

**QTS-CLX-PVX
PROVOX®
Module**

User Manual



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Throughout this manual we use notes to make you aware of safety considerations.

Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

These warnings help to:

WARNING!

- identify a hazard
- avoid the hazard
- recognize the consequences

IMPORTANT!

Identifies information that is especially important for successful application and understanding of the product.

TIP

Identifies information that explains the best way to use the QTS-CLX-PVX

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QTS-CLX-PVX Module Overview



The QTS-CLX-PVX connects a ControlLogix controller to a PROVOX[®] Control I/O bus.

The QTS-CLX-PVX is intended to be used to migrate PROVOX systems to ControlLogix controllers. You can retain the PROVOX I/O as the first step in the migration.

The module can act as a monitor or as a master on the Control I/O bus. You select the mode by downloading different firmware to the module.

In monitor mode, the QTS-CLX-PVX sends PROVOX I/O input and output data to input and status input data in the ControlLogix. It cannot transmit on the bus.

In master mode, the ControlLogix sends output data to the QTS-CLX-PVX, which then transmits it as output data on the PROVOX Control I/O bus. The QTS-CLX-PVX sends PROVOX input data to input data in the ControlLogix.

The QTS-CLX-PVX:

- supports I/O bus redundancy
- supports 20-series Control I/O files 1-16
- supports up to 64 I/O cards. For larger systems, split the bus and use two QTS-CLX-PVX modules.
- supports 10 series I/O with serial buffer card
- does not support EIC or IDI

- does not support Control I/O card redundancy

The QTS-CLX-PVX communicates with the ControlLogix processor using scheduled connections. You configure the module as a Generic Module in RSLogix 5000 with:

- 250 16-bit words of scheduled input data
- 248 16-bit words of scheduled output data
- 250 16-bit words of status input data

The Windows configuration program supplied with the module maps Control I/O bus data to the scheduled data. It also:

- uploads and downloads configuration data
- downloads firmware to the module
- saves and opens configuration files
- exports aliases for use in your RSLogix 5000 application

Firmware Update

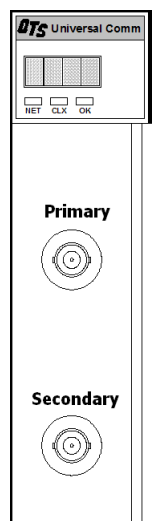
The module firmware can be updated using the Windows utility supplied (see page 32).

Part Number

The part number of the module is QTS-CLX-PVX

Module Features

The following figure shows the features of the module.



The module has:

- A label that identifies the module, text QTS Universal Comm
- A 4-character scrolling display
- 3 LEDs, labelled NET, CLX, and OK, to indicate the status of the I/O bus, the state of the connection to the ControlLogix processor, and the internal state of the module
- 2 BNC connectors to connect to the primary and secondary I/O bus cables

The module supports insertion and removal under power.



The module is shipped in monitor mode, with a blank configuration.

Watchdog and Jabber Inhibit

A watchdog timer is implemented in the module's hardware. If the firmware does not kick the watchdog within the timeout period the watchdog times out and generates a fatal error (see page 31) with error code D1. In master mode, the module stops scanning and stops communicating with the ControlLogix.

A jabber inhibit timer is implemented in the module's hardware. If the bus transmitter is on longer than 150% of the longest frame time, the jabber inhibit forces the transmitter off and generates a fatal error (see page 31) with error code D0. In master mode, the module stops scanning and stops communicating with the ControlLogix.

Power Requirements

The QTS-CLX-PVX module requires 675 mA @ 24VDC and 5 mA @ 5.1VDC from I/O chassis backplane.

Other Requirements

To use the Windows utility programs, you must have RSLinx software, version 2.54 or later, with an activation. Use RSLinx Gateway or RSLinx Professional software. Do not use RSLinx Lite.

Package Contents

- QTS-CLX-PVX module
- CD containing software and documentation



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Installation

Prevent Electrostatic Discharge

The module is sensitive to electrostatic discharge.

ATTENTION: Electrostatic discharge can damage integrated circuits or semiconductors if you touch backplane connector pins. Follow these guidelines when you handle the module:

WARNING!

- Touch a grounded object to discharge static potential
- Wear an approved wrist-strap grounding device
- Do not touch the backplane connector or connector pins
- Do not touch circuit components inside the module
- If available, use a static-safe work station
- When the module is not in use, keep it in its static-shield packaging

Prepare the Chassis for Module Installation

Before you install the ControlLogix module, you must install and connect a ControlLogix chassis and power supply. To install these products, refer to the installation instructions you received with them.

Determine Module Slot Location

This example shows chassis slot numbering in a 4-slot chassis. Slot 0 is the first slot and is always located to the right of the power supply. You can use any size ControlLogix chassis and install the module in any slot.

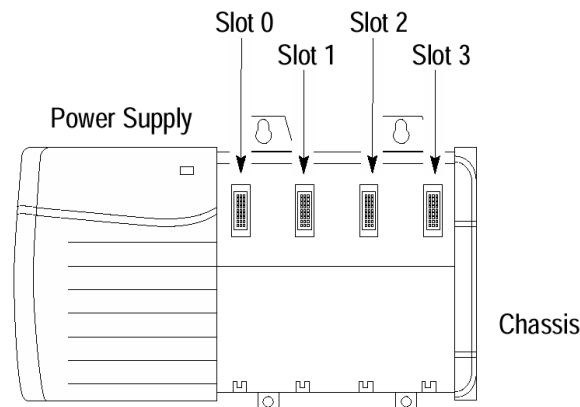


Figure 1 Chassis Slots

You can use multiple modules in the same chassis.

Insert the Module in the Chassis

The ControlLogix module is designed to be installed or removed while chassis power is applied.

WARNING!

ATTENTION: When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.



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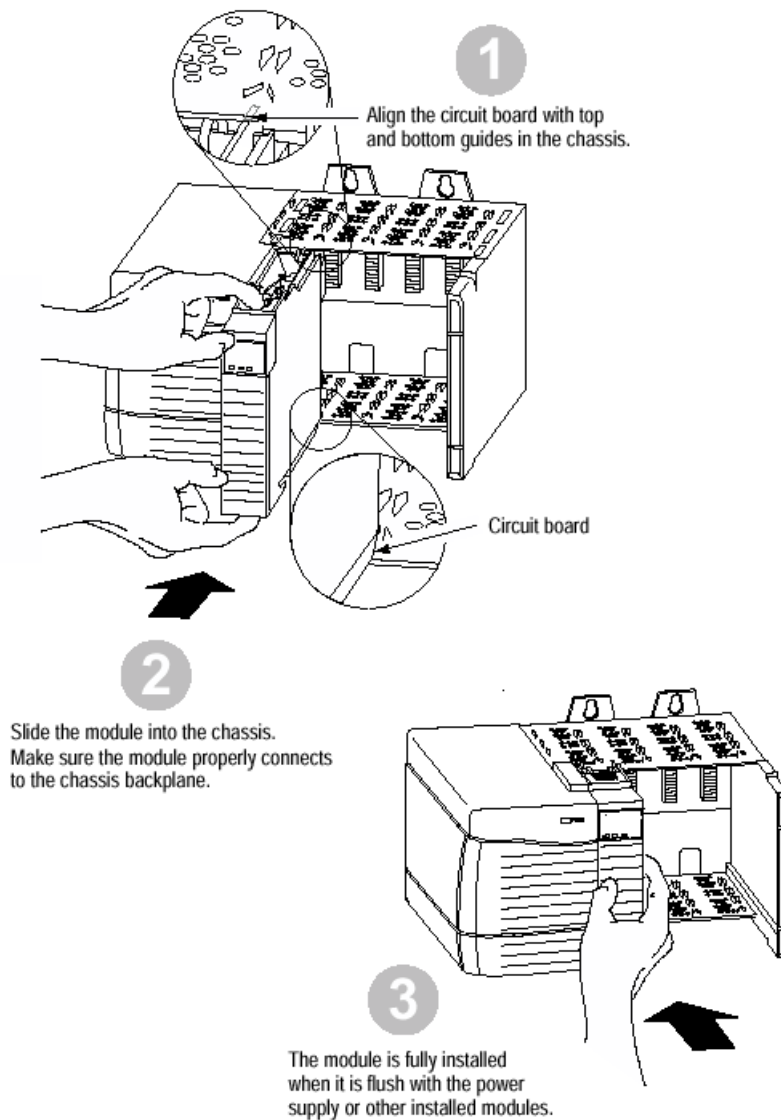


Figure 2 Inserting the Module

Replacing a Module

If you are replacing an existing module with an identical one, and you want to resume identical system operation, you must:

- install the new module in the same slot.
- run the configuration program and download the appropriate configuration to the module.
- check that it has the correct firmware, scanner or monitor version.
- ensure that the data has been synchronized

Cabling and Termination

WARNING!

