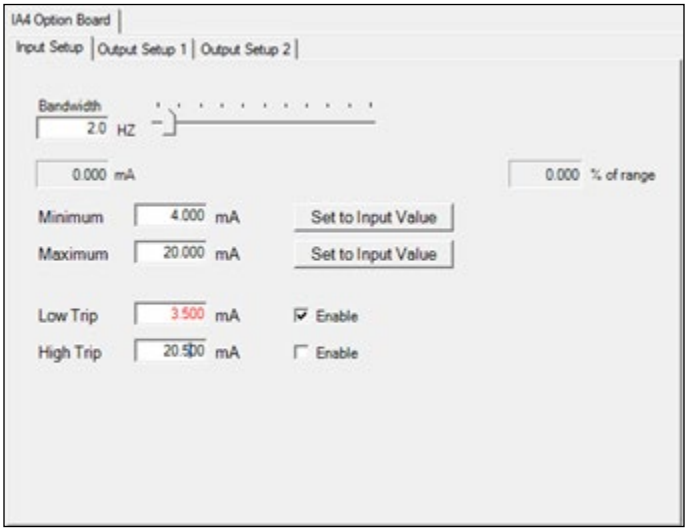
The *Analog Output* has been calibrated at the factory so 0-100% covers a span of 0 V to +10.0 V. Re-calibration of the analog output is not recommended.

10.5 IA4 OPTION BOARD

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

10.5.1 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.

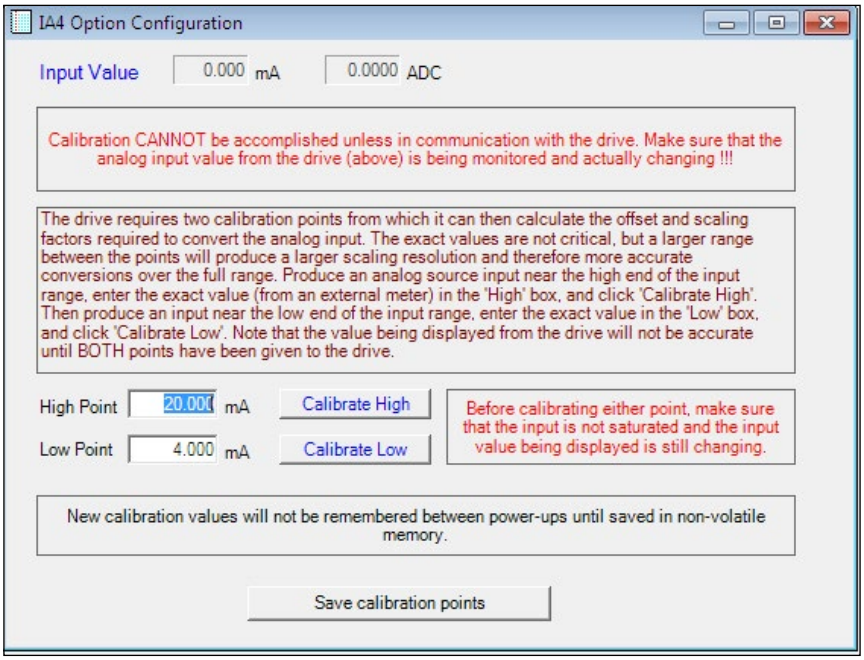


Enable Analog Input	This was a user option prior to firmware version 2.02. In all releases version 2.02 and later it is automatically enabled, and the option bit is ignored. The checkbox should not show up unless the software connects to an actuator with firmware version 2.01 or earlier.
Bandwidth	Is 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 4-20 mA Input. Typically 4 mA is assigned as the 0% value and 20 mA 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	These buttons can be used only when actively online with the actuator. The purpose of these buttons is to provide an easy method of matching the min and max 4-20 mA 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 20 mA values, set the host controller to apply 4 mA and click the Minimum Set to Input Value button, then set the host controller to apply 20 mA and click the Maximum Set to Input Value button. The Actual mA values, 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 mA limits can be set, if the enable check box is selected and the 4-20 mA 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, a fault condition will occur.

10.5.2 4-20 mA 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.

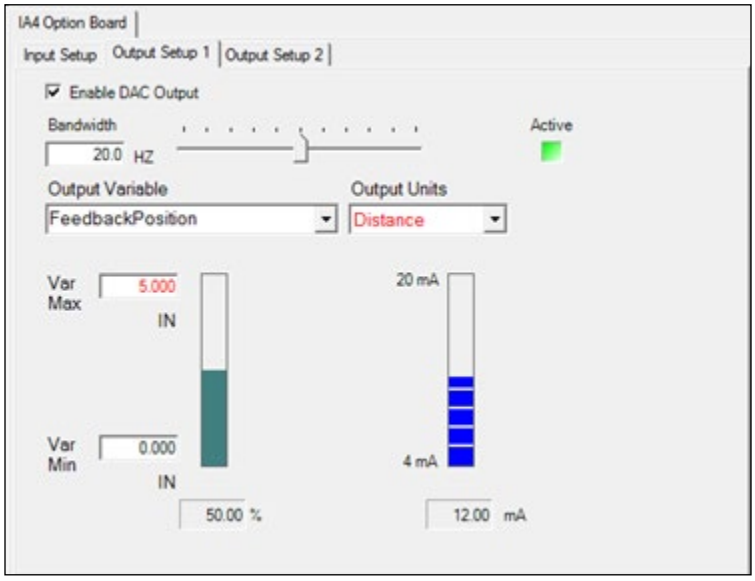
To access the calibration page, click on the red Calibrate button on the IA4 Option Board page, Input Setup tab. If such a button is not visible, right click in the area just outside of the border of the Input Setup tab. Then click on the Show Page Details line in the menu that pops up. The Calibrate button will then appear. The IA4 Option Configuration page is shown below. The process for Tritex T2X090/115 and R2M/G090/115 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 4-20 mA input. The input is best calibrated at 4 mA and 20 mA.

10.5.3 4-20 mA Output

The Tritex actuator with –IA4 option has one physical analog 4-20 mA 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 4-20 mA output channel unless input function *Switch Analog Output* is active when the variable in Output Setup 2 is applied.

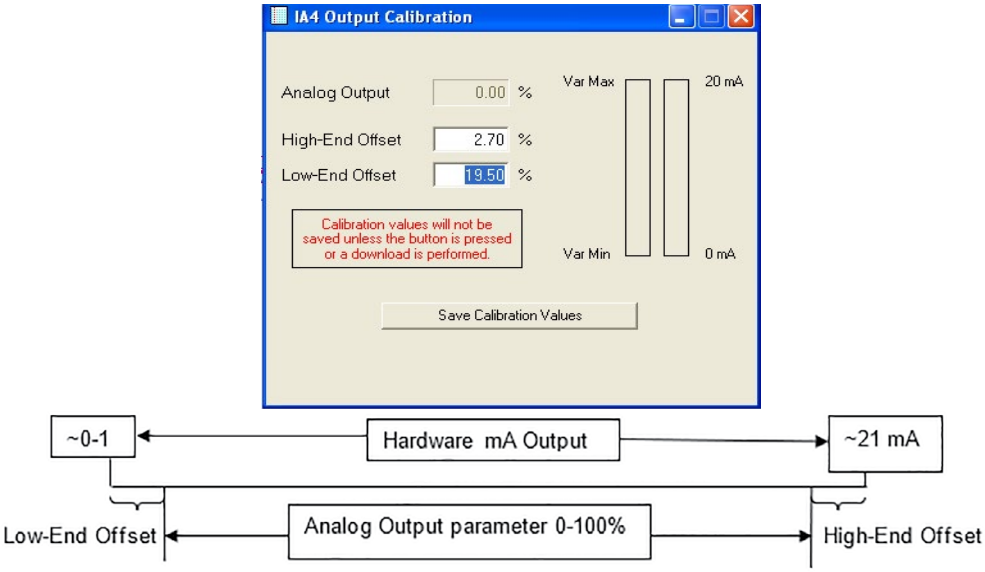


Output 1, Output 2 tabs	Each of the two setups has a tab to configure and scale a variable to be applied to the 4-20 mA output channel. The *Active* LED box indicates which channel is currently applied to the 4-20 mA output channel.
Enable DAC Output	This was a user option prior to firmware version 2.02. In all releases version 2.02 and later it is automatically enabled, and the option bit is ignored. The checkbox should not show up unless the software connects to an actuator with firmware version 2.01 or earlier.
Bandwidth	Is the break frequency in Hz 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	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 20 mA on the Analog Output.
% and mA Display	These displays are only active while online. 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, the Range is 0.000 to 5.000 in, and the actual Feedback Position is 2.500 in. Therefore 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 not the actual mA output.

10.5.4 4-20 mA Output Calibration

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



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

⚠ Make sure all configuration changes are saved to the actuator and save the drive file before calibrating.

To calibrate the 4-20 mA analog output:

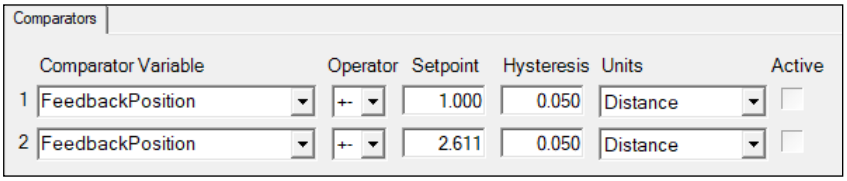
1) Connect a Loop Calibrator or loop power supply and DVM in mA mode to the Analog Output terminals of the actuator. Meter must be able to read to at least 20 mA with 2 uA resolution.
2) With the actuator disabled, record the correct values of the following parameters on the Output Setup that is Active 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 T2X090/115 and R2M/G090/115 or 6.5 for a Tritex II DC or AC 75 mm actuator in the High End Offset entry box as a starting point. Measure the current on the output which should be close to 20 mA.
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 T2X090/115 and R2M/G090/115 or 6.5 for a Tritex II DC or AC 75 mm actuator in the Low End Offset entry box as a starting point. Measure the current on the output which should be close to 4 mA.
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 is correctly calibrated and then disconnect the loop power supply and meter.

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

11. COMPARATORS

⚠ This feature is available in Firmware version 2.37 and higher for the Tritex TTX, TDX, RDM/G and T2X075 and version 2.20 or higher for the T2X090/115 and R2M/G090/115.

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.
Active indicator	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.

