

QTS-CLX-APACS
APACS®
IOBUS 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-APACS

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QTS-CLX-APACS Module Overview



The QTS-CLX-APACS connects a ControlLogix controller to an APACS[®] IOBUS network.

Use the QTS-CLX-APACS to migrate APACS systems to ControlLogix controllers. You can retain the APACS I/O as the first step in the migration.

The module acts as either a monitor or as a master on the APACS IOBUS. You select the mode by downloading different firmware to the module, using the Windows configuration programs provided.

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

In master mode, the ControlLogix sends output data to the QTS-CLX-APACS, which then transmits it as output data on the APACS IOBUS. The QTS-CLX-APACS sends APACS input data to input data in the ControlLogix.

The QTS-CLX-APACS:

- supports IOBUS cable redundancy
- supports up to the maximum of 39 I/O cards allowed by the APACS IOBUS in a maximum of 4 MODULRACS

The QTS-CLX-APACS communicates with the ControlLogix processor using scheduled connections. You configure the module in RSLogix 5000 (v19 or greater) with up to:

- 10 I/O connections, 9 for data and 1 for status

Each I/O connection supports:

- scheduled input data, 496 SINTs or 124 REALs
- scheduled output data, 496 SINTs or 124 REALs

The Windows configuration programs supplied with the module map IOBUS data to the scheduled data. They also:

- upload and download configuration data
- map the IOBUS data to ControlLogix scheduled data
- save and open configuration files
- export aliases for use in your RSLogix 5000 application
- change the module mode, between monitor and master modes

Firmware Update

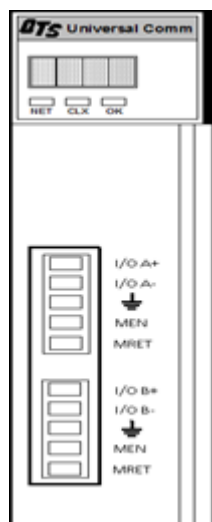
The module firmware can be updated using the Change Module Mode functions in the Windows utilities supplied (see page 44).

Part Number

The part number of the module is QTS-CLX-APACS.

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 5-pin Phoenix connectors to connect to the IOBUS A and IOBUS B 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 43) 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 43) with error code D0. In master mode, the module stops scanning and stops communicating with the ControlLogix.

Power Requirements

The QTS-CLX-APACS module requires 5 mA @ 24VDC and 475 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-APACS 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.

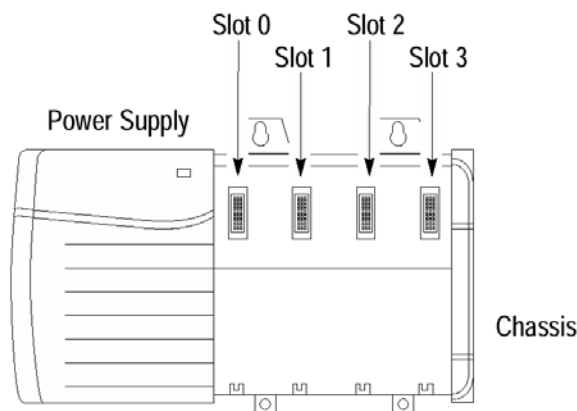


Figure 1 Chassis Slots

You can install multiple QTS-CLX-APACS 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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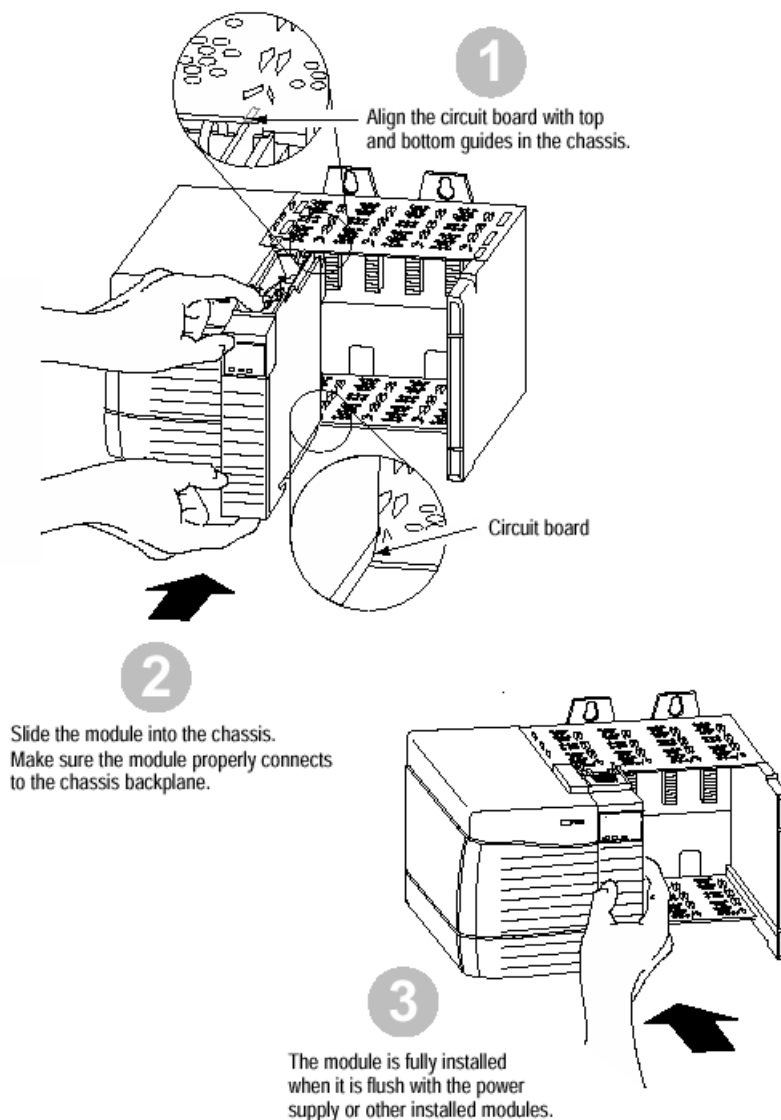


Figure 2 Inserting the Module

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 master or monitor firmware and the correct 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-APACS like any other IOBUS device.

Refer to the following Siemens document for details on cabling:

- "APACS+ / QUADLOG MODULRAC and Local Termination Panel Installation and Service Instructions", SD39MODULRAC-1

Refer to section 2.10.2 of the manual shown above.

Place the QTS-CLX-APACS module at the beginning or end of the currently installed MODULRAC racks:

1. Purchase a Siemens cable that fits the end of the MODULRAC rack that will be used (left side of first rack or right side of last rack).
2. Cut off the end of the cable that will connect to the QTS-CLX-APACS module and strip the cabling.
3. Wire the Bus A signals IOBUS (+) to I/O A+, IOBUS (-) to I/O A-, MRET to MRET and MEN to MEN on the top Phoenix connector.
4. Set the shunt plug on the MODULRAC from terminate to the I/O bus continue position and place a 120 ohm resistor between I/O A+ and I/O A- signals on the top Phoenix connector.

Repeat steps 1 through 4 for IOBUS B cabling on the bottom Phoenix connector of the QTS-CLX-APACS module.

Terminate both ends of the IOBUS A and B using termination provided by the MODULRAC racks or a 120 ohm resistor attached to the physical ends of the bus, if the QTS-CLX-APACS module is placed at the beginning or end of the bus. There should be two and only two terminators on each bus.

The cabling is the same for monitor and master modes of the QTS-CLX-APACS.

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 QtsApacs_vx.x.exe on the CD to install the Windows software.



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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 monitor mode, the QTS-CLX-APACS sends APACS IOBUS input and output data to input data in the ControlLogix. The QTS-CLX-APACS cannot transmit on the bus.

In master mode, the ControlLogix sends output data to the QTS-CLX-APACS, which then transmits it as output data on the APACS IOBUS. The QTS-CLX-APACS sends APACS input data to input data in the ControlLogix.

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

Module Configuration

The ControlLogix configuration may be different for master and monitor modes of the QTS-CLX-APACS.

The Windows configuration tools show the required connections and minimum connection sizes.

The QTS-CLX-APACS module supports up to 10 scheduled connections. Connection 9 is reserved for diagnostics.

Discrete data is mapped from connection 0 upwards, analog data is mapped to connection 8 downwards.

Adding the Module

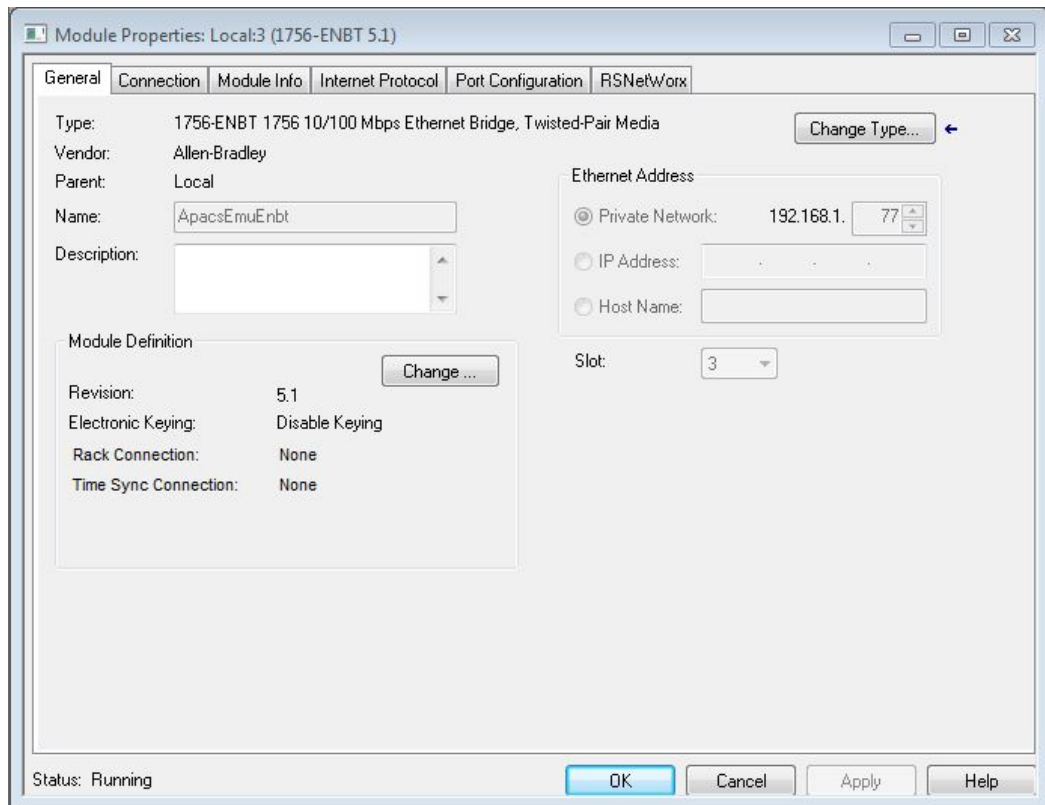
1. Place an ENBT in the I/O tree.