Connecting the module disrupts bus traffic!

Connect the module at a time when it is safe to do so.

Connect the QTS-CLX-PVX like any other device on the Control I/O bus.

The bus cable is 75-ohm RG-6, for example Belden 9290

Terminate both ends of the primary and secondary I/O bus using 75 ohm resistors attached to the physical ends of the bus. There should be two and only two terminators on each bus.

Refer to the following Emerson documents for details on cabling:

- section 3.8 of "Installing and Maintaining the SRx Controller Family", PN8.0:CL6640
- *Installing Control I/O Subsystem* (PN2.1:CP6701)
- Signal Wiring and Highway System Guidelines PN1:004

Software Installation

You must uninstall any previous version of the software before you can install a new version. Use the Windows Control Panel Add and Remove Programs to remove the old version.

Insert the CD supplied and run the program QtsPvx.msi on the CD to install the Windows software.



Summary of Operations

The following is a short summary of the steps typically followed. Refer to the appropriate manual section for details.

Step	Operation	See page
1	Install the QTS-CLX-PVX module in the ControlLogix chassis	4
2	Set the module mode to monitor (the default)	15
3	Connect the module to the Control I/O bus	7
4	Autoconfigure the module from the PROVOX Control I/O bus	16
5	Configure the module in RSLogix 5000	10
6	Decide if you are going to use monitor mode to develop and test your application	28
7	Disconnect the PROVOX master	
8	Change the module mode to master	15
9	Save the configuration and download it to the module	19
10	Create aliases for RSLogix 5000	21
11	Import the aliases into RSLogix 5000	21
12	Use the aliases to access data	



Important Considerations

The operation of the QTS-CLX-PVX is different in several important ways from that of a standard ControlLogix module and in some ways from a PROVOX controller.

It is essential that you be aware of the following:

- the QTS-CLX-PVX in master mode write changes in the ControlLogix output data table to PROVOX outputs even in program mode. If you make a change in the output table, it will appear on the bus
- in master mode, if the I/O configuration in the QTS-CLX-PVX changes, it is essential that you clear the ControlLogix output table for the module before you connect it to the Control I/O bus
- the QTS-CLX-PVX continues to scan the Control I/O bus even if the the connection to the ControlLogix processor is lost. This is so that I/O on the bus does not time out.
- on the Control I/O bus, data is passed only when it changes. In monitor mode, the QTS-CLX-PVX sees only data that changes while it is connected to the bus. In master mode, the QTS-CLX-PVX writes outputs only when they change and receives inputs only when they change.
- configuring the QTS-CLX-PVX module requires that you reset the PROVOX controller. This can cause major disruptions to the running system. Reset the controller only when you know it is safe to do so. A reset can last up to 3 minutes.
- if you switch from a real PROVOX scanner to a QTS-CLX-PVX scanner, you should download the configuration to the QTS-CLX-PVX. This forces a reset on the Control I/O bus. A reset is necessary because the two scanners implement the bus token passing slightly differently. A reset ensures that all files and cards update.



Configuring the Module in RSLogix 5000

You configure the module in RSLogix 5000 to set how much scheduled data to transfer and how often to transfer it.

The terms input and output are relative to the ControlLogix.

In master mode, the ControlLogix sends output data to the QTS-CLX-PVX, which then transmits it as output data on the PROVOX Control I/O bus. The QTS-CLX-PVX sends PROVOX input data to input data in the ControlLogix.

In monitor mode, the QTS-CLX-PVX sends PROVOX I/O input and output data to input and status input data in the ControlLogix. It cannot transmit on the bus.

You should always access data using the aliases generated by the configuration program.

Module Configuration

Configure the module as a Generic module in RSLogix 5000.

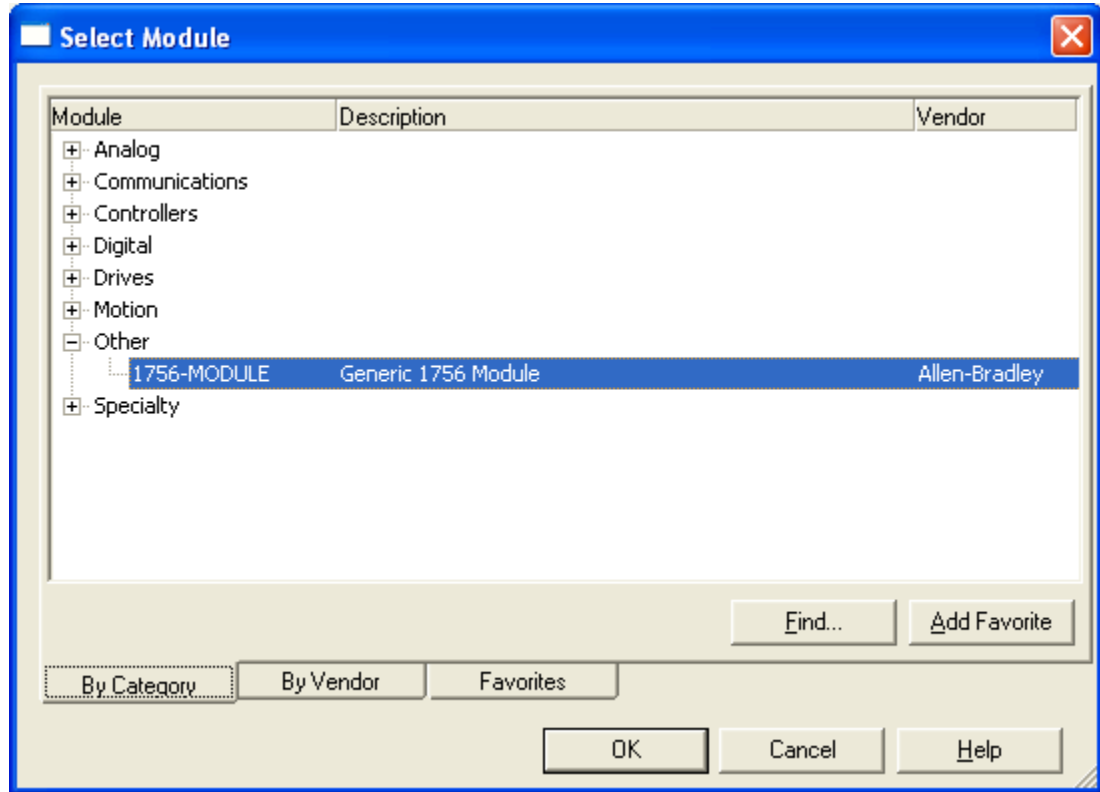
The same ControlLogix configuration is used for master and monitor modes of the QTS-CLX-PVX.

