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Intelligent Technologies

Modbus to QCPort Adapter (D77D-EMA)

Modbus TCP

Serial Modbus RS485

Installation and User Manual

January 2006
Supercedes
November 2004

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Product Overview

Description

Eaton Electrical Intelligent Technologies (*IT*) D77 Modbus Adapter (D77D-EMA) has greatly increased the functionality of the *IT* communicating products, allowing monitoring and control for *IT* IO and *IT* motor control devices. The Adapter subscans the devices and then concentrates all their data into a single Modbus node.

To simplify the configuration of the Modbus Adapter, a simple button press will auto configure the system for default operation. This feature automatically configures the IO data into registers in a convenient scan table.

For more information on the *IT* family of products, visit our web site at: www.eatonelectrical.com

Features and Benefits

The *IT* D77D-EMA includes the following significant features:

- Communications to both Modbus TCP and Serial Modbus RS485 within one device.

- Provides for control of all *IT* communicating devices connected to the Adapter

- Innovative Pass-Through mode to control Serial Modbus RS485 devices from Modbus TCP.

- Single button press auto configures the Adapter, setting up the system for default operation

- Advanced configuration using CH Studio

- 10 Base T connection for Modbus TCP

- DB9 Connection for Serial Modbus RS485

- Two independent QCPort (communication) channels

- Both QCPort channels can be configured as a Serial Modbus master for Pass-Through

- QCPort powers the Adapter; no need for an extra power supply

- Channel B QCPort Isolated

- Status LEDs

- Provides for configuration of QCPort devices from Ethernet

- Upgradeable firmware

- Small package size

- DIN rail mountable

Safety

The following safety statements relate to the installation, setup, and operation of the Eaton Electrical *IT* Modbus Adapter.

Notice
Make sure you read and understand the installation procedures in this manual **before** you attempt to operate or setup the equipment.

⚠ Warning
This instruction manual should be used for proper installation, setup, and operation of the *IT* Modbus Adapter. Improperly installing and maintaining this product can result in serious personal injury or property damage. Before attempting installation, setup or operation, read and understand this entire manual.

⚠ Warning
Only apply 24V DC to the Modbus Adapter connectors and terminals. Use of any other voltage may result in personal injury, property damage, and damage to the *IT* Modbus Adapter.

⚠ Warning
To provide continued protection against fire or shock hazard, the *IT* Modbus Adapter must be replaced if it becomes inoperative.

Environmental Ratings

Table 1: Environmental Ratings

Category	Description	Specification
Transportation and Storage	Temperature	-50°C to 80°C [-58°F to 176°F]
	Humidity	5 – 95% non-condensing
Operating	Temperature	-25°C to 65°C [-13°F to 149°F]
	Humidity	5 – 95% non-condensing
	Altitude	Above 2000 meters [6600 feet] consult factory
	Shock IEC 68-2-27	15G any direction for 11 milliseconds
	Vibration IEC 68-2-6	5 – 150 Hz, 5G, 0.7 mm maximum peak-to-peak

Approvals/Certifications

Table 2: Approvals/Certifications

Standard	Approval/Certification
Electrical/EMC	
Electrical/EMC	
ESD Immunity (IEC61000-4-2)	+/- 8kV air, +/- 4kV contact
Radiated RF (IEC61000-4-3)	10V/m 80-1000 MHz, 80% amplitude modulation @ 1kHz
Fast Transient (IEC61000-4-4)	+/- 2kV supply and control +/- 1kV communications
Surge (IEC61000-4-5)	+/- 1kV line-to-line +/- 2kV line-to-ground
RF Conducted (IEC61000-4-6)	10V, 0.15 – 80MHz
Magnetic Field (IEC61000-4-8)	30 A/m, 50Hz

Other Standards

Agency Certifications	UL 508 CE (Low Voltage Directive) CUL (CSA C22.2 No. 14)
Radiated and Conducted Emissions	EN5011 Class A
Ingress Protection	IP20
Modbus	Certified

Modbus Specifications

Table 3: Modbus Specifications

Modbus Connections	Register IO Scan 10 Modbus TCP Connections (Sockets) Pass-through Port 2000 and 2001
Max Modbus IO Size	1024 bytes input 1024 bytes output
Serial Modbus RS485 Baud Rate	1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K, 115.2K
Modbus Ethernet Baud Rate	10Mb
QCPort Channels	2 Independent Channels

Module Current Draw

Channel A	50mA
Channel B	15 mA
Serial Modbus RS485	0 mA

Catalog Numbering System

There is only one catalog number for the *IT* D77 Modbus Adapter: D77D-EMA.

Physical Features

Physical Description

The following figure illustrates the various features of the *IT* Modbus Adapter (D77D-EMA).
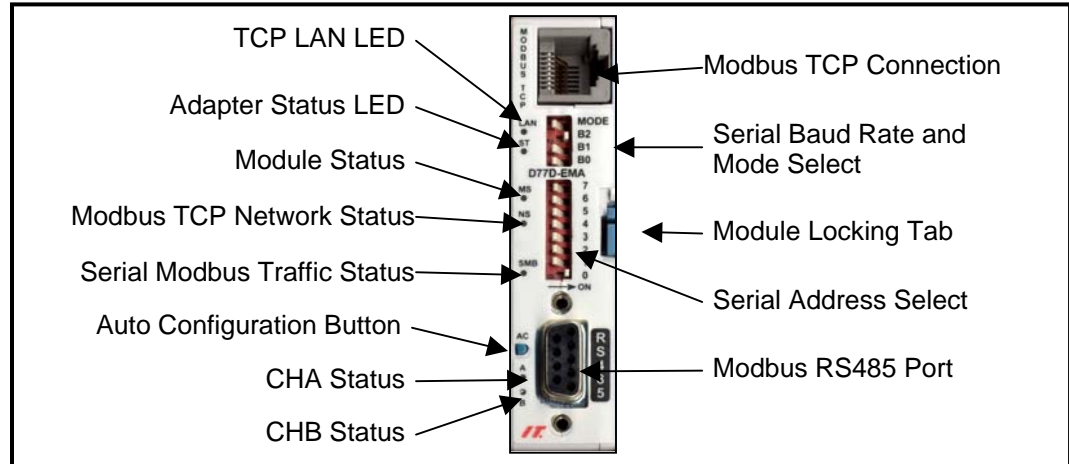
Table 4: Modbus Adapter (D77D-EMA) Front Features
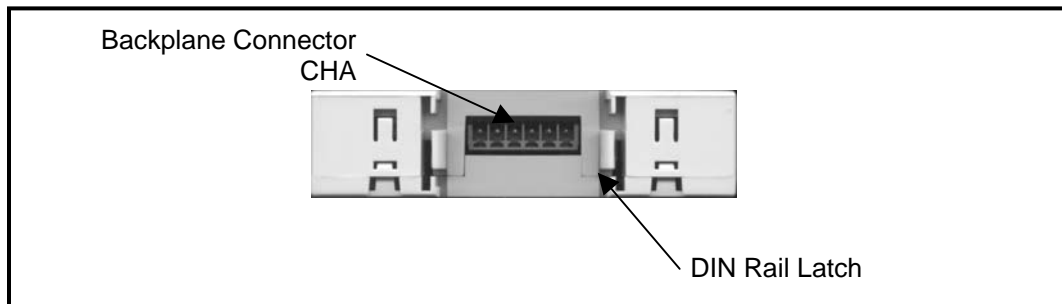
Table 5: Modbus Adapter (D77D-EMA) Back Features
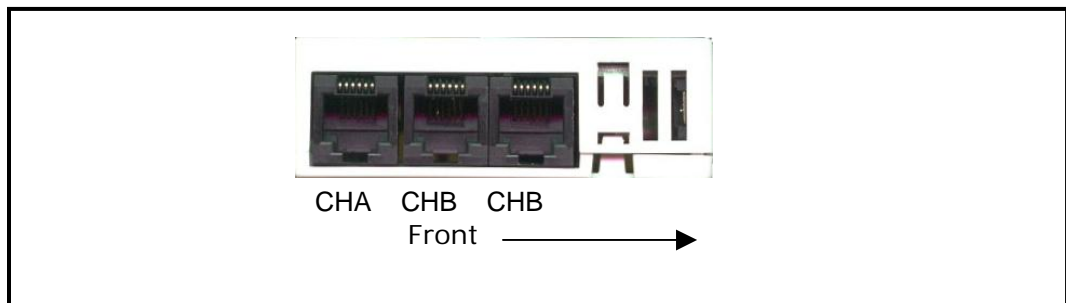
Table 6: Modbus Adapter (D77D-EMA) Bottom Features

Dimensions

The following figures illustrate the dimensions of the *IT* Modbus Adapter and ventilation space requirements for the device.
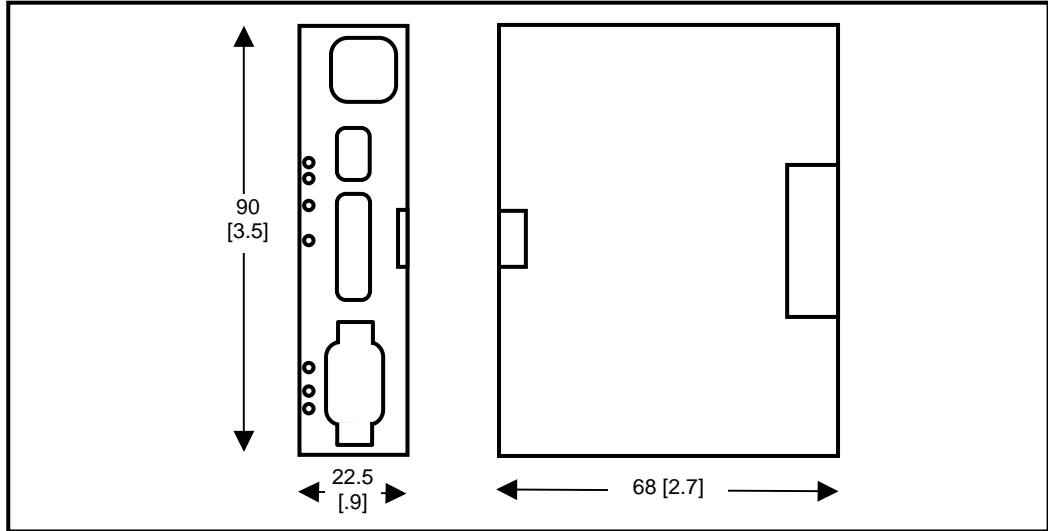
Table 7: Modbus Adapter (D77D-EMA) Dimensions, mm [in]
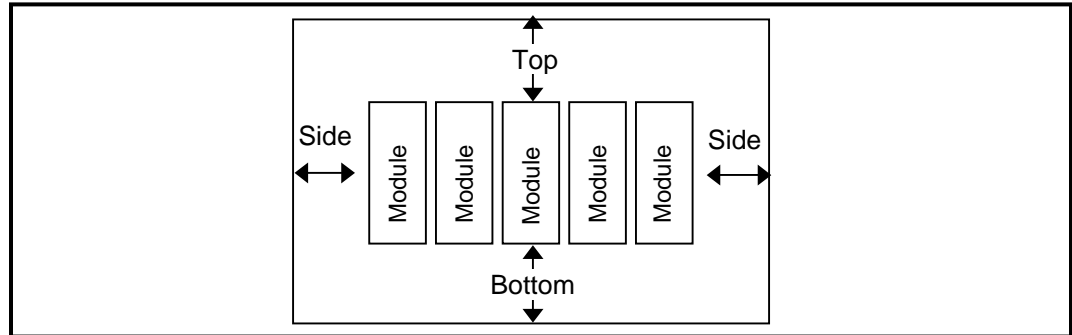
Table 8: Device Ventilation

Notice
Allow a minimum of 50mm (2 in) of ventilation space on the top and bottom of each device and to each side of a grouping of devices.

Power Supply Requirements

Power from multiple sources is required for operation of the Modbus Adapter. The Modbus Adapter CPU operates from power supplied on QCPort Channel A. The isolation between QCPort and Modbus is performed at the Modbus communication processor. This processor requires some power from Modbus to operate.

```
┌─────────────┐  ┌─────────────┐
│  Ethernet   │  │   Modbus    │
│  10Bast T   │  │   RS485     │        ┌──────────────┐
└─────────────┘  └─────────────┘        │ Power Supply │
                                        └──────────────┘
              ┌─────────────┐        ┌─────────────┐
              │     CPU     │        │     CHA     │
              └─────────────┘        └─────────────┘
                        ┌─────────────┐  ┌─────────┐
                        │  Isolation  │  │   CHB   │
                        └─────────────┘  └─────────┘
```
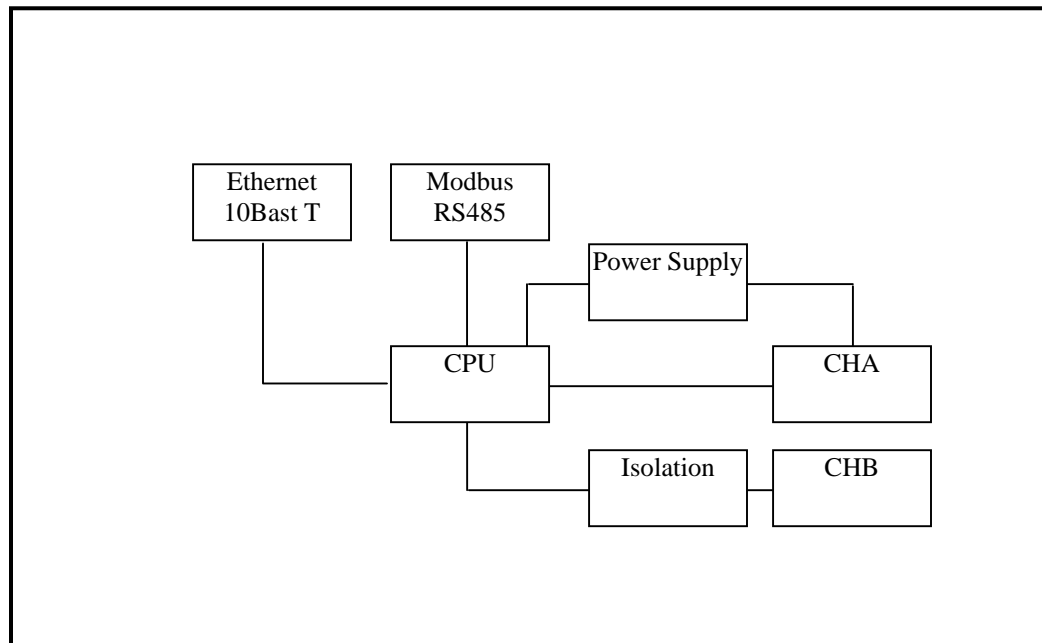
Table 9: Modbus Adapter (D77D-EMA) Power Isolation

Operation

This section provides details about the following features and aspects of D77D-EMA operation:

- Connect to Modbus

- Configuration Using CH Studio

- Auto Configuration

    o Overview

    o Preparation

    o Soft Configuration

    o Hard Configuration

- Scanning

- Adding or Removing Devices from

- Replacing an Existing Device on QCPort

- Typical Application

- Modbus Register Mapping

- Modbus Pass-Through

- Status LEDs

Connect to Modbus

There are two communication connections for the Modbus Adapter, they are Ethernet and the RS485. The Ethernet connection is 10 Base T and the RS485 connection is a DB9.

Ethernet

The Ethernet port is a RJ45 10 Base T connection and communicates at 10Mb/s. By default the speed is 10Mb/s and the mode is set to half duplex. It is possible to change the duplex mode to full duplex by setting register 7557 to a (1) from (0). For switches that support full duplex it is recommended to set this register to (1). Refer to Appendix C register 7557 in the Auto Configuration (AC) Pushbutton Functionality table. It is suggested that Cat5 or better cable be used; shielded cable is not required but is suggested if the shields can be tied to ground at one central location.