Disable keying, set the Rack Connection to None, and set the slot to whatever slot the QTS-CLX-APACS is in.

The IP address doesn't matter, e.g., use Private Network 192.168.1.77

The Name doesn't matter, e.g., use ApacsEmuEnbt





2. Place another ENBT on the Ethernet under the first ENBT.

Disable keying, set the Rack Connection to None, set the slot to 16.

The IP Address doesn't matter, e.g., Private Network 192.168.1.78

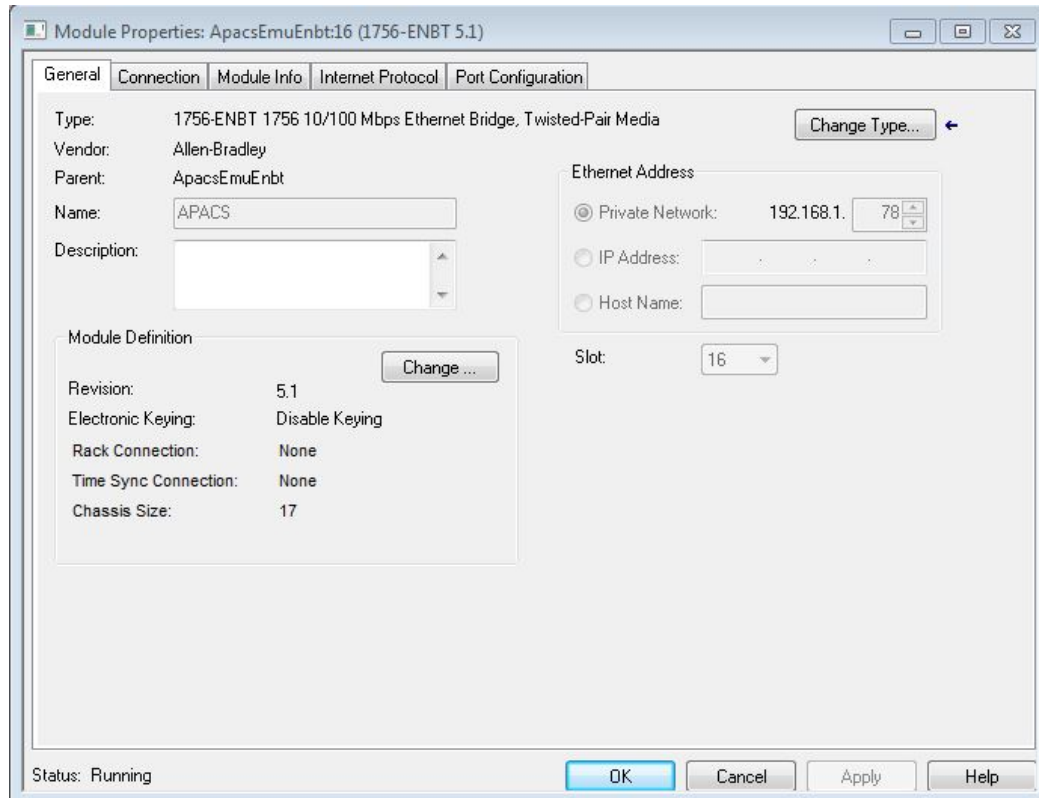
Name this ENBT what you want the Controller Tag Name to be, e.g., APACS.

Make this name the same as the name you give the module in the configuration program (monitor or master).

This name will prefix all aliases.

TIP

This name will appear on the module's 4-character scrolling display so you can easily identify it if you have more than one QTS-CLX- APACS module.



3. Place generic 1756-MODULEs in slots 0 to 9, as required.

The configuration programs assign IOBUS data to connections 0 to 8. Discrete inputs and outputs and module status bytes are mapped to SINT data in connection 0 and up. That is, if connection 0 is full, the configuration programs start mapping data to connection 1, and so on.

Analog inputs and outputs are mapped to REAL data in connection 8 and down. That is, if connection 8 is full, the configuration programs start mapping data to connection 7, and so on.

Diagnostic counters are mapped to INT data in connection 9.

Right click on the backplane associated with the second ENBT and select *New Module*.

Expand the *Other* tab, select a module of Type *1756-MODULE Generic 1756 Module* and click OK.

RSLogix 5000 displays the *New Module* dialog box.

Assign the module a *Name* and optionally a *Description*.

Set the *Slot* to match the connection number

Connection for SINT data

Set the Comm Format to Data – SINT

.

Set the Connection Parameters as shown. The sizes shown are the maximum values.

Module Properties: APACS:0 (1756-MODULE 1.1)

General Connection Module Info Backplane

Type: 1756-MODULE Generic 1756 Module
Parent: APACS

Name: Slot0
Description:
Comm Format: Data - SINT
Slot: 0

Connection Parameters

	Assembly Instance:	Size:	
Input:	1	500	(8-bit)
Output:	2	496	(8-bit)
Configuration:	4	0	(8-bit)
Status Input:			
Status Output:			

Status: Offline OK Cancel Apply Help

Click OK

Connection for REAL data

Set the Comm Format to Data – REAL

Set the Connection Parameters as shown. The sizes shown are the maximum values.

Module Properties: APACS:8 (1756-MODULE 1.1)

General Connection Module Info Backplane

Type: 1756-MODULE Generic 1756 Module
Parent: APACS

Name: Slot8
Description:
Comm Format: Data - REAL
Slot: 8

Connection Parameters

	Assembly Instance:	Size:	
Input:	1	125	(32-bit)
Output:	2	124	(32-bit)
Configuration:	4	0	(8-bit)
Status Input:			
Status Output:			

Status: Offline OK Cancel Apply Help

Click OK.

Connection for Diagnostic Data

Diagnostics are always mapped to connection 9. Connection 9 is not required but we strongly recommend that you create it.

Set the Comm Format to Data – INT

Set the Connection Parameters as shown.

Module Properties: APACS:9 (1756-MODULE 1.1)

General Connection Module Info Backplane

Type: 1756-MODULE Generic 1756 Module
Parent: APACS

Name: Slot9Diags
Description:
Comm Format: Data - INT
Slot: 9

Connection Parameters

	Assembly Instance:	Size:	
Input:	1	250	(16-bit)
Output:	2	1	(16-bit)
Configuration:	4	0	(8-bit)
Status Input:			
Status Output:			

Status: Offline

OK Cancel Apply Help

Do not reduce the connection size for connection 9 from the values shown. In addition to the diagnostic counters, other undocumented diagnostic information which may be useful for technical support is also mapped to connection 9.

The sizes of connections 0 to 8 (as needed) can be smaller than the maximum to reduce traffic in the ControlLogix backplane. Double click on the root of the network tree in the APACS configuration programs to determine the minimum connection sizes.

RPI

Next, set the RPI for the connection.

Selecting an RPI.

The module supports RPIs from 2.0 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.

You can use different RPIs for each connection, depending on the requirements of your application.

For example, you can use a longer RPI for the diagnostic data in connection 9, for example 500 milliseconds, since diagnostics do not need to be updated as frequently as I/O data.

Remote Connections

If you are using the QTS-CLX-APACS 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).



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RSLinX

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

Parameter	Value
Device Name	CLX-APACS-MON (Monitor) CLX-APACS-MAS (Master)
Vendor	832 (Quest Technical Solutions)
Product Type	12
Product Code	1062 (Monitor) 1061 (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.

When you create a driver for the configuration programs to access the QTS-CLX-APACS module, use the *Remote Devices via Linx Gateway* driver.



Monitor Mode Operation

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

Step	Operation	See page
	Install the QTS-CLX-APACS module in the ControlLogix chassis	4
	Connect the module to the APACS IOBUS	7
	Export the database from 4-mation software	16
	Run the monitor configuration software	15
	Import a 4-mation exported object file (obt)	16
	Assign ControlLogix addresses to the IOBUS data	17
	Set the module name	19
	Save the configuration	21
	Download the configuration to the module	21
	Configure the module in RSLogix 5000	8
	Create aliases for RSLogix 5000	22
	Import the aliases into RSLogix 5000	23
	Use the aliases to access the data	38

ClxApacsMonCfg Software

The QTS-CLX-APACS module is supplied with a Windows configuration tool, ClxApacsMonCfg.exe for using the module as a monitor.

Use this configuration tool to:

- Configure the monitor from a 4-mation software object (obt) file
- Map I/O data to ControlLogix scheduled connections
- Save and load configuration files
- Set the RSLinx path to the QTS-CLX-APACS module
- Download and upload configurations
- Export aliases for I/O data for import into RSLogix 5000
- Switch between monitor and master modes
- Update the module firmware



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Exporting a 4-mation database file

The monitor configuration program uses a database file exported from the Siemens 4-mation Configuration Program.

To export a database file:

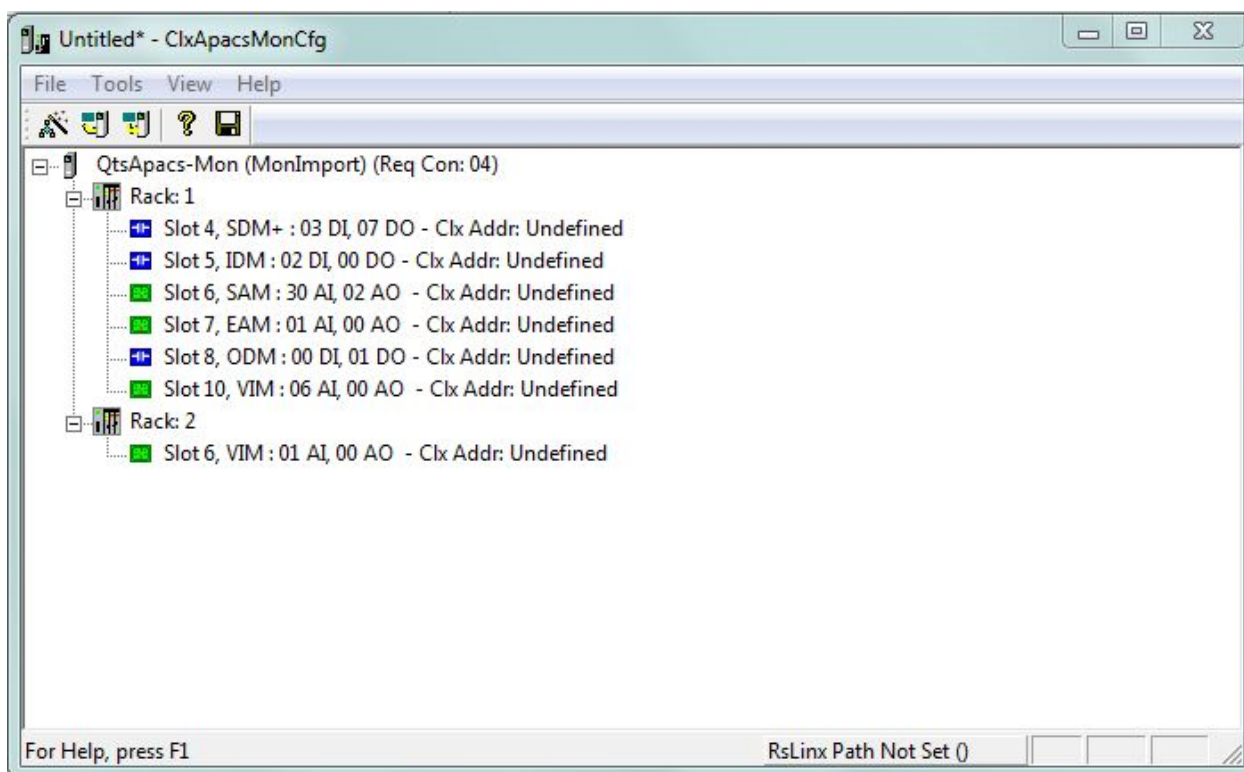
1. Go to the Module tree and put your cursor on the ACM
2. Select File/Export/Database...
3. In the Export Options box, check ASCII Format
4. Use the Directories: list to choose the destination
5. Click the Export button

Configuring the IOBUS

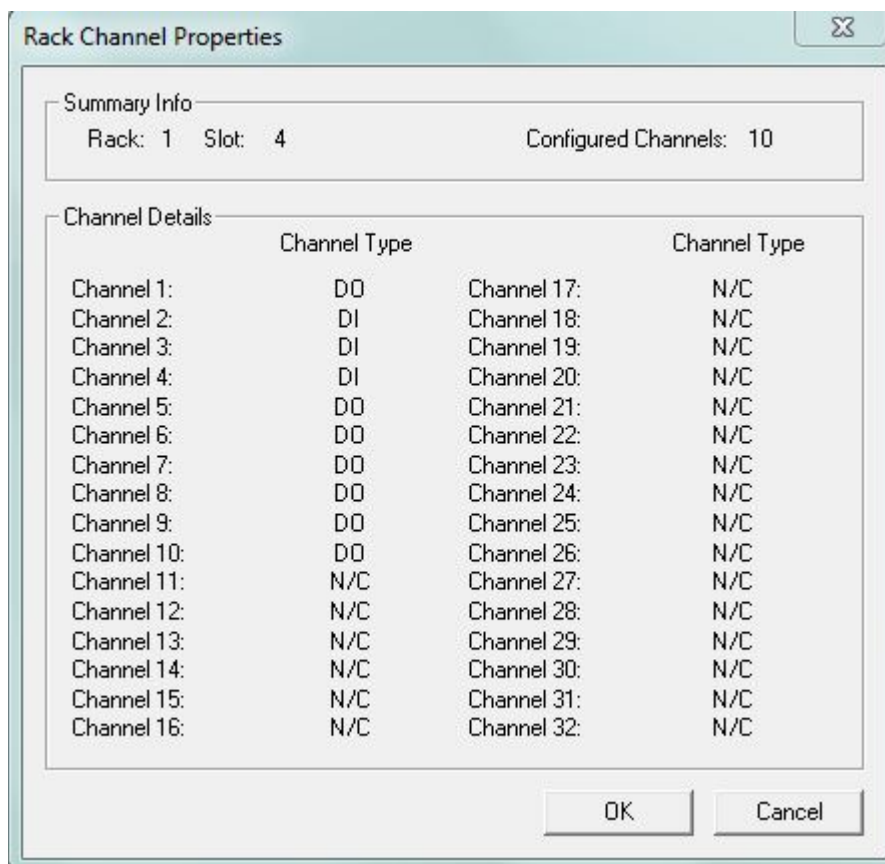
Run the monitor configuration tool, ClxApacsMonCfg.exe

Select *Tools/Import APACS Configuration* and select the 4-mation *.obt file to import.

When the file has been imported, check the module tree and confirm that the APACS modules are all present and correct.



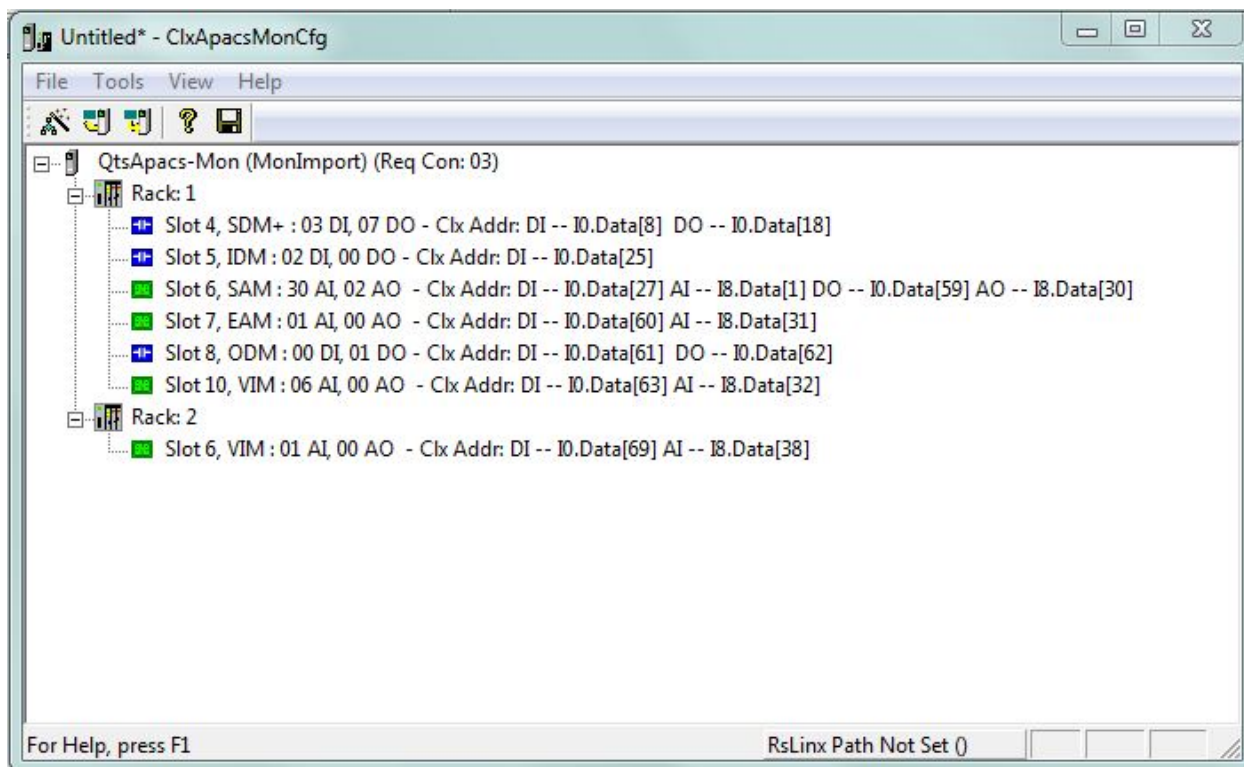
Double click on each module and confirm that the channel types for that module are all present and correct.



Assigning ControlLogix addresses

Select *Tools/Auto-allocate CLX Addressing* to map the APACS IOBUS data to ControlLogix addresses.

The module tree now shows the CLX addresses associated with each APACS module.



What gets mapped

I/O Data

APACS IOBUS discrete inputs and outputs are mapped to the input data on ControlLogix connections from 0 upwards, as required. Discrete input and output data points consist of a byte of data and are mapped to SINT data in the ControlLogix. The low bit in each SINT corresponds to the value of the point (0 or 1, False or True).

APACS IOBUS analog inputs and outputs are mapped to the input data on ControlLogix connections from 8 downward, as required. Analog inputs and outputs are mapped to REAL data in the ControlLogix.

In addition, each discrete output, analog input and analog output has an associated status byte. These are also mapped to SINT input data in the ControlLogix, in connections 0 and up.

Diagnostic Counters

QTS-CLX-APACS diagnostic counters are integers are mapped to ControlLogix input data of type INT on connection 9.

Alias Name	Offset	Description
StatRxGood	0	Good packets received from the network
StatAbortErr	1	Bad packets, abort errors



Alias Name	Offset	Description
StatBusANoiseErr	2	Bad packets, network noise
StatFrameErr	3	Bad packets, framing errors
StatCrcErr	4	Bad packets, CRC errors
StatProtocolErr	5	Protocol errors
StatRxTimeOut	6	Bad packets, timeout errors

Each alias name is prefixed by the module name and an underscore.

In addition, bit 0 of the first word of output data on connection 9 is used for the command to clear the diagnostic counters. The alias name is StatResetBit. The counters are cleared when this bit changes from 0 to 1.

Slot Status Bits

The QTS-CLX-APACS maintains an array of bits that indicate the status of the APACS modules.

In master mode, the bit is 0 if the module has good communication status and is 1 if the associated module is in error or is not responding.

Use the slot status bits to determine when you can access data from a module in master mode. Some APACS modules take several seconds to go online.

In monitor mode, the bits do not update and are always 0. Aliases to the bits are provided by the configuration tool for compatibility with master mode.

Aliases for these bits have names like

APACS_SlotStatus_R01S04

for the bit associated with the module in rack 1 slot 4.

Use the aliases to access the status bits.