Adding the Module

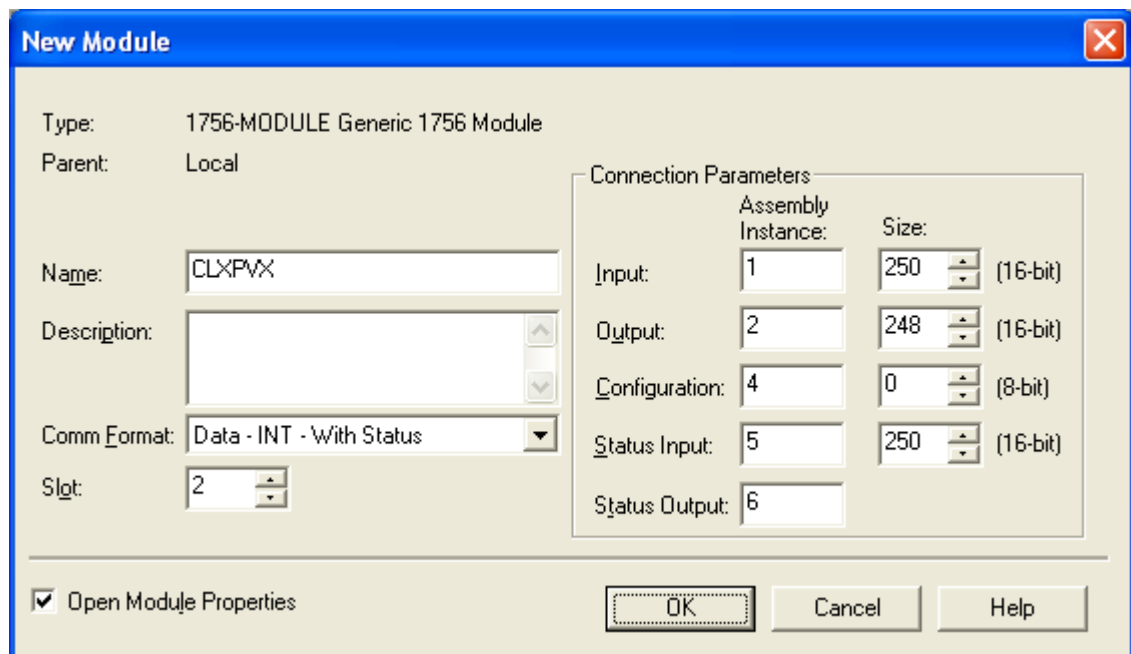
To add the module to the I/O configuration in RSLogix 5000, you must be offline.

1. If you are creating a new project, select *File/New* to create a new project, give the processor a name, and enter the slot it occupies in the ControlLogix rack.
2. Right click on the I/O configuration Folder, or on the bridge module in the desired remote chassis in the I/O Configuration Folder, and select *New Module...*
3. Expand the *Other* tab, select a module of Type *1756-MODULE Generic 1756 Module* and click OK.



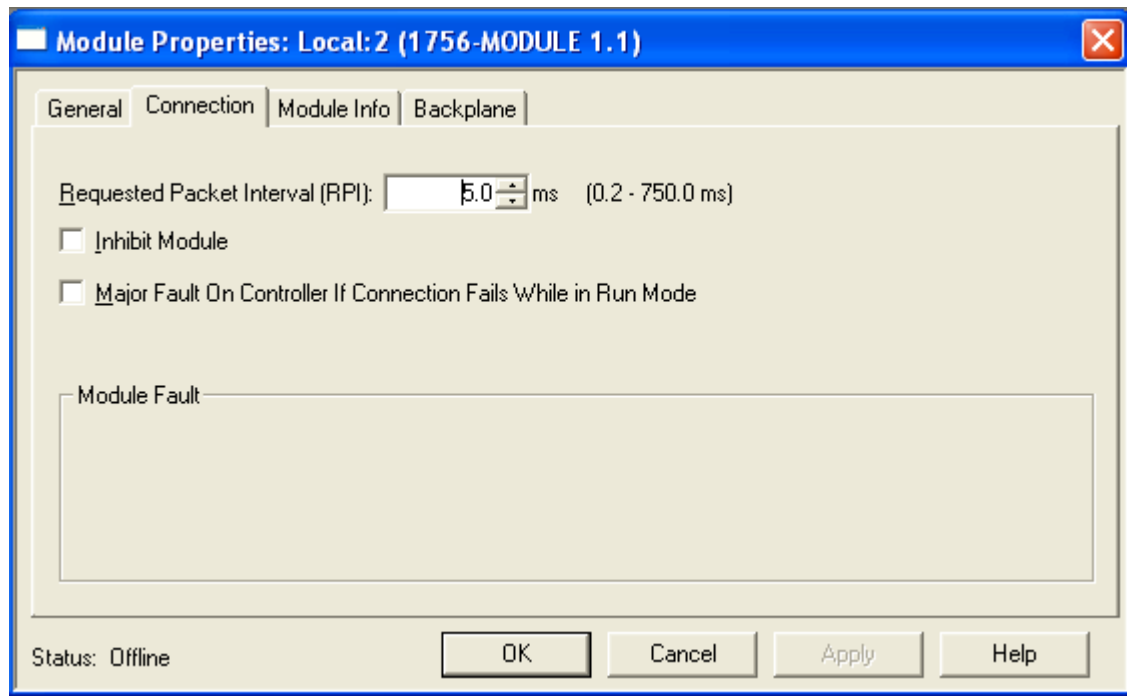


4. RSLogix 5000 displays the *New Module* dialog box.



5. Assign the module a *Name* and optionally a *Description*.
6. Set the Comm Format to Data – INT – With Status.
7. Set the *Slot* to match the slot number of the QTS-CLX-PVX module in the chassis.

8. Set the Connection Parameters as shown above. Click OK.
9. Next set the RPI.



10. Click OK to accept the module

Selecting an RPI.

The module supports RPIs from 0.2 to 750.0 ms. The default RPI is 5 ms.

Select an RPI appropriate to the I/O bus scan time and to your process. It makes no sense to use an RPI that is much faster than the bus or process update time. Typical RPIs are from 100 to 150 ms.

Remote Connections

If you are using the QTS-CLX-PVX in a remote chassis, for example a chassis connected to the controlling ControlLogix processor over Ethernet or ControlNet, it may be necessary to increase the RPI, as the intermediate network may not have sufficient bandwidth to support faster updates (small RPIs).

I/O Data Mapping

The configuration program (see page 14) maps the I/O data to ControlLogix tags.

The configuration program creates aliases to I/O data that you can import into RSLogix 5000 to access I/O data. The alias names address data by file, card and channel.

Use these aliases to access data in any applications you develop. If the mapping changes, you simply re-import aliases and the application accesses the correct I/O location. The configuration program also creates aliases to diagnostic data which is not easily accessible other than by using the aliases.



RSLinx

When you right click on the module in RSLinx and select Properties, RSLinx displays the following:

Parameter	Value
Device Name	CLX-PVX-MON (Monitor) CLX-PVX-MAS (Master)
Vendor	832 (Quest Technical Solutions)
Product Type	12
Product Code	1052 (Monitor) 1051 (Master)
Revision	depends on firmware
Serial Number	depends on module

RSLinx Properties

To use the Windows utility programs, you must have RSLinx software, version 2.54 or later, with an activation. Use RSLinx Gateway or RSLinx Professional software. Do not use RSLinx Lite.

The installation CD contains EDS files for the QTS-CLX-PVX in monitor and master modes.



Configuring the I/O

ClxPvxCfg Software

The QTS-CLX-PVX module is supplied with a Windows configuration tool, ClxPvxCfg.exe.