Notice
If possible, it is advised to run in full duplex mode to eliminate collisions on the Ethernet network.
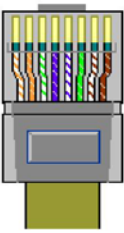
Straight Through Cable			Crossover Cable	
RJ-45 PIN	**RJ-45 PIN**		**RJ-45 PIN**	**RJ-45 PIN**
1 Tx+	1 Tx+		1 Rx+	3 Tx+
2 Tx-	2 Tx-		2 Rc-	6 Tx-
3 Rc+	3 Rc+		3 Tx+	1 Rc+
6 Rc-	6 Rc-		6 Tx-	2 Rc-

Figure 1 Ethernet Cabling

When a hub or a switch is used, the type of cable to use is a straight through cable since most hubs and switches perform the crossover inside the device. When connecting from a PC directly to the D77D-EMA, a crossover cable will be needed unless your PC can automatically detect that a crossover is needed.

Ethernet Server Connections

The Modbus Adapter supports 10 active server connections over port 502. Each of the server connections can be used to read and write to any of the supported registers within the Modbus Adapter. It is not required to choose the server connection to communicate with the Adapter, the Adapter will automatically choose the next available when another connection is made. For example multiple devices such as a HMI, system controller and a tool can all be connected to adapter each using a unique connection.

To support the pass-through feature from Ethernet to QCPort Channel A and Channel B, ports 2000 and 2001 each support 1 active server connection. For more information on Pass-Through, refer to section Modbus Pass-Through.

Ethernet Addressing

The Modbus Adapter supports addressing using a Static IP address and also using BOOTP (default).

The following registers are used to setup and configure the TCP address.

Table 10 TCP/IP Configuration

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
MAC ID	7527	3	48 bit Hardware address	R
IP address	7530	2	The current active IP address HH.HL.LH.LL Word 7530 - HH HL Word 7531 - LH LL	R/W
IP address mode	7532	1	0 – 192.168.10.1 1 – Static IP 2 – BootP (default) 3 – Save (saves the BootP address as static and sets mode to static IP)	R/W
Subnet Mask	7533	2	The current active subnet mask HH.HL.LH.LL Word 7533 - HH HL Word 7534 - LH LL	R/W
Default Gateway	7535	2	The currently set default Gateway HH.HL.LH.LL Word 7535 - HH HL Word 7536 - LH LL	R/W
Allowed Sockets	7537	1	# of Modbus socket connections allowed	R/W
Modbus TCP Slave Address	7538	1	The MBAP header unit ID which this Modbus Adapter will respond to (default 1)	R/W

It is suggested that a BootP service is used to set the original IP address within the Adapter. Once the IP is chosen set Register 7532 to 3 and the IP address will be saved as the static address and will use that address at every power up. Register 7532 will be set to 1 automatically after the IP address is saved to nonvolatile memory.

If a BootP service is to be used to set the IP address at every power up, it is not necessary to change the setting for register 7532.

Serial Modbus RS485

The serial port uses the standard Serial Modbus RS485 connection, a DB9. Refer to the figure below for details on the pin out.

1	GND	GND
5	-	B
9	+	A
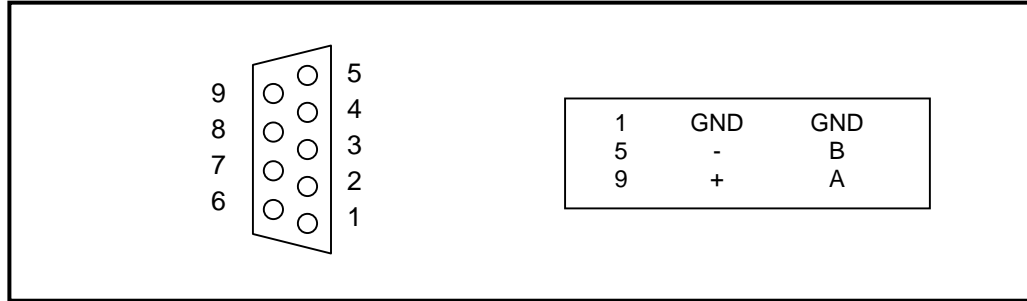
Table 11: Modbus Connection

Set the Serial Modbus Address

The address and baud can only be set through the hardware. A software tool (such as CH Studio) can view the settings for the Modbus Adapter address and baud rate, but cannot be used to modify them.

The address is set using DIP switches on the face of the Modbus Adapter. Refer to the following instructions, figure, and table when setting the address.

- Moving a DIP switch to the right is **ON** and moving the switch to the left is **OFF**. The address is in binary with the major units numbered to the right of the switch on the label. Adding up the major units set to **ON** will provide the address of the Modbus Adapter.

  Example: To set the address to 25, start from the top (or 128) and set the switches from the top down to OFF, OFF, OFF, ON, ON, OFF, OFF, ON (16+8+1=25).

To set the serial Modbus address, place the address DIP switches in the desired positions.
The following example is set to address=25

ON/1

	128
	64
	32
	16
	8
	4
	2
	1
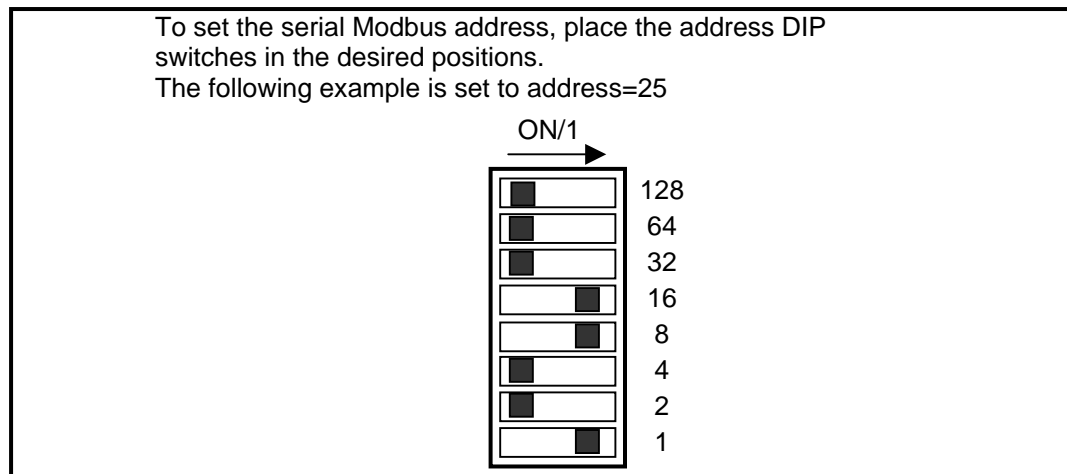
Table 12: Address DIP Switch Designation

Set the Serial Modbus RS485 Baud Rate

To set the baud rate for the serial Modbus, change the B0 through B2 DIP Switch settings. The following table displays valid baud rates.

Table 13: Baud Rate Table

B0	B1	B2	Baud
OFF	OFF	OFF	1200
ON	OFF	OFF	2400
OFF	ON	OFF	4800
ON	ON	OFF	9600
OFF	OFF	ON	19200
ON	OFF	ON	38400
OFF	ON	ON	57600
ON	ON	ON	115200

To set the serial Modbus baud rate, place the baud DIP switches in the desired positions.
The following example is set to baud of 1200

ON/1

MODE
B2
B1
B0

Table 14: Baud Rate DIP Switch Designation

Set the Serial Modbus RS485 Mode

To set the serial Modbus mode to ASCII or RTU use the MODE DIP Switch.

To set the serial Modbus MODE, place the MODE DIP Switch in the desired position.
OFF = RTU
ON = ASCII
The following example is set to RTU

ON/1

MODE
B2
B1
B0

Table 15: MODE DIP Switch Designation

Configuration Using CH Studio

CH Studio Component Manager

Pressing the Auto Configuration button performs a basic setup of the D77D-EMA and connected devices that is sufficient for most applications. When an application requires that parameters have to be modified from default, use CH Studio Component Manager. The CH Studio tool is used for configuration, maintenance and monitoring of Eaton Electrical nodes and QCPort devices. After going on-line, using CH Studio, the Studio Explorer will display the Eaton Electrical nodes on Modbus and allow the user to "drill" down through the D77D-EMA to view and configure the QCPort devices.

Part of the setup of the TCP/IP network is to select the range of temporary IP address to assign devices and the setup of the subnet mask and default gateway. For most users, these settings will not need to be modified from default since CH Studio using current network settings to preconfigure the TCP/IP network settings. Once these parameters are setup, pressing the Go Online button will allow CH Studio to search for Eaton Electrical nodes on Modbus TCP.
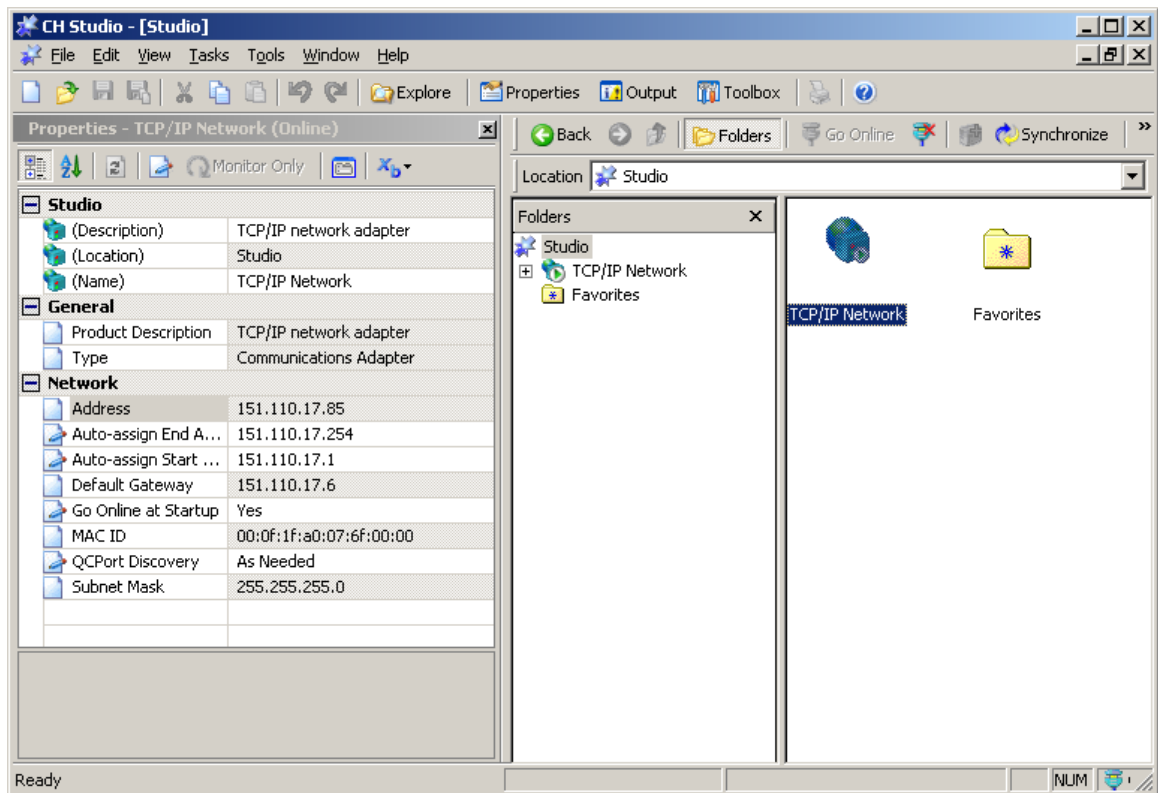
Table 16 TCP/IP Setup

An unconfigured D77D-EMA with out an IP address will be visible from CH Studio due to a feature called Discovery that is build into each Eaton Electrical Ethernet Node. Once the node shows up on the explorer with in CH Studio, a temporary IP address is assigned to the D77D-EMA from the range of IP addresses in the TCP/IP network setup.
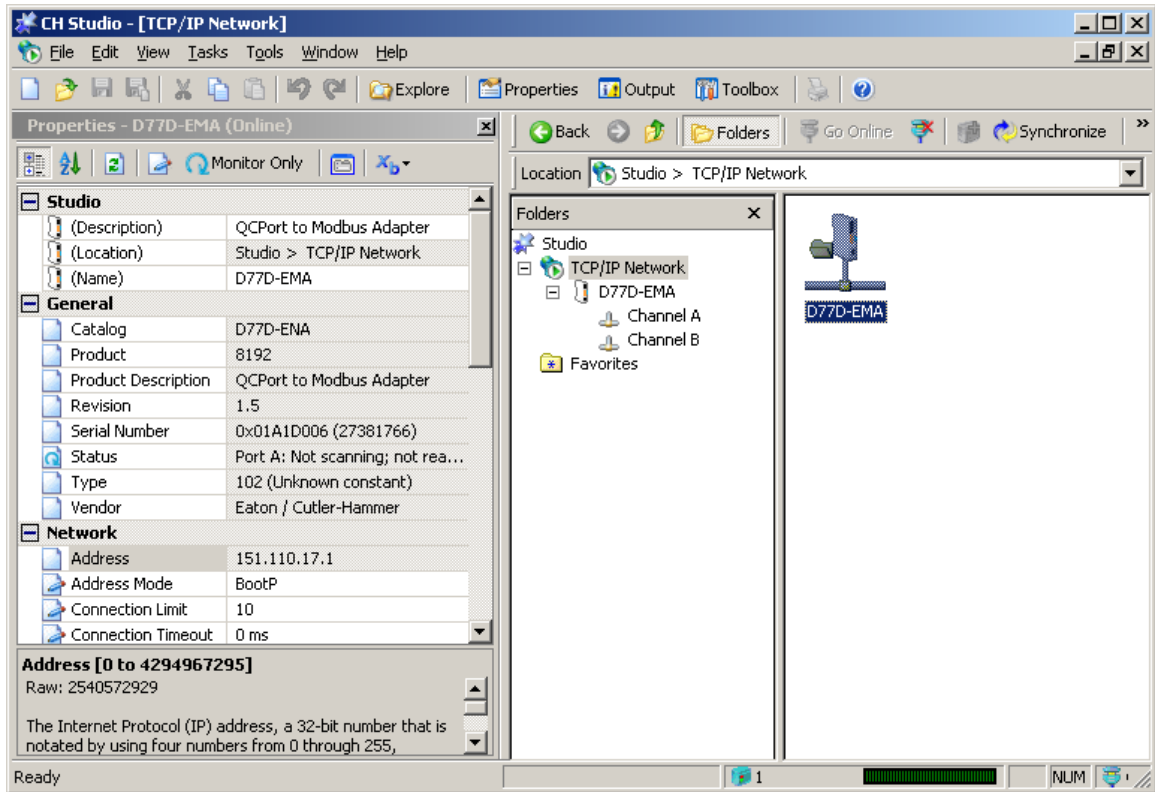
Table 17 Studio Explorer (Docked View)

General Tab

Once a Modbus node or QCPort device is selected, the Properties Window will display the attributes and parameters of that device. From this window, node/device parameters can be viewed and modified. This information is also contained within the Property Pages of the node/device that is being viewed by going to the toolbar and selecting View and then Property Pages (Shift + F4).

