

# Modicon Quantum Automation Series Hardware Reference Guide

840 USE 100 00    Version 11.0





---

## Document Set

---

### At a Glance

This manual consists of two volumes.

#### Volume 1

- Quantum Automation System Overview
- Quantum Configurations
- Network Configurations
- System Specifications for Quantum Modules
- Hardware Specifications for Quantum Modules
- Power Supply Modules
- CPU Modules
- Quantum Field Bus Modules
- Distributed I/O (DIO) for Quantum Modules
- Quantum Remote I/O Communication Modules
- Quantum Modbus Plus Network Option Modules
- Quantum Modbus Plus Networking on Fiber Module
- Quantum Ethernet Modules
- Intelligent/Special Purpose Modules for Quantum
- Quantum Intrinsically Safe Analog/Digital, Input/Output Modules
- Quantum Simulator Modules
- Quantum Battery Module

#### Volume 2

- Quantum I/O Modules
- Miscellaneous Components
- Spare Parts
- Hardware Installation
- Power and Grounding Guidelines
- CableFast Cabling
- Error Stopped Codes
- Agency Approvals





---

# Table of Contents



---

	<b>Safety Information</b> .....	<b>xi</b>
	<b>About the Book</b> .....	<b>xiii</b>
	<b>Part I Quantum Automation System Overview</b> .....	<b>1</b>
<b>Chapter 1</b>	<b>Modicon Quantum Automation System Overview</b> .....	<b>3</b>
	Modicon Quantum Automation Series Overview .....	4
	Quantum Power Supplies .....	5
	Quantum CPU Modules .....	6
	Quantum I/O Modules .....	7
	Quantum Communication Interface Modules .....	8
	Quantum Intelligent/Special Purpose I/O Modules .....	11
	Quantum Simulator Modules (XSM) .....	12
	Quantum Battery, Backplanes, and CableFast Cabling .....	13
	Quantum Programming Packages .....	14
	<b>Part II Quantum System Configurations</b> .....	<b>15</b>
<b>Chapter 2</b>	<b>Quantum Configurations</b> .....	<b>17</b>
	Quantum Local I/O, Remote I/O and Distributed I/O Configurations .....	18
	Quantum Local I/O .....	20
	Quantum Remote I/O (RIO) .....	21
	Quantum Distributed I/O (DIO) .....	25
<b>Chapter 3</b>	<b>Network Configurations</b> .....	<b>29</b>
	Quantum Network Support .....	30
	Quantum Network Interface Techniques .....	33
	Quantum Modbus and Modbus Plus Communications .....	37
	<b>Part III Quantum System Specifications</b> .....	<b>41</b>
<b>Chapter 4</b>	<b>System Specifications for the Quantum Module</b> .....	<b>43</b>

---

<b>Part IV</b>	<b>Quantum Module Specifications and Configuration . . .</b>	<b>47</b>
<b>Chapter 5</b>	<b>Hardware Specifications for the Quantum Modules. . . . .</b>	<b>49</b>
<b>Chapter 6</b>	<b>Power Supply Modules . . . . .</b>	<b>59</b>
	140CPS11100 AC Power Supply 115/230 Vac 3 A Module . . . . .	60
	140CPS11100 AC Power Supply 115/230 Vac 3 A Module (PV01 or Greater) . . . . .	63
	140CPS11400 AC Power Supply, 115/230 Vac, 8 A Module . . . . .	66
	140CPS11410 AC Summable Power Supply 115/230 Vac, 8 A . . . . .	69
	140CPS11420 AC Summable Power Supply 115/230 Vac, 11 A . . . . .	72
	140CPS12400 AC Redundant Power Supply, 115/230 Vac 8 A Module . . . . .	75
	140CPS12420 AC Redundant Power Supply, 115/230 Vac 11 A Module . . . . .	78
	140CPS21100 DC Power Supply, 24 Vdc, 3 A Module. . . . .	81
	140CPS21400 DC Summable Power Supply, 24 Vdc, 8 A Module. . . . .	84
	140CPS22400 DC Redundant Power Supply, 24 Vdc, 8 A Module . . . . .	87
	140CPS41400 DC Summable Power Supply, 48 Vdc, 8 A Module. . . . .	90
	140CPS42400 DC Redundant Power Supply, 48 Vdc, 8 A Module . . . . .	93
	140CPS51100 DC Power Supply, 125 Vdc, 3 A Module. . . . .	96
	140CPS52400 DC Standalone/Redundant Power Supply, 125 Vdc, 8 A . . . . .	99
<b>Chapter 7</b>	<b>CPU Modules . . . . .</b>	<b>103</b>
	140CPU11302 CPU Module . . . . .	105
	140CPU11303 CPU Module . . . . .	115
	140CPU21304 CPU Module . . . . .	125
	140CPU42402 CPU Module . . . . .	135
	140CPU43412 CPU Module . . . . .	145
	140CPU43412A CPU Module . . . . .	156
	140CPU53414 CPU Module . . . . .	167
	140CPU53414A CPU Module . . . . .	178
<b>Chapter 8</b>	<b>Quantum Field Bus Modules . . . . .</b>	<b>189</b>
	140CRP81100 Profibus DP Master Communications Module. . . . .	190
	140EIA92100 Quantum AS-i Master Module. . . . .	195
	140NOA6XXXX Quantum InterBus Communications Modules. . . . .	201
	140NOL911X0 Quantum LonWorks Network Option Modules . . . . .	208
<b>Chapter 9</b>	<b>Distributed I/O (DIO) for the Quantum Modules . . . . .</b>	<b>213</b>
	140CRA21X10 Quantum Distributed I/O (DIO) Modules. . . . .	214
	140CRA21X20 Quantum Distributed I/O (DIO) Modules. . . . .	219
<b>Chapter 10</b>	<b>Quantum Remote I/O Communication Modules . . . . .</b>	<b>225</b>
	140CRP93X00 Remote I/O (RIO) Head Single and Dual Channel Module. . . . .	226
	140CRA93X00 Quantum RIO Adapter Drop Single and Dual Channel Module . . . . .	230
<b>Chapter 11</b>	<b>Quantum Modbus Plus Network Option Modules . . . . .</b>	<b>235</b>
	140NOM21X00 Quantum Modbus Plus Network Option Modules . . . . .	235

<b>Chapter 12</b>	<b>Quantum Modbus Plus Networking on Fiber Module . . . . .</b>	<b>245</b>
	140NOM25200 Quantum Networking Modbus Plus on Fiber Module . . . . .	245
<b>Chapter 13</b>	<b>Quantum Ethernet Modules . . . . .</b>	<b>265</b>
	140NOE2X100 Quantum Ethernet TCP/IP Module . . . . .	266
	140NOE3X100 Quantum Ethernet SY/MAX Modules . . . . .	270
	140NOE5X100 Quantum Ethernet MMS Modules . . . . .	273
	140NOE771xx Ethernet Modules . . . . .	276
<b>Chapter 14</b>	<b>Intelligent/Special Purpose Modules for the Quantum . . . . .</b>	<b>289</b>
	140EHC10500 High Speed Counter Module . . . . .	290
	I/O Configuration for 140EHC20200 . . . . .	294
	140EHC20200 High Speed Counter Module . . . . .	319
	140ESI06210 ASCII Interface Module . . . . .	332
	140HLI34000 High Speed Interrupt Module . . . . .	338
	140MSB/MSX10100 Quantum MSX Motion Modules . . . . .	342
	140XBE10000 Backplane Expander and Cable . . . . .	352
	140CHS11000 Hot Standby Module . . . . .	357
<b>Chapter 15</b>	<b>Quantum Intrinsically Safe Analog/Digital, Input/Output Modules . . . . .</b>	<b>361</b>
15.1	Intrinsically Safe Modules - General Information . . . . .	362
	Intrinsically Safe Modules – General Description . . . . .	362
15.2	Intrinsically Safe Analog Modules . . . . .	366
	I/O Configuration for Intrinsically Safe Analog Modules . . . . .	367
	140AI33000 Intrinsically Safe Analog Input Module . . . . .	375
	140AI33010 Intrinsically Safe Current Input Module . . . . .	387
	140AIO33000 Intrinsically Safe Analog Output Module . . . . .	393
15.3	Intrinsically Safe Discrete Modules . . . . .	399
	I/O Configuration for Intrinsically Safe Discrete Modules . . . . .	400
	140DII33000 Intrinsically Safe Discrete Input Module . . . . .	402
	140DIO33000 Intrinsically Safe Discrete Output Module . . . . .	408
<b>Chapter 16</b>	<b>Quantum Simulator Modules . . . . .</b>	<b>415</b>
	140XSM00200 Quantum Point Discrete Simulator Module . . . . .	416
	140XSM01000 Analog Simulator Module . . . . .	417
<b>Chapter 17</b>	<b>Quantum Battery Module . . . . .</b>	<b>421</b>
	I/O Configuration for the 140XCP90000 Battery Module . . . . .	422
	140XCP90000 Quantum Battery Module . . . . .	423
<b>Chapter 18</b>	<b>Quantum I/O Modules . . . . .</b>	<b>429</b>
18.1	Overview of I/O Modules . . . . .	430
	Quantum I/O Modules . . . . .	431
	I/O Map Status Byte . . . . .	442
18.2	Analog Input Modules . . . . .	444
	I/O Configuration for Analog Input Modules . . . . .	445

	140ACI03000 I/O Analog In Module . . . . .	461
	140ACI04000 High Density Analog in I/O Module. . . . .	464
	140ARI03010 I/O RTD Input 8 Channel Module . . . . .	467
	140ATI03000 I/O Thermocouple Input 8 Channel Module . . . . .	470
	140AVI03000 I/O Analog IN 8 Channel Bipolar Module . . . . .	473
18.3	Analog Output Modules . . . . .	477
	I/O Configuration for Analog Output Modules . . . . .	478
	140ACO02000 Quantum I/O Analog Current Out Module. . . . .	482
	140ACO13000 High Density Analog Out I/O Module . . . . .	486
	140AVO02000 Quantum I/O Analog Voltage Out Module. . . . .	489
18.4	Analog Input/Output Modules . . . . .	493
	Configuration of the 140AMM09000 Analog Input/Output Module . . . . .	494
	140AMM09000 Analog Input/Output Module. . . . .	498
18.5	Discrete Input Modules . . . . .	504
	I/O Configuration for Discrete Input Modules. . . . .	505
	140DAI34000 Quantum I/O 24 VAC IN Module. . . . .	509
	140DAI35300 Quantum I/O AC Input 24 Vac Module . . . . .	512
	140DAI44000 Quantum I/O 48 VAC IN Module. . . . .	515
	140DAI45300 Quantum I/O AC Input 48 Vac 4x8 Module. . . . .	518
	140DAI54000 Quantum I/O 115 VAC In Module. . . . .	521
	140DAI54300 Quantum I/O AC Input 115 Vac 2x8 Module. . . . .	524
	140DAI55300 Quantum I/O AC Input 115 Vac 4x8 Module. . . . .	527
	140DAI74000 Quantum I/O AC Input 230 Vac 16x1 Module. . . . .	530
	140DAI75300 Quantum I/O AC Input 230 Vac 4x8 Module. . . . .	533
	140DDI15310 Quantum I/O DC Input 5 V TTL 4x8 Source Module . . . . .	536
	140DDI35300 Quantum I/O DC Input 24 Vdc 4x8 Sink Module . . . . .	538
	140DDI35310 Quantum I/O DC Input 24 Vdc True Low 4x8 Input Module . . . . .	540
	140DDI36400 I/O DC Input 24 VDC 6x16 Telefast Input Module . . . . .	542
	140DDI67300 Quantum I/O DC Input 125 Vdc 3x8 Sink Module . . . . .	546
	140DDI84100 Quantum I/O DC Input 10 ... 60 Vdc 8x2 Sink Module . . . . .	550
	140DDI85300 Quantum I/O DC Input 10 ... 60 Vdc 4x8 Sink Module . . . . .	553
18.6	Discrete Output Modules . . . . .	556
	I/O Configuration for Discrete Output Modules . . . . .	557
	140DAO84000 I/O AC Output 24 ... 230 Vac 16x1 Module. . . . .	564
	140DAO84010 I/O AC Output 24 ... 115 Vac 16x1 Module. . . . .	568
	140DAO84210 Quantum I/O AC Output 100 ... 230 Vac 4x4 Module. . . . .	572
	140DAO84220 Quantum I/O AC Output 24 ... 48 Vac 4x4 Module. . . . .	577
	140DAO85300 Quantum I/O AC Output 24 ... 230 Vac 4x8 Module. . . . .	582
	140DDO15310 I/O DC Output 5 V TTL 4x8 Sink Module . . . . .	586
	140DDO35300 Quantum I/O DC Output 24 Vdc 4x8 Source Module . . . . .	590
	140DDO35301 I/O DC Output 24 VDC 4x8 Discrete Source Module . . . . .	594
	140DDO35310 I/O DC Output 24 Vdc 4x8 Sink Module . . . . .	597
	140DDO36400 I/O DC Output 24VDC 6x16 Telefast Output Module . . . . .	601
	140DDO84300 Quantum I/O DC Output 10 ... 60 Vdc 2x8 Source Module . . . . .	606
	140DDO88500 Quantum I/O DC Output 24-125 Vdc 2x6 Source Module . . . . .	609

	140DRA84000 Quantum I/O Relay Output 16x1 Normally Open Module. . . .	613
	140DRC83000 Quantum I/O Relay Output 8x1 Normally Open/ Normally Closed Module . . . . .	616
18.7	Discrete Verified Output Module . . . . .	619
	I/O Configuration for the Discrete Verified Output Module – 140DVO85300 . .	620
	140DVO85300 I/O Verified 10-30 VDC Out Module . . . . .	625
18.8	Discrete Supervised Input Module . . . . .	629
	I/O Configuration for the Discrete Supervised Input Module – 140DSI35300. .	630
	140DSI35300 I/O DC 24V Supervised Input Module . . . . .	631
18.9	Discrete Input/Output Modules . . . . .	634
	I/O Configuration for Discrete Input/Output Modules . . . . .	635
	140DAM59000 Quantum I/O AC Input 115 Vac 2x8 / AC Output 115 Vac 2x4) . . . . .	639
	140DDM39000 I/O DC Input 24 Vdc 2x8 Sink/DC Output 24 Vdc 2x4 Source Module . . . . .	646
	140DDM69000 I/O 125 VDC Input/High Power Output Module . . . . .	651

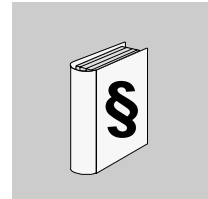
<b>Appendices</b>		<b>657</b>
<b>Appendix A</b>	<b>Miscellaneous Components</b>	<b>659</b>
<b>Appendix B</b>	<b>Spare Parts</b>	<b>669</b>
<b>Appendix C</b>	<b>Hardware Installation</b>	<b>673</b>
	Hardware Installation – Selecting Backplanes . . . . .	674
	Hardware Installation – Mounting Brackets. . . . .	681
	Hardware Installation – Space Requirements for the Quantum System. . . . .	684
	Hardware Installation – Mounting Quantum Modules . . . . .	686
<b>Appendix D</b>	<b>Power and Grounding Guidelines</b>	<b>691</b>
	Power and Grounding Considerations for AC and DC Powered Systems . . . .	692
	System Design Considerations for Quantum Power Supplies . . . . .	703
	Grounding . . . . .	710
	Closed System Installation . . . . .	712

---

<b>Appendix E</b>	<b>CableFast Cabling</b> .....	<b>715</b>
	Features of the CableFast Cabling System .....	716
	140 CFA 040 00 Quantum CableFast Cabling Block .....	722
	140 CFB 032 00 Quantum CableFast Cabling Block .....	724
	140 CFC 032 00 Quantum CableFast Cabling Block .....	727
	140 CFD 032 00 Quantum CableFast Cabling Block .....	733
	140 CFE 032 00 Quantum CableFast Cabling Block .....	735
	140 CFG 016 00 Quantum CableFast Cabling Block .....	737
	140 CFH 008 00 Quantum CableFast Cabling Block .....	742
	140CFI00800 Quantum CableFast Cabling Block .....	746
	140CFJ00400 Quantum CableFast Cabling Block .....	750
	140CFK00400 Quantum CableFast Cabling Block .....	754
	CableFast Cables .....	758
	CableFast Accessories .....	763
<b>Appendix F</b>	<b>Error Stopped Codes</b> .....	<b>765</b>
<b>Appendix G</b>	<b>Agency Approvals</b> .....	<b>769</b>
	<b>Index</b> .....	<b>xv</b>

---

# Safety Information



---

## Important Information

### NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



## DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death, serious injury, or equipment damage.



## WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.



## CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

---

**PLEASE NOTE**

Electrical equipment should be serviced only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained persons.

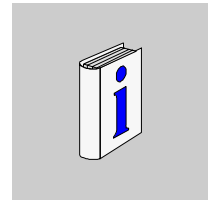
© 2004 Schneider Electric. All Rights Reserved.

---



---

## About the Book



---

### At a Glance

**Document Scope** This manual is a reference guide for the hardware of the Quantum automation system.

**Validity Note** The data and illustrations found in this book are not binding. We reserve the right to modify our products in line with our policy of continuous product development. The information in this document is subject to change without notice and should not be construed as a commitment by Schneider Electric.

**Product Related Warnings** Schneider Electric assumes no responsibility for any errors that may appear in this document. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

No part of this document may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without express written permission of Schneider Electric.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When controllers are used for applications with technical safety requirements, please follow the relevant instructions.

Failure to use Schneider Electric software or approved software with our hardware products may result in improper operating results.

Failure to observe this product related warning can result in injury or equipment damage.

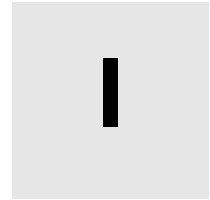
**User Comments** We welcome your comments about this document. You can reach us by e-mail at [techpub@schneider-electric.com](mailto:techpub@schneider-electric.com)

---



---

# Quantum Automation System Overview



---

## At a Glance

### Overview

This part provides an overview of the Quantum Automation System.

### What's in this Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
1	Modicon Quantum Automation System Overview	3



---

# Modicon Quantum Automation System Overview

# 1

---

## At a Glance

### Introduction

This chapter provides an overview of the Modicon Quantum Automation System, which includes Modicon Quantum software support.

### What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Modicon Quantum Automation Series Overview	4
Quantum Power Supplies	5
Quantum CPU Modules	6
Quantum I/O Modules	7
Quantum Communication Interface Modules	8
Quantum Intelligent/Special Purpose I/O Modules	11
Quantum Simulator Modules (XSM)	12
Quantum Battery, Backplanes, and CableFast Cabling	13
Quantum Programming Packages	14

---

## Modicon Quantum Automation Series Overview

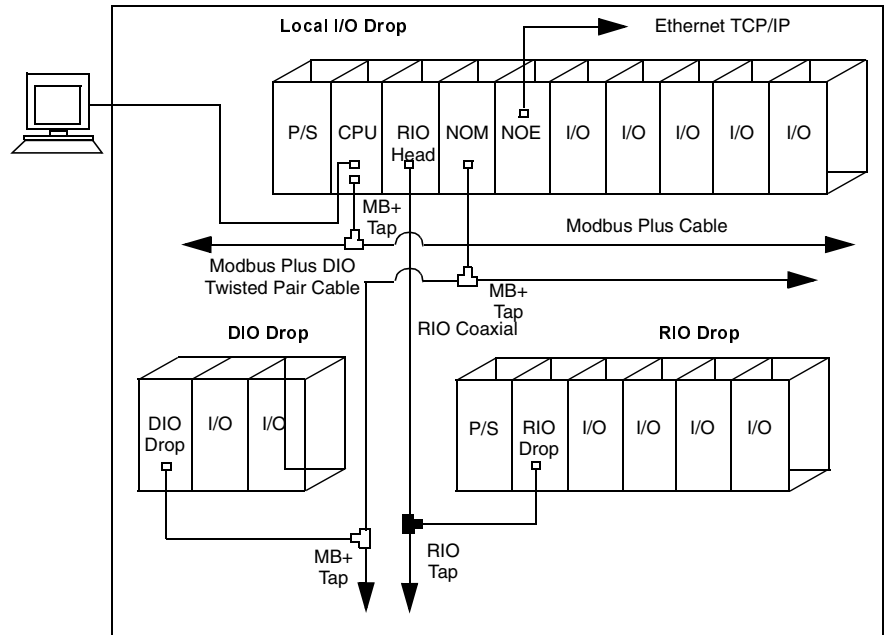
### Overview

The Modicon Quantum system is a special-purpose computing system with digital processing capabilities. Modicon Quantum is designed for real time control in industrial and manufacturing applications in a modular, expandable architecture employing the following modules.

- Power Supply
- CPU
- I/O
- I/O Network Interface
- Intelligent/Special Purpose I/O
- Simulator (XSM)
- Battery
- Backplanes
- CableFast Cabling

### Modicon Quantum System Block Diagram

The following figure is a block diagram of a typical Modicon Quantum system.



## Quantum Power Supplies

### Overview

Quantum power supplies are used to supply system power to all modules inserted into the backplane, including:

- Quantum CPU modules
- Quantum Interface modules
- Quantum I/O modules

Depending upon the system configuration, the option exists of using the power supply in three different modes.

### Power Supply Modes

The following table shows the power supply modes.

Power Supply Type	Usage
Standalone	For 3 A, 8 A or 11 A configurations that do not require fault tolerant or redundant capabilities.
Standalone Summable	For configurations consuming more than the rated current of one supply, two summing power supplies can be installed in the same backplane.
Redundant	For configurations requiring power for uninterrupted system operation. Two redundant power supplies are required for redundancy.



## CAUTION

### System Safety

Exercise caution when considering a combination of power supplies in a backplane. Use only like power supplies with the exceptions noted in *System Design Considerations for Quantum Power Supplies*, p. 703.

**Failure to follow this precaution can result in injury or equipment damage.**

## Quantum CPU Modules

---

### Overview

The Quantum CPU is a module residing on the Quantum local I/O backplane. The CPU is a digitally operating electronic system, which uses a programmable memory for the internal storage of user instructions. These instructions are used to implement specific functions such as:

- Logic
- Process sequencing
- Timing
- Coupling
- Arithmetic

These instructions allow control through digital and analog outputs, for various types of machines and processes.

The Quantum CPU serves as a bus master controlling the local, remote, and distributed I/O of the Quantum system.

---



## Quantum I/O Modules

---

### Overview

Quantum I/O modules are electrical signal converters that convert signals to and from field devices to a signal level and format, which can be processed by the CPU, such as:

- Limit switches
- Proximity switches
- Temperature sensors
- Solenoids
- Valve actuators

All I/O modules are optically isolated to the bus, ensuring safe and trouble-free operation. All I/O modules are also software configurable.

---

## Quantum Communication Interface Modules

### Overview

Nine types of communication interface modules are available and presented in the table below, and are described in the following text.

### Network Interface Modules

The following table shows the communication interface modules.

Type	Description
RIO	Single and dual channel Remote I/O interface modules (RIO heads and drops) connected via a coaxial cable network.
DIO	Single and dual channel Distributed I/O interface modules connected via a twisted pair Modbus Plus cable network.
NOM	Single and dual channel Network Option Modules (NOM) connected via a twisted pair Modbus Plus cable network.
Fiber Optic Modbus Plus	Modbus Plus on fiber module connected via a fiber optic Modbus Plus cable network.
Ethernet TCP/IP	Single channel Ethernet TCP/IP interface module connected via a twisted pair or fiber optic cable network.
InterBus	InterBus Interface module connected via a twisted pair network.
SY/MAX Ethernet	SY/MAX Ethernet module connected via a twisted pair or fiber optic cable network.
LonWorks	LonWorks module connected via a twisted-pair network.
MMS Ethernet	MMS Ethernet module connected via a fiber optic cable network.
Profibus	Profibus Master module connected via a Profibus RS-485 port.
AS-i	AS-i module connected via a two-wire AS-i port.

---

<b>RIO Modules (CRA/CRP)</b>	<p>Quantum RIO head and drop modules use a S908-based networking I/O configuration. Communication is done via single or dual coaxial cabling up to 15,000 feet away. This configuration supports a mix of the following product lines:</p> <ul style="list-style-type: none"><li>● SY/MAX</li><li>● 200 Series</li><li>● 500 Series</li><li>● 800 Series</li><li>● Quantum I/O</li></ul> <p>When Quantum RIO is required, the Quantum controller may support up to 31 RIO drops. In an RIO configuration, an RIO head module is connected with coaxial cable to RIO drop modules at each remote drop.</p>
<b>DIO Module (CRA)</b>	<p>Quantum DIO is implemented over a Modbus Plus network. The CPU or NOMs module may be the network head via their Modbus Plus ports.</p> <p>Quantum DIO Modbus Plus drop adaptors are specifically designed to link Quantum I/O modules to the head via twisted pair shielded cable (Modbus Plus). The DIO drop modules also provide the I/O with power (maximum 3A) from a 24 Vdc or a 115/230 Vac source. Each DIO network supports up to 63 distributed drops using repeaters.</p>
<b>Network Option Module (NOM)</b>	<p>Quantum NOM modules provide extended communication capabilities for the Quantum system within a Modbus Plus configuration.</p>
<b>Modbus Plus on Fiber Module (NOM)</b>	<p>Quantum Modbus Plus on Fiber modules provides connectivity to Modbus Plus nodes by fiber cable without fiber optic repeaters, and allows the creation of a pure fiber optic network or a mixed fiber optic/twisted-pair network (with the use of a 490NRP254 Fiber Optic Repeater).</p>
<b>Ethernet TCP/IP (NOE) Modules</b>	<p>Quantum Ethernet TCP/IP modules make it possible for a Quantum controller to communicate with devices on an Ethernet network using TCP/IP – the de facto standard protocol. An Ethernet module may be inserted into an existing Quantum system and connected to existing Ethernet networks via fiber optic or twisted pair cabling.</p>
<b>SY/MAX Ethernet Modules (NOE)</b>	<p>Quantum-SY/MAX-Ethernet modules are Quantum CPU network option modules that can be placed in a Quantum backplane to connect Quantum controllers to SY/MAX devices and applications.</p>

---

**MMS-Ethernet  
Modules (NOE)**

Quantum-MMS-Ethernet modules are Quantum CPU network option modules that can be placed in a Quantum backplane to connect Quantum controllers to MMS devices and applications.

---

**InterBus  
Interface Module  
(NOA)**

The Quantum InterBus is the interface module to the InterBus bus. The InterBus bus is a fieldbus network designed for I/O blocks and intelligent devices used in manufacturing. It offers a master/slave topology that permits deterministic I/O servicing over its 13 km twisted pair network.

---

**LonWorks  
Modules (NOL)**

Quantum NOL modules provide connectivity between a Quantum controller and a LonWorks network, based on Echelon's LonWorks technology. The NOL module is offered in three models for different transceiver types, and supports three twisted-pair media types with different network topologies or data transfer speeds.

---

**Profibus  
Interface Module  
(CRP)**

Quantum Profibus module is the interface module to Profibus-DP networks. The interface modules use Type A, shielded twisted pair to join inline connectors, with or without service ports and bus terminators.

---

**AS-i Interface  
Module**

Quantum AS-i modules provide connectivity between a Quantum controller and AS-i networks. AS-i bus cable is an unshielded flat two-wire link on which communication and power are transmitted to connected devices. The media insulation is self-healing to accommodate junction block removal.

---

## Quantum Intelligent/Special Purpose I/O Modules

---

### Overview

Quantum Intelligent/Special Purpose I/O modules operate with minimum intervention from the Quantum controller after initially downloading module parameters or programs. The Quantum intelligent/special purpose I/O modules include the following.

- High Speed Counter modules (EHC)
  - ASCII Interface module (ESI)
  - High Speed Interrupt module (HLI)
  - Single Axis Motion Modules (MSx)
  - Multi-Axis Motion Modules (MMS)
-

## Quantum Simulator Modules (XSM)

---

### Overview

There are two types of simulator modules, as described below.

---

### Discrete and Analog Simulators

The following table shows discrete and analog simulators.

Type	Description
Discrete 16 Point Simulator (140XSM00200)	The Discrete Simulator (16 points) is used to generate up to 16 binary input signals to the 140DAI54000 and the 140DAI74000 AC input modules.
Analog Simulator (140XSM01000)	The Analog Simulator (2 channels in, 1 channel out) module is used for simulating 4 ... 20 mA field current loops used with current input Quantum modules.

---

## Quantum Battery, Backplanes, and CableFast Cabling

---

<b>Battery Module (XCP)</b>	The Quantum battery module provides RAM backup power for the Quantum expert module.
<b>Backplanes (XBP)</b>	Quantum backplanes may be used in all locations of local, remote, or distributed I/O. There are six backplanes available in 2, 3, 4, 6, 10, and 16 slot versions. All I/O slots are usable with any module able to be used in any slot.
<b>CableFast Cabling</b>	The Quantum CableFast wiring system consists of pre-wired Quantum field wiring terminal strips and DIN rail-mounted terminal blocks, offered in straight through or special application versions.

---

## Quantum Programming Packages

---

**Overview** Quantum controllers support several editors.

---

**Quantum Editors** The following table shows the editors for the Quantum controllers.

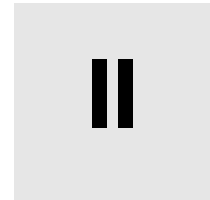
<b>Editor</b>	<b>Where Discussed</b>
Modsoft V2.6	For more information on Modsoft, refer to the Modicon Modsoft Programmer User Manual (890USE11500).
Concept V2.5	For more information on Concept, refer to the Concept User Manual (840USE49300).
ProWORX NXT V2.1	For more information on ProWorX, refer to the ProWorX User Manual (372SPU68001 NMAN)
ProWORX 32 (V 1.0 minimum)	For more information on ProWORX 32, refer to the ProWORX 32 Programming Software for PLCs User Guide (372SPU780 01EMAN)
ProWORX Plus (V 1.0 minimum)	For more information on ProWORX Plus, refer to the ProWORX Plus for Modicon Reference Manual (371SPU68001 PMAN).
Modicon State Language (V1.2 minimum)	For more information on Modicon State Language, refer to the Modicon State Language User Manual (GM-MSL1-001).

---



---

# Quantum System Configurations



---

## At a Glance

### Overview

This part provides information on Quantum system configurations.

### What's in this Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
2	Quantum Configurations	17
3	Network Configurations	29



---

# Quantum Configurations



# 2

---

## At a Glance

### Introduction

The following chapter provides information on the Quantum configurations, including Local I/O, Remote I/O (RIO), and Distributed I/O (DIO).

### What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Quantum Local I/O, Remote I/O and Distributed I/O Configurations	18
Quantum Local I/O	20
Quantum Remote I/O (RIO)	21
Quantum Distributed I/O (DIO)	25

---

## Quantum Local I/O, Remote I/O and Distributed I/O Configurations

### Overview

The following information contains a description of the Local I/O, Remote I/O and Distributed I/O and their configurations.

These configurations (see the configuration table below for valid Quantum configurations) can be equipped with a combination of:

- Quantum CPUs
- Power supplies
- I/O interfaces
- Expert modules
- I/O modules

**Note:** Refer to p. 43 for a complete list of part numbers for all Quantum modules.

### Local, RIO, and DIO Configuration

The following table provides valid Quantum configurations, including backplanes and modules.

If Configuration Type Is	Backplane Types (Typical) Are	Required Modules Are	Optional Modules Are	Modules Not Permitted Are
Local	6, 10, 16 slots	Power Supply CPU	RIO Head, I/O, NOx*	RIO Drop, DIO Drop
RIO**	6, 10, 16 slots	Power Supply RIO Drop	I/O	CPU, RIO Head, DIO Drop NOx*
DIO	2, 3, 4, 6 slots	DIO Drop	Power Supply, I/O	CPU, RIO Head, RIO Drop NOx*

\*NOM, NOA, and NOE.

\*\*Remote I/O is typically used for large (number of modules) drops 6, 10, or 16 slot backplanes. Distributed I/O is typically used for small drops using 2, 3, 4, or 6 slot backplanes.

**Note:** Every Quantum module requires power from the backplane (except power supply and DIO modules). For a valid configuration, add up the required backplane current (in mA) for every module, and ensure that this number is less than the available power in the selected power supply.

**Local, Remote  
and Distributed  
I/O Configuration**

Depending on the type of configuration—Local, Remote, or Distributed I/O, a variety of features will apply, as shown in the following table.

Feature	Configuration		
	Local I/O	Remote I/O	Distributed I/O
<b>Maximum I/O Words</b>			
Per drop	64 in / 64 out	64 in / 64 out	30 in / 32 out
Per network		1,984 in / 1,984 out	500 in / 500 out
<b>Maximum Physical Discretes</b>			
Per drop	*864 any mix	*864 any mix	448 any mix
<b>Maximum drops per network</b>		31	63
<b>Media</b>		Coax	Twisted Pair
<b>Speed</b>		1.5 Mhz	1 MHz
<b>Maximum distance without repeaters</b>		15,000 ft. (4,573 m)	1,500 ft. (457 m)
<b>Scan synched I/O servicing</b>		Yes	No
<b>Momentum I/O support</b>		No	Yes
<b>Hot Standby support</b>		Yes	No
<b>Modbus Plus compatible</b>		No	Yes

\*Requires use of backplane expander, Telefast module excepted (27 modules x 32 points = 864). May be limited by bus power requirements.

## Quantum Local I/O

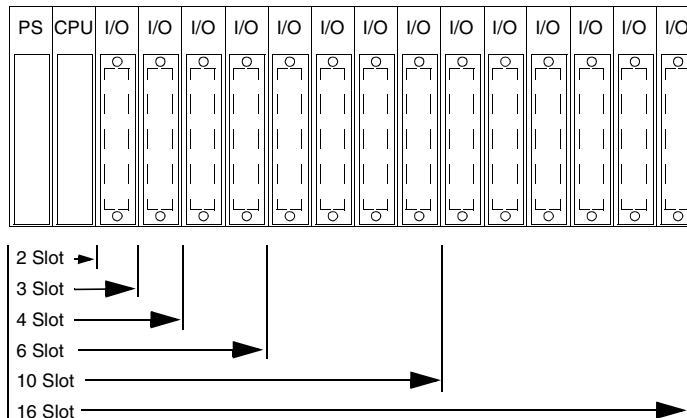
### Overview

A local I/O configuration is contained in one rack and includes all Quantum modules mounted in a standard Quantum backplane. Quantum Local I/O can be as few as one I/O module (in a three slot backplane), or as many as 14, along with a CPU and power supply in a single 16 slot backplane.

If required for the application, system interface modules are also included in the Local I/O backplane. These modules could consist of one RIO processor or network option modules.

### I/O Configuration

The following figure is an example of a typical local I/O configuration.



**Note:** A maximum of 448 digital I/O points (14, 4x8 digital I/O modules), or a maximum of 48 analog input channels (six 8-channel analog in modules) and 32 analog output channels (eight 4-channel analog out modules) may be serviced in a single local I/O rack.

## Quantum Remote I/O (RIO)

### Overview

Quantum RIO can be set up in single or dual cable configurations (refer to the following two figures) and is contained in one rack at each RIO drop. When RIO is used, the Quantum CPU may support several drops (a drop can be either Quantum, SY/MAX, 200, 500, or 800 Series I/O systems).

**Note:** As stated above, the Quantum provides connectivity to other Modicon I/O products via the same system. It will connect to 800 series I/O via the J890, J892, P890, or P892 remote I/O adapters; 200 series I/O via J290 and J291 remote I/O adapters; 500 series I/O via 29X/J540 remote I/O adapters; and SY/MAX 8030CRM931

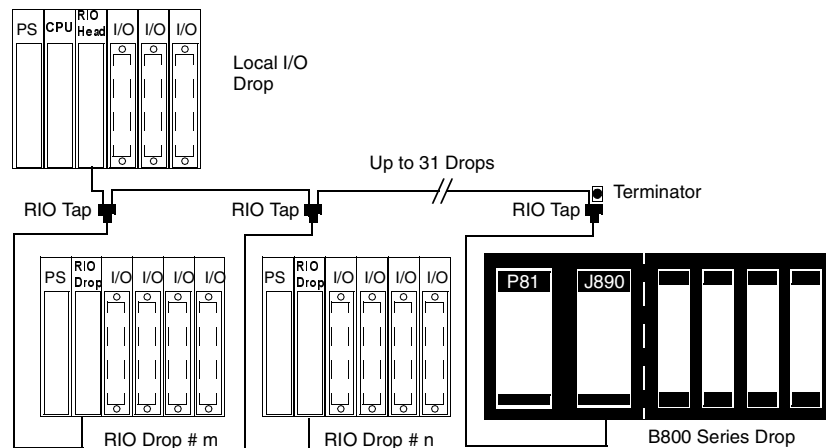
### Related Documentation

For more information on use and installation of Quantum RIO, see *Modicon Remote I/O Cable System Planning and Installation Guide*, Part Number 890USE10100

For more information on Hot Standby systems, see the *Quantum Hot Standby Installation and Planning Guide*, Part Number 840USE10600.