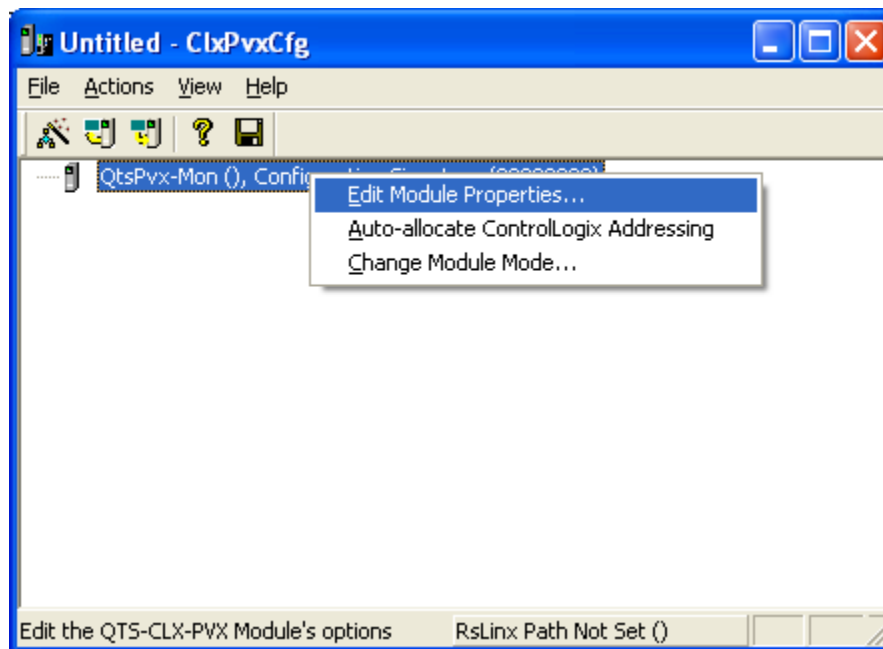
Use this configuration tool to:

- Switch between monitor and master mode
- Autoconfigure the monitor from an attached Control I/O bus
- Convert the configuration for master mode
- Map I/O data to ControlLogix scheduled connections
- Save and load configuration files
- Download and upload configurations
- Set the RSLinx path to the QTX-CLX-PVX module
- Export aliases for I/O data for import into RSLogix 5000, for both master and monitor modes
- Update the module firmware

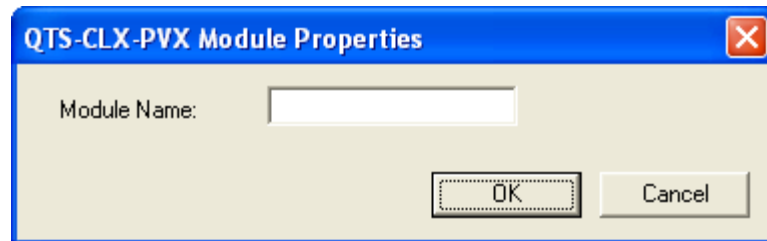
ClxPvxCfg is an offline configuration tool; any changes must be downloaded to the QTS-CLX-PVX module.

Setting the Module Name

To set the module name, right click on the QTS-CLX-PVX at the root of the tree and select *Edit Module Properties*.



The *QTS-CLX-PVX Module Properties* dialog appears.



Enter the *Module Name*. It can be up to 15 characters long. It should follow the rules for naming ControlLogix aliases; it should contain only alphanumeric characters and the underscore. Click OK to accept the name.

The name is displayed on the 4-character display and is used by ClxPvxCfg to build aliases for ControlLogix data.

The default name assigned when you perform an autoconfiguration is Auto_Scan.

The name should be unique so that if you have more than one QTS-CLX-PVX module, the alias names associated with each module are unique.

TIP

Use the same name that you assign the module in RSLogix 5000 to make it easy to associate aliases with the module.

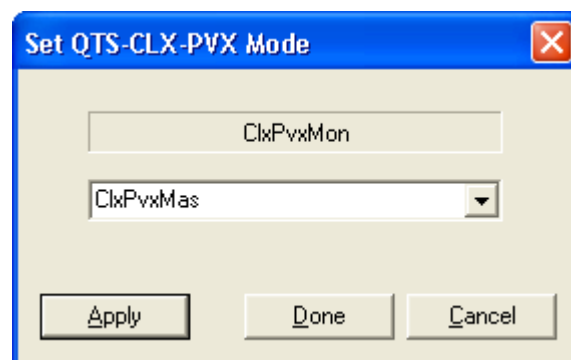
You can use the name of the controller you are monitoring, for example, SRx101.

Setting the Module Mode

To switch between modes or to update module firmware, select *Actions/Change Module Mode...* Changing the module mode downloads firmware to the card.

If the RSLinx path has not been set, select the module in the tree.

The Set QTS-CLX-PVX Mode dialog appears.



It shows the current mode and lets you select the firmware to download.

IMPORTANT!

If you change the mode (monitor to master or master to monitor), any configuration on the module is cleared. If the firmware you download is the same as the firmware already on the module (for example, if you are

updating firmware), the configuration is unaffected.

Click Apply to download the firmware.

When the firmware download is successful, the module displays the following message and shows the version of firmware downloaded.



Click OK to clear the message, then click Done.

If you change the module mode from master to monitor or from monitor to master:

- the configuration in the configuration program is converted to the new mode
- data mappings change

The ControlLogix controller with the connection to the module must be in program mode when you change mode. If the processor is in run mode, the following message appears.



The QTS-CLX-PVX displays the module and firmware and version on the 4-character display.

Configuring from a PROVOX Control I/O Bus

The QTS-CLX-PVX must be configured by capturing configuration information sent by a PROVOX master to a running PROVOX system.

WARNING!

Connecting the module to the Control I/O disrupts bus traffic!

Connect the module only at a time when it is safe to do so.

Use the following steps to configure the QTS-CLX-PVX.

1. Connect the module, in monitor mode, to a running PROVOX bus.

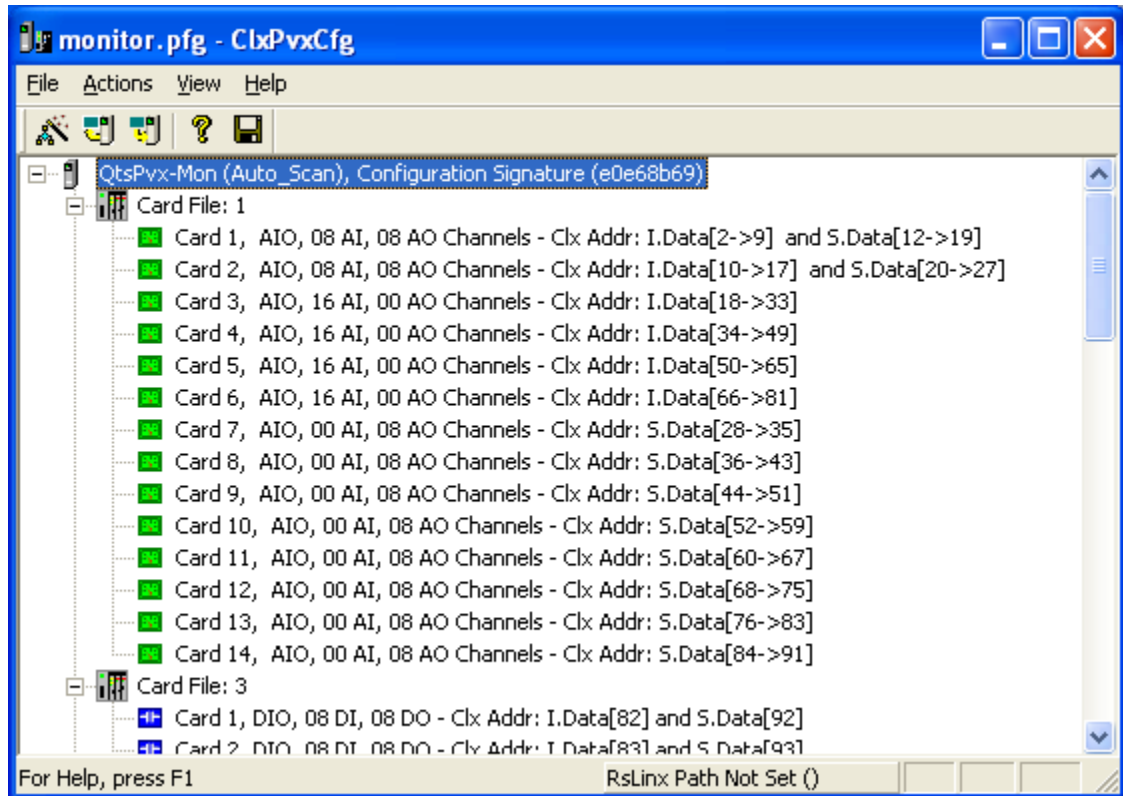
2. Use the *Actions/Start Auto Configuration* menu command or use *Auto Configuration* toolbar command to start an auto-configuration cycle.

WARNING!

Resetting the PROVOX controller disrupts the running system!

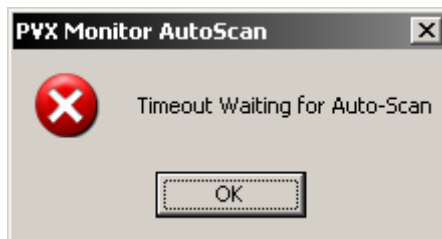
Reset the controller only at a time when it is safe to do so.