The parameters such as the IP address, address mode and other D77D-EMA parameters can be directly modified. It is also possible to "drill" down into the QCPort channels to configure the QCPort devices once an IP address has been set on the D77D-EMA. The general tab will provide the ability to set a static IP address or assign the IP address using BootP and set the other network parameters.
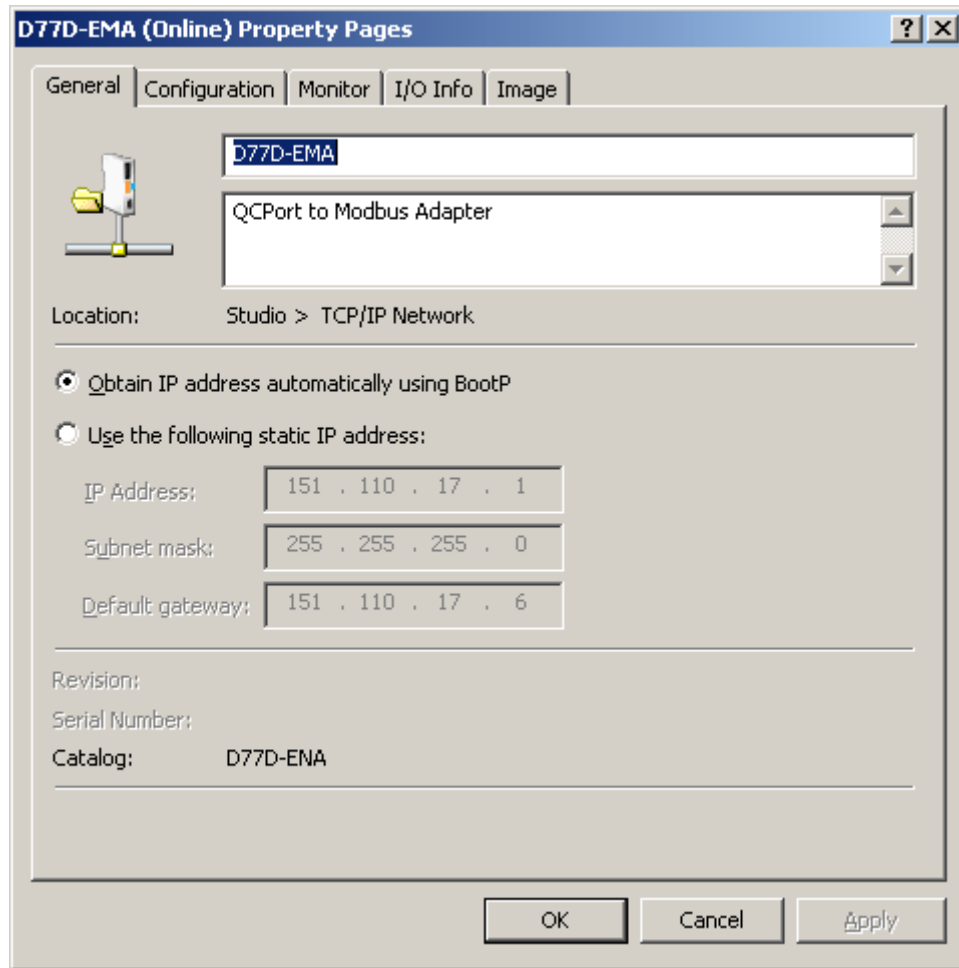
Table 18 General Tab

Configuration Tab

The configuration tab is only used for setting up the Modbus Pass-Through parameters, if Modbus Pass-Through is not going to be used then it is not necessary to set any of these parameters. If Modbus Pass-Through is going to be used, it is important to set up the Serial Modbus baud rate and parity of the Modbus network devices. All the Serial Modbus devices must be set to the same baud rate as the D77D-EMA Pass-Through settings. If a device takes more than 100 ms to respond to a Serial Modbus message, it is important to set the Allow slow response check box.
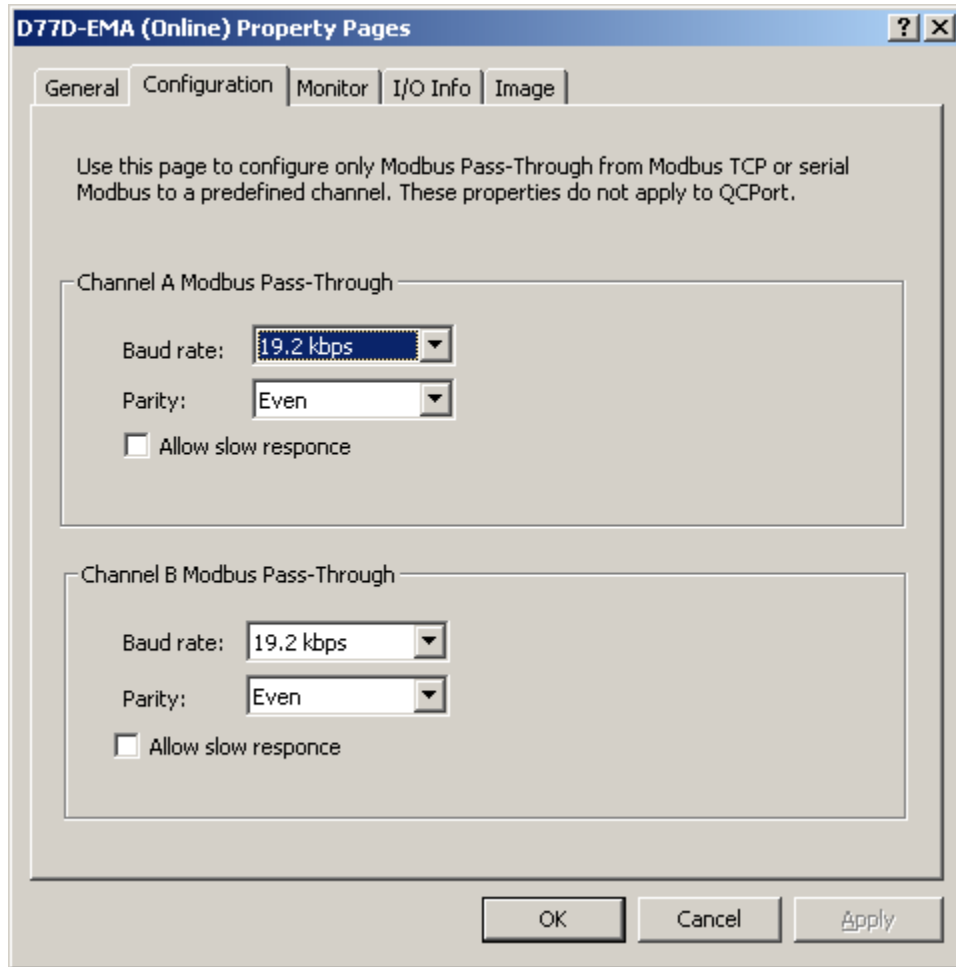
Table 19 Configuration Tab

Monitor Tab

Once the D77D-EMA is configured, viewing the Monitor Tab will provide information as to the state of the D77D-EMA.

D77D-EMA (Online) Property Pages

General | Configuration | Monitor | I/O Info | Image

Channel A Scan status
- Scanning
- Ready to scan

Channel A Fault status
- Device faulted
- Group duplicated
- Configuration corrupted

Channel B Scan status
- Scanning
- Ready to scan

Channel B Fault status
- Device faulted
- Group duplicated
- Configuration corrupted

OK | Cancel | Apply
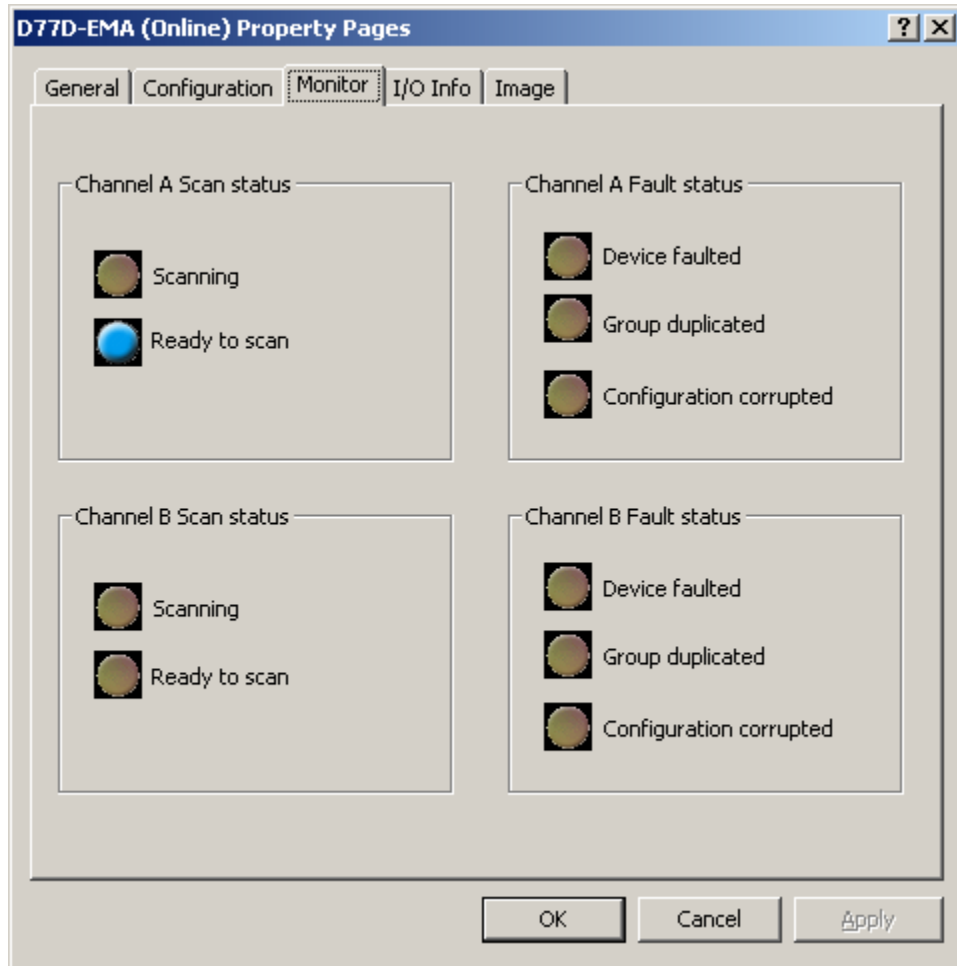
Table 20 Monitor Tab

I/O Info Tab

The I/O Info Tab provides all the information as to the IO mapping of the connected QCPort devices. Not only will it give the order of the mapped IO, but also the register information for the inputs, outputs and the status registers for diagnostics.
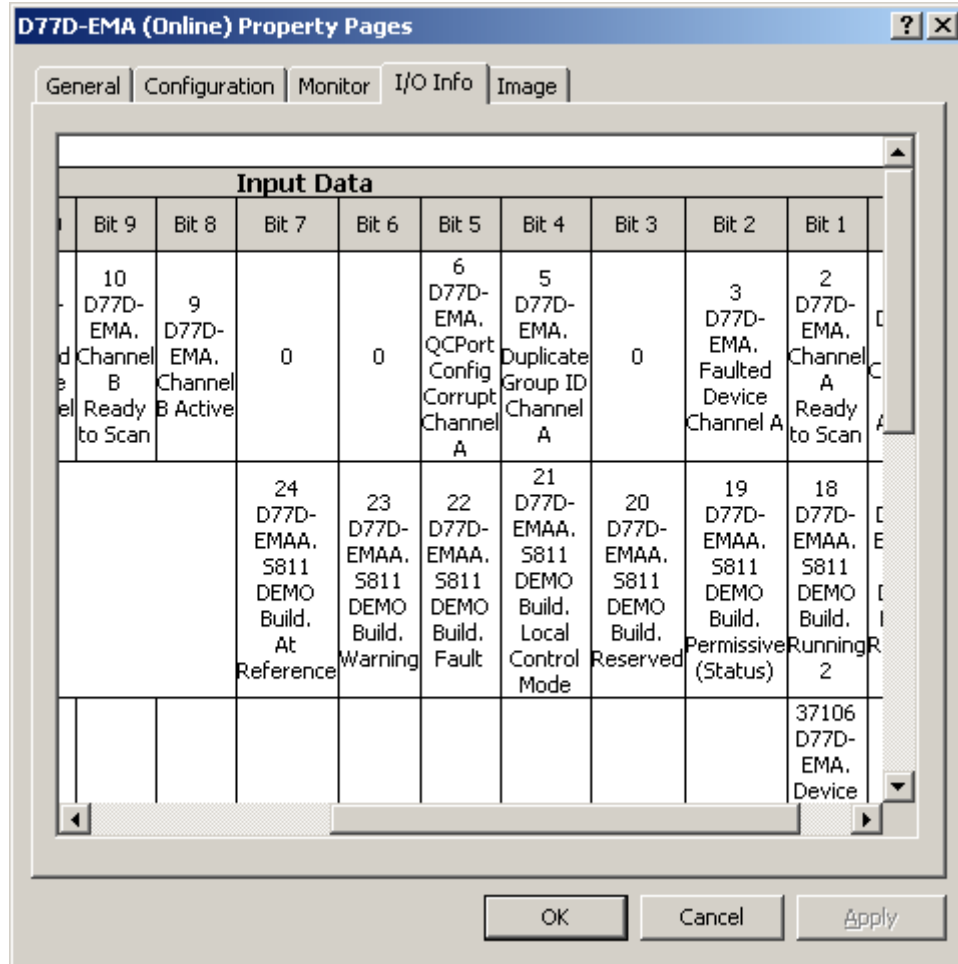
Table 21 I/O Info Tab

Using Another Configuration Tool

It is possible to configure the D77D-EMA using another Modbus TCP tool by referencing the registers located in the back of this manual. It is not possible to configure QCPort devices using a tool other than CH Studio.

Auto Configuration

Overview

When an auto configuration is performed, the D77D-EMA assembles the IO data into input data registers and output data registers for the devices on QCPort channels CHA and CHB. The data is assembled by QCPort channel and then in ascending order by device Group ID (address switch setting on device) using the default IO assembly for each device. For further assistance on the IO size and how data is mapped within the registers, refer to the user manual for that device or refer to CH Studio for on-line help.

Once the QCPort system is assembled, powered and properly addressed, one of two types of auto configuration can be performed. The procedure for performing a Soft Configuration or Hard Configuration starts on **Page 26**. No additional configuration of the D77D-EMA is required for normal operation.

Notice
Use CH Studio when it is necessary to configure enhanced features

Preparation

Prior to performing an auto configuration procedure, take the following steps to ensure a properly assembled system.

- Verify that all QCPort devices are set to a unique Group ID (QCPort address). For Group ID settings above the Group ID switch range, CH Studio is required.
- Verify the sizing of the power supply.
- Check that QCPort is properly wired and properly terminated.
- Refer to MN05001002E *(QCPort System Installation and Planning Guide)* for further information on QCPort System design.

When the system is powered properly and Modbus is connected properly, the status LEDs should be in the following state:

Table 22 Proper State of LEDs

LED	State
LAN	
ST (Status)	LED Blinking Green
MS	Solid Green or Flashing Green
NS	Solid Green or Flashing Green
SMB	
CHA	Off or Intermittent Flash
CHB	Off or Intermittent Flash

For more information on the LED state meanings, refer to section Status LEDs.

Soft Configuration

Performing a soft configuration reconfigures the internal QCPort scan list to match all physically connected devices on CHA and CHB. It generates the register mappings that contain the IO information for these connected devices. To disable the auto configure (AC) push button refer to register 7556 in Appendix C: Register Mapping.

Soft Configuration:

1. Erases the old QCPort scan list and creates a new scan list

2. Erases the old register mappings and creates new register mapping

3. Leaves the QCPort device's parameters unchanged

Notice
If an active network needs to be reconfigured, the Modbus scan of the specific D77D-EMA must cease and the scan bits for Channel A and Channel B must be cleared. If the Auto Configuration button is pressed during Modbus network scanning of the D77D-EMA, configuration will not occur.