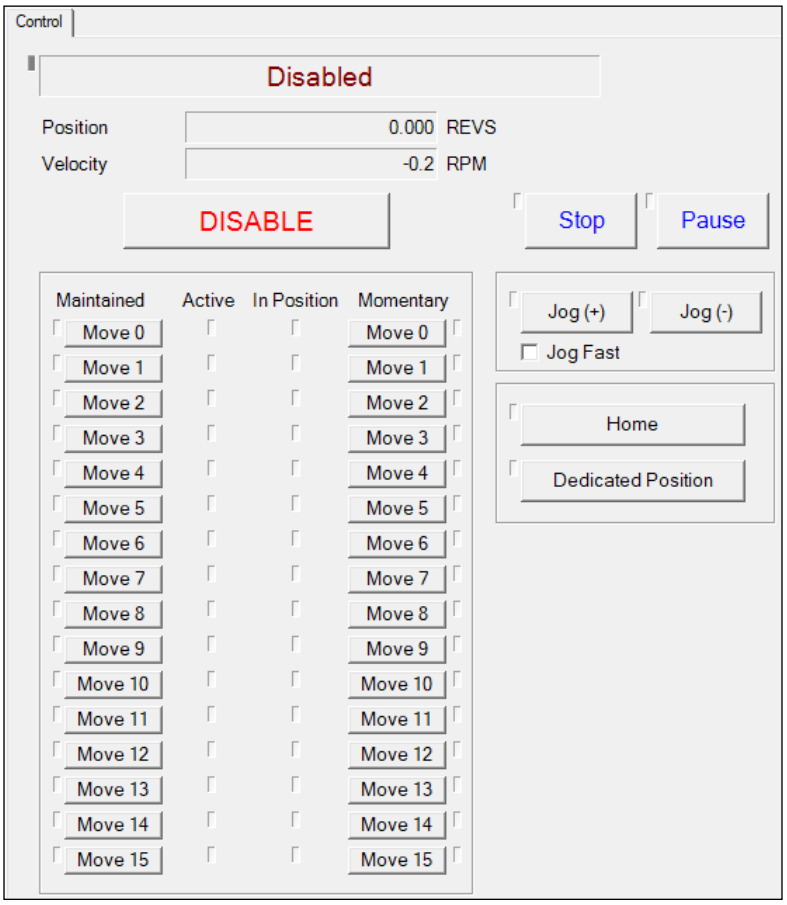
12. ADVANCED CONTROLS

12.1 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

12.2 CONTROL PAGE

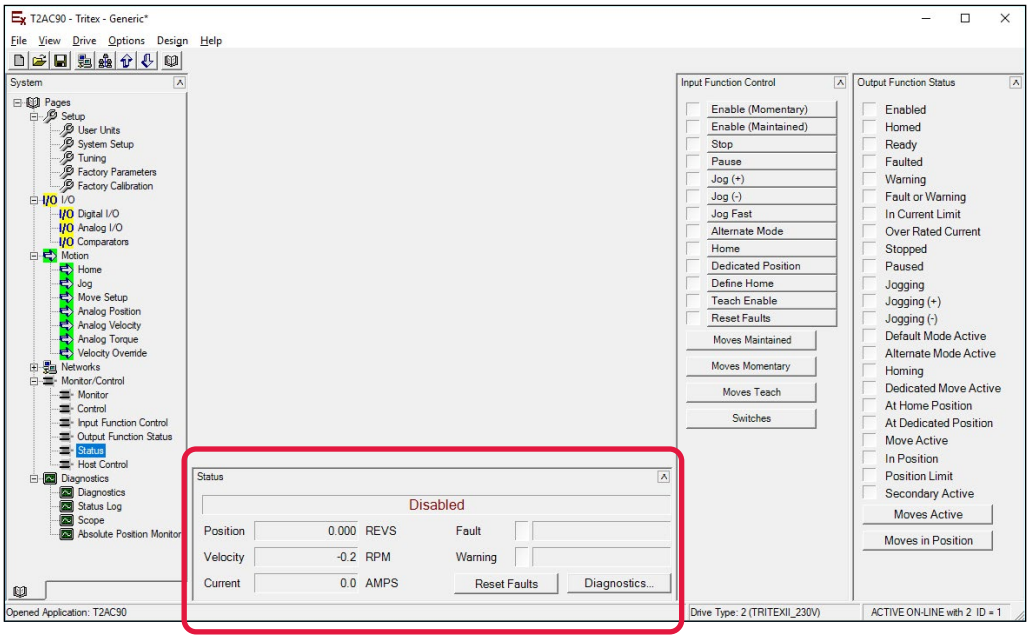
The *Control* page can be used for starting and stopping motion directly from the screen.



12.3 STATUS CONTROL

Operating state, key conditions, faults, and warnings can be viewed most easily on 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.

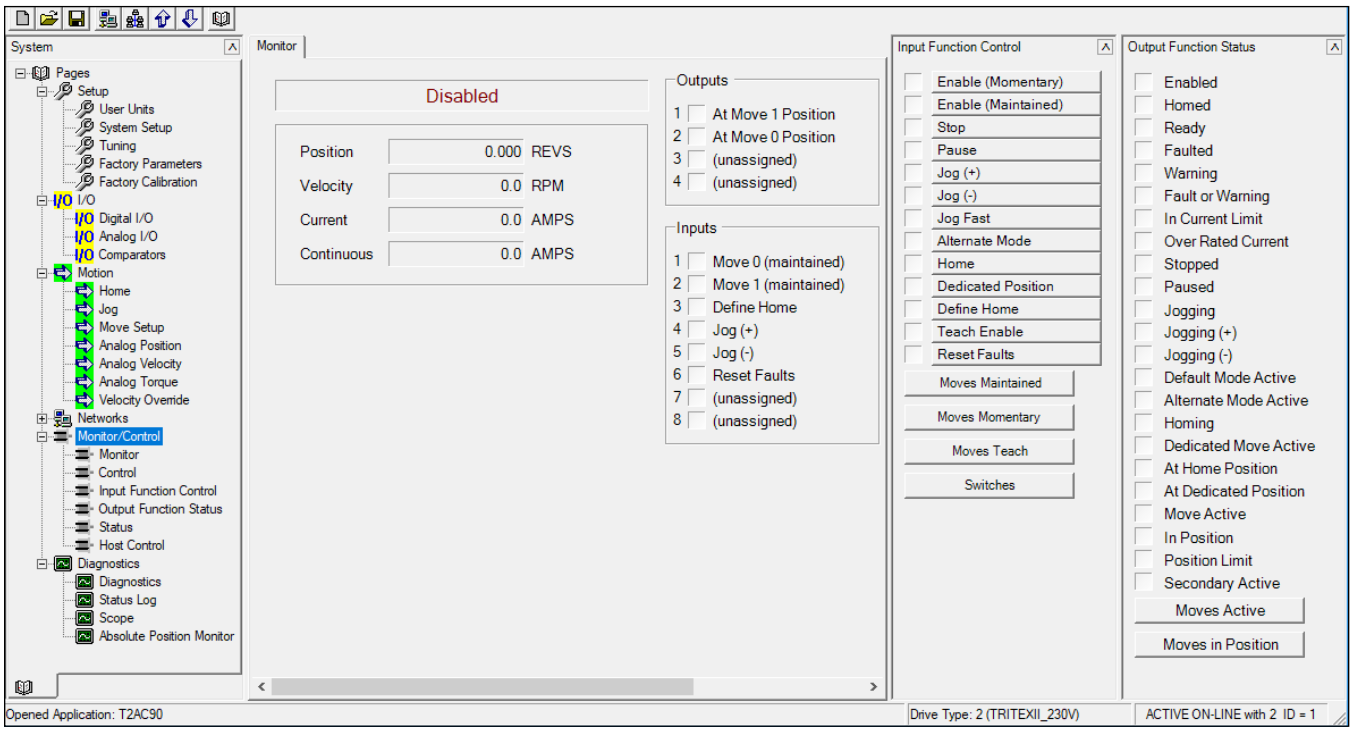
Faults & *Warnings* are also displayed on the *Status* page. A *Following Error* is displayed as the current fault condition for the example above. If the fault condition no longer exists, clicking the *Reset Fault* button will clear this fault. If the condition still exists, the drive will fault again.

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

12.4 INPUT FUNCTION CONTROL / OUTPUT FUNCTION STATUS

The *Input Function Control* allows the user to monitor and control all input functions. When enabled the control appears on the right-hand side of the screen. It can also be used in conjunction with the *Output Function Status*.

The *Output Function Status* indicates the status of all 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.



12.4.1 Input Function Definitions

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.
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 (+ / -)	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.
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.
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.
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.
Reset Faults	[1] 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.

[1] ⚠ Toggling the *Enable* input function performs this same action.

Teach Select	Performs a *Teach* function.
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.
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)	[1] 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*.
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 if 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 not affect 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, i.e., a switch being set active or inactive.
Switch Analog Output	When active applies the alternate analog signal to the analog output channel. Available on 4-20 mA Output only.
Calibrate Stroke	When this input function goes active, the Stroke Calibration sequence launches.

[1] 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.

12.4.2 Output Function Definitions

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.
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.
Jog (+ / -)	Indicates when *Jog* + or *Jog* - is active.
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.
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	[1] Indicates when the actual position is within the window, defined by the *In Position Window* parameters, of the defined *Final Home 2 Position*.
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.

[1] ⚠ 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.)

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

[1] ⚠ For Incremental Move Types: The At Move Position is NOT activated.

[2] ⚠ 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)