3. Reset the PROVOX master. The QTS-CLX-PVX captures the configuration data the master sends out and passes it to the configuration program, which analyzes it and builds the tree.



4. Download the captured configuration to the QTS-CLX-PVX.
5. Export aliases from the configuration tool to a file.
6. Import those aliases into RSLogix 5000.
7. Use the aliases to monitor data on the PROVOX bus.

If the module does not capture the configuration within a timeout period (approximately 60 seconds), it displays this message.



Note: If the ControlLogix processor previously had a connection open to the QTS-CLX-PVX module when the autoconfiguration timed out, that connection remains open, even though there is now no configuration on the module. However, if the module has no configuration, it will not accept new connections.

WARNING!

If the configuration in the PROVOX controller changes, you must repeat this procedure to capture the new configuration. Failure to do so results in the monitored values being incorrect.

Card and Data Limits

The QTS-CLX-PVX supports a maximum of 64 cards in monitor or master mode. If there are more than 64 cards in the captured configuration, ClxPvxCfg displays a message. You will have to delete some cards from the configuration. Right click on the card and select Delete.

Note: You cannot delete a 10 Series Communication Card. It disappears automatically when you delete all the other cards in the file.

In addition there are limits on the amount of available ControlLogix data space. Depending on the type of cards, you may exceed one of these limits without exceeding the maximum of 64 cards. In monitor mode, you will have to remove some cards from the configuration or use two QTS-CLX-PVX modules as monitors. In master mode, you can split the bus and use a QTS-CLX-PVX master on each bus.

Monitor-Only Files

A monitor-only file is created under two circumstances:

- the captured configuration contains an unsupported card type
- a card in the PROVOX controller's configuration is not responding on the bus

A monitor-only file can be used with the QTS-CLX-PVX in monitor mode but cannot be converted for use in master mode.

Mapping the I/O Data

When you autoconfigure the monitor from the PROVOX bus, the configuration tool automatically maps the I/O data to locations in the ControlLogix scheduled input and status input data.

When you change the module to master mode, the configuration tool remaps the data to ControlLogix scheduled input and output data.

If you delete any cards from the configuration, all mappings are cleared. Unassigned I/O addresses are shown as Undefined in the tree. To remap the data, select Actions/Auto-allocate Logix Addressing.

WARNING!

Whenever the data mapping changes, make sure you export a new alias file and re-import it into RSLogix 5000 so that you are using the correct



addresses for data.

Failure to do so will result in writing incorrect data and may result in injury or death.

If the QTS-CLX-PVX is in master mode and data mappings change, make sure you clear the output data table for the module in the ControlLogix processor before you connect the QTS-CLX-PVX to the Control I/O bus.

What gets mapped

Master Mode

PROVOX inputs (AI, DI) are mapped to ControlLogix inputs (path:I).

PROVOX outputs (AO, DO) are mapped to ControlLogix outputs (path:O)

Diagnostics are mapped to ControlLogix inputs and status inputs (path:S).

Monitor Mode

PROVOX inputs (AI, DI) are mapped to ControlLogix inputs (path:I).

PROVOX outputs (AO, DO) are mapped to ControlLogix status inputs (path:S).

Diagnostics are mapped to ControlLogix inputs and status inputs.

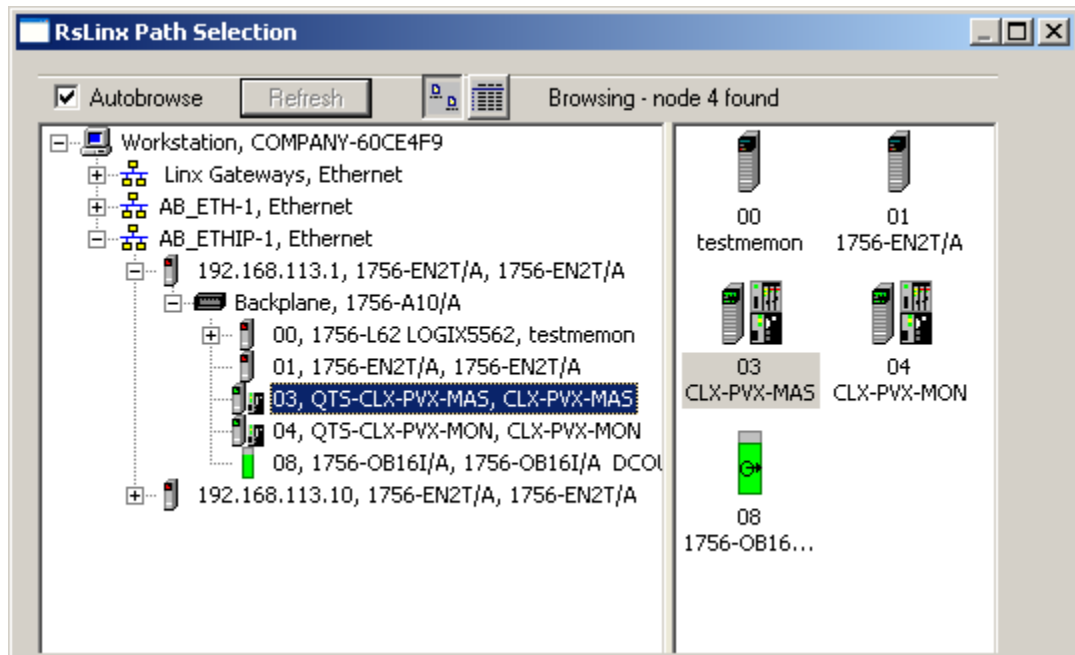
Uploading and Downloading Configurations

To download a configuration to the QTS-CLX-PVX, select *Actions/Download Configuration* or use the *Download Configuration to Module* button on the toolbar.

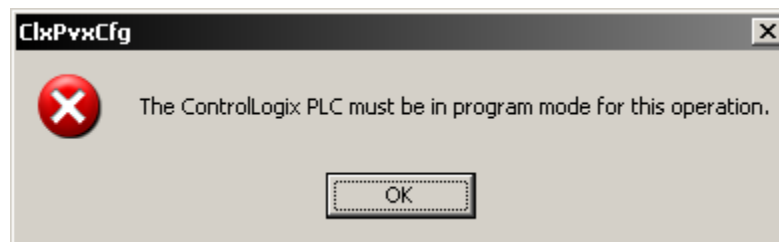
To upload a configuration from the QTS-CLX-PVX, select *Actions/Upload Configuration* or use the *Upload Configuration from Module* button on the toolbar. The uploaded configuration will be given the default file name Untitled.

If the RSLinx path to the module has not been set when you upload or download, an RSLinx Path Selection window opens.





If the ControlLogix processor with the connection to the QTS-CLX-PVX is in run mode when you download, the following message is displayed.



TIP

In master mode, to do the equivalent of a PROVOX reset, download the configuration to the module.

Saving a Configuration File

To save a configuration to disk, select *File/Save* or *File/Save As*.

Opening a Configuration File

To open a configuration file, select *File/Open..*

This does not change the configuration in the module; the configuration in the module changes only when you download.

Clearing the Configuration

To clear the configuration in the program, select *File/New*.



This does not change the configuration in the module; the configuration in the module changes only when you download.

The Configuration Signature

The configuration signature is displayed at the root of the tree. It can be used to determine if there are differences between a configuration file and the configuration in the module.

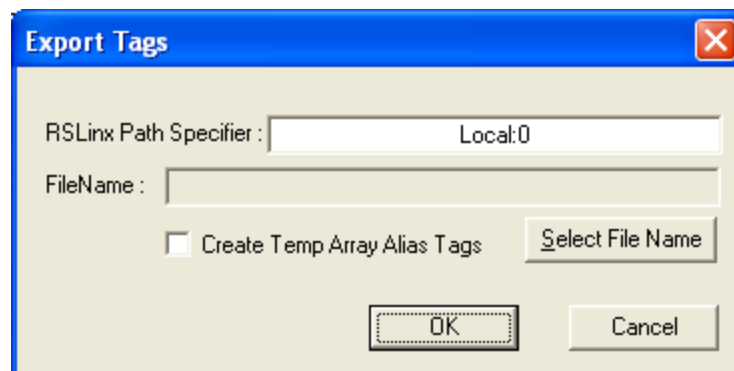
Open the configuration file and note the configuration signature. Now upload the configuration from the module and compare the configuration signatures. If they are the same, the configurations are identical.

