TriStation 1131 Developer's Workbench

Developer's Guide

TriStation 1131, Version 4.1

Assembly No. 9700100-003

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Contents

Preface

TriStation 1131™ Developer's Workbench is a software application for developing, testing, and documenting safety-critical and process-control applications that execute on Triconex controllers.

New Features in TriStation 1131 v4.1

The following are new features in TriStation 1131 version 4.1:

- MS Windows 2000 and Windows XP compatible.
- Support for new Analog Input and Digital Output (Next Generation IO) modules.
- Support for the Tricon Communication Module (TCM).
- Backup project file is automatically saved after a Download All or Download Changes.
- New feature—Restore Project To Last Download—allows the file which was saved after the download to be restored as the project file.
- Write to File feature for intermediate ST code.

Note For more detailed information about the changes made in each TriStation 1131 v4.1 release, see the *Product Release Notice for TriStation v4.x*, available on Triconex CustomerNet.

Summary of Sections

- Chapter 1, Project Administration—Explains how to install the TriStation 1131 software, create a project, set up security, and use libraries of functions and function blocks.
- Chapter 2, Application Development—Explains how to develop an application.
- Chapter 3, Controller Configuration—Explains how to configure modules used in the installation.
- Chapter 4, TriStation 1131 Communication—Explains how to set up communication between a TriStation 1131 PC and Triconex controller.
- Chapter 5, Implementation—Explains how to implement an application on a controller.
- Appendix A, Commands and Properties—Describes TriStation 1131 commands, properties, and tools.
- Appendix B, Data Types—Describes data types included with the TriStation 1131 software.
- Appendix C, TCM Model 4351/4352 Configuration—Explains how to configure the older model 4351 or 4352 Tricon Communication Module.

Related Documents

- *SOE Recorder User's Guide*
- *TriStation 1131 Libraries Reference*
- *Enhanced Diagnostic Monitor User's Guide*
- *Tricon and Trident Safety Considerations Guides*
- *Communication Guide for Tricon v9-v10 Systems*
- *Product Release Notices* for specific Tricon and TriStation versions

Product and Training Information

To obtain information about Triconex products and in-house and on-site training, see the Triconex Web site or contact your regional customer center.

Web Site

http://www.triconex.com

Technical Support

Customers in the U.S. and Canada can obtain technical support from the Customer Satisfaction Center (CSC) at the numbers below. International customers should contact their regional support center.

Requests for support are prioritized as follows:

- Emergency requests are given the highest priority
- Requests from participants in the System Watch Agreement (SWA) and customers with purchase order or charge card authorization are given next priority
- All other requests are handled on a time-available basis

If you require emergency or immediate response and are not an SWA participant, you may incur a charge. Please have a purchase order or credit card available for billing.

Telephone

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Web Site

http://customernet.triconex.com (registration required)

E-mail

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We Welcome Your Comments

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- A brief description of the content you are referring to (for example, step-by-step instructions that are incorrect, information that requires clarification or more details, missing information that you would find helpful)
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15345 Barranca Parkway
Irvine, CA 92618

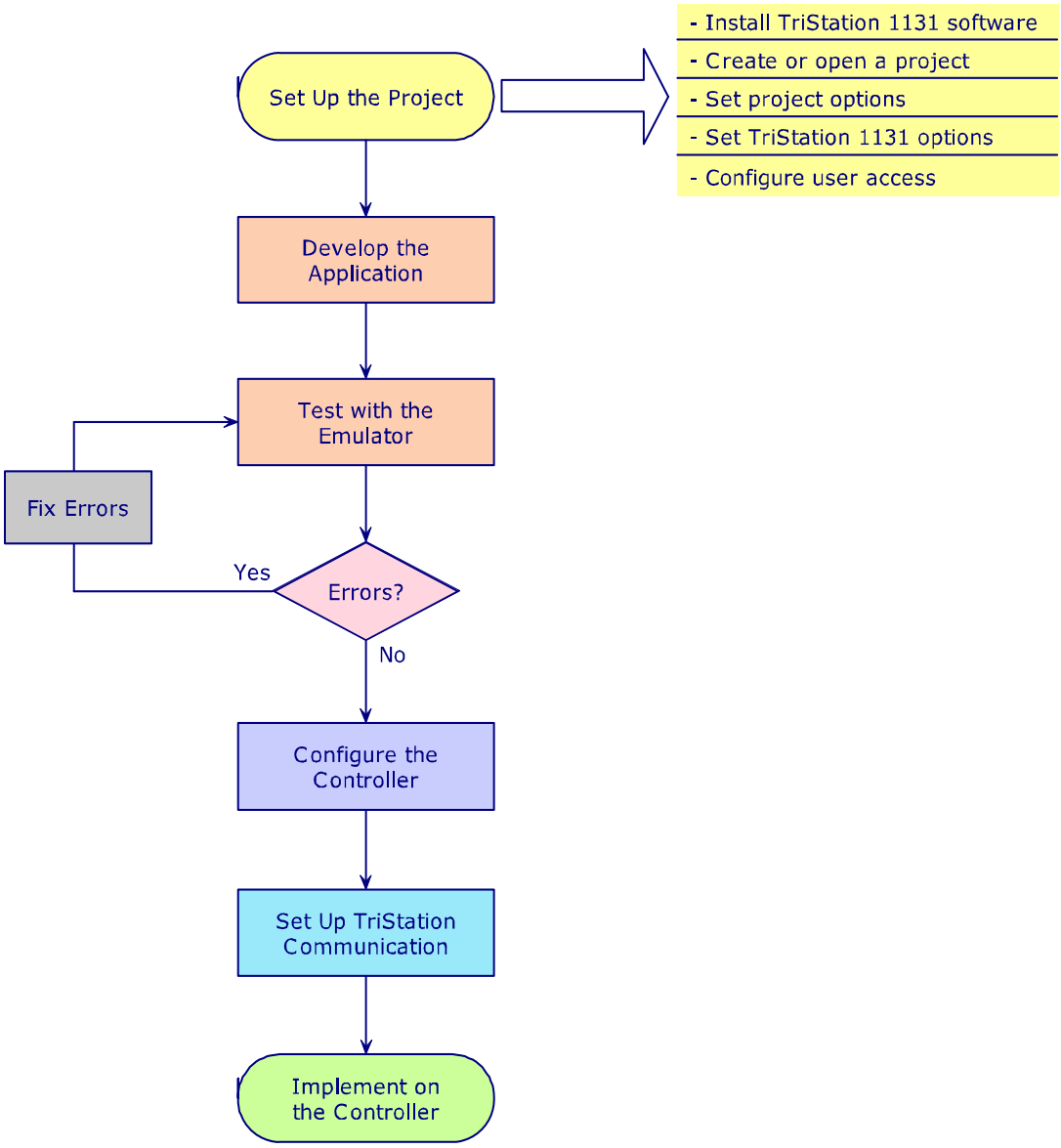
Thank you for your feedback.

1

Project Administration

Overview

This figure shows a typical project cycle and the main steps for setting up a TriStation 1131 project.



Project Administration Steps

This list includes steps that can be or should be done during project administration.

	Steps	See
❒	Install the TriStation1131 software (if needed)	• TriStation 1131 Installation on page 4
❒	Create or open an existing project.	• Project Creation on page 14
❒	Specify the language to be used as a default.	• Specifying Language Options on page 17
❒	Specify whether annotations are automatically included.	• Specifying Annotation Options on page 18
❒	Specify monitor colors for displaying variables in the emulator and controller.	• Specifying Monitor Colors for BOOL Values on page 20
❒	Specify options to be used when you use TriStation 1131.	• TriStation 1131 Options on page 21
❒	Specify FBD, LD, and CEM Editor options, as needed. (Optional)	• Specifying FBD Editor Options on page 24 • Specifying LD Editor Options on page 25 • Specifying CEM Editor Options on page 26
❒	Configure user access.	• User Access on page 27
❒	Add libraries from other projects. (Optional)	• Adding Libraries on page 38
❒	View standard reports; add custom reports.	• Reports on page 41

TriStation 1131 Installation

This section explains how to install and uninstall the TriStation 1131 software, and how to verify that the software is correctly installed. The installation also installs the TS1131 Install Check software.

Topics include:

System Requirements

The following are the minimum system requirements for TriStation 1131:

- PC running Windows 2000 or XP
- Pentium 233 MHz with 128 MB RAM
- 125 MB free hard drive space
- CD-ROM drive
- Network adapter card
- SVGA monitor running at 1024 x 768 resolution with 64,000 colors
- DLC protocol installed (see Installing DLC or TCP/IP Protocol on a TriStation PC on page 243)

Upgrading from Previous Versions of TriStation 1131

If you are upgrading from a previous version of TriStation 1131, please note the following:

- If you have previously installed version 2.x or 3.x of the TriStation 1131 software, you do not need to uninstall it before installing version 4.1.
- If you have previously installed version 4.1.*x* of the TriStation 1131 software, you do not need to uninstall it before installing a later version of 4.1.x. For example, if you have version 4.1.419 installed, you do not need to uninstall it before you install version 4.1.420 or later.
- If you have previously installed version 4.0 of the TriStation 1131 software, you do not need to uninstall it before you install version 4.1. You may wish to keep both versions of the TriStation software installed on your workstation until you have finished converting all your projects to version 4.1 (see Converting Existing Projects to Version 4.1 on page 11).

However, **uninstalling version 4.0 *after* you have installed version 4.1 will cause version 4.1 to no longer work**. To correct this, simply uninstall both 4.0 and 4.1 and then reinstall version 4.1.

- Additionally, if you installed other Triconex applications (such as SOE Recorder) after you installed TriStation version 4.0, uninstalling version 4.0 may cause other installed Triconex applications to no longer work. To correct this, simply uninstall and then reinstall the other Triconex applications after you uninstall TriStation version 4.0.

Installing the TriStation 1131 Software

This procedure explains how to install the TriStation 1131 software. The setup program provided by Triconex installs all the components of the TriStation 1131 Developer's Workbench on your PC. If you purchased the optional CEMPLE software, it is installed at the same time.

Note If you are installing the TriStation 1131 software on a Windows XP workstation, you must also install the DLC protocol. Without this protocol installed, you will be unable to open a new or existing project in TriStation. See Installing DLC on Windows XP on page 244 for detailed instructions.

The TriStation 1131 software must be installed on a local drive. Do NOT install and run TriStation 1131 on a network server.

Procedure

1. Log on as an administrator or as a user with administrator privileges.
2. Close all open applications.
3. Insert the TriStation 1131 CD in the CD-ROM drive.

   If the installation starts automatically, go to step 8. Otherwise, go to the next step.
4. From the Start menu, click Settings, and then click Control Panel.
5. Double-click Add New Programs.
6. Click the CD or Floppy button, and then browse to locate the setup.exe file on the CD.
7. Double-click setup.exe to start the installation.
8. Follow the InstallShield Wizard instructions.

   Triconex recommends installing the TriStation 1131 software in the default destination folder, which is: `C:\Program Files\Triconex\TriStation 1131 4.1.`
9. To restart your PC after the installation has finished, click Yes. You are not required to restart your PC before running the TriStation 1131 software.
10. To complete the installation, click Finish.

Uninstalling the TriStation 1131 Software

This procedure explains how to uninstall the TriStation 1131 software.

Procedure

1. Log on as an administrator or as a user with administrator privileges.
2. From the Start menu, click Settings, and then click Control Panel.
3. Double-click Add/Remove Programs, and select TriStation 1131 4.1.
4. Click Change/Remove.

   Follow the on-screen instructions to confirm the deletion of the selected application and all its components.

   Note If you saved projects in the default directory, (`C:\Program Files\Triconex\TriStation 1131 4.1`), the uninstall program *does not* remove them.
5. Click Yes or Yes to All if the Remove Shared File dialog box asks about removing unused DLLs.
6. Click Finish to complete the uninstallation process.

Verifying the TriStation 1131 Installation

This procedure explains how to verify the TriStation 1131 software is correctly installed and that associated files are not corrupted.

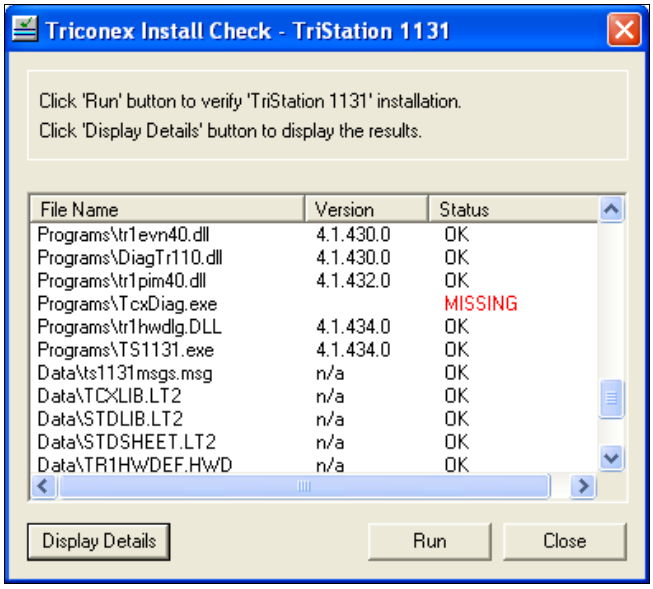
After installing the software and before downloading an application to the controller, you should run the TriStation 1131 Install Check program. The Install Check software is copied to your hard drive when you install the TriStation 1131 software.

Note Running TS1131 Install Check is required for safety applications. For more information, see the *Safety Considerations Guide.*

Procedure

1. From the Start menu, select Programs, Triconex, and then Install Check 4.1.
2. Click Run.

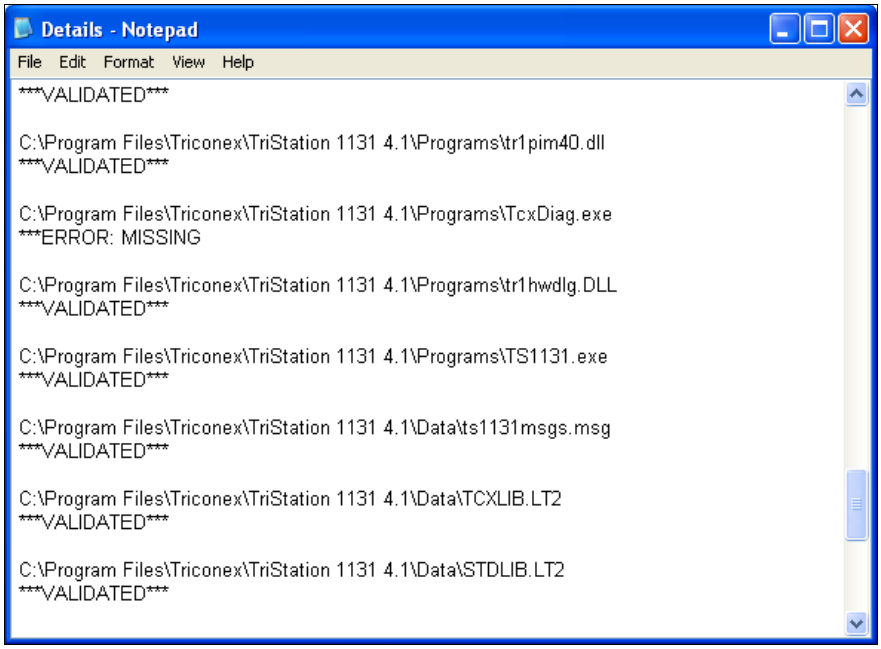
   Install Check verifies that all TriStation files are correctly installed. When verification is complete, the name, version, and status of each file are displayed in the list.



3 Verify that the program is validated by viewing each item in the list.

The status of each file should be "OK". If there are files that have "Missing" in the Status column, you should re-install TriStation 1131.

4 Click Display Details to view the full path for verified files and expanded error messages for any identified problems.



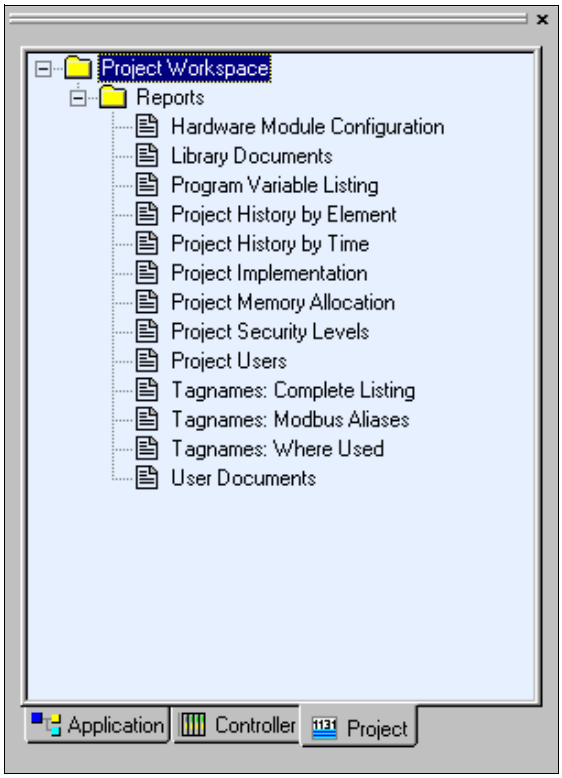
TriStation 1131 Projects

This section provides an overview of TriStation 1131 projects and related information.

Topics include:

The Project Workspace

The Project Workspace includes the Reports folder. Other project features are accessed from the menus.

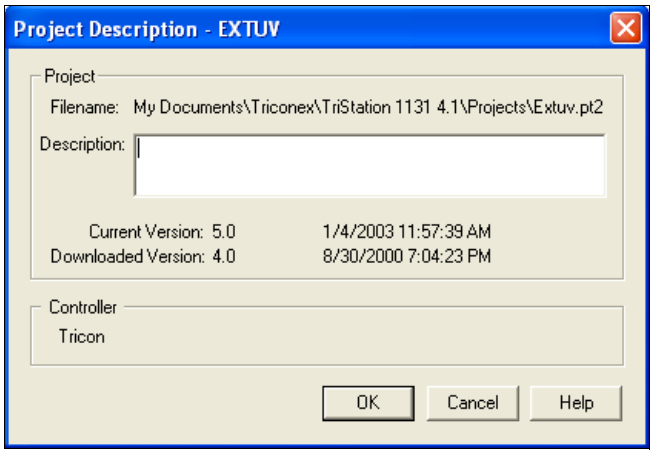


Displaying Version Numbers of Projects and Documents

This procedure explains what version numbers are and how they can be viewed. Version numbers are used with the project under development (current version), the downloaded application (downloaded version), and project elements. Version numbers include a major (first) and minor (second) number, separated by a period.

Procedure for Projects

1 On the Project menu, click Project Description.



2 View these properties in the Project Description dialog box.

Property	Action
Current Version	Displays the version of the project which is under development.
Downloaded Version	Displays the version of the project (application) which is downloaded to the controller.

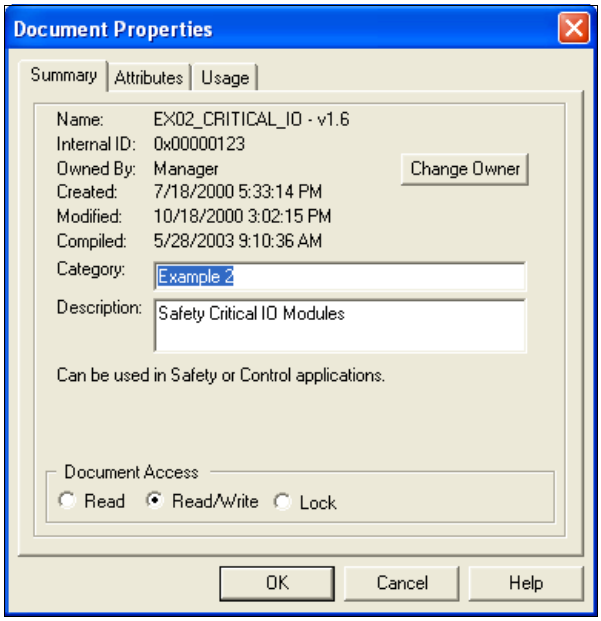
3 Click OK to close the dialog box.

Procedure for Documents

1 Expand the Application Workspace (see The Application Workspace on page 54), and right-click a document.

2 From the shortcut menu that appears, select Properties.

The Document Properties dialog box appears.



3 View this property on the Summary tab.

Property	Action
Name	Displays the version of the document at the end of the name. For example, if the document name is displayed as LightEmUp - v1.26, the version number is 1.26.

4 Click OK to close the dialog box.

Converting Existing Projects to Version 4.1

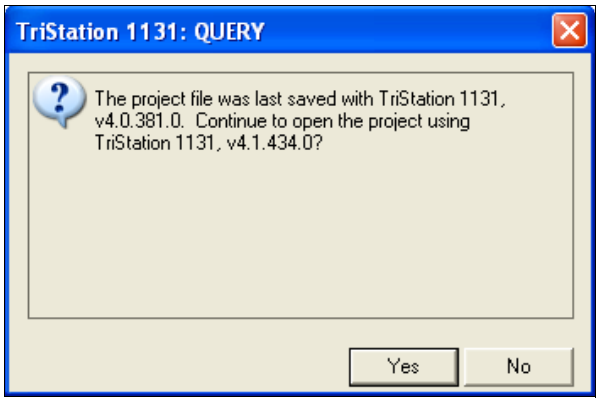
This procedure explains how an existing TriStation 1131 project can be automatically converted to version 4.1. Any project created with version 2.x through 3.x can be converted to version 4.1.

Projects created with version 4.0.x can be opened in version 4.1, but once they have been opened in v4.1 they can no longer be opened with an earlier version of TriStation 1131.

The programming model for TriStation 4.0 and later is significantly different from versions 3.x and earlier. The most significant differences are:

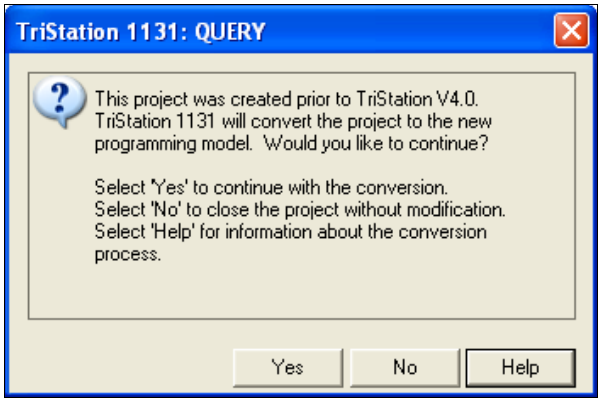
- There are no program instances
- Programs can directly reference tagnames
- Programs cannot use VAR_INPUT, VAR_OUTPUT, or VAR_IN_OUT variables

Procedure for Version 4.0.x Projects



1. Open the TriStation 1131 project to be converted.
2. When prompted, click Yes to continue the conversion or No to cancel.

Procedure for Version 2.x or 3.x Projects



1. Open the TriStation 1131 project to be converted.
2. When prompted, click Yes to continue the conversion or No to cancel. To get information about what is converted, click Help.
3. If you clicked Yes, you must log in to the project as a Level 01 user.

   After you log in, the project is opened and a backup is made using this naming convention: <project name>_<version>_Pre40Cnv.bt2.
4. After completing the conversion, you must perform a Download All (see Using the Download All Command on page 316).

The following table identifies the changes made during a version 2.x or 3.x project conversion.

Table 1 Changes Made During Version 2.x or 3.x Project Conversion

Item	Description
Application Snapshot	The conversion removes the snapshot of the application which was saved during the last download. This means you will not be able to compare the current version of the project to the previously downloaded version of the project until after the first download.
Application State	The state of the application is changed to Download All.
Multiple Program Instances	If there are multiple instances of a program, each instance is converted to a new program document. The name of each new document is generated by appending _# to the program name, where # is a consecutive number starting at 1. For example, if there were two instances of program TankAlarm, the first instance is named TankAlarm_1, and the second is named TankAlarm_2.
Naming Conflicts	If renaming a program input or output results in a name conflict with a local variable, the name of the local variable is appended with ?Dup? and a message is written to the message output view. You must rename the local variable before compiling the program.
Trident System Variables	If a tagname references a Trident system variable, the variable name is appended with ?Sys? and a message is written to the message output view. You must change the names and change the Point Type to memory. One way to do this is to replace the dot (period) in the name with an underscore and then delete the ?Sys? from the end of the name. You must also use the system status function blocks (SYS_*) to set the value of these variables. The best place to do this is in the first network in your program. The reason this must be done is that in this version of TriStation 1131, Trident system status values are only accessible by using the system status function blocks.
Variable Changes	In FBD, LD, and CEM programs, input and output variable declarations are changed to tagname declarations. In ST programs, all VAR_INPUT, VAR_OUTPUT, and VAR_IN_OUT declarations are changed to VAR_EXTERNAL.

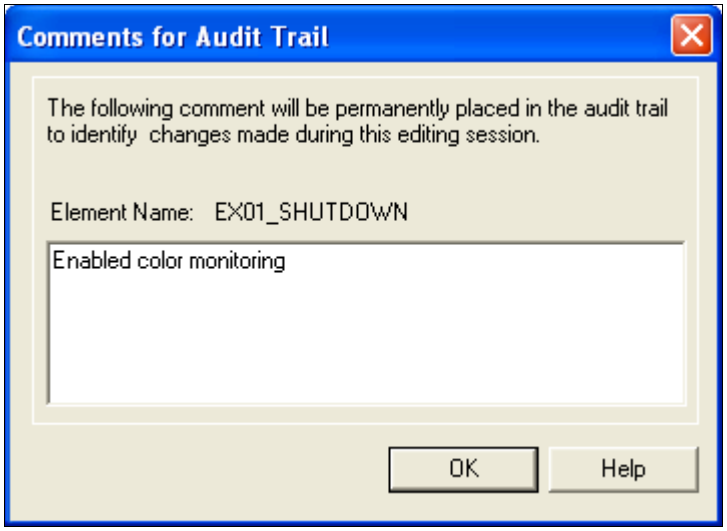
Adding Audit Comments

This procedure explains how to add comments when you change a program, function, or function block. These comments provide an audit trail which can be viewed in reports.

Procedure

1 Close a program, function, or function block that was changed.

The following dialog box appears, allowing you to describe the changes before the element is saved.



2 Enter a comment and click OK.

Project Creation

This section describes how to create and log on to a TriStation 1131 project.

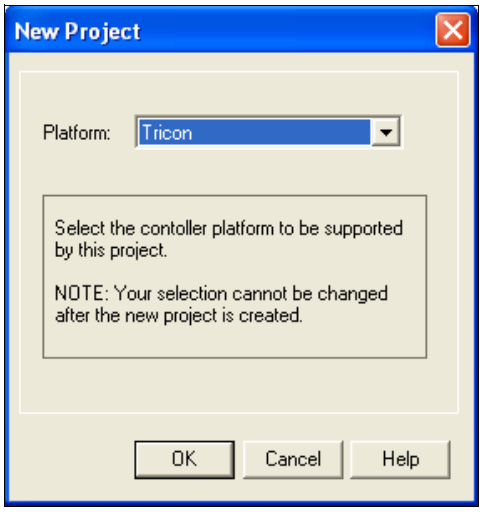
Topics include:

Creating a TriStation 1131 Project

This procedure explains how to create a TriStation 1131 project. When a new project is created, a user name and password are automatically created with the highest level of privileges—Level 01 (see User Access on page 27). You are automatically logged on as this default user when the project is created.

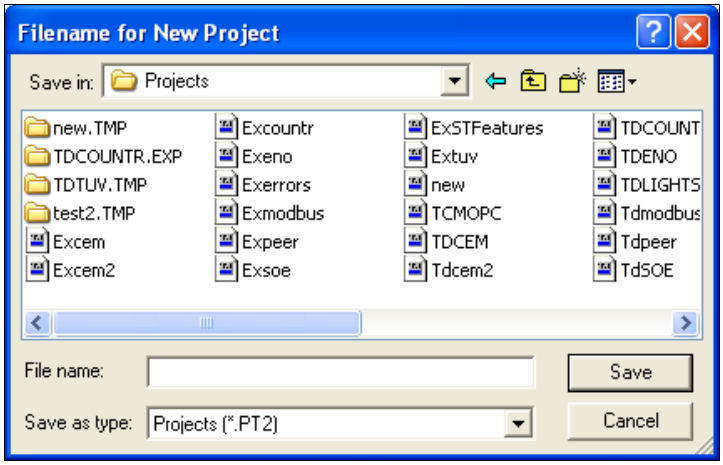
Procedure

1 Open TriStation 1131. On the File menu, click New Project.



2 For the Platform (controller), select Tricon, Tricon Low Density, or Trident.

3 Click OK to continue.



4 Navigate to the folder you want to save the project in, enter a file name, and click Save.

Note TriStation projects must always be run from a local drive. Projects may be saved to a network drive for backup purposes, but you must copy the project to your local drive before you open it in TriStation.

Files that are used in TriStation 1131 are copied to the project. After the file creation process finishes, you are automatically logged on to the project using the default user name (MANAGER) and default password (PASSWORD).

Adding a Project Description

This procedure explains how to add a description to a project. The Project Description dialog box displays information about the project, including the version of the project being developed and the version of the project downloaded to the controller, which may be different.

CAUTION

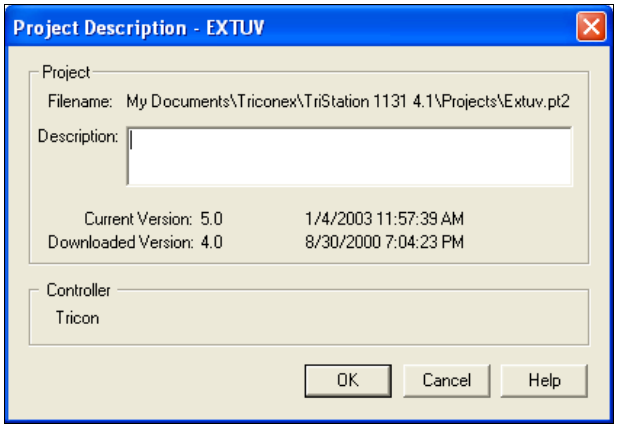
Do not use the Windows file properties dialog box to maintain descriptive information about your project. Changing or adding information to the Summary tab in the Windows File Properties dialog box for a TriStation project file (.pt2) will prevent TriStation from opening the file. There is no way to recover a project file that has been changed in this way.

Procedure

1 On the Project menu, click Project Description.

2 Enter a description of any length for the project.

3 Click OK to save.



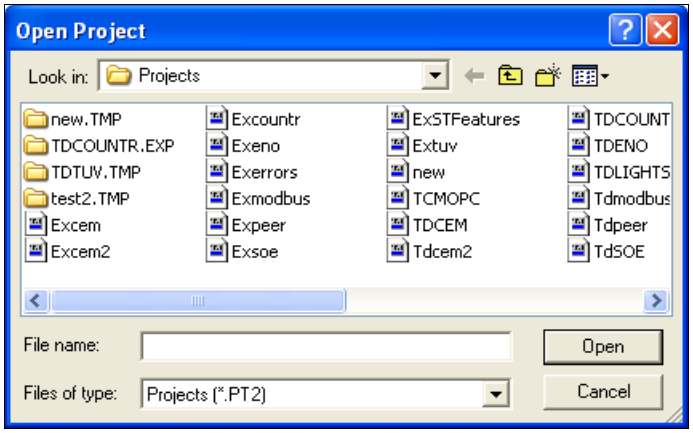
Logging on to an Existing Project

This procedure explains how to open and log on to an existing project. Only one project can be opened at a time. TriStation projects must always be run from a local drive. A project that has been saved to a network drive must be copied to your local drive before you open it.

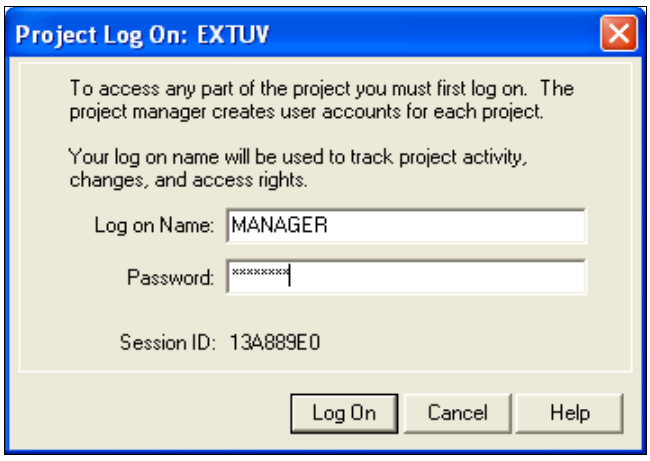
Note If an existing TriStation project was created by a user with restricted or administrator-level rights in Windows, other users may be unable to open that project. Windows security file access rules apply to all TriStation project files. You must have read/write access to a TriStation project, *and the folder it is located in*, to be able to open the project. If you are unable to open a TriStation project created by another user, contact your network or system administrator for assistance with changing the access rights for the selected project file and/or file location.

Procedure

1 Open TriStation 1131. On the File menu, click Open Project.



2 Select the folder to look in. Click the project to be opened, and then click Open.



3 Enter a user name and password. The default user name is MANAGER. The default password is PASSWORD.

4 Click Log On. The project opens.

Project Options

Project Options are settings that specify the language, annotation, and monitor settings used when new project elements are created. When you create new elements in a project, default settings are used unless you specify different settings. For example, the Default Language property is set to Function Block Diagram, which means that a new function is automatically created in FBD language unless you specify another language.

You can change the default settings when you begin a new project or any time during project development. The settings only affect new elements.

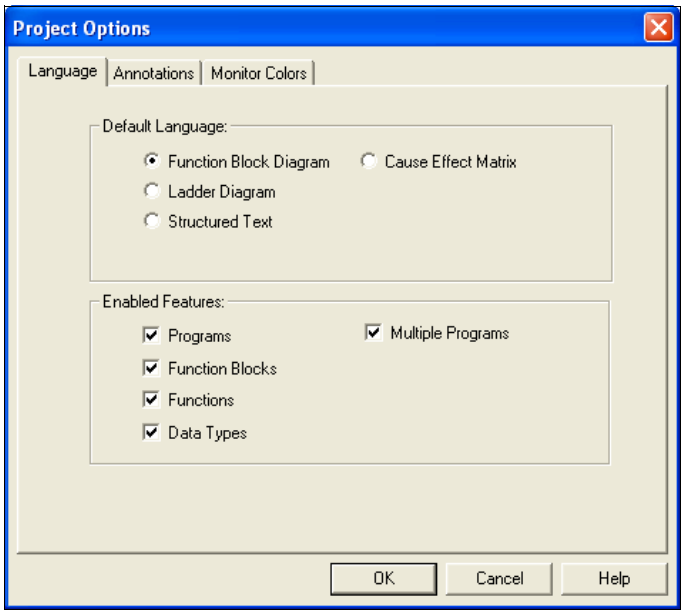
Topics include:

Specifying Language Options

This procedure explains how to specify the language and element types used to create new programs, functions, and function blocks.

Procedure

1 On the Project menu, click Project Options, and then click the Language tab.



2 Specify these properties on the Language tab.

Property	Action
Default Language	Specify the type of programming language to use when creating a program, function, function block, or data type. The default is Function Block Diagram.
Enabled Features	Select the check box for each feature (programs, functions, function blocks, data types, and multiple programs) that can be created in the project. The default is selected for all features.

3 Click OK to save the settings.

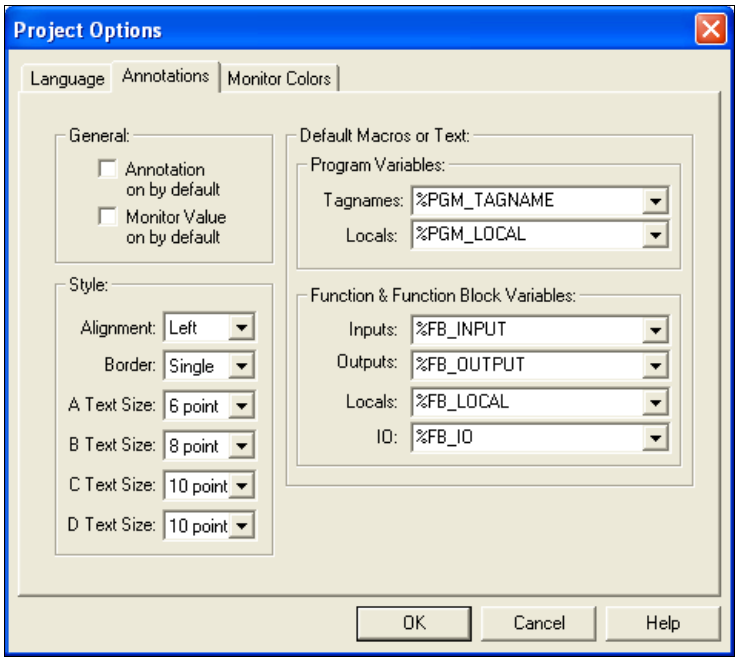
Specifying Annotation Options

Annotations can be used to display descriptive text about a constant, tagname, or variable, including information specified in system and user-modifiable macros.

This procedure explains how to specify whether annotations are automatically included when comments and variables are created and whether the value is shown when an application is monitored. You can also specify text or macros to be included in annotations.

Procedure

1 On the Project menu, click Project Options, and then click the Annotations tab.



2 Specify these properties on the Annotations tab.

Property	Action
Annotation on by Default	Select the check box to have annotation boxes automatically added to variables used with a program, function, or function block. The default is cleared.
Monitor Value on by Default	Select the check box to have the value of the variable displayed when the program or function block is executed. The default is cleared.
Alignment	Specify how to align the text in an annotation or comment. The default is Left.
Border	Specify the type of border to include with an annotation or comment. The default is Single.
Text Size	Specify the point size for text used in the project. The default settings are: A (6 points), B (8 points), C (10 points), and D (10 points.)
Default Macros or Text	Specify the default macro or text to be included with a program or function variable. The program variable defaults are: Tag Refs: %PGM_TAGNAME Locals: %PGM_LOCAL The function and function block variable defaults are: Input: %FB_INPUT Output: %FB_OUTPUT Local: %FB_LOCAL I/O: %FB_IO See Using Macros with Annotations and Comments on page 143 for more information.

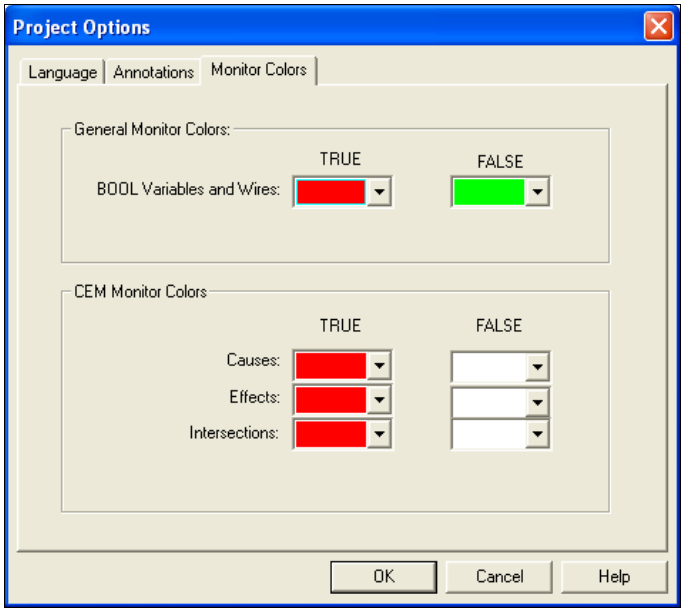
3 Click OK to save the settings.

Specifying Monitor Colors for BOOL Values

This procedure explains how to specify what colors are displayed for BOOL True and False values when the application is run on the controller or emulator. This feature allows you to change the colors to meet an industry or corporate standard.

Procedure

1 On the Project menu, click Project Options, and then click the Monitor Colors tab.



2 Specify these properties on the Monitor Colors tab.

Property	Action
General Monitor Colors	Select the color for True and False for BOOL variables and wires. The default for True is red; False is green.
CEM Monitor Colors	Select the color for True and False for cause, effect, and intersection cells in a CEM (cause and effect matrix). The default for True is red; False is white.

3 Click OK to save the settings.

TriStation 1131 Options

TriStation 1131 options include properties that affect the TriStation 1131 interface. All the properties included in the Options dialog box have default settings that specify how features are initially configured. For example, the Wire Tool property can be specified for right-handed or left-handed use.

You can change these settings at any time during project development. The settings you configure are saved for your user ID only.

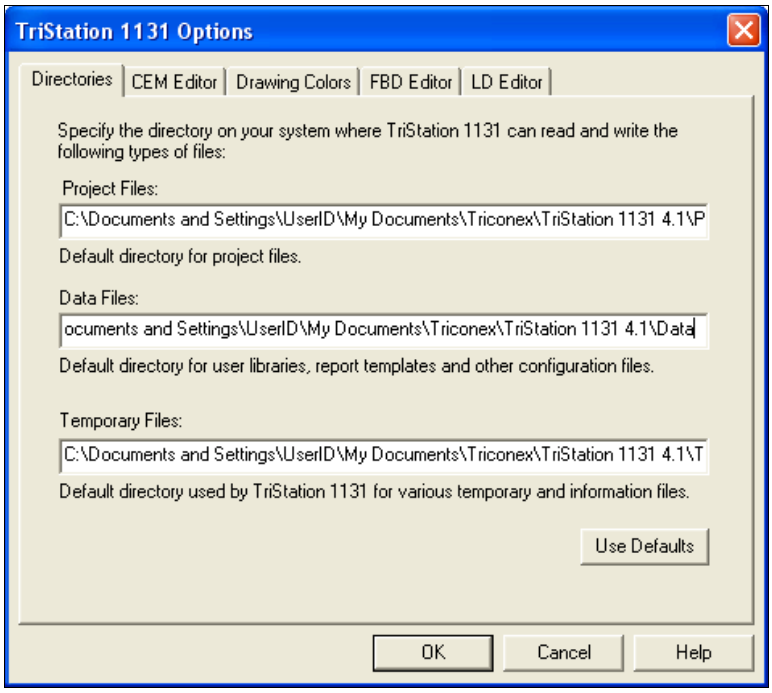
Topics include:

Specifying Directory Locations

This procedure explains how to specify the directory locations for project, library, and report files.

Procedure

1 On the Tools menu, click TriStation 1131 Options, and then click the Directories tab.



2 Specify these properties on the Directories tab.

Property	Action
Project Files	Enter the path. The default is: `C:\...My Documents\Triconex\TriStation 1131 4.1\Projects`
Data Files	Enter the path. The default is: `C:\...My Documents\Triconex\TriStation 1131 4.1\Data`
Temporary Files	Enter the path. The default is: `C:\...My Documents\Triconex\TriStation 1131 4.1\Temp`
Use Defaults	Click the Use Defaults button to return the settings to the default paths.

Note TriStation projects must always be run from a local drive. You should not enter directory paths that point to a location on your network.

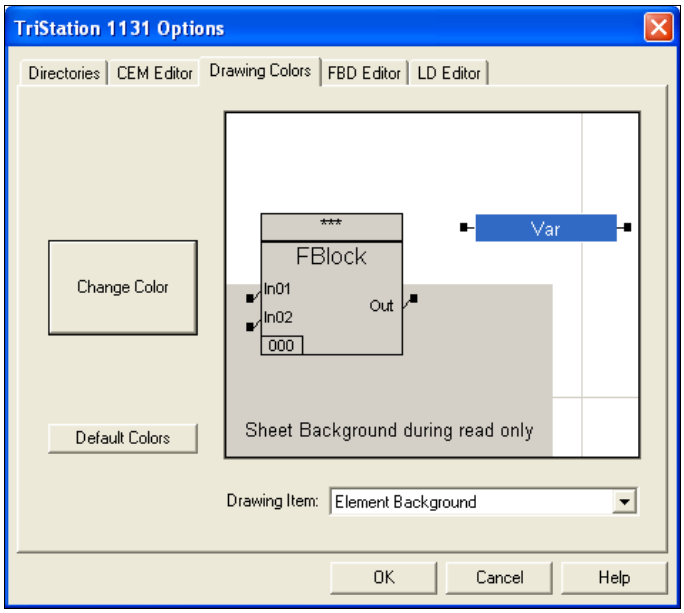
3 Click OK to save the settings.

Specifying Drawing Colors

This procedure explains how to specify the colors used for items in the programming editors. The default drawing colors are based on the Windows color scheme selected in Control Panel.

Procedure

1 On the Tools menu, click TriStation 1131 Options, and then click the Drawing Colors tab.



2 Specify these properties on the Drawing Colors tab.

Property	Action
Drawing Item	Select an item to be shown in a color.
Change Colors Command	Click to display a color palette from which to choose a color for the selected drawing item.
Default Colors Command	Click to change the colors of all items to the default colors.

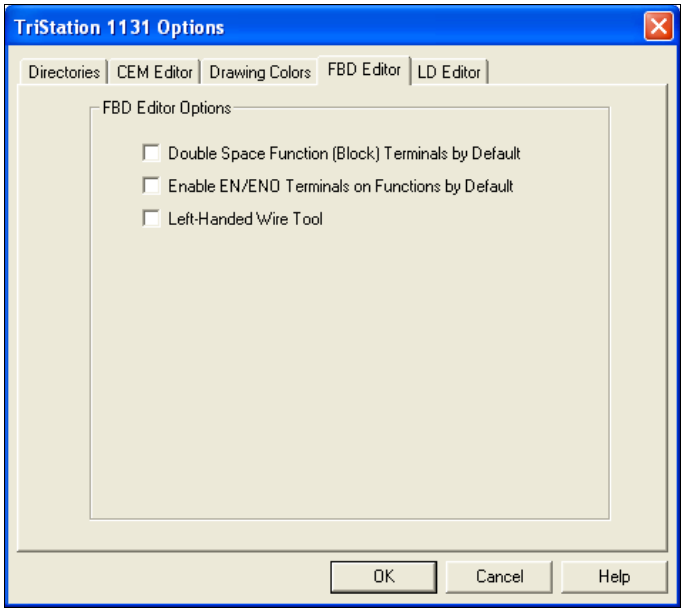
3 Click OK to save the settings.

Specifying FBD Editor Options

This procedure explains how to specify Function Block Diagram (FBD) Editor settings that are used throughout the project unless changed on a specific FBD function. You can also change the Double Space and EN/ENO properties for a specific function.

Procedure

1 On the Tools menu, click TriStation 1131 Options, and then click the FBD Editor tab.



2 Specify these properties on the FBD Editor tab.

Property	Action
Double Space Function (Block) Terminals by Default	Select the check box to automatically have the spacing doubled between terminals (inputs and outputs) on the function block, which creates additional space for annotation. The default is cleared.
Enable EN/ENO Terminals on Functions by Default	Select the check box to automatically enable EN/ENO terminals on functions. The default is cleared.
Left-Handed Wire Tool	Select the check box to enable the wire tool for left-handed use. The default is cleared.

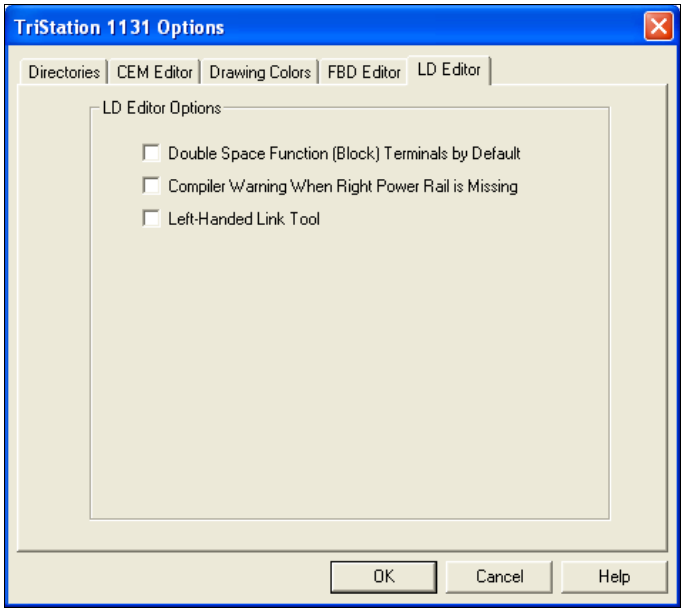
3 Click OK to save the settings.

Specifying LD Editor Options

This procedure explains how to specify Ladder Diagram (LD) editor settings that are used throughout the project unless changed on a specific LD function. You can also change the Double Space property for a specific function.

Procedure

1 On the Tools menu, click TriStation 1131 Options, and then click the LD Editor tab.



2 Specify these properties on the LD Editor tab.

Property	Action
Double Space Function (Block) Terminals by Default	Select the check box to automatically have the spacing doubled between terminals (input and output parameters) on the function block, which adds space for annotation. The default is cleared.
Compiler Warning When Right Power Rail is Missing	Select the check box to display a compiler warning displayed if the right (power) rail is missing from a Ladder Diagram function. The default is cleared.
Left-Handed Link Tool	Select the check box to enable the link tool for left-handed use. The default is cleared.

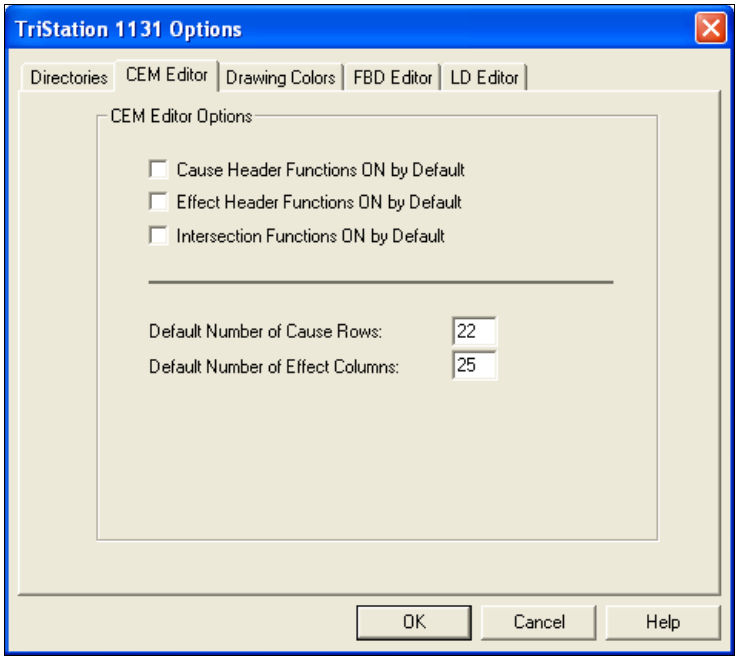
3 Click OK to save the settings.

Specifying CEM Editor Options

This procedure explains how to set the options used as initial settings for all the CEM (cause and effect matrix) programs in a project. After a program is created, you can modify these settings on a program-by-program basis.

Procedure

1 On the Project menu, click TriStation 1131 Options, and then click the CEM Editor tab.



2 Specify these properties on the CEM Editor tab.

Property	Action
Cause Header Functions On by Default	Select the check box to automatically add input and function columns. The default is cleared.
Effect Header Functions On by Default	Select the check box to automatically add output and function columns. The default is cleared.
Intersection Functions On by Default	Select the check box to automatically add function columns. The default is cleared.
Default Number of Cause Rows	Enter the number of rows to include in a new matrix. The default is 22.
Default Number of Effect Columns	Enter the number of columns to include in a new matrix. The default is 25.

3 Click OK to save the settings.

User Access

This section explains how to provide user access to controller and TriStation 1131 operations. Access is based on the security level assigned to the user, from the highest level (01) to the lowest level (10).

Each level of security includes default settings for the operation privileges allowed for that level. For example, the Manager level (03) includes privileges for operations associated with managing a TriStation 1131 project.

Only users assigned to levels 01, 02, or 03 can access the security controls for controller and TriStation operations.

Each new TriStation 1131 project is created with a default user name (MANAGER) and password (PASSWORD). To ensure unauthorized users do not access the project, you should create user names and passwords before application development begins.

Note If a TriStation project was created by a user with restricted or administrator-level rights in Windows, other users may be unable to access that project. Windows security file access rules apply to all TriStation project files. Your network or system administrator can assist with changing the access rights for the selected project file and/or file location.

Access to a project can be further restricted by settings on documents and operating parameters. If you are trying to edit a user document created by another user, and are unable to do so even when you have the correct user level and access privileges, check the document's access property. If it is locked, you must ask the user who created the document to change the access property. See Restricting Access to a Document on page 67.

Note If you have a model 4351A or 4352A Tricon Communication Module (TCM) installed in your system, access to the Tricon via TriStation can also be controlled via the optional TCM client access list. See Controlling Access to the TCM on page 267.

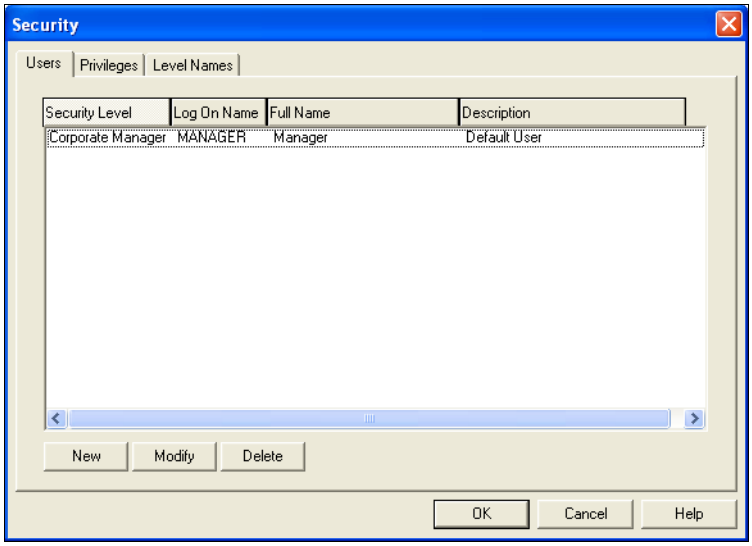
Topics include:

Managing User Access

This procedure explains how to manage user access, which includes creating, modifying, and deleting a TriStation 1131 user. Only users assigned to security levels 01, 02, or 03 can access the Security dialog box and view user access settings.

Procedure

1 On the Project menu, click Security, and then click the Users tab.



2 Perform one of these actions on the Users tab.

Command	Action
New	To create a new user, click New. See Adding and Modifying User Access on page 29 for further instructions.
Modify	To modify a user, select a user in the list, and then click Modify. See Adding and Modifying User Access on page 29 for further instructions.
Delete	To delete a user, select a user in the list, and then click Delete.

Note Unless you have level 01 access, you cannot add or delete users who have the same or higher security level as yourself. For example, if you have level 02 access, you cannot add or delete users with level 02 or 01 access.

If you have security level 01 access, you can add or delete other level 01 users, but you cannot delete yourself.

3 Click OK to save your changes.

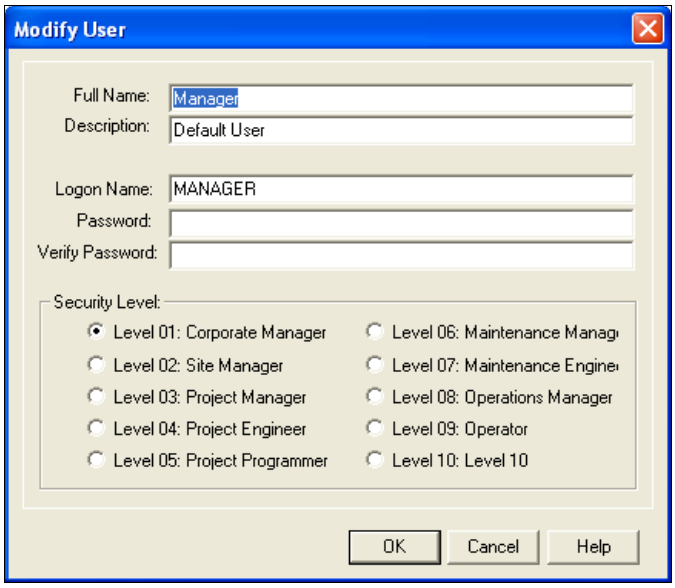
Adding and Modifying User Access

This procedure explains how to add or modify access properties for a TriStation 1131 user.

Procedure

1 On the Project menu, click Security, and then click the Users tab.

- To add a user, click Add.
- To modify a user, click the user name, and then click Modify.



2 Specify these properties in the Add or Modify User dialog box.

Property	Action
Full Name	Enter or change the name for the user.
Description	Enter or change the description for the user.
Logon Name	Enter or change the name to be used to log on to the project.
Password	Enter or change the logon password.
Verify Password	Enter the new or changed password again to ensure the password is what you intended.
Security Level	Select the security level for this user. Level 01 is the highest; level 10 is the lowest.

3 Click OK to save your changes.

Note Even if you are not changing the password, you must enter a password in the Password and Verify Password fields to confirm the other changes to the user's information. You should enter the user's existing password in these fields. If you don't know the user's password, you can enter a new password in these fields; just be sure to tell the user their new password.

Changing the Security Level for Privileges

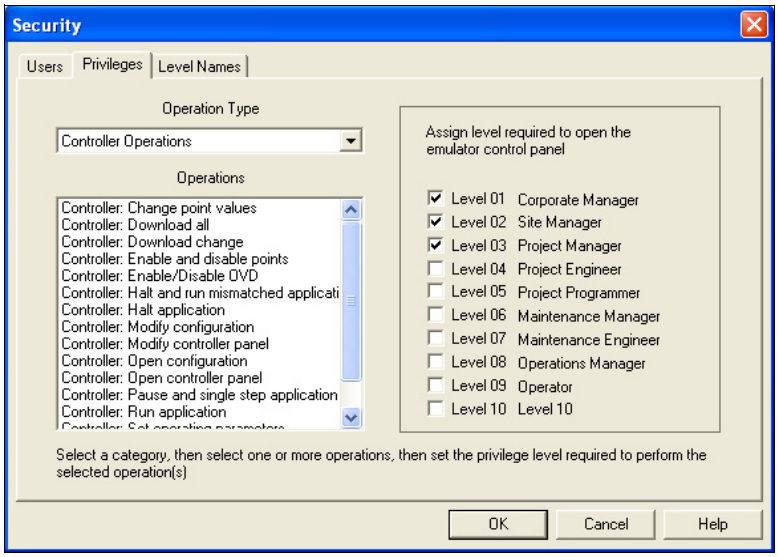
This procedure explains how to change the security level required for privileges to controller and TriStation 1131 operations. By default, each operation is assigned a security level, from the highest level (01), to the lowest level (10).

Each security level includes a set of privileges for that level, which also includes the privileges for lower levels. For example, if the operation is set to level 04, users with level 01, 02, and 03 privileges also have access to the operation. Only users with level 01, 02 or 03 access can change security level privileges.

If a TCM is installed in the Tricon, access to the controller via TriStation can also be managed via the optional TCM client access list. For example, even if a user has the correct security level privileges to perform a Download All command, if they do not have Read/Write TriStation access through the TCM, they will be unable to perform the Download All command. See Controlling Access to the TCM on page 267 for more information.

Procedure

1 On the Project menu, click Security, and then click the Privileges tab.



2 Specify these properties on the Privileges tab.

Property	Action
Operation Type	Select Controller Operations or TriStation 1131 Operations, depending on the operations you want to specify.
Operations	Click the operation, and then select the check box for the level of security to be assigned to the operation. Press Shift and click to select multiple contiguous items. Press Ctrl and click to select multiple non-contiguous items.

3 Click OK to save your changes.

Note Users with security levels 04–10 cannot perform the following tasks: *Security: Add/modify users, Security: Change level descriptions, Security: Change level privileges*.

Additionally, you cannot remove privileges from your own security level. For example, if you are a level 03 user, you cannot remove privileges from security level 03.

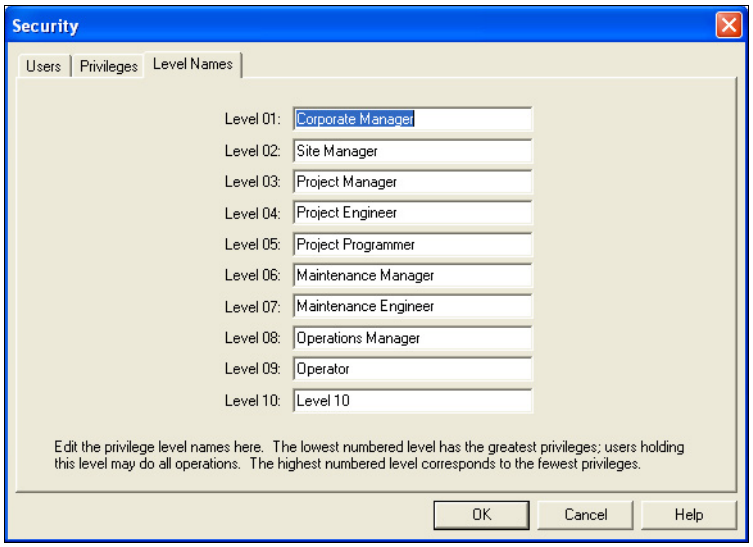
Changing Security Level Names

This procedure explains how to change the names associated with security levels. If you change a name on this tab, it is reflected on the other security tabs. Changing the name does not affect the security level assignments.

Only users with level 01, 02, or 03 access can change security level names.

Procedure

1 On the Project menu, click Security, and then click the Level Names tab.



2 Enter the name to associate with each security level on the Level Names tab. These are the default names.

Level	Name	Level	Name
01	Corporate Manager	06	Maintenance Manager
02	Site Manager	07	Maintenance Engineer
03	Project Manager	08	Operations Manager
04	Project Engineer	09	Operator
05	Project Programmer	10	Level 10

3 Click OK to save your changes.

Library Documents

Libraries are collections of project elements (programs, functions, and data types) that can be used in a project. This section describes how to create a library that can be added to other projects, and how to manage libraries that can include TriStation and user-created project elements.

Note Libraries created in TriStation 1131 version 4.1 can be imported to projects developed in versions 4.1 or 4.0. Libraries created in version TriStation 4.0 can also be imported to projects developed in version 4.1.

These libraries are available:

- TCXLIB: Triconex library for Tricon and Trident controllers
- STDLIB: Industry-standard library for Tricon and Trident controllers
- TR1LIB and TX1LIB: Libraries for Tricon controllers
- TRDLIB: Library for Trident controllers

For more information about the libraries automatically included with a TriStation 1131 project, see the *TriStation 1131 Libraries Reference*. Information about the version numbers of libraries included with each TriStation 1131 release can be found in the *Product Release Notice for TriStation v4.x*, available on Triconex CustomerNet.

Topics include:

Creating a Library of Project Elements

This procedure explains how to create a library of project elements (programs, functions, function blocks, and data types) that can be imported to another TriStation 1131 project.

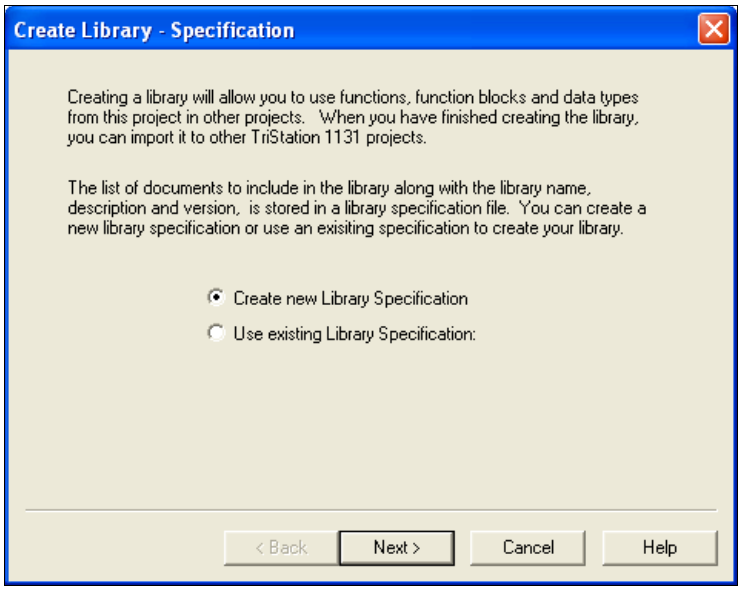
The library specification (.lsp) and export library (.lt2) files are created in the imported libraries directory. To identify or change this library, see Specifying Directory Locations on page 22.

The default location is:

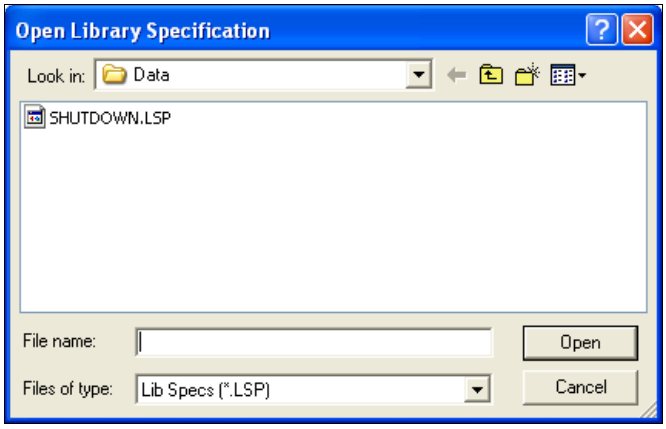
```
C:\...\My Documents\Triconex\TriStation 1131 4.1\Data
```

Procedure

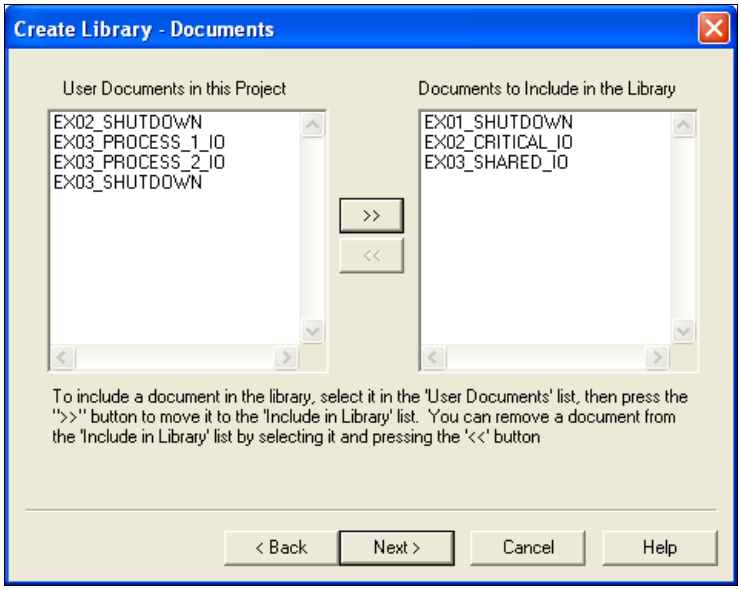
1. Open the TriStation 1131 project that contains the elements you want to copy.
2. Expand the Application tree, right-click User Documents, and then click Create Library.



3. Do either of these:
   - To create a new library, click Create New Library Specification, click Next, and skip to step 5.
   - To add elements to an existing library, click Use Existing Library Specification, and then click Next.



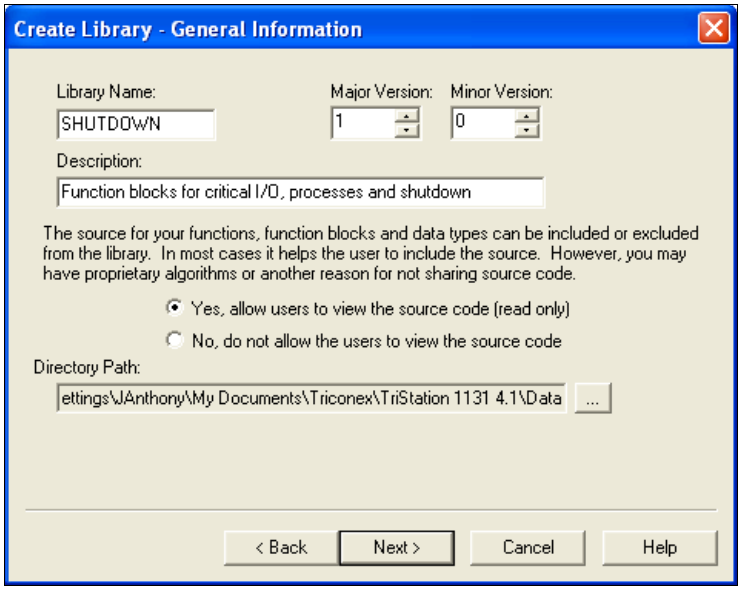
4 Navigate to the library directory, and click the library file you want to add elements to.



5 In the list on the left, click the document that you want to include, and then click the angle brackets (>>) to move the element to the right side.

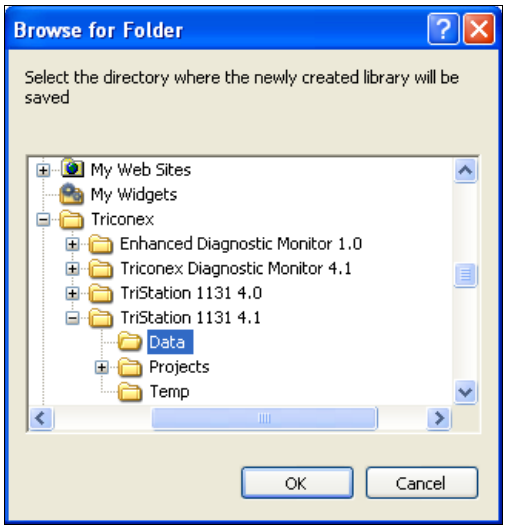
To select several documents at the same time, press Ctrl, and click each document. To select all the documents, press Ctrl and Shift, and click the top and bottom documents.

6 When you are finished selecting the elements to be included in the library, click Next.

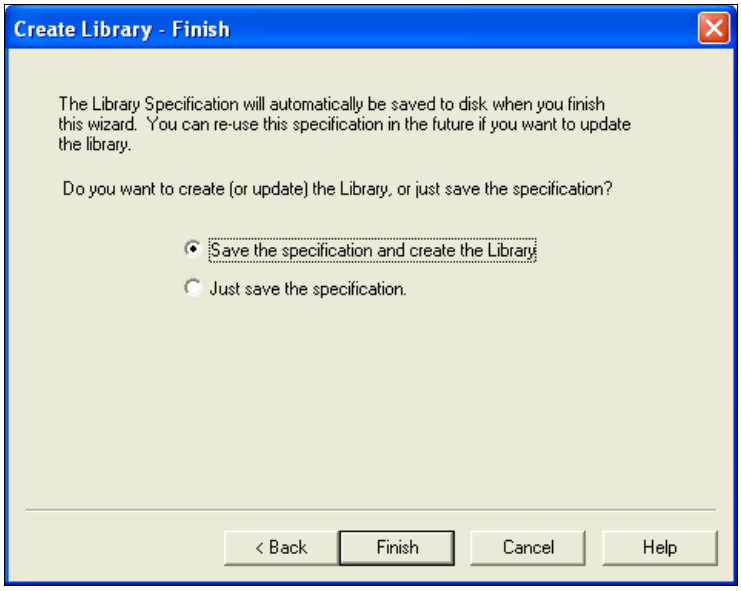


7 Add information about the library, including a name, description, and major and minor version number. You can also specify whether the source code can be viewed or restricted from other users.

If you want to save the library to a path other than the default directory, browse to select the path where you want to save the new library files.



8 Click Next to continue.



9 Do either of these:

- To save the files as a library, click Save the specification and create the Library. If you create a library, a *library*.lsp file and a *library*.lt2 file are created (where *library* is the name you selected in step 7).
- To save the specification, but not create the library, click Just save the specification. You might want to do this if you are planning to create a project library, but are not finished with the documents in the project. If you save just the specification, a *library*.lsp file is created. You can open this file and create the library file based on the specifications at a later time.

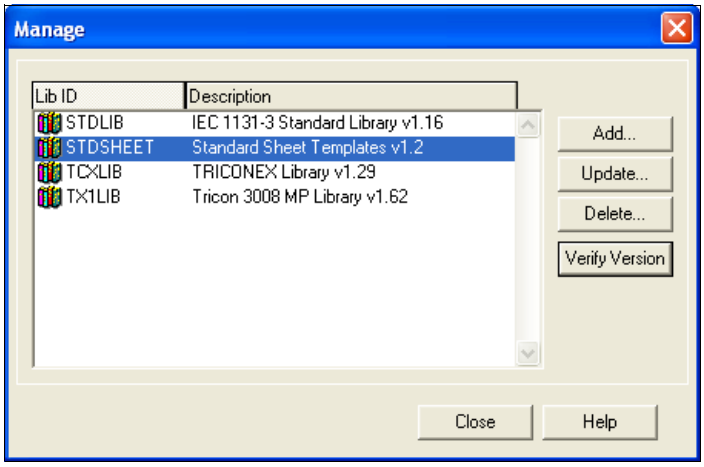
10 Click Finish.

Managing Libraries

This procedure explains how to manage libraries. TriStation 1131 automatically includes IEC libraries with functions, function blocks, and data types that can be copied and sometimes modified for a project. You can also add libraries of project elements that were created in other TriStation 1131 projects.

Procedure

1 Expand the Application tree, right-click Library Documents, and click Manage.



2 Perform one of these actions in the Manage dialog box.

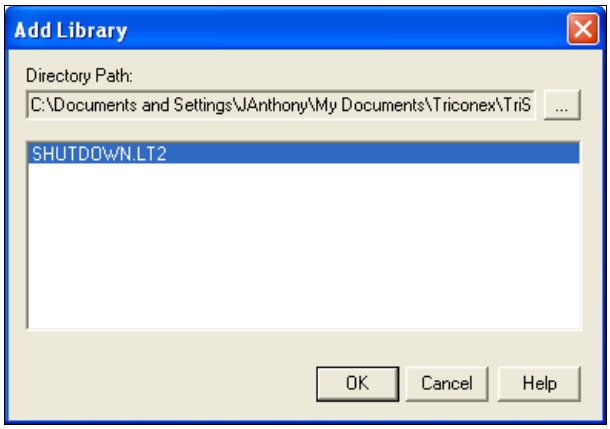
Command	Action
Add	Click to add a new library. See Adding Libraries on page 38 for further instructions.
Update	Click to update an existing library. See Updating Libraries on page 39 for further instructions.
Delete	Click to delete an existing library. See Deleting Libraries on page 39 for further instructions.
Verify Version Command	Click to verify the most current version of the selected library is loaded. See Verifying a Library Version on page 40 for further instructions.

Adding Libraries

This procedure explains how to add libraries to a TriStation 1131 project. This allows you to update libraries provided by Triconex and to add libraries of project elements from other TriStation projects.

Procedure

1. Expand the Application tree, right-click Library Documents, click Manage, and then click Add.



2. If the library you want to add is located in a path other than the default directory, browse to select the path where the library you want to add is located.
3. Click the library to add, and then click OK.
4. Click Yes on the Query screen.

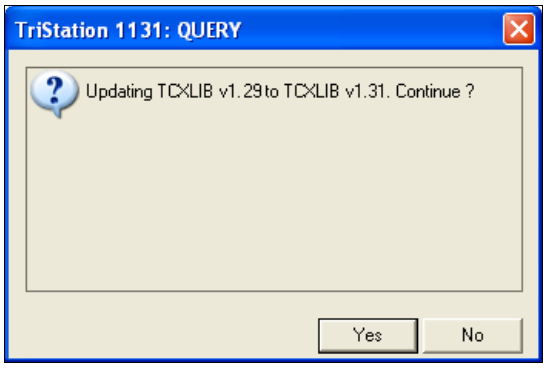
   The library is added to the project, and is displayed in the list.

Updating Libraries

This procedure explains how to update TriStation 1131 libraries for your project. When you request an update, TriStation 1131 compares the library in the project with the most current installed library and displays a message indicating the versions of each. You can then update the library or cancel the operation.

Procedure

1. Expand the Application tree, right-click Library Documents, and then click Manage.
2. On the Manage screen, click the library to be updated, and then click Update.



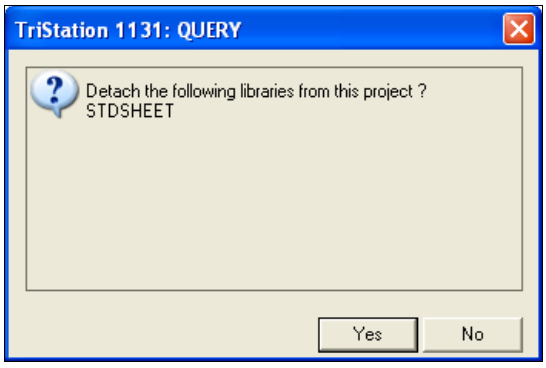
3. Click Yes to continue the update process. Click No to cancel.

Deleting Libraries

This procedure explains how to delete a library from a TriStation 1131 project.

Procedure

1. Expand the Application tree, right-click Library Documents, and then click Manage.
2. Click the library to be deleted, and then click Delete.



3. When prompted, click Yes to confirm deletion of the library. Click No to cancel.

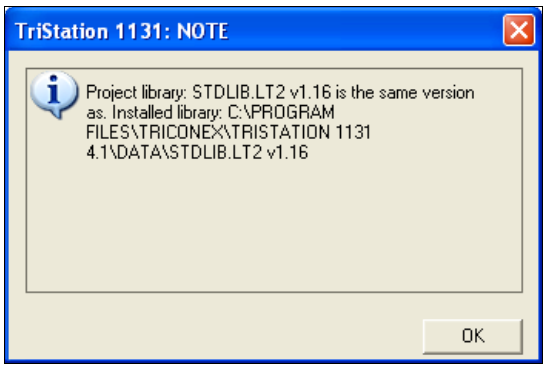
Verifying a Library Version

This procedure explains how to determine the version of TriStation 1131 libraries used in your project.

Procedure

1. Expand the Application tree, right-click Library Documents, and then click Manage.
2. Click the library to be verified, and then click Verify Version.

   A message appears, identifying the library, version, and whether the project library is the same as the installed library.



3. Click OK to close the message box.

Reports

This section describes how to view and print standard TriStation 1131 reports. You can also export reports to a variety of formats, which can be saved to disk or sent to an e-mail address.

Standard reports are displayed through the Crystal Reports viewer, which is installed with the TriStation 1131 software. Custom reports must be created using Crystal Reports, which can be purchased separately.

Topics include:

Updating the Report Database

This procedure explains how to update the report database. This copies project information to a database used for generating reports. You should update the report database after making changes to a project, and after installing or updating the TriStation 1131 v4.1 software.

Procedure

1. Open the Project Workspace (see The Project Workspace on page 8), and right-click the Reports folder.
2. Click Update Reports Database.

   The status of the updated operation can be viewed in the status bar at the bottom of the TriStation window.

Viewing and Printing a Report

This procedure explains how to view and print a report.

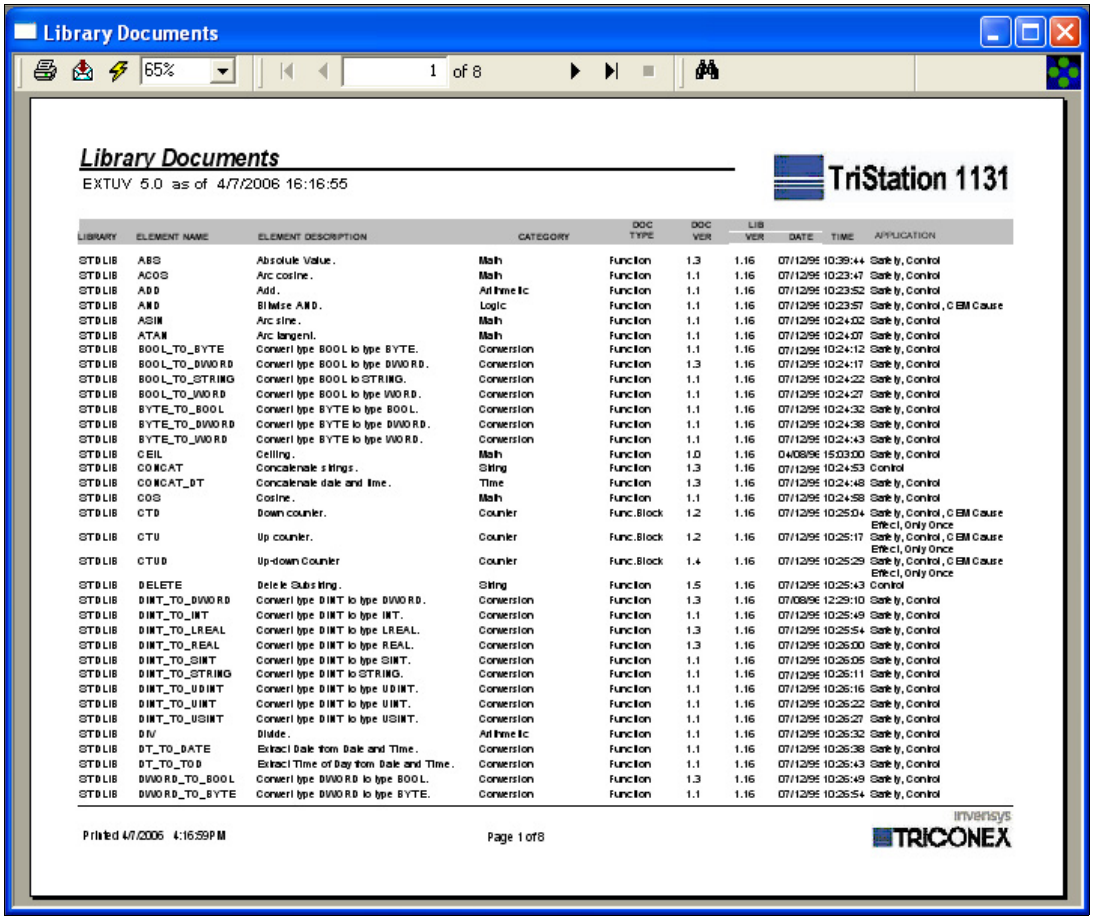
Before You Begin

Before you view a report, you should update the report database if changes have been made to the project or if the report database was not updated after installing the TriStation 1131 software.

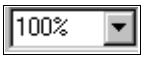
Procedure

1. Open the Project Workspace and then double-click a report. The report appears in the report viewer window.

Note If the report database was not updated after the TriStation 1131 software was installed, a "File Not Found" message will appear. Update the reports database (see Updating the Report Database on page 41) and then try viewing the report again.



2 Perform any of the following tasks in the report viewer.

Command	Action
 Print Command	Click to print the report being viewed.
 Export Report Command	Click to export the report data to a file. See Exporting Reports on page 43 for further instructions.
 Refresh Command	Click to refresh the display, which re-loads project data to the report. If project information has changed, update the report database, and then click Refresh to have the updated data displayed in the report.
 Size of view	Type or select a percentage to change the size of the report view.
 Search Text Command	Click to search for text in the report.

Adding Custom Reports to a Project

This procedure explains how to add a custom report created in the Crystal Reports software to a TriStation 1131 project. Only reports generated in Crystal Reports can be used in TriStation 1131; Crystal Reports must be purchased separately.

Procedure

1. In Crystal Reports, create a report and save it in a file with the extension .RPT.
2. Put the .RPT file in the Report Template directory. For more information on directory locations, see Specifying Directory Locations on page 22.

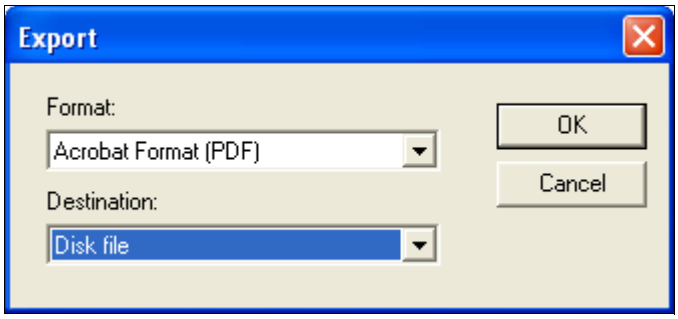
   The next time you open the project, the report will be included in the Reports list. If the report is added while the project is open, you must close and re-open the project to view the report in the list.

Exporting Reports

This procedure explains how to export report data in TriStation 1131. You can export reports to a variety of file formats, and can save the exported data to a disk or send it to someone via Microsoft Mail.

Procedure

1. Open the Project Workspace and then double-click the report you want to export. The report appears in the report viewer window.
2. On the report viewer toolbar, click the Export Report button. 



3. Specify these properties in the Export dialog box.

Property	Action
Export Format	Select the file format. The default is PDF.
Export Destination	Select the destination as either Disk file or Microsoft Mail. The default is Disk.

4. Click OK to continue.

   Depending on the format, additional information, such as the characters to use to separate and delimit a file, may be requested.

Report Database Information

This section provides information on the dBASE IV relational databases that are used when the Crystal Report Engine generates a report in TriStation 1131. In addition to the standard reports, you can create custom reports that can be used in TriStation 1131. You must purchase Crystal Reports in order to create custom reports.

After a project is opened, the databases are automatically updated with information from the project when you print the first report. You can also update the databases by right-clicking the Reports folder and clicking Update Reports Database.

Databases include:

The TRHWDCHS file contains information about the chassis types used in the system.

Table 2 System Definition: Chassis Types (TRHWDCHS.DBF)

Field Name	Field Type	Description
CHASTYPE (key)	Number	Chassis type numerical identifier
CHASDESC	String	Chassis description

The TRHWDMOD file contains information about the modules used in the system.

Table 3 System Definition: Module Types (TRHWDMOD.DBF)

Field Name	Field Type	Description
MODTYPE (key)	Number	Triconex module identifier
MODDESC	String	Module description
MODMODEL	String	Module marketing model number

The TRPRGINS file contains information about the programs in the project.

Table 4 Configuration: Program (TRPRGINS.DBF)

Field Name	Field Type	Description
PROGNAME	String	Program name
SEQUENCE	Number	Execution sequence number

The TRINSVAR file contains information about the variable connections in the program.

Table 5 Configuration: Instance Variable Connections (TRINSVAR.DBF)

Field Name	Field Type	Description
INSTNAME (key)	String	Program execution name. In v4.1, this is the same as the program name.
VARPATH	String	Program variable path
PROGNAME	String	Program name
VARNAME	String	Program variable name. In v4.1, this is the same as the tagname.
TAGNAME	String	Tagname
VAROUTPUT	Strings	W if written by instance; otherwise blank

The TRGLBVAR file contains information about the tagnames (global variables) in the project.

Table 6 Configuration: Tagnames (TRGLBVAR.DBF)

Field Name	Field Type	Description
TAGNAME (key)	String	Tagname
GROUP1	String	Group 1 name
GROUP2	String	Group 2 name
DESCRIP	String	Tagname description
LOCATION	String	Tagname location (same format as in configuration)
MODBUS	String	Modbus alias number
DATATYP	String	Data type: BOOL, DINT, REAL, and so on.
DATACLASS	String	Data class: memory, input, or output.
TYPECLASS	String	Point memory address. See Memory Address on page 382.
APPLICATN	String	Tagname application type (safety or control)
SHARED	String	Tagname shared for read state (Yes or No)
RETENTIVE	Boolean	Retain value indicator
INITVALUE	String	Initial value of tagname
DECPL	Number	Decimal places for REAL tagname
MINSPAN	Number	Lower limit for REAL number in Engineering Units
MAXSPAN	Number	Upper limit for REAL number in Engineering Units
SYSTEMTAG	Boolean	Is a system variable
MULTIWRIT	Boolean	Multiple writes enabled

The TRSYSOPS file contains information about the operating parameter settings in the project.

Table 7 Configuration: Operating Parameters (TRSYSOPS.DBF)

Field Name	Field Type	Description
CNFGVERS	String	Configuration version number
NETNODE	Number	NCM node number (switch setting)
NETALIAS	String	Network IP alias name
SCANRATE	Number	Scan rate (in milliseconds)
PSWDREQD	Boolean	Password required for download
DSBLSTOP	Boolean	Tricon Keyswitch STOP disabled
DSBLMBWR	Boolean	Disable Modbus writes to outputs
DSBLRCHG	Boolean	Disable remote changes
DSBLPNTS	Boolean	Permit disabling points

The TRSOEBLK file contains information about the SOE block definitions in the project.

Table 8 Configuration: SOE Block Definition (TRSOEBLK.DBF)

Field Name	Field Type	Description
SOEBLKNUM (key)	Number	SOE block number
SOEBLKTTL	String	SOE block title
SOEBUFSIZ	Number	Event buffer size
SOEBLKTYP	String	SOE block type

The TRSOEVAR file contains information about the SOE tagnames used in the project.

Table 9 Configuration: SOE Block Variables (TRSOEVAR.DBF)

Field Name	Field Type	Description
SOEBLKNUM (key)	Number	SOE block number
TAGNAME	String	Tagname
TRUENAME	String	Name of TRUE state
FALSENAME	Strings	Name of FALSE state
TRUECLR	String	Color of TRUE state
FALSECLR	String	Color of FALSE state

The TRMODCFG file contains information about the module configuration used in the project.

Table 10 Configuration: Module Configuration (TRMODCFG.DBF)

Field Name	Field Type	Description
CHASNUM (key)	Number	Chassis number (1-n)
CHASTYPE	Number	Chassis type numerical identifier
SLOTNUM	Number	Module type numerical identifier
MODTYPE	Number	Module type numerical identifier

The TRMALLOC file contains information about how memory is allocated.

Table 11 Configuration: Memory Allocation (TRMALLOC.DBF)

Field Name	Field Type	Description
DATADESC	String	Brief (coded) description of memory section
MAXPTS	Number	Maximum number of points for this type
ALLOCPTS	Number	Allocated points of this type
FCASTPNTS	Number	Forecasted points of this type after the next download
CURRPTS	Number	Currently used points of this type

The SECUSERS file contains information about the users authorized access to the project.

Table 12 Security: Users (SECUSERS.DBF)

Field Name	Field Type	Description
LOGINNAME (key)	String	User's log in name
USERNAME	String	User's full name
DESCRIP	String	User description
PRIVLEVEL	Number	User's privilege level

The SECLVLS file contains information about the user's access (privilege) level in the project.

Table 13 Security: Levels (SECLVLS.DBF)

Field Name	Field Type	Description
PRIVLEVEL (key)	Number	User's privilege level
DESCRIP	String	User description

The SECOPRS file contains information about the level of access required to use TriStation and controller operations.

Table 14 Security: Operations (SECOPRS.DBF)

Field Name	Field Type	Description
CATEGORY	String	Operation category name
DESCRIP	String	User description
PRIVLEVEL	Number	Minimum privilege level required

The PRINFO file contains information that is used when reports are printed.

Table 15 Project: Information (PRINFO.DBF)

Field Name	Field Type	Description
PRJNAME	String	Project name
DESCRIP	String	Project description
VERSION	String	Project version number
COINFO1	String	Company information 1
COINFO2	String	Company information 2
COINFO3	String	Company information 3
DBDATE	Date	Date the report database was updated
DBTIME	String	Time the report database was updated

The PRLIBS file contains information about the libraries included in the project.

Table 16 Project: Shared Libraries (PRLIBS.DBF)

Field Name	Field Type	Description
LIBNAME (key)	String	Library name
DESCRIP	String	Library description
VERSION	String	Library version number

The PRELEMS file contains information about the elements (programs, functions, function blocks, and data types) in the project.

Table 17 Project: Elements (PRELEMS.DBF)

Field Name	Field Type	Description
ELEMNAME (key)	String	Element name
VERSION	String	Element version number
CATEGORY	String	Element category
DESCRIP	String	Element description
ELEMTYPE	String	Element type: function, function block, and so on.
LANGUAGE	String	Language type: Function Block Diagram, Ladder Diagram, and so on.
OWNER	String	Element owner name
USERDEFINE	Boolean	User defined indicator
LIBRARY	Boolean	Library indicator
LIBNAME	8 characters	Library name
LOCKED	Boolean	Element locked indicator
READONLY	Boolean	Element read-only indicator
DRWGTITLE	String	Drawing title
DRWGNUM	Strings	Drawing number
DRWGREV	String	Drawing revision
DRWGCBY	String	Created by user name
DRWGCDATE	Date	Created date
DRWGCTIME	String	Created time
DRWGMBY	String	Modified by user name
DRWGMDATE	Date	Modified date
DRWGMTIME	String	Modified time
DRWGAB	String	Approved by name
DRWGADT	String	Approved date

Table 17 Project: Elements (PRELEMS.DBF) *(continued)*

Field Name	Field Type	Description
APPLICATN	String	Element application type (safety or control)

The PRPOUVAR file contains information about the POUs (program organizational units), which include programs, functions, and function blocks.

Table 18 Project: POU Variables (PRPOUVAR.DBF)

Field Name	Field Type	Description
VARPATH	String	POU variable path
POUNAME (key)	String	POU name
VARNAME ((key)	String	POU variable name
DESCRIP	String	Element description
DATATYPE	String	Data type: BOOL, DINT, REAL, and so on.
DATACLASS	String	Data class: local, input, output, and so on.
INITVALUE	String	Initial value of the POU variable

The PRPOUXRF file contains information about where variables are located in the project.

Table 19 Project: POU Cross-Reference (PRPOUXRF.DBF)

Field Name	Field Type	Description
VARPATH (key)	String	Program variable path which indicates where the variable is used
SEQNO	Number	Record sequence number 0–n
SHTCOORD	String	Sheet coordinates of variable on SHTNUM

The PRHIST file contains information about the project history.

Table 20 Project: Audit History (PRHIST.DBF)

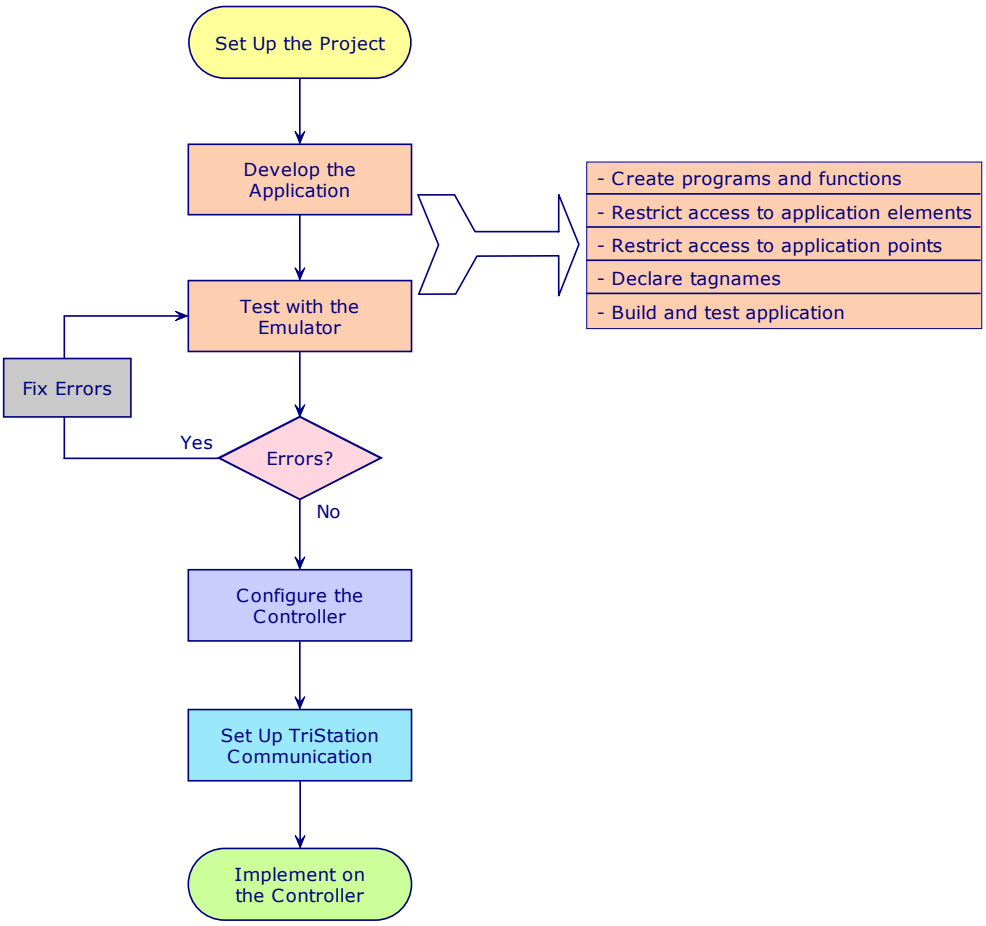
Field Name	Field Type	Description
EVENTID	String	ID of the event
USERNAME	String	User's full name
ELEMNAME	String	Name of element that was changed
COMMENT	String	Comment on change
DATE	Date	Date of change
TIME	String	Time of change
ACTION	String	Action performed (including version number)

2

Application Development

Overview

This figure shows the main steps for developing a TriStation 1131 application. An application can be developed and tested on the emulator before downloading the application to a controller.



Application Development Steps

This list includes the steps that can or should be performed during application development.