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

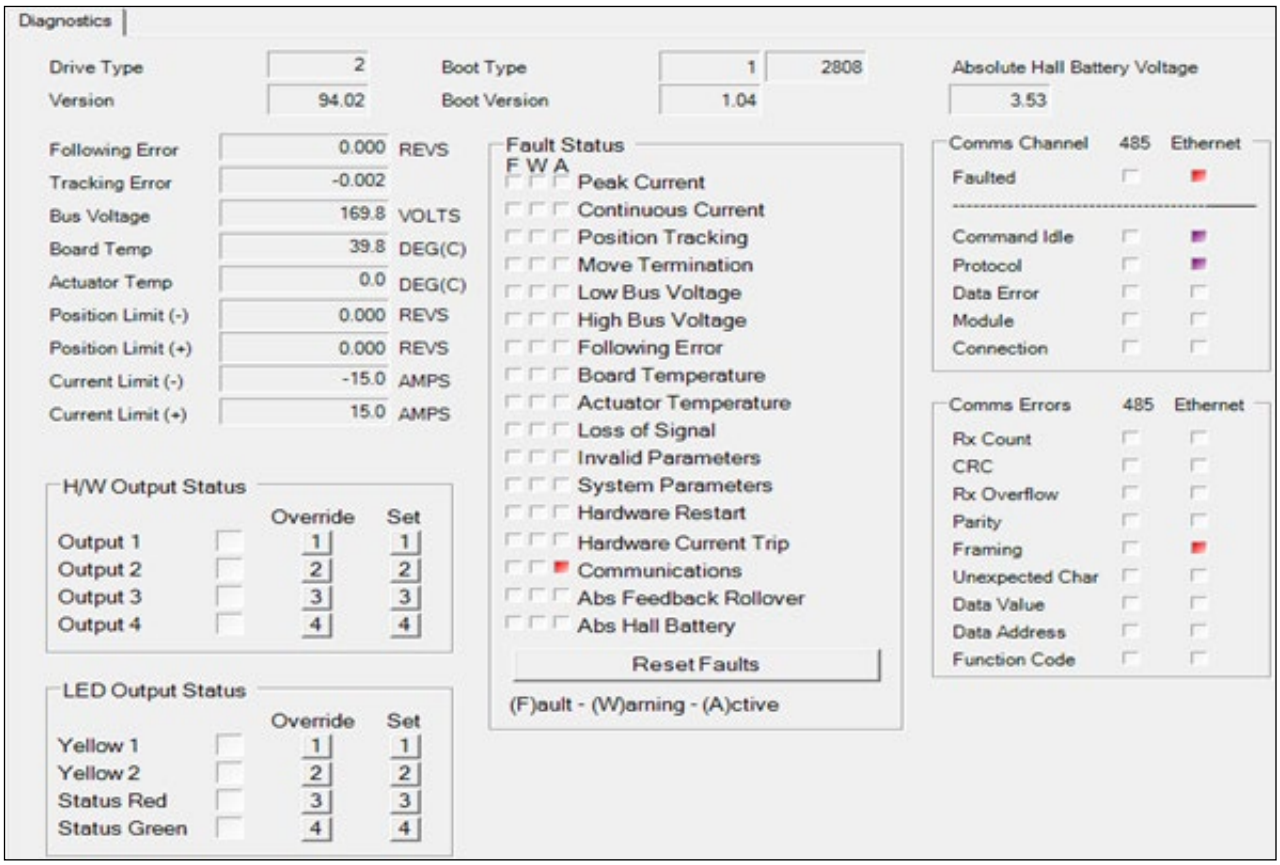
13. MANAGING APPLICATIONS

13.1 COPYING

When copying an existing set of user parameters to a different actuator to replace an actuator or create a new instance of a design, as long as the new actuator is the same drive type, it is possible to open the original application, connect, and download the user parameters. A normal download will not write factory parameters and a few other special parameters. Once written to the new actuator, the original application should be closed without uploading from the actuator. This is the best time to install the latest release of Expert software on the PC. Then create a new application for this actuator, connect, and upload parameters. The resulting new application folder will contain a complete record of the actuator parameters including factory parameters and parameters for new features for possible future use.

14. DIAGNOSTICS

14.1 DIAGNOSTICS PAGE



Groups	Description
Firmware Information	Shows the Firmware and Boot version of the actuator
Actuator Information	Shows the critical actuator information, such as position, temperature, and limits
H/W Output Status	Actuator outputs with method to set output to a logic state
LED Output Status	Shows current LED's status and method to force on
Comms Channel	Channel A and B communication status
Comms Errors	Channel A and B Modbus communication fault information
Fault Status	Displays the currently active faults and their severity F – Firmware hard fault is active, which could cancel the move operation. W – Firmware soft fault warning is active; the Warning will clear when the fault condition clears. A – Fault and/or Warning is active

14.2 STATUS LOG PAGE

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 needs 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 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.

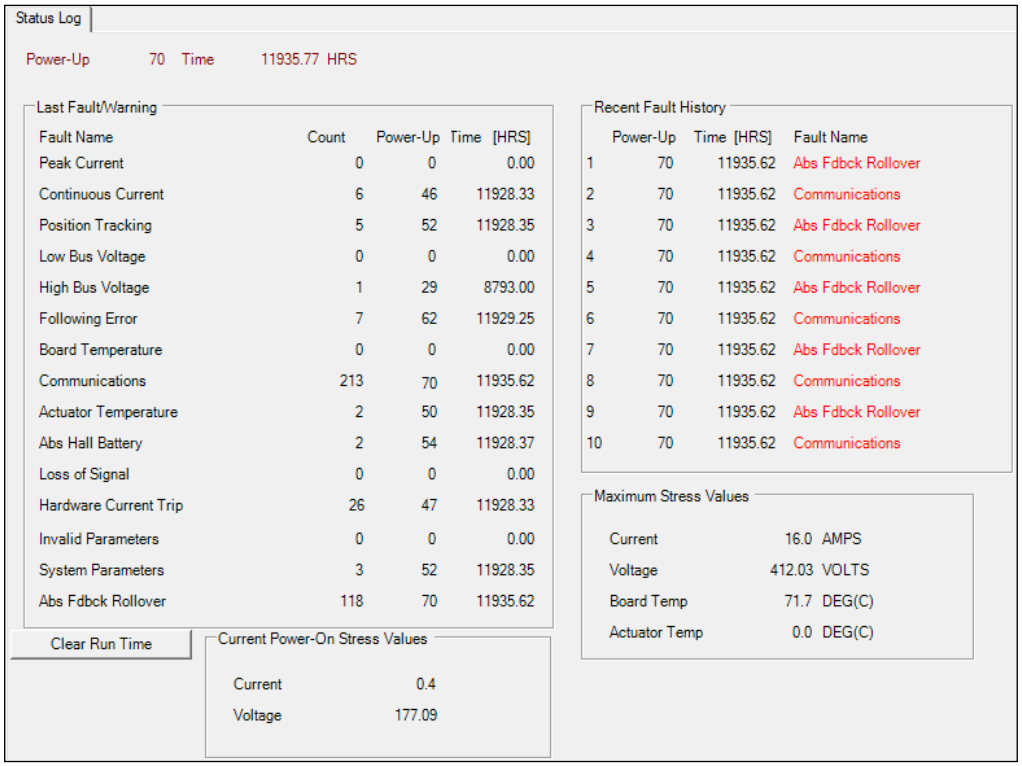
The *Recent Fault History* section displays the last ten faults that have been logged with #1 the most recent. The *Power-up* count and *Time* for each fault are also saved here.

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.

⚠ 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.

14.2.1 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 Error	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 Error* 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, hard stop, or end travel has been reached. Another cause could be attempting to accelerate a high inertia load too quickly. *Following Error* can and should be kept low by keeping requested motion within the limits of the actuator and properly tuning the actuator for its application.
Board Temperature	[1] 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.
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 another fieldbus.

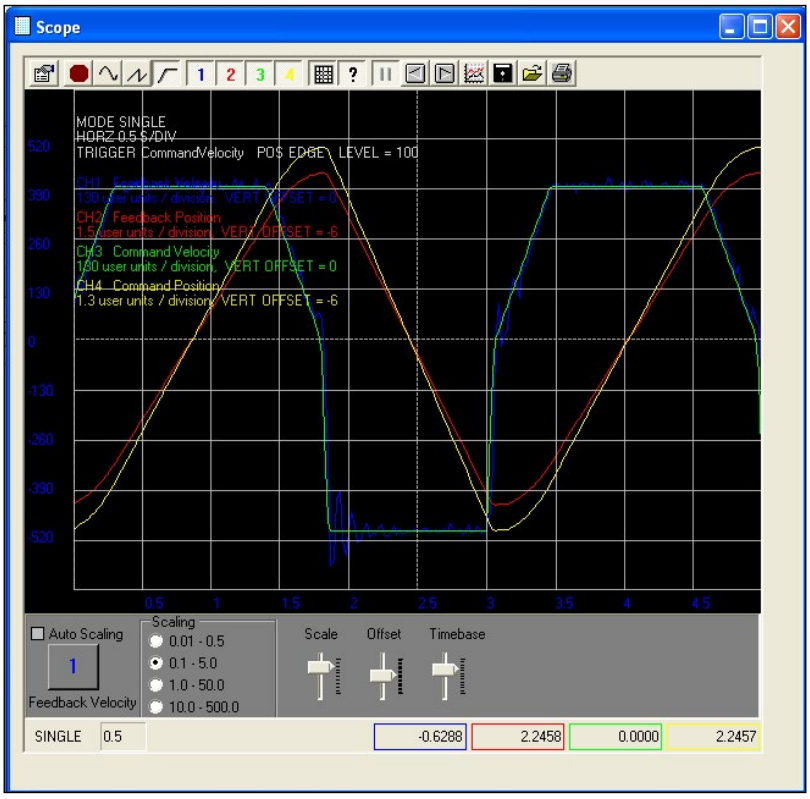
[1] ⚠ Power de-ratings apply to units operated at an elevated ambient.

Actuator Temperature	[1] This condition occurs when the temperature sensor in the stator winding reports a temperature higher than the factory set limit.
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 90/115 mm 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). 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. 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. 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 always saved, 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.

[1] 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.

14.3 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.



14.3.1 Button Controls

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

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 four buttons toggle the capture and display of the four channels.

This button toggles the grid lines.

This button toggles 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.

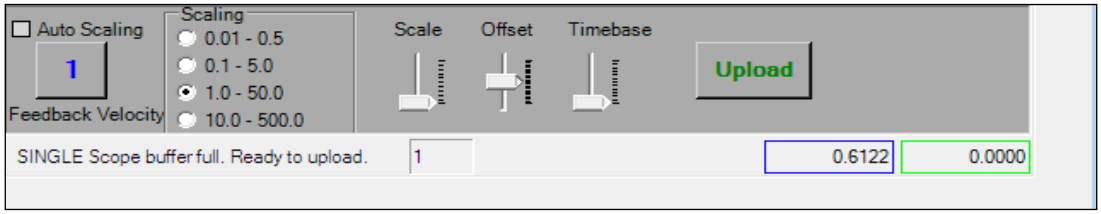
This button toggles between the default plotting method of data over time and the secondary method of plotting channel 1 over channel 2.

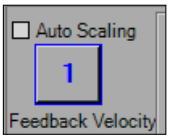
Save the data to a CSV file.

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.





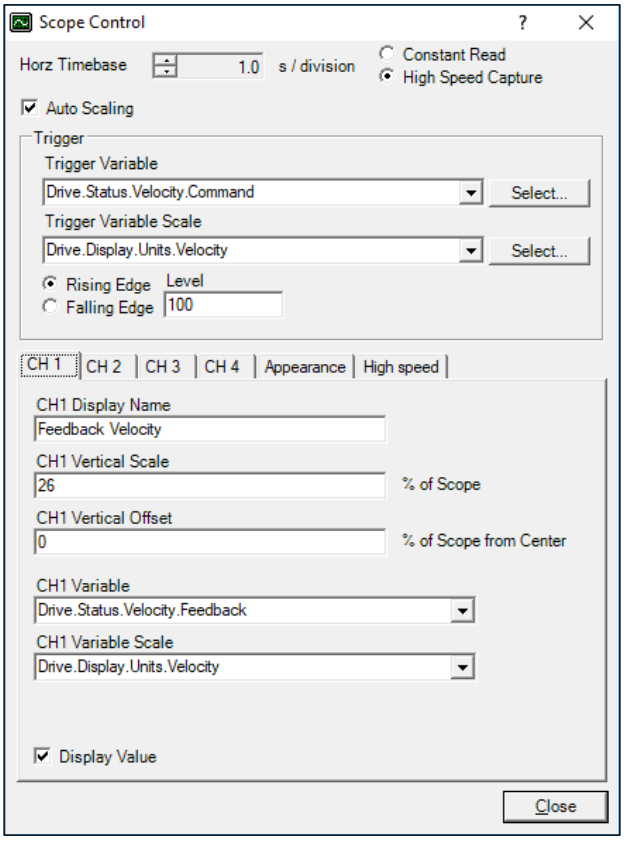
This button, whose number changes as it is toggled, selects which channel will be affected when the *Scale* or *Offset* slide bars are used. This is also the channel that the values displayed on the vertical grid line will represent.