Aliases

The configuration tool creates aliases for I/O data that can be exported and imported into RSLogix 5000.

You should write programs in terms of these aliases rather than using absolute addresses. If the mapping of the I/O data changes, simply reimport the new aliases and the program will point to the new data locations.

To export aliases, select *Files/Export Tags...*



Enter the *RSLinx Path Specifier* to set the location of the module. In the example shown, the module is in slot 0 of the Local chassis.

To determine the RSLinx Path Specifier, look at the raw tags for the module in RSLogix 5000.

Controller Tags - testmemaster(controller)							
Scope:		testmemaster	Show...	Show All			
Name	△	Value	←	For	Style	Data Type	Description
+ Local:3:C		{...}	{...}			AB:1756_...	
+ Local:3:I		{...}	{...}			AB:1756_...	
+ Local:3:O		{...}	{...}			AB:1756_...	
+ Local:3:S		{...}	{...}			AB:1756_...	

The RSLinx Path Specifier includes everything up to but not including the colon before I, O, C or S. In the example shown, it is Local:3



Use the Select File Name button to enter the file location.

If you are using monitor mode to develop your application, check the Create Temp Array Alias Tags checkbox. You should also create an array of 250 INTs with name TempPvxOutputArray in the ControlLogix.

Click OK to create the alias file.

WARNING!

If you change the I/O or ControlLogix configuration, re-import aliases so that the ControlLogix processor uses the correct addresses and clear the ControlLogix output table so that values don't get written to incorrect addresses.

Importing Aliases in RSLogix 5000

To import the alias file into RSLogix 5000, you must be offline. Select *Tools/Import...* and import the alias file.

TIP

If you have changed mode on the QTS-CLX-PVX, delete any aliases you previously imported into RSLogix 5000 before you import the new aliases.

Alias Format

ClxPvxCfg builds each alias name from the Module name and address information supplied by the configuration program

The ControlLogix data address is built from the RSLinx Path Specifier you enter and the data mappings created by the configuration program.

For example,

```
ALIAS,"","D3R_Mas_AI_F01C01C01","D3R_Mas_AI_F01C01C01","", "Local:0:I.Data[2]"
```

In this example, the module is in slot 0. The alias is for an analog input at PROVOX address File 1, card 1, channel 1, which is mapped to ControlLogix address input data at offset 2. The module name is D3R_Mas.

To build the alias name, ClxPvxCfg appends an underscore and F01C01C01 to the module name. The module is in slot 0 of the local chassis so the alias data address is Local:0:I.Data[2]



Accessing I/O Data

Required Connections

In master mode, the QTS-CLX-PVX does not begin scanning the I/O bus until all ControlLogix connections to the module are present.

If the connection is later closed, the QTS-CLX-PVX continues scanning the bus. Inputs do not update in the ControlLogix while the connection is closed and outputs do not update.

In monitor mode, the module does not wait for ControlLogix connections.

Data Updates

It is important to remember always that the PROVOX Control I/O bus updates data only when the data changes.

Any changes that occur when the module is not connected to the bus will not be captured.

Discrete Data

Use the aliases created by ClxPvxCfg to access discrete data to ensure that you are using the correct address and bit.

Analog Data Format

Analog values on the Control I/O bus are expressed in PROVOX Percent Format. The number is shown in the PROVOX controller as a percent with 3 decimal places. The range is -13.969% to +113.970%.

Each 16-bit word consists of:

upper byte = signed byte, represents the whole number part of the percentage

lower byte = unsigned byte, represents the fractional part, as a fraction of 256

Some examples:

Number, percent	High byte, hex	Low byte, hex	Number, hex
-13.97%	F2	08	F208
-1.75%	FE	40	FE40
0.00%	00	00	0000
1.75%	01	C0	01C0
25%	19	00	1900
25.25%	19	40	1940
50%	32	00	3200
75%	4B	00	4B00
100%	64	00	6400



Number, percent	High byte, hex	Low byte, hex	Number, hex
113.97%	71	F8	71F8

Modules like thermocouples linearize the inputs to percent of range, 1 to 5V.

Add-on instructions for RSLogix 5000 to convert between PROVOX percent and ControlLogix real numbers are available from the downloads area of the Rockwell Automation support website

<http://samplecode.rockwellautomation.com/>

In the Sample Code Library, search for “AOI for QTS-CLX-PVX PROVOX Module REV”

Converting PROVOX Percent Format to ControlLogix Real

For positive values (high bit of upper byte clear), add the whole number part (upper byte) to the fraction (lower byte divided by 256).

For negative values (high bit of upper byte set), subtract 256 from the whole number part and add the fractional part.

Example 1:

To convert 1940 hex, first note that the number is positive (high bit clear).

Convert the whole number part, 19 hex, to 25 decimal. The fractional part is 40 hex = 64 decimal. Convert it to a fraction = $64/256 = .25$ and add the whole number part to get 25.25%.

Example 2:

To convert E780 hex, first note that the number is negative (high bit set). Subtract 256 from the whole number part (E7 hex = decimal 231), to get -25. The fractional part is 80 hex = 128 decimal. Convert it to a fraction = $128/256 = .5$. Add the parts to get $-25 + .5 = -24.5\%$

Converting ControlLogix Real to PROVOX Percent Format

For positive values:

1. Convert the whole number part and store it in the upper byte.
2. Multiply the fractional part by 256 and store it in the lower byte.

For negative values:

1. First add 256 to the whole part. If the fractional part is non-zero (in practice, greater than .039), subtract 1 from the result. Store the result in the upper byte.
2. Subtract the fractional part from 1 and multiply the result by 256. Store the result in the lower byte.



Example 1:

To convert 74.5%, first convert 74 to hexadecimal 4A and store it in the upper byte. Multiply .5 by 256 to get 128 = 80 hex and store it in the lower byte.

The result is 4A80 hex.

Example 2:

To convert -1.75%:

Since the number is negative and the fractional part is non-zero, first add 256 to -1 to get 255 and subtract 1. Put 254 = FE hex in the upper byte.

The fractional part is .75. Subtract it from 1 to get .25, multiply by 256 to get 64 = 40 hex, and put 40 hex in the lower byte.

The result is FE40 hex.

Diagnostic Data

The QTS-CLX-PVX maintains diagnostic counters and other diagnostic status information.

Primary and Secondary File Error Table

In both master and monitor modes, the first two words of ControlLogix input data contain a table that shows which card files have communication problems on either the primary or secondary bus.

The first word, at offset 0, corresponds to the primary.

The second word, at offset 1, corresponds to the secondary.

In each word, bit 0 corresponds to file 1, bit 1 corresponds to file 2, and so on.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
File	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

The bit is set if there's at least one card in the file with a problem on that bus.

The bits are 0 for unconfigured card files.

TIP

You can use the file error tables to determine if a particular piece of data is valid.

If there's a problem with the connection to the QTS-CLX-PVX module, the ControlLogix processor sees all bits in this table as set to 1.

Integrity Bits

In master mode, PROVOX integrity bits for each configured card are mapped to ControlLogix status inputs. Use the aliases created by ClxPvxCfg to access the integrity bits.



Channel Status Bits

In master mode, PROVOX channel status bits for each channel are mapped to ControlLogix status inputs. Use the aliases created by ClxPvxCfg to access the channel status bits.

Diagnostic Counters

In both monitor and master mode, the module maintains diagnostic counters that can be used to diagnose bus problems.

Use the aliases generated by the configuration program to access the diagnostic counters.

The counters are slightly different for monitor and master modes.

