

# **QTS-CLX-PVX Application Note**

## **PROVOX Card Emulation Firmware (BETA)**

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### ***Introduction:***

The QTS PROVOX Control I/O card emulator firmware (QtsPvxSlv.qtf) provides the ability for the QTS-CLX-PVX ControlLogix backplane module to emulate up to 64 PROVOX 20 series Control I/O cards. This allows a PROVOX controller to communicate in a bi-directional fashion with a Rockwell Automation ControlLogix backplane.

### ***Card Emulation Functionality:***

The Control I/O card emulation functionality provided by card emulation firmware is designed with the following general attributes:

- Supports up to 64 emulated cards at any legal Control I/O FILE, CARD address.
- Card types support is limited to 20 series I/O types AI, AO, DI, DO.
- Number of configured channels is automatically assigned according to the selected card type: AI-16 channels, AO-8 channels, DI-16 channels, DO-16 channels.
- Channel types are assigned on a per card basis with all channel types set to the same configured type (AI-single ended, AO, DI, DO-latching).
- PROVOX controllers can ask for special, detailed status from 20 series I/O cards. The card emulation firmware does not support these types of informational messages.
- All data exchanged between the PROVOX controller and the card emulation firmware adheres to the standard Control I/O Bus formats for discrete and analog data (see QTS-CLX-PVX User's Manual for details on PROVOX percent format and any available conversion routines.)

### ***Configuration:***

The QTS-CLX-PVX module is placed in card emulation mode by updating the module's firmware with the QtsPvxSlv.qtf firmware image. Updating the firmware will change the QTS-CLX-PVX module to a dedicated card emulator (slave) on the Control I/O bus.

This procedure assumes the user has already placed the QTS-CLX-PVX module in a ControlLogix backplane and configured an RSLogix 5000 project to include the QTS-CLX-PVX module (see QTS-CLX-PVX User's Manual included with the QTS hardware module for details).

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### ***Firmware Updating Procedure:***

Obtain the QTS-CLX-PVX card emulation BETA disk image from QTS customer support staff (see, QTS web site for details). Extract the zip file containing the card emulation disk image to your local computer and use the following procedure to change a QTS-CLX-PVX module to card emulation mode:

1. Make sure the ControlLogix Controller is in program mode.
2. In the root directory of the BETA disk image, run the SetPvxMode.exe application and pick the proper path to the intended QTS-CLX-PVX module.
3. The “*Set QTS-PVX-CLX Mode*” dialog box displays the current QTS-CLX-PVX module's mode. Select “QtsPvxSlv” firmware from the list of firmware update choices and hit the “*Done*” button.

### ***Card Emulation Configuration:***

The card emulator mode does not use QtsPvxCfg GUI configuration tool to define the number, type or ControlLogix data mapping for the emulated 20 Series cards. The configuration information is sent to the QTS-PVX-CLX card using the C.Data[] array of bytes (Configuration Bytes). The configuration of the card emulator firmware is therefore part of the RSLogix 5000 project file.

#### **Step 1 – Change QTS-PVX-CLX I/O Configuration in RSLogix 5000:**

Edit the I/O configuration of the QTS-PVX-CLX module in RSLogix 5000 and change the “*Configuration*” connection parameter's “*Size*” from 0 to 400 and save this change.

#### **Step 2 – Set values in C.Data[] array to emulate desired cards:**

Using the data monitor in RSLogix 5000, view the C.Data[] array for the configured QTS-CLX-PVX module. The C.Data[] array elements are defined as follows:

<b>CLX Address</b>	<b>Parameter</b>
C.Data[0]	Number of cards to emulate – 1 to 64
C.Data[1]	Configuration Options – not currently supported (ignored)
C.Data[2]	1 <sup>st</sup> card address – see below for details on addressing
C.Data[3]	1 <sup>st</sup> card type – see below for details on card types
C.Data[4]	1 <sup>st</sup> card CLX address – see below for details
C.Data[5]	2 <sup>nd</sup> card address
C.Data[6]	2 <sup>nd</sup> card type

CLX Address	Parameter
C.Data[7]	2 <sup>nd</sup> card CLX address
C.Data[8]	3 <sup>rd</sup> card address
C.Data[9]	3 <sup>rd</sup> card type
C.Data[10]	3 <sup>rd</sup> card CLX address
Pattern repeats for up to 64 configured cards	

**Card Address Parameter:** View parameter in hexadecimal and set as follows:

(File Number – 1) contained in upper 4 bits.