### Single Cable RIO Configuration

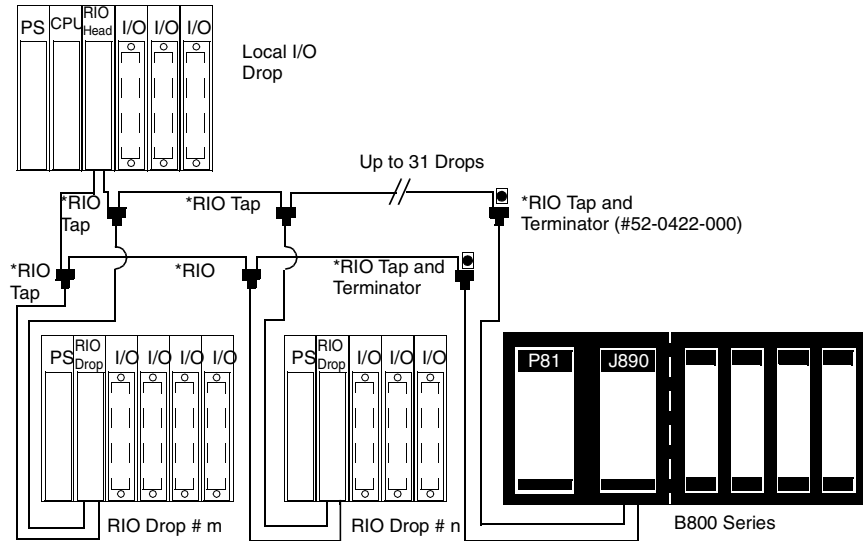
The following figure is an example of a single cable Quantum RIO configuration.



\*A RIO tap is required for every RIO drop in the system.

### Dual Cable RIO Configuration

The following figure is an example of a dual cable Quantum RIO configuration.



\*An RIO tap (# MA-0185-100) is required for every RIO drop in the system.

**Note:** The dual cable option is provided for systems that require added protection against cable breaks or damaged connectors. With two cables connected between the host and each node, no single cable break will disrupt communications.

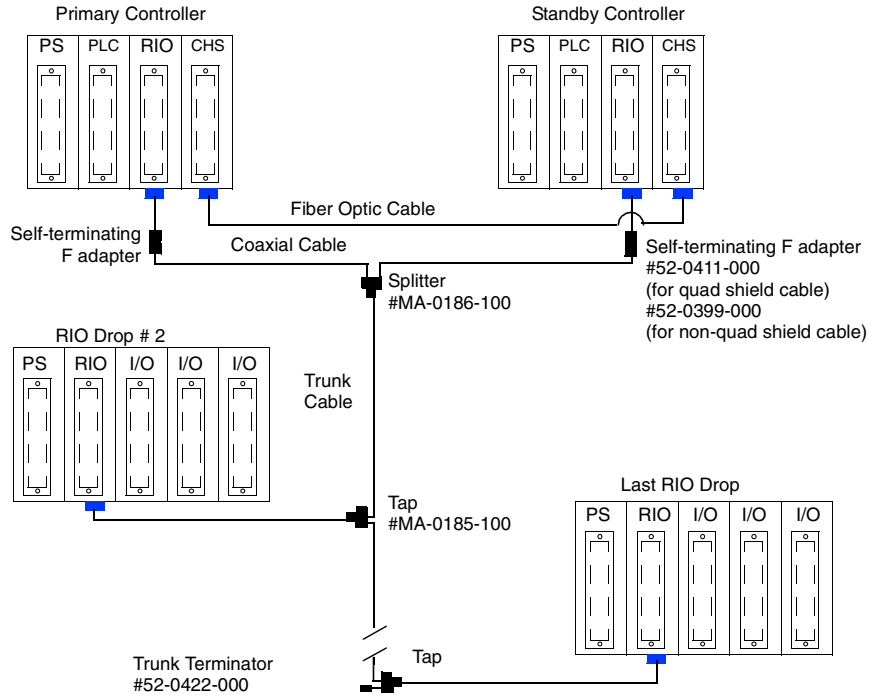
### Hot Standby System

The Quantum Hot Standby system is designed for use with remote I/O networks. A Quantum Hot Standby system may be set-up using single or dual cable configurations (refer to the following two figures).



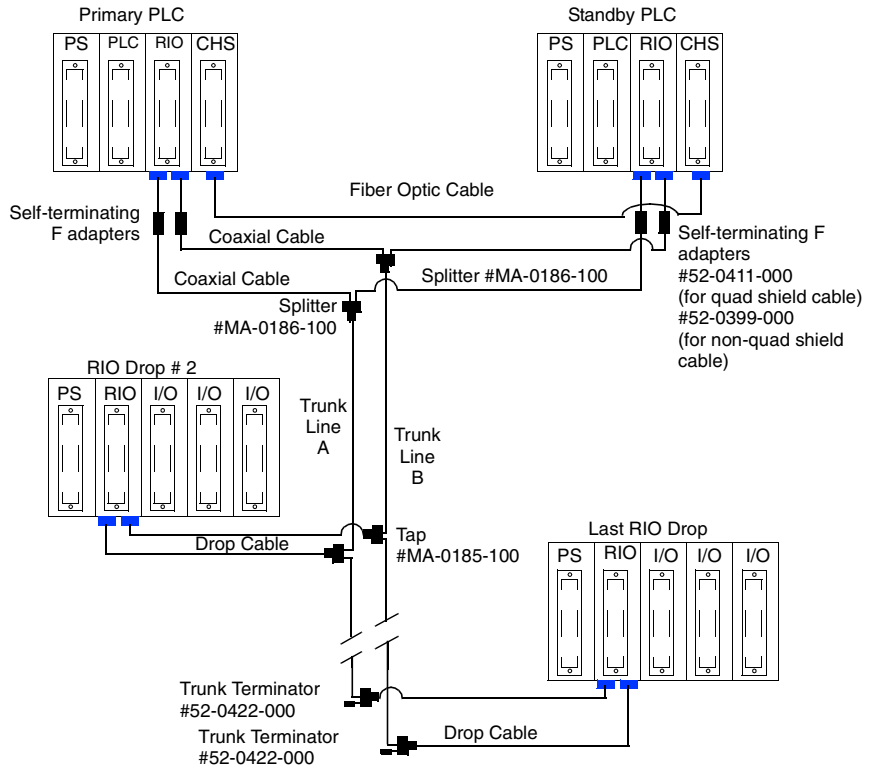
**Single Cable Hot Standby Configuration**

The following figure is an example of a single cable Quantum Hot Standby configuration.



### Dual Cable Hot Standby Configuration

The following figure is an example of a dual cable Quantum Hot Standby configuration.



## Quantum Distributed I/O (DIO)

### Overview

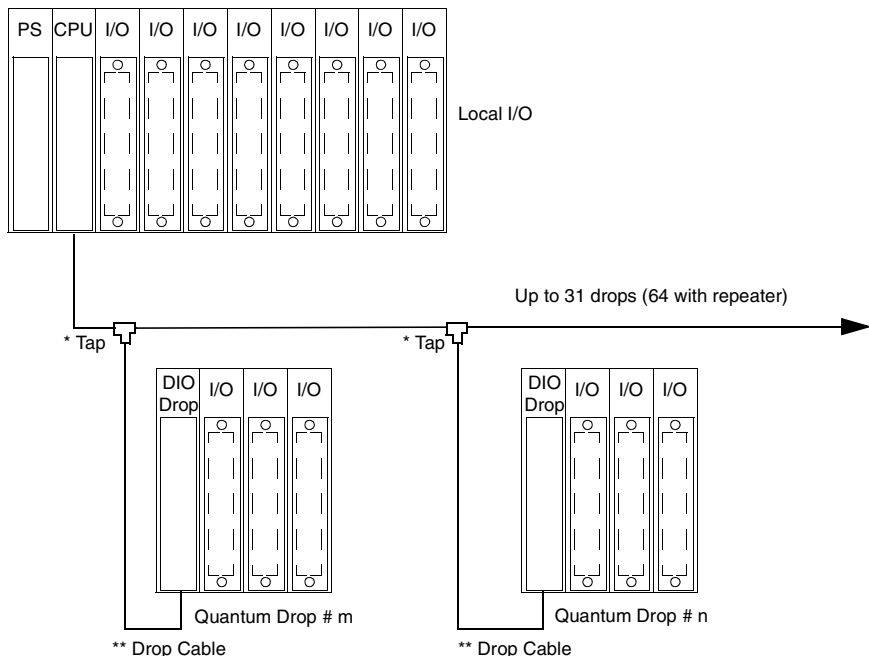
Quantum DIO can be set up in standard single or dual cable configurations (refer to the following two figures). The Quantum DIO architecture is based on Modicon's Modbus Plus technology. When DIO is utilized, the Quantum system may support up to three distributed networks of up to 64 drops (using a repeater) each. Communication between the various nodes and the Modbus Plus head, in both single and dual cable DIO configurations, is done by twisted pair cabling from the head to the DIO adapters at the drops.

### Related Documentation

For detailed information concerning the Quantum DIO systems, refer to the *MODBUS Plus I/O Servicing User Guide*, part number 840USE10400.

### Single Cable DIO Configuration

The following figure is an example of a single cable Quantum DIO configuration.

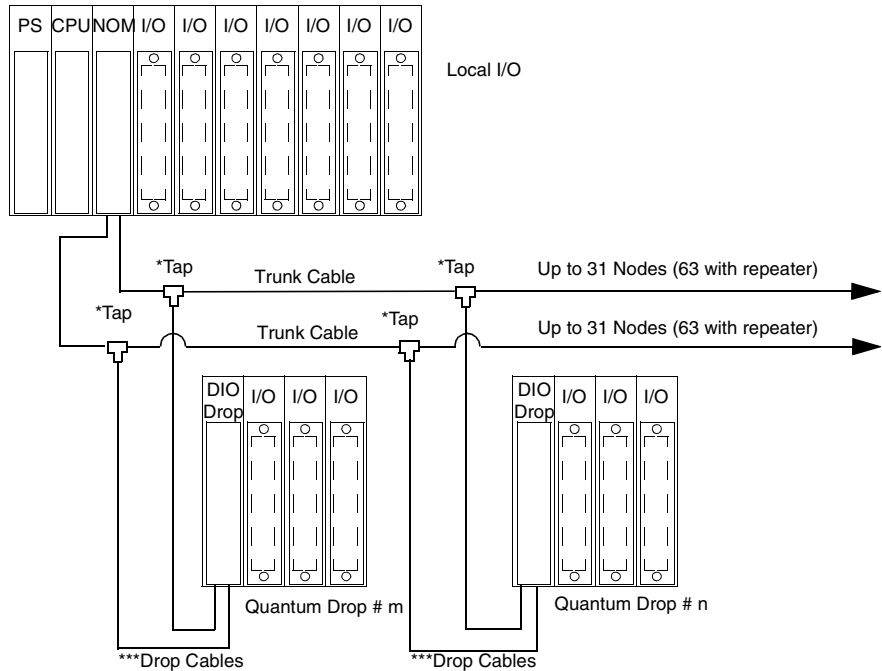


\* A MODBUS Plus tap is required for every participant on the network.

\*\* A drop cable is required for each drop from the MODBUS Plus tap.  
(Cables are not included with the modules and need to be ordered.)

**Dual Cable DIO Configuration**

The following figure is an example of a dual cable Quantum DIO configuration.



\*A MODBUS Plus tap (plastic, Part # 990NAD23000; ruggedized, Part # 990NAD23010) is required for every participant on the network.

\*\*\*A drop cable (8 ft/2.4 m, Part # 990NAD21110; 20 ft/6 m, Part # 990NAD21130) is required for each drop from the MODBUS Plus tap. Cables are not included with the modules and need to be ordered.

**Note:** The dual cable option is provided for systems that require added protection against cable breaks or damaged connectors. With two cables connected between the host and each node, no single cable break will disrupt communications.

**Part Numbers**

MODBUS Plus taps that can be used for single and dual cable DIO configurations include:

- Part Number 990NAD23000, plastic; and
- Part Number 990NAD23010, ruggedized.

The following MODBUS Plus trunk cables can be used with these DIO configurations:

- Part Number 490NAA27101 (100 ft/30 m)
- Part Number 490NAA27102 (500 ft/152 m)
- Part Number 490NAA27103 (1000 ft/304 m)
- Part Number 490NAA27104 (1500 ft/456 m)
- Part Number 490NAA27105 (5000 ft/1520 m)

Drop cables that can be used for these configurations include:

- Part Number 990NAD21110 (8 ft/2.4 m)
  - Part Number 990NAD21130 (20 ft/6 m)
-



---

# Network Configurations



---

## At a Glance

**Introduction** The following chapter provides information on the Quantum network support, network interface techniques, and Modbus and Modbus Plus communications.

**What's in this Chapter?** This chapter contains the following topics:

Topic	Page
Quantum Network Support	30
Quantum Network Interface Techniques	33
Quantum Modbus and Modbus Plus Communications	37

---

## Quantum Network Support

---

### Overview

Quantum systems provide multiple choices for open, standards-based networking and fieldbus connectivity requirements. The Quantum supported networks include:

- Modbus
- Modbus Plus
- Remote I/O
- TCP/IP Ethernet
- SY/MAX Ethernet
- MMS Ethernet
- Interbus
- LonWorks
- SERCOS

Combinations of these networks can be used to provide simple, high performance communication architectures which meet the tightly integrated needs of computer and controller connectivity. A summary of the services available on these networks is shown in the following table.

---



## Quantum Supported Networks

The following table shows the Quantum supported networks.

Service Description	Modbus	Modbus Plus	Remote I/O	Ethernet			Interbus	LonWorks	SERCOS	Profibus
				TCP/ IP	SY/ MAX	MMS				
Native to Quantum CPU	Y	Y	N	N	N	N	N	N	N	N
Available on a Network Module	Y	Y	Y	Y	Y	Y <sup>5</sup>	Y	Y	Y	Y
CPU Programming	Y <sup>1</sup>	Y	N	Y	N	N	N	N	N	N
CPU Executive Firmware Loading Support	Y <sup>1</sup>	Y <sup>1</sup>	N	N	N	N	N	N	N	N
Module Firmware Loaded From CPU	Y	Y	Y	Y	Y	Y	N <sup>6</sup>	N	Y	Y
Report By Exception Communications	Y <sup>2</sup>	Y	N	Y	Y	Y <sup>5</sup>	N	N	N	N
Multi-node Broadcast Communications	N	Y <sup>1</sup>	N	N	N	N	N	N	N	N
Synchronized I/O Scanning	N	N	Y	N	N	N	N	N	Y	Y
NonSynchronized I/O Scanning	N	Y <sup>1</sup>	N	N	N	N	Y	Y	N	N
Quantum I/O Drops	N	Y <sup>1</sup>	Y	N	N	N	N	N	N	N
Hot Standby Quantum I/O Drop Support	N	N	Y	N	N	N	N	N	N	N

Service Description	Modbus	Modbus Plus	Remote I/O	Ethernet			Interbus	LonWorks	SERCOS	Profibus
				TCP/IP	SY/MAX	MMS				
Hot Standby Data Communications Support	Y	Y	N	Y	N	N	N	N	N	N
Optional Dual Cabling	N	Y <sup>1</sup>	Y	N	N	N	N	N	N	N
Optional Fiber Optics	Y <sup>3</sup>	Y <sup>1</sup>	Y	Y	Y	Y <sup>5</sup>	Y <sup>3</sup>	Y <sup>4</sup>	Y <sup>4</sup>	N
Momentum I/O Drops	N	Y <sup>1</sup>	N	N	N	N	Y	N	N	Y
Variable Speed Drives	Y <sup>3</sup>	Y <sup>1</sup>	N	N	N	N	Y <sup>3</sup>	Y <sup>4</sup>	N	Y
Servo Motion Control	N	Y <sup>1</sup>	N	N	N	N	Y <sup>3</sup>	Y <sup>4</sup>	Y	Y
HMI: Displays & Panels	Y	Y <sup>1</sup>	Y	N	N	N	Y <sup>3</sup>	Y <sup>4</sup>	N	N
HMI: Workstations	Y	Y <sup>1</sup>	N	Y	Y	Y <sup>3, 5</sup>	N	Y <sup>4</sup>	N	N

1. Refer to the Modbus Plus portion of the Quantum Specifier's guide section for details of available services on 140NOM2XXX00 Modbus Plus Network modules
2. Service is only available on the native controller Modbus port when the XMIT loadable is used.
3. Available from third parties.
4. The SERCOS network standard is fiber optics.
5. The software for this module is a modConnect product.
6. Module firmware loaded through serial port on module.

## Quantum Network Interface Techniques

---

### Overview

Quantum communication and networking modules use a variety of different techniques to interface to the Quantum controller over the local backplane.

---

### Direct CPU Driver

This technique allows the CPU to control high speed data transfers to and from the communication and networking modules, maximizing throughput and performance.

This technique is used extensively by the Remote I/O network and Hot Standby system to ensure highly deterministic synchronization of the CPU and I/O scans.

**Note:** Only one Remote I/O Head Interface is supported for each Quantum CPU.

---

### Option Module Interface

This technique allows the communication and networking modules to control data transfers to and from the CPU, maximizing the flexibility of the communications interface.

This technique is used extensively by the Modbus Plus and Ethernet peer-to-peer network modules. The number of option module interfaces supported by each CPU model is described in the following table.

---

### CPU Interface Support

The following table shows the summary of Quantum CPU option module interface support in standalone configurations.

Quantum Controller Model Number	Available Option Module Interfaces Supported Per CPU
140CPU53414(A)	6
140CPU43412(A)	6
140CPU42402	6
140CPU21304	2
140CPU11303	2
140CPU11302	2

**Note:** Refer to *p. 37* for details of available services on 140NOM2XX00 Modbus Plus Network modules.

---

**I/O Map Interface** Some network and communication modules are interfaced to the controller through the standard I/O map configuration tables. In the following table, note that some network and communication modules require a Loadable instruction which enhances the standard controller Executive to support certain unique features of individual modules.

In addition, some loadables allow the communication and networking modules to be controlled by means of user-application code. The number of loadables and associated modules that can be handled by an individual CPU depends upon its memory size, the size of the application program, and the size of the loadables.

---

**Communications and Networking** The following table shows the Quantum communications and networking modules.

Model Number	Description	Module Interface Technique	Loadable Required	Backplane Support			Bus Power mA
				Local	RIO	DIO	
140CRP81100	Profibus	Direct CPU Driver	N	Y	N	N	1200
140CRP93100	Remote I/O Head Interface, single cable	Direct CPU Driver	N	Y	N	N	780
140CRP93200	Remote I/O Head Interface, dual cable	Direct CPU Driver	N	Y	N	N	780
140CHS21000	Hot Standby Processor Kit	Direct CPU Driver	Y	Y	N	N	700
140NOA61110	Interbus Master	Direct CPU Driver	Y	Y	N	N	700
140NOM21100	Modbus Plus Options, single cable	Option Module	N	Y	N	N	780
140NOM21200	Modbus Plus Option, dual cable	Option Module	N	Y	N	N	780
140NOM25200	Modbus Plus Option, single channel fiber	Option Module	N	Y	N	N	900
140NOE21100	Ethernet TCP/IP Twisted Pair	Option Module	N	Y	N	N	1000
140NOE25100	Ethernet TCP/IP Fiber Optic	Option Module	N	Y	N	N	1000
140NOE31100	Ethernet SY/MAX Twisted Pair	Option Module	N	Y	N	N	1000
140NOE35100	Ethernet SY/MAX Fiber Optic	Option Module	N	Y	N	N	1000
140NOE5100 <sup>1</sup>	Ethernet MMS Twisted Pair	Option Module	N	Y	N	N	1000
140NOE55100 <sup>1</sup>	Ethernet MMS Fiber Optic	Option Module	N	Y	N	N	1000

Model Number	Description	Module Interface Technique	Loadable Required	Backplane Support			Bus Power mA
				Local	RIO	DIO	
140NOE77100/1	Ethernet TCP/IP 10/100 TX/FX	N	N	Y	N	N	750
140NOE77110/1	Ethernet TCP/IP 10/100 TX/FX Factory Cast	N	N	Y	N	N	750
140MMS42500	Multi-Axis Motion Controller w/ SERCOS	Option Module	N	Y	N	N	2500
140NOL91100	LonWorks Interface, twisted pair FTT10	I/O Map (16/16)	Y	Y	Y	N	950
140NOL91110	LonWorks Interface, twisted pair TPT/XF-78	I/O Map (16/16)	Y	Y	Y	N	950
140NOL91120	LonWorks Interface, twisted pair TPT/XF-1250	I/O Map (16/16)	Y	Y	Y	N	950

1. The software for this module is a ModConnect product.

---

## Quantum Modbus and Modbus Plus Communications

---

### Overview

Each Quantum CPU includes both a Modbus and Modbus Plus communications port. The features offered by both these communication protocols are listed in the following table.

---

### Modbus and Modbus Plus Features

The following table shows the Modbus and Modbus Plus features.

Features	Modbus	Modbus Plus
Technique	Slaves polled by a master	Peer-to-peer, token rotation
Speed	19.2K typical	1 M
Electrical	RS-232, various others	RS-485
Distance without repeater	RS-232, 50 ft. (15 m)	1,500 ft. (457 m)
Media	Various	Twisted pair, Fiber optics
Max nodes per network	247	64
Max network traffic	300 registers/sec @ 9.6 Kb	20,000 registers/sec
Programming	Yes	Yes
Read/Write data	Yes	Yes
Global data	No	Yes
Peer Cop	No	Yes

---

### Modbus

Modbus, a master/slave protocol, is a de facto industry standard with support from over 500 industrial suppliers.

On-line programming or data acquisition applications are easily supported directly from the serial port of any computer.

Modbus can be used in either a simple point-to-point manner with a pair of devices, or in a network architecture with up to 247 slave devices.

---

## **Modbus Plus**

Modbus Plus combines high speed, peer-to-peer communication and easy installation to simplify applications and reduce installation costs.

It allows host computers, controllers and other data sources to communicate as peers throughout the network via low-cost twisted pair cable or optional fiber optic cable.

As a deterministic token-passing network, Modbus Plus communicates at one megabaud for fast access to process data. It's strength is its ability to control real-time control devices like I/O and drives, without degraded performance due to loading or traffic.

Bridging between Modbus and Modbus Plus is done automatically on CPUs and Modbus Plus network modules.

The bridge mode redirects Modbus messages onto the Modbus Plus network for easy connectivity between Modbus and Modbus Plus devices.

A summary of the available services on Quantum Modbus and Modbus Plus ports is given in the following table.

---



## Modbus and Modbus Plus Services

The following table shows the Quantum Modbus and Modbus Plus services.

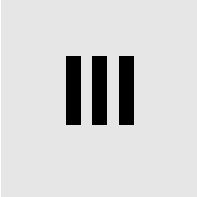
Type	Service Description	Native CPU Ports		NOM 1-2 Ports		NOM 3-6 Ports	
		Modbus	Modbus Plus	Modbus	Modbus Plus	Modbus	Modbus Plus
<b>Modbus Services</b>	Default Modbus Port Parameters	Y	-	Y	-	Y	-
	Configurable Modbus Port Parameters	Y	-	Y	-	Y <sup>5</sup>	-
	Modbus to Modbus Plus Bridging	Y <sup>2</sup>	-	Y <sup>3</sup>	-	Y <sup>3</sup>	-
	Local CPU Programming	Y <sup>4</sup>	-	Y <sup>4</sup>	-	N	-
	Remote CPU Programming over Modbus Plus	Y <sup>4</sup>	-	Y <sup>4</sup>	-	Y <sup>2</sup>	-
	Modbus access to local CPU	Y	-	Y	-	N	-
	Modbus access to remote CPU over Modbus Plus	Y	-	Y	-	Y	-
	Modbus Network Slave Support	Y	-	N	-	N	-
	Modbus Master support with XMIT Loadable	Y	-	N	-	N	-
	Executive Firmware Loading Support	Y	-	N	-	N	-
<b>Modbus Plus Services</b>	MSTR read/write register messaging <sup>6</sup>	-	Y	-	Y	-	Y
	MSTR read/write Global Data messaging	-	Y	-	Y	-	Y
	MSTR get/clear local/remote statistics	-	Y	-	Y	-	Y
	Config Extension Global Data Support	-	Y	-	Y	-	N
	Config Extension Peer Cop Support	-	Y	-	Y	-	N
	Distributed I/O Support	-	Y	-	Y	-	N
	CPU Programming	-	Y <sup>4</sup>	-	Y <sup>4</sup>	-	Y <sup>4</sup>
	Executive Firmware Loading Support	-	Y	-	N	-	N

**Note:**

1. Only supported on the 140CPU42402, 140CPU42412(A) and 140CPU53414(A) Quantum Controllers.
2. The native CPU Modbus port can be disabled from bridge mode operation with the native Modbus Plus Port.
3. Modbus ports on NOMs are always in bridge mode with their associated Modbus Plus port.
4. Only one programmer connection can be logged in at a time to any CPU, and only one program monitor can be attached at a time to any CPU.
5. Modbus port parameters on NOMs 3-6 are defined by Modbus Port 3 in Concept and Modsoft when the comm parameter selector switch is in mem.
6. Up to 4 MSTR read/write register instructions can be serviced per CPU scan per Modbus Plus port.

---

# Quantum System Specifications



---

## At a Glance

### Overview

This part provides system specifications for the Quantum automation system.

### What's in this Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
4	System Specifications for the Quantum Module	43



---

# System Specifications for the Quantum Module

# 4

---

## Quantum System Specifications

### Overview

All modules are designed to the following system specifications, which include:

- mechanical
- electrical
- AC/DC power supplies

It shows the I/O modules operating voltages for:

- less than 24 Vac or Vdc
- between 24 and 48 Vac or Vdc
- greater than 48 Vac or Vdc

Also given are the operating and storage conditions as well as agency approvals.

### Mechanical Specifications

The following table shows individual Quantum module mechanical specifications.

Weight	2 lbs. (1 kg) max
Dimensions (H x D x W)	9.84 in. x 4.09 in. x 1.59 in. (250 mm x 103.85 mm x 40.34 mm)
Wire Size	1-14 AWG or 2-16 AWG max. 20 AWG min.
Material (Enclosures and Bezels)	Polycarbonates
Space Requirements	1 backplane slot

### Electrical Specifications

The following table shows the Quantum electrical specifications.

RFI Immunity (IEC 1000-4-3)	80 ... 1000 MHz, 10 V/m
Ground Continuity (IEC 1000-4-5)	2 kV shield to ground
Electrostatic Discharge (IEC 1000-4-2)	8 kV air / 4 kV contact
Flammability	Wiring Connector: 94V-0 Module Enclosure: 94V-1

**AC/DC Power Supplies**

The following table shows the Quantum AC/DC power supplies.

Fast Transients (IEC 1000-4-4)	2 kV common mode
Damped Oscillatory Transients	2 kV common mode 1 kV differential mode
Surge Withstand Capability (Transients) (IEC 1000-4-5)	2 kV common mode 1 kV differential mode
Non Periodic Peak Input Voltage	2.3 times nominal for 1.3 ms (Nominal = DC average or AC peak)

**I/O Modules - Table 1**

The following table shows the Quantum function I/O modules with operating voltages less than 24 Vac or Vdc.

Fast Transients (IEC 1000-4-4)	0.5 kV common mode
Damped Oscillatory Transients	1 kV common mode 0.5 kV differential mode
Surge Withstand Capability (Transients) (IEC 1000-4-5)	1 kV common mode 0.5 kV differential mode

**I/O Modules - Table 2**

The following table shows the Quantum I/O modules with operating voltages between 24 and 48 Vac or Vdc.

Fast Transients (IEC 1000-4-4)	1 kV
Damped Oscillatory Transients	2 kV common mode 1 kV differential mode
Surge Withstand Capability (Transients) (IEC 1000-4-5)	1 kV common mode 0.5 kV differential mode

**I/O Modules - Table 3**

The following table shows the Quantum I/O modules with operating voltages greater than 48 Vac or Vdc.

Fast Transients (IEC 1000-4-4)	2 kV
Damped Oscillatory Transients	2 kV common mode 1 kV differential mode
Surge Withstand Capability (Transients) (IEC 1000-4-5)	2 kV common mode 1 kV differential mode

**Operating Conditions**

The following table shows the Quantum operating conditions.

Temperature	0 ... 60° C (32 ... 140° F)
Humidity	0 ... 95 percent RH non-condensing at 60° C
Chemical Interactions	Enclosures and terminal strips are made of polycarbonates. This material can be damaged by strong alkalis and various hydrocarbons, esters, halogens and ketones in combination with heat. Common products containing these include detergents, PVC products, petroleum products, pesticides, disinfectants, paint removers, and spray paints.
Altitude	2,000 meters. When the altitude exceeds this, reduce the 60°C maximum operating temperature by 6°C per 1000 meters of additional elevation.
Vibration	10 ... 57 Hz at 0.075 mm d.a. 57 ... 150 Hz at 1 g
Shock	+/-15 g peak, 11 ms, half-sine wave

**Gas Resistance in Conformally Coated Modules**

The following table shows gas resistance data for conformally coated Quantum modules.

<b>Mixed Flowing Gas Test, 22 days exposure</b>			
<b>Standard</b>	<b>Gas</b>	<b>Test Requirement</b>	<b>Actual Exposure</b>
EIA364-65 Level III	CL <sub>2</sub> (Chlorine)	20 PPB, +/- 5 PPB	20 PPB
	NO <sub>2</sub> (Nitric Oxide)	200 PPB, +/- 50 PPB	1250 PPB
	H <sub>2</sub> S (Hydrogen Sulfide)	100 PPB, +/- 20 PPB	100 PPB
	SO <sub>2</sub> (Sulfur Oxide)	N/A	300 PPB
ISA-S71.04 (GX Severe)	CL <sub>2</sub> (Chlorine)	10 PPB	20 PPB
	NO <sub>2</sub> ((Nitric Oxide)	1250 PPB	1250 PPB
	H <sub>2</sub> S (Hydrogen Sulfide)	50 PPB	100 PPB
	O <sub>2</sub> (Sulfur Oxide)	300 PPB	300 PPB

**Storage Conditions**

The following table shows the Quantum storage conditions.

Temperature	-40 ... 85° C (-40 ... 185° F)
Humidity	0 ... 95 percent RH non-condensing at 60° C
Free Fall	3 ft. (1 m)

**Agency Approvals**

The following table shows the agency approvals.

UL 508
CSA 22.2-142
Factory Mutual Class 1, Div 2
European Directives (CE) 89/336/EEC, 73/23/EEC and amendments

**Note:** All Quantum system modules contain static-sensitive components. Each module is labeled with the following static-sensitive symbol. The following figure shows the static sensitive symbol.





---

# Quantum Module Specifications and Configuration



---

## At a Glance

### Overview

This part provides information on Quantum module specifications as well as configuration of the modules.

### What's in this Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
5	Hardware Specifications for the Quantum Modules	49
6	Power Supply Modules	59
7	CPU Modules	103
8	Quantum Field Bus Modules	189
9	Distributed I/O (DIO) for the Quantum Modules	213
10	Quantum Remote I/O Communication Modules	225
11	Quantum Modbus Plus Network Option Modules	235
12	Quantum Modbus Plus Networking on Fiber Module	245
13	Quantum Ethernet Modules	265
14	Intelligent/Special Purpose Modules for the Quantum	289
15	Quantum Intrinsically Safe Analog/Digital, Input/Output Modules	361
16	Quantum Simulator Modules	415
17	Quantum Battery Module	421
18	Quantum I/O Modules	429

---



---

# Hardware Specifications for the Quantum Modules

# 5

---

## Quantum Hardware Specifications

### Overview

This section shows the specifications for Quantum hardware modules including:

- Power Supplies
- CPUs
- Networking
- Intelligent/Special Purpose
- I/O

### Power Supply Specifications

The following table shows the power supplies for local and RIO Drops.

Part Number	Source Voltage	Type	Bus Current Provided
140CPS11100	115 ... 230 Vac	Standalone	3 A
140CPS11400	115 ... 230 Vac	Standalone	8 A
140CPS11410	115 ... 230 Vac	Standalone/Summable	8 A
140CPS11420	115 ... 230 Vac	Standalone/Summable	11A/16A/20A
140CPS12400	115 ... 230 Vac	Standalone/Redundant	3 A
140CPS12420	115 ... 230 Vac	Standalone/Redundant	8A/10A/11A
140CPS21100	24 Vdc	Standalone	3 A
140CPS21400	24 Vdc	Standalone/Summable	8 A
140CPS22400	24 Vdc	Standalone/Redundant	8 A
140CPS41400	48 Vdc	Standalone/Redundant	8 A
140CPS42400	48 Vdc	Standalone/Redundant	8 A
140CPS51100	100 ... 150 Vdc	Standalone	3 A
140CPS52400	125 Vdc	Standalone/Redundant	8 A

**CPU Specifications**

The following table shows specifications for the CPUs.

Part Numbers	Max IEC Program	SRAM Size	Ladder Logic	Available Registers	Bus Current Required
140CPU11302	109 k	256 k	8 k	10 k	780 mA
140CPU11303	368 k	512 k	16 k	10 k	790 mA
140CPU21304	606 k	768 k	32 k or 48 k	64 k or 32 k	900 mA
140CPU42402	570 k	2 M	64 k	64 k	1.8 A
140CPU43412	896 k	2 M	64 k	57 k	1.8 A
140CPU43412A	896 k	2 M	64 k	57 k	1.25 A
140CPU53414	2.5 M	4 M	64 k	57 k	1.8 A
140CPU53414A	2.5 M	4 M	64 k	57 k	1.25A

**Networking Modules – RIO**

The following table shows specifications for RIO Networking modules.

Part Numbers (RIO)	Drop Location	Communication Channel(s)	Bus Current Provided
140CRA93100	Remote (Drop)	1	600 mA
140CRA93200	Remote (Drop)	2	750 mA
140CRP93100	Local (Head)	1	600 mA
140CRP93200	Local (Head)	2	750 mA

**Field Bus Modules**

The following table shows specifications for field bus modules.

Part Number	Communication Channel(s)	Bus Current Required
140CRP81100	1 Profibus port, 1 RS-232 port (db 9 pin)	1.2 A
140EIA92100	1 AS-i	250mA
140NOA61100	1 InterBus, LED display, gen 3	700 mA
140NOA61110	1 InterBus, 7 segment display, gen 3	700 mA
140NOA62200	1 InterBus, LED, gen 4	800 mA
140NOL91100	2 free topology, twisted pair; 78,000 BPS, LonWorks	400 mA
140NOL91110	2 linear topology, twisted pair, transformer isolated, 78,000 BPS, LonWorks	400 mA
140NOL91120	2 linear topology, twisted pair, transformer isolated, 1.25 BBPS, LonWorks	400 mA

### Networking Modules – DIO (Modbus Plus)

The following table shows specifications for DIO Networking modules.

Part Numbers (DIO)	Source Voltage	Communication Channel(s)	Bus Current Provided
140CRA21110	115 Vac	1	3 A
140CRA21210	115 Vac	2	3 A
140CRA21120	24 Vdc	1	3 A
140CRA21220	24 Vdc	2	3 A

### Networking Modules – Ethernet

The following table shows specifications for ethernet modules.

Part Numbers	Communication Channels	Bus Current Required
140NOE21100	1 10BASE-T Ethernet network (RJ-45) port	1 A
140NOE25100	1 10BASE-FL Ethernet network (ST-style) port	1 A
140NOE31100	1 10BASE-T Ethernet network (RJ-45) port	1 A
140NOE35100	2 10BASE-FL Ethernet network (ST-style) ports	1 A
140NOE51100	1 10BASE-T Ethernet network (RJ-45) port	1 A
140NOE55100	2 10BASE-FL Ethernet network (ST-style) ports	1 A
140NOE771xx	1 10/100 BASE-TX Ethernet network (RJ-45) port 1 100 BASE-FX (MT-RJ connector) fiber optic port	750 mA

### Networking Modules – NOM

The following table shows specifications for Modbus Plus NOM Networking modules.

Part Numbers (NOM)	Communication Channels	Bus Current Required
140NOM21100	1, twisted pair, 1 Modbus, 9-pin D-Sub	780 mA
140NOM21200	2, twisted pair, 1 Modbus, 9-pin D-Sub	780 mA
140NOM25200	2, fiber optic (ST-style); 1 Modbus (RJ-45)	780 mA

### Intelligent/ Special Purpose – Hot Standby Module

The following table shows specifications for the Hot Standby module.

Part Number	Communication Channel	Bus Current Required	Special Features
140CHS11000	Fiber Optic	700 mA	Use kit P/N - 140 CHS21000

**Counter Modules** The following table shows specifications for the high speed Counter modules.

Part Number	Function	Points/ Channels	Bus Current Required	Special Features
140EHC10500	High Speed Counter (100 kHz)	5	250 mA	35 kHz @ 24 Vdc 100 kHz @ 5 Vdc
140EHC20200	High Speed Counter (500 kHz)	2	650 mA	500 kHz, Incremental or Quadrature

**ASCII Interface Module** The following table shows specifications for the ASCII Interface Module.

Part Numbers	Function	Communication Channels	Bus Current Required	Special Features
140ESI06210	Intelligent, Bi-directional, ASCII Interface	2	300 mA	1 Port @ 19.2 kbps

**High Speed Interrupt Module** The following table shows specifications for the High Speed Interrupt module.

Part Number	Function	Points/Channels	Bus Current Required
140HLI34000	High Speed, Latch, and Interrupt	16	400 mA

**Single Axis Motion Modules** The following table shows specifications for the Single Axis Motion modules.

Part Numbers	Function	Channels	Bus Current Required	Special Features
140MSB10100	Motion Controller, Single Axis Bi-directional, ASCII Interface	1	750 mA	Dual Encoder Feedback
140MSC10100	Motion Controller, Single Axis	1	1000 mA	Dual Encoder Feedback and Resolver Feedback

**I/O Modules –  
Discrete In**

The following table shows specifications for the Discrete In modules.