Soft Configuration Procedure

1. Set each QCPort device to a unique non-zero Group ID (per QCPort channel) using the manual Group ID switches. To set the Group ID to an extended address greater than the setting on the switch, use CH Studio.

2. Apply power to each of the QCPort channel that has QCPort devices on it. This ensures that each device is powered and that the D77D-EMA is powered.

3. Using a pointed tool (such as a ball point pen), lightly press the Auto Configuration button and hold for five seconds. During this time, the D77D-EMA status LED will turn on solid green. After three seconds, the D77D-EMA status LEDs will all turn on, then blink three times in one second and then goes off, signaling the start of the Soft Configuration process. At this time, release the AC button.

Press and hold the Configuration Button for five seconds to perform a Soft Configuration.

Configures the Modbus IO register mappings for the Modbus Adapter.

AC
A
B
RS485

Table 23 Soft Configuration

None of the QCPort devices may be faulted while performing an IO Configuration. To verify that the devices are not faulted, check status LED for each device. The status LED for most devices is in upper left of most products and may not be marked. A faulted state will have a LED flash of500 milliseconds on, 500milliseconds off.

Notice
If, for any reason, the system is not configured properly, when the Auto Configuration button is pressed the MS LED will go to solid red or flashing red. This indicates that further configuration is required. For example, this would occur if two devices on the same QCPort channel have the same Group ID.

Hard Configuration

Performing a Hard Configuration reconfigures the internal QCPort scan list to match all physically connected devices on CHA and CHB. It generates the Modbus IO register mappings that contain the input/output information for these connected devices. In addition, the QCPort device parameters for all devices on QCPort CHA and CHB are set to "factory default."

Hard Configuration:

- Sets all QCPort device parameters to their "factory default" settings

- Erases the old QCPort scan list and creates a new scan list

- Erases the old Modbus IO register mappings and creates new Modbus IO register mappings

⚠ Warning
If any connected device has been custom configured, a Hard Configuration will return the device's parameters to "factory default".

Hard Configuration Procedure

1. Set each QCPort device to a unique non-zero Group ID (per QCPort channel) using the manual Group ID switches. To set the Group ID to an extended address greater than the setting on the switch, use CH Studio.

2. If Channel B is being used, apply power to that channel so that the devices on Channel B are active when the configuration takes place.

3. Using a pointed tool (such as a ball point pen), lightly press the Auto Configuration button **while applying power to CHA and the D77D-EMA**. You must hold the AC button during the power-up for a minimum of 5 seconds to begin the Auto Configure process. During this time, the D77D-EMA Status LED will be solid green. Once it is viewed that the Status LEDs on the QCPort devices change from fast flashing to a slow flash (mostly off), the AC button can be released.

Press and hold the Configuration Button for fiveseconds while applying power to QCPort to perform a Factory Configuration.

Configures the Modbus IO registers for the Modbus Adapter and sets the QCPort device parameters to "factory default"
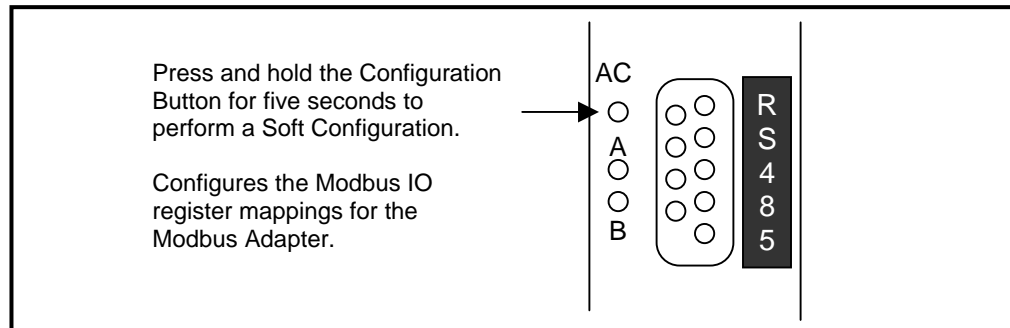
AC

A

B

RS232
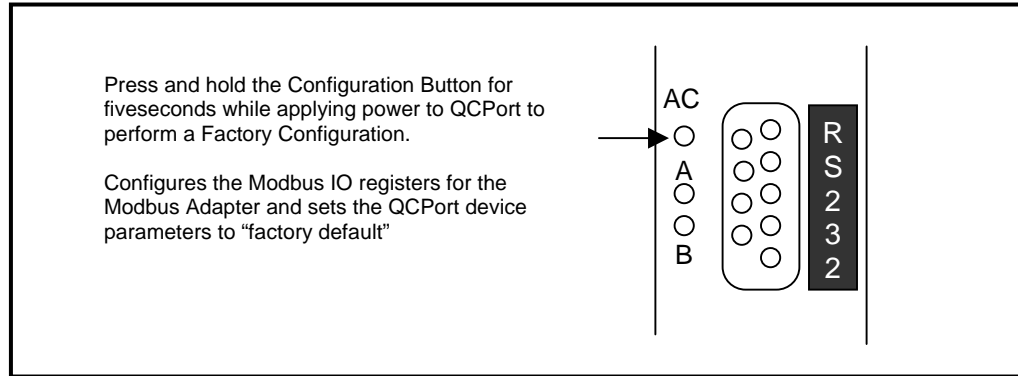
Table 24 Hard Configuration

None of the QCPort devices may be faulted while performing an IO Configuration. To verify that the devices are not faulted, check status LED for each device. The status LED for most devices is in upper left of most products and may not be marked. A faulted state will have a LED flash of500 milliseconds on, 500milliseconds off.

Notice
If, for any reason, the system is not configured properly, when the Auto Configuration button is pressed the MS LED will be solid red or flashing red. This indicates that further configuration is required. For example, this would occur if two devices on the QCPort system have the same Group ID.

Scanning

The Modbus Adapter is as a subscanner for the QCPort devices. The subscan places QCPort input data in Modbus registers and sets the QCPort outputs from Modbus registers. The CPU prevents data tearing by letting QCPort or Modbus (QCPort and Modbus) gain access to the shared memory at a given time.

The QCPort scan is master/slave poll request/response. Since the slave devices only talk when talked to, collisions are eliminated, providing for a deterministic scan time. Both channels are independent and the Modbus Adapter scans each channel simultaneously, asynchronously and in a deterministic fashion.

Notice
A minor recoverable fault may occur if QCPort scanning is stopped by the system controller, and then reinitiated in less then 3 seconds from when the scan was stopped. The fault will indicate that not all the QCPort devices are on line, this fault will self clear as the devices are brought back into the scan list. If the time between stopping scanning and starting scanning is greater than 3 seconds, this fault will not occur. The registers to control the QCPort scan are registers 2049 and 2050 or 1025.

Notice
If RS485 is employed to set the scan for CHA or CHB and a connection is made and then broke over Ethernet without rewriting the scan bit on RS485 the scan will stop on those channels. If the control is to be employed using RS485 and there are going to be connections made and broken over Ethernet it is required that the scan bit be set continuously over RS485.

Notice
With some PLC scanner cards it is important to stagger the scan rates when multiple connections are employed on one D77D-EMA.

Adding or Removing Devices from QCPort

If at any time devices are added or removed from QCPort, the IO registers will have to be revised using the Soft Configuration procedure or CH Studio. When a Soft Configuration is performed, it erases the old register mappings and creates new ones based on the remapped information from QCPort CHA and CHB.

⚠️ Warning
When adding or removing a device and performing the Soft Configure procedure, the IO register mappings are erased and recompiled. Because of this, data in the controller registers may be different than prior to re-configuration. Care should be taken to verify the register mapping before bringing the controller/D77D-EMA back on-line.

When adding a new device to QCPort, it is desirable for register mapping to change as little as possible (to minimize PLC programming changes). To achieve this, add the new device at a Group ID that is larger than the largest ID currently on CHA (when only CHA is used), when both channels are used, add to CHB. This will add the device to the end of the IO register mapping, minimizing the programming changes within the controller.

When removing a device from QCPort, reprogramming of the IO data in the controller is necessary. Remove the device and perform a soft configuration, this will remap all register data within the Adapter.

Replacing an Existing Device on QCPort

It is possible to replace a QCPort device with a like device when the system is scanning and active, a feature called "Hot Swap". There are only a few rules to follow, they are:

- The new device has to have the same product code as the replaced device (same type of device). For example, if an MCC bucket (Cover Control) is to be replaced, the new MCC bucket must have the same device type (Cover Control) as the old one. . It is not permissible to replace non-like type of products with out performing a soft configuration. For example a S811 soft start cannot replace a S751 soft start with a cover control

- The new device must have the same IO configuration as the replaced device. If the IO configuration was changed from default (look in user manual for that device), then a tool will be required to reconfigure the IO configuration to match.

⚠️ Warning
Configuration parameters such as communication loss action, debounce times, initial state, thresholds and fault/warnings enable/disable are not required to match. Once the system is running, it is strongly suggested that a tool be used to synchronize the old device settings to the new device. The hot swap feature is designed to bring a system back up and running as quickly as possible with minimal user intervention and may cause limited functionality.

Typical Application

The following figure illustrates a typical Modbus Adapter application for a motor control center (MCC). In this application, the motor control (cover control units) is located on CHA.

This application has many devices (not shown) on Modbus, and the Modbus Adapter is a single node on that network. The Modbus Adapter presents the QCPort devices on CHA and CHB as registers on Modbus so the controller can monitor and control the IO and motor control connected to the Modbus Adapter. In an effort to simplify the graphic, the power supply and terminating resistor are not shown in this example.
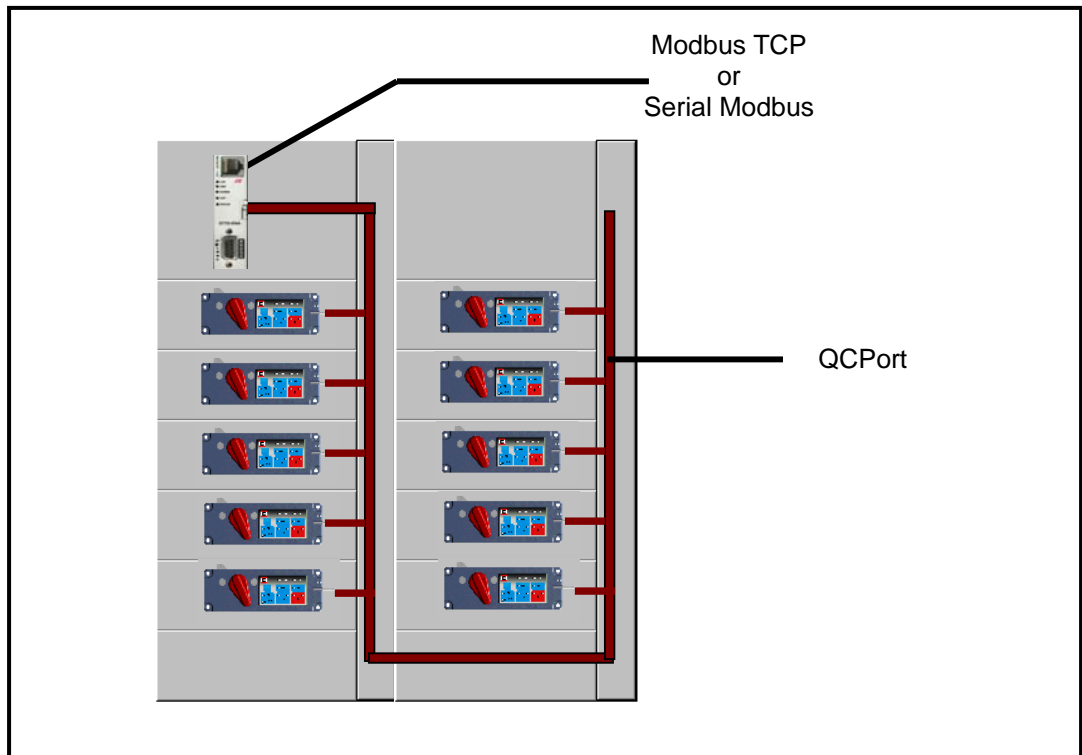
Table 25: Typical Modbus Adapter (D77D-EMA) Application

Due to the way the Modbus registers are created, each devices' data (IO) parameters are located in a unique register. For a device that has multiple parameters, each parameter will be located in a register that is adjacent to the next parameter. An example will be given in a later section.

Eaton | Cutler-Hammer

Table 26 Modbus Addressing

Output Coils

	Decimal Addressing

Type	Boolean
Format	0xxxx
Security	Read/Write
Range	1 - 65536

Input Coils

	Decimal Addressing

Type	Boolean
Format	1xxxx
Security	Read
Range	1 - 65536

Holding Registers

	Decimal Addressing

Type	Word, Short, BCD
Format	4xxxx
Security	Read/Write
Range	1 - 65536

Type	Boolean
Format	4xxxx.bb
Security	Read/Write
Range	xxxx.0 - xxxx.15

Type	Float, DWord, Long, LBCD
Format	4xxxx
Security	Read/Write
Range	1 - 65535

Notice
Unless noted, every register (Modbus Register) documented with in this document is a holding register.

Floating Point Mapping

Floating point data formats are 32 bit quantities; consequently, floating point numbers are stored in two consecutive registers.

Table 27. IEEE-754 Floating Point Format

Bit 31	Bits 30..23	Bits 22………………0
Sign	Exponent	Fractional Portion

The IEEE-754 Floating Point Single Precision Standard is used to format QCPort 24 bit floating point numbers for use on the Modbus network.   Due to the Big endian requirements of Modbus, multi-register floating point data will be formatted as shown in Table 28.

Table 28. Modbus Floating Point Format

Bits 15…..8	Bits 7…..0	Bits 31…..24	Bits 23…..16
1st Byte	0th byte	3rd byte	2nd byte

Connection Timeout

A Connection Timeout register guards against loss of communication to the Modbus Adapter. Every time a valid message is sent to the consumption data area (registers 1025 – 2048), the timer is reset and starts timing again. When the timer expires, the scan for Channel A and Channel B will be disabled allowing the QCPort devices to enter their communication loss action. This is a safety feature that can be disabled (default) or set to 200ms increments.

Notice
The Modbus Adapter will round up to the nearest 200ms if a value is chosen that is not a multiple of 200.

Once this timer expires, the scan registers 2049 and 2050 or 1025 will need to be set to re-enable scanning.

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
Connection Timeout	7526	1	milli-second connection timeout. 0 = disabled, increments of 200ms (automatically rounds up to the nearest 200ms)	R/W

Modbus Register Mapping

Table 29 Modbus Register Mapping

Register Name	Starting Register (Dec)	Length (Dec)	Bytes (Dec)
Production Data (Read Only)	0x0001 (1)	0x0400 (1024)	0x0800 (2048)
Consumption Data (Read/Write)	0x0401 (1025)	0x0400 (1024)	0x0800 (2048)
Control (Read/Write)	0x0801 (2049)	0x0100 (256)	0x0200 (512)
Status (Read Only)	0x0901 (2305)	0x0350 (848)	0x06A0 (1696)
Registry (Read/Write)	0x0C51 (3153)	0x1000 (4096)	0x2000 (8192)
Scan List (Read)	0x1C51 (7249)	0x0100 (256)	0x0200 (512)
Configuration (Read)	0x1D51 (7505)	0x0100 (256)	0x0200 (512)
Data Copy Area (Read/Write)	0x1E51 (7761)	0x1000 (4096)	0x2000 (8192)
Special Function Registers	0x2E51 (11857)	0x1000 (4096)	0x2000 (8192)

Control Registers

There are two control registers that control the scan of the QCPort devices and two words that provide status of the QCPort channels.