	Step	See
❒	Plan the application.	• Safety and Control Applications on page 58
❒	Create programs and functions.	• User Documents on page 62 • Function Block Diagram and Ladder Diagram Development on page 69 • Structured Text Development on page 77 • Cause Effect Matrix Development on page 88
❒	Add annotations and comments.	• Preparing an Excel File for Import on page 129
❒	Determine access to a document.	• Restricting Access to a Document on page 67
❒	Determine access to points.	• Tricon Application Access on page 163 • Trident Application Access on page 168
❒	Declare tagnames.	• Tagnames on page 115
❒	Import or export tagnames.	• Importing and Exporting Tagnames on page 126
❒	Assign Modbus aliases.	• Modbus Applications on page 146
❒	Add Peer-to-Peer features.	• Peer-to-Peer Applications on page 156
❒	Compile project programs and functions.	• Compiling a Program on page 173
❒	Build the application.	• Building an Application on page 172

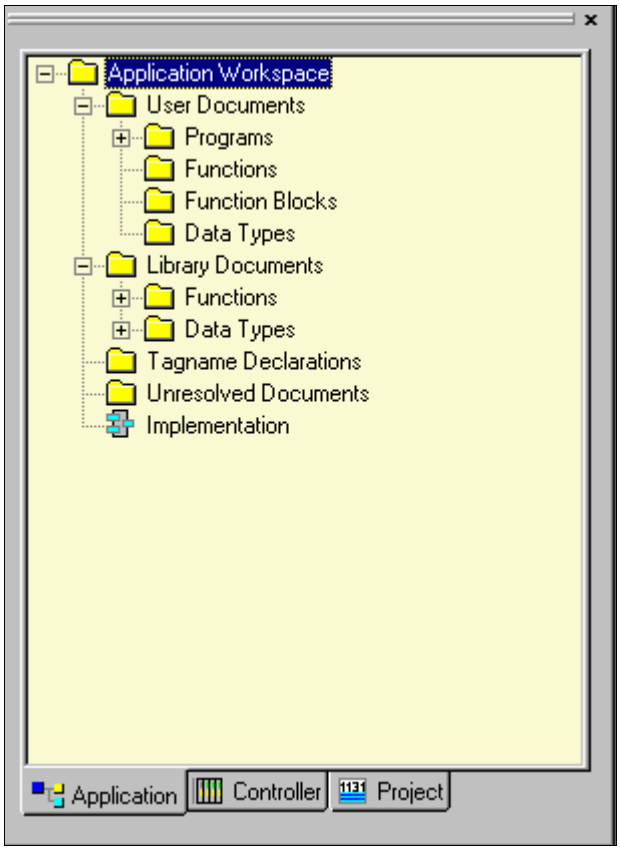
Application Elements

This section describes the elements of an application and the steps in application development.

Topics include:

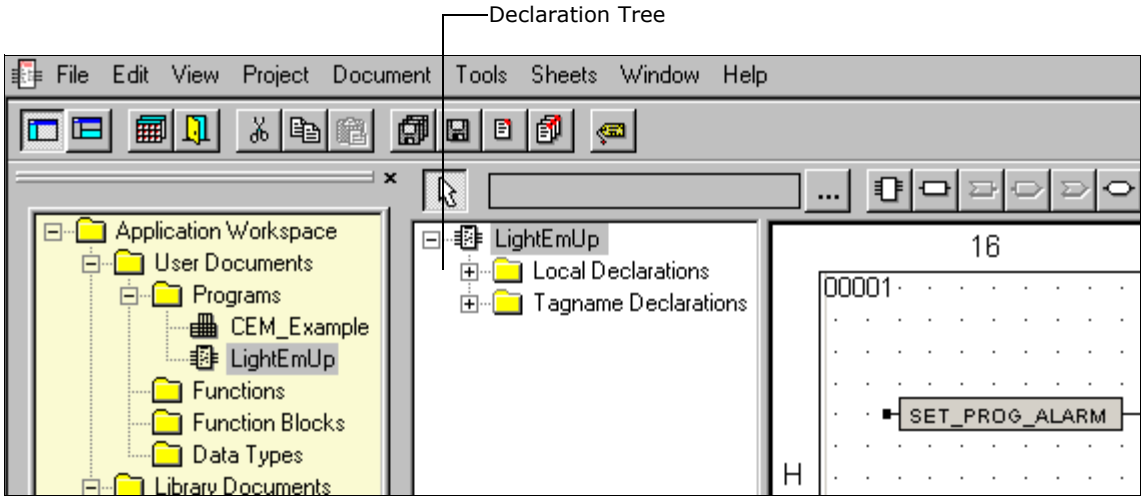
The Application Workspace

Application development takes place in the Application Workspace. The folders in this tree include the user programs, functions, function blocks, data types, tagnames, and implementation settings needed for the application. The tree also includes the TriStation 1131 library of functions, function blocks, and data types that can be used in the project.



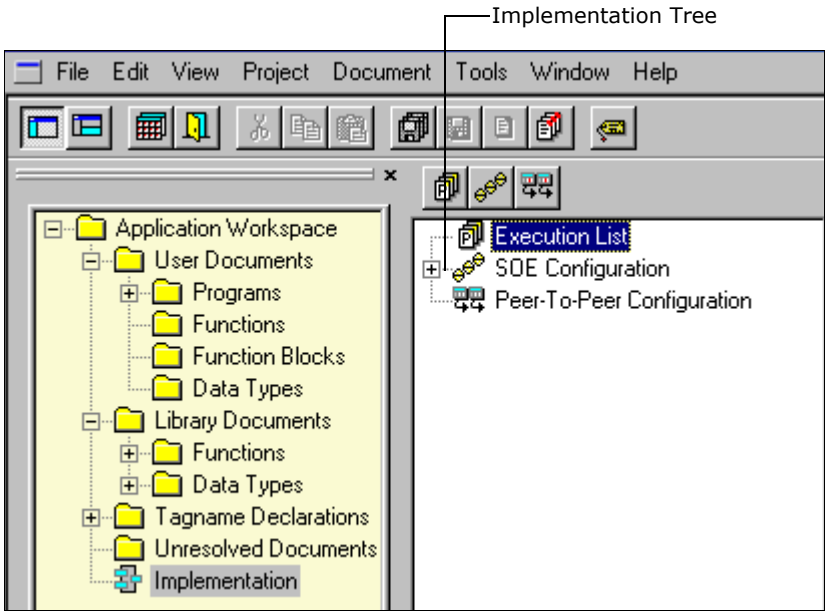
The Declaration Tree

The Declaration Tree lists the declarations for the currently opened program, function, or function block.



The Implementation Tree

The Implementation Tree lists the elements that can be specified for the application, including the Execution List (list of programs and scan time), SOE Configuration, and Peer-To-Peer Configuration.



Parts of an Application

The major elements in an application are programs, functions, function blocks, tagnames, variables, implementation information, and controller configuration.

Application

An application includes application elements and configuration information that is built (compiled) into executable code and downloaded and run on a Triconex controller.

The maximum number of programs in an application is 250.

Programs

A program is an executable element that includes one or more functions and function blocks. A program can invoke functions and function blocks but cannot invoke another program. A program is initiated from the Execution List.

The maximum number of variables that can be used in a program is 2,000, which includes local variables and tagnames, but not VAR_TEMP variables.

Functions and Function Blocks

A function is an executable element that returns exactly one result. The values in a function exist only while the function is executing.

A function block is an executable element that returns one or more values and retains the values derived during one evaluation for use in the next evaluation. For function blocks, a set of input values may not yield the same output values.

The maximum number of variables that can be used in a function or function block is 400, which includes input, output, input/output, and local variables, but not VAR_TEMP variables.

TriStation 1131 Libraries

TriStation 1131 includes libraries of functions, function blocks, and data types that are automatically included with each project.

For information on specific functions, function blocks, and data types, see the *TriStation 1131 Libraries Reference*.

User-Defined Functions

In user-defined functions, if no value is assigned to the function output, the return value is the default initial value. If there is not a statement that assigns a value to the function output, a compiler error occurs. No error or warning is issued if an assignment to the function output is in a conditional statement and is not executed.

Tagnames

A tagname identifies input, output, and memory points that are accessible to all programs in the application. In IEC terminology, tagnames are called global variables.

Variables

A variable is a named area in memory that stores a value or string assigned to that variable.

Table 21 Variable Types and Uses

Variable Type	Used With
Input	Functions and function blocks
In/Out	Function blocks
Output	Functions and function blocks
Local	Functions, function blocks, and programs
Tagname	Programs
VAR_TEMP	Currently available only in ST programs and function blocks

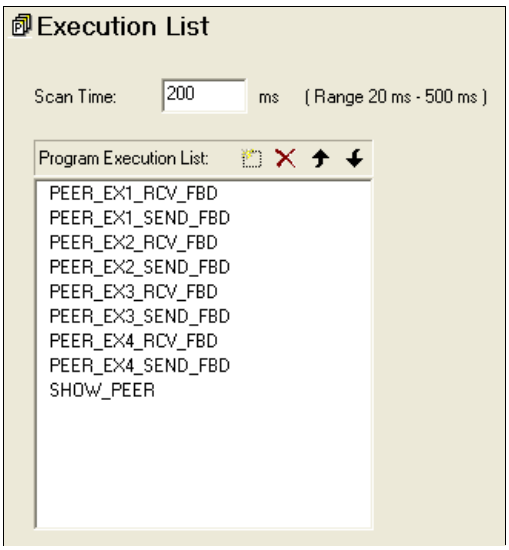
Data Types

A data type identifies the type of data used in tagnames and variables. TriStation 1131 uses both elementary and generic data types. For more information, see Appendix B, Data Types.

- Elementary types are defined by IEC 61131-3 and include: BOOL, DATE, DINT, DT, DWORD, INT, LREAD, REAL, STRING, TIME, and TOD. TriStation 1131 also supports the derivation of structured, array, and enumerated data types.
- Generic data types are used to organize elementary data types that have similar properties and can be used with IEC 61131-3 standard functions that support overloaded inputs and outputs. Generic data type names use the prefix ANY.

Implementation Information

Implementation information includes the Execution List, Scan, SOE, and Peer-to-Peer setup.



Controller Configuration

The controller configuration specifies the communication characteristics for memory, module configuration, and other hardware-related settings. When the application is built, this information is required. For more information, see Chapter 3, Controller Configuration.

Safety and Control Applications

An application can include safety programs only, control programs only, or a combination of safety and control programs. Safety applications are the most restrictive type because they are designed to take a process to a safe state when predetermined conditions are violated. All elements of the application (programs, functions, function blocks, and tagnames) must be approved or specified for safety.

Control applications are designed to control a process and can use control, or safety and control functions and function blocks. The tagnames must be specified as control tagnames.

This table describes how programs, functions, function blocks, and tagnames can be used in safety and control applications.

Table 22 Safety and Control Usage

Application Elements	Use
Programs	Safety programs cannot use control functions, function blocks, or tagnames. Control programs cannot use safety tagnames.
Functions and Function Blocks	Can be safety and control, or control. Library functions and function blocks are designated as approved for use in safety and control or control applications. These designations cannot be changed.
Tagnames	Can be safety or control. If Shared Read is selected, a safety program can read a control tagname and vice-versa.

Programming Languages

TriStation 1131 supports programming languages for developing, testing, and documenting applications that run on a Triconex controller.

TriStation 1131 supports these programming languages:

- Function Block Diagram Language (FBD)
- Ladder Diagram Language (LD)
- Structured Text Language (ST)
- CEMPLE (Cause and Effect Matrix Programming Language Editor)

The Function Block Diagram, Ladder Diagram, and Structured Text languages comply with the IEC 61131-3 International Standard on Programming Languages for Programmable Controllers. CEMPLE is an optional language that can be purchased separately from Triconex.

Function Block Diagram Language

Function Block Diagram (FBD) language is a graphical language that corresponds to circuit diagrams. The elements used in this language appear as blocks wired together to form circuits. The wires can communicate binary and other types of data between FBD elements. In FBD, a

group of elements visibly interconnected by wires is known as a network. An FBD diagram can contain one or more networks.

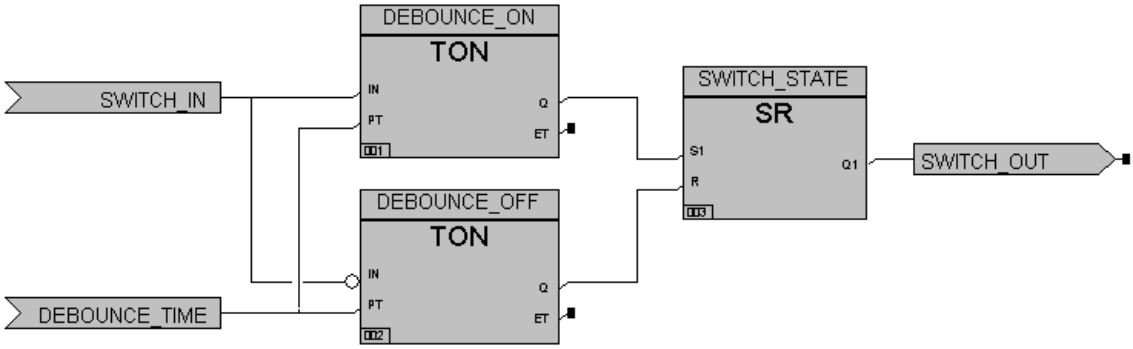


Figure 1 Sample FBD Network

Ladder Diagram Language

Ladder Diagram (LD) language is a graphical language that uses a standard set of symbols to represent relay logic. The basic elements are coils and contacts which are connected by links. Links are different from the wires used in FBD because they transfer only binary data between LD symbols, which follow the power flow characteristics of relay logic. Function blocks and function elements which have at least one binary input and output can be used in LD diagrams.

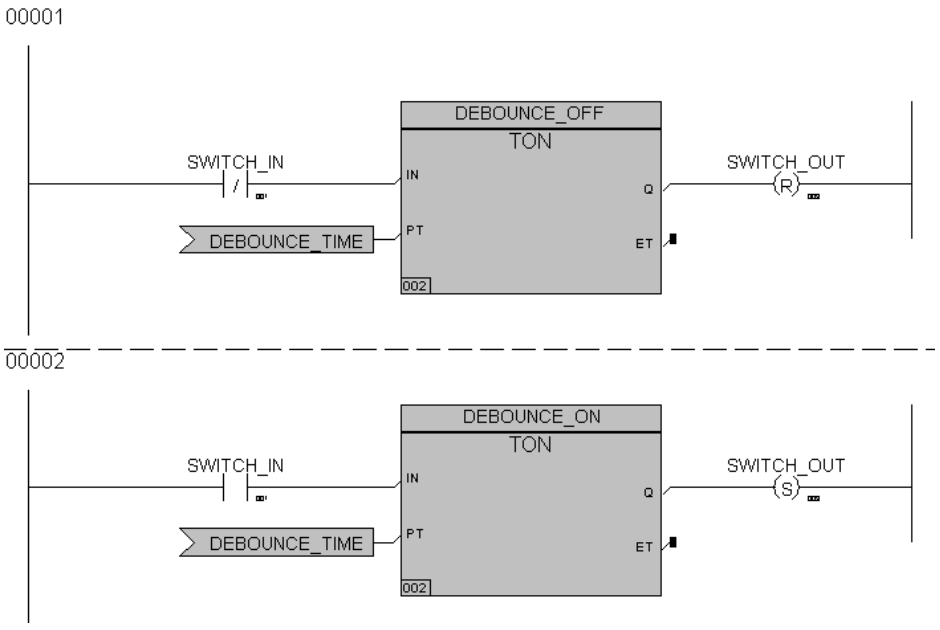


Figure 2 Sample Ladder Diagram

Structured Text Language

Structured Text (ST) language is a general purpose, high-level programming language, similar to PASCAL or C. Structured Text is particularly useful for complex arithmetic calculations, and can be used to implement complicated procedures that are not easily expressed in graphical languages such as FBD or LD.

ST allows you to create Boolean and arithmetic expressions as well as structured programming constructs such as conditional statements (IF...THEN...ELSE). Functions and function blocks can be invoked in ST.

```
FUNCTION_BLOCK DEBOUNCE_ST

(* External Interface *)
        VAR_INPUT
                SWITCH_IN : BOOL ;
                DEBOUNCE_TIME : TIME;
        END_VAR

        VAR_OUTPUT
                SWITCH_OUT : BOOL ;
        END_VAR

        VAR
                DEBOUNCE_OFF : TON;
                DEBOUNCE_ON : TON;
        END_VAR

(* Function Block Body *)
        DEBOUNCE_OFF(IN := NOT SWITCH_IN, PT := DEBOUNCE_TIME);
        IF DEBOUNCE_OFF.Q THEN SWITCH_OUT := FALSE; END_IF;
        DEBOUNCE_ON (IN := SWITCH_IN, PT := DEBOUNCE_TIME);
        IF DEBOUNCE_ON.Q THEN SWITCH_OUT := TRUE; END_IF;

END_FUNCTION_BLOCK
```

Figure 3 Sample Structured Text Code

CEMPLE (Cause and Effect Matrix Programming Language Editor)

CEMPLE™, which stands for Cause and Effect Matrix Programming Language Editor, is a Triconex language based on cause and effect matrix methodology, which is commonly used in the process control industry. A cause and effect matrix is frequently used for applications such as fire and gas systems for which the programming logic is simple, but the volume of inputs and outputs that need to be controlled is high. A matrix is readily understood by a broad range of plant personnel from process control engineers to maintenance operators.

CEMPLE allows you to associate a problem in a process with one or more actions that must be taken to correct the problem. The problem is known as a cause and the action is known as an effect. In a typical matrix, a cause is represented by a row in the matrix and an effect is represented by a column. An X in the intersection of a cause row and an effect column establishes a relationship between the cause and the effect.

				OR	OR	OR	OR	OR
			Effect	UNIT_1_ALARM	UNIT_2_ALARM	UNIT_3_ALARM	UNIT_4_ALARM	UNIT_5_ALARM
			Description	High level alarm indicator for tank 1	High level alarm indicator for tank 2	High level alarm indicator for tank 3	High level alarm indicator for tank 4	High level alarm indicator for tank 5
	Cause	Description		E01	E02	E03	E04	E05
	LEVEL_1_	TRUE=Fluid level in tank 1 is high	C01	X	☐	☐	☐	☐
	LEVEL_2_HI	TRUE=Fluid level in tank 2 is high	C02	☐	X	☐	☐	☐
	LEVEL_3_HI	TRUE=Fluid level in tank 3 is high	C03	☐	☐	X	☐	☐
	LEVEL_4_HI	TRUE=Fluid level in tank 4 is high	C04	☐	☐	☐	X	☐

Loc	Terminal	Var/Const	VarType	DataType	Description
C01		P1_LEVEL_1_HI	Tagname	BOOL	

Figure 4 Sample CEMPLE Matrix

User Documents

This section describes the how to create and specify user documents, which include programs, functions, function blocks, and data types. Topics include:

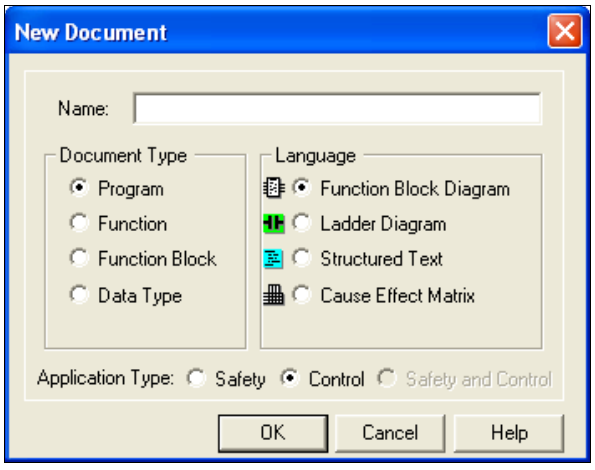
Note If you are trying to edit a user document created by another user, and are unable to do so even when you have the correct user level and access privileges, check the document's access property. If it is locked, you must ask the user who created the document to change the access property. See Restricting Access to a Document on page 67.

Creating a User Document

This procedure explains how to create a user document. A user document can be a program, function, function block, or data type.

Procedure

1 Expand the Application tree, right-click the User Documents folder, and then click New Document.



2 Specify these properties in the New Document dialog box.

Property	Action
Name	Enter a descriptive name for the document.
Document Type	Click the type of document to create. The default is Program.
Language	Click the language type to use. The default is Function Block Diagram.
Application Type	Click the type of application the document is to be used in. The default is Control.

3 Click OK. The document is opened in the specified programming language.

Copying User or Library Documents

You can make copies of user documents you have created, as well as library documents. This can help you reduce development time by using an existing document as the basis for a new document.

Copying a User Document

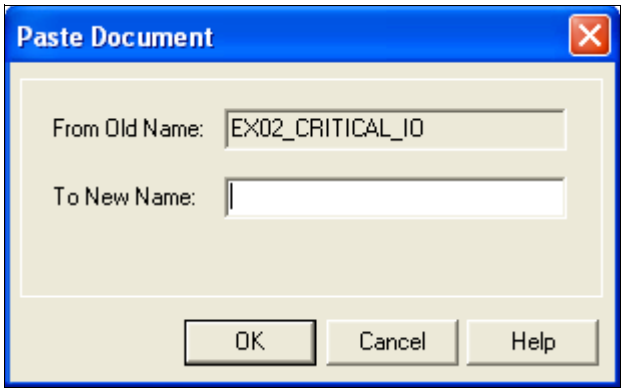
This procedure explains how to copy a user document.

Procedure

1 Expand the Application tree, right-click the document to be copied, and click Copy.

If the document is open in TriStation, the Copy command will be unavailable. Close the document and then repeat step 1.

2 On the Edit menu, click Paste.



3 Enter the name for the new document, and click OK.

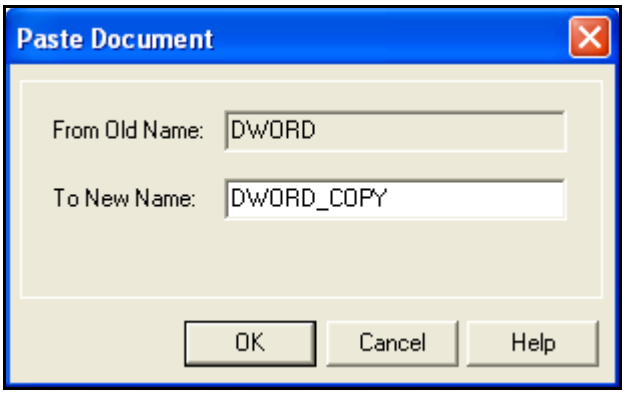
Copying a Library Document

This procedure explains how to make a copy of an existing library document. Only functions and data types can be copied; function blocks cannot be copied.

Procedure

1. Expand the Application tree, open the Library Documents folder and locate the function or data type you want to copy.
2. Right-click on the function or data type, and select Copy.

   If the document is open in TriStation, the Copy command will be unavailable. Close the document and then repeat steps 1 and 2.
3. In the Application tree, right-click the User Documents folder and select Paste.



4. Enter a name for the copied document, and then click OK.

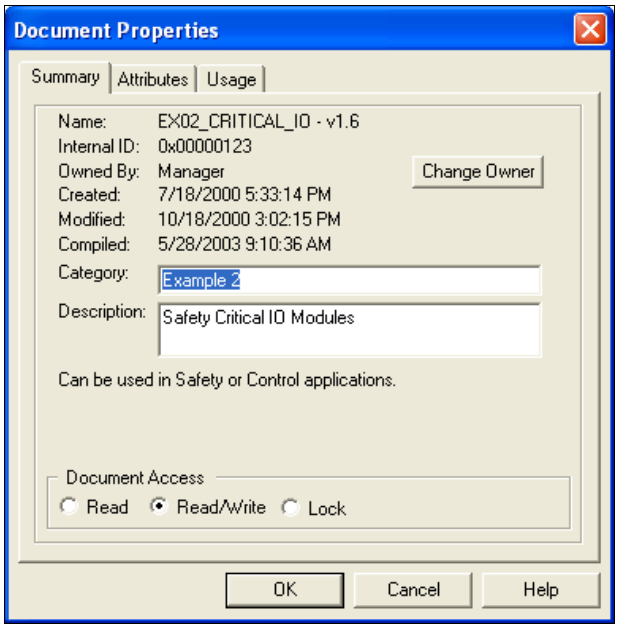
   The new function or data type is now located in the appropriate folder in the User Documents folder.

Specifying Document Summary Information

This procedure explains how to specify summary information for a document.

Procedure

1 Expand the Application tree, right-click a document (program, function, function block, or data type) and click Properties.



2 Specify these properties on the Summary tab.

Property	Action
Name	Displays the name of the document and version number.
Internal ID	Displays an internal number used to identify the document.
Owned by	Displays the name of the owner. To change, click Change Owner.
Created	Displays the date and time the document was created.
Modified	Displays the date and time the document was last modified.
Compiler	Displays the date and time the document was last compiled.
Category	Enter a name to be used to categorize the document. Documents can be organized and displayed by categories.
Description	Enter a description for the document.
Document Access	Select the type of access to allow for this document. The default is Read/Write. See Restricting Access to a Document on page 67.
Change Owner Command	Click the Change Owner button to change the owner of the document. See Changing a Document Owner on page 68.

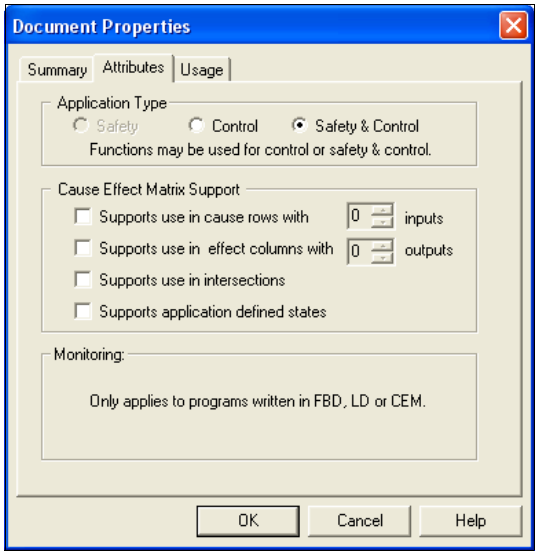
3 Click OK to save your changes.

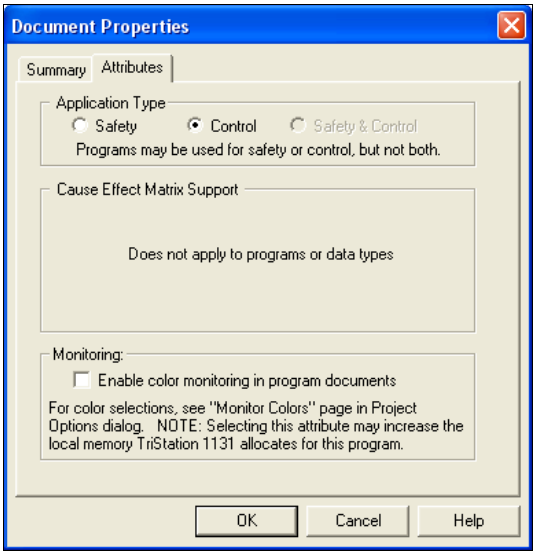
Specifying Document Attributes

This procedure explains how to specify document attributes, which include the type of application the document can be used in, and whether the document can be used in a CEM program.

Procedure

1 Expand the Application tree, right-click a document (program, function, function block, or data type) and click Properties. Click the Attributes tab.





2 Specify these properties on the Attributes tab.

Property	Action
Application Type	Specify whether this document can be used in Safety, Control, or Safety and Control applications. The default is Control.
Cause Effect Matrix Support	Select the check box for each type that is supported. Specify the number of inputs and outputs, if needed. Only available for functions and function blocks. See Enabling User-Defined Functions and Application-Defined States on page 97.
Enable Color Monitoring	Select the check box if you want a color displayed for BOOL inputs and outputs when the application is run on the controller or emulator. Only available for programs written in FBD, LD, or CEM.

3 Click OK to save your changes.

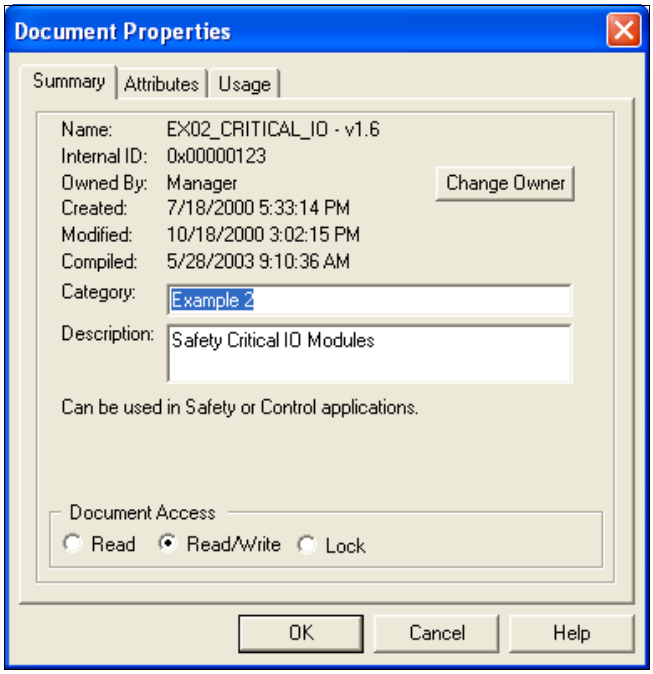
Restricting Access to a Document

This procedure explains how to restrict access to a document by setting the Access property. The most restrictive setting is for Read, which means anyone with a lesser security level than yours cannot change it. The least restrictive setting is for Read/Write, which means all users can read and change the document. You can also Lock the document to prevent editing by unauthorized users.

To change the setting for this property, you must have a User Security level that includes Change Access Attributes. See User Access on page 27 for more information.

Procedure

1. Expand the Application tree, right-click a document (program, function, function block, or data type), and click Properties.



2. On the Summary tab, select the access type for this document. The default value is Read/Write.
3. Click OK to save your changes.

Changing a Document Owner

This procedure explains how to change the owner of a document, which determines whether other users can change the element. Normally, the owner of a document is the user who created it.

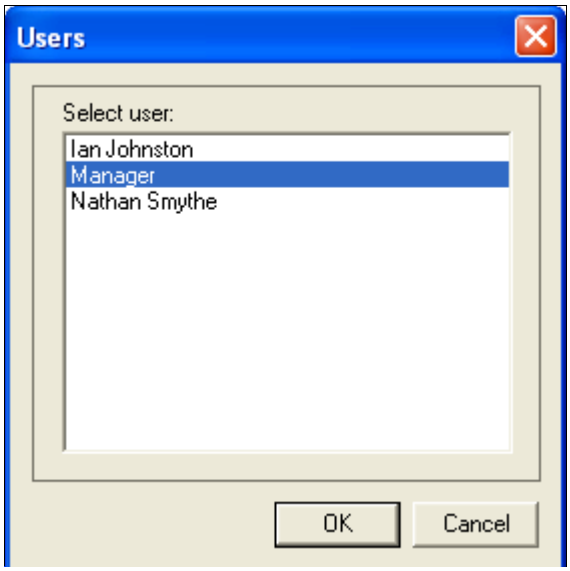
To change the setting for this property, your user security level must:

- include the Elements: Change Access Attributes privilege
- be the same or greater than the security level of the user you want to assign as owner

See User Access on page 27 for more information about user security levels.

Procedure

1. Expand the Application tree, right-click a document (program, function, function block, or data type), and click Properties.
2. On the Summary tab, click Change Owner.



3. In the Users dialog box, select the user who is to become owner of this element.
4. Click OK.

   The Owned By property in the Document Properties dialog box displays the name of the new owner.

Function Block Diagram and Ladder Diagram Development

This section explains how to use Function Block Diagram (FBD) and Ladder Diagram (LD) languages to develop programs, functions, and function blocks. Topics include:

Using the FBD Editor

The Function Block Diagram (FBD) editor allows you to develop programs and functions by using a graphical language that corresponds to circuit diagrams. Toolbar commands are described in detail in Appendix A, Commands and Properties.

1	Declaration Tree	6	Output Variable	11	Comment	16	Zoom to Fit
2	Selection Tools	7	I/O Variable	12	Horizontal Network	17	Previous Sheet
3	Function (Block)	8	Tagname	13	Vertical Network	18	Sheet Manager
4	Local Variable	9	Constant	14	Auto Name	19	Next Sheet
5	Input Variable	10	Wire Tool	15	Zoom		

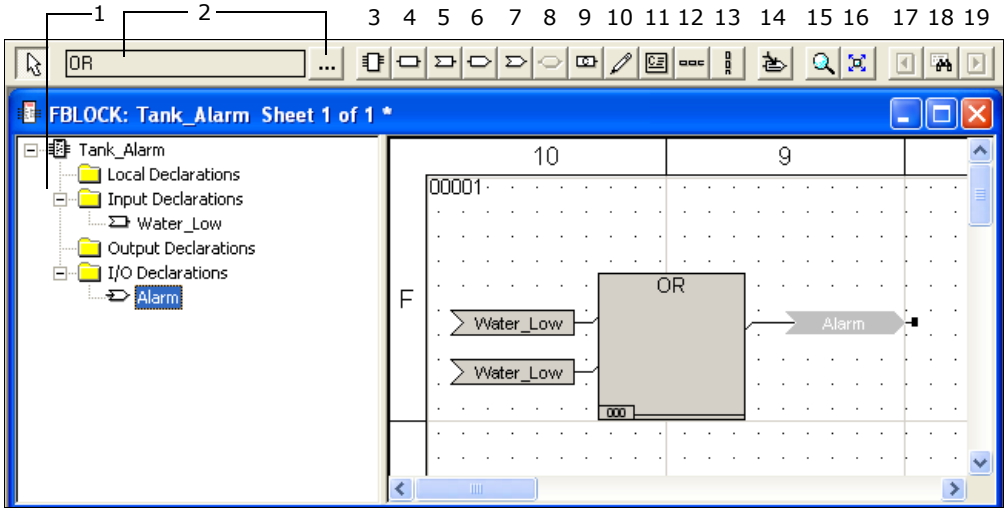


Figure 5 Function Block Diagram Editor Elements

Using the LD Editor

The Ladder Diagram (LD) editor allows you to develop programs and functions by using a graphical language that corresponds to relay logic. Toolbar commands are described in detail in Appendix A, Commands and Properties.

1	Declaration Tree	7	Input	13	Link Tool	19	Zoom to Fit
2	Selection Tools	8	Local Variable	14	Comment	20	Previous Sheet
3	Function (Block)	9	Output Variable	15	Horizontal Network	21	Sheet
4	Contact	10	I/O Variable	16	Vertical Network	22	Next Sheet
5	Coil	11	Tagname	17	Auto Name		
6	Right Power Rail	12	Constant	18	Zoom		

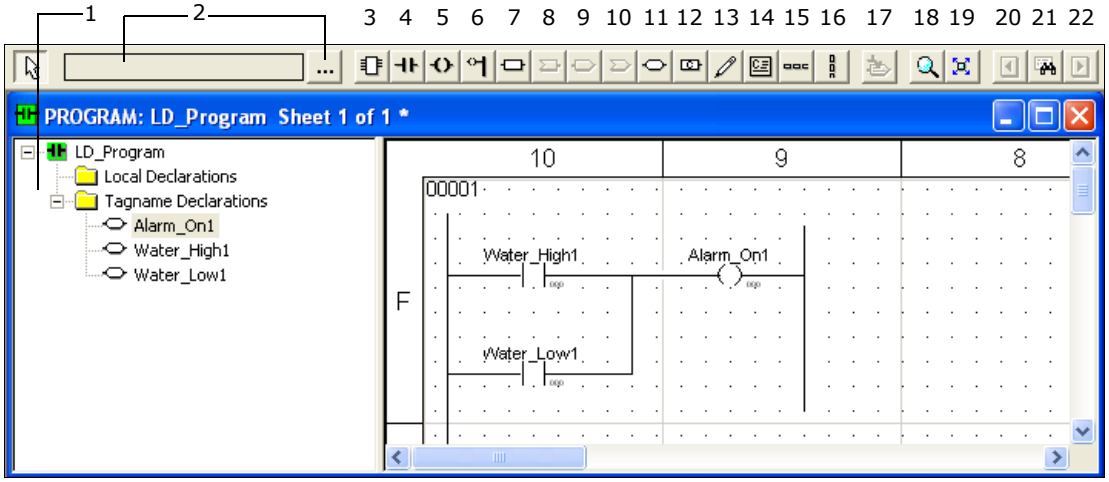


Figure 6 Ladder Diagram Editor Elements

Function and Function Block Graphics

In FBD and LD languages, each function and function block is graphically represented on the logic sheet. For more information on specific functions and function blocks, see the *TriStation 1131 Libraries Reference.*

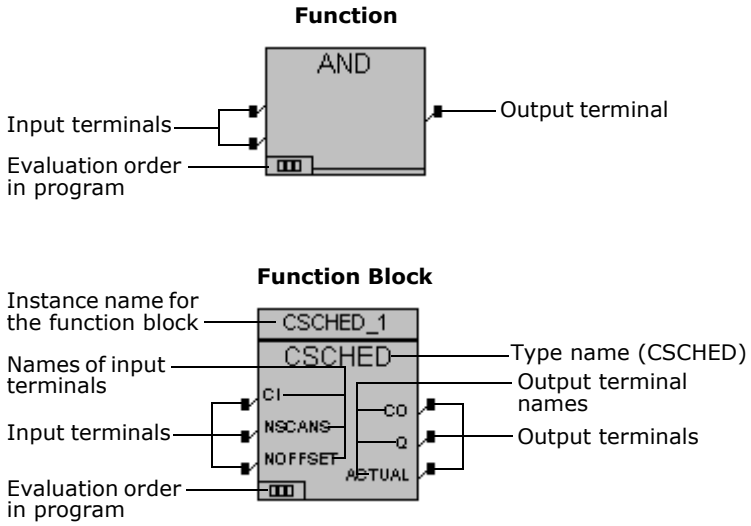


Figure 7 Function and Function Block Elements

Table 23 Function Block Graphic Elements

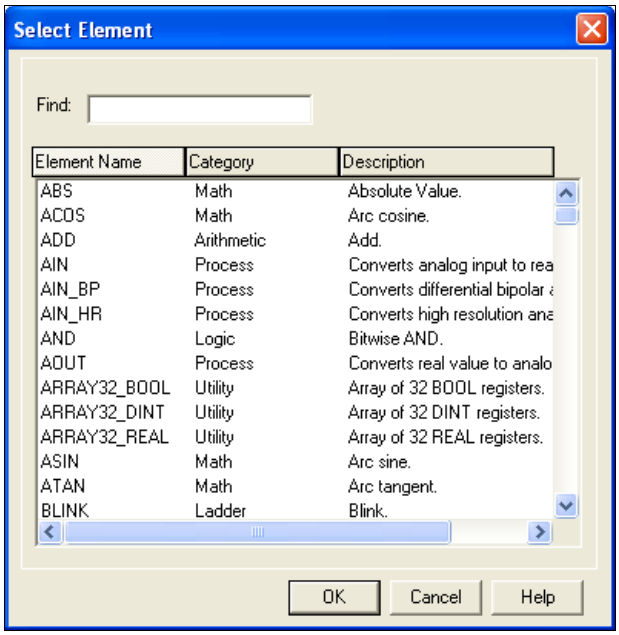
Item	Description
Instance name	Identifies the specific implementation of a function block type. For function blocks only.
Names of terminals	Identify the input and output parameters used with the function block.
Terminals	Locations where variables are attached.
Evaluation order	Identifies the order in which the function is executed in the program.
Type name	Identifies the function block type.

Selecting Library Elements

This procedure explains how to select a library element to include in a project program or function. TriStation 1131 includes libraries of functions, function blocks, and data types that can be used in a project. Many of these elements include the source code, which can be copied to a program or function.

Procedure

1. Expand the Application tree, create or open a program.
2. Click the Select Function (Block) Tool Element button ....



3. Select the function or function block to be inserted, click OK, and then click on the logic sheet to place the element.
4. To insert another function or function block of the same type, click the Function (Block) Tool , then click on the logic sheet to place the element.
5. To select a different function or function block, repeat steps 2 and 3.

Note You can easily create your own function by making a copy of an existing library function, and then modifying it to suit your needs. See Copying a Library Document on page 64.

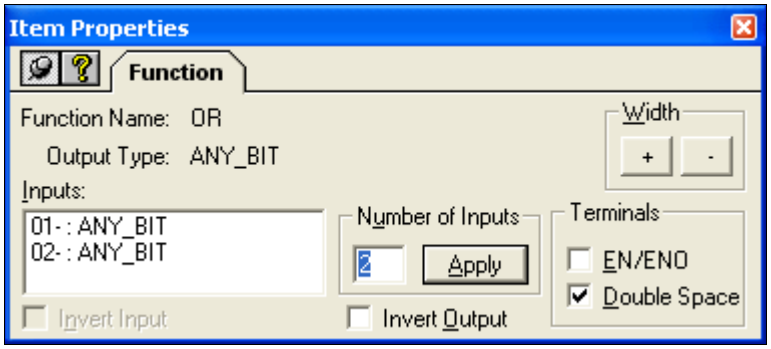
Specifying Function Properties

This procedure explains how to specify properties for functions.

Procedure

1 Expand the Application tree and open a program or function.

2 Double-click the graphic of the function whose properties you want to define.



3 Specify these properties on the Function tab.

Property	Action
Number of Inputs	If the Number of Inputs fields is enabled, the function is extensible, which means the number of inputs can be changed. To add inputs, enter the number of inputs and click Apply.
Invert Input	If an input is inverted, the value is changed to the opposite value (True to False, or False to True) when the function is executed. Only available for BOOL inputs. To invert the value for a specific BOOL value, select the input and then select the Invert Selected Input check box.
Invert Output	If an output is inverted, the value is changed to the opposite value (True to False, or False to True) when the function is executed. Only available for BOOL outputs. To invert the value for the output, select the Invert Output check box.
Width	Click + or – to increase or decrease the width of the selected function graphic on the logic sheet.
EN/ENO	To include an input and output parameter that detects errors in FBD and LD logic, select the EN/ENO check box. Required in functions and function blocks used in LD programs.
Double Space	Select the check box to have space in the function graphic on the logic sheet doubled between the inputs and outputs.

4 Click OK to save your changes.

Specifying Function Block Properties

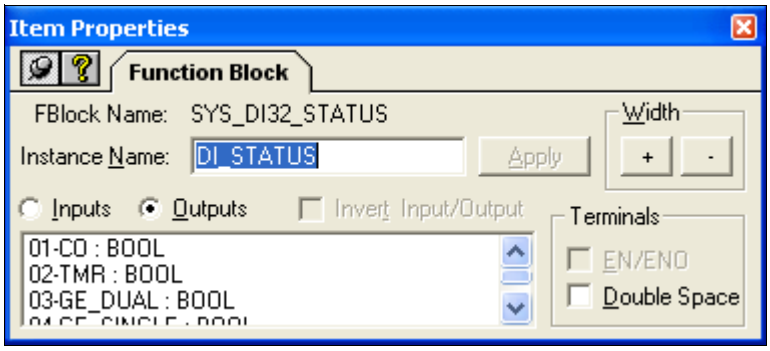
This procedure explains how to specify properties for function blocks.

Function blocks must have at least one BOOL input and one BOOL output. All input, output, and local variables in a function block persist from one execution of a function block to the next execution. Consequently, the same function block invoked with the same inputs may not return the same outputs.

Any function block previously declared can be used in the declaration of another function block or program. The scope of an instance of a function block is local to the function block or program that declares the instance.

Procedure

1. Expand the Application tree and open a program or function block.
2. Double-click the graphic of the function block.



3. Specify these properties on the Function Block tab.

Property	Action
Instance Name	Enter a name for this specific implementation of the function block.
Invert Input/Output	If an input or output is inverted, the value is changed to the opposite value (True to False, or False to True) when the function is executed. Only available for BOOL inputs. To invert the value for a specific BOOL value, select the input or output and then select the Invert Input/Output check box.
Width	Click + or – to increase or decrease the width of the selected function block graphic on the logic sheet.
EN/ENO	Only available with functions.
Double Space	Select the check box to have space in the function block graphic on the logic sheet doubled between the inputs and outputs. The default is cleared.

4. Click OK to save your changes.

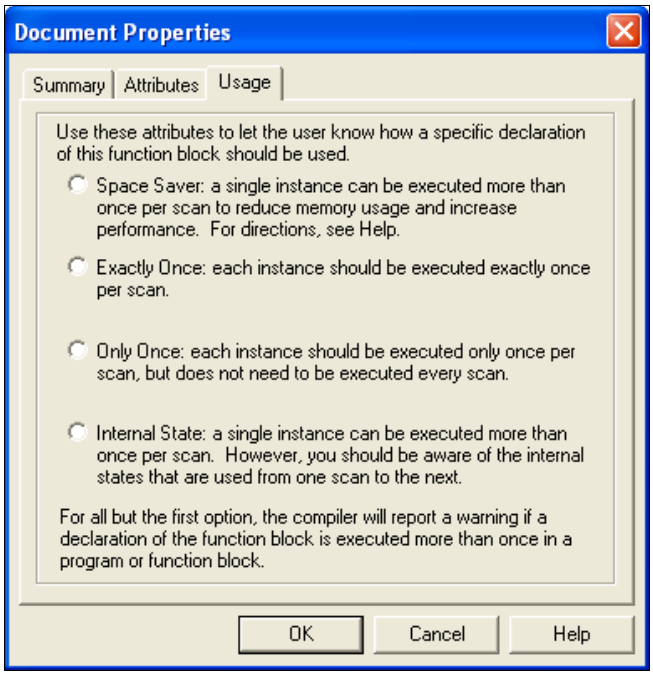
Specifying Function Block Application Usage

This procedure explains how to specify the Usage property for function blocks, which determines how the function block is used in a program. You can specify the usage for user-defined function blocks, but you cannot change the settings for TriStation 1131 library function blocks.

Procedure

1 Expand the Application tree and expand the User Documents folder.

2 Right-click a function block, click Properties, and then click the Usage tab.



3 Specify one of these settings on the Usage tab.

Setting	Action
Space Saver	Use when a single instance can be executed more than once per scan to reduce memory usage and increase performance. For more information on specific requirements for using a function block as a space saver, see Space Saver on page 428.
Exactly Once	Use when each instance should be executed exactly once per scan.
Only Once	Use when each instance should be executed only once per scan, but does not need to be executed every scan.
Internal State	Use when a single instance can be executed more than once per scan.

4 Click OK to save your selection.

Using a Space Saver Function Block

This procedure explains how to use a function block as a space saver. The Space Saver setting means a single instance can be executed more than once per scan to reduce memory usage and increase performance.

For user-defined function blocks, you can specify this setting. For Triconex Library function blocks, the setting cannot be changed.

Procedure

1. Declare only one instance of the function block and use that same instance throughout your program. On a function block diagram, just use the same instance name repeatedly.
2. To prevent mistakes, connect a value to every function block input. If you forget to connect an input, then you must search for a previous execution of the function block to see the input value because the function block remembers the input value from one execution to the next if the input is not connected.
3. Do not use the function block instance more than once in a network—the result is a WG0014 warning because the diagram could be ambiguous.

Structured Text Development

This section explains how to use Structured Text (ST) language to write a program, function, function block, or data type. Structured Text is a high level language that has been specifically developed for industrial control applications.

For more information, see *Programming Industrial Control Systems Using IEC 1131-3*, by R.W. Lewis, London: Short Run Press Ltd., 1998.

Topics include:

Using the ST Editor

The Structured Text (ST) editor allows you to develop programs and functions by writing code. This figure shows the logic sheet and commands. Toolbar commands are described in detail in Appendix A, Commands and Properties.

1	Read-Only	3	Replace Text	5	Larger Font	7	Type Over
2	Find Text	4	Line Numbers	6	Smaller Font	8	Auto Indent

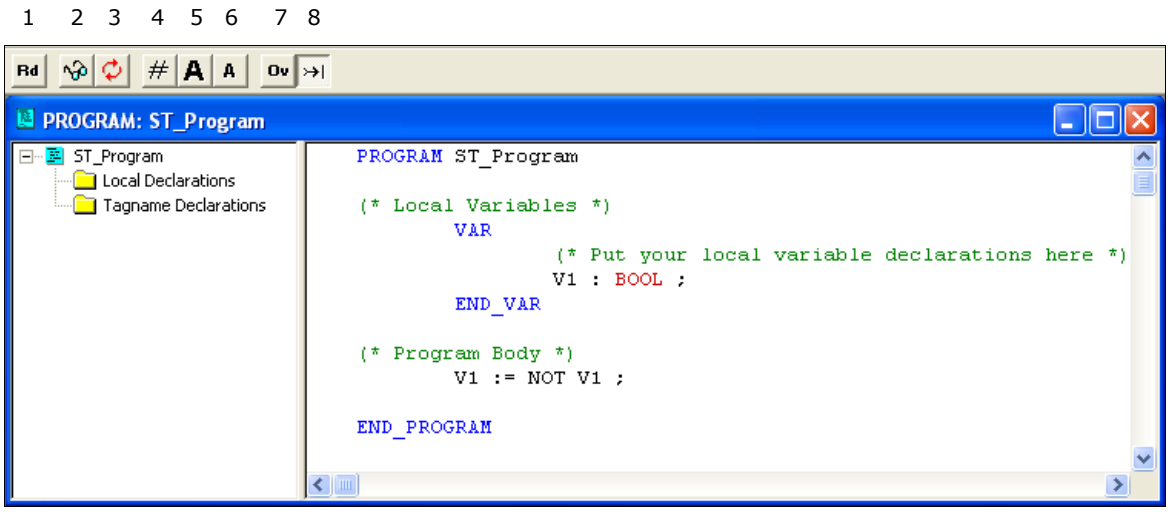


Figure 8 Structured Text Editor Elements

The ST compiler allows you to insert tabs, spaces, and comments between keywords and identifiers wherever a space is required. Each statement must be terminated with a semi-colon (;) separator. Comments must be preceded by (* and followed by *), as shown in this example:

```
(* this is a comment *)
```

Note You can easily add code to your ST program by copying and pasting code from existing library or user documents. To do so, while viewing the code you want to copy, select the code, right-click on it, and select Copy. Then, return to your ST program, right-click where you want to add the code, and select Paste.

Defining an Enumeration Data Type

An enumerated data type is a data type that allows different states of a value to be given different names.

Syntax Example

```
TYPE ENUM_COLORS:
   (YELLOW, RED, GREEN);
END_TYPE
```

In this example, the value of a variable of type ENUM_COLORS is YELLOW, RED, or GREEN. Any other value is an error. The default initial value is YELLOW. The order for comparison increases from left to right.

Example

```
PROGRAM ST_Enumerations
VAR
   MY_COLORS : ENUM_COLORS := GREEN;
END_VAR
   if (MY_COLORS = GREEN)then
      MY_COLORS := RED;
   elsif (MY_COLORS = RED)then
      MY_COLORS := YELLOW;
   elsif (MY_COLORS = YELLOW)then
      MY_COLORS :=GREEN;
   end_if;

   (* The following statement causes an error *)
   (* MY_COLORS := 6; *)

END_PROGRAM
```

Defining an Array Data Type

An array is a group of data objects with identical attributes, which is sometimes referred to as multi-element variables.

- Arrays can have one or two levels, and be up to 32 KB maximum.
- The maximum number of array elements is 256,000.
- An array index must be in the range of -2,147,483,648 to +2,147,483,647.

Syntax Example

```
TYPE ARRAY_DINTS :
   ARRAY[1..6,1..20] OF DINT;
END_TYPE
```

Example

For each array, the default initial value is the one defined for the array type. In this example, array type A has 10 elements of type INT.

```
TYPE A:
   ARRAY [0 .. 9] OF INT ;
END_TYPE
```

Example

In this example, a variable declaration specifies a variable V of type A.

```
VAR V : A ; END_VAR
```

This means the array elements are referenced by the expressions:

```
V[0], V[1], . . , V[9]
```

The default initial values are 0 (zero).

Example

An index can be an expression of type ANY_INT, for example, V [I + 1].

For an array with more than one dimension, the sub-range is replaced with a comma-separated list of sub-ranges, and the array index is replaced with a comma-separated list of array indexes.

Defining a Structured Data Type

A structured data type is derived by defining a structure from existing data types by using elements of other specified types, which are accessed by their specified names. A structure can have a maximum of 400 elements.

Syntax Example

```
TYPE STRUCT_SENSOR :
   STRUCT
      INPUT:DINT;
      STATUS:BOOL;
      HIGH_LIMIT:REAL;
      ALARM_COUNT:INT;
   END_STRUCT;
END_TYPE
```

Each structured declaration consists of an element name followed by a colon, followed by a type specification. The default initial value of each structured element is the one defined for the structured type. In this example, the structured type called STRUCT_SENSOR has four structure elements: element INPUT of type DINT, element STATUS of type BOOL, element HIGH_LIMIT of type REAL, and element ALARM_COUNT of type INT.

If a variable declaration specifies a variable V of type STRUCT_SENSOR (VAR V : STRUCT_SENSOR ; END_VAR), then the four structure elements are referenced by the expressions V. INPUT, V.STATUS, and so on. The default initial values are 0, False (0), 0.0, and 0.

Declaring a VAR CONSTANT

A VAR CONSTANT is a named constant, which is appropriate for safety applications because the value cannot be changed in a program.

Syntax Example

```
VAR CONSTANT
   StartUp_Speed: REAL : 12.3;
   Gear_Ratio:INT : 12;
END_VAR
```

Program Example

```
PROGRAM ST_Constants
VAR CONSTANT
   MILLISECS_IN_SEC : DINT := 1000;
END_VAR
VAR
   TIMER_MILLISECS, TIMER_SECS : DINT;
   GET_CALENDAR : TR_CALENDAR;
END_VAR
   GET_CALENDAR(CI := TRUE);
   TIMER_SECS := GET_CALENDAR.SECOND;
   TIMER_MILLISECS := TIMER_SECS * MILLISECS_IN_SEC;
   (* The following statement causes an error because MILLISECS_IN_SEC
   *is a VAR CONSTANT*)
   (* MILLISECS_IN_SEC := 999; *)
END_PROGRAM
```

Declaring a VAR_TEMP

A VAR_TEMP is a variable which is appropriate for safety applications because the variables are placed in a temporary memory area (not local memory) which is cleared when the program, function, or function block terminates. A VAR_TEMP variable provides no persistence. During each scan, it is automatically initialized to zero at the start of the program, function, or function block.

Syntax Example

```
VAR_TEMP
   RESULT : REAL;
END_VAR;
```

Function Block Example

```
FUNCTION_BLOCK ST_VarTemp
VAR_TEMP
   (* These 4 bytes will not be counted
      as LOCAL variables *)
   TEMP_SUM : REAL;
   IS_ROUNDUP : BOOL;
END_VAR

VAR_INPUT
   INP_1, INP_2, INP_3: REAL ;
   FORCE_ROUNDUP: BOOL ;
END_VAR

VAR_OUTPUT
   OUT_SUM : DINT ;
   OUT_BOOL : BOOL ;
END_VAR

VAR
   LOC_ROUNDUP : BOOL := FALSE;
END_VAR

TEMP_SUM := INP_1 + INP_2 + INP_3;
IS_ROUNDUP := (LOC_ROUNDUP OR FORCE_ROUNDUP);
if (IS_ROUNDUP) then
    TEMP_SUM := CEIL(TEMP_SUM);
    LOC_ROUNDUP := FALSE;
else
    TEMP_SUM := FLOOR(TEMP_SUM);
    LOC_ROUNDUP := TRUE;
end_if;

OUT_SUM := REAL_TO_DINT(TEMP_SUM);
OUT_BOOL := IS_ROUNDUP;

END_FUNCTION_BLOCK
```

Declaring a VAR_EXTERNAL

A VAR_EXTERNAL (also known as a global variable) allows access to tagnames (also known as *tagname declarations* in TriStation 1131).

Syntax Example

```
VAR_EXTERNAL
   TagName_1, Tagname_5, Tagname_9 : BOOL;
END_VAR
```

Program Example

```
PROGRAM ST_VarExternal

VAR_EXTERNAL
   TagName_1, Tagname_5, Tagname_9 : BOOL;
END_VAR

if (Tagname_1) then
   Tagname_1 := FALSE;
else
   Tagname_1 := TRUE;
end_if;

if (Tagname_5) then
   Tagname_5 := FALSE;
else
   Tagname_5 := TRUE;
end_if;

if (Tagname_9) then
   Tagname_9 := FALSE;
else
   Tagname_9 := TRUE;
end_if;

END_PROGRAM
```

Declaring Local Variables in ST

A local variable is declared within function blocks using the `VAR. .END_VAR` construct. Local variables in a program or function block are initialized with initial values (the default is zero) at startup. Function block instances are actually local variables and are declared as such.

Syntax Example

```
VAR
   UpCount : INT:= 100; (* Declares initial value to be 100 *)
   Reset : BOOL;        (* Declares Boolean variable Reset *)
   UpCounter : CTU;     (* Declares instance of CTU function block*)
END_VAR
```

Declaring Input and Output Variables in ST

Input and output variables are declared using the VAR_INPUT ... END_VAR and VAR_OUTPUT...END_VAR constructs. All input variables must be declared before any output variables can be declared.

Function Block Example

```
FUNCTION_BLOCK AVERAGE
(* Variable Declarations *)
VAR_INPUT
   RESET : BOOL ;         (* 1 = reset, 0 = calculate *)
   CURRENT_VALUE : DINT ;(* Current Value from UPDOWN *)
END_VAR
VAR_OUTPUT
   STATUS : BOOL ; (* State => 1 = resetting, 0 = calculating *)
   XOUT : DINT ;   (* Avg Output = Current_Value Divided by MAX_COUNT *)
END_VAR
(* Your execution statements here *)
END_FUNCTION_BLOCK
```

Using ForLoop and Exit Statements

The ForLoop and Exit statements allow a set of statements to be repeated depending on the value of an iteration variable.

Program Example

```
PROGRAM ST_ForLoop

VAR
   MY_ARRAY : ARRAY_DINTS;
   COUNT : DINT;
   IDX_1, IDX_2 : INT;
END_VAR

for IDX_1 := 1 to 6 do
   for IDX_2 := 1 to 20 do
       MY_ARRAY[IDX_1,IDX_2] := COUNT;
         (* This statement causes an error because IDX_1 is being used
          * as the counter for the ForLoop structure *)
         (* IDX_1 := 20; *)
   end_for;
   if (COUNT = 100) then
      exit;
   end_if;
end_for;

COUNT := COUNT + 1;

END_PROGRAM
```

Using a CASE Statement

The CASE statement allows a selected statement to be executed depending on the value of an expression that returns an integer result. Only numerical values can be used for the reference items in the CASE statement. If variables are used, TriStation rejects the code.

Allows up to 5,000 selection statements.

Program Example

```
PROGRAM ST_Case

VAR
   SETTING : DINT := 0;
   SPEED :REAL := 0.0;
END_VAR

if (SETTING > 10) then
   SETTING := 0;
end_if;
SETTING := SETTING + 1;
   (*Select a SPEED based on the value of SETTING *)
case SETTING of
   1: SPEED := 5.0;
   2: SPEED := 7.5;
   3,4,5:SPEED := 12.0;
   6: SPEED := 15.0;
   7,8:SPEED := 18.0;
   9: SPEED := 21.0;
   10:SPEED := 25.0;
else
   SPEED := 0.0;
end_case;

END_PROGRAM
```

VAR_IN_OUT Function Parameters

The VAR_IN_OUT function parameters allow more than one input and more than one output in a function block.

CAUTION

You should not use the VAR_IN_OUT variable in a safety application. Safety standards (such as IEC 61508) recommend limiting the use of pointers in safety applications; VAR_IN_OUT is used as a pointer in TriStation 1131.

To automatically check for the use of VAR_IN_OUT in your safety application, set the Application Type to Safety for the programs included in the application (for more information, see Application Type on page 320).

Syntax Example

```
VAR_IN_OUT
   INOUT_1, INOUT_2, INOUT_3 : DINT ;
END_VAR
```

Function Example

```
FUNCTION ST_VarInOut : BOOL

VAR_IN_OUT
   INOUT_1, INOUT_2, INOUT_3 : DINT ;
END_VAR

if (INOUT_1 > 64000) then
   INOUT_1 := 0;
end_if;
INOUT_1 := INOUT_1 + 1;

if (INOUT_2 > 64000) then
   INOUT_2 := 0;
end_if;
INOUT_2 := INOUT_2 + 2;

if (INOUT_3 > 64000) then
   INOUT_3 := 0;
end_if;
INOUT_3 := INOUT_3 + 3;

ST_VarInOut := TRUE;

END_FUNCTION
```

Cause Effect Matrix Development

This section explains how to use the Cause Effect Matrix (CEM) language to create a program based on a cause and effect matrix. Topics include:

CEMPLE Overview

CEMPLE is an optional TriStation 1131 language editor that automates the process of creating a program based on a cause and effect matrix. Cause and effect matrix is a methodology that is commonly used in the process control industry to define alarms, emergency shutdown strategies, and mitigation actions.

A matrix created in CEM language can be as basic or complex as your situation requires. In a basic matrix, causes are identified as True or False inputs related to one or more effects through the intersections between them. The *state* of a cause (True or False) determines the state of the related effect. If more than one cause is related to an effect, the state of the effect is based on how the matrix is evaluated. You can specify the matrix evaluation as a de-energize-to-trip (fail-safe) or energize-to-trip system. In a typical de-energize-to-trip system, if one of the inputs changes to False, the related outputs also change to False. In an energize-to-trip system, the reverse is true; if one of the inputs changes to True, the related outputs also change to True.

For more complex processes, CEM language allows you to add functions or function blocks to causes, intersections, and effects. This feature can be used for many purposes; for example, to accept non-Boolean input and convert to Boolean output, to set timers before evaluating the input, and to pass additional input variables to output variables.

CEM language includes these features:

- Ability to specify up to 99 causes, 99 effects, and 1,000 intersections
- Ability to invoke functions and function blocks to evaluate cause, intersection, and effect states
- Choice of de-energize-to-trip or energize-to-trip matrix evaluation
- Automatic conversion of matrix to Function Block Diagram language
- Customized view monitoring of active causes, intersections, and effects
- Multiple levels of undo and redo editing

Matrix Planning

Planning includes determining the causes (problems) to be monitored, and determining how the matrix is to be evaluated.

Restrictions and Limitations

- No more than 99 causes, 99 effects, and 1,000 intersections.
- Variables with a variable type of In/Out (VAR_IN_OUT) are not allowed in CEM programs, function blocks that are invoked by matrix programs, or any safety program or function block.

Matrix Evaluation Options

When planning a matrix, you must determine how the matrix is evaluated when it includes multiple causes and effects. If the matrix is based on an energize-to-trip system, such as a fire suppression system, an OR evaluation is typically used because the normal state of inputs is False. If one of the inputs changes to True, the related outputs also change to True. The default setting is OR.

If the matrix is based on a de-energize-to-trip (fail-safe) system, an AND evaluation is typically used because the normal state of inputs is True. If one of the inputs changes to False, the related outputs also change to False. This is why it is typically used with systems that are designed to be fail-safe.

How a Matrix is Evaluated

When a matrix is executed, the states of causes, effects, and intersections are evaluated in a specific order. The states of causes, intersections, and effects are saved in internal variables. An internal Move function moves the cause state to the intersection state, and then to the effect state. The order of evaluation is shown and described in this figure.

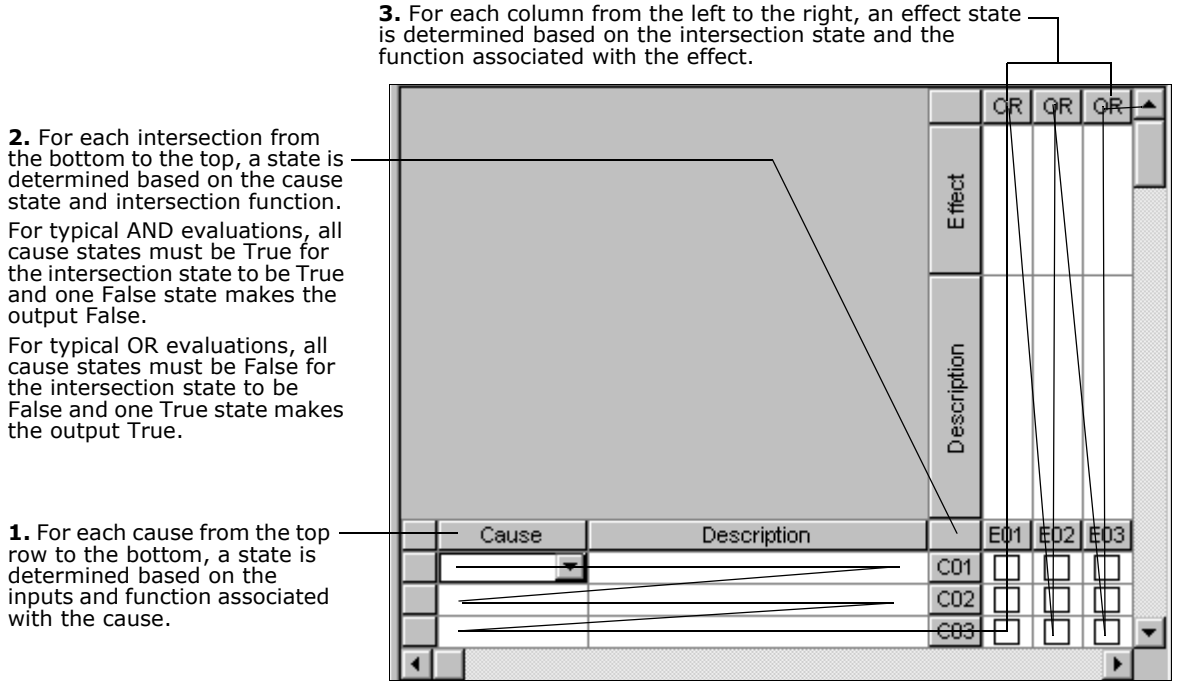


Figure 9 CEMPLE Matrix Evaluation Steps

Using the CEM Editor

The CEM editor allows you to create a TriStation 1131 program based on a cause and effect matrix. The editor includes the following areas:

- **Matrix**: Identifies causes, effects, and the intersections between them. Can also include inputs, outputs, functions, and function blocks related to causes, effects, and intersections.
- **FBD Network**: Displays the Function Block Diagram (FBD) related to the cause, effect, or intersection that you select in a matrix. It also allows you to specify properties and to invert the values of variables.
- **Variable Detail Table**: Displays the inputs and outputs of an FBD network that are generated when a cause, effect, or intersection is selected. It also allows you to specify variable type and data type.

This figure depicts the areas in the CEM Editor.

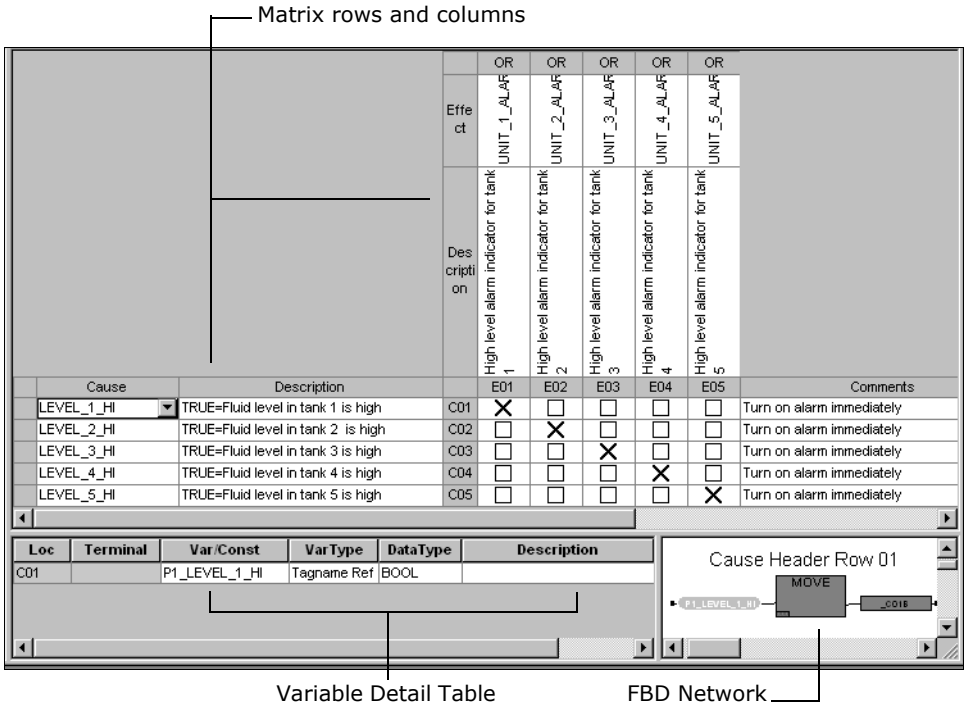


Figure 10 CEMPLE Editor Elements

Matrix

The matrix area of the CEM editor includes the rows, columns, and intersections of a matrix. In a basic matrix that does not use functions, causes can be directly related to effects through intersections. In a more complex matrix, such as this figure, functions can be included for causes, effects, and intersections. When functions are included, the inputs and outputs of those functions can be specified in the matrix.

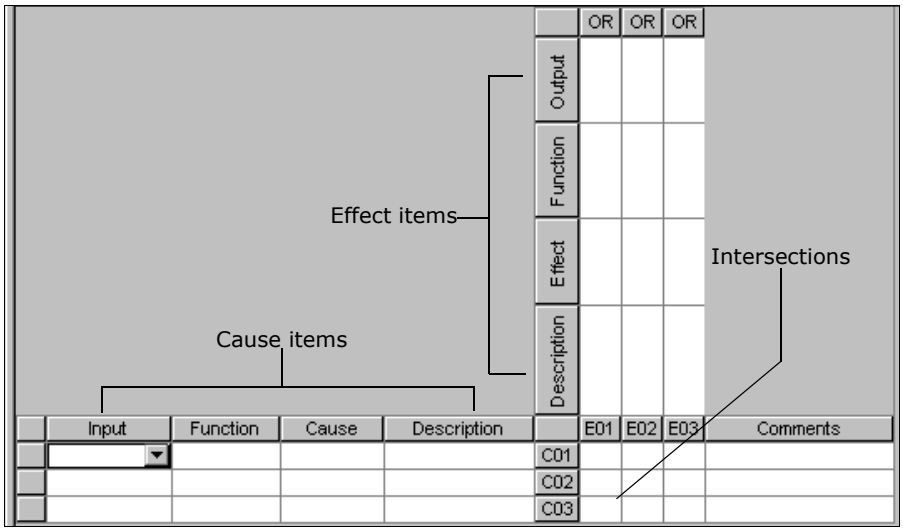


Figure 11 CEMPLE Matrix Elements

FBD Network

The FBD Network area of the CEM editor displays the Function Block Diagram (FBD) related to the cause, effect, or intersection that you select in the matrix. The FBD network uses internal Boolean variables to save and move results to associated cells so that causes and effects can be evaluated. When you create a cause, intersection, or effect, an internal variable is automatically created for each.

The CEM editor uses internal variables to store and move results between cells. Although you cannot directly access the internal variables, you can create variables and copy the values to those variables. You can also specify properties and invert values of variables.

If you select a cause, effect, or intersection that does not contain a function, or if you make multiple selections, the FBD network cannot display appropriate information.

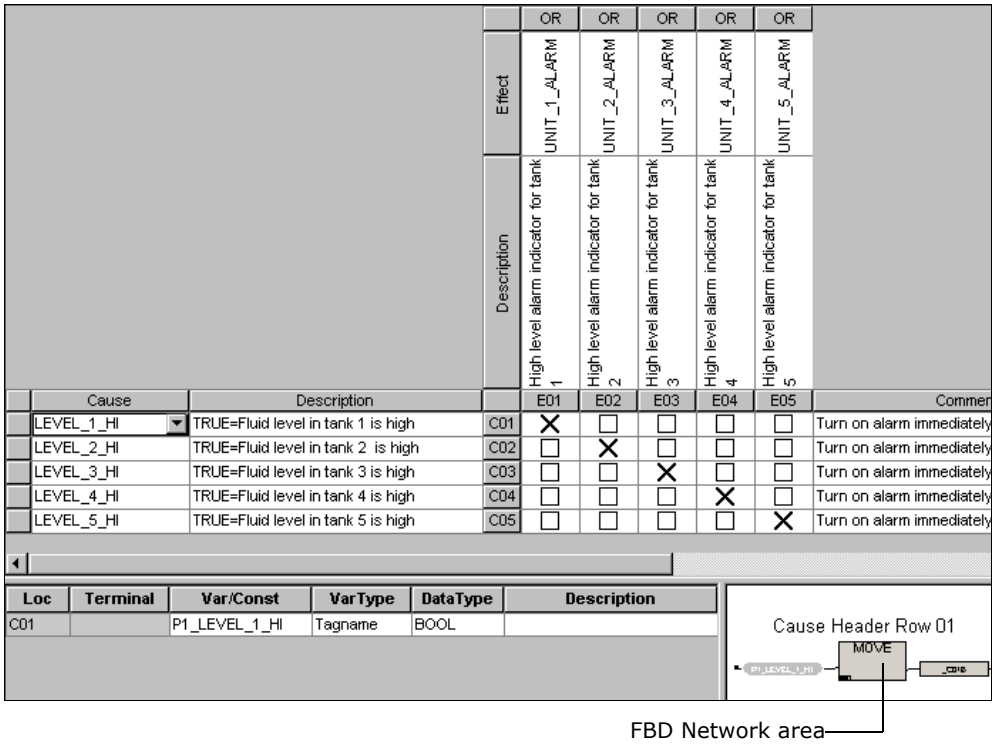
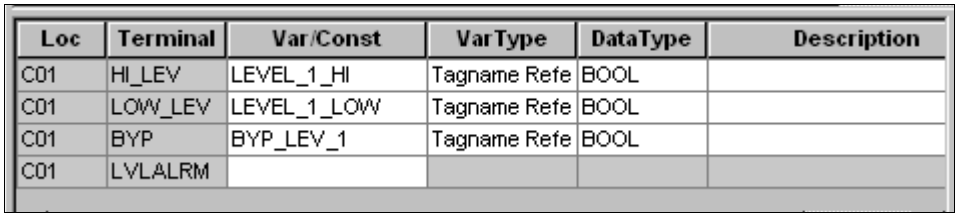


Figure 12 FBD Network Area in CEMPLE Editor

Variable Detail Table

The Variable Detail Table area of the CEM editor displays the inputs and outputs of an FBD Network that are generated when a cause, effect, or intersection is selected. This figure shows the names, variable types, and data types related to the function block.



Loc	Terminal	Var/Const	VarType	DataType	Description
C01	HI_LEV	LEVEL_1_HI	Tagname Refe	BOOL	
C01	LOW_LEV	LEVEL_1_LOW	Tagname Refe	BOOL	
C01	BYP	BYP_LEV_1	Tagname Refe	BOOL	
C01	LVLALRM				

Figure 13 Variable Detail Table in CEMPLE Editor

Setting up a CEM Program

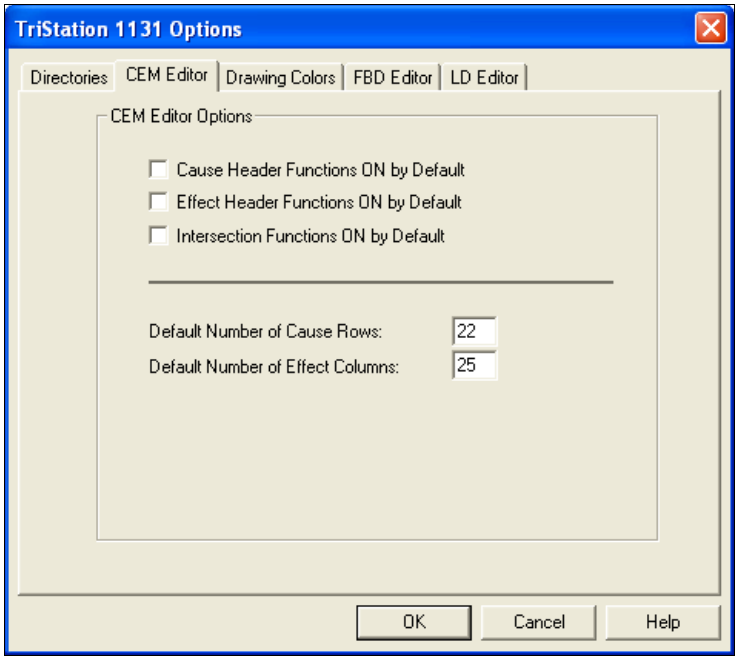
The following sections describe how to set default options that apply to CEM programs.

Specifying CEM Editor Options

This procedure explains how to set the options used as initial settings for all the CEM (cause and effect matrix) programs in a project. After a program is created, you can modify these settings on a program-by-program basis.

Procedure

1 On the Tools menu, click TriStation 1131 Options, and then click the CEM Editor tab.



2 Specify these properties on the CEM Editor tab.

Property	Action
Cause Header Functions On by Default	Select the check box to have input and function columns added. The default is cleared.
Effect Header Functions On by Default	Select the check box to have output and function columns added. The default is cleared.
Intersection Functions On by Default	Select the check box to have function columns added. The default is cleared.
Default Number of Cause Rows	Enter the number of rows to include in a new matrix. The default is 22.
Default Number of Effect Columns	Enter the number of columns to include in a new matrix. The default is 25.

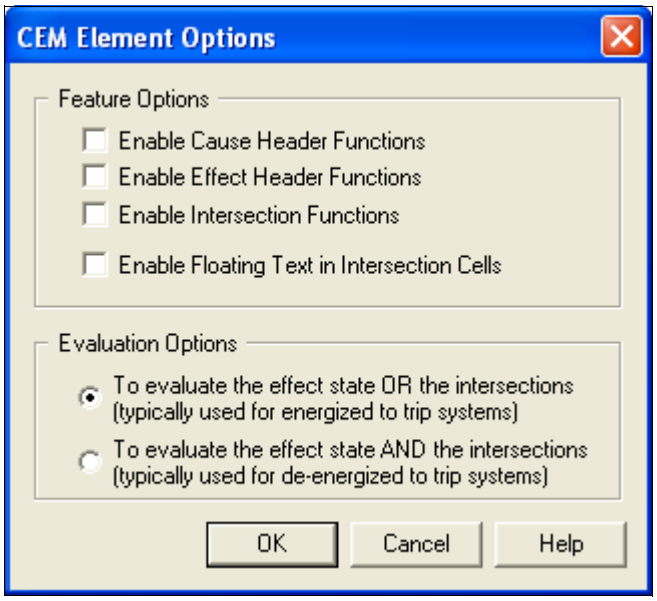
3 Click OK to save the settings.

Specifying CEM Element Options

This procedure explains how to specify whether functions are used in a specific CEM program, and how the matrix is evaluated.

Procedure

1 Expand the Application tree, double-click a program, click the Document menu, and then click Options.



2 Specify these properties in the CEM Element Options dialog box.

Property	Action
Enable Cause Header Functions	Select the check box to add an input and function column to the cause header. The default is selected.
Enable Effect Header Functions	Select the check box to add an output and function column to the effect header. The default is selected.
Enable Intersection Functions	Select the check box to add a function column to the intersection. The default is selected.
Enable Floating Text in Intersection Cells	Select the check box to allow the name of the function or function block to be displayed in a neighboring cell if that cell is empty. This is useful when the name of the function or function block is long. The default is cleared.
Evaluation Options	Specify how the matrix is to be evaluated when it includes multiple intersections between a cause and effect. The default is OR.

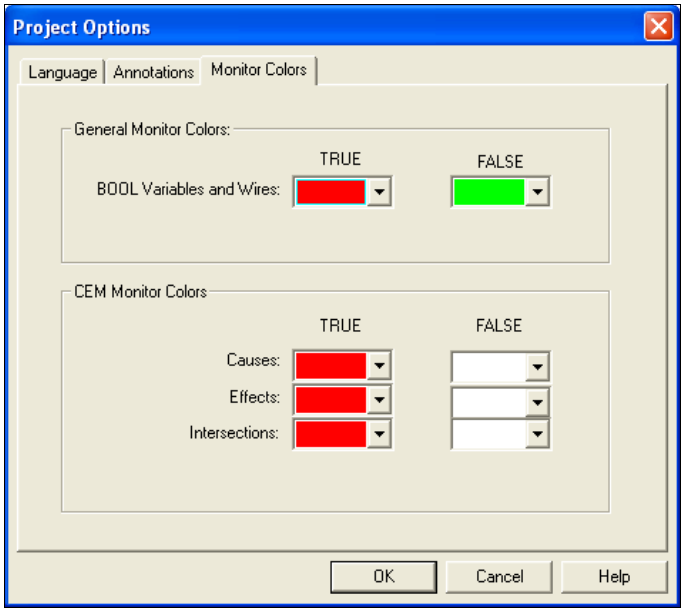
3 Click OK to save the settings.

Specifying Monitor Colors and Names

This procedure explains how to specify the colors that are displayed for True and False BOOL values when an application is monitored on the Controller and Emulator Panels.

Procedure

1 On the Project menu, click Project Options, and then click the Monitor Colors tab.



2 Under CEM Monitor Colors, select the color for True and False for cause, effect, and intersection cells in a CEM (cause and effect matrix).

The default for True is red; False is white.

3 Click OK to save your changes.

Using User-Defined Functions and Application-Defined States

This section describes how user-defined functions and application-defined states can be used in a CEM program.

User-Defined Functions

User-defined functions must be enabled before they can be used in a CEM program. (Triconex-supplied functions and function blocks do not have to be enabled.) When you enable a function, it is validated to ensure it can be used in that part of the matrix. For example, a function used in an intersection must have a Boolean primary input and Boolean primary output. If not enabled, the function is not available for selection.

Application States

User-defined functions can include a variable that stores application states and that is evaluated in the same way as the cause, intersection, and effect internal variables. This means you can include application information that is evaluated with an AND or OR operation when the matrix is run. Application state inputs and outputs must be a DWORD data type, which is a 32-bit string.

This figure shows an example of using a variable to store the application state.

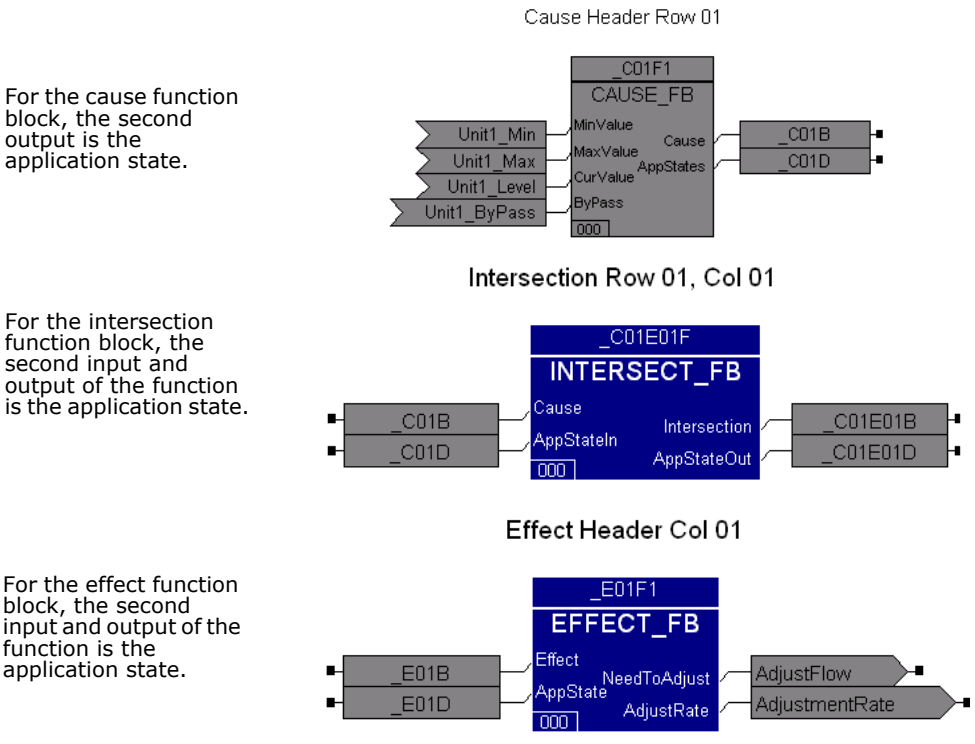


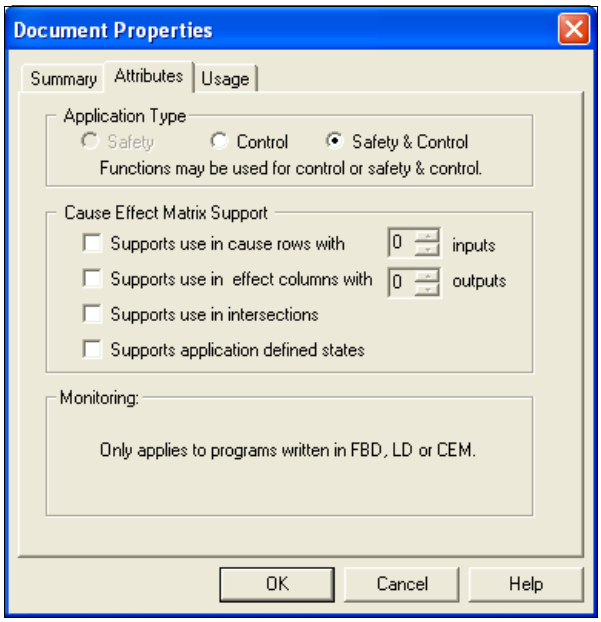
Figure 14 Using a Variable to Store Application State

Enabling User-Defined Functions and Application-Defined States

This procedure explains how to enable user-defined functions and application-defined states for a specific matrix. If a user-defined function is not enabled, it cannot be used in a matrix.

Procedure

1 Expand the Application tree, right-click the user-defined function, click Properties, and then click the Attributes tab.



2 Specify these properties on the Attributes tab.

Property	Action
Application Type	Click either Control or Safety and Control.
Supports Use in Cause Rows with... Inputs	Select the check box to enable the function for use in cause rows, and then select the required number of inputs. The default is cleared.
Supports Use in Effect Columns With... Outputs	Select the check box to enable the function for use in effect columns, and then select the required number of outputs. The default is cleared.
Supports Use in Intersections	Select the check box to enable the function for use in intersections. The default is cleared.
Supports Application Defined States	Select the check box to enable the function to add a variable to store the application defined state. The default is cleared.

3 Click OK to save the settings.

4 In the Application tree, double-click the function to open it on a logic sheet.

5 On the Document menu, click Compile.

The compile process determines whether the function can be used.

Specifying Local Variables, Tagnames, and Constants in a CEM Program

This procedure explains how to specify local variables, tagnames, and constants in a CEM program. When functions are used with causes or effects, the inputs and outputs to the functions must be specified as variables or constants.

In/Out variables (VAR_IN_OUT) are not allowed in CEM programs, function blocks that are invoked by CEM programs, or any safety program or function block.

Procedure

1. Expand the Application tree, expand User Documents, and double-click a CEM program.
2. Select or type the name in the Input or Output columns, or in the Var/Const column in the Variable Detail Table.

Specifying Properties in the Variable Detail Table

This procedure explains how to modify properties in the Variable Detail Table, which is located in the lower left part of the CEM program.

Procedure

1. Expand the Application tree, and open a CEM program.

Loc	Terminal	Var/Const	VarType	DataType	Description
C01		Input_2	Tagname Reference	BOOL	
C01		Alarm_Flag	Local	DINT	Flag to detect alarm
C01	AND				

2. Specify these properties in the Variable Detail Table.

Property	Action
Var/Const	Enter a variable or constant name.
Var Type	Select Local or Tagname.
Data Type	Select a data type.
Description	Enter a description for the variable or constant.

If the changes are valid, the declaration is changed. If not, a message displays explaining why the declaration was not changed.

Working with Cells, Rows, and Columns in a CEM Program

The following sections describe how to work with the cells, rows, and columns that make up a CEM program matrix.

Selecting and Editing Cells in a CEM Program

This table and figure explain how to select one or more cells in a CEM program.

To ...	Do This ...
Select a single cell	Click anywhere in the cell.
Select contiguous (adjacent) cells	Click the first cell, hold down the shift key, and click the last cell in the area.
Select discontiguous (non-adjacent) cells	Click a cell, hold down the Ctrl key, and click the rows or column.

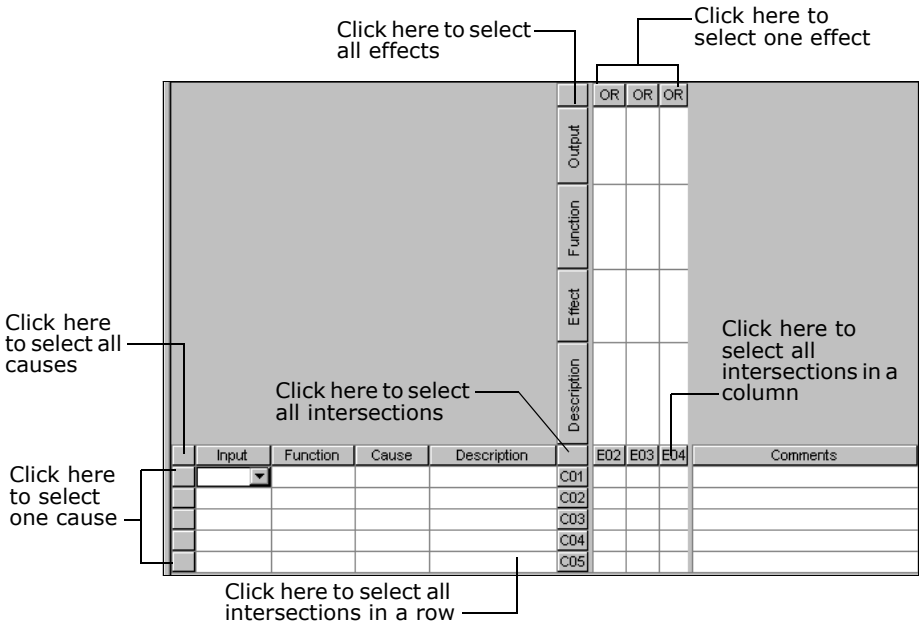


Figure 15 Selecting CEMPLE Matrix Cells

This table explains how to edit cells in a matrix.

To ...	Do This ...
Enter edit mode	Click directly over the text in an editable cell.
Complete a cell entry	Press the tab key or Enter to complete a cell entry and move the cursor to the next cell to the right.
Move to the next cell	Press the tab key or Enter to move the cursor to the next cell to the right.
Delete the contents of a cell or group of cells	Select a cell or group of cells (but do not place in edit mode) and press the delete key.

Displaying and Sizing Cells from the Matrix

This table describes how to change the display and size of cells in a matrix. You can also make changes by using commands on the View menu. These actions do not affect the matrix evaluation.

To drag or double-click a cell boundary, you must use the double-arrow cursor, which is only active in the gray cells of a matrix.

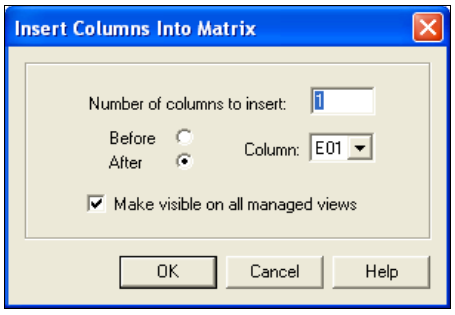
To ...	Do This ...
Change width of column	Drag the column boundary left or right.
Restore size of column	Drag the column boundary to the left so that the column is almost hidden, then release the button.
Change height of row	Drag the row boundary up or down.
Restore default size of row	Drag the row boundary upward until the row is almost hidden, then release the button.
Hide a column	Drag the column boundary to the left until it meets the nearest boundary. For an effect column, double-click the thickened column boundary.
Unhide a column	For a cause column, double-click the boundary between the currently displayed columns and the hidden column.
Hide a row	Drag the row boundary upward until it meets the nearest boundary.
Unhide a row	Double-click the thickened row boundary.

Inserting Columns

This procedure explains how to insert columns in a CEM program.

Procedure

1. Expand the Application tree, open a CEM program, and do either of these:
   - Click the Insert Columns button  on the toolbar
   - Click the Edit menu, and then click Insert Columns

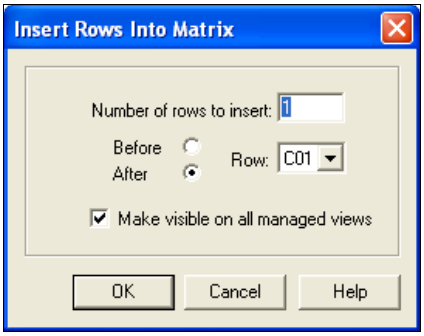


2. Enter the number of columns to insert.
3. Select the column and click Before or After to specify where the column is to be inserted.
4. If you do not want the column to be displayed, clear the Make visible on all managed views check box.
5. Click OK. The new column is inserted in the location you specified.

Inserting Rows

This procedure explains how to insert rows in a CEM program.

Procedure



1. Expand the Application tree, open a CEM program, and do either of these:
   - Click the Insert Rows button on the toolbar
   - Click the Edit menu, and then click Insert Rows
2. Enter the number of rows to insert.
3. Select the row and click Before or After to specify where the row is to be inserted.
4. If you do not want the column to be displayed, clear the Make visible on all managed views check box.
5. Click OK. The new row is inserted in the location you specified.

Deleting Columns

This procedure explains how to delete columns in a CEM program. Column numbers are identified at the top of the column as shown in this figure.

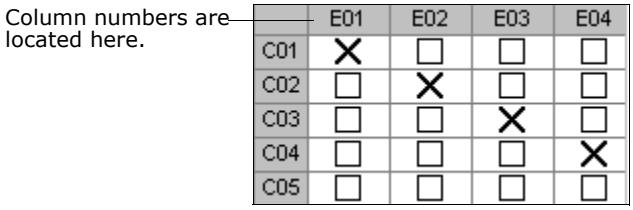
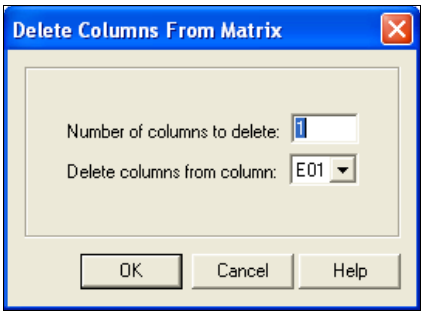


Figure 16 CEMPLE Matrix Column Numbers

Procedure



1. Expand the Application tree, open a CEM program, and do either of these:
   - Click the Delete Columns button on the toolbar
   - Click the Edit menu, and then click Delete Columns
2. Enter the number of columns to delete and the starting column number.

   The selected column (E01 in this example), and the *x* columns to the right of the selected column will be deleted, where *x* is the number of columns to delete.
3. Confirm your selections, and then click OK. The selected columns are deleted.

Deleting Rows

This procedure explains how to delete rows in a CEM program. Row numbers are identified to the left of the row as shown in this figure.

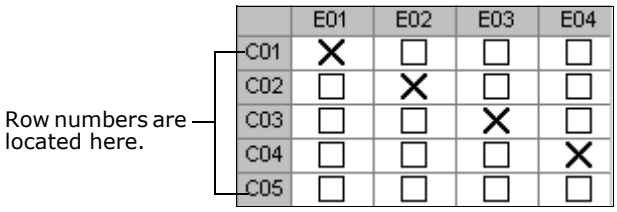
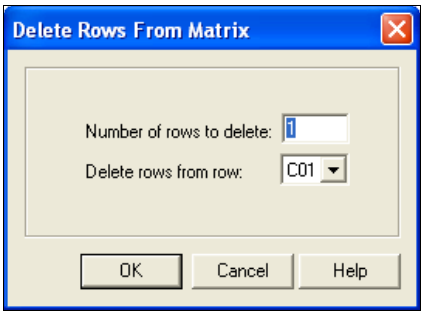


Figure 17 CEMPLE Matrix Row Numbers

Procedure



1. Expand the Application tree, open a CEM program, and do either of these:
   - Click the Delete Rows button on the toolbar
   - Click the Edit menu, and then click Delete Rows
2. Enter the number of rows to delete and the starting row number.

   The selected row (C01 in this example), and the *x* columns below the selected row will be deleted, where *x* is the number of rows to delete.
3. Confirm your selections, and then click OK. The selected rows are deleted.

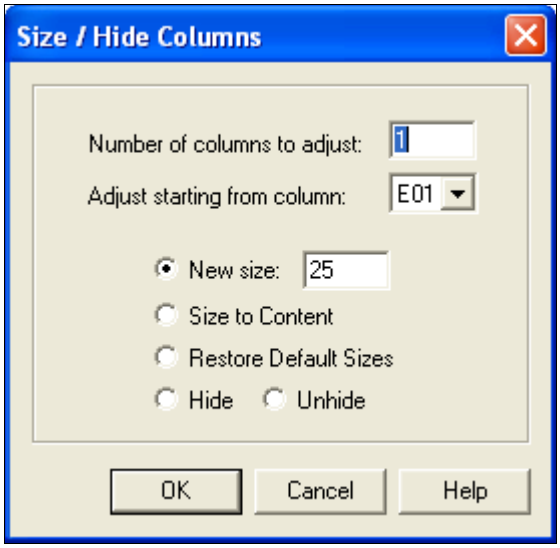
Sizing and Hiding Columns

This procedure explains how to size and hide columns in a CEM program.

Procedure

1 Expand the Application tree, open a CEM program, and do either of these:

- Click the Size/Hide Columns button on the toolbar
- Click the View menu, and then click Size/Hide, and then Columns



2 Specify these properties in the Size/Hide Columns dialog box.

Property	Action
Number of columns to adjust	Enter the number of columns you want to resize.
Adjust starting from column	Select the starting column.
New size	Select and then enter the new size for the column.
Size to Content	Select to automatically size the column to its content.
Restore Default Sizes	Select to restore the column to the default size.
Hide or Unhide	Select Hide or Unhide. If hidden, the column is not displayed, but it is used in the matrix evaluation.