Type/Part Number	Function	Points/ Channels	Points per Group	Bus Current Required	Special Features
140DAI34000	24 Vac	16	N/A	180 mA	Isolated
140DAI35300	24 Vac	32	8	250 mA	Grouped
140DAI44000	48 Vac	16	N/A	180 mA	Isolated
140DAI45300	48 Vac	32	8	250 mA	Grouped
140DAI54000	115 Vac	16	N/A	180 mA	Isolated
140DAI54300	115 Vac	16	8	180 mA	Grouped
140DAI55300	115 Vac	32	8	250 mA	Grouped
140DAI74000	230 Vac	16	N/A	180 mA	Isolated
140DAI75300	230 Vac	32	8	250 mA	Grouped
140DDI15310	5 Vdc	32	8	170 mA	Grouped
140DDI35300	24 Vdc	32	8	330 mA	Grouped
140DSI35300	24 Vdc	32	8	250 mA	Supervised inputs grouped
140DDI35310	24 Vdc	32	8	330 mA	Grouped
140DDI36400	24 Vdc	96	16	270 mA	Grouped
140DDI67300	125 Vdc	24	8	200 mA	Grouped
140DDI84100	10 ... 60 Vdc	16	2	200 mA	Grouped
140DDI85300	10 ... 60 Vdc	32	8	300 mA	Grouped
140DSI35300	24 Vdc	32	8	250 mA	Supervised Inputs Grouped

**I/O Modules –  
Discrete Out**

The following table shows specifications for the Discrete Out modules.

Type/Part Number	Function	Points/ Channels	Points per Group	Bus Current Required	Special Features
140DAO84000	24 ... 230 Vac	16	N/A	350 mA	4 A per point, isolated
140DAO84010	24 ... 115 Vac	16	N/A	350 mA	4 A per point, isolated
140DAO84210	115 ... 230 Vac	16	4	350 mA	4 A per point, group fused
140DAO84220	24 ... 48 Vac	16	4	350 mA	4 A per point, group fused
140DAO85300	230 Vac	32	8	1A	1 A per point, group fused
140DDO15310	5 Vdc	32	8	350 mA	0.5 A per point, group fused
140DDO35300	24 Vdc	32	8	330 mA	0.5 A per point, group fused
140DDO35301	24 Vdc	32	8	250 mA	0.5 A per point
140DDO35310	24 Vdc	32	8	330 mA	0.5 A per point, group fused
140DDO36400	24 Vdc	96	16	250 mA	0.5 A per point, group fused
140DDO84300	10 ... 60 Vdc	16	8	160 mA	2 A per point, group fused
140DDO88500	24 ... 125 Vdc	12	6	6 points: 375 mA 12 points: 650 mA	0.5 A per point with short circuit protection, Group fused
140DRA84000	N.O. Relay	16	1	1,100 mA	2 A per point
140DRC83000	N.O./N.C. Relay	8	1	560 mA	5 A per point
140DVO85300	10 ... 30 Vdc	32	8	500 mA	0.5 A per point, verified output, group fused



**I/O Modules –  
Discrete In/Out**

The following table shows specifications for the Discrete In/Out modules.

Type/Part Number	Type/Part Number	Points/channels	Points per group	Bus current required	Special features
140DAM59000	115 Vac	16 In 8 Out	8 4	250 mA	0.5 A per point on outputs, grouped fused
140DDM39000	24 Vdc	16 In 8 Out	8 4	330 mA	0.5 A per point on outputs, grouped fused
140DDM69000	125 Vdc	4 In 4 Out	4 N/A	350 mA	Inputs: Grouped Outputs: 4 A per point isolated

**I/O Modules –  
Analog In/Out**

The following table shows specifications for the Analog In/Out module.

Type/Part Number	Function	Points/Channels	Points per group	Bus Current Required	Special Features
140AMM09000	<b>Inputs</b> Vdc: +/- 10 +/- 5 0 ... 10 0 ... 5 1 ... 5 mA: +/- 20 0 ... 20 4 ... 20	4 In	N/A	350 mA	Mixed inputs, current or voltage
	<b>Outputs</b> 4 ... 20 mA	2 Out	N/A		Isolated

**I/O Modules –  
Analog In**

The following table shows specifications for the Analog In modules.

Type/Part Number	Function	Points/ Channels	Points per Group	Bus Current Required	Special Features
140ACI03000	4 ... 20 mA 1 ... 5 Vdc	8	1	240 mA	Mixed inputs, current or voltage
140ACI04000	0 ...25 mA 0 ... 20 mA 4 ... 20 mA	16	16	360 mA	High density
140ARI03010	RTD: Pt, Ni, Ohms	8	1	200 mA	IEC/American
140AVI03000	0 ... 20 mA, +/- 20 mA +/- 10 Vdc +/- 5 Vdc	8	1	280 mA	Mixed inputs, current or voltage
140ATI03000	T/C: B, E, J, K, R, S, T	8	1	280 mA	CJC INT/EXT

**I/O Modules –  
Analog Out**

The following table shows specifications for the Analog Out modules.

Type/ Part Number	Function	Points/ Channels	Points per group	Bus Current Required	Special Features
140ACO02000	4 ... 20 mA	4	N/A	480 mA	Channels isolated
140ACO13000	0 ... 25 mA 0 ... 20 mA 4 ... 20 mA	8	8	550 mA	High density
140AVO02000	0 ... 10 Vdc, +/- 10 Vdc 0 ... 5 Vdc +/- 5 Vdc	4	N/A	700 mA	Mixed outputs

**Intrinsic Safe  
Analog Modules**

The following table shows specifications for the Intrinsic Safe analog modules.

Type/Part Number	Function	Points/ Channels	Points per Group	Bus Current Required	Special Features
140AII33000	TC: B, E, J, K, R, S, T RTD: Pt, Ni Ohms	8	1	400 mA	CJC INT/EXT IEC/American
140AII33010	0 ... 25 mA 0 ... 20 mA 4 ... 20 mA	8	8	1.5 A	Mixed inputs, current. Internal power supply.
140AIO33000	0 ... 25 mA 0 ... 20 mA 4 ... 20 mA	8	8	2.5 A	Internal power supply.

**Intrinsic Safe  
Discrete  
Modules**

The following table shows the specifications for the Intrinsic Safe discrete modules.

Type/Part Number	Function	Points/ Channels	Points per Common	Bus Current Required	Special Features
140DII33000	Discrete In	8	8	400 mA	Internal power supply
140DIO33000	Discrete Out	8	8	2.2 A	Internal power supply

**Miscellaneous  
Modules**

The following table shows specifications for miscellaneous modules.

Type/Part Number	Function	Bus Current Required
140XBE10000	Backplane expander	500 mA
140XCP90000	Battery backup	None
140XSM01000	Analog simulator	None



---

# Power Supply Modules



# 6

---

## At a Glance

### Overview

The following chapter describes the Quantum power supplies, including: specifications, LED indicators and descriptions, and wiring diagrams. Where applicable, it includes operating curves and hold-up capacitor timing charts.

### What's in this Chapter?

This chapter contains the following topics:

Topic	Page
140CPS11100 AC Power Supply 115/230 Vac 3 A Module	60
140CPS11100 AC Power Supply 115/230 Vac 3 A Module (PV01 or Greater)	63
140CPS11400 AC Power Supply, 115/230 Vac, 8 A Module	66
140CPS11410 AC Summable Power Supply 115/230 Vac, 8 A	69
140CPS11420 AC Summable Power Supply 115/230 Vac, 11 A	72
140CPS12400 AC Redundant Power Supply, 115/230 Vac 8 A Module	75
140CPS12420 AC Redundant Power Supply, 115/230 Vac 11 A Module	78
140CPS21100 DC Power Supply, 24 Vdc, 3 A Module	81
140CPS21400 DC Summable Power Supply, 24 Vdc, 8 A Module	84
140CPS22400 DC Redundant Power Supply, 24 Vdc, 8 A Module	87
140CPS41400 DC Summable Power Supply, 48 Vdc, 8 A Module	90
140CPS42400 DC Redundant Power Supply, 48 Vdc, 8 A Module	93
140CPS51100 DC Power Supply, 125 Vdc, 3 A Module	96
140CPS52400 DC Standalone/Redundant Power Supply, 125 Vdc, 8 A	99

---

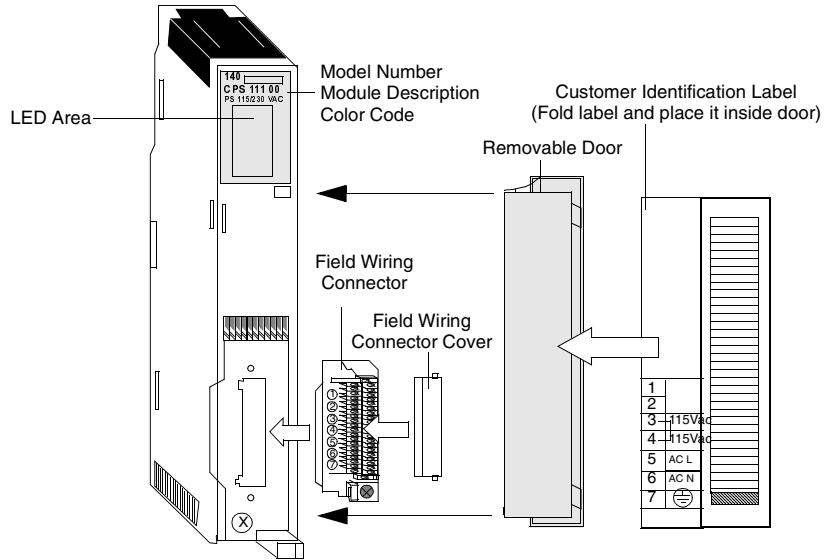
## 140CPS11100 AC Power Supply 115/230 Vac 3 A Module

### Overview

The following provides information on the AC Power Supply, 115/230 Vac, 3 A module (Product Version 01 or greater).

### Power Supply Module

The following figure shows the power supply module components.



**Note:** When field wiring the power supply module, the maximum wire size that should be used is 1 - 14 AWG or 2 - 16 AWG; the minimum is 20 AWG.

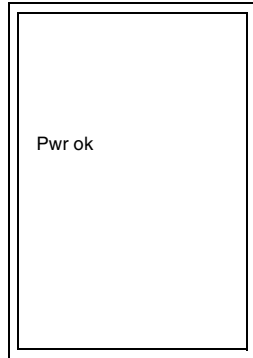
**Specifications**

The following table shows the specifications for the CPS11100 115/230 VAC power supply module.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	93 ... 132 Vac (jumper installed) 170 ... 264 Vac (no jumper)
Input Frequency	47 ... 63 Hz
Input Voltage Total Harmonic Distortion	Less than 10% of the fundamental ms value
Input Current	0.4 A @ 115 Vac. 0.2 A @ 230 Vac
Inrush Current	13 A @ 115 Vac. @ 25°C first power up 23 A @ 230 Vac. @ 25°C first power up
VA Rating	50 VA
Input Power Interruption	1/2 cycle @ full load and minimum rated line voltage / frequency. No less than 1 second between interruptions.
Fusing (external)	1.5 A slo-blo recommended (Part # 043502515 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Maximum Current	3 A
Minimum Current	None required
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector (included)	7 point terminal strip (Part # 043506326)
Internal Power Dissipation	6 Watts typ.
Operating Mode	Standalone

**LED Indicator and Description**

The following figure shows the CPS11100 LED indicator.



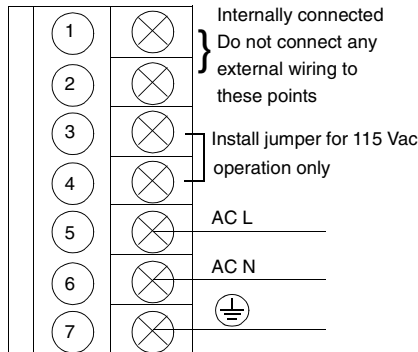
**Note:** For "Closed System" installations, connector 140XTS00 500 must be used (see p. 712).

The following table shows the CPS11100 LED description.

LED Description		
LEDs	Color	Indication when On
Pwr ok	Green	Power is supplied to the bus.

**Wiring Diagram**

The following figure shows the CPS11100 wiring diagram.



**Note:** See p. 692 for power and grounding wiring guidelines and operational information.



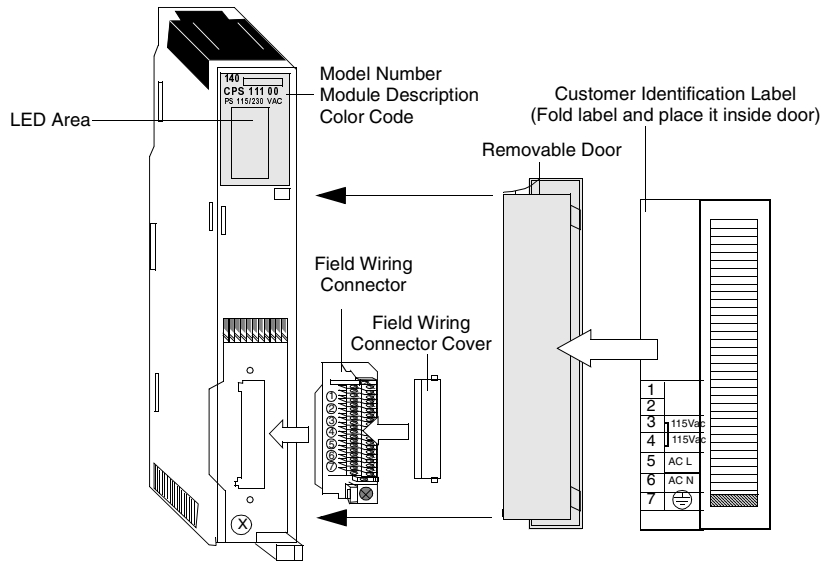
## 140CPS11100 AC Power Supply 115/230 Vac 3 A Module (PV01 or Greater)

### Overview

The following provides information on the AC Power Supply, 115/230 Vac, 3 A module (PV01 or greater).

### Power Supply Module

The following figure shows the power supply module (PV01 or greater) components.



**Note:** When field wiring the power supply module, the maximum wire size that should be used is 1 - 14 AWG or 2 - 16 AWG; the minimum is 20 AWG.

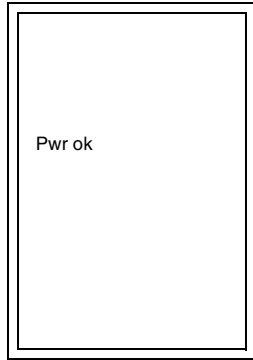
**Specifications**

The following table shows the specifications for the CPS11100 115/230 VAC power supply module (PV01 or greater).

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	100 ... 276 Vac
Input Frequency	47 ... 63 Hz
Input Voltage Total Harmonic Distortion	Less than 10% of the fundamental ms value
Input Current	0.4 A @ 115 Vac. 0.2 A @ 230 Vac
Inrush Current	10 A @ 115 Vac. 20 A @ 230 Vac
VA Rating	50 VA
Input Power Interruption	1/2 cycle @ full load and minimum rated line voltage / frequency. No less than 1 second between interruptions.
Fusing (external)	1.5 A slo-blo recommended (Part # 043502515 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Maximum Current	3 A
Minimum Current	0.3 A
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector (included)	7 point terminal strip (Part # 043506326)
Internal Power Dissipation	$2.0 + 3.0 \times I_{OUT} = \text{Watts}$ (where $I_{OUT}$ is in Amperes)
Operating Mode	Standalone

**LED Indicator and Description**

The following figure shows the CPS11100 (PV01 or greater) LED indicator.



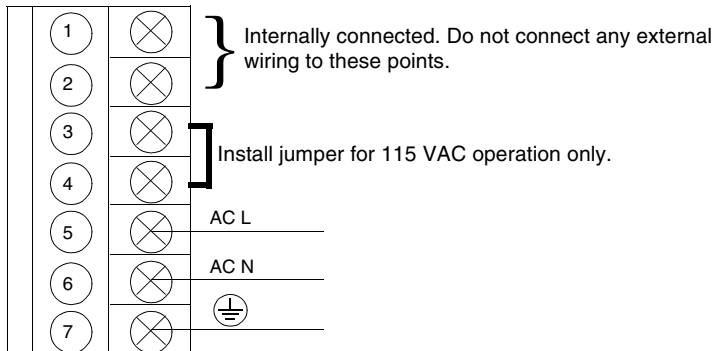
**Note:** For "closed system" installations, connector 140XTS00 500 must be used (see p. 712 ).

The following table shows the CPS11100 (PV01 or greater) LED description.

LED Description		
LEDs	Color	Indication when On
Pwr ok	Green	Power is supplied to the bus.

**Wiring Diagram**

The following figure shows the CPS11100 (PV01 or greater) wiring diagram.



**Note:** See p. 692 for power and grounding wiring guidelines and operational information.

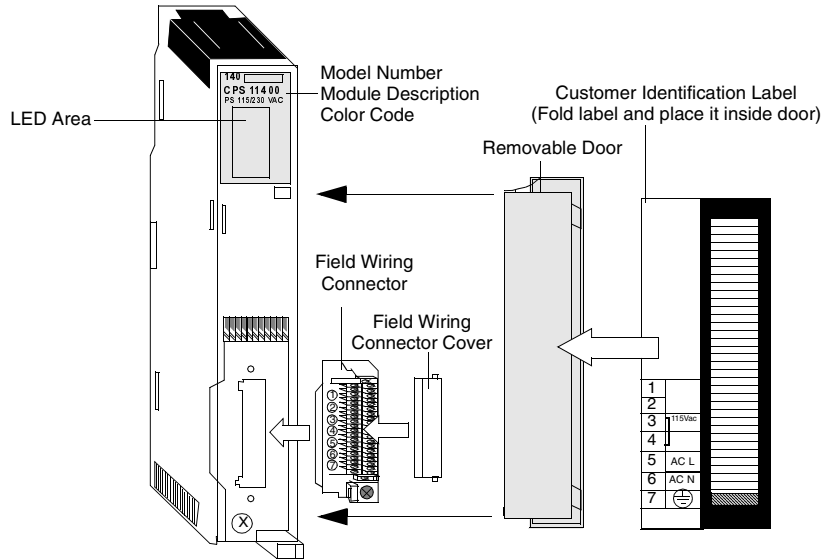
## 140CPS11400 AC Power Supply, 115/230 Vac, 8 A Module

### Overview

The following provides information on the AC Power Supply, 115/230 Vac, 8 A module.

### Power Supply Module

The following figure shows the power supply module components.



**Note:** When field wiring the power supply module, the maximum wire size that should be used is 1 - 14 AWG or 2 - 16 AWG; the minimum is 20 AWG.

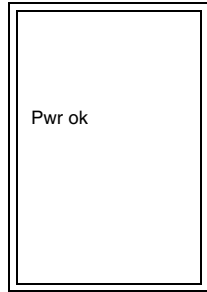
**Specifications**

The following table shows the specifications for the CPS11400 115/230 VAC power supply module.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	93 ... 138 Vac. 170 ... 276 Vac
Input Frequency	47 ... 63 Hz
Input Voltage Total Harmonic Distortion	Less than 10% of the fundamental ms value
Input Current	1.1 A @ 115 Vac. 0.6 A @ 230 Vac
Inrush Current	38 A @ 115 Vac. 19 A @ 230 Vac
VA Rating	130 VA
Input Power Interruption	1/2 cycle @ full load and minimum-rated line voltage / frequency. No less than 1 second between interruptions.
Fusing (external)	2.0 A slo-blo recommended (Part # 57-0089-000 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Maximum Current	8 A @ 60° C (See the operating curve below)
Minimum Current	None required
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector (included)	7 point terminal strip (Part # 043506326)
Internal Power Dissipation	$6.0 + 1.5 \times I_{out} = \text{Watts}$ (where $I_{out}$ is in Amperes)
Operating Mode	Standalone

**LED Indicator and Description**

The following figure shows the CPS11400 LED indicator.

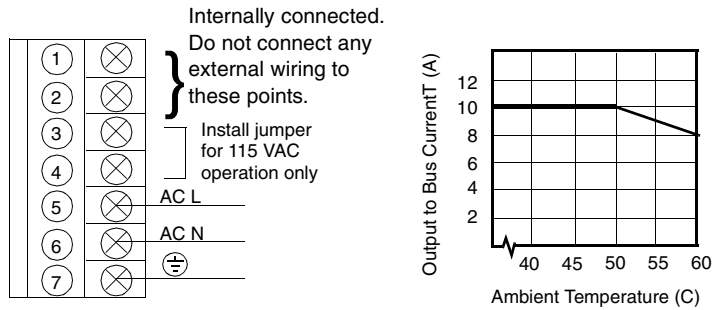


The following table shows the CPS11400 LED description.

LED Description		
LEDs	Color	Indication when On
Pwr ok	Green	Power is supplied to the bus.

**Wiring Diagram and Operating Curve**

The following figures show the CPS11400 Wiring Diagram (left) and operating curve (right).



**Note:** See p. 692 for power and grounding wiring guidelines and operational information.

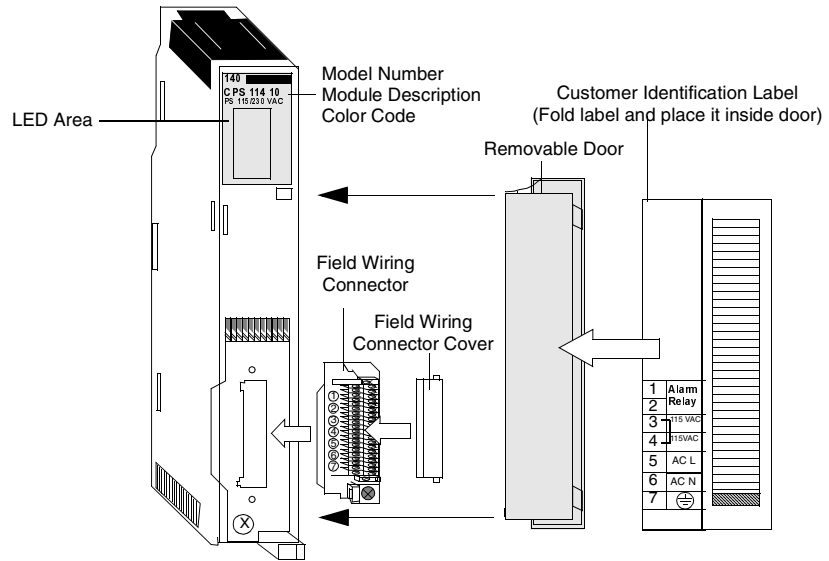
## 140CPS11410 AC Summable Power Supply 115/230 Vac, 8 A

### Overview

The following provides information on the AC power supply, 115/230 Vac, 8 A module.

### Power Supply Module

The following figure shows the power supply module and its components.



**Specifications**

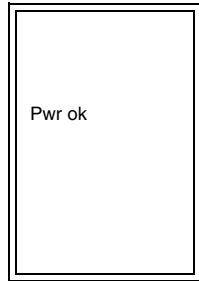
The following table shows the specifications for the CPS11410 115/230 VAC power supply module.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	93 ... 138 Vac. 170 ... 276 Vac
Input Frequency	47 ... 63 Hz
Input Voltage Total Harmonic Distortion	Less than 10% of the fundamental rms value
Input Current	1.1 A @ 115 Vac. 0.6 A @ 230 Vac
Inrush Current	38 A @ 115 Vac. 19 A @ 230 Vac
VA Rating	130 VA
Input Power Interruption	1/2 cycle @ full load and minimum rated line voltage / frequency. No less than 1 second between interruptions.
Fusing (external)	2.0 A slo-blo recommended (Part # 57-0089-000 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Maximum Current	8 A @ 60° C
Minimum Current	None required
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector (included)	7 point terminal strip (Part # 043506326)
Internal Power Dissipation	$6.0 + 1.5 \times I_{OUT} = \text{Watts}$ (where $I_{OUT}$ is in Amperes)
Operating Mode	Standalone / Summable



**LED Indicator and Description**

The following figure shows the CPS11410 LED indicator.

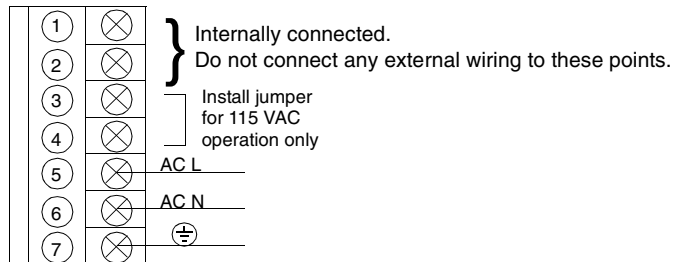


The following table shows the CPS11410 LED description.

LED Description		
LEDs	Color	Indication when On
Pwr ok	Green	Power is supplied to the bus.

**Wiring Diagram**

The following figures shows the 140CPS11410.



**Note:** See *p. 692* for power and grounding wiring guidelines and operational information.

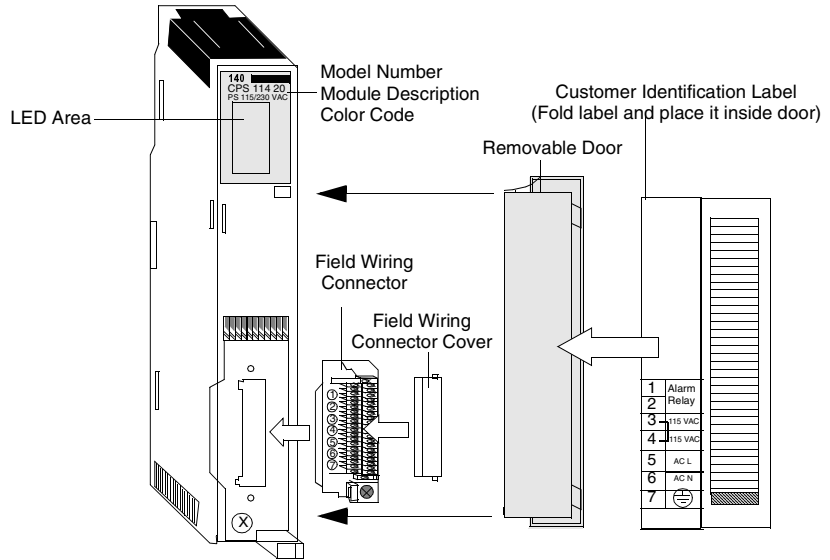
## 140CPS11420 AC Summable Power Supply 115/230 Vac, 11 A

### Overview

The following provides information on the AC power supply, 115/230 Vac, 11 A module.

### Power Supply Module

The following figure shows the power supply module and its components.



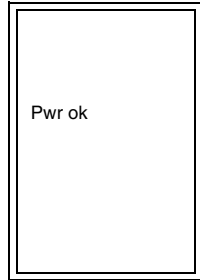
**Specifications**

The following table shows the specifications for the CPS11420 115/230 VAC power supply module.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	93 ... 132 Vac. 170 ... 264 Vac
Input Frequency	47 ... 63 Hz
Input Voltage Total Harmonic Distortion	Less than 10% of the fundamental rms value
Input Current	1.2 A @ 115 Vac. 0.7 A @ 230 Vac
Inrush Current @ 25° C (first power up)	≤ 20 A @ 115 Vac. ≤ 25 A @ 230 Vac
VA Rating	160 VA @ 11 A
Input Power Interruption	1/2 cycle @ full load and minimum rated line voltage / frequency. No less than 1 second between interruptions.
Fusing (external)	2.0 A slo-blo recommended (Part # 57-0089-000 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Maximum Current	Stand alone configuration: 11 A @ 60° C Summable configuration (Two 140CPS11420): 20 A @ 60° C (Total load capacity) Summable configuration (One 140CPS11420 and one 140CPS11410): 16A @ 60° C (Total load capacity)
Minimum Current	None required
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector (included)	7 point terminal strip (Part # 043506326)
Internal Power Dissipation	Less than 12 W at full load
Operating Mode	Standalone / Summable

**LED Indicator and Description**

The following figure shows the CPS11420 LED indicator.

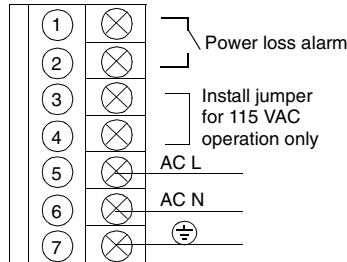


The following table shows the CPS11420 LED description.

LED Description		
LEDs	Color	Indication when On
Pwr ok	Green	Power is supplied to the bus.

**Wiring Diagram**

The following figures shows the CPS11420.



**Note:** A normally closed relay contact rated at 220 Vac, 6A / 30 Vdc, 5A is available on terminals 1 and 2 of the power terminal strip. This contact set may be used to signal input power OFF. The relay will de-energize when input power drops below 8 Vdc.

**Note:** See *p. 692* for power and grounding wiring guidelines and operational information.

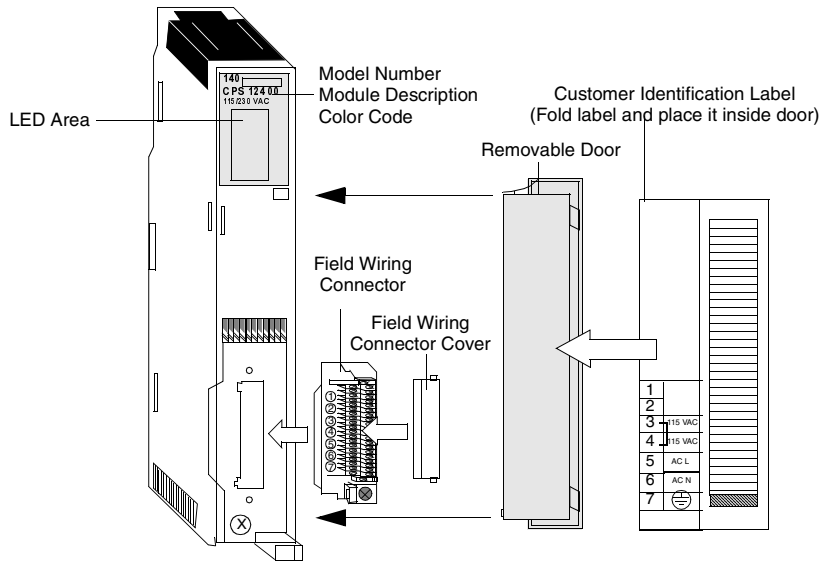
## 140CPS12400 AC Redundant Power Supply, 115/230 Vac 8 A Module

### Overview

The following provides information on the AC redundant power supply, 115/230 Vac, 8 A module.

### Power Supply Module

The following figure shows the power supply module components.



**Note:** When field wiring the power supply module, the maximum wire size that should be used is 1 - 14 AWG or 2 - 16 AWG; the minimum is 20 AWG.

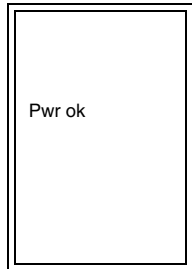
**Specifications**

The following table shows the specifications for the CPS12400 PS 115/230 VAC power supply module.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	93 ... 138 Vac. 170 ... 276 Vac
Input Frequency	47 ... 63 Hz
Input Voltage Total Harmonic Distortion	Less than 10% of the fundamental rms value
Input Current	1.1 A @ 115 Vac. 0.6 A @ 230 Vac
Inrush Current	38 A @ 115 Vac. 19 A @ 230 Vac
VA Rating	130 VA
Input Power Interruption	1/2 cycle @ full load and minimum rated line voltage / frequency. No less than 1 second between interruptions.
Fusing (external)	2.0 A slo-blo recommended (Part # 57-0089-000 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Maximum Current	8 A @ 60° C
Minimum Current	None required
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector (included)	7 point terminal strip (Part # 043506326)
Internal Power Dissipation	$6.0 + 1.5 \times I_{out} = \text{Watts}$ (where $I_{out}$ is in Amperes)
Operating Mode	Standalone / Redundant

**LED Indicator and Description**

The following figure shows the CPS12400 LED indicator.

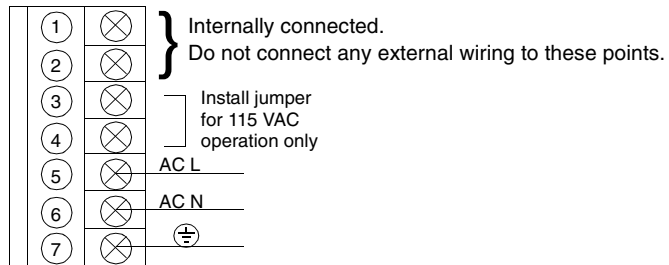


The following table shows the CPS12400 LED description.

LED Description		
LEDs	Color	Indication when On
Pwr ok	Green	Power is supplied to the bus.

**Wiring Diagram**

The following figure shows the 140CPS12400 wiring diagram.



**Note:** See p. 692 for power and grounding wiring guidelines and operational information.

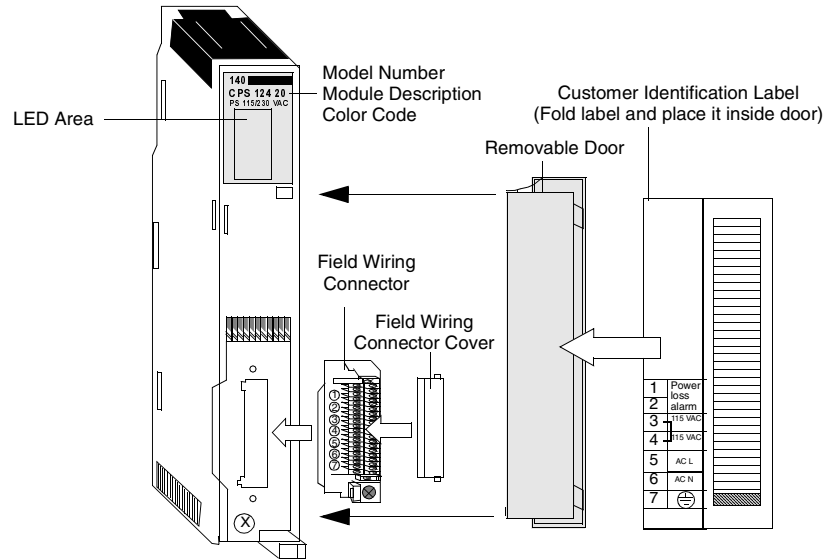
## 140CPS12420 AC Redundant Power Supply, 115/230 Vac 11 A Module

### Overview

The following provides information on the AC redundant power supply, 115/230 Vac, 11 A module.

### Power Supply Module

The following figure shows the power supply module components.



**Note:** When field wiring the power supply module, the maximum wire size that should be used is 1 - 14 AWG or 2 - 16 AWG; the minimum is 20 AWG.



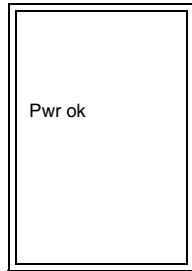
**Specifications**

The following table shows the specifications for the CPS12420 PS 115/230 VAC power supply module.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	93 ... 132 Vac. 170 ... 264 Vac
Input Frequency	47 ... 63 Hz
Input Voltage Total Harmonic Distortion	Less than 10% of the fundamental rms value
Input Current	1.2 A @ 115 Vac 0.7 A @ 230 Vac
Inrush Current	≤ 20 A @ 115 Vac @ 25° C first power up ≤ 25 A @ 230 Vac
VA Rating	160 VA @ 11 A
Input Power Interruption	1/2 cycle @ full load and minimum rated line voltage / frequency. No less than 1 second between interruptions.
Fusing (external)	2.0 A slo-blo recommended (Part # 57-0089-000 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Maximum Current	Standalone configuration: 11 A @ 60° C Redundant configuration (two 140CPS12420): 10 A @ 60° C (total load capacity) Redundant configuration (one 140CPS12420 and one 140CPS22400): 8 A @ 60° C (total load capacity) Redundant configuration (one 140CPS12420 and one 140CPS42400): 8 A @ 60° C (total load capacity)
Minimum Current	None required
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector (included)	7 point terminal strip (Part # 043506326)
Internal Power Dissipation	Less than 12 W at full load
Operating Mode	Standalone / Redundant

**LED Indicator and Description**

The following figure shows the CPS12420 LED indicator.

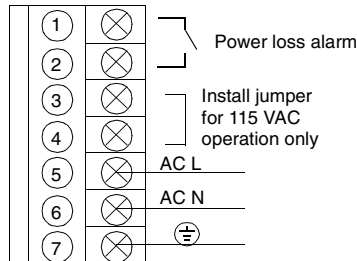


The following table shows the CPS12420 LED description.

LED Description		
LEDs	Color	Indication when On
Pwr ok	Green	Power is supplied to the bus.

**Wiring Diagram**

The following figure shows the CPS12420 wiring diagram.



**Note:** A normally closed relay contact rated at 220 Vac, 6A / 30 Vdc, 5A is available on terminals 1 and 2 of the power terminal strip. This contact set may be used to signal input power OFF. The relay will de-energize when input power drops below 8 Vdc.

**Note:** See *p. 692* for power and grounding wiring guidelines and operational information.

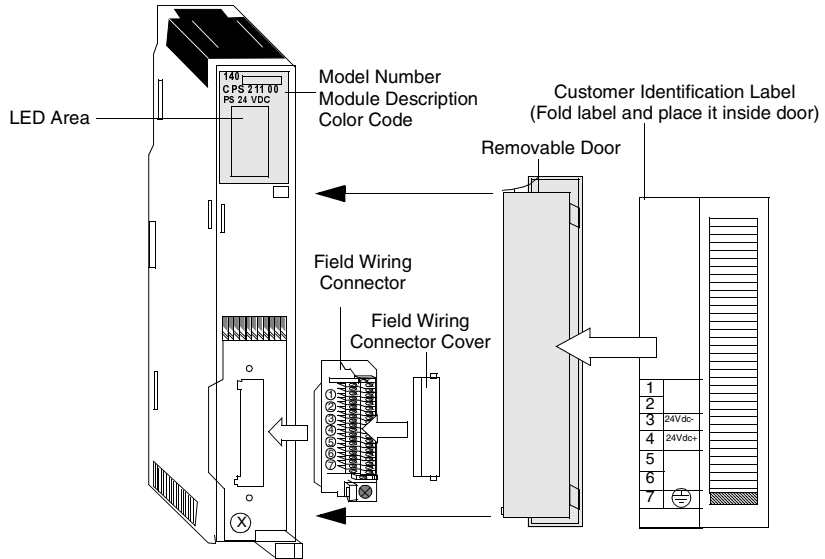
## 140CPS21100 DC Power Supply, 24 Vdc, 3 A Module

### Overview

The following provides information on the DC power supply, 24 Vdc, 3 A module.