Channel Scan Registers (Read/Write)

Table 30: Output Control Register

Bit	Name	Description
Register 2049 Channel A		
0	Active Scan Channel A	0 – IO scan will not occur on the selected channel and all devices will exhibit their communication loss action and be offline.
		1 – IO scan will occur on the selected channel, the devices will be online and operating in an online state.
1 – 15	Reserved	
Register 2050 Channel B		
0	Active Scan Channel B	0 – IO scan will not occur on the selected channel and all devices will exhibit their communication loss action and be offline.
		1 – IO scan will occur on the selected channel, the devices will be online and operating in an online state.
1 – 15	Reserved	

A duplicate combined scan control register is located at register 1025, prior to the consumption data. This single register provides for ease of control since this register is just one before the output registers.

Bit	Name	Description
Register 1025 Combined Channel A Channel B		
0	Active Scan Channel A	0 – IO scan will not occur on the selected channel and all devices will exhibit their communication loss action and be offline.
		1 – IO scan will occur on the selected channel, the devices will be online and operating in an online state.
1 – 6	Reserved	
7	Active Scan Channel B	0 – IO scan will not occur on the selected channel and all devices will exhibit their communication loss action and be offline.
		1 – IO scan will occur on the selected channel, the devices will be online and operating in an online state.
8 – 15	Reserved	

Notice
These bits must be set to active from your control program. Reading these registers will reflect the actual state of the scanner; a 0 indicates not scanning while a 1 indicates scanning.

Channel Health Registers (Read)

Table 31: Input Control Registers

Bit	Name	Description
Register 2311 Channel A		
0	Channel A Active	0 – Selected channel not scanning
		1 – Selected channel scanning
1	Channel A Ready to Scan	0 – Selected channel scan list registry requirements **have** been met
		1 – Selected channel scan list registry requirements **have not** been met
2	Faulted Device Channel A	0 – selected channel does not have any faulted devices
		1 – selected channel has at least one faulted device
3	Reserved	
4	Duplicate Group ID Channel A	1 = A duplicate Group ID exists on Channel A
5	QCPort Config Corrupt Channel A	0 – selected channel has a valid registry
		1 – selected channel has a corrupt registry
6 – 15	Reserved	
Register 2327 Channel B		
0	Channel B Active	0 – Selected channel not scanning
		1 – Selected channel scanning
1	Channel B Ready to Scan	0 – Selected channel scan list registry requirements **have** been met
		1 – Selected channel scan list registry requirements **have not** been met
2	Faulted Device CHB	0 – selected channel does not have any faulted devices
		1 – selected channel has at least one faulted device
3	Reserved	
4	Duplicate Group ID Channel B	1 = A duplicate Group ID exists on Channel B
5	QCPort Config Corrupt Channel A	0 – selected channel has a valid registry
		1 – selected channel has a corrupt registry
6 – 15	Reserved	

Notice
The input status registers are also available as a combined status register located at register 1 in the produced data area.

Notice
Your control program uses this information to detect fault conditions.

Status Registers

There are three registers with in the Modbus Adapter to aide in troubleshooting and operation.

Register 2305 - 2310 Modbus Adapter Faults

These 6 registers will represent the fault index with in the Modbus Adapter. These fault registers are a bit representation of the Appendix D Modbus Adapter Fault List and are capable of indicating multiple faults at one time. For example if there is a fault 23 and a fault 27 at the same time, bit location 23 and also 27 will be true (Register 2306 bit 7 and bit 11).

Register 2320 – 2323 Fault Bit Array Channel A

Reading these 4 registers will provide feedback as to the state of the devices on QCPort Channel A, one bit for each device on the system. If the system only has 18 devices on Channel A, for example, only registers 2320 and 2321 need to be read. The location of the bit with in the register correlates to the location of the device in the scan list. For example, QCPort device ID 4 may be the 3rd device in the scan list if the addresses on that Channel are 2, 3 and 4

15	14	13		3	2	1	0
Device 15	Device 14	Device 13		Device 3	Device 2	Device 1	Faulted Device

Table 32 Fault Bit Array Channel A

Notice
Any time a device in the fault bit array is faulted bit 0 will be true. A device may be faulted because it has been removed from the system and no longer communicates to the network adapter.

Register 2336 – 2339 Fault Bit Array Channel B

Reading these 4 registers will provide feedback as to the state of the devices on QCPort Channel B, one bit for each device on the system. If the system only has 18 devices on Channel B, for example, only registers 2320 and 2321 need to be read. The location of the bit with in the register correlates to the location of the device in the scan list. For example, QCPort device ID 4 may be the 3rd device in the scan list if the addresses on that Channel are 2, 3 and 4.

15	14	13		3	2	1	0
Device 15	Device 14	Device 13		Device 3	Device 2	Device 1	Faulted Device

Table 33 Fault Bit Array Channel B

Notice
Any time a device in the fault bit array is faulted bit 0 will be true. A device may be faulted because it has been removed from the system and no longer communicates to the network adapter.

IO Register Mapping

Sample Modbus IO Register Mapping

When an auto configuration is completed, the device data will be located in concurrent registers within the input and output ranges of the IO holding register table. The device data will start with the first device (lowest ID) and finish at the last device with all the IO data one right after another.

Input registers start at holding register 0001 and end at 1024 where register 0001 is reserved for QCPort channel status.

Output registers start at holding register 1025 and end at 2048 where register 1025 is reserved for QCPort channel control.

Following are some very simple rules that govern how the IO data registers are constructed:

- All device parameters will be located in a unique register.

- An 8 bit parameter will be in single 16 bit register (occupying the lower byte).

- A 16 bit parameter will bit in a single 16 bit register.

- A 32 bit parameter will use two concurrent registers.

Example 1

Example 1 illustrates a typical MCC with factory IO configuration, for this example the MCC will have two buckets (cover control) of address 1 and 2. Each device has the following IO parameters.

Cover Control Data

Table 34 Default Cover Control IO Data

Byte	Data

Cover Control Produced Data

0	Fault Word Low Byte (word)
1	Fault Word High Byte
2	% FLA Word Low Byte (word)
3	% FLA Word High Byte
4	% Thermal Memory (byte)
5	Motor Status Byte

Cover Control Consumed Data

0	Motor Control Byte

Modbus Registers

Table 35 Modbus Register Data

Register	Description	Device Address	Bits used with in register

Input Registers (holding)

Register	Description	Device Address	Bits used with in register
0001	QCPort Channel Status Register	N/A	16
0002	Fault Word	1	16
0003	% FLA	1	16
0004	% Thermal Memory	1	8 (lower byte)
0005	Motor Status Byte	1	8 (lower byte)
0006	Fault Word	2	16
0007	% FLA	2	16
0008	% Thermal Memory	2	8 (lower byte)
0009	Motor Status Byte	2	8 (lower byte)

Output Registers (holding)

Register	Description	Device Address	Bits used with in register
1025	QCPort Channel Control Register	N/A	16
1026	Motor Control Byte	1	8 (lower byte)
1027	Motor Control Byte	2	8 (lower byte)

Example 2

Example 1 illustrates a typical MCC with user defined IO configuration, for this example the MCC will have two buckets (cover control) of address 1 and 2 and one 8 point input module at address 3. Each device has the following IO parameters.

Cover Control Data

Table 36 Cover Control IO Data

Byte	Data

Cover Control Produced Data

Byte	Data
0	Application Status Low Byte (word)
1	Application Status High Byte
2	RMS Scaled Current Low Byte (word)
3	RMS Scaled Current High Byte
4	Breaker Status (byte)
5	% Thermal Memory (byte)
6	Motor Status Byte (byte)

8 point Input Module Produced Data

0	I 7	I 6	I 5	I 4	I 3	I 2	I 1	I 0

Cover Control Consumed Data

0	Motor Control Byte

Modbus Registers

Table 37 Modbus Register Data

Register	Description	Device Address	Bits used with in register

Input Registers (holding)

Register	Description	Device Address	Bits used with in register
0001	QCPort Channel Status Register	N/A	16
0002	Application Status	1	16
0003	RMS Scaled Current	1	16
0004	Breaker Status	1	8 (lower byte)
0005	% Thermal Memory	1	8 (lower byte)
0006	Motor Status Byte	1	8 (lower byte)
0007	Application Status	2	16
0008	RMS Scaled Current	2	16
0009	Breaker Status	2	8 (lower byte)
0010	% Thermal Memory	2	8 (lower byte)
0011	Motor Status Byte	2	8 (lower byte)
0012	8 Point Input Module Data	3	8 (lower byte)

Output Registers (holding)

Register	Description	Device Address	Bits used with in register
1025	QCPort Channel Control Register	N/A	16
1026	Motor Control Byte	1	8 (lower byte)
1027	Motor Control Byte	2	8 (lower byte)

Modbus Pass-Through

Connect Modbus Slaves to Channel A or B

When one or both of the QCPort channels are reconfigured for Modbus, it will be required to wire the Modbus communication wires to the proper pins. If Channel B is used for the Modbus Pass-Through, the desired port if also using QCPort, then it is recommended to use a D77E-QPLR as the interface between the Modbus network and the D77D-EMA.

Connect a standard QCPort interconnect between the Channel B of the D77D-EMA and the D77E-QPLR, apply power to the + and – from a 24Vdc power supply. It is required to power Channel B externally since the channel is electrically isolated from the D77D-EMA and requires power to operate RS485 circuitry. The terminal block on the D77E-QPLR will have connection points for connecting the Serial Modbus RS485 connections; the connections are A, B and (-).   Modbus needs to be terminated with 100 ohm resistors.
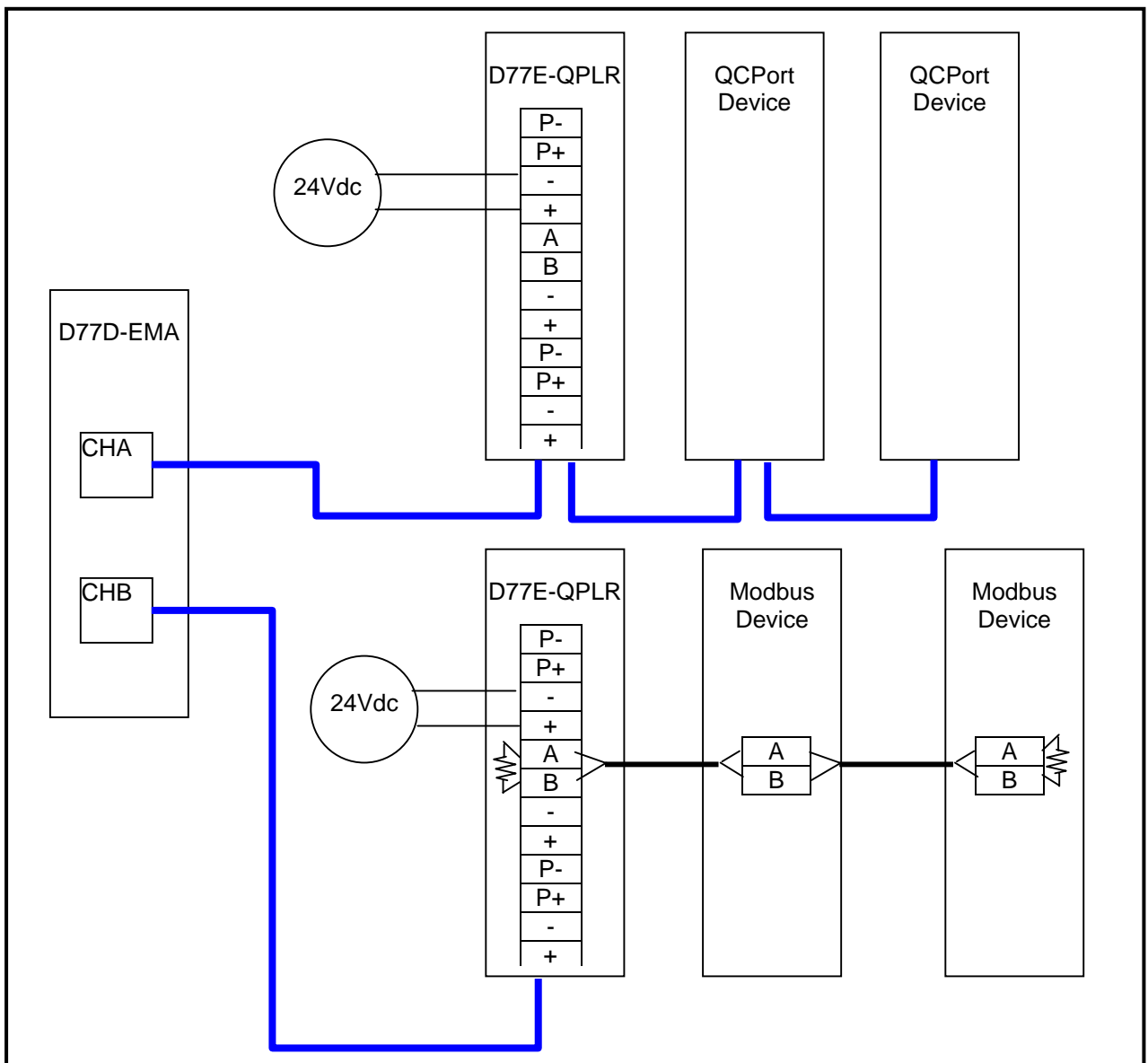

Table 38: Modbus Wiring for Pass-Through

Notice
When using wormhole, if the end device returns an exception response the D77D-EMA will respond to the master with a 0B indicating there is no response from the end Modbus device.

Pass-Through Setup

When configuring either Channel A or Channel B as a Pass-Through, it is important to set up the properties of the network so it matches the properties of the slave devices being communicated to. What will need to be configured are minimally the baud rate and the parity. The following chart has all the properties of the Modbus network that can be edited. Since either Channel A or Channel B can be configured as a Modbus, which ever channel is used is required to be configured. Once the configuration is set, the values are set in non-volatile memory and stored through a power cycle.

Table 39 Register Settings for Pass-Through Channel Setup

Description	Modbus Register	Size	Usage	Read/ Write
QCPort Channel A Modbus Parity	7547	1	Even = 0 Odd = 1 None = 2 (default)	R/W
QCPort Channel A Modbus baud.	7548	1	1200 = 384 2400 = 192 4800 = 96 9600 = 48 19200 = 24 = (default) 38400 = 12 57600 = 8 115200 = 4 230400 = 2 460800 = 1	R/W
QCPort Channel B Modbus Parity	7552	1	Even = 0 Odd = 1 None = 2 (default)	R/W
QCPort Channel B Modbus baud	7553	1	1200 = 384 2400 = 192 4800 = 96 9600 = 48 19200 = 24 = (default) 38400 = 12 57600 = 8 115200 = 4 230400 = 2 460800 = 1	R/W

Pass-Through On Ethernet using port 2000 and 2001

It is possible to connect Modbus RTU slaves on QCPort Channel A and Channel B while QCPort devices are connected and scanning. This Pass-Through feature will slow the scan rate for that channel so it is recommended that if this feature is used, that all the Modbus devices be connected to a channel that is not scanning QCPort devices.

The format for Port 2000 and 2001 will be the same as the format used for standard Modbus TCP messaging (Modbus frame pre-pended with a MBAP header). The difference between Port 502 Modbus messages and Port 2000 and 2001 Modbus messages will be with routing, the port 2000/2001 Modbus messages will be stripped of the TCP frame and sent to the appropriate channel. A Modbus CRC will be automatically added to the end of the message, and the message will be transmitted on the corresponding port. If a response is received on the serial port before the receive message timeout, the response will be formatted as a Modbus TCP message, and sent back to the Modbus master. If no serial receive message is received before the timeout period, an ACK will be sent back to the Master indicating a receipt of message.