Monitor Diagnostic Counters

Name	Description
StatPrimRxGood	Number of good packets received on primary channel
StatPrimAbortErr	Number of abort packets on primary channel
StatPrimNoiseErr	Number of error packets caused by noise on primary channel
StatPrimFrameErr	Number of packet frame errors on primary channel
StatPrimCrcErr	Number of packets with CRC errors on primary channel
StatPrimPacketLenErr	Number of short packets received on primary channel
StatSecRxGood	Number of good packets received on secondary channel
StatSecAbortErr	Number of abort packets on secondary channel
StatSecNoiseErr	Number of error packets caused by noise on secondary channel
StatSecFrameErr	Number of packet frame errors on secondary channel
StatSecCrcErr	Number of packets with CRC errors on secondary channel
StatSecPacketLenErr	Number of short packets received on secondary channel



Master Diagnostic Counters

Name	Description
StatPrimTxGood	Number of good packets sent on primary channel
StatPrimRxGood	Number of good packets received on primary channel
StatPrimAbortErr	Number of abort packets on primary channel
StatPrimNoiseErr	Number of error packets caused by noise on primary channel
StatPrimFrameErr	Number of packet frame errors on primary channel
StatPrimCrcErr	Number of packets with CRC errors on primary channel
StatPrimPacketLenErr	Number of short packets received on primary channel
StatPrimRxTimeOut	Number of packet timeout errors on primary channel
StatSecTxGood	Number of good packets sent on secondary channel
StatSecRxGood	Number of good packets received on secondary channel
StatSecAbortErr	Number of abort packets on secondary channel
StatSecNoiseErr	Number of error packets caused by noise on secondary channel
StatSecFrameErr	Number of packet frame errors on secondary channel
StatSecCrcErr	Number of packets with CRC errors on secondary channel
StatSecPacketLenErr	Number of short packets received on secondary channel
StatSecRxTimeOut	Number of packet timeout errors on secondary channel



Using Monitor Mode for Migration

You can use monitor mode on the QTS-CLX-PVX to migrate existing PROVOX applications to ControlLogix.

In monitor mode, the QTS-CLX-PVX captures live inputs and outputs from the PROVOX bus.

You first create an array of 250 INTs with name TempPvxOutputArray in the ControlLogix.

The configuration program creates aliases for PROVOX inputs and outputs and for dummy outputs in the temporary array.

You import those aliases into RSLogix 5000, then create a new ControlLogix application that reads live inputs from the PROVOX bus and writes outputs to the temporary array, always using the aliases from ClxPvxCfg.

You compare the outputs from the new ControlLogix application (in the temporary array) with the live outputs from PROVOX.

When you are satisfied that the new application duplicates the behaviour of the existing PROVOX control application (state of outputs and timing), disconnect the PROVOX controller and switch the QTS-CLX-PVX module to master mode.

Export aliases from ClxPvxCfg in master mode and import them into RSLogix 5000. The names for the output aliases will be the same as those that pointed to the temporary array but now they will point to the corresponding PROVOX outputs. Your new ControlLogix application will write to the real outputs instead of the temporary array. Since you developed your application using these aliases, no further changes will be necessary.

You will start up with a ControlLogix application that has been tested and proved to duplicate the behaviour of the previous PROVOX control application.

Example:

This is the alias ClxPvxCfg generated in monitor mode for a PROVOX monitored output

```
ALIAS,"","SRx101_AO_F01C01C01","SRx101_AO_F01C01C01","","TempPvxOutputArray[0]"
```

and this is the alias it generated for the same output in master mode

```
ALIAS,"","SRx101_AO_F01C01C01","SRx101_AO_F01C01C01","","Local:3:O.Data[0]"
```

The alias names are the same but in the first case the program would write to the temporary array; in the second it would write to a ControlLogix output.



Troubleshooting

ControlLogix Module LEDs

The module has three status LEDs to indicate the state of internal operations. The LEDs are labeled NET, CLX and OK.

NET LED – Control I/O Bus Status

The NET LED shows the status of I/O communication. The NET LED states are the same for master and monitor modes.

In order of priority, highest first, these are:

Color	Meaning
Solid Red	Card offline - happens when there is no configuration on the module
Flashing red	Net LED blinks RED for 1 second with every bus error. A burst of bus errors causes the LED to stay red for longer than 1 second.
Yellow	One or more configured cards is offline (can't be reached via primary or secondary links)
Green	All configured cards are online

CLX LED – ControlBus Status

The CLX LED indicates the status of communication with the ControlLogix processor.

Color	Meaning
Green	All required connections are open
Yellow	Idle, no scheduled connections, ControlLogix PLC does not have a configuration for the QTS-CLX-PVX module or the configuration is inhibited.
Flashing Red/Off	The module has returned a CIP error within the last second - no scheduled connections, QTS-CLX-PVX module configuration not present
Solid Red	The module has returned a CIP error - no scheduled connections.



OK LED – Module Health

The OK LED indicates module health. A red LED indicates that module startup diagnostics have failed or a major module fault has occurred. Green indicates that the module has passed all power-up diagnostics and is functioning normally.

All LEDs Red

If all three LEDs are solid red and the 4-character display shows something like M#66, this indicates that a fatal error has occurred. Refer to page 31 for information on clearing fatal errors. If a fatal error occurs, clear the fatal error, save the file and contact Technical Support.

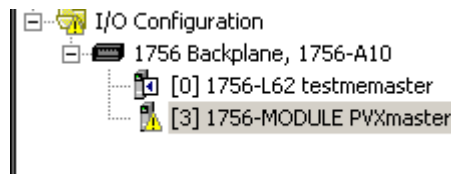
QTS-CLX-PVX Module 4-Character Display

The 4-character display shows the firmware in the module, either CLX-PVX-MON or CLX-PVX-MAS, followed by the firmware version number, and the Module Name you entered in the module configuration (see page 14).

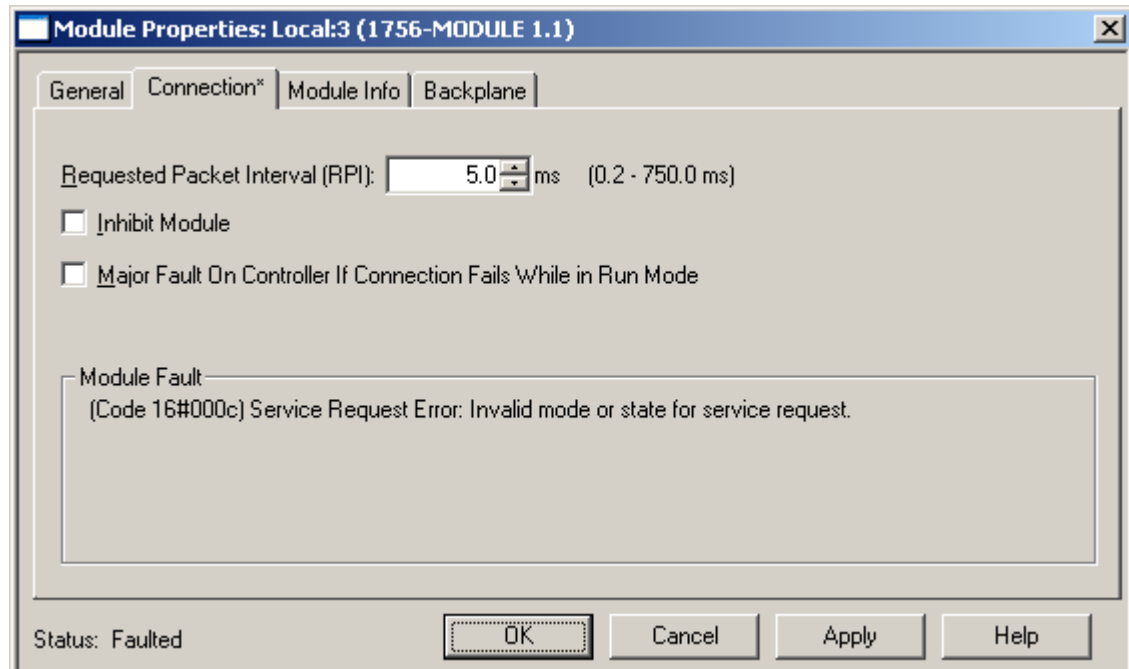
If there is no configuration in the module, the display shows <NoConfig> instead of the module name.