### Power Supply Module

The following figure shows the power supply module components.



**Note:** When field wiring the power supply module, the maximum wire size that should be used is 1 - 14 AWG or 2 - 16 AWG; the minimum is 20 AWG.

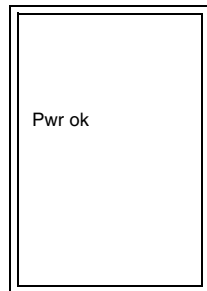
**Specifications**

The following table shows the specifications for the CPS21100 PS 24 VDC power supply module.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	20 ... 30 Vdc
Input Current	1.6 A
Inrush Current	30 A
Input Power Interruption	1.0 ms max @ 20 V. 20.0 ms max @ 24 V
Fusing (external)	2.5 A slo-blo recommended (Part # 043502516 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Maximum Current	3 A
Minimum Current	0.3 A
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector (included)	7 point terminal strip (Part # 043503328)
Internal Power Dissipation	$2.0 + 3 \times I_{out} = \text{Watts}$ (where $I_{out}$ is in Amperes)
Operating Mode	Standalone

**LED Indicator and Description**

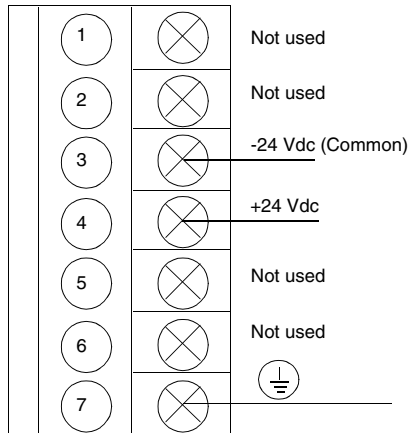
The following figure shows the CPS21100 LED indicator.



The following table shows the CPS21100 LED description.

<b>LED Description</b>		
<b>LEDs</b>	<b>Color</b>	<b>Indication when On</b>
Pwr ok	Green	Power is supplied to the bus.

**Wiring Diagram** The following figure shows the 140CPS21100 wiring diagram.



**Note:** See p. 692 for power and grounding wiring guidelines and operational information.

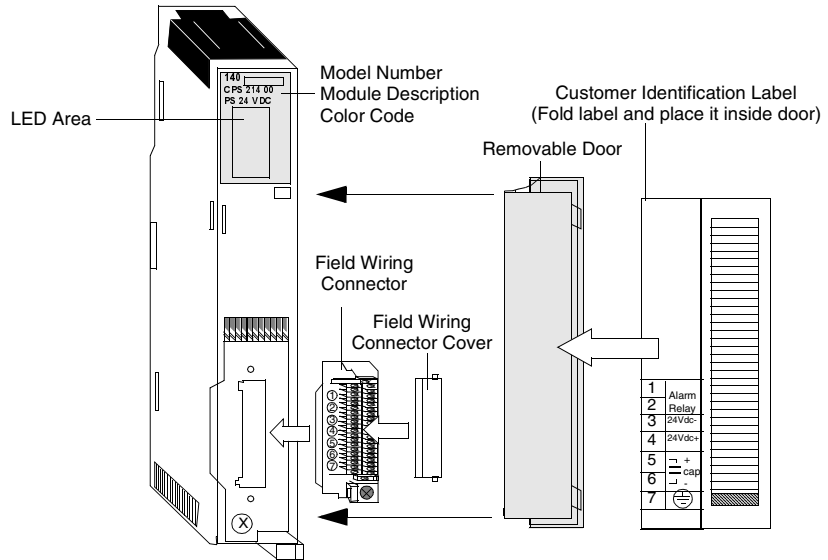
## 140CPS21400 DC Summable Power Supply, 24 Vdc, 8 A Module

### Overview

The following provides information on the DC summable power supply, 24 Vdc, 8 A module.

### Power Supply Module

The following figure shows the power supply module components.



**Note:** When field wiring the power supply module, the maximum wire size that should be used is 1 - 14 AWG or 2 - 16 AWG; the minimum is 20 AWG.

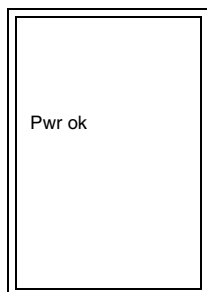
**Specifications**

The following table shows the specifications for the 140CPS21400 PS 24 Vdc power supply module.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	20 ... 30 Vdc
Input Current	3.8 A max
Inrush Current	25 A @ 24 Vdc. 14 A @ 20 Vdc
Input Ripple	2.4 Vdc max, 94 ... 189 Hz
Input Power Interruption	1 ms max @ 24 Vdc (see the hold-up capacitor timing chart)
Fusing (external)	5.0 A slo-blo recommended (Part # 043502405 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Maximum Current	8 A
Minimum Current	None required
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector	7 point terminal strip (Part # 043503328)
Internal Power Dissipation	$6.0 + 1.8 \times I_{OUT} = \text{Watts}$ (where $I_{OUT}$ is in Amperes)
Operating Mode	Standalone / Summable

**LED Indicator and Description**

The following figure shows the CPS21400 LED indicator.

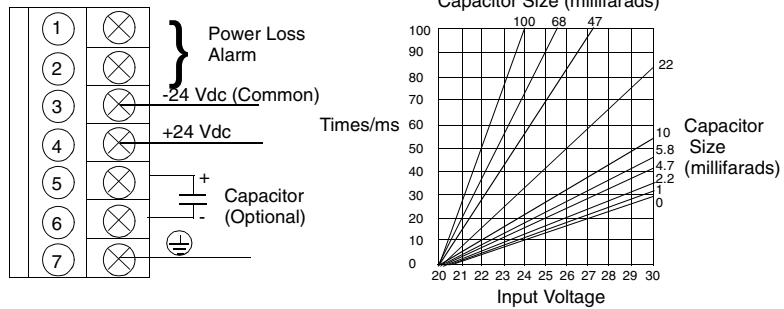


The following table shows the CPS21400 LED description.

<b>LED Description</b>		
<b>LEDs</b>	<b>Color</b>	<b>Indication when On</b>
Pwr ok	Green	Power is supplied to the bus.

**Wiring Diagram and Timing Chart**

The following figures show the CPS214 wiring diagram (left) and the hold-up capacitor timing chart (right).



**Note:**

1. A normally closed relay contact rated at 220 Vac, 6A / 30 Vdc, 5A is available on terminals 1 and 2 of the power terminal strip. This contact set may be used to signal input power OFF. The relay will de-energize when input power drops below 8 Vdc.
2. Tolerance to input interruptions may be increased by adding a  $\geq 50$  Vdc electrolytic capacitor between 5 and 6 of the power terminal strip. Refer to the hold-up capacitor timing chart for capacitor values.

**Note:** See *p. 692* for power and grounding wiring guidelines and operational information.



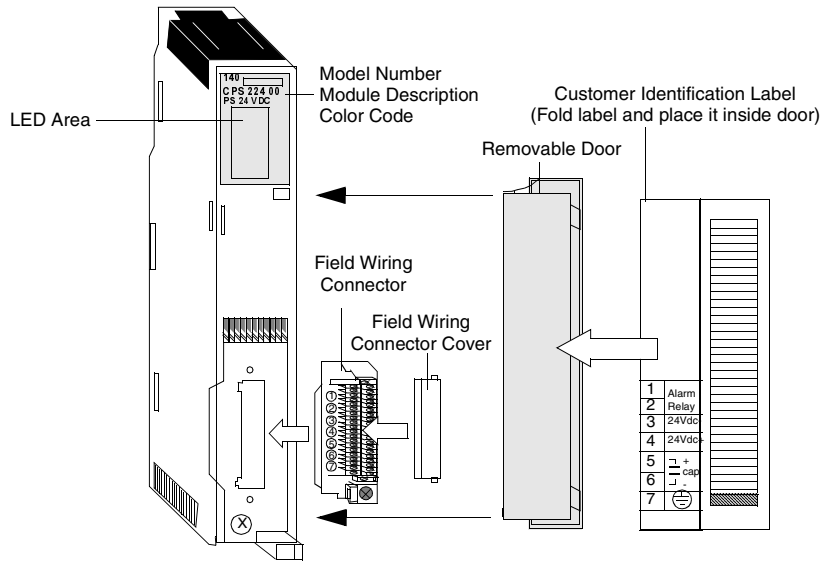
## 140CPS22400 DC Redundant Power Supply, 24 Vdc, 8 A Module

### Overview

The following provides information on the DC Redundant Power Supply, 24 Vdc, 8 A module.

### Power Supply Module

The following figure shows the power supply module components.



**Note:** When field wiring the power supply module, the maximum wire size that should be used is 1 - 14 AWG or 2 - 16 AWG; the minimum is 20 AWG.

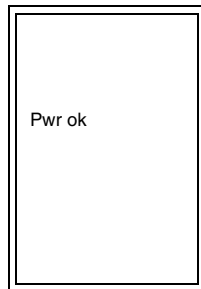
**Specifications**

The following table shows the specifications for the 24 Vdc, 8 A DC redundant power supply.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	20 ... 30 Vdc
Input Current	3.8 A max
Inrush Current	25 A @ 24 Vdc. 14 A @ 20 Vdc
Input Ripple	2.4 Vdc max, 94 ... 189 Hz
Input Power Interruption	1 ms max @ 24 Vdc
Fusing (external)	5.0 A slo-blo recommended (Part # 043502405 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Current	8 A
Protection	Over Current, Over Voltage
<b>General</b>	
Surge Withstand	2.3 x Maximum Rated Input Voltage for 1.3 ms
Field Wiring Connector	7 point terminal strip (Part # 043503328)
Internal Power Dissipation	$6.0 + 1.8 \times I_{out} = \text{Watts}$ (where $I_{out}$ is in Amperes)
Operating Mode	Standalone / Redundant

**LED Indicator and Description**

The following figure shows the CPS22400 LED indicator.

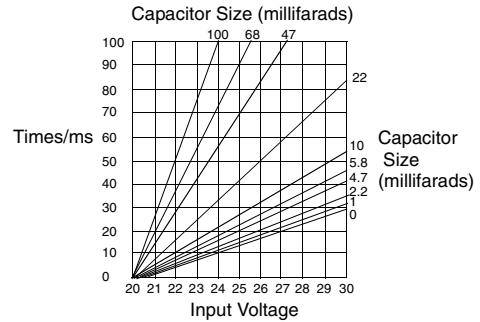
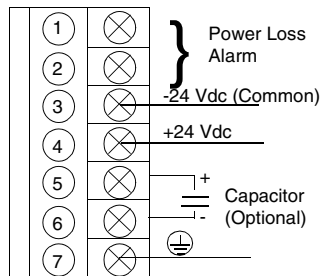


The following table shows the CPS22400 LED description.

<b>LED Description</b>		
<b>LEDs</b>	<b>Color</b>	<b>Indication when On</b>
Pwr ok	Green	Power is supplied to the bus.

## Wiring Diagram and Timing Chart

The following figures show the 140CPS22400 wiring diagram (left) and the 140CPS22400 hold-up capacitor timing chart (right).



### Note:

1. A normally closed relay contact rated at 220 Vac, 6A / 30 Vdc, 5A is available on terminals 1 and 2 of the power terminal strip. This contact set may be used to signal input power OFF, or a power supply failure. The relay will de-energize when input power drops below 8 Vdc.
2. Tolerance to input interruptions may be increased by adding a  $\geq 50$  Vdc electrolytic capacitor between 5 and 6 of the power terminal strip. Refer to the hold-up capacitor timing chart (above) for capacitor values.

**Note:** See p. 692 for power and grounding wiring guidelines and operational information.

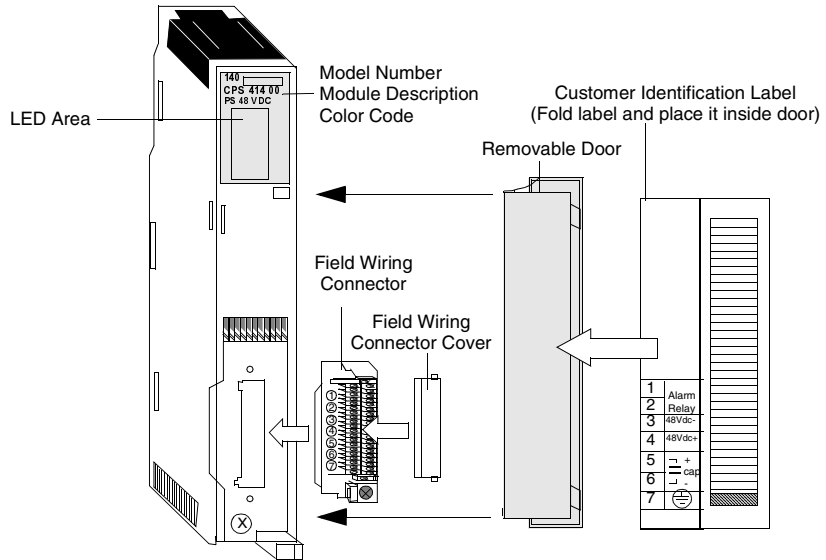
## 140CPS41400 DC Summable Power Supply, 48 Vdc, 8 A Module

### Overview

The following provides information on the DC summable power supply, 48 Vdc, 8 A module.

### Power Supply Module

The following figure shows the power supply module components.



**Note:** When field wiring the power supply module, the maximum wire size that should be used is 1 - 14 AWG or 2 - 16 AWG; the minimum is 20 AWG.

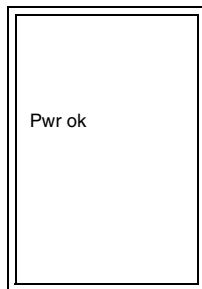
**Specifications**

The following table shows the specifications for the CPS41400, 48 VDC power supply module.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	40 ... 72 Vdc
Input Current	1.2 A @ 48 Vdc
Inrush Current	25 A @ 40 Vdc
Input Power Interruption	13 ms @ 48 Vdc
Fusing (external)	2.0 A medium time-lag recommended (Part # 57-0089-000 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Current	8 A (see operating curve)
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector	7 point terminal strip (Part # 043503328)
Internal Power Dissipation	15.6 W @ 8 A
Operating Mode	Standalone / Summable

**LED Indicator and Description**

The following figure shows the CPS41400 LED indicator.

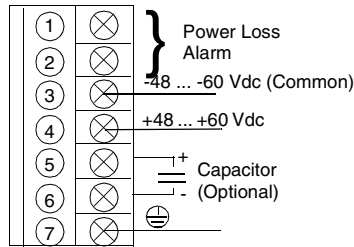


The following table shows the CPS41400 LED description.

<b>LED Description</b>		
<b>LEDs</b>	<b>Color</b>	<b>Indication when On</b>
Pwr ok	Green	Power is supplied to the bus.

**Wiring Diagram**

The following figure shows the CPS41400 wiring diagram.

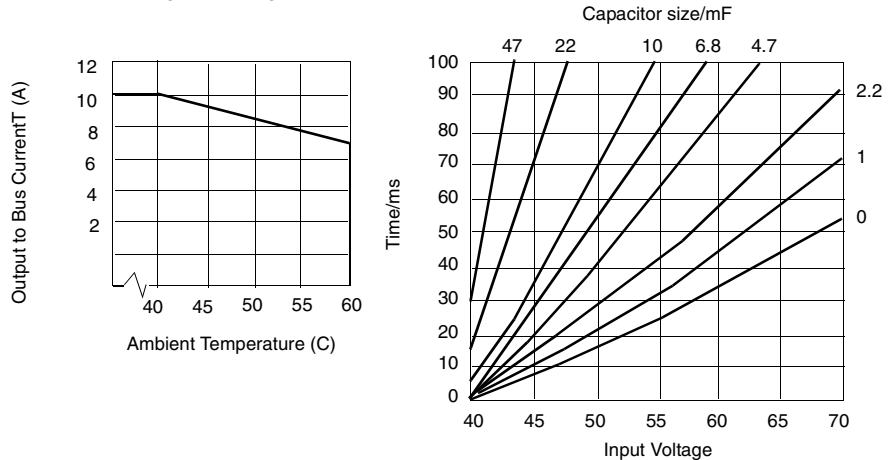


**Note:** A normally closed relay contact rated at 220 Vac, 6A / 30 Vdc, 5A is available on terminals 1 and 2 of the power terminal strip. This contact set may be used to signal input power OFF, or a power supply failure.

**Note:** See p. 692 for power and grounding wiring guidelines and operational information.

**Operating Curve and Timing Chart**

The following figures show the CPS41400 operating curve (left) and the hold-up capacitor timing chart (right).



**Note:** Tolerance to input interruptions may be increased by adding a  $\geq 80$  Vdc electrolytic capacitor between 5 and 6 of the power terminal strip. Refer to the hold-up capacitor timing chart (above) for capacitor values.

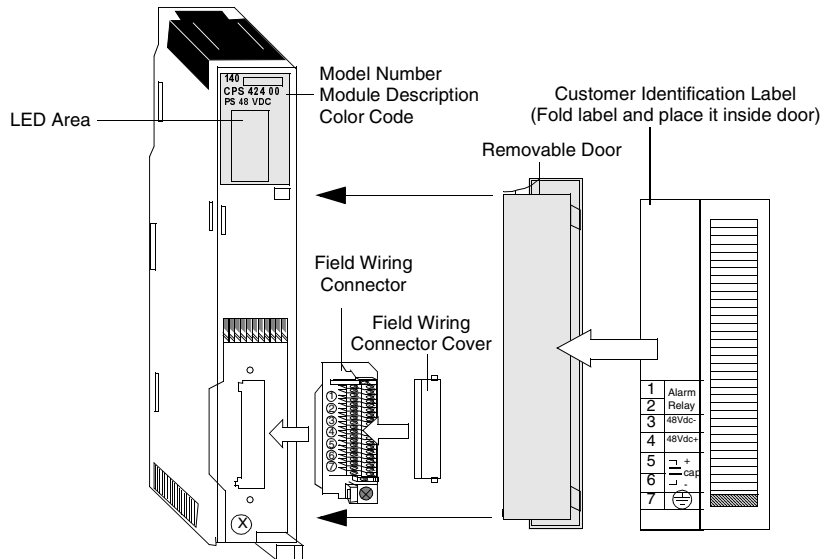
## 140CPS42400 DC Redundant Power Supply, 48 Vdc, 8 A Module

### Overview

The following provides information on the DC redundant power supply, 48 Vdc, 8 A module.

### Power Supply Module

The following figure shows the power supply module components.



**Note:** When field wiring the power supply module, the maximum wire size that should be used is 1 - 14 AWG or 2 - 16 AWG; the minimum is 20 AWG.

**Note:** Tolerance to input interruptions may be increased by adding an 80 Vdc electrolytic capacitor between 5 and 6 of the power terminal strip. Refer to the hold-up capacitor timing chart (above) for capacitor values.

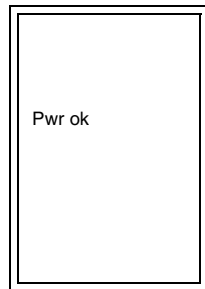
**Specifications**

The following table shows the specifications for the 140CPS42400 PS 48 VDC RED power supply module.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	40 ... 72 Vdc
Input Current	1.3 A @ 48 Vdc
Inrush Current	25 A @ 48 Vdc
Input Power Interruption	13 ms @ 48 Vdc
Fusing (external)	2.0 A medium time-lag recommended (Part # 57-0089-000 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Current	8 A (see operating curve)
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector	7 point terminal strip (Part # 043503328)
Internal Power Dissipation	17.2 W @ 8 A
Operating Mode	Standalone / Redundant

**LED Indicator and Description**

The following figure shows the CPS42400 LED indicator.



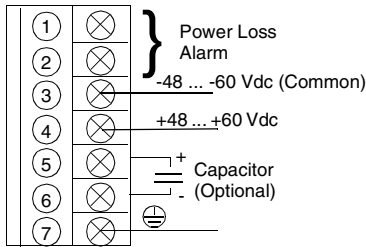
The following table shows the CPS42400 LED description.

<b>LED Description</b>		
<b>LEDs</b>	<b>Color</b>	<b>Indication when On</b>
Pwr ok	Green	Power is supplied to the bus.



**Wiring Diagram**

The following figure shows the CPS42400 wiring diagram.

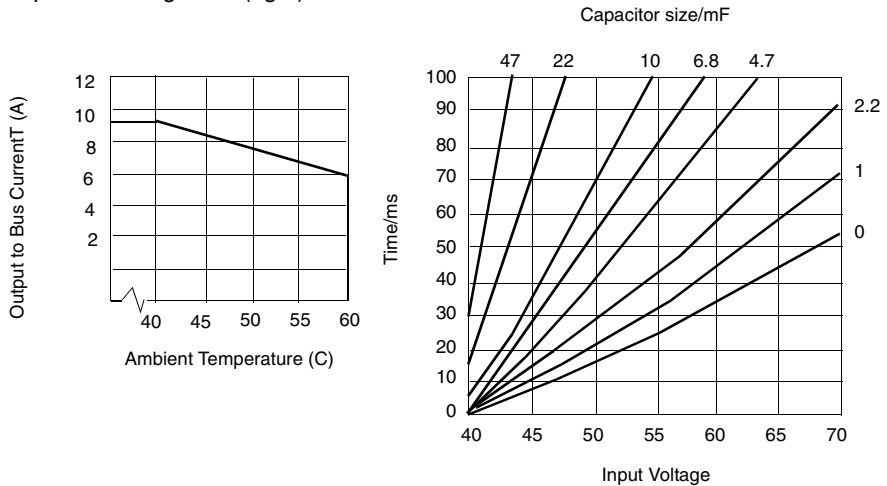


**Note:** See p. 692 for power and grounding wiring guidelines and operational information.

**Note:** A normally closed relay contact rated at 220 Vac, 6A / 30 Vdc, 5A is available on terminals 1 and 2 of the power terminal strip. This contact set may be used to signal input power OFF, or a power supply failure.

**Operating Curve and Timing Chart**

The following figures show the CPS42400 operating curve (left) and the hold-up capacitor timing chart (right).



**Note:** Tolerance to input interruptions may be increased by adding a  $\geq 80$  Vdc electrolytic capacitor between 5 and 6 of the power terminal strip. Refer to the hold-up capacitor timing chart (above) for capacitor values.

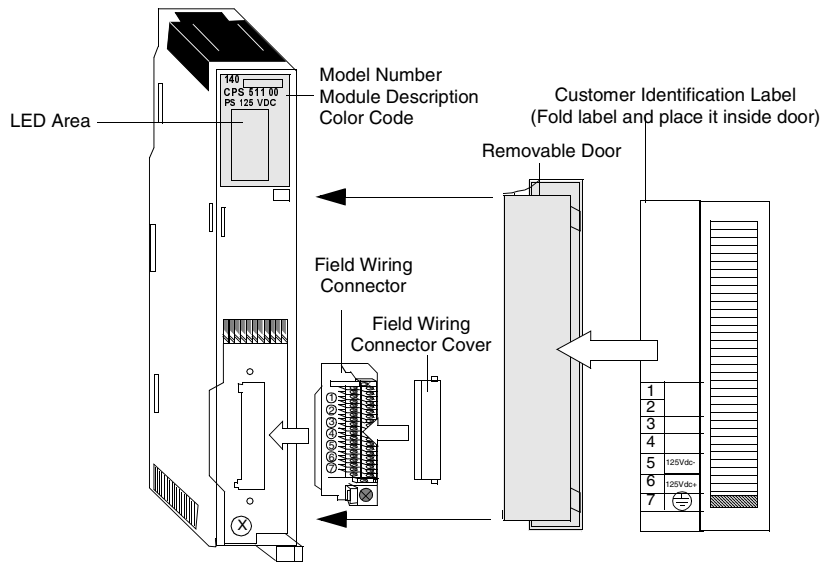
## 140CPS51100 DC Power Supply, 125 Vdc, 3 A Module

### Overview

The following provides information on the DC power supply, 125 Vdc, 3 A module.

### Power Supply Module

The following figure shows the power supply module components.



**Note:** When field wiring the power supply module, the maximum wire size that should be used is 1 - 14 AWG or 2 - 16 AWG; the minimum is 20 AWG.

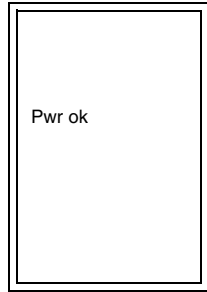
**Specifications**

The following table shows the specifications for the CPS51100 125 Vdc power supply module.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	100 ... 150 Vdc including ripple
Input Current	0.4 A
Inrush Current	10 A
Input Power Interruption	1.0 ms max
Fusing (external)	1.5 A slo-blo recommended (Part # 043502515 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Maximum Current	3 A
Minimum Current	0.3 A
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector (included)	7 point terminal strip (Part # 043506325)
Internal Power Dissipation	$2.0 + 3 \times I_{out} = \text{Watts}$ (where $I_{out}$ is in Amperes)
Operating Mode	Standalone

**LED Indicator and Description**

The following figure shows the CPS51100 LED indicator.

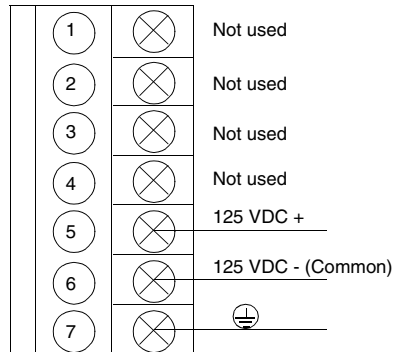


The following table shows the CPS51100 LED description.

LED Description		
LEDs	Color	Indication when On
Pwr ok	Green	Power is supplied to the bus.

**Wiring Diagram**

The following figure shows the CPS51100 wiring diagram.



**Note:** See *p. 692* for power and grounding wiring guidelines and operational information.

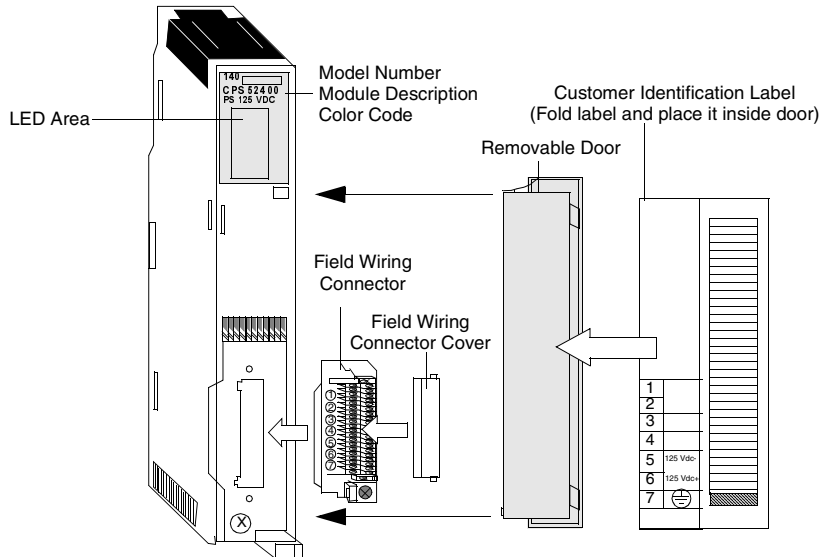
## 140CPS52400 DC Standalone/Redundant Power Supply, 125 Vdc, 8 A

### Overview

The following provides information on the DC Standalone/Redundant power supply, 125 Vdc, 8 A module.

### Power Supply Module

The following figure shows the power supply module components.



**Note:** When field wiring the power supply module, the maximum wire size that should be used is 1 - 14 AWG or 2 - 16 AWG; the minimum is 20 AWG.

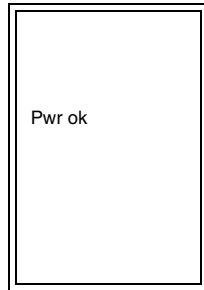
**Specifications**

The following table shows the specifications for the CPS52400 125 VDC power supply module.

<b>Specifications</b>	
<b>Input Requirements</b>	
Input Voltage	100 ... 150 Vdc including ripple
Input Current	0.5 A @ 125 Vdc
Inrush Current	28 A @ 125 Vdc
Input Power Interruption	1.0 ms max
Fusing (external)	2 A slo-blo recommended (Part # 57-0089-000 or equivalent)
<b>Output to Bus</b>	
Voltage	5.1 Vdc
Maximum Current	8 A @ 60° C
Minimum Current	None required
Protection	Over Current, Over Voltage
<b>General</b>	
Field Wiring Connector (included)	7 point terminal strip (Part # 043506325)
Internal Power Dissipation	$6.0 + 1.5 \times I_{OUT} = \text{Watts}$ (where $I_{OUT}$ is in Amperes)
Operating Mode	Standalone / Redundant

**LED Indicator and Description**

The following figure shows the CPS52400 LED indicator.

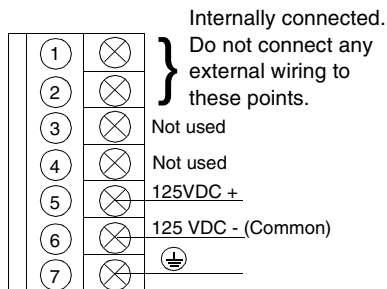


The following table shows the CPS52400 LED description.

LED Description		
LEDs	Color	Indication when On
Pwr ok	Green	Power is supplied to the bus.

**Wiring Diagram**

The following figure shows the CPS52400 wiring diagram.



**Note:** See p. 692 for power and grounding wiring guidelines and operational information.





---

# CPU Modules

# 7

---

## At a Glance

### Introduction

This chapter provides information on the specifications, LED indicators and description and error codes for the Quantum CPU modules.

The following table shows an overview of the Quantum CPU modules.

CPU	SRAM (bytes)	Ladder	Registers	Extended	984 Ladder Performance	Max IEC Program
140CPU11302	256 k	8 k	10 k	none	0.3 - 1.4 ms/k	109 k
140CPU11303	512 k	16 k	10 k	none	0.3 - 1.4 ms/k	368 k
140CPU21304	768 k	32 k or 48 k	57 k or 28 k *	80 k or 0 k *	0.3 - 1.4 ms/k	606 k
140CPU42402	2 M	64 k	57 k	96 k *	0.1 - 0.5 ms/k	570 k
140CPU43412	2 M	64 K	57 K*	96 k	0.1 - 0.5 ms/k	896 k
140CPU43412A	2 M	64K	57 K*	96 k	0.1 - 0.5 ms/k	896 k
140CPU53414	4 M	64 K	57 K*	96 k	0.9 - 0.45 ms/k	2.5 M
140CPU53414A	4 M	64 K	57 K*	96K	0.1 - 0.5 ms/k	2.5 M

\*Refer to the individual specification pages for detailed information.

**What's in this Chapter?**

This chapter contains the following topics:

<b>Topic</b>	<b>Page</b>
140CPU11302 CPU Module	105
140CPU11303 CPU Module	115
140CPU21304 CPU Module	125
140CPU42402 CPU Module	135
140CPU43412 CPU Module	145
140CPU43412A CPU Module	156
140CPU53414 CPU Module	167
140CPU53414A CPU Module	178

---

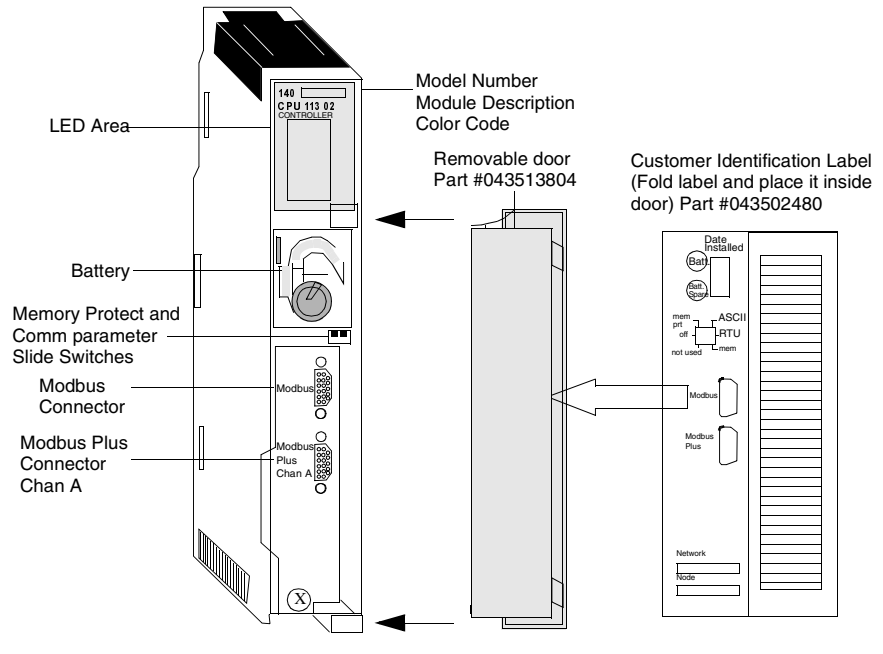
## 140CPU11302 CPU Module

### Overview

The following provides information on the 140CPU11302 Controller module – CPU 256 K, 1xModbus Plus, Max IEC Program 109 K (requires IEC-only Exec.)

### CPU Module

The following figure shows the CPU Module and its components.



**Specifications**

The following table shows the specifications for the 140CPU11302 CONTROLLER module.

<b>Specifications</b>	
<b>984 Ladder Logic</b>	8 k words max
<b>Reference Capacity</b>	
Discrete	8192 In and 8192 Out max
Register	9999 max
<b>Local I/O (Main Backplane)</b>	
Maximum I/O Words	64 In and 64 Out*
Maximum Number of I/O Racks	2 (Requires expander)
<b>Remote I/O</b>	
Maximum I/O Words per Drop	64 In / 64 Out*
Maximum Number of Remote Drops	31
<b>Distributed I/O</b>	
Maximum Number of Networks per System	3**
Maximum Words per Network (For every DIO drop, there is a minimum of two words input of overhead.)	500 In and 500 Out
Maximum Words per Node	30 In and 32 Out
<b>Watchdog Timer</b>	250 ms (S/W adjustable)
<b>Logic Solve Time</b>	0.3 ms / k to 1.4 ms / k
<b>Battery</b>	
Service Life	1200 mAh
Shelf Life	10 years with 0.5% loss of capacity per year
<b>Battery Load Current @ Power-off</b>	
Typical	5 $\mu$ A
Maximum	110 $\mu$ A
<b>Communication</b>	
Modbus (RS-232)	1 serial port (9-pin D-shelf)
Modbus Plus (RS-485)	1 network port (9-pin D-shell)

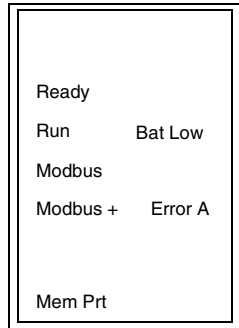
<b>Specifications</b>		
<b>General</b>		
Diagnostics	<b>Power Up</b>	<b>Runtime</b>
	RAM	RAM
	RAM Address	RAM Address
	Executive Checksum	Executive Checksum
	User Logic Check	User Logic Check
	Processor	
Bus Current Required	780 mA	
Power Dissipation	3.9 W	
TOD Clock	+/- 8.0 seconds/day 0 ... 60° C	
Maximum Number of NOM, NOE, and MMS modules (any combination)	2	

\* This information can be a mix of Discrete or Register I/O. For each word of register I/O configured, one word of I/O words must be subtracted from the total available. The same holds true for each block of 8 bits or 16 bits of Discrete I/O configured – one word of Register I/O must be subtracted from the total available.

\*\*Requires the use of the 140NOM2x00 Option Processor.–

## LED Indicators and Descriptions

The following figure shows the CPU LED indicators.



The following table shows the LED descriptions.

<b>LED Descriptions</b>		
<b>LEDs</b>	<b>Color</b>	<b>Indication when On</b>
Ready	Green	The CPU has passed powerup diagnostics.
Run	Green	The CPU has been started and is solving logic. (See the following table for Run LED error codes).
Modbus	Green	Communications are active on the Modbus port.
Modbus +	Green	Communications are active on the Modbus Plus port.
Mem Prt	Amber	Memory is write protected (the memory protect switch is on).
Bat Low	Red	The battery needs replacing.
Error A	Red	Indicates a communications error on the Modbus Plus network.

**LED Error Codes** The following table show the number of times the Run LED blinks for each type of error, and the crash codes possible for that group (all codes are in hex) for the 140CPU11302 module.