3 Click OK to save your changes.

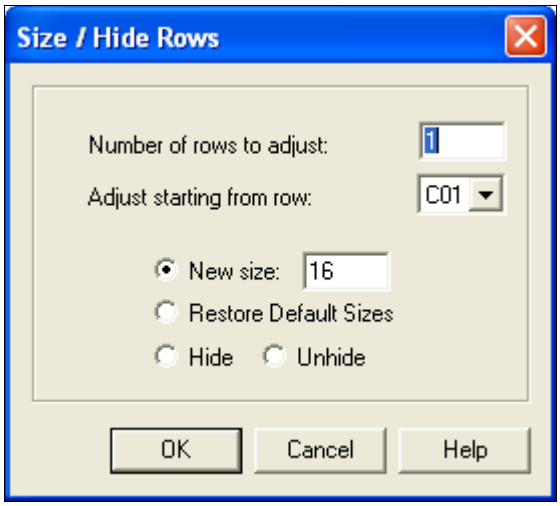
Sizing and Hiding Rows

This procedure explains how to size and hide rows in a CEM program.

Procedure

1 Expand the Application tree, open a CEM program, and do either of these:

- Click the Size/Hide Rows button on the toolbar
- Click the View menu, and then click Size/Hide, and then Rows



2 Specify these properties in the Size/Hide Rows dialog box.

Property	Action
Number of rows to adjust	Enter the number of rows you want to resize.
Adjust starting from row	Select the starting row.
New size	Select and then enter the new size for the row.
Restore Default Sizes	Select to restore the row to the default size.
Hide or Unhide	Select Hide or Unhide. If hidden, the row is not displayed, but it is used in the matrix evaluation.

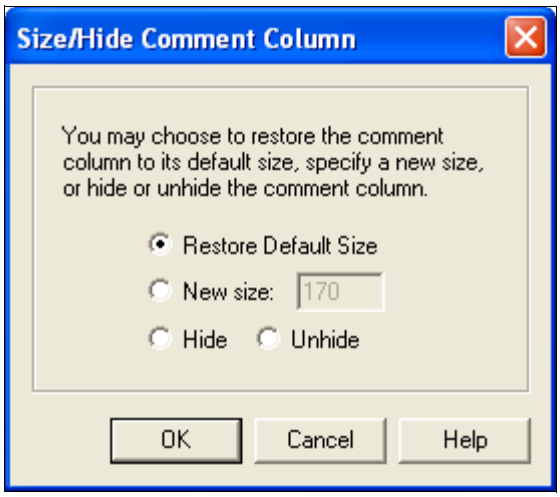
3 Click OK to save your changes.

Sizing and Hiding the Comment Column

This procedure explains how to size and hide the comment column in a CEM program.

Procedure

1 Expand the Application tree and open a CEM program. From the View menu, click Size/Hide, and then Comment Column.



2 Specify one of these properties in the Size/Hide Comment Column dialog box.

Property	Action
Restore Default Size	Select to restore the comment column to its default size.
New size	Select and then enter the new size for the column.
Hide or Unhide	Select Hide or Unhide. If hidden, the column is not displayed.

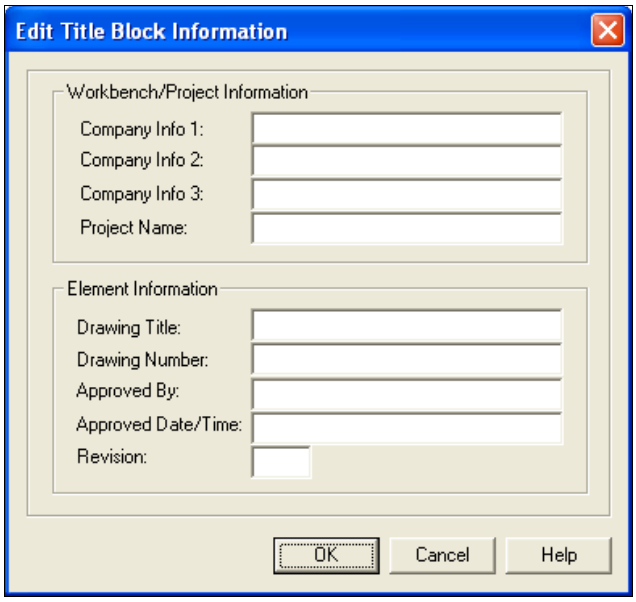
3 Click OK to save your changes.

Editing the Title Block

This procedure explains how to edit information in the title block, which is included when the CEM program is printed.

Procedure

1. Expand the Application tree, open a CEM program, click the Sheets menu, and then click Edit Sheet Title.



2. Enter text to describe the matrix.
3. Click OK to save your changes.

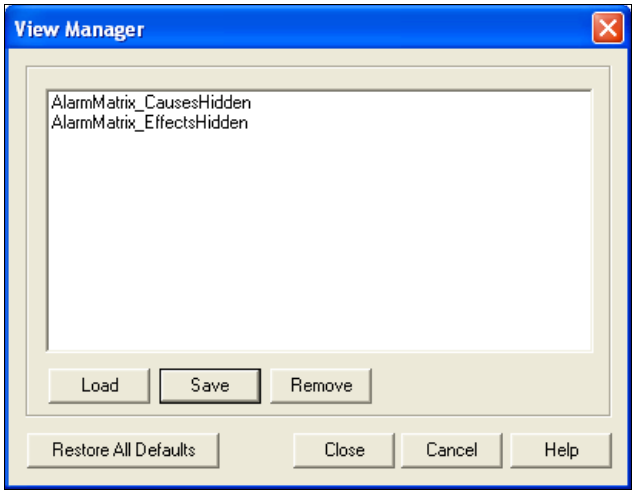
Managing Views

This procedure explains how to save, load, and remove views of CEM programs.

A view is a display of a selected portion of the matrix. You can create a view by hiding or showing columns and rows on the matrix, either by using menu commands or by dragging columns and rows on the matrix. Saving the view allows you to load it at anytime.

Procedure

1. Expand the Application tree and open a CEM program.
2. Change the view by showing or hiding columns and rows. Use commands on the View menu or drag columns and rows on the matrix.
3. On the View menu, click Manage Views.



4. Perform one or more of these actions in the View Manager dialog box.

Command	Action
Load	Select a view and click Load to have it displayed.
Save	Click to save the currently displayed view.
Remove	Select a view and click Remove to delete the view from the list.
Restore All Defaults	Click to restore the current view to show all causes and effects.
Close	Click to save your changes and close the View Manager dialog box.
Cancel	Click to close the View Manager dialog box without saving your changes.

Variables and Constants

This section explains how to create variables and constants in FBD, LD, and CEM languages. For information on tagnames (global variables), see Tagnames on page 115.

The maximum number of tagnames and variables in a program is 2000.

Topics include:

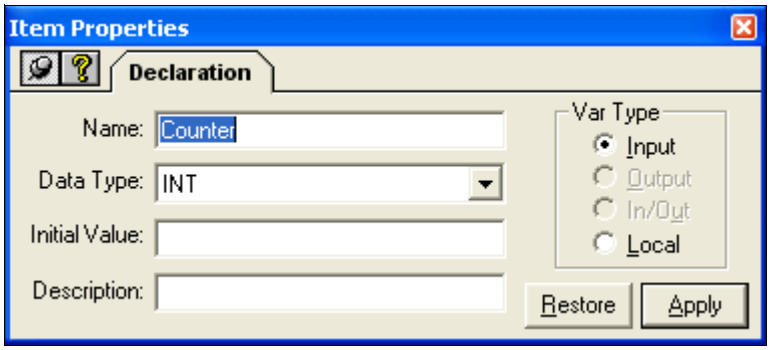
Declaring Variables

This procedure explains how to declare input, output, in/out, and local variables in FBD, LD, and CEM languages. Variables store values and must be declared in order to be used in a program or function.

Procedure

1. Create a variable by doing either of the following:
   - On the toolbar, click the icon for the variable, and then click on the logic sheet (FBD or LD only).
   - On the program or function Declarations tree, right-click the folder for the type of variable to be declared, and click New Declaration.

   The Item Properties dialog box for the variable appears.



2 Specify these properties on the Declaration tab.

Property	Action
Name	Enter a name for the variable. Use only alphanumeric characters and underscores. No symbols or spaces are allowed.
Data Type	Select a data type; must be BOOL, DINT, or REAL. Required. If the variable is dragged to a function terminal, the Data Type is automatically set to the correct type for the function.
Initial Value	Specify a value to be used on the first scan. Must agree with the Data Type.
Description	Enter a description for the variable. (Optional)
Var Type	Select the type of variable. Required. For programs, can be Local only. For functions, can be Input, Output, In/Out, or Local.

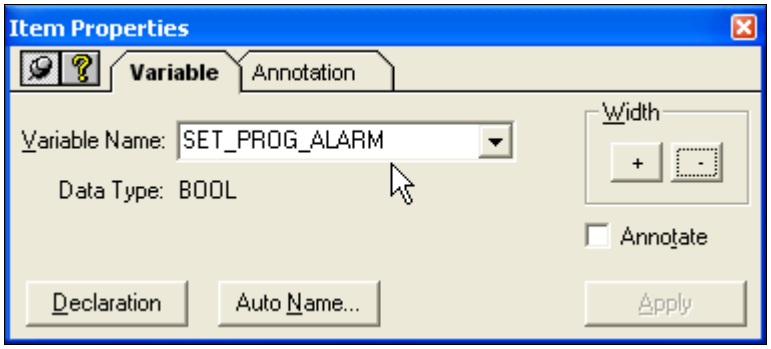
Specifying Variable Properties

This procedure explains how to specify properties for variables. Properties affect the selected occurrence of the variable. For example, when you add an annotation to a variable, it affects only the selected variable.

Procedure

1 Expand the Application tree and then open a program or function.

2 On the logic sheet, double-click the icon that represents the variable.



3 Specify these properties on the Variable tab.

Property	Action
Variable Name	To change the selected variable to a different variable, select the variable name and click Apply. To create a new variable, enter a new name, and click Apply. To change the name of all the variables with this name, click Declaration and change the name of the variable.

Property	Action
Data Type	Displays the data type that was set on the Declaration tab. If the variable has not been declared, the Data Type is undefined.
Width	Click + or – to increase or decrease the width of the variable icon on the logic sheet.
Annotate	Select the check box to add an annotation to the variable. The default is cleared. See Specifying Variable Annotation Properties on page 110 for more information about annotations.
Declarations Command	Click to view the Declaration tab for the variable. See Declaring Variables on page 108 for more information.
Auto Name Command	Click to view the Automatic Naming dialog box. See Naming Multiple Variables on page 111 for more information.

4 Click Apply to save your changes.

Specifying Variable Annotation Properties

This procedure explains how to specify text and macros to be included with an annotation.

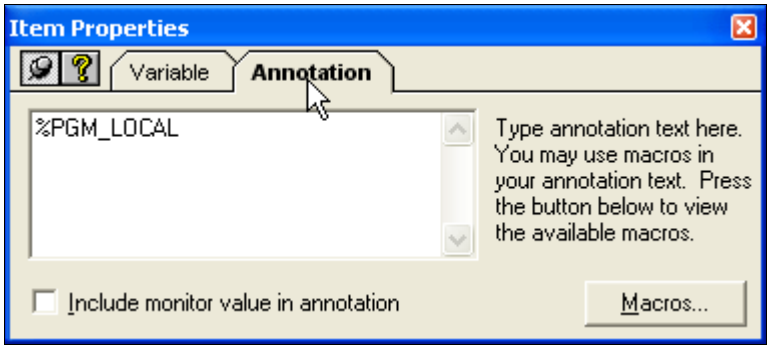
Annotations are available only in FBD and LD programs.

Procedure

1 Expand the Application tree and then open a program or function.

2 On the logic sheet, double-click the icon that represents the variable.

3 On the Variable tab, select the Annotate check box and then click the Annotation tab.



4 Specify these properties on the Annotation tab.

Property	Action
Annotation Text	Enter text or copy macros to be used in the annotation. To copy a macro, see Using Macros with Annotations and Comments on page 143.

Property	Action
Include Monitor Value in Annotation	Select this check box to display the value of the variable in the annotation when the element is run on the controller or emulator. Available only in programs.
Macros Command	Click to display the list of macros that can be added. To copy a macro, click the macro and press Ctrl+C. Click OK to close the Edit Macro dialog box. To paste the macro in the Annotation tab, press Ctrl+V.

5 Close the Properties dialog box to save your changes to the Annotation tab.

Naming Multiple Variables

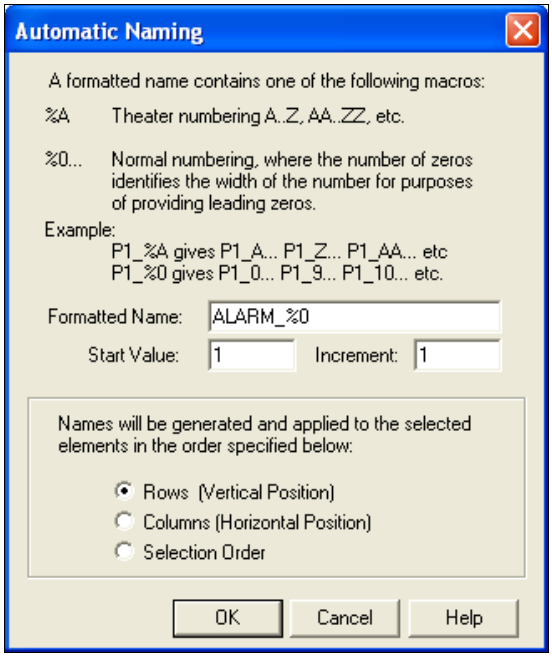
This procedure explains how to name multiple variables by specifying a format. Variables can be named by row, column, and selection order. The variables must exist before they can be named.

Procedure

1 Expand the Application tree and open a program or function logic sheet. On the logic sheet, hold the Shift key.

To have variables named based on the selection order, click them in the order in which you want them named.

2 On the Tools, menu, click Auto Name Selected Items.



3 Specify these properties in the Automatic Naming dialog box.

Property	Action
Formatted Name	Specify whether to use theater numbering, which uses letters, or normal numbering, which uses numbers.
Start Value and Increment	Enter the starting value for the first variable and the number to use when incrementing each successive variable.
Name Order	Select the order in which to name variables. • Rows — Names are applied vertically, from left to right. • Columns — Names are applied horizontally, from top to bottom. • Selection Order — Names are applied based on the order in which they were selected.

4 Click OK to apply the formatted name to the selected variables.

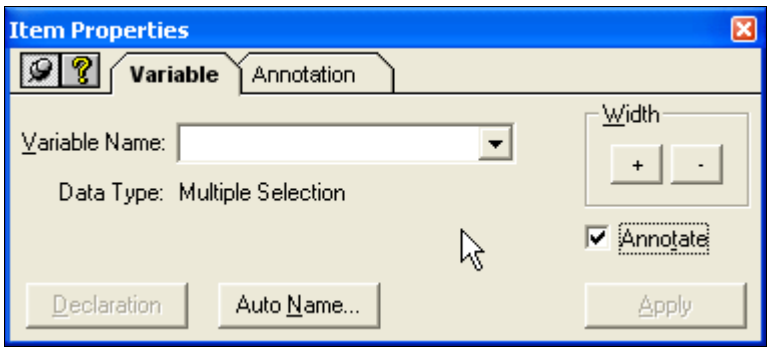
Changing Multiple Variables

This procedure explains how to change size and annotation settings for multiple variables on a logic sheet.

Procedure

1 On a logic sheet, select the variables you want to change by pressing the Shift key while you click the variables.

2 Double-click one of the selected variables. The Item Properties dialog box appears.



3 Specify these properties on the Variable or Annotation tabs.

Property	Action
Variable Name	To change all the variables to the same variable, select or enter the name. To undo this change, press Ctrl+Z.
Width	Click the + button to increase the width of the variable graphics. Click the – button to decrease the width of the variable graphics.

Property	Action
Annotate	To add the same annotation to each variable, select the Annotate check box, click the Annotation tab, and then enter or copy the text or macro.
Auto Name Command	To automatically name the selected variables based on a pattern, click and specify the pattern. See Naming Multiple Variables on page 111.

4 Close the Properties dialog box to save your changes to the Annotation tab.

5 If necessary, undo the changes you just made by pressing Ctrl+Z. Multiple levels of undo are available.

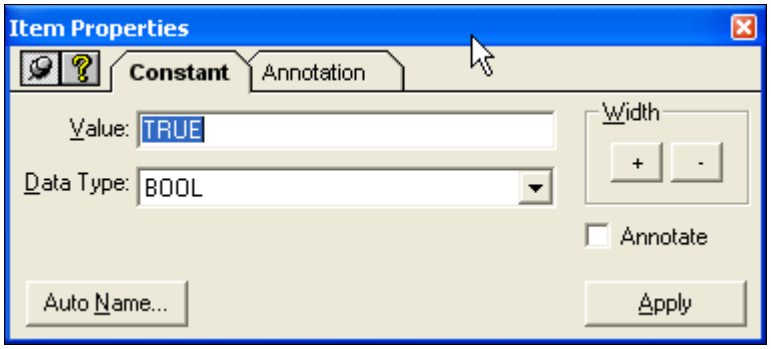
Creating Constants

This procedure explains how to create constants in FBD, LD, and CEM languages. A constant is a value that can be used in a program or function.

Procedure

1 Expand the Application tree, and open a program or function.

2 On the toolbar, click  , and then click in the logic sheet.



3 Specify these properties on the Constant tab.

Property	Action
Use Local Time	Enter the value for the constant.
Data Type	Select the data type; must be appropriate for the Value property.
Width	Click the + button to increase the width of the constant graphic. Click the – button to decrease the width of the constant graphic.
Annotate	To add an annotation to the constant, select the Annotate check box, click the Annotation tab, and then enter or copy the text or macro.
Auto Name Command	To automatically name the selected constants based on a pattern, click and specify the pattern. See Naming Multiple Variables on page 111.

4 Click the Apply to save your changes.

Specifying Constant Annotation Properties

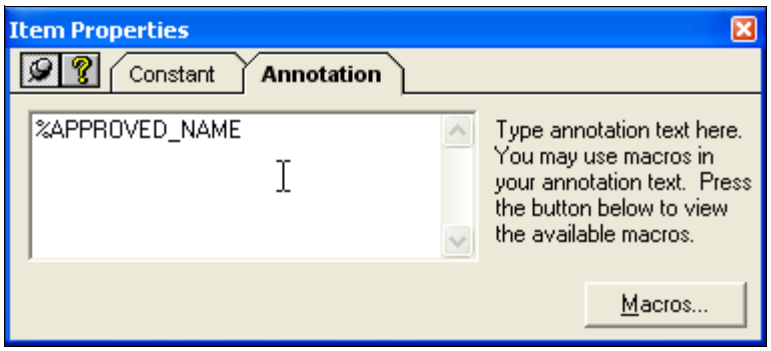
This procedure explains how to specify text and macros to be included with a constant annotation. This can be used only in FBD and LD development.

Procedure

1. On a logic sheet, double-click a constant.

   The Item Properties dialog box appears.

2. On the Constant tab, select the Annotate check box and then click the Annotation tab.



3. Specify these properties on the Annotation tab.

Property	Action
Annotation Text	Enter text or copy macros to be used in the annotation.
Macros Command	Click to copy a macro. See Using Macros with Annotations and Comments on page 143.

Tagnames

This section describes tagnames. Tagname is the term commonly used when referring to input points (sensors) and output points (final elements). In TriStation 1131, tagnames are references to physical tagnames (labels) on the connected field devices or to memory points which are locations in the controller memory. In IEC terminology, tagnames are called *global variables*.

For Modbus or DDE communication, tagnames must be assigned an *alias number* that allows read or read/write access. An alias number is a five-digit identifier which defines the data type and location of a point in the controller memory.

For Peer-to-Peer, OPC, or TSAA applications, tagnames can be accessed by the tagname—an alias number is not needed.

Topics in this section include:

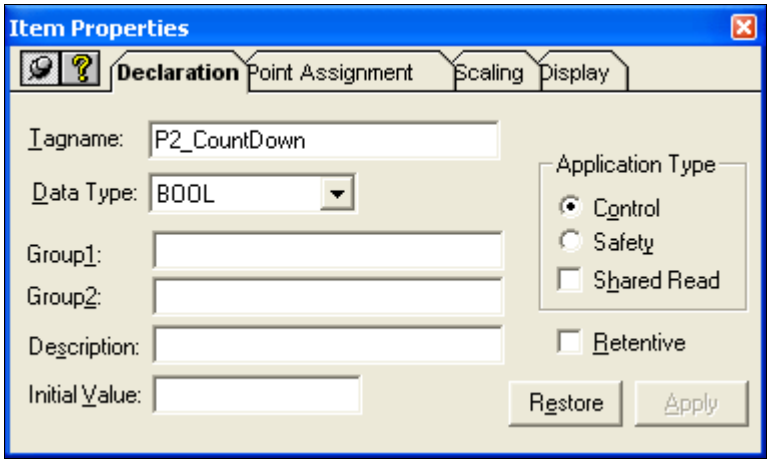
Declaring Tagnames

This procedure explains how to declare tagnames for points. Tagnames describe the type of point (input, output, or memory) and the properties associated with the point. You can declare tagnames before or after writing programs. Tagnames must be declared before downloading the application to the controller.

Procedure

1 Create a tagname by doing any of these:

- On the toolbar, click the tagname tool  , click on the logic sheet, enter a new name, and then click the Declarations button.
- Right-click the Tagname Declarations folder, and click New Tagname.
- Right-click the Declarations tree, and click New Tagname.



2 Specify these properties on the Declaration tab.

Property	Action
Tagname	Enter a name for the tagname.
Data Type	Select a data type. The default is BOOL.
Group 1 and Group 2	Enter the names of the groups this tagname belongs to.
Description	Enter a description for the tagname.
Initial Value	Enter the value to be used for the tagname when the system starts up.
Application Type	Specify whether the tagname is to be used in a Safety or Control application. The default is Control.
Shared Read	Select the check box to allow a different Application Type to read the tagname. The default is cleared.
Retentive	Select the check box to have the value of the tagname retained if a power failure occurs. The default is cleared.

3 Click Apply to save your changes.

Assigning an Alias Number, Alias Type, and Physical Address

This section includes procedures for assigning information to a tagname, including assigning an alias number and physical address to input or output points, and assigning an alias number and alias type to memory points.

Before You Begin

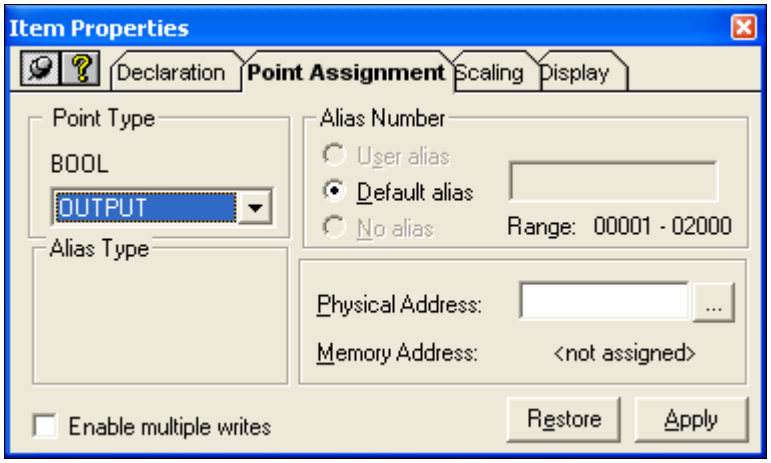
For input and output points, the I/O hardware configuration must be completed before a physical address or alias number can be assigned. For more information, see Tricon Hardware Allocation on page 184 or Trident Hardware Allocation on page 192.

Procedure for Input and Output Points

1 Open an input or output point by doing either of these:

- On the Tagname Declarations or Declarations tree, double-click a tagname.
- Double-click a tagname on a logic sheet, and then click the Declarations button.

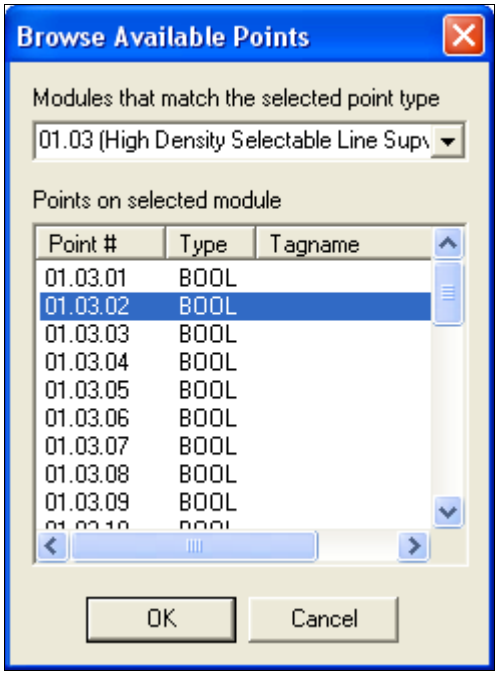
2 Click the Point Assignment tab.



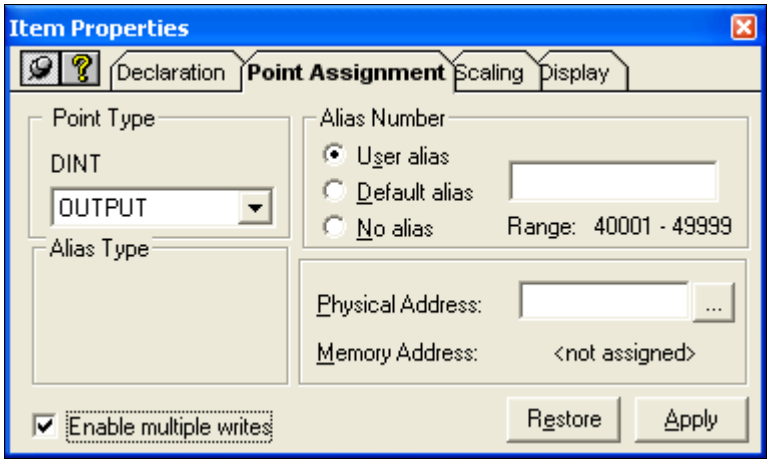
3 Enter a physical address by doing either of these:

- Enter the number representing the Physical Address (for example: 01.06.05), then go to step 6.
- Click the Browse button ... to select an address from a list of related modules, then go to step 4.

4 On the Browse Available Points screen, select the module, and then click the point to be assigned.



5 Click OK to return to the Point Assignment tab.



6 Specify the Alias Number assignment as follows:

- For Tricon, the default alias number must be used.
- For Trident, the alias number can be user-specified (within the range), system-specified based on a default range, or not aliased. For alias number information, see Alias Number on page 317.

7 To allow the point to be written to multiple times from programs in the application, select the Enable Multiple Writes check box.

8 To save your changes and have a memory address assigned, click Apply.

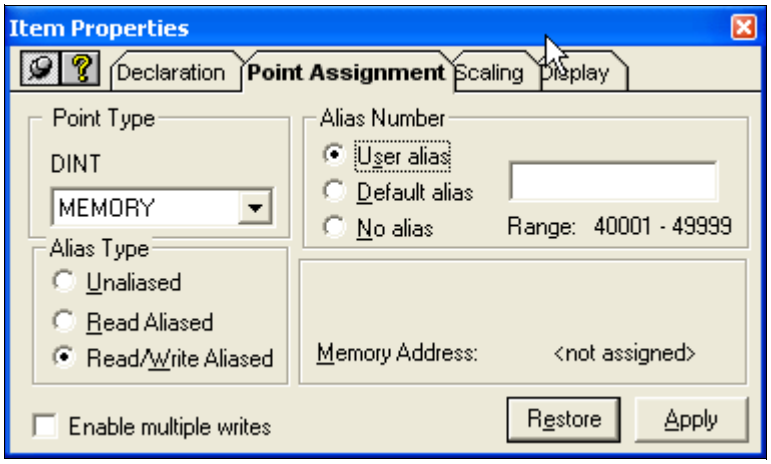
To cancel your changes and restore the original settings, click Restore *before* clicking Apply. Once you click Apply, you cannot revert to the original settings.

Procedure for Memory Points

1 Open a memory point by doing either of these:

- On the Tagname Declarations or Declarations tree, double-click a tagname.
- Double-click a tagname on a logic sheet, and then click the Declarations button.

2 Click the Point Assignment tab.



3 Specify these properties on the Point Assignment tab.

Property	Action
Alias Type	To allow a memory point to be accessed from a remote device, select Read Aliased or Read/Write Aliased. The default is unaliased.
Alias Number	Specify the alias number assignment as follows: • For Tricon, the default alias number must be used. • For Trident, the alias number can be user-specified (within the range), or system-specified based on a default range. For alias number information, see Alias Number on page 317. The default is Default alias. See the note in Assigning Alias Numbers to Tagnames on page 147 for additional information.
Memory Address	The memory address identifies the location in the controller memory and is displayed after the alias number is set.
Enable Multiple Writes	Select the check box to allow the point to be written to multiple times from programs in the application.

4 To save your changes and have a memory address assigned, click Apply.

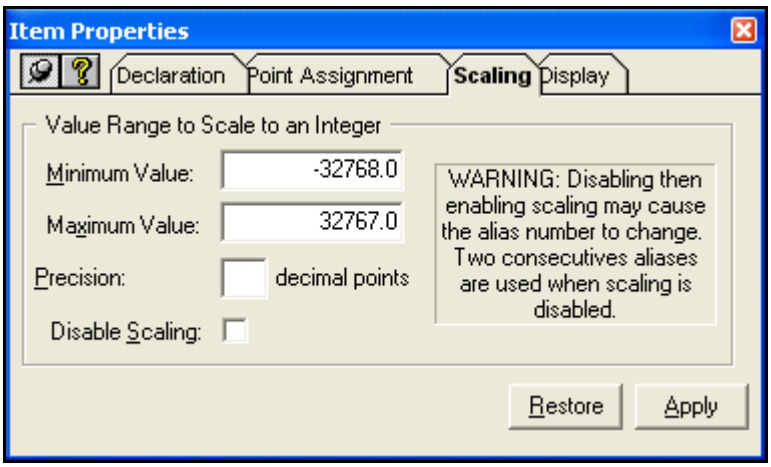
To cancel your changes and restore the original settings, click Restore *before* clicking Apply. Once you click Apply, you cannot revert to the original settings.

Scaling a REAL Point

This procedure explains how to scale a point, which allows the value of a REAL point to be scaled to an integer so it can be transmitted through Modbus communication protocol. The integer is derived from a formula that includes values specified on the Scaling tab and values for the Modbus minimum and maximum range on the Tricon TCM and EICM, and Trident MP and CM Setup screens. For information on the formula, see How REAL Numbers are Scaled to Integers on page 150.

Procedure

1. Open a tagname by doing either of these:
   - On the Tagname Declarations or Declarations tree, double-click a tagname.
   - Double-click a tagname on a logic sheet, and then click the Declarations button.
2. Click the Scaling tab.



3. Specify these properties on the Scaling tab.

Property	Action
Minimum Value (Min Span)	Enter the minimum value to be used to scale the REAL number to an integer; must be less than the maximum value. The default is -32768.0.
Maximum Value (Max Span)	Enter the maximum value to be used to scale the REAL number to an integer; must be more than the minimum value. The default is 32767.0.
Precision	Enter the number of decimal points to be used. The default is blank.
Disable Scaling	To allow scaling of REAL numbers to integers, do not select this check box. Scaling cannot be disabled on the Tricon. The default is cleared.

4. To save your changes, click Apply.

   To cancel your changes and restore the original settings, click Restore *before* clicking Apply. Once you click Apply, you cannot revert to the original settings.

Specifying Display Options for Tagnames

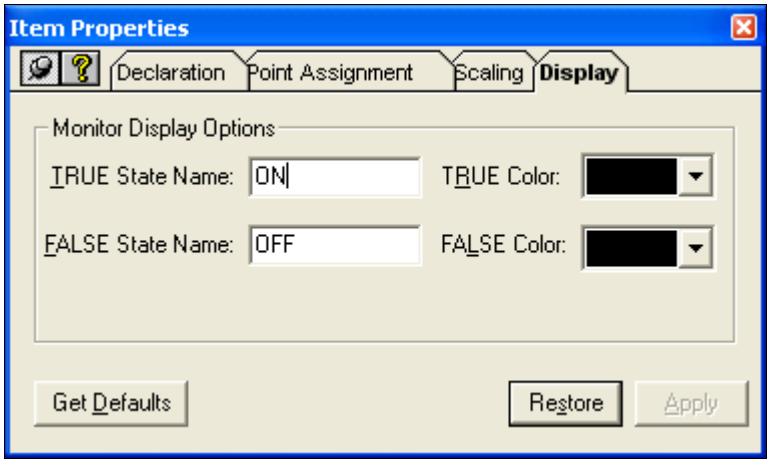
This procedure explains how to specify monitor display options used when the tagname is displayed in the Controller or Emulator Panel. This setting also affects the display of tagnames in SOE Recorder. For more information, see the *SOE Recorder User's Guide*.

Procedure

1 Open a tagname by doing either of these:

- On the Tagname Declarations or Declarations tree, double-click a tagname.
- Double-click a tagname on a logic sheet, and then click the Declarations button.

2 Click the Display tab.



3 Specify these properties on the Display tab.

Property	Action
Monitor Display Options	Enter the name and color to be displayed when the state of the tagname is True or False. The default name is TRUE; the default color is red. The default name is FALSE; the default color is green.

4 To save your changes, click Apply.

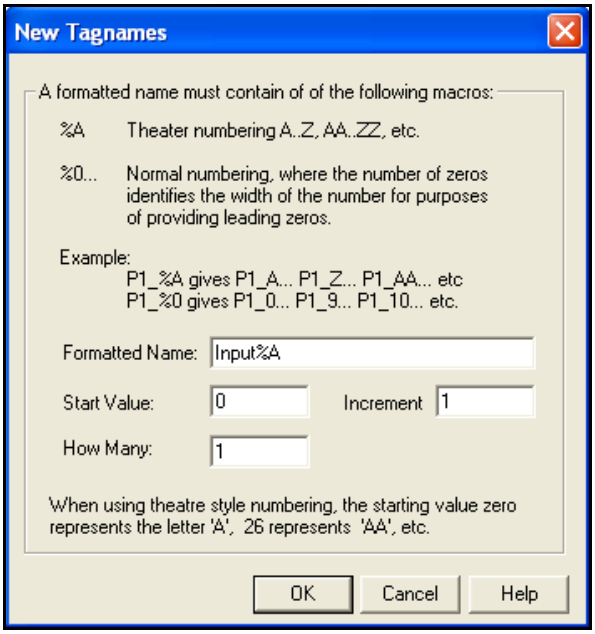
To cancel your changes and restore the original settings, click Restore *before* clicking Apply. To use the default settings, click Get Defaults at any time.

Creating Multiple Tagnames

This procedure explains how to create multiple tagnames by specifying a naming pattern.

Procedure

1 Expand the Application tree, right-click the Tagname Declarations folder, and click New Tagnames (plural).



2 Specify these properties on the New Tagnames screen.

Property	Action
Formatted Name	Specify whether to use theater numbering, which uses letters, or normal numbering, which uses numbers.
Start Value and Increment	Enter the starting value for the first tagname and the number to use when incrementing each successive tagname.
How Many	Enter the number of tagnames you want to create.

3 Click OK to create the tagnames.

Renaming a Tagname

This procedure explains how to rename a tagname.

Procedure

1. On the Tagname Declarations or Declarations tree, right-click a tagname, and then click Rename.
2. Enter the new name and press Enter.

   If the tagname already exists, a message is displayed and you must enter another name.

Deleting Tagnames

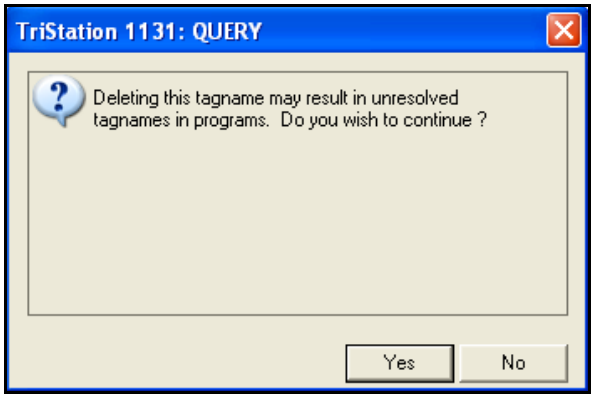
This procedure explains how to delete a tagname.

Procedure

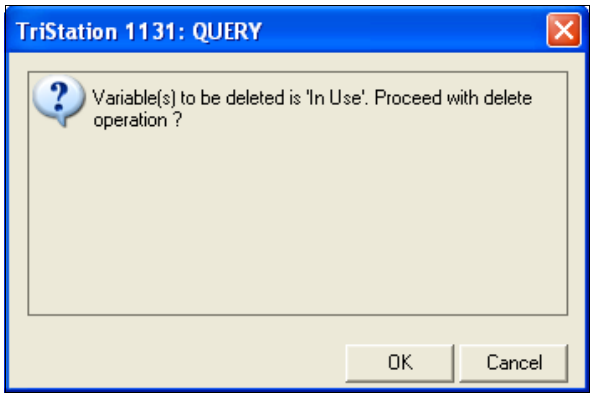
1. On the Tagname Declarations or Declarations tree, right-click a tagname, and then click Delete.

   If the tagname is already in use, a message warns you that deleting the tagname may result in unresolved tagnames or that the tagname is in use.

   If you deleted the tagname from the Tagname Declarations tree, the message is similar to this screen:



   If you deleted the tagname from the program Declarations tree, the message is similar to this screen:



2. To cancel, click No or Cancel. To confirm deletion of the tagname, click Yes or OK. This action cannot be undone.

Changing Multiple Tagnames

This procedure explains how to change the properties of multiple tagnames by using a tabular view of the tagnames. The tabular view shows a subset of the tagname properties which can be sorted or changed by inserting or deleting columns. Tagnames can then be sorted by different properties. For example, alias numbers can be added to a group of tagnames by sorting them, selecting the tagnames, and then making the changes.

Procedure

1 Expand the Application tree. Right-click the Tagname Declarations folder, and click Display Tabular View.

The tagnames and properties are displayed in a table. You can change the size of the columns and the properties that are displayed.

Tagname	Point Type	Alias Type	Data Type	Point Address	Alias #
CAUSE_1	Memory	Unaliased	BOOL	n/a	n/a
CAUSE_2	Memory	Unaliased	BOOL	n/a	n/a
CAUSE_3	Memory	Unaliased	BOOL	n/a	n/a
CAUSE_4	Memory	Unaliased	BOOL	n/a	n/a
EFFECT_1	Memory	Unaliased	BOOL	n/a	n/a
EFFECT_2	Memory	Unaliased	BOOL	n/a	n/a
EFFECT_3	Memory	Unaliased	BOOL	n/a	n/a
EFFECT_4	Memory	Unaliased	BOOL	n/a	n/a

2 Perform any of these actions.

Action	Description
Sort by property	Click the column heading of the property you want to sort by, or right-click the column heading and select Sort Ascending or Sort Descending.
Select multiple tagnames	To select a contiguous group, click a tagname, hold the Shift key, and click the last tagname. To select a non-contiguous group, click the top tagname, hold the Ctrl key, and click all the other tagnames to be selected.
Change multiple tagnames	Sort and select the tagnames to be changed. In the Tagname Declarations tree, right-click on one of the selected tagnames, and then click Item Properties. Make changes to the properties and click Apply. The changes are applied to all the tagnames in the selection.

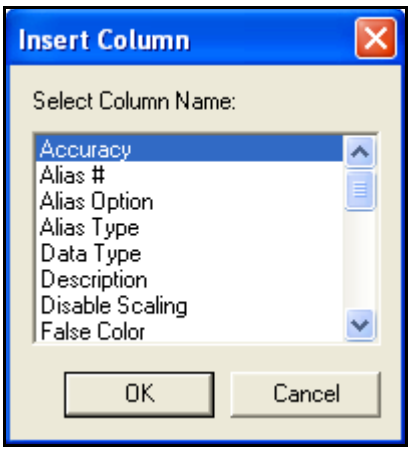
Inserting a Column into the Tagnames Table

This procedure explains how to insert a column into the Tagnames table. This action displays an additional tagname property in the table. By inserting columns, you can customize the table to display properties that are useful to you.

You can reorder the columns by clicking a column heading and dragging it to another location.

Procedure

1. Expand the Application tree, right-click the Tagname Declarations folder, and click Display Tabular View.
2. Right-click in the column heading to the right of where you want to insert another column, and then select Insert Column.



3. Select the name of the column to be inserted, and then click OK.

Deleting a Column from the Tagnames Table

This procedure explains how to delete a column from the Tagnames table. This action removes the column from the table so you can display another column. For example, you might want to view colors set for False by adding the False Color column and then sorting by the column.

The Tagname column cannot be deleted.

Procedure

1. Expand the Application tree, right-click the Tagname Declarations folder, and click Display Tabular View.
2. Right-click in the heading of the column you want to delete, and then select Delete This Column.

   The column is removed from the table.

   Note You can add a deleted column to the table again at any time; see Inserting a Column into the Tagnames Table on page 125.

Importing and Exporting Tagnames

This section explains how to import and export tagnames using a file with point information. Topics include:

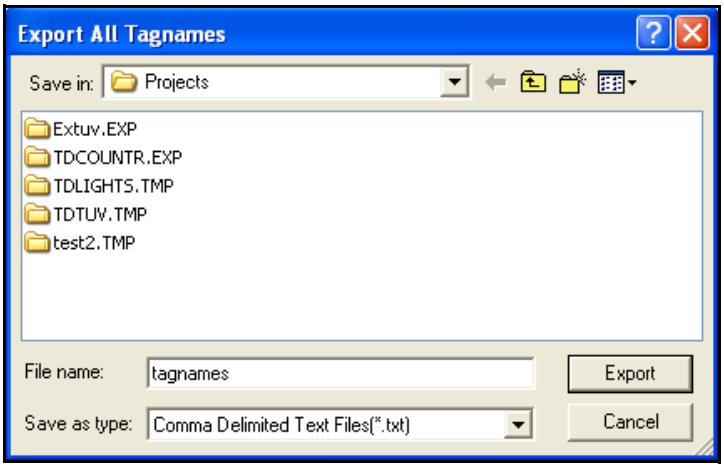
Exporting Tagname Properties

This procedure explains how to export tagname properties to a file. File formats you can export to include:

- dBase (dbf)
- Microsoft Access (mbd)
- Microsoft Excel (xsl)
- Comma delimited text file (txt or csv)
- Matrikon OPC XML Data file (xml)

Procedure

1. Expand the Application tree, right-click the Tagname Declarations folder, and click Export.



2. Select the location, file name, and file type to save the tagname information.
3. Click Export.

   If you enter a file name longer than eight characters, you are warned that you may need to rename the file if you want to import it to a TriStation 1131 project.

Format of an Exported Tagname File

The exported file includes these columns.

Table 24 Exported Tagname File Format

Point Property	Description
TAGNAME	The tagname for the point. Must be 31 characters or less to be a valid IEC 61131-3 identifier.
DESCRIP	The description for the point.
GROUP1	The Group1 description.
GROUP2	The Group2 description
ALIASTYPE	The alias type for the point: U = Unaliased R = Read-only aliased W = Read/Write aliased
ALIASNUM	The alias number for the point. For Tricon, from 0 to 49999 For Trident, from 0 to 42000
TAGTYPE	The data type: D = Discrete (BOOL) I = Integer (DINT) R = Real (REAL)
TAGCLASS	The data class: I = Input O = Output M = Memory
INITVALUE	The initial value: For BOOL, True or False For DINT, an integer value For REAL, a real value
RETENTIVE	Retentive flag: if R, the value is retained if a power outage shuts down the controller. N = Non-retentive R = Retentive
IOP	IOP number (1) (Trident)
SLOT	Slot number (1 - 6) (Trident)
POINT	Point number (1 - 32) (Trident)
CHASSIS	Chassis number (0 - 15) (Tricon)
SLOT	Slot number (0 - 8) (Tricon)

Table 24 Exported Tagname File Format

Point Property	Description
POINT	Point number (0 - 64) (Tricon)
MIN SPAN	The lower limit for REAL in Engineering Units; the default is –32767.00. The range is –3.402823466e+38 to +3.402823466e+38. Must be less than the MAX SPAN value.
MAX SPAN	Upper limit for REAL in Engineering Units; the default is 32767.00. The range is –3.402823466e+38 to +3.402823466e+38. Must be greater than the MAX SPAN value.
DECPL	Decimal places for displaying Real variables. (Corresponds to the Precision property and Min/Max Accuracy field in the Import Wizard.)
SCALING	Scaling flag: if S, real numbers are scaled. N = Non-scaling S = Scaling For more information, see Disable Scaling on page 344.
APPLICATION	Application flag: C = Control S = Safety
SHARED	Shared for Read flag: Y = Yes, N = No
FALSE STATE	Text. For example, False or Zero.
TRUE STATE	Text. For example, True or Zero.
FALSE COLOR	Black, Red, Green, Blue, Cyan, Yellow, Pink, and White are allowed.
TRUE COLOR	Black, Red, Green, Blue, Cyan, Yellow, Pink, and White are allowed.

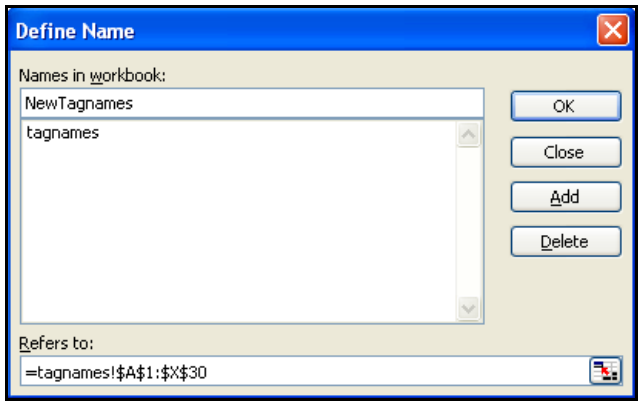
Preparing an Excel File for Import

This procedure explains how to prepare a Microsoft Excel file if you created the file from scratch or renamed a previously exported file. This procedure does not have to be performed if you exported tagnames to an Excel file, modified the contents, but did not change the file name.

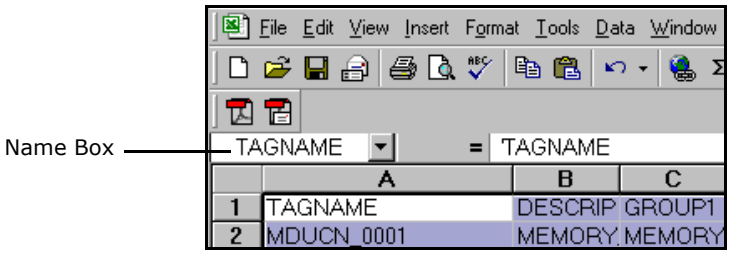
Procedure

1. Open an Excel file that contains tagname data.
2. Ensure the data is formatted as follows:
   - All cells must have the Format setting as Text.
   - The Tagname, Data Type, and Point Type cells are required.
   - The values in these cells must be numeric and must begin with a single quotation mark (’): Alias Number, Initial Value, Chassis, Slot, Point, Min Span, Max Span, and Display Precision.
3. Select the range of data cells to be included by selecting the headings and cells. Do not select empty records.
4. On the Insert menu, click Name, then Define.
5. In the Define Name dialog box, enter the new name (in this example, NewTagnames) in the text box, and then click Add.
6. Select the names to delete (in this example, tagnames), click Delete, and then click OK.

   Ensure the *Refers to* range reference at the bottom of the screen includes information. If it is blank, repeat step 3 through step 6.



7. To verify the table name was created, click the Name Box list box.



   All the records (columns and rows) should be highlighted. If not, repeat steps 4 and 5.

8. Save the file. The file is ready to be imported.

File Format Requirements for Tagname Import

This section describes the requirements for database or text files with tagnames to be imported into a TriStation 1131 project.

Note You *cannot* delete existing tagname information by importing a database or text file with blank fields where the existing data resides. Importing a file only updates or creates tagname data. Blank fields for *existing* tagnames are ignored, so that any existing information will remain as-is. Blank fields may be imported for *new* tagnames only; see the following table for instructions.

However, you can create a "blank" field for an existing tagname by typing spaces to replace the existing data. The field will then appear blank. After the import is complete, you can remove the spaces from the field to create a true blank field by editing the tagname's properties; see Changing Multiple Tagnames on page 124.

Table 25 General File Requirements

Item	Database File	Text File
Filename	Must be 8 characters or less.	Must be 8 characters or less.
Table or Lines	Each row must contain columns mapped to these point properties: • Tag Name • Tag Type • Tag Class	Must have a consistent format; the same number of fields in each line. Each line must contain fields mapped to these point properties: • Tag Name • Tag Type • Tag Class
Columns or Fields	Can include more columns than the number of fields to be imported, but no more than one column can be mapped to each point property. Column headings can be any name. Blank numeric fields and blank string fields are allowed for new tagnames only (in .DBF or .XLS files).	Must be delimited by commas with no spaces before or after. Can include more than 22 fields, but only 22 fields can be mapped. Blank fields (for new tagnames only) must be represented as follows: • For a blank numeric field, use two commas with no spaces between. • For a blank string field, use two quotation marks with no spaces between.

Table 26 Import Data Requirements

Point Property	Description
TAGNAME	The tagname for the point. Must be 31 characters or less to be a valid IEC 61131-3 identifier. Can be any string of letters, digits, and underscores provided that the first character is not a digit and there are not two or more underscore characters together.
DESCRIP	The description for the point; cannot be more than 131 characters.
GROUP1	The Group1 description; cannot be more than 63 characters.
GROUP2	The Group2 description; cannot be more than 63 characters.
ALIAS TYPE	The alias type for the point: U = Unaliased R = Read-Only aliased W = Read/Write aliased
ALIAS NUMBER	The alias number for the point. For Tricon, from 0 to 49999 For Trident, from 0 to 42000
TAG TYPE	The data type: D = Discrete (BOOL) I = Integer (DINT) R = Real (REAL)
TAG CLASS	The data class: I = Input O = Output M = Memory
INITIAL VALUE	The initial value: For BOOL, True or False For DINT, an integer value For REAL, a real value
RETENTIVE FLAG	Retentive flag: if R, the value is retained if a power outage shuts down the controller. N = Non-retentive R = Retentive
IOP	IOP number (1) (Trident)
SLOT	Slot number (1 - 6) (Trident)
POINT	Point number (1 - 32) (Trident)
CHASSIS	Chassis number (0 - 15) (Tricon)
SLOT	Slot number (0 - 8) (Tricon)
POINT	Point number (0 - 64) (Tricon)

Table 26 Import Data Requirements *(continued)*

Point Property	Description
MIN SPAN	The lower limit for REAL in Engineering Units; the default is –32767.00. The range is –3.402823466e+38 to +3.402823466e+38. Must be less than the MAX SPAN value.
MAX SPAN	Upper limit for REAL in Engineering Units; the default is 32767.00. The range is –3.402823466e+38 to +3.402823466e+38. Must be greater than the MAX SPAN value.
DISPLAY PRECISION	Decimal places to display MIN SPAN and MAX SPAN properties. Limited to 125 digits. REAL values are set to 1. BOOL and DINT values are set to 0.
SCALING	Scaling flag: if S, real numbers are scaled. N = Non-scaling S = Scaling For more information, see Disable Scaling on page 344.
APPLICATION	Application flag: C = Control S = Safety
SHARED READ	Shared for Read flag: Y = Yes, N = No
FALSE STATE	Text. For example, False or Zero.
TRUE STATE	Text. For example, True or Zero.
FALSE COLOR	Black, Red, Green, Blue, Cyan, Yellow, Pink, and White are allowed.
TRUE COLOR	Black, Red, Green, Blue, Cyan, Yellow, Pink, and White are allowed.

Import Options and Validation Criteria

When importing tagname information from a database or file, you can specify whether to update, add, or update and add new tagnames.

Adding New Points

If the imported tagname includes a tagname, tag type (BOOL, DINT, or REAL), tag class (input, output, or memory), and alias type (R for Read, W for read/write, or U for no alias), the tagname is imported. If the tagname matches an existing tagname or is invalid in any way, a message is displayed alerting you of the problem or error when the import operation is complete, but the tagname is still imported.

Updating Existing Points

If the imported tagname matches a tagname, tag type (BOOL, DINT, or REAL), and tag class (input, output, or memory), the tagname is updated. All fields, with the exception of the

TAGNAME field (see below), can be updated for an existing tagname. If an updated value is invalid in any way, a message is displayed alerting you of the error when the import operation is complete, but the attribute is still changed to the new value.

Updating the TAGNAME field for an existing tagname will create a new tagname. The existing tagname will be retained. For example, if you update the TAGNAME field for the tagname Counter1 by changing it to Counter10, after the import process is complete, you will have two tagnames: Counter1 AND Counter10.

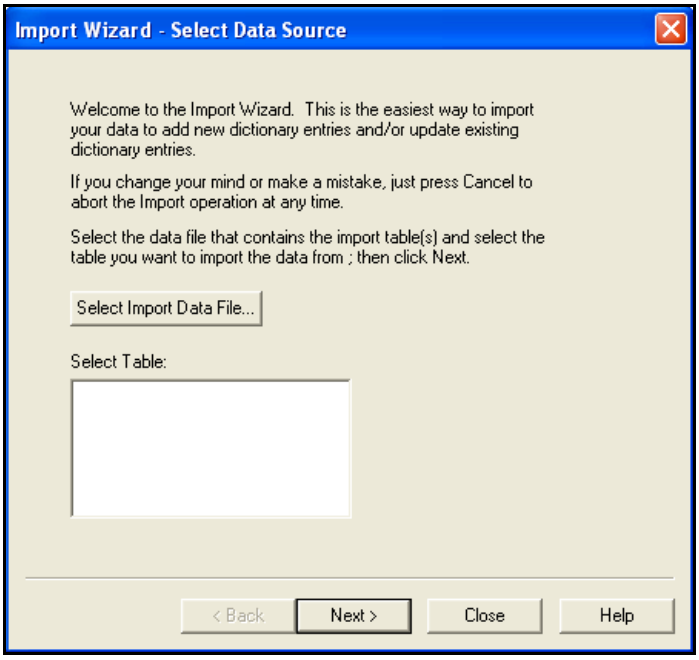
Importing Tagname Properties

This procedure explains how to import tagname properties from a file.

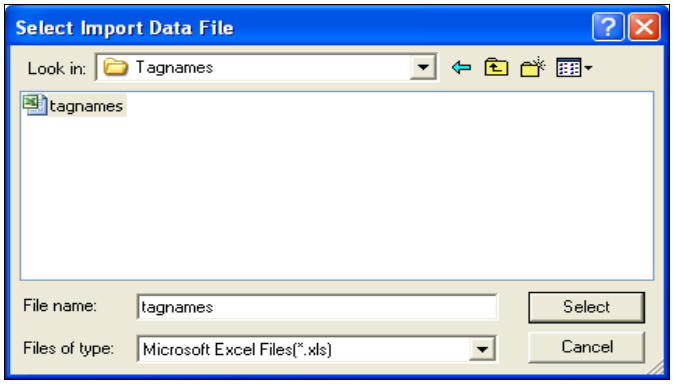
Procedure

1 Expand the Application tree, right-click Tagname Declarations, and click Import.

Note The project you are importing tagnames into must be in the Download All state. If the project is not in the Download All state, the Import menu option is disabled. Use the Change State to Download All Command on page 326 to change the project state before continuing this procedure.



2 Click Select Import Data File and go to the folder that contains the file.



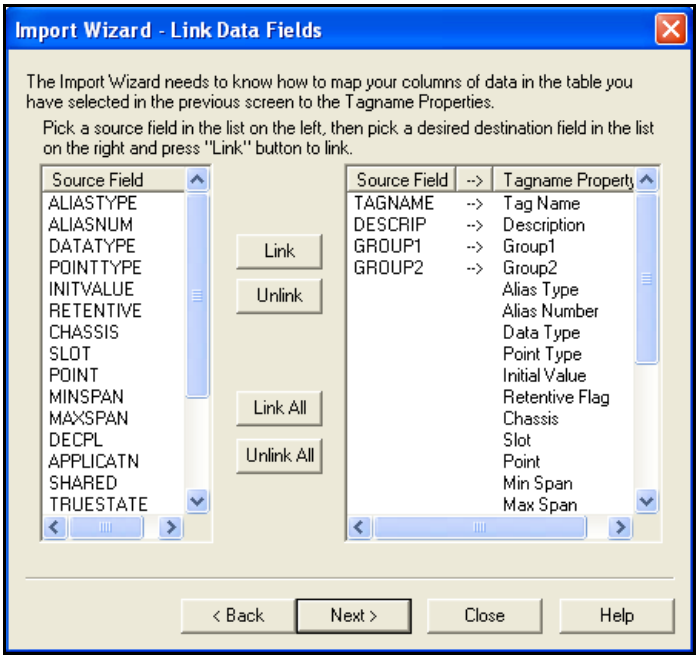
If the file is not displayed, you may need to change the type of file to match the extension used in the file to be imported.

3 Click the file name and click Select. Click Next to continue.

4 On the Link Data Fields screen, match the source fields to the tagname properties by clicking a field in the list on the left, and a tagname property in the list on the right, and then clicking Link.

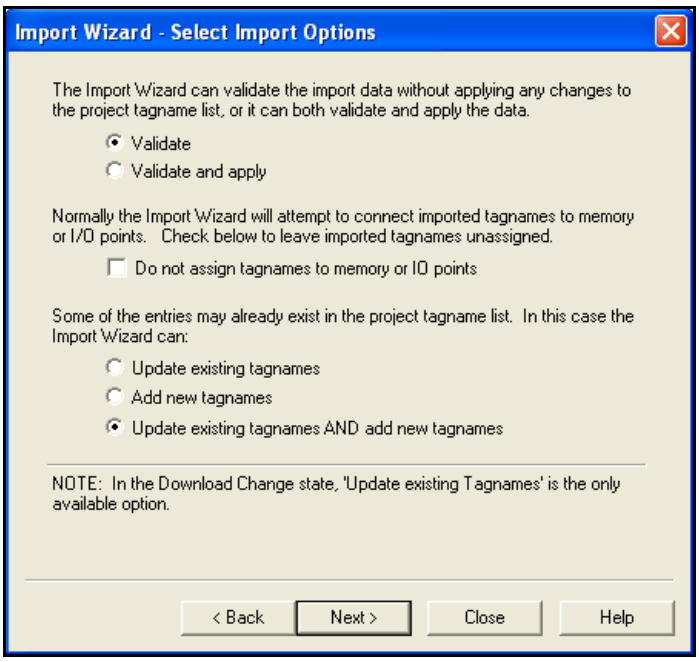
The following required tagname properties must be linked before continuing:

- Data Type
- Point Type
- Tag Name



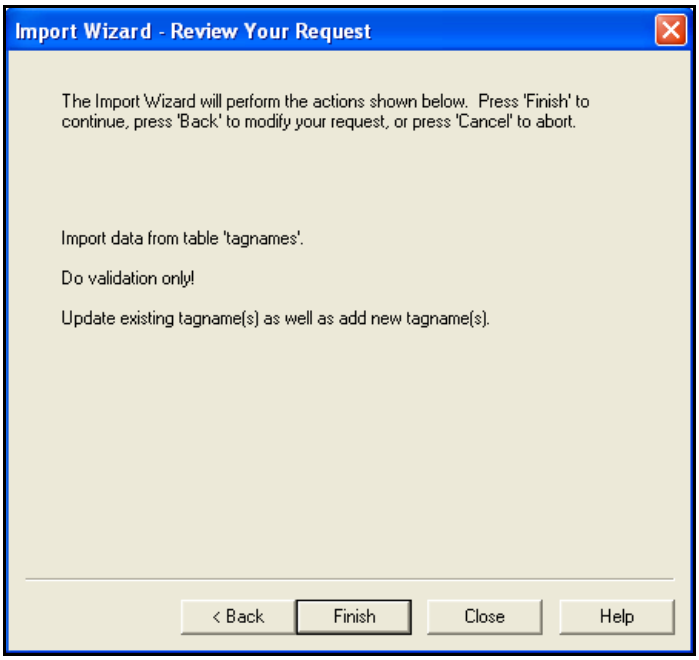
5 Once fields and properties are linked, click Next.

6 On the Select Import Options screen, select options as needed.



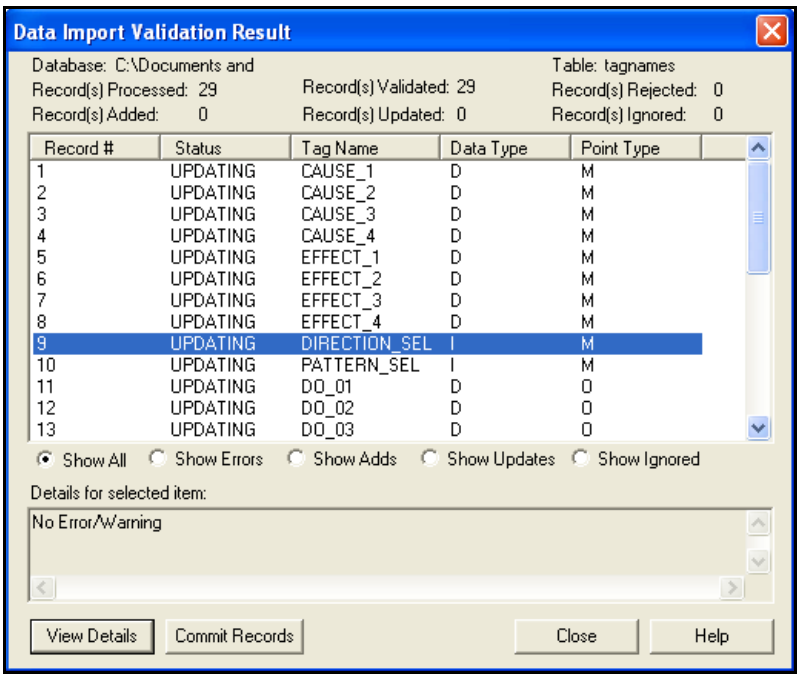
7 Click Next to continue.

8 Read the Review Your Request screen. Click Finish to continue, or Back to make changes.



9 Review the status of the records on the Data Import Validation Result screen.

- If there are errors, close the screen, edit the data, and then go back to step 1 to import the file again.
- If you selected the Validate option on the Select Import Options screen and there are no errors, click Commit Records to import the data. This action cannot be undone.



This table describes the status of the imported records.

Status	Description
Ignored	The import record is mapped to an existing point that has the same properties, so the import record is being ignored.
Added	A new record is being added to the configuration.
Error	The import record has been rejected due to one or more errors.
Updated	The import record is updating properties of an existing point.

Note If you opened the Tagnames table before you imported new tagnames, you need to close the Tagnames table and then open it again in order to see the newly imported tagnames in the table.

Annotations and Comments

This section describes how to use annotations and comments in an FBD or LD program or function. Topics include:

Adding Annotations

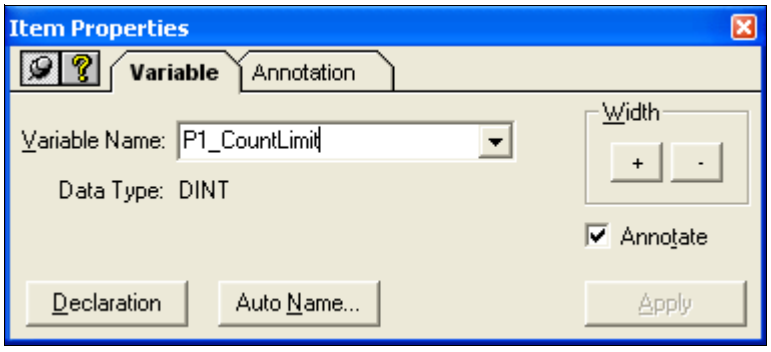
This procedure explains how to add an annotation to a constant, tagname, or variable. Annotations can be used to display descriptive text, including information specified in system and user-modifiable macros. You can also display the value of a variable during program execution in the emulator or controller.

To have annotations automatically included for all new elements, see Specifying Annotation Options on page 18 and Using Macros with Annotations and Comments on page 143.

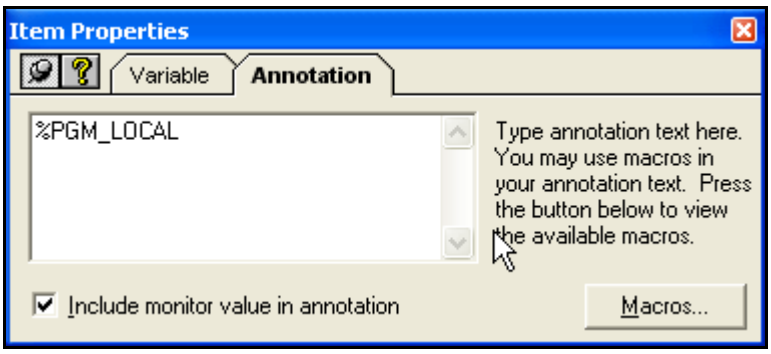
Procedure

1. Expand the Application tree, and open an FBD or LD program or function.
2. Double-click the graphic for a constant, tagname, or variable.

   The Item Properties dialog box appears.



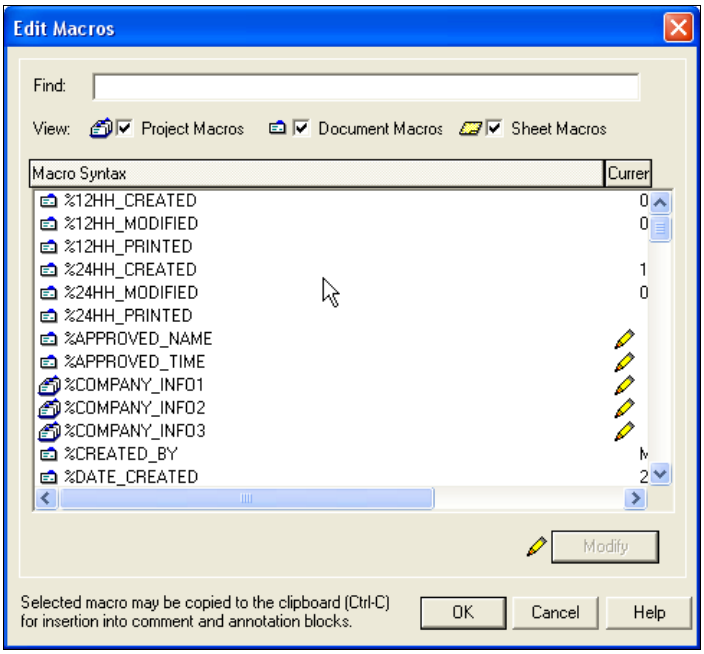
3. Select the Annotate check box. For constants, the check box is on the Constant tab. For tagname references and variables, the check box is on the Variable tab.
4. Click the Annotation tab.



5 To add text, enter the text in the annotation area.

6 To add a macro:

- Click Macros. The Edit Macros dialog box appears.



- Select a macro to be added. To change the value of a macro identified by a pencil icon, double-click the macro, enter the value, and click OK.
- With the macro selected, press Ctrl+C to copy the macro.
- Click OK to close the Edit Macros dialog box.
- Click in the annotation area, and press Ctrl+V to paste the macro.

7 For variables, select the Include Monitor Value in Annotation check box to display the value of the variable in the Controller or Emulator Panel.

Specifying Annotation Properties

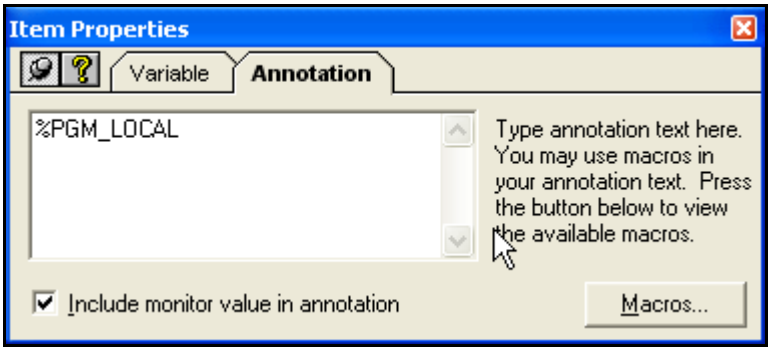
This procedure explains how to specify text and macros to be included with an annotation.

Procedure

1 Expand the Application tree, and open an FBD or LD program or function.

2 On the logic sheet, double-click an annotation.

The Item Properties dialog box appears, with the Annotation tab selected.



3 Specify these properties on the Annotation tab.

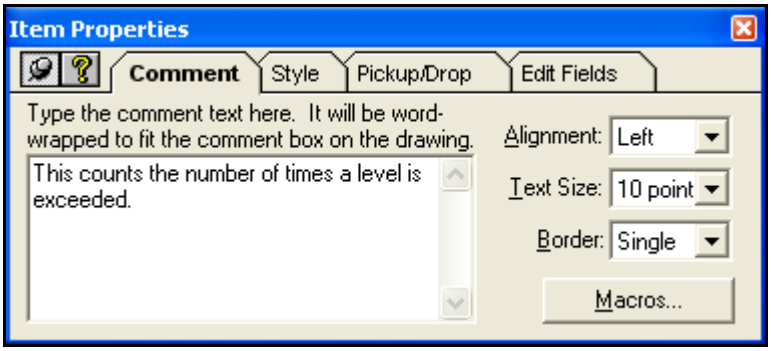
Property	Action
Annotation Text	Enter the text and/or macros to be used in the annotation.
Include Monitor Value in Annotation	Select the check box to display the value of the variable in the annotation when the element is run on the controller or emulator.
Macros Command	Click to add macros to the annotation. See Using Macros with Annotations and Comments on page 143.

Adding a Comment

This procedure explains how to add comment text in FBD and LD programs. Comments are used to add information about operations performed by a program, function, or function block. There is no limitation on the number of comment boxes per program or their placement on a logic sheet. If you draw a comment box around a project element it is ignored when you compile the element.

Procedure

1. Expand the Application tree, and open an FBD or LD program or function.
2. On the toolbar, click the icon for comments .
3. On the logic sheet, click and drag to create the comment box.
4. Double-click the comment box to display the Comment properties.



5. Specify these properties on the Comment tab.

Property	Action
Comment Text	Enter the text to be included as a comment. Can include text and macros.
Alignment	Select how to align the text. The default is left.
Text Size	Select the point size for the text; from 3 to 24 points.
Border	Select whether to include a border around an annotation or comment box.The default is single.
Macros Command	Click to view macros that can be included with the comment text. To copy, click the macro and press Ctrl + C. To paste, return to the Comment tab and press Ctrl + V.

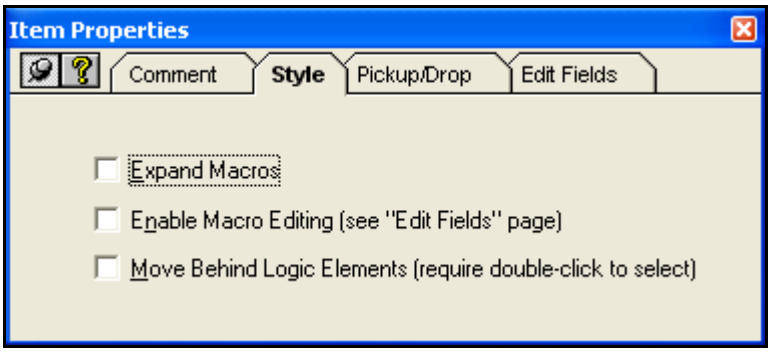
Specifying Comment Style

This procedure explains how to specify style features used with comments.

Procedure

1 Expand the Application tree, and open an FBD or LD program or function.

2 Double-click a comment, and then click the Style tab.



3 Specify these properties on the Style tab.

Property	Action
Expand Macros	Select this check box to display the value of the macro when the application is run on the emulator or controller. For example, if expanded, the macro %DATE_CREATED displays the month, day, and year when the project was created. The default is cleared.
Enable Macro Editing	Select this check box to list the user-modifiable macros on the Edit Fields tab, which allows you to edit the value for the macro. The default is cleared.
Move Behind Logic Elements	Select this check box to move the selected comment box behind a logic element. This affects the appearance of the logic sheet only; it does not affect the execution of the logic element. Move the comment box to the desired position before selecting this option. Once this option is selected, the comment box cannot be moved. To move the comment box after this option has been selected, double-click the comment box to access the Properties dialog box, and then clear this option. The default is cleared.

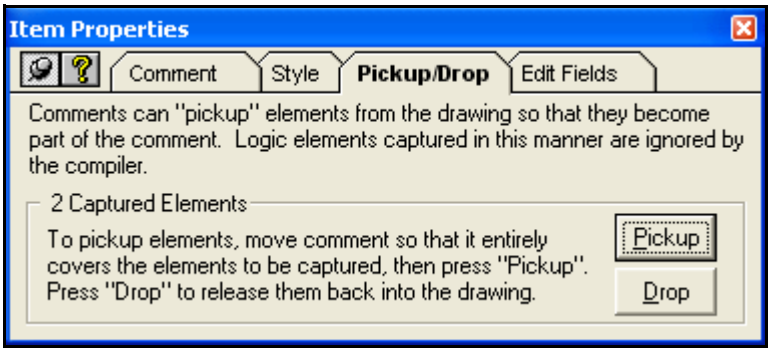
Picking and Dropping Elements for Comments

This procedure explains how to pick up and drop elements from a comment box. Elements in comment boxes are ignored when you compile the program. You can also remove captured elements from a comment by selecting the comment and dropping the elements back onto the logic sheet. This is useful for isolating logic during testing or troubleshooting.

Note To use the Pickup and Drop commands, the Move Behind Logic Elements option cannot be selected. For more information about this option, see Specifying Comment Style on page 141.

Procedure

1. Expand the Application tree, and open an FBD or LD program or function.
2. Double-click a comment, and then click the Pickup/Drop tab.



3. Specify these commands on the Pickup/Drop tab.

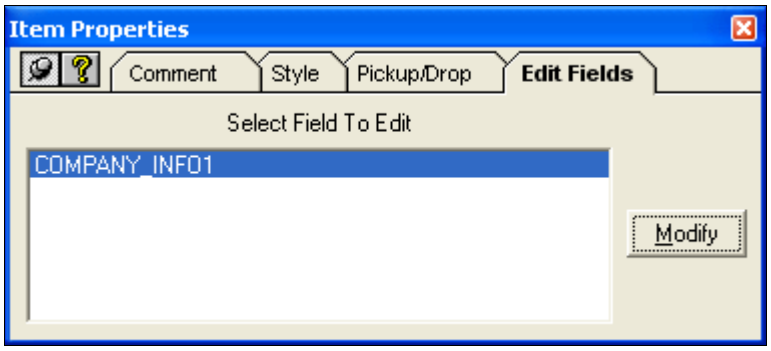
Command	Action
Pickup Command	To pick up elements to include in the comment, click and drag the comment box so it entirely covers the elements to be captured. Double-click the comment, click the Pickup/Drop tab, and then click Pickup.
Drop Command	To remove elements from the comment, double-click the comment box, click the Pickup/Drop tab, then click Drop.

Editing Comment Fields

This procedure explains how to modify the comment text if the comment includes a macro that can be edited and the macro is enabled for editing.

Procedure

1. Expand the Application tree, and open an FBD or LD program or function.
2. Double-click a comment, and then click the Edit Fields tab.



3. Select a field and then click Modify.
4. Change the text used for the macro.
5. Click OK to save the change.

Using Macros with Annotations and Comments

This procedure explains how to use macros in an annotation or comment. Macros are placeholders for text or information supplied by the system or by you. The value is displayed when the element is run on the controller or emulator.

Macros can be used only in FBD and LD development.

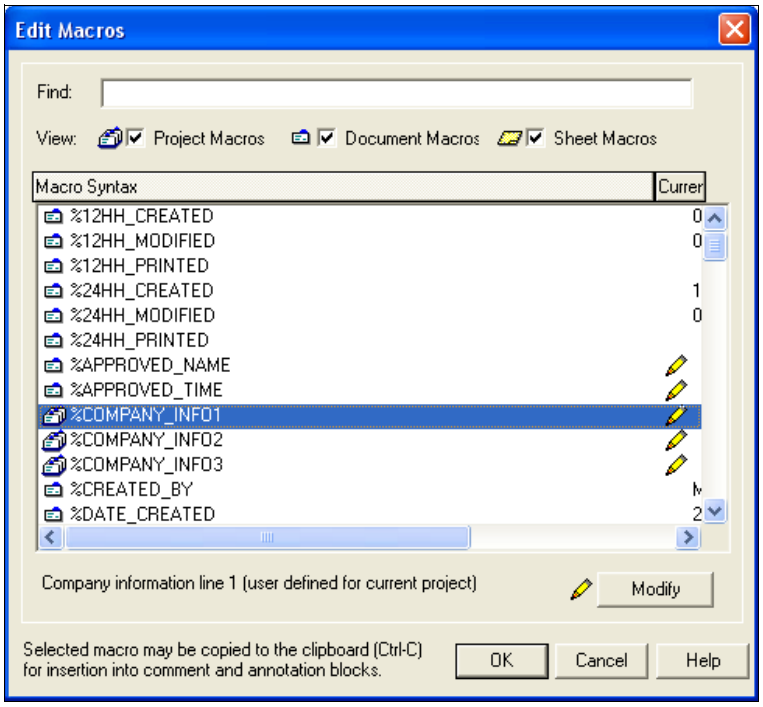
There are two types of macros:

- System macros are values supplied by the system and cannot be changed. For example, the %CREATED_ BY macro includes the user ID of the person who created the element. You cannot change values for these macros.
- User-modifiable macros, identified by a pencil icon  , are values you can specify. For example, the %APPROVED_NAME macro can include any name you enter.

CAUTION When you change the value of a macro, you change it for ALL annotations and comments in the project that use the macro.

Procedure

1. Expand the Application tree, and open an FBD or LD program or function.
2. Do either of these:
   - For a comment, double-click the comment, and click the Macros button.
   - Double-click a variable or tagname reference. Click the Annotation tab, then click the Macros button.
3. If needed, select the check boxes for project, document, or sheet to view the macros available for those elements.



4. Do any of the following:
   - To change the value of a user-modifiable macro, identified by a pencil icon  , select the macro, click Modify and then make the change.
   - To copy a macro to an annotation or comment, select the macro and copy it by pressing Ctrl+C.
5. Click OK to close the Edit Macros dialog box. You are returned to the Item Properties dialog box.
6. To add the copied macro to the annotation or comment, click inside the text area and paste the macro by pressing Ctrl+V.

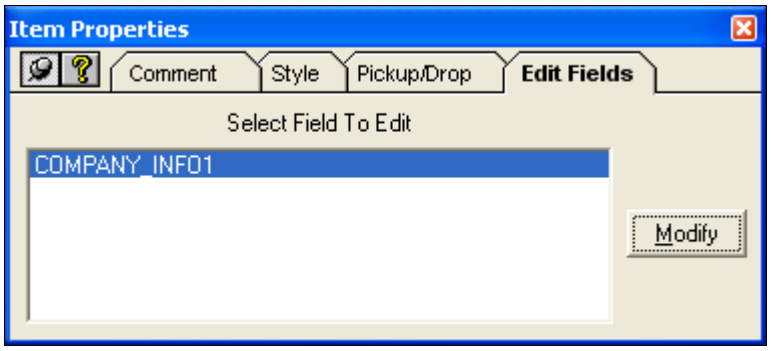
Editing Macro Text

This procedure explains how to edit text associated with a macro. You can include text and macros that supply information from the system.

Procedure

1. Expand the Application tree, and open an FBD or LD program or function.
2. Double-click a comment, constant, tagname, or variable.

   The Item Properties dialog box appears.
3. Click the Edit Fields tab, select the field to be changed, and then click Modify.



4. Enter the text to be used when the macro is displayed.
5. Click OK to save.

Modbus Applications

This section describes information related to developing a Modbus application. Modbus is an industry-standard master/slave communication protocol that is traditionally used for energy management, transfer line control, pipeline monitoring, and other industrial processes.

Tricon Functionality

A Tricon controller with an EICM or TCM can operate as a Modbus master, slave, or both. A DCS typically acts as the master, while the Tricon acts as a slave. The master can also be an operator workstation or other device that is programmed to support Modbus devices.

The Tricon controller has serial ports on the EICM, and network and serial ports on the TCM that provide options for communication with a Modbus devices. Each serial port can operate in a point-to-point configuration with a single Modbus device, or in a multi-point configuration with several Modbus devices connected to a serial link.

Trident Functionality

The Trident controller has serial ports on the CM and MP that provide options for communication with a Modbus devices. Each CM and MP port can operate in a point-to-point configuration with a single Modbus device. In addition, each CM port can operate in a multi-point configuration with several Modbus devices connected to a serial link.

Topics include:

Assigning Alias Numbers to Tagnames

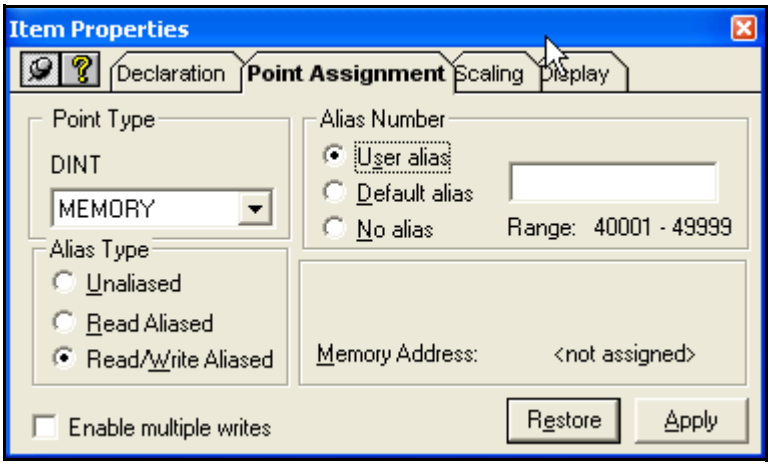
This procedure explains how to assign an alias number for input, output, and memory points.

Procedure

1 Open a tagname by doing either of these:

- On the Tagname Declarations tree, double-click a tagname.
- Double-click a tagname on a logic sheet, and then click the Declaration button.

2 Click the Point Assignment tab.



3 Specify these properties on the Point Assignment tab.

Property	Action
Alias Type	For memory points, specify either Read Aliased, or Read/Write Aliased. (Input and output points can only be Read Aliased.)
Alias Number	For aliased memory points, specify either User alias or Default alias. If User alias, enter a number within the range, and then click Apply. • For Tricon, if the User alias number is valid, the default alias number is changed for the memory address. • For Trident, if the User alias number is valid, the memory address that corresponds to the alias number is displayed.
Physical Address	For input and output points, the physical address must be specified before an alias number can be assigned.
Memory Address	The memory address is displayed once you click Apply. It cannot be changed.
Enable Multiple Writes	Select the check box to allow the point to be written to multiple times in a scan. The default is cleared.

Note When you select Default alias as the alias number for memory point tagnames, these aliases can be automatically reassigned under certain circumstances. For example, if another tagname using the Default alias setting is deleted, the next time you build the application, TriStation will re-use the alias number of the deleted tagname.

You can avoid this behavior by always using the User alias setting to define your own alias numbers and keep control of assigned aliases.

4 To set the alias number, click Apply. To cancel your changes and restore the original settings, click Restore *before* clicking Apply. Once you click Apply, you cannot revert to the original settings.

How Tricon Transmits REAL Values With Special Alias Numbers

This section explains how the Tricon controller transmits REAL values for tagnames by using special alias numbers which map one 32-bit REAL value into two 16-bit Modbus integers. One Modbus integer is mapped to the 16 most significant bits and the other Modbus integer is mapped to the 16 least significant bits in the REAL number.

The Modbus master can also read and write values by using a scaled value in an alias number.

Reading REAL Values

This figure shows a Modbus master reading a REAL value from two consecutive special aliases which correspond to a REAL alias. The Tricon controller splits the 32-bit REAL value into two 16-bit integers and places them in the special aliases to be read by the Modbus master.

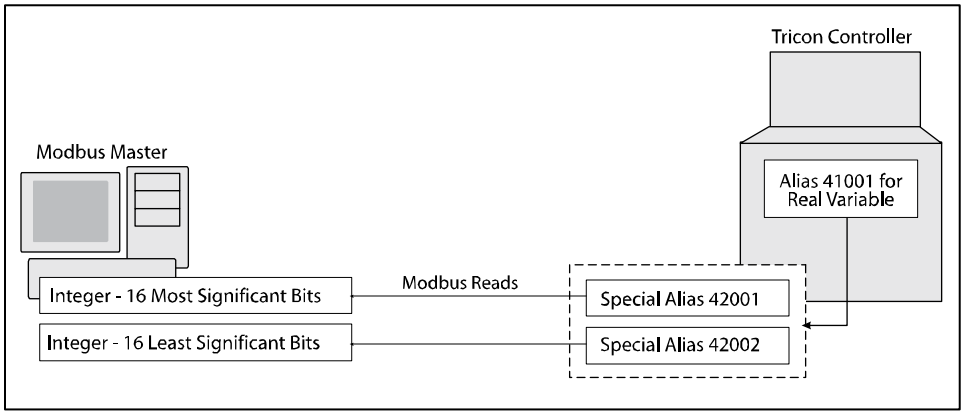


Figure 18 Modbus Master Reading REAL Values from the Tricon

Writing REAL Values

This figure shows a Modbus master writing a REAL value to the Tricon controller by transmitting two 16-bit integer values to two consecutive special aliases. The controller concatenates the two 16-bit integers to form a 32-bit REAL value.

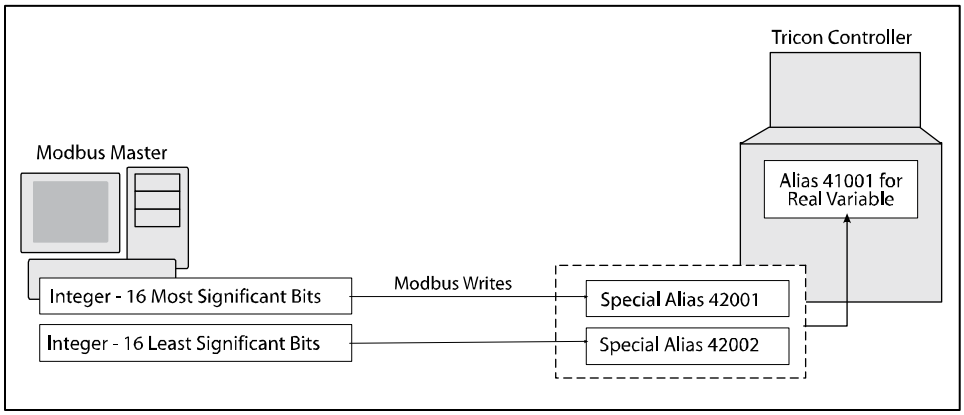


Figure 19 Modbus Master Writing REAL Values to the Tricon

Tricon Special Alias Numbers

This table lists the special alias numbers used for read and write operations with REAL tagnames. The Most and Least columns refer to the most significant and least significant bits.

Variable Type	Aliases	Special Aliases				
		Most	Least		Most	Least
Input REAL, Read Only	32001	34001	34002	- or -	44001	44002
	32002	34003	34004	- or -	44003	44004
	.	.	.	.	.	.
	.	.	.	.	.	.
	.	.	.	.	.	.
	32120	34239	34240	- or -	44239	44240
Memory REAL, Read Only	33001	35001	35002	- or -	45001	45002
	33002	35003	35004	- or -	45003	45004
	.	.	.	.	.	.
	.	.	.	.	.	.
	.	.	.	.	.	.
	34000	36999	37000	- or -	46999	47000
Memory REAL, Read/Write	41001	42001	42002			
	41002	42003	42004			
	.	.	.	.	.	.
	.	.	.	.	.	.
	.	.	.	.	.	.
	42000	43999	44000			

How REAL Numbers are Scaled to Integers

This section explains how 32-bit REAL scaled numbers are transmitted in Modbus protocol, which uses 16-bit integers.

If a REAL value is scaled, these operations occur:

- When a Modbus master writes a 16-bit integer to a Triconex slave, the controller scales the integer to a 32-bit REAL number before using it in the TriStation application.
- When a Modbus master reads a 32-bit REAL variable from a Triconex slave, the controller scales the REAL variable to a 16-bit integer before transmitting it.

Scaled REAL numbers use a formula that includes the value of the tagname, the Minimum Value (Min Span) and Maximum Value (Max Span) for the tagname, and the Modbus minimum (Modbus Min) and maximum (Modbus Max) range set for the Modbus Range property.

Scaling Integer Values to REAL Values

This figure shows how a Modbus master writes an integer value to the Triconex controller, where it is scaled to a REAL value.

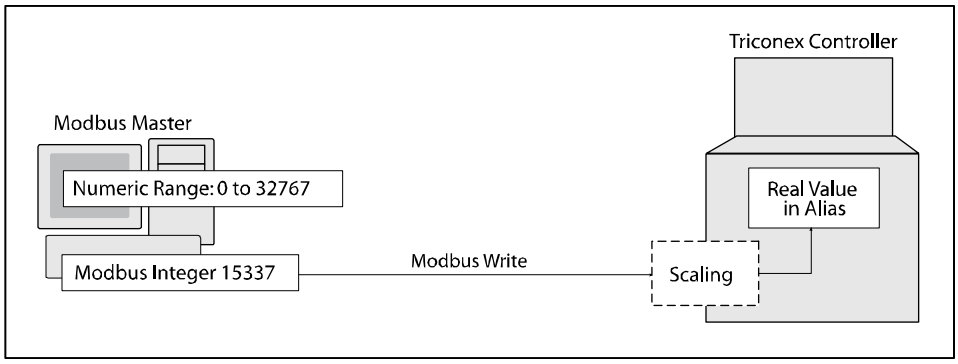


Figure 20 How Triconex Controller Scales a Integer Value to a REAL Value

Scaling an integer to a REAL value uses this formula:

$$\text{Real Value} = \frac{(\text{MaxSpan} - \text{MinSpan})}{(\text{Modbus Max} - \text{Modbus Min})} \times (\text{Modbus Value} - \text{Modbus Min}) + \text{Minspan}$$

This figure shows how scaling is done. Values above the Max Span or below the Min Span are clamped to the respective limit. The same principle applies to values outside the Modbus range.

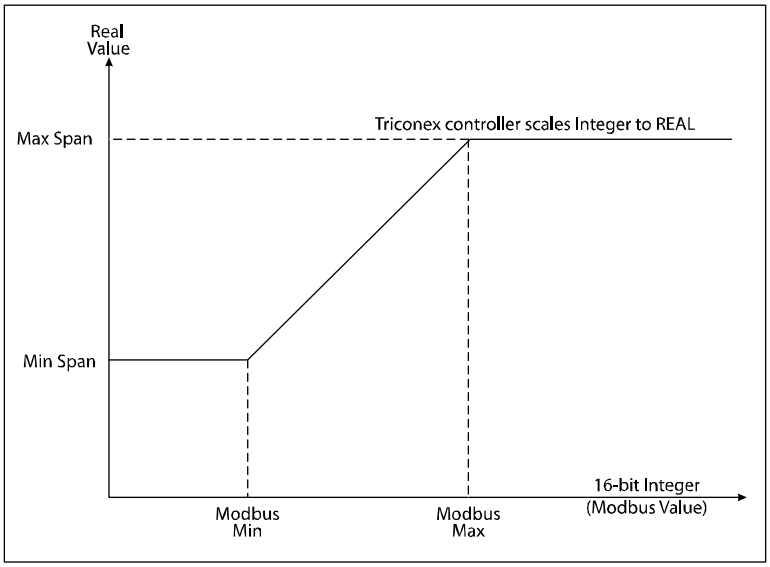


Figure 21 Scaling an Integer Value to a REAL Value

To avoid division by zero, do not set Modbus Max equal to Modbus Min—the REAL value result is undefined. For the Trident or Tricon v9.6 and later controllers, the result is one of the floating point standard special numbers: NAN (not a number: -1.#IND) or infinity (1.#INF).

Scaling REAL Values to Integer Values

This figure shows how a Modbus master reads a REAL value which has been scaled to an integer.

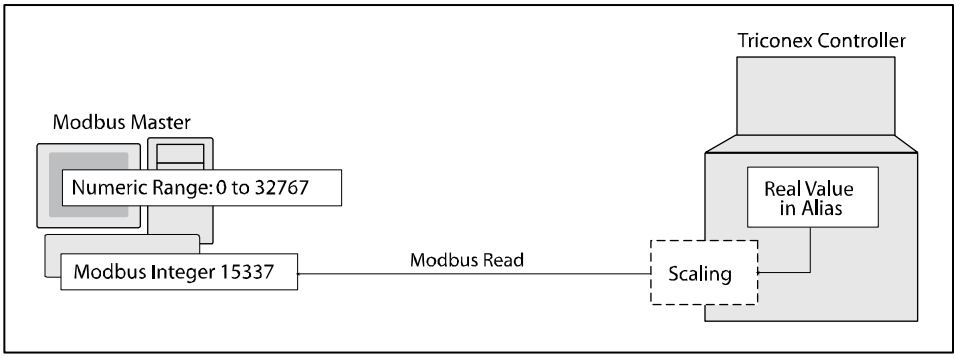


Figure 22 How the Modbus Master Reads a REAL Value Scaled to an Integer Value

Scaling a REAL value to an integer value uses this formula:

$$\text{Modbus Value} = \frac{(\text{Modbus Max} - \text{Modbus Min})}{(\text{Maxspan} - \text{MinSpan})} \times (\text{Real Value} - \text{MinSpan}) + \text{ModbusMin}$$

This figure shows how scaling is done. Values above the Max Span or below the Min Span are clamped to the respective limit. The same principle applies to values outside the Modbus range.

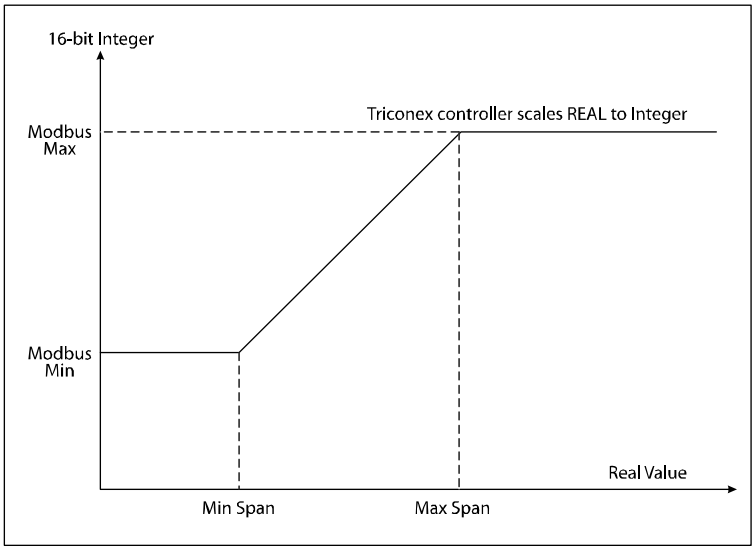


Figure 23 Scaling a REAL Value to an Integer Value

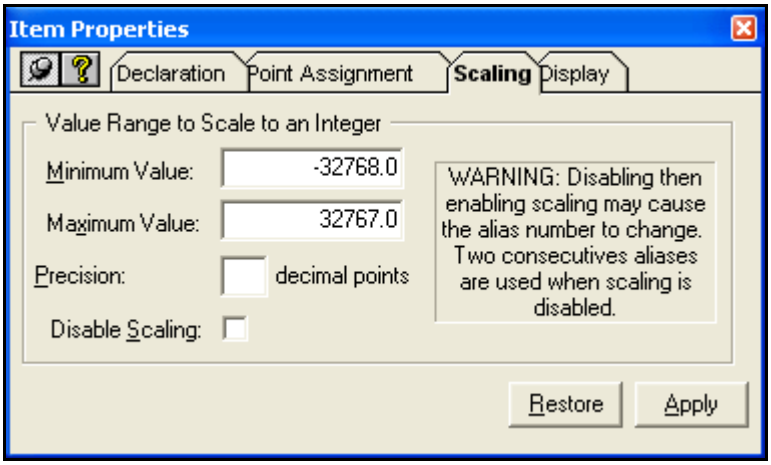
To avoid division by zero, do not set Max Span equal to Min Span—the resulting Modbus value is undefined. Typically, for a Triconex controller, the result is -1.

Scaling REAL Values to Integers

This procedure explains how to scale a REAL value to an integer. Scaling may be needed to transmit numbers through Modbus protocol, which uses 16-bit integer numbers. Numbers are scaled by using minimum (Min Span) and maximum (Max Span) values for the point and minimum and maximum values for the Modbus Range.

Procedure

1. Open a tagname by doing either of these:
   - On the Tagname Declarations tree, double-click a tagname.
   - Double-click a tagname on a logic sheet, and then click the Declaration button.
2. Click the Scaling tab.



3. Specify these properties on the Scaling tab.

Property	Action
Minimum Value (Min Span)	Enter the minimum value to be used to scale the REAL number to an integer; must be less than the maximum value. The default is -32768.0.
Maximum Value (Max Span)	Enter the maximum value to be used to scale the REAL number to an integer; must be more than the minimum value. The default is 32767.0.
Precision	Enter the number of decimal points to be used. The default is blank.
Disable Scaling	To allow scaling of REAL numbers to integers, do not select this check box. Scaling cannot be disabled on the Tricon. The default is cleared.