Notice
Port 2000 and 2001 use the unit ID from the MBAP header when constructing the serial Modbus frame.

With in the control program, connect to Port 2000 for Channel A or Port 2001 for Channel B. To read/set a register of a specific device, send the message to the Modbus Device ID to read/set and construct the functions and data just as if communicating directly to Modbus slave device. The data in the response field will constructed just as if the Modbus master was directly communicating to a Modbus slave. The message is constructed low byte high byte, but gets sent on the wire low high byte low byte, refer to the example below.

Table 40 Modbus Ethernet Pass-Through Transmit Message Format

Address		xx HEX
Function Code		xx HEX
Data		
	Starting address HI	xx HEX
	Starting address LO	xx HEX
	Data HI	xx HEX
	Data LO	xx HEX

Example Transmit Message

Read Register 40111 (nominal frequency) from an SV drive
SV drive address is 02
Read using function code 03

Message will be constructed:
0x01 for the Modbus node ID
0x03 for the function code
0x006E to read register 111

Notice
Modbus is address based, not register based. The address is equal to 1 minus the register; therefore register 111 is address 110, which is why to read register 111 a 0x006E (110 decimal) was written.

Table 41 Modbus Ethernet Pass-Through Receive Message Format

Address	02 hex	Slave Address 01 hex
Function Code	03 hex	Function code 3 (read single register)
Data		
Starting address HI	00	
Starting address LO	6E	

The response will be 0x003C (60)

Pass-Through using Registers

Modbus pass-through messages can be transmitted by writing to the Modbus Pass-Through special function registers. The first register in this series (offset 0) specifies the number of bytes in the Modbus message (CRC should not be included), and the second register in the series is the start of the message. The Modbus CRC must not be included as part of the message, as the Modbus Adapter calculates and appends the CRC to the message before transmission. Due to the fact that the message length register triggers the Modbus pass-through message transmission, the Modbus frame registers (register 1..n) should be written first, followed by the message length. All of the registers can be written at the same time if the "write multiple registers" command is used. Once the Modbus Adapter has queued the message for transmission, the message length will be set back to zero. Because of this feature, the message length should always be read before any data is written to the Modbus pass-through special function register area. If the message length is a non-zero number, this will indicate that a Modbus pass-through transmission is still occupying the register space and has not yet been queued for transmission.

Table 42 Pass-Through Register Information

Description	Modbus Register	Size (Reg)	Usage	Read/Write
Modbus Wormhole Tx Channel A	12395	251	Modbus wormhole transmit area A	R/W
Modbus Wormhole Rx Channel A	12646	251	Modbus wormhole Receive area A	R/W
Modbus Wormhole Tx Channel B	12897	251	Modbus wormhole transmit area B	R/W
Modbus Wormhole Rx Channel B	13148	251	Modbus wormhole Receive area B	R/W

Table 43 Modbus Ethernet Pass-Through Receive Message Format

Byte	CHA	CHB	Data
0	12395	12897	Modbus Message Byte Count
1			Unused
2	12396	12898	To Address
3			Function Code
4	12397	12989	Data
5			Data
6	12398	12990	Data
7			Data
n			Last data byte

If the Modbus wormhole transmission invokes a response on the destination port, the received response will be placed in the Modbus Wormhole receive register area. The format of the receive registers is identical to the format of the transmit registers except that the Message length register will be replaced by a sequence number register indicating the sequence # of the received message.

Example Transmit Message

Read Register 40111 (nominal frequency) from an SV drive
SV drive address is 01
Read using function code 03 (read multiple holding registers)

Notice
Modbus is address based, not register based. The address is equal to 1 minus the register; therefore register 111 is address 110, which is why to read register 111 a 0x006E (110 decimal) was written.

12897 = 0000
12898 = 0103
12899 = 006E
12900 = 0001
After the data portion is written, then write the message length (12897 = 0006) (6 bytes of data)

The slave will then see this message 0103 006E 0001

If the Modbus transmission invokes a response on the destination port, the received response will be placed in the Modbus receive registers.

Table 44 Modbus Pass-Through Receive Message Format

Byte	CHA	CHB	Data
0	12646	13148	Sequence Number
1			Unused
2	12647	13149	Message Length
3			Message Length
4	12648	13150	To Address
5			Function Code
6	12649	13151	Data
7			Data
n			Last data byte

Example Receive Message

13148 = 00XX (sequence number)
13149 = 0007 (7 bytes of data)
13150 = 0103 (address 01, function code 03)
13151 = 0002 (high byte of data 00, 2 bytes of data)
13152 = 3CB9 (high byte of data 3C [60] ,low byte CRC B9)
13153 = 5500 (high byte of CRC 55, low byte n/a)

Status LEDs

The status LED's are located along left of the Modbus Adapter, as pictured in Table 4: Modbus Adapter (D77D-EMA) Front Features. The LED's status changes depending on the state of the Modbus Adapter.

The following tables list and describe the various states of the LAN, Modbus Adapter Status LEDs; Modbus Module Status, Modbus Network Status and QCPort Channels.

Table 45 Status LED

LED State	Meaning
LAN LED	
Amber	Flashes to signal network transmission or reception
Modbus Adapter Status LED	
Flashing	The adapter is healthy.
On Solid	CPU Fault
Off	No Power or CPU Fault
Rapid Flash	Identify when CH Studio is connected
Module Status LED (MS)	
Off	There is no power to the device
Green	Device is operating normally
Flashing Green	Adapter needs commissioning (mimor or soft fault)
Flashing Red	A recoverable fault has been detected See Appendix D Modbus Adapter Fault List
	A QCPort device is missing from the scan list
Red	A non-recoverable fault has been detected, the device may need to be replaced
Flashing Green-Red	The device is performing a self test

LED State	Meaning

TCP Network Status LED (NS)

LED State	Meaning
Off	IF the MS LED is on or flashing, then the D77D-EMA does not have a valid IP address
Flashing Green	No Connection established
Green	A Connection has been established
Red	Device cannot communicate on the network (may have a duplicate IP address)
Red-Green blink	Self Test
Flashing Red	Network connection error or timeout

SMB (Serial Modbus RS485)

LED State	Meaning
Amber	Flashes to signal network transmission or reception

CHA/CHB Status LED

LED State	Meaning
Off	No Power on QCPort or no communication taking place on that channel.
Solid Amber	A Connection has been established to all devices.
Flashing	One or more of the devices have a fault and the D77D-EMA cant scan QCPort
	The D77D-EMA is in idle mode (not scanning)
	The D77D-EMA is looking for a faulted device
	The D77D-EMA is attempting a Hot Swap
	Indicates QCPort traffic

Notice
The CHA and CHB status LED is an indication as to the traffic on each of the channels. When a message is sent or received, the LED will be lit. A solid LED or one that is mostly solid indicates healthy QCPort activity.

Installation

This section provides details about the following features and aspects of D77D-EMA Installation:

- Installation on a DIN Rail

- Replace Existing Module

- Connect to Devices

    o Connections/Interconnects

Installation on a DIN Rail

Use one of the following two procedures to install the Adapter on a DIN rail:

- Install on a DIN Rail (no backplane)

- Install on DIN a Rail with backplane

Install on a DIN Rail (No Backplane)

Prepare Module for Installation

The DIN rail locking tab is on the right middle of the Modbus Adapter. When installing the Modbus Adapter on a DIN rail, verify that the slide of the DIN Rail Lock is extended to the unlocked position.

Insert a screwdriver under the DIN rail locking tab and lift up to unlock the locking tab, as illustrated in the following figure.

Table 46: Unlock DIN Rail Locking Tab

Install Module

The module is now ready for installation on the DIN rail.

⚠️ Warning
Do not "rock" the Modbus Adapter module onto the DIN rail. The rocking action could damage the module.

1. The module must always be inserted perpendicular onto the DIN rail. **Push the module straight back** onto the DIN rail.

2. Depress the locking tab to secure the module to the DIN rail.

Press locking tab to secure module

Locked Position
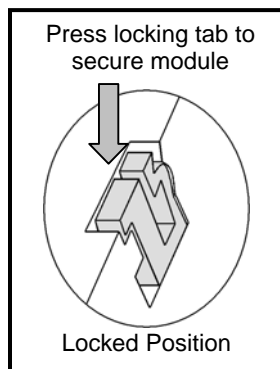
Table 47: Lock DIN Rail Locking Tab

Notice
After the Modbus Adapter is installed, interconnects will need to be installed; see the QCPort *System Install and User Manual* (Publication MN05001002E for more information.

Install on DIN Rail With Backplane

Prepare Module for Installation

The DIN rail locking tab is on the right middle of the Modbus Adapter. When installing the Modbus Adapter on a DIN rail, verify that the slide of the DIN Rail Lock is extended to the unlocked position.

Insert a screwdriver under the DIN rail locking tab and lift up to unlock the locking tab, as illustrated in the following figure.
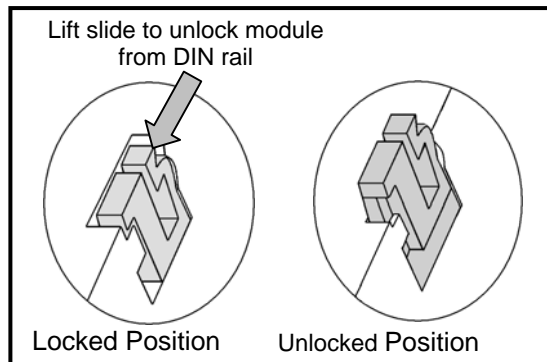
Lift slide to unlock module
from DIN rail

Locked Position   Unlocked Position
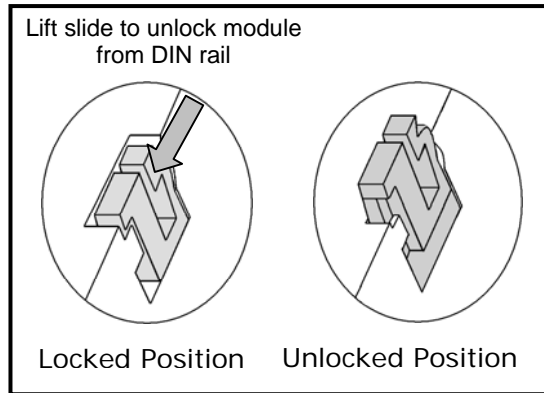
Table 48: Unlock DIN Rail Locking Tab

Install Module

The module is now ready for installation on the DIN rail.

⚠️ **Warning**
Do not "rock" the Modbus Adapter module onto the DIN rail. The rocking action could damage the module.

1. Line the center of the module up with the backplane connector on the DIN rail. Ensure the backplane connector is installed with the arrows up. The module must always be inserted perpendicular onto the DIN rail.

Table 49: Adapter Installation on a Backplane

2. Push the module straight back onto the DIN rail and backplane connector.

3. Depress the locking tab to secure the module to the DIN rail.

Press locking tab to secure module

Locked Position
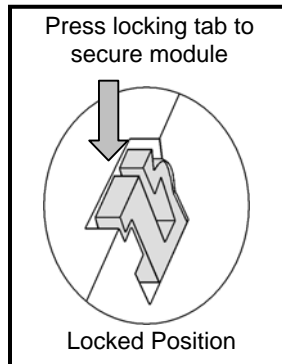
Table 50: Lock DIN Rail Locking Tab

Replace Existing Module

To replace an existing Modbus Adapter, first remove the old one.

1. Remove all connectors (Modbus and QCPort) from the Adapter.

2. Insert a screwdriver under the DIN rail locking tab and lift up to unlock the locking tab, as illustrated in the following figure.
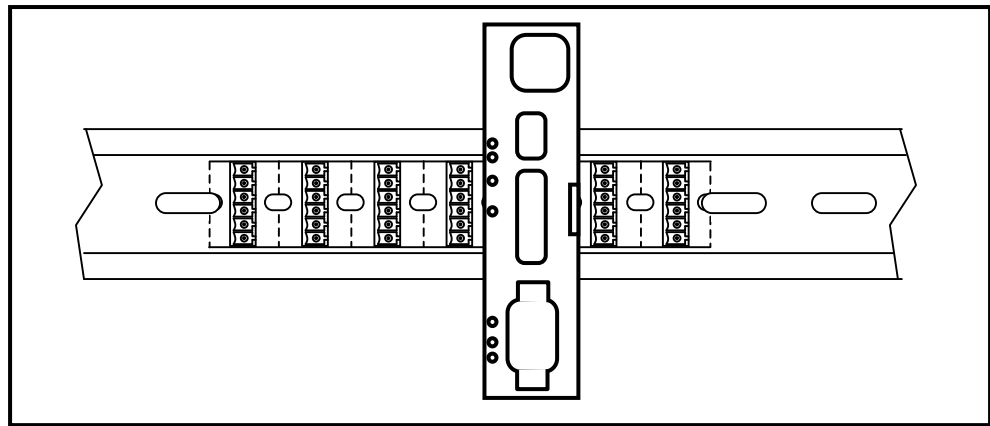
Lift slide to unlock module from DIN rail

Locked Position   Unlocked Position
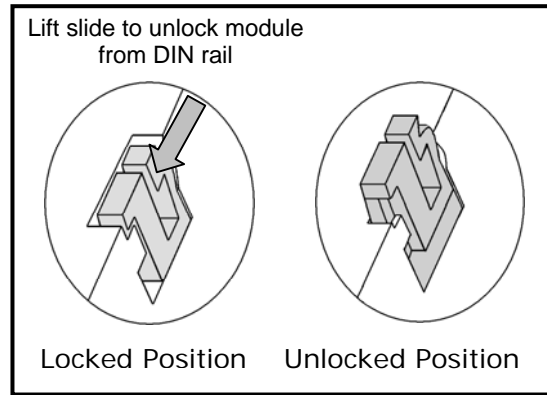
Table 51: Unlock DIN Rail Locking Tab

3. Remove the old module by pulling straight off the DIN rail.

4. Align the new module where the old one was removed. The module must always be inserted perpendicular onto the DIN rail. **Push the module straight back** onto the DIN rail.

5. Depress the locking tab to secure the module to the DIN rail.

Press locking tab to secure module

Locked Position
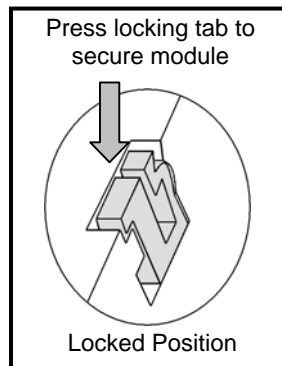
Table 52: Lock DIN Rail Locking Tab

6. Reconnect the Modbus and QCPort connectors.

7. Reconfigure the device according to the IO Configure procedure in "Operation" or with a configuration tool, as described in "Advanced Configuration."

Connect to Devices

Connections/Interconnects

Connecting the Modbus Adapter and other *IT* family products involves using one or more of the QCPort interconnects. The Modbus Adapter employs two types of connectors—one is the backplane interconnect and the other is the short run interconnect. These interconnects provide the QCPort products with both power and communications.

The backplane interconnect fits within the DIN rail and has plugs on it that connect one module to another module seated on the DIN rail. The backplane interconnect supports the power and communication for QCPort and is a passive device. The short run interconnect uses the RJ style connectors that are ordered in standard lengths.

For more information on making interconnects and applying interconnects, refer to the QCPort *System Install and User Manual* (Publication MN05001002E.