TIP

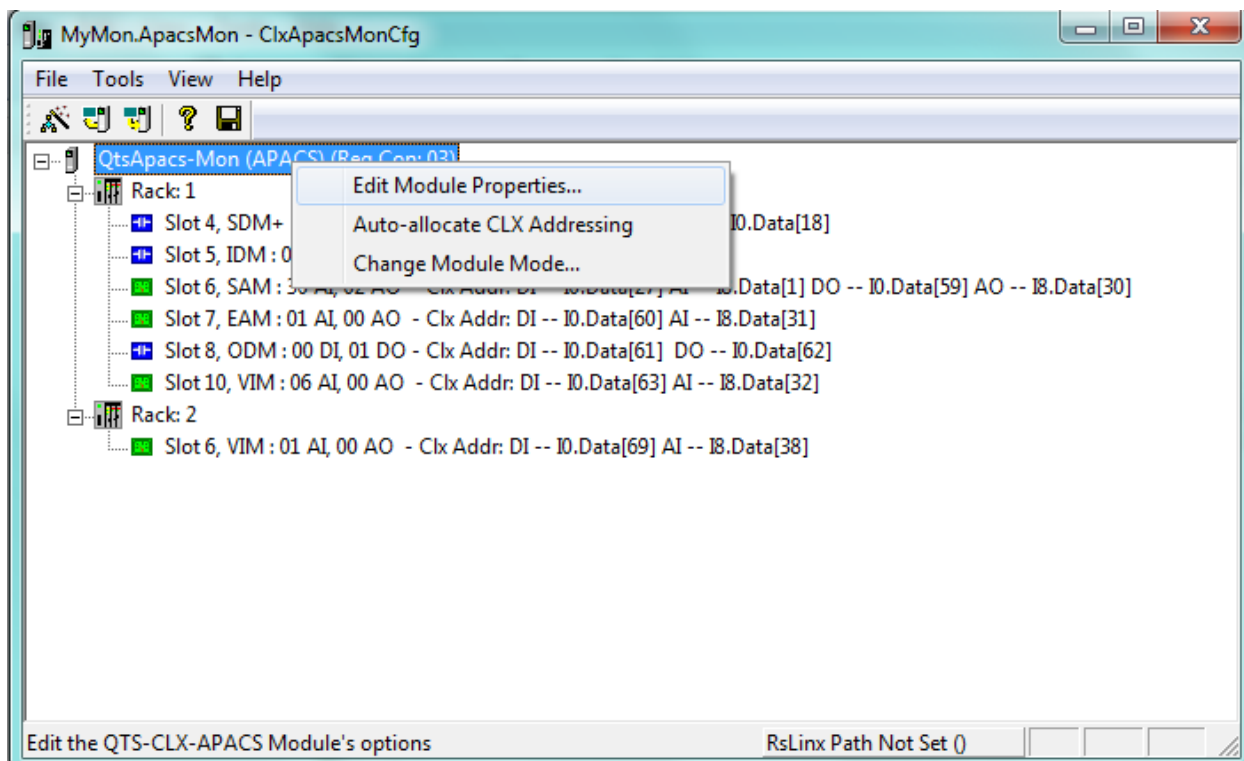
If the ControlLogix loses communication with the QTS-CLX-APACS, it sets the first four bytes of connection 0 to FF hexadecimal (11111111 binary).

Monitor these four bytes to determine if there is a problem.

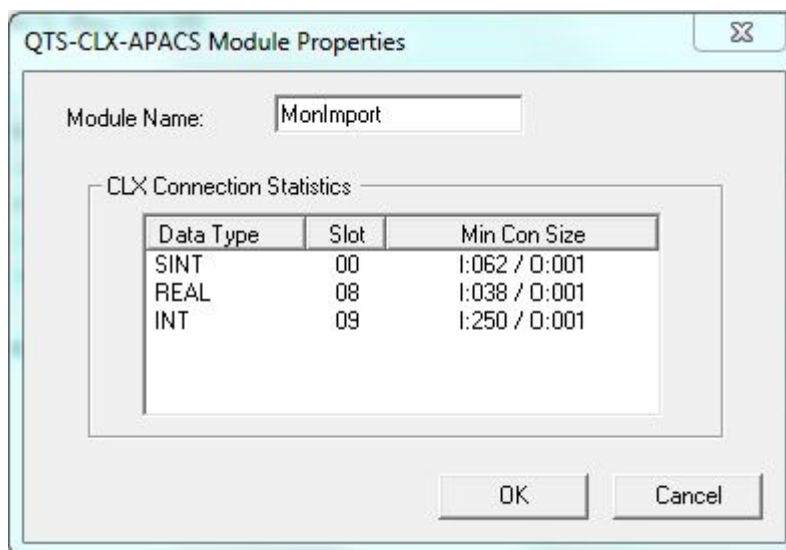
Setting the Module Name

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





The *QTS-CLX-APACS 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 ClxApacsMonCfg to build aliases for ControlLogix data.

The default name assigned when you create a monitor configuration is MonImport.

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



TIP

Use the same name that you assign the second ENBT module associated with the QTS-CLX-APACS in RSLogix 5000 to make it easy to associate aliases with the module. See page 9.

Saving a Configuration File

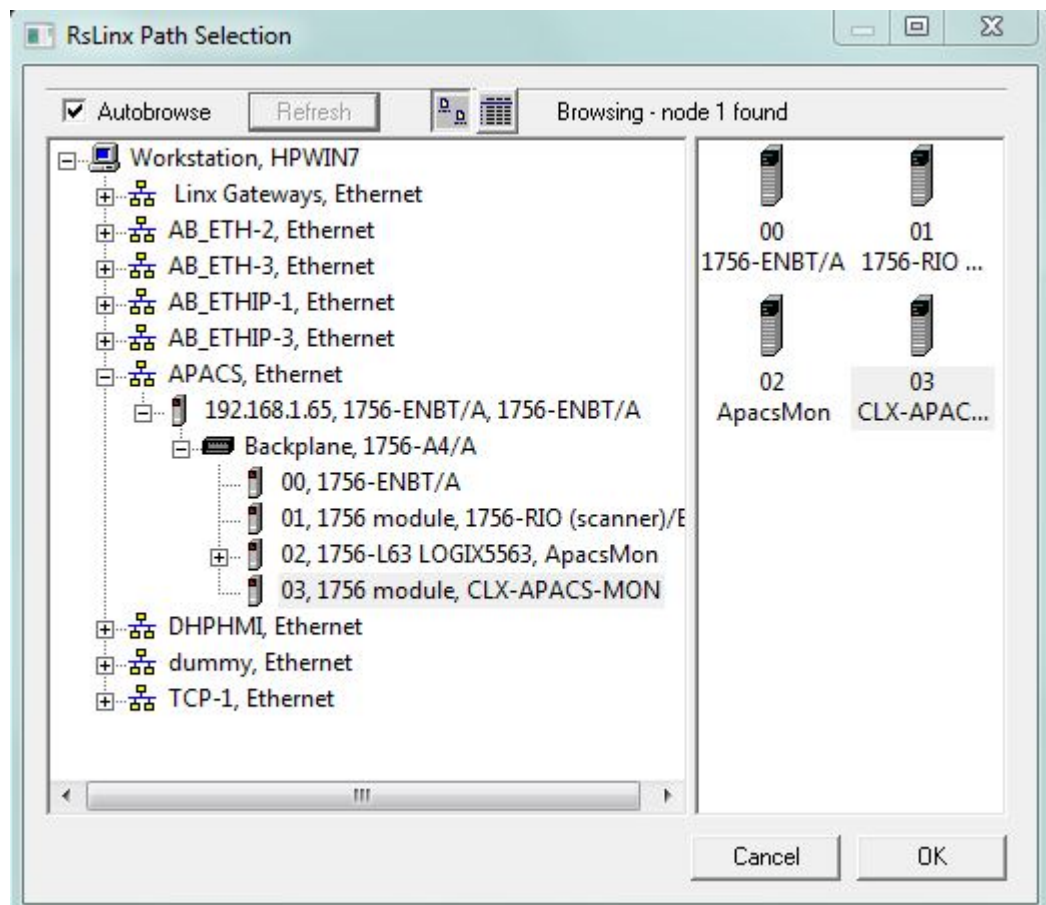
To save a configuration to disk, select *File/Save* or *File/Save As*.

Uploading and Downloading Configurations

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

To upload a configuration from the QTS-CLX-APACS, select *Tools/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.

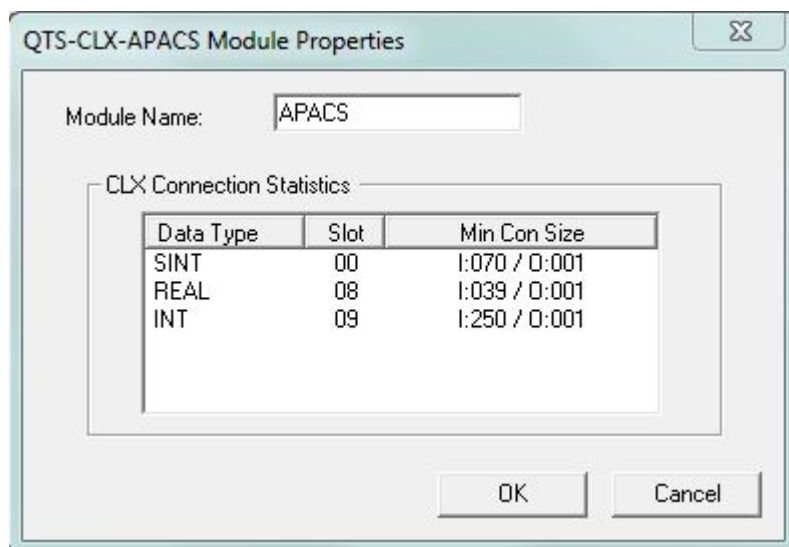


Configuring the QTS-CLX-APACS Module in RSLogix 5000.

Follow the procedure on page 8 to configure the QTS-CLX-APACS in RSLogix 5000.

To determine which connections you need to create, right click on the root of the tree and select *Edit Module Properties*.

The *QTS-CLX-APACS Module Properties* dialog box appears. It shows the required connections and the minimum connection sizes.



In the example shown, the required connections are:

- connection 0 with type SINT, minimum input size 70 and minimum output size 1
- connection 8 with type REAL, minimum input size 39 and minimum output size 1

In addition, connection 9 is always shown, although it is not required. Connection 9 is used for module diagnostics. It is recommended that you always create connection 9, with the sizes shown.

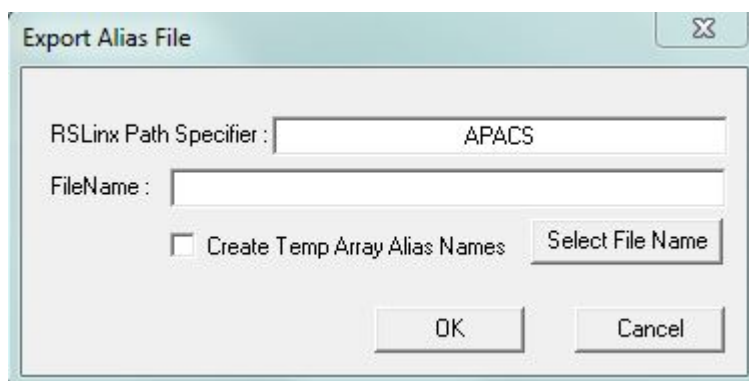
In monitor mode, the QTS-CLX-APACS does not wait for all connections to be open.