4. Click Apply to save your changes.
5. On the Setup dialog box for the communication module, specify the Modbus minimum and maximum range. See the following sections for detailed instructions:
   - Configuring Tricon EICM Ports on page 201
   - Configuring TCM Serial Ports on page 208
   - Configuring Trident MP Serial Ports on page 219
   - Configuring Trident CM Serial Ports on page 221

How Trident REAL Values are Transmitted Without Scaling

This section explains how 32-bit REAL unscaled numbers are transmitted in Modbus protocol, which uses 16-bit integers. This applies only to Trident controllers.

If a REAL value is not scaled, these operations occur:

- A Modbus master reads the least significant 16 bits of a 32-bit number which is derived from the integer and decimal parts of a 32-bit REAL value.
- A Modbus master writes a REAL value as two consecutive 16-bit integer aliases which the Trident concatenates to form a 32-bit REAL value.
- A Modbus slave sends the least significant 16 bits of a 32-bit number.

This figure shows the standard format for REAL values, which adheres to the *IEE Standard for Binary Floating-Point Arithmetic*. For more information, see IEE Std 754-1985.

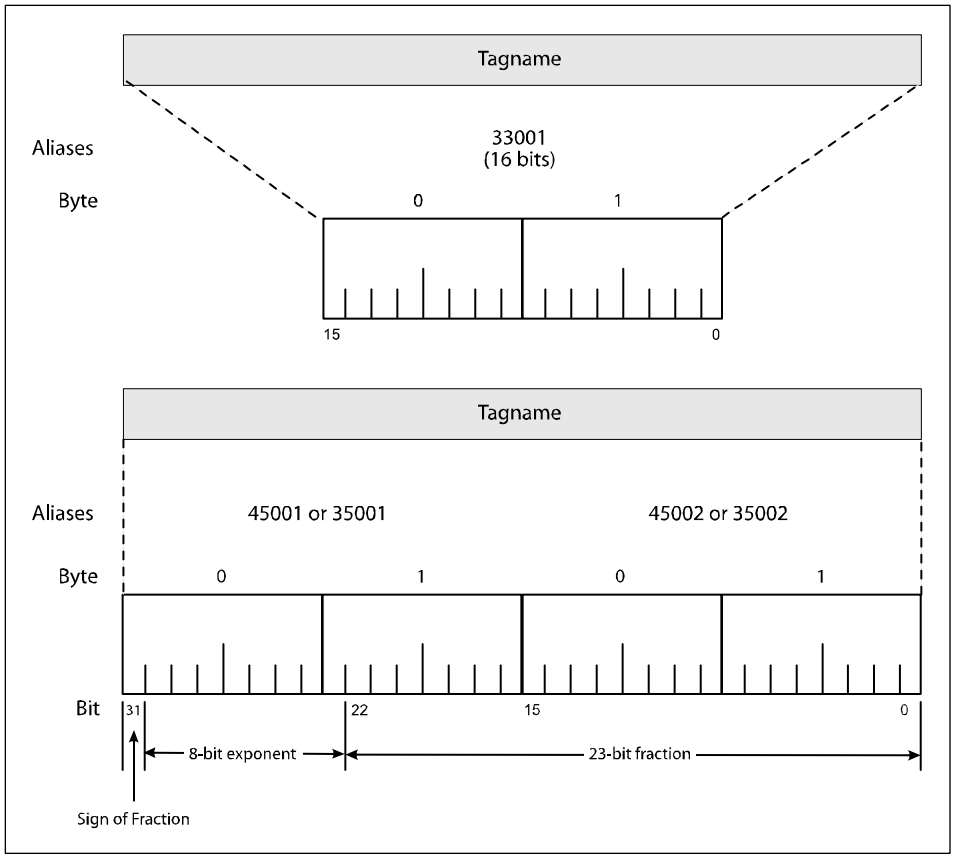


Figure 24 Standard Format for REAL Values

Disabling Scaling of REAL Values for Trident Tagnames

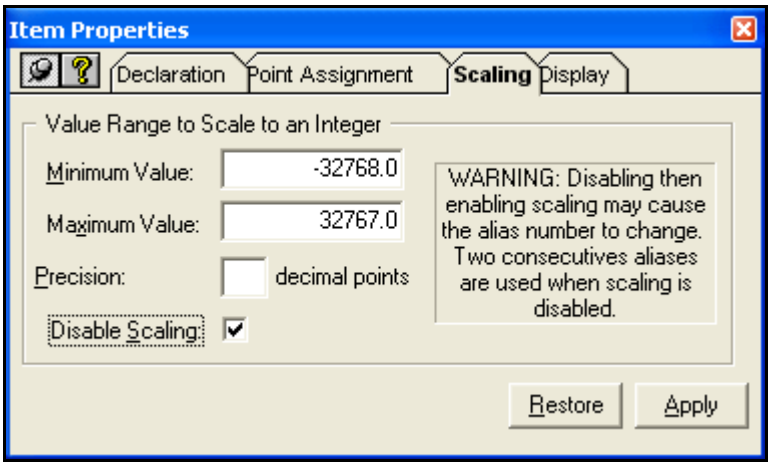
This procedure explains how to disable scaling on a specific REAL tagname. Scaling cannot be disabled for Tricon. The default setting is to use scaling.

Procedure

1. Expand the Application tree, and double-click a tagname which is a REAL data type and is not to be scaled.

   The Item Properties dialog box appears.

2. Click the Scaling tab.



3. On the Scaling tab, select the Disable Scaling check box to ensure the point is not scaled. The default is cleared.
4. Click OK to apply and save.

Peer-to-Peer Applications

This section explains how to use Peer-to-Peer communication to allow Triconex controllers to send and receive information from each other. Peer-to-Peer communication is performed through Send and Receive function blocks included in the application.

For information on the Send and Receive function blocks used for Peer-to-Peer communication, see the *TriStation 1131 Libraries Reference*.

If you have a TCM installed, also see Configuring TCM Peer-To-Peer Ports on page 210.

Topics include:

Peer-to-Peer Data Transfer Time

In a Peer-to-Peer application, data transfer time includes the time required to initiate a send operation, send the message over the network, and have the message read by the receiving node. Additional time (at least two scans) is required for a sending node to get an acknowledgment from the MPs that the message has been acted on.

These time periods are a function of the following parameters of the sending and receiving controllers:

- Scan time
- Configuration size
- Number of bytes for aliased variables
- Number of Send function blocks, Receive function blocks, printing function blocks, and Modbus master function blocks
- Number of controllers on the Peer-to-Peer network

Send function blocks require multiple scans to transfer data from the sending controller to the receiving controller. The number of send operations initiated in a scan is limited to five. The number of pending send operations is limited to 10.

A typical data transfer time (based on a typical scan time) is 1 to 2 seconds, and the time-out limit for a Peer-to-Peer send (including three retries) is 5 seconds. Consequently, the *process-tolerance time* of the receiving controller must be greater than 5 seconds. Process-tolerance time is the maximum length of time that can elapse before your control algorithms fail to operate correctly. If these limitations are not acceptable, further analysis of your process is required.

Estimating Memory for Peer-to-Peer Data Transfer Time

This procedure explains how to estimate memory for Peer-to-Peer data transfer time between a pair of Triconex controllers. The more memory allocated for aliased points, the slower the transfer time.

Procedure

1. On the sending controller, expand the Controller tree, and double-click Configuration. On the Configuration tree, click Memory Allocation.
2. Find the bytes allocated for BOOL, DINT, and REAL points:
   - On the Configuration tree, click Memory Points, Input Points, or Output Points. Double-click the graphic for the point type.
   - Add the number of bytes allocated for all BOOL input, output, and aliased memory points. Enter the number in step 1 of the following worksheet. Do the same for DINT and REAL points and enter the results in step 1.
3. On the receiving controller, get the BOOL, DINT, and REAL points and enter the numbers in step 3. Follow the instructions on the following worksheet to estimate the transfer time.

Steps	Point Type	Allocated Bytes	Operation	Result
1. Enter the number of bytes for each point type on the *sending* controller and divide or multiply as indicated. Add the results.	BOOL	_____	÷ 8 =	_____
	DINT	_____	x 4 =	_____
	REAL	_____	x 4 =	_____
	Total bytes of aliased points TBS =			_____
2. Multiply the total bytes sending (TBS) from step 1 by 0.01			TS =	_____
3. Enter the number of bytes for each point type on the *receiving* controller and divide or multiply as indicated. Add the results.	BOOL	_____	÷ 8 =	_____
	DINT	_____	x 4 =	_____
	REAL	_____	x 4 =	_____
	Total bytes of aliased points TBR =			_____
4. Multiply the total bytes receiving (TBR) from step 3 by 0.01			TR =	_____
5. Get the scan time of the sending node in milliseconds by viewing the Scan Time in the Execution List.			SS =	_____
6. Get the scan time of the receiving node in milliseconds by viewing the Scan Period in the Execution List.			SR =	_____
7. Multiply the larger of TS or SS by 2.				_____
8. Multiply the larger of TR or SR by 2.				_____
9. Add the results of step 7 and 8 to get the data transfer time			DT=	_____
10. If the number of pending send requests in the application is greater than 10, divide the number of send requests by 10.				_____

Steps	Point Type	Allocated Bytes	Operation	Result
11. Multiply the results of steps 9 and 10 to get the adjusted data transfer time.			Adjusted DT	_____
12. Compare the adjusted DT to the process-tolerance time to determine if it is acceptable.				

Allocating Peer-to-Peer Memory

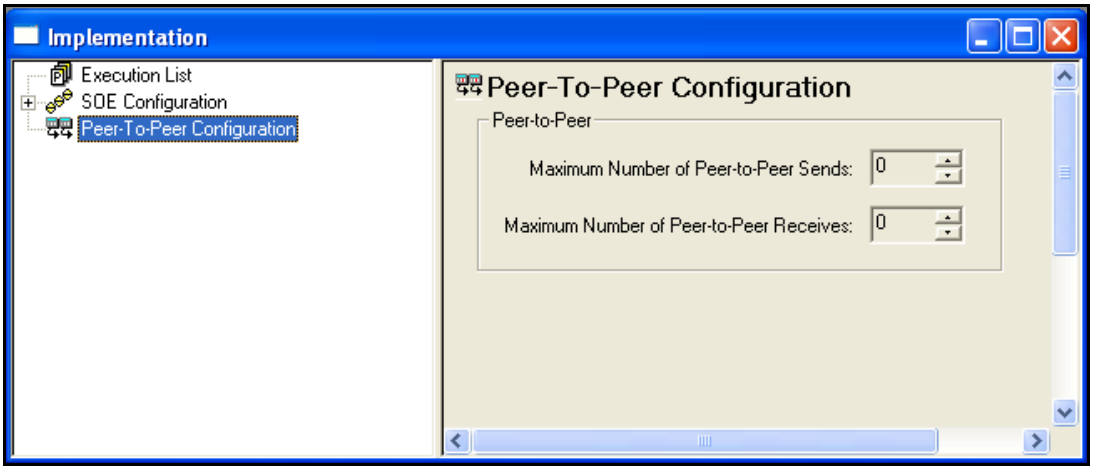
This procedure explains how to allocate memory for Peer-to-Peer functions, which is based on the maximum number of Send and Receive numbers you specify. To save memory and minimize scan time, you should use the lowest possible numbers.

The maximum number does not have to be the same for Sends and Receives. For example, a TriStation application might need to send messages to three applications, but need to receive messages from only one application.

A change in Peer-to-Peer allocation requires a Download All (see Using the Download All Command on page 316).

Procedure

1 Expand the Application tree, double-click Implementation, and then click Peer-to-Peer Configuration.



2 Set these properties by clicking the up and down arrows.

- Maximum Number of Peer-to-Peer Sends
- Maximum Number of Peer-to-Peer Receives

3 If you want to change the settings for an application running on the controller, you must build the application and perform a Download All.

SOE Development

This section explains how to enable sequence of events collection in a project. Events can be retrieved from a Triconex controller by using the SOE Recorder software. For more information, see the *SOE Recorder User's Guide*.

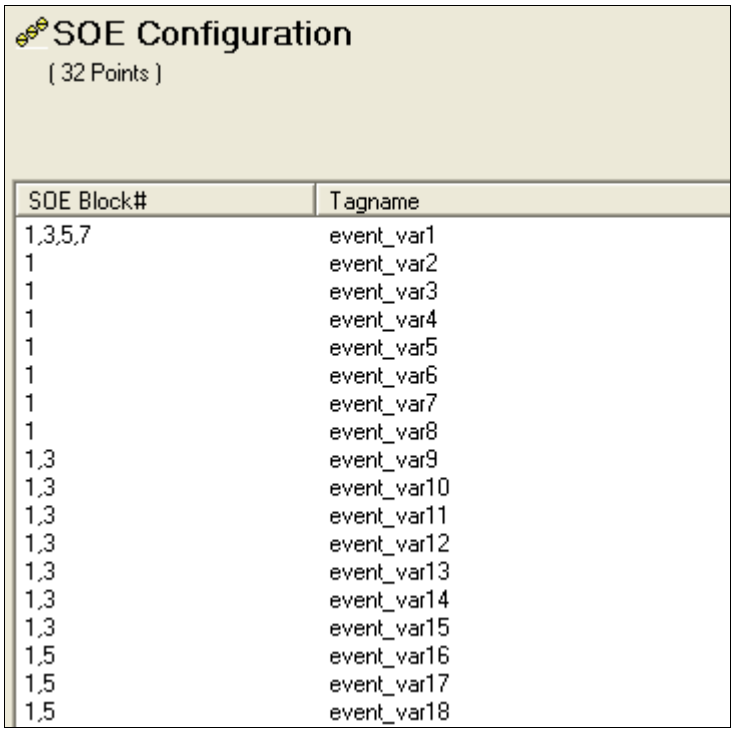
Topics include:

Displaying the SOE Configuration

This procedure explains how to view the SOE Configuration screen, which displays the SOE blocks that have been configured.

Procedure

1 Expand the Application tree, double-click Implementation, and click SOE Configuration.



2 To change the SOE block properties, see Defining SOE Block Properties on page 160.

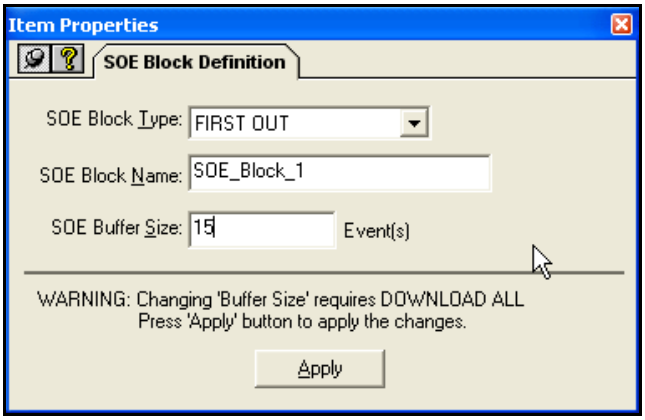
Defining SOE Block Properties

This procedure explains how to define the properties of an SOE block, which is required if you are using sequence of events in an application.

Defining SOE block properties is related to the general task of controller configuration and can be completed at the same time. You can define SOE blocks to provide continuous event information to external devices on a network, or you can define them for limited operation when your controller is not on a network.

Procedure

1. Click the Application tree, and double-click Implementation.
2. Expand the SOE Configuration tree, and double-click a block number.



3. Specify these settings on the SOE Block Definition tab.

Property	Action
SOE Block Type	Select the Block Type. The default is unassigned.
SOE Block Name	Enter a title for the block.
SOE Buffer Size	Enter a buffer size. The default is 0.

4. Click Apply to save your changes.
5. Repeat steps 2 and 3 for all the blocks to be configured.

Assigning Event Variables to SOE Blocks

This procedure explains how to assign event variables to an SOE block, which is required if you are using sequence of events in an application.

Event variables must be of type BOOL and their states can be displayed with names and colors that you define. You can designate one variable in a TriStation project as the trip variable that notifies the operator when a trip occurs.

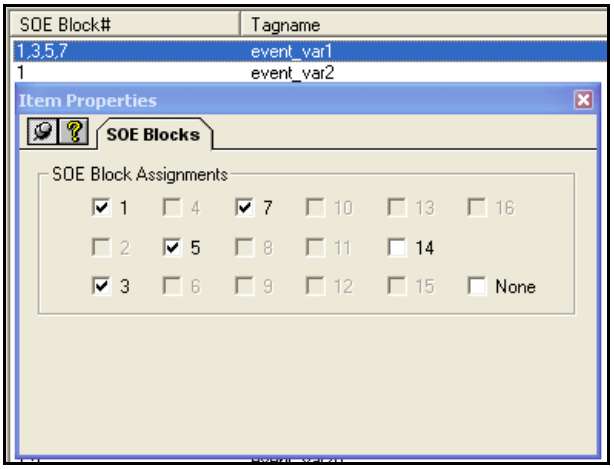
Note For Tricon, if you define a block for use with the Advanced Communication Module (ACM), the Foxboro I/A Series system assigns the event variables. The only additional configuration you can do is to specify a type of External and a buffer size. For more information, see the *Tricon Communication Guide*.

Before You Begin

Before you can assign event variables, you must define SOE block properties (see Defining SOE Block Properties on page 160).

Procedure

1. Open the Application tree, and double-click Implementation.
2. Click the SOE Configuration branch. The tagnames and block assignments, if any, are listed in a pane to the right of the tree.
3. To assign a tagname to one or more SOE Blocks, double-click the row for the tagname. The Item Properties dialog box appears.



4. To assign the tagname to specific blocks, select the block number check box. If the number is disabled, it means the block has not been defined.

   Note If you add tagnames after opening the SOE Configuration screen, you must close and re-open the SOE Configuration screen to have the new tagnames displayed.

5. Continue to assign tagnames to blocks as needed.
6. After assigning all the event variables, save the project so the tagnames are available when specifying a trip variable.

Specifying a Trip Variable

This procedure explains how to designate a trip variable, which is optional if you are using sequence of events in an application.

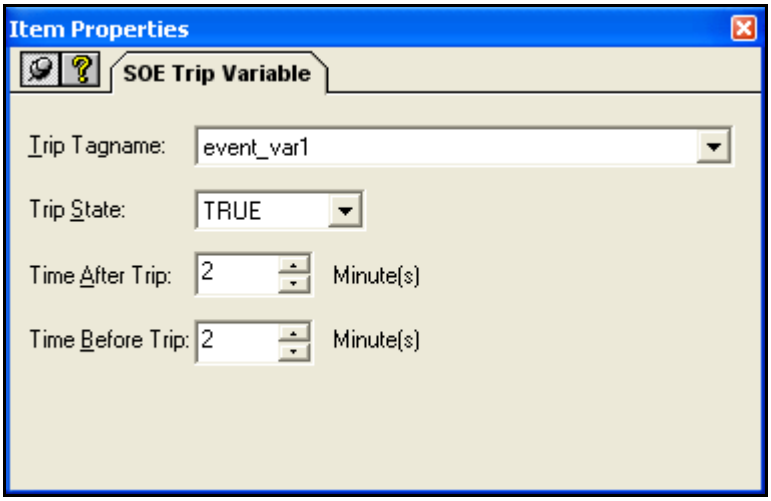
In an application used for safety shutdown, a trip variable is an aliased tagname whose state transition causes SOE Recorder to automatically create a trip snapshot. An application can have only one trip variable, but it can apply to all blocks. If an application requires several variables related to trip conditions, these variables must be evaluated in combination to determine the final state of the trip variable.

Before You Begin

You must define at least one SOE block and assign an event variable to the block (see Defining SOE Block Properties on page 160 and Assigning Event Variables to SOE Blocks on page 161).

Procedure

1. Open the Application tree, and double-click Implementation.
2. Double-click SOE Configuration. The Item Properties dialog box appears.



3. Specify these settings on the SOE Trip Variable tab.

Property	Action
Trip Tagname	Select the Trip Tagname from the list of event variable names, and then select a Trip State of True or False.
Trip State	Select True or False.
Time After Trip	Set the Time After Trip in minutes. The minimum time is two minutes; the maximum time is ten minutes.
Time Before Trip	Set the Time Before Trip in minutes.The minimum time is two minutes; the maximum time is ten minutes.

Tricon Application Access

This section explains how to restrict connection access to a Tricon controller and how to restrict or allow write access to output and memory points in the downloaded application. Topics include:

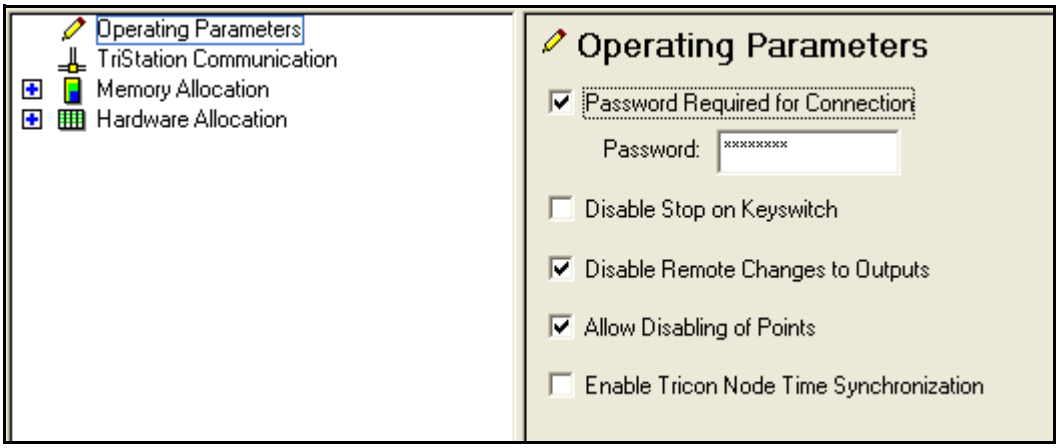
Restricting Access to a Tricon Controller

This procedure explains how to restrict access to a Tricon controller from a TriStation PC. If access is restricted, only users with access privileges can disable points or download changes to the controller.

Note If you have a a model 4351A or 4352A TCM installed, you can also use the optional TCM client access list to restrict access to the Tricon on a per-client basis. See Controlling Access to the TCM on page 267.

Procedure

1. Expand the Controller tree, and double-click Configuration.
2. On the Configuration tree, click Operating Parameters.



3. Specify these properties on the Operating Parameters screen.

Property	Action
Password Required for Connection	Select the check box to restrict access by requiring a password when connecting to the controller. The default is cleared.
Password	Enter the password required to access the controller. The default is PASSWORD.

Property	Action
Disable Stop on Keyswitch	Select the check box to prevent the keyswitch from halting the application if it is turned to Stop. The default is cleared.
Disable Remote Changes to Outputs	Clear the check box to allow remote devices to write to output points. The default is selected.
Allow Disabling of Points	Select the check box to allow the TriStation PC to disable points while the application is running on the controller. The default is cleared.

The settings you selected are used when the application is built.

What Affects Tricon Write Access from External Devices

This section describes the system properties, communication properties, and function blocks that affect read and write access to memory and output points on a Tricon controller.

These types of read and write access are possible:

- Input, output, and memory points can be read by any external device that can communicate with a Tricon controller.
- Write access to input points is not allowed from any external device.
- Write access to a output or memory point is allowed or restricted based on the system, communication, application, and point settings.

This table describes write access to Tricon points from external devices.

Table 27 Tricon Write Access

Property or Feature	Description
Tricon keyswitch	A system setting that determines write access to output and memory points unless overruled by the GATENB function block in the application. • Restricts write access when set to the Run position. • Allows write access when set to the Remote or Program position.
GATENB	A Tricon function block that programmatically allows write access to a specified range of aliased memory points when the keyswitch is in the Run position.
GATDIS	A Tricon function block that programmatically restricts remote write access for all ranges of aliased memory points that were previously enabled by GATENB.
Disable Remote Changes to Outputs	A system setting on the Operating Parameters screen that determines write access to output points. When selected, external devices cannot write to output points, no matter what other settings are made.

Table 27 Tricon Write Access *(continued)*

Property or Feature	Description
Privilege	A Tricon ACM and NCM module setting that determines whether network devices using DDE, OPC, or TSAA communication have write access to output points and read/write aliased memory points. • For Tricon ACM, the default it Read. • For Tricon NCM, the default is Read/Write. • The Tricon EICM, TCM, HIM, and SMM modules do not have this property.
Port Write Enabled	A Tricon TCM setting that determines whether TriStation, TSAA, or Modbus have write access to the selected port. The default value is cleared, meaning the port is read-only. The Tricon EICM, ACM, NCM, HIM, and SMM modules do not have this property.
TCM Client Access List	An optional Tricon TCM feature that gives you the ability to control which clients can access TCM resources, the protocols they can use, and the level of access each client has. See Controlling Access to the TCM on page 267.
Prohibit Writes	A Tricon SMM module setting that determines whether Honeywell devices have write access to output points and read/write aliased memory points. The default is cleared, which means write access is allowed.
Point Assignment	A tagname setting that determines whether the output and memory point is assigned a Read or Read/Write alias number. • For output points, all alias numbers are Read/Write. • For memory points, alias numbers can be Read or Read/Write.

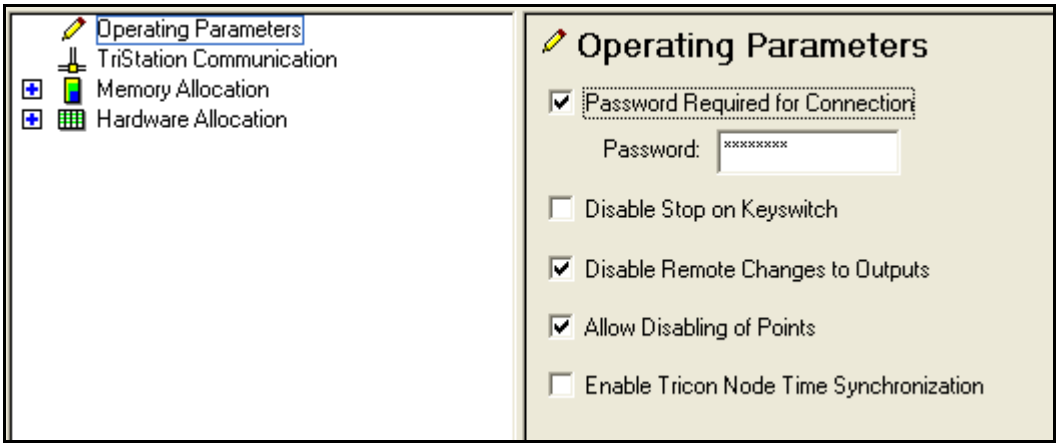
Restricting Write Access to Tricon Points

This procedure explains how to restrict external devices from writing to output or memory points. Input, output, and memory points can be read by any external device that can communicate with the Tricon controller. Input points cannot be written to.

When the Tricon keyswitch is turned to Run, external devices cannot write to points unless the GATEB function block is used programmatically to allow write access to a range of aliased memory points.

Procedure

1. Expand the Controller tree, and double-click Configuration.
2. On the Configuration tree, click Operating Parameters.



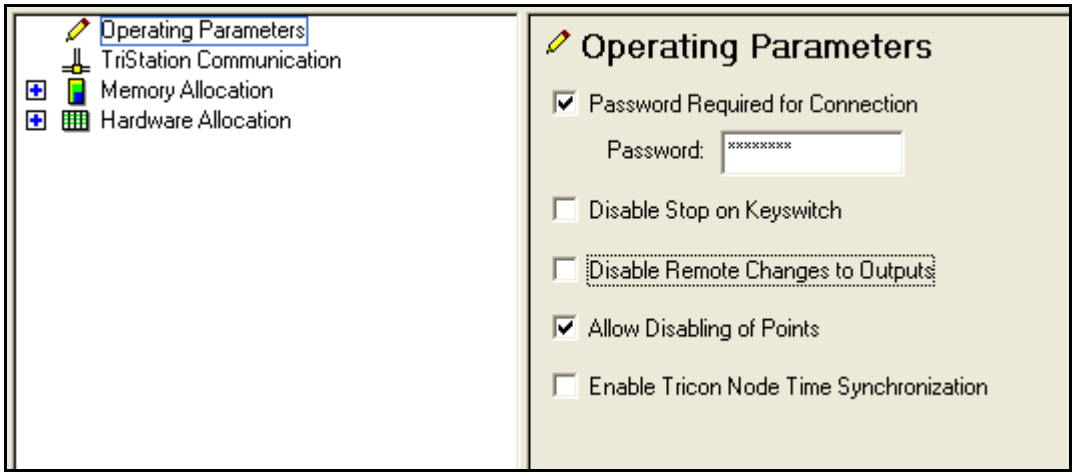
3. Ensure the Disable Remote Changes to Outputs check box is selected. The default is selected.

Allowing Write Access to Tricon Points

This procedure explains how to allow external devices to write to memory and output points. Input points can be read, but cannot be written to. External devices must use supported communication protocols (Modbus, TSAA, OPC, and DDE) to communicate with the controller.

Procedure

1. Expand the Controller tree, and double-click Configuration.
2. On the Configuration tree, click Operating Parameters.



3. Clear the Disable Remote Changes to Outputs check box. The default is selected.
4. Do one of the following:
   - If the external devices are communicating through an ACM or NCM, ensure the Privilege property for the module is set to Read/Write. See Privilege on page 402. The default for Tricon ACM is Read; for Tricon NCM the default is Read/Write.
   - If the external devices are communicating through a TCM, ensure the Port Write Enabled property for the selected port and protocol is selected, or that the TCM client access list is configured to allow read/write access for the selected client using the appropriate protocol. See Port Write Enabled on page 400 or Controlling Access to the TCM on page 267.
5. Ensure the output or memory point is assigned a Read/Write alias number. See Assigning an Alias Number, Alias Type, and Physical Address on page 117.

Trident Application Access

This section explains how to restrict connection access to a Trident controller and how to restrict or allow write access to output and memory points in the downloaded application. Topics include:

Restricting Access to a Trident Controller

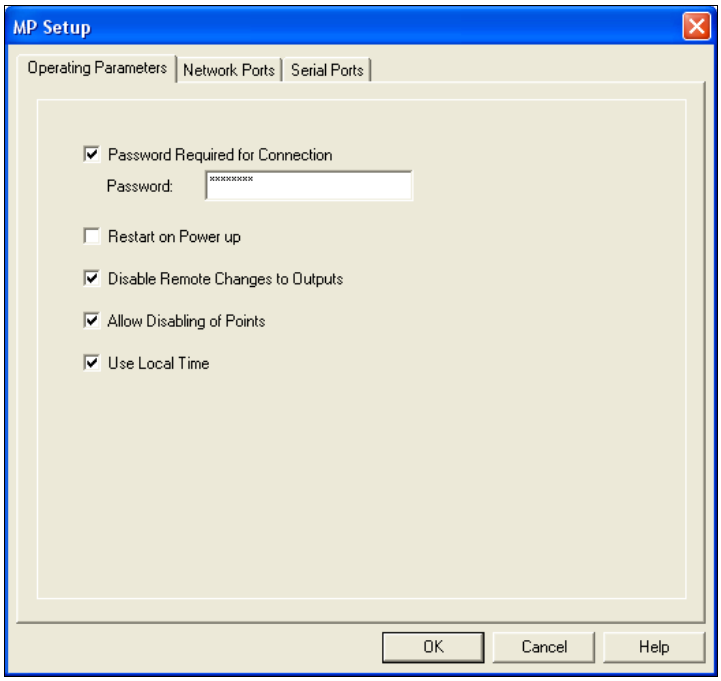
This procedure explains how to restrict access to a Trident controller from a TriStation PC. If access is restricted, only users with access privileges can disable points or download changes to the controller.

Procedure

1. Expand the Controller tree, and double-click Configuration.
2. On the Configuration tree, open the Hardware Allocation node, and then double-click the MP.

   The Item Properties dialog box appears.
3. Click Setup.

   The MP Setup dialog box appears.



4 Specify these properties on the Operating Parameters tab.

Property	Action
Password Required for Connection	Select the check box to restrict access by requiring a password when connecting to the controller. The default is cleared.
Password	Enter the password required to access the controller. The default is PASSWORD.
Restart on Power Up	Select the check box to have the application restarted after a power failure. The default is cleared.
Disable Remote Changes to Outputs	Clear the check box to allow remote devices to write to output points. The default is selected.
Allow Disabling of Points	Select the check box to allow the TriStation PC to disable points while the application is running on the controller. The default is cleared.
Use Local Time	Clear the check box if you do not want to use local time. The default is checked.

The settings you selected are used when the application is built.

What Affects Trident Write Access from External Devices

This section describes the system properties, communication properties, and function blocks that affect read and write access to memory and output points on a Trident controller.

These types of read and write access are possible:

- Input, output, and memory points can be read by any external device that can communicate with a Trident controller.
- Write access to input points is not allowed from any external device.
- Write access to a output or memory point is allowed or restricted based on the system, communication, application, and point settings.

This table describes write access to Trident points from external devices.

Table 28 Trident Write Access

Property or Feature	Description
Disable Remote Changes to Outputs	A system setting on the MP Operating Parameters tab that determines write access to output points. When selected, external devices cannot write to output points, no matter what other settings are made.
SYS_SET_REMOTE_WRT_ENBL	A Trident function block that programmatically allows or restricts write access to output or memory read/write aliased points when used in an application. To allow write access, the Disable Remote Changes to Outputs property cannot be selected.

Table 28 Trident Write Access *(continued)*

Property or Feature	Description
Privilege	A Trident CM module setting that determines whether network devices using DDE, OPC, or TSAA communication have write access to output points and read/write aliased memory points. • For Trident CM, the default is Read/Write. • This setting does not affect Modbus access.
Point Type	A tagname setting that determines whether the output and memory point is assigned a Read or Read/Write alias number. • For output points, all alias numbers are Read/Write. • For memory points, alias numbers can be Read or Read/Write.

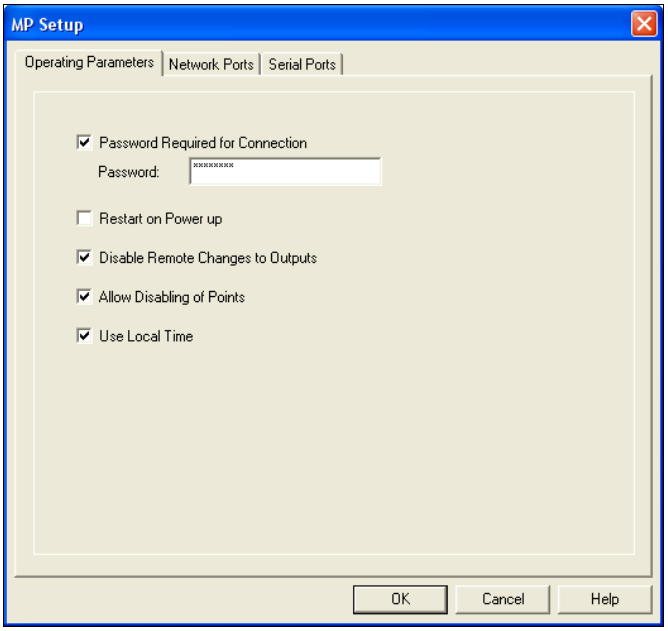
Restricting Write Access to Trident Points

This procedure explains how to restrict external devices from writing to memory and output points. Input, output, and memory points can be read by any external device that can communicate with the Triconex controller. Input points cannot be written to.

The SYS_SET_REMOTE_WRT_ENBL function block can be used programmatically to override the Disable Remote Changes to Outputs setting and allow write access to a range of aliased output or memory points.

Procedure

1. On the Configuration tree, open the Hardware Allocation node, and then double-click the MP. The Item Properties dialog box appears.
2. Click Setup. The MP Setup dialog box appears.
3. On the Operating Parameters tab, ensure the Disable Remote Changes to Outputs check box is selected.

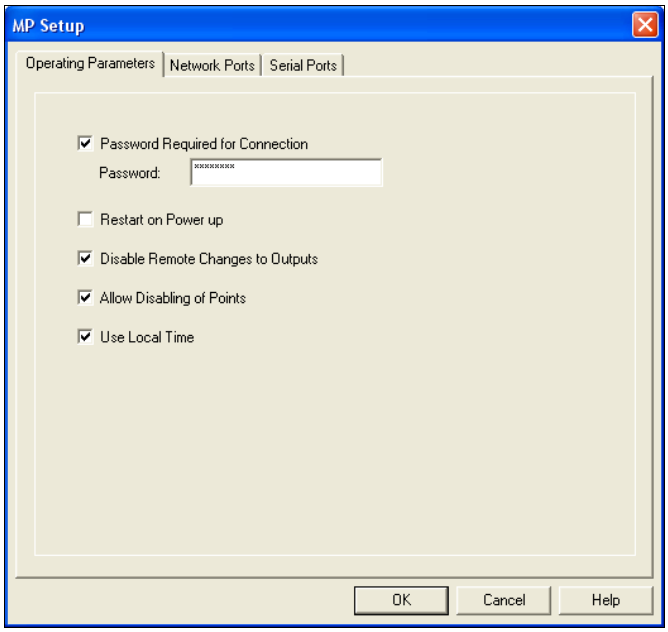


Allowing Write Access to Trident Points

This procedure explains how to allow external devices to write to memory and output points. Input points can be read, but cannot be written to. External devices must use supported communication protocols (Modbus, TSAA, OPC, and DDE) to communicate with the controller.

Procedure

1. On the Configuration tree, open the Hardware Allocation node, and then double-click the MP. The Item Properties dialog box appears.
2. Click Setup. The MP Setup dialog box appears.



3. If the external devices are communicating through an Open Network port on the Communication Module, ensure the Privilege property on the Network tab is set to Read/Write.

   See Configuring Trident CM Network Ports on page 220. The default is Read/Write.
4. Ensure the output or memory point is assigned a Read/Write alias number. See Assigning an Alias Number, Alias Type, and Physical Address on page 117.

Building an Application

This section includes information on how to build an application, which must be done before testing. If you try to download an application before building it, TriStation 1131 tries to build it and then download it. If the build has errors, the download does not continue.

Topics include:

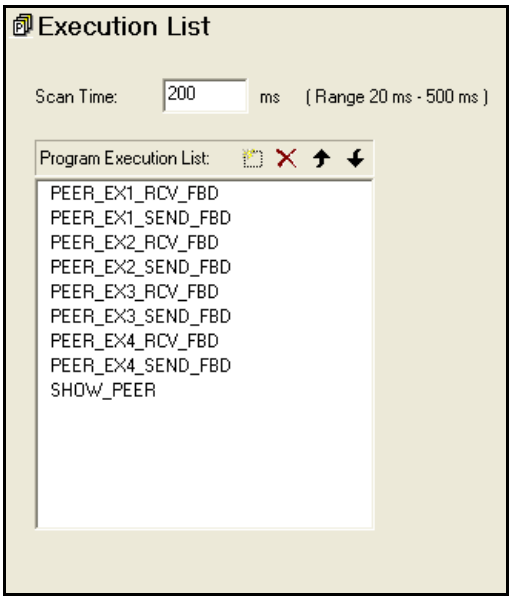
Specifying the Program Order and Scan Time

This procedure explains how to specify the programs and order of execution in the application. You can also set the scan time of the application, which determines the number of milliseconds that is taken to execute the application once.

The maximum number of programs in an application is 250.

Procedure

1. On the Application Tree, double-click Implementation.
2. On the Implementation tree, double-click Execution List.



3. Specify these properties on the Execution List screen.

Property or Button	Action
Scan Time	Enter the number of milliseconds anticipated for the scan. The actual scan time is determined after the application is downloaded and run on the controller. For more information, see the Enhanced Diagnostic Monitor application. The default is 200 milliseconds.
 New (insert) button	Click to add a program to the list.
 Delete button	Click to delete the selected program from the list.
 Move Up button	Select a program and then click to move a program up in the execution order.
 Move Down button	Select a program and then click to move a program down in the execution order.
 Browse button	To add or change a program, double-click a program, then enter the name, or click the Browse button to select a name from the available programs.

Compiling a Program

This procedure explains how to manually compile a program, which can be done before building an application. Programs are automatically compiled when you build an application.

Procedure

1. On the Project menu, click Compile All User Documents.

   The Message View automatically opens and displays the status of the compile process.
2. If there are errors, fix them before building the application.

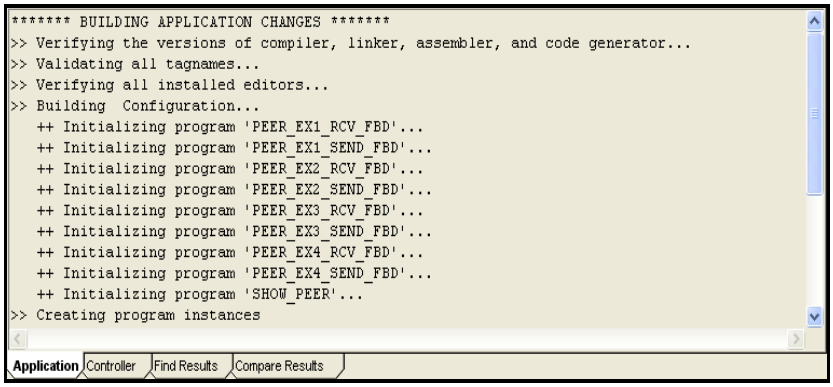
Building or Rebuilding an Application

This procedure explains how to use the Build Application command or Rebuild Application command to build an application. If the programs in the application have not been compiled, the Build Application command compiles them and then attempts to build the application.

Errors and warnings are displayed in the Message View. Errors must be resolved before an application can be downloaded, but warnings do not affect online execution. Typically, warnings refer to unused points in an application.

Procedure

1. On the Project menu, click Build Application or Rebuild Application.
2. Check the Message View for errors. If there are no errors, the build is successful.
3. If there are errors, click each error message to locate the location of the error.



4. Correct the errors, compile the affected user documents, and then build or rebuild the application.

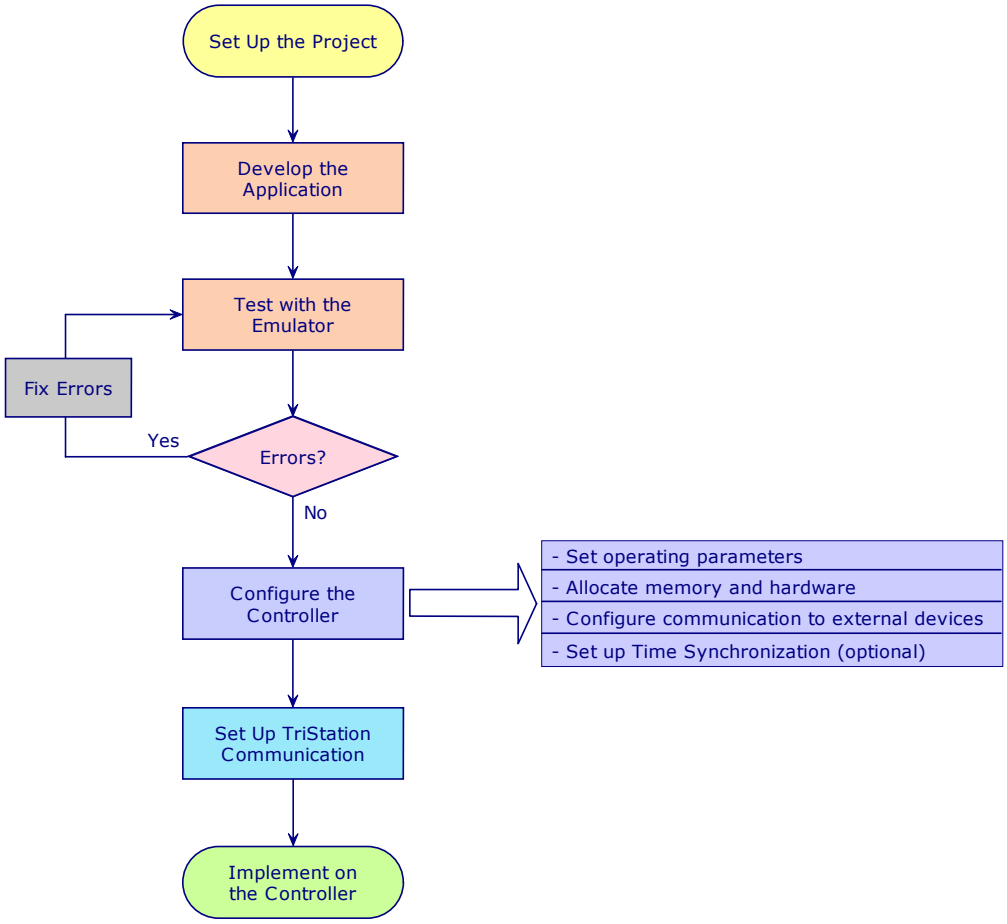
Note When you build a CEM program, intermediate FBD and ST code is generated. This code is useful for understanding and debugging the CEM program. To view the intermediate code, from the Document menu, select View Intermediate FBD or View Intermediate ST.

3

Controller Configuration

Overview

This figure shows the main steps for configuring the controller and their typical order in the project cycle. The controller must be configured before an application can be downloaded and implemented on a controller.



Controller Configuration Steps

This list includes the steps that can or should be done during controller configuration. Controller configuration must be completed before an application is downloaded to the controller.

	Description	See
❒	Set the operating parameters.	Operating Parameters on page 180
❒	Allocate memory and hardware.	Memory Allocation on page 183 Tricon Hardware Allocation on page 184 Trident Hardware Allocation on page 192
❒	Configure communication to external devices.	Tricon Communication Configuration on page 197 Trident Communication Configuration on page 216
❒	Set up time synchronization.	Tricon Time Synchronization on page 224 Trident Time Synchronization on page 235

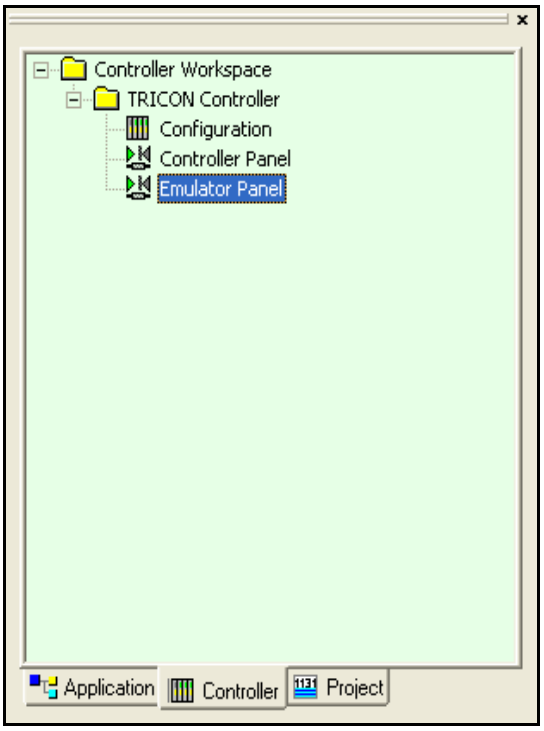
The Controller Workspace

This section explains the Controller Workspace, which is where you specify the configuration for the project.

Topics include:

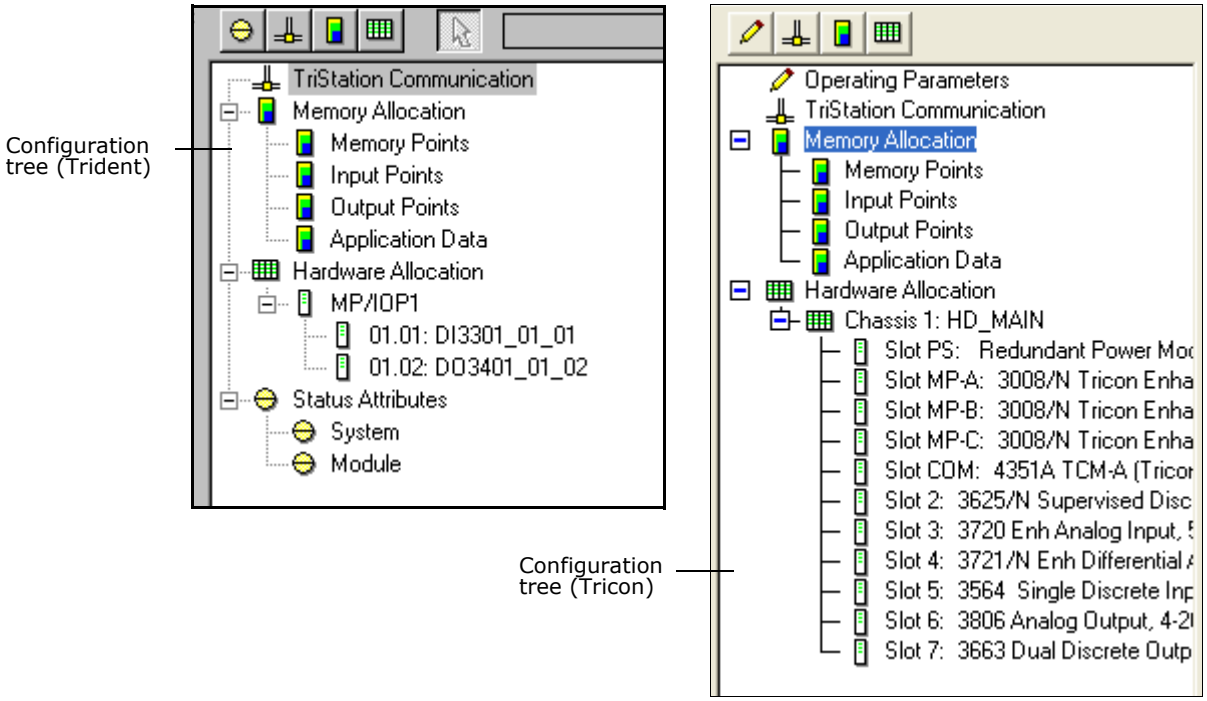
The Controller Tree

The Controller tree includes the elements (operating parameters, communication settings, memory allocation, and hardware allocation) that can be configured. The tree also includes the Controller and Emulator Panels used to emulate and run an application.



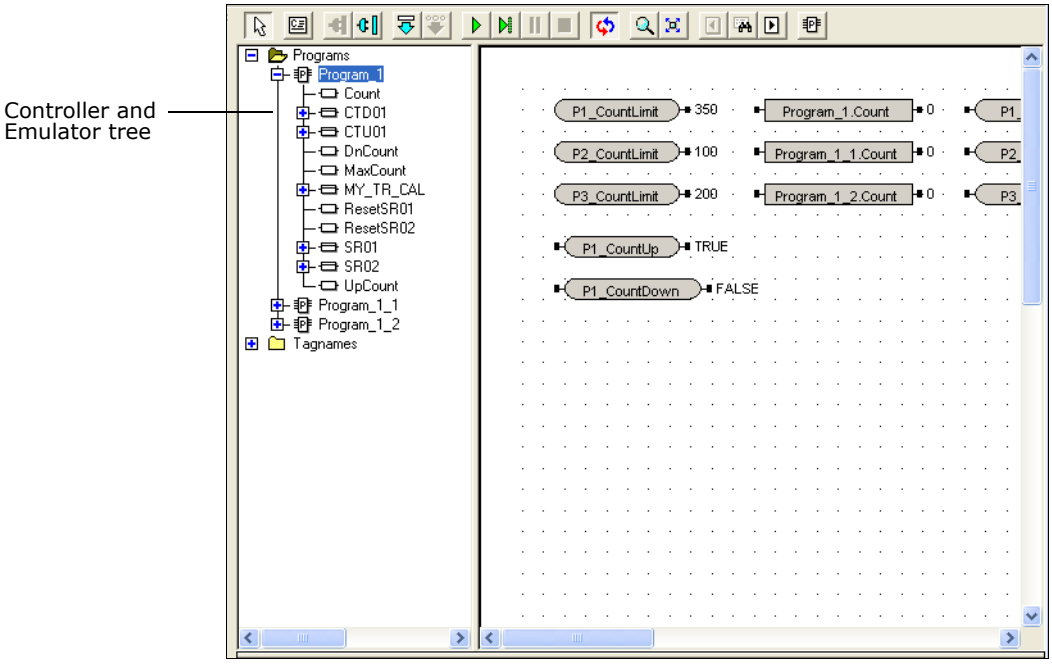
The Configuration Tree

The Configuration tree includes operating parameters (Tricon only), communication, memory allocation, hardware allocation, and Control and Status Attributes (Trident only).



The Controller and Emulator Panels

The Controller and Emulator Panels display programs running in emulation or in the controller.



Operating Parameters

This section explains how to specify operating parameters, which are settings that affect the general operation of the controller.

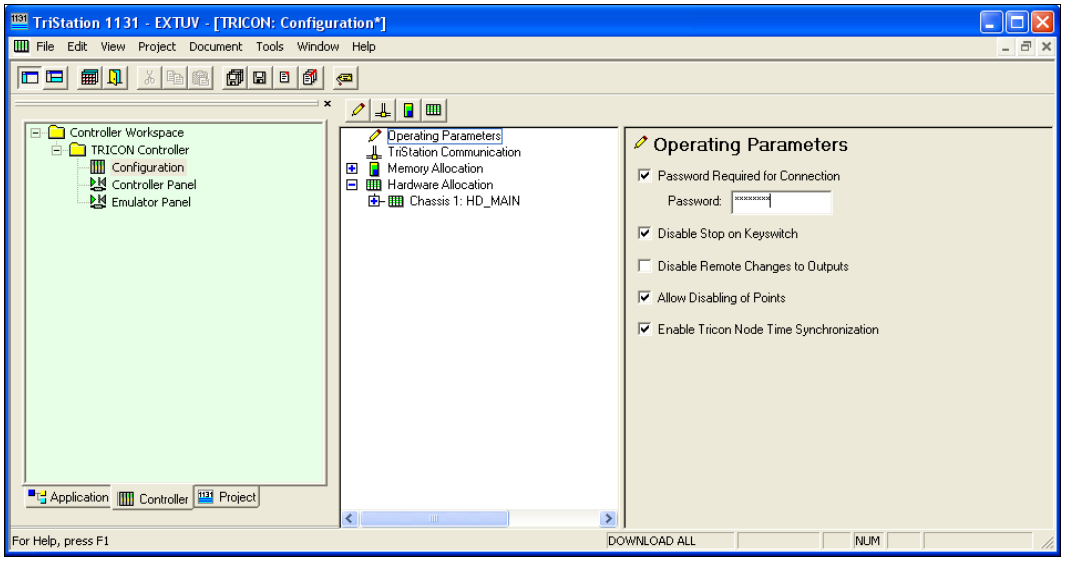
Topics include:

Setting Tricon Operating Parameters

This procedure explains how to specify Tricon operating parameters, which include settings to restrict access to the controller from a TriStation PC and from remote devices.

Procedure

1 Expand the Controller tree, double-click Configuration, and then click Operating Parameters.



2 Specify these properties on the Operating Parameters screen.

Property	Action
Password Required for Connection	Select the check box to require a password to be used to connect from the TriStation PC to the controller. If selected, enter a password. The default is cleared.
Password	If a password is required, enter the password. Not case-sensitive.
Disable Stop on Keyswitch	Select the check box to prevent the STOP keyswitch from halting the application running on the controller. The default is cleared.

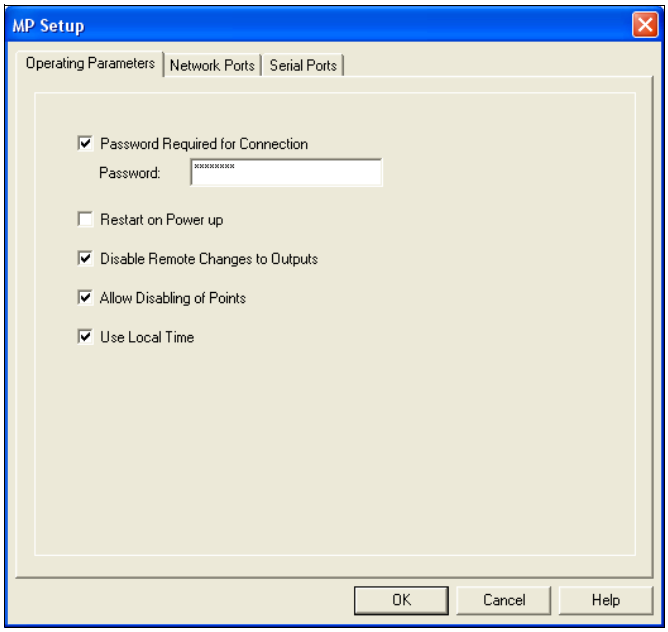
Property	Action
Disable Remote Changes to Outputs	Select the check box to prevent external devices, such as a DCS, from writing to output tagnames in the TriStation 1131 application. The default is selected.
Allow Disabling of Points	Select the check box to allow points to be disabled from TriStation 1131. The default is selected.
Enable Tricon Node Time Synchronization	Select the check box to allow the controller to participate in time synchronization across the Peer-to-Peer network as a master node or a slave node (see Configuring Triconex Time Synchronization on the TCM on page 233).

Setting Trident Operating Parameters

This procedure explains how to specify Trident operating parameters, which include settings to restrict access to the controller from a TriStation PC and from remote devices.

Procedure

1. On the Configuration tree, open the Hardware Allocation node, and then double-click the MP. The Item Properties dialog box appears.
2. Click Setup. The MP Setup dialog box appears.



3. Specify these properties on the Operating Parameters tab.

Property	Action
Password Required for Connection	Select the check box to restrict access by requiring a password when connecting to the controller. The default is cleared.
Password	Enter the password required to access the controller. The default is PASSWORD.
Restart on Power Up	Select the check box to have the application restarted after a power failure. The default is cleared.
Disable Remote Changes to Outputs	Clear the check box to allow remote devices to write to output points. The default is selected.
Allow Disabling of Points	Select the check box to allow the TriStation PC to disable points while the application is running on the controller. The default is cleared.
Use Local Time	Clear the check box if you do not want to use local time. The default is selected.

4. Click OK to save.

Memory Allocation

This section explains how to allocate memory, which includes specifying the memory used for input, output, and memory points.

Allocating Memory for Points

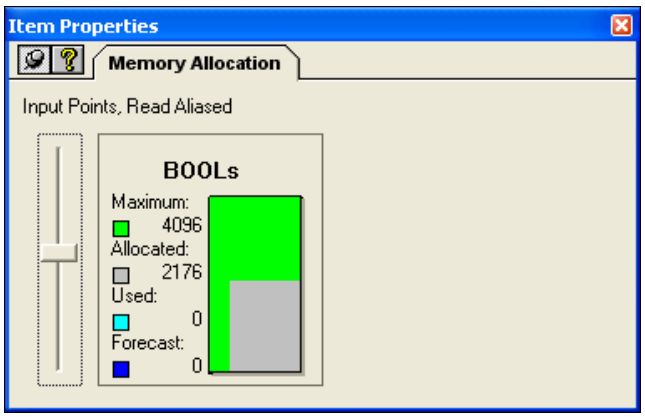
This procedure explains how to change the amount of memory used for input, output, and memory points in the application. Initially, the amount of memory for input and output points is determined by the number and type of I/O modules configured in the TriStation project. The amount of memory for memory points is set when a TriStation project is created. You can change these allocations at any time before building and downloading the application.

CAUTION

After an application is downloaded to a controller, changes to memory allocation require a Download All (see Using the Download All Command on page 316).

Procedure

1. Expand the Controller tree, double-click Configuration, and then expand Memory Allocation.
2. Double-click the type of point you want to change.



3. Move the slider up or down to change the memory allocated for the selected point.
4. Repeat for all points to be changed.

Tricon Hardware Allocation

This section explains how to configure the hardware allocation for a Tricon controller. Topics include:

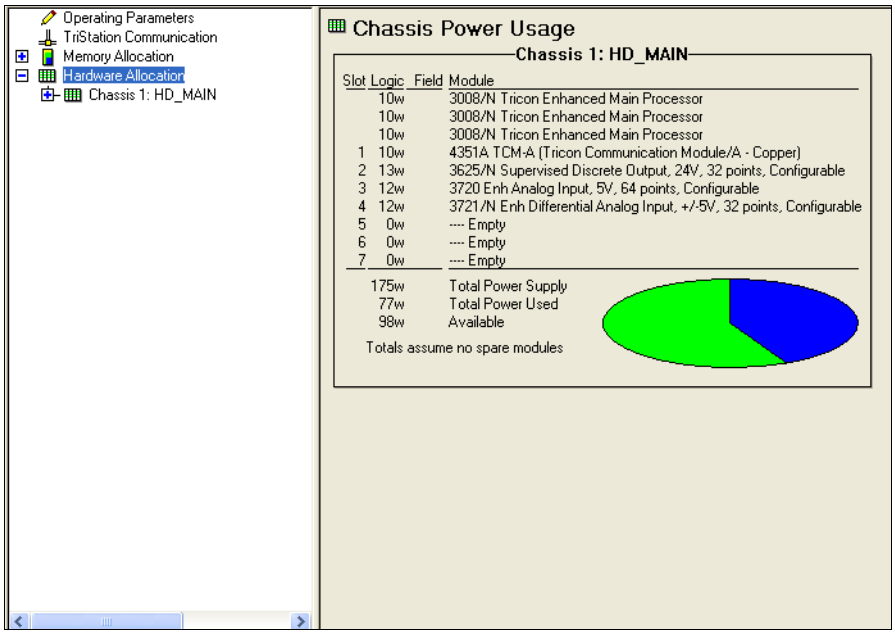
Determining Tricon Chassis Power Usage

This procedure explains how to display the amount of power used by a Tricon chassis.

For more information, see the *Tricon Planning and Installation Guide*.

Procedure

1 Expand the Controller tree, double-click Configuration, and then click Hardware Allocation.



The Chassis Power Usage screen shows information about the logic power used by each chassis.

- **Total Power Supply**: Shows the maximum logic power that the chassis can support.
- **Total Power Used**: Shows how much logic power is being used by the current configuration of modules in a chassis.
- **Available**: Shows the amount of available (unused) logic power.

2 If the Available power is negative, delete one or more modules from the chassis and add them to another chassis in the configuration.

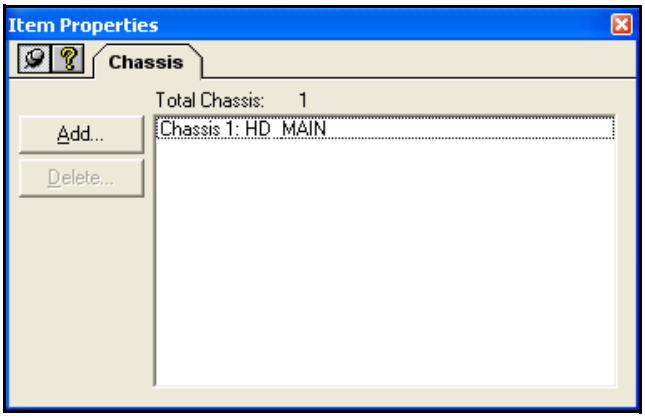
3 Recheck the power usage for the chassis to ensure the logic power is acceptable. If acceptable, the physical installation must be changed to match the logical configuration in TriStation.

Adding or Deleting a Tricon Chassis

This procedure explains how to add or delete a Tricon chassis from the controller configuration. Each controller configuration includes a main chassis, usually called HD_MAIN (High-Density chassis) or LD_MAIN (Low-Density chassis). Additional chassis in a a configuration are expansion chassis (HD_EXP) or remote chassis (HD_RXM).

Procedure

1 Expand the Controller tree, double-click Configuration, and then double-click Hardware Allocation. The Item Properties dialog box for the chassis appears.



2 Take either of these actions.

Commands	Actions
Add	Click to add a chassis. Select the type of chassis from the list that appears.
Delete	Select a chassis and then click Delete.

Changing the Tricon MP Model

This procedure explains how to change the model of Tricon MPs in the TriStation configuration. If you install different model MPs in the controller, you must logically configure the change in the TriStation project. This change requires a Download All.

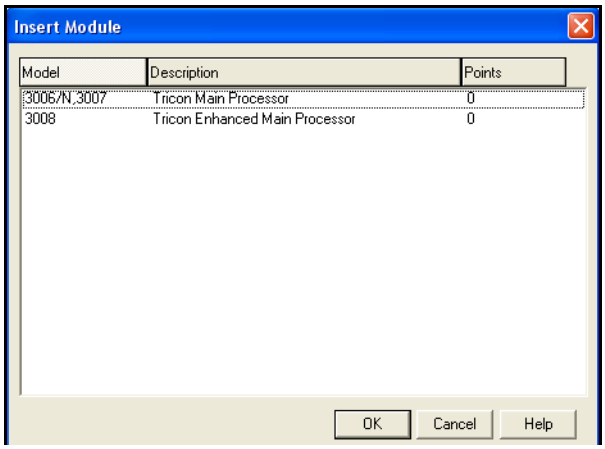
When you change MPs, TriStation saves the configuration and attaches the Tricon library that supports the installed MPs. Before saving the configuration, you are allowed to back up your project.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.

   The Insert Module dialog box appears.

2. Double-click the chassis whose model you want to change, and then click Replace MPs.
3. Click the model of MPs that are installed in the Tricon, and then click OK.
4. Click OK to save the project.



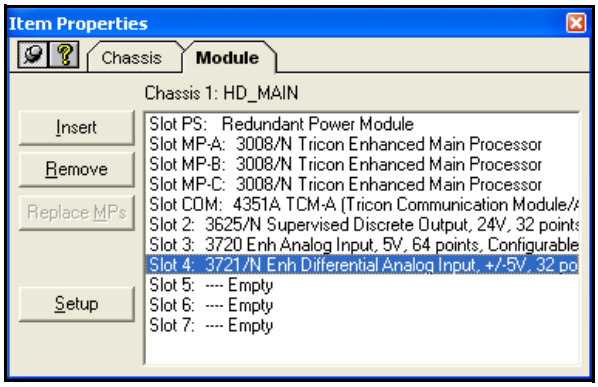
5. To finish the process, you must build the application and download it to the controller.

Inserting and Removing Tricon Modules

This procedure explains how to add and delete modules from a configuration. If a module is deleted, you must use the Download All command to download the application to the controller.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the chassis that you want to add or remove a module from.
3. Do one of the following:
   - Click an empty slot, and then click Insert. On the Insert Module screen, select the type of module to insert, and then click OK.
   - Click the module to be removed from the configuration, and then click Remove. This cannot be undone.



Configuring a Tricon AI Single-Ended or Differential Module

This procedure explains how to configure a Tricon Analog Input Single-Ended (model 3720) or Differential (model 3721) module[1]. For both modules, the resolution type and field power monitoring status can be specified. For the Differential module, the input type can also be specified.

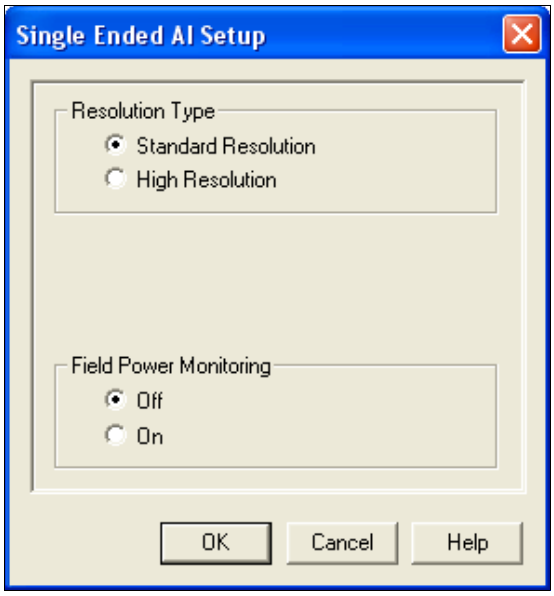
WARNING

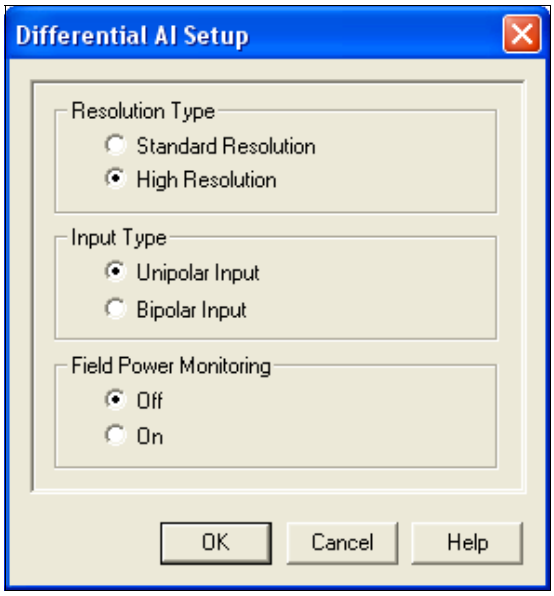
Changing the resolution type on model 3720 and 3721 AI modules will cause all input points on the module to change. A change from high to low resolution (or vice-versa) results in a value change by a factor of four. You must modify your application to take this change into account.

During a download change operation, the implementation of the logic change will occur before the implementation of the range change on the modules. This may result in a mismatch between the range the application expects and the actual range from the module. All points should be bypassed during a resolution change to prevent any unintended application problems.

Procedure

1. Expand the Controller tree, click Configuration, and expand Hardware Allocation.
2. Expand the chassis where the module is installed, double-click the slot where the module is installed, and then click Setup.





3. Specify these properties in the AI Setup dialog box.

1. The model 3720 and 3721 AI modules are compatible only with Tricon v10.2 and later systems.

Property	Action
Resolution Type	Select the resolution to be used for the point. Available with Single-Ended and Differential AI modules. • Standard Resolution: Data resolution is 12 bits, which is 4095 counts at the maximum range of 5 volts. For a Differential AI module, Standard Resolution cannot be selected if Bipolar Input is selected. • High Resolution: Data resolution is 14 bits, which is 16383 counts at the maximum range of 5 volts. The default is Standard Resolution.
Differential AI Input Type	Select the input type for the point. Only available with the Differential AI module. • Unipolar Input: 0 to 5 volts (with 6% over-range). • Bipolar Input: -5 to 5 volts (with 6% under-range and over-range). Available only if High Resolution is selected. The default is Unipolar Input.
Field Power Monitoring	Select whether the module should monitor field power at the termination panel. When field power monitoring is On, the module will report when field power at the term panel goes in or out of range. Applicable *only* if you are using a term panel that passes field power to the module. The default is Off. If you are not using a term panel that passes field power to the module, you must select Off. If you select On, and the term panel does not support field power monitoring, you will see Field Power faults on the module. For more information about external term panels, see the *Tricon Field Terminations Guide*.

4 Click OK to save your changes.

Configuring a Tricon DO Module

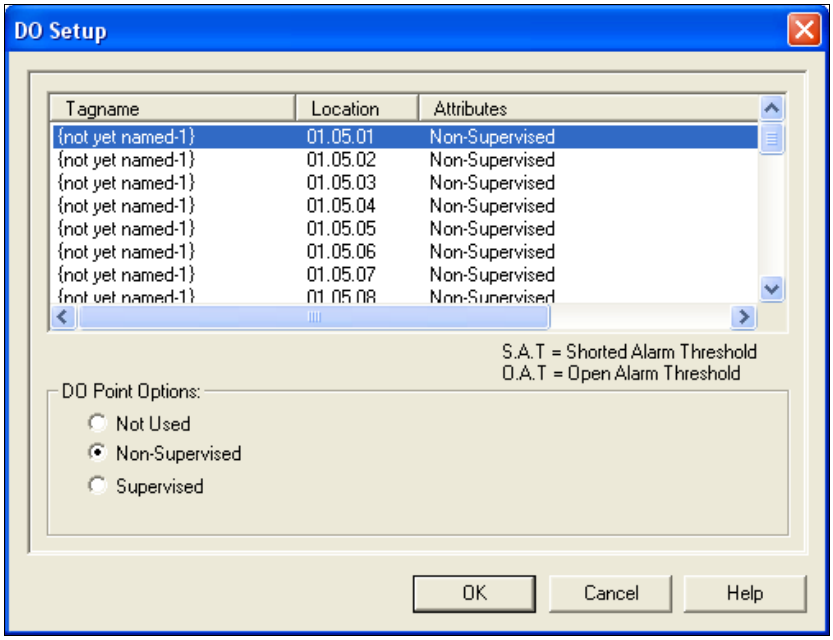
This procedure explains how to configure a Tricon Digital Output (model 3625) module[2], which allows you to specify how each point is configured.

Procedure

1 Expand the Controller tree, click Configuration, and expand Hardware Allocation.

2 Expand the chassis where the module is installed, double-click the slot where the module is installed, and then click Setup.

2. The model 3625 DO module is compatible only with Tricon v10.2 and later systems.



3 Select the tagname to be configured, and then specify these properties in the DO Setup dialog box.

Property	Action
DO Point Options	Select the option to be used for the DO point. • **Not Used**: Provides the same fault detection as for Non-Supervised points, except reporting of benign field fault conditions is suppressed. Points configured as Not Used *will* be energized if the application commands them on. • **Non-Supervised**: Provides detection of all internal faults and limited external faults associated with the field device or wiring. • **Supervised**: Provides detection of all internal faults and detection of all external faults associated with field device or wiring. The default is Non-Supervised.
Shorted Point Alarm Threshold	Enter the number of ohms below which values are alarmed as a shorted load. Typical threshold values are 10 to 48 ohms. The available range is 0 to 65,535. The default is 10. Only available if the points are supervised.
Open Point Alarm Threshold	Enter the number of ohms above which values are alarmed as an open load. Typical threshold values are 480 to 3200 ohms. The available range is 0 to 65,535. The default is 2400. Only available if the points are supervised.

4 Continue to select tagnames and specify settings as needed.

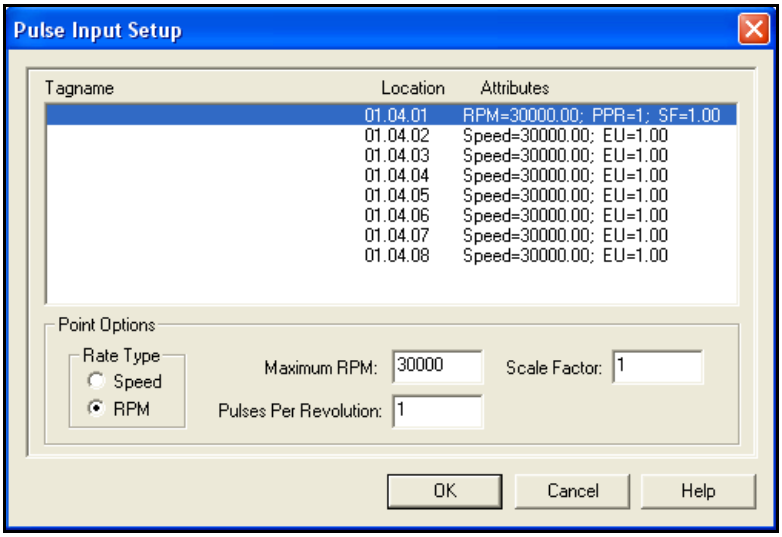
5 Click OK to save your changes.

Configuring a Tricon PI Module

This procedure explains how to configure a Tricon Pulse Input or Enhanced Pulse Input module, which are used for speed and RPM inputs. Each point can be independently configured.

Procedure

1. Expand the Controller tree, click Configuration, and expand Hardware Allocation.
2. Expand the chassis where the module is installed, double-click the slot where the module is installed, and then click Setup.



3. Select the tagname to be configured, and then specify these properties in the Pulse Input Setup dialog box.

Property	Action
Rate Type	Select the type of rate applied to pulse input signals: Speed or RPM.
Maximum RPM	Enter the revolutions per minute for the pulse input device; used with RPM.
Maximum Speed	Enter the speed for the pulse input device; used with Speed rate type.
Pulses Per Revolution	Enter the number of pulses per revolution of the measuring shaft; used with RPM rate type.
Scale Factor	Enter the scaling value to convert pulse input signals into engineering units. For: • Pulses per second, set to 0.016667. • Pulses per minute, set to 1.0 (default). • Pulses per hour, set to 60.0

4. Continue to select tagnames and specify settings as needed.
5. Click OK to save your changes.

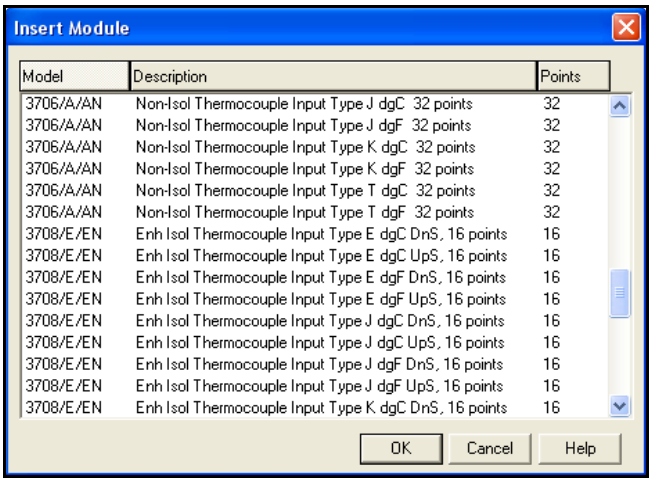
Adding a Tricon Thermocouple Module

This procedure explains how to specify the type of Tricon thermocouple module, which must match the module that is installed in the system. Because these modules come in a variety of configurations, select carefully. For more information, see the *Tricon Planning and Installation Guide*.

Procedure

1 Expand the Controller tree, click Configuration, and expand Hardware Allocation.

2 Expand the chassis where the module is installed, double-click the thermocouple module slot, and then click Insert.



3 From the module list, select the type of thermocouple module installed in the Tricon, as indicated by these properties.

Property	Description
Model	3706/A/AN or 3708/E/EN
Type E, J, K, T	Specifies the thermocouple type installed. For 3706, J, K, or T. For 3708, E, J, K, or T.
Degree conversion	dgC is converted to Celsius.dgF is converted to Fahrenheit.
UpS (upscale) DnS (downscale)	Specifies value returned if voltage is out-of-range, or burnout occurs. • Upscale returns +32,767. • Downscale returns –32,767. For model 3708E only.
Points	For model 3706, 32 points. For model 3708, 16 points.

4 Click the type of module installed in the controller, and click OK. There are no other properties to specify.

Trident Hardware Allocation

This section explains how to configure the hardware allocation for a Trident controller. Topics include:

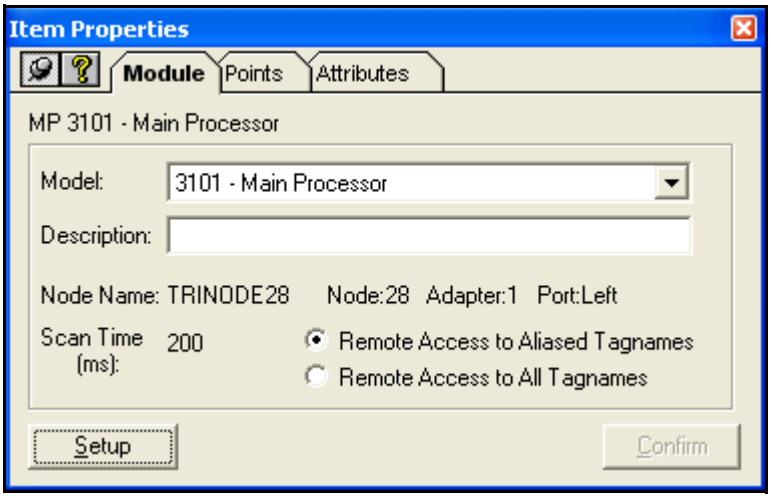
Specifying Trident MP Module Properties

This procedure explains how to specify properties on the Trident MP Module tab. The properties that are displayed vary depending on the module.

Procedure

1. On the Controller tree, double-click Configuration.
2. On the Configuration tree, open the Hardware Allocation node, and then double-click an MP.

   The Item Properties dialog box appears.



3. Specify these properties on the Module tab.

Property	Action
Model	Select the model used in the physical system.
Description	Enter a description, if desired.
Node Name	Displays the node name and number.
Scan Time	Displays the scan time, if it has been specified.

Property	Action
Remote Access to Aliased Tagnames	Select to have remote access only to aliased tagnames.
Remote Access to All Tagnames	Select to have remote access to all aliased tagnames.
Setup	Click to specify properties for operating parameters, network ports, and serial ports.

4 Click Confirm to save your changes.

Note You cannot specify point properties for a Trident MP.

Displaying Trident MP Attribute Properties

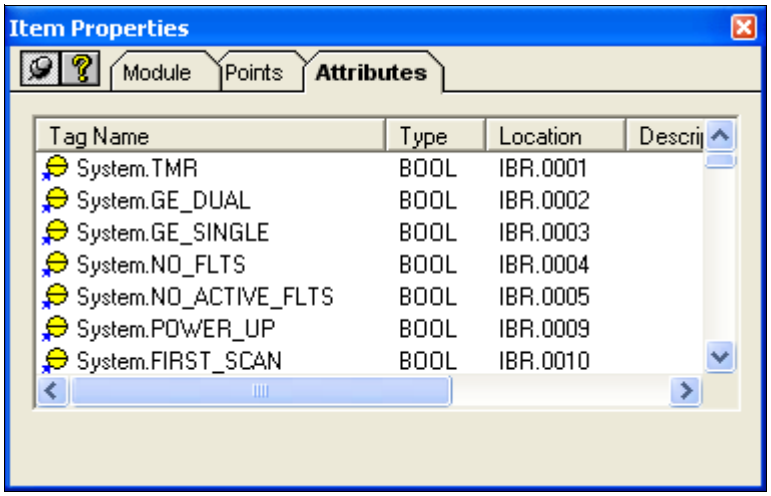
This procedure explains how to display MP attribute properties (status and control attributes).

Procedure

1 On the Controller tree, double-click Configuration.

2 On the Configuration tree, open the Hardware Allocation node, and then double-click an MP. The Item Properties dialog box appears.

3 Click the Attributes tab.



These properties are displayed on the Attributes tab.

Property	Description
Tagname	The name of the status or control attribute.
Data Type	The data type.
Location	The memory location for the attribute.
Description	The description of the attribute.

Inserting Trident Modules

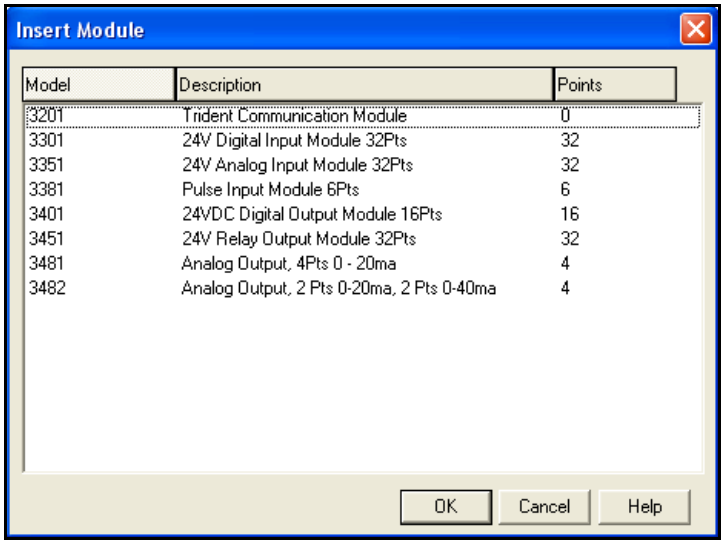
This procedure explains how to insert Trident modules in a configuration.

If a Trident Communication Module (CM) is added to a configuration after the application has been downloaded to the controller, you must use the Download All command to download the change.

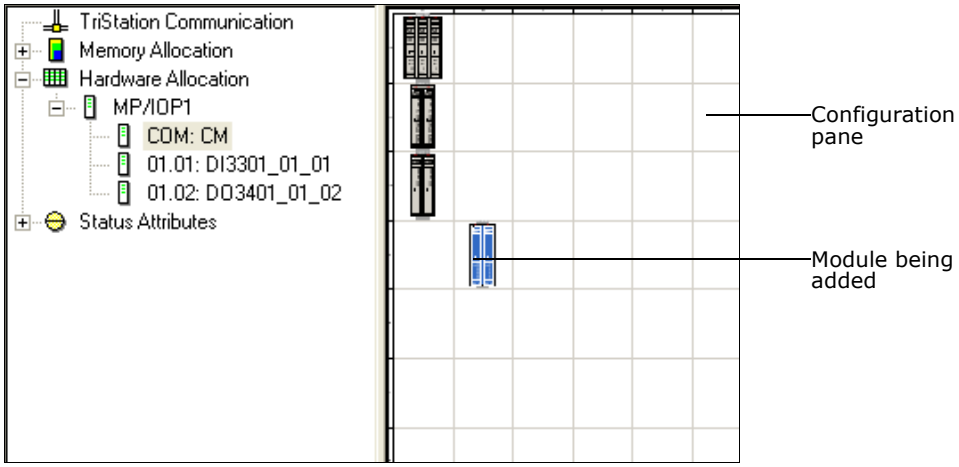
Procedure

1. On the Controller tree, double-click Configuration.
2. On the Configuration tree, open the Hardware Allocation node, and then click the MP slot.
3. On the Tools menu, click Insert Module. The Insert Module dialog box appears.
4. Select the type of module you want to add to the configuration, and click OK.

   The mouse pointer changes to look like this: 



5. Click on the configuration pane to add the module to the configuration.



6. Configure the module using the instructions specific to that module:
   - Configuring a Trident PI Module on page 195
   - Trident Communication Configuration on page 216

Removing Trident Modules

This procedure explains how to remove modules from a Trident configuration.

If a Trident Communication Module (CM) is removed from a configuration after the application has been downloaded to the controller, you must use the Download All command to download the change.

Procedure

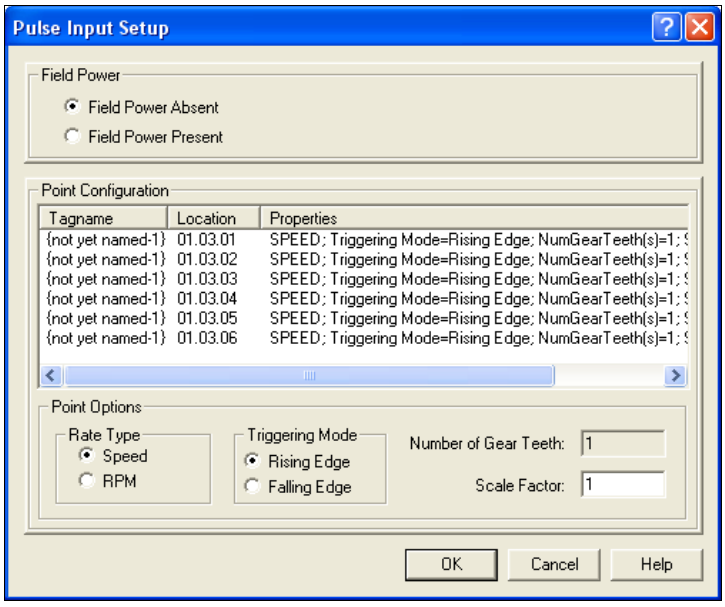
1. On the Controller tree, double-click Configuration.
2. On the Configuration tree, click Hardware Allocation.
3. On the configuration pane, click the icon that represents the module, and then press the Delete key.

Configuring a Trident PI Module

This procedure explains how to configure a Trident PI module, which is used for speed and RPM inputs. Each point can be independently configured.

Procedure

1. On the Controller tree, double-click Configuration.
2. On the Configuration tree, expand the Hardware Allocation node, and then expand the MP node the PI module is installed in.
3. Double-click the PI module, and then click Setup.



4. Select the tagname to be configured, and then specify these properties in the Pulse Input Setup dialog box.

Property	Action
Field Power	Select Field Power Present if the installed system has field power connected to the Pulse Input Baseplate. The default in Field Power Absent.
Field Maximum Power	Enter the maximum range for field power in volts. The default is 33 volts.
Field Minimum Power	Enter the minimum range for field power in volts. The default is 0 volts.
Rate Type	Select Speed or RPM to specify the type of rate applied to pulse input signals.
Triggering Mode	Select Rising Edge or Falling Edge depending on the installation.
Number of Gear Teeth	Enter the number of gear teeth that are counted in each revolution. The PI Point Options property must be specified as RPM to enable this property.
Scale Factor	Specifies how to convert pulse input signals into engineering units. For: Pulses per second, set to 0.016667. Pulses per minute, set to 1.0 (default). Pulses per hour, set to 60.0

5 Continue to select tagnames and specify settings as needed.

6 Click OK to save your changes.

Tricon Communication Configuration

This section explains how to configure Tricon communication modules for communication with external devices. For information on connecting a TriStation PC to a Triconex controller, see TriStation PC Setup on page 242.

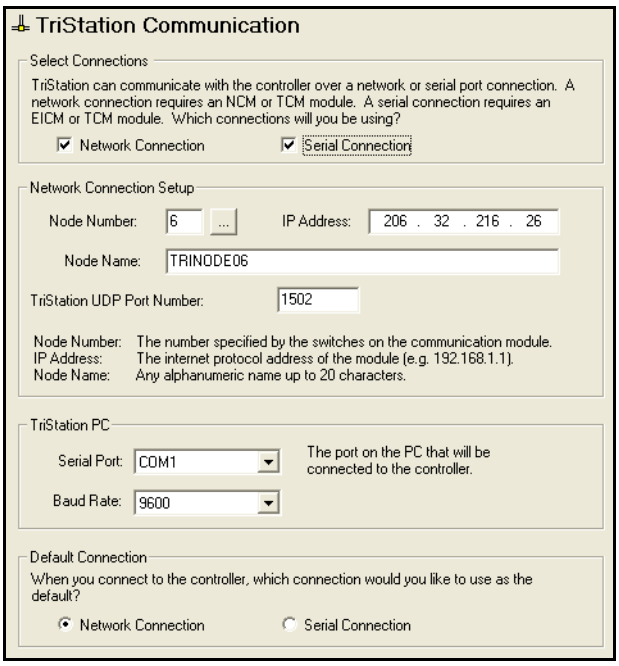
Topics include:

Specifying the Tricon Default Connection

This procedure explains how to specify the default connection setting in the Connect To dialog box, which appears when you establish communication between a TriStation PC and a controller. The connection setting—Network or Serial Connection—is an initial setting and can be changed when you use the Connect command.

Procedure

1 Expand the Configuration tree, double-click Configuration, and then click TriStation Communication.



2 Specify these properties on the TriStation Communication screen.

Property	Action
Select Connections	If using ACM or NCM select the Network Connection check box. If using EICM, select the Serial Connection check box. If using TCM, select the Network Connection check box, the Serial Connection check box, or both.
Node Number	For a network connection, enter the node number. Click the browse button to select the node from a list.
Node Name	For a network connection, enter the node name.
UDP Base Port Number	Enter the UDP port to use for the TriStation connection. The default is 1502. Available only when a TCM is installed.
IP Address	For a network connection, enter the IP address.
Serial Port	For a serial connection, select the TriStation PC port that is connected to the controller.
Baud Rate	Select the data transmission speed. The default is 9600. Available only when a TCM is installed.
Default Connection	If only one Selected Connection is checked, the default connection is set based on it. If both network and serial connections are set, you must specify the default connection setting.

3 To complete the connection, you must configure a Tricon ACM, EICM, NCM, or TCM module.

Configuring Tricon ACM Ports

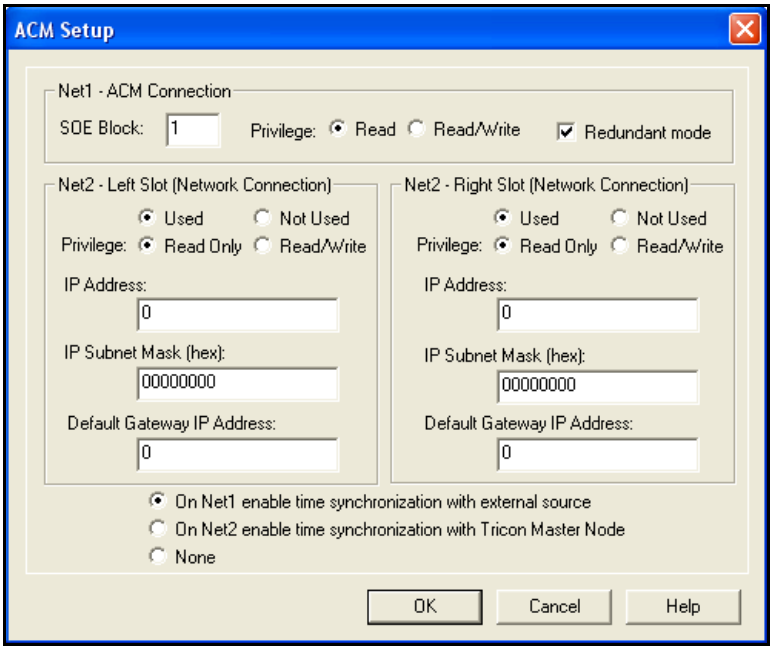
This procedure explains how to configure ports on a Tricon ACM, which support these connections:

- On NET 1, a network connection to a Foxboro Intelligent Automation (I/A) Series DCS
- On NET 1, time synchronization with a Foxboro Intelligent Automation (I/A) Series DCS
- On NET 2, a network connection to a TriStation PC or other network devices
- On NET 2, time synchronization with the Tricon master node

You can install primary and redundant ACM modules in either chassis 1 or chassis 2.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the ACM slot, and then click Setup.



3. For a NET 1 connection, specify these properties on the ACM Setup screen.

Property	Action
SOE Block Name	If using SOE, specify the block number.
Privilege	Specify Read/Write to allow external devices to read and write points. The default is Read.
Redundant Mode	Select the check box to specify that a redundant ACM is installed.
Time Synchronization	Select On NET 1 enable time synchronization with external source to allow time synchronization with the I/A DCS.

4 For a NET 2 connection, specify these properties on the ACM Setup screen.

Property	Action
Redundant Mode	Select the check box to specify that a redundant module is installed.
Used/Not Used	Select Used to specify the slots that have an installed ACM module. To enable the right slot, select the Redundant Mode check box (above).
Privilege	Specify Read/Write to allow external devices to read and write points. The default is Read.
IP Address	If using a default IP address, leave blank. If not, enter the IP address that identifies the controller on the network. This must be the same IP address as entered on the TriStation Communication screen (see Specifying the Tricon Default Connection on page 197).
IP Subnet Mask	If the controller is on a subnet, enter the subnet address.
Default Gateway IP Address	If needed, enter an IP address to be used as the default for a gateway.
Time Synchronization	Select NET 2 to enable time synchronization with the Tricon Master controller.

5 Click OK to save your changes.

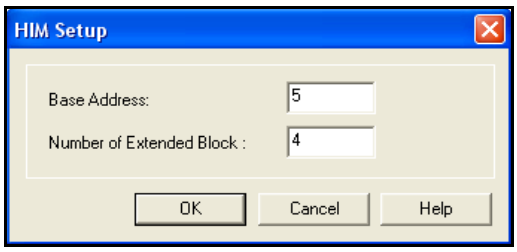
Configuring Tricon HIM Ports

This procedure explains how to configure ports on a Tricon HIM, which supports a connection between a Tricon controller and a Honeywell control system.

Procedure

1 Expand the Controller tree, double-click Configuration, and expand Hardware Allocation. Double-click the HIM slot, and then click Setup.

2 Specify these properties on the HIM Setup screen.



Property	Action
Base AddressBase Address	Enter a number between 5 and 31 to specify the block address for the HIM based on the Data Hiway memory map. The default is 5.
Number of Extended Block	Enter a number which identifies a pair of HIM blocks consisting of a base block and a secondary block (which is offset from the 6-bit block address by 32). The default is 4.

3 Click OK to save your changes.

Configuring Tricon EICM Ports

This procedure explains how to configure ports on a Tricon EICM, which supports these serial connections:

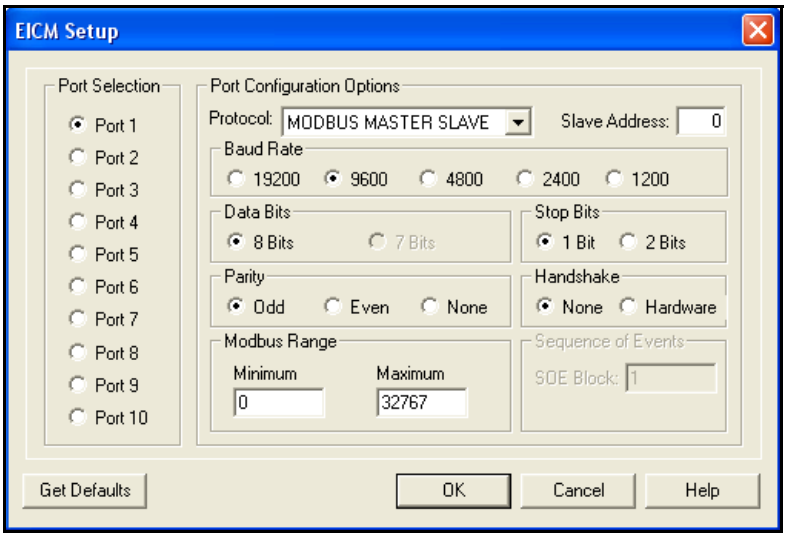
- To a TriStation PC using TriStation 1131 protocol
- To an external device using Modbus protocol (master, slave, and master/slave)
- To a Centronics printer

You can install an EICM module in either chassis 1 or the first expansion chassis.

Procedure

1 Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.