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.

14.3.2 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.

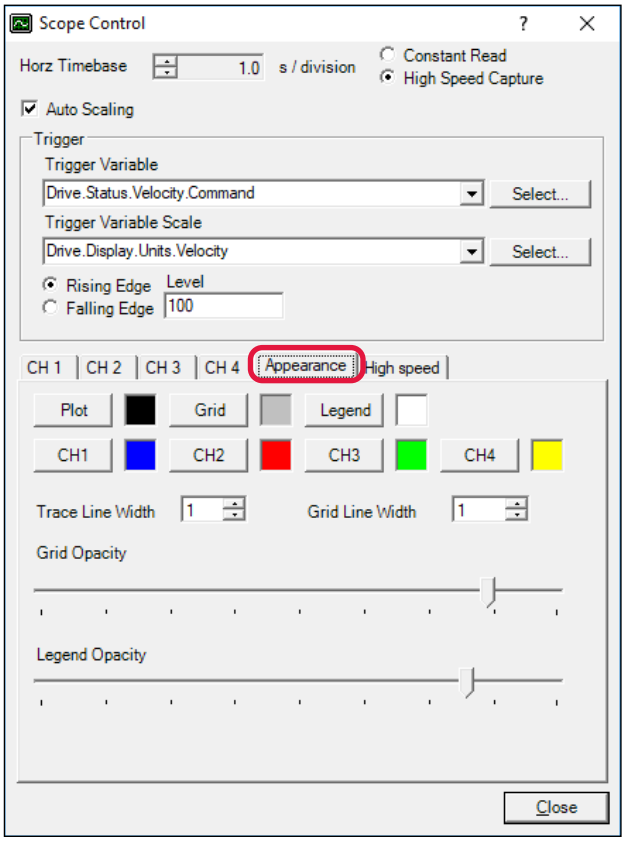
Channel Setup

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.

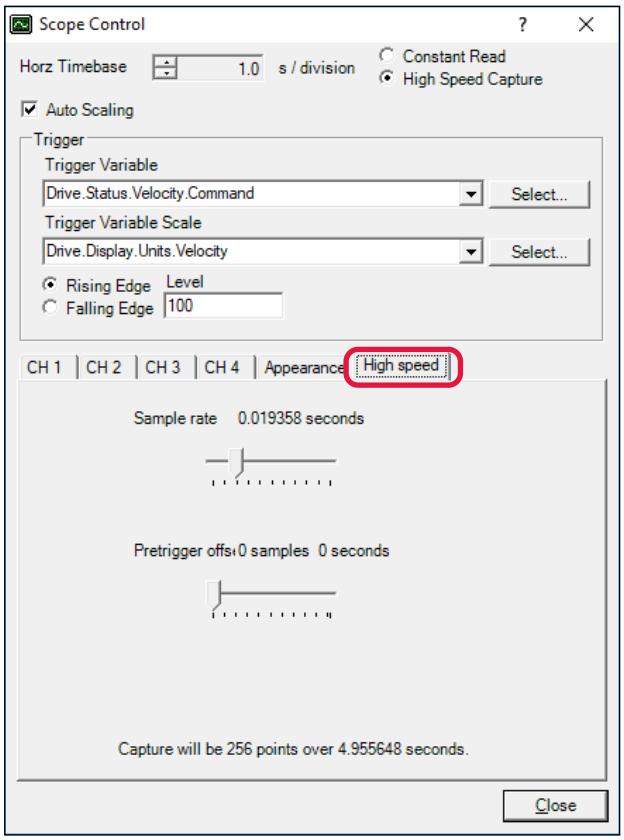
Scope Appearance

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.



15. FIELDBUS OPTIONS

15.1 ETHERNET/IP OPTION

15.1.1 Functionality

For detailed information on Tritex TTX & Tritex II EtherNet/IP & Rockwell AOI User 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

15.1.2 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.

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

15.1.3 Tritex Expert Software IP Address Configuration

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.

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

Changes to Ethernet parameters 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.

15.1.4 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.

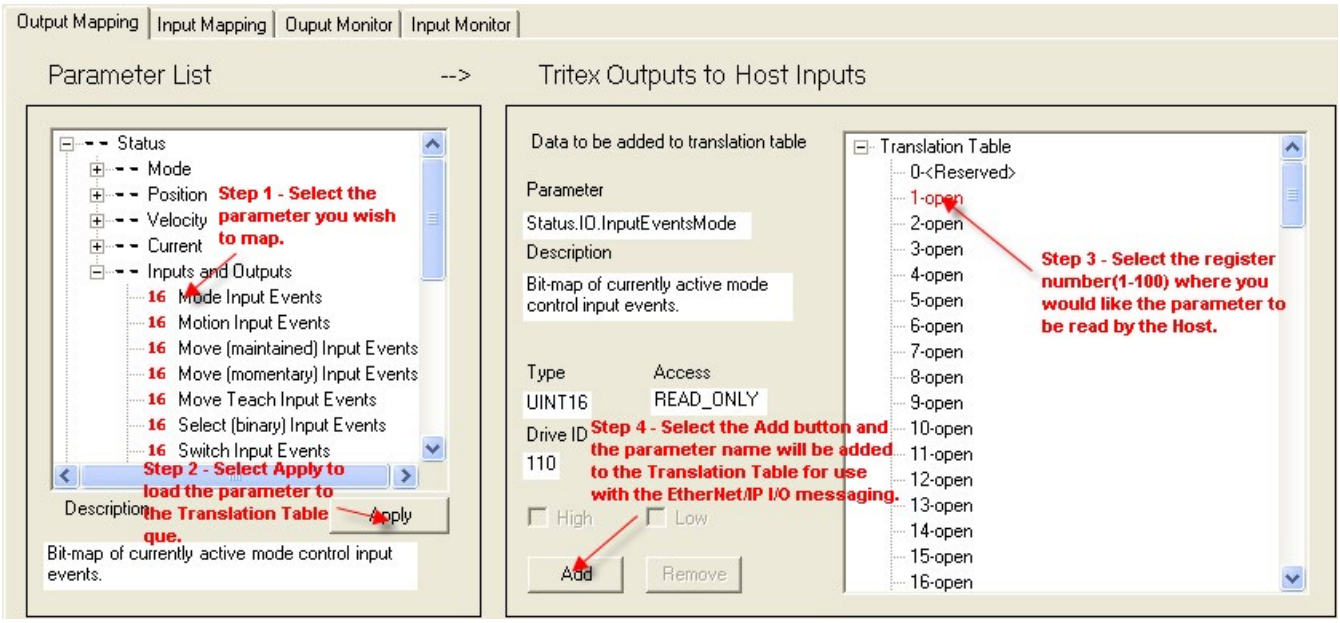
A *Host* is the device capable of initiating an EtherNet/IP Implicit connection with the Tritex, such as a PLC or other plant control system. The *Assemblies* used to setup the *Host* and transmit I/O Messaging data are:
Assembly 101 is defined for Host Inputs(Tritex Outputs) with a data size of 101 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.

⚠ 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.

15.1.5 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.

⚠ 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.

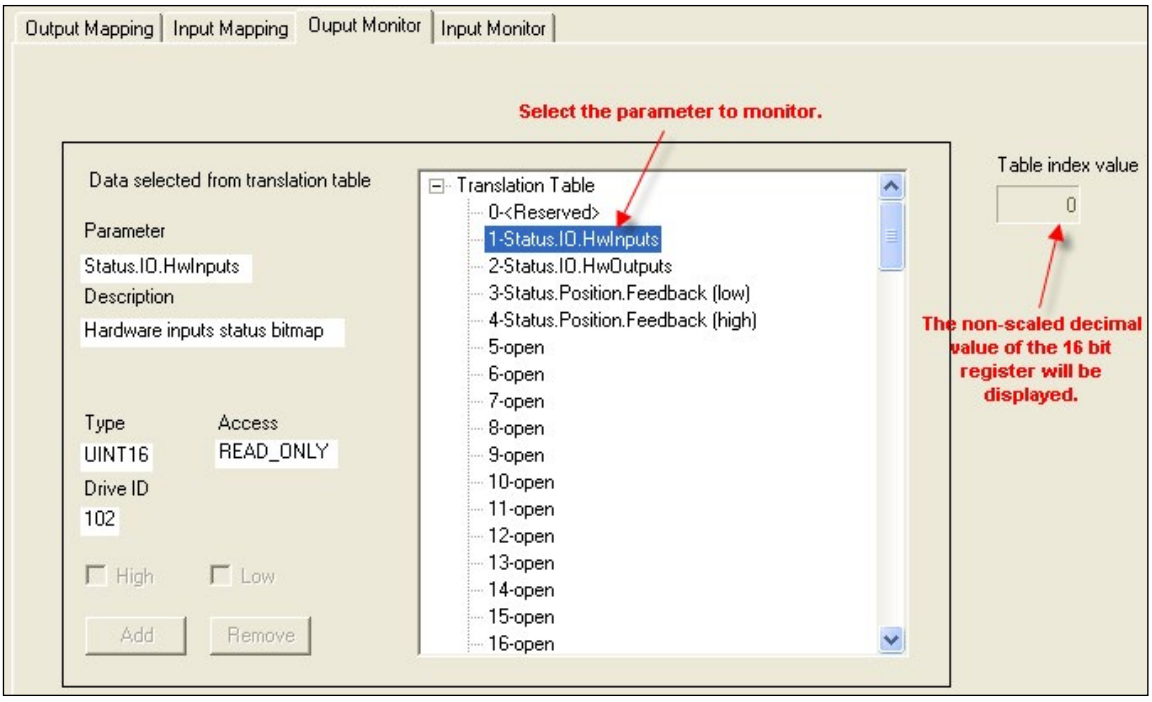


Selecting parameters to be mapped to the Translation Table.

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.

15.2 PROFINET IO OPTION

15.2.1 Functionality

⚠ 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.

15.2.2 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 IO 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.

15.2.3 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.

15.2.4 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.