Aliases

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

Write programs using 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 Alias File...*



Enter the *RSLinx Path Specifier* to set the location of the module. This will be the name of the second ENBT module associated with the QTS-CLX-APACS modules (see page 8). In the example shown, the name is APACS.

Type the *FileName* or use the *Select File Name* button to enter the file location where the exported aliases will be saved.

If you are using monitor mode to develop an application that will be used in master mode, check the *Create Temp Array Alias Tags* checkbox. This creates aliases for the internal arrays you will need. Refer to page 25 for details.

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-APACS, delete any aliases you previously imported into RSLogix 5000 before you import the new aliases.

Alias Format

ClxApacsMonCfg builds each alias name from the Module Name and address information (Rack, Slot and Channel) 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.

Example:

```
ALIAS,"","APACS_AI_R01S06C02","APACS_AI_R01S06C02","", "APACS:8:I.Data[1]"
```

In this example, the module is in rack 1slot 6. The alias is for an analog input from channel 2 on the module, which is mapped to ControlLogix address input data at offset 1 of connection 8.

To build the alias name, ClxApacsMonCfg prefixes the name with the module name and an underscore. It prefixes the address with the RSLinx path specifier.

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.

Setting the RSLinx Path

Select *Tools/Set RSLinx Path...* to assign or change the current RSLinx path.

This may be useful if, for example, you have more than one QTS-CLX- APACS module.

Changing the Module Mode

Select *Tools/Change Module Mode...* to switch a QTS-CLX-APACS module between monitor and master modes, or to update the module firmware (see page 44)

Select the firmware to download and click *Apply*. When the download is complete, ClxApacsMonCfg displays the version of the firmware downloaded.



Using Monitor Mode for Migration

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

In monitor mode, the QTS-CLX-APACS captures live inputs and outputs from the APACS IOBUS.

You first create two arrays in the ControlLogix:

- [Module name]_TempApacsSintOutputArray[8,500] of type SINT
- [Module name]_TempApacsRealOutputArray[8,125] of type REAL

The configuration program creates aliases for IOBUS inputs and outputs and for dummy outputs in the temporary arrays.

You import those aliases into RSLogix 5000, then create a new ControlLogix application that reads live inputs from the APACS IOBUS and writes outputs to the temporary arrays, always using the aliases from ClxApacsMonCfg.

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

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

Export aliases from ClxApacsMasCfg in master mode and import them into RSLogix 5000. The names for the output aliases will be the same as those that previously pointed to the temporary array but now they will point to the corresponding IOBUS 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 should be necessary.

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

Example:

This is the alias ClxApacsMonCfg generated in monitor mode for a monitored discrete output

```
ALIAS,"","APACS_DO_R01S04C01","APACS_DO_R01S04C01","", "APACS_TempApacsSintOutputArray[0,0]"
```

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

```
ALIAS,"","APACS_DO_R01S04C01","APACS_DO_R01S04C01","", "APACS:0:O.Data[0] "
```

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

Similarly for analog outputs, this is the alias ClxApacsMonCfg generated in monitor mode for a monitored analog output

```
ALIAS,"","APACS_AO_R01S06C01","APACS_AO_R01S06C01","", "APACS_TempApacsRealOutputArray[0,0]"
```



and the corresponding alias in master mode

```
ALIAS,"","APACS_AO_R01S06C01","APACS_AO_R01S06C01","","APACS:8:O.Data[0] "
```

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

Slot Status Bits

In monitor mode, the bits do not update and are always 0. Aliases to the bits are provided by the configuration tool for compatibility with master mode.

When you develop your control application using monitor mode, include logic that monitors the slot status bits to determine when you can access I/O data, so that the logic will be in place when you switch to master mode.



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Master Mode Operation

WARNING!

Never connect the APACS in master mode to the network while the ACM is controlling I/O. It transmits even if there is no configuration and will disrupt communication.

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-APACS module in the ControlLogix chassis	4
2	Power down all APACS racks.	
3	Connect the module to the APACS IOBUS	7
4	Run the QTS-CLX-MAS master configuration program, ClxApacsMasCfg.exe	28
5	Temporarily load the monitor firmware on the QTS-CLX-APACS	28
6	Clear the stored ACM configuration on the QTS-CLX-APACS	28
7	Power up the APACS racks and wait for the OK LEDs on all modules to be green	
8	Read the captured configuration data that the ACM sent to the modules	28
9	Check that all modules and channels are correct	28
10	Assign ControlLogix addresses to the IOBUS data	30
11	Set the module name	32
12	Save the configuration	33
13	Remove the ACM	
14	Change the QTS-CLX-APACS to master mode	37
15	Download the configuration to the module	33
16	Configure the module in RSLogix 5000	8
17	Create aliases for RSLogix 5000	35
18	Import the aliases into RSLogix 5000	36
19	Use the aliases to access the data	38



ClxApacsMasCfg Software

The QTS-CLX-APACS module is supplied with a Windows configuration tool, ClxApacsMasCfg.exe for configuring the module as a master.

Use this configuration tool to:

- Switch between monitor and master mode
- Capture IOBUS configuration data from a running network
- Map I/O data to ControlLogix scheduled connections
- Save and load configuration files
- Set the RSLinx path to the QTS-CLX-APACS module
- Download and upload configurations
- Export aliases for I/O data for import into RSLogix 5000
- Update the module firmware

Configuring from an APACS IOBUS

The QTS-CLX-APACS master must be configured by capturing configuration information sent by an APACS ACM master to a running APACS IOBUS system at powerup. Power must be cycled to all APACS modules in all APACS racks in the system. All APACS modules must be present and configured. Check that the OK LEDs on all modules are green.

WARNING!

Connecting the module to the IOBUS disrupts bus traffic!

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

Wire the QTS-CLX-APACS as described on page 7. If you have been using monitor mode, the wiring does not need to be changed.

Power down all APACS racks.

Run the master config tool, ClxApacsMasCfg.exe.

Select *Tools/Change Module Mode* to temporarily load the monitor firmware.

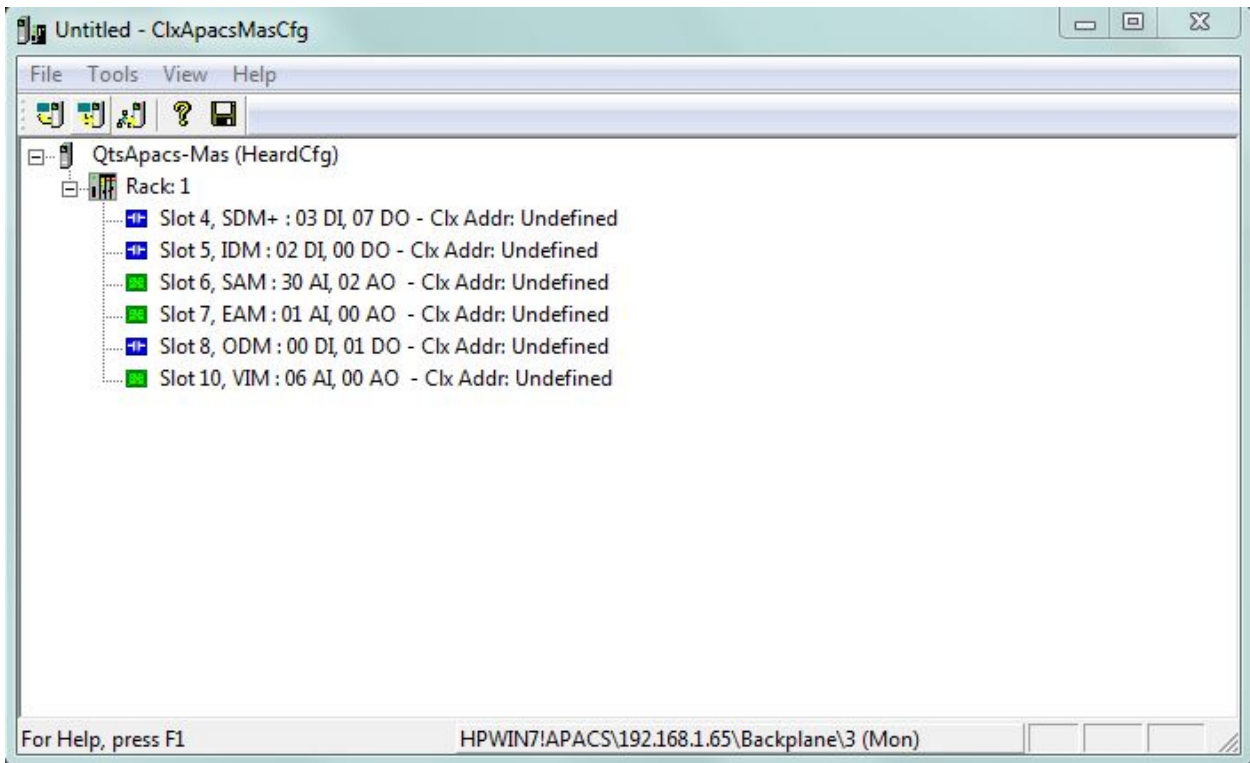
Select *Tools/Clear ACM Config* to clear any previously stored configuration.

Power up the rack and wait for the OK LEDs on all APACS modules to go green.

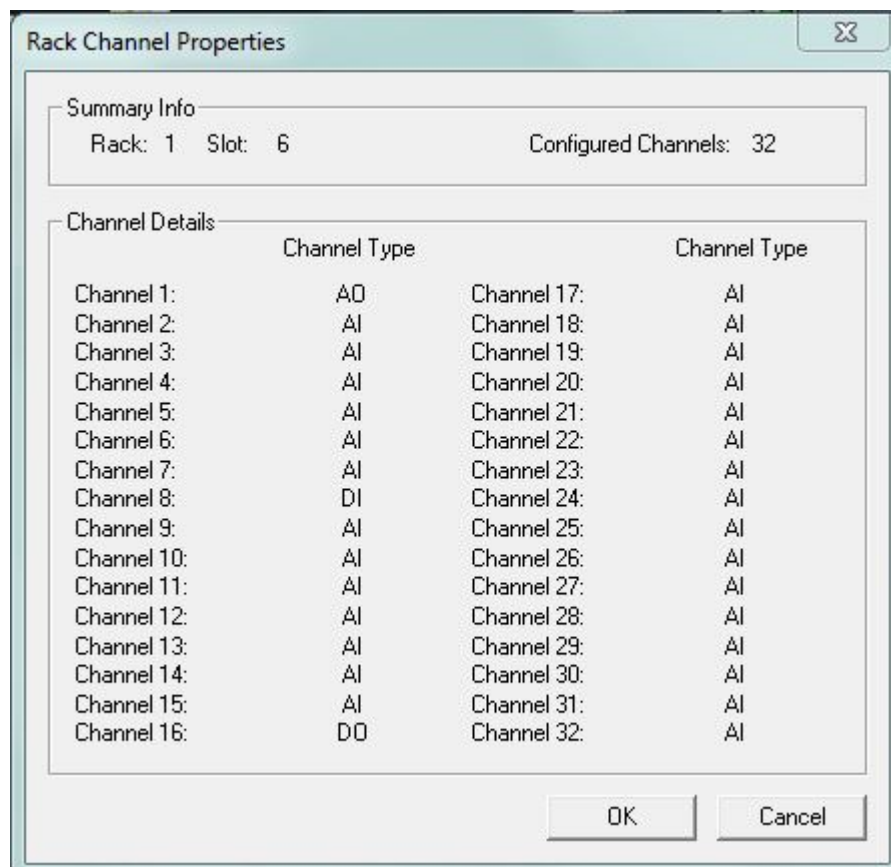
Select *Tools/ Read ACM Config* to build the module tree from the configuration data the QTS-CLX-APACS has captured..