2 Double-click the EICM slot, and then click Setup.



3 Specify these properties in the EICM Setup dialog box.

Property	Action
Port Selection	For TriStation 1131 or Modbus communication, select ports 1–4 or 6–9. For a printer connection, select ports 5 or 10.
Protocol	For TriStation 1131, select TriStation. For Modbus, select the specific Modbus protocol.
Modbus Slave Address	Enter the number of the slave address, which can be 1–247. Only available with Modbus slave and Modbus slave/master protocols.
Baud Rate	Select the rate, which must be the same as other slaves on the network. The default is 9600. The total rate for all four ports must be less than or equal to 57,600.

Property	Action
Data Bits	Set as needed; must be the same as other Modbus slaves. Modbus slave can use 7 or 8 bits. Modbus master and master/slave must use 8 bits.
Stop Bits	Select either 1 Bit or 2 Bits to specify whether to send 1 or 2 bits to indicate that the transmission of a byte of data is complete.
Parity	Must use the same setting as other Modbus slaves.
Handshake	If set to Hardware, see Setting Signal Delays for Tricon EICM on page 422.
Modbus (Minimum and Maximum) Range	Set minimum between 0 and 32767; maximum between 1 and 32767.
Rows and Columns	Type the number of characters for the printer; only available with port 5 and 10. Rows can be 0–255; columns can be 0–255.
SOE Block Name	The SOE block name. Reserved for future use.

4 Click OK to save your changes.

Configuring Tricon NCM Ports

This procedure explains how to configure ports on a Tricon NCM, which supports these connections:

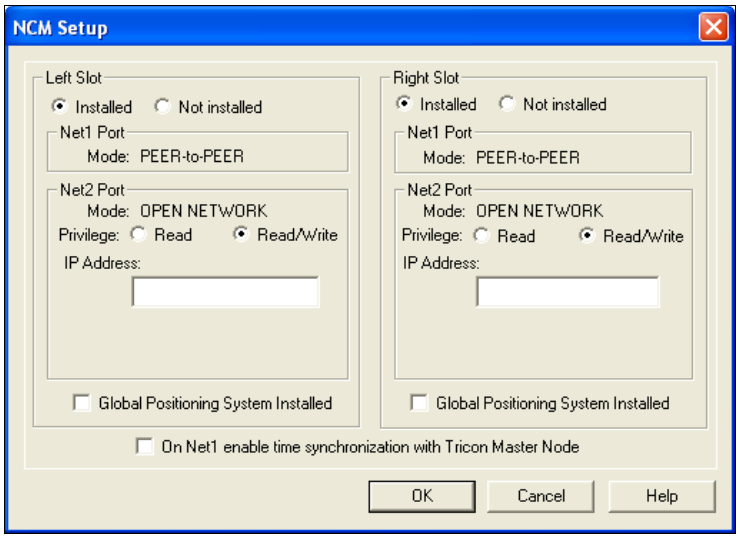
- On NET 1, a network connection to other Triconex controllers using the Peer-to-Peer protocol and Triconex Time Synchronization
- On NET 2, a network connection to a TriStation PC or other external devices
- Serial connection between a Tricon NCMG module and a Global Positioning System (GPS) interface

You can install a primary and redundant module in one logical slot.

Procedure

1 Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.

2 Double-click the NCM slot, and then click Setup.



3 Specify these properties in the NCM Setup dialog box.

Property	Action
Installed/Not Installed	Select to indicate which slots have modules installed. Available for the right slot only when the module is installed in a redundant (non-COM) slot.
Privilege	Select Read or Read/Write.
IP Address	Enter the IP address for the NCM.
	Select the check box to synchronize time with a GPS. The default is cleared.
Time Synchronization	Select the check box to synchronize time with the Tricon master node. The default is cleared.

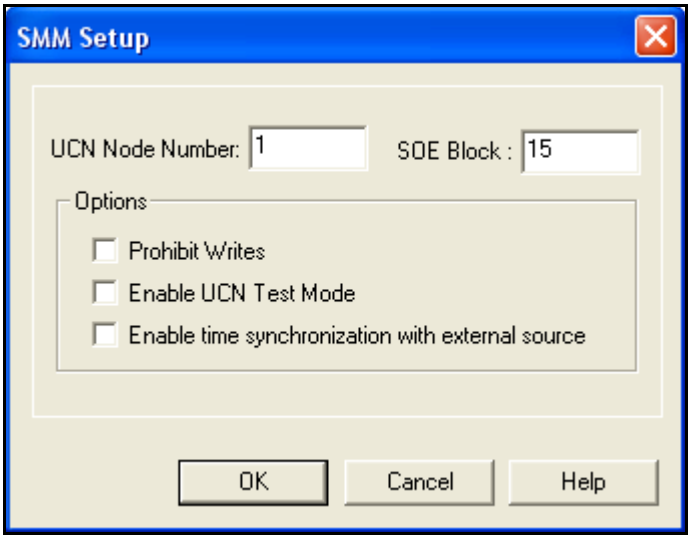
4 Click OK to save your changes.

Configuring Tricon SMM Ports

This procedure explains how to configure ports on a Tricon Safety Manager Module (SMM), which supports a connection between a Tricon controller and a Honeywell Universal Control Network (UCN).

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the SMM slot, and then click Setup.



3. Specify these properties in the SMM Setup dialog box.

Property	Action
UCN Node Number	Enter the UCN node number.
SOE Block	Enter 15 or 16, which are Modified External blocks reserved for the SMM.
Prohibit Writes	Select the check box to prevent Honeywell workstations from writing to memory and output points. The default is cleared.
Enable UCN Test Mode	Should only be selected if requested by Honeywell factory test personnel. The default is cleared.
Time Synchronization	Select the check box to enable time synchronization with the UCN. The default is cleared.

4. Click OK to save your changes.

Configuring TCM Ports

Note The information and procedures in this section apply only to model 4351A and 4352A TCMs. If you have an older model 4351 or 4352 TCM installed in your system, please see Appendix C, TCM Model 4351/4352 Configuration.

A single Tricon v10 system[3] supports a maximum of four TCMs, which must reside in two logical slots. You cannot mix model 4351A/4352A TCMs and 4351/4352 TCMs in the same system, even if they are installed in different chassis. See the *Planning and Installation Guide for Tricon v9-v10 Systems* for detailed TCM installation guidelines.

TCM models 4351A (Copper)/4352A (Fiber) support the following protocols on network and serial ports.

Protocol	Network Ports	Serial Ports
TriStation	NET 1, NET 2	Port 4
TSAA (UDP/IP)	NET 1, NET 2	—[a]
Peer-to-Peer (UDP/IP)	NET 1, NET 2	—
Peer-to-Peer (DLC)	NET 1	—
Modbus Slave (ASCII or RTU)	—	Any port
Modbus Master (RTU)	—	Any port
Modbus Master or Slave (TCP)	NET 1, NET 2	—
GPS Time Synchronization	—	Port 1
Triconex Time Synchronization via DLC	NET 1	—
Triconex Time Synchronization via UDP/IP	NET 1, NET 2	—
SNTP Triconex Time Synchronization	NET 1, NET 2	—
Network Printing using Jet Direct	NET 1, NET 2	—

a. — means the protocol is not available on this port.

To configure specific types of ports, see these topics:

- Configuring TCM Network Ports on page 206
- Configuring TCM Serial Ports on page 208
- Configuring TCM Peer-To-Peer Ports on page 210
- Configuring TCM Modbus TCP Ports on page 212
- Configuring TCM Routing on page 214

For additional information on configuring the TCM, see these topics:

- Tricon Time Synchronization on page 224 for instructions on configuring the TCM to synchronize time.

3. TCMs can be installed only in Tricon v10.*x* systems. They **cannot** be installed in Tricon v9.*x* or earlier systems.

- Controlling Access to the TCM on page 267 for instructions on controlling access to the TCM on a per-client level.
- Configuring a Tricon TCM Port for Printing on page 278 for instructions on configuring the TCM for use with a printer.

Note Once TCM ports have been configured, *but prior to downloading the configuration to the controller*, you can change the existing TCM model to a different model TCM without losing your port settings (see Inserting and Removing Tricon Modules on page 186). Note that you can switch only from a 4351A to a 4352A, or vice-versa; you cannot switch from a 4351A or 4352A to a 4351 or 4352.

However, once the configuration has been downloaded to the controller, you cannot change the TCM model installed in the Tricon without downloading a new configuration.

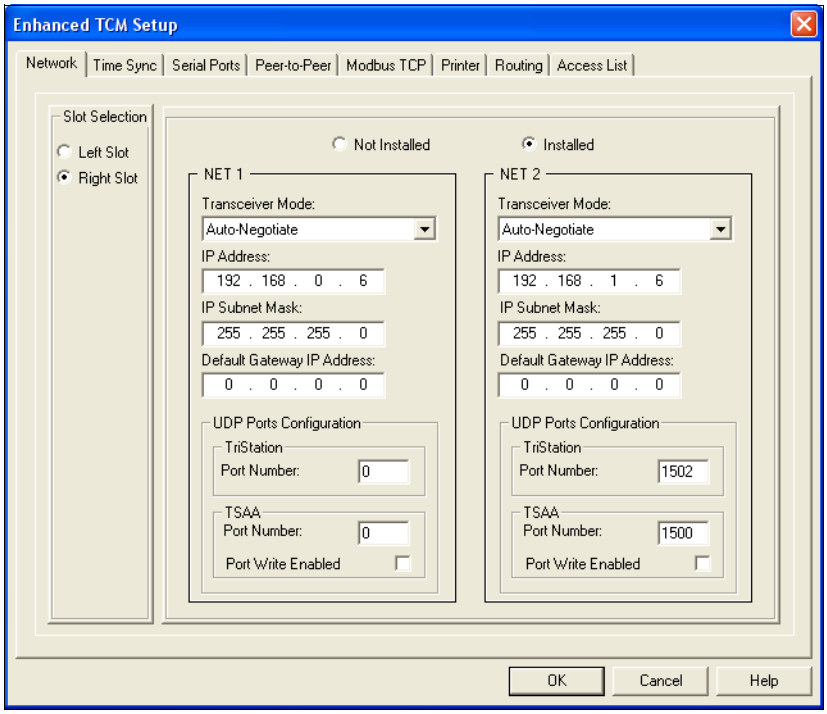
Configuring TCM Network Ports

This procedure explains how to configure network ports on a Tricon TCM.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The Enhanced TCM Setup dialog box appears.



3. Specify these properties on the Network tab.

Property	Action
Slot Selection	Select the slot where the TCM module you want to configure is installed.
Not Installed, Installed	Click Installed to enable configuration of the module. Clicking Not Installed resets all options to their default state and makes them unavailable for configuration. The default is Not Installed.
Transceiver Mode	Select the communication mode. The default is Auto-Negotiate. If you have a model 4352A TCM with fiber connectors, you **must** select 100 Mbps as the communication mode. The 4352A module cannot connect at 10 Mbps.
IP Address	Enter the IP Address for the port. NET 1 and NET 2 cannot use the same IP address. The default values are: • NET 1: 192.168.0.*x* • NET 2: 192.168.1.*x* where *x* is the node number.
IP Subnet Mask	If needed, enter the IP address for the subnet. The default is 255.255.255.0.
Default Gateway IP Address	If needed, enter the IP address for the default gateway. The default is 0.0.0.0.
TriStation Port Number	Enter the UDP port to use for the TriStation connection. The default is 1502. See UDP Base Port Number on page 438 for additional information.
TSAA Port Number	Enter the UDP port to use for TSAA connections, including DDE Server, SOE Recorder, and OPC Server. The default is 1500. See UDP Base Port Number on page 438 for additional information.
Port Write Enabled	Select this check box if you want to allow TSAA writes to this port. Applies to all TSAA connections on this port. The default is cleared (the port is read-only).

4 Click OK to save your changes.

Note Changes to TCM IP addresses are not effective until the existing connection is closed and a new connection is opened. Once a connection is opened, it remains open until you close it, even if the IP address is changed via a download change operation.

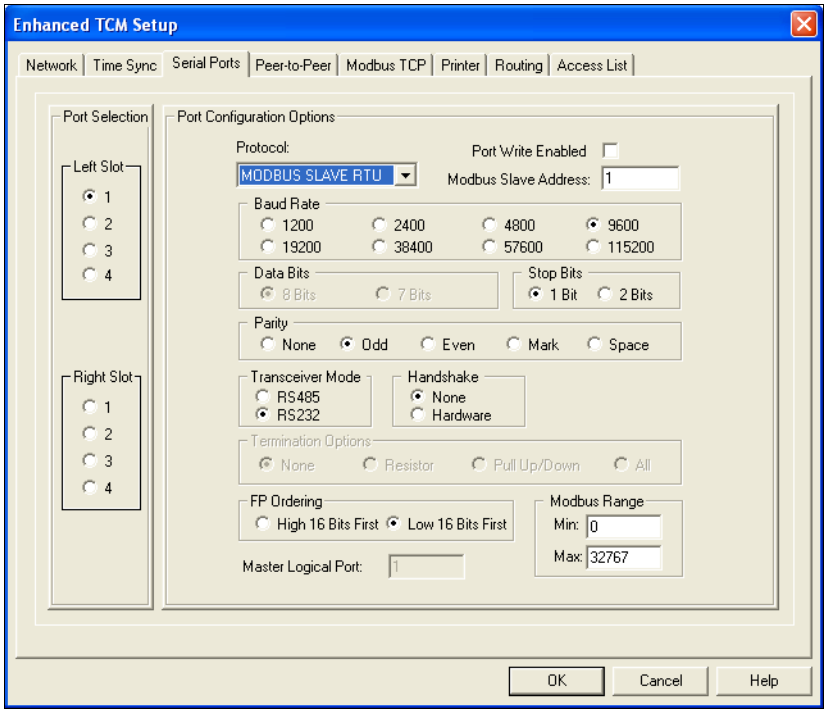
Configuring TCM Serial Ports

This procedure explains how to configure serial ports on a Tricon TCM.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The Enhanced TCM Setup dialog box appears.
3. Click the Serial Ports tab.



4. Specify these properties.

Property	Action
Port Selection	Click the port to be configured. Ports can be configured only for a slot with an installed module.
Port Write Enabled	Available only if Modbus Slave (ASCII or RTU) is selected as the communication protocol. Select this check box if you want to allow Modbus writes to this slave port. The default is cleared (the port is read-only).

Property	Action
Protocol	Select the communication protocol for the port: • All ports can use Modbus Master, Modbus Slave ASCII, Modbus Slave RTU. • Only port 1 can use GPS. This port is automatically configured for GPS when you enable time synchronization. See Using a Tricon TCM to Synchronize Time on page 229. • Only port 4 can use TriStation.
Modbus Slave Address	If you selected Modbus Slave RTU or ASCII, enter the number of the Modbus slave device. The default is 1.
Baud Rate	Enter the communication rate for the port. The default is 9600.
Data Bits	Select 8 or 7 bits. The default is 8. Available only with Modbus Slave ASCII.
Stop Bits	Select 1 or 2 bits. The default is 1 bit.
Parity	Select the type of parity for the port. The default is Odd.
Transceiver Mode	Select RS-485 or RS-232. The default is RS232. On port 4 when TriStation is selected as the protocol, RS-485 is not available.
Handshake	Select None or Hardware; the default is None.
Termination Options	Select the type of termination used with cables. Only available with RS-485 Transceiver Mode. The default is None.
FP Ordering	Select the order to be used with floating point numbers. The default is Low 16 Bits First.
Modbus (Minimum and Maximum) Range	Enter the minimum and maximum values to be used for the Modbus data range. The default minimum is 0. The default maximum is 32,767.
Master Logical Port	Enter the port number that the TCM will use in Modbus Master functions to access the port. Only available for Modbus Master.

5 Click OK to save your changes.

Note Even if port 4 is set to Not Configured (the default value), it can still be used to connect to the Tricon via TriStation. This is useful when you are unable to connect via a network connection.

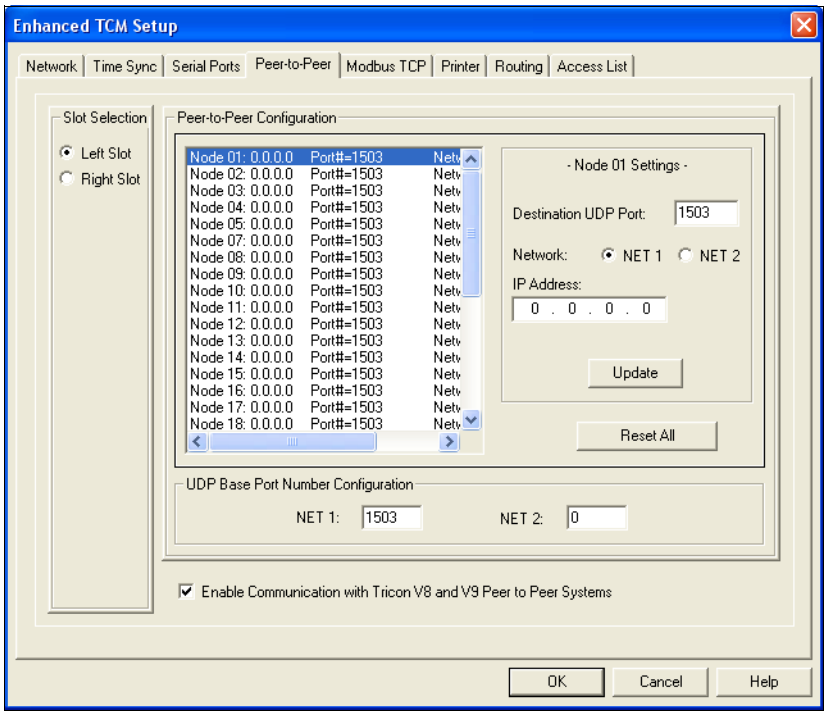
Configuring TCM Peer-To-Peer Ports

This procedure explains how to configure the IP addresses for controllers communicating on a Peer-to-Peer network through a Tricon TCM.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The Enhanced TCM Setup dialog box appears.
3. Click the Peer-to-Peer tab.



4. Under Slot Selection, select the module (slot) you want to configure Peer-to-Peer ports for.
5. Select a node (controller), and specify these properties.

Property	Action
Destination UDP Port	Enter the UDP port number for each controller to be communicated with on the Peer-to-Peer network. This must be the same number that the controller uses as its UDP Base Port Number.
Network	Click the network port that the selected node is connected to. The default is NET 1.
IP Address	Enter the IP address for the controller.

6. Click Update to apply the new settings for the selected node.

7 Repeat steps 4 through 6 for each node to be included in the network.

Note If necessary, click Reset All to reset *all* node settings for the selected slot to their default, unconfigured state.

8 Once all nodes have been configured, specify these properties (applicable to all nodes on the Peer-to-Peer network).

Property	Action
UDP Base Port Number	For each network port, enter the UDP base port number for the controller. Enter 0 to disable Peer-to-Peer over UDP/IP on the network. The default is 1503 on NET 1 (meaning Peer-to-Peer is enabled on NET 1) and 0 on NET 2 (meaning Peer-to-Peer is disabled on NET 2). UDP port numbers must be unique. See UDP Base Port Number on page 438 for reserved values.
Enable Communication with Tricon V8 and V9 Peer-to-Peer Systems	Select the check box to enable communication with Tricon version 8 and 9 systems. The default is cleared. Available only for a module installed in the left slot.

9 Click OK to save your changes.

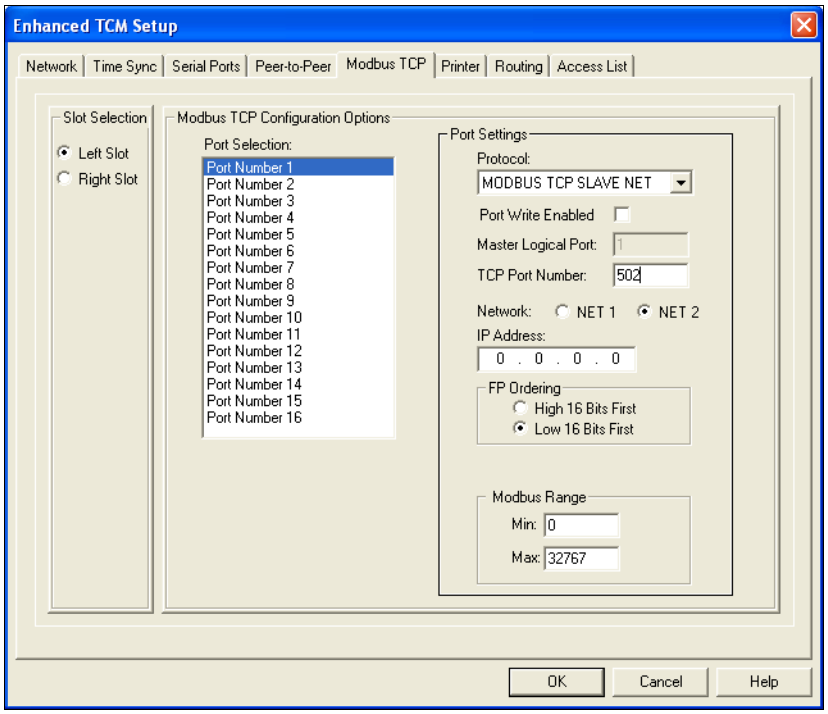
Configuring TCM Modbus TCP Ports

This procedure explains how to configure Modbus TCP ports on a Tricon TCM, which enables Modbus communication through network ports.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The Enhanced TCM Setup dialog box appears.



3. Click the Modbus TCP tab.
4. Under Slot Selection, select the module (slot) you want to configure Modbus TCP ports for.
5. Select a port and specify these properties.

Property	Action
Protocol	Select the communication protocol for the port. Options include Modbus TCP Master and Modbus TCP Slave Net.
Port Write Enabled	Available only if Modbus TCP Slave is selected as the communication protocol. Select this check box if you want to allow Modbus writes to this slave port. The default is cleared (the port is read-only).
Master Logical Port	Enter the number of the Modbus Master node. Available only with Modbus TCP Master protocol.
TCP Port Number	Enter the number for the TCP port. The default is 502.

Property	Action
Network	Click the network that the selected port is connected to. The default is NET 2.
IP Address	If the port uses Modbus Master protocol, enter the IP address of the slave node. If the port uses Modbus Slave protocol, enter either of these: • To accept communication from any Modbus Master, leave the IP address as 0.0.0.0. • To accept communication only from a defined Modbus Master, enter the specific master IP address.
FP Ordering	Select the ordering to use for floating point numbers. The default is Low 16 Bits First.
Modbus (Minimum and Maximum) Range	Enter the minimum and maximum for the modbus data range. Available only with Modbus TCP Slave Net.

6 Click OK to save your changes.

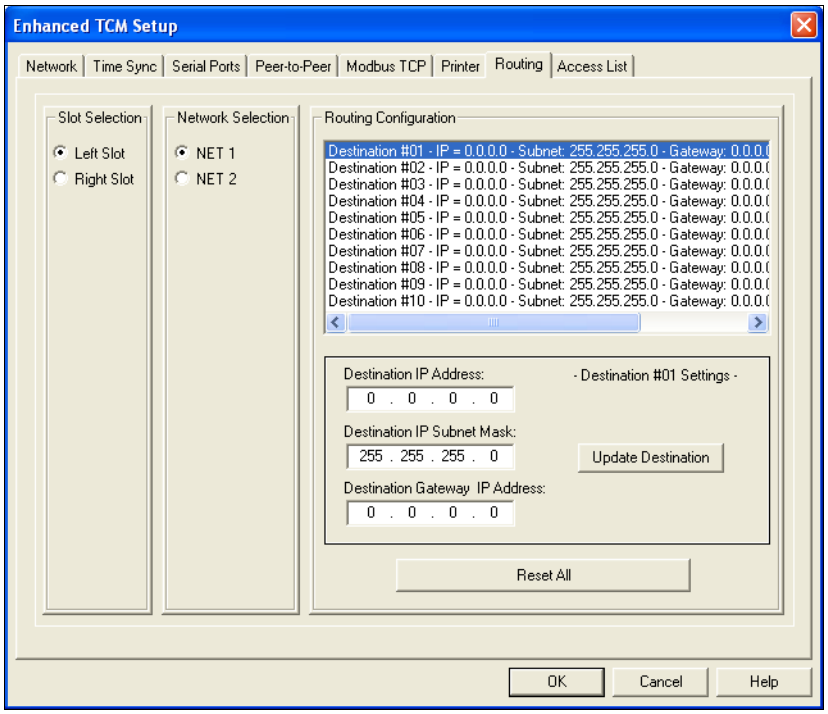
Configuring TCM Routing

This procedure explains how to configure routing on a Tricon TCM. Up to 10 different routes can be configured for each network; each slot (module) has two networks (NET 1 and NET 2).

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The Enhanced TCM Setup dialog box appears.



3. Click the Routing tab.
4. Select the module (slot) you want to configure routing for.
5. Select the network (NET 1 or NET 2) you want to configure routing for.
6. Select a destination route and then specify these properties.

Property	Action
Destination IP Address	Enter the IP address which is used if the controller is not on the same subnet as other devices.
Destination IP Subnet Mask	Enter the IP address of the subnet mask. If the gateway address is on NET 2, then the subnet mask must be the same as the NET 2 subnet mask defined on the Network tab. If the gateway address is on NET 1, then the subnet mask must be the same as the NET 1 subnet mask defined on the Network tab. See Configuring TCM Network Ports on page 206.

Property	Action
Destination Gateway IP Address	Enter the IP address of the gateway to which the controller is connected. The gateway address must always be on NET 1 or NET 2.

7 Click Update Destination to apply the settings.

Note If necessary, click Reset All to change all destination settings for the selected slot to their default, unconfigured state.

8 Click OK to save your changes.

Trident Communication Configuration

This section explains how to configure Trident communication modules for communication with external devices. For information on connecting a TriStation PC to a Triconex controller, see TriStation PC Setup on page 242. Topics include:

- Specifying the Trident Default Connection on page 216
- Configuring Trident MP Network Ports on page 218
- Configuring Trident MP Serial Ports on page 219
- Configuring Trident CM Network Ports on page 220
- Configuring Trident CM Serial Ports on page 221
- Configuring Trident CM Routing on page 223

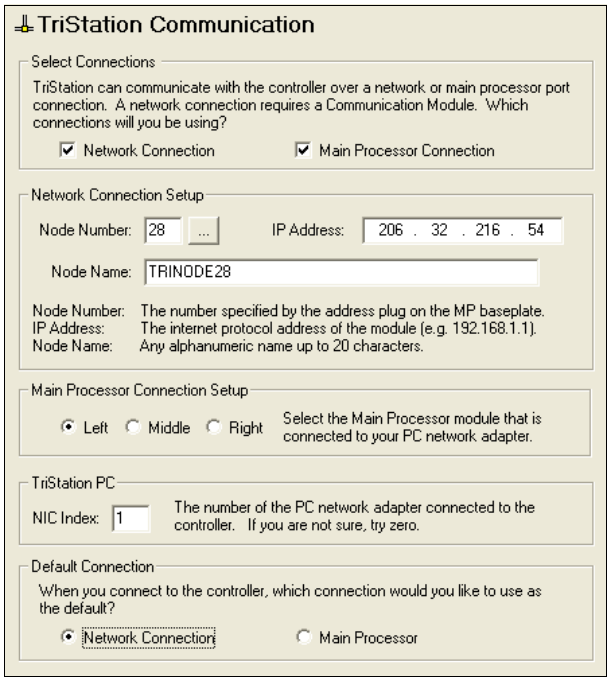
See Trident Printing on page 280 for instructions on configuring the Trident for use with a printer.

Specifying the Trident Default Connection

This procedure explains how to specify the default connection setting on the Connect To dialog box, which appears when you establish communication between a TriStation PC and a controller. The connection setting—Network or Main Processor Connection—is an initial setting and can be changed when you use the Connect command.

Procedure

1 Expand the Controller tree, double-click Configuration, and then click TriStation Communication.



2 Specify these properties on the TriStation Communication screen.

Property	Action
Select Connections	To connect through the CM, select the Network Connection check box. To connect through the MP, select the Main Processor Connection check box.
Node Number	Enter the node number for the controller. Click the browse button to select the node from a list.
Node Name	Enter the name for the controller.
IP Address	For a network connection, enter the IP address.
Main Processor Connection Setup	For an MP connection, select the MP that is connected to the TriStation PC. The default is left.
NIC Index	Enter the number of the network interface card index in the TriStation PC. Needed only for a MP connection.
Default Connection	If only one connection type is selected under Select Connections, the default connection is set based on it. If both network and MP connections are selected, you must specify the default connection setting.

3 To complete the connection, you must configure a Trident MP or CM module.

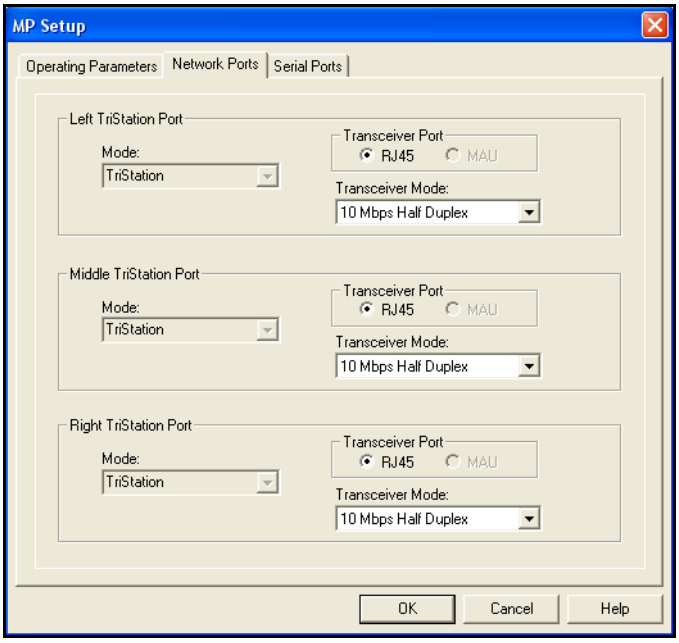
Configuring Trident MP Network Ports

This procedure explains how to configure network ports on a Trident MP, which supports network connections to a TriStation PC.

Each port must be configured separately and can operate independently with different Modbus Masters. Or, they can operate as redundant serial ports, connected to redundant ports of the same Modbus Master.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the MP slot, click Setup, and then click the Network Ports tab.



3. Specify these properties on the Network Ports tab.

Property	Action
Mode	Set to TriStation; cannot be changed.
Transceiver Port	Set to RJ-45; cannot be changed.
Transceiver Mode	Select half or full duplex depending on the installation.

4. Click OK to save your changes.

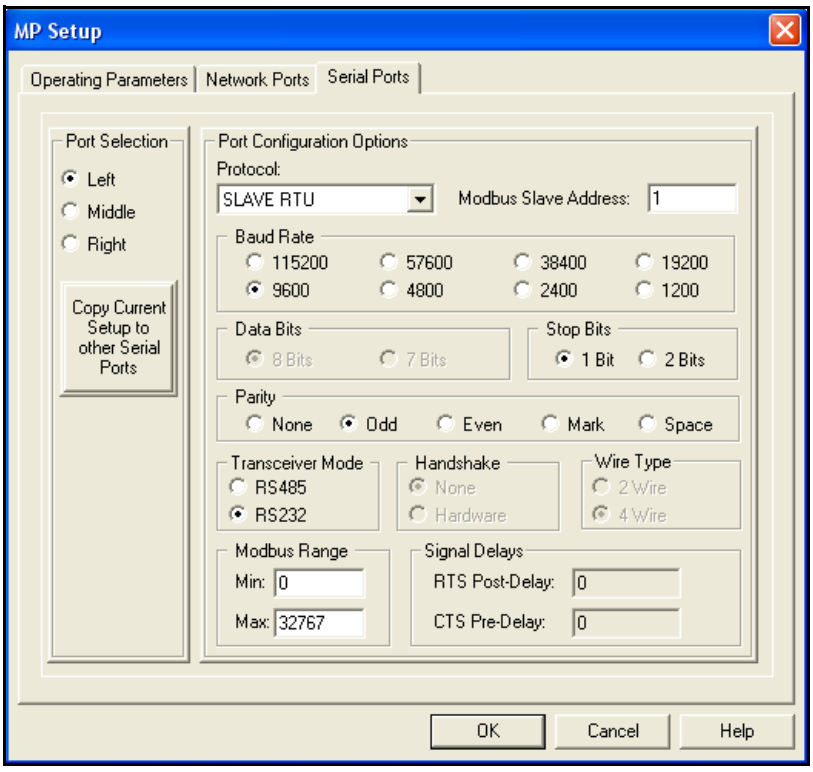
Configuring Trident MP Serial Ports

This procedure explains how to configure serial ports on a Trident MP, which supports serial connections using Modbus slave RTU protocol.

Procedure

1 Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.

2 Double-click the MP slot, click Setup, and then click the Serial Ports tab.



3 Specify these properties on the Serial Ports tab.

Property	Action
Port Selection	Select the port to be configured.
Protocol	Only Modbus Slave RTU is available.
Modbus Slave Address	Enter the slave address of the serial port on the MP Baseplate.
Baud Rate	Select the rate used in the installation.
Data Bits	Set at 8 bits; cannot be changed.
Stop Bits	Select 1 Bit or 2 Bits.
Parity	Select a parity option.
Transceiver Mode	Select RS-232 or RS-485, depending on the physical connection.

Property	Action
Handshake	Set to none; cannot be changed.
Wire Type	Set to 4 wire; cannot be changed.
Modbus (Minimum and Maximum) Range	Enter a minimum value (0 is default) and maximum value (32,767 is maximum).
Signal Delays	Set to 0; cannot be changed.
Copy Current Setup to Other Serial Ports Command	Click to have the settings for the selected port copied to the other ports.

4 Click OK to save your changes.

Configuring Trident CM Network Ports

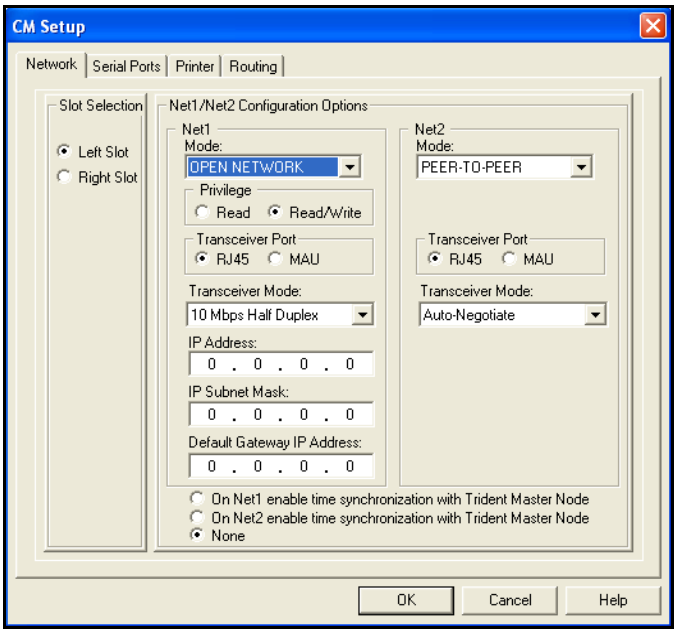
This procedure explains how to configure network ports on a Trident CM, which supports these connections:

- To a TriStation PC
- To a Peer-to-Peer network of Triconex controllers
- To an external device or network

Procedure

1 Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.

2 Double-click the CM, click Setup, and then click the Network tab.



3 Specify these properties on the Network tab.

Property	Action
Slot Selection	Select the slot to be configured.
Mode	Select either Open Network or Peer-to-Peer for either NET 1 or NET 2. You cannot use the same mode on both ports.
Privilege	Select Read Only to restrict access from external devices. Not available with Peer-to-Peer. The default is Read/Write.
Transceiver Port	Select the type of port used.
Transceiver Mode	Select the mode used.Not available with Peer-to-Peer.
IP Address	Enter the IP address of the controller. Not available with Peer-to-Peer.
IP Subnet Mask	Enter the subnet mask, if needed. Not available with Peer-to-Peer.
Default Gateway IP Address	Enter the default gateway, if needed. Not available with Peer-to-Peer.
Time Synchronization	Select to enable time synchronization on NET 1 or NET 2.

4 Click OK to save your changes.

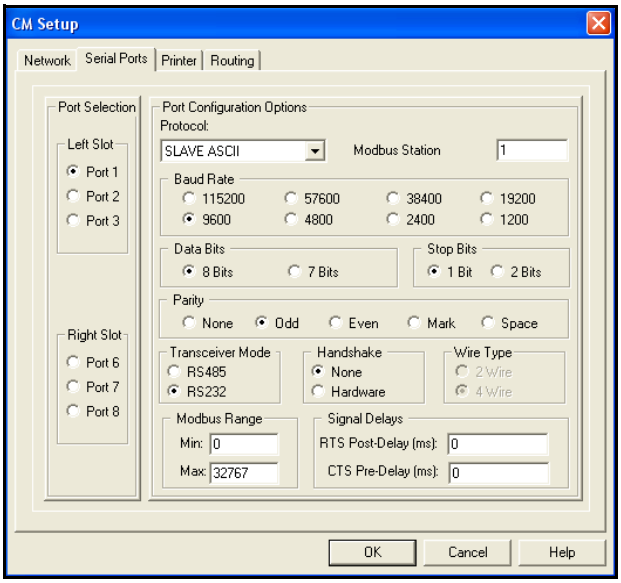
Configuring Trident CM Serial Ports

This procedure explains how to configure serial ports on a Trident CM, which support connections using Modbus slave, master, and master/slave protocols.

Procedure

1 Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.

2 Double-click the CM slot, click Setup, and then click the Serial Ports tab.



3 Specify these properties on the Serial Ports tab.

Property	Action
Port Selection	Select the port to be configured.
Protocol	Select the protocol to use.
Modbus Slave Address	Enter the slave address of the serial port on the MP Baseplate. Not used with Master protocol.
Baud Rate	Select the rate used in the installation.
Data Bits	Select 7 or 8 bits; only available with slave ASCII protocol. Set to 8 bits for all other protocols.
Stop Bits	Select 1 Bit or 2 Bits.
Parity	Select the parity option.
Transceiver Mode	Select RS-232 or RS-485, depending on the physical connection.
Handshake	Select Hardware to use signal delays to determine if the connection is valid.
Wire Type	Select 2 or 4 wire, depending on the installation.
Modbus (Minimum and Maximum) Range	Enter a minimum value (0 is default) and maximum value (32,767 is maximum). Only available with Modbus.
Signal Delays	Enter the number of milliseconds to adjust timing of the data transmission.

4 Click OK to save your changes.

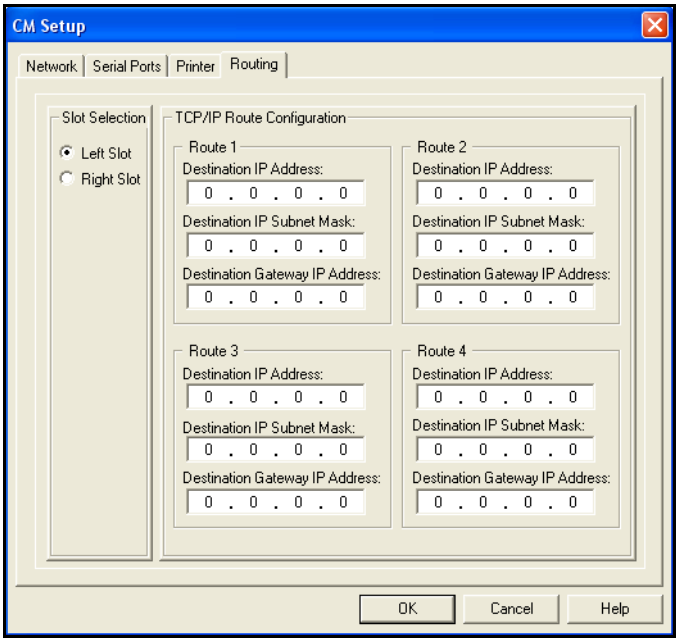
Configuring Trident CM Routing

This procedure explains how to configure routing information for network communication on a Trident CM. This procedure is optional depending on your network configuration. For more information, see your network administrator.

Procedure

1 Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.

2 Double-click the CM slot, click Setup, and then click the Routing tab.



3 Specify these properties on the Routing tab.

Property	Action
Slot Selection	Select the slot to configure.
Destination IP Subnet Mask	Enter the address for the subnet mask.
Destination Gateway IP Address	Enter the address for the gateway.
Destination IP Address	Enter the destination address.

4 Repeat for each route required on your network.

5 Click OK to save your changes.

Tricon Time Synchronization

This section explains how to use the Time Synchronization communication protocol with Tricon controllers. Time synchronization enables a network of Triconex controllers to synchronize time with each other or with external devices, such as a DCS or the Global Positioning System (Tricon only).

Topics include:

About Tricon Time Synchronization

This table summarizes the ways Tricon controller time can be synchronized to an external device or to the Tricon master node in a Peer-to-Peer network.

Table 29 Tricon Time Synchronization

Module	Time Synchronization Options
ACM	• To a Foxboro DCS. • To the Tricon master node in a Peer-to-Peer network.
ACM or NCM	• To an OPC client. For more information, see the *Tricon Communication Guide*. • By writing aliased data to the TIMESET or TIMEADJ function blocks in a TriStation 1131 application. For assistance with the specialized programming that is required, contact Triconex Technical Support. • To the Tricon master node in a Peer-to-Peer network.
NCMG	• To the GPS (Global Positioning System). • To the Tricon master node in a Peer-to-Peer network.
SMM	• To the Honeywell Universal Control Network (UCM).
TCM	• To the GPS (Global Positioning System). • To SNTP. • To the Tricon master node in a Peer-to-Peer network (Triconex Time Synchronization).

Using a Tricon ACM to Synchronize Time

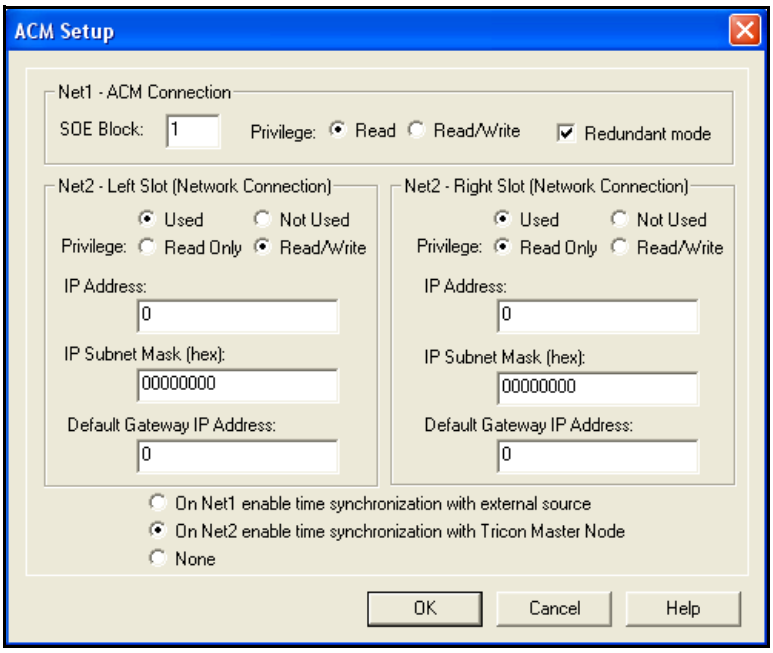
This procedure explains how to use a Tricon ACM to enable time synchronization based on:

- The Foxboro I/A Series nodebus system time
- The Tricon master node in a Peer-to-Peer network

Procedure

1 Expand the Configuration tree, double-click Configuration, and expand Hardware Allocation.

2 Double-click the ACM slot, and then click Setup.



3 Specify these properties on the ACM Setup screen.

Property	Action
Privilege	For synchronization on NET 2, specify Read/Write. The default is Read.
Time Synchronization	• Select On NET 1 enable time synchronization with external source to allow time synchronization with a Foxboro I/A DCS. • Select NET 2 to enable time synchronization with the Tricon Master node (controller).

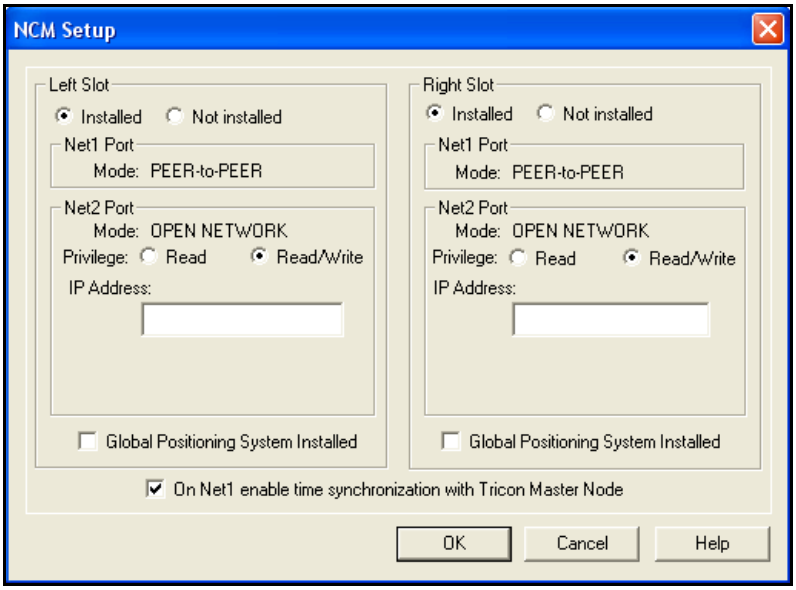
4 Click OK to save your changes.

Using a Tricon NCM to Synchronize Time

This procedure explains how to use a Tricon NCM to enable time synchronization with the Tricon master node in a Peer-to-Peer network.

Procedure

1. Expand the Configuration tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the NCM slot, and then click Setup.



3. Select the On NET 1 enable time synchronization with Tricon Master Node check box.
4. Click OK to save your changes.

Using a Tricon NCMG to Synchronize Time

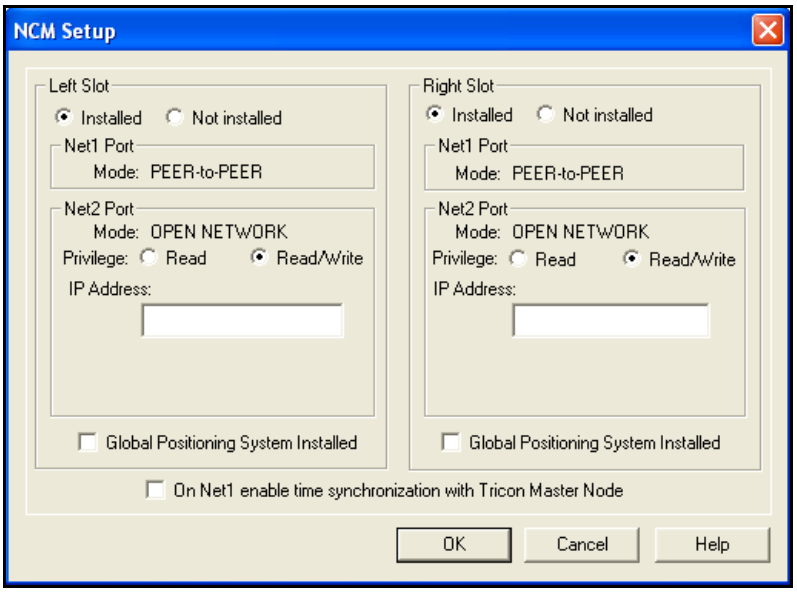
This procedure explains how to use a Tricon NCMG to enable time synchronization through the Global Positioning System (GPS) by using the Trimble Acutime 2000 Synchronization Kit. If the Tricon NCMG is in a Peer-to-Peer network, it can be used as the master node for time synchronization of the controllers on the network.

For information on installing the kit, see the *Tricon Communication Guide*.

CAUTION To ensure the accuracy of GPS time adjustments, the Tricon clock must be set to within 10 minutes of the correct local time.

Procedure

1. Expand the Configuration tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the NCMG slot, and then click Setup.



3. Specify these properties on the NCM Setup screen.

Property	Action
Global Positioning System Installed	Select this check box to enable time synchronization through the GPS. If selected, other controllers can also be synchronized to the Tricon master controller.
Time Synchronization	For a network of Triconex controllers, select the On NET 1 enable time synchronization with the Tricon Master Node check box.

4. Click OK to save your changes.

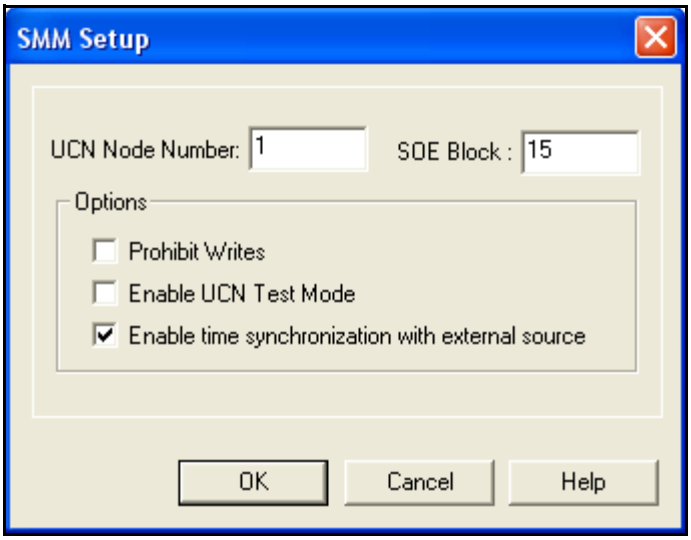
Using a Tricon SMM to Synchronize Time

This procedure explains how to configure a Tricon SMM module to synchronize time based on the Honeywell Universal Control Network (UCM).

For more information, see the *SMM User's Guide.*

Procedure

1. Expand the Configuration tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the SMM slot, and then click Setup.



3. Select the Enable time synchronization with external source check box.
4. Click OK to save your changes.

Using a Tricon TCM to Synchronize Time

The information in this section explains how to enable time synchronization on a TCM. Time synchronization can be enabled using the following protocols:

- GPS
- SNTP
- Triconex Time Synchronization via DLC (NET 1 only) or UDP/IP (NET 1 or NET 2) on a Peer-to-Peer network

In a redundant network of Triconex controllers that each have two TCMs installed, you can implement redundant time synchronization by configuring time synchronization for both TCM modules (both left and right slots). Time synchronization can be enabled only for a single logical slot.

If the TCM is installed in the COM slot, you configure time synchronization only for the left slot (there is no redundancy when installed in the COM slot).

Note The following procedures apply only to model 4351A and 4352A TCMs. If you have an older model 4351 or 4352 TCM installed in your system, please go to Appendix C, TCM Model 4351/4352 Configuration.

Topics include:

Configuring GPS Time Synchronization on the TCM

This procedure explains how to configure a TCM to enable time synchronization through the Global Positioning System (GPS) by using the Trimble Acutime 2000 Synchronization Kit. For information on installing the kit, see the *Tricon Communication Guide for v9-v10 Systems*.

CAUTION To ensure the accuracy of GPS time adjustments, the Tricon clock must be set to within 10 minutes of the correct local time.

If the TCM is in a Peer-to-Peer network, it can also be used as the master node for time synchronization of other controllers on the network. In this configuration, the master node TCM synchronizes time with the GPS, and any slave nodes on the Peer-to-Peer network synchronize their time with the master TCM. In this way, all nodes on the Peer-to-Peer network are synchronized with GPS time.

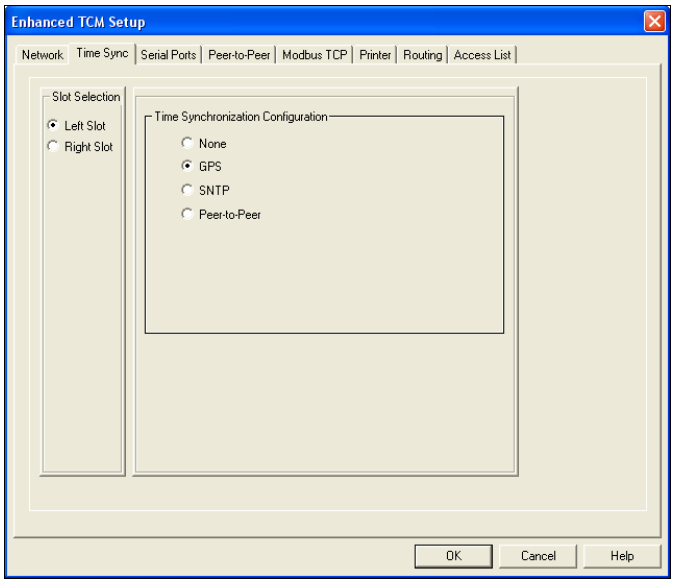
If the TCM is acting as a slave node on a Peer-to-Peer network, it *cannot* be configured for GPS time synchronization. Slave nodes synchronize their time *only* to the master node on the Peer-to-Peer network, and reject all other time change requests.

GPS time synchronization uses Serial Port 1 on the TCM.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The Enhanced TCM Setup dialog box appears.
3. Click the Time Sync tab.



4. Under Slot Selection, click Left Slot. You must configure the module in the left slot first.
5. Under Time Synchronization Configuration, select GPS.

   If you previously configured Port 1 to use a Modbus protocol, selecting GPS will reset Port 1 to use the GPS protocol. See Configuring TCM Serial Ports on page 208 for more information.
6. (Optional) If you have a redundant TCM installed in the right slot, under Slot Selection, click Right Slot, and then select GPS Redundant.

   Note The module in the right slot can be configured only if it has been installed (see Configuring TCM Network Ports on page 206) and if the module in the left slot has already been configured for GPS time synchronization.
7. Click OK to save your changes.

Enabling the TCM as a Master Node for Triconex Time Synchronization (Optional)

If you also want the TCM to be able to act as a master node for time synchronization of other controllers on a Peer-to-Peer network (using Triconex Time Synchronization) do the following:

1. In the Configuration tree, click Operating Parameters (see Operating Parameters on page 180).
2. Select the Enable Tricon Node Time Synchronization check box.

Configuring SNTP Time Synchronization on the TCM

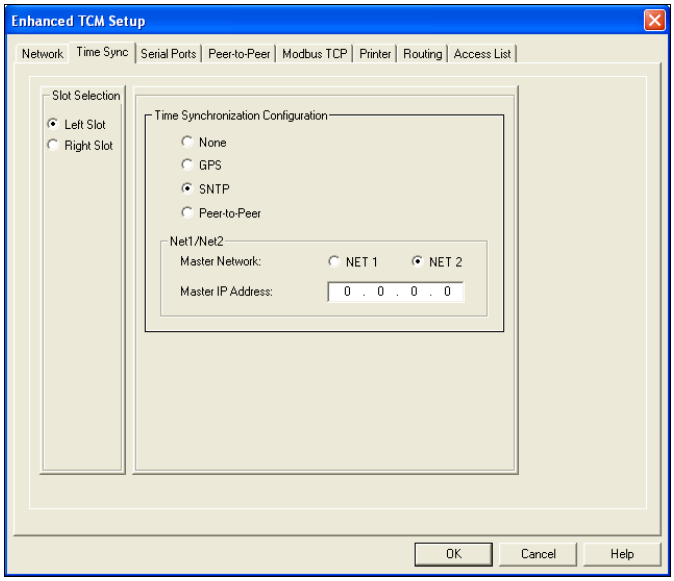
This procedure explains how to configure TCM time synchronization to an SNTP server.

If the TCM is in a Peer-to-Peer network, it can also be used as the master node for time synchronization of other controllers on the network. In this configuration, the master node TCM synchronizes time with the SNTP server, and any slave nodes on the Peer-to-Peer network synchronize their time with the master TCM. In this way, all nodes on the Peer-to-Peer network are synchronized with SNTP time.

If the TCM is acting as a slave node on a Peer-to-Peer network, it *cannot* be configured for SNTP time synchronization. Slave nodes synchronize their time *only* to the master node on the Peer-to-Peer network, and reject all other time change requests.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup. The Enhanced TCM Setup dialog box appears.
3. Click the Time Sync tab.



4. Under Slot Selection, click Left Slot. You must configure the module in the left slot first.
5. Select these properties.

Property	Action
Time Synchronization Configuration	Select SNTP. The default is None.
SNTP Master Network	Click the network the SNTP server is located on.
SNTP Master IP Address	Enter the IP address of the SNTP server to synchronize time with.

6 (Optional) If you have a redundant TCM installed in the right slot, under Slot Selection, click Right Slot, and then select these properties.

Property	Action
Time Synchronization Configuration	Select SNTP Redundant.
SNTP Master Network	Click the network the SNTP server is located on. This can be different than the master network selected for the left slot.
SNTP Master IP Address	Enter the IP address of the SNTP server to synchronize time with.

Note The module in the right slot can be configured only if it has been installed (see Configuring TCM Network Ports on page 206) and if the module in the left slot has already been configured for SNTP time synchronization.

7 Click OK to save your changes.

Enabling the TCM as a Master Node for Triconex Time Synchronization (Optional)

If you also want the TCM to be able to act as a master node for time sychronization of other controllers on a Peer-to-Peer network (using Triconex Time Synchronization) do the following:

1 In the Configuration tree, click Operating Parameters (see Operating Parameters on page 180).

2 Select the Enable Tricon Node Time Synchronization check box.

Configuring Triconex Time Synchronization on the TCM

In a Peer-to-Peer network, Triconex Time Synchronization can be used to synchronize time across controllers on a network. The controller with the lowest node number serves as the master node.

The master node can also synchronize its time with a GPS or an SNTP server. In this configuration, the master node synchronizes time with the GPS or SNTP server, and any slave nodes on the Peer-to-Peer network synchronize their time with the master node. In this way, all nodes on the Peer-to-Peer network are synchronized with GPS or SNTP time.

Note Currently, when a Trident controller is on a Peer-to-Peer network using Triconex Time Synchronization, with a Tricon TCM acting as a master node, the Trident will not correctly synchronize its time to the master node.

Configuring a Master Node

This procedure describes how to configure the TCM as a master node on the Peer-to-Peer network when GPS or SNTP time synchronization is **not** being used.

If you want the master node to synchronize to a GPS or SNTP server, use the procedures in the these sections:

- Configuring SNTP Time Synchronization on the TCM on page 231
- Configuring GPS Time Synchronization on the TCM on page 229

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup. The Enhanced TCM Setup dialog box appears.
3. Click the Time Sync tab.
4. Under Time Synchronization Configuration, select None.
5. Click OK to save your changes.
6. In the Configuration tree, click Operating Parameters (see Operating Parameters on page 180).
7. Select the Enable Tricon Node Time Synchronization check box.

   This allows the controller to participate as a master node in time synchronization across the Peer-to-Peer network.

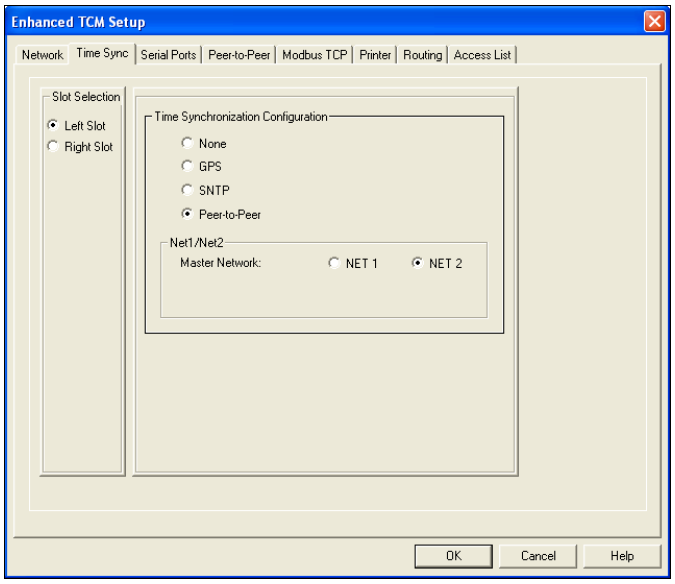
Configuring a Slave Node

This procedure describes how to configure the TCM as a slave node on the Peer-to-Peer network.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The Enhanced TCM Setup dialog box appears.
3. Click the Time Sync tab.



4. Under Slot Selection, click Left Slot. You must configure the module in the left slot first.
5. Specify these properties.

Property	Action
Time Synchronization Configuration	Select Peer-to-Peer. The default is None.
Peer-to-Peer Master Network	Click the network you want to enable Triconex Time Synchronization for. The default is NET 2.This property applies to the modules installed in both the left and right slots simultaneously.

   Note If you have a redundant TCM installed in the right slot, Time Synchronization Configuration is automatically set to Peer-to-Peer and cannot be changed.
6. Click OK to save your changes.
7. In the Configuration tree, click Operating Parameters (see Operating Parameters on page 180).
8. Select the Enable Tricon Node Time Synchronization check box.

   This allows the controller to participate as a slave node in time synchronization across the Peer-to-Peer network.

Trident Time Synchronization

This section explains how to use the Time Synchronization communication protocol with Trident controllers. Time synchronization enables a network of Triconex controllers to synchronize time with each other or with external devices.

Topics include:

About Trident Time Synchronization

This table summarizes the ways Trident controller time can be synchronized to an external device or to the Trident master node in a Peer-to-Peer network.

Table 30 Trident Time Synchronization

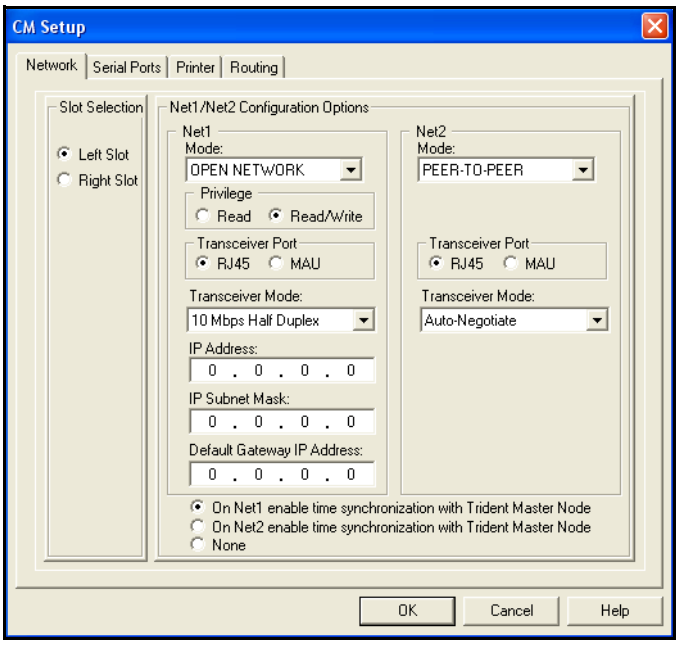
Module	Time Synchronization Feature
CM	• To an OPC client. For more information, see the *Tricon Communication Guide*. • By writing aliased data to the TIMESET or TIMEADJ function blocks in a TriStation application. For assistance with the specialized programming that is required, contact Technical Support. • To the Trident master node.
MP	• By writing aliased data to the TIMESET or TIMEADJ function blocks in a TriStation application. For assistance with the specialized programming that is required, contact Technical Support.

Using a Trident CM to Synchronize Time

This procedure explains how to use a Trident CM to synchronize Trident controllers to the master node in a Peer-to-Peer network.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the CM slot, click Setup, and then click the Network tab.



3. Specify this property on the CM Setup screen.

Property	Action
Time Synchronization	• Select the On NET 1 enable time synchronization with Tricon Master Node check box. • Select the On NET 2 enable time synchronization with Tricon Master Node check box.

4. Click OK to save your changes.

Trident System and Module Attributes

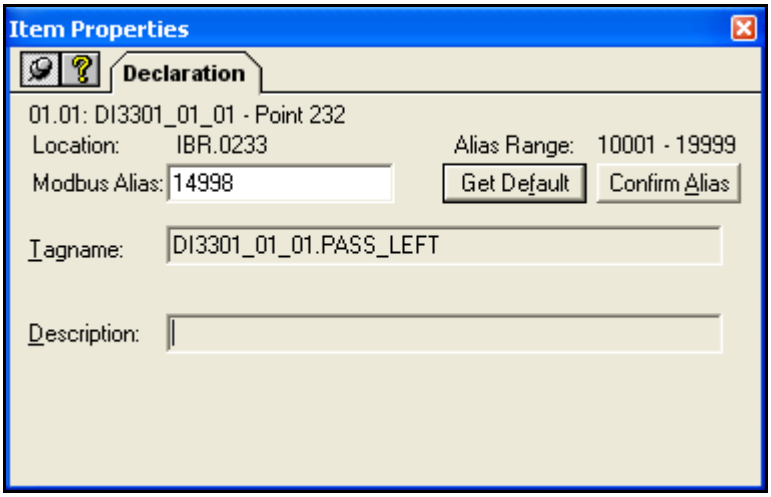
Trident system and module attributes are variables that can be used to monitor status and control Trident operations. You can add an alias number so the variable can be read or written to.

Specifying an Alias Number for a Trident Attribute

This procedure explains how to specify an alias number for a system or module attribute, which allows you to read or write to the attribute.

Procedure

1. Expand the Controller tree and double-click Configuration.
2. Expand Status Attributes and double-click the attribute to be assigned an alias.



3. Click Get Default, or enter a number for the Modbus Alias and click Confirm Alias.

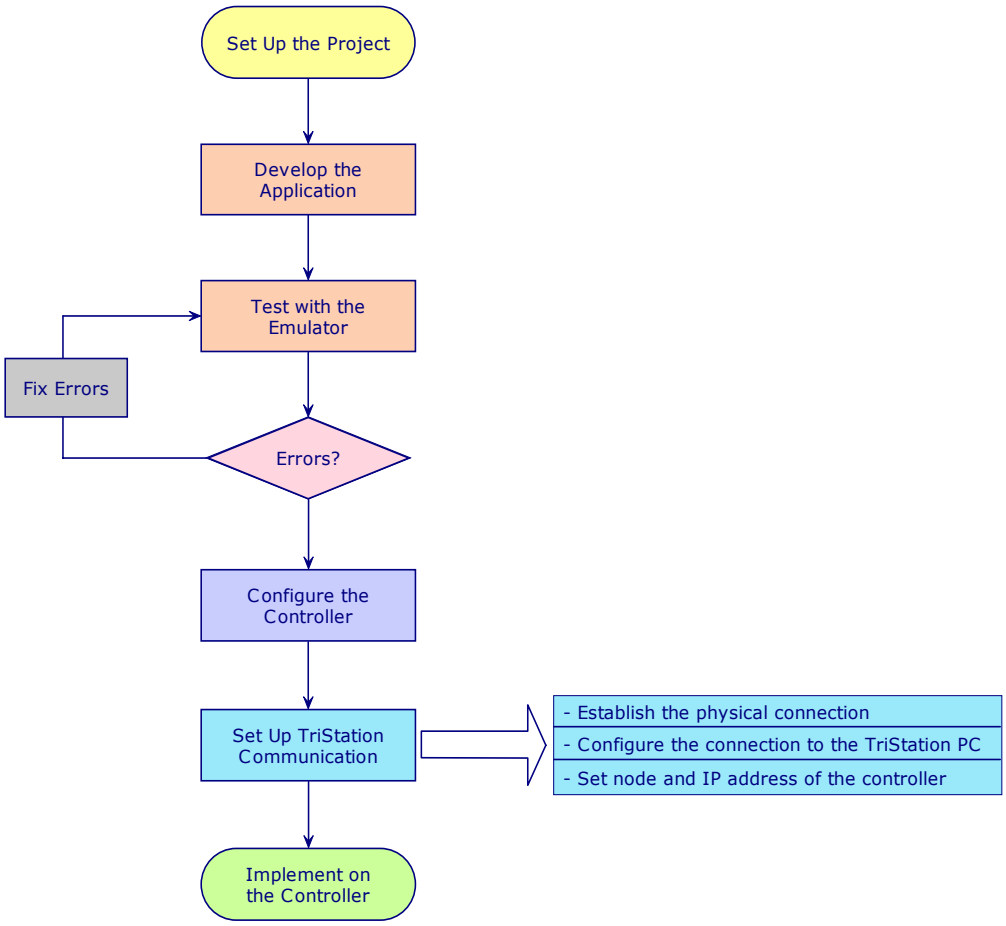
   The alias number is assigned to the attribute.

4

TriStation 1131 Communication

Overview

This figure shows the main steps for setting up TriStation 1131 communication and the typical order in the project cycle. Communication setup can be done anytime before implementation.



TriStation 1131 Communication Steps

This checklist includes the items that can be or should be performed to set up communication between a TriStation PC and a Triconex controller.

	Description	See
❒	Connect to a Tricon EICM	Tricon Serial Connection on page 246
❒	Connect to a Tricon ACM, NCM or TCM	Tricon Network Connection on page 249
❒	Connect to a Trident MP	Trident MP Network Connection on page 256
❒	Connect to a Trident CM	Trident CM Network Connection on page 261
❒	Configure user access to the Tricon TCM	Controlling Access to the TCM on page 267
❒	Set up printing	Tricon Printing on page 273 Trident Printing on page 280

TriStation PC Setup

This section explains the setup required for a network connection from the TriStation PC. Topics include:

Installing a NIC Card in a TriStation PC

This procedure explains how to install a network interface card (NIC) in a TriStation PC to be connected to a Tricon ACM, NCM, or TCM, or to a Trident MP or CM.

Procedure – Tricon TCM

1. Install the network interface card by following the manufacturer's instructions. *Do not change the factory default settings on the NIC card.*
2. Do one of the following:
   - If the network interface card has an RJ-45 connector, you can connect it to the NET 1 or NET 2 port on the TCM (model 4351/4351A) via a router or hub using a patch cable.
   - If the network interface card has a MTRJ (fiber) connector, you can connect it to the NET 1 or NET 2 port on the TCM (model 4352/4352A) via a router or hub using a patch cable.
   - If the network interface card does not have the appropriate connector for your TCM model, connect the network interface card to a media converter that is connected to the NET 1 or NET 2 port.

   Note See the *Communication Guide for Tricon v9–v10 Systems* for more information about the differences between the TCM model 4351/4351A (copper) and model 4352/4352A (fiber).
3. Run the diagnostics provided with the network interface card according to the manufacturer's instructions.

Procedure – Tricon ACM or NCM

1. Install the network interface card by following the manufacturer's instructions. *Do not change the factory default settings on the NIC card.*
2. Do one of the following:
   - If the network interface card has a BNC connector, you can connect it directly to the NET 2 port.
   - If the network interface card does not have a BNC connector, connect the network interface card to a media converter that is connected to the NET 2 port.
3. Run the diagnostics provided with the network interface card according to the manufacturer's instructions.

Procedure – Trident MP or CM

1. Install the network interface card by following the manufacturer's instructions. *Do not change the factory default settings on the NIC card.*
2. Connect the network interface card directly to an MP port on the Trident controller or to an Ethernet hub.
3. Run the diagnostics provided with the network interface card according to the manufacturer's instructions.

Installing DLC or TCP/IP Protocol on a TriStation PC

These procedures explain how to install DLC or TCP/IP protocol on a TriStation PC.

- The DLC protocol is required for Trident MP connection, and for using TriStation on a Windows XP workstation.
- The TCP/IP protocol is required for Tricon ACM, NCM, TCM, and Trident CM connection.

Installing TCP/IP or DLC on Windows 2000

1. On the Start menu, click Settings, then click Network and Dial-up Connections.
2. Right-click the network connection where you want to install the protocol, then click Properties.
3. Do one of the following:
   - On the Networking tab, if the protocol is checked on the list of installed components, it means the protocol is installed and you are finished with this procedure.
   - If the protocol is not checked, go to the next step to continue the installation.
4. Click Install, click Protocol, then click Add.
5. On the Select Network Protocol screen, click the protocol on the Network Protocol list, and then click OK.
6. Verify the check box for the protocol is checked, and then click OK.

Installing TCP/IP on Windows XP

1. On the Start menu, click Control Panel, and then double-click Network Connections.
2. Right-click the network connection where you want to install the protocol, then click Properties.
3. Do one of the following:
   - On the General tab, if the TCP/IP protocol is checked on the list of installed components, it means the protocol is installed and you are finished with this procedure.
   - If the TCP/IP protocol is not checked, go to the next step to continue the installation.

4 On the General tab, click Install.

5 In the Select Network Component Type dialog box, click Protocol, and then click Add.

6 Click the TCP/IP protocol, and then click OK.

Installing DLC on Windows XP

Installing the DLC protocol on a Windows XP workstation is a 3-step process.

Note If you have already installed the DLC protocol on your workstation, you can configure it to start automatically each time you start your workstation by changing a registry value. Go to HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Services\Dlc, and then change the Start value to 1.

Step 1: Download the DLC Protocol Installation Program

1 Open your Internet browser, and enter the following URL in the address field: http://www.microsoft.com/downloads/

2 In the Search for a Download section, perform a search for "DLC Protocol" and then go to the download page for the DLC protocol for Windows XP.

3 Follow the instructions on the download page to start the download process.

4 When prompted, save the dlc.exe file to your local drive.

5 When the download is complete, double-click the self-extracting dlc.exe file to unzip the five DLC protocol files.

Save the files to a location on your local drive that will be easy to remember (for example, C:\DLC).

Step 2: Modify the .INF File

1 Go to the location where you saved the DLC protocol files in step 4 of the previous section.

2 Right-click on NetDLC.inf, and select Open with from the shortcut menu that appears. Then select Notepad from the Open with dialog box and click OK. The .inf file opens in Notepad.

3 Scroll down until you see the following section:

```
;------------------------------------------------------------------------
; DLC Service Definitions and Settings
;------------------------------------------------------------------------
[DLC_Service_Inst]
DisplayName     = %DLC_Desc%
ServiceType     = 1 ;SERVICE_KERNEL_DRIVER
StartType       = 3 ;SERVICE_MANUAL_START
ErrorControl    = 1 ;SERVICE_ERROR_NORMAL
ServiceBinary   = %12%\dlc.sys
AddReg          = AddReg_Service_Inst
Description     = %DLC_Desc%

[AddReg_Service_Inst]
HKR,"Parameters",,%FLG_ADDREG_KEYONLY%,
```

4 Change the value for StartType from 3 to 1. This ensures that the DLC protocol will start automatically each time you start your workstation.

5 Save the file and then exit Notepad.

Step 3: Configure the DLC Protocol Network Connection

1. Go to the location where you saved the DLC protocol files in Step 1.
2. Double-click install.cmd to start the installation script.
3. On the Start menu, click Control Panel, and then double-click Network Connections.
4. Right-click the network connection where you want to install the protocol, then click Properties.
5. On the General tab, click Install.
6. In the Select Network Component Type dialog box, click Protocol, and then click Add.
7. Click the DLC Protocol, and then click OK.
8. Once installation is complete, you can close the Network Connections dialog box.

Tricon Serial Connection

This section explains how to make a direct (point-to-point) serial connection between a Tricon EICM or TCM and a TriStation PC. You cannot use both an EICM and TCM module in the same Tricon system. Additionally, the TCM can be used only with a Tricon v10 controller.

By default, both the EICM and the TCM use port 4 for the TriStation connection. Triconex strongly recommends you use the default setting. If port 4 on the EICM fails, port 1, 2, or 3 can be used by changing settings on the module switch block. If port 4 on the TCM fails, you can connect to TriStation using the NET 1 or NET 2 port; see the *Communication Guide for Tricon v9–v10 Systems* for more information.

Topics include:

Connecting a Tricon Serial Port to a TriStation PC

This procedure explains how to connect a Tricon EICM or TCM serial port to a TriStation PC.

Triconex provides a serial cable that has a 9-pin connector on each end. If the COM port on the PC has a 25-pin connector, you can use a Triconex 25-pin to 9-pin adapter. If you need other parts, you can purchase them from another manufacturer. For more information, see the *Communication Guide for Tricon v9–v10 Systems*.

Procedure

1. Connect one end of the serial cable to a serial port on the EICM or TCM. This is typically port 4.
2. Connect the other end of the serial cable to a COM port on the TriStation PC. The COM port is typically numbered COM1, COM2, COM3, or COM4.

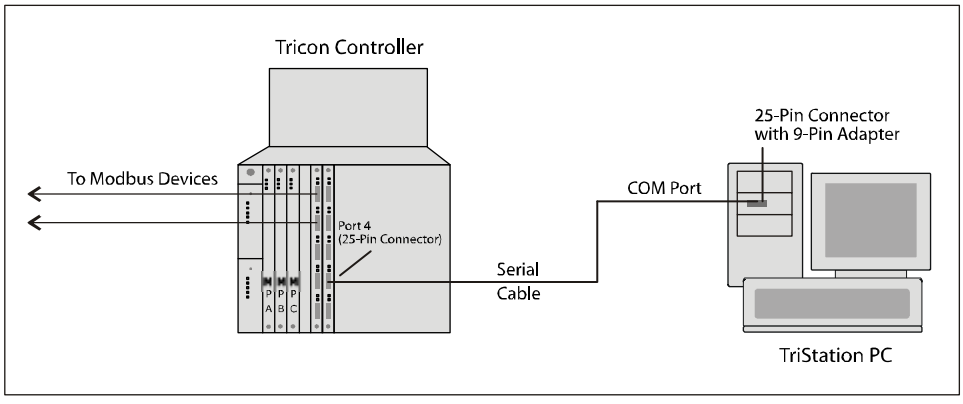


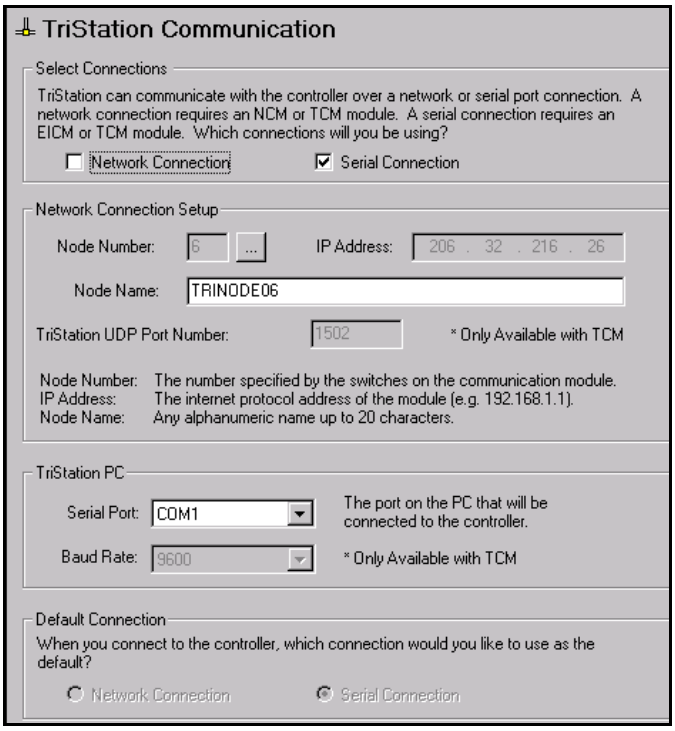
Figure 25 Connecting a Tricon Serial Port to the TriStation PC

Configuring a Tricon Serial Connection

This procedure explains how to configure a Tricon EICM or TCM serial port that is connected to a TriStation PC.

Procedure

1 Expand the Controller tree, double-click Configuration, and then click TriStation Communication.



2 Specify these properties on the TriStation Communication screen.

Note The data displayed on the screen is used by TriStation only to connect to a Tricon communication port. The data that you enter will not be downloaded to the Tricon controller.

Property	Action
Serial Connection	Select this check box.
Node Name	Enter the name of the Tricon controller. You can use a default name, or enter your own user-defined name. The default names are TRINODE01 through TRINODE31.
Serial Port	Select the COM port on the TriStation PC to which the serial cable is connected.
Baud Rate	Specify the data transmission speed. The default is 9600.

3 On the Configuration tree, expand Hardware Allocation, double-click EICM or TCM, and then click Setup.

4 Specify these properties in the EICM dialog box or the Serial Ports tab of the Enhanced TCM Setup dialog box.

Property	Action
Port	Select the port that the TriStation PC is attached to. The default TriStation connection is port 4. For TCM, you **must** select port 4, as this is the only serial port supported for TriStation connection.
Protocol	Select TriStation.

5 Click OK.

Tricon Network Connection

This section explains how to make a network connection between a ACM, NCM, or TCM communication module and a TriStation PC. This can be a direct connection from the communication module to the PC, or a connection through a router, hub, or media converter. A router or hub is not required if you do not need to connect any additional devices besides the TCM and the PC. You cannot use both an NCM and TCM module in the same Tricon system.

To set up the connection, you must:

- Install a network interface card and the TCP/IP protocol on the PC.
- Set the node number of the controller.
- Connect the PC to a network port on the communication module.
- Configure the connection in the TriStation 1131 project.

CAUTION

The node setting (on the ACM or NCM module or the 3008 MP Front Panel) must match the node number specified in the TriStation project. See the *Planning and Installation Guide for Tricon v9-v10 Systems* for instructions on changing the MP node setting.

For instructions on installing a network interface card and the TCP/IP protocol on the TriStation PC, see TriStation PC Setup on page 242.

Topics in this section include:

Note If you are connecting the TCM or EICM to the TriStation PC via serial port, see Tricon Serial Connection on page 246.

Directly Connecting an ACM or NCM Network Port to a TriStation PC

This procedure explains how to directly connect an ACM or NCM to a TriStation PC if the network interface card in the PC has a BNC connector.

The connection requires a 10Base2 coaxial cable. Triconex provides an accessory kit that includes a 10Base2 coaxial cable, BNC T-connectors, and 50-ohm terminators for unused connectors (see the *Communication Guide for Tricon v9-v10 Systems* for more information).

Procedure

1. To each end of a 10Base2 cable, attach a BNC T-connector and a terminator.
2. Attach one of the T-connectors to a BNC connector on NET 2 of the communication module. An NCM is used as an example in the following figure.
3. Attach the other T-connector to the BNC connector on the network interface card in the TriStation PC.

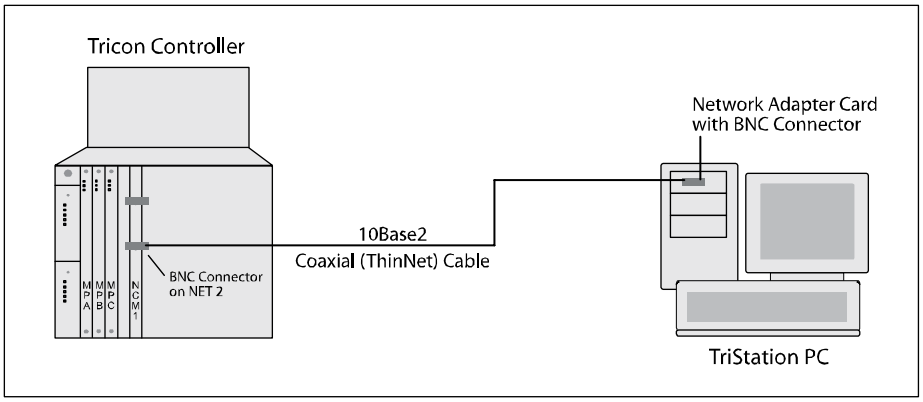


Figure 26 Directly Connecting an ACM or NCM to a TriStation PC

4. Terminate the BNC connectors on all communication modules that are installed in the Tricon controller.
5. To terminate an unused BNC connector, you can attach a T-connector with 50-ohm terminators on each end to produce a 25-ohm parallel resistance. Ask your network administrator for information about other termination methods.

Connecting a TCM Network Port to a TriStation PC Using a Router or Hub

This procedure explains how to connect a TCM to a TriStation PC if the network interface card in the PC has an RJ-45 connector or a MTRJ fiber connector. You must use an Ethernet router or hub between the Tricon and the TriStation PC.

The RJ-45 connection requires twisted-pair straight-through cables. The fiber connection requires 62.5/125 um multimode fiber cables. See the *Communication Guide for Tricon v9–v10 Systems* for more information about the required cables and how some may be purchased from Triconex.

Procedure

1. Attach one end of the first cable to the NET 2 port on the TCM.
2. Attach the other end of the first cable to the connector on the Ethernet router or hub.
3. Attach one end of the second cable to the connector on the network interface card in the TriStation PC.
4. Attach the other end of the second cable to the connector on the router or hub.

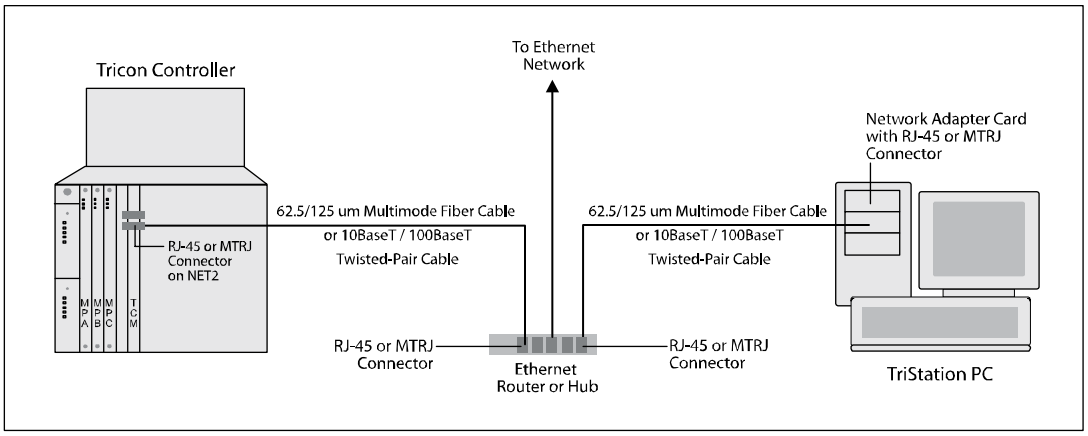


Figure 27 Connecting a TCM (Copper or Fiber) to a TriStation PC Using a Router or Hub

If the correct cable is connected to the TCM and the TCM is installed in a powered Tricon chassis, the green LED indicator turns on. If the LED indicator is not on, there is a problem with the physical cable connection.

Connecting a Tricon Network Port Using a Media Converter

This procedure explains how to connect an ACM, NCM, or TCM to a TriStation PC if the network interface card in the PC requires a media converter because it does not have the appropriate connector.

- The connection to an ACM or NCM requires a 10Base2 cable, a media converter, and another appropriate cable, such as a twisted-pair cable.
- The connection to a TCM (model 4352/4352A - Fiber) requires a 62.5/125 um multimode fiber cable, a media converter, and another appropriate cable, such as a twisted-pair cable.

Procedure for Connecting an ACM or NCM

1. To each end of a 10Base2 cable, attach a BNC T-connector and a terminator.
2. Attach one of the T-connectors to a BNC connector on the NET 2 port on the communication module.
3. Attach the other T-connector to a BNC connector on the media converter.

   For the TriStation PC, you can use a 10BaseT or 100BaseTX twisted-pair cable for faster communication.
4. Attach one end of the twisted-pair cable to an RJ-45 connector on the network interface card in the TriStation 1131 PC.
5. Attach the other end of the twisted-pair cable to an RJ-45 connector on the media converter.

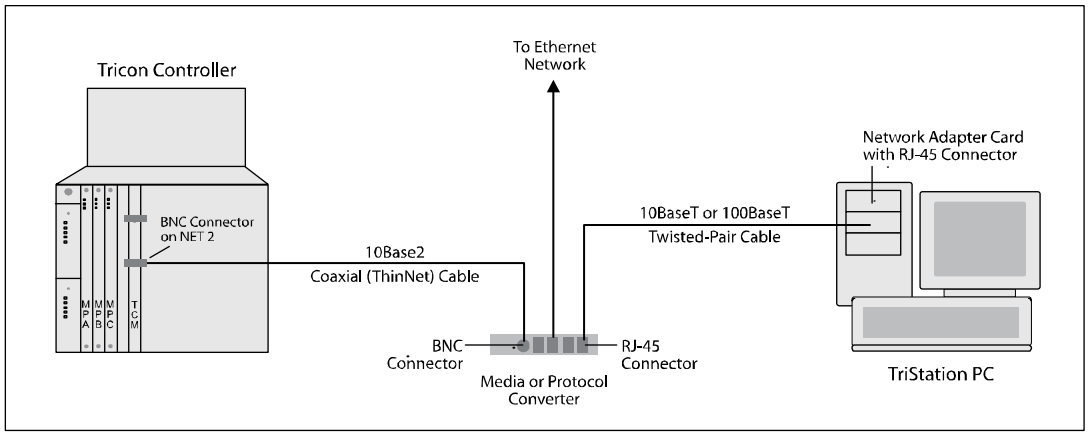


Figure 28 Connecting an ACM or NCM to the TriStation PC Using a Media Converter

Procedure for Connecting a TCM (Model 4352/4352A - Fiber)

1. Attach one end of the fiber cable to the NET 1 or NET 2 port on the TCM.
2. Connect one end of the twisted-pair cable to the RJ-45 connector on the network interface card in the TriStation PC.
3. Attach the other end of the twisted-pair cable to an RJ-45 connector on the media converter.
4. Attach the other end of the fiber cable to a MTRJ fiber connector on the media converter.

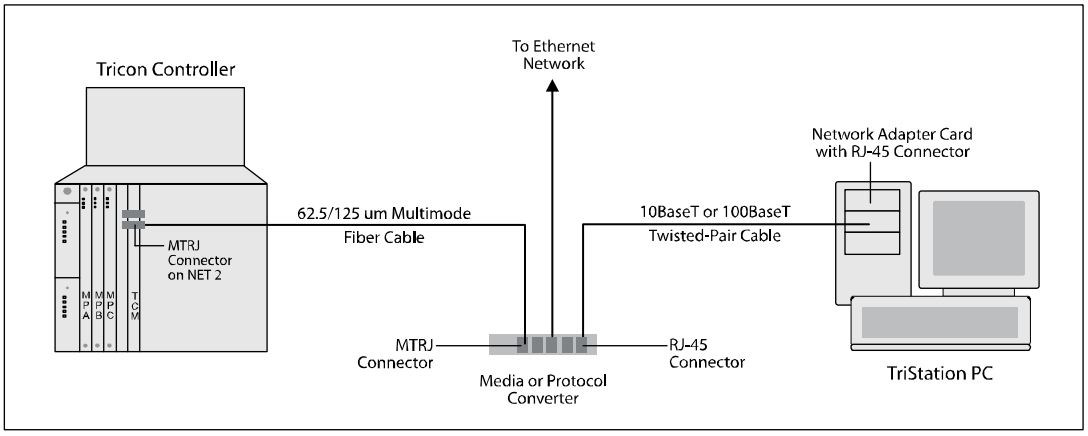


Figure 29 Connecting a TCM (Model 4352/4352A) to the TriStation PC Using a Media Converter

If the correct cable is connected to the TCM and the TCM is installed in a powered Tricon chassis, the green LED indicator turns on. If the LED indicator is not on, there is a problem with the physical cable connection.

Configuring the TriStation Network Connection

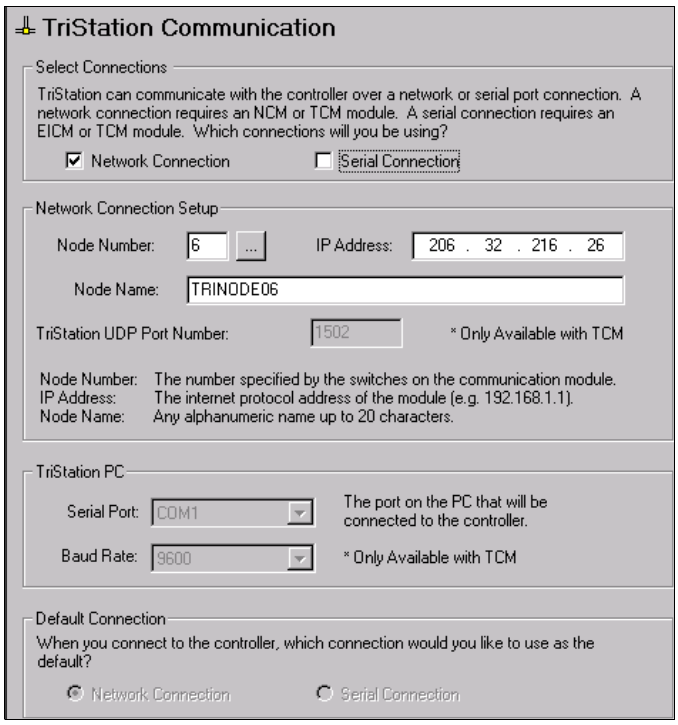
This procedure explains how to configure an ACM, NCM, or TCM network connection to a TriStation PC.

Before You Begin

Before beginning this procedure, you must determine which IP address to use for the communication module. Typically, you can get an IP address from your network administrator or Information Technology department.

Procedure

1. In TriStation 1131, expand the Controller tree, and double-click Configuration.
2. On the Configuration tree, click TriStation Communication.



3. Specify these properties on the TriStation Communication screen.

Note The data displayed on the screen is used by TriStation only to connect to a Tricon communication port. The data that you enter will not be downloaded to the Tricon controller.

Property	Action
Network Connection	Select the Network Connection check box.
Node Number	For the ACM and NCM, enter the number represented on the rotary switches. For TCM, enter the number represented by the Network Node Address setting on the MP front panel.

Property	Action
Node Name	Enter a name containing eight or fewer characters to identify the Tricon controller.
IP Address	Enter the physical address of the controller on the network.

4 On the Configuration tree, click the chassis that contains the ACM, NCM, or TCM.

5 Double-click the module to open the Properties dialog box, and then click Setup.

6 Specify these properties on the ACM, NCM, or TCM Network Setup screen.

Property	Action
Installed (NCM and TCM) Used (ACM)	Select this property for all installed modules.
IP Address	If using a default IP address, leave blank. If not, enter the IP address that identifies the controller on the network. This must be the same IP address entered on the TriStation Communication screen.
IP Subnet Mask	If using a default IP Subnet Mask, leave blank. For ACM or TCM, get the subnet mask from your network administrator. For NCM, do not change the default setting (eight zeroes).

7 Click OK.

Trident MP Network Connection

This section explains how a Trident MP can be used for a network connection to a TriStation PC which uses the DLC protocol. This can be a direct connection from the MP to the PC, or a connection through a hub on a network.

To set up the connection you must install a network interface card and DLC protocol on the PC. For more information, see TriStation PC Setup on page 242. For information on setting the node number of the controller, see the *Trident Communication Guide*. For instructions on connecting and configuring the connection, see procedures in this section.

CAUTION

The node setting which is physically set on the MP Baseplate must match the node number specified in the TriStation project.

Topics in this section include:

Directly Connecting a Trident MP to a TriStation PC

This procedure explains how to directly connect a TriStation PC to a network port on a Trident MP Baseplate using a 10BaseT cross-over cable.

Procedure

1. Attach one end of the cross-over cable to one of the RJ-45 connectors on the MP Baseplate. This is typically MP A, as shown in the figure.
2. Attach the other end of the cross-over cable to the network interface card in the PC.

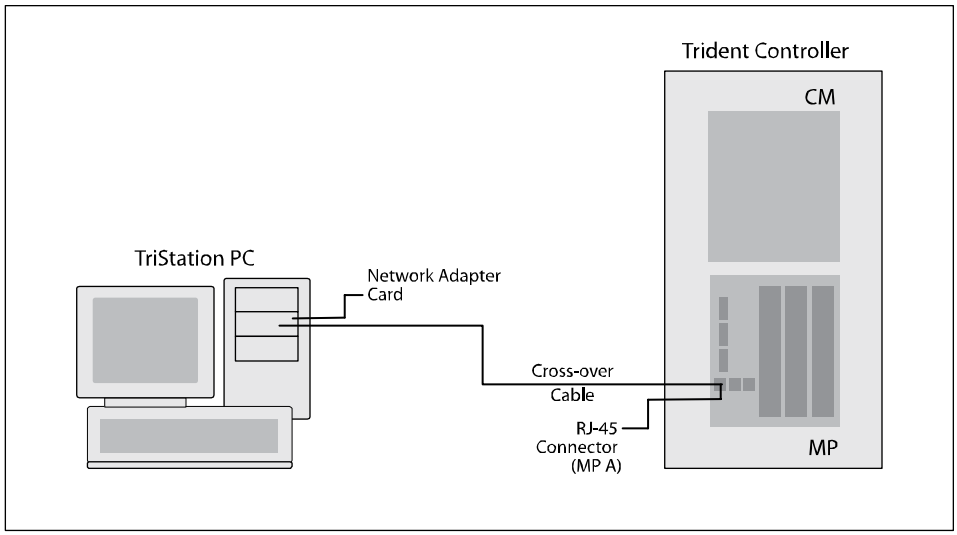


Figure 30 Connecting the TriStation PC to a Trident Main Processor

Connecting a Trident MP to a TriStation PC Using a Hub

This procedure explains how to connect a Trident MP to a TriStation PC using a 10BaseT straight-through cable and a hub.

Procedure

1. Attach at least one 10BaseT straight-through cable from an RJ-45 connector on an MP Baseplate to the hub.

   Note Using more than one cable provides redundancy for the TriStation connection. If you use only one cable during live operation, you have to unplug it and move it to another RJ-45 connector if the original connection fails.