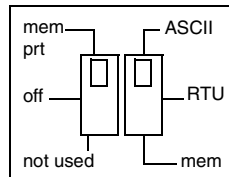
<b>LED Error Codes</b>		
<b>Number of Blinks</b>	<b>Code</b>	<b>Error</b>
Continuous	0000	requested kernel mode
2	80B	ram error during sizing
	80C	run output active failed
	82E	MB command handler stack error
3	769	bus grant received
	72A	not master asic on cpu
	72B	master config write bad
	72C	quantum bus DPM write failure
	72F	plc asic loopback test
	730	plc asic BAD_DATA
4	604	UPI timeout error
	605	bad UPI response opcode
	606	UPI bus diagnostic error
	607	modbus cmd-buffer overflow
	608	modbus cmd-length is zero
	609	modbus abort command error
	614	mbp bus interface error
	615	bad mbp response opcode
	616	timeout waiting for mbp
	617	mbp out of synchronization
	618	mbp invalid path
	619	page 0 not paragraph aligned
	61E	bad external uart hardware
	61F	bad external uart interrupt
	620	bad receive comm state
	621	bad transmit comm state
	622	bad comm state trn_asc
	623	bad comm state trn_rtu
624	bad comm state rcv_rtu	
625	bad comm state rcv_asc	
626	bad modbus state tmr0_evt	

LED Error Codes		
Number of Blinks	Code	Error
	627	bad modbus state trn-int
	628	bad modbus state rcv-int
	631	bad interrupt
5	503	ram address test error
	52D	P.O.S.T BAD MPU ERROR
6	402	ram data test error
7	300	EXEC not loaded
	301	EXEC Checksum
8	8001	Kernal prom checksum error
	8002	flash prog / erase error
	8003	unexpected executive return

### Front Panel Switches

Two, three-position slide switches are located on the front of the CPU. The left switch is used for memory protection when in the top position and no memory protection in the middle and bottom positions. The three-position slide switch on the right is used to select the communication parameter settings for the Modbus (RS-232) ports.

The following figure shows the three options that are available for the CPU11302.



**Note:** The CPU hardware defaults to bridge mode when the front panel switch is set to RTU or ASCII mode. When networking controllers, a panel device connected to the CPU Modbus port can communicate with the controller to which it is connected, as well as log into any nodes on the Modbus Plus network.



Setting the slide switch to the top position assigns ASCII functionality to the port; the following communication parameters are set and cannot be changed.

<b>ASCII Communication Port Parameters</b>	
Baud	2,400
Parity	Even
Data Bits	7
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the middle position assigns remote terminal unit (RTU) functionality to the port; the following communication parameters are set and cannot be changed.

<b>RTU Communication Port Parameters</b>	
Baud	9,600
Parity	Even
Data Bits	8
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the bottom position gives you the ability to assign communication parameters to the port in software; the following parameters are valid.

<b>Valid Communication Port Parameters</b>		
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
Data Bits	7 / 8	
Stop Bits	1 / 2	
Parity	Enable/Disable Odd/Even	
Device Address	1 ... 247	

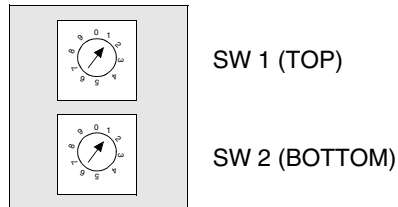
## Rear Panel Switches

Two rotary switches are located on the rear panel of the CPU. They are used for setting the Modbus Plus node and Modbus port addresses.

**Note:** The highest address that may be set with these switches is 64.

SW1 (the top switch) sets the upper digit (tens) of the address; SW2 (the bottom switch) sets the lower digit (ones) of the address. The illustration below shows the correct setting for an example address of 11.

The following figure shows SW1 and SW2.



The following table shows the SW1 and SW2 address settings.

SW1 and SW2 Address Settings		
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

**Note:** If "0" or an address greater than 64 is selected, the Modbus + LED will be "on" steady, to indicate the selection of an invalid address.

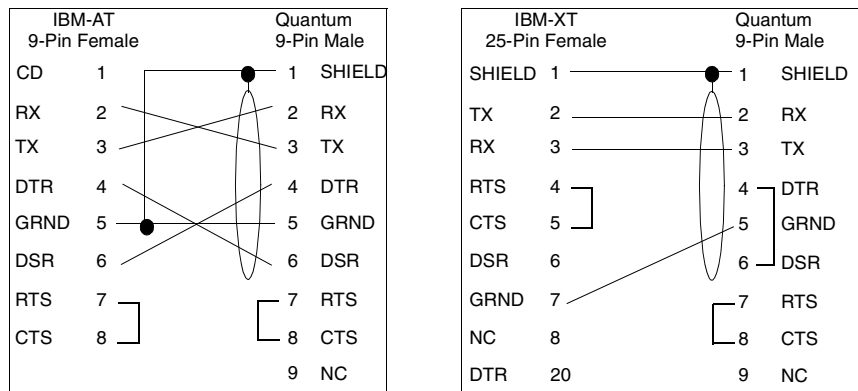
## Modbus Connector Pinouts

All Quantum CPUs are equipped with a nine-pin RS-232C connector that supports Modicon's proprietary Modbus communication protocol. The following is the Modbus port pinout connections for nine-pin and 25-pin connections.

**Note:** Although the Modbus ports electrically support existing Modbus cables, it is recommended that a Modbus programming cable (Part # 990NAA2620 or 990NAA26350) be used. This cable has been designed to fit under the door of a Quantum CPU or NOM module.

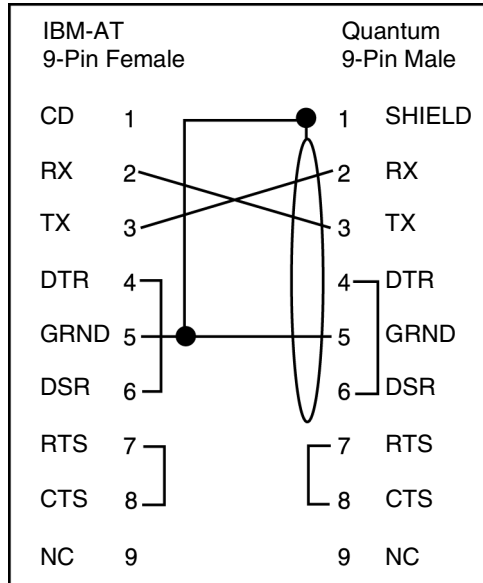
## Modbus Ports Pinout Connections

The following figure shows the Modbus port pinout connections for nine-pin and 25-pin connections.



**Modbus Ports  
Pinout  
Connections for  
Portable  
Computers**

The following figure shows the Modbus port pinout connections for nine-pin portable (laptop) computers.



The following is the abbreviation key for the above figures.

TX: Transmitted Data	DTR: Data Terminal Ready
RX: Received Data	CTS: Clear to Send
RTS: Request to Send	NC: No Connection
DSR: Data Set Ready	CD: Carrier Detect

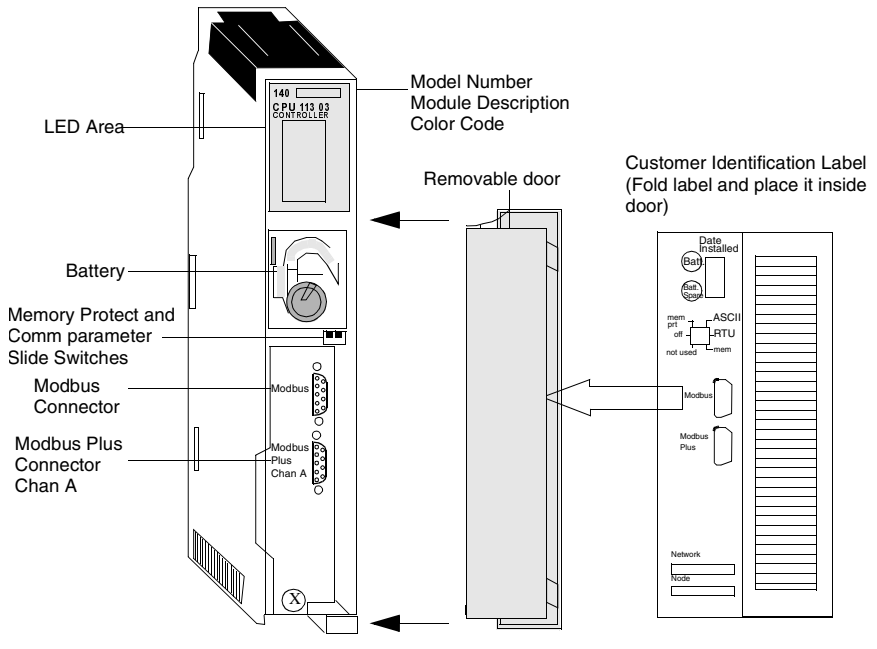
## 140CPU11303 CPU Module

### Overview

The following provides information on the 140CPU11303 Controller module – CPU 512 k, 1xModbus Plus, Max IEC Program 368 K (requires IEC Exec.)

### CPU Module

The following figure shows the CPU Module and its components.



**Specifications**

The following table shows the specifications for the 140CPU11303 CONTROLLER module.

<b>Specifications</b>	
<b>984 Ladder Logic</b>	16 k words max
<b>Reference Capacity</b>	
Discrete	8192 In and 8192 Out max
Register	9999 max
<b>Local I/O (Main Backplane)</b>	
Maximum I/O Words	64 In and 64 Out*
Maximum Number of I/O Racks	2 (Requires expander)
<b>Remote I/O</b>	
Maximum I/O Words per Drop	64 In / 64 Out*
Maximum Number of Remote Drops	31
<b>Distributed I/O</b>	
Maximum Number of Networks per System	3**
Maximum Words per Network (For every DIO drop, there is a minimum of two words input of overhead.)	500 In and 500 Out
Maximum Words per Node	30 In and 32 Out
<b>Watchdog Timer</b>	250 ms (S/W adjustable)
<b>Logic Solve Time</b>	0.3 ms / k to 1.4 ms / k
<b>Battery</b>	
Service Life	1200 mAh
Shelf Life	10 years with 0.5% loss of capacity per year
<b>Battery Load Current @ Power-off</b>	
Typical	7 $\mu$ A
Maximum	210 $\mu$ A
<b>Communication</b>	
Modbus (RS-232)	1 serial port (9-pin D-shell)
Modbus Plus (RS-485)	1 network port (9-pin D-shell)

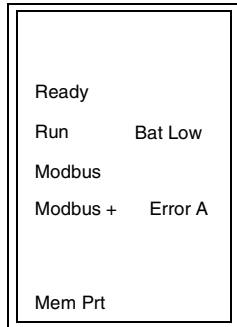
<b>Specifications</b>		
<b>General</b>		
Diagnostics	<b>Power Up</b>	<b>Runtime</b>
	RAM	RAM
	RAM Address	RAM Address
	Executive Checksum	Executive Checksum
	User Logic Check	User Logic Check
	Processor	
Bus Current Required	790 mA	
Power Dissipation	3.95 W	
TOD Clock	+/- 8.0 seconds/day 0 ... 60° C	
Maximum Number of NOM, NOE, and MMS modules (any combination)	2	

\* This information can be a mix of Discrete or Register I/O. For each word of register I/O configured, one word of I/O words must be subtracted from the total available. The same holds true for each block of 8 bits or 16 bits of Discrete I/O configured - one word of Register I/O must be subtracted from the total available.

\*\*Requires the use of the 140NOM21x00 Option Processor.

## LED Indicators and Descriptions

The following figure shows the CPU11303 LED indicators.



The following table shows the CPU11303 LED descriptions.

LED Descriptions		
LEDs	Color	Indication when On
Ready	Green	The CPU has passed powerup diagnostics.
Run	Green	The CPU has been started and is solving logic (see the following table for Run LED error codes).
Modbus	Green	Communications are active on the Modbus port.
Modbus +	Green	Communications are active on the Modbus Plus port.
Mem Prt	Amber	Memory is write protected (the memory protect switch is on).
Bat Low	Red	The battery needs replacing.
Error A	Red	Indicates a communications error on the Modbus Plus network.



**LED Error Codes** The LED Error Codes table shows the number of times the Run LED blinks for each type of error and the crash codes possible for that group (all codes are in hex). The following table shows the blinking run LED error codes.

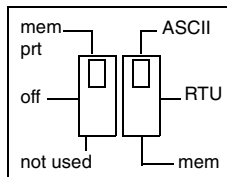
LED Error Codes		
Number of Blinks	Code	Error
Continuous	0000	requested kernel mode
2	80B	ram error during sizing
	80C	run output active failed
	82E	MB command handler stack error
3	769	bus grant received
	72A	not master asic on cpu
	72B	master config write bad
	72C	quantum bus DPM write failure
	72F	plc asic loopback test
	730	plc asic BAD_DATA
4	604	UPI timeout error
	605	bad UPI response opcode
	606	UPI bus diagnostic error
	607	modbus cmd-buffer overflow
	608	modbus cmd-length is zero
	609	modbus abort command error
	614	mbp bus interface error
	615	bad mbp response opcode
	616	timeout waiting for mbp
	617	mbp out of synchronization
	618	mbp invalid path
	619	page 0 not paragraph aligned
	61E	bad external uart hardware
	61F	bad external uart interrupt
	620	bad receive comm state
	621	bad transmit comm state
	622	bad comm state trn_asc
	623	bad comm state trn_rtu
624	bad comm state rcv_rtu	
625	bad comm state rcv_asc	
626	bad modbus state tmr0_evt	

LED Error Codes		
Number of Blinks	Code	Error
	627	bad modbus state trn-int
	628	bad modbus state rcv-int
	631	bad interrupt
5	503	ram address test error
	52D	P.O.S.T BAD MPU ERROR
6	402	ram data test error
7	300	EXEC not loaded
	301	EXEC Checksum
8	8001	Kernal prom checksum error
	8002	flash prog / erase error
	8003	unexpected executive return

### Front Panel Switches

Two, three-position slide switches are located on the front of the CPU. The left switch is used for memory protection when in the top position and no memory protection in the middle and bottom positions. The three-position slide switch on the right is used to select the communication parameter settings for the Modbus (RS-232) ports.

The following figure shows the three options that are available.



**Note:** The CPU hardware defaults to bridge mode when the front panel switch is set to RTU or ASCII mode. When networking controllers, a panel device connected to the CPU Modbus port can communicate with the controller to which it is connected, as well as log into any nodes on the Modbus Plus network.

Setting the slide switch to the top position assigns ASCII functionality to the port; the following communication parameters are set and cannot be changed. The following table shows the ASCII communication port parameters.

<b>ASCII Communication Port Parameters</b>	
Baud	2,400
Parity	Even
Data Bits	7
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the middle position assigns remote terminal unit (RTU) functionality to the port; the following communication parameters are set and cannot be changed.

<b>RTU Communication Port Parameters</b>	
Baud	9,600
Parity	Even
Data Bits	8
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the bottom position gives you the ability to assign communication parameters to the port in software; the following parameters are valid.

<b>Valid Communication Port Parameters</b>		
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
Parity	Enable/Disable Odd/Even	
Data Bits	7 / 8	
Stop Bits	1 / 2	
Device Address	1 ... 247	

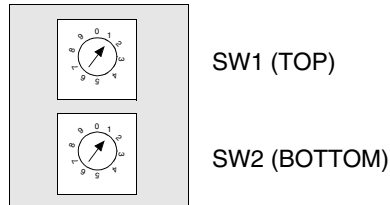
## Rear Panel Switches

Two rotary switches (refer to the illustration and table that follow) are located on the rear panel of the CPU. They are used for setting the Modbus Plus node and Modbus port addresses.

**Note:** The highest address that may be set with these switches is 64.

SW1 (the top switch) sets the upper digit (tens) of the address; SW2 (the bottom switch) sets the lower digit (ones) of the address. The illustration below shows the correct setting for an example address of 11.

The following figure shows SW1 and SW2 switches.



The following table shows the SW1 and SW2 address settings.

<b>SW1 and SW2 Address Settings</b>		
<b>Node Address</b>	<b>SW1</b>	<b>SW2</b>
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

**Note:** If "0" or an address greater than 64 is selected, the Modbus + LED will be "on" steady, to indicate the selection of an invalid address.

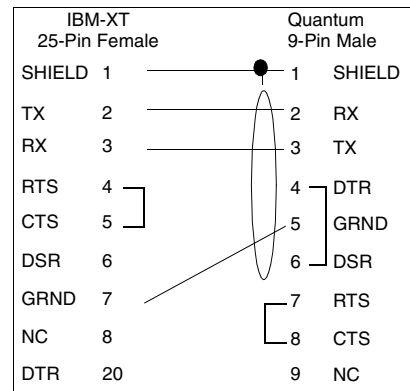
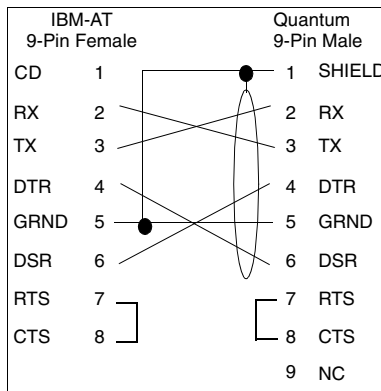
## Modbus Connector Pinouts

All Quantum CPUs are equipped with a nine-pin RS-232C connector that supports Modicon's proprietary Modbus communication protocol. The following is the Modbus port pinout connections for nine-pin and 25-pin connections.

**Note:** Although the Modbus ports electrically support existing Modbus cables, it is recommended that a Modbus programming cable (Part # 990NAA26320 or 990NAA26350) be used. This cable has been designed to fit under the door of a Quantum CPU or NOM module.

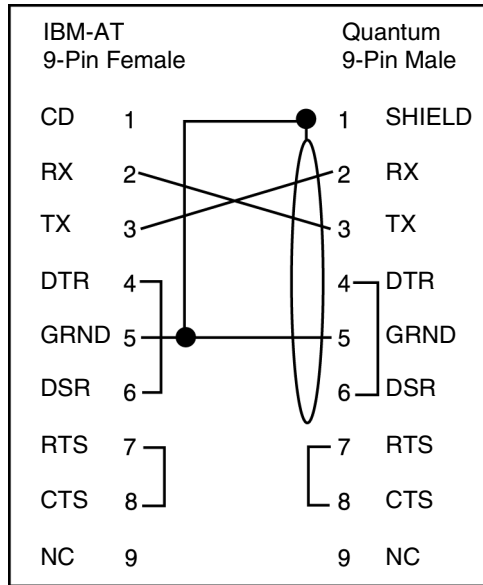
## Modbus Ports Pinout Connections

The following figure shows the Modbus port pinout connections for nine-pin and 25-pin connections.



**Modbus Ports  
Pinout  
Connections for  
Portable  
Computers**

The following figure shows the Modbus port connections for nine-pin portable computer connections.



The following is the abbreviation key for the above figures.

TX: Transmitted Data	DTR: Data Terminal Ready
RX: Received Data	CTS: Clear to Send
RTS: Request to Send	N/C: No Connection
DSR: Data Set Ready	CD: Carrier Detect

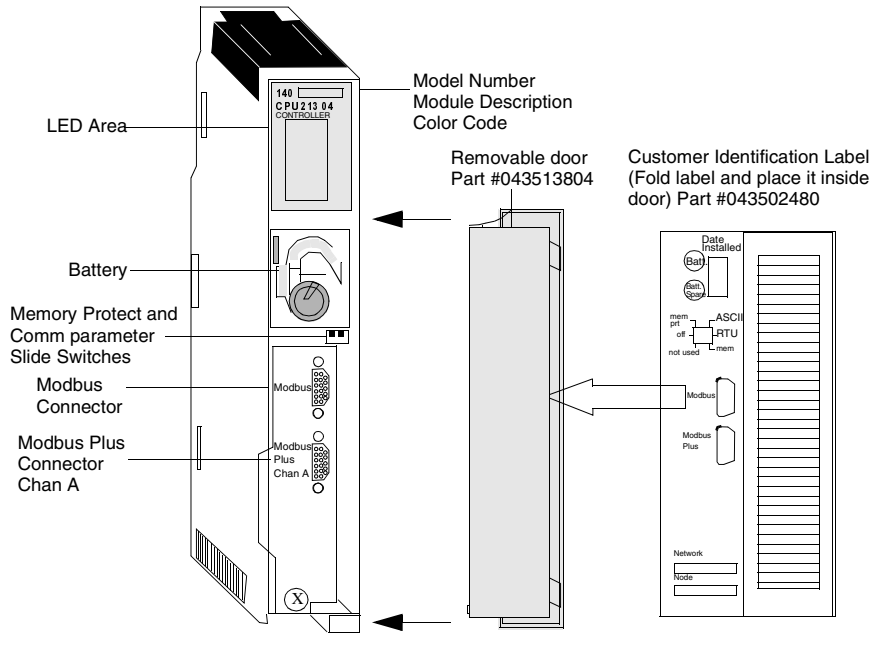
## 140CPU21304 CPU Module

### Overview

The following provides information on the 140CPU21304 Controller module – CPU 768 K, MATH, 1xModbus Plus, Max IEC Program 606 K.

### CPU Module

The following figure shows the CPU Module and its parts.



**Specifications**

The following table shows the specifications for the CPU21304 controller module.

<b>Specifications</b>				
<b>User Logic/Reference Capacity</b>	<b>984 Ladder Logic</b>	<b>Discrete</b>	<b>Register</b>	<b>Extended Register</b>
	32 k words	64 k	57 k	80 k
	48 k words	64 k	28 k	0 k
	57,766 4XX registers max Only if: 0XXX = 16 and 1XXX = 16 and 3XXX = 16			
Discrete	64 k - any mix			
<b>Local I/O (Main Backplane)</b>				
Maximum I/O Words	64 In and 64 Out*			
Maximum Number of I/O Racks	2 (Requires expander)			
<b>Remote I/O</b>				
Maximum I/O Words per Drop	64 In and 64 Out*			
Maximum Number of Remote Drops	31			
<b>Distributed I/O</b>				
Maximum Number of Networks per System	3**			
Maximum Words per Network (For every DIO drop, there is a minimum of words input of overhead.)	500 In and 500 Out			
Maximum Words per Node	30 In and 32 Out			
<b>Watchdog Timer</b>	250 ms (software adjustable)			
<b>Logic Solve Time</b>	0.3 ms / k to 1.4 ms / k			
<b>Battery</b>	3 V Lithium			
Service Life	1200 mAh			
Shelf Life	10 years with 0.5% loss of capacity per year			
<b>Battery Load Current @ Power-off</b>				
Typical	5 $\mu$ A			
Maximum	110 $\mu$ A			
<b>Communication</b>				
Modbus (RS-232)	1 serial port (9-pin D-shell)			



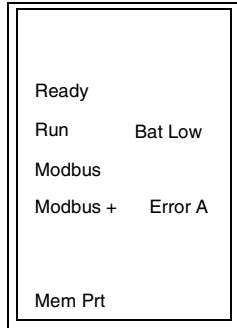
<b>Specifications</b>		
Modbus Plus (RS-485)	1 network port (9-pin D-shell)	
<b>General</b>		
Diagnostics	<b>Power Up</b>	<b>Runtime</b>
	RAM	RAM
	RAM Address	RAM Address
	Executive Checksum	Executive Checksum
	User Logic Check	User Logic Check
	Processor	
Bus Current Required	900 mA	
Power Dissipation	4.5 W	
TOD Clock	+/- 8.0 seconds/day 0 ... 60° C	
Maximum Number of NOM, NOE, and MMS modules (any combination)	2	

\*This information can be a mix of Discrete or Register I/Os. For each word of Register I/O configured, one word of I/O words must be subtracted from the total available. The same holds true for each block of 8 bits or 16 bits of Discrete I/O configured - one word of Register I/O must be subtracted from the total available.

\*\*Requires the use of the 140NOM2x00 Option Processor.

**LED Indicators and Descriptions**

The following figure shows the CPU LED indicators.



The following table shows the CPU LED descriptions.

<b>LED Descriptions</b>		
<b>LEDs</b>	<b>Color</b>	<b>Indication when On</b>
Ready	Green	The CPU has passed powerup diagnostics.
Run	Green	The CPU has been started and is solving logic (see the following table for Run LED error codes).
Modbus	Green	Communications are active on the Modbus port.
Modbus +	Green	Communications are active on the Modbus Plus port.
Mem Prt	Amber	Memory is write-protected (the memory protect switch is on).
Bat Low	Red	The battery needs replacing.
Error A	Red	Indicates a communications error on the Modbus Plus network.

**LED Error Codes** The Blinking Run LED Error Codes table shows the number of times the Run LED blinks for each type of error and the crash codes possible for that group (all codes are in hex).

The following table shows the run LED error codes for the 140CPU21304.

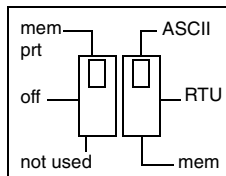
LED Error Codes		
Number of Blinks	Code	Error
Continuous	0000	requested kernel mode
2	80B	ram error during sizing
	80C	run output active failed
	82E	MB command handler stack error
3	769	bus grant received
	72A	not master asic on cpu
	72B	master config write bad
	72C	quantum bus DPM write failure
	72F	plc asic loopback test
	730	plc asic BAD_DATA
4	604	UPI timeout error
	605	bad UPI response opcode
	606	UPI bus diagnostic error
	607	modbus cmd-buffer overflow
	608	modbus cmd-length is zero
	609	modbus abort command error
	614	mbp bus interface error
	615	bad mbp response opcode
	616	timeout waiting for mbp
	617	mbp out of synchronization
	618	mbp invalid path
	619	page 0 not paragraph aligned
	61E	bad external uart hardware
	61F	bad external uart interrupt
	620	bad receive comm state
	621	bad transmit comm state
	622	bad comm state trn_asc
623	bad comm state trn_rtu	
624	bad comm state rcv_rtu	

LED Error Codes		
Number of Blinks	Code	Error
	625	bad comm state rcv_asc
	626	bad modbus state tmr0_evt
	627	bad modbus state trn-int
	628	bad modbus state rcv-int
	631	bad interrupt
5	503	ram address test error
	52D	P.O.S.T BAD MPU ERROR
6	402	ram data test error
7	300	EXEC not loaded
	301	EXEC Checksum
8	8001	Kernal prom checksum error
	8002	flash prog / erase error
	8003	unexpected executive return

### Front Panel Switches

Two, three-position slide switches are located on the front of the CPU. The left switch is used for memory protection when in the top position and no memory protection in the middle and bottom positions. The three-position slide switch on the right is used to select the communication parameter settings for the Modbus (RS-232) ports.

The following figure shows the three options that are available.



**Note:** The CPU hardware defaults to bridge mode when the front panel switch is set to RTU or ASCII mode. When networking controllers, a panel device connected to the CPU Modbus port can communicate with the controller to which it is connected, as well as log into any nodes on the Modbus Plus network.

Setting the slide switch to the top position assigns ASCII functionality to the port; the following communication parameters are set and cannot be changed

<b>ASCII Communication Port Parameters</b>	
Baud	2,400
Parity	Even
Data Bits	7
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the middle position assigns remote terminal unit (RTU) functionality to the port; the following communication parameters are set and cannot be changed.

<b>RTU Communication Port Parameters</b>	
Baud	9,600
Parity	Even
Data Bits	8
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the bottom position gives you the ability to assign communication parameters to the port in software; the following parameters are valid.

<b>Valid Communication Port Parameters</b>		
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
Parity	Enable/Disable Odd/Even	
Data Bits	7 / 8	
Stop Bits	1 / 2	
Device Address	1 ... 247	

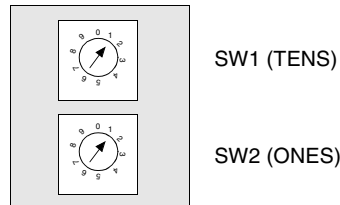
## Rear Panel Switches

Two rotary switches (refer to the illustration and table below) are located on the rear panel of the CPU. They are used for setting Modbus Plus node and Modbus port addresses.

**Note:** The highest address that may be set with these switches is 64.

SW1 (the top switch) sets the upper digit (tens) of the address; SW2 (the bottom switch) sets the lower digit (ones) of the address. The illustration below shows the correct setting for an example address of 11.

The following figure shows SW1 and SW2.



The following table shows the SW1 and SW2 address settings.

<b>SW1 and SW2 Address Settings</b>		
<b>Node Address</b>	<b>SW1</b>	<b>SW2</b>
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

**Note:** If "0" or an address greater than 64 is selected, the Modbus + LED will be "on" steady, to indicate the selection of an invalid address.

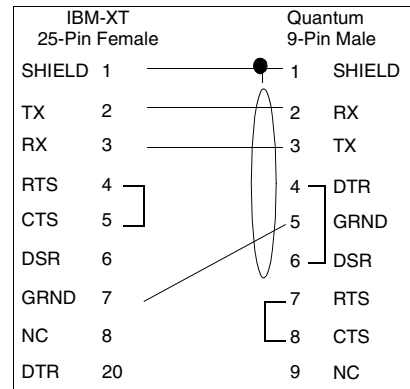
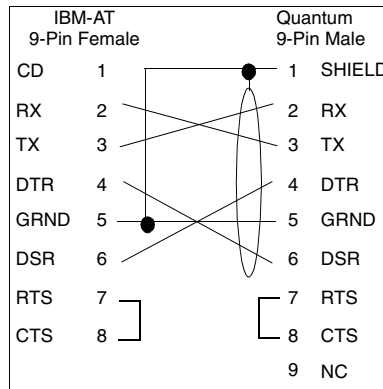
## Modbus Connector Pinouts

All Quantum CPUs are equipped with a nine-pin RS-232C connector that supports Modicon's proprietary Modbus communication protocol. The following is the Modbus port pinout connections for nine-pin and 25-pin connections.

**Note:** Although the Modbus ports electrically support existing Modbus cables, it is recommended that a Modbus programming cable (Part # 990NAA26320 or 990NAA26350) be used. This cable has been designed to fit under the door of a Quantum CPU or NOM module.

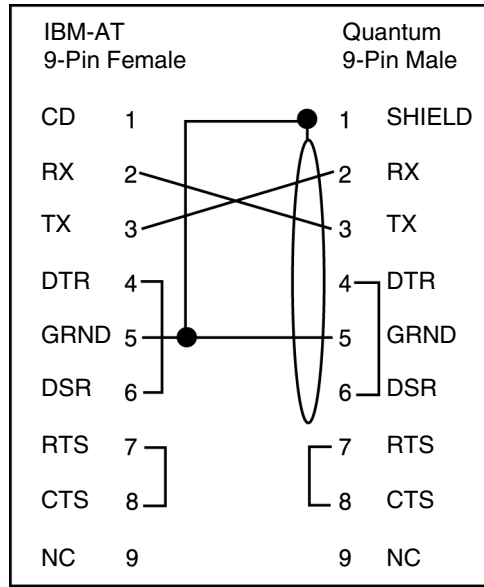
## Modbus Ports Pinout Connections

The following figure shows the Modbus port pinout connections for nine-pin and 25-pin connections.



**Modbus Ports  
Pinout  
Connections for  
Portable  
Computers**

The following figure shows the Modbus port pinout connections for nine-pin portable computers.



The following is the abbreviation key for the above figures.

TX: Transmitted Data	DTR: Data Terminal Ready
RX: Received Data	CTS: Clear to Send
RTS: Request to Send	NC: No Connection
DSR: Data Set Ready	CD: Carrier Detect



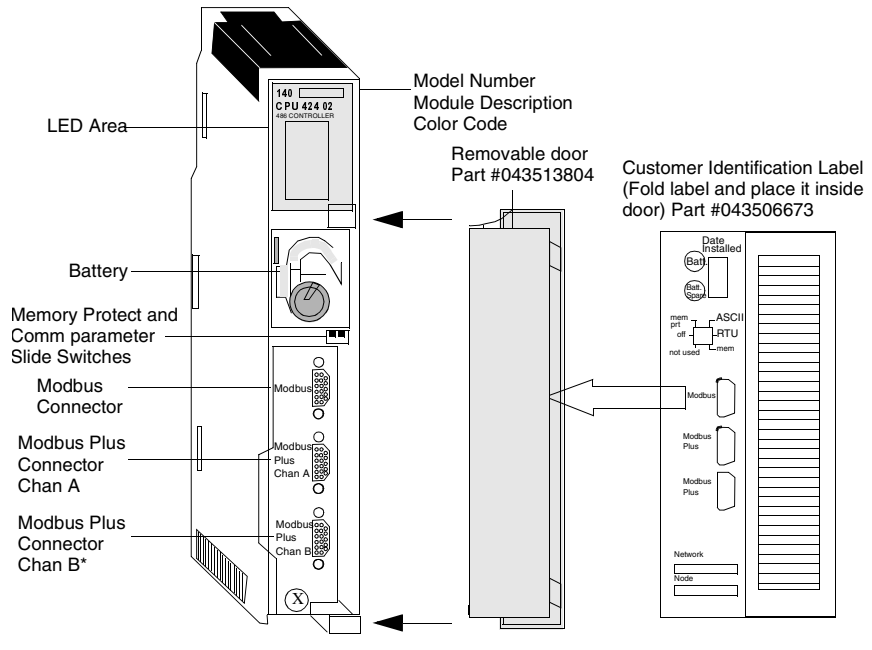
## 140CPU42402 CPU Module

### Overview

The following provides information on the 140CPU42402 Controller module – CPU 2 M, MATH, 2xModbus Plus, Max IEC Program 570 K.

### CPU Module

The following figure shows the CPU module and its components.



**Specifications**

The following table shows the specifications for the 140CPU42402 CONTROLLER module.

<b>Specifications</b>				
<b>User Logic/Reference Capacity</b>	<b>984 Ladder Logic</b>	<b>Discrete</b>	<b>Register</b>	<b>Extended Register</b>
	64 k words	64 k	57 k	96 k
57,766 4XX registers max Only if: 0XXX = 16 and 1XXX = 16 and 3XXX = 16				
<b>Reference Capacity</b>				
Discrete	64 k - any mix			
<b>Local I/O (Main Backplane)</b>				
Maximum I/O Words	64 In and 64 Out*			
Maximum Number of I/O Racks	2 (Requires expander)			
<b>Remote I/O</b>				
Maximum I/O Words per Drop	64 In and 64 Out*			
Maximum Number of Remote Drops	31			
<b>Distributed I/O</b>				
Maximum Number of Networks per System	3**			
Maximum Words per Network (For every DIO drop, there is a minimum of words input of overhead.)	500 In and 500 Out			
Maximum Words per Node	30 In and 32 Out			
<b>Watchdog Timer</b>	250 ms (S/W adjustable)			
<b>Logic Solve Time</b>	<b>0.1 ms / k to 0.5 ms / k</b>			
Battery	3 V Lithium			
Service Life	1200 mAh			
Shelf Life	10 years with 0.5% loss of capacity per year			
<b>Battery Load Current @ Power-off</b>				
Typical	7 $\mu$ A			
Maximum	210 $\mu$ A			

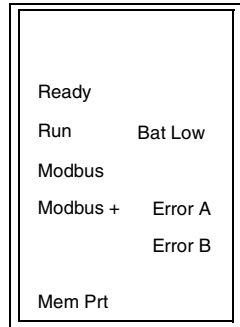
<b>Specifications</b>		
<b>Communication</b>		
Modbus (RS-232)	1 serial port (9-pin D-shell)	
Modbus Plus (RS-485)	2 (redundant) network ports (9-pin D-shell)	
<b>General</b>		
Diagnostics	<b>Power Up</b>	<b>Runtime</b>
	RAM	RAM
	RAM Address	RAM Address
	Executive Checksum	Executive Checksum
	User Logic Check	User Logic Check
	Processor	
Bus Current Required	1.8 A	
Power dissipation	9 W	
TOD Clock	+/- 8.0 seconds/day 0 ... 60 °C	
Maximum Number of NOM, NOE, and MMS modules (any combination)	6	

\*This information can be a mix of Discrete or Register I/Os. For each word of Register I/O configured, one word of I/O words must be subtracted from the total available. The same holds true for each block of 8 bits or 16 bits of Discrete I/O configured—one word of Register I/O must be subtracted from the total available.

\*\*Requires the use of the 140NOM2x00 Option Modules.

**LED Indicators and Descriptions**

The following figure shows the CPU LED indicators.



The following table shows the CPU LED descriptions.

<b>LED Descriptions</b>		
<b>LEDs</b>	<b>Color</b>	<b>Indication when On</b>
Ready	Green	The CPU has passed powerup diagnostics.
Run	Green	The CPU has been started and is solving logic (see the following table for Run LED error codes).
Modbus	Green	Communications are active on the Modbus port.
Modbus +	Green	Communications are active on the Modbus Plus port.
Mem Prt	Amber	Memory is write protected (the memory protect switch is on).
Bat Low	Red	The battery needs replacing.
Error A	Red	Indicates a communications error on the redundant Modbus Plus port A (140CPU42402 only).
Error B	Red	Indicates a communications error on the redundant Modbus Plus port B (140CPU42402 only).

**LED Error Codes** The following table shows the run LED error codes for the CPU42402.

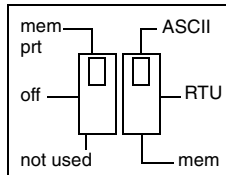
LED Error Codes		
Number of Blinks	Code	Error
Continuous	0000	requested kernel mode
2	80B	ram error during sizing
	80C	run output active failed
	82E	MB command handler stack error
3	769	bus grant received
	72A	not master asic on cpu
	72B	master config write bad
	72C	quantum bus DPM write failure
	72F	plc asic loopback test
	730	plc asic BAD_DATA
4	604	UPI timeout error
	605	bad UPI response opcode
	606	UPI bus diagnostic error
	607	modbus cmd-buffer overflow
	608	modbus cmd-length is zero
	609	modbus abort command error
	614	mbp bus interface error
	615	bad mbp response opcode
	616	timeout waiting for mbp
	617	mbp out of synchronization
	618	mbp invalid path
	619	page 0 not paragraph aligned
	61E	bad external uart hardware
	61F	bad external uart interrupt
	620	bad receive comm state
	621	bad transmit comm state
	622	bad comm state trn_asc
	623	bad comm state trn_rtu
	624	bad comm state rcv_rtu
	625	bad comm state rcv_asc
626	bad modbus state tmr0_evt	
627	bad modbus state trn-int	

LED Error Codes		
Number of Blinks	Code	Error
	628	bad modbus state rcv-int
	631	bad interrupt
5	503	ram address test error
	52D	P.O.S.T BAD MPU ERROR
6	402	ram data test error
7	300	EXEC not loaded
	301	EXEC Checksum
8	8001	Kernal prom checksum error
	8002	flash prog / erase error
	8003	unexpected executive return

### Front Panel Switches

Two, three-position slide switches are located on the front of the CPU. The left switch is used for memory protection when in the top position and no memory protection in the middle and bottom positions. The three-position slide switch on the right is used to select the comm parameter settings for the Modbus (RS-232) ports.