Check the module tree and confirm that the APACS modules are all present and correct.





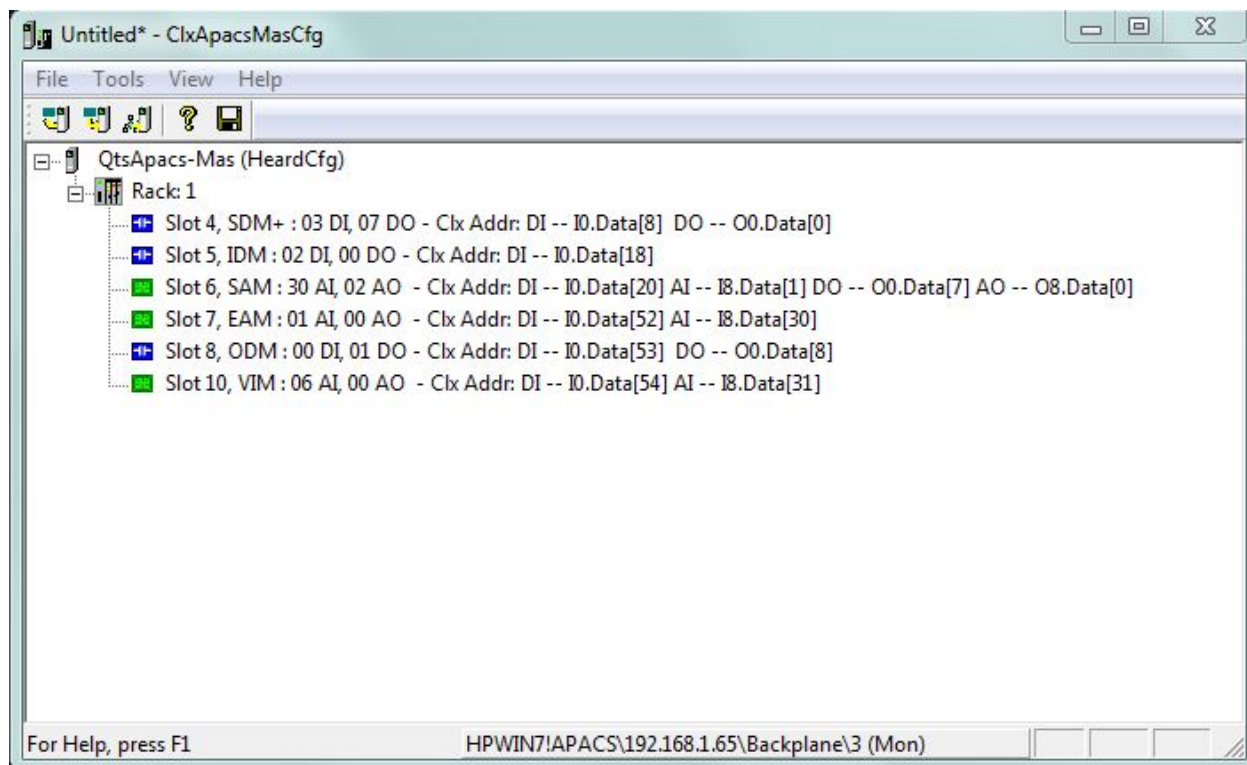
Double click on each module and confirm that the channel types for that module are all present and correct.



Assigning ControlLogix addresses

Select *Tools/Auto-allocate CLX Addressing* to map the APACS IOBUS data to ControlLogix addresses.

The module tree shows the CLX addresses associated with each APACS module.



What gets mapped

APACS IOBUS discrete inputs are mapped to the input data on ControlLogix connections from 0 upwards, as required. Discrete outputs are mapped to the output data on ControlLogix connections from 0 upwards, as required.

Discrete input and output data points consist of a byte of data and are mapped to SINT data in the ControlLogix. The low bit in each SINT corresponds to the value of the point (0 or 1, False or True).

APACS IOBUS analog inputs are mapped to the input data on ControlLogix connections from 8 downward, as required. APACS IOBUS analog outputs are mapped to the output data on ControlLogix connections from 8 downward, as required. Analog inputs and outputs are mapped to REAL data in the ControlLogix.

In addition, each discrete output, analog input and analog output has an associated status byte. These are also mapped to SINT input data in the ControlLogix, in connections 0 and up.

Diagnostic Counters

QTS-CLX-APACS diagnostic counters are integers and are mapped to ControlLogix input data of type INT on connection 9.

Alias Name	Offset	Description
StatTxGood	0	Good packets transmitted on both channels
StatBusARxGood	1	Good packets received on bus A
StatBusARxTimeOut	2	Receive timeouts on bus A
StatBusAAbortErr	3	Abort errors on bus A
StatBusANoiseErr	4	Noise errors on bus A
StatBusACrcErr	5	CRC errors on bus A
StatBusBRxGood	6	Good packets received on bus B
StatBusBRxTimeOut	7	Receive timeouts on bus B
StatBusBAbortErr	8	Abort errors on bus B
StatBusBNoiseErr	9	Noise errors on bus B
StatBusBCrcErr	10	CRC errors on bus B
StatProtocolErr	11	Protocol errors

The alias names are prefixed with the module name and an underscore.

In addition, bit 0 of the first word of output data on connection 9 is used for the command to clear the diagnostic counters. The alias name is StatResetBit. The counters are cleared when this bit changes from 0 to 1.

Slot Status Bits

The QTS-CLX-APACS maintains an array of bits that indicate the status of the APACS modules.

Use the slot status bits to determine when you can access data from a module. Some APACS modules take several seconds to go online.

In master mode, the bit is 0 if the module has good communication status and is 1 if the associated module is in error or is not responding.

In monitor mode, the bits do not update and are always 0. Aliases to the bits are provided by the configuration tool for compatibility with master mode.

Aliases for these bits have names like

APACS_SlotStatus_R01S04

for the bit associated with the module in rack 1 slot 4.

Use the aliases to access the status bits.



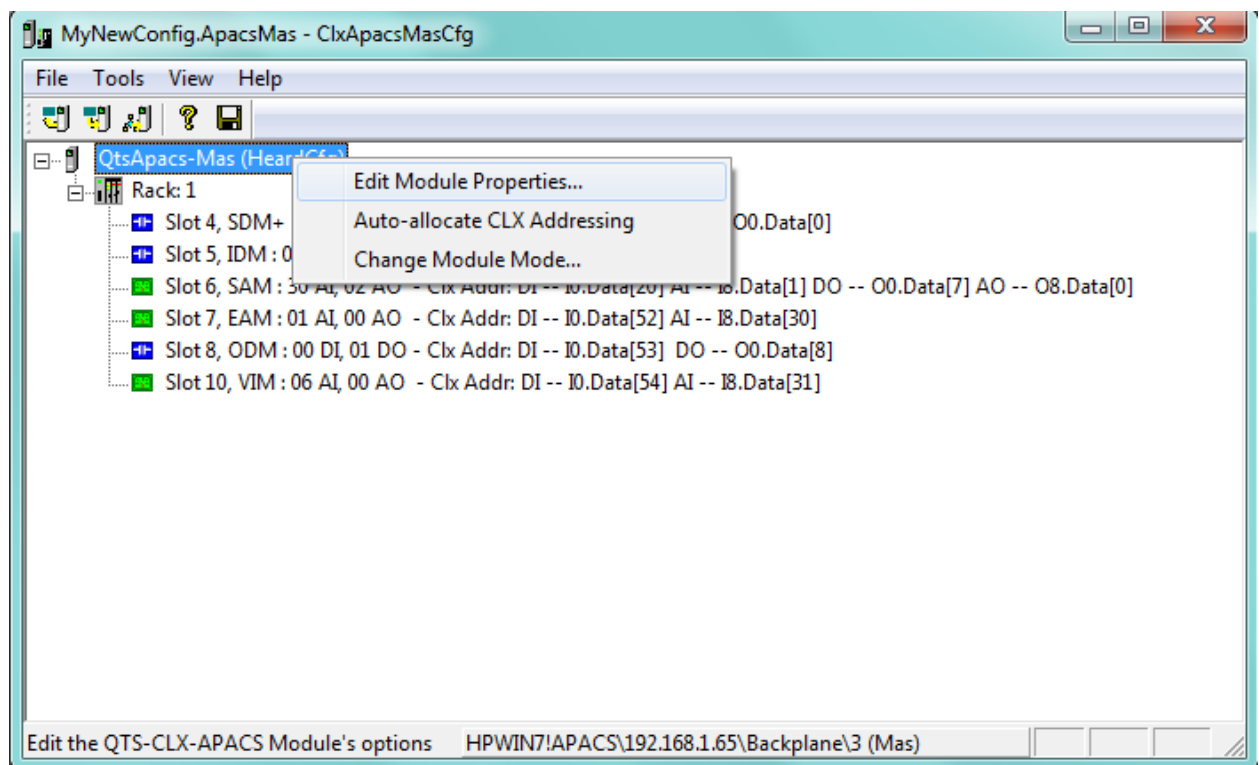
TIP

If the ControlLogix loses communication with the QTS-CLX-APACS, it sets the first four bytes of connection 0 to FF hexadecimal (11111111 binary).