2. Attach the network interface card in the TriStation PC to the hub using another 10BaseT straight-through cable.

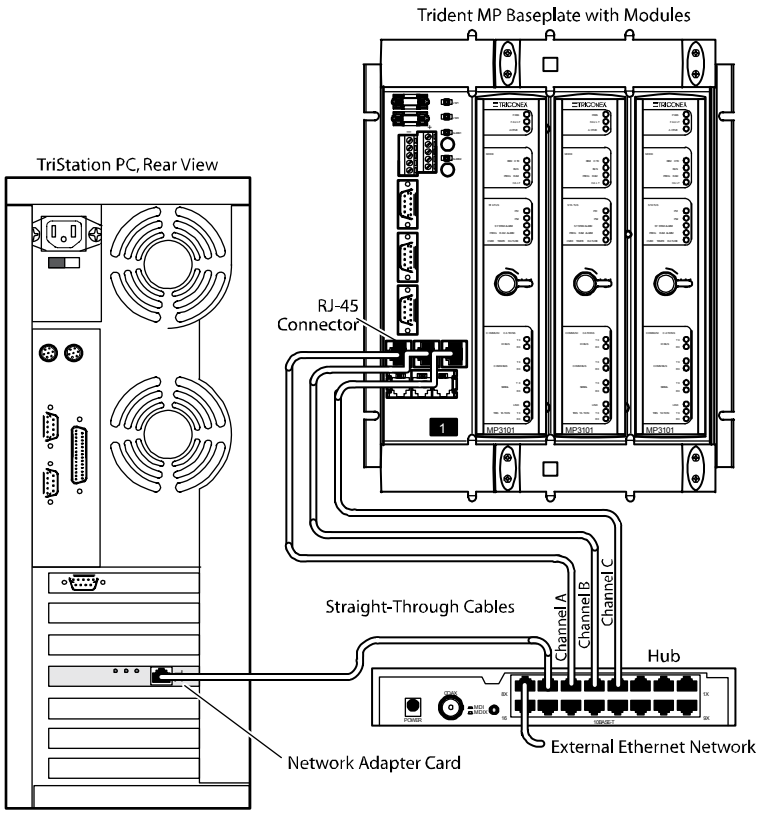


Figure 31 Connecting the TriStation PC to the Trident Main Processor Using a Hub

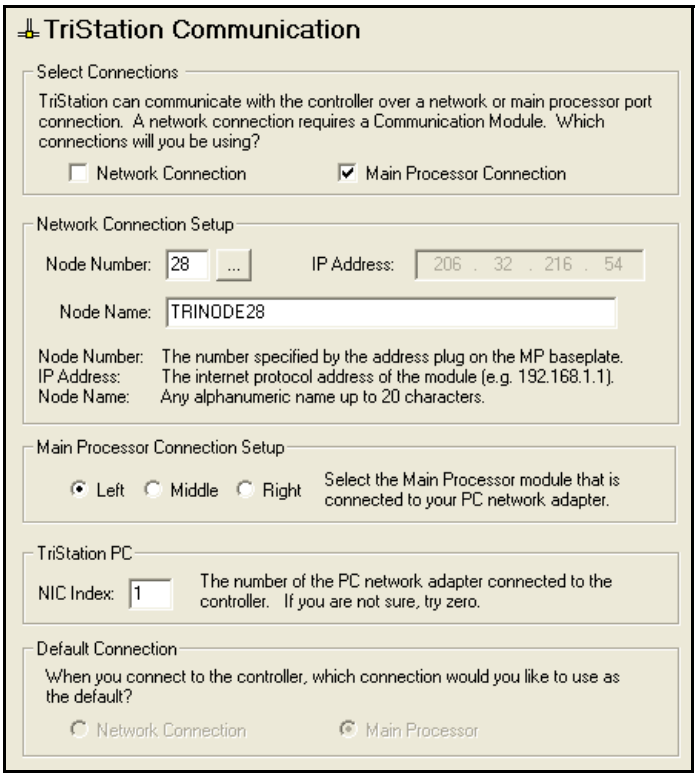
Configuring a Trident MP Connection to a TriStation PC

This procedure explains how to configure a Trident MP connection to a TriStation PC.

Procedure

1 Expand the Controller tree, and double-click Configuration.

2 On the Configuration tree, click TriStation Communication.



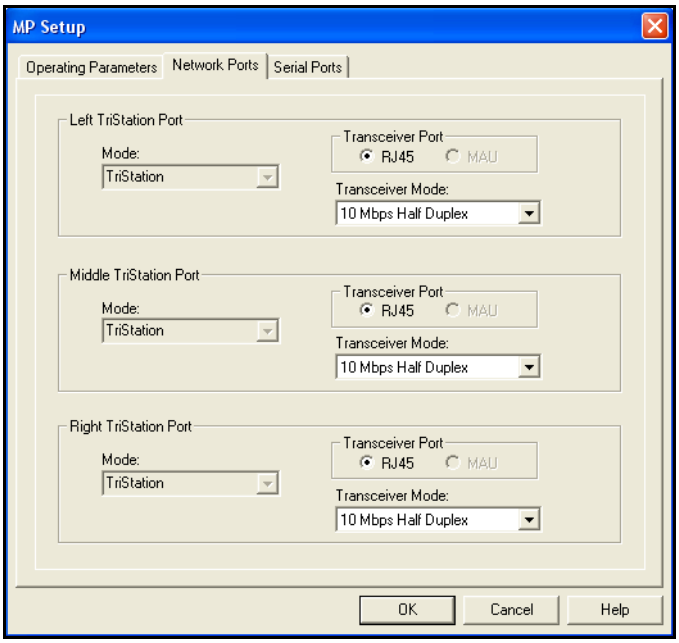
3 Specify these properties on the TriStation Communication screen.

Property	Action
Main Processor Connection	Select the Main Processor Connection check box.
Node Number	Enter the number specified on the address plug on the MP Baseplate.
Node Name	Enter a name with eight or fewer characters to identify the Trident controller.
Main Processor Setup	Select Left, Middle, or Right to specify which MP port is connected to the TriStation PC.
NIC Index	Enter the index position of the network interface card in the TriStation PC.

4 On the Configuration tree, expand Hardware Allocation, and then double-click the Main Processors (MP/IOP1).

5 In the Properties dialog box, click Setup.

6 In the MP Setup dialog box, click the Network Ports tab.



7 For the port that is physically connected to TriStation PC (Left, Middle, or Right) specify the Transceiver Mode to match the installed hardware.

8 Click OK to save your changes.

Trident CM Network Connection

This section explains how to configure a CM connection to the TriStation PC.

To set up the connection you must install a network interface card and TCP/IP protocol on the PC. For more information, see TriStation PC Setup on page 242. For information on setting the node number of the controller, see the *Trident Communication Guide*. For instructions on connecting and configuring the connection, see the procedures in this section.

CAUTION The node setting which is physically set on the MP Baseplate must match the node number specified in the TriStation project.

Topics include:

Directly Connecting a Trident CM to a TriStation PC

This procedure explains how to directly connect a Trident CM to a TriStation PC using a cross-over cable.

For a NET 1 port, you must use a 10BaseT cable. For a NET 2 port, you can use either a 10BaseT or 100BaseTX cable. On the CM baseplate, you can attach the cable to an RJ-45 connector or to a MAU. For information about MAUs, see the *Trident Communication Guide*.

Procedure

1. Attach one end of a cross-over cable to a NET 1 or NET 2 connector on the CM baseplate, as shown in this example.
2. Attach the other end of the cross-over cable to the network interface card in the TriStation PC.

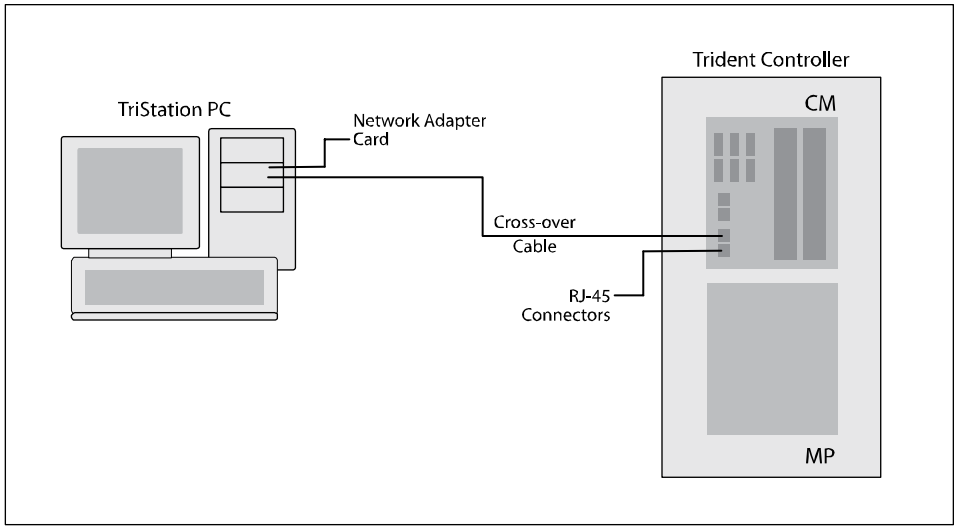


Figure 32 Connecting the TriStation PC Directly to a Trident CM

Connecting a Trident CM to a TriStation PC Using a Hub

This procedure explains how to connect a Trident CM to a TriStation PC using a straight-through cable and a hub.

For a NET 1 port, you must use a 10BaseT cable. For a NET 2 port, you can use either a 10BaseT or 100BaseTX cable. On the CM baseplate, you can attach the cable to an RJ-45 connector or to a MAU. For information about MAUs, see the *Trident Communication Guide*.

Procedure

1. Attach one end of a straight-through cable to a NET 1 or NET 2 connector on the CM baseplate.
2. Attach the other end of the straight-through cable to a network hub, as shown in the example below.
3. Connect the TriStation PC to the hub using another straight-through cable.

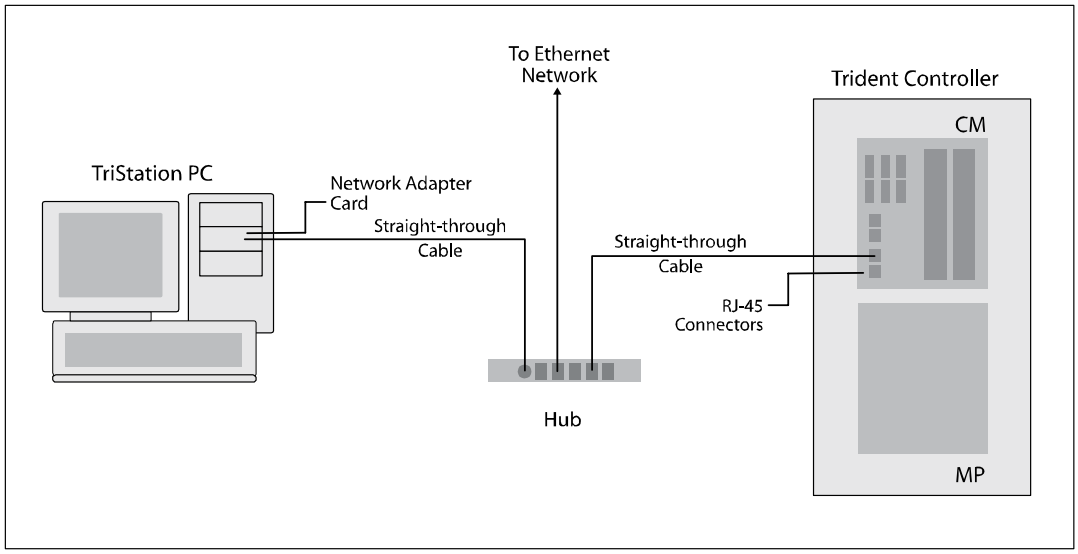


Figure 33 Connecting the TriStation PC to a Trident CM Using a Hub

Configuring a Trident CM Connection

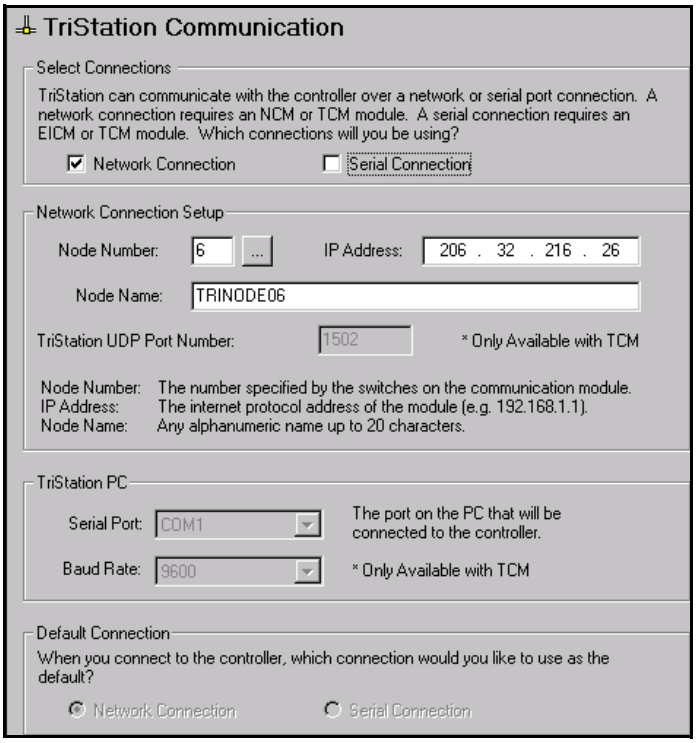
This procedure explains how to configure a Trident CM connection to a TriStation PC.

Before You Begin

Before you begin this procedure, you must determine the IP address to use for the CM. If the connection goes through a gateway or a router, you also need IP addresses for those devices. Typically, you can get the necessary IP addresses from your network administrator or Information Technology department.

Procedure

1. Expand the Controller tree, and double-click Configuration.
2. On the Configuration tree, click TriStation Communication.

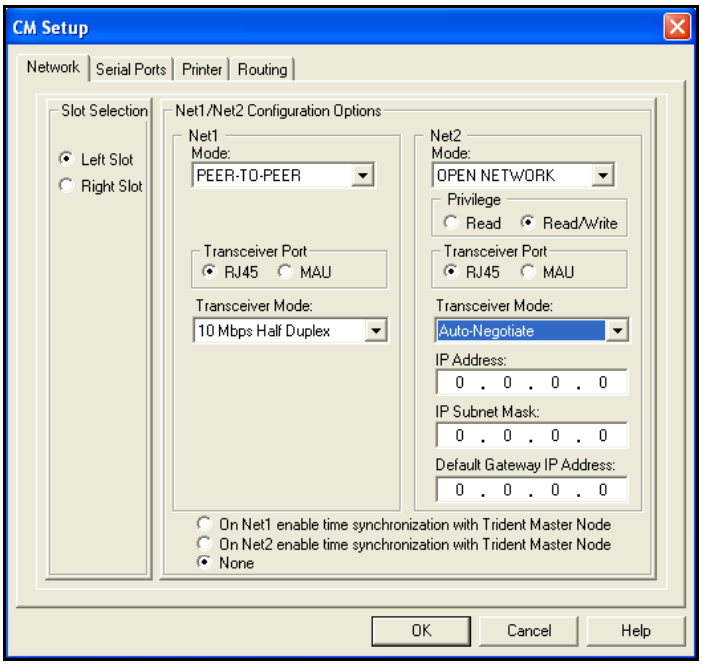


3. Specify these properties on the TriStation Communication screen.

Property	Action
Network Connection	Select the Network Connection check box.
Node Number	Enter the number specified on the address plug on the MP baseplate.
Node Name	Enter a name that contains eight or fewer characters to identify the Trident controller.
IP Address	Enter the IP address.
NIC Index	Enter the index position of the network interface card in the TriStation PC.

4 On the Configuration tree, double-click the CM (COM: CM).

5 In the Properties dialog box, click Setup.



6 Specify these properties for the NET 1 or NET 2 port, depending on which is connected to the TriStation PC.

Property	Action
Slot Selection	Select Left Slot or Right Slot, depending on which slot contains the module that is connected to the TriStation PC.
Mode	For the TriStation connection, select Open Network. For each CM on a baseplate, you can select Open Network for either NET 1 or NET 2, but not for both ports.
Privilege	Select Read or Read/Write to specify access privileges for external devices on the network. A TriStation application must use the Privilege option in conjunction with the MP.REMOTE_WRT_ENBL control attribute (and possibly other write controls) to enable writes by external devices.
Transceiver Port	Select RJ-45 or MAU depending on the type of CM baseplate port to which you have physically attached the TriStation cable.
Transceiver Mode	Select the Auto mode if the TriStation cable can auto-negotiate to either 10 or 100 megabits per second. If your cable operates at only one speed, select the appropriate speed from the list.

Property	Action
IP Address	If using the default node number, do not change this property (leave blank). If using a different node number, enter the IP address that identifies the controller on the network. This must be the same address you entered in step 2.
IP Subnet Mask	Get the subnet mask from your network administrator.
Default Gateway IP Address	If the CM connection to the TriStation PC goes through a default gateway, enter the IP address of the gateway.
Time Synchronization	Select None. This property does not apply to TriStation communication.

7 Click OK to save your changes.

Controlling Access to the TCM

The model 4351A and 4352A Tricon Communication Modules (TCMs) give you the ability to control who can access TCM resources through the module's network ports, and the level of access each user has.

What Are TCM Resources?

A *resource* is any service or information provided by the TCM through the supported communications protocols. Examples of these resources include:

- Access to the controller via TriStation (ability to perform a Download Change or Download All)
- Access to Tricon diagnostic information via the Enhanced Diagnostic Monitor
- Access to information provided in applications such as SOE Recorder or DDE Server that use the TSAA protocol
- Access to any other applications that use the TSAA protocol

How Is Access Controlled?

Access is controlled via client IP addresses. You can control access for a single IP address (one client), or for a group of IP addresses (a group of clients).

If you want to group clients into a single access list entry, they must be physically separated in a sub-network, and a *subnet mask* must be used to group them in the access list. A subnet mask of 255.255.255.255 restricts an access list entry so that it applies only to the specific IP address identified in the entry. A subnet mask of 255.255.255.0 applies an access list entry to *any* client on the same subnet as the IP address identified in the entry. Other subnet masks may also be used, depending on your network structure.

For example, if you want two clients with IP addresses of 192.168.1.134 and 192.168.1.65 to share the same access permissions, and there are no other clients on the same subnet, you can group them in the access list by setting the IP address for a single entry as 192.168.1.*x* and the subnet mask to 255.255.255.0.

For each IP address or group of IP addresses, you can set the access level, the protocols the client can use to access the TCM, and the network ports the client can use to access the TCM.

What Are Access Levels?

There are three levels of access:

- **Deny Access:** Prevents all access to resources provided by the TCM. Connections to the Tricon are not allowed.
- **Read Only:** Allows client to connect to the Tricon and view information provided via the TCM. Does not allow the client to change any settings or perform certain commands.

- **Read/Write:** Full access. Allows client to view information provided by the TCM, change settings, and perform all commands (including Download Change or Download All for TriStation). This access level should only be provided to trusted clients.

Access levels are configured by adding entries to the Client Access List. A maximum of 10 entries can be provided in the access list.

The same access level is applied to all selected protocols in a single access list entry. If you want to provide different access levels for a selected client depending on which protocol they are using, you will need to create two separate entries in the access list, one for each protocol.

Access levels apply to *all* users using the PC assigned the IP address entered in the access list. This means if multiple users are using the same PC, they will all have the same access rights. For example, every user using TriStation on a PC with a particular IP address would have the same access rights to the TCM. Individual user access should be controlled via workstation security; TCM access is controlled only at the IP address level.

CAUTION

Once you enable TCM client access control by selecting the Enable Access List check box, you **must** configure at least one client with TriStation Read/Write access.

Failure to do so will prevent you from connecting to the Tricon again after your next download, and you will be unable to make any further changes to the application running on the controller, including changes to the TCM access control list.

If all TriStation clients are accidentally locked out of Read/Write access, you can connect via a TriStation serial connection to reconfigure the access list. See Configuring a Tricon Serial Connection on page 247.

Note If you choose not to enable access list control, you can still manage read/write access to specific ports using the Port Write Enabled property. See Port Write Enabled on page 400.

Sample Access List and Resulting Access Control

The following table is a sample access list, with the access control scenarios that would result if it was enabled on the TCM.

Table 31 Sample TCM Access Control List

Entry	IP Address	Subnet Mask	Protocol	Network	Access Level	Resulting Access Control Scenario
1	206.216.1.12	255.255.255.0	TriStation	NET 2	Read/Write	A client with an IP address of 206.216.1.12 (or any client on the same subnet) attempting to access the TCM using the TriStation protocol on NET 2 would be granted Read/Write access.
2	206.216.1.12	255.255.255.0	TSAA	NET 2	Read Only	A client with an IP address of 206.216.1.12 (or any client on the same subnet) attempting to access the TCM using the TSAA protocol on NET 2 would be granted Read Only access.
3	192.168.1.05	255.255.255.255	TriStation	NET 1 NET 2	Deny Access	A client with an IP address of 192.168.1.05 attempting to access the TCM using the TriStation protocol on NET 1 or NET 2 would be denied access.
4	192.168.1.09	255.255.255.255	TSAA	NET 1 NET 2	Deny Access	A client with an IP address of 192.168.1.09 attempting to access the TCM using TSAA on NET 1 or NET 2 would be denied access.
5	192.168.1.05	255.255.255.0	TSAA	NET 1	Read Only	A client with an IP address of 192.168.1.05 (or any client on the same subnet) attempting to access the TCM using TSAA on NET 1 would be granted Read Only access.
6	192.168.1.05	255.255.255.0	TriStation	NET 2	Read Only	A client with an IP address of 192.168.1.05 (or any client on the same subnet) attempting to access the TCM using the TriStation protocol on NET 2 would be granted Read Only access. [a]
7	192.168.1.09	255.255.255.0	TriStation	NET 1	Read/Write	A client with an IP address of 192.168.1.09 (or any client on the same subnet) attempting to access the TCM using the TriStation protocol on NET 1 would be granted Read/Write access.
8	0.0.0.0	0.0.0.0	All	All	Deny Access	Access is denied for all IP addresses not included in entries 1–7, using any protocol on NET 1 or NET 2.
9	NULL	NULL	NULL	NULL	NULL	None

a. If a client with the specific IP address of 192.168.1.05 attempts to access the TCM using the TriStation protocol on NET 2, the TCM will deny access. This is because the TCM evaluates the access control list beginning from the top, and continuing through the list until it encounters an entry that applies to the IP address requesting access. In this case, entry 3 specifically denies access to a client with the IP address of 192.168.1.05, so the TCM will deny access and not evaluate the list any further.

Configuring the Access List

This section describes how to enable access control on the TCM and configure the access list for your selected clients. This applies *only* to model 4351A and 4352A TCMs; it does not apply to model 4351 or 4352 TCMs.

When configuring the access list, take care to organize your entries so that the most specific are at the top, and the least specific are at the bottom. The last entry in the list should be used to define the access level for unspecified clients.

The TCM evaluates the access control list from top (Entry 1) to bottom (Entry 10). The first match that the TCM makes (between the client's network parameters and those listed in an access list entry) determines which entry is used to authorize or deny access. If no match is found, the TCM automatically denies all access.

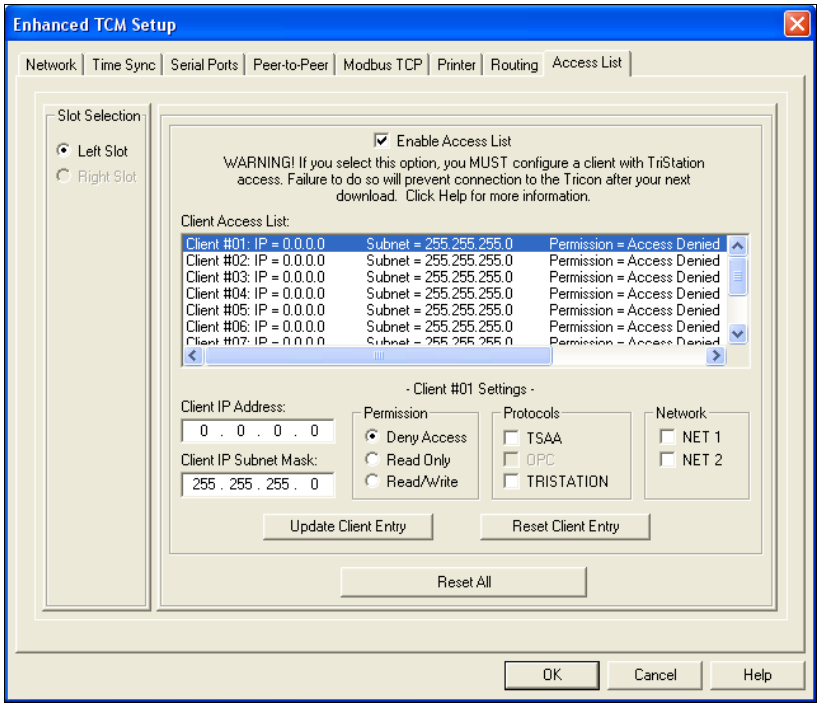
Once you have enabled access control and configured the access list, you must perform a Download Change for the access control to take effect.

Note After a Download Change or Download All has been performed so that access control on the TCM is enabled, all *existing* connections will remain connected, even if the client's access has been changed to Read Only or Deny Access. The new access levels will not take effect until the client disconnects and attempts to reconnect.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The Enhanced TCM Setup dialog box appears.
3. Click the Access List tab.



4 Specify these properties.

Property	Action
Slot Selection	Select the slot where the TCM module you want to configure an access list for is installed. In most cases, you should create identical access lists for the modules in both slots.
Enable Access List Command	Click to enable access control for this TCM. If cleared, access control will be disabled and all users can access TCM resources. The default is cleared.
Client Access List	Click on the entry for the client you want to configure or change.
Client IP Address	Specify the IP address of the client that you want to allow, restrict, or deny access to the TCM. Can be used in conjunction with the Client IP Subnet Mask property to create groups of IP addresses with the same access levels.
Client IP Subnet Mask	This property allows you to group IP addresses, so that you can create a single entry in the client access list for all IP addresses on the subnet. If needed, enter the IP address for the subnet. The default is 255.255.255.0.
Permission	Click the level of access to the TCM you want to provide for the selected client. If the application includes safety-critical outputs, you should not set this property to Read/Write.

Property	Action
Protocol	Select the protocol(s) that the selected client can use to access the TCM. The OPC protocol is not currently supported.
Network	Select the network(s) on which the selected client can access the TCM.

5 Click Update Client Entry to save the settings for the selected client.

6 Repeat steps 4 and 5 for each client to be included in the access list.

Note If necessary, click Reset Client Entry to reset the settings for the *selected* client to the default, unconfigured state. Click Reset All to reset *all* entries in the access list to the default, unconfigured state.

7 If a TCM is installed in the right slot, repeat steps 4 through 6 for that module.

In most cases, you should configure identical access lists for the modules in both slots.

8 Click OK to save your changes.

Tricon Printing

A Tricon controller can print brief ASCII text messages if a communication port is connected to a printer and the TriStation application includes standard print function blocks.

Print messages are typically used for alarms, status, and maintenance. A sample alarm message might include the name of an analog input point, its time stamp and value, and a statement that the value is out of range. If the Tricon system includes numerous controllers or is connected to a DCS, alarms are typically displayed on an operator workstation.

To print from a Tricon controller with a TCM, you must connect a TCM Ethernet port to a print server that is connected to a printer, configure these devices in the TriStation project, and use print function blocks in the TriStation application.

To print from a Tricon controller with an EICM, you must connect an EICM parallel port to a Centronics-compatible printer, configure the port in the TriStation project, and use print function blocks in the TriStation application.

Topics include:

See the *Communication Guide for Tricon v9–v10 Systems* for more information about the types of devices that can be used for printing from the Tricon.

Affect of Printing on Scan Time

Each time a message is printed, the print function blocks in the TriStation application are executed and the scan time increases. Typically, the print function blocks are subject to conditional execution, which means they are not executed every scan. When you set the scan time in TriStation, make sure it includes the execution time for all conditional statements in the application.

If the scan time is not long enough, the execution of all conditional statements (when the conditions are True) could result in scan-time overruns. You can minimize this problem by limiting the amount of printer output. An alternative is to use a PC event logger such as the Triconex SOE Recorder. For more information, see the *SOE Recorder User's Guide.*

Connecting a Tricon EICM Port to a Printer

This procedure explains how to set up a Centronics-compatible printer and connect it directly to a Tricon EICM parallel port.

You can use a standard PC printer cable with a maximum cable length of 5 to 6 meters (15 to 20 feet), depending on the quality of the cable

Procedure

1. If the printer package has an installation program, copy the program to the TriStation PC.
2. Follow the instructions, and run the diagnostic routine, if available.

   You do not need the printer driver that may have come with the package.
3. Connect one end of the cable to the printer, and connect the other end to port 5 or 10 on the EICM. (Other EICM ports cannot be used for printing.)
4. Go to the next section to configure the EICM port for printing.

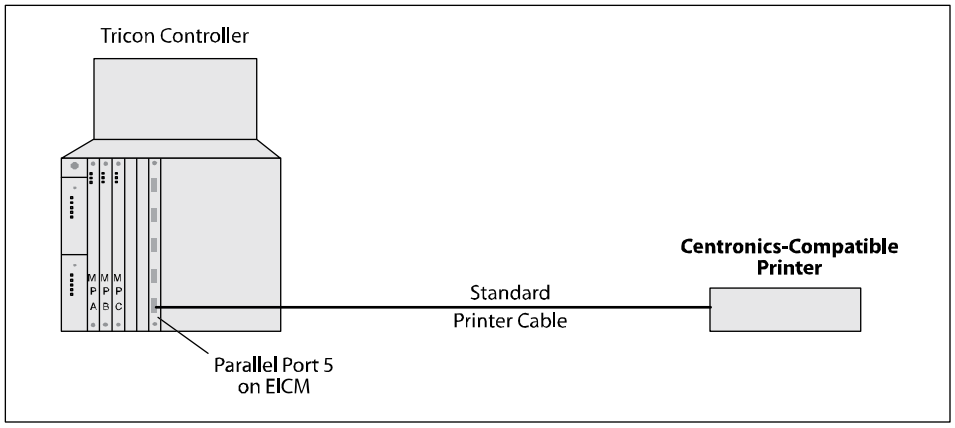


Figure 34 Connecting an EICM to a Centronics-Compatible Printer

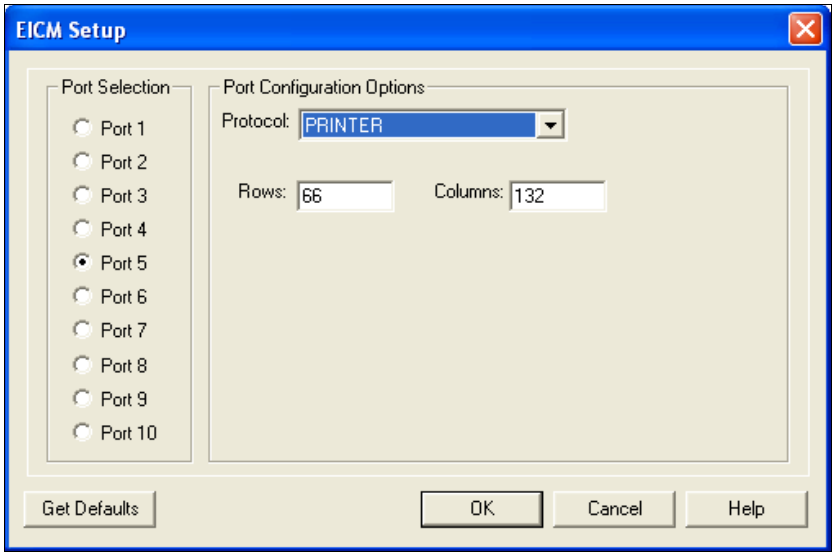
Configuring a Tricon EICM Port for Printing

This procedure explains how to configure a Tricon EICM port that is connected to a Centronics-compatible printer.

Procedure

1 In TriStation, open your project, expand the Controller tree, and double-click Configuration.

2 On the Configuration tree under Hardware Allocation, double-click EICM, and then click Setup.



3 Specify these properties on the EICM Setup screen.

Property	Action
Port Selection	Select Port 5 or Port 10. Other ports cannot be used for printing.
Protocol	Select Printer from the Protocol list.
Rows	Enter the number of lines (rows) to be displayed on a page.
Columns	Enter the number of characters per line.

4 Click OK.

Connecting a TCM to Printing Devices

This procedure explains how to directly connect a TCM to an HP JetDirect-compatible print server and printer.

You can use standard communication cables for these connections.

Procedure

1. If the print server and printer packages have installation programs, install them on the TriStation PC.
2. Follow the instructions, and run the diagnostic routines if available.

   You do not need the printer drivers that came with the packages.
3. Record the IP address of the print server. You will need the IP address when configuring the TCM printer.

   Connect the printer to the print server, and connect the print server to a TCM Ethernet port (NET 1 or NET 2).

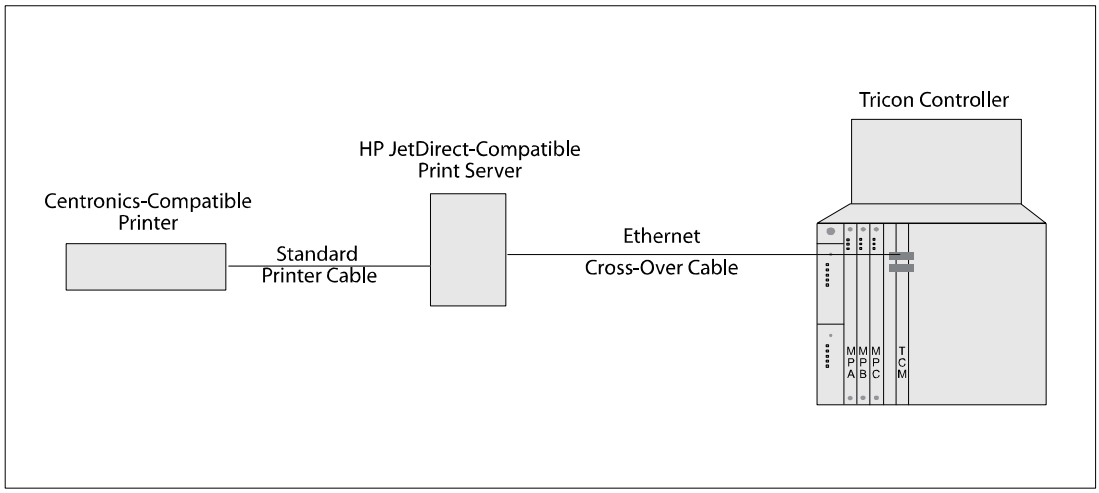


Figure 35 Connecting a Tricon TCM to a Printer and Print Server

Connecting a TCM to Printing Devices Using a Hub

This procedure explains how to connect a TCM to an HP JetDirect-compatible print server and printer by using a hub. You can use standard communication cables for these connections.

You do not need to install the printer drivers that may have come with the print server and printer packages.

Procedure

1. If the print server and printer packages have installation programs, install them on the TriStation PC.
2. Follow the instructions that came with the packages, and run the diagnostic routines, if available.
3. Record the IP address of the print server. You will need the IP address when configuring the TCM printer.

   Connect the printer to the print server, and connect the print server to a hub. Connect the hub to a TCM Ethernet port (NET 1 or NET 2).

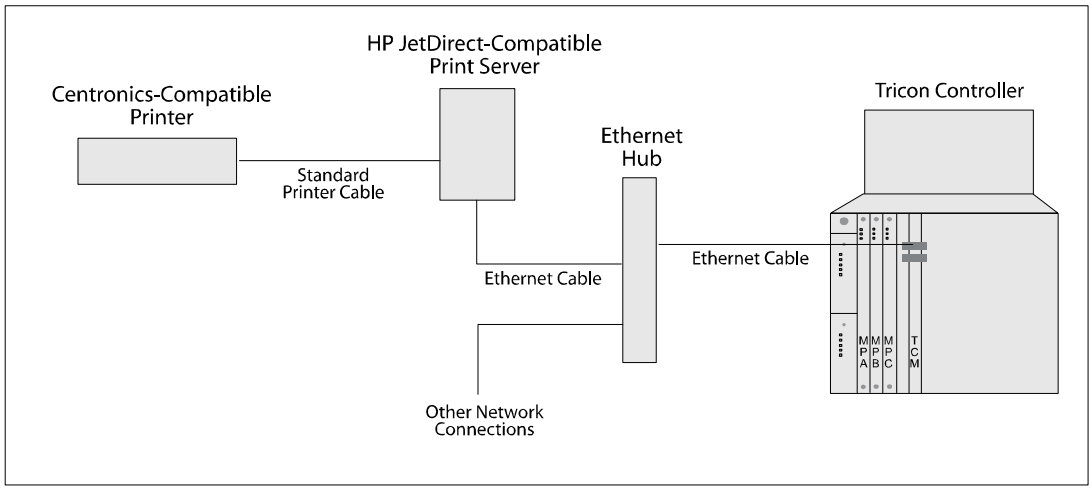


Figure 36 Connecting the Tricon TCM to a Printer Server and Printer Using a Hub

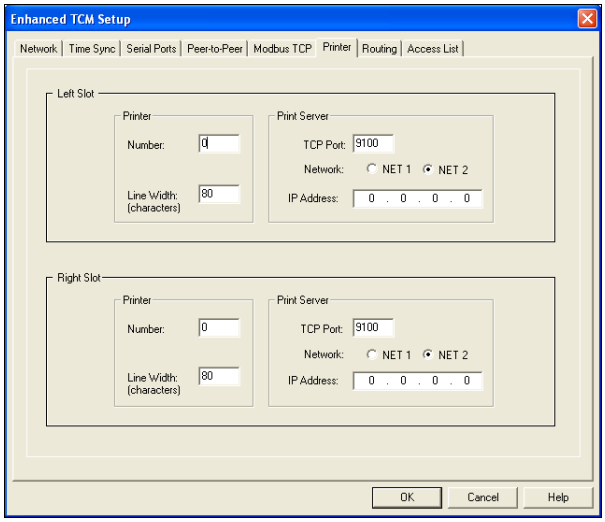
Configuring a Tricon TCM Port for Printing

This procedure explains how to configure a Tricon TCM port that is connected to a Centronics-compatible printer. You do not need the printer driver that may have come with the printer package.

Note The following procedure applies only to model 4351A and 4352A TCMs. If you have an older model 4351 or 4352 TCM installed in your system, please see Appendix C, TCM Model 4351/4352 Configuration.

Procedure

1. In TriStation, open your project, expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup. The Enhanced TCM Setup dialog box appears.
3. Click the Printer tab.



4. Specify these properties for the module installed in the Left Slot.

Property	Action
Printer Number	Enter the number for the printer; can only be 5 or 10. Both slots cannot have the same printer number. The default is 0, meaning a printer is not configured.
Line Width	Enter the number of characters to be printed on a line. The valid range is 80–132 characters. The default is 80 characters.
TCP Port Number	Enter the number of the TCP port for the print server. The default is 9100 for an HP printer.
Network	Click the network that the print server is connected to. The default is NET 2.
IP Address	Enter the IP address of the print server.

5. If a module is also installed in the Right Slot, repeat step 4 for that module.
6. Click OK.

About Function Blocks for Printing

A TriStation application must use print function blocks to send messages to a printer.

Each print function block has a PRINTER parameter which specifies the port number where the printer cable is connected. For a Tricon EICM or TCM port, the PRINTER parameter must be 5 for a left EICM or TCM port, or 10 for a right EICM or TCM port. (Other EICM or TCM ports cannot be used for printing.) The PRINTER parameter must be the same number as is defined in TriStation.

Each time a message is printed, the print function blocks in the TriStation application are executed and the scan time increases.

This table lists the print function blocks in the Tricon Library.

Print Function Block	Purpose
PRINT_BOOL	Prints a three-character field containing either Off or On.
PRINT_CDT	Prints the current date and time.
PRINT_CRLF	Prints a new line (carriage return and line feed).
PRINT_CTOD	Prints the current time of day.
PRINT_DINT	Prints a DINT value.
PRINT_REAL	Prints a REAL value.
PRINT_STRING	Prints a string of text.
PRINTR_FLUSH	Clears the print buffer.

See the *TriStation Libraries Reference* for more detailed information about the print function blocks.

Trident Printing

A Trident controller can print brief ASCII text messages if a communication port is connected to a printer and the TriStation application includes standard print function blocks.

Print messages are typically used for alarms, status, and maintenance. A sample alarm message might include the name of an analog input point, its time stamp and value, and a statement that the value is out of range. If the Trident system includes numerous controllers or is connected to a DCS, alarms are typically displayed on an operator workstation.

To print from a Trident controller, you must connect a CM Ethernet port to a print server that is connected to a printer; configure these devices in the TriStation project; and use print function blocks in the TriStation application.

Topics include:

Affect of Printing on Scan Time

Each time a message is printed, the print function blocks in the TriStation application are executed and the scan time increases. Typically, the print function blocks are subject to conditional execution, which means they are not executed every scan. When you set the scan time in TriStation , make sure it includes the execution time for all conditional statements in the application.

If the scan time is not long enough, the execution of all conditional statements (when the conditions are True) could result in scan-time overruns. You can minimize this problem by limiting the amount of printer output. An alternative is to use a PC event logger such as the Triconex SOE Recorder. For more information, see the *SOE Recorder User's Guide*.

Devices for Trident Printing

At a minimum, the printing devices you can use with a Trident controller are an HP JetDirect-compatible print server and a line printer for ASCII text. You can also use a router or a hub.

Print Server and Cables

A print server that is connected to a Trident CM must use the HP JetDirect print protocol and operate at speeds of 10 or 100 megabits per second. Standard communication cables are suitable for this connection.

You can purchase communication cables from other manufacturers. You must purchase print servers elsewhere because Triconex does not supply them. Black-box cables and Hewlett-Packard print servers are examples of dependable network printing devices.

Triconex has tested these Hewlett-Packard print servers and can recommend them.

- HP JetDirect Ex Plus
- HP JetDirect 500X Series, model J3265A

Printers

You must select a printer that is compatible with your print server. The Trident controller prints ASCII text only, which does not include formatting or graphics, so a Centronics-compatible printer is adequate. Laser printers are also suitable.

For more information, see the *Trident Communication Guide*.

Directly Connecting a Trident CM to Printing Devices

This procedure explains how to directly connect a Trident CM to an HP JetDirect-compatible print server and printer.

You can use standard communication cables for these connections.

Procedure

1. If the print server and printer packages have installation programs, install them on the TriStation PC.
2. Follow the instructions, and run the diagnostic routines if available.

   You do not need the printer drivers that came with the packages.
3. Connect the printer to the print server, and connect the print server to a CM Ethernet port (NET 1 or NET 2).

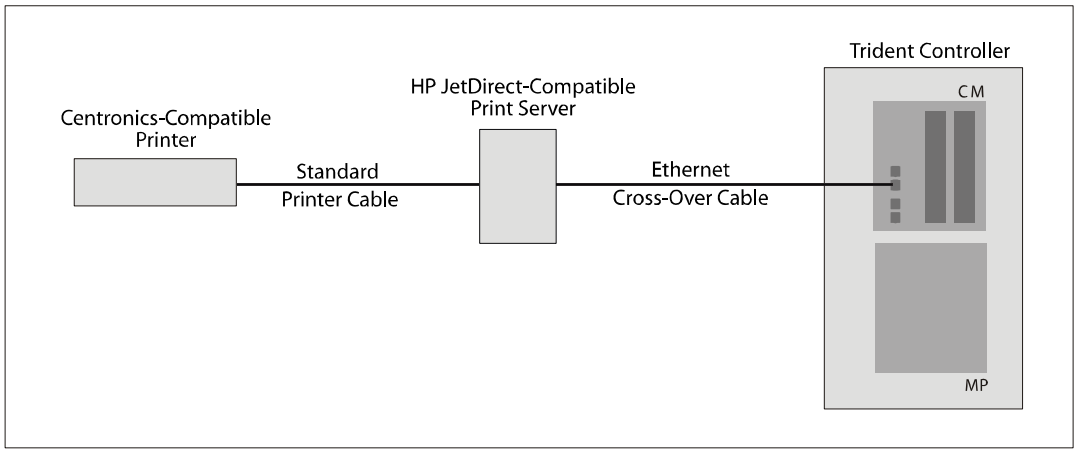


Figure 37 Connecting a Trident CM to a Printer and Print Server

Connecting a Trident CM to Printing Devices Using a Hub

This procedure explains how to connect a Trident CM to an HP JetDirect-compatible print server and printer by using a hub. You can use standard communication cables for these connections.

You do not need to install the printer drivers that may have come with the print server and printer packages.

Procedure

1. If the print server and printer packages have installation programs, copy the programs to the TriStation PC.
2. Follow the instructions that came with the packages, and run the diagnostic routines, if available.
3. Connect the printer to the print server, and connect the print server to a hub. Connect the hub to a CM Ethernet port (NET 1 or NET 2).

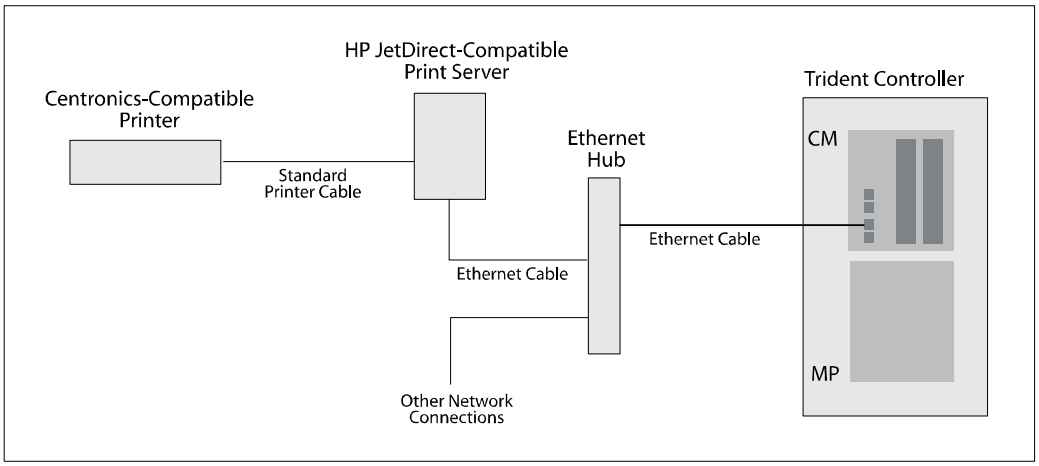


Figure 38 Connecting the Trident CM to a Print Server and Printer Using a Hub

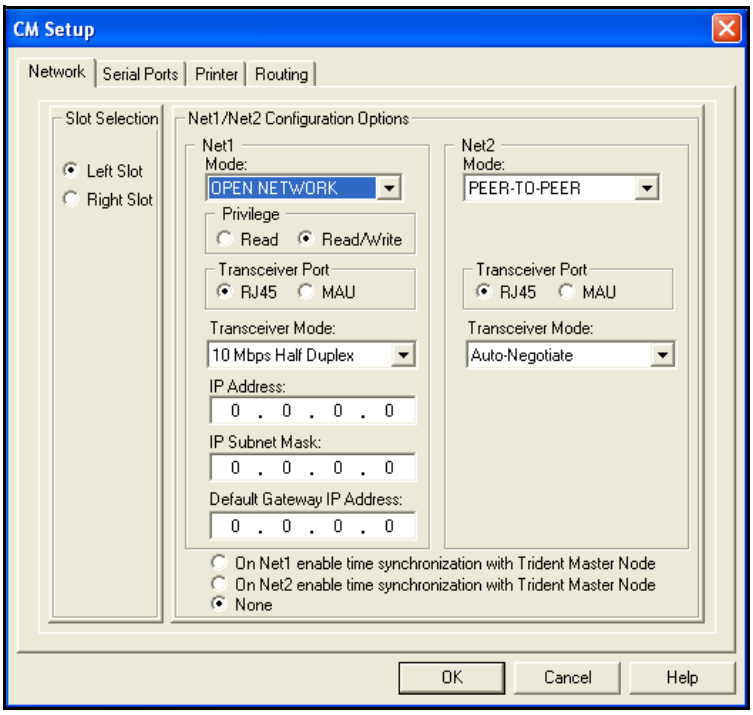
Configuring a Trident CM for Printing Devices

This procedure explains how to configure a Trident CM port that is connected to a print server and printer.

Procedure

1 Expand the Controller tree, and double-click Configuration.

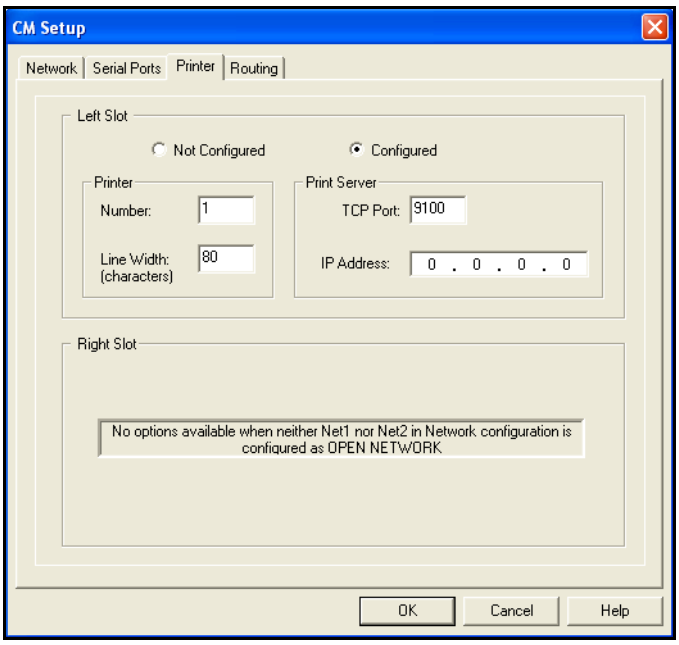
2 On the Configuration tree, expand Hardware Allocation, double-click CM (COM: CM), and then click Setup.



3 Specify these properties on the CM Setup Network tab.

Property	Action
Slot Selection	Select Left Slot or Right Slot depending on where the CM is installed on the baseplate.
Mode	For the NET 1 or NET 2 port, whichever is connected to the printer, select the Open Network mode.

4 Click the Printer tab.



5 Specify these properties on the CM Setup Printer tab.

Property	Action
Not Configured or Configured	Select Configured for the slot in which the CM is installed.
Printer Number	Enter a number from 1 to 10. This must be the same number that is declared for the PRINTER parameter in print function blocks.
Line Width	Enter the maximum printable line width for your printer, based on the manufacturer's specifications. The most typical line widths are 80 characters and 132 characters.
TCP Port Number	Enter the TCP/IP Port number that was defined by the manufacturer of the print server.
IP Address	Enter the 32-bit IP address of the print server on the network. If the print server is not on the same subnet as the controller, you must specify the destination address on the Routing tab of the CM Setup dialog box.

6 Click OK to save the configuration.

IP Addresses

When communication between a TriStation PC and a Triconex controller occurs over a network, the IP address of the controller must be specified on the communication module.

If the controller is not part of a larger network, it may be possible to use the default IP address set when the TriStation project is downloaded (assuming the correct node number and default IP address are specified in the project).

If you cannot use a default address, there are other ways to set an IP address on a network. All begin with asking the network administrator for the intended IP addresses. The easiest way is to use a Reverse ARP (RARP) server that has been programmed in advance with the intended addresses. Other ways include temporary connection of the TriStation PC to a non-Ethernet module during downloading.

All the procedures for setting the IP address are based on the assumption that the controller includes at least one communication module with an Ethernet port connected to a network.

To use the procedures, you should know how to:

- Connect the Triconex controller to a network
- Connect the TriStation PC to the controller
- Configure the TriStation project with the node number of the controller and the IP address

For more information, see the *Communication Guide for Tricon v9–v10 Systems*.

Note Typically, Triconex controllers are located on their own subnet which is connected to a larger network such as a DCS. Your network administrator can set up the subnet for compatibility with the Triconex default IP addresses and can program any routers that lie between the DCS and the Triconex subnet with addressing information about the Triconex controllers.

Topics include:

Using the Default IP Address for TriStation Communication

This procedure explains how to use the default IP address for network communication between a controller and a TriStation PC.

Procedure

1. Connect the controller to the network using the NET 2 port on the ACM, NCM, or TCM, or the NET 1 or NET 2 port on the CM.
2. Power up the controller.
3. Connect the TriStation PC to the network, or directly to a NET 2 port on the ACM, NCM, or TCM, or an Ethernet port on the CM (Trident).
4. In the TriStation project, expand the Controller tree, double-click Configuration, and then click TriStation Communication.
5. On the TriStation Communication screen, verify the IP Address is:
   - 192.168.1.1 (Tricon ACM, NCM, or TCM)
   - 192.168.1.1 (Trident CM NET 1)
   - 192.168.2.2 (Trident CM NET 2)

   If the controller includes two communication modules, the default address applies to both modules.

   Note The left and right modules in ACM or NCM slots (Tricon) and the Left CM and Right CM (Trident) use the same 48-bit physical MAC address and cannot be connected to the same network.
6. On the Controller tree, click Configuration.
7. Expand Hardware Allocation, click the slot where the communication module is installed, and then click Setup.

   If a communication module is not installed, insert a communication module, and then click Setup.
8. In the Setup dialog box, enter the same IP address specified on the TriStation Communication screen.
9. If the controller includes a redundant communication module, enter the same IP address for the other slot.
10. On the Controller tree, click the Controller Panel. From the Commands menu, click Connect.
11. Wait about 40 seconds for the module to reset and become active.

    When the module is active, the Active indicator is green.
12. On the Commands menu, click Download All to download the TriStation 1131 project to the controller.
13. On the TriStation PC, from the Start menu, click the MS-DOS Command Prompt.
14. Type the command *ping* followed by the IP address to be tested.

For example, for an IP address of 206.32.216.43, enter this:

```
ping 206.32.216.43
```

If the network connection is made, the reply includes the IP address followed by byte and time information.

If the connection is not okay, the reply is Request timed out.

Note If you receive a Request timed out reply, check your network cable and port connections to verify they are securely connected, verify your configuration settings are correct, and then retry the ping command.

Setting an IP Address Using a RARP Server

This procedure explains how to set the IP address of a communication module using a RARP server on the local network. To use this procedure, the network administrator must program the RARP server with the intended IP address for the controller. If this is not possible, use another method to set the IP address.

Procedure

1. Give the network administrator the MAC address, which is:

   40-00-00-00-00 (Tricon)

   40-00-00-00-*x*-03 (where *x* is the Trident controller node number).

2. Ask the network administrator for the IP address that is to be used for the controller.
3. Connect the controller to the network through a network port on the communication module.
4. Power up the controller.

   During initialization, the communication module sends a request to the RARP server for an IP address that has been mapped to its own 48-bit MAC address.

   Note The left and right modules in ACM or NCM slots (Tricon) and the Left CM and Right CM (Trident) use the same 48-bit physical MAC address and cannot be connected to the same network.

5. On the TriStation PC, from the Start menu, click the MS-DOS Command Prompt.
6. Enter the command *ping* followed by the IP address to be tested. For example, for an IP address of 206.32.216.43, enter this:

   ```
   ping 206.32.216.43
   ```

   If the network connection is made, the reply includes the IP address followed by byte and time information.

   If the connection is not okay, the reply is Request timed out.

   Note If you receive a Request timed out reply, check your network cable and port connections to verify they are securely connected, verify your configuration settings are correct, and then retry the ping command.

7 Connect the TriStation PC to the network, or directly to a network port on the communication module.

8 In the TriStation project, expand the Controller tree, click Configuration, and then click TriStation Communication.

9 On the TriStation Communication screen, specify the Node Number of the controller and the intended IP address.

10 On the Commands menu, click Connect. Wait until the connection is made.

11 On the Commands menu, click Download All to download the TriStation project to the controller.

Setting a Tricon IP Address Using an EICM or TCM

This procedure explains how to set the IP address of the Triconex controller by initially connecting the TriStation PC to an EICM or TCM serial port, and downloading the TriStation project. After the address is set, you can disconnect the TriStation PC from the EICM or TCM serial port, and reconnect it to a NET 2 port on the ACM, NCM, or TCM.

Procedure

1 Ask the network administrator for the IP address to be used for the ACM, NCM, or TCM.

2 Connect the TriStation PC to a serial port on the EICM or TCM.

3 Connect the controller to the network using a NET 2 port on the ACM, NCM, or TCM.

4 In the TriStation project, configure the following:

- The EICM or TCM serial port and NET 2 Ethernet ports
- The node number and node name of the controller
- The intended IP address

5 Power up the controller.

6 On the Controller tree, click Controller Panel.

7 On the Command menu, click Connect To.

8 On the Connect To screen, select the Serial Port option and the COM port to which the TriStation cable is connected.

9 Connect to the Triconex controller and download the TriStation project.

The ACM, NCM, or TCM initializes (resets) and accepts the IP address that you specify in the TriStation project.

10 On the TriStation PC, from the Start menu, click the MS-DOS Command Prompt.

11 Enter the command *ping* followed by the IP address to be tested. For example, for an IP address of 206.32.216.43, enter this:

```
ping 206.32.216.43
```

If the network connection is made, the reply includes the IP address followed by byte and time information.

If the connection is not okay, the reply is Request timed out.

Note If you receive a Request timed out reply, check your network cable and port connections to verify they are securely connected, verify your configuration settings are correct, and then retry the ping command.

12 If the IP address is set, you can disconnect the TriStation PC from the EICM or TCM serial port, and connect it to a NET 2 port or to the network.

Setting a Trident IP Address Using an MP Connection

This procedure explains how to set the IP address of the Trident controller by initially connecting the TriStation PC to an MP port and downloading the TriStation project. After the address is set, you can disconnect the TriStation PC from the MP port, and reconnect it to a network port on the CM.

Procedure

1 Ask the network administrator for the IP address to be used for the controller.

2 Connect the TriStation PC to a TriStation port on the MP Baseplate.

3 Connect the controller to the network through a network port on the CM.

4 In the TriStation project, configure the following:

- The MP and CM ports
- The node name and node number of the controller
- The intended IP address

5 Power up the controller.

6 On the Controller tree, click Controller Panel.

7 On the Command menu, click Connect To.

8 On the Connect To screen, click Main Processor Module Port and Left, Middle, or Right for the MP port to which the TriStation cable is connected.

9 After connecting to the controller, download the TriStation project.

The CM initializes (resets) and accepts the IP address you specified in the TriStation project.

10 On the TriStation PC, from the Start menu, click the MS-DOS Command Prompt.

11 Enter the command *ping* followed by the IP address to be tested. For example, for an IP address of 206.32.216.43, enter this:

```
ping 206.32.216.43
```

If the network connection is made, the reply includes the IP address followed by byte and time information.

If the connection is not okay, the reply is Request timed out.

12 If the IP address is set, you can disconnect the TriStation PC from the MP port, and connect it to a network port on the CM or to the network.

Setting a Trident IP Address Using a CM Connection

This procedure explains how to set the IP address for a Trident CM by temporarily configuring a default IP address for the CM, and assigning a default IP address to the TriStation PC.

Procedure

1. Ask the network administrator for the IP address to be used for the CM.
2. Connect the Trident controller to the network using a network port (NET 1 or NET 2) on the CM.
3. Connect the TriStation PC to a network port on the CM, using a direct or network connection.
4. On the TriStation PC, use Windows procedures to set the IP address of the PC to either of the following:
   - 192.168.1.x if the PC is physically connected to a NET 1 port, where x is any unused host number.
   - 192.168.2.x if the PC is physically connected to a NET 2 port, where x is any unused host number.
5. Wait for the TriStation PC to reset.
6. Open the TriStation project.
7. Expand the Configuration tree, click Configuration, and then click TriStation Communication.
8. Specify the node name, node number, and the default IP address of the controller.
9. Use the Network tab on the CM Setup screen to specify the intended IP address for the Ethernet port that is connected to the network.
10. Power up the Trident controller.
11. On the Controller tree, click Controller Panel. On the Command menu, click Connect To.
12. On the Connect To screen, click the Serial Port option and the COM port to which the TriStation cable is connected.
13. Verify that Communication Module Port is selected and the default IP address is displayed.
14. Connect to the controller and download the TriStation project. Wait for the download to complete.

    After the download is complete, TriStation displays the message, Connection failed. The default IP address you specified in the node definition is invalid, and the intended IP address of the CM is set.
15. On the TriStation PC, use Windows procedures to set the IP address of the PC to its actual address on the network.
16. On the TriStation PC, from the Start menu, click the MS-DOS Command Prompt.
17. Enter the command *ping* followed by the IP address to be tested.

For example, for an IP address of 206.32.216.43, enter this:

```
ping 206.32.216.43
```

If the network connection is made, the reply includes the IP address followed by byte and time information.

If the connection is not okay, the reply is Request timed out.

18 In the TriStation project, change the default IP address to the newly set IP address of the TriStation Communication screen.

19 Use the Controller Panel to reconnect the TriStation project to the controller.

20 After the IP address is set on the network, you must reconfigure the IP address in the TriStation project, and assign a valid IP address to the TriStation PC.

Specifying a Trident CM Default Gateway

This procedure explains how to set the address of a default gateway for a controller that must communicate with devices on another network. A default gateway is a router that forwards all messages not addressed to stations within the local subnet.

Procedure

1 Expand the Controller tree and double-click Configuration.

2 On the Configuration tree, click Hardware Allocation to display the modules that are configured for this system.

3 Double-click the CM icon to open the Properties dialog box, and click Setup to display the configuration options for the CM.

4 On the Network tab, select Left Slot or Right Slot depending on which CM you are configuring.

5 For NET 1 or NET 2 (depending on which one is connected the network), select Open Network from the list under Mode.

6 Under Default Gateway Address, enter the IP address of the default gateway that is connected to the local subnet.

Specifying a Trident CM for Network Routing

This procedure explains how to specify routes to destinations outside the local network for controllers that do not have access to a default gateway.

Each route must include an IP address for the destination, a subnet mask, and a gateway address.

Procedure

1. Expand the Controller tree and double-click Configuration.
2. On the Configuration tree, click Hardware Allocation to display the modules that are configured for this system.
3. Double-click the CM icon to open the Properties dialog box, and click Setup to display the configuration options for the CM.
4. Click the Routing tab and enter an IP address under Destination Address, Subnet Mask, and Gateway Address for each route that you need to specify.

Testing a Network Connection

This procedure explains how to test a connection from a Triconex communication module to a network by using the ping command from an MS-DOS command prompt.

The test is performed on the TriStation PC. Before doing the test, you must have set the IP address of the communication module on the network.

Procedure

1. On the TriStation PC, from the Start menu, click the MS-DOS Command Prompt.
2. Type the command *ping* followed by the IP address to be tested. For example, for an IP address of 206.32.216.43, enter this:

   ```
   ping 206.32.216.43
   ```

   If the network connection is made, the reply includes the IP address followed by byte and time information.

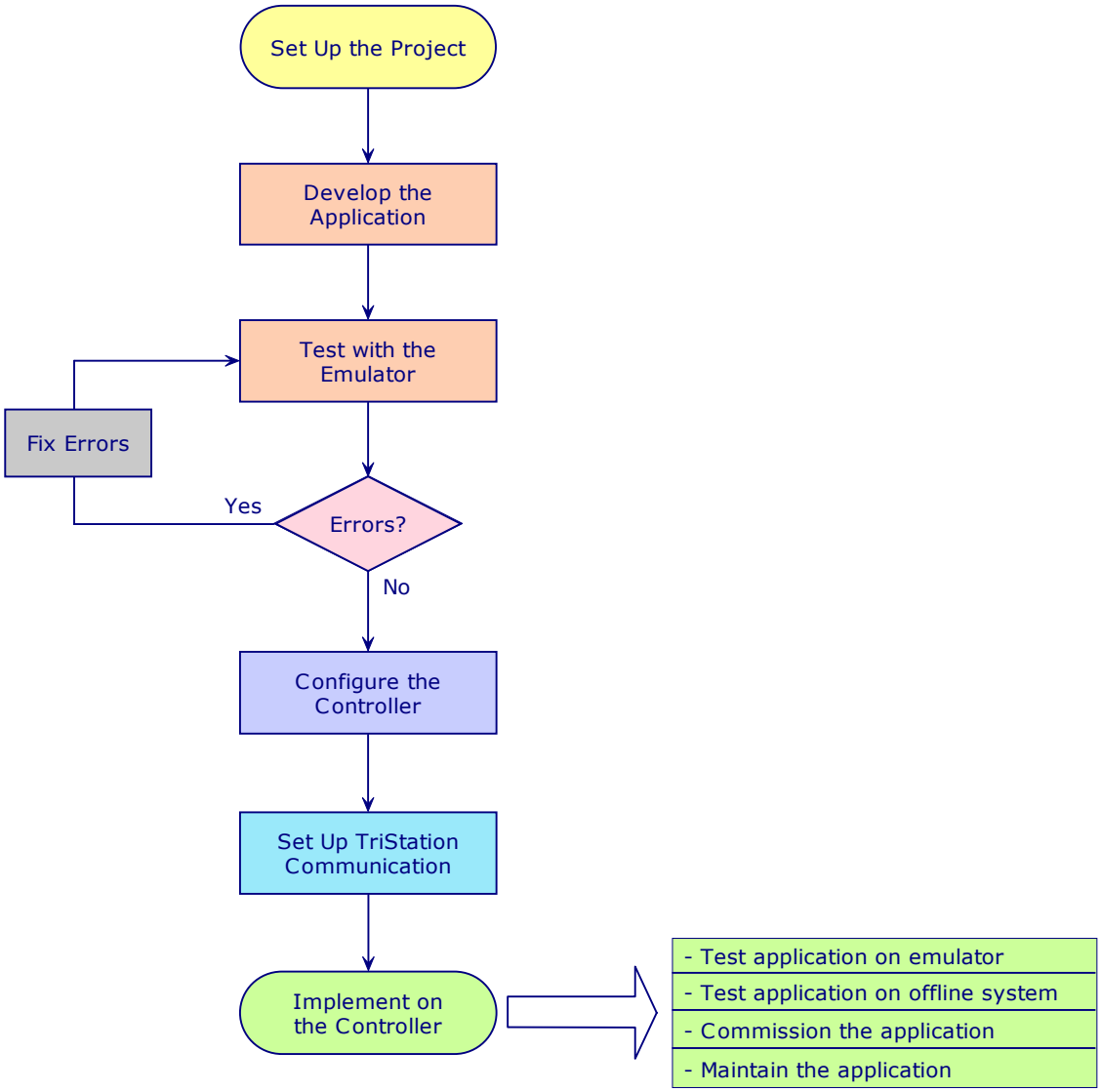
   If the connection is not okay, the reply is Request timed out.

5

Implementation

Overview

This figure shows the main steps for implementing an application, which is the last step in a TriStation project.



Implementation Steps

This list includes steps for testing and maintaining an application.

	Step	See
❒	Test on the emulator	• Downloading to the Emulator on page 297 • Monitoring Variables on the Emulator on page 298 • Monitoring the Program Execution on page 299 • Adding Annotation for Variables on page 300
❒	Test on the controller	• Downloading to the Controller on page 302 • Monitoring Variables on the Controller on page 303 • Monitoring the Program Execution on page 304 • Adding Annotation for Variables on page 300 • Displaying Hardware Allocation Exceptions on page 308
❒	Maintain an application	• Steps for Downloading Changes on page 310 • Planning and Controlling Changes on page 311 • Commands Required with Application Changes on page 312 • Disabling (Forcing) Points on page 313 • Using the Download Changes Command on page 314 • Using the Download All Command on page 316

Controlling the Operational Mode

This section describes the operational modes available on a controller. Although the functionality is the same for Tricon and Trident, the method of executing the mode may be different. This table describes the mode and method.

Table 32 Tricon and Trident Operational Modes

Mode	Description
Run	Controller runs the downloaded application with read-only capability. Attempts to write to program variables by TriStation, Modbus masters, or external devices are rejected, however, an application may call gated access functions to enable external writes during a designated window of time. For more information, see the GATDIS and GATENB function blocks in the *TriStation Libraries Reference*. • For Tricon, the keyswitch must be set to RUN and the Run command used. • For Trident, the Run command must be used and the Set Programming Mode option must be set to Disable Programming Control Operations.
Program	Controller allows application loading, verification, and write access. Allows Download All and Download Changes commands from TriStation. Also allows writes to program variables by Modbus masters and external devices. • For Tricon, the keyswitch must be set to PROGRAM. • For Trident, the Set Programming Mode option must be set to Enable Programming and Control Operations. (This is the default setting.)
Halt	Controller stops running the application and retains the values of tagnames. • For Tricon, the Halt command is used. • For Trident, the Halt command or the SYS_APP_HALT function can be used.
Stop	Controller stops reading inputs, forces non-retentive digital and analog outputs to zero, and halts the application. Retentive outputs return to the value they had before the Stop was issued. Stop mode is recommended for installation and service of process-related equipment, but is not required for service of the controller. • For Tricon, the keyswitch must be set to STOP. • For Trident, the Stop command must be used.
Remote	Controller runs the downloaded application and allows writes to program variables by TriStation, Modbus masters, and external devices. Download All and Download Changes by TriStation are not allowed. • For Tricon, the keyswitch must be set to PROGRAM. • For Trident, the Set Programming Mode option must be set to Enable Programming and Control Operations. (This is the default setting.)

Emulator Testing

This section describes how to test an application on the emulator, which can be done without physically connecting to a controller or field instruments. Although the physical connections and logical configuration do not need to be completed, it is a good practice to do so before testing on the controller.

Topics include:

Note Under certain conditions, an application may appear to work correctly during emulator testing, but will not work when downloaded to the controller. The emulator is designed only to check your application code; it does not check the application against any restrictions imposed by the specific controller you will be downloading to.

For example, the size of your application is not emulated exactly due to code differences between the emulator and a controller. Thus, an application that appears to download correctly to the emulator may be unable to be downloaded to the controller, due to size restrictions imposed by the controller.

Additionally, many function blocks in the controller library (TR1LIB, TRDLIB, or TX1LIB) are not emulated. One exception is TR_CALENDAR, which is emulated using the local time on your PC. Also, the print function blocks print to TriStation's output window.

Downloading to the Emulator

This procedure explains how to use the Download All command to load an application to the emulator, which allows you to test an application without connecting to a controller. The Download Changes command cannot be used with the emulator.

Procedure

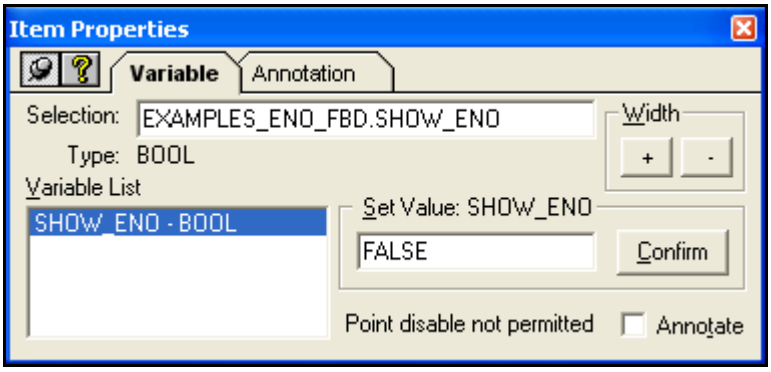
1. Open the Controller workspace, expand the Configuration tree, and double-click Emulator Panel.
2. Click Connect  .
3. Click Download All  .

Monitoring Variables on the Emulator

This procedure explains how to monitor and test values for variables on the emulator.

Procedure

1. To connect and download an application, see Downloading to the Emulator on page 297.
2. If needed, drag variables to be tested onto the emulator sheet.
3. Double-click a variable to view its Item Properties dialog box and make changes to its value.



4. For the Set Value property, enter a test value and click Confirm. The value is applied to the selected variable.
5. Continue to monitor the program execution.

Monitoring the Program Execution

This procedure explains how to display the program execution, which shows the program executing on the emulator.

Procedure

1. To connect and download an application, see Downloading to the Emulator on page 297.
2. On the emulator tree, expand Programs, and click the program you want to monitor.
3. Click Display Program Document .
4. To view the program execution, click Run or Single Step .
5. To quit running the program, click Disconnect .

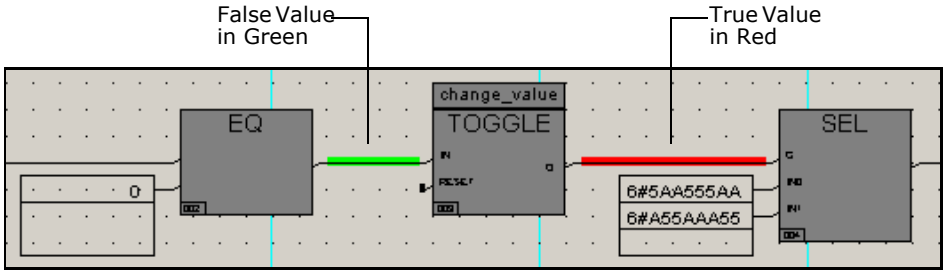


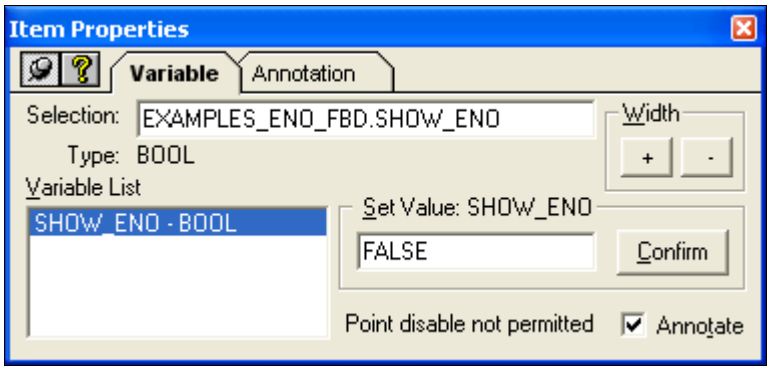
Figure 39 Sample Program Running on the Emulator

Adding Annotation for Variables

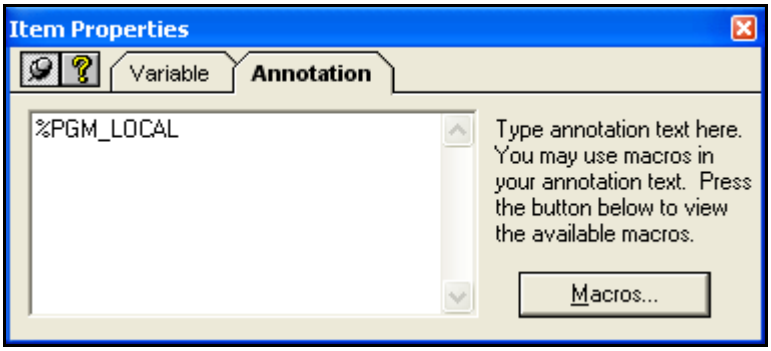
This procedure explains how to add an annotation to a variable, which allows you to specify information displayed while the program is executing. The annotation can include text and macros.

Procedure

1. To connect and download an application, see Downloading to the Emulator on page 297.
2. If needed, drag variables to be tested onto the sheet.
3. Double-click a variable, and select the Annotate check box on the Variable tab.



4. Click the Annotation tab.



5. Click the Macros button to change the macro identified with the annotation.
6. To copy a macro, click the macro name and press Ctrl+C. To paste the macro, close the Edit Macros dialog box, click in the Annotation area, and press Ctrl+V. You can also enter text with the macros.
7. Continue testing, as needed.

Controller Testing

This section explains how to test on the controller, which is usually done when the controller is physically connected to field instruments either in a test facility that simulates the system (Factory Acceptance Test) or at the site while the control process is offline (Site Acceptance Test). The logical hardware configuration in TriStation must be completed and must match the physical configuration.

Topics include:

Downloading to the Controller

This procedure explains how to use the Download All command to load an application to the controller. A best practice is to rebuild the application before downloading it.

This procedure can be used for testing when the controller is connected to simulation field devices or the control process is offline. This procedure can also be used to run the application when the control process is online.

Procedure

1. Open the Controller workspace, expand the Configuration tree, and double-click the Controller Panel.
2. On the Commands menu, click Connect  .

   The Connect To screen shows the default communication setting. If needed, change the connection setting and click OK. For more information, see Specifying the Tricon Default Connection on page 197 or Specifying the Trident Default Connection on page 216.
3. Enter the connection password if required.
4. Do one of the following:
   - For Tricon, ensure the keyswitch is turned to PROGRAM. This is the factory setting.
   - For Trident, ensure the mode is Enable Programming and Control Operations. This is the default setting. (To view this setting, on the Commands menu, click Set Programming Mode, and then click Enable Programming and Control Operations.)
5. On the Commands menu, click Download All  .

   If the download is successful, a backup file of the project is automatically created with the major version, minor version, time stamp, and the extension DWLD. For example, EXCOUNTR_333_1_4120e077.DWLD. If needed, this file can be restored by using the Restore Project To Last Download Command on page 410.
6. To start the application, click Run  .
7. Do one of the following:
   - For Tricon, turn the keyswitch to RUN (to start the program on the controller) or to REMOTE (to start the program and allow external devices to write to tagnames or aliases).
   - For Trident, set the mode to Run and disable Download commands by doing this: On the Commands menu, click Set Programming Mode, and then click Disable Programming and Control Operations.

Monitoring Variables on the Controller

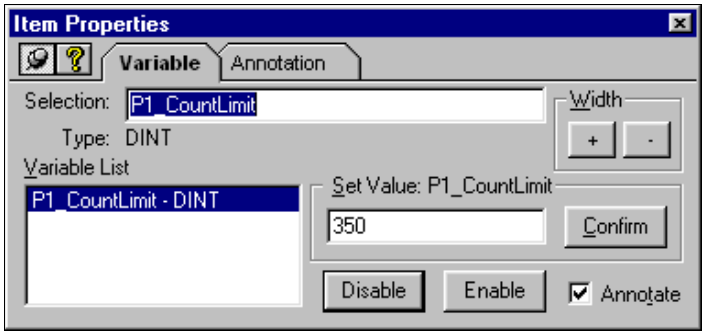
This procedure explains how to monitor and enable or disable variables while the application is running on the controller.

CAUTION Monitoring and disabling variables should only be done if the controller is not connected to a live system or if maintenance is being performed.

Procedure

1. To connect and download an application, see Downloading to the Controller on page 302 and Monitoring the Program Execution on page 304.
2. Drag the function blocks and variables you want to monitor to the sheet.
3. On the Commands menu, click Run or Single Step .

   Note When you click Single Step, the application executes for one scan only. As a result, Modbus Master and Peer-to-Peer behavior can be unpredictable when Single Step is applied.
4. To enable or disable a variable, double-click the variable and click Enable or Disable.



5. Continue testing, as needed.

Note While monitoring variables on the controller, you may occasionally see a question mark (?) instead of the variable's actual value. This is normal and should resolve itself within the next few scans.

The question mark appears only when TriStation does not know the actual value of the variable. This can occur in situations when the list of variables is being updated (for example, when you've scrolled down the variables list, or resized the sheet view) and TriStation doesn't have enough communications bandwidth to display all the new values in one scan.

Monitoring the Program Execution

This procedure explains how to display the program execution, which shows the program executing on the controller.

Procedure

1. To connect and download an application, see Downloading to the Controller on page 302.
2. On the controller tree, expand Programs, and click the program you want to test.
3. Click Display Program Document .
4. To view the program execution, click Run or Single Step .

   Note When you click Single Step, the program executes for one scan only. As a result, Modbus Master and Peer-to-Peer behavior can be unpredictable when Single Step is applied.

5. To quit running the program, click Disconnect .

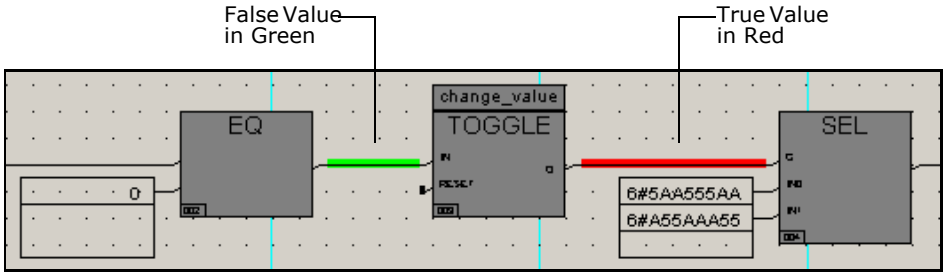


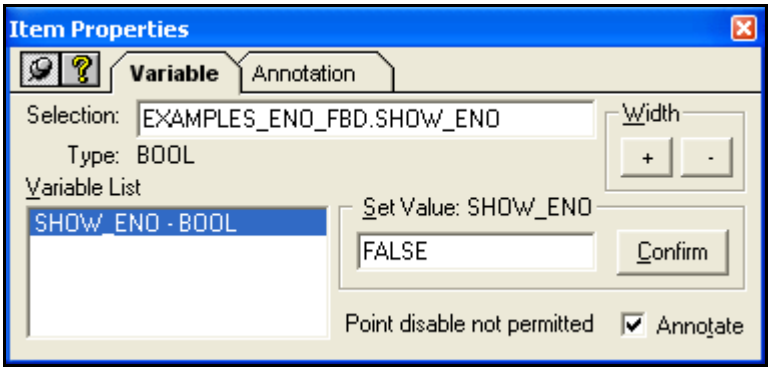
Figure 40 Sample Program Running on the Controller

Adding Annotation for Variables

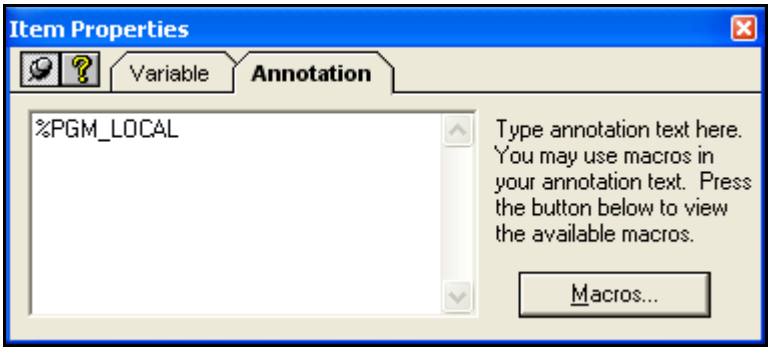
This procedure explains how to add an annotation to a variable, which allows you to specify information displayed while the program is executing. The annotation can include text and macros.

Procedure

1. To connect and download an application, see Downloading to the Controller on page 302.
2. If needed, drag variables to be tested onto the sheet.
3. Double-click a variable, and select the Annotate check box on the Variable tab.



4. Click the Annotation tab.



5. Click the Macros button to change the macro identified with the annotation.
6. To copy a macro, click the macro name and press Ctrl+C. To paste the macro, close the Edit Macros dialog box, click in the Annotation area, and press Ctrl+V. You can also enter text with the macros.
7. Continue testing, as needed.

Determining the Scan Surplus

This section explains how to determine the scan surplus, which indicates whether the actual scan time required to execute the application uses less time or more time than the requested scan time in the project. When the actual time is less, the scan surplus is positive, which means the scan time setting can be decreased. When actual time is more, the scan surplus is negative, which means the scan time should be increased to ensure that communication errors do not occur. For more information, see Setting the Scan Time for a Downloaded Application on page 307.

The Triconex Enhanced Diagnostic Monitor (sold separately) displays information to determine scan surplus, including the requested Scan Time, Actual Scan Time, and Scan Surplus for an application. For more information, see the Help documentation for the Enhanced Diagnostic Monitor.

Positive Scan Surplus

A positive scan surplus means the application executes in less time than the requested scan time. For example, if the requested scan time is 150 milliseconds, and the actual scan time is 100 milliseconds, there is a positive scan surplus of 50 milliseconds.

- If the surplus is 20 milliseconds or 10 percent of the actual scan time, do nothing.
- If the surplus is greater than 20 milliseconds or 10 percent of the actual scan time, decrease the number for the scan time. In this example, the scan time could be set to 130 milliseconds.

Negative Scan Surplus

A negative scan surplus means the actual scan time is greater than the requested scan time. For example, if the requested scan time is 150 milliseconds, and the actual scan time is 200 milliseconds, there is a negative scan surplus of 50 milliseconds.

- If the surplus is negative, increase the number for the requested scan time by the negative amount plus 20 milliseconds. In this example, the scan time should be set to 220 milliseconds.

Process Safety Time Requirements

You should determine the *Process Safety Time* (PST) required by the application. The PST is the period of time during which the process could shift from a safe operating condition to a dangerous condition. The scan time for an application should be half the PST. For example, a burner management system has a PST of 1 second, which means the scan time should be 500 milliseconds.

Setting the Scan Time for a Downloaded Application

This procedure explains how to set the scan time for a downloaded application running in the controller. (The emulator does not provide real-time information on scan time.) This should be done if the scan time set in the project is less than the actual scan time required to run the application. For more information, see Determining the Scan Surplus on page 306.

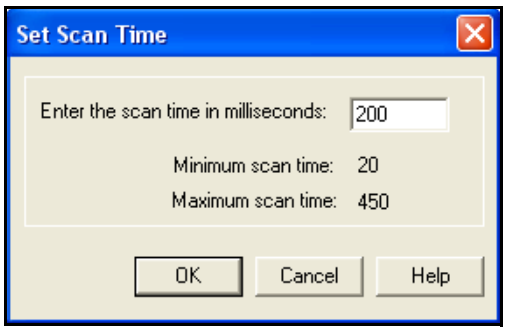
If you need a faster scan time than the low end of the range, you must redesign the application or the process.

Procedure

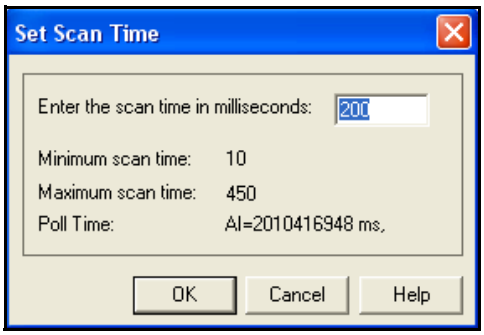
1 On the Controller tree, double-click the Controller Panel and download the application.

2 On the Commands menu, click Set Scan Time.

This is the Tricon 3008 screen.



This is the Trident screen.



3 Specify this property on the Set Scan Time screen.

Property	Action
Enter the scan time in milliseconds	Enter the number of milliseconds for the scan time used while the application is running in the controller. The number must be in the minimum to maximum range. • For Tricon 3006/3007, the range is 20 to 500 milliseconds. • For Tricon 3008, the range is 20 to 450 milliseconds. • For Trident, the range is 10 to 450 milliseconds. The minimum must be equal to or larger than the poll times. This setting does not affect the requested scan time for the project. To change the requested scan time in the project, you must set the scan time on the Implementation screen.

Note To guarantee that the controller provides a deterministic response time, the scan time should always be set to a value **greater than** the I/O poll time (the maximum time needed by the controller to obtain data from the input modules). You can view the I/O poll time on the System Overview screen in the Enhanced Diagnostic Monitor (sold separately). For more information, see the Help documentation for the Enhanced Diagnostic Monitor.

4 Click OK to save your changes.

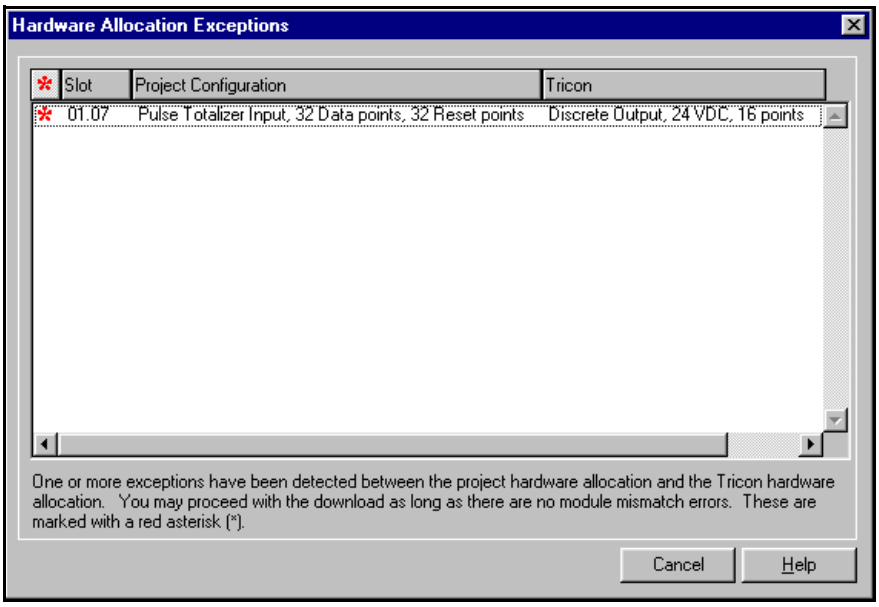
Displaying Hardware Allocation Exceptions

This procedure explains how to display hardware allocation exceptions, which indicate that the hardware configuration in the project does not match the physical hardware configuration.

Procedure

1 Download an application to the controller.

If the logical and physical configurations do not match, the Hardware Allocation Exception dialog box appears.



2 Differences identified with an asterisk must be fixed in the project before the application can be download. Other differences may allow you to download the application.

Identifier	Description
Asterisk (*)	A red asterisk identifies a module mismatch, which means the module specified in the hardware configuration for the project is different from the module in the physical system. This error must be fixed by changing the hardware configuration in the project.
Empty slot	An empty slot error indicates either of these: • The hardware configuration specifies a module that is empty in the controller. • The controller contains a module that is not included in the hardware configuration. The application can be downloaded.

Maintenance

This section explains how to plan and manage changes to an application running on a controller attached to a live system.

Changing a safety-critical application that is running on a controller should be avoided because an error in the application could cause a trip or unpredictable behavior.

Topics include:

Steps for Downloading Changes

This list includes steps for making changes to an application running on a controller.

- For a safety-critical application running on a live system, you must use extreme caution because a configuration error in the changed application could cause unpredictable behavior or a trip.
- When a Download Changes command is issued, the scan time is doubled for one scan immediately following the command. For example, if the normal scan time is 100 ms, the scan following a Download Changes would be 200 ms.

	Step	See
❒	Verify the TriStation software is correctly installed.	• Verifying the TriStation 1131 Installation on page 6
❒	Plan for the change.	• Planning and Controlling Changes on page 311.
❒	Determine whether a Download All or Download Changes is required.	• Commands Required with Application Changes on page 312.
❒	Review the hardware configuration. If needed, correct the hardware configuration to match the physical configuration.	• See the Hardware Module Configuration report. See Reports on page 41.
❒	Compare the current project with the last downloaded.	• Compare Project to the Last Downloaded Command on page 330
❒	Test on the emulator.	• Emulator Testing on page 297
❒	Ensure the scan time has a surplus	• Determining the Scan Surplus on page 306
❒	Download the changed application.	• Using the Download Changes Command on page 314. • Using the Download All Command on page 316
❒	Backup the project and copy it to another storage medium.	• Backup Project Command on page 322

Planning and Controlling Changes

This section describes recommended procedures for planning and controlling changes to an existing application. All changes to an application should be controlled by a change control board or the equivalent, and should comply with strict control procedures.

Recommended Procedure

1. Generate a change request defining all changes to the application and the reasons for the changes, then obtain approval for the changes from the board.
2. Develop a specification for changes, including a test specification, then obtain approval for the specification from the board.
3. Make the appropriate changes to the application, including those related to design, operation, or maintenance documentation.
4. Verify the application in the controller matches the last downloaded application. See Verify Last Download to the Controller Command on page 441. If the applications do not match, contact Triconex Technical Support.
5. Print the Hardware Module Configuration report to compare the current configuration with the last one downloaded to the controller.
6. Print all user documents and thoroughly check all changed networks in each document to ensure the changes do not affect other parts of the application.
7. Test the new application on the emulator and write a test report.
8. Review and audit all changes and the test results with the board.
9. When approved by the board, download the changes to the controller.
10. Save the downloaded application and back up the appropriate files on a CD or other storage medium.
11. Archive two copies of the PT2 (project) file and all associated documentation.

Commands Required with Application Changes

After an application is downloaded to a controller, the state is set to accept changes to the project which are allowed with the Download Changes command. If a change requires the Download All command, it is either disabled or a message advises you to change the state or cancel the change. For example, a program cannot be deleted unless the state is changed to Download All.

This table identifies whether a Download All or Download Changes command is required.

Table 33 Commands Required with Changes

Component	Command Required
Chassis	Download All: Required if a chassis is added, deleted, or the type is changed.
Functions and function blocks	Download All: Required if a function or function block is modified or deleted. Download Changes: Allowed if a function or function block is added.
IP Address	Download Changes: Allowed, but not advised, if the IP address of a communication module is changed.
Memory allocation	Download All: Required if memory allocation is increased.
Modules	Download All: Required if modules are deleted or moved in the configuration. Download Changes: Allowed if a module is added and the chassis has empty slots, and there is sufficient memory allocated for the points.
Node Number	Download All: Required if the address plug and node number configuration are changed.
Number of Send or Receive function blocks	Download All: Required if the number of send or receive function blocks is increased or decreased.
Operating Parameters	Download All: Required if the Allow Disabling of Points property is changed. Download Changes: Allowed if these properties are changed: Disable Remote Changes to Outputs, Password Required for Connection, Restart on Power-Up (Trident only), Scan Time, and Use Local Time.
Programs	Download All: Required if a program is deleted from an application. Download Changes: Allowed if a program is added to an application and there is sufficient memory.
Tagnames	Download Changes: Allowed if tagnames are added, modified, or deleted. Tagnames can also be disconnected or connected to different points, if there is enough memory allocated for the required point types. Points must be enabled.
Variables	Download All: Required if changes to the Data Type or Alias Type require additional memory allocation. Download Changes: Allowed if changes to the Data Type or Point Type do *not* require additional memory allocation. Points must be enabled. Also allowed if the variable Name, Description, or Initial Value is added or changed.

Disabling (Forcing) Points

This procedure explains how to disable points on an application running on a controller, which should be used with care. When a point is disabled, inputs from field instruments do not change the value of the point. Disabling points is typically used when field instruments need to be replaced or repaired.

For Tricon v9.*x*, a maximum of 64 points can be disabled at any one time. For Tricon v10.*x*, a maximum of 256 points can be disabled.

- A project should not contain disabled points unless there is a specific reason for disabling them, such as initial testing or maintenance.
- Disabling points can increase the scan time.

Procedure

1. Expand the Configuration tree, and click Controller Panel.
2. On the Commands menu, click the Connect command, and enter the connection password if required.
3. Double-click a point to be disabled, and click Disable.

   Only one point can be disabled at a time.
4. Repeat step 3 until all desired points have been disabled.

Using the Download Changes Command

This procedure explains how to use the Download Changes command to download changes to an application that has been downloaded and is running on a controller. For information on changes that are allowed with this command, see Download Changes Command on page 349.

These warnings should be reviewed before proceeding.

WARNING

- Changing a safety-critical application that is running on a controller should be avoided because an error in the application could cause a trip or unpredictable behavior.
- If the application has a negative Scan Surplus, do not use the Download Changes command because it could cause a trip or unpredictable behavior.
- When a Download Changes command is issued, the scan time is doubled for one scan immediately following the command.
- If the IP Address is changed, the Fault indicator on the communication module turns on during the reset, which temporarily compromises the TMR status of the controller.
- If an I/O module is added, the TMR status of the controller is temporarily compromised for as much as 8 to 16 scans. For more information, see Adding an I/O Module below.
- If the AI module type for models 3703 or 3704 is changed, the TMR status of the controller is temporarily compromised for as much as 8 to 16 scans.
- If the DO module type for models 3611, 3613, 3614, 3615, or 3617 is changed, the TMR status of the controller is temporarily compromised for as much as 8 to 16 scans.
- If in doubt about the effect of this command, contact Technical Support.

Adding an I/O Module

If the application uses the following function blocks, the changed application should include logic to accommodate the behavior.

- For Tricon, the IOMAIN and IOBAD parameters of the TR_MP_STATUS function block turn off.
- For Trident, the parameters for the SYS_IO_STATUS, SYS_IOP_STATUS, and SYS_SYSTEM_STATUS function blocks turn off.

For more information, see the Tricon or Trident *Safety Considerations Guide*.

Procedure

1. Expand the Configuration tree, and double-click the Controller Panel.
2. On the Commands menu, click Connect  , and enter the connection password if required.
3. On the Commands menu, click Download Changes  .

   If the download is successful, a backup file of the project is automatically created with the major version, minor version, time stamp, and the extension DWLD. For example, EXCOUNTR_333_1_4120e077.DWLD. If needed, this file can be restored by using the Restore Project To Last Download Command on page 410.

   The changes are made while the application is running.

Using the Download All Command

This procedure explains how to use the Download All command to download a changed application to a controller. For information on changes that require this command, see Download All Command on page 348.

WARNING Using the Download All command requires the current application running on the controller to be halted.

Procedure

1. Expand the Configuration tree, and double-click the Controller Panel.
2. On the Commands menu, click Connect  .
3. If needed, change the connection setting. Click OK.
4. If required, enter the connection password.
5. If needed, change the state to Download All. On the Commands menu, click Change State to Download All.
6. Click Halt to stop the application.
7. For Tricon, turn the keyswitch to PROGRAM.
8. For Trident, ensure the mode is Enable Programming and Control Operations, by doing this:

   On the Commands menu, click Set Programming Mode, and then click Enable Programming and Control Operations. (This is the default setting.)
9. Click Download All  .

   If the download is successful, a backup file of the project is automatically created with the major version, minor version, time stamp, and the extension DWLD. For example, EXCOUNTR_333_1_4120e077.DWLD. If needed, this file can be restored by using the Restore Project To Last Download Command on page 410.
10. Click Run  to start the application running on the controller.
11. For Tricon, turn the keyswitch to RUN.

A

Commands and Properties

This appendix provides descriptions of TriStation commands and properties.