Connections to the QCPort Channels

The Modbus Adapter has two independent QCPort channels: CHA and CHB. CHA has connections on the backplane (plug) and the RJ12 port closest to the back of the Modbus Adapter. CHB has two RJ12 connections, the two closest to the front of the Modbus Adapter.
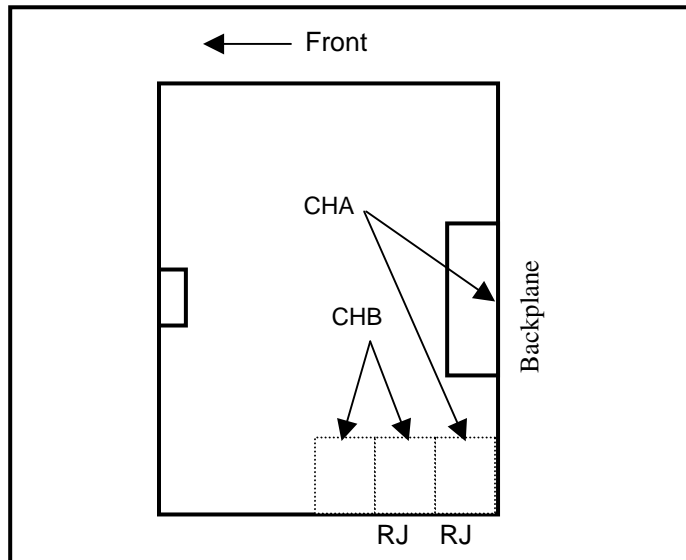
Table 53: QCPort Channels

Backplane Interconnect

The backplane interconnect is used when connecting Adapter and IO products on a DIN rail. The interconnect fits inside the channel of the DIN rail and provides for connection of power and communication to Adapter and IO products.

6
+24
A
B
GND
1
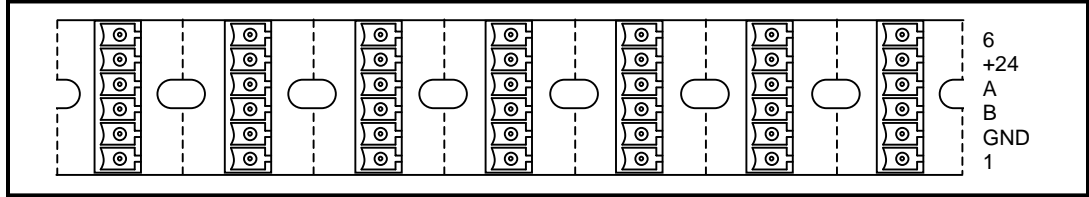
Table 54: Backplane Interconnect

Device
(female)

6
+24
A
B
GND
1

DIN Rail
Backplane
(male)
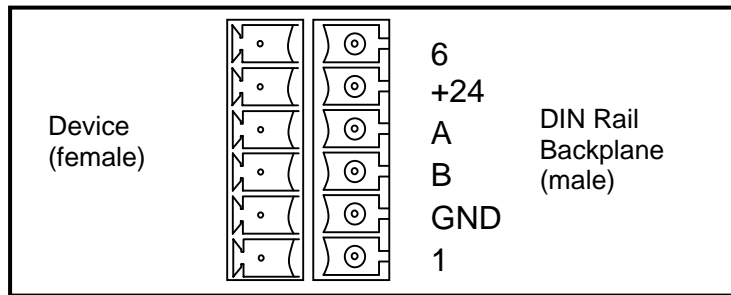
Table 55: Device/Backplane Interconnect

Short Run Interconnect

To connect the Modbus Adapter to devices without using a backplane, use the RJ style connectors that are located at the bottom of the D85 IO module. There are two connections located next to each other that are in parallel with each other, this allows daisy chaining using Pre-Manufactured cables. There are standard sizes for the Pre-Manufactured cables. These sizes are listed in the "Renewal Parts" portion of "Troubleshooting and Maintenance."

When making this interconnect, refer to the QCPort *System Install and User Manual* (Publication MN05001002E for the recommended cable and connections.

Female
Socket

Male
Plug

1 – +24
2 – GND
3 – B
4 – A
5 – +24
6 – GND
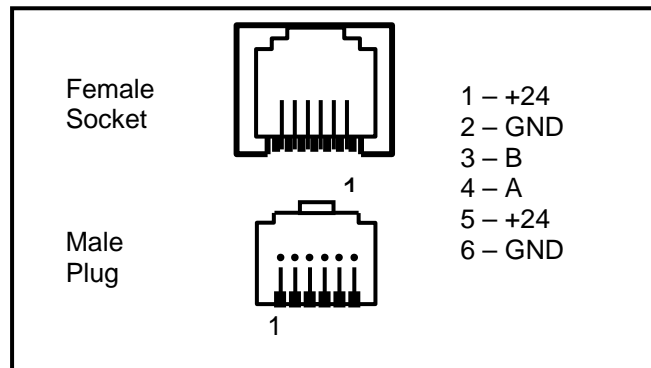
Table 56: RJ Connector

Troubleshooting and Maintenance

Renewal Parts

There are no renewal parts on the Modbus Adapter (D77D-EMA); the only related parts are the following accessories.

Table 57: Accessories

Part Number	Description
D77E-BP7	Expansion Backplane for 7 slots
D77E-BP12	Expansion Backplane for 12 slots
D77E-BP25	Expansion Backplane for 25 slots
D77E-QPLR	Terminator and Power Tap for QCPort
D77E-TERRJ	Terminator for QCPort RJ Style
D77E-QPIP25	25 CM QCPort Interconnect Cable
D77E-QPIP100	1 M QCPort Interconnect Cable
D77E-QPIP200	2 M QCPort Interconnect Cable
D77E-QPIP300	3 M QCPort Interconnect Cable
D77E-PS1	85 – 260 VAC input 24 VDC@1A output Power Supply
D77A IO Products	Remote IO Products
97-190x-42	Cover Control Products for Motor Control Center Product Line
D77B SNAP Products	Starter Network Adapter Products for the IT Starters

Troubleshooting

Use the following chart for assistance in troubleshooting the Modbus Adapter; the chart contains the most common faults and corrective actions.

Table 58: Troubleshooting Chart

Observation	Possible Cause/Action
None of the LEDs are illuminated	Verify that power (24 VDC) is applied to the Modbus terminal and that power is on the QCPort channels.
IO Configuration will not complete	Verify that all devices on the QCPort ports are set to unique addresses.
	Verify that you are holding the Configure button for the required 5 seconds
	Power cycle the Modbus Adapter and QCPort devices.
The data in the Modbus input assembly is all zero's	Verify that the Scan Active bit in the Modbus register 2049, 2050 or 1025 is set to one.
Cant auto configure QCPort or cant see any devices on QCPort	Verify that QCPort has a biasing resistor installed such as the D77E-QPLR or the D77E-TERRJ.
Unit ID	1 (always 1 but can be changed)
IP Lost	Use Studio to rediscover the device
	Power Up Reset
Not scanning	Is scan enabled in register 1025
Controller cant see after setting IP address	Check subnet mask
Can communicate over Serial Modbus RS485	Verify valid range, 1 – 246

Appendix A: Supported Modbus Function Codes

Access	Type	Description	Code
Data Access			
Bit	Physical Discrete Inputs	Read Input Status	0x02 (2)
	Internal Bits or Physical Coils	Read Coil status	0x01 (1)
		Force Single Coil	0x05 (5)
		Write Multiple Coils	0x0F (15)
16 bits	Physical Input Registers	Read Input Registers	0x04 (04)
	Internal Registers or Physical Output Registers	Read Holding Registers	0x03 (3)
		Write Single Register	0x06 (6)
		Write Multiple Registers	0x10 (16)
		Read/Write Multiple Registers	0x17 (23)
		Mask Write Register	0x16 (22)
Diagnostics			
		Read Exception status	0x07 (7)
		Diagnostics	0x08 (8)
User Defined			
		QCPort Pass Through	0x41 (65)
		Reset Services	0x42 (66)

Notice
The entire register space for the D77D-EMA is a shared register space, therefore each register supports each function code.

Read Exception Status 0x07 (7)

Bit	Description
0	1 = Adapter Faulted 0 = Adapter OK
1 – 7	Reserved

Pass Through 0x41 (65)

Request PDU

Function code	1 byte	0x41
QCPort Channel	1 byte	0 = channel A 1 = channel B
QCPort request message	n bytes	

Response PDU

Function code	1 byte	0x41
QCPort response message	n bytes	

Error

Function code	1 byte	0xC1
Exception code	1 byte	0x03: Illegal data value 0x0B: Modbus Adapter target device failed to respond 0x0A: Modbus Adapter path unavailable – if an illegal channel is specified

Reset Services 0x42 (66)

Request PDU

Function code	1 byte	0x42
QCPort Channel	1 byte	0 = Channel A; 1 = Channel B
Modbus Adapter/Node ID	2 bytes	0xffff = Modbus Adapter, any other = QCPort device id
Reset type	1 byte	0 = Reset processor 1 = Hard Reconfiguration 2 = Soft Reconfiguration 3 = Regather 4 = Set to Factory Defaults

Response PDU

Function code	1 byte	0x42
Asynchronous channel	0 or 1 bytes	If the reset occurs asynchronously (reset type 1,2,3,4), these are copies of Channel and Reset type from the Request PDU; otherwise, these are omitted.
Asynchronous reset type	0 or 1 bytes	
Asynchronous completion status	0 or 1 bytes	If reset type is 1,2,3,4: 0 = In progress 1 = Complete Otherwise, omitted.

Error

Function code	1 byte	0xC2
Exception code	1 byte	0x03: Illegal data value

Appendix B: MODBUS Exception Responses

When a client device sends a request to a server device it expects a normal response. One of four possible events can occur from the master's query:

- If the server device receives the request without a communication error, and can handle the query normally, it returns a normal response.

- If the server does not receive the request due to a communication error, no response is returned. The client program will eventually process a timeout condition for the request.

- If the server receives the request, but detects a communication error (parity, LRC, CRC...), no response is returned. The client program will eventually process a timeout condition for the request.

- If the server receives the request without a communication error, but cannot handle it (for example, if the request is to read a non–existent output or register), the server will return an exception response informing the client of the nature of the error.

The exception response message has two fields that differentiate it from a normal response:

Function Code Field: In a normal response, the server echoes the function code of the original request in the function code field of the response. All function codes have a most–significant bit (MSB) of 0 (their values are all below 80 hexadecimal). In an exception response, the server sets the MSB of the function code to 1. This makes the function code value in an exception response exactly 80 hexadecimal higher than the value would be for a normal response.

With the function code's MSB set, the client's application program can recognize the exception response and can examine the data field for the exception code.

Data Field: In a normal response, the server may return data or statistics in the data field (any information that was requested in the request). In an exception response, the server returns an exception code in the data field. This defines the server condition that caused the exception.

Example of a client request and server exception response

Request		Response	
Field Name	*(Hex)*	*Field Name*	*(Hex)*
Function	01	Function	81
Starting Address Hi	04	Exception Code	02
Starting Address Lo	A1		
Quantity of Outputs Hi	00		
Quantity of Outputs Lo	01		

In this example, the client addresses a request to server device. The function code (01) is for a Read Output Status operation. It requests the status of the output at address 1245 (04A1 hex). Note that only that one output is to be read, as specified by the number of outputs field (0001).

If the output address is non–existent in the server device, the server will return the exception response with the exception code shown (02). This specifies an illegal data address for the slave.

Table 59-Modbus Exception Codes

Code	Name	Meaning
01	Illegal function	The function code received in the query is not an allowable action for the server (or slave). This may be because the function code is only applicable to newer devices, and was not implemented in the unit selected. It could also indicate that the server (or slave) is in the wrong state to process a request of this type, for example because it is unconfigured and is being asked to return register values.
02	Illegal data address	The data address received in the query is not an allowable address for the server (or slave). More specifically, the combination of reference number and transfer length is invalid. For a controller with 100 registers, a request with offset 96 and length 4 would succeed, a request with offset 96 and length 5 will generate exception 02.
03	Illegal data value	A value contained in the query data field is not an allowable value for server (or slave). This indicates a fault in the structure of the remainder of a complex request, such as that the implied length is incorrect. It specifically does NOT mean that a data item submitted for storage in a register has a value outside the expectation of the application program, since the MODBUS protocol is unaware of the significance of any particular value of any particular register.
04	Slave device failure	An unrecoverable error occurred while the server (or slave) was attempting to perform the requested action.
05	Acknowledge	Specialized use in conjunction with programming commands. The server (or slave) has accepted the request and is processing it, but a long duration of time will be required to do so. This response is returned to prevent a timeout error from occurring in the client (or master). The client (or master) can next issue a Poll Program Complete message to determine if processing is completed.
06	Slave device busy	Specialized use in conjunction with programming commands. The server (or slave) is engaged in processing a long–duration program command. The client (or master) should retransmit the message later when the server (or slave) is free.
08	Memory parity error	Specialized use in conjunction with function codes 20 and 21 and reference type 6, to indicate that the extended file area failed to pass a consistency check. The server (or slave) attempted to read record file, but detected a parity error in the memory. The client (or master) can retry the request, but service may be required on the server (or slave) device.
0a	Modbus adapter path unavailable	Specialized use in conjunction with Modbus adapter, indicates that the Modbus adapter was unable to allocate an internal communication path from the input port to the output port for processing the request. Usually means that the Modbus adapter is misconfigured or overloaded.
0b	Modbus adapter target device failed to respond	Specialized use in conjunction with Modbus adapter, indicates that no response was obtained from the target device. Usually means that the device is not present on the network.