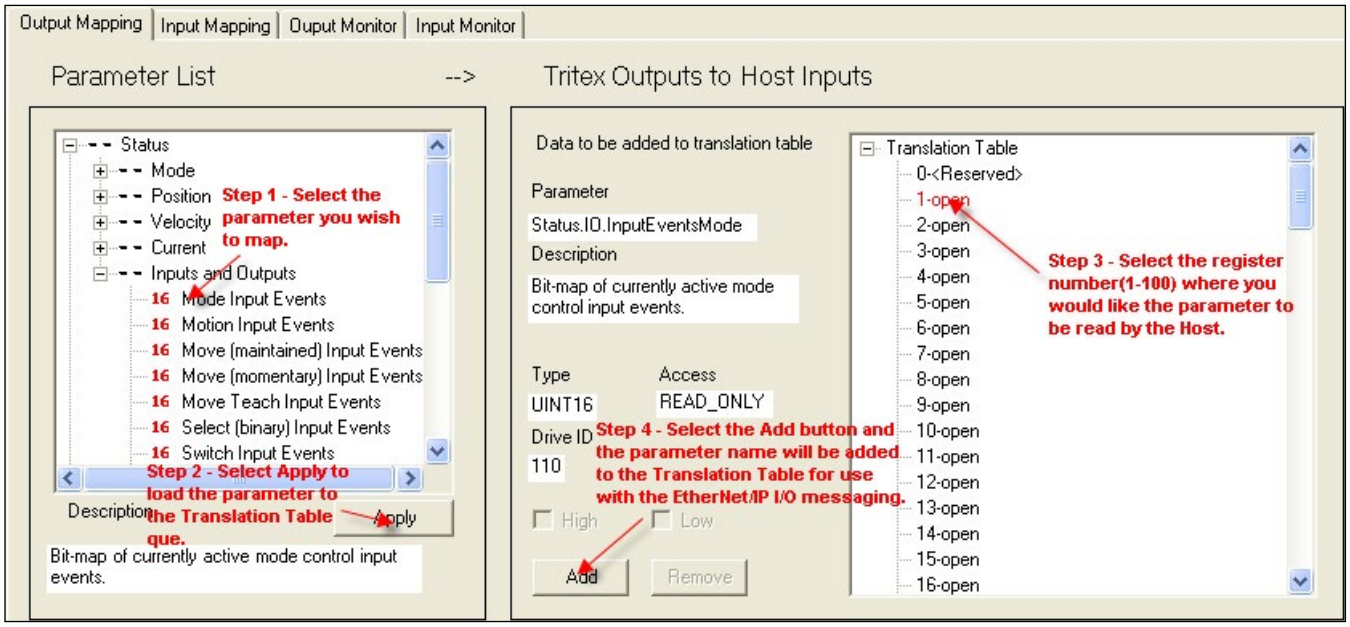
A Host is the device capable of initiating a PROFINET IO connection with the Tritex, such as a PLC or other plant control system.

⚠ 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.

15.2.5 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.

⚠ 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.



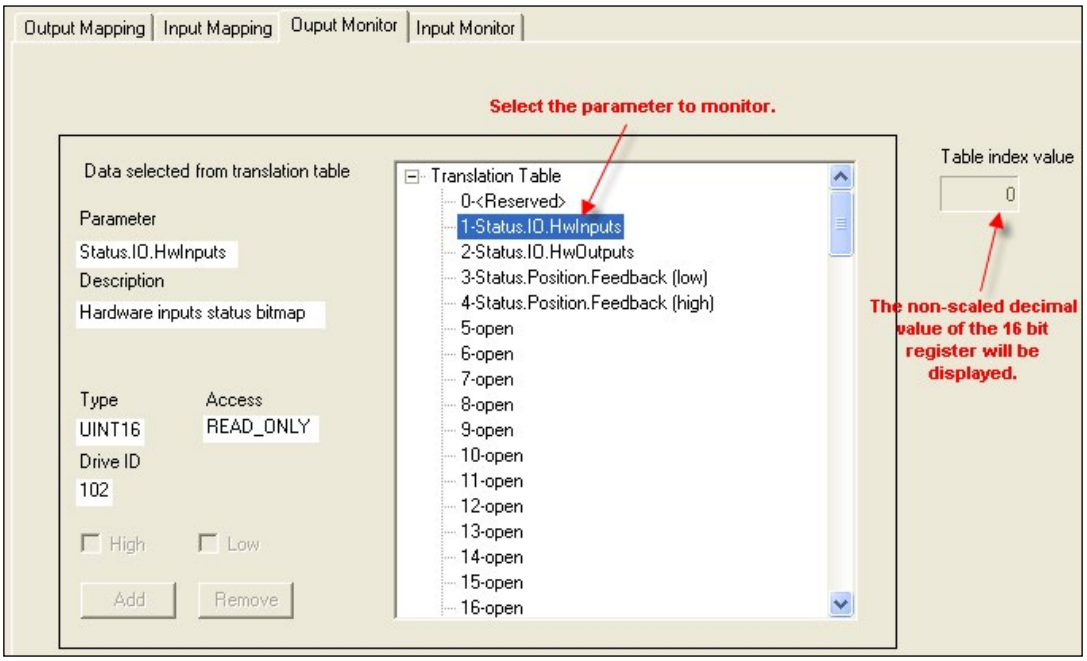
Selecting parameters to be mapped to the Translation Table.

⚠ 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.

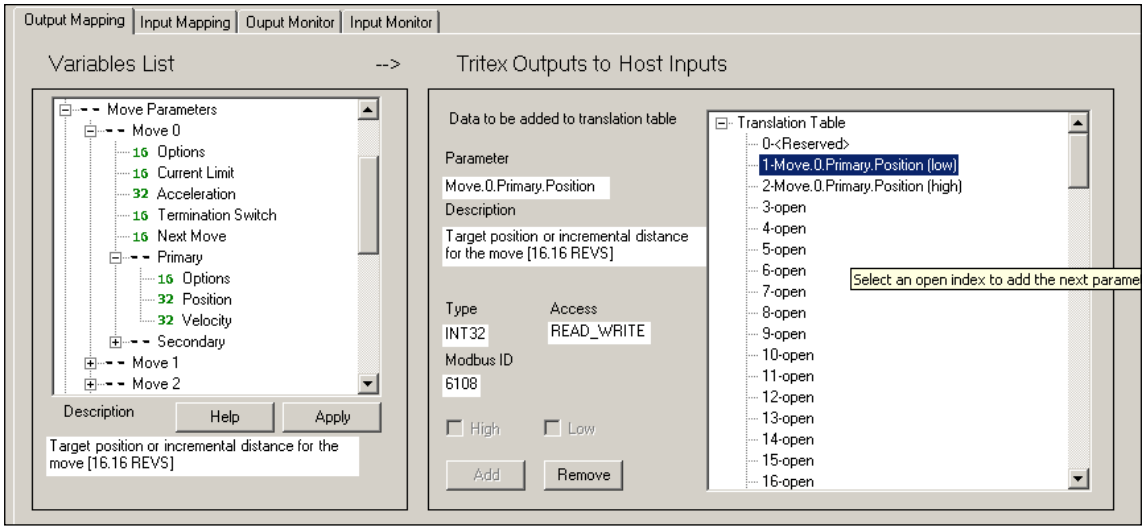
Assigning the parameters to be transferred between the Tritex and PLC is simple; the hard part is understanding the Tritex parameters and their format so they can be controlled from the PLC. The *Tritex II Parameters Manual* describes the function of every parameter, in some cases even the interaction 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.



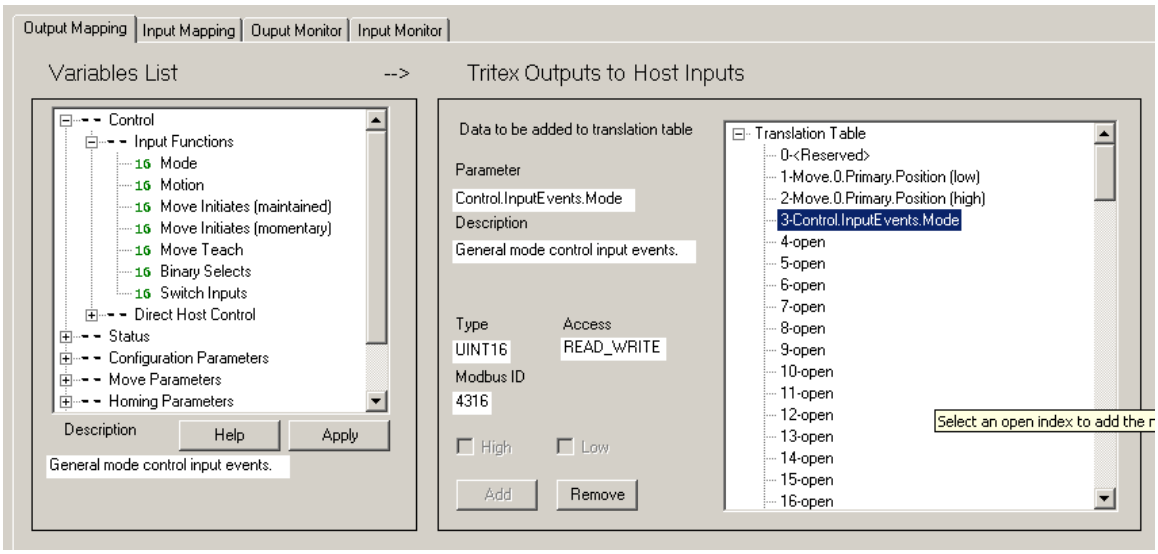
Monitoring parameters to validate data sent/received by the host.

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* subgroup 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

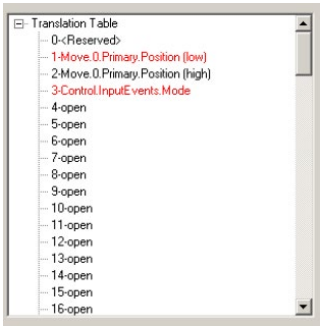
RESET	BKOV	TSEL	TENA	H2	H1			ALT						EL	EE
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

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*.

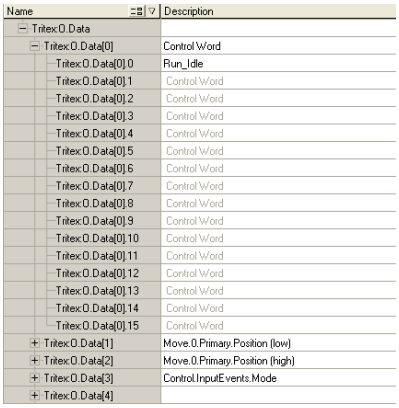
The below figure shows the relationship between Tritex *Input Translation Table* to RSLogix Output controller tags

Tritex Expert Software



Inputs

RSLogix (I/O Connection)



Outputs

Tritex Input vs. RSLogix Output Tags

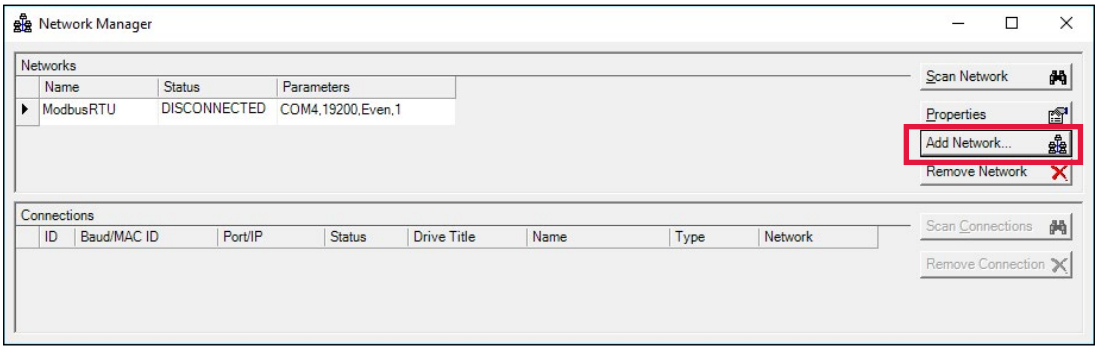
15.3 MODBUS TCP OPTION

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.