RSLogix 5000

If there is a problem with the connection to the module, it is shown with a yellow triangle in the I/O Configuration tree



The Connection Tab for the QTS-CLX-PVX module displays an error message if there is a problem with the connection to the module.



If the module has no PROVOX configuration, it refuses connection requests from the ControlLogix processor and returns an error.

The Debug Log

The firmware on the module maintains a log of informational and diagnostic messages that can be useful in determining the cause of configuration and I/O bus problems.

To view the log, run the program LogMon from the Start Menu.

Fatal Errors

Fatal errors occur when the firmware on the module encounters an unexpected condition. The module stops running, turns all three LEDs red, and displays the fatal error number on the 4-character display. The module also records its state at the time the fatal error occurred in a log.

To clear the fatal error and capture the fatal error log:

1. Cycle power on the module. The 4-character display should show "FatalErrorCapture required".
2. Run the utility FatalCapt.exe from the subdirectory Tools where you installed the configuration tool (usually Program Files\QtsPvx)
3. Store the fatal error log to a file. This also clears the fatal error on the module.

Contact technical support. Provide them with the fatal error log, which will help diagnose the cause of the problem.



Updating the Firmware

The module firmware is updated using the configuration program.

Select *Actions/Set Module Mode*.

To update the firmware, set the mode to match the firmware already loaded in the module.

Set Module Mode uses the firmware files (*.qtf) in the same directory as ClxPvxCfg.exe.

The configuration program displays the version after the firmware has been downloaded.

The module displays the firmware and version currently loaded on the 4-character display.



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Appendix: ClxPvxCfg

ClxPvxCfg is the configuration program for the QTS-CLX-PVX module. It is an offline configuration program; you must upload or download configuration data.

Summary of Operations

Menu Item	Description
File Menu	
New File	Close the configuration in ClxPvxCfg and open a new file
Open File	Open a configuration file from disk
Save File	Save a configuration file to disk
Save File As	Save a configuration file to disk under a new name
Export Alias File	Export a file that contains aliases for import into RSLogix 5000
Recent File list	Open a file that has been previously opened
Exit	Exit ClxPvxCfg
Actions Menu	
Upload Config	Upload a configuration from the QTS-CLX-PVX to ClxPvxCfg
Download Config	Download a configuration from ClxPvxCfg to the QTS-CLX-PVX module
Start Auto Configuration	Monitor mode only. Capture a configuration from a Control I/O Bus
Auto Allocate CLX Addressing	Assign ControlLogix data addresses
Change Module Mode	Download firmware to the QTS-CLX-PVX module, to switch between monitor/master modes or to update firmware If there is a configuration in ClxPvxCfg and you change modes, the configuration is also converted.
Set RSLinx Path	Set or change the path to a QTS-CLX-PVX module
View Menu	
Toolbar	Display/hide the toolbar
Status Bar	Display/hide the status bar
Help Menu	
Help Topics	Display the help main window
About ClxPvxCfg	Display about box, shows version



Menu Item	Description
Right Click on Module	
Edit Module Properties	Change module name
Auto-allocate CLX Addressing	see above
Change Module Mode	see above
Right click on card	
Delete Card	Delete a card from the configuration Also clears all ControlLogix addresses
View Card Properties	Display configuration data for a card



Appendix: Configuration File Format

Configuration files for the QTS-CLX-PVX are text files. The following information is provided for reference only. It is recommended to use the auto-configuration capabilities of the gateway, as this reduces the risk of introducing configuration errors through manually creating or editing configuration files.

The first line of the configuration file consists of:

```
Number of Cards: 39 Name: D3R_Mas Mode: 54cd3514 Options: 01010101 Cfg
Id: 43960cce
```

Number of cards = the number of configured card to follow

Name: the module name

Mode = hexadecimal value that indicates whether this is a master or monitor file (54cd3514 – master, 54cd3512 - monitor)

Options: the starting card in each of the four scan segments

Cfg Id: the hexadecimal configuration ID calculated by ClxPvxCfg.exe.

This is followed by card definitions for each card.

Card definitions

A typical card definition consists of:

```
Byte Address: 001 Type: 13 State: 9
Priority: 01 CfgMask: ffff IpMask: ffff OpMask: 0000
TokenLst: 2 2 2 2
ChanType: 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14
ChanParam: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Input Copy Table
1 4 32
Output Copy Table
0 0 0
```

The *Byte Address* is the address of the card, stored in decimal; however, if you convert it to hex it is more meaningful: upper nibble = cardfile -1, lower nibble = card number

i.e. decimal 17 = 11 hex = card file 2, card 1

The *Type* is the base card type.

Supported card types are:

Card Type	Value, Hex	Value, Decimal
AIO_CARD_TYPE	0D	13
DIO_CARD_TYPE	0F	15
TPO_CARD_TYPE	11	17



Card Type	Value, Hex	Value, Decimal
PCI_CARD_TYPE	16	22

State is used with card redundancy, which is not supported. Always set the value to 9.

Priority defines the card priority, 1,2 or 4

CfgMask, *IpMask* and *OpMask* define which channels are configured, which channels are inputs and which channels are outputs, respectively.

TokenList gives the card address this card will give the token to (for all 4 scan segments)

ChanType is an array of 16 bytes, one byte per channel starting at channel 1

Possible channel types are:

Channel Type	Value, Hex	Value, Decimal
DO_MOMENTARY_TYPE_CODE	04	4
DO_LATCHING_TYPE_CODE	06	6
DI_CHANNEL_TYPE_CODE	05	5
PCI_CHANNEL_TYPE_CODE	16	22
TPO_CONTINUOUS_TYPE_CODE	12	18
TPO_ONESHOT_TYPE_CODE	13	19
AI_CHANNEL_ISO_1TO5	0b	13
AI_CHANNEL_ISO_0TO10	0c	12
AI_CHANNEL_SINGLE_ENDED	0e	14
AI_CHANNEL_LOW_VOLTAGE	10	16
AI_CHANNEL_TYPEJ_LOW	22	34
AI_CHANNEL_TYPEJ_HIGH	23	35
AI_CHANNEL_TYPEK_HIGH	24	36
AI_CHANNEL_TYPEK_LOW	25	37
AI_CHANNEL_TYPE_T	26	38
AI_CHANNEL_TYPE_E	27	39
AI_CHANNEL_TYPE_R	28	40
AI_CHANNEL_LOW_SP1	29	41
AI_CHANNEL_LOW_SP2	2a	42
AI_CHANNEL_TYPE_B	2e	46
AI_CHANNEL_TYPE_S	2f	47
AI_CHANNEL_RTD_270_140	36	54



Channel Type	Value, Hex	Value, Decimal
AI_CHANNEL_RTD_148_212	37	55
AI_CHANNEL_RTD_100_600	38	56
AI_CHANNEL_RTD_32_392	39	57
AI_CHANNEL_RTD_32_1112	3a	58
AI_CHANNEL_RTD_100_500	3b	59
AI_CHANNEL_RTD_32_300	3c	60
AI_CHANNEL_RTD_SPEC	3d	61
AO_CHANNEL_TYPE_CODE	02	2

ChanParam is an array of 16 bytes containing any channel parameters

Input Copy Table and *Output Copy Table* define where the input and output data for the card are copied to or from in the ControlLogix.

The layout is:

CLX area, CLX Offset (byte offset), Length (bytes)

Area	ControlLogix data area
0	no data mapped
1	input (I.Data[])
2	status (S.Data[])
3	output (O.Data[])

If you edit the configuration file manually, set the entries for the copy tables to 0 and let the configuration tool assign ControlLogix addresses.



Specifications

QTS-CLX-PVX ControlLogix Module

Parameter	Specification
Module Location	ControlLogix chassis
Function	ControlLogix module for PROVOX Control I/O bus
Maximum Backplane Current Load	675 mA @ 24VDC and 5 mA @ 5.1VDC from I/O chassis backplane
Power dissipation	20W maximum
Environmental Conditions:	
Operational Temperature	0-60°C (32-140°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Relative Humidity	5-95% without condensation



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