Appendix C: Register Mapping

Production (holding register area)

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
QCPort Channel Status	0001	1	Status of QCPort channel A and B	R
Production Data 1st Device	0002	1023	Production Data area	R
Production Last Register	1024	1	Production Data Last Register	R

Consumption (holding register area)

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
QCPort Channel Control	1025	1	Control of QCPort channel A and B	R
Consumption Data 1st Device	1026	1023	Consumption Data area	R/W
Consumption Last Register	2048	1	Consumption Data Last Register	R/W

Control (holding register area)

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
QCPort Channel A Command	2049	1	0 disable scan 1 enable scan	R/W
QCPort Channel B Command	2050	1	0 disable scan 1 enable scan	R/W

Status (holding register area)

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
Faults	2305	6	Modbus Adapter Faults 6 registers – raw hex representing faults. See Appendix D Modbus Adapter Fault List	R

Channel A Status (holding register area)

Description	Modbus Register	Size (Reg)	Usage		Read/ Write
Channel A status	2311	1	0	1 = Channel A Active	R
			1	1 = Channel A **Not** Ready to Scan	
			2	1 = Faulted Device Channel A	
			3	Reserved	
			4	1 = Duplicate Group ID Channel A	
			5	1 = QCPort Config Corrupt Channel A	
			6 – 15	Reserved	
Channel A Total Transactions	2312	1	Number of good messages on channel		R
Channel A Wormhole Transactions	2313	1	Number of Wormhole messages passed including transmit and receive on Channel A		
Channel A collisions	2314	1	Number of detected collisions since last power cycle		R
Channel A CRC error count	2315	1	Number of message frame CRC errors detected since power cycle		R
Expected devices Channel A	2316	1	The number of devices detected during the last configuration cycle.		R
Actual devices Channel A	2317	1	The number of devices that are actually communicating.		R
Expected Scan devices Channel A	2318	1	The number of devices added to the scan list during configuration.		R
Actual Scan devices Channel A	2319	1	The actual number of devices communicating in the scan.		R
Fault Bit array Channel A	2320	4	64 bits – 1 bit per device for error indication.		R
Channel A Gateway State	2324	1	Configuring/Ready/Faulted (0,1,2)		R
Production data size Channel A	2325	1	The number of bytes of data in the consumption scan		R
Consumption data size A	2326	1	The number of bytes of data in the production scan		R
Channel A Attached device listing	2343	190	Total registers in listing (2343) Starting at 2344 format is as follows per QCPort device: Device ID Starting Production Register Starting Consumption Resister		R
Channel A Interscan Delay	7545	1	Adds a dead time in the QCPort scan of the register value times 5ms. 0-65536 x 5ms		R/W

Channel B Status (holding register area)

Description	Modbus Register	Size (Reg)	Usage		Read/ Write
Channel B status	2327	1	0	1 = Channel B Active	R
			1	1 = Channel B **Not** Ready to Scan	
			2	1 = Faulted Device Channel B	
			3	Reserved	
			4	1 = Duplicate Group ID Channel AB	
			5	1 = QCPort Config Corrupt Channel B	
			6 – 15	Reserved	
Channel B Total Transactions	2328	1	Number of good messages on channel		R
Channel B Wormhole Transactions	2329	1	Number of Wormhole messages passed including transmit and receive on Channel B		
Channel B collisions	2330	1	Number of detected collisions since last power cycle		R
Channel B CRC error count	2331	1	Number of message frame CRC errors detected since power cycle		R
Expected devices Channel B	2332	1	The number of devices detected during the last configuration cycle.		R
Actual devices Channel B	2333	1	The number of devices that are actually communicating.		R
Expected Scan devices Channel B	2334	1	The number of devices added to the scan list during configuration.		R
Actual Scan devices Channel B	2335	1	The actual number of devices communicating in the scan.		R
Fault Bit array Channel B	2336	4	64 bits – 1 bit per device for error indication.		R
Channel B Gateway State	2340	1	Configuring/Ready/Faulted (0,1,2)		R
Production data size Channel B	2341	1	The number of bytes of data in the consumption scan		R
Consumption data size B	2342	1	The number of bytes of data in the production scan		R
Channel B Attached device listing	2533	190	Total registers in listing (2343) Starting at 2344 format is as follows per QCPort device: Device ID Starting Production Register Starting Consumption Resister		R
Channel B Interscan Delay	7550	1	Adds a dead time in the QCPort scan of the register value times 5ms. 0-65536 x 5ms		R/W

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Modbus Adapter Configuration (holding register area)

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
Modbus Adapter Serial Number	7505	2	This devices serial number	R
Modbus Adapter Hardware Revision	7507	1	This devices hardware revision number	R
Modbus Adapter Firmware Revision	7508	1	Major firmware ware revision	R
Modbus Adapter Firmware Build	7509	1	Minor firmware Build	R
Catalog Number	7510	16	ASCII text product description	R
Connection Timeout	7526	1	milli-second connection timeout. 0 = disabled (default), increments of 200ms (automatically rounds up to the nearest 2000ms)	R/W

TCP/IP Configuration (holding register area)

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
MAC ID	7527	3	48 bit Hardware address	R
Address	7530	2	The current active IP address HH.HL.LH.LL Word 7530 - HH HL Word 7531 - LH LL	R/W
Address mode	7532	1	0 – 192.168.10.1 1 – Static (will save current IP address) 2 – Bootp (default)	R/W
Subnet Mask	7533	2	The current active subnet mask HH.HL.LH.LL Word 7533 - HH HL Word 7534 - LH LL	R/W
Default Gateway	7535	2	The currently set default Gateway HH.HL.LH.LL Word 7535 - HH HL Word 7536 - LH LL	R/W
Connection Limit	7537	1	Number of Modbus socket connections allowed	R/W
Modbus TCP Slave Address	7538	1	The MBAP header unit ID which this Modbus Adapter will respond to (default 1)	R/W

Serial Modbus RS485 Configuration (holding register area)

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
Serial Modbus RS485 Baud Rate	7539	1	The currently selected Serial Modbus RS485 baud. Uses Modbus Adapter baud rate enumerations.	R
Serial Modbus RS485 Node ID	7540	1	The currently active Serial Modbus RS485 node ID	R
Serial Modbus RS485 Protocol	7541	1	0 = RTU (Default) 1 = ASCII	R
Parity	7542	1	0 = even (default) 1 = odd 2 = none	R/W

QCPort A Configuration (holding register area)

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
Modbus Adapter QCPort Device IDA	7544	1	Default 0xffff	R
QCPort Channel A Baud	7546	1	9600 = 48 19200 = 24 38400 = 12 57600 = 8 115200 = 4 230400 = 2 460800 = 1 (default)	R/W
QCPort Channel A Modbus Parity	7547	1	0 = even (default) 1 = odd 2 = none	R/W
QCPort Channel A Modbus baud.	7548	1	1200 = 384 2400 = 192 4800 = 96 9600 = 48 19200 = 24 (default) 38400 = 12 57600 = 8 115200 = 4 230400 = 2 460800 = 1	R/W

QCPort B Configuration (holding register area)

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
Modbus Adapter QCPort Device IDB	7549	1	Default 0xffff	R
QCPort Channel B baud	7551	1	9600 = 48 19200 = 24 38400 = 12 57600 = 8 115200 = 4 230400 = 2 460800 = 1	R/W
QCPort Channel B Modbus Parity	7552	1	Even = 0, Odd = 1, None = 2	R/W
QCPort Channel B Modbus baud	7553	1	1200 = 384 2400 = 192 4800 = 96 9600 = 48 19200 = 24 (default) 38400 = 12 57600 = 8 115200 = 4 230400 = 2 460800 = 1	R/W

Serial Slow Response Setup (holding register area)

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
Modbus Allow Channel A Slow Response	7554	1	0 – Disable (default) 1 – Enable When performing serial pass through, some Serial Modbus devices respond slower then 100 ms, because of this if this register is set true the response time will be lengthened to 750 ms prior to timing out the message.	R/W
Modbus allow Channel B Slow Response	7555	1	0 – Disable (default) 1 – Enable When performing serial pass through, some Serial Modbus devices respond slower then 100 ms, because of this if this register is set true the response time will be lengthened to 750 ms prior to timing out the message.	R/W

Auto Configuration (AC) Push Button Functionality (holding register area)

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
AC Push Button Enable	7556	1	0 – Disable 1 – Enable (default) This setting is used to disable the use of the AC push button after a power up. If the button is disabled, then a power up reset will reset the IP address and mode to BootP.	R/W
Duplex Mode V1.007 and later	7557	1	Duplex mode of the TCP connection. 0 = Half (default) 1 = Full	R/W
Data Swap V1.007 and later	7558	1	By default the D77D-EMA is big endian, for little endian controllers this register will swap bytes within the holding registers. 0 – data is not swapped (default) 1 – swap data	R/W

Special Functions (holding register area)

Description	Modbus Register	Size (Reg)	Usage	Read/ Write
Power Cycle D77D-EMA	11857	1	0xaa55 to activate, register is cleared when action complete	R/W
Reset D77D-EMA to Out of Box	11858	1	0xaa55 to activate, register is cleared when action complete	R/W
Reset Service – hard reconfiguration	11859	1	Channel(s) 0x0001 A, 0x0002 B 0x0003 both, cleared when complete	R/W
Reset Service – soft reconfiguration	11860	1	Channel(s) 0x0001 A, 0x0002 B 0x0003 both, cleared when complete	R/W
Modbus Wormhole TxA	12395	251	Modbus wormhole transmit area A	R/W
Modbus Wormhole RxA	12646	251	Modbus wormhole receive area A	R/W
Modbus Wormhole TxB	12897	251	Modbus wormhole transmit area B	R/W
Modbus Wormhole RxB	13148	251	Modbus wormhole receive area B	R/W
Get QCPort Device Fault	14485	3	Register 14485 =Channel Register 14486 =QCPort Device ID Register 14487 =Fault	
Power Supply Volatage	14490	1	Power Supply voltage x 10	R
Flash CPU Status LED	14493	1	0 = CPU status LED flash normal 1 = CPU status LED rapid flash	R/W
Deleted Connections V1.007 and later	14560	1	Number of total deleted connections of the D77D-EMA .	R
Active Connections V1.007 and later	14561	1	Number of active connections to the D77D-EMA.	R
Collision Counter V1.007 and later	14562	1	Total number of collisions that have occurred on the TCP network between the D77D-EMA and the master.	R

Dynamic Device Addition (DDA) Functions (Version 1.007 and later)

Description	Modbus Register		Size (Reg)	Usage	Read/ Write
	CH A	CH B			
DDA Produced Data Allocated	14494	14510	1	Sets the total consumed data size when using DDA.	R/W
DDA Consumed Data Allocated	14495	14511	1	Sets the total produced data size when using DDA.	R/W
DDA Produced Data Free	14496	14512	1	DDA Consumed Data Max minus Current Consumed data.	R
DDA Consumed Data Free	14497	14513	1	DDA Produced Data Max minus Current Produced data.	R
DDA Production Size	14498	14514	1	The amount of production data this node will use if added	R
DDA Consumption Size	14499	14515	1	The amount of consumption data this node will use if added	R
DDA Add Method	14500	14516	1	0 – Auto Add 1 – Explicit 2 – Reserved	R/W
DDA Enable	14501	14517	1	0 - Disabled 1- Enabled	R/W
DDA Device Available	14502	14518	1	0 - No node available 1- Node available to add	R
DDA Next Device ID	14503	14519	1	The device ID you should use for DDA	R
Device Type	14504	14520	1	The type of device which is showing up on QCPort	R
DDA Added Device Count	14505	14521	1	The number of devices added	R
DDA Add Device Explicit	14506	14522	1	When the explicit method of adding a device is chosen, writing the value in register 14503/14519 will execute the DDA and add the device to the scan list.	R/W

Appendix D Modbus Adapter Fault List

Hard – Solid Red MS LED (Major Fault)
Medium – Flashing Red MS LED (Recoverable Fault)
Soft – Flashing Green MS LED (Minor Fault)

Register 2305 (holding register area)

Bit	Fault	Fault Name	Type	Fault Description
0				Reserved
1	1	Interdevice comm. failure	Hard	Processor unable to communicate with Ethernet. This could be caused by extreme noise, esd or eft. Try removing potential problems and cycle power to the D77D-EMA. Ultimately this may mean that the circuit board is faulty.
2	2	TCP Poll Timeout	Medium	A TCP connection has timed out. This may mean that no traffic has occurred on the connection for a long time, or that the Ethernet cable has been disconnected. Logical connections which are not properly terminated can result in "half open connections". Half open connections actually use up a connection on the D77D-EMA and can result in no resources being left to connect to. Check Ethernet physical connections and attempt to re-connect using a client tool. If no connections can be obtained, cycle power to the D77D-EMA to clear all logical connections.
3	3	Serial Modbus RS485 ID Fault	Medium	Modbus dip switches are set illegally. Either 0 or a number greater than 247 has been selected on the D77D-EMA. Select a valid Modbus ID and cycle power to the D77D-EMA.
4-6				Reserved
7	7	NV Flash Fault	Hard	The non-volatile flash data check failed. Stored data may be corrupted. D77D-EMA should be power-cycled. If the fault still exists the D77D-EMA should be totally re-configured.
8-11				Reserved
12	12	Phantom ISR	Hard	An unexpected interrupt occurred.
13-15				Reserved

Register 2306 (holding register area)

Bit	Fault	Fault Name	Type	Fault Description
0-2				Reserved
3	19 0x13	QCPort Channel A Busy	Hard	D77D-EMA can't get QCPort channel A. QCPort channel fault. Line may be oscillating due to lack of termination or from a shorted line.
4	20 0x14	QCPort Channel B Busy	Hard	D77D-EMA can't get QCPort channel B. QCPort channel fault. Line may be oscillating due to lack of termination or from a shorted line.
5-15				Reserved

Register 2307 (holding register area)

Bit	Fault	Fault Name	Type	Fault Description
0-2				Reserved
3	32 0x20	Invalid Device ID Channel A	Hard	Device ID is wrong. (Group out of range)
4	33 0x21	Invalid Device ID Channel B	Hard	Device ID is wrong. (Group out of range)
5-15				Reserved

Register 2308 (holding register area)

Bit	Fault	Fault Name	Type	Fault Description
0-1				Reserved
2	50 0x32	Too Many Devices connected to Channel A	Medium	Too many devices were attached to the channel.
3	51 0x33	Too Many Devices connected to Channel B	Medium	Too many devices were attached to the channel.
4	52 0x34	Duplicate Device ID Channel A	Hard	Two or more devices have the same ID.
5	53 0x35	Duplicate Device ID Channel B	Hard	Two or more devices have the same ID.
6	54 0x36	Device Failed to Respond Channel A	Medium	Request to device went unanswered. A device is not responding with necessary information.
7	55 0x37	Device Failed to Respond Channel B	Medium	Request to Device went unanswered. A device is not responding with necessary information.
8	56 0x38	Device Config CRC Error Channel A	Medium	Device configuration CRC is bad.
9	57 0x39	Device Config CRC Error Channel B	Medium	Device configuration CRC is bad.
10	58 0x3A	Scan Fail to respond Channel A	Medium	Device failed to send data in its scan slot.
11	59 0x3B	Scan Fail to respond Channel B	Medium	Device failed to send data in its scan slot.
12	60 0x3C	Configuration Channel A Fault	Medium	An non-recoverable error occurred while trying to obtain configuration regarding a device on channel A. Since the configuration is necessary to run, this is an unrecoverable fault. Recommended action, try performing the appropriate reset service in an attempt to obtain the correct configuration information.
13	61 0x3D	Configuration Channel B Fault	Medium	An non-recoverable error occurred while trying to obtain configuration regarding a device on channel B. Since the configuration is necessary to run, this is an unrecoverable fault. Recommended action, try performing the appropriate reset service in an attempt to obtain the correct configuration information
14-15				Reserved

Register 2309 (holding register area)

Bit	Fault	Fault Name	Type	Fault Description
0	64 0x40	QCPort Device Fault	Medium	A QCPort device has responded with a fault or a fault has been logged specific to a QCPort device.
1	65 0x41	OS Mailbox Fault	Hard	A software problem has occurred – it is no longer safe to continue running. Reset the D77D-EMA, or cycle power.
2	66 0x42	Duplicate Group ID	Hard	The physical group ID switch is set the same on two QCPort devices.
3	67 0x43	Invalid Group ID	Hard	A QCPort device is using a reserved group ID.
4	68 0x44	Power Fail	Hard	The main QCPort supply is failing.
5	69 0x45	Gather Configuration A Fault	Hard	We failed to successfully build up configuration for devices on channel A.
6	70 0x46	Gather Configuration B Fault	Hard	We failed to successfully build up configuration for devices on channel B.
7	71 0x47	No QCPort Devices Found	Soft	No QCPort devices were found or are registered.
8	72 0x48	Too much consumption data Fault	Medium	Devices connected to the D77D-EMA consume more data than the D77D-EMA is allowed to consume.
9	73 0x49	Too much production data Fault	Medium	Devices connected to the D77D-EMA produce more data than the D77D-EMA is allowed to produce.
10-15				Reserved

Register 2310 (holding register area)

Bit	Fault	Fault Name	Type	Fault Description
0	80 0x50	Unexpected Fault	Hard	Some unexpected or irregular sequence has occurred.
1-3				Reserved
4	84 0x54	Data Change Fault Ch A	Medium	The production or consumption data on A does not agree with stored. Something has changed the data size or type in one or more devices such that the data size or type no longer agrees with the expected data size.
5	85 0x55	Data Change Fault Ch B	Medium	The production or consumption data on A does not agree with stored. Something has changed the data size or type in one or more devices such that the data size or type no longer agrees with the expected data size.
6-15				Reserved

Technical Support

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**For additional information on this product,
Please call our Customer Support Center at:**

1-800-356-1243

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**For service or start-up assistance
24 hours/day, 7 days/week,
please call:**

1-800-498-2678

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Company Information

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