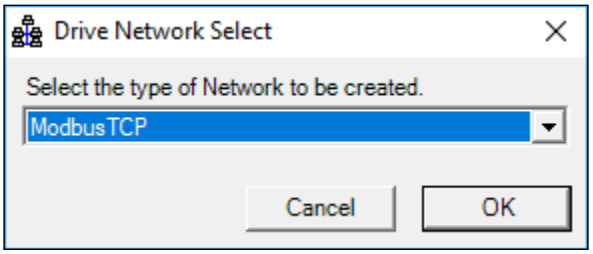
It is necessary to connect Expert Software with an actuator over Modbus TCP to change the Ethernet parameters such as the IP address for the intended application. The following procedure shows how to establish a connection.

Select *View* → *Network Communications Manager* or click on the  button.

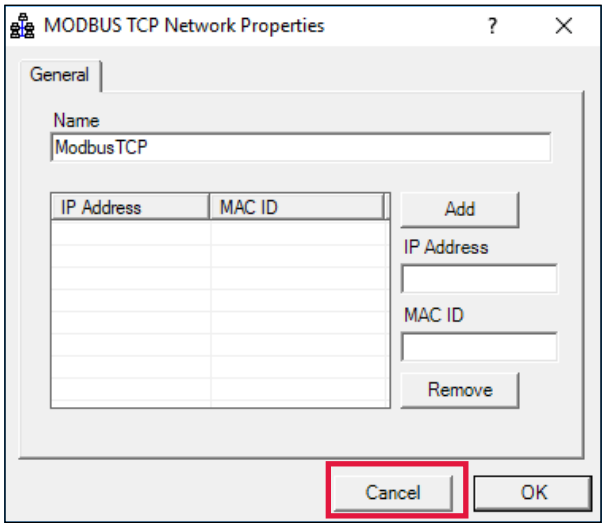
1) Click on the Add Network button. This screen currently shows a Modbus RTU connection present.



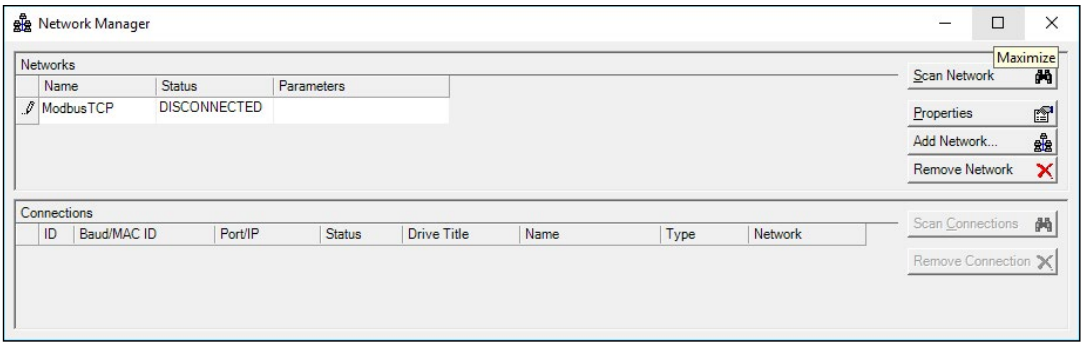
2) Select the Modbus TCP from the drop box.



3) Close the MODBUS TCP Network Properties window that opens.



4) The Network Manager will now show both a Modbus RTU and the new Modbus TCP connection.

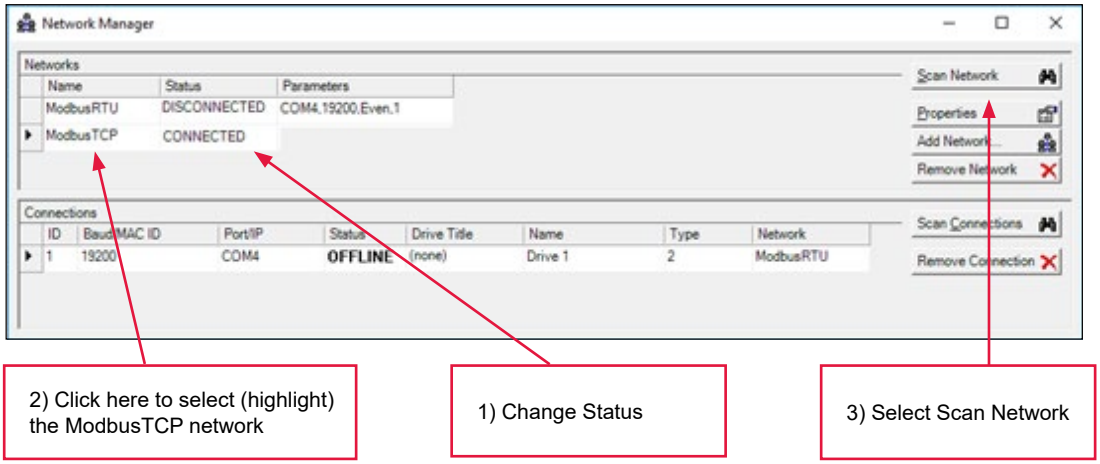


5) Scan for Drive

a) 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

b) Select the ModbusTCP Network

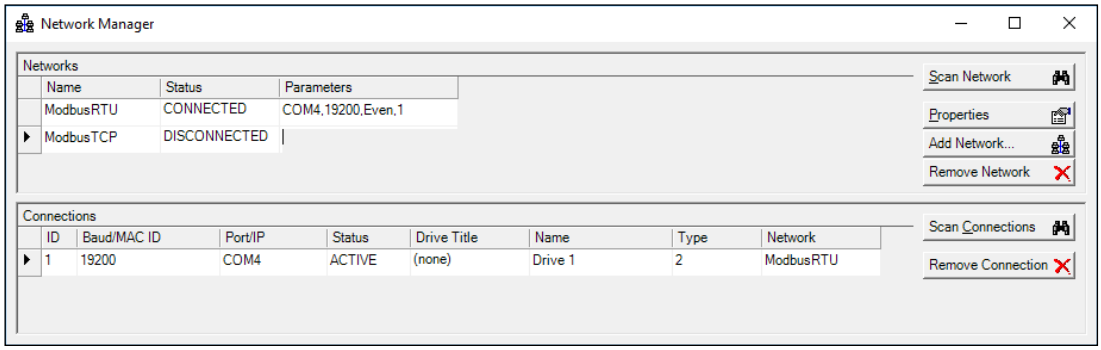
c) Scan network



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

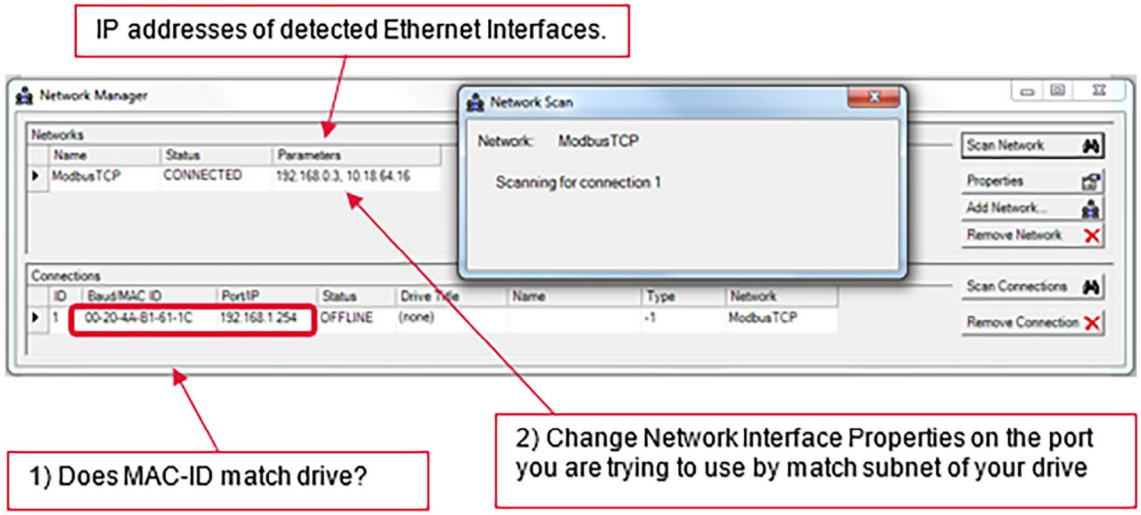
15.3.1 No Ethernet Network is Found

If no Ethernet Network is found, continue with these steps



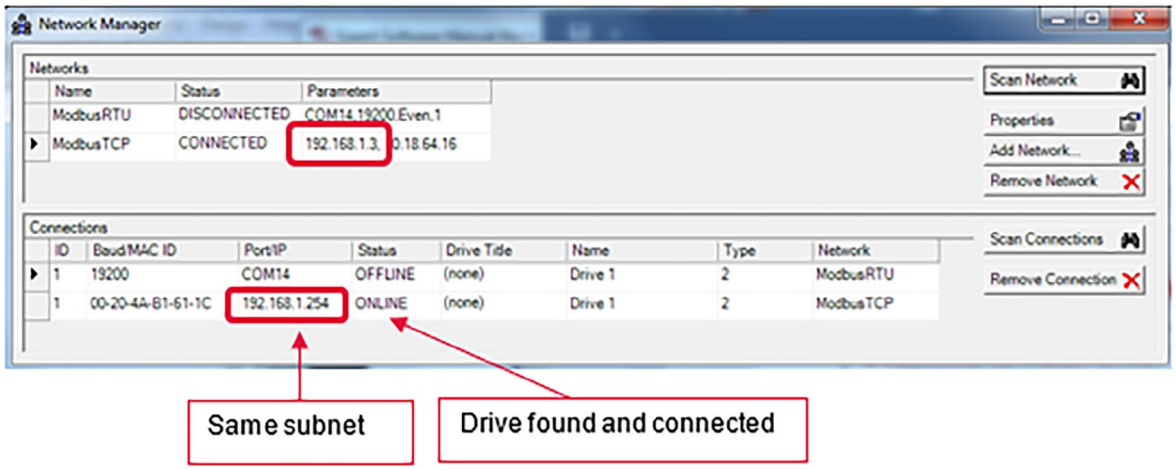
Above image is after 'Scan Network' and Ethernet Network interface not detected. This is not a likely result, but needs to be fixed in the PC first. More likely there will be one or more IP addresses. However if nothing shows up in the Connections area as shown above, there is a problem with the Ethernet 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.