The following figure shows the three options that are available for the CPU42402 module.



**Note:** The CPU hardware defaults to bridge mode when the front panel switch is set to RTU or ASCII mode. When networking controllers, a panel device connected to the CPU Modbus port can communicate with the controller to which it is connected, as well as log into any nodes on the Modbus Plus network.

Setting the slide switch to the top position assigns ASCII functionality to the port; the following comm parameters are set and cannot be changed.

<b>ASCII Comm Port Parameters</b>	
Baud	2,400
Parity	Even
Data Bits	7
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the middle position assigns remote terminal unit (RTU) functionality to the port; the following comm parameters are set and cannot be changed.

<b>RTU Comm Port Parameters</b>	
Baud	9,600
Parity	Even
Data Bits	8
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the bottom position gives you the ability to assign comm parameters to the port in software; the following parameters are valid.

<b>Valid Comm Port Parameters</b>		
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
Parity	Enable/Disable Odd/Even	
Data Bits	7 / 8	
Stop Bits	1 / 2	
Device Address	1 ... 247	

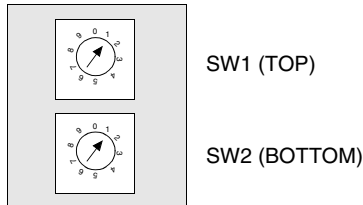
## Rear Panel Switches

Two rotary switches (refer to the following illustration) are located on the rear panel of the CPU. They are used for setting Modbus Plus node and Modbus port addresses.

**Note:** The highest address that may be set with these switches is 64.

SW1 (the top switch) sets the upper digit (tens) of the address; SW2 (the bottom switch) sets the lower digit (ones) of the address. The illustration below shows the correct setting for an example address of 11.

The following figure shows SW1 and SW2.



The following table shows the SW1 and SW2 address settings.

<b>SW1 and SW2 Address Settings</b>		
<b>Node Address</b>	<b>SW1</b>	<b>SW2</b>
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

**Note:** If "0" or an address greater than 64 is selected, the Modbus + LED will be "on" steady, to indicate the selection of an invalid address.



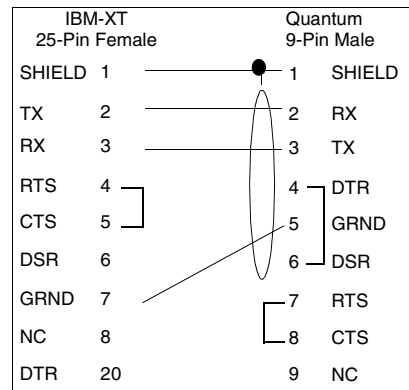
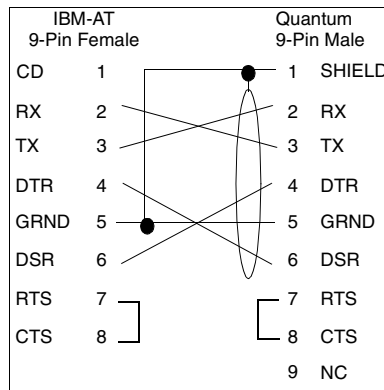
## Modbus Connector Pinouts

All Quantum CPUs are equipped with a nine-pin RS-232C connector that supports Modicon's proprietary Modbus communication protocol. The following is the Modbus port pinout connections for nine-pin and 25-pin connections.

**Note:** Although the Modbus ports electrically support existing Modbus cables, it is recommended that a Modbus programming cable (Part # 990NAA26320 or 990NAA26350) be used. This cable has been designed to fit under the door of a Quantum CPU or NOM module.

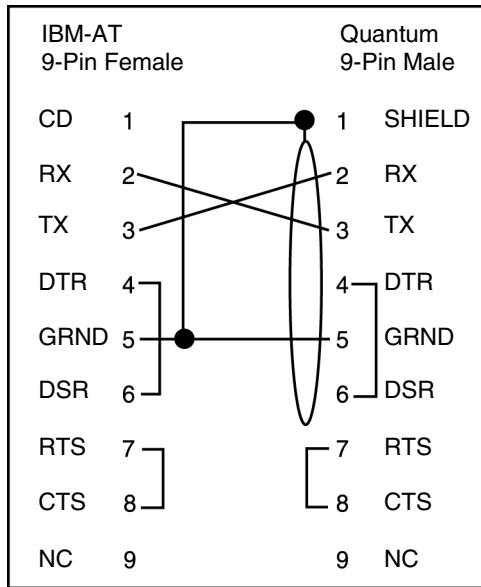
## Modbus Ports Pinout Connections

The following figure shows the Modbus port pinout connections for nine-pin and 25-pin connections.



**Modbus Ports  
Pinout  
Connections for  
Portable  
Computers**

The following figure shows the Modbus port pinout connections for nine-pin portable computers



The following is the abbreviation key for the above figures.

TX: Transmitted Data	DTR: Data Terminal Ready
RX: Received Data	CTS: Clear to Send
RTS: Request to Send	NC: No Connection
DSR: Data Set Ready	CD: Carrier Detect

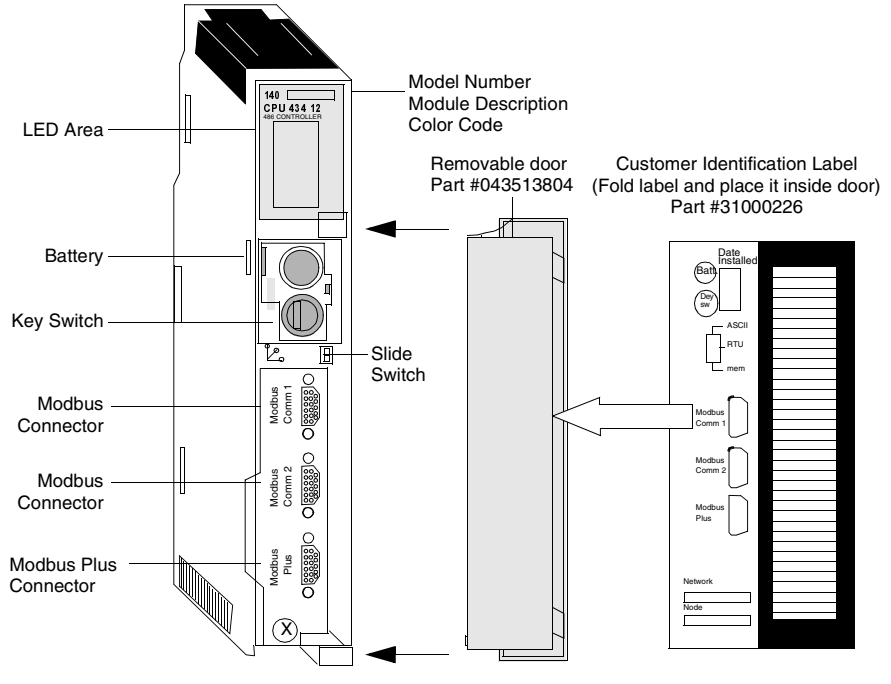
## 140CPU43412 CPU Module

### Overview

The following provides information on the 140CPU43412 Controller module – CPU 2M, 1xModbus Plus, Max IEC Program – 896 k.

### CPU Module

The following figure shows the CPU Module and its components.



**Specifications**

The following table shows the specifications for the CPU43412 CONTROLLER module.

<b>Specifications</b>				
<b>User Logic/Reference Capacity</b>	<b>984 Ladder Logic</b>	<b>Discrete</b>	<b>Register</b>	<b>Extended Register</b>
	64 k words	64 k	57 k	96 k
57,766 4XX registers max Only if: 0XXX = 16 1XXX = 16 and 3XXX = 16				
<b>Reference Capacity</b>				
Discrete	64 k - any mix			
<b>Local I/O (Main Backplane)</b>				
Maximum I/O Words	64 In and 64 Out*			
Maximum Number of I/O Racks	2 (Requires expander)			
<b>Remote I/O</b>				
Maximum I/O Words per Drop	64 In and 64 Out*			
Maximum Number of Remote Drops	31			
<b>Distributed I/O</b>				
Maximum Number of Networks per System	3**			
Maximum Words per Network (for every DIO drop, there is a minimum of words input of overhead.)	500 In and 500 Out			
Maximum Words per Node	30 In and 32 Out			
Maximum Number of Option Module Interfaces	Supports up to six network modules (i.e., Modbus Plus, Ethernet and Multi-Axis Motion option modules) using the option module interface technique (see p. 33). <b>Note:</b> Only two Modbus Plus modules can have full functionality, including Quantum DIO support.			
<b>Watchdog Timer</b>	250 ms (S/W adjustable)			
<b>Logic Solve Time</b>	0.1 ms / k to 0.5 ms / k			
<b>Battery</b>	3 V Lithium			
Service Life	1200 mAh			
Shelf Life	10 years with 0.5% loss of capacity per year			
<b>Battery Load Current at Power-off</b>				

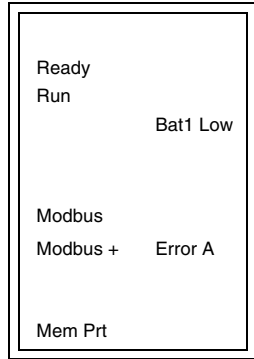
<b>Specifications</b>		
Typical	7 $\mu$ A	
Maximum	210 $\mu$ A	
<b>Communication</b>		
Modbus (RS-232)	2 serial port (9-pin D-shell)	
Modbus Plus (RS-485)	1 network port (9-pin D-shell)	
<b>General</b>		
Diagnostics	<b>Power Up</b>	<b>Runtime</b>
	RAM	RAM
	RAM Address	RAM Address
	Executive Checksum	Executive Checksum
	User Logic Check	User Logic Check
	Processor	
Bus Current Required	1.8 A	
Power Dissipation	9W	
TOD Clock	+/- 8.0 seconds/day 0 ... 60° C	
Operating Temperature	0 ... 60° C	

\*This information can be a mix of Discrete or Register I/Os. For each word of register I/O configured, one word of I/O words must be subtracted from the total available. The same holds true for each block of 8 bits or 16 bits of Discrete I/O configured – one word of Register I/O must be subtracted from the total available.

\*\*Requires the use of two 140NOM21x00 Option Modules.

**LED Indicators and Descriptions**

The following figure shows the LED indicators.



The following table shows the LED descriptions.

LEDS	Color	Indication when On
Ready	Green	The CPU has passed power-up diagnostics.
Run	Green	The CPU has been started and is solving logic.
Bat Low	Red	The battery needs replacing or is not present.
Modbus	Green	Communications are active on the Modbus port 1 or 2.
Modbus +	Green	Communications are active on the Modbus Plus port.
Error A	Red	Indicates communications error on the Modbus Plus port.
Mem Prt	Amber	Memory is write-protected (the memory protect switch is on).

**LED Error Codes** The following table shows the run LED error codes for the 140CPU43412.

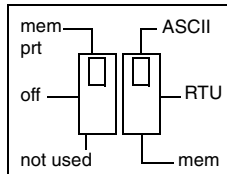
LED Error Codes		
Number of Blinks	Code	Error
Continuous	0000	requested kernel mode
2	80B	ram error during sizing
	80C	run output active failed
	82E	MB command handler stack error
3	769	bus grant received
	72A	not master asic on cpu
	72B	master config write bad
	72C	quantum bus DPM write failure
	72F	plc asic loopback test
	730	plc asic BAD_DATA
4	604	UPI timeout error
	605	bad UPI response opcode
	606	UPI bus diagnostic error
	607	modbus cmd-buffer overflow
	608	modbus cmd-length is zero
	609	modbus abort command error
	614	mbp bus interface error
	615	bad mbp response opcode
	616	timeout waiting for mbp
	617	mbp out of synchronization
	618	mbp invalid path
	619	page 0 not paragraph aligned
	61E	bad external uart hardware
	61F	bad external uart interrupt
	620	bad receive comm state
	621	bad transmit comm state
	622	bad comm state trn_asc
	623	bad comm state trn_rtu
	624	bad comm state rcv_rtu
	625	bad comm state rcv_asc
626	bad modbus state tmr0_evt	
627	bad modbus state trn-int	

LED Error Codes		
Number of Blinks	Code	Error
	628	bad modbus state rcv-int
	631	bad interrupt
5	503	ram address test error
	52D	P.O.S.T BAD MPU ERROR
6	402	ram data test error
7	300	EXEC not loaded
	301	EXEC Checksum
8	8001	Kernal prom checksum error
	8002	flash prog / erase error
	8003	unexpected executive return

### Front Panel Switches

Two, three-position slide switches are located on the front of the CPU. The left switch is used for memory protection when in the top position and no memory protection in the middle and bottom positions. The three-position slide switch on the right is used to select the comm parameter settings for the Modbus (RS-232) ports.

The following figure shows the three options that are available for the 140CPU43412 module.



**Note:** The CPU hardware defaults to bridge mode when the front panel switch is set to RTU or ASCII mode. When networking controllers, a panel device connected to the CPU Modbus port can communicate with the controller to which it is connected, as well as log into any nodes on the Modbus Plus network.



Setting the slide switch to the top position assigns ASCII functionality to the port; the following comm parameters are set and cannot be changed.

<b>ASCII Comm Port Parameters</b>	
Baud	2,400
Parity	Even
Data Bits	7
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the middle position assigns remote terminal unit (RTU) functionality to the port; the following comm parameters are set and cannot be changed.

<b>RTU Comm Port Parameters</b>	
Baud	9,600
Parity	Even
Data Bits	8
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the bottom position gives you the ability to assign comm parameters to the port in software; the following parameters are valid.

<b>Valid Comm Port Parameters</b>		
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
Parity	Enable/Disable Odd/Even	
Data Bits	7 / 8	
Stop Bits	1 / 2	
Device Address	1 ... 247	

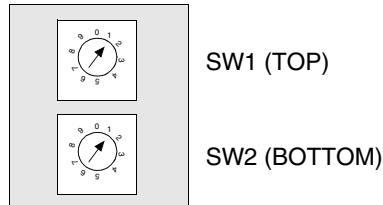
## Rear Panel Switches

Two rotary switches (see the following illustration and table) are located on the rear panel of the CPU. They are used for setting Modbus Plus node and Modbus port addresses.

**Note:** The highest address that may be set with these switches is 64.

SW1 (the top switch) sets the upper digit (tens) of the address; SW2 (the bottom switch) sets the lower digit (ones) of the address. The illustration below shows the correct setting for an example address of 11.

The following figure shows SW1 and SW2.



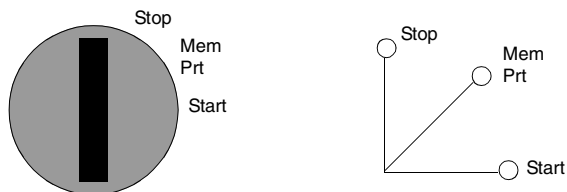
**Note:** If "0" or an address greater than 64 is selected, the Modbus + LED will be "on" steady, to indicate the selection of an invalid address.

The following table shows the SW1 and SW2 address settings.

SW1 and SW2 Address Settings		
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

## Key Switch

The key switch is used to protect memory from programming changes while the controller is in operation. The following figure shows the key switch.



**Note:** The key switch positions shown next to the switch (above) are for reference only and are marked on the module as indicated on the right.

The following table shows the key switch information.

Key Switch Description				
Key switch Position	Controller Status	Memory Protected From Programmer Changes	Will Accept Programmer Stop or Start	Key switch Transition
Stop	Controller is stopped and disables Programmer changes.	Y	N	From Start or Memory Protect: Stops controller, if running, and disables Programmer changes
Mem Prt	Controller may be either stopped or running and Programmer changes are disabled. User cannot write to unlocated variables.	Y	N	From Stop or Start: Prevents Programmer changes, controller run status is not changed

Key Switch Description				
Key switch Position	Controller Status	Memory Protected From Programmer Changes	Will Accept Programmer Stop or Start	Key switch Transition
Start	Controller may be either stopped or running. Programmer may make changes and start/stop the controller	N	Y	From Stop: Enables Programmer changes, starts controller. From Memory Protect: Enables programmer changes, starts controller if stopped.

### Modbus Connector Pinouts

All Quantum CPUs are equipped with a nine-pin RS-232C connector that support Modicon's proprietary Modbus communication protocol. The following is the Modbus port pinout connections for nine-pin and 25-pin connections.

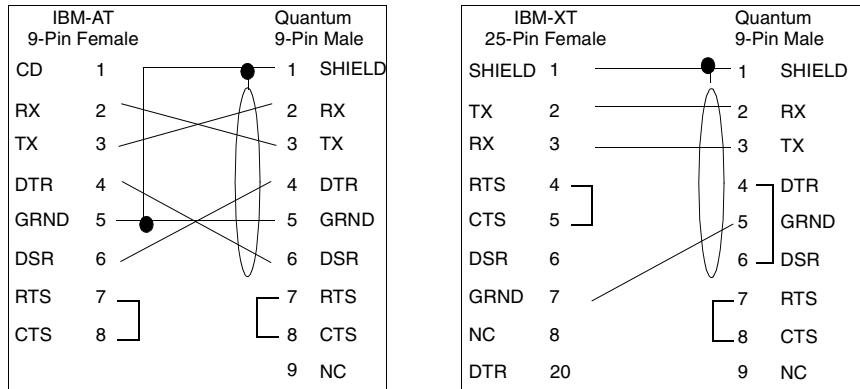
**Note:** Although the Modbus ports electrically support existing Modbus cables, it is recommended that a Modbus programming cable (Part # 990NAA26320 or 990NAA26350) be used. This cable has been designed to fit under the door of a Quantum CPU or NOM module.

### Modbus Port Modem Support

Modbus Port 1 has full modem interfacing ability. Modbus Port 2 RTS/CTS connections function properly for normal non-modem communications but do not support modems.

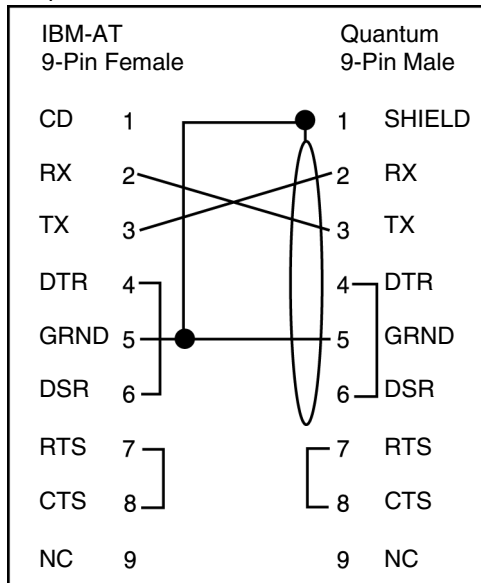
**Modbus Ports  
Pinout  
Connections**

The following figure shows the Modbus port pinout connections for 9-pin and 25-pin connections.



**Modbus Ports  
Pinout  
Connections for  
Portable  
Computers**

The following figure shows the Modbus port pinout connections for 9-pin portable computers.



The following is the abbreviation key for the above figures.

TX: Transmitted Data	DTR: Data Terminal Ready
RX: Received Data	CTS: Clear to Send
RTS: Request to Send	NC: No Connection
DSR: Data Set Ready	CD: Carrier Detect

## 140CPU43412A CPU Module

### Overview

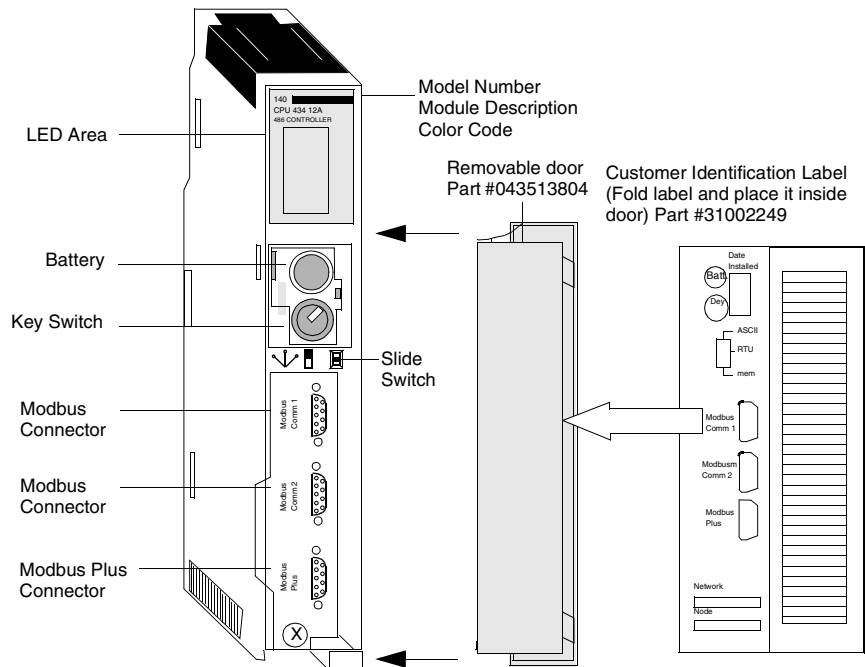
The following provides information on the specifications, LED indicators and description and error codes for the 140CPU43412A Controller Module.

This module is functionally identical to the non-"A" version, however, the following should be considered:

- If you are using the module in a Hot Standby topology, then you **must** use either two non-"A" models or two "A" models.
- The "A" version requires a new flash executive.
- The "A" version and non-"A" flash executives are **not** interchangeable.
- Schneider Automation software (Concept, ProWORX, and Modsoft) supports the "A" version. Any existing or new 140CPU43412 program configuration will load into a 140CPU43412A without any modifications.

### CPU Module

The following figure shows the CPU Module and its components.



**Specifications**

The following table shows the specifications for the CPU43412A Controller module.

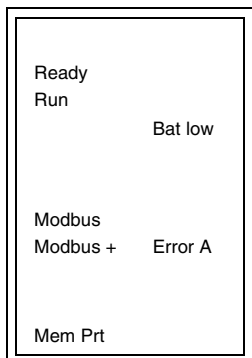
<b>Specifications</b>					
<b>User Logic/Reference Capacity</b>	<b>984 Ladder Logic</b>	<b>Discrete</b>	<b>Register</b>	<b>Extended Register</b>	<b>IEC Application</b>
	64 k words	64 k	57 k	96 k	800 k
57,766 4XX registers max Only if: 0XXX = 16 and 1XXX = 16 and 3XXX = 16					
<b>Reference Capacity</b>					
Discrete	64 k - any mix				
<b>Local I/O</b>					
Maximum I/O Words	64 In and 64 Out*				
Maximum Number of I/O Racks	2 (Requires Expander)				
<b>Remote I/O</b>					
Maximum I/O Words per Drop	64 In and 64 Out*				
Maximum Number of Remote Drops	31				
<b>Distributed I/O</b>					
Maximum Number of Networks per System	3**				
Maximum Words per Network (for every DIO drop, there is a minimum of words input of overhead.)	500 In and 500 Out				
Maximum Words per Node	30 In and 32 Out				
*This information can be a mix of Discrete or Register I/O. For each word of register I/O configured, one word must be subtracted from the total available. The same holds true for each block of 8 bits or 16 bits of Discrete I/O configured--one word must be subtracted from the total available. **Requires the use of two 140NOM21X00 Option Modules.					
<b>Maximum Number of Network Module Interfaces</b>	6				
<b>Watchdog Timer</b>	250 ms (software adjustable)				
<b>Logic Solve Time</b>	0.1 ms / k to 0.5 ms / k				

<b>Specifications</b>		
<b>Battery</b>		
Type	3 V Lithium	
Service Life	1200 mAh	
Shelf Life	10 years with 0.5% loss of capacity per year	
<b>Battery Load Current at Power-off</b>		
Typical	7 $\mu$ A	
Maximum	210 $\mu$ A	
<b>Communication</b>		
Modbus (RS-232)	2 serial port (9-pin D-shell)	
Modbus Plus (RS-485)	1 network port (9-pin D-shell)	
<b>Programming Software Capability</b>	Modsoft, version 2.6 minimum Concept, version 2.1 with B2.1 patch Concept 2.2 with SR2 ProWORX NxT, version 2.0 minimum ProWORX Plus, version 1.05 minimum ProWORX 32, version 1.0 minimum	
<b>General</b>		
Diagnostics	<b>Power Up</b>	<b>Runtime</b>
	RAM RAM Address Executive Checksum User Logic Check Processor	RAM RAM Address Executive Checksum User Logic Check
Bus Current Required	1.25 A	
Power Dissipation	6.25 W	
TOD Clock	+/- 8.0 seconds/day 0 ... 60° C	
Operating Temperature	0 ... 60° C	



## LED Indicators and Descriptions

The following figure shows the LED indicators.



The following table provides a description of the LED indicators for the 140CPU43412A module.

LEDS	Color	Indication when On
Ready	Green	The CPU has passed power-up diagnostics.
Run	Green	The CPU has been started and is solving logic.
Bat Low	Red	The battery needs replacing or is not present.
Modbus	Green	Communications are active on the Modbus port 1 or 2.
Modbus +	Green	Communications are active on the Modbus Plus port.
Error A	Red	Indicates communications error on the Modbus Plus port.
Mem Prt	Amber	Memory is write-protected (the memory protect switch is on).

**LED Error Codes** The following table shows the run LED error codes for the 140CPU43412A.

<b>LED Error Codes</b>		
<b>Number of Blinks</b>	<b>Code</b>	<b>Error</b>
Continuous	0000	requested kernel mode
2	80B	ram error during sizing
	80C	run output active failed
	82E	MB command handler stack error
3	769	bus grant received
	72A	not master asic on cpu
	72B	master config write bad
	72C	quantum bus DPM write failure
	72F	plc asic loopback test
	730	plc asic BAD_DATA
4	604	UPI timeout error
	605	bad UPI response opcode
	606	UPI bus diagnostic error
	607	modbus cmd-buffer overflow
	608	modbus cmd-length is zero
	609	modbus abort command error
	614	mbp bus interface error
	615	bad mbp response opcode
	616	timeout waiting for mbp
	617	mbp out of synchronization
	618	mbp invalid path
	619	page 0 not paragraph aligned
	61E	bad external uart hardware
	61F	bad external uart interrupt
	620	bad receive comm state
	621	bad transmit comm state
	622	bad comm state trn_asc
	623	bad comm state trn_rtu
	624	bad comm state rcv_rtu
	625	bad comm state rcv_asc
626	bad modbus state tmr0_evt	
627	bad modbus state trn-int	

LED Error Codes		
Number of Blinks	Code	Error
	628	bad modbus state rcv-int
	631	bad interrupt
5	503	ram address test error
	52D	P.O.S.T BAD MPU ERROR
6	402	ram data test error
7	300	EXEC not loaded
	301	EXEC Checksum
8	8001	Kernal prom checksum error
	8002	flash prog / erase error
	8003	unexpected executive return

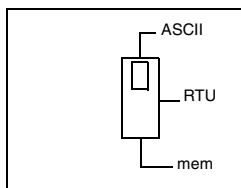
**Note:** Information in the Code column is visible only with the Flash download utility.

### Front Panel Slide Switch

The slide switch is used to select the comm parameter settings for the Modbus (RS232) ports. Three options are available:

1. Setting the switch to the top position assigns ASCII functionality to the port.
2. Setting the switch to the middle position assigns remote terminal unit (RTU) functionality to the port.
3. Setting the switch to the bottom position lets you assign comm parameters to the port in software.

The figure shows the three options that are available on the front panel slide switch.



**Note:** The CPU hardware defaults to bridge mode when the front panel switch is set to RTU or ASCII mode. When networking controllers, a panel device connected to the CPU Modbus port can communicate with the controller to which it is connected, as well as log into any nodes on the Modbus Plus network.

The following table shows the ASCII comm port parameters.

<b>ASCII Comm Port Parameters</b>	
Baud	2,400
Parity	Even
Data Bits	7
Stop Bits	1
Device Address	Rear panel rotary switch setting

The following table shows the RTU comm port parameters. The comm parameters are set and cannot be changed.

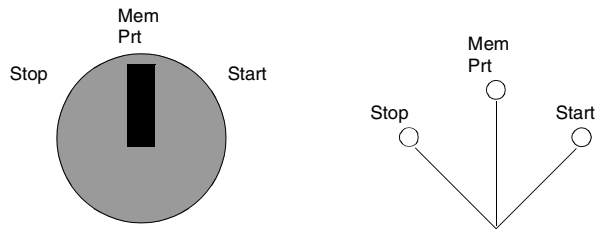
<b>RTU Comm Port Parameters</b>	
Baud	9,600
Parity	Even
Data Bits	8
Stop Bits	1
Device Address	Rear panel rotary switch setting

The following table shows the valid comm port parameters.

<b>Valid Comm Port Parameters</b>		
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
Parity	Enable/Disable Odd/Even	
Data Bits	7 / 8	
Stop Bits	1 / 2	
Device Address	1 ... 247	

## Key Switch

The key switch protects memory from programming changes while the controller is in operation. The following figure shows the key switch.



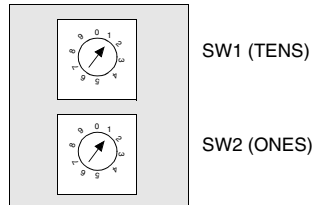
**Note:** The key switch positions shown next to the switch (above) are for reference only and are marked on the module as indicated on the right.

The CPU43412A has 1435KByte of Flash EPROM memory, which can be used to save the program and the initial values of variables. On power up, if you have a program in flash memory, you can choose the desired operating mode using the PLC MEM switch on the processor front panel. The 140CPU43412A has a key switch with Run, Mem Prt, and Stop positions.

Stop position	The application in Flash is not transferred to internal RAM: warm restart of the application.
Mem Prt position	The application in Flash is not transferred to internal RAM: warm restart of the application.
Start position	The application in Flash is automatically transferred to internal RAM when the PLC processor is powered up: cold restart of the application.

## Rear Panel Address Switch

The following figure shows the SW1 and SW2 settings for the Address Switch located on the rear panel.



SW1 sets the upper digit (tens) of the address. SW2 sets the lower digit (ones) of the address. The following table shows the SW1 and SW2 address settings.

SW1 and SW2 Address Settings		
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

**Note:** If "0" or an address greater than 64 is selected, the Modbus + LED will be "on" steady, to indicate the selection of an invalid address.

## Key Switch Description

The following table shows the key switch information.

Key Switch Description				
Key switch Position	Controller Status	Memory Protected From Programmer Changes	Will Accept Programmer Stop or Start	Key switch Transition
Stop	Controller is stopped and disables Programmer changes.	Y	N	From Start or Memory Protect: Stops controller, if running, and disables Programmer changes
Mem Prt	Controller may be either stopped or running and Programmer changes are disabled. User cannot write to unlocated variables.	Y	N	From Stop or Start: Prevents Programmer changes, controller run status is not changed
Start	Controller may be either stopped or running. Programmer may make changes and start/stop the controller.	N	Y	From Stop: Enables Programmer changes, starts controller. From Memory Protect: Enables programmer changes, starts controller if stopped.

## Modbus Connector Pinouts

All Quantum CPUs are equipped with a nine-pin RS-232 connector that support Modicon's proprietary Modbus communication protocol. The following is the Modbus port pinout connections for nine-pin and 25-pin connections.

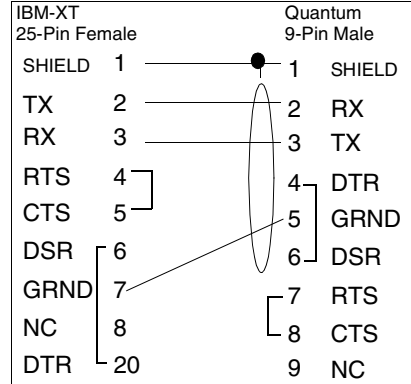
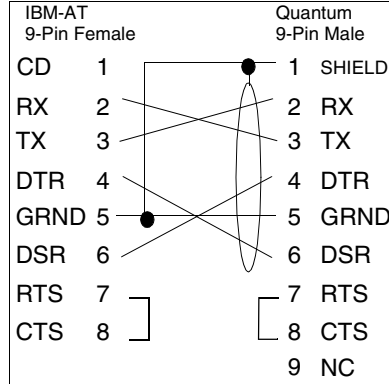
**Note:** Although the Modbus ports electrically support existing Modbus cables, it is recommended that a Modbus programming cable (Part # 990NAA26320 or 990NAA26350) be used. This cable has been designed to fit under the door of a Quantum CPU or NOM module.

**Modbus Port Modem Support**

Modbus Port 1 has full modem interfacing ability. Modbus Port 2 RTS/CTS connections function properly for normal non-modem communications but do not support modems.

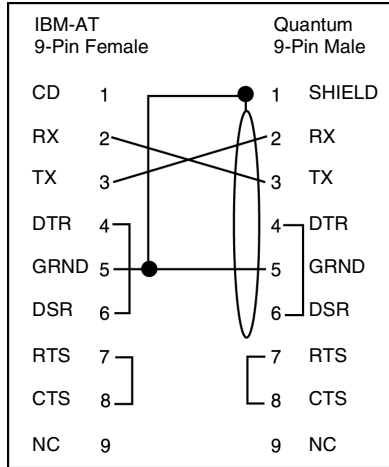
**Modbus Ports Pinout Connections Figure**

The following figure shows the Modbus port pinout connections for 9-pin and 25-pin connections.



**Modbus Ports Pinout Connections for Portable Computers**

The following figure shows the Modbus port pinout connections for portable (laptop) computers.



The following is the abbreviation key for the above figures.

TX: Transmitted Data	DTR: Data Terminal Ready
RX: Received Data	CTS: Clear to Send
RTS: Request to Send	NC: No Connection
DSR: Data Set Ready	CD: Carrier Detect



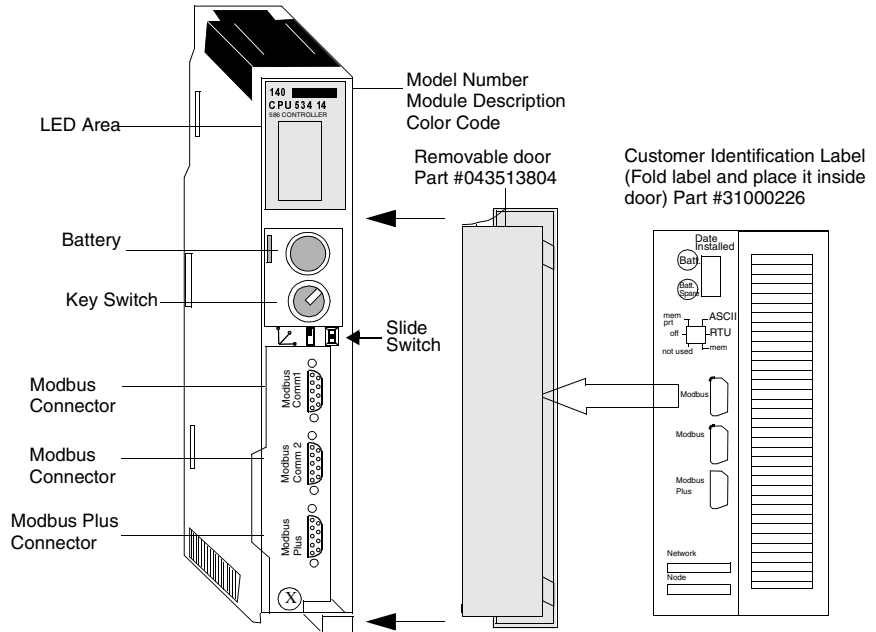
## 140CPU53414 CPU Module

### Overview

The following provides information on the 140CPU53414 Controller module – CPU 4M, 1xModbus Plus, Max IEC Program – 2.5 M.

### CPU Module

The following figure shows the CPU Module and its components.



**Specifications**

The following table shows the specification for the 140CPU53414 CONTROLLER module.