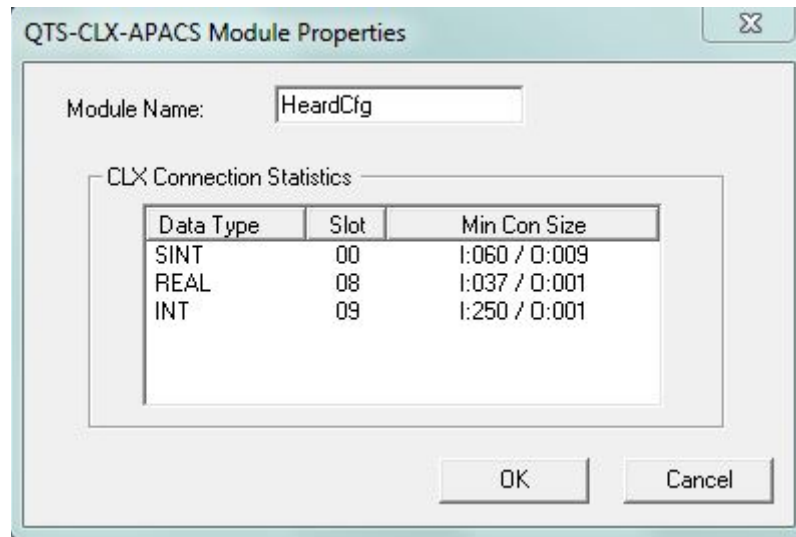
Monitor these four bytes to determine if there is a problem.

Setting the Module Name

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



The QTS-CLX-APACS 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 ClxApacsMasCf to build aliases for ControlLogix data.

The default name assigned when you create a monitor configuration is HeardCf.

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

TIP

Use the same name that you assign the second ENBT module associated with the QTS-CLX-APACS in RSLogix 5000 to make it easy to associate aliases with the module. See page 9.

Saving a Configuration File

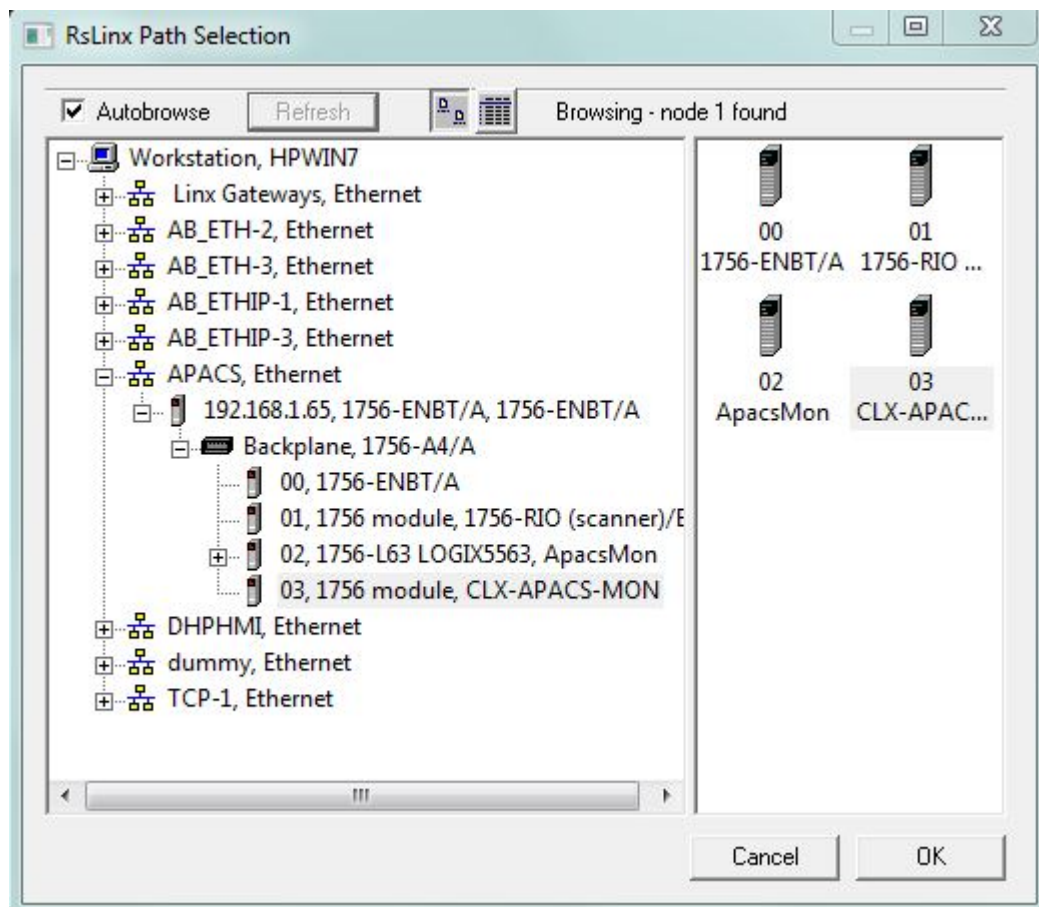
To save a configuration to disk, select *File/Save* or *File/Save As*.

Uploading and Downloading Configurations

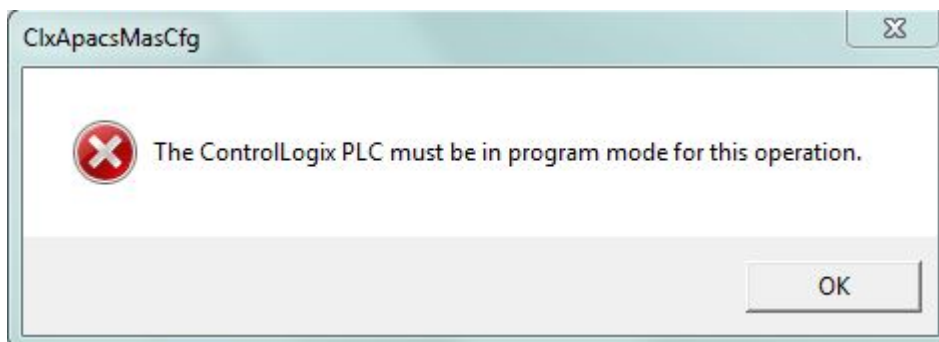
To download a configuration to the QTS-CLX-APACS, select *Tools/Download Config* or use the *Download Config to Module* button on the toolbar.

To upload a configuration from the QTS-CLX-APACS, select *Tools/Upload Config* or use the *Upload Config from Module* button on the toolbar.

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-APACS is in run mode when you download, the following message is displayed.

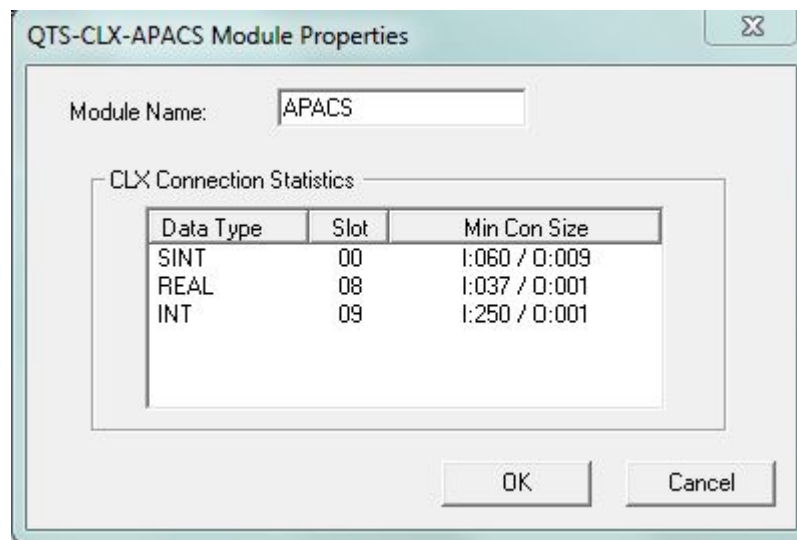


Configuring the QTS-CLX-APACS Module in RSLogix 5000.

Follow the procedure on page 9 to configure the QTS-CLX-APACS in RSLogix 5000.

To determine which connections you need to create, right click on the root of the tree and select Edit Module Properties.

The QTS-CLX-APACS Module Properties dialog box appears. It shows the required connections and the minimum connection sizes.



In the example shown, the required connections are:

- connection 0 with type SINT, minimum input size 60 and minimum output size 9
- connection 8 with type REAL, minimum input size 37 and minimum output size 1

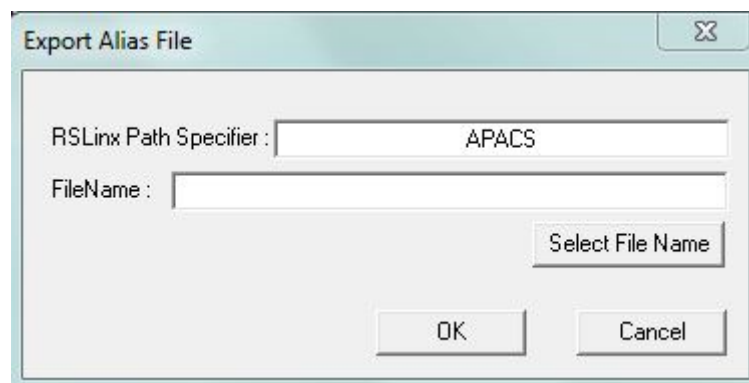
In addition, connection 9 is always shown, although it is not required. Connection 9 is used for module diagnostics. It is recommended that you always create connection 9, with the sizes shown.

Aliases

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

Write programs using 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 Alias File...*



Enter the *RSLinx Path Specifier* to set the location of the module. This will be the name of the second ENBT module associated with the QTS-CLX-APACS modules (see page 9). In the example shown, the name is APACS.

Type the *FileName* or use the *Select File Name* button to enter the file location where the exported aliases will be saved.

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-APACS, delete any aliases you previously imported into RSLogix 5000 before you import the new aliases.

Alias Format

ClxApacsMasCfg builds each alias name from the Module name and address information (Rack, Slot and Channel) 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.

To build the alias name, ClxApacsMasCfg prefixes the name with the module name and an underscore. It prefixes the ControlLogix address with the RSLinx specifier you supply.

Examples:

```
ALIAS,"","APACS_DO_R01S04C05","APACS_DO_R01S04C05","","APACS:0:O.Data[1] "
```

In this example, the alias is for a discrete output on channel 5 of the module in rack 1 slot 4, which is mapped to ControlLogix address output data at offset 1 of connection 0. The module name is APACS, as is the RSLinx path.

```
ALIAS,"","APACS_DI_R01S05C01","APACS_DI_R01S05C01","","APACS:0:I.Data[18]"
```

In this example, the alias is for a discrete input on channel 1 of the module in rack 1 slot 5, which is mapped to ControlLogix address input data at offset 18 of connection 0.

```
ALIAS,"","APACS_AI_R01S06C03","APACS_AI_R01S06C03","","APACS:8:I.Data[2]"
```

In this example, the alias is for an analog input on channel 3 of the module in rack 1 slot 6, which is mapped to ControlLogix address input data at offset 2 of connection 8.

```
ALIAS,"","APACS_AO_R01S06C01","APACS_AO_R01S06C01","","APACS:8:O.Data[0] "
```



In this example, the alias is for an analog output on channel 1 of the module in rack 1 slot 6, which is mapped to ControlLogix address output data at offset 0 of connection 8.