Add Program to Execution List Command

The Add Program to Execution List command places the cursor inside the Program Execution List box, which allows you to enter or select a program to be added to the list.

Applies To

Application

Location

Application tree > Implementation > Edit menu

Alias Number

The Alias Number property identifies the range of five-digit alias numbers that can be assigned to the point. For Trident, the alias number can be set within a default range or within a larger allowable range.

This table identifies Tricon and Trident ranges.

Table 34 Alias Number Information

Bin	Data Type	Variable Type	Message Type	Tricon Range	Trident Default Range	Trident Allowable Range	Bin Size
0	BOOL	Output	Read/Write	00001 - 02000	00001 - 04999	00001 - 09999	2048
1	BOOL	Memory	Read/Write	02001 - 04000	05000 - 09999	00001 - 09999	2016
2	BOOL	Input	Read	10001 - 12000	10001 - 14999	10001 - 19999	4096
3	BOOL	Memory	Read	12001 - 14000	15000 - 19999	10001 - 19999	2016
4	DINT	Input	Read	30001 - 31000	30001 - 32499	30001 - 39999	1024
5	DINT	Memory	Read	31001 - 32000	32500 - 34999	30001 - 39999	1000
6	REAL	Input	Read	32001 - 32120	35000 - 37499	30001 - 39999	120

Table 34 Alias Number Information *(continued)*

Bin	Data Type	Variable Type	Message Type	Tricon Range	Trident Default Range	Trident Allowable Range	Bin Size
7	REAL	Memory	Read	33001 - 34000	37500 - 39999	30001 - 39999	1000
10	DINT	Output	Read/Write	40001 - 40250	40000 - 42499	40001 - 49999	512
11	DINT	Memory	Read/Write	40251 - 41000	42500 - 44999	40001 - 49999	750
12	REAL	Memory	Read/Write	41001 - 42000	45000 - 49999	40001 - 49999	1000
13	DINT	Memory	Read	38000 - 39630	n/a	n/a	1630
14	BOOL	Memory	Read	18001 - 19999	n/a	n/a	2000

Applies To

Communication

Location

Application tree > Tagnames > Item Properties > Point Assignment tab

Alias Type

The Alias Type property identifies whether the memory point has an alias number and whether the point is read or read/write. Settings include:

- **Unaliased**: Means the point cannot be read or written to.
- **Read aliased**: Means the point can be read by an external device. If specified, you can accept the default alias, or enter a number for the alias.
- **Read/write aliased**: Means the point can be read or written by an external device. If specified, you can accept the default alias, or enter a number for the alias.

Applies To

Communication

Location

Application tree > Tagnames > Item Properties > Point Assignment tab

Alignment

The Alignment property specifies how the text for an annotation or comment is aligned in the comment box; either left, center, or right. The default is left.

Applies To

Comments

Locations

Item Properties > Comment tab
Project menu > Project Options > Annotations tab

Allow Disabling of Points

The Allow Disabling of Points property specifies whether points can be disabled from the TriStation PC. A TriStation PC cannot write to disabled points, however, external devices such as Modbus masters can write to disabled points unless you disable external device writes.

The default is cleared, which means points cannot be disabled from the TriStation PC.

Once you have selected this property, you must rebuild the application and perform a Download All to apply your changes to the controller. See Building or Rebuilding an Application on page 174 and Using the Download All Command on page 316.

Applies To

Memory and Output Points

Locations

Tricon Controller tree > Configuration > Operating Parameters
Trident Controller tree > Configuration > MP Setup > Operating Parameters tab

Annotate

The Annotate property specifies whether to add an annotation, which is similar to a comment, to a variable. If selected, an annotation box is attached to the bottom of an input, output, input/output, or local variable. You can change the size of the annotation box.

An annotation can include any of the following:

- The monitor value (value of the variable as the configuration executes)
- The default macro for the particular type of variable
- Other standard macros
- User-modified macros
- Text that you type in

The default is cleared, which means an annotation is not included. If Annotate is cleared, no properties are available to view when the application is run on the controller or emulator.

Applies To

Variables

Location

Item Properties > Constant tab

Annotation on by Default

The Annotation on by Default property specifies whether to automatically add annotation boxes to variables used with a program or function block. Annotations allow you to include information that is displayed at the bottom of an input, output, input/output, or local variable. If you enable annotation for the project, the annotation display is automatically added to all the variables in the project.

The default is cleared, which means annotation is not automatically added.

Applies To

Variables

Location

Project menu > Project Options > Annotations tab

Application Type

The Application Type property determines whether an application element (program, function, function block, or tagname) is used with safety, control, or safety and control applications.

The default is Control.

Table 35 Application Types

Setting	Description
Safety	An application that is designed to take a process to a safe state when predetermined conditions are violated. Also referred to as an Emergency Shutdown System (ESD), Safety Instrumented System (SIS), and Safety Interlock System. Applies to programs and tagnames.
Control	An application that controls a process. Cannot be used in Safety programs. Applies to programs, functions, function blocks, and tagnames.
Safety or Control	An application that includes a mixture of safety and control components. Applies to functions and function blocks.

Applies To

Programs, Functions, Function Blocks, and Tagnames

Locations

Item Properties > Application tab
Declarations > Application tab

Apply Command

The Apply command allows you to save and apply changes you have entered. For example, if you enter an initial value of 2 for a BOOL tagname and click Apply, a message indicates that the value and data type are not compatible.

Applies To

Validation of application elements

Location

Item Properties > Constants or Point Assignment tab

Auto Indent Command

The Auto Indent Command toggles to allow you to use automatic indentation or set your own indentation in Structured Text code.

Applies To

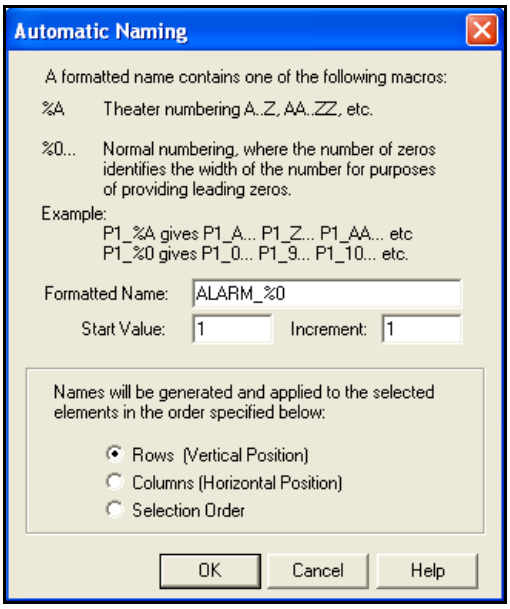
ST programs and functions

Location


Auto Indent button, or View menu

Auto Name Command

The Auto Name command names more than one variable or constant according to a pattern that you specify. You can specify a name, starting value, and incremental value. You can also specify the order in which to apply the names to the selected elements.



Properties include:

- Formatted Name on page 364
- Start Value and Increment on page 428
- Name Order on page 387

Applies To

Variables

Locations


Auto Name button, or Tools menu
Item Properties > Constants or Selected tab

Auto Scroll Delay

The Auto Scroll Delay property specifies how many milliseconds to delay scrolling while scrolling through the Structured Text.

Applies To

ST Language

Location

View menu > Set Editor Options

Backup Project Command

The Backup Project command saves a copy of the open project elements and settings, and creates a backup file named <*project_name*>.bt2.

Procedure

1. On the File menu, click Backup Project.
2. Specify the folder to save the file to. Use the suggested name or specify a new one. The file extension (.bt2) does not have to be included in the name.
3. Click Save.

Applies To

Project

Location

File menu

Base Address

For Tricon, the Base Address property specifies the block address for the Tricon HIM based on the Data Hiway memory map. Must be an integer between 5 and 31; the default is 5.

Applies To

Tricon HIM

Location

Controller tree > Configuration > HIM Setup

Baud Rate

The Baud Rate property specifies the data transmission speed. Settings include:

- For Tricon EICM: 19200, 9600, 4800, 2400, or 1200.
- For Tricon TCM: 115200, 57600, 38400, 19200, 9600, 4800, 2400, or 1200.
- For Trident: 115200, 57600, 38400, 19200, 9600, 2400, or 1200.

The default is 9600.

Applies To

Tricon EICM, Tricon TCM, Trident MP, Trident CM

Locations

Tricon Controller tree > Configuration > Hardware Allocation > EICM Setup
Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Serial Ports tab
Tricon Controller tree > Configuration > TriStation Communication
Trident Controller tree > Configuration > Hardware Allocation > MP or CM Setup > Serial Ports tab

Block Type

See SOE Block Type on page 426.

Border

The Border property specifies whether to include a border around an annotation or comment box. The border property can be specified for the project, or for individual annotations and comments.

Options include None, Single, and Double. The default is Single.

Applies To

Annotations, Comments

Locations

Item Properties > Comment tab
Project menu > Project Options > Annotations tab

Build Application Command

The Build Application command builds an application by compiling programs in the execution list that have been modified since the last time they were compiled. The command then links the object code, library routines, and configuration elements to create an executable application.

Each successive time you use the Build Application command, it compiles and links only documents and items that have changed since the last build.

After using the Build Application command several times, you should use the Rebuild Application command. A rebuild compiles and links all documents and items in the application, not just the ones that have changed since the last build.

Applies To

Application

Location

Build Application button, or Project menu

Category

The Category property specifies a name for a category that can be associated with documents (programs, functions, function blocks, and data types). By adding a category name, you can sort elements by type.

Applies To

Documents

Location

Right-click a document > Document Properties > Summary tab

Cause Effect Matrix Support

The Cause Effect Matrix Support properties specify whether and how a function or function block can be used in a CEM program. For user-defined functions, function blocks, and data types, you can specify the setting. (For TriStation 1131 Library elements, the setting cannot be changed.)

Settings include:

- Supports use in cause rows with ... inputs
- Supports use in effect columns with ... outputs
- Supports use in intersections
- Supports application defined states

The default is cleared for all options.

Applies To

Functions and function blocks used in CEM programs

Location

Application tree > right-click a function or function block > click Attributes tab

Cause Header Functions On by Default

The Cause Header Functions On by Default property specifies whether an input and function column are automatically included in the cause header when a CEM program is created. The default is cleared.

Applies To

CEM programs

Location

Tools menu > TriStation 1131 Options > CEM Editor tab

CEM Monitor Colors

The CEM Monitor Colors property specifies the colors to display for cause, effect, and intersection cells in a CEM program. These colors are used when the application is run on the controller or emulator.

The default for True is red. The default for False is white.

Applies To

CEM programs

Location

Project menu > Project Options > Monitor Colors tab

CEM Editor Options

The CEM Editor Options properties specify the initial settings used when a CEM program is created. Settings on individual CEM programs can be changed by setting the CEM Element Options on page 325.

Properties include:

- Cause Header Functions On by Default on page 324
- Effect Header Functions On by Default on page 351
- Intersection Functions On by Default on page 373
- Default Number of Cause Rows on page 339
- Default Number of Effect Columns on page 339

Applies To

CEM programs

Location

Tools menu > TriStation 1131 Options > CEM Editor tab

CEM Element Options

The CEM Element Options properties specify the settings for a specific CEM program. For information on specifying initial properties, see Specifying CEM Element Options on page 94.

Properties include:

- Enable Cause Header Functions on page 353
- Enable Effect Header Functions on page 354
- Enable Intersection Functions on page 355
- Enable Floating Text in Intersection Cells on page 355
- Evaluation Options on page 358

Applies To

CEM programs

Location

Open a CEM program > click the Document menu > click Options

Change Colors Command

The Change Colors command displays a color palette that allows colors to be used when an element is displayed on a logic sheet.

Applies To

Project elements

Location

Tools menu > TriStation 1131 Options > Drawing Colors tab

Change Owner Command

The Change Owner command allows you to change the owner of a document. Normally, the owner of a document is the user who created it.

Applies To

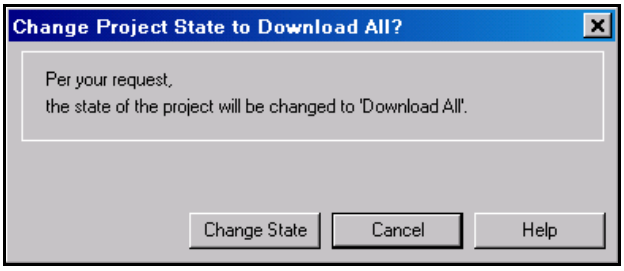
Programs and functions

Location

Right-click an element > Item Properties > Change Owner

Change State to Download All Command

The Change State to Download All command changes the download state so that the Download All command can be used when the application is downloaded. You cannot reverse this command. Before changing the state, you may want to make a backup copy of the application so that you can use it if you decide that a Download All command is not needed.



This command is only available after an application has been downloaded to the controller. If the project is opened in a newer version of TriStation, this screen may be displayed to indicate that changes, such as adding new libraries, will require a Download All.

WARNING The Download All command should not be used if the application on the controller is running on a live system. If needed, the system should be taken offline while the download is done.

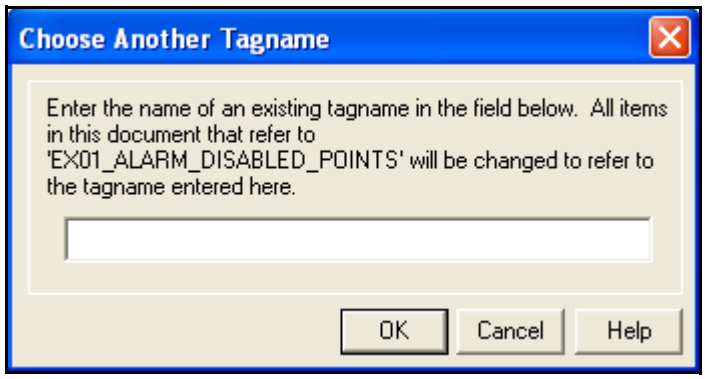
Applies To

Downloaded application

Location

Project menu

Choose Another Tagname Command



The Choose Another Tagname command allows you to select a tagname and specify a different tagname to replace it. If there is more than one occurrence of the selected tagname, all occurrences are changed to the specified name.

Applies To

Tagnames in FBD editor

Location

FBD editor > right-click a tagname in the Tagname Declarations tree

Clear History Command

The Clear History command deletes the history of actions, which is a listing of all changes made to a project. Each item includes the date, element, user, action, and comment for the change.

Applies To

Project

Location

Project menu

Client IP Address

The Client IP Address property specifies the IP address of the client that you want to allow, restrict, or deny access to the TCM. Also see IP Address on page 374.

Can be used in conjunction with the Client IP Subnet Mask property to create groups of IP addresses with the same access levels.

Applies only to a model 4351A or 4352A Tricon Communication Module (TCM).

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Access List tab

Client IP Subnet Mask

The Client IP Subnet Mask property allows you to group IP addresses, so that you can create a single entry in the TCM client access list for all IP addresses on the subnet. Also see IP Subnet Mask on page 375. Applies only to a model 4351A or 4352A Tricon Communication Module (TCM).

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Access List tab

Client Protocols

The Protocols property in the TCM client access list specifies the protocol(s) that the selected client can use to access the TCM. Applies only to a model 4351A or 4352A Tricon Communication Module (TCM).

Table 36 TCM Client Access Protocols

Protocol	Description
TSAA	Stands for Triconex System Access Application, which is a protocol that enables client/server communication between Triconex controllers and PCs. OPC Server and DDE Server use TSAA protocol to exchange data with Triconex controllers. TSAA protocol can be used to write programs for accessing controller tagnames.
OPC	Not supported by TriStation in this release.
TriStation	A Triconex master/slave protocol in which the master (a TriStation 1131 PC) communicates with the slave (a Triconex controller) over an Ethernet network.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Access List tab

Close Project Command

The Close Project command closes an open project and prompts you to save it if changes have been made.

Applies To

Project

Location

File menu

Coil Tool Command

The Coil Tool Command allows you to add a coil, which represents the state of an output variable.

Applies To

LD program or function

Location

 Coil Tool button, or Tools menu > Select Tools

Coil Type

The Coil Type property represents the output state of a coil used in an LD program or function.

Table 37 Coil Type Symbols and Descriptions

Coil Type	Symbol	Description
Normal (Momentary)	( )	The state of the left link is copied to the associated Boolean variable and to the right link.
Negated (Momentary)	(/)	The inverse of the state of the left link is copied to the associated Boolean variable and to the right link.
Positive Transition	(P)	The state of the associated Boolean variable is On from one evaluation to the next if the left link changes from Off to On.
Negative Transition	(N)	The state of the associated Boolean variable is On from one evaluation to the next if the left link changes from On to Off.
Set (Latch)	(S)	The associated Boolean variable is set to On if the left link is in the On state and remains On until reset by the RESET coil.
Reset (Unlatch)	(R)	The associated Boolean variable is reset to Off if the left link is in the On state and remains Off until set by the SET coil.

Applies To

LD program or function

Location

Item Properties > Selected tab

Comment Tool

The Comment Tool allows you to draw a text box for a non-executable comment, and then type text inside the box.

Applies To

Logic sheets in user documents, test sheets in the Controller and Emulator Panels

Locations

Comment Tool button

Application tree > User Documents tree > Tools menu > Select Tool command
Configuration tree > Controller or Emulator Panel > Tools menu > Select Tool command

Communication Command

The Communication command displays the Communication screen on the Controller tree.

Applies To

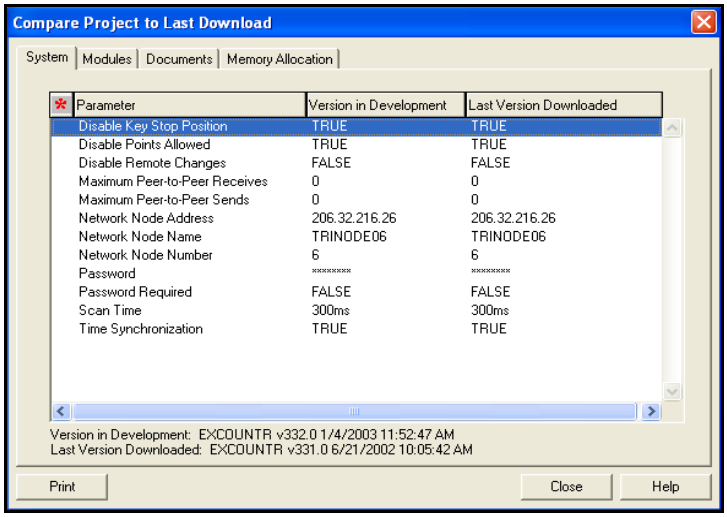
Communication

Location

Communication button, or Controller tree > View menu > Go to > Communication

Compare Project to the Last Downloaded Command

The Compare Project to Last Download command allows you to compare the changes made in the new application to-be-downloaded with the application already downloaded to a controller. You can view the comparison online, or print a report. Differences between the project and the downloaded application are identified with a red asterisk (*).



This report should be run for all safety applications.

Click each tab to compare differences. A red asterisk marks differences.

Applies To

Application and configuration elements

Location

Project menu

Compile Command

The Compile command compiles the selected document and displays any errors.

Applies To

Programs, functions, and function blocks

Location

 Compile button, or Document menu

Compile All User Documents Command

The Compile All User Documents command compiles all the user-created documents in a project.

Applies To

Application

Location

Project menu

Compiler Warning When Right Power Rail is Missing

The Compiler Warning When Right Power Rail is Missing property specifies whether to display a warning if the right rail is missing on a Ladder Diagram program.

The default is cleared, which means a warning is not displayed if the right rail is missing.

Applies To

Ladder Diagram programs

Location

Tools menu > TriStation 1131 Options > LD Editor tab

Connect Command

The Connect command attempts to connect the TriStation PC to the controller or emulator, depending on whether the command is issued from the Controller or Emulator Panel.

When the Connect Command is issued from the Controller Panel, a screen allows you to change some default connection settings.

Table 38 Connect Properties for Communication Modules

Communication Module	Properties that can be set
Tricon EICM or NCM	Serial or Network port settings.
Tricon TCM	Serial or Network port settings, TriStation UDP Port Number, and Baud Rate (for serial connection only).
Trident MP or CM	Serial or Network port settings.

Applies To

Communication modules, controller

Location

Connect button, or Controller or Emulator Panel > Command menu

Contact Command

The Contact command allows you to add a contact to a Ladder Diagram. After adding a contact, you can specify the Contact Type.

Applies To

Ladder Diagrams

Location

Contact Tool button, or Tools menu > Select Tools

Contact Type

The Contact Type property specifies the type of a contact used in a Ladder Diagram.

Table 39 Contact Type Symbols and Descriptions

Contact Type	Symbol	Description
Normally Open	–| |–	The state of the left link is copied to the right link if the state of the Boolean variable is On.
Normally Closed	–| / |–	The state of the left link is copied to the right link if the state of the Boolean variable is Off.
Positive Transition	–| P |–	The state of the right link is On from one evaluation to the next when the associated variable changes from Off to On while the state of the left link is On.
Negative Transition	–| N |–	The state of the right link is On from one evaluation to the next when the associated variable changes from On to Off while the state of the left link is On.

Applies To

Contacts in Ladder Diagram programs

Location

Item Properties > Variable tab > Contact Type area

Continuous Refresh Command

The Continuous Refresh command continuously displays the current values of variables on test sheets or on the program document display. The default is On.

Applies To

Controller or Emulator Panel

Locations


Continuous Refresh button
Controller tree > Controller or Emulator Panel > Commands menu

Copy Command

The Copy command copies the selected items from the current tree or sheet and places them on the clipboard.

Applies To

Test sheets and elements in Controller or Emulator Panel
User documents and elements on logic sheets

Location


Copy button, or Edit menu

Copy Current Setup to Other Serial Ports Command

The Copy Current Setup to Other Serial Ports command copies the settings for the selected serial port to the other serial ports.

Applies To

Trident MP serial ports

Location

Trident Controller tree > Configuration > Hardware Allocation > MP Setup > Serial Ports tab

Current Version

The Current Version property identifies the current version of the project under development. This is how the version is determined:

- The version of a newly created project is 1.0.
- If it is changed and saved after being downloaded to the controller, the minor number is increased by 1. For example, 1.1.
- If the state is changed to Download All, the major number is increased by 1 and the minor number is changed to 0. For example, version 1.1 is changed to 2.0.

Applies To

Projects

Location

Project menu

Cut Command

The Cut command deletes the selected items from the current tree or sheet and places them on the clipboard, erasing the previous clipboard contents.

Applies To

Test sheets and elements in Controller and Emulator Panels
User documents and elements on logic sheets

Location


Cut button, or Edit menu

Data Bits

The Data Bits property specifies whether the data format includes 7 or 8 data bits. To set this property, you must use Modbus slave or Modbus slave ASCII protocol. The default is 8 bits.

Applies To

Tricon EICM, Tricon TCM
Trident CM

Locations

Tricon Controller tree > Configuration > Hardware Allocation > EICM Setup
Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Serial Ports tab
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Serial Ports tab

Data Files

The Data Files property specifies the path name for documents including user libraries, configuration files, and custom report templates. The default path name and file extension is:

```
C:\My Documents\Triconex\TriStation 1131 4.1\Data
```

Applies To

Project

Location

Tools menu > TriStation 1131 Options > Directories tab

Data Type

The Data Type property specifies the kind of data that can be stored in the variable. For more information about TriStation data types, see Appendix B, Data Types.

This table identifies the data types available for variables.

Table 40 Variable Data Types

Variables	Data Types
Tagnames	BOOL, DINT, REAL
Constants and local variables	DATE, DT, DWORD, INT, LREAD, STRING, TIME, TOD

Applies To

Constants, local variables, and tagnames

Location

Item Properties > Constant or Declaration tab

Declarations Command

The Declarations command displays a dialog box that allows you to declare an input, output, in/out, local, or tagname declaration. Variables must be declared to be used in programs and functions.

Applies To

Variables

Location

Double-click a variable or right-click the Tagname Declarations folder

Default Colors Command

The Default Colors command returns the colors of drawing items to the default colors. The color settings on your PC affect the default colors. This table describes the drawing items for which colors can be changed.

Table 41 Drawing Item Default Colors

Drawing Item	Default Color
Element background	Medium gray
Element text and border	Black
Selected element background	Dark blue
Selected element text	White
Sheet background	White
Sheet background (read-only documents)	Medium gray
Zone division lines	Medium gray

Applies To

Logic sheets in user documents
Test sheets in Controller and Emulator Panels

Location

Tools menu > TriStation 1131 Options > Drawing Colors tab

Default Connection

The Default Connection property specifies the initial setting used when the Connect dialog box is displayed. This setting can be changed in the Connect dialog box before connecting to the controller. This property is only available when both types of connections are selected in the Select Connections area. Default settings are:

- For Tricon, the default is Network Connection.
- For Trident, the default is Main Processor.

Applies To

Application, controller, modules

Location

Configuration tree > TriStation Communication

Default Gateway IP Address

The Default Gateway IP Address property specifies the IP address of the gateway to which the controller is connected. Typically, this information is available from a network administrator or Information Technology department.

Applies To

Communication

Locations

Tricon Controller tree > Configuration > Hardware Allocation > ACM Setup
Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Network and Routing tabs
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Network or Routing tab

Default Language

The Default Language property specifies the programming language to use initially when creating a user document. The default is Function Block Diagram.

Options include:

- Function Block Diagram
- Ladder Diagram
- Structured Text
- Cause Effect Matrix

Applies To

User documents

Location

Project menu > Project Options > Language tab

Default Macros or Text

The Default Macros or Text property specifies a default macro or text to include with a variable in a program, function, or function block.

Variable	Program Defaults	Function Defaults
Tag Refs	%PGM_TAGNAME	
Local variables	%PGM_LOCAL	%FB_LOCAL
I/O variables	%PG_IO	%FB_IO

Default Macros for Annotations

The default macros used with annotations vary depending on the element and variable type. For example, the %PGM_TAGNAME macro expands to include the tagname (P1.WATER_LOW), location on controller (03.04.13), and alias number (10018).

Table 42 Default Macros for Annotations

Macro Name	Default Value	Used With	Sample Expanded Macro
%PGM_TAGNAME	%TAG_MEMORYADDRESS% TAG_ALIAS	Program Externals	P1.WATER_LOW 03.04.13 10018
%PGM_LOCAL	%WHERE_USED	Program Locals	PROCESS_COUNT 1(C7) 3(D5) 4(A2)
%FB_INPUT	<no default>	Function Inputs	<no default>
%FB_OUTPUT	<no default>	Function Outputs	<no default>
%FB_IO	<no default>	Function Inputs/Output	<no default>
%FB_LOCAL	<no default>	Function Locals	<no default>

Macros Used in the Default Macros

Macros beginning with %TAG cannot be modified.

Table 43 %TAG Macros Used in the Default Macros

Macro Name	Description
%PGM_TAGNAME	The name of the point to which the program variable is connected.
%TAG_MEMORY ADDRESS	The location of the point to which the program variable is connected. This only applies to physical input and output points and is displayed in this format: • *For Tricon*: CC.SS.PP; where CC is the chassis, SS is the slot, and PP is the point. For memory points, an empty string is returned. • *For Trident*: ii.ss.pp; where ii is the I/O processor number, ss is the module baseplate address plug number, and pp is the point number.
%TAG_ALIAS	The Modbus alias of the point to which the program variable is connected. If the point has no alias, an empty string is returned.

Applies To

Annotations and Comments

Location

Item Properties > Annotation or Comment tab > Macros button

Default Number of Cause Rows

The Default Number of Cause Rows property specifies the number of rows added when a matrix is created using the CEM editor. The default is 22.

Applies To

CEM programs

Location

Tools menu > TriStation 1131 Options > CEM Editor tab

Default Number of Effect Columns

The Default Number of Effect Columns property specifies the number of columns added when a program (matrix) is created using the CEM editor. The default is 25.

Applies To

CEM programs

Location

Tools menu > TriStation 1131 Options > CEM Editor tab

Delete Command

The Delete command deletes the selected item.

Applies To

Project elements

Location

Edit menu

Delete Columns Command

The Delete Columns command displays a dialog box that allows you to specify the number of columns to delete in a CEM program and the beginning column position.

Applies To

CEM programs

Location


Delete Columns button, or Edit menu

Delete Rows Command

The Delete Rows command displays a dialog box that allows you to specify the number of rows to delete and the beginning row position.

Applies To

CEM programs

Location

 Delete Rows button, or Edit menu

Delete Unreferenced Tagnames Command

The Delete Unreferenced Tagnames command removes tagnames that are not used in programs or functions.

Applies To

Tagnames

Location

Application tree > Tagname Declarations

Description

The Description property specifies descriptive text about the selected item. The maximum number of characters is 131, which can include A to Z, and 0 to 9. The underscore character (_) can also be used, but not as the first character in the description. To include this text in an annotation or comment, use the %DESCRIPTION macro.

Applies To

Project elements

Locations

Item Properties > Selected or Declarations tab
Project menu > Security > New or Modify > Add User or Modify User

Destination IP Address

The Destination IP Address property specifies an IP address which is used if the controller is not on the same subnet as other devices.

Applies To

Communication

Locations

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Routing tab
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Routing tab

Destination Gateway IP Address

The Destination Gateway IP Address property specifies the IP address of the gateway device which is used if the controller is not on the same subnet as other devices.

Applies To

Communication

Locations

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Network and Routing tabs
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Routing tab

Destination IP Subnet Mask

The Destination IP Subnet Mask property specifies the binary pattern that is matched with the IP address to turn part of the host ID address field into a field for subnets.

Applies To

Communication

Locations

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Routing tab
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Routing tab

Destination UDP Port

The Destination UDP Port property specifies the port number for other controllers on a Peer-to-Peer network.

Applies To

Peer-to-Peer communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Peer-to-Peer tab

Differential AI Input Type

The Differential AI Input Type property specifies the input type for an analog input point. Only available with AI model 3721. Options include:

- Unipolar: 0 to 5 volts with 6% over-range.
- Bipolar: -5 to 5 volts with 6% under-range and over-range.

For detailed range information, see Resolution Type on page 408.

The default is Unipolar.

Applies To

Analog input points

Location

Controller tree > Configuration > Hardware Allocation > Differential AI Setup

Directories

See:

- Data Files on page 335
- Project Files on page 403
- Temporary Files on page 431

Disable OVD on All Modules Command

For Tricon, the Disable OVD on All Modules command disables Output Voter Diagnostics (OVD) on the points of all digital output modules in a controller (except Supervised DO modules, which cannot have OVD disabled). The application must be running on a controller to use this command.

For Trident, OVD is disabled for individual points by using the SYS_OVD_INHIBIT function. For more information, see the *TriStation 1131 Libraries Reference*.

The default OVD state is enabled for all digital output points.

A safety application may not disable the output voter diagnostic.

Applies To

Application

Location

Controller tree > Controller Panel > Commands menu

Disable OVD on Module... Command

For Tricon, the Disable OVD on Module... command disables Output Voter Diagnostics (OVD) for all points on specified digital output modules in the controller. The application must be running on a controller to use this command.

OVD cannot be disabled for points on a Supervised Digital Output module.

For Trident, OVD is disabled for individual points by using the SYS_OVD_INHIBIT function. For more information, see the *TriStation 1131 Libraries Reference*.

The default OVD state is enabled for all digital output points.

A safety application may not disable the output voter diagnostic.

Applies To

Application, modules

Location

Controller tree > Controller Panel > Commands menu

Disable Programming and Control Operations

Trident only. See Set Programming Mode Command on page 418.

Disable Remote Changes to Outputs

The Disable Remote Changes to Outputs property specifies whether external devices can write to output points in the TriStation application. If selected, external devices cannot write to output points regardless of the settings for other properties. You should select this check box if the application includes safety-critical outputs.

The default is selected, which means output points cannot be changed by external devices.

Applies To

Application

Locations

Tricon Controller tree > Configuration > Operating Parameters
Trident Controller tree > Configuration > Hardware Allocation > MP Setup > Operating Parameters tab

Disable Scaling

For Trident, the Disable Scaling property specifies whether REAL numbers are scaled to integers when they are transmitted from a Trident controller. For Tricon, REAL values are always scaled.

The default is cleared, which means real numbers are not scaled.

Setting	Description
Selected	Two consecutive 16-bit aliases are assigned to each REAL tagname so that IEEE 754 single-precision, floating-point representation is used. This option is available because Modbus has a 16-bit size limitation. Only the first alias of the two is displayed in the Modbus Alias field of the Declaration tab.
Cleared	Only one alias is used.

Applies To

Modbus communication

Location

Application tree > Tagname Declarations> Item Properties > Scaling tab

Disable Stop on Keyswitch

For Tricon, the Disable Stop on Keyswitch property specifies whether to logically disable the STOP position of the keyswitch on the Tricon Main Chassis so that the application is not stopped if the key is turned to the STOP position. If selected, setting the keyswitch to STOP does not halt the application.

The default is cleared, which means that the application is stopped if the keyswitch is turned to STOP.

Applies To

Application

Location

Controller tree > Configuration > Operating Parameters

Disconnect Command

The Disconnect command disconnects an application from the controller or emulator.

Applies To

Communication

Locations

Disconnect button
Controller tree > Controller or Emulator Panel > Commands menu

Display Program Document Command

The Display Program Document command allows you to monitor the execution (power flow) of an FBD program or LD program while an application is emulated in TriStation or run online on a controller.

You can perform monitoring using the default colors or custom colors, which you can change online using the Project Options command. After changing the monitor colors, you must perform a Download Changes operation for the new colors to take effect.

Applies To

Programs

Locations

Display Program Document button
Controller tree > Controller or Emulator Panel > Commands menu

Display Report Command

The Display Report command displays a selected report.

Applies To

Reports

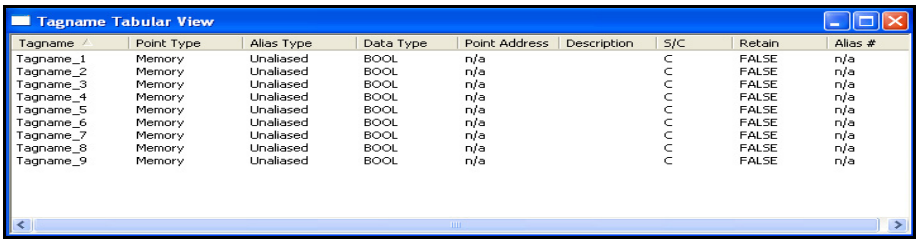
Location

Project tree > Report viewer toolbar

Display Tabular View Command

The Display Tabular View command displays tagnames in a table format, which allows you to change multiple tagnames at a time. To make sorting and changing easier, you can also change the columns that are displayed and the order in which they are displayed.

Properties include: tagname, point type, alias type, data type, point address, description, S/C (safety or control), retain (Retentive), alias #, Min Span, Max Span, Group 1, Group 2, and initial value.



Applies To

Tagnames

Location

Application tree > right-click Tagname Declarations folder

DO Point Options

The DO Point Options property specifies the type of fault detection used for the point. Each point can be specified with one of these options.

Available only with the 3625 digital output module.

Table 44 DO Point Options

Option	Description
Not Used	Fault detection is the same as for Non-Supervised points, except reporting of benign field fault conditions is suppressed. Points configured as Not Used *will* be energized if the application commands them on.
Non-Supervised	Fault detection includes: • Detection of all internal faults, including those in the output circuitry. • Detection of external faults associated with the field device or wiring—limited to loss of field power and shorted loads under most conditions. Non-supervised is the default.
Supervised	Fault detection includes: • Detection of all internal faults, including those in the output circuitry. • Detection of all external faults associated with field device or wiring, such as, loss of power, shorted loads, open loads, and so on.

Applies To

Tricon DO Points

Location

Controller tree > Configuration > Hardware Allocation > DO Setup

Document Access

The Document Access property specifies whether the document can be read, read and written to (changed), or is locked. Settings include:

- Read: Any user can read the document, which means it can be viewed.
- Read/Write: Any user can read or change the document.
- Lock: Only users with the same or higher security level can read and write the document.

The default is Read/Write.

Applies To

Programs, functions, function blocks, and data types

Location

Right-click a document > Properties > Summary tab

Document Type

The Document Type property specifies whether a document is a program, function, function block, or data type.

Applies To

Document

Location

Project menu > New Document

Double Space

The Double Space property specifies whether to display double spaces between the terminals (inputs and outputs) on a function or function block, which provides additional space for annotations and comments. This setting specifies spacing on an individual function or function block.

CAUTION If you select Double Space after input and output variables have been attached to the function or function block, the variables will have to be reattached.

The default is cleared, which means the terminals are single spaced.

Applies To

Functions and function blocks

Location

Item Properties > Function tab > Terminals > Double Space

Double Space Function (Block) Terminals by Default

The Double Space Function Block Terminals property specifies whether to display double space between the terminals (inputs and outputs) on a function or function block, which allows space for annotations and comments. This setting affects all new functions and function blocks created in a project.

The default is cleared, which means the terminals are single spaced by default.

Applies To

Functions and function blocks

Location

Tools menu > TriStation 1131 Options > FBD Editor tab and LD Editor tab

Download All Command

The Download All command downloads an application to the controller or emulator.

A Download All command requires that the application on the controller is halted.

Table 45 Download All Required

Component	Description
Chassis	Required if adding, changing (the type), or deleting a chassis. To avoid a Download All after the initial download, include the maximum number of chassis in the application before downloading the application.
Functions and function blocks	Required if changing or deleting a function or function block.
Memory allocation	Required if changing memory allocation.
Modules	Required if moving or deleting modules in the configuration.
Node Number	Required if changing the address plug and node number configuration.
Number of Send or Receive function blocks	Required if increasing or decreasing the number of send or receive function blocks.
Operating Parameters	Required if changing the Allow Disabling of Points property.
Programs	Required if changes to a program exceed available memory. Required if deleting a program.
Tagnames	Required if importing tagnames from an Excel or database file. Required if changes to tagnames require additional memory allocation.
Variables	Required if changes to variables require additional memory allocation.

Applies To

Application

Locations

Download All button
Controller > Controller or Emulator Panel > Commands menu

Download Changes Command

The Download Changes command downloads changes made to an application, while an application is running on the controller. This command is only available on the Controller Panel.

WARNING

- Changing a safety-critical application that is running on a controller should be avoided because an error in the application could cause a trip or unpredictable behavior.
- For additional warnings, see Using the Download Changes Command on page 314.

Table 46 Download Changes Allowed

Element	Description
Functions and function blocks	Allowed if adding a function or function block, but not if changing or deleting an existing function or function block.
IP Address	Allowed, but not advised, if the IP address of a communication module is changed.
Modules	Allowed if adding a module to an empty slot, which has sufficient memory allocated for the points. Not allowed if moving or deleting modules.
Operating Parameters	Allowed if changing these properties: Disable Remote Changes to Outputs Password Required for Connection Restart on Power-Up (Trident only) Scan Time Use Local Time
Programs	Allowed if adding or changing a program and there is sufficient memory. Not allowed if deleting a program.
Tagnames	Allowed if adding, changing, or deleting tagnames. Tagnames can also be disconnected or connected to different points, if there is enough memory allocated for the required point types. Points must be enabled.
Variables	Allowed if changing variable properties does *not* require additional memory allocation. If the Initial Value is changed, the value is not used until the application is stopped and restarted. Points must be enabled.

Applies To

Application changes

Locations

Download Changes button
Controller tree > Controller Panel > Commands menu

Downloaded Version

The Downloaded Version property identifies the version of the application (project) that is downloaded and running on the controller.

Applies To

Projects

Location

Project menu

Drawing Item

The Drawing Item property specifies the colors to use to with elements on logic sheets.

Applies To

Logic sheets

Location

Tools menu > TriStation 1131 Options > Drawing Colors tab

Drop Command

The Drop command drops all the logic elements enclosed by the comment box so they are not part of the comment.

To drop, double-click the comment box, click the Pickup/Drop tab, and click Drop.

Applies To

Comments

Location

Item Properties > Pickup/Drop tab

Edit...Macros Commands

The Edit Document Macros, Edit Project Macros, and Edit Sheet Macros commands allow you to specify text for macros that can be used in annotations and comments.

Applies To

Documents

Location

Document, Project, and Sheets menu

Edit Sheet Title Command

The Edit Sheet Title command displays a dialog box that allows you to enter a title for the logic sheet.

Applies To

Logic sheets

Location

Sheets menu

Edit Title Block Command

The Edit Title Block command displays a dialog box that allows you to add information to the title block that is used when the CEM program is printed.

Applies To

CEM programs

Location

Sheets menu

Edit/View Source Command

The Edit/View Source command displays the source code for the selected element. The source code can be edited only for user-created functions and function blocks.

Applies To

CEM programs

Location

Application tree > User Documents > open a CEM program > right-click in the FBD Network

Effect Header Functions On by Default

The Effect Header Functions On by Default property specifies whether an output and function column are automatically included in the effect header when a CEM program is created. The default is cleared.

Applies To

CEM programs

Location

Tools menu > TriStation 1131 Options > CEM Editor tab

EN/ENO

The EN/ENO property specifies whether to include EN (an input parameter) and ENO (an output parameter) in the function.

- For the FBD language, the parameters are optional.
- For the LD language, the parameters are required.

Usage

- If EN/ENO is visible on any function in a network, then EN/ENO must be visible on every function in the network.
- If there is more than one function with EN/ENO visible in a network, then for every function except the last function, you must connect the ENO output directly to the EN input of the next function.
- You must not connect an ENO output to more than one EN input.

Parameter	Description
EN	An input parameter that enables invocation of the function and carries power from the left power rail. • If True, the function was called and ENO indicates whether the function detected an error. • If False, the function was not called and the value of ENO is set to False.
ENO	An output parameter that indicates whether the function detected an error and connects either to the EN input of the next function or to the ground rail. • If True, the function did not detected any errors. • If False, the function detected an error, and evaluation of the network stops—the return value is not written to any variable.

Applies To

Functions

Location

Item Properties > Function tab

Enable Access List Command

The Enable Access List command turns on user access control for the TCM, so that client access list settings are used to determine which IP addresses can access the TCM, and whether that access is read-only, read/write, or denied. Applies only to a model 4351A or 4352A Tricon Communication Module (TCM).

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Access List tab

Enable All Disabled Points Command

The Enable All Disabled Points command enables all disabled points on an application running on the controller.

Applies To

Application, tagnames

Location

Configuration tree > Controller or Emulator Panel > Commands menu

Enable Cause Header Functions

The Enable Cause Header Functions property specifies whether an input and function column are included in a cause header of a CEM program. The default is cleared, which means cause header functions are not included.

Applies To

CEM programs

Location

Application tree > open a CEM program > Document menu > Options

Enable Color Monitoring

The Enable Color Monitoring property specifies whether color is used when the application is run on the controller or emulator. The default is cleared, which means that color monitoring is not used.

Applies To

Programs

Location

Document Properties > Attributes tab

Enable Communication with Tricon V8 and V9 Peer-to-Peer Systems

The Enable Communication with Tricon V8 and V9 Peer-to-Peer Systems property specifies whether communication is enabled with these systems.

Applies To

Peer-to-Peer communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Peer-to-Peer tab

Enable Effect Header Functions

The Enable Effect Header Functions property specifies whether an output and function column are included in an effect header of a CEM program. The default is cleared, which means effect headers are not included.

Applies To

CEM programs

Location

Application tree > open a CEM program > Document menu > Options

Enable EN/ENO Terminals on Functions by Default

The Enable EN/ENO Terminals on Functions by Default property specifies whether to automatically include EN (BOOL input) and ENO (BOOL output) parameters that detect and isolate errors in FBD and LD logic. The default is cleared, which means EN/ENO terminals are not automatically included.

Applies To

Functions

Location

Tools menu > TriStation 1131 Options > FBD Editor tab

Enabled Features

The Enabled Features property specifies whether to allow programs, functions, function blocks, data types, and multiple program to be created in the project. Options include:

- Programs
- Functions
- Function Blocks
- Data Types
- Multiple Programs

The default is all options are selected, which means all options are enabled.

Applies To

Programs, functions, function blocks, data types, multiple programs

Location

Project menu > Project Options > Language tab

Enable Floating Text in Intersection Cells

The Floating Text Functions property allows the name of the function or function block to be displayed in a neighboring cell of the CEM matrix if it is empty. This may be useful if the name of the function or function block is long. The default is cleared.

Applies To

CEM programs

Location

Application tree > open a CEM program > Document menu > Options

Enable Intersection Functions

The Intersection Functions property specifies whether a function column is included in the intersection of a CEM matrix. The default is cleared, which means intersection functions are not included.

Applies To

CEM programs

Location

Application tree > open a CEM program > Document menu > Options

Enable Macro Editing

The Enable Macro Editing property specifies whether you can change the value for a user-modifiable macro.

User-modifiable macros are identified with a pencil graphic  on the Edit Macros screen.

The default is cleared, which means the macro value cannot be changed.

Applies To

Annotations and Comments

Location

Item Properties > Style tab

Enable Multiple Writes

The Enable Multiple Writes property specifies whether a tagname can be written to multiple times from programs in the application. If this property is not selected and the tagname is written to more than once, an error is displayed when the program is compiled.

The default is cleared, which means the tagname can only be written to once in an application.

Applies To

Tagnames

Location

Application tree > double-click a tagname > Point Assignment tab

Enable OVD on All Modules Command

For Tricon, the Enable OVD on All Modules command enables Output Voter Diagnostics (OVD) on the points of all digital output modules in a controller.

The default OVD state is enabled for all digital output points.

A safety application may not disable the output voter diagnostic.

Applies To

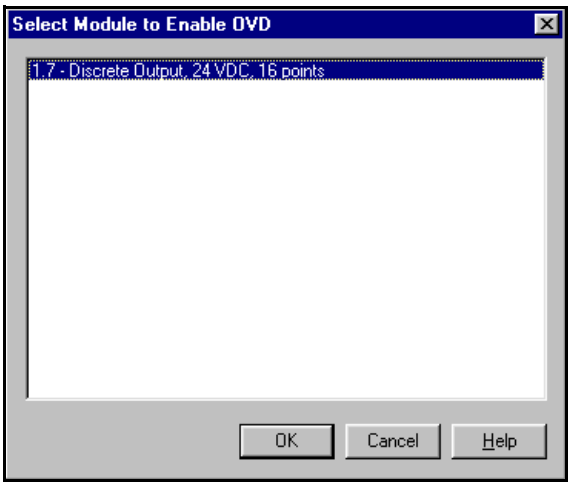
Application, modules

Location

Tricon Controller tree > Controller Panel > Commands menu

Enable OVD on Module... Command

For Tricon, the Enable OVD on Module... command enables Output Voter Diagnostics (OVD) for all points on specified digital output modules in the controller. The default OVD state is enabled for all digital output points.



Applies To

Application, modules

Location

Tricon Controller tree > Controller Panel > Commands menu

Enable Programming and Control Operations

For Trident only. See Set Programming Mode Command on page 418.

Enable Time Synchronization with External Source

See Time Synchronization on page 433.

Enable Tricon Node Time Synchronization

For Tricon, the Enable Tricon Node Time Synchronization parameter enables the controller to participate in time synchronization across the Peer-to-Peer network as a Triconex Time Synchronization master or slave node.

The default value is cleared, which means the controller will not synchronize time across the Peer-to-Peer network. See also Time Synchronization on page 433.

Applies To

Communication

Location

Controller tree > Configuration > Operating Parameters

Enable UCN Test Mode

For Tricon, the Enable UCN Test Mode property specifies whether UCN test mode is enabled on the Tricon SMM module. The default is cleared.

Applies To

Tricon SMM

Location

Tricon Controller tree > Configuration > Hardware Allocation > SMM Setup

Enlarge Font Size Command

The Enlarge Font Size command increases the size of the font for the entire ST program or function.

Applies To

ST programs and functions

Location

Larger Font button, or View menu

Evaluation Options

The Evaluation Options property specifies how a matrix is evaluated when it includes multiple intersections between a cause and effect. The evaluation can be based on AND or OR logical processing. The default is OR.

OR Evaluation

If the matrix is based on an energize-to-trip system, such as a fire suppression system, an OR evaluation is typically used because the normal state of inputs is False. If one of the inputs changes to True, the related outputs also change to True.

AND Evaluation

If the matrix is based on a de-energize-to-trip (fail-safe) system, an AND evaluation is typically used because the normal state of inputs is True. If one of the inputs changes to False, the related outputs also change to False. This is why it is typically used with systems that are designed to be fail-safe.

Applies To

CEM programs

Location

Application tree > open a CEM program > Document menu > Options

Exactly Once

The Exactly Once setting indicates that each function block instance should be executed exactly once per scan because the function block contains internal data that must be updated exactly once per scan.

For user-defined function blocks, you can specify this setting.

For Triconex Library function blocks, the setting cannot be changed.

Applies To

Library and user-defined function blocks

Location

Document Properties > Usage tab

Exit Command

The Exit command closes the current project and quits the TriStation 1131 application.

Applies To

Project

Location

Edit menu

Expand Macros

The Expand Macros property specifies whether the values or the name of the macro displays. If selected, the value displays. For example, the macro %DATE_CREATED displays the month, day, and year when the project was created.

The default is cleared, which means the name, not the value, of the macro is displayed.

Applies To

Annotations and Comments

Location

Item Properties > Style tab

Export Command

The Export command specifies a database or text file to export points to. If the file is to be imported back to TriStation, the filename must be eight characters or less.

Applies To

Tagnames

Location

Right-click the Tagname Declarations folder

Export Destination

The Export Destination property specifies the destination to use when exporting a report file.

Settings include Disk file and Microsoft Mail. The default is Disk file.

Applies To

Reports

Location


Export Report button on Project tree > Reports toolbar

Export Format

The Export Format property specifies the format to use when exporting a report file. Formats include:

Acrobat Format (PDF)	Excel 8.0 (XLS) (Extended)
Character-separated values	Paginated Text
Comma-separated values (CSV)	Rich Text (Exact) Format
Excel 5.0 (XLS)	Tab-separated text
Excel 5.0 (XLS) (Extended)	Tab-separated values
Excel 7.0 (XLS)	Text
Excel 7.0 (XLS) (Extended)	Word for Windows document
Excel 8.0 (XLS)	XML

The default is PDF.

Applies To

Reports

Location


Export Report button on Project tree > Reports toolbar

Export Report Command

The Export Report command exports the viewed report to a file format and destination you specify.

Applies To

Reports

Location

 Export Report button on Project tree > Reports toolbar

FBD Editor Options

The FBD Editor options include:

- Double Space Function (Block) Terminals by Default
- Enable EN/ENO Terminals on Functions by Default
- Left-Handed Wire Tool

Applies To

Functions and function blocks

Location

Tools menu > TriStation 1131 Options > FBD Editor tab

Field Maximum Power

For Trident, the Field Maximum Power property specifies the maximum range for power, based on volts on the Pulse Input Module. The default is 33 volts.

Applies To

Pulse Input Module

Location

Trident Controller tree > Configuration > Hardware Allocation > Pulse Input Setup

Field Minimum Power

For Trident, the Field Minimum Power property specifies the minimum range for power, based on volts for the Pulse Input Module. The default is 0 volts.

Applies To

Pulse Input Module

Location

Controller tree > Configuration > Hardware Allocation > Pulse Input Setup

Field Power

For Trident, the Field Power property specifies whether field power is connected to the Pulse Input Baseplate for use by the field sensors. The default is cleared, which means that field power is absent.

Setting	Description
Field Power Absent	Select if field power is not connected to the PI Baseplate. This setting is typically chosen if all the field sensors are passive.
Field Power Present	Select if field power is connected to the PI Baseplate. This setting is typically chosen if some or all the sensors are active.

Applies To

Trident Pulse Input Setup

Location

Trident Controller tree > Configuration > Hardware Allocation > Pulse Input Setup

Field Power Monitoring

For Tricon, the Field Power Monitoring property specifies whether the module should monitor the 24V field power (also known as loop power) at the external termination panel. When field power monitoring is on, the module will report when field power at the term panel goes in or out of range.

Available only with the 3720 and 3721 analog input modules. Applicable *only* if you are using a term panel that passes field power to the module.

If you are not using a term panel that passes field power to the module, you must select Off. If you select On, and the term panel does not support field power monitoring, you will see Field Power faults on the module.

The default is Off.

Applies To

AI Modules

Location

Tricon Controller tree > Configuration > Hardware Allocation > Single-Ended and Differential AI Setup

Find In Application Command

The Find In Application command finds the specified text by searching through the entire application (project). Click the Options button to further narrow the search.

Applies To

Application elements

Location

Edit menu

Find Text Command

The Find Text command finds the specified text in the current program, function, or function block. Click the Options button to narrow the search.

Applies To

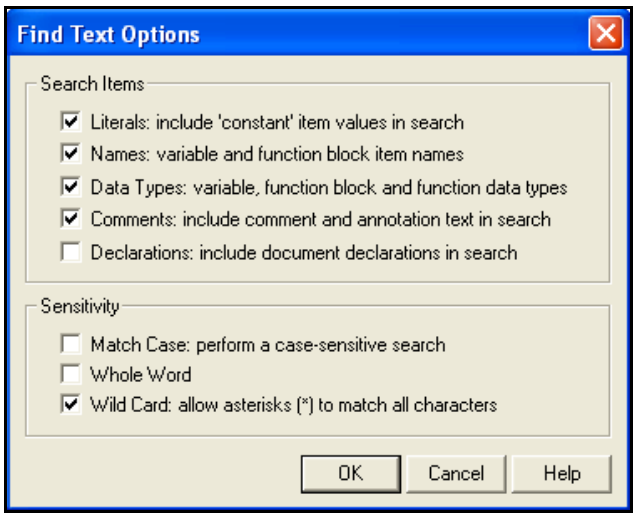
Application elements

Location

Edit menu

Find Text Options

The Find Text Options dialog box allows you to narrow the search for text on a specific element or in an application.



Applies To

Application elements

Location

Find Text button, or View menu

Formatted Name

The Formatted Name property specifies a pattern to use when naming variables. The pattern includes:

- Text: The text used as the base for the name.
- Macro: The numbering scheme to use as an increment.
  - For theater numbering (A to Z, and AA to ZZ), use %A.
  - For normal numbering, (0-nnn), use %0.

For example, ALARM_%0 would result in names of ALARM_1 through ALARM_nnn. ALARM_%A would result in ALARM_A ... ALARM_Z, depending on the start and increment value, and the number of variables.

Applies To

Comments and variables in user documents

Locations

Item Properties > Auto Name > Auto Name button
Tools menu > Auto Name Selected Items

Font Size

The Font Size property specifies the size of the font displayed for Structured Text code.

Applies To

ST Language

Location

View menu > Set Editor Options

FP Ordering

The FP Ordering property specifies which 16-bit section of a floating point number is read first.

- High 16 Bits First: the 16 *most* significant bits of the floating point number are read first.
- Low 16 Bits First: the 16 *least* significant bits of the floating point number are read first.

The default value is Low 16 Bits First.

Applies To

Modbus communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Serial Ports and Modbus TCP tabs

Function Variables

See Default Macros or Text on page 337.

Full Name

The Full Name property specifies the name of the user.

Applies To

User Security

Location

Project menu > Security > Users tab > Modify button

Function Block Command

The Function Block command allows you to add multiple function blocks at the same time to a program. If a function block has not been selected, a dialog box allows you to select the function block

Applies To

Programs

Location

Function Block button, or Tools menu > Select Tool > Function Blocks

General Monitor Colors

The General Monitor Colors property specifies the colors to display for the value of BOOL variables and wires.

The default for True is red.

The default for False is green.

Applies To

Tagnames

Location

Project menu > Project Options > Monitor Colors tab

Global Positioning System Installed

For Tricon, the Global Positioning System Installed property specifies whether a GPS interface is installed. The default is cleared, which means GPS is not installed.

Applies To

Tricon communication, Time Synchronization

Location

Tricon Controller tree > Configuration Panel > NCM Setup

Go To Cell Command

The Go To Cell command allows you to go to a specific row and column in the matrix.

Applies To

CEM programs

Location

Application tree > User Documents > Programs > open a CEM program > Edit menu

Group 1 and Group 2

The Group 1 and Group 2 properties specify group names to use for tagnames. Group names allow you to categorize tagnames by a name you define. Group 2 is subordinate to group 1. All the tagnames in a group must be of the same data type. The name can be a maximum of 63 characters.

Applies To

Tagnames

Location

Tagname Declarations > Declaration tab

Halt Command

The Halt command stops the execution of an application in the controller or emulator. In Halt mode, tagnames retain the values they had in the scan during which the application was halted.

For Tricon, the Halt command is used. For Trident, the Halt command or the SYS_APP_HALT function can be used.

Applies To

Application

Locations


Halt button
Configuration tree > Controller or Emulator Panel > Commands menu

Handshake

The Handshake property specifies whether to use signals to establish a valid connection. With hardware handshake, a separate wire sends a signal when the receiving device is ready to receive the signal, which ensures that a device transmits data only when the other device is ready to receive it.

- On the Tricon EICM, the switch settings determine whether handshaking is allowed.
- On the Tricon TCM, the setting is configured on the Serial Ports tab.
- On the Trident CM, the setting of the Transceiver Mode property determines whether hardware handshake is valid.

The default is None, which means hardware handshake is not used.

Settings include:

Setting	Description
Hardware	Select for: • Any 2-wire configuration (required) • A multi-point configuration that uses the RS-485 transceiver mode (required) • A point-to-point configuration that uses an external modem with RS-232 transceiver mode (optional)
None	Select for configurations that do not allow or require Hardware Handshake.

Used with RS-232 Transceiver Mode

With the Handshake property set to Hardware, the Trident CM asserts the Request to Send (RTS) signal when it has a message to transmit. The CM begins transmission when it receives a Clear to Send (CTS) signal from the Modbus master. The Trident CM ignores all characters unless the Modbus master asserts the Data Carrier Detect (DCD) signal. This settings allows the Modbus master to use half-duplex modems.

With the Handshake property set to None (typically for point-to-point connections), the Trident CM asserts RTS at all times and ignores CTS and DCD. In other words, the CM transmits characters even if the receiving device is not ready. This could result in an overrun state, and the characters would have to be re-transmitted.

Used with RS-485 Transceiver Mode

With the Handshake property set to Hardware, the Trident CM enables its RS-485 transmit driver only when it is sending data. Use this setting for all single-pair networks and for slave ports in two-pair, multi-point networks.

With the Handshake property set to None, the Trident CM enables its RS-485 transmit driver at all times. Use this setting for a Modbus slave port in a two-pair, point-to-point network.

Applies To

Communication

Locations

Tricon Controller tree > Configuration > Hardware Allocation > EICM Setup
Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Serial Ports tab
Trident Controller tree > Configuration > Hardware Allocation > MP Setup > Serial Ports tab
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Serial Ports tab

Hardware Allocation Command

The Hardware Allocation command displays the Hardware Allocation screen in the Controller tree.

Applies To

Configuration

Location


Hardware Allocation button, or View menu

Hide Causes Unrelated to Effects Command

The Hide Causes Unrelated to Effects command hides causes on a CEM program that are not related to an effect.

Applies To

CEM programs

Location

View menu

Hide Effects Unrelated to Causes Command

The Hide Effects Unrelated to Causes command hides effects on a CEM program that are not related to a cause.

Applies To

CEM programs

Location

View menu

Horizontal Network Divider Command

The Horizontal Network Divider command allows you to place a horizontal divider on a logic sheet to divide networks.

Applies To

FBD logic sheets

Location

 Horizontal Network Divider button, or Tools menu > Select Tool

IDLE State

IDLE is an application state which indicates that the TriStation PC is connected to a controller or the emulator, but the application has not been downloaded.

Applies To

Application

Location

Controller tree > Controller or Emulator Panel > Title bar

Import Command

The Import command provides a wizard that allows you to specify the fields to import, and how to link them to tagname properties.

Applies To

Tagnames

Location

Right-click the Tagname Declarations folder

Include Monitor Value in Annotation

The Include Monitor Value in Annotation property specifies whether to display the value of the variable in the annotation. The default is cleared, which means the value is not displayed in the annotation.

Applies To

Variables

Location

Item Properties > Annotation tab

Initial Value

The Initial Value property specifies the beginning value assigned to a variable on the first scan of the application. The value can be changed with a Download Changes command, however, the value is not used until a *first scan* which is not issued with the Download Changes command.

A first scan occurs under any of these conditions:

- The Download All and the Run command are issued
- The Halt command and the Run command are issued
- The application is restarted after a power failure

To identify whether a first scan has occurred, use the TR_SCAN_STATUS (Tricon) or SYS_SYSTEM_STATUS (Trident) function blocks.

In programs, only local variables are assigned an initial value. In functions and function blocks, all variables are assigned an initial value. The value is either the value declared for the property or zero.

Applies To

Tagnames, Variables

Location

Application tree > Tagname Declarations > Declaration tab

Insert Columns Command

The Insert Columns command displays a dialog box that allows you to insert columns in a CEM program.

Applies To

CEM programs

Location

Insert Columns button, or Edit menu

Insert From File Command

The Insert From File command displays an Open dialog box that allows you to select a file to be inserted in the ST program or function.

Applies To

ST programs and functions

Location

Edit menu

Insert Input Variable Command

The Insert Input Variable command inserts an input variable to a logic sheet.

Applies To

CEM, FBD, and LD functions

Location


Input Variable Tool button, or Edit menu

Insert In/Out Variable Command

The Insert In/Out Variable command inserts an in/out variable to a logic sheet. In Structured Text language, VAR IN/OUT are added to the code, not inserted by a command.

Applies To

FBD and ST functions and function blocks

Location


In/Out Variable Tool button, or Edit menu

Insert Local Variable Command

The Insert Local Variable command inserts a local variable to a logic sheet.

Applies To

CEM, FBD, and LD programs

Location


Local Variable Tool button, or Edit menu

Insert Output Variable Command

The Insert Output Variable command inserts an input variable to a logic sheet.

Applies To

FBD and LD functions

Location


Input Variable Tool button, or Edit menu

Insert Module Command

The Insert Module command displays a dialog box that allows you to select a module to add to the configuration.

Applies To

Hardware configuration

Locations


Insert Module button (on Trident Configuration toolbar)
Tricon Configuration tree > Hardware Allocation > double-click slot
Trident Configuration tree > Hardware Allocation > MP/IOP1 > Tools menu

Insert Rows Command

The Insert Rows command displays a dialog box that allows you to insert rows in a CEM program.

Applies To

CEM programs

Location


Insert Rows button, or Edit menu

Insert Tagname Declaration Command

The Insert Tagname Declaration command inserts a tagname declaration to the program.

Applies To

FBD and LD programs

Location


Tagname Declaration Tool button, or Edit menu

Internal State

The Internal State setting means each function block instance may have an internal state which is remembered from one execution to the next and from one scan to the next. There are no restrictions on usage of a function block labeled internal state; that is, you can execute the function block instance more than once per scan, or you can skip scans.

For user-defined function blocks, you can specify this setting. For Triconex Library function blocks, the setting cannot be changed.

Applies To

Library and user-defined function blocks

Location

Document Properties > Usage tab

Intersection Functions On by Default

The Intersection Functions On by Default property specifies whether a function column is automatically included in the intersection when a matrix is created. The default is cleared.

Applies To

CEM programs

Location

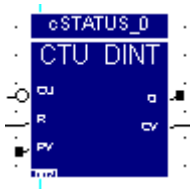
Tools menu > TriStation 1131 Options > CEM Editor tab

Invert Input

The Invert Input property specifies whether to invert the value of a BOOL input that is connected to a function or function block. If selected, the value for the input is changed to the opposite value when the function or function block is executed. For example, if the value is True it is changed to False.

The default is cleared, which means the input value is not inverted.

When an input is inverted, a small circle (referred to as a fiducial) is displayed on the input terminal of the function.



Applies To

BOOL input points

Location

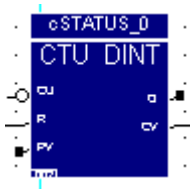
Function and function blocks

Invert Input/Output

The Invert Input/Output property specifies whether to invert the value of a BOOL input/output that is connected to a function block. If selected, the value for the input/output is changed to the opposite value when the function block is executed. For example, if the value is True it is changed to False.

The default is cleared, which means the input value is not inverted.

When an input/output is inverted, a small circle (referred to as a fiducial) is displayed on the input terminal of the function.



Applies To

BOOL input points

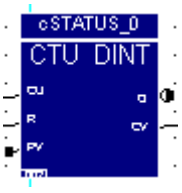
Location

Function blocks

Invert Output

The Invert Output property specifies whether to invert the value of a BOOL output that is connected to a function or function block. If selected, the value for the output is changed to the opposite value when the function is executed. For example, if the value is True it is changed to False.

The default is cleared, which means the output value is not inverted.



When an output is inverted, a small circle (referred to as a fiducial) is displayed on the output terminal of the function.

Applies To

BOOL output points

Location

Functions and function blocks

IP Address

The IP Address property specifies a unique 32-bit address of a computer attached to a network. A network uses IP addresses to route messages to their destinations. An IP address is formatted as four numbers separated by periods, where each number can be zero to 255. An example is 1.160.10.240. Every client and server in a network requires an IP address which is either permanently or dynamically assigned at startup. The defaults are as follows:

- **ACM/NCM**: 192.168.1.<*node number*>
- **TCM**: 192.168.0.<*node number*> for NET 1; 192.168.1.<*node number*> for NET 2

Applies To

Communication

Locations

Controller tree > Configuration > Communication
Tricon Controller tree > Configuration > Hardware Allocation > ACM or NCM Setup
Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Network, Peer-to-Peer, Modbus TCP, and Printer tabs
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Network or Printer tab

IP Subnet Mask

The IP Subnet Mask property specifies a binary pattern that is matched with the IP address to turn part of the host ID address field into a field for subnets.

- For Tricon ACM and TCM, see the network administrator.
- For Tricon NCM, do not change the default setting which is eight zeroes.
- For Trident CM, see the network administrator.

Applies To

Communication

Locations

Tricon Controller tree > Configuration > Hardware Allocation > ACM and NCM Setup
Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Network and Routing tab
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Network and Routing tab

Item Properties Command

The Item Properties command displays an Item Properties dialog box, which varies depending on the item currently selected.

Applies To

Chassis, modules, tagnames, variables

Location


Item Properties button, or View menu

Language

The Language property specifies the language to be used for the program, function, function block, or data type. Settings include:

- Function Block Diagram
- Ladder Diagram
- Structured Text
- Cause Effect Matrix

Applies To

Programs, functions, function blocks, and data types

Location

Project menu > New Document

LD Editor Options

The LD Editor Options include:

- Compiler Warning When Right Power Rail is Missing on page 331
- Double Space Function (Block) Terminals by Default on page 347
- Left-Handed Link Tool on page 376

Left-Handed Link Tool

The Left-Handed Link Tool specifies whether to have the link tool configured for left-handed use for LD programs. The default is cleared, which means the right-handed link tool is used.

Applies To

Ladder Diagrams

Location

Tools menu > TriStation 1131 Options > LD Editor tab

Left-Handed Wire Tool

The Left-Handed Wire Tool specifies whether to have the wire tool configured for left-handed use for FBD programs.

The default is cleared, which means the right-handed tool is used.

Applies To

Project

Location

Tools menu > TriStation 1131 Options > FBD Editor tab

Line Width

The Line Width property specifies the number of characters per line. The default is 80.

Applies To

Project

Locations

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Printer tab
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Printer tab

Link Command

The Link command draws a horizontal or vertical link between power rails and logic elements. The direction of the link determines how it is evaluated in the logic.

Link Direction	Description
Horizontal	Transmits the state of the element on its immediate left to the element on its immediate right. The state represents the Inclusive OR of the On states of the horizontal links on its left side.
Vertical	Intersects one or more horizontal link elements on each side. The state is copied to all attached horizontal links on its right, but is not copied to attached horizontal links on its left. • Is Off if the states of all attached horizontal links to its left are Off. • Is On if the state of one or more attached horizontal links to its left is On.

Applies To

LD programs

Location

Link Tool button, or Tools menu, Select Tools

List Disabled Points Command

The List Disabled Points command displays a list of all disabled points on a controller, so that individual points can be selected and enabled. To use this command, the application must be running on the controller.

Applies To

Tagnames

Location

Controller tree > Controller Panel > Commands menu

Loc

The Loc property displays the coordinates for the location of an element in terms of cause row and effect column in a CEM program. For example, C01 identifies cause 1 and C02E02 identifies the intersection of cause 2 and effect 2.

Applies To

CEM programs

Location

Application tree > open a CEM program > Variable Detail Table

Location

The Location property specifies the location of the tagname based on the position in the Tricon chassis or Trident system. The address is a three-part number in this format: CC.SS.PP

Identifier	Description
CC	Stands for Tricon chassis, or Trident I/O Processor (IOP).
SS	Stands for slot (Tricon), or baseplate (Trident).
PP	Stands for point number.

For example, 01.02.23 is the address for point 23, on the module in slot 2, in chassis 1.

Applies To

Tagnames

Locations

Tricon Controller tree > Configuration > Hardware Allocation > DO and PI Setup
Trident Controller tree > Configuration > Hardware Allocation > PI Setup

Log On As New User Command

The Log On As New User command allows you to save and close the current project and log on as a different user. You are prompted on whether to save project elements.

Applies To

Project

Location

File menu

Logon Name

The Logon Name property specifies the identifier used to log on to the TriStation 1131 project.

Applies To

User access

Location

Project menu > Security > Users tab > New or Modify button

Macros Command

The Macros command displays macros that can be included in an annotation or comment. You can specify whether to display macros available by Project, Document, or Sheet.

To copy, click the macro and press Ctrl+C. To paste, close the Edit Macro dialog box, click in the Comment area, and press Ctrl+V.

Applies To

Comments and variables

Locations

Document, Project, and Sheets menus
Annotation tab (tagnames and variables), or Comments tab (comments)

Main Processor Connection Setup

For Trident, the Main Processor Connection Setup property specifies which MP is connected to the TriStation PC. The options are left, middle, and right. The default is left.

Applies To

TriStation communication

Location

Trident Controller tree > Configuration > TriStation Communication

Manage Sheets Command

The Manage Sheets command displays a screen that allows you to manage logic sheets. These commands are on the Sheets Manager screen.

Command	Action
Append	Adds a new sheet after an existing sheet.
Insert	Adds a new sheet before an existing sheet
Delete	Delete the selected sheet.
Title	Allows you to edit the title of the current sheet. The sheet title is displayed in the title block, the window caption bar and the Window Menu list.
Go To	Click a sheet to be displayed, and then click Go To.

Applies To

Logic sheets

Location

Sheets menu

Manage Views Command

The Manage Views command allows you to save, load, and remove views of a CEM program. These commands are on the View Manager screen.

Command	Action
Load	Click a view and click Load to have it displayed.
Save	Click to save the view currently displayed.
Remove	Click a view and click Remove to delete the view from the list.
Restore All Defaults	Click to restore the current view to show all causes and effects.
Close	Click to close the View Manager screen.
Cancel	Click to cancel the action.

Applies To

CEM programs

Location

View menu

Master Logical Port

The Master Logical Port property specifies the logical port number that the TriStation application uses with Modbus Master Functions to access the port. This property is only available for Modbus Master.

Applies To

Modbus Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Modbus TCP and Serial Ports tabs

Maximum Number of Peer-to-Peer Receives

The Maximum Number of Peer-to-Peer Receives property specifies the maximum number of Receive function blocks for each TriStation application. To conserve memory and minimize scan time, set this number as low as possible. However, if you plan to add Receive function blocks in the future, specify the anticipated maximum to avoid having to perform a Download All later.

This number set for Receive and Send does not have to be the same. The default is 0.

Applies To

Peer-to-Peer communication

Location

Application tree > Implementation > Peer-to-Peer Configuration

Maximum Number of Peer-to-Peer Sends

The Maximum Number of Peer-to-Peer Sends property specifies the maximum number of Send function blocks for each TriStation application. To conserve memory and minimize scan time, set this number as low as possible. However, if you plan to add Send function blocks in the future, specify the anticipated maximum to avoid having to perform a Download All later.

The number set for Send and Receive does not have to be the same. The default is 0.

Applies To

Peer-to-Peer communication

Location

Application tree > Implementation > Peer-to-Peer Configuration

Maximum RPM

The Maximum RPM property specifies the revolutions per minute for the device attached to the Pulse Input Module. The number must be a positive floating point value.

The default is 30,000.

Applies To

Pulse Input Module

Location

Controller tree > Configuration > Hardware Allocation > Pulse Input Setup

Maximum Speed

The Maximum Speed property specifies the speed for the device attached to the Pulse Input Module. The number must be a positive floating point value.

The default is 30,000.

Applies To

Pulse Input Module

Location

Controller tree > Configuration > Hardware Allocation > Pulse Input Setup

Maximum Value (Max Span)

The Maximum Value (Max Span) value identifies the maximum value for the range to scale a REAL tagname to an integer; must be greater than the minimum value.

The maximum value and default value is 32,767. (For Honeywell, the maximum value is 9,999.)

Applies To

Tagnames with REAL data types

Location

Application tree > Tagname Declarations > Scaling tab

Memory Address

The Memory Address property specifies where information about input, output, and memory tagnames is stored in the Triconex controller.

Each tagname in a section is assigned to a memory address which is shown in TriStation in the format <section>.<offset>. For example, MBW.0012 is the 12th memory BOOL read/write aliased point in the controller.

Section Name	Description
MBN	Memory BOOL unaliased points
MBR	Memory BOOL read aliased points
MBW	Memory BOOL read/write aliased points
MIN	Memory DINT unaliased points
MIR	Memory DINT read aliased points
MIW	Memory DINT read/write aliased points
MRN	Memory REAL unaliased points
MRR	Memory REAL read aliased points
MRW	Memory REAL read/write aliased points
IBR	Input BOOL read aliased points
IIR	Input DINT read aliased points
IRR	Input REAL read aliased points
QBW	Output BOOL read/write aliased points
QIW	Output DINT read/write aliased points

Applies To

Tagnames

Location

Application tree > Tagname Declarations > Item Properties > Point Assignment tab

Memory Allocation Command

The Memory Allocation command displays the Memory Allocation screen in the Controller tree.

Applies To

Configuration

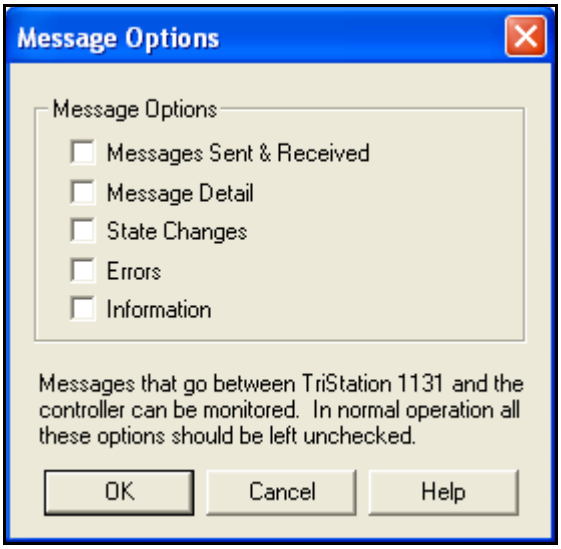
Location

Memory Allocation button, or View menu

Message Options Command

The Message Options command allows you to specify the type of messages to be sent between the TriStation PC and controller, and is generally used to troubleshoot problems.

The default for all options is cleared.



Applies To

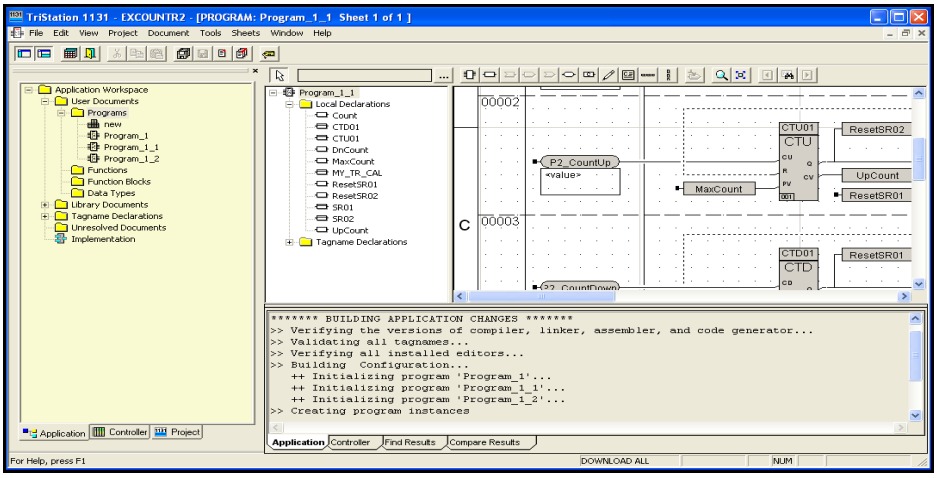
Troubleshooting problems

Location

Configuration tree > Controller Panel > Tools menu > Message Options

Message View Command

The Message View button displays a message area at the bottom of the TriStation 1131 screen. Tabs in the area allow you to display information for Application, Controller, Find Results, and Compare Results. You can toggle the Workspace View On or Off.



Applies To

View

Location


Message View button, or View menu > Messages

Minimum Value (Min Span)

The Minimum Value (Min Span) value identifies the minimum value for the range used to scale a REAL tagname to an integer; must be less than the maximum value. The minimum value and default value is –32,767. (For Honeywell, the minimum value is 0.)

Applies To

Tagnames with REAL data types

Location

Application tree > Tagname Declarations > Scaling tab

Modbus (Minimum and Maximum) Range

The Modbus (Minimum and Maximum) Range property specifies the minimum and maximum limits of values communicated via serial ports. This property is used with the Minimum Value (Min Span) and Maximum Value (Max Span) to communicate REAL values using Modbus or Honeywell protocol.

- The minimum value is -32768; the default is 0.
- The maximum value is 32767; the default is 32767.
- For Honeywell, the minimum is 0; the maximum is 9,999.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > EICM Setup
Tricon Controller tree > Configuration > Hardware Allocation >Enhanced TCM Setup > Serial Ports tab
Trident Controller tree > Configuration > Hardware Allocation > MP and Setup > Serial Ports tab

Modbus Slave Address

The Modbus Slave Address property specifies the number of the Modbus slave device which is connected to the Modbus master. This property is only available if using Modbus slave, and master/slave protocols. If using Modbus master protocol, the address of the slave is specified in the Modbus Read and Write function blocks.

The address can be from 1 to 247; the default is 1.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > EICM Setup
Tricon Controller tree > Configuration > Hardware Allocation >Enhanced TCM Setup > Serial Ports tab
Trident Controller tree > Configuration > Hardware Allocation > MP and Setup > Serial Ports tab

Mode

The Mode property specifies the type of communication, which can support one or more communication protocols.

Table 47 Communication Modes

Modes	Supported Protocols
Open Network	TriStation, TSAA, OPC, DDE, and printer protocol
Peer-to-Peer	Peer-to-Peer and Time Synchronization
TriStation	TriStation

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > NCM Setup
Trident Controller tree > Configuration > Hardware Allocation > MP and CM Setup > Network tab

Monitor Display Options

The Monitor Display Options include properties that specify the names and colors for BOOL variables.

Properties include:

- True State Name: the default is TRUE.
- False State Name: the default is FALSE.
- True Color: the default is red.
- False Color: the default is green.

Applies To

BOOL values

Location

Application tree > Tagname Declarations > Item Properties > Display tab

Monitor Value on by Default

The Monitor Value on by Default property specifies whether to display the value of the variable when the program or function block is executed.

The default is cleared, which means the monitor does not display the value of the variable.

Applies To

Variables

Location

Project menu > Project Options > Annotations tab

Move Behind Logic Elements

The Move Behind Logic Elements property moves a selected comment box behind a logic element, which means the element is considered part of the comment and not executed with the logic.

The default is cleared, which means the element is not enclosed in a comment.

Applies To

Annotations and Comments

Location

Item Properties > Style tab

Name

The Name property specifies an identifier or description for an element.

Feature	Description
Restrictions	The name must begin with an alpha character (A to Z) and can include up to 31 alphanumeric characters (A to Z, and 0 to 9), including the underscore (_) character. Letters are not case-sensitive.
Version Numbers	Names of documents include a version number at the end of the name. The number includes a major number, which is always 1 and a minor number, which changes when the document is changed, saved, and closed.

Applies To

Variables, Contacts, Coils

Location

Item Properties

Name Order

The Name Order property specifies how automatic naming is applied to the selected variables.

Settings include:

- Rows—Names are applied vertically, from left to right.
- Columns—Names are applied horizontally, from top to bottom.
- Selection order—Names are applied based on the order in which they were selected.

Applies To

Comments and variables in user documents

Location

Item Properties > Auto Name > Auto Name button
Tools menu > Auto Name Selected Items

Network

The Network property specifies the TCM network port—NET 1 or NET 2— that the selected external device is connected to.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup

New Document Command

The New Document command opens a dialog box that allows you to specify the type of document to create and the type of language to use.

Applies To

Application

Location

Project menu

New Project Command

The New Project command creates a new project.

Applies To

Project

Location

File menu

New Tagname Command

The New Tagname command opens a screen that allows you to specify a new tagname.

Applies To

Tagnames

Locations

Project menu
Application tree > right-click Tagname Declarations

New Tagnames Command

The New Tagnames command opens a screen that allows you to create multiple tagnames based on a naming scheme. Properties include:

- Formatted Name on page 364
- Start Value and Increment on page 428
- Name Order on page 387

Applies To

Tagnames

Location

Project menu
Application tree > right-click Tagname Declarations

NIC Index

The NIC Index property specifies the index position of the network interface card in the TriStation PC.

To determine the NIC index:

1. Open the Control Panel and click the System icon.
2. On the Hardware tab, click Device Manager, and then expand the Network Adapters tree.
3. Starting with zero, count down the list of adapter cards to the one that is connected to the TriStation PC. For example, if your adapter card is fifth in the list, its index position is 4.

Applies To

Communication

Location

Controller tree > Configuration > TriStation Communication

Node Name

The Node Name property specifies the name for a Triconex controller, which can be a default name or a user-defined name. The default names are TRINODE01 through TRINODE31.

Applies To

Communication

Location

Controller tree > Configuration > TriStation Communication

Node Number

The Node Number property specifies a number for a Triconex controller, which must be the same as on the switch setting (Tricon) or the address plug (Trident). The numbers can be from 1 to 31.

Applies To

Communication

Location

Controller tree > Configuration > TriStation Communication

Number of Extended Block

For Tricon, the Number of Extended Block property specifies a pair of HIM blocks consisting of a base block and a secondary block (which is offset from the six-bit block address by 32). The default is 4. For more information, see the *HIM User's Guide*.

Applies To

Tricon HIM

Location

Tricon Controller tree > Configuration > Hardware Allocation > HIM Setup

Number of Gear Teeth

For Trident, the Number of Gear Teeth property specifies the number of gear teeth that are counted in each revolution for the Pulse Input Module. The PI Point Options property must be specified as RPM to enable this property. The default is 60.

Applies To

Trident Pulse Input Module

Location

Trident Controller tree > Configuration > Hardware Allocation > Pulse Input Setup

Number of Inputs

The Number of Inputs property specifies the number of inputs to include with the function. Only extensible functions, which are functions that can include additional inputs, have this property.

For more information, see the *TriStation 1131 Libraries Reference*.

Applies To

Functions

Location

Item Properties > Function tab

OFFLINE State

The OFFLINE state is an application state which indicates the application is not connected to the emulator or to a controller.

Applies To

Application

Location

Controller tree > Controller or Emulator Panel > Title bar

On NET 1 Enable Time Synchronization

See Time Synchronization on page 433

On NET 2 Enable Time Synchronization

See Time Synchronization on page 433.

Only Once

The Only Once setting means each instance of a function block should be executed only once per scan, but does not need to be executed every scan. This means the function block has internal data that does not need to be updated on every scan, but should not be updated *more than once* per scan.

For user-defined function blocks, you can specify this setting. For Triconex Library function blocks, the setting cannot be changed.

Applies To

Library and user-defined function blocks

Location

Document Properties > Usage tab

Open Document Command

The Open Document command opens an existing document.

Applies To

Application

Location

Project menu

Open Point Alarm Threshold

The Open Point Alarm Threshold property specifies the number of ohms above which values are alarmed as an open load. This option is only available if the points are supervised.

Typical threshold values are 480 to 3200 ohms. The available range is 0 to 65,535 ohms. The default is 2400 ohms.

Available only with the model 3625 digital output module.

Applies To

Tricon DO points

Location

Tricon Controller tree > Configuration > Hardware Allocation > DO Setup

Open Project Command

The Open Project command allows you to specify an existing project to open.

Applies To

Project

Location

File menu

Operation Type

The Operation Type property specifies whether the security selection is for controller operations or TriStation 1131 operations. Depending on the selection, different operations are displayed.

Applies To

Project

Location

Project menu > Security command > Privileges tab

Operations

The Operations property specifies TriStation and controller operations that can be assigned a security level. These tables describe the operations and default settings for security levels.

Table 48 Controller Operations

Panel	Operation	Description	Default Level
Controller	Change point values	Permits use of the Set Value command for variables in the Controller and Emulator Panels.	1
	Download All	Permits use of the Download All command in the Controller and Emulator Panels.	1
	Download Changes	Permits use of the Download Changes command in the Controller and Emulator Panels.	1
	Enable and disable points	Permits points to be disabled in the Controller Panel.	1
	Change state to Download All	Permits state to be changed from Download changes to Download All.	1
	Halt and run mismatched application	Permits use of the Halt, Download All, and Run commands when the project executing in the controller does not match the application that is currently open in TriStation.	1
	Halt application	Permits use of the Halt command in the Controller and Emulator Panels.	1
	Modify configuration	Permits use of the Configuration editor and the Build Element, Build Configuration, and Rebuild Configuration commands.	1
	Modify Controller Panel	Permits use of the Controller Panel.	1
	Open Configuration	Permits the Configuration editor to be opened.	1
	Open Controller Panel	Permits use of the Controller Panel.	1–2
	Pause and Single Step application	Permits use of the Pause and Single Step commands in the Controller or Emulator Panel.	1

Table 48 Controller Operations *(continued)*

Panel	Operation	Description	Default Level
	Run Application	Permits use of the Run command in the Controller or Emulator Panel.	1
	Set Operating Parameters	Permits the operating parameters to be set.	1
Emulator	Open Emulator Panel	Permits use of the Emulator Panel.	1–3

Table 49 TriStation Operations

Type	Operation	Description	Default Level
Elements	Change Access Attributes	Permits changes to Access Attributes property, which allows Read Only, Read/Write, or Lock status.	1–3
	Change Owner	Permits using the Change Owner command to change the owner of a document.	1–3
	Modify control elements	Permits creating, modifying, and deleting programs, functions, and function blocks which are defined for control applications.	1–5
	Modify safety elements	Permits creating, modifying, and deleting programs, functions, and function blocks which are defined for safety applications.	1–5
	View elements	Permits viewing of programs, functions, and function blocks.	1–9
Libraries	Export	Permits exporting project documents to a shared library.	1–2
	Import	Permits importing shared libraries.	1–2
Printing	Print reports	Permits printing of reports.	1–9
	Update report database	Permits use of the Update Data command.	1–5
Project	Change Project Options	Permits changes to properties in Project Options.	1–3
	Change state to Download All	Permits use of Change State to Download All command.	1–2
	Clear history logs	Permits use of the Clear History command.	1–2
Security	Add/Modify Users	Permits adding, modifying, and deleting users if the user has equal or higher privileges than the selected user.	1–2
	Change level descriptions	Permits changes to the names associated with security levels.	1–2

Table 49 TriStation Operations *(continued)*

Type	Operation	Description	Default Level
	Change level privileges	Permits changes to the privileges associated with security levels if the user has equal or higher privileges than the selected user.	1–2
Workbench	Change TriStation Options	Permits changes to properties in TriStation Options.	1–2

Applies To

Security

Location

Project menu > Security > Privileges tab

Organize Command

The Organize command allows you to organize the data types, functions, and function blocks in the TriStation 1131 Libraries in these ways:

- By Library: Organizes by the library where the elements are located.
- By Type: Organizes by Functions and Data Types.
- By Category: Organizes by the typical usage. For example, Arithmetic, Data Type, Counter, and so on.
- By Name: Organizes alphabetically by name.

The default is By Type.

Applies To

TriStation 1131 Library data types, functions, and function blocks

Location

Application tree > right-click the Library Documents folder

Parity

The Parity property indicates whether to use parity checking, which is a way to detect data communication errors on the transmitted data.

Odd and Even parity counts the number of 1 bits in a one-byte data item then sets the parity bit (9th bit) to 0 or 1 to result in an Odd or Even total number of 1 bits. Mark and Space parity (also called high/low parity) set the parity bit to 1 or 0 regardless of the number of 1 bits in the data item.

Settings include:

- Odd sets the parity bit to 0 or 1 to make the total number of 1 bits odd.
- Even sets the parity bit to 0 or 1 to make the total number of 1 bits even.

- Mark sets the parity bit to 1 for each data item.
- Space sets the parity bit to 0 for each data item.
- None deletes the parity bit.

The default is Odd.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Serial Ports tab
Tricon Controller tree > Configuration > Hardware Allocation > EICM Setup
Trident Controller tree > Configuration > Hardware Allocation > Trident MP or CM Setup > Serial Ports tab

Password

The Password property specifies a code required to access the project or to perform certain operations in the project. The default is PASSWORD.

Applies To

Security

Location

Controller tree > Configuration > Operating Parameters
Project menu > Security command > Users tab > Add or Modify button

Password Required for Connection

The Password Required for Connection property specifies whether a password is required to connect to the controller. If selected, you must enter a password. This setting takes effect after the application is downloaded to the controller.

The default is cleared, which means a password is not required.

If selected, a dialog box displays that requires the password to be entered before the connection can be attempted.

Applies To

Security

Location

Controller tree > Configuration > Operating Parameters
Project menu > Security command > Users tab > Add or Modify button

Paste Command

The Paste command puts the current contents of the clipboard onto the current sheet.

Applies To

Editing

Location

Paste button, or Edit menu

Pause Command

The Pause command pauses the execution of an application in the controller or the emulator. If an application is paused, the Run command must be used to resume execution.

Applies To

Application

Location

Pause button
Configuration tree > Controller or Emulator Panel > Commands menu

Peer-to-Peer Time Synchronization Enabled

The Peer-to-Peer Time Synchronization Enabled property determines whether the Triconex Time Synchronization protocol is used to synchronize time with controllers on the network.

Applies to TCM models 4351 and 4352 only.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > TCM Setup > Peer-to-Peer tab

Permission

The Permission property specifies the level of access to the TCM for the selected client IP address. If the application includes safety-critical outputs, you should not set this property to Read/Write.

Setting	Description
Deny Access	Prevents all access to resources provided by the TCM. Connections to the Tricon are not allowed.
Read	Allows client to connect to the Tricon and view information provided via the TCM. Does not allow the client to change any settings or perform certain commands.
Read/Write	Full access. Allows client to view information provided by the TCM, change settings, and perform all commands (including Download Changes or Download All for TriStation). This access level should only be provided to trusted clients.

Applies only to a model 4351A or 4352A Tricon Communication Module (TCM).

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Access List tab

Physical Address

The Physical Address property specifies the physical point location on an input or output module. The address is a three-part number in this format: CC.SS.PP

Identifier	Description
CC	Stands for Tricon chassis, or Trident I/O Processor (IOP).
SS	Stands for slot (Tricon), or baseplate (Trident).
PP	Stands for point number.

For example, 01.02.23 is the address for point 23, on the module in slot 2, in chassis 1.

Applies To

Input and output tagnames

Location

Application tree > Tagname Declarations > Item Properties > Point Assignment tab

Pickup Command

The Pickup command picks up all the elements enclosed by the comment box so they are considered part of the comment and ignored by the compiler.

To pick up, move the comment box so it entirely covers the elements to be captured. Resize the box if needed.

To drop, double-click the comment box, click the Pickup/Drop tab, and click Drop.

Applies To

Comments

Location

Item Properties > Pickup/Drop tab

PI Point Options

The PI Point Options properties specify options on the Pulse Input Module. Settings include:

- Maximum RPM on page 381
- Maximum Speed on page 381
- Scale Factor on page 413

Applies To

Pulse Input Setup

Location

Controller tree > Configuration > Hardware Allocation > Pulse Input Setup

Point Assignment

The Point Assignment properties specify whether the point uses an alias, and whether the point has a physical or local address.

Properties include:

- User alias: A number that can be assigned if the point is a Read or Read/Write Alias.
- Default alias: A number is automatically assigned if the point is a Read or Read/Write Alias.
- No alias: Means the point is input, output, or an unaliased memory point.

Applies To

Tagnames

Location

Tagname References > Item Properties > Point Assignment tab

Point Type

The Point Type property specifies the type of tagname. Settings include:

- Input
- Output
- Memory

Applies To

Tagnames

Location

Item Properties > Point Assignment tab

Port Selection

The Port Selection property specifies the port to be configured. The default is port 1 or Left.

Table 50 Protocols Available with Specific Ports

Module	Selections
Tricon EICM	Ports 1–4 and 6–9: TriStation, Debug, Modbus Slave, Modbus Master, and Modbus Master Slave. Ports 5 and 10: Printer.
Tricon TCM	Ports 1–3 and 6: Modbus Slave RTU, Modbus Slave ASCII, Modbus Master, and GPS. Ports 4 and 9: Modbus Slave ASCII, Modbus Slave RTU, Modbus Master, and TriStation. Ports 5 and 10: Printer.
Trident MP	Left, middle, and right: Modbus Slave RTU.
Trident CM	Ports 1–3 and 6–8: Modbus Slave ASCII, Modbus Slave RTU, Modbus Master, Modbus Master/Slave.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > EICM Setup
Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Serial Ports tab
Trident Controller tree > Configuration > Hardware Allocation > MP Setup > Serial Ports tab
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Serial Ports tab

Port Write Enabled

The Port Write Enabled property provides a fast and easy way to manage port security if you don't want to configure a user access list (see Controlling Access to the TCM on page 267).

Select this property to allow TriStation, TSAA, or Modbus writes to the selected port. The default value is cleared, meaning the port is read-only.

Projects converted from earlier versions of TriStation will have the default value automatically set for this property, so that ports configured for TSAA, Serial Modbus Slave, and TCP Modbus Slave will be read-only until selected otherwise.

Applies only to a model 4351A or 4352A Tricon Communication Module (TCM).

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Network, Serial Ports, and Modbus TCP tabs

Precision

The Precision property specifies the number of decimals to use with a REAL point that has been scaled. The default is 0.

Applies To

Tagnames with REAL data types

Location

Application tree > Tagname Declarations > Item Properties > Scaling tab

Previous Sheet Command

The Previous Sheet command displays the previous logic sheet.

Applies To

Logic sheets

Location

Previous Sheets button, or Sheets menu

Print Command

The Print command prints the logic sheets or reports displayed in the current window.

Applies To

Logic Sheets, Reports

Location

 Print button, or Edit menu

Print Preview Command

The Print Preview command displays the sheets to be printed.

Applies To

Logic Sheets, Reports

Location

Edit menu

Print Report Command

The Print Report command allows you to print the selected report.

Applies To

Reports

Location

 Print Report button, or Edit menu

Printer Number

The Printer Number property specifies the number used in the Printer parameter declared for the print function blocks in the TriStation 1131 project. The value must be from 1 to 10.

Applies To

Project

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Printer tab
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Printer tab

Privilege

The Privilege property specifies whether Read or Read/Write access is allowed by external devices. You should set this property to Read, if the application includes safety-critical outputs.

Setting	Description
Read	An external device cannot write to any point, regardless of the settings for other properties. This is the default for Tricon ACM.
Read/Write	Other properties may need to be set to enable write access. See Disable Remote Changes to Outputs on page 343. This is the default for Tricon NCM and Trident CM.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > ACM Setup
Tricon Controller tree > Configuration > Hardware Allocation > NCM Setup
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Network tab

Program Execution List

The Program Execution List property identifies the programs included in the application. Programs can be added, deleted, or moved up and down in order.

Applies To

Application

Location

Application tree > Implementation > Execution List

Program Command

The Program command allows you to implement or change an application in these ways:

- Perform a Download All or Download Changes
- Disable points
- Change the values of points

For Tricon, the Program command is set by turning the keyswitch to PROGRAM.

For Trident, the Program command is set with the Set Programming Mode command in the Controller Panel, or the SYS_SET_APP_LOCK function in a program.

Applies To

Application, controller

Location

Tricon keyswitch on PROGRAM
Trident Configuration tree > Controller Panel > Set Programming Mode command
Trident Application tree > Programs > SYS_SET_APP_LOCK function

Prohibit Writes

For Tricon, the Prohibit Writes property specifies whether to deny Honeywell workstations from writing to the application running on the Tricon controller.

The default is cleared, which means Honeywell workstations can write to memory and output tagnames.

Applies To

Tricon HIM Module

Location

Tricon Controller tree > Configuration > Hardware Allocation > HIM Setup

Project Description Command

The Project Description command displays information about the project including the file name and location, current and downloaded version, and controller type.

Applies To

Project

Location

Project menu

Project Files

The Project File property specifies the path name for documents including projects and related files. The default path name and file extension is:

```
C:\My Documents\Triconex\TriStation 1131 4.1\Projects
```

Applies To

Project

Location

Tools menu > TriStation 1131 Options > Directories tab

Protocol

The Protocol property specifies the communication protocol used with the port. This table describes the protocols available with specific communication modules.