<b>Specifications</b>				
<b>User Logic/Reference Capacity</b>	<b>984 Ladder Logic</b>	<b>Discrete</b>	<b>Register</b>	<b>Extended Register</b>
	64 k words	64 k	57 k	96 k
	57,766 4XX registers max Only if: 0XXX = 16 and 1XXX = 16 and 3XXX = 16			
<b>Reference Capacity</b>				
Discrete		64 k - any mix		
<b>Local I/O (Main Backplane)</b>				
Maximum I/O Words		64 In and 64 Out*		
Maximum Number of I/O Racks		2 (Requires Expander)		
<b>Remote I/O</b>				
Maximum I/O Words per Drop		64 In and 64 Out*		
Maximum Number of Remote Drops		31		
<b>Distributed I/O</b>				
Maximum Number of Networks per System		3**		
Maximum Words per Network. (For every DIO drop, there is a minimum of words input of overhead.)		500 In and 500 Out		
Maximum Words per Node		30 In and 32 Out		
<b>Maximum Number of Option Module Interfaces</b>		Supports up to six network modules (i.e., Modbus Plus, Ethernet and Multi-Axis Motion option modules) using the option module interface technique. <b>Note:</b> Only two Modbus Plus modules can have full functionality, including Quantum DIO support.		
<b>Watchdog Timer</b>		250 ms (S/W adjustable)		
<b>Logic Solve Time</b>		0.1 ms/k to 0.5 ms/k		
<b>Battery</b>		3 V Lithium		
Service Life		1200 mAh		
Shelf Life		10 years with 0.5% loss of capacity per year		
<b>Battery Load Current @ Power-off</b>				
Typical		14 µA		

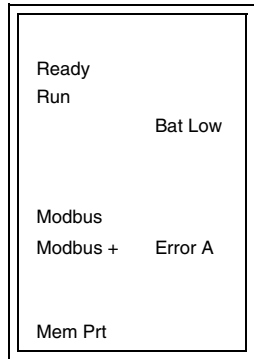
<b>Specifications</b>		
Maximum	420 $\mu$ A	
<b>Communication</b>		
Modbus (RS-232)	2 serial port (9-pin D-shell)	
Modbus Plus (RS-485)	1 network port (9-pin D-shell)	
<b>General</b>		
Diagnostics	<b>Power Up</b>	<b>Runtime</b>
	RAM	RAM
	RAM Address	RAM Address
	Executive Checksum	Executive Checksum
	User Logic Check	User Logic Check
	Processor	
Bus Current Required	1.8 A	
Power dissipation	9 W	
TOD Clock	+/- 8.0 seconds/day 0 ... 60° C	
Operating Temperature	0 ... 45° C	

\*This information can be a mix of Discrete or Register I/Os. For each word of Register I/O configured, one word of I/O words must be subtracted from the total available. The same holds true for each block of 8 bits or 16 bits of Discrete I/O configured – one word of Register I/O must be subtracted from the total available.

\*\*Requires the use of two 140NOM21x00 Option Modules.

## LED Indicators and Descriptions

The following figure shows the LED indicators.



The following table shows the LED descriptions.

<b>LED Descriptions</b>		
<b>LEDS</b>	<b>Color</b>	<b>Indication when On</b>
Ready	Green	The CPU has passed power-up diagnostics.
Run	Green	The CPU has been started and is solving logic.
Bat Low	Red	The battery needs replacing or is not present.
Modbus	Green	Communications are active on Modbus port 1 or 2.
Modbus +	Green	Communications are active on the Modbus Plus port.
Error A	Red	Indicates communications error on the Modbus Plus port.
Mem Prt	Amber	Memory is write-protected (the memory protect switch is on).

**LED Error Codes** The following table shows the run LED error codes for the 140CPU53414 module.

LED Error Codes		
Number of Blinks	Code	Error
Continuous	0000	requested kernel mode
2	80B	ram error during sizing
	80C	run output active failed
	82E	MB command handler stack error
3	769	bus grant received
	72A	not master asic on cpu
	72B	master config write bad
	72C	quantum bus DPM write failure
	72F	plc asic loopback test
	730	plc asic BAD_DATA
4	604	UPI timeout error
	605	bad UPI response opcode
	606	UPI bus diagnostic error
	607	modbus cmd-buffer overflow
	608	modbus cmd-length is zero
	609	modbus abort command error
	614	mbp bus interface error
	615	bad mbp response opcode
	616	timeout waiting for mbp
	617	mbp out of synchronization
	618	mbp invalid path
	619	page 0 not paragraph aligned
	61E	bad external uart hardware
	61F	bad external uart interrupt
	620	bad receive comm state
	621	bad transmit comm state
	622	bad comm state trn_asc
	623	bad comm state trn_rtu
	624	bad comm state rcv_rtu
	625	bad comm state rcv_asc
626	bad modbus state tmr0_evt	
627	bad modbus state trn-int	

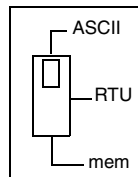
LED Error Codes		
Number of Blinks	Code	Error
	628	bad modbus state rcv-int
	631	bad interrupt
5	503	ram address test error
	52D	P.O.S.T BAD MPU ERROR
6	402	ram data test error
7	300	EXEC not loaded
	301	EXEC Checksum
8	8001	Kernal prom checksum error
	8002	flash prog / erase error
	8003	unexpected executive return

### Front Panel Slide Switch

The slide switch, located on the front panel of the CPU, is used to select the communication parameter settings for the Modbus (RS-232) ports. Three positions are available:

1. Setting the switch to the top position assigns ASCII functionality to the port.
2. Setting the switch to the middle position assigns remote terminal unit (RTU) functionality to the port.
3. Setting the switch to the bottom position lets you assign comm parameters to the port in software.

The slide switch:



**Note:** The CPU hardware defaults to bridge mode when the front panel switch is set to RTU or ASCII mode. When networking controllers, a panel device connected to the CPU Modbus port can communicate with the controller to which it is connected, as well as log into any nodes on the Modbus Plus network.

Setting the slide switch to the top position assigns ASCII functionality to the port; the following communication parameters are set and cannot be changed.

<b>ASCII Communication Port Parameters</b>	
Baud	2,400
Parity	Even
Data Bits	7
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the middle position assigns remote terminal unit (RTU) functionality to the port; the following communication parameters are set and cannot be changed.

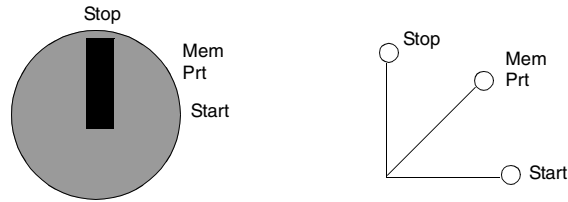
<b>RTU Communication Port Parameters</b>	
Baud	9,600
Parity	Even
Data Bits	8
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the bottom position gives you the ability to assign communication parameters to the port in software; the following parameters are valid.

<b>Valid Communication Port Parameters</b>		
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
Parity	Enable/Disable Odd/Even	
Data Bits	7 / 8	
Stop Bits	1 / 2	
Device Address	1 ... 247	

**Key Switch**

The key switch, located on the front of the CPU, is used to protect memory from programming changes while the controller is in operation. The following figure shows the key switch.



**Note:** The key switch positions shown on the switch (above, left) are for reference only and are marked on the module as indicated on the right.

**Key Switch Description**

The following table provides descriptions of the key switch information.

Key Switch Description				
Key Switch Position	Controller Status	Memory Protected From Programmer Changes	Will Accept Programmer Stop or Start	Key Switch Transition
Stop	Controller is stopped and disables Programmer changes.	Y	N	From Start or Memory Protect: Stops controller, if running, and disables Programmer changes
Mem Prt	Controller may be either stopped or running and Programmer changes are disabled. The user cannot write to unlocated variables.	Y	N	From Stop or Start: Prevents Programmer changes, controller run status is not changed
Start	Controller may be either stopped or running. Programmer may make changes and start/stop the controller	N	Y	From Stop: Enables Programmer changes, starts controller. From Memory Protect: Enables programmer changes, starts controller if stopped.



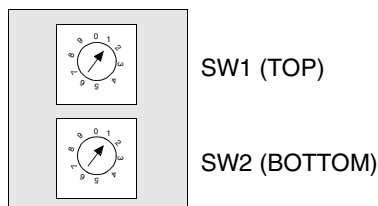
## Rear Panel Switches

Two rotary switches (refer to the following illustration and table) are located on the rear panel of the CPU. They are used for setting Modbus Plus node and Modbus port addresses.

**Note:** The highest address that may be set with these switches is 64.

SW1 (the top switch) sets the upper digit (tens) of the address; SW2 (the bottom switch) sets the lower digit (ones) of the address. The illustration below shows the correct setting for an example address of 11.

The following figure shows SW1 and SW2.



The following table shows the SW1 and SW2 address settings.

Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

**Note:** If "0" or an address greater than 64 is selected, the Modbus + LED will be "on" steady, to indicate the selection of an invalid address.

## Modbus Port Modem Support

Modbus Port 1 has full modem interfacing ability. Modbus Port 2 RTS/CTS connections function properly for normal non-modem communications but do not support modems.

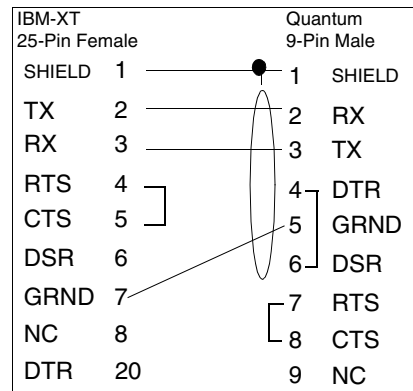
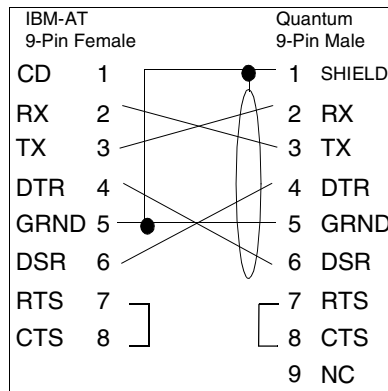
**Modbus Connector Pinouts**

All Quantum CPUs are equipped with a 9-pin RS-232C connector that supports Modicon's proprietary Modbus communication protocol. The following is the Modbus port pinout connections for 9-pin and 25-pin connections.

**Note:** Although the Modbus ports electrically support existing Modbus cables, it is recommended that a Modbus programming cable (Part # 990NAA26320 or 990NAA26350) be used. This cable has been designed to fit under the door of a Quantum CPU or NOM module.

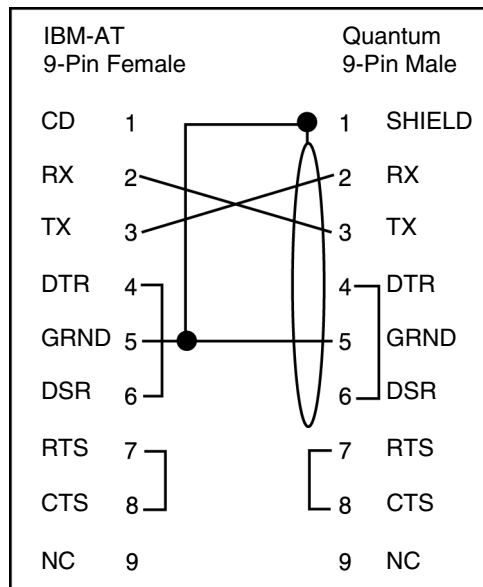
**Modbus Ports Pinout Connections**

The following figure shows the Modbus port pinout connections for 9-pin and 25-pin connections.



**Modbus Ports  
Pinout  
Connections for  
Portable  
Computers**

The following figure shows the Modbus port pinout connections for 9-pin portable (laptop) computers.



The following is the abbreviation key for the above figures.

TX: Transmitted Data	DTR: Data Terminal Ready
RX: Received Data	CTS: Clear to Send
RTS: Request to Send	NC: No Connection
DSR: Data Set Ready	CD: Carrier Detect

## 140CPU53414A CPU Module

### Overview

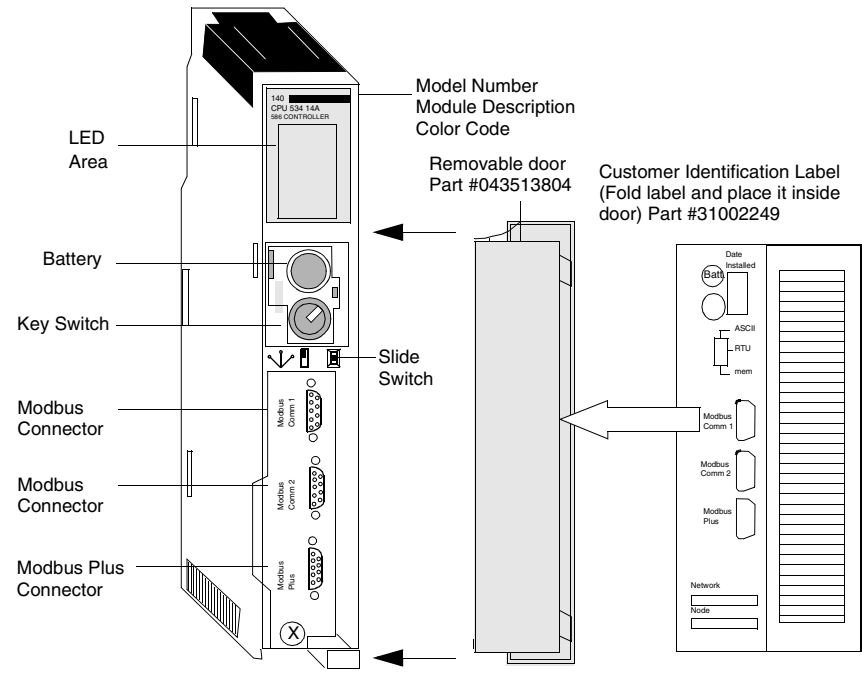
This unit provides information on the specifications, LED indicators and description and error codes for the 140CPU53414A Controller Module.

This module is functionally identical to the non-"A" version, however, the following should be considered:

- If you are using the module in a Hot Standby topology, then you **must** use either two non-"A" models or two "A" models.
- The "A" version requires a new flash executive.
- The "A" version and non-"A" flash executives are **not** interchangeable.
- Schneider Automation software (Concept, ProWORX, and Modsoft) supports the "A" version. Any existing or new 140CPU53414 program configuration will load into a 140CPU53414A without any modifications.

### CPU Module

The following figure shows the CPU Module and its components.



**Specifications**

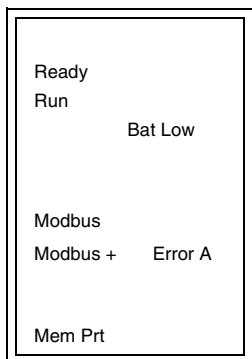
The following table shows the specifications for the CPU53414A Controller module.

<b>Specifications</b>					
<b>User Logic/Reference Capacity</b>	<b>984 Ladder Logic</b>	<b>Discrete</b>	<b>Register</b>	<b>Extended Register</b>	<b>IEC Application Memory</b>
	64 k words	64 k	57 k	96 k	2.7M
57,766 4XX registers max Only if: 0XXX = 16 and 1XXX = 16 and 3XXX = 16					
<b>Reference Capacity</b>					
Discrete	64 k - any mix				
<b>Local I/O</b>					
Maximum I/O Words	64 In and 64 Out*				
Maximum Number of I/O Racks	2 (Requires Expander)				
<b>Remote I/O</b>					
Maximum I/O Words per Drop	64 In and 64 Out*				
Maximum Number of Remote Drops	31				
<b>Distributed I/O</b>					
Maximum Number of Networks per System	3**				
Maximum Words per Network (for every DIO drop, there is a minimum of words input of overhead.)	500 In and 500 Out				
Maximum Words per Node	30 In and 32 Out				
*This information can be a mix if Discrete or Register I/O. For each word of register I/O configured, one word of I/O words must be subtracted from the total available. The same holds true for each block of 8 bits or 16 bits of Discrete I/O configured---one word Register I/O must be subtracted from the total available. **Requires the use of two 140NOM21X00 Option Modules.					
<b>Maximum Number of Network Option Module Interfaces</b>	Supports up to six network modules (i.e., Modbus Plus, Ethernet and Multi-Axis Motion option modules) using the option module interface technique (see p. 33). <b>Note:</b> Only two Modbus Plus modules can have full functionality, including Quantum DIO support.				

<b>Specifications</b>		
<b>Watchdog timer</b>	250 ms (software adjustable)	
<b>Logic Solve Time</b>	0.1 ms/k to 0.5 ms/k	
<b>Battery</b>		
Type	3 V Lithium	
Service Life	1200 mAh	
Shelf Life	10 years with 0.5% loss of capacity per year	
<b>Battery Load Current at Power-off</b>		
Typical	14 $\mu$ A	
Maximum	420 $\mu$ A	
<b>Communication</b>		
Modbus (RS-232)	2 serial port (9-pin D-shell)	
Modbus Plus (RS-485)	1 network port (9-pin D-shell)	
<b>Programming Software Capability</b>	Modsoft, version 2.6 Concept, version 2.1 with B2.1 patch exec Concept 2.2 with SR2 ProWorx NxT, version 2.0 ProWorx Plus, version 1.05	
<b>General</b>		
Diagnostics	<b>Power Up</b>	<b>Runtime</b>
	RAM RAM Address Executive Checksum User Logic Check Processor	RAM RAM Address Executive Checksum User Logic Check
Bus Current Required	1.25 A	
Power dissipation	6.25 W	
TOD Clock	+/- 8.0 seconds/day 0 ... 60° C	
Operating Temperature	0 ... 50° C	

## LED Indicators and Descriptions

The following figure shows the LED indicators.



The following table provides a description of the LED indicators for the 140CPU53414A module.

LED Descriptions		
LEDS	Color	Indication when On
Ready	Green	The CPU has passed power-up diagnostics.
Run	Green	The CPU has been started and is solving logic.
Bat Low	Red	The battery needs replacing or is not present.
Modbus	Green	Communications are active on Modbus port 1 or 2.
Modbus +	Green	Communications are active on the Modbus Plus port.
Error A	Red	Indicates communications error on the Modbus Plus port.
Mem Prt	Amber	Memory is write-protected (the memory protect switch is on).

**LED Error Codes** The following table shows the run LED error codes for the 140CPU53414A.

LED Error Codes		
Number of Blinks	Code	Error
Continuous	0000	requested kernel mode
2	80B	ram error during sizing
	80C	run output active failed
	82E	MB command handler stack error
3	769	bus grant received
	72A	not master asic on cpu
	72B	master config write bad
	72C	quantum bus DPM write failure
	72F	plc asic loopback test
	730	plc asic BAD_DATA
4	604	UPI timeout error
	605	bad UPI response opcode
	606	UPI bus diagnostic error
	607	modbus cmd-buffer overflow
	608	modbus cmd-length is zero
	609	modbus abort command error
	614	mbp bus interface error
	615	bad mbp response opcode
	616	timeout waiting for mbp
	617	mbp out of synchronization
	618	mbp invalid path
	619	page 0 not paragraph aligned
	61E	bad external uart hardware
	61F	bad external uart interrupt
	620	bad receive comm state
	621	bad transmit comm state
	622	bad comm state trn_asc
	623	bad comm state trn_rtu
	624	bad comm state rcv_rtu
	625	bad comm state rcv_asc
626	bad modbus state tmr0_evt	
627	bad modbus state trn-int	



LED Error Codes		
Number of Blinks	Code	Error
	628	bad modbus state rcv-int
	631	bad interrupt
5	503	ram address test error
	52D	P.O.S.T BAD MPU ERROR
6	402	ram data test error
7	300	EXEC not loaded
	301	EXEC Checksum
8	8001	Kernal prom checksum error
	8002	flash prog / erase error
	8003	unexpected executive return

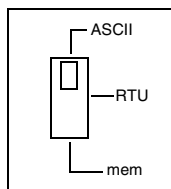
**Note:** Information in the Code column is visible only with the Flash download utility.

### Front Panel Slide Switch

The slide switch, located on the front of the CPU, is used to select the comm parameter settings for the Modbus (RS232) ports. Three options are available.

1. Setting the switch to the top position assigns ASCII functionality to the port.
2. Setting the switch to the middle position assigns remote terminal unit (RTU) functionality to the port.
3. Setting the switch to the bottom position lets you assign comm parameters to the port in software.

Slide switch::



**Note:** The CPU hardware defaults to bridge mode when the front panel switch is set to RTU or ASCII mode. When networking controllers, a panel device connected to the CPU Modbus port can communicate with the controller to which it is connected, as well as log into any nodes on the Modbus Plus network.

The following table shows the ASCII comm port parameters.

<b>ASCII Comm Port Parameters</b>	
Baud	2,400
Parity	Even
Data Bits	7
Stop Bits	1
Device Address	Rear panel rotary switch setting

The following table shows the RTU comm port parameters. The comm parameters are set and cannot be changed.

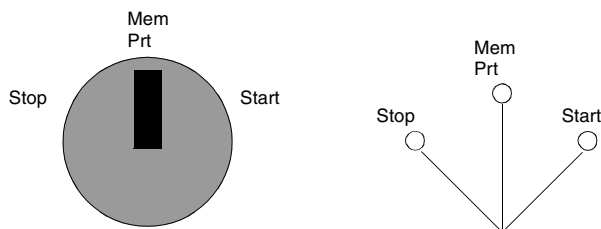
<b>RTU Comm Port Parameters</b>	
Baud	9,600
Parity	Even
Data Bits	8
Stop Bits	1
Device Address	Rear panel rotary switch setting

The following table shows the valid comm port parameters.

<b>Valid Comm Port Parameters</b>		
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
Parity	Enable/Disable Odd/Even	
Data Bits	7 / 8	
Stop Bits	1 / 2	
Device Address	1 ... 247	

## Key Switch

The following figure shows the key switch.



**Note:** The key switch positions shown next to the switch (above, left) are for reference only and are marked on the module as indicated on the right.

The CPU53414A has 1435KByte of Flash EPROM memory, which can be used to save the program and the initial values of variables. On power up, if you have a program in flash memory, you can choose the desired operating mode using the PLC MEM switch on the processor front panel. The 140CPU53414A has a key switch with Run, Mem Prt, and Stop positions.

Stop position	The application in Flash is not transferred to internal RAM: warm restart of the application.
Mem Prt position	The application in Flash is not transferred to internal RAM: warm restart of the application.
Start position	The application in Flash is automatically transferred to internal RAM when the PLC processor is powered up: cold restart of the application.

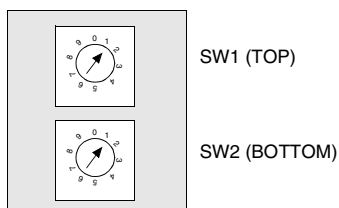
**Key Switch Description**

The following table provides a description of the key switch information.

<b>Key Switch Description</b>				
<b>Key Switch Position</b>	<b>Controller Status</b>	<b>Memory Protected From Programmer Changes</b>	<b>Will Accept Programmer Stop or Start</b>	<b>Key Switch Transition</b>
Stop	Controller is stopped and disables Programmer changes.	Y	N	From Start or Memory Protect: Stops controller, if running, and disables Programmer changes
Mem Prt	Controller may be either stopped or running and Programmer changes are disabled. The user cannot write to unlocated variables.	Y	N	From Stop or Start: Prevents Programmer changes, controller run status is not changed
Start	Controller may be either stopped or running. Programmer may make changes and start/stop the controller	N	Y	From Stop: Enables Programmer changes, starts controller. From Memory Protect: Enables programmer changes, starts controller if stopped.

## Rear Panel Switches

The following figure shows the SW1 and SW2 settings.



SW1 sets the upper digit (tens) of the address. SW2 sets the lower digit (ones) of the address. The following table shows the SW1 and SW2 address settings.

SW1 and SW2 Address Settings		
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

**Note:** If "0" or an address greater than 64 is selected, the Modbus + LED will be "on" steady, to indicate the selection of an invalid address.

## Modbus Connector Pinouts

All Quantum CPUs are equipped with a nine-pin RS-232 connector that support Modicon's proprietary Modbus communication protocol. The following is the Modbus port pinout connections for nine-pin and 25-pin connections.

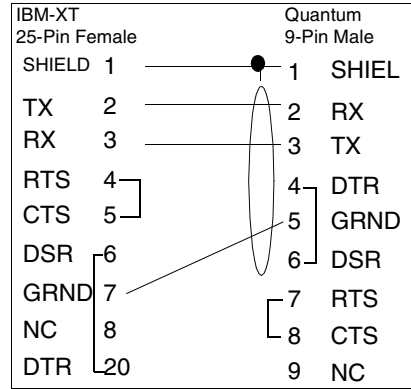
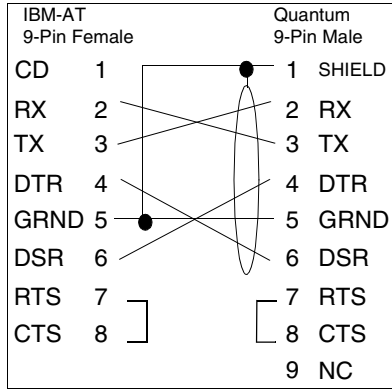
**Note:** Although the Modbus ports electrically support existing Modbus cables, it is recommended that a Modbus programming cable (Part # 990NAA26320 or 990NAA26350) be used. This cable has been designed to fit under the door of a Quantum CPU or NOM module.

## Modbus Port Modem Support

Modbus Port 1 has full modem interfacing ability. Modbus Port 2 RTS/CTS connections function properly for normal non-modem communications but do not support modems.

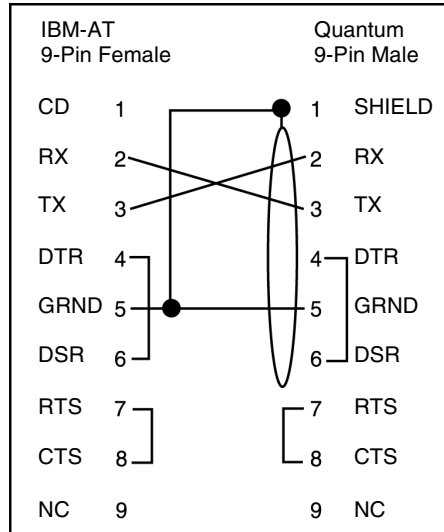
**Modbus Ports Pinout Connections**

The following figure shows the Modbus port pinout connections for 9-pin and 25-pin connections.



**Modbus Ports Pinout Connections for Portable Computers**

The following figure shows the Modbus port pinout connections for 9-pin portable computers.



The following is the abbreviation key for the above figures.

TX: Transmitted Data	DTR: Data Terminal Ready
RX: Received Data	CTS: Clear to Send
RTS: Request to Send	NC: No Connection
DSR: Data Set Ready	CD: Carrier Detect

---

# Quantum Field Bus Modules



---

## At a Glance

### Overview

This chapter contains information on various Quantum Field Bus Modules.

### What's in this Chapter?

This chapter contains the following topics:

Topic	Page
140CRP81100 Profibus DP Master Communications Module	190
140EIA92100 Quantum AS-i Master Module	195
140NOA6XXXX Quantum InterBus Communications Modules	201
140NOL911X0 Quantum LonWorks Network Option Modules	208

## 140CRP81100 Profibus DP Master Communications Module

### Overview

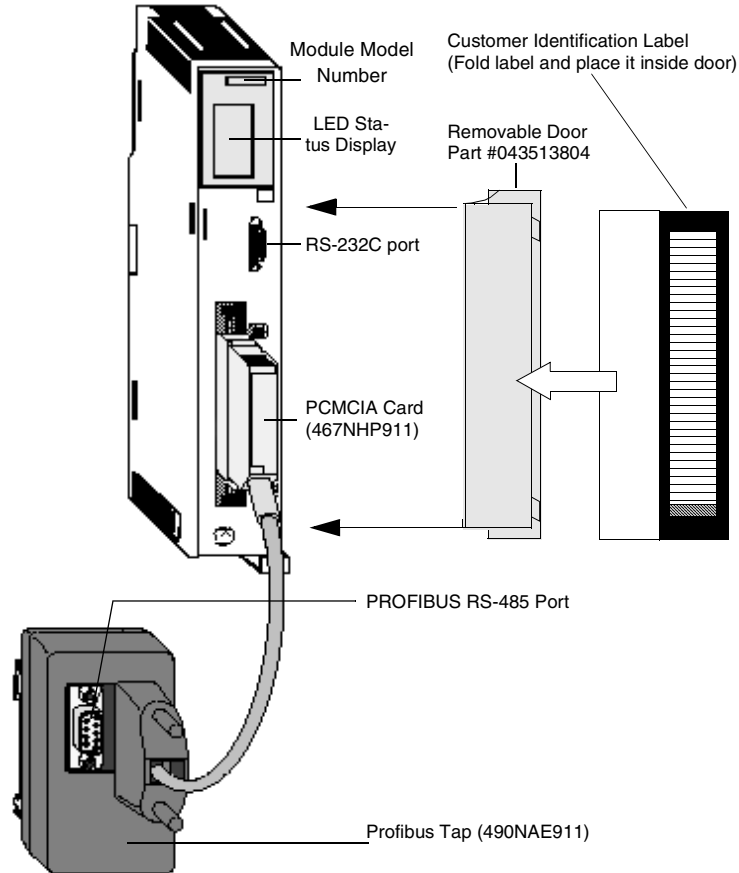
The following information describes the 140CRP81100 Field Bus Communication Module, which provides interface to Profibus-DP networks for the Quantum Automation Series systems.

### Related Documentation

For a detailed discussion of the planning, installation and use of a Quantum Profibus system, refer to the *Modicon TSX Quantum Profibus-DP Under Modsoft User Manual* (840 USE 468 00), *Profibus-DP Under Concept Manual* (840 USE 487 00), and the *Profibus-DP Configurator for CRP 811* (840 USE 469 00).

### Communications Module

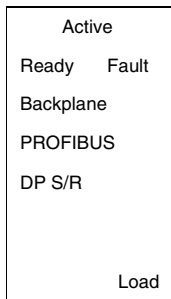
View of the 140CRP81100 communications module and the Profibus tap:





**LED Status**

The following figure shows the LED Status display.



The following table provides descriptions of the Status LEDs.

LEDs	Color	Function	Description
Active	Green	On	Indicates bus communication is present
		Flashing	The flash ram load operation is active
Ready	Green	On	Module is operational
Fault	Red	On	Indicates fault. Refer to LED fault codes in manual 840USE46800.
Backplane	Green	Flashing	Indicates fault. Refer to LED fault codes in manual 840USE46800.
PROFIBUS	Green	Flashing	Erroneous configuration data or PROFIBUS fault
DP S/R	Green	Fast flashing frequency	Sending/receiving DP bus data
		Medium flashing frequency	Slaves are configuring
		Slow flashing frequency	Waiting for configuration data
		Flashing with fault code	Erroneous configuration data
Load	Yellow	Flashing	Configuration data load operation active
		Flashing with fault code	Load operation fault



## CAUTION

### Resetting Fault LED

To reset the fault LED the CRP811 must be power cycled or hot swapped.

**Failure to follow this precaution can result in injury or equipment damage.**



## WARNING

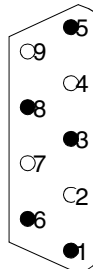
### Hot Swapping Restriction

Modules may be hot swapped when the area is known to be non-hazardous. Do not hot swap modules in a Class 1, Division 2 environment.

**Failure to follow this precaution can result in death, serious injury, or equipment damage.**

### PROFIBUS RS-485 Port d-Sub pinouts

Below are the pinouts for the PROFIBUS RS-485 port.

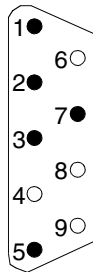


Legend to pinouts for the RS-485 port:

Pin	Signal	Function
1	Shield	Shield, Protective Ground
3	RxD/TxD-P	Receive/Transmit-Data-P (+)
5	DGND	5 V common
6	VP	+5 V
8	RxD/TxD-N	Receive/transmit-data-N(-)

**RS-232C Port**

Below are pinouts for the RS-232C port



Legend to pinouts for the RS-232C port:

Pin	Signal	Function
2	RXD	Received Data
3	TXD	Transmitted Data
5	GND	Signal Ground
7	RTS	Request to Send
8	CTS	Clear to Send

**Specifications**

The following table shows the technical specifications for the 140CRP81100 Communication Module:

<b>Specifications</b>	
<b>Programming software</b>	Modsoft version 2.32 or greater Concept version 2.2 or greater
<b>Bus current required</b>	1.2 A
<b>Power dissipation</b>	6.5 W
<b>Data Interface</b>	
RS-232C	9 pin D-shell non-isolated, Shielded cable, 3 m max; 19.2 Kbps default.
RS-485	Profibus, up to 12 Mbps
<b>Installation</b>	Local backplane only
<b>Bus Specifications</b>	
Bus nodes	max. 32
Bus lengths, transmission rates (for 12 Mbps cable)	max. 1.2 km at 9.6 Kbps max 1.2 km at 19.2 Kbps max. 1.2 km at 93.75 Kbps max 1.0 km at 187.5 Kbps max 0.5 km at 500 Kbps max 0.2 km at 1.5 Mbps max 0.1 km at 3 Mbps max 0.1 km at 6 Mbps max 0.1 km at 12 Mbps
Transmission media	shielded twisted pair
Connection interface	EIA RS-485
Node type	Master class 1
Bus access procedure	Master/slave to dP bus slaves
Transmission procedure	half-duplex
Frame length	Max. 255 bytes
Data unit length	Max. 246 bytes
Data security	Hamming distance, HD = 4
Node addresses	1 ... 126

## 140EIA92100 Quantum AS-i Master Module

---

### Overview

The 140EIA92100 field bus communications module provides communications interface to AS-i networks for the Quantum Automation Series systems.

---

### Related Documentation

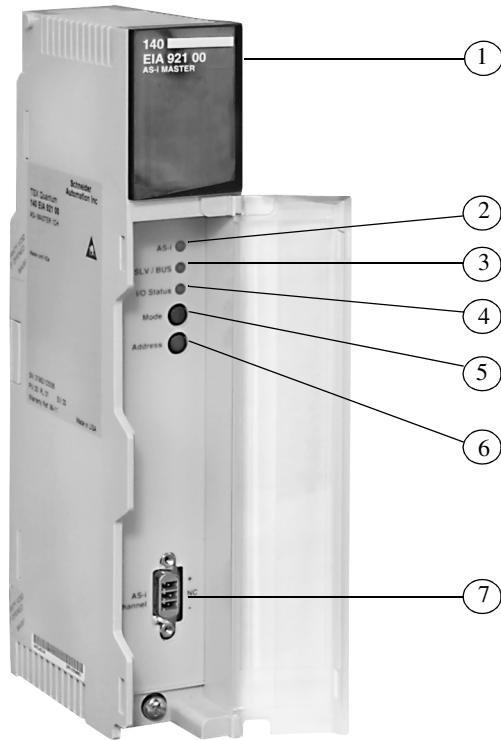
For more detailed information see *Modicon Quantum AS-i Master Module* manual, part number 840USE11700, or start the newmod.hlp from your Concept CD. To locate it, go to the root of your Concept Installation directory. Example of path: Drive\_X:\Concept\\*.hlp

<p><b>Note:</b> The newmod help system on your Concept CD contains a hyperlink labeled "Back to Main Content." This link will not return you to Concept 2.5 Help.</p>
---

---

**Communications Module**

The following diagram provides a view of the 140EIA92100 communications module.



- 1 LED Display
  - 2 AS-i (Red): ON shows the module is not powered. Flashing shows automatic addressing enabled.
  - 3 SLV/BUS (Green): ON when LEDs 0-31 are in bus display mode.
  - 4 I/O Status (Green): ON when LEDs 0-31 are in slave display mode.
  - 5 Mode (Push Button): Press and hold this button to change from slave mode to bus mode.
  - 6 Address (Push Button): Press this button to scroll through the 32 slaves. Hold to reverse direction of the scroll.
  - 7 AS-i Channel Cable Connector: Connects module to AS-i cable and AS-i power supply.
-

**LED Display and Descriptions**

Diagram of the LED display:

B	Active	F	
0	8	16	24
1	9	17	25
2	10	18	26
3	11	19	27
4	12	20	28
5	13	21	29
6	14	22	30
7	15	23	31

The following table provides LED descriptions.

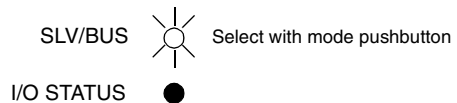
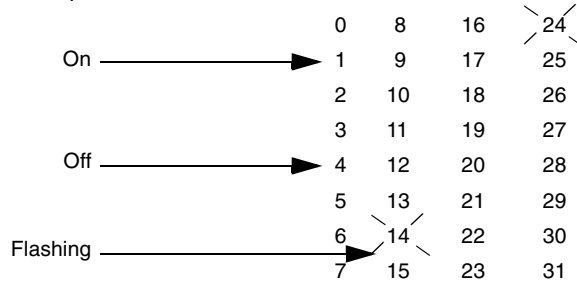
LED Descriptions		
LED	Color	Description
Active	Green	Bus communication is present.
F	Red	Fault on the AS-i bus. Steady: module fault Flashing: bad bus configuration or slave address
B	Green	Communication exists between master and slaves.
0-31	Green	Slave indicators.

**LED Bus Mode**

Each indicator lamp 1-31 corresponds to a slave address on the bus.

- On: Slave is present.
- Flashing: Slave is mapped but not detected, or detected but not mapped. It may also be projected and detected, but not activated (bad profile or I/O code).
- Off: Slave is neither mapped nor detected.

Example:

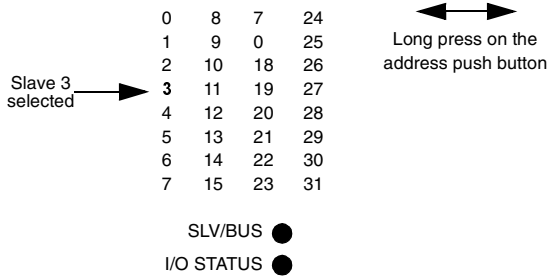


**LED Slave I/O Mode** Slave mode (SLV) figure:

Display of the address of the selected slave:

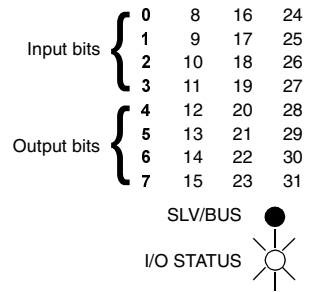
- On: number of the selected slave

A short press on the address button will change the selected slave.