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.

Setting the RSLinx Path

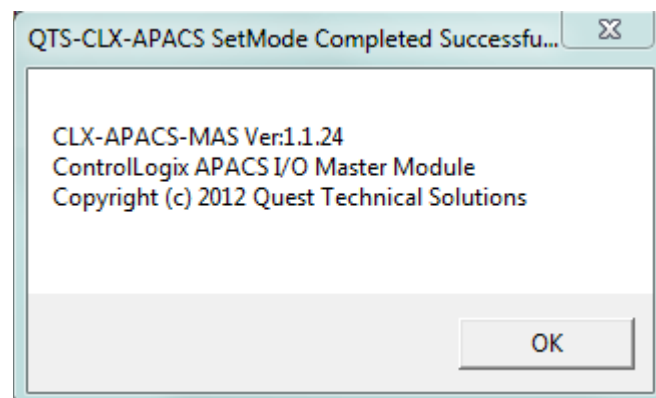
Select *Tools/Set RSLinx Path...* to assign or change the current RSLinx path.

This may be useful if, for example, you have more than one QTS-CLX- APACS module.

Changing the Module Mode

Select *Tools/Change Module Mode...* to switch a QTS-CLX-APACS module between monitor and master modes, or to update the module firmware (see page 44).

Select the firmware to download and click *Apply*. When the download is complete, ClxApacsMasCfg displays the version of the firmware downloaded.



Accessing Data

Required Connections

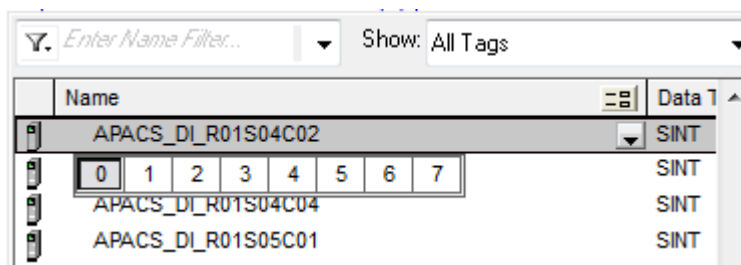
In master mode, the QTS-CLX-APACS does not begin scanning the I/O bus until all ControlLogix connections to the module are present.

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

I/O Data

Use the aliases created by ClxApacsMonCfg or ClxApacsMasCfg to access data to ensure that you are using the correct address.

Each discrete point is mapped to a SINT in the ControlLogix. The data value is the low bit in the SINT. Use the low bit of the Alias to read or change the data value.



Each analog point is mapped to a REAL in the ControlLogix.

Program/Run

In master mode, the QTS-CLX-APACS does not scan I/O in program mode.

Diagnostic Data

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

SlotStatus Bits

The QTS-CLX-APACS maintains an array of bits that indicate the status of the APACS modules.

Use the slot status bits to determine when you can access data from a module. Some APACS modules take several seconds to go online.

In master mode, the bit is 0 if the module has good communication status and is 1 if the associated module is in error or is not responding.



In monitor mode, the bits do not update and are always 0. Aliases to the bits are provided by the configuration tool for compatibility with master mode.

Aliases for these bits have names like

APACS_SlotStatus_R01S04

for the bit associated with the module in rack 1 slot 4.

Use the aliases to access the status bits.

TIP

If the ControlLogix loses communication with the QTS-CLX-APACS, it sets the first four bytes of connection 0 to FF hexadecimal (11111111 binary).

Monitor these four bytes to determine if there is a problem.

Diagnostic Counters

Refer to page 18 for details about monitor mode diagnostic counters.

Refer to page 31 for details about master mode diagnostic counters.



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 – IOBUS Status

The NET LED shows the status of I/O communication.

Monitor Mode

Color	Meaning
Red	Bad frame received
Green	Receiving good frames
Off	Idle

Master Mode

Color	Meaning
Red	Cable A error
Yellow	Cable B error
Green	Receiving good frames
Flashing	One or more APACS modules offline
Off	Idle, not trying to talk to APACS modules

CLX LED – ControlBus Status

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

Color	Meaning
Green	All required connections are open
Flashing Green/Off	Not all required connections are open (master mode)
Yellow	Connection 0 not open (master mode)



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 43 for information on clearing fatal errors. If a fatal error occurs, clear the fatal error, save the file and contact Technical Support.

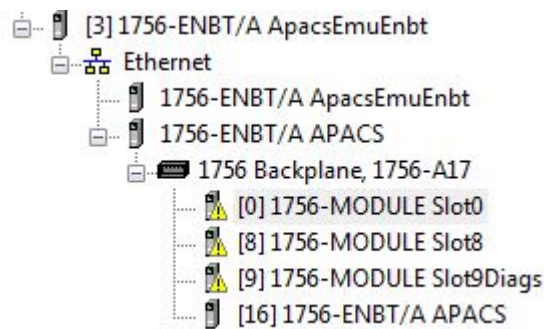
QTS-CLX-APACS Module 4-Character Display

The 4-character display shows the firmware in the module, either APACS-MON or APACS-MAS, followed by the firmware version number, and the Module Name you entered in the module configuration.

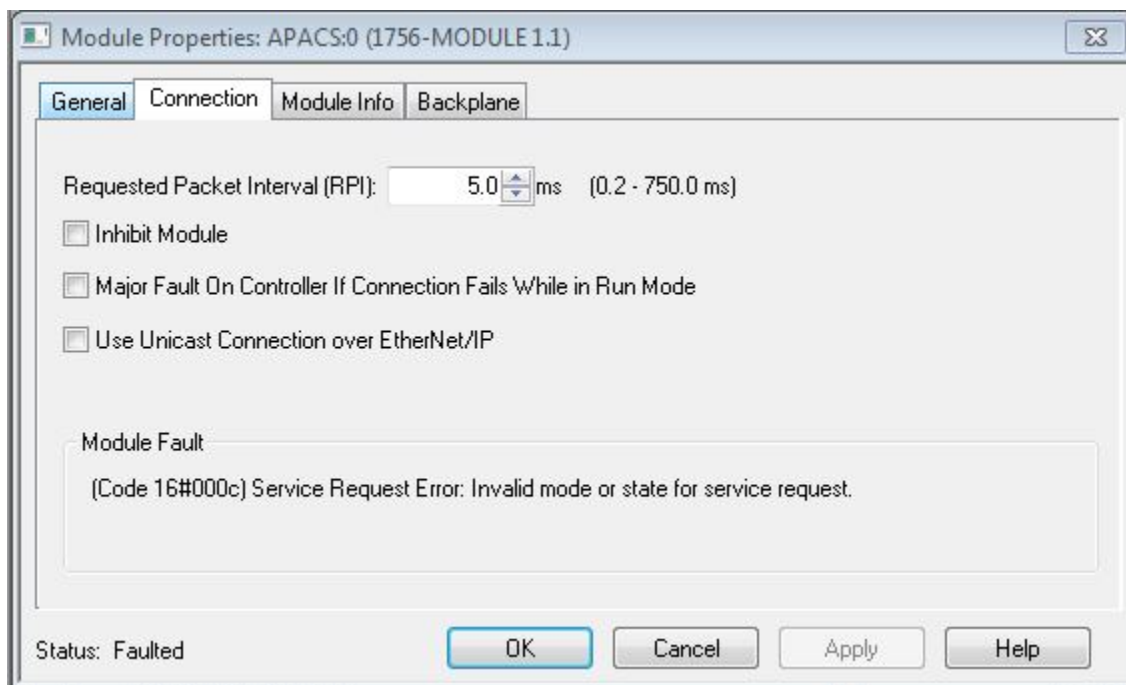
If there is no configuration in the module, the display shows <NoConfig> instead of the module name.

RSLogix 5000

If there is a problem with the connection to the module, the connections are shown with yellow triangles in the I/O Configuration tree



The *Connection* tab for each connection to the QTS-CLX-APACS module displays an error message if there is a problem with the connection to the module.



If the module has no 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.

Diagnostic Counters

Refer to page 18 for details about monitor mode diagnostic counters.

Refer to page 31 for details about master mode diagnostic counters.

Slot Status Bits

The QTS-CLX-APACS maintains an array of bits that indicate the status of the APACS modules.

Use the slot status bits to determine when you can access data from a module. Some APACS modules take several seconds to go online.

In master mode, the bit is 0 if the module has good communication status and is 1 if the associated module is in error or is not responding.

In monitor mode, the bits do not update and are always 0. Aliases to the bits are provided by the configuration tool for compatibility with master mode.

Aliases for these bits have names like

APACS_SlotStatus_R01S04



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for the bit associated with the module in rack 1 slot 4.

Use the aliases to access the status bits.

TIP

If the ControlLogix loses communication with the QTS-CLX-APACS, it sets the first four bytes of connection 0 to FF hexadecimal (11111111 binary).

Monitor these four bytes to determine if there is a problem.

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.
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 either of the two configuration programs.

Copy the new firmware file to the same directory as ClxApacsMonCfg.exe or ClxApacsMasCfg.exe.

Select *Tools/Set Module Mode*.

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

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

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



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Specifications

QTS-CLX-APACS ControlLogix Module

Parameter	Specification
Module Location	ControlLogix chassis
Function	ControlLogix module for APACS IOBUS
Maximum Backplane Current Load	5 mA @ 24VDC and 475 mA @ 5.1VDC from I/O chassis backplane
Power dissipation	2.5W 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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Warranty

Quest Technical Solutions warrants its products to be free from defects in workmanship or material under normal use and service for three years after date of shipment. Quest Technical Solutions will repair or replace without charge any equipment found to be defective during the warranty period. Final determination of the nature and responsibility for defective or damaged equipment will be made by Quest Technical Solutions personnel.

All warranties hereunder are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without Quest Technical Solutions approval or which have been subjected to accident, improper maintenance, installation or application, or on which original identification marks have been removed or altered. This Limited Warranty also will not apply to interconnecting cables or wires, consumables nor to any damage resulting from battery leakage.

In all cases Quest Technical Solutions' responsibility and liability under this warranty shall be limited to the cost of the equipment. The purchaser must obtain shipping instructions for the prepaid return of any item under this Warranty provision and compliance with such instruction shall be a condition of this warranty.

Except for the express warranty stated above Quest Technical Solutions disclaims all warranties with regard to the products sold hereunder including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of Quest Technical Solutions for damages including, but not limited to, consequential damages arising out of/or in connection with the use or performance of the Product.



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