Table 51 Communication Module Available Protocols

Protocol	Description	Communication Module
GPS	Controller receives time synchronization via the Global Positioning System.	Tricon TCM
Modbus Slave	Controller acts as a slave to a Modbus master.	Tricon EICM
Modbus Slave ASCII	Controller acts as a slave to a Modbus master with data sent in pairs of ASCII characters.	Tricon TCM, Trident CM
Modbus Slave RTU	Controller acts as a slave to a Modbus master with data sent in 8-bit binary characters.	Tricon TCM, Trident MP and CM
Modbus TCP Slave Net	Controller acts as a slave to a Modbus master on an open network.	Tricon TCM
Modbus Master	Controller acts as a Modbus master.	Tricon EICM and TCM, and Trident CM
Modbus TCP Master	Controller acts as a Modbus master on an open network.	Tricon TCM
Modbus Master/Slave	Controller acts as a Modbus master or slave.	Tricon EICM and Trident CM
Peer-to-Peer	Controller communicates with other controllers on an open network.	Tricon NCM, TCM and Trident CM
TriStation 1131	Controller communicates with a TriStation PC. The NCM/TCM communicates on an open network. The EICM/TCM connect on a serial port.	Tricon EICM, NCM, TCM and Trident CM

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > EICM and NCM Setup
Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Serial Ports and Modbus TCP tabs
Trident Controller tree > Configuration > Hardware Allocation > MP and CM Setup

Pulses Per Revolution

For Trident, the Pulses Per Revolution property specifies the number of pulses per revolution of the measuring shaft for the Pulse Input Module. The default is 1.

Applies To

Trident Pulse Input Module

Location

Trident Controller tree > Configuration > Hardware Allocation > Pulse Input Setup

Rate Type

The Rate Type property specifies how the Pulse Input Module is to measure pulse inputs. Settings include:

- Speed: Used for pulses measured in seconds, minutes, or hours.
- RPM: Used for pulses measured in the number of revolutions per minute of the shaft that connects a gear to the rotating equipment.

The default is Speed.

Applies To

Pulse Input Module

Location

Controller tree > Configuration > Hardware Allocation > Pulse Input Setup

Read Only Command

The Read Only command toggles between read only and edit in Structured Text programs and functions.

Applies To

ST programs and functions

Location

Read Only button, or View menu

Rebuild Application Command

The Rebuild Application command builds an application by compiling all documents required by the programs in the execution list, then linking all the object code, library routines, and configuration information to form an executable application.

Applies To

Application

Location

Project menu

Redo Command

The Redo command reverses the last Undo command. You must use this command before other editing is done or the changes cannot be redone.

Applies To

Programs, functions, and function blocks

Location

Edit menu

Reduce Font Size Command

The Reduce Font Size command reduces the size of the font for the entire ST program or function.

Applies To

ST programs and functions

Location

Reduce Font Size button, or View menu

Redundant Mode

For Tricon, the Redundant Mode property specifies whether there is a redundant Tricon ACM module in the installation. The default is cleared, which means not redundant.

Applies To

Tricon ACM Module

Location

Tricon Controller tree > Configuration > Hardware Allocation > ACM Setup

Refresh Command

The Refresh command replaces the data on a report that is currently displayed with data from the reports database. If project changes are made, you must first update the report database, and then click Refresh.

Applies To

Reports

Location

Refresh button on Project tree > Reports folder

Remote Access to Aliased Tagnames

The Remote Access to Aliased Tagnames property specifies whether external devices using the TSAA client/server protocol can write to output tagnames (points) that have aliases. (Read access is always allowed for input, memory, and output points.)

This property must be used for DDE communication and can be used for OPC, TSAA, and Peer-to-Peer communication.

In addition to setting this property, these properties must be set:

- The Disable Remote Changes to Outputs property on the Trident MP Operating Parameters screen must be cleared. The default is selected.
- The Privilege property must be set to Read/Write on the Trident CM.

Applies To

Tagnames for outputs

Location

Trident MP > Item Properties > Module tab

Remote Access to All Tagnames

The Remote Access to All Tagnames property specifies whether external devices using the TSAA client/server protocol have read/write access to all tagnames (points) whether or not they have aliases.

This property can be used for OPC, TSAA, and Peer-to-Peer communication.

In addition to setting this property, these properties must be set:

- The Disable Remote Changes to Outputs property on the Trident MP Operating Parameters screen must be cleared. The default is selected.
- The Privilege property must be set to Read/Write on the Trident CM.

Applies To

Application

Location

Trident MP > Item Properties > Module tab

Remote Mode

The Remote mode enables external (remote) devices to have read/write access to aliases in an application running on a controller.

- For Tricon, Remote mode is set by turning the keyswitch to REMOTE.
- For Trident, Remote mode is set programmatically by enabling write access with the SYS_SET_REMOTE_WRT_ENBL function block in a program.

The default is not enabled, which means external devices are not allowed to write to aliases.

Applies To

Application, controller, tagnames

Location

Tricon keyswitch set to REMOTE
Trident Application tree > Library Documents > Functions

Remove Invalid Items (Red X'd)

The Remove Invalid Items (Red X'd) command removes, from all test sheets, any invalid elements (each marked with a red X) that may be left over from previous builds or editing.

Applies To

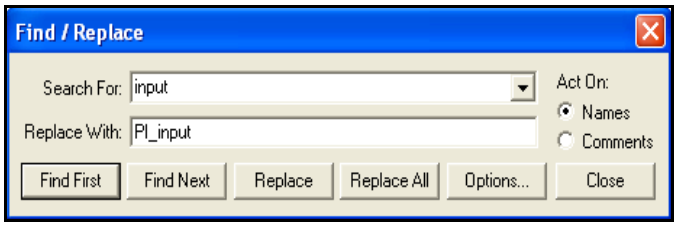
Test sheets in the emulator and controller

Location

Configuration tree > Controller or Emulator Panel > Tools menu

Replace Command

The Replace command searches and replaces specified text in programs, functions, or function blocks.



Applies To

Editing

Location


Replace Text button, or File menu

Resolution Type

The Resolution Type property specifies the resolution for the Single-Ended and the Differential AI Modules (models 3720 and 3721 only). The Single-Ended AI uses unipolar input.

Types include:

- Standard Resolution: Data resolution is 12 bits.
- High Resolution: Data resolution is 14 bits.

The default is Standard Resolution.

The value returned is based on the input voltage, the resolution type, and the module type. This table identifies the ranges and returns.

Table 52 Resolution Type Ranges and Returns

Input (volts)	Standard Resolution (Unipolar Input)	High Resolution (Unipolar Input)	High Resolution (Bipolar Input)
<-5.3	32767 (out-of-range under)	-32767 (out-of-range under)	-32767 (out-of-range under)
-5.3	32767 (out-of-range under)	-32767 (out-of-range under)	-17366 (under-range)
-5	32767 (out-of-range under)	-32767 (out-of-range under)	-16383 (minimum range)
< 0	32767 (out-of-range under)	-32767 (out-of-range under)	—
0	0 (minimum range)	0 (minimum range)	0 (minimum range)
5	4095 (maximum range)	16383 (maximum range)	16383 (maximum range)
5.3	4341 (over-range)	17366 (over-range)	17366 (over-range)
>5.3	32767 (out-of-range over)	32767 (out-of-range over)	32767 (out-of-range over)

Applies To

AI Modules

Location

Tricon Controller tree > Configuration > Hardware Allocation > Single-Ended and Differential AI Setup

Restart on Power Up

For Trident, the Restart on Power Up property specifies whether the controller automatically restarts on power up. The default is cleared, which means the controller is not automatically restarted on power up.

Applies To

Trident MP

Location

Trident Controller tree > Configuration > Hardware Allocation > MP > Setup > Operating Parameters tab

Restore Command

The Restore command returns the previous settings for the item, if the Apply command has not been used. For example, if you changed the default values for a property such as the Initial Value, you can go back to the defaults by clicking Restore.

Applies To

Project elements

Location

Item Properties

Restore Project Command

The Restore Project command allows you to open a backup file named <project_name>.BT2. You can then save the file to a name with a project file extension, such as <project_name>.PT2.

Applies To

Project

Location

File menu

Restore Project To Last Download Command

The Restore Project To Last Download command restores the project that was last successfully downloaded to the controller. When a download is successful, a backup file of the project is automatically created with the major version, minor version, time stamp, and the extension DWLD. For example, PEER_333_1_4120e077.DWLD.

Applies To

Project

Location

File menu

Retentive

The Retentive property specifies whether the value of a memory point is retained if a power failure occurs. If selected, when the system is powered up the memory point uses the value it had prior to the power failure. Only memory points can be specified as retentive. For input and output points, the value retained after a power failure is either zero or the value set for the Initial Value property. The default is cleared, which means the value is not retained.

Applies To

Memory points

Location

Application tree > Tagname Declarations > Item Properties > Declaration tab

Right Power Rail Command

The Right Power Rail command allows you to place a right power rail on a logic sheet to delimit the LD network. The right power rail has an undefined status, and can be explicit or implicit.

The left power rail is automatically included when a new logic sheet is created. The first element in every network must be linked to the left power rail, which is considered On at all times.

To change the height of the rail, double-click the rail and use the + or – buttons.

Applies To

LD logic sheets

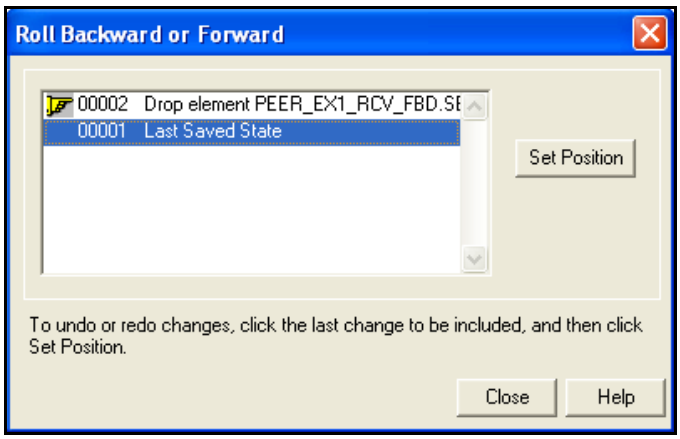
Location

Right Power Rail button, or Tools menu > Select Tools

Roll Backward or Forward Command

The Roll Backward or Forward command displays all the project changes made since the last save, and allows you to roll backward or forward to a specific change.

After the project is saved, the changes are incorporated and the listing is cleared.



Applies To

Project

Location

Edit menu

Routing Configuration

The Routing Configuration property displays the Destination IP Address, IP Subnet Mask, and Default Gateway IP Address for the node.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Routing tab

Run Command

The Run command executes an application in the controller or emulator. Programs to be executed must be included on the Program Execution List.

- For Tricon, the Run command is only available when the keyswitch is set to the RUN or PROGRAM mode. The Run command is unavailable if the keyswitch is set to STOP or REMOTE.
- For Trident, the Run command is unavailable if the SYS_APP_HALT function is set to halt execution programmatically.

Applies To

Application, programs

Location


Run button
Configuration tree > Controller or Emulator Panel > Commands menu

RUNNING State

The RUNNING state is an application state which indicates the application is downloaded and running in the controller or emulator.

Applies To

Application

Location

Controller tree > Controller or Emulator Panel > Commands menu or Title bar

Save Element Command

The Save Element command saves an open element.

Applies To

Project

Location

Save Element button, or File menu

Save Project Command

The Save Project command saves an open project.

Applies To

Project

Location


Save Project button, or File menu

Save As Command

The Save As command saves a project under a different name or folder.

Applies To

Project

Location

File menu

Save Implementation

The Save Implementation command saves the changes made to the Implementation area, which includes the Execution List, SOE Configuration, and Peer-to-Peer Configuration.

Applies To

Project

Location

File menu

Save View Command

The Save View command saves a view of a matrix, which is a display of a selected portion of the matrix. You can create a view by hiding or showing columns and rows on the matrix, either by using menu commands or by dragging columns and rows on the matrix. Saving the view allows you to load it anytime.

Applies To

CEM programs

Location

Application tree > open a CEM program > View menu

Scale Factor

The Scale Factor property specifies how to convert pulse input signals into engineering units. The default is 1. The number must be a positive real number.

This table shows the correct scale factor to use for converting pulse input signals into seconds, minutes, and hours.

To Convert	Set Scale to
Pulses per second	0.016667
Pulses per minute	1.000000 (default)
Pulses per hour	60.000000

Speed Measurement

This formula converts speed measurement to different engineering units. The default is pulses per minute.

Speed =(Pulses /Minute) x Scale

RPM Measurement

This formula scales RPM measurements under special circumstances. For example, the Scale Factor property can be used to adjust the RPM measurement when the measuring shaft rotates at a different rate from the output shaft.

Speed =((Pulses /Minute)/Number of Gear Teeth) x Scale

Applies To

Pulse Input Configuration

Location

Controller tree > Configuration Panel > Hardware Allocation > Pulse Input Setup

Scan Time

The Scan Time property specifies the requested number of milliseconds for a scan (execution of the application) on the controller. The number is requested before an application is built. After the application is built and downloaded, the controller determines an actual scan time range and uses the specified scan time if it falls within these limits.

CAUTION

When a Download Changes command is issued, the scan time is doubled for one scan immediately following the command. For example, if the normal scan time is 100 ms, the scan following a Download changes would be 200 ms.

The controller determines a valid range for the scan time based on these operations:

- Reads inputs
- Executes the application
- Processes messages
- Writes outputs

If the application is running, the scan time can be set to a number different from the requested number without downloading the application. To determine what the actual, requested and surplus scan times are, see the Enhanced Diagnostic Monitor (sold separately).

- For Tricon (3006 MP), the maximum scan time is 500 milliseconds.
- For Tricon (3008 MP), the maximum scan time is 450 milliseconds.
- For Trident, the maximum scan time is 450 milliseconds.

For Tricon and Trident, the default is 200 milliseconds.

Applies To

Application

Location

Application tree > Implementation > Execution List

Search Text Command

The Search Text command allows you to search for text in a report.

Applies To

Reports

Location

 Search Text button

Security Command

The Security command opens the Security dialog box, which allows user access to be created and modified.

Applies To

User security

Location

 Security button, or Project menu

Security Level

The Security Level property specifies the level of security for the user.

Settings include:

- Level 01 is the highest security level
- Level 10 is the lowest security level

Each level allows access to its own operations and the operations associated with all lower levels. For example, a user with security level 03 has access to operations for security levels 04, 05, 06, 07, 08, 0,9 and 10.

Applies To

Security

Location

Project menu > Security command > Users tab

Select Function Block Command

The Select Function Block command displays a dialog box that allows you to select a function block to add to a program.

Applies To

Programs

Location

Select Function Block Element button
Tools menu > Select Tool > Function Block

Select Network Contents Command

The Select Network Contents command selects all the elements in a network for the current document. You must select at least one element (input, output variable) before using this command.

Applies To

Editing

Location

Edit menu

Select Sheet Contents Command

The Select Sheet Contents command selects all the elements on the current logic sheet.

Applies To

Editing

Location

Edit menu

Selection Tool

The Selection Tool command changes the cursor to a selection tool, which allows you to select elements.

Applies To

Logic sheets in user documents, test sheets in emulator and controller

Location

Selection Tool button, or Tools menu > Select Tool

Serial Port

The Serial Port property specifies the port on the TriStation PC that is connected to the controller.

Applies To

Communication

Location

Tricon Controller tree > Configuration tree > Communication

Set Calendar Clock Command

The Set Calendar Clock command sets the controller clock to the TriStation PC time. Before using the Set Calendar Clock command, you should ensure the PC is set to the correct local time.

When you download and run a TriStation application, the controller automatically sets its clock to the TriStation PC time. If the accuracy of the controller clock degrades over time, you can reset the clock while the application is running, without having to download again.

Procedure

1. On the TriStation PC, right-click the time icon in the message bar or open the Date/Time dialog box from the Control Panel.
2. Ensure the PC is set to the correct local time.
3. Open the TriStation project that is running in the controller.
4. On the Configuration tree, double-click the Controller or Emulator Panel.
5. On the Commands menu, click Connect, and then click Set Calendar Clock.
6. Click Yes when asked whether to set the calendar clock to the current configuration.

Applies To

Controller

Location

Configuration tree > Controller or Emulator Panel > Commands menu

Set Editor Options Command

The Set Editor Options command specifies how to set tabs, font size, and auto-scroll delay. Properties include:

- Tabs on page 430
- Font Size on page 364
- Auto Scroll Delay on page 321

Applies To

ST Language

Location

View menu

Set Programming Mode Command

For Trident, the Set Programming Mode command specifies whether changes to the application are allowed. To use this command, the application must be downloaded to the controller.

Setting	Description
Enable Programming and Control	Allowed changes include: Download Changes and Download All commands, changing the values of variables, changing scan time, and changing the operational mode.
Disable Programming and Control	Prohibits all changes to the application.

The Set Programming Mode command is unavailable if the SYS_SET_APP_LOCK function has been set to prohibit (lock out) changes programmatically.

The default setting is Enable Programming and Control.

Applies To

Application, controller

Location

Trident Controller tree > Controller Panel > Commands menu

Set Scan Time Command

The Set Scan Time command specifies, in milliseconds, how often the emulator or controller performs a scan. Changing the scan time on the Set Scan Time screen does not change the scan time for the project. To change the time for the project, you must set the time on the Execution List.

The minimum time is determined by the controller after the application is downloaded. The maximum time is determined by the type of controller. The scan time must be within the minimum and maximum range.

- For Tricon 3008 MPs, the maximum time is 450 milliseconds.
- For Tricon 3006/3007 MPs, the maximum is 500 milliseconds.
- For Trident systems, the maximum is 450 milliseconds.

For Trident, you can set the scan time between the minimum and maximum times. The scan time must be larger than the AI and DI poll times.

Applies To

Application

Location

Configuration tree > Controller or Emulator Panel > Commands menu

Set Value

The Set Value property specifies the value for the variable during testing on the controller or emulator. To ensure the value is valid for the data type, click Confirm when specifying the value on the Variable tab.

Applies To

Variables on test sheets in the Controller and Emulator Panels

Location

Item Properties > Variable tab

Shared Read

The Shared Read property specifies whether a program can read a tagname that is a different Application type. For example, if the tagname is a Control type, it cannot be read by a Safety program unless Shared Read is checked. The default is cleared, which means that programs can only read tagnames that have the same Application type.

Applies To

Tagnames

Location

Application tree > Tagname Declarations > Item Properties > Declaration tab

Sheets Menu

The Sheets menu includes commands that allow you to change the properties of logic sheets, which provide the workspace for developing programs, functions, and function blocks. The Sheets menu includes these commands.

Command	Description
Sheet Title	Edits the title of the current sheet. The sheet title is displayed in the title block, the window caption bar, and the Window Menu list.
Edit Sheet Macros	Allows you to change the text associated with macros which are identified by a pencil icon.
 Next Sheet	Displays the next sheet.
 Previous Sheet	Displays the previous sheet.
Append Sheet	Adds a new sheet *after* an existing sheet.
Insert Sheet	Adds a new sheet *before* an existing sheet.
Delete Sheet	Deletes the selected sheet.
Organize Sheets	Allows you to append, insert, and delete sheets. Also allows you to change the sheet title and to display (go to) the selected sheet.

Command	Description
Select Sheet Template...	Includes the following sheet templates: Sheet A — 8.5" x 11" Sheet B — 11" x 17" (default) Sheet C — 17" x 22" Sheet D — 22" x 34"

Applies To

Logic sheets in user documents, test sheets in Controller and Emulator Panels

Location

Sheet Manager button, or Sheets menu

Shorted Point Alarm Threshold

The Shorted Point Alarm Threshold property specifies the number of ohms below which values are alarmed as a shorted load. This option is only available if the points are supervised.

Typical threshold values are 10 to 48 ohms. The available range is 0 to 65,535 ohms. The default is 10 ohms.

Available only with the model 3625 digital output module.

Applies To

Tricon DO points

Location

Tricon Controller tree > Configuration > Hardware Allocation > DO Setup

Show Causes for Selected Effect Command

The Show Causes for Selected Effects command displays the causes of all selected effects in a CEM program.

Applies To

CEM programs

Location

View menu

Show Effects for Selected Causes Command

The Show Effects for Selected Causes command displays the effects of all selected causes in a CEM program.

Applies To

CEM programs

Location

View menu

Show Grid Command

The Show Grid command toggles on and off to show or hide dotted grid lines.

Applies To

FBD and LD programs and functions

Location

View menu

Show IEC Representation

The Show IEC Representation command toggles between displaying the IEC (International Electro-Technical Commission) representation and the TriStation 1131 graphical view.

Applies To

FBD and LD programs and functions

Location

View menu

Show Network Numbers Command

The Network Number command toggles on and off to show or hide network numbers.

Applies To

FBD and LD programs and functions

Location

View menu

Show Line Numbers Command

The Show Line Numbers command toggles to display or show line numbers in a ST program or function.

Applies To

ST programs and functions

Location

Line Numbers button, or View menu

Show Zones Command

The Zones command toggles on and off to show or hide network zone lines.

Applies To

FBD and LD programs and functions

Location

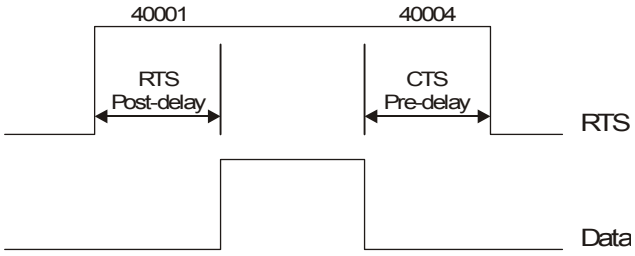
View menu

Signal Delays

The Signal Delays property adjusts the timing of data transmission to Modbus devices that use hardware handshake, which is a method of ensuring devices are ready to receive data. Signal delays adjust the timing for CTS and RTS signals for Modbus devices that have slow throughput or other limitations.

The RTS (Request to Send) signal opens and closes the data transmission channel. The RTS pre-delay setting specifies the number of milliseconds to wait before the data is transmitted.

The CTS (Clear to Send) signal indicates the transmitting station that it is ready to receive data. The CTS Pre-delay setting specifies the number of milliseconds to keep the channel open after data is transmitted.



The settings can be from 0 to 10,000 milliseconds; the default is 0.

Setting Signal Delays for Tricon EICM

Signal delays are set by using the MBWRITE function blocks in a program.

Procedure

1. Set the Handshake property to Hardware on the Tricon EICM Setup screen.
2. Add an MBWRITE function block for each type of delay (CTS and RTS) you want to specify.
3. Specify these parameters in the function block.

Parameter	Action
Alias	For CTS, enter 40001. For RTS, enter 40004.
Port	Enter the EICM port number.
Station	Enter the slave station address.
D01	Enter the delay in milliseconds; 0 to 10,000.

Applies To

Modbus Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > EICM Setup
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Serial Ports tab

Single Step Command

The Single Step command executes a single scan of the application in the controller or emulator.

Applies To

Application

Location


Single Step button
Configuration tree > Controller or Emulator Panel > Commands menu

Size/Alignment Command

The Size/Alignment command includes commands that specify whether to increase or decrease the size of the element and how to align the element. The commands apply actions to the other elements using the currently selected element as the reference. For example, the Same Width command changes all other elements to the same width as the selected element.

The subcommands include:

- Same Width
- Same Height
- Same Size
- Align Left
- Align Right
- Align Top
- Align Bottom
- Center Horizontally
- Center Vertically
- Space Across
- Space Down

Applies To

Comments, constants, variables

Location

Right-click an element

Size/Hide Columns Command

The Size/Hide Columns command displays a dialog box that allows you to specify the font size and hide or unhide the columns.

Applies To

CEM programs

Location

Size/Hide Columns button, or View menu

Size/Hide Comment Column Command

The Size/Hide Comment Column command displays a dialog box that allows you to specify the font size and hide or unhide the comment.

Applies To

CEM programs

Location

View menu

Size/Hide Rows Command

The Size/Hide Rows command displays a dialog box that allows you to specify the font size and hide or unhide the rows.

Applies To

CEM programs

Location


Size/Hide Rows button, or View menu

Slot Selection

The Slot Selection property specifies the slot to be configured on the communication module.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Network and Routing tabs

SNTP Master IP Address

The SNTP Master IP Address property specifies the IP Address for the master node using the Simple Network Time Protocol.

Applies To

Time synchronization

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Time Sync tab

SNTP Master Network

The SNTP Master Network property specifies the network on which the master node is located.

Applies To

Time synchronization

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Time Sync tab

SOE Block

The SOE Block property identifies a data structure in the MP memory. The block header contains the block type, the buffer size, and a list of the event variables assigned to the block. The buffer stores the event entries, each containing a time stamp and one or more data entries.

There are 16 SOE blocks. For more information, see the *SOE Recorder User's Guide.*

Applies To

Sequence of Events (SOE)

Location

Application tree > Implementation > SOE Configuration
Controller tree > Configuration > Hardware Allocation > HMM Setup

SOE Block Assignments

The SOE Block Assignments property specifies the SOE blocks that the tagname is assigned to for purposes of collecting SOE data. For more information, see the *SOE Recorder User's Guide.*

Applies To

Sequence of Events (SOE)

Location

Application tree > Implementation > SOE Configuration > double-click the row for the tagname

SOE Block Name

The SOE Block Name property specifies the name of the SOE block. For more information, see the *SOE Recorder User's Guide.*

Applies To

Sequence of Events (SOE)

Location

Application tree > Implementation > SOE Configuration tree > double-click a block

SOE Block Type

The SOE Block Type property specifies how the events are saved, discarded, or cleared from the buffer. Types include: External, First Out, Modified External, and Unassigned. For more information, see the *SOE Recorder User's Guide*.

External

The External Block Type setting is typically used when an external device, such as a Foxboro or Honeywell DCS or PC running SOE Recorder, is retrieving events from a controller on a continual basis. When events are collected by the external device, event data is cleared from the block. When the buffer is full, new event entries are discarded.

First Out

The First Out Block Type setting is typically used to retrieve the first and subsequent events that led to a trip. When the buffer is full, the Main Processors change the block's status from collecting to stopped. New events are discarded.

Historical

The Historical Block Type setting is typically used to monitor current events in SOE Recorder application. An external device can collect events at any time, however, the collection does not clear the block. If the TriStation application does not clear and restart recording, the oldest event entries are overwritten when the buffer is full.

Modified External

The Modified External Block Type setting is used for event retrieval with the Safety Manager Module (SMM). The SMM is the Triconex communication interface with the Honeywell Universal Control Network (UCN), which is one of the principal networks of the Honeywell TCD 3000 Distributed Control System. Only blocks 15 and 16 can be specified as Modified External.

The default is Unassigned.

Applies To

Sequence of events (SOE)

Location

Application tree > Implementation > SOE Configuration tree > Blocks

SOE Buffer Size

The SOE Buffer Size property specifies the size of the buffer based on the number of events.

The maximum is 20,000; the default is 0.

Applies To

Sequence of Events (SOE)

Location

Application tree > Implementation > SOE Configuration tree > Blocks

Space Saver

The Space Saver property means a single instance can be executed more than once per scan to reduce memory usage and increase performance.

Note If a function block is not a space saver, using the same function block instance more than once on a function block diagram results in a WF0031 warning—whereas there is no such warning for a space saver function block.

- For user-defined function blocks, you can specify this setting.
- For Triconex Library function blocks, the setting cannot be changed.

Applies To

Library and user-defined function blocks

Location

Function Blocks > Document Properties > Usage tab

Start Value and Increment

The Start Value property specifies the beginning letter or number to use when naming multiple variables. The Increment property specifies the number to increase each time a variable is named.

The default value is 1 for both properties.

Applies To

Comments and variables in user documents

Location

Item Properties > Auto Name > Auto Name button
Tools menu > Auto Name Selected Items

Stop Bits

The Stop Bits property specifies whether to transmit 1 bit or 2 bits after each character to notify the receiving computer that the transmission of a byte of data is complete. The default is 1 bit.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > EICM Setup
Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Serial Ports tab
Trident Controller tree > Configuration > Hardware Allocation > MP and CM Setup > Serial Ports tab

Stop Mode

Stop mode stops the TriStation application from reading field inputs and forces non-retentive digital and analog outputs to zero. Retentive outputs retain the values they had before the application was halted.

Stop mode is useful for installation and service of external equipment, but is not required for service of the controller. Before using the stopping the application, the Halt command should be used to halt the application.

- For Tricon, Stop mode is set by turning the keyswitch to the STOP position.
- For Trident, Stop mode is set by using the SYS_APP_HALT function in a program.

Applies To

Application, controller

Location

Tricon keyswitch set to STOP
Trident Controller tree > Controller Panel > Commands menu
Trident Application tree > Library Documents > Functions

Supports Application Defined States

The Supports Application Defined States property specifies whether to allow user-defined functions to include a variable that stores application states.

If included, the variable stores application states and is evaluated in the same way as the cause, intersection, and effect internal variables. The default is cleared, which means not enabled.

Application state inputs and outputs must be a DWORD data type 32-bit string.

Applies To

Functions, function blocks

Location

Document menu > Item Properties > Attributes tab

Supports Use in Cause Rows with... Inputs

The Supports Use in Cause Rows with... Inputs property specifies whether a specific user-defined function can be used in a cause row. Triconex-supplied functions do not have to be enabled.

The default is cleared, which means not enabled.

Applies To

Functions, function blocks

Location

Document menu > Item Properties > Attributes tab

Supports Use in Effect Columns With... Outputs

The Supports Use in Effect Columns with... Outputs property specifies whether a specific user-defined function can be used in an effect column. Triconex-supplied functions do not have to be enabled. The default is cleared, which means not enabled.

Applies To

Functions, function blocks

Location

Document menu > Item Properties > Attributes tab

Supports Use in Intersections

The Supports Use in Intersections property specifies whether a specific user-defined function can be used in an intersection. Triconex-supplied functions do not have to be enabled. The default is cleared, which means not enabled.

Applies To

Functions, function blocks

Location

Document menu > Item Properties > Attributes tab

Tabs

The Tabs property specifies the number of tab settings used in the Structured Text code. The default is 8.

Applies To

ST Language

Location

View menu > Set Editor Options

Tagname

The Tagname property specifies the name of an input, output, or memory point. The name comes from the use of tags tied to field points. In TriStation, it generally refers to points.

Tagnames can include up to 31 alphanumeric (A to Z and 0 to 9) characters and the underscore (_) character. Tagnames cannot begin with an underscore.

Applies To

Input, output, and memory points

Location

Application tree > Tagname Declarations > Declaration tab

TCP Port Number

The TCP Port property specifies a port number used by a network device.

- For the Tricon TCM, the default is 502.
- For the Trident CM, the TCP Port property specifies a port number specified by a printer manufacturer. This information should be available with the printer instructions.
- An HP JetDirect print server with one port uses port number 9100.
- An HP JetDirect print server with three ports uses port numbers 9100, 9101, and 9102.

The default is blank.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Printer and Modbus TCP tabs
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Printer tab

Temporary Files

The Temporary Files property specifies the path name for documents which include temporary files created by TriStation 1131 or other utilities. The default path name is:

```
C:\My Documents\Triconex\TriStation 1131 4.1\Temp
```

Applies To

Project

Location

Tools menu > TriStation 1131 Options > Directories tab

Terminal

The Terminal property displays the names of the input and output terminals for the function or function block included with the selected cause, intersection, or effect. Extensible functions do not have terminal names.

Applies To

CEM programs

Location

Variable Detail Table

Terminals

See Double Space on page 347 and EN/ENO on page 352.

Termination Options

The Termination Options property specifies whether resistors are used to terminate the Modbus cable connections. This option is only available with RS-485 Transceiver Mode.

Options include:

- None: The cables are not terminated.
- Resistor: Resistors are used at each end of the cables.
- Pull-Up/Pull-Down Resistors: Pull-up/pull-down resistors are used.
- All: Both pull-up/pull-down and standard resistors are used.

The default is None.

Applies To

Modbus communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Serial Ports tab

Text Size

The Text Size property specifies the point size for the text; from 3 to 24 points.

The defaults are: A=6, B=8, C=10, and D=10.

Applies To

Comments

Location

Properties > Comment tab
Project menu > Project Options > Annotations tab

Time After Trip

The Time After Trip property specifies the number of minutes after the trip to continue collecting events for the trip snapshot.

The minimum is 2 minutes; the maximum is 10 minutes. The default is 2 minutes.

Applies To

SOE

Location

Application > Implementation > double-click SOE Configuration branch

Time Before Trip

The Time Before Trip property specifies the number of minutes before the trip to begin collecting events for the trip snapshot.

The minimum is 2 minutes; the maximum is 10 minutes. The default is 2 minutes.

Applies To

SOE

Location

Application > Implementation > double-click SOE Configuration branch

Time Synchronization

The Time Synchronization properties specify whether and how time is synchronized for the controller. Depending on the controller, the following properties can be specified. The default is cleared, which means time synchronization is not used.

Controller	Property
Tricon ACM	On NET 1 enable time synchronization with external source
Tricon ACM	On NET 2 enable time synchronization with Tricon Master Node
Tricon NCM	On NET 1 enable time synchronization with Tricon Master Node
Tricon SMM	Enable time synchronization with external source
Tricon TCM	See Time Synchronization Configuration on page 434.
Trident CM	On NET 1 enable time synchronization with Trident Master Node
Trident CM	On NET 2 enable time synchronization with Trident Master Node

Applies To

Controller

Location

Tricon Controller tree > Configuration > Hardware Allocation > ACM, NCM, SMM, Enhanced TCM Setup
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Network tab

Time Synchronization Configuration

The Time Synchronization Configuration property specifies the type of synchronization to be done by the TCM. These options are available.

Option	Description
None	No time synchronization.
GPS	Time synchronization based on the GPS interface and one TCM module.
GPS Redundant	Time synchronization based on the GPS interface and two TCM modules.
SNTP Redundant	Simple Network Time Protocol with two TCMs.
SNTP	Simple Network Time Protocol with one TCM.
Peer-to-Peer	Triconex Time Synchronization based on the master node in the Peer-to-Peer network.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Time Sync tab

Toggle Terminal Inverter Command

The Toggle Terminal Inverter command toggles the inversion state of an input or output terminal on the selected function or function block. When the terminal is inverted, a small circle appears at the terminal connection.

Applies To

CEM programs

Location

Application tree > open a CEM program > right-click in the FBD Network

Transceiver Mode

The Transceiver Mode property specifies the type of physical connection.

For Ethernet ports, settings include:

- Auto-Negotiate (TCM will connect at either 10 Mbps or 100 Mbps, depending on the speed of the connection)
- 10 Mbps Half Duplex
- 10 Mbps Full Duplex
- 100 Mbps Half Duplex (Tricon TCM only)
- 100 Mbps Full Duplex (Tricon TCM only)

Note If you have a model 4352A TCM with fiber connectors, you **must** select 100 Mbps as the communication mode. The 4352A module cannot connect at 10 Mbps.

For Serial Ports, settings include:

- RS-232 for point-to-point communication over distances up to 50 feet
- RS-485 for multi-point communication over distances up to 4,000 feet

RS-232 Transceiver Mode with Handshake

Hardware handshake is a method for controlling the flow of serial communication between two devices which uses a separate wire to send a signal when the receiving device is read to receive the signal. Hardware handshake can be used with Tricon TCM and Trident CM.

With the Handshake property set to Hardware, the communication module asserts the Request to Send (RTS) signal when it has a message to transmit. The communication module begins transmission when it receives a Clear to Send (CTS) signal from the Modbus master. The communication module ignores all characters unless the Modbus master asserts the Data Carrier Detect (DCD) signal. This settings allows the Modbus master to use half-duplex modems.

With the Handshake property set to None (typically for point-to-point connections), the communication module asserts RTS at all times and ignores CTS and DCD. In other words, the communication module transmits characters even if the receiving device is not ready. This could result in an overrun state, and the characters would have to be re-transmitted.

RS-485 Transceiver Mode with Handshake

With the Handshake property set to Hardware, the communication module enables its RS-485 transmit driver only when it is sending data. Use this setting for all single-pair networks and for slave ports in two-pair, multi-point networks.

With the Handshake property set to None, the communication module enables its RS-485 transmit driver at all times. Use this setting for a Modbus slave port in a two-pair, point-to-point network.

RS-485 cannot be used for a TriStation serial connection on TCM port 4.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Network and Serial Ports tabs
Trident Controller tree > Configuration > Hardware Allocation > MP Setup > Serial Ports tab
Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Network and Serial Ports tab

Transceiver Port

For Trident, the Transceiver Port property specifies the type of connection to be used for the port. Settings include RJ-45 and MAU. The default is RJ-45.

Applies To

Communication

Location

Trident Controller tree > Configuration > Hardware Allocation > CM Setup > Network tab

Triggering Mode

For Trident, the Triggering Mode property specifies where the input signal is triggered. For asymmetrical waveforms, select the option that corresponds to the sharper edge. Settings include Rising Edge and Falling Edge.

The default is Rising Edge.

Applies To

Trident Pulse Input Module

Location

Trident Controller tree > Configuration > Hardware Allocation > Pulse Input Setup

Trip State

The Trip State property specifies the value on which to begin collecting events.

Applies To

SOE

Location

Application tree > Implementation > SOE Configuration

Trip Tagname

The Trip Tagname property specifies the tagname (variable) that identifies whether a trip has occurred.

Applies To

SOE

Location

Application tree > Implementation > SOE Configuration

TriStation Port Number

The TriStation Port Number property identifies the UDP port number used for the TriStation connection to the TCM. The default number is 1502.

Applies To

Communication

Location

Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Network tab

TSAA Port Number

The TSAA Port Number property identifies the UDP port number used with TSAA client/server network communication. The default number is 1500.

Applies To

Communication

Location

Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Network tab

Type Over Command

The Type Over command toggles between typing over and inserting characters in a Structured Text program or function.

Applies To

ST programs and functions

Location

Type Over button, or View menu

UCN Node Number

For Tricon, the UCN Node Number property specifies an number on the Tricon SMM, which can be any odd number from 1 to 63. Even numbers are used for hot-spare module communication.

The default is 1.

Applies To

Tricon SMM

Location

Tricon Controller tree > Configuration > Hardware Allocation > SMM Setup

UDP Base Port Number

The UDP Base Port Number property specifies the UDP port number for the controller where the TriStation application is to be run. This number identifies the controller in a Peer-to-Peer network. Entering 0 as the UDP port number disables Peer-to-Peer over UDP/IP on the network. The following values are reserved:

Reserved Value(s)	Protocol	Notes
1500	TSAA	Can be changed via configuration
1502	TriStation	Can be changed via configuration
1503–1504	Peer-to-Peer	Can be changed via configuration
1505–1508	Firmware download	Cannot be changed; for Triconex use only
1–1023	—	Reserved by the Internet Assigned Numbers Authority (IANA)

Also see TriStation Port Number on page 437 and TSAA Port Number on page 437.

Applies To

Communication

Location

Tricon Controller tree > Configuration > Hardware Allocation > Enhanced TCM Setup > Network tab
Tricon Controller tree > Configuration > TriStation Communication

Undo Command

The Undo command reverses the last action performed when editing a program, function, or function block.

Applies To

Editing

Location

Edit menu

Update Reports Database Command

The Update Reports Database command copies project information to a database used when reports are generated.

Applies To

Reports

Location

Project tree > right-click the Reports folder

Update Selected Function Cells Command

The Update Selected Function Cells command updates selected out-of-date elements which are marked with a red X in the active window.

Applies To

CEM programs

Location

Tools menu

Usage

The Usage property specifies how function blocks can be used in a function or function block.

For library function blocks, the options determine the usage and cannot be changed. For user-defined function blocks, the settings can be specified.

Settings include:

- Exactly Once on page 359
- Only Once on page 391
- Space Saver on page 428
- Internal State on page 372

Applies To

Library and user-defined function blocks

Location

Document Properties > Usage tab

Use Local Time

The Use Local Time property specifies whether to use local time or universal time. The default is selected, which means local time is used.

Applies To

Application

Location

Trident Controller tree > Configuration > Hardware Allocation > MP > Setup > Operating Parameters tab

Value

The Value property specifies the value for the constant. To ensure the value agrees with the Data Type, click Apply.

Applies To

Constants

Location

Properties > Constant tab

Value Range to Scale an Integer

The Value Range to Scale an Integer properties specify how a REAL number is scaled to an integer so it can be transmitted using Modbus protocol, which does not use REAL numbers. The values set for the scale range are used with the Modbus minimum and maximum range to derive an integer value that represents the real value.

Properties include:

- Minimum Value (Min Span) on page 384
- Maximum Value (Max Span) on page 381
- Precision on page 400
- Disable Scaling on page 344

Applies To

Points with REAL data types

Location

Application tree > Tagname Declarations > Scaling tab

Var/Const

The Var/Const property displays the names of the variables connected to the terminals of the function or function block in a CEM program. Only user-defined variables are displayed. Internal variables are hidden.

Applies To

CEM programs

Location

Application tree > open a CEM program > Variable Detail Table

Var Type

The Var Type property specifies the type of variable. Types include:

Type	Description
Input	A variable which provides a value to a program, function, or function block. Must be connected to a point.
Output	A variable which returns the result of a program, function, or function block. Must be connected to a point.
In/Out	A variable which is used as both an input and output variable. Must be connected to a point.
Local	A variable used for internal logic. Cannot be connected to a point.
Tagname	A variable that references a point.

Applies To

Variables

Location

Properties > Declarations tab

Verify Last Download to the Controller Command

The Verify Last Download to the Controller compares the application that was last downloaded to the controller with the application running on the controller. If there is a difference, you should contact Triconex Technical Support.

Applies To

Application

Location

Controller tree > Controller Panel > Commands menu

Verify Password

The Verify Password property allows you to enter the password a second time to verify it is the same as entered for the Password property.

Applies To

User access, Security

Location

Project menu > Security command > Users tab > Add or Modify button

Verify Version Command

The Verify Version command compares the version of the selected library in the project with the most current version available. If the version in the project is out of date, you are prompted to update it.

Applies To

Libraries

Location

Application tree > right-click Library Documents > Manage command

Vertical Network Divider Command

The Vertical Network Divider command allows you to place a vertical divider on a logic sheet to divide networks.

Applies To

FBD logic sheets

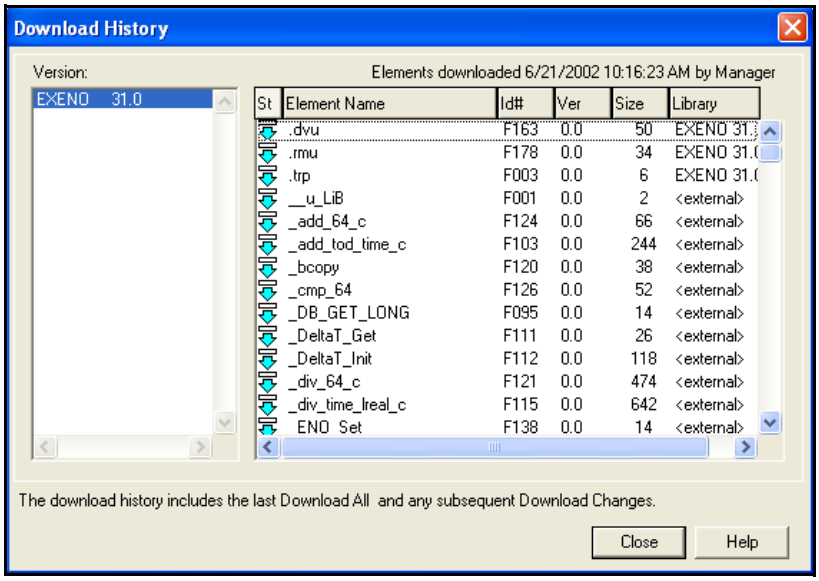
Location

Vertical Network Divider button, or Tools menu > Select Tool

View Download History Command

The View Download History command displays version information for each download for the current project, which is a list of the elements affected for the last Download All and subsequent Download Changes commands. The history is cleared and restarted with each Download All command.

These properties are displayed on the Download History screen.



Property	Description
St	An icon that indicates the status of the element. An arrow indicates that the element was included in a Download All; an ellipsis (...) means it was included in a Download Changes.
Element Name	The name of the program, function, or function block.
ID#	A system-generated identification for the program or function.
Ver	The version of the element.
Size	The size of the element in bytes.
Library	The library the element is included in.

Applies To

Project

Location

Project menu

View Intermediate FBD Command

The View Intermediate FBD command displays source code that is generated in the Function Block Diagram language when the CEM program is compiled.

Applies To

CEM programs

Location

Document menu

View Intermediate ST Command

The View Intermediate ST command displays source code that is generated when the program is compiled. You can copy the source code by using the Write to File command on the Edit menu.

Applies To

Programs, Functions, and Function Blocks

Location

Document menu

View Manager Command

The View Manager command allows you to save, load, or remove views of a CEM matrix.

Applies To

CEM programs

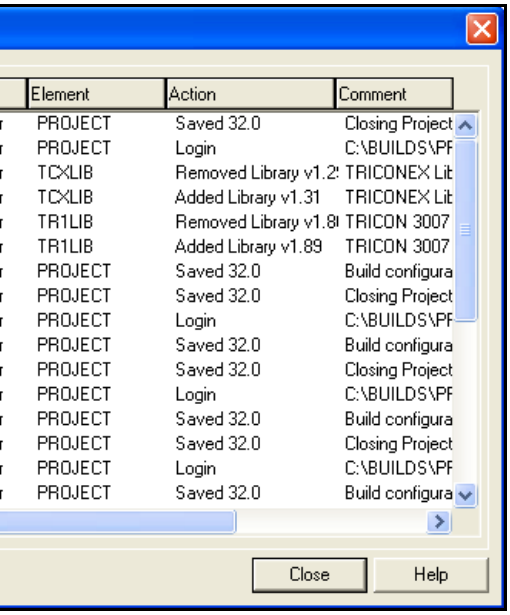
Location

View menu

View Project History Command

The View Project History command displays an audit trail of user access and modification of the project.

This history is automatically generated during project development.



Applies To

Project

Location

Project History button, or Project menu

Width

The Width property specifies the width (horizontal space) of the variable or constant symbol. By selecting either the plus (+) or the minus (-) buttons, you can expand or shrink the width of the variable symbol so you can use a longer name or fit the symbol into a smaller space.

Applies To

Variables

Location

Properties > Selected tab

Wire Tool Command

The Wire tool command provides a pointer tool to a connect logic elements in FBD programs.

Settings include:

- Normal: Represented by a solid line.
- Feedback: Represented by a dashed line.

The default is Normal. To set, double-click the wire and select either Normal or Feedback.

Applies To

FBD programs

Location


Wire Tool button, or Tools menu > Select Tool

Wire Type

The Wire Type property specifies the type of wire used for serial communication.

Settings include:

- 2-Wire (half duplex) if using one pair of wires for Modbus reads and writes. (Only available when the Transceiver Mode property is set to RS-485.)
- 4-Wire (full duplex) if using two pairs of wires—one pair for Modbus reads and the other pair for Modbus writes. (Trident MP serial ports must use this setting.)

The default is 4-Wire.

Applies To

Serial ports

Location

Trident Controller tree > Configuration > Hardware Allocation > MP or CM Setup > Serial Ports tab

Workspace View Command

The Workspace View command toggles to display or hide the Application and Controller workspace tree.

Applies To

TriStation 1131 workspace

Location


Workspace View button, or View menu

Write To File Command

The Write To File command displays a dialog box that allows you to specify a file name and location to save ST code as a text file.

Applies To

ST programs, ST functions, and intermediate ST for all programs and functions

Location

Edit menu

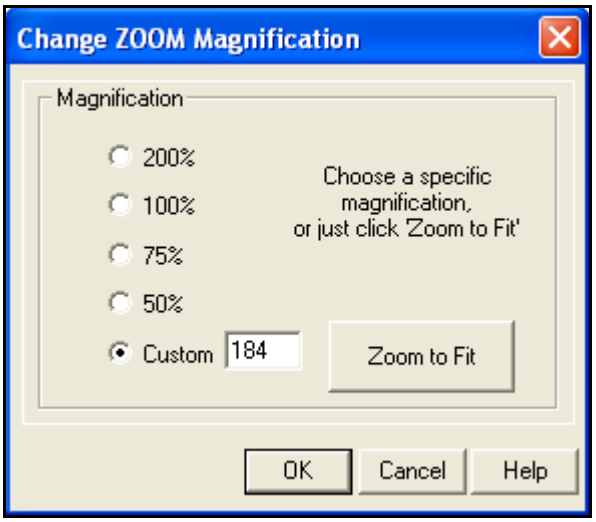
Zoom Command

The Zoom command enlarges or decreases the view of an element.

Standard settings are: 50%, 75%, 100%, and 200%. You can also enter a number or click Zoom To Fit to size the elements to fit the current window.

You can enlarge the view of elements on a logic sheet by:

- Using the Zoom button or Zoom command from the View menu
- Double-clicking an empty area to see a Zoom Selection view.



Applies To

Logic sheets for user documents, test sheets for Controller and Emulator Panels

Location


Zoom button, or View menu, or double-click an empty area in a logic sheet

Zoom To Fit Command

The Zoom To Fit command toggles between a large and small view of the logic sheet.

Applies To

Logic sheets for user documents, test sheets for the Controller and Emulator Panels

Location


Zoom To Fit button, or View menu, or double-click an empty area in a logic sheet

Zoom To Region

The Zoom To Region command allows you to zoom into a region of the sheet.

Procedure

1. On the View menu, click Zoom to Region.

   The cursor changes to a cross-bar.
2. Select the region to view by dragging the cross-bar across the area.

   The region is magnified.

Applies To

FBD and LD editors

Location

View menu

B

Data Types

Overview

Data types, which adhere to the IEC 61131-3 standard, specify the type of data used for the following:

- Constants
- Tagname declarations and references
- Local, input, output, and I/O variables

Elementary Data Types

An elementary data type specifies the size and characteristics of most data used in a program, function, or function block and the operations that can be applied to the data.

This table describes the elementary data types and how they can be used.

Table 53 Elementary Data Types and Usage

Data Type	Description	Tagnames	Constants and Local Variables
BOOL	A Boolean, 1 bit in length	✓	✓
DATE	A specific date		✓
DINT	A double integer, 32 bits in length	✓	✓
DT	A specific date and time		✓
DWORD	A double word, 32 bits in length		✓
INT	An integer, 16 bits in length		✓
LREAL	A long real number, 64 bits in length		✓
REAL	A real number, 32 bits in length	✓	✓
STRING	A sequence of up to 132 alphanumeric characters delimited by single quotes		✓
TIME	A period of time (duration) expressed in days, hours, minutes, seconds, or milliseconds		✓
TOD	A specific time of day		✓

Only three data types can be declared as controller *points*: BOOL, DINT, and REAL. These variables point to hardware addresses in the controller and are accessible to all programs in a project.

BOOL Data Type

A BOOL data type is one bit in length and has two possible values: false (0) or true (1).

Attribute	Description
Keyword/type	BOOL
Description	Boolean
Size	1 bit
Default value	False (0)
Lower limit	False (0)
Upper limit	True (1)
Result if intermediate value is less than lower limit	N/A
Result if upper limit is less than intermediate value	Intermediate Value MOD 2

Application Notes

- Can be used in Safety or Control applications.
- Can be used in CEM Cause, Effect, and Intersection cells.

DATE Data Type

A DATE data type refers to a specific date expressed as the year, month, and day.

Attribute	Description
Keyword/type	DATE
Description	Date
Size	64 bits
Syntax	D#CCYY-MM-DD
Default value	D#1970-01-01
Lower limit	D#1970-01-01
Upper limit	D#2029-12-31
Result if intermediate value is less than lower limit	Invalid date
Result if upper limit is less than intermediate value	Invalid date

Application Notes

- Can be used in Safety or Control applications.
- Can be used in CEM Cause, Effect, and Intersection cells.

DINT Data Type

A DINT data type is a double integer, 32 bits in length.

Attribute	Description
Keyword/type	DINT
Description	Double integer
Size	32 bits
Default value	0
Lower limit	–2**31
Upper limit	2**31–1
Result if intermediate value[a] is less than lower limit	–2**31 or V modulo 2**32
Result if upper limit is less than intermediate value[a]	2**31–1 or V modulo 2**32

a. If the intermediate conversion value is out of range (for example, when converting LREAL to DINT), the return value is the smallest or greatest double integer.

Application Notes

- Can be used in Safety or Control applications.
- Can be used in CEM Cause, Effect, and Intersection cells.

DT Data Type

A DT data type represents a date and time of day. To specify the time of day, you can use fractions (FFF) of a second. Values are stored internally in microseconds and displayed in the TriStation 1131 Controller Panel in milliseconds.

A DT data type cannot be used as a program input or output.

Attribute	Description
Keyword/type	DT
Description	Date and time of day
Size	64 bits
Syntax	DT#CCYY-MM-DD-HH:MM:SS or DT#CCYY-MM-DD-HH:MM:SS.FFF or DATE_AND_TIME#CCYY-MM-DD-HH:MM:SS
Default value	DT#1970-01-01-00:00:00
Lower limit	DT#1970-01-01-00:00:00

Attribute	Description
Upper limit	DT#2029-12-31-23:59:59.999
Result if intermediate value is less than lower limit	Invalid date
Result if upper limit is less than intermediate value	Invalid date

Application Notes

- Can be used in Safety or Control applications.
- Can be used in CEM Cause, Effect, and Intersection cells.

DWORD Data Type

A DWORD data type is a double word, 32 bits in length. The result is always in the range from 0 to 16#FFFFFFFF. If the intermediate value is out of range, then the result is the least-significant 32 bits of the intermediate value. For example, if you shift 16#FFFFFFFF to the left once, the intermediate value is 16#1FFFFFFFE and the result is 16#FFFFFFFE.

A DWORD data type cannot be used as a program input or output.

Attribute	Description
Keyword/type	DWORD
Description	Double word
Size	32 bits
Default value	0
Lower limit	0
Upper limit	16#FFFFFFFF
Result if intermediate value is less than lower limit	N/A
Result if upper limit is less than intermediate value	V and 16#FFFFFFFF

Application Notes

- Can be used in Safety or Control applications.
- Can be used in CEM Cause, Effect, and Intersection cells.

INT Data Type

An INT data type is an integer, 16 bits in length. Arithmetic operators ADD, SUB, and MUL are implemented with 32-bit arithmetic and the container for INT is 32 bits. The ADD, SUB, and MUL operations do not check the range of results and can have resultant values out of the specified range (–32768 and +32767). For example, using the SUB function to subtract 1 from -32768 results in –32769 (clearly out of range) without clearing ENO or reporting a BADPARAM error. However, an out-of-range value does display "Inv INT" on the Controller Panel.

To verify that output values from these functions are within range, connect the output terminal to the INT_TO_DINT function, which converts the integer output to double integer and does a range check for the integer output.

An INT data type cannot be used as a program input or output.

Attribute	Description
Keyword/type	INT
Description	Integer
Size	32 bits
Default value	0
Lower limit	–2**15
Upper limit	2**15–1
Result if intermediate value is less than lower limit	InvINT
Result if upper limit is less than intermediate value	InvINT

Application Notes

- Can be used in Safety or Control applications.
- Can be used in CEM Cause, Effect, and Intersection cells.

LREAL Data Type

An LREAL data type is 64 bits in length and has 15 decimal digits of precision. In TriStation 1131, the LREAL data type follows the IEC-559 Standard floating-point format.

An LREAL data type cannot be used as a program input or output.

Attribute	Description
Keyword/type	LREAL
Description	Long-real number
Size	64 bits
Default value	0.0
Most positive number	1.7976931348623158 e +308

Attribute	Description
Least positive number	4.9406564584124654 e –324
Least negative number	– 4.9406564584124654 e –324
Most negative number	–1.7976931348623158 e +308
Result if intermediate value is less than lower limit	–Infinity or HUGE
Result if upper limit is less than intermediate value	+Infinity or HUGE

Gradual Underflow for LREAL Data Types

In PCs and controllers, the floating-point implementation includes a standard feature called *gradual underflow* that extends the range for an LREAL number and gradually changes the precision as values approach zero.

This table compares the values obtained when gradual underflow is not present, to the values obtained when it is present.

Without Gradual Underflow	With Gradual Underflow
The smallest positive number that can be stored in an LREAL variable is: 2^{-1022} = 2.2250738585072014E–308.	The smallest positive number that can be stored in an LREAL variable is: 2^{-1074} = 4.9406564584124654E–324.
The precision changes abruptly from 17 digits to 0 digits when the value changes from a number greater than 2^{-1023} to a number less than 2^{-1023}.	The precision changes gradually from 17 digits to 1 digit as the value changes from 2^{-1023} to 2^{-1074}.
The maximum relative error changes abruptly from 2^{-53} to 1 when the value changes from a number greater than 2^{-1023} to a number less than 2^{-1023}.	The maximum relative error changes gradually from 2^{-53} to 1 as the value changes from 2^{-1023} to 2^{-1074}.
For values from 2^{-1075} to 2^{-1022}, the maximum absolute error equals the value.	For values from 2^{-1075} to 2^{-1022}, the maximum absolute error is a constant 2^{-1075}.

This table shows how the precision changes as LREAL numbers approach zero.

If |x| Is Greater Than:	Then the Precision Is Greater Than:
5.0E–308	17 digits
5.0E–309	16 digits
5.0E–310	15 digits
.	.
.	.
.	.
5.0E–322	3 digits
5.0E–323	2 digits

If |x| Is Greater Than:	Then the Precision Is Greater Than:
5.0E–324	1 digits
0.0	0 digits

Absolute error is the absolute value of x – a, where *x* is the exact value and *a* is the actual value stored.

Relative error is the absolute value of (x – a)/x, where *x* is the exact value and *a* is the actual value stored.

This table shows how gradual underflow affects absolute error and relative error as LREAL numbers approach zero.

Range	Maximum Absolute Error	Maximum Relative Error
$0 < \|x\| \leq 2^{-1075}$	$\|x\|$	1
$2^{-1075} < \|x\| \leq 2^{-1022}$	2^{-1075}	$2^{-1075} / \|x\|$
$2^{-1022} \leq \|x\| < 2^{1024} - 2^{972}$	$2^{-53} * \|x\|$	2^{-53}

Application Notes

- Can be used in Safety or Control applications.
- Can be used in CEM Cause, Effect, and Intersection cells.

REAL Data Type

A REAL data type is 32 bits in length and has 6 decimal digits of precision. In TriStation 1131, the REAL data type follows the IEC-559 Standard Floating-Point format.

Attribute	Description
Keyword/type	REAL
Description	Real number
Size	32 bits
Default value	0.0
Most positive number	3.402823466 e +38
Least positive number	1.401298464 e –45
Least negative number	–1.401298464 e 45
Most negative number	–3.402823466 e +38
Result if intermediate value is less than lower limit	–Infinity or HUGE
Result if upper limit is less than intermediate value	+Infinity or HUGE

Gradual Underflow for REAL Data Types

In PCs and safety controllers, the floating-point implementation includes a standard feature called *gradual underflow*. This feature extends the range of a REAL number and gradually changes the precision as values approach zero.

This table compares the values obtained when gradual underflow is not present, to the values obtained when it is present.

Without Gradual Underflow	With Underflow
The smallest positive number that can be stored in a REAL variable is: 2^{-126} = 1.175494351E-38.	The smallest positive number that can be stored in a REAL variable is: 2^{-149} = 1.401298464E–45.
The precision changes abruptly from 7 digits to 0 digits when the value changes from a number greater than 2^{-127} to a number less than 2^{-127}.	The precision changes gradually from 7 digits to 1 digit as the value changes from 2^{-127} to 2^{-149}.
The maximum relative error changes abruptly from 2^{-24} to 1 when the value changes from a number greater than 2^{-127} to a number less than 2^{-127}.	The maximum relative error changes gradually from 2^{-24} to 1 as the value changes from 2^{-127} to 2^{-149}.
For values from 2^{-150} to 2^{-126}, the maximum absolute error equals the value.	For values from 2^{-150} to 2^{-126}, the maximum absolute error is a constant 2^{-150}.

This table shows how the precision changes as numbers approach zero.

If |x| Is Greater Than:	Then the Precision Is Greater Than:
1.5E–39	7 digits
1.5E–40	6 digits
1.5E–41	5 digits
1.5E–42	4 digits
1.5E–43	3 digits
1.5E–44	2 digits
1.5E–45	1 digits
0.0	0 digits

Absolute error is the absolute value of x – a, where *x* is the exact value and *a* is the actual value stored.

Relative error is the absolute value of (x – a)/x, where *x* is the exact value and *a* is the actual value stored.

This table shows how gradual underflow affects absolute error and relative error as REAL numbers approach zero.

Range	Maximum Absolute Error	Maximum Relative Error
$0 < \|x\| \leq 2^{-150}$	$\|x\|$	1
$2^{-150} < \|x\| \leq 2^{-126}$	2^{-150}	$2^{-150} / \|x\|$
$2^{-126} \leq \|x\| < 2^{128} - 2^{103}$	$2^{-24} * \|x\|$	2^{-24}

Application Notes

- Can be used in Safety or Control applications.
- Can be used in CEM Cause, Effect, and Intersection cells.

STRING Data Type

A STRING data type is an alphanumeric sequence, up to 132 characters in length, which is delimited by single quotation marks ('). The count of 132 characters does not include the null terminator or the single quotation mark.

A STRING data type cannot be used as a program input or output.

Attribute	Description
Keyword/type	STRING
Description	Character string
Size	136 bytes
Default Value	Empty string (two single quotation marks not separated by any characters)
Lower limit	0 characters
Upper limit	132 characters
Result if intermediate value is less than lower limit	Truncated string
Result if upper limit is less than intermediate value	N/A

Application Notes

- Can be used in Safety or Control applications.
- Can be used in CEM Cause, Effect, and Intersection cells.

TIME Data Type

A TIME data type refers to a period of time (duration) in days, hours, minutes, seconds, and milliseconds. The range is ± 9999 years and the precision is 0.1 milliseconds.

A TIME data type cannot be used as a program input or output.

Attribute	Description
Keyword/type	TIME
Description	Duration
Size	64 bits
Syntax	TIME#11d or TIME#22.2h or TIME#33.3m or TIME#44.4s or TIME#55.5ms or TIME#11d22h33m44s55.5ms or T#11d22h33m44s55.5ms or T#44.4s
Default value	TIME#0S
Lower limit	TIME#-3652134d
Upper limit	TIME#3652134d
Result if intermediate value is less than lower limit	Inv Time
Result if upper limit is less than intermediate value	Inv Time

Application Notes

- Can be used in Safety or Control applications.
- Can be used in CEM Cause, Effect, and Intersection cells.

TOD Data Type

A TOD data type refers to a specific time of day expressed in hours, minutes, seconds, and fractions (FFF) of a second. The precision is 0.001 seconds.

A TOD data type cannot be used as a program input or output.

Attribute	Description
Keyword/type	TOD
Description	Time of day
Size	64 bits
Syntax	TOD#HH:MM:SS or TOD#HH:MM:SS.FFF or TIME_OF_DAY#HH:MM:SS
Default value	TOD#00:00:00
Lower limit	TOD#00:00:00
Upper limit	TOD#23:59:59.999
Result if intermediate value is less than lower limit	V modulo 24 hours
Result if upper limit is less than intermediate value	V modulo 24 hours

Application Notes

- Can be used in Safety or Control applications.
- Can be used in CEM Cause, Effect, and Intersection cells.

Generic Data Types

Generic data types, identified by the prefix ANY, are used exclusively in the functions and function blocks that are available in the TriStation Standard Library.

If a function specifies a generic data type for an argument, then the argument type must be one of the data types represented by that generic data type. If a function specifies one generic data type for more than one argument, then all such arguments must have the same data type.

For example, the function ADD specifies type ANY_NUM for all arguments and the return value. You can add two double integers, or two integers, or two long real numbers, or two real numbers, but you cannot add a real number to a long real number.

The TriStation generic data types are based on the IEC 61131-3 standard. The hierarchy for them is shown in this figure.

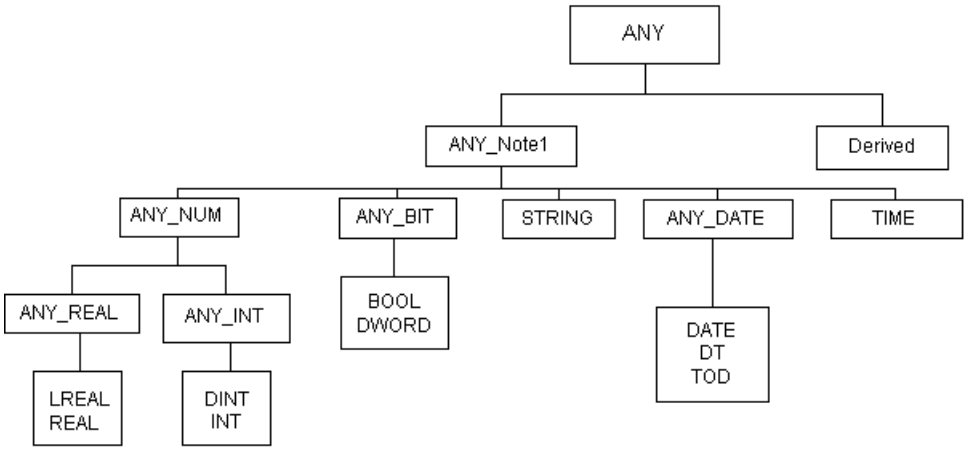


Figure 41 Generic Data Types Hierarchy

This table lists the meaning of each generic data type and the standard data types it represents.

Table 54 Generic Data Types

Data Type	Standard Data Type Represented
ANY	Any of the standard data types: BOOL, DATE, DINT, DT, DWORD, INT, LREAL, REAL, STRING, TIME, TOD, or Derived
ANY_NUM	Any number: DINT, INT, LREAL, or REAL
ANY_REAL	Any real number: LREAL or REAL
ANY_INT	Any integer: LREAL or REAL
ANY_BIT	Any bitwise data type: BOOL or DWORD
ANY_DATE	Any date or time of day or both: DATE, DT, or TOD
ANY_NOTE1	Any elementary data type: BOOL, DATE, DINT, DT, DWORD, INT, LREAL, REAL, STRING, TIME, or TOD. Note that each of these types is ordered so that values of the same type can be compared (see functions EQ, GE, GT, LE, LT, NE, MIN, and MAX).

C

TCM Model 4351/4352 Configuration

Overview

If you have an older model 4351 or 4352 TCM installed in your system, some of the configuration options are different than those for the model 4351A or 4352A TCM.

The procedures in this appendix apply specifically to configuring the ports on the model 4351 or 4352 TCM, and should be followed in place of the TCM configuration procedures provided in Chapters 3 and 4 of this guide.

Note If you have a newer model **4351A** or **4352A** TCM, *do not* use the procedures in this appendix. You should instead use the information found in the following sections:

- Configuring TCM Ports on page 205
- Using a Tricon TCM to Synchronize Time on page 229
- Configuring a Tricon TCM Port for Printing on page 278

Configuring TCM Ports

A single Tricon system supports a maximum of four TCMs, which must reside in two logical slots. You cannot mix model 4351A/4352A TCMs and 4351/4352 TCMs in the same system, even if they are installed in different chassis. See the *Planning and Installation Guide for Tricon v9-v10 Systems* for detailed TCM installation guidelines.

TCM models 4351 (Copper)/4352 (Fiber) support the following protocols on network and serial ports.

Protocol	Network Ports	Serial Ports
TriStation	NET 2	Port 4
TSAA (UDP/IP)	NET 2	—[a]
Peer-to-Peer (UDP/IP)	NET 1	—
Peer-to-Peer (DLC)	NET 1	—
Modbus Slave (ASCII or RTU)	—	Any port
Modbus Master (RTU)	—	Any port
Modbus Master or Slave (TCP)	NET 2	—
GPS Time Synchronization	—	Port 1
Triconex Time Synchronization via DLC or UDP/IP	NET 1	
SNTP Triconex Time Synchronization	NET 2	—
Network Printing using Jet Direct	NET 2	—

a. — means the protocol is not available on this port.

To configure specific types of ports, see these topics:

- Configuring TCM Network Ports on page 466
- Configuring TCM Serial Ports on page 468
- Configuring TCM Peer-To-Peer Ports on page 470
- Configuring TCM Modbus TCP Ports on page 472
- Configuring TCM Routing on page 473

For additional information on configuring the TCM, see these topics:

- Using a Tricon TCM to Synchronize Time on page 475 for instructions on configuring the TCM to synchronize time.
- Configuring a Tricon TCM Printer Port for Printing on page 481 for instructions on configuring the TCM for use with a printer.

Note Once TCM ports have been configured, *but prior to downloading the configuration to the controller*, you can change the existing TCM model to a different model TCM without losing your port settings (see Inserting and Removing Tricon Modules on page 186). Note that you can switch only from a 4351 to a 4352, or vice-versa; you cannot switch from a 4351 or 4352 to a 4351A or 4352A.

However, once the configuration has been downloaded to the controller, you cannot change the TCM model installed in the Tricon without downloading a new configuration.

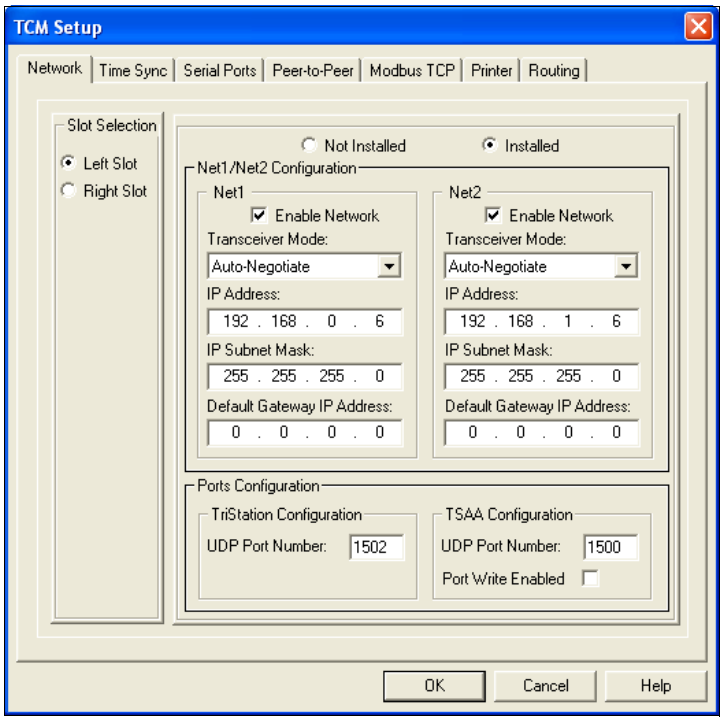
Configuring TCM Network Ports

This procedure explains how to configure network ports on a Tricon TCM.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The TCM Setup dialog box appears.



3 Specify these properties on the Network tab.

Property	Action
Slot Selection	Select the slot where the TCM module you want to configure is installed.
Not Installed, Installed	Click Installed to enable configuration of the module. Clicking Not Installed resets all options to their default state and makes them unavailable for configuration. The default is Not Installed.
Enable Network	Select the check box to enable the network port to be configured.
Transceiver Mode	Select the communication mode. The default is Auto-Negotiate. If you have a model 4352 TCM with fiber connectors, you **must** select 100 Mbps as the communication mode. The 4352 module cannot connect at 10 Mbps.
IP Address	Enter the IP Address for the port. NET 1 and NET 2 cannot use the same IP address. The default for NET 1 is 192.168.1.0; for NET 2 is 192.168.1.1.
IP Subnet Mask	If needed, enter the IP address for the subnet. The default is 255.255.255.0.
Default Gateway IP Address	If needed, enter the IP address for the default gateway. The default is 0.0.0.0.
TriStation Configuration: UDP Port Number	The UDP port to use for the TriStation connection. The default is 1502. See UDP Base Port Number on page 438 for additional information.
TSAA Configuration: UDP Port Number	The UDP port to use for TSAA connections, including DDE Server, SOE Recorder, and OPC Server. The default is 1500. See UDP Base Port Number on page 438 for additional information.
Port Write Enabled	Select this check box if you want to allow TSAA writes to the network ports. Applies to all TSAA connections on these ports. The default is cleared (the ports are read-only).

4 Click OK to save your changes.

Note Changes to TCM IP addresses are not effective until the existing connection is closed and a new connection is opened. Once a connection is opened, it remains open until you close it, even if the IP address is changed via a Download Changes operation.

Configuring TCM Serial Ports

This procedure explains how to configure serial ports on a Tricon TCM.

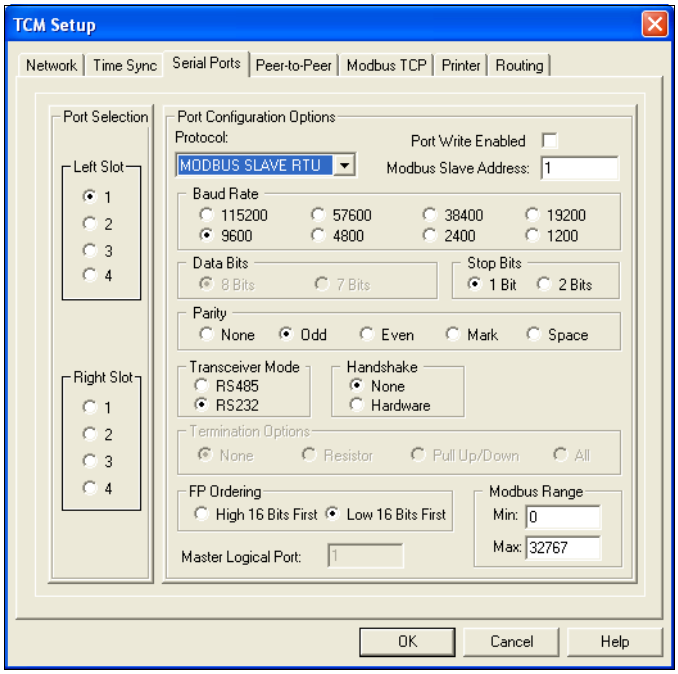
Procedure

1 Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.

2 Double-click the slot where the TCM module is installed and then click Setup.

The TCM Setup dialog box appears.

3 Click the Serial tab.



4 Specify these properties.

Property	Action
Port Selection	Click the port to be configured. Ports can be configured only for a slot with an installed module.
Protocol	Select the communication protocol for the port: • All ports can use Modbus Master, Modbus Slave ASCII, Modbus Slave RTU. • Only port 1 can use GPS. This port is automatically configured for GPS when you enable time synchronization. See Using a Tricon TCM to Synchronize Time on page 475. • Only port 4 can use TriStation.

Property	Action
Port Write Enabled	Available only if Modbus Slave (ASCII or RTU) is selected as the communication protocol. Select this check box if you want to allow Modbus writes to this slave port. The default is cleared (the port is read-only).
Modbus Slave Address	If you selected Modbus Slave RTU or ASCII, enter the number of the Modbus slave device. The default is 1.
Baud Rate	Enter the communication rate for the port. The default is 9600.
Data Bits	Select 8 or 7 bits. The default is 8. Available only with Modbus Slave ASCII.
Stop Bits	Select 1 or 2 bits. The default is 1 bit.
Parity	Select the type of parity for the port. The default is Odd.
Transceiver Mode	Select RS-485 or RS-232. The default is RS232. On port 4 when TriStation is selected as the protocol, RS-485 is not available.
Handshake	Select None or Hardware; the default is None.
Termination Options	Select the type of termination used with cables. Only available with RS-485 Transceiver Mode. The default is None.
FP Ordering	Select the order to be used with floating point numbers. The default is Low 16 Bits First.
Modbus (Minimum and Maximum) Range	Enter the minimum and maximum values to be used for the Modbus data range. The default minimum is 0. The default maximum is 32,767.
Master Logical Port	Enter the port number that the TCM will use in the Modbus Master functions to access the port. Only available for Modbus Master.

5 Click OK to save your changes.

Note Even if port 4 is set to Not Configured (the default value), it can still be used to connect to the Tricon via TriStation. This is useful when you are unable to connect via a network connection.

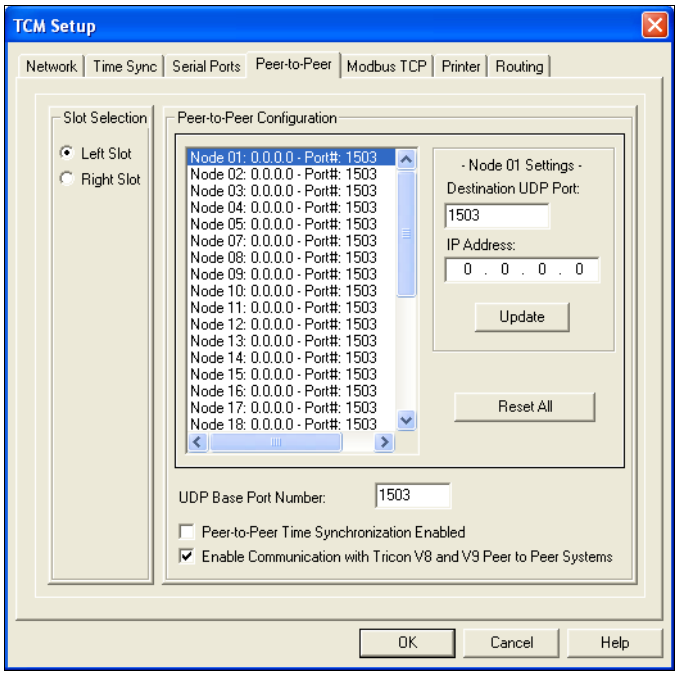
Configuring TCM Peer-To-Peer Ports

This procedure explains how to configure the IP address for controllers communicating on a Peer-to-Peer network through a Tricon TCM.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The TCM Setup dialog box appears.
3. Click the Peer-to-Peer tab.



4. Under Slot Selection, select the module (slot) you want to configure Peer-to-Peer ports for.
5. Select a node (controller), and specify these properties.

Property	Action
Destination UDP Port	Enter the UDP port number for each controller to be communicated with on the Peer-to-Peer network. This must be the same number that the controller uses as its UDP Base Port Number.
IP Address	Enter the IP address for the controller.

6. Click Update to apply the new settings for the selected node.
7. Repeat steps 4 through 6 for each node to be included in the network.

Note If necessary, click Reset All to reset *all* node settings for the selected slot to their default, unconfigured state.

8 Once all nodes have been configured, specify these properties (applicable to all nodes on the Peer-to-Peer network).

Property	Action
UDP Base Port Number	Enter the UDP base port number for the controller. Enter 0 to disable Peer-to-Peer over UDP/IP on the network. The default is 1503. UDP port numbers must be unique. See page 438 for reserved values.
Peer-to-Peer Time Synchronization Enabled	Select the check box to enable Triconex Time Synchronization across the Peer-to-Peer network. See Using a Tricon TCM to Synchronize Time on page 475 for more information.
Enable Communication with Tricon V8 and V9 Peer-to-Peer Systems	Select the check box to enable communication with Tricon version 8 and 9 systems. The default is cleared. Available only for a module installed in the left slot.

9 Click OK to save your changes.

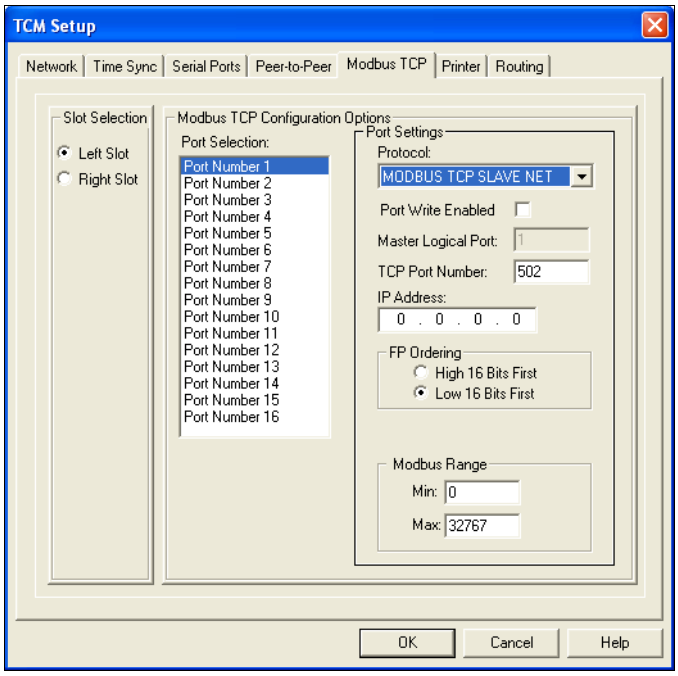
Configuring TCM Modbus TCP Ports

This procedure explains how to configure Modbus TCP ports on a Tricon TCM, which enables Modbus communication through network ports.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The TCM Setup dialog box appears.
3. Click the Modbus TCP tab.



4. Under Slot Selection, select the module (slot) you want to configure Modbus TCP ports for.
5. Select a port and specify these properties.

Property	Action
Protocol	Select the communication protocol for the port. Options include Modbus TCP Master and Modbus TCP Slave Net.
Port Write Enabled	Available only if Modbus TCP Slave is selected as the communication protocol. Select this check box if you want to allow Modbus writes to this slave port. The default is cleared (the port is read-only).
Master Logical Port	Enter the number of the Modbus Master node. Available only with Modbus TCP Master protocol.
TCP Port Number	Enter the number for the TCP port. The default is 502.

Property	Action
IP Address	If the port uses Modbus Master protocol, enter the IP address of the slave node. If the port uses Modbus Slave protocol, enter either of these: • To accept communication from any Modbus Master, leave the IP address as 0.0.0.0. • To accept communication only from a defined Modbus Master, enter the specific master IP address.
FP Ordering	Select the ordering to use for floating point numbers.
Modbus (Minimum and Maximum) Range	Enter the minimum and maximum for the modbus data range. Available only with Modbus TCP Slave Net.

6 Click OK to save your changes.

Configuring TCM Routing

This procedure explains how to configure routing on a Tricon TCM. Up to 10 different routes can be configured for each module.

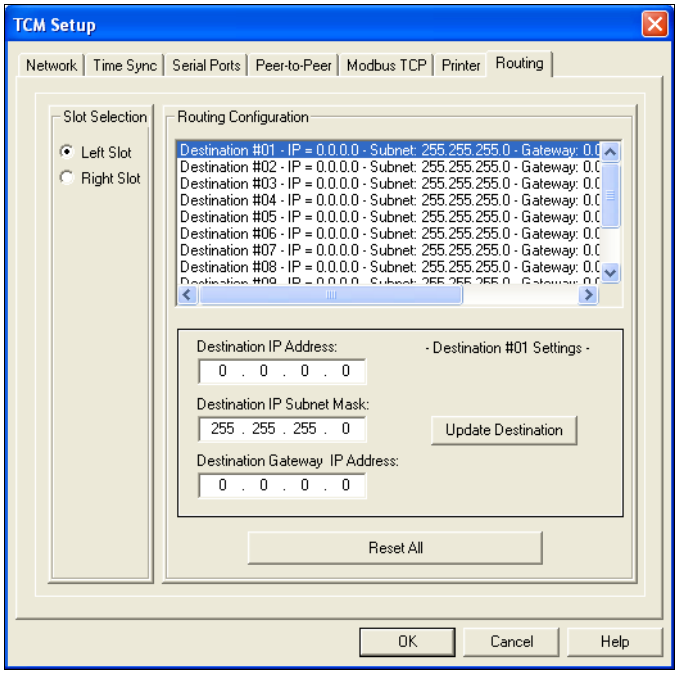
Procedure

1 Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.

2 Double-click the slot where the TCM module is installed and then click Setup.

The TCM Setup dialog box appears.

3 Click the Routing tab.



4 Select the module (slot) you want to configure routing for.

5 Select a destination route and then specify these properties.

Property	Action
Destination IP Address	Enter the IP address which is used if the controller is not on the same subnet as other devices.
Destination IP Subnet Mask	Enter the IP address of the subnet mask. If the gateway address is on NET 2, then the subnet mask must be the same as the NET 2 subnet mask defined on the Network tab. If the gateway address is on NET 1, then the subnet mask must be the same as the NET 1 subnet mask defined on the Network tab. See Configuring TCM Network Ports on page 466.
Destination Gateway IP Address	Enter the IP address of the gateway to which the controller is connected. The gateway address must always be on NET 1 or NET 2.

6 Click Update Destination to apply the settings. If necessary, click Reset All to reset all destination settings for the selected slot to their default, unconfigured state.

7 Click OK to save your changes.

Using a Tricon TCM to Synchronize Time

This procedure explains how to enable time synchronization on a TCM. Time synchronization can be enabled using the following protocols:

- GPS
- SNTP
- Triconex Time Synchronization via DLC or UDP/IP on a Peer-to-Peer network

In a redundant network of Triconex controllers that each have two TCMs installed, you can implement redundant time synchronization by configuring time synchronization for both TCM modules (both left and right slots). Time synchronization can be enabled only for a single logical slot.

If the TCM is installed in the COM slot, you configure time synchronization only for the left slot (there is no redundancy when installed in the COM slot).

Topics include:

Configuring GPS Time Synchronization on the TCM

This procedure explains how to configure a TCM to enable time synchronization through the Global Positioning System (GPS) by using the Trimble Acutime 2000 Synchronization Kit. For information on installing the kit, see the *Tricon Communication Guide for v9-v10 Systems*.

CAUTION To ensure the accuracy of GPS time adjustments, the Tricon clock must be set to within 10 minutes of the correct local time.

If the TCM is in a Peer-to-Peer network, it can also be used as the master node for time synchronization of other controllers on the network. In this configuration, the master node TCM synchronizes time with the GPS, and any slave nodes on the Peer-to-Peer network synchronize their time with the master TCM. In this way, all nodes on the Peer-to-Peer network are synchronized with GPS time.

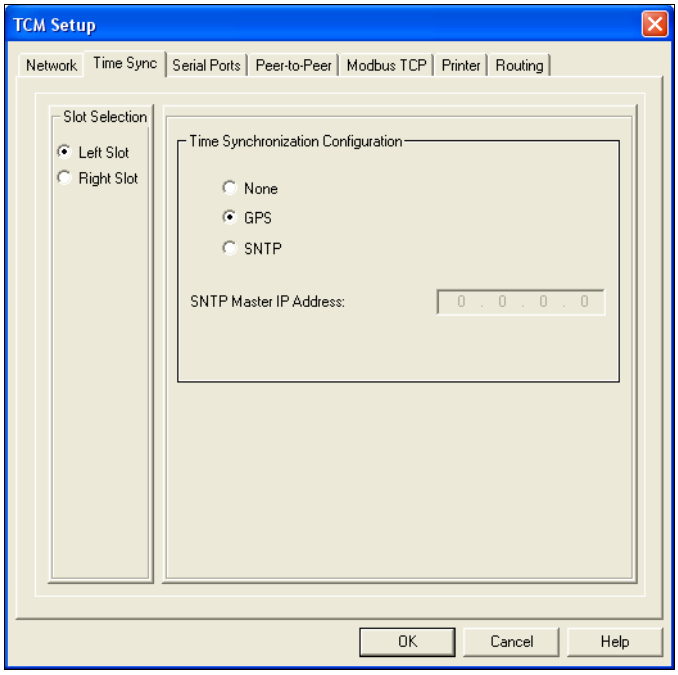
If the TCM is acting as a slave node on a Peer-to-Peer network, it *cannot* be configured for GPS time synchronization. Slave nodes synchronize their time *only* to the master node on the Peer-to-Peer network, and reject all other time change requests.

GPS time synchronization uses Serial Port 1 on the TCM.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup. The TCM Setup dialog box appears.

3 Click the Time Sync tab.



4 Under Slot Selection, click Left Slot. You must configure the module in the left slot first.

5 Under Time Synchronization Configuration, select GPS.

If you previously configured Port 1 to use a Modbus protocol, selecting GPS will reset Port 1 to use the GPS protocol. See Configuring TCM Serial Ports on page 468 for more information.

6 (Optional) If you have a redundant TCM installed in the right slot, under Slot Selection, click Right Slot, and then select GPS Redundant.

Note The module in the right slot can be configured only if it has been installed (see Configuring TCM Network Ports on page 466) and if the module in the left slot has already been configured for GPS time synchronization.

7 Click OK to save your changes.

Enabling the TCM as a Master Node for Triconex Time Synchronization (Optional)

If you also want the TCM to be able to act as a master node for time synchronization of other controllers on a Peer-to-Peer network (using Triconex Time Synchronization) do the following:

1 In the Configuration tree, click Operating Parameters (see Operating Parameters on page 180).

2 Select the Enable Tricon Node Time Synchronization check box.

Configuring SNTP Time Synchronization on the TCM

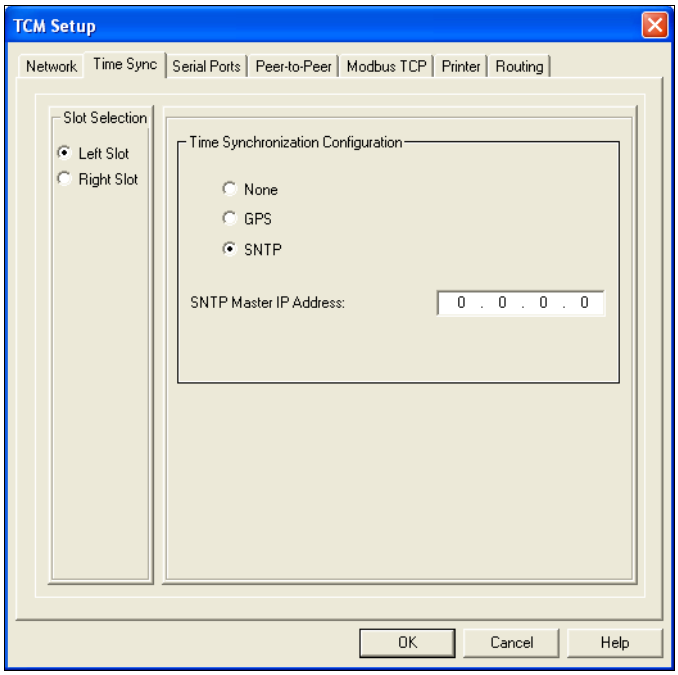
This procedure explains how to configure TCM time synchronization to an SNTP server.

If the TCM is in a Peer-to-Peer network, it can also be used as the master node for time synchronization of other controllers on the network. In this configuration, the master node TCM synchronizes time with the SNTP server, and any slave nodes on the Peer-to-Peer network synchronize their time with the master TCM. In this way, all nodes on the Peer-to-Peer network are synchronized with SNTP time.

If the TCM is acting as a slave node on a Peer-to-Peer network, it *cannot* be configured for SNTP time synchronization. Slave nodes synchronize their time *only* to the master node on the Peer-to-Peer network, and reject all other time change requests.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup. The TCM Setup dialog box appears.
3. Click the Time Sync tab.



4. Under Slot Selection, click Left Slot. You must configure the module in the left slot first.
5. Select these properties.

Property	Action
Time Synchronization Configuration	Select SNTP. The default is None.

Property	Action
SNTP Master IP Address	Enter the IP address of the SNTP server to synchronize time with.

6 (Optional) If you have a redundant TCM installed in the right slot, under Slot Selection, click Right Slot, and then select these properties.

Property	Action
Time Synchronization Configuration	Select SNTP Redundant.
SNTP Master IP Address	Enter the IP address of the SNTP server to synchronize time with.

Note The module in the right slot can be configured only if it has been installed (see Configuring TCM Network Ports on page 466) and if the module in the left slot has already been configured for SNTP time synchronization.

7 Click OK to save your changes.

Enabling the TCM as a Master Node for Triconex Time Synchronization (Optional)

If you also want the TCM to be able to act as a master node for time synchronization of other controllers on a Peer-to-Peer network (using Triconex Time Synchronization) do the following:

1 In the Configuration tree, click Operating Parameters (see Operating Parameters on page 180).

2 Select the Enable Tricon Node Time Synchronization check box.

Configuring Triconex Time Synchronization on the TCM

In a Peer-to-Peer network, Triconex Time Synchronization can be used to synchronize time across controllers on a network. The controller with the lowest node number serves as the master node.

The master node can also synchronize its time with a GPS or an SNTP server. In this configuration, the master node synchronizes time with the GPS or SNTP server, and any slave nodes on the Peer-to-Peer network synchronize their time with the master node. In this way, all nodes on the Peer-to-Peer network are synchronized with GPS or SNTP time.

Note Currently, when a Trident controller is on a Peer-to-Peer network using Triconex Time Synchronization, with a Tricon TCM acting as a master node, the Trident will not correctly synchronize its time to the master node.

Configuring a Master Node

This procedure describes how to configure the TCM as a master node on the Peer-to-Peer network when GPS or SNTP time synchronization is **not** being used.

If you want the master node to synchronize to a GPS or SNTP server, use the procedures in the these sections:

- Configuring GPS Time Synchronization on the TCM on page 475
- Configuring SNTP Time Synchronization on the TCM on page 477

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup. The TCM Setup dialog box appears.
3. Click the Time Sync tab.
4. Under Time Synchronization Configuration, select None.
5. Click OK to save your changes.
6. In the Configuration tree, click Operating Parameters (see Operating Parameters on page 180).
7. Select the Enable Tricon Node Time Synchronization check box.

   This allows the controller to participate as a master node in time synchronization across the Peer-to-Peer network.

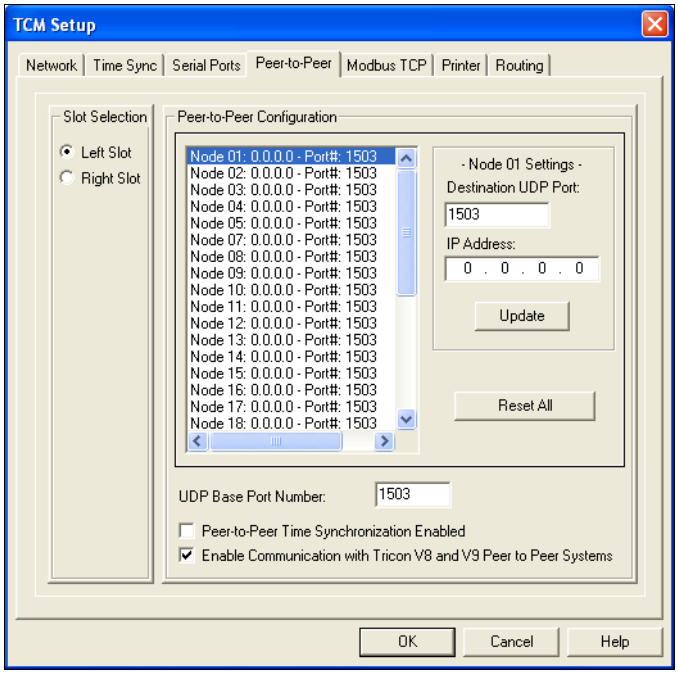
Configuring a Slave Node

This procedure describes how to configure the TCM as a slave node on the Peer-to-Peer network.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The TCM Setup dialog box appears.
3. Click the Peer-to-Peer tab.



4. Under Slot Selection, click Left Slot.
5. Select the Peer-to-Peer Time Synchronization Enabled check box.
6. Click OK to save your changes.
7. In the Configuration tree, click Operating Parameters (see Operating Parameters on page 180).
8. Select the Enable Tricon Node Time Synchronization check box.

   This allows the controller to participate as a slave node in time synchronization across the Peer-to-Peer network.

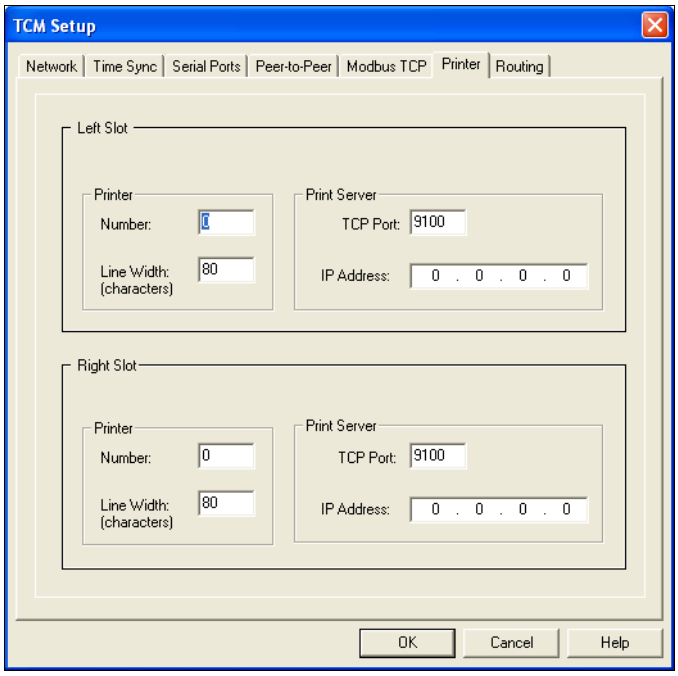
Configuring a Tricon TCM Printer Port for Printing

This procedure explains how to configure a Tricon TCM port that is connected to a Centronics-compatible printer. You do not need the printer driver that may have come with the printer package. See Tricon Printing on page 273 for more information about printing from the Tricon.

Procedure

1. Expand the Controller tree, double-click Configuration, and expand Hardware Allocation.
2. Double-click the slot where the TCM module is installed and then click Setup.

   The TCM Setup dialog box appears.
3. Click the Printer tab.



4. Specify these properties for the module installed in the Left Slot.

Property	Action
Printer Number	Enter the number for the printer; can only be 5 or 10. The default is 0, meaning a printer is not configured.
Line Width	Enter the number of characters to be printed on a line. The default is 80 characters.
TCP Port Number	Enter the number of the TCP port for the print server. The default is 9100 for an HP printer.
IP Address	Enter the IP address of the printer server.

5. If a module is also installed in the Right Slot, repeat step 4 for that module.
6. Click OK to save your changes.

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