Card Number contained in lower 4 bits.

For example,

File 1, Card 6 = 06 Hexadecimal

File 14, Card 3 = D3 Hexadecimal

**Card Type Parameter:**

Card Type	Value (Hex)	Value (Dec)	Emulated Card Summary
AI	0E	14	16 AI (single-ended) input channels
AO	2	2	8 AO output channels
DI	5	5	16 DI input channels
DO	6	6	16 DO (latching) output channels

**CLX Address Parameter:**

The I.Data or O.Data array element of the start of the emulated card's data. The specific data array (I.Data or O.Data) will depend on the card type as follows:

AI,DI card types are mapped to the O.Data[] array.

AO,DO card types are mapped to the I.Data[] array.

For example,

To map an AI emulated card to O.Data[10]-O.Data[25], card parameter value is set to 10 Decimal (0A hex).

To map an AO emulated card to I.Data[2]-I.Data[9], card parameter value is set to 02

### **Step 3 – Send Configuration Bytes to QTS-CLX-PVX module:**

This step is accomplished by downloading the ControlLogix application to the ControlLogix controller or inhibit and then enable the QTS-CLX-PVX module in the I/O configuration tree.

Steps 2 and 3 can be repeated each time the user wishes to change the configuration of the card emulator mode (number of emulated cards, card types or CLX addressing). Any change in the C.Data[] array values only take effect after a program download or a inhibit/enable cycle of the QTS-CLX-PVX module.

**Important note** – if a change is made to the CLX address information contained in the configuration bytes, make sure to clear the output table (O.Data[]) so that values aren't inadvertently written to the wrong PROVOX Controller card addressing.

## ***Diagnostic Data:***

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

### ***Primary and Secondary File Error Table:***

The first two words of ControlLogix input data contain a table that shows which emulated card files have communication and/or configuration problems on the primary and secondary links.

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.

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

The bits are always 0 for unconfigured card files.

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

### **Validate Data using the File Error Table:**

The file error table can be used to provide a "Valid Data" indicator to CLX applications.

For example:

The card emulation mode has been configured to emulate 4 cards in file 6, cards 1,2,3 and 4. Therefore, primary file error bit I.Data[0].5 and secondary file error bit I.Data[1].5 indicate errors for all 4 cards in rack 6.

All the data recieved in the O.Data[] array (AO/DO data from the PROVOX controller), for card file 6, is valid when either I.Data[0].5 equals zero (logical 0) OR I.Data[1].5 equals zero (DataValid=[NOT I.Data[0].5] OR [NOT I.Data[1].5]).

**Network Diagnostic Counters:**

The first 16 words of the ControlLogix status data (S.Data[0]-S.Data[15]) contain a table that shows network related network counters for both the Primary and Secondary Control I/O network ports:

CLX Address	Name	Description
S.Data[0]	StatPrimTxGood	Number of good packets sent on primary channel
S.Data[1]	StatPrimRxGood	Number of good packets received on primary channel
S.Data[2]	StatPrimAbortErr	Number of abort packets on primary channel
S.Data[3]	StatPrimNoiseErr	Number of error packets caused by noise on primary channel
S.Data[4]	StatPrimFrameErr	Number of packet frame errors on primary channel
S.Data[5]	StatPrimCrcErr	Number of packets with CRC errors on primary channel
S.Data[6]	StatPrimPacketLenErr	Number of short packets received on primary channel
S.Data[7]	StatPrimRxTimeOut	Number of packet timeout errors on primary channel
S.Data[8]	StatSecTxGood	Number of good packets sent on secondary channel
S.Data[9]	StatSecRxGood	Number of good packets received on secondary channel
S.Data[10]	StatSecAbortErr	Number of abort packets on secondary channel
S.Data[11]	StatSecNoiseErr	Number of error packets caused by noise on secondary channel
S.Data[12]	StatSecFrameErr	Number of packet frame errors on secondary channel
S.Data[13]	StatSecCrcErr	Number of packets with CRC errors on secondary channel

CLX Address	Name	Description
S.Data[14]	StatSecPacketLenErr	Number of short packets received on secondary channel
S.Data[15]	StatSecRxTimeOut	Number of packet timeout errors on secondary channel

***ControlLogix Module LEDs:***

Refer to QTS-CLX-PVX User's manual for details.

***QTS-CLX-PVX Module 4-Character Display:***

The 4-character display show the card emulation mode name (QTS-PVX-SLV) and the version of the firmware. No other messages appear on the display.