15.3.2 Use a 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 press *Scan Connection* button again.

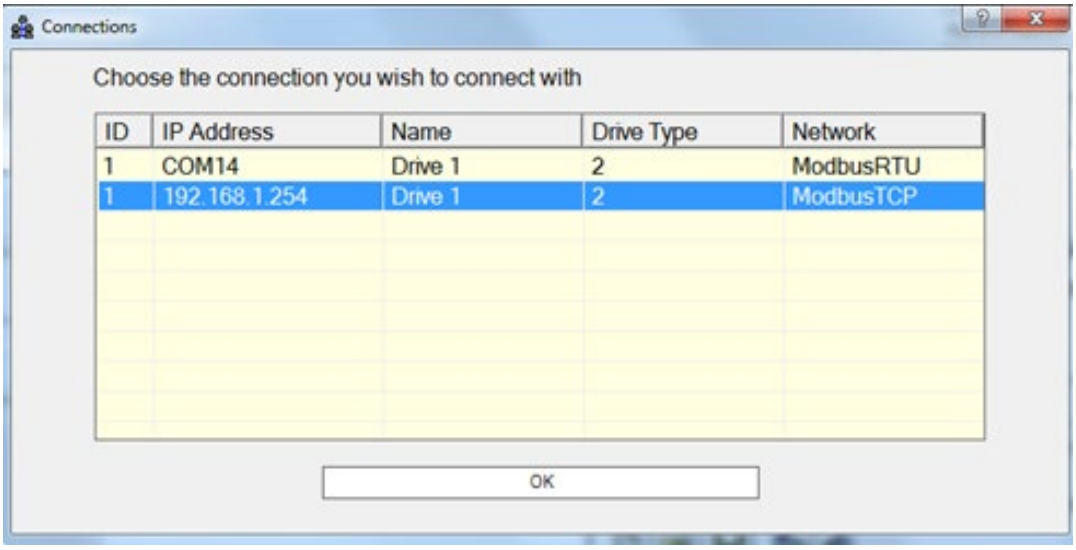
If more than, one TCP drive is found, select the drive that matches MAC ID by highlighting drive in 'Connections'. This will become the active drive. If all that was desired was to find the IP address, the task is done. If the IP address needs to be changed see the Change IP Address section.



15.3.3 Change IP Address

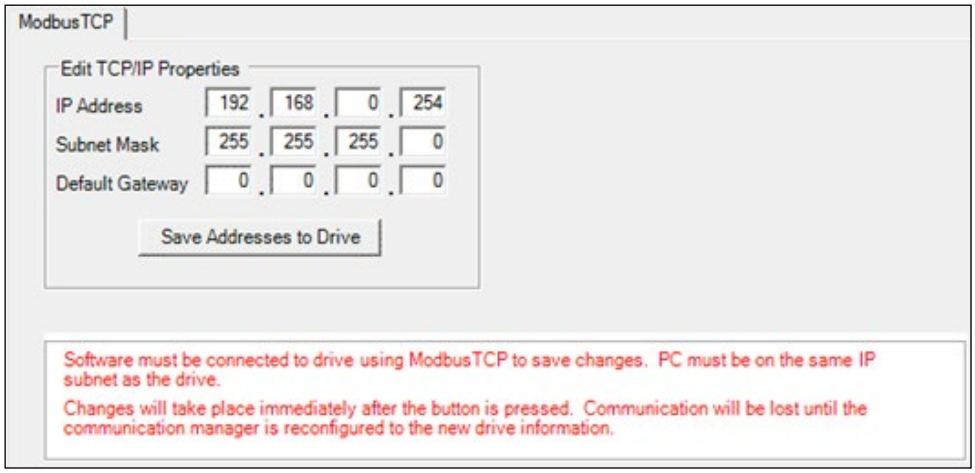
Select *Drive* → *Read Parameters from Drive* or click on the  button.

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.

⚠ 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.



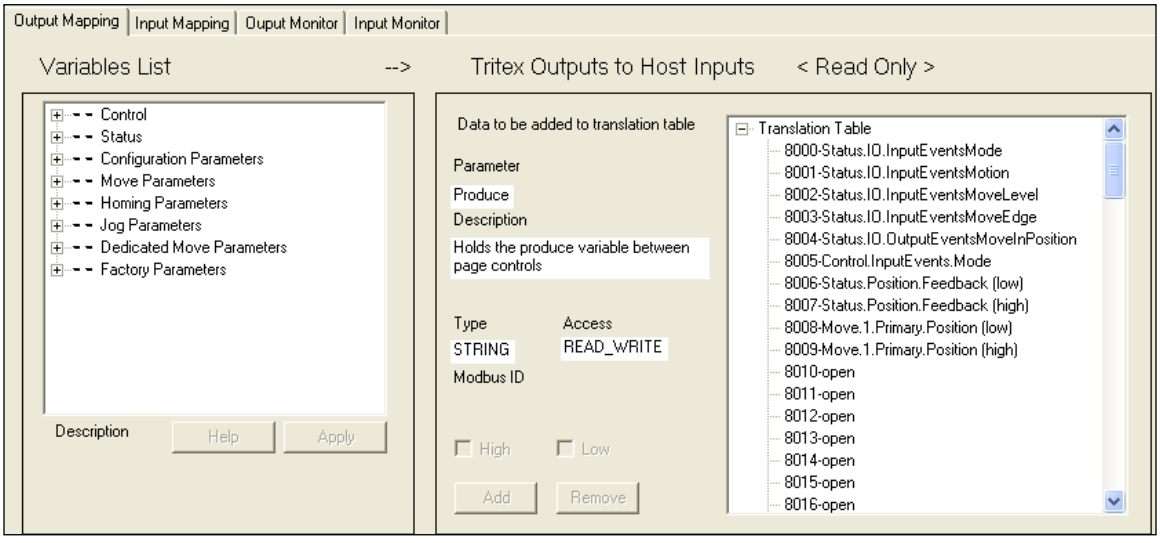
After saving to drive, the connection will be lost immediately. Many times there is no further reason to connect to the drive via the ModbusTCP network from Expert Software. The connection can be accessed over the ModbusRTU network. Reconnection is possible over ModbusTCP, but the Network Interface may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

⚠ Expert Software must be connected to the actuator using Modbus/TCP to change IP Properties.

15.3.4 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.

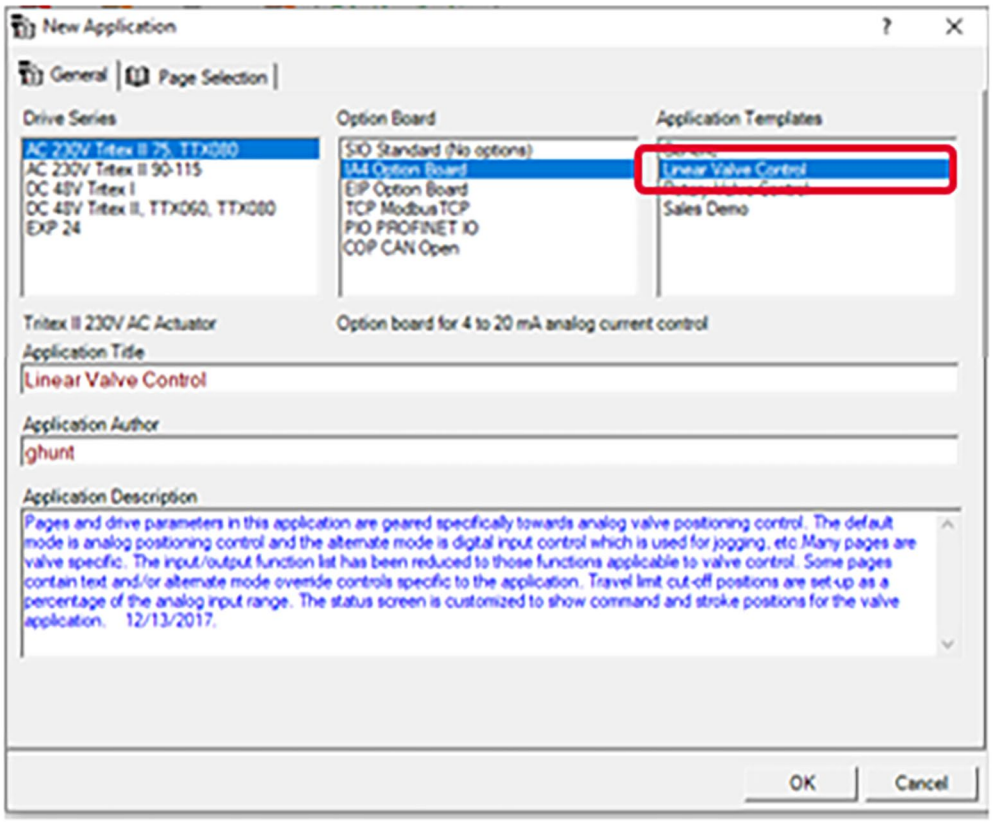


(See the *Tritex Data Mapping to I/O Registers* in *EtherNet/IP Options* section for detailed instructions on how to setup and edit these tables.)

16. VALVE CONFIGURATION

16.1 STARTING A NEW VALVE APPLICATION

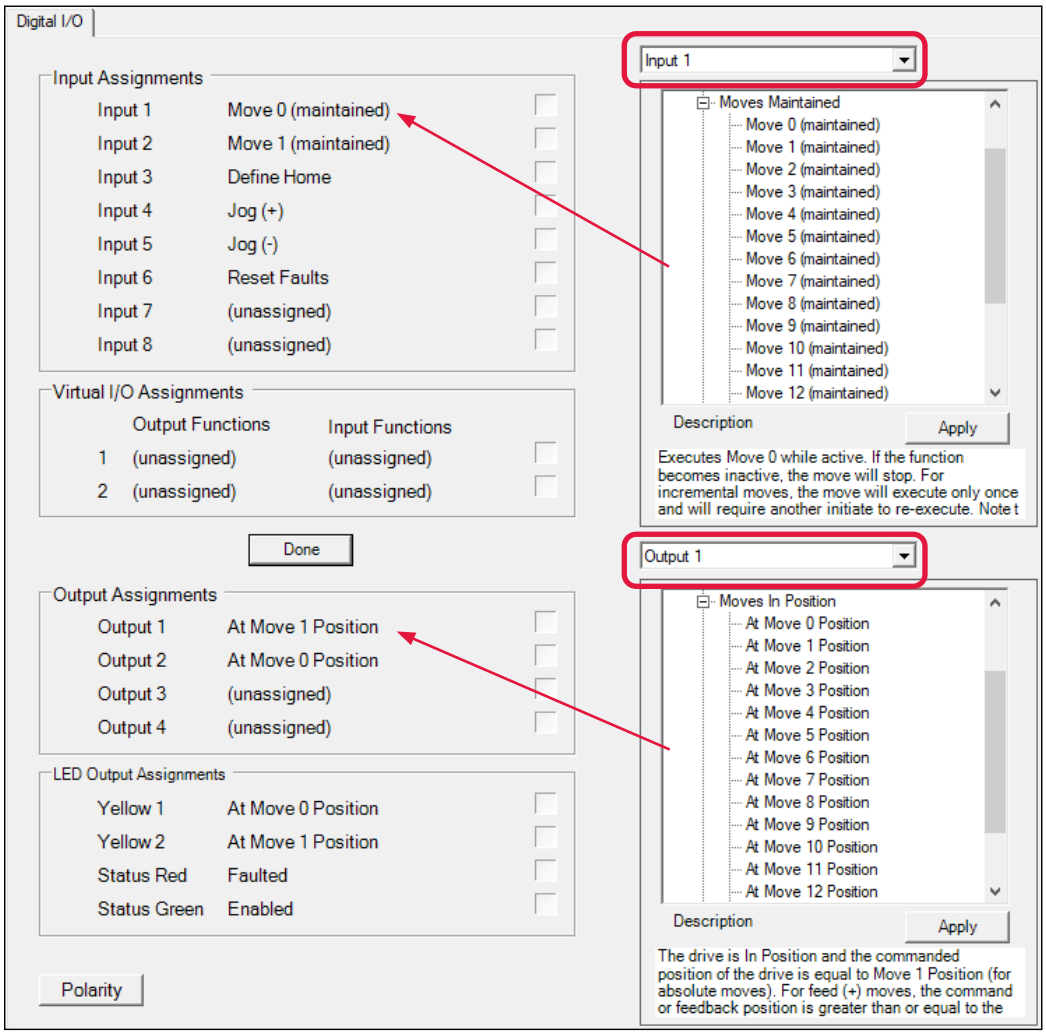
Select *File* → *New* → *Application* or click on the button.



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

16.2 VALVE DIGITAL I/O

Click on the *Edit* button to show the *Input / Output* selection screens.



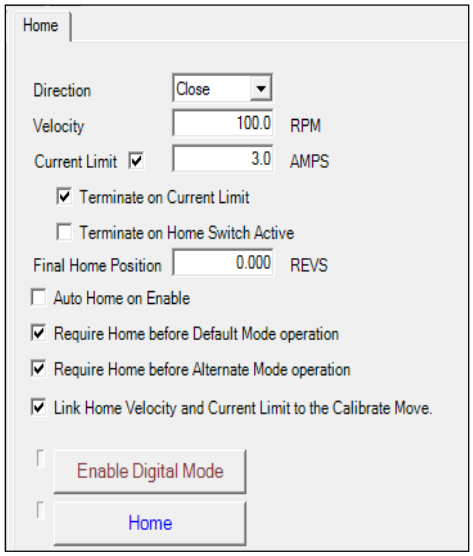
Select the *Input/Output* from the drop box.

Select the desired function from the Functions tree. A description of the function will appear for the action that will be taken. Click the *Apply* button to assign the function to the selected Input/Output.

A few additional items that are available specifically for valves are:

Calibrate Stroke	An input event which will initiate the stroke calibration.
User Configuration Reset	An input event which will clear the stroke calibration completed flag.
At Closed Position	An output event which will be active when the actuator is at the closed position.
At Open Position	An output event which will be active when the actuator is at the Open position.

16.3 VALVE APP HOME

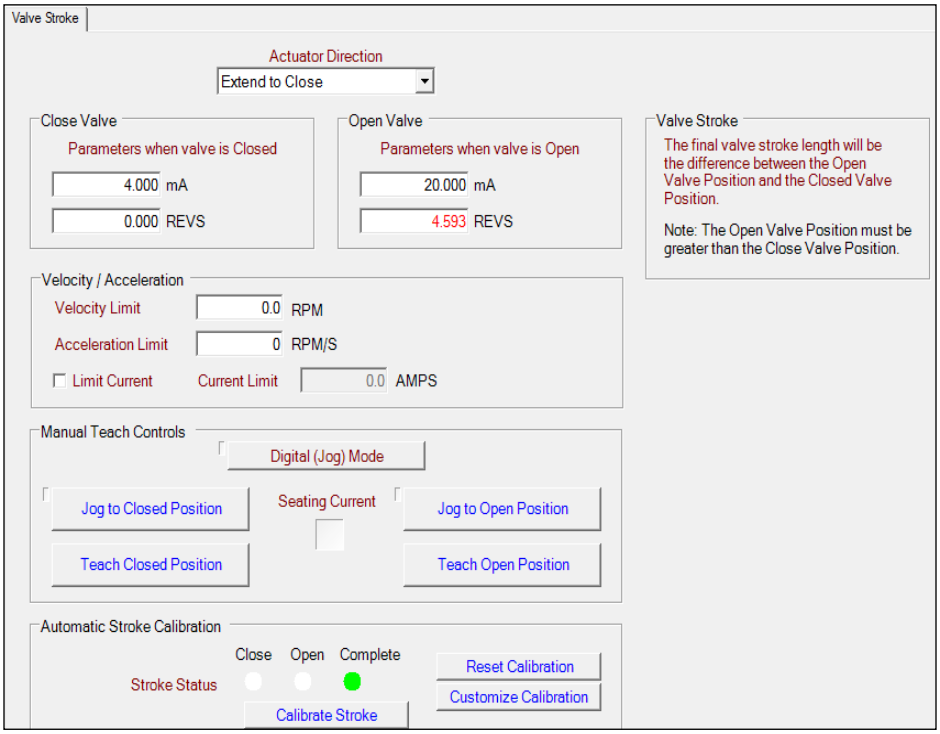


Direction	Select plus or minus direction; minus is the default.
Velocity	This is the *Home* move maximum velocity. This may or may not be achieved, depending on the distance traveled and acceleration parameter.
Acceleration	The acceleration ramp used during a *Home* move.
Current Limit	[1] This sets 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)
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 from 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	[2] If checked the Velocity and Current Limit for the Stroke Calibration will be set to the same values as the home move.
Enable Digital Mode	If pressed selects alternate (digital) control mode to allow home and jog functions.
Home	If pressed initiates home motion.

[1] 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.

[2] 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.

16.4 VALVE STROKE



Actuator Direction	[1] *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.
Close Valve/Open Valve	[2] Enter the mA position you need for the closed and open positions. This can be either 4 mA or 20 mA, depending on your control loop configuration.
Velocity/Acceleration	Set the Velocity and Acceleration Limits for the valve stroke.

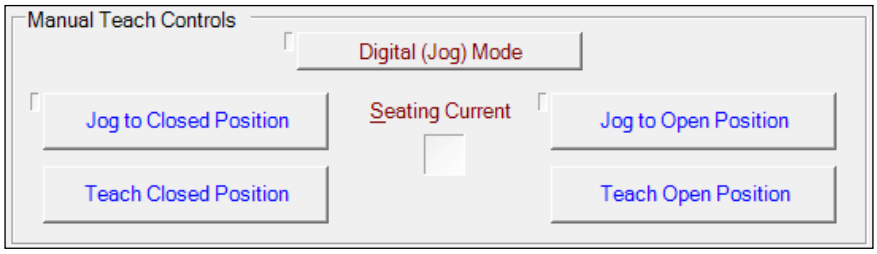
1 ⚠ Changing this flag changes the definition of all absolute position and therefore automatically clears the *Homed* output function. A Home is required to resume operation.

There are three methods of determining the stroke or span of the valve: The desired positions corresponding to 4 mA 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.

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

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.

16.4.1 Manual Teach Controls



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.

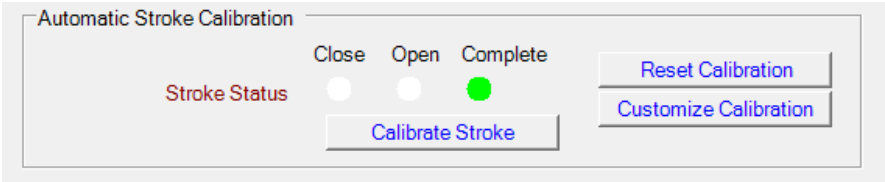
⚠ The analog signal will be disabled while in digital mode.

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.

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

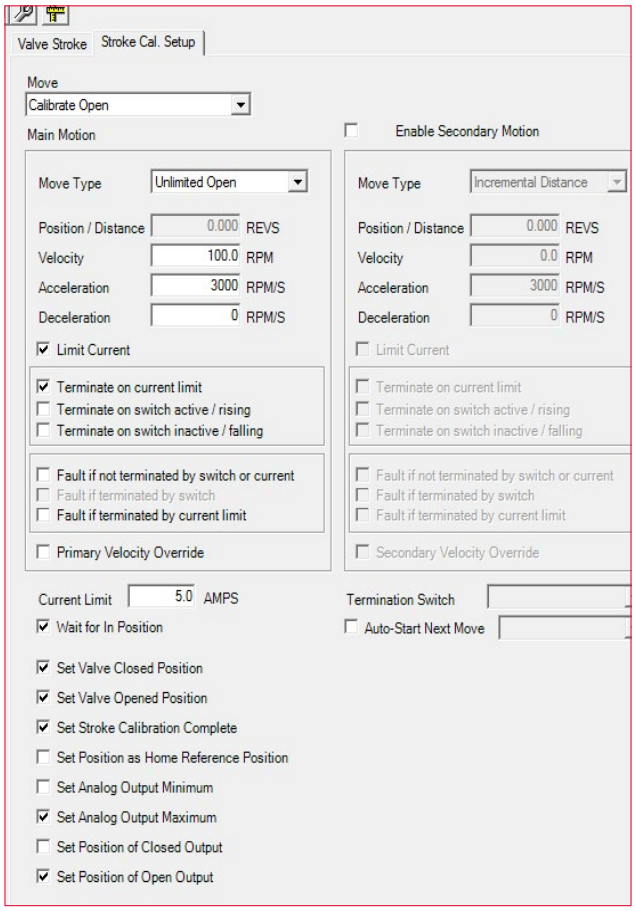
16.4.2 Automatic Stroke Calibration

⚠ 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 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.

16.5 CUSTOMIZE STROKE CALIBRATION



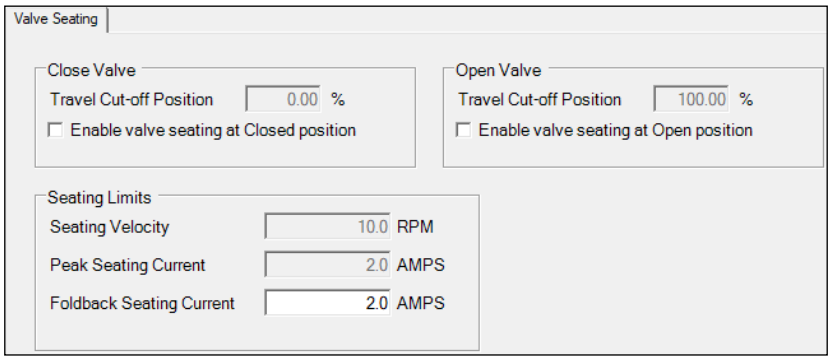
Customize Calibration allows the user to customize the complete calibration process. Except for the select boxes on the bottom, the page is just like the Move Setup page used in the Generic Application and described earlier in this document except instead of Move 0 – Move 15, the moves are Calibrate 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.

16.5 VALVE SEATING



Travel Cut-off Position	[1] 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.
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	[2] 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

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