Display of the state of the I/O bits of the selected slave:

- 0-3: displays the state of the input bits
- 4-7: displays the state of the output bits
- On: bit = 1
- Off: bit = 0 or not significant





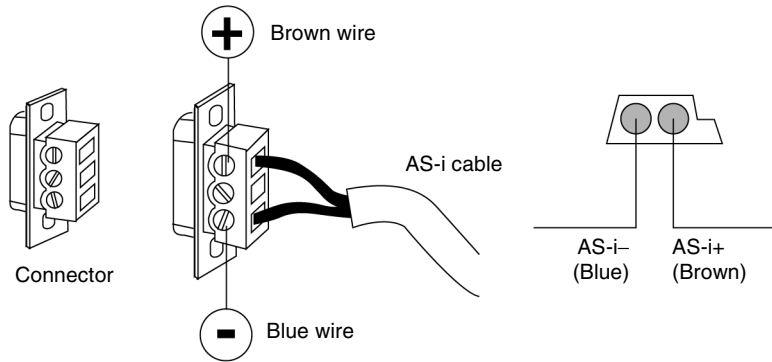
**LED Diagnostics** State of Indicator Lamps:

<b>B</b>	<b>Active</b>	<b>F</b>	<b>Meaning</b>	<b>Corrective Action</b>
○	○	○	Module switched off.	Switch the device on.
○	●	○	Operating in Protected Mode (normal). Displaying Outputs.	—
●	●	○	Operating in Protected Mode (normal). Displaying Inputs.	—
○	●	⊗ (1)	Fault on AS-i bus (self-programming possible).	Replace the faulty slave with a new identical slave.
○	●	⊗ (2)	Fault on AS-i bus (self-programming not possible).	Connect the terminal.
●	○	⊗	AS-i power supply fault or no slave on the AS-i bus.	1. Check AS-i power supply. 2. Check the continuity of the AS-i bus cable.
⊗	⊗	⊗	Module self-tests in progress.	—

●	Indicator lamp is on.	○	Indicator lamp is off.	⊗	Indicator lamp is flashing.	⊗	Indicator lamp is in indeterminate state.
(1) Faulty slave ID is flashing.							
(2) No slave ID numbers are flashing.							

**AS-i Cable Connection**

The following figure shows the AS-i cable connection:



**Specifications**

The following table provides specifications for the 140EIA92100 AS-i module:

Specifications	
Master profile	M2
Bus length	100m max, no repeaters
I/O	124IN/124OUT
# slaves	31 max
Power supply	30Vdc @ 120mA max
Scan time	156 msec x (n+2) if n < 31 156 msec x (n+1) if n = 31
Transmission	167 kbits/sec
Polarity reversal	Non-destructive
Bus current required	250mA max
Power dissipation	2.5W max
Installation	Local, RIO, DIO
Programming software	Concept v2.5 ProWORX Nxt v2.1 Modsoft v2.61

## 140NOA6XXXX Quantum InterBus Communications Modules

### Overview

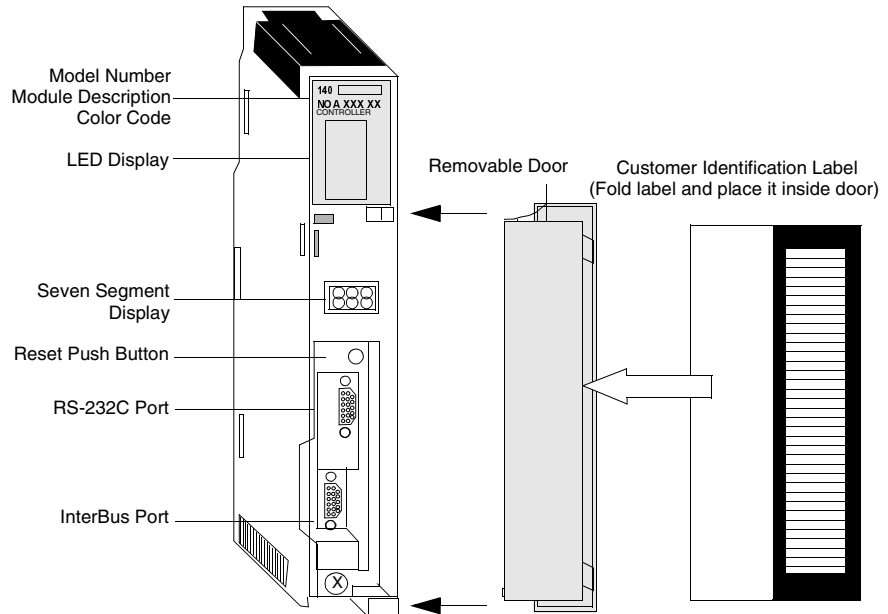
This section includes information for the NOA6XXXX InterBus communications modules which provide interface to InterBus networks for the Quantum Automation Series systems.

### Related Documentation

For more detailed information on the installation and use of Quantum InterBus modules, see the *Modicon TSX Quantum 140NOA61110 User Manual* (840 USE 419 00); the *Modicon TSX Quantum 140NOA61100 User Manual* (840 USE 418 00); and the *TSX Quantum 140NOA62200 User Manual* (840 USE 497 00).

### InterBus Communications Module

The following figure shows the NOA6XXXX InterBus Communications module.



**Specifications**

The following table shows the InterBus specifications.

<b>Specifications</b>	
<b>Data Interface</b>	
InterBus	RS-485, isolated (500 V test voltage)
RS-232C maximum cable length	As per DIN 66 020, non-isolated 20 m shielded
Data Transfer Frequency	500 kbaud
<b>Connection Styles</b>	Interbus RS-232C (Use cable part number 990NAA26320 or 990NAA26350)
<b>Bus Current Required</b>	700 mA
<b>Power Dissipation</b>	Max. 3.7 W, typically 2.5 W
<b>Installation</b>	Local backplane only

---

## LED Indicators and Descriptions for NOA611X0

The following figure shows the NOA611X0 LED indicators.

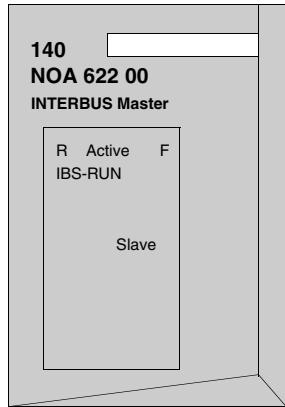
R	Active	F
IB-S Run	Master	
	RBUS	
	LBUS	
	Slave	
	DEA202	
	Memory	
	Start Up	
BS Off		

The following table shows the NOA611X0 LED descriptions.

LED Descriptions		
LEDs	Color	Function
R	Green	Ready. The firmware is running correctly and the module is ready for service.
Active	Green	Bus communication is active.
F	Red	Fault. A fault occurred on the module.
IB-S Run	Green	The InterBus is functioning normally and carrying data.
BS Off	Yellow	One or more bus segments are shut down.
Master	Red	Processor fault. Fault on the InterBus processor or the communications processor has failed.
RBUS	Red	Remote bus fault. The remote bus has been diagnosed as defective.
LBUS	Red	Peripheral bus fault. The peripheral bus has been diagnosed as defective.
Slave	Red	An InterBus node has reported a (module) fault.
DEA202	Red	Initialization fault with the DEA 202.
Memory	Red	Memory fault.
Start Up	Red	The InterBus master is not operational.

## LED Indicators and Descriptions for NOA62200

The following figure shows the NOA62200 LED indicators.



The following table shows the NOA62200 LED descriptions.

LED Descriptions			
LEDs	Color	Status	Meaning
R	Green	On	Ready. The switch-on routine was completed successfully. The firmware is running correctly and the module is ready for operations. RAM and checksum are ok.
		Flashing	No firmware; or firmware is being loaded.
		Off	Module error.
Active	Green	On	The communication with the TSX Quantum CPU is active.
F	Red	On	Fault. An error has occurred on the INTERBUS.
IB-S Run	Green	On	The INTERBUS is functioning, normal data transfer.
		Flashing cyclically.	The INTERBUS is ready.
		No cyclic flashing.	No INTERBUS configuration (error message).
Slave	Red	On	An INTERBUS node is indicating a module error.

## Seven Segment Display

The seven segment display is only applicable to the NOA61110 module.

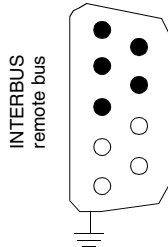
Display	Meaning
0	Interbus is not able to run.
-     -	Interbus is able to run but stopped.
- -	Interbus is running.
RBUS LED on	Number of the defective remote bus segments.
LBUS LED on	Number of the defective peripheral bus.
RBUS & LBUS LEDs on	Bus segment fault, interbus comm stopped. Faulted bus segment number (or next segment) displayed.
Slave LED on	Bus segment number containing a faulted module.

## Front Panel Connections and Controls

The InterBus module is equipped with an InterBus port and a Modbus Plus port, both are female 9-pin D connectors (see below for pinouts), and a reset push button.

### InterBus Port

Connect the remote bus cable to the female connector port labeled interbus. The following figure shows the InterBus port connection.

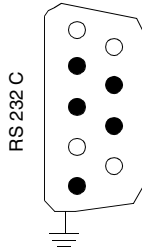


The following table shows the key to the remote bus.

Pin	Signal	Function
1	DO	Data Out (+)
2	DI	Data In (+)
3	GND	Comm
4	GND (NOA622 only)	F/O Interface
5	VCC (NOA622 only)	F/O Interface
6	DO	Data Out (-)
7	DI	Data In (-)
8	VCC (NOA622 only)	Auxiliary Supply for F/O Interface
9	RBST (NOA622 only)	RBST Coupling
Black circle = Pin occupied. White circle = N/C		

**RS-232C Port**

Use a Modbus data cable, Part Number 990NAA26320 (2.7 m) or Part Number 990NAA26350 (15.5 m). The following figure shows the RS-232C port connection.



The following table shows the key to the RS-232C port.

Pin	Signal	Function
2	D2 (RXD)	Received Data
3	D1 (TXD)	Transmitted Data
5	E2 (GND)	Signal Ground
7	S2 (RTS)	Request to Send
8	M2 (CTS)	Clear to Send
Black circle = Pin occupied. White circle = N/C		

**Reset Push Button**

The reset push button performs a hardware reset of the module which must be done each time new firmware has been downloaded. This button allows you to reset the module without removing it from the backplane.

**Required Loadables**

Loadables are accessible from Groupe Schneider's World Wide Web site at <http://www.schneiderautomation.com>. Click on the appropriate software under the "Control Software" section on the home page.

**Note:** 140CPU11302 does not support the 140NOA61110 or the 140NOA62200 module.



**Comparison of  
NOA61100,  
61110, and 62200  
Modules**

The following table provides a comparison of the NOA61100, 61110, and 62200 modules.

<b>Characteristics</b>	<b>NOA61100</b>	<b>NOA61110</b>	<b>NOA62200</b>
Physical Addressing	Y	Y	Y
Logical Addressing	N	Y	Y
PCP Channel	N	Y	Y
Startup Check of Configuration	Possible via user-program triggering one of the active bits 10 ... 15	Y	Y
Support of Remote Bus Branch	Y	Y	Y
Support for Hot Standby	N	N	N
Number of NOAs in Local Drop	3	3	2 (140CPU11303) 6 (140CPUX341XA)
Interbus Compatibility	Generation 3	Generation 3	Generation 4
Maximum Slaves	512	512	251
Configuration Tool	Phoenix Contact CMD V1.21 or V1.30	Phoenix Contact CMD V1.21 or V1.30	Sycon TLX L FBC 10M V2.725
<i>Software Versions</i>			
Modsoft Rev. (min.)	2.4	2.4	N/A
Concept Rev. (min.)	2.0	2.1	2.5 SR2
ProWORX (min.)	2.0	2.0	N/A

## 140NOL911X0 Quantum LonWorks Network Option Modules

### Overview

The NOL modules provide connectivity between a Modicon Quantum controller and a control network based on Echelon's LonWorks technology. Once the NOL module has been installed in a Quantum backplane and configured, it can be bound to an existing LonWorks network, and installed as a standard node.

**Note:** The NOL module requires a valid LonWorks configuration file (.XIF) loaded into it to define the LonWorks network variables to which it will be bound.

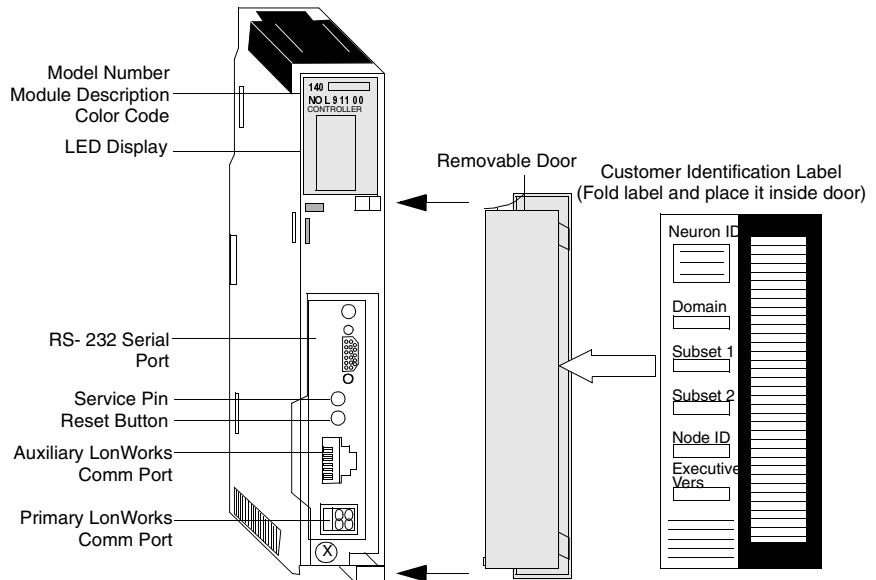
**Note:** You must have a LonWorks compliant network management tool, such as Metra Vision, to install an NOL module on a LonWorks network.

### Related Documentation

For more detailed information, see the *Quantum Automation Series Network Option Module for LonWorks* (840 USE 109 00).

### LonWorks Network Option Modules

The following figure shows the NOL911X0 LonWorks Network Option Module.



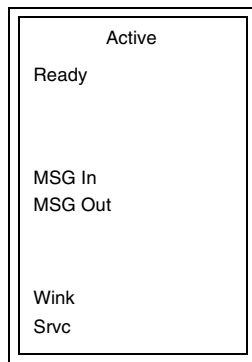
**Specifications**

The following table shows the specifications for the NOL911X0 module.

<b>Specifications</b>	
Data Transfer Frequency	78 Kbps (140 NOL 911 10)
Connection Styles	Screw terminals, telephone jack
Bus Current Required	400 mA
Quantum Controllers	V2.0 at a minimum
Remote I/O	V2.0 at a minimum

**LED Indicators, Descriptions, and Status**

The condition of the NOL module is indicated by the status (off, on, or blinking) of the LED indicators. The following figure shows the LED indicators.



The following table shows the LED descriptions.

<b>LED Descriptions</b>	
<b>LEDs</b>	<b>Function</b>
Active	Bus communication is present.
Ready	Module has passed internal diagnostics, and is configured.
MSG In	Flashes every 10 ms when an update message for a bound network variable is received by the NOL module from the LonWorks network.
MSG Out	Flashes every 10 ms when an update message for a bound network variable is transmitted by the NOL module to the LonWorks network.
Wink	Flashes briefly when the NOL module receives a wink message from the LonWorks network. Also used to display internal error codes defined in the Wink LED Error Codes table.
Svc	Indicates status of LonWorks network service.

The following table shows the LED Indicator Status.

LED Indicator Status					
LED	Color	Condition of NOL Module			Error Condition
		Powered Up Not Configured Not Programmed	Powered Up Configured Not Programmed	Normal Operation Configured Programmed	
Active	Green	Off	Off	On	Off <sup>1</sup>
Ready	Green	Blink	On	On	Off <sup>2</sup>
MSG In	Green	Off	Off	Blink	N/A
MSG Out	Green	Off	Off	Blink	N/A
Wink	Green	Off	Off	Blink on command	Blink <sup>3</sup>
Srvc	Yellow	Off	Blink	Off	N/A

- If not lit, either the LON module requires configuration and mapping or is not communicating with the CPU by way of the DX Loadable.
- If a LON module is inserted into the backplane and the Ready LED does not illuminate, the Wink LED should be observed for an error code.
- See the following Wink LED error codes.

### Wink LED Error Codes

The Wink LED is used to display error conditions. The following table shows the number of times the LED blinks for each type of error.

LED Error Codes	
Number of Blinks	Error Condition
1	Module is in the bootloader
2	Error in writing to flash memory
3	Error in initializing the Lon Works network
4	Error in the module configuration

### Front Panel Push Buttons

Two push buttons are located on the front of the NOL module. The **service pin push button** initiates the LonWorks network installation. When depressed, it causes the Service LED to illuminate, and forces the Neuron Chip in the module to output its unique 48-bit ID and Program ID.

The **reset push button** performs a hardware reset of the module, and must be done each time new firmware has been downloaded.

**Note:** The Reset push-button is recessed and requires a paper clip or similar tool to activate.

## Front Panel Connectors

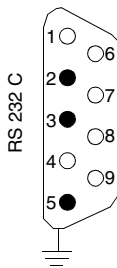
There are three connectors located on the front of the NOL module. These are the RS-232 configuration port; the primary LonWorks communication port; and the auxiliary LonWorks configuration port.

## RS-232 Configuration Port

This 9 pin, D-shell, female, RS-232 compatible serial port's attributes are:

- Configured at a fixed rate of 9600 baud, 8 data bits, 1 stop bit, and no parity.
- Used to download configuration and new firmware to the module.
- Supports XMODEM protocol with an ASCII terminal based command processor.
- Can be directly connected to a PC serial communications port.

The following figure shows the 9-pin configuration port.



The following table shows the key to the RS-232C port.

Pin	Signal	Function
2	RXD	Received Data
3	TXD	Transmitted Data
5	GND	Signal Ground
Black circle = Pin occupied. White circle = N/C		

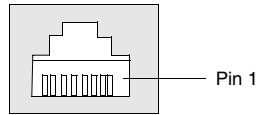
Modbus cables 990NAA26320 and 990NAA26350 are suitable for connection between the PC serial port and NOL module RS-232 port.

## Primary LonWorks Communication Port

This is the primary interface for wiring into a LonWorks network. The connector is a two-position 5.08 mm screw terminal.

**Auxiliary  
LonWorks  
Communication  
Port**

This is the auxiliary interface for wiring into a LonWorks network. The connector is an eight position RJ-45 (phone jack) socket. The figure below shows the Pin 1 connector.



**Note:** The Auxiliary LonWorks Communications Port is not intended to be connected to any public telecommunications network. Both the Primary and Secondary ports provide standard interfaces to LonWorks networks and are wired in parallel for flexibility. The connections are not polarity sensitive.

**NOL Module  
Media Types**


The NOL module supports three twisted pair media types with different network topologies or data transfer speeds.

- 140NOL91100
- 140NOL91110
- 140NOL91120

The following table shows the transceiver types supported by each module are as follows:

NOL Model Number	Transceiver Type	Configuration	Data Transfer Rate
140NOL91100*	TP/FTT-10	Free topology, twisted pair	78,000 BPS
140NOL91110	TP/XF-78	Linear topology, twisted pair, transformer isolated	78,000 BPS
140NOL91120*	TP/XF-1250	Linear topology, twisted pair, transformer isolated	1.25 MBPS

\*Not actively sold after 10/00.



WARNING

**Incompatibility**  
 NOL modules are not compatible in Quantum Distributed I/O (DIO) racks.  
**Failure to follow this precaution can result in death, serious injury, or equipment damage.**

---

# Distributed I/O (DIO) for the Quantum Modules

# 9

---

## At a Glance

### Introduction

This chapter provides information on the distributed I/O (DIO) modules. This information includes specifications, LED indicators and descriptions, rear panel switches, and wiring diagrams for the following modules:

- 140CRA21110
- 140CRA21210
- 140CRA21120
- 140CRA21220

### What's in this Chapter?

This chapter contains the following topics:

Topic	Page
140CRA21X10 Quantum Distributed I/O (DIO) Modules	214
140CRA21X20 Quantum Distributed I/O (DIO) Modules	219

---

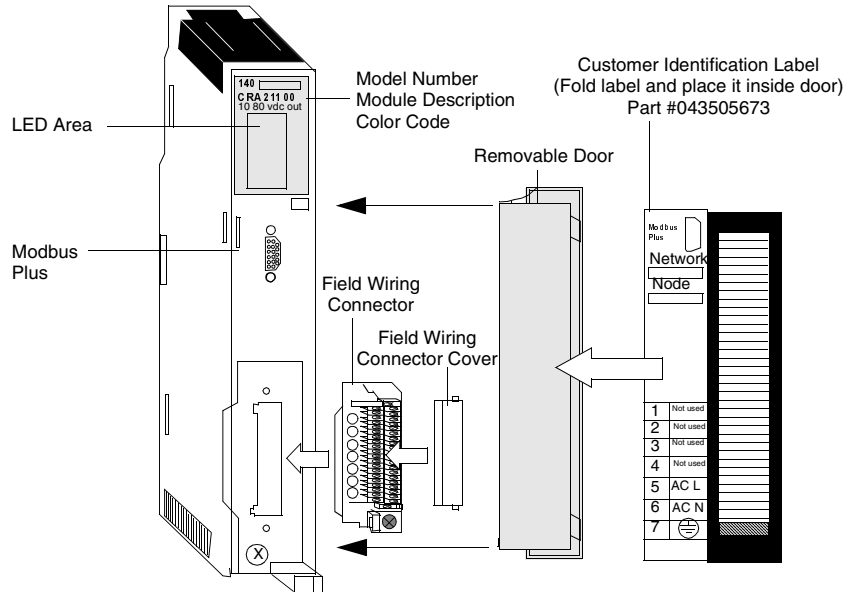
## 140CRA21X10 Quantum Distributed I/O (DIO) Modules

### Overview

This section includes specifications and wiring diagrams for the Modbus Plus Distributed I/O AC powered single (CRA21110) and dual (CRA21210) channel modules.

### DIO Module

The following figure shows the parts of the distributed I/O (DIO) module.





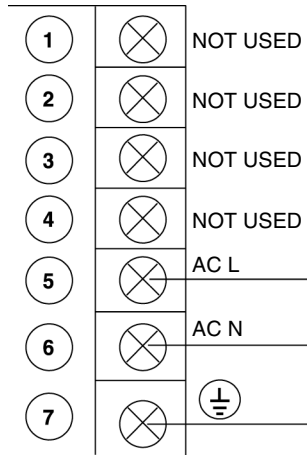
**Specifications**

The following specifications are for the Modbus Plus CRA21110 and CRA21210 AC powered single and dual channel DIO modules.

<b>Specifications</b>		
<b>Input Requirements</b>		
Input Voltage	85 ... 276 Vac	
Input Frequency	47 ... 63 Hz	
Input Voltage Total Harmonic Distortion	Less than 10% of the fundamental rms value	
Input Current	0.4 A @ 115 Vac. 0.2 A @ 230 Vac	
Inrush Current	10 A @ 115 Vac. 20 A @ 230 Vac	
VA Rating	50 VA	
Input Power Interruption	1/2 cycle at full load and minimum rated line voltage / frequency. No less than 1 second between interruptions.	
Fusing (external)	1.5 A (Part #043502515 or equivalent)	
Operating Mode	Standalone or not powered (see <i>p. 69f</i> ).	
<b>Output to Bus</b>		
Voltage	5.1 Vdc	
Current	3 A	
Minimum Load	0 A	
Protection	Over Current, Over Voltage	
<b>Communication</b>		
Modbus Plus	1 port (single cable); 2 ports (dual cable)	
<b>General</b>		
Specifications	<b>I/O Type:</b>	<b>Quantum</b>
	Modules/Drop:	Depends on bus current loading and word count
	Words:	30 In / 32 Out. (Two additional input words are reserved for drop status.)
Diagnostics	Power Up Runtime	
	RAM Data/Address	
	Executive Checksum	
Field Wiring Connector	7 point terminal strip (Part # 043506326)	
Internal Power Dissipation	$2.0 V + 3.0 V \times I_{BUS} = \text{Watts}$ (where $I_{BUS}$ is in Amperes)	

**Wiring Diagram**

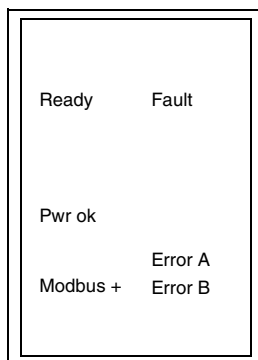
The following figure shows the wiring diagram for the 140CRA21110 and 21210 wiring diagram.



**Note:** See p. 692 for power and grounding wiring guidelines and operational information.

## LED Indicators and Descriptions

The following figure shows the LED panel.



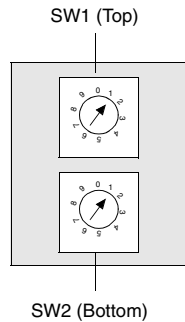
The following table shows the DIO LED indicators and descriptions.

LED Descriptions		
LEDS	Color	Indication when On
Ready	Green	The module has passed power-up diagnostics.
Fault	Red	A communications error exists between the DIO module and one or more I/O modules, or an output module is not being written to, over the Modbus Plus network.
Pwr ok	Green	Bus power is present.
Modbus +	Green	Communications are active on the Modbus Plus port.
Error A	Red	Communication error on the Modbus Plus Channel A (dual cable only).
Error B	Red	Communication error on the Modbus Plus Channel B (dual cable only).

## Rear Panel Switches

Two rotary switches (refer to the following illustration and table) are located on the rear panel of the CPU. They are used for setting Modbus Plus node addresses for the unit.

SW1 (the top switch) sets the upper digit (tens) of the address; SW2 (the bottom switch) sets the lower digit (ones) of the address. The illustration below shows the correct setting for an example address of 11.



The following table shows the node addresses of the SW1 and SW2 switches.

SW1 and SW2 Switches		
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

**Note:** If "0" or an address greater than 32 is selected, the RIO module displays a flashing Error A and Error B LED to indicate an error condition. Only addresses 1-32 are valid.

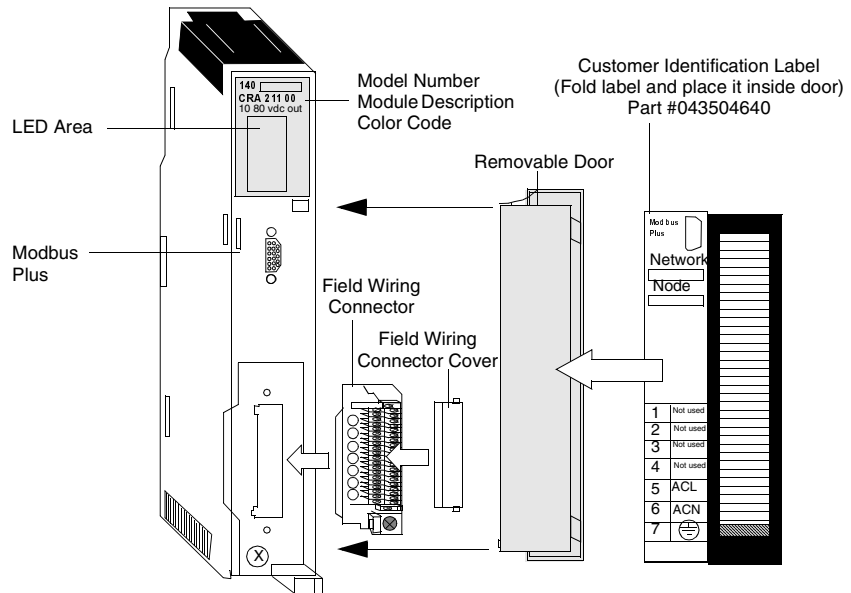
## 140CRA21X20 Quantum Distributed I/O (DIO) Modules

### Overview

This section includes specifications and wiring diagrams for the Modbus Plus Distributed I/O DC powered single (CRA21120) and dual (21220) channel modules.

### DIO Module

The following figure shows the parts of the Distributed I/O (DIO) module.



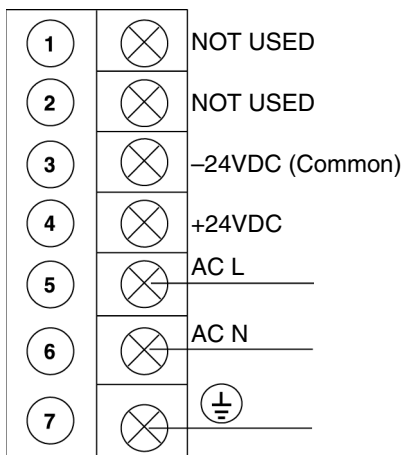
**Specifications**

The following specifications are for the Modbus Plus CRA21120 and CRA21220 DC powered single and dual channel DIO modules.

<b>Specifications</b>		
<b>Input Requirements</b>		
Input Voltage	20 ... 30 Vdc	
Input Current	1.6 A	
Inrush Current	30 A	
Input Power Interruption	1.0 ms max	
Fusing (external)	2.5 A (Part #043503948 or equivalent)	
Operating Mode	Standalone or not powered (see p. 691).	
<b>Output to Bus</b>		
Voltage	5.1 Vdc	
Current	3 A	
Minimum Load	0 A	
Protection	Over Current, Over Voltage	
<b>Communication</b>		
Modbus Plus	1 port (single cable). 2 ports (dual cable)	
<b>General</b>		
Specifications	<b>I/O Type</b>	<b>Quantum</b>
	Modules/Drop	Depends on bus current loading and word count
	Words	30 In / 32 Out. (Two additional input words are reserved for drop status)
Diagnostics	Power Up Runtime	
	RAM Data/Address	
	Executive Checksum	
Field Wiring Connector	7 point terminal strip (Part #043503328)	
Internal Power Dissipation	2.0 V + 3.0 V × I <sub>BUS</sub> = Watts (where I <sub>BUS</sub> is in Amperes)	

**Wiring Diagram**

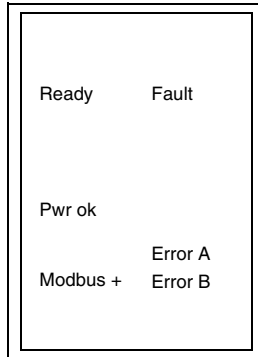
The following figure shows the wiring diagram for the 140CRA21110 and 21210 wiring diagram.



**Note:** See p. 692 for power and grounding wiring guidelines and operational information.

## LED Indicators and Descriptions

The following figure shows the LED panel.



The following table shows the DIO LED indicators and descriptions.

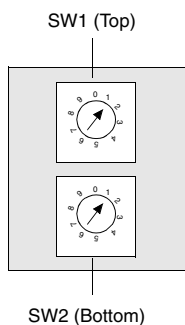
LED Descriptions		
LEDS	Color	Indication when On
Ready	Green	The module has passed power-up diagnostics.
Fault	Red	A communications error exists between the DIO module and one or more I/O modules or an output module is not being written to over the Modbus Plus network.
Pwr ok	Green	Bus power is present.
Modbus +	Green	Communications are active on the Modbus Plus port.
Error A	Red	Communication error on the Modbus Plus Channel A (dual cable only).
Error B	Red	Communication error on the Modbus Plus Channel B (dual cable only).



## Rear Panel Switches

Two rotary switches (refer to the illustration and table that follow) are located on the rear panel of the CPU. They are used for setting Modbus Plus node addresses for the unit.

SW1 (the top switch) sets the upper digit (tens) of the address; SW2 (the bottom switch) sets the lower digit (ones) of the address. The illustration shows the correct setting for an example address of 11.



The following table shows the node addresses of the SW1 and SW2 switches.

SW1 and SW2 Switches		
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

**Note:** If "0" or an address greater than 32 is selected, the RIO module displays a flashing Error A and Error B LED to indicate an error condition. Only addresses 1-32 are valid.



---

# Quantum Remote I/O Communication Modules

# 10

---

## At a Glance

### Introduction

Quantum networking modules provide open, standards-based networking and fieldbus connectivity using Modbus, Modbus Plus, Ethernet, InterBus, SY/MAX and LonWorks networks. Specifications for these modules are included below.

### What's in this Chapter?

This chapter contains the following topics:

Topic	Page
140CRP93X00 Remote I/O (RIO) Head Single and Dual Channel Module	226
140CRA93X00 Quantum RIO Adapter Drop Single and Dual Channel Module	230

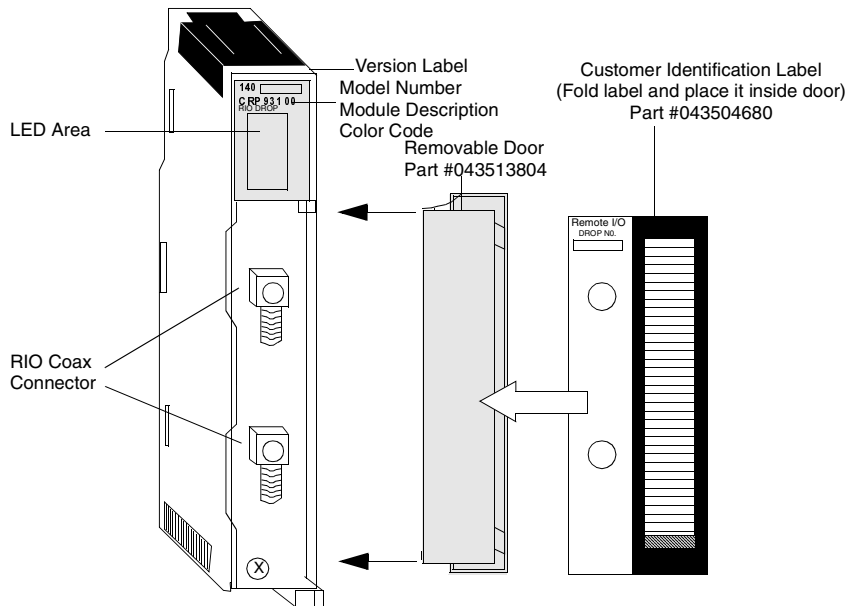
## 140CRP93X00 Remote I/O (RIO) Head Single and Dual Channel Module

### Overview

The Remote I/O Head Single and Dual Channel modules are installed in the same backplane as the system controlling CPU modules. The RIO head is used to transfer data bi-directionally between the CPU and RIO drop modules installed in separate backplanes. A coaxial cable network is used to interconnect the RIO head module and one or more RIO drop modules.

### RIO Head Module

The following figure shows the Remote I/O (RIO) module's parts. The specific module illustrated is the 140CRP93200.



**Specifications**

The following table shows the specifications for the Remote I/O Head Single and Dual Channel modules.

<b>Specifications</b>		
<b>Drop Type</b>	Quantum, 200 Series, 500 Series, 800 Series, or SY/MAX (any mix)	
<b>Drops</b>	31 max	
<b>Words/Drop</b>	64 In / 64 Out	
<b>ASCII</b>	2 ports/drop, 32 ports (16 drops) max	
	Requires the use of AS-P892-000, AS-J892-101/102, or AS-J290-0X0 at the RIO drops.	
<b>Coax Termination</b>	Internal 75Ω	
<b>Coax Shield</b>	Tied to chassis ground	
<b>Data Transfer Rate</b>	1.544 mb	
<b>Dynamic Range</b>	35 dB	
<b>Isolation</b>	500 Vdc coaxial cable center conductor to ground	
<b>External Connections</b>		
One Channel (CRP93100)	One "F" type female connector with a right angle adapter	
Two Channels (CRP93200)	Two "F" type female connectors with a right angle adapter	
<b>General</b>		
Diagnostics	<b>Power Up</b>	<b>Power Up and Runtime</b>
	Dual Port Memory Check	Executive Checksum
	LAN Controller Check	RAM Address/Data
Maximum Number of CRPs Supported by the Controller	1	
Bus Current Required (Typical)	Single Channel: 600 mA	
	Dual Channel: 750 mA	
Power Dissipation (Typical)	Single Channel: 3 W	
	Dual Channel: 3.8 W	



## CAUTION

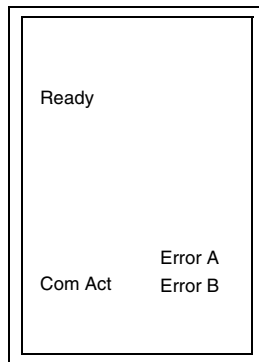
### Connectivity Compliance

To maintain CE compliance with the European Directive on EMC (89/336/EEC), the RIO head module must be connected using quad shielded cable (see the Remote I/O Cable System Planning and Installation Guide, 890USE10000, V2.0).

**Failure to follow this precaution can result in injury or equipment damage.**

### LED Indicators and Descriptions

The following figure shows the LED indicators for the RIO Head module.



The following table shows the LED descriptions for the RIO Head module.

LED Descriptions		
LEDS	Color	Indication When On
Ready	Green	The module has passed powerup diagnostics.
Com Act	Green	The module is communicating on the RIO network.
Error A	Red	There is a loss of communication on Channel A with one or more of the drops.
Error B	Red	There is a loss of communication on Channel B with one or more of the drops (dual cable only).

**LED Error Codes** The Blinking Com Act LED error codes for the RIO Head module table show the number of times the Com Act LED on the RIO Head module blinks for each type of error and the crash codes for each (all codes are in hex).

LED Error Codes		
Number of Blinks	Code	Error
Slow (steady)	0000	Requested Kernel Mode
2	6820	hcb frame pattern error
	6822	head cntrl blk diag error
	6823	mod personality diag error
	682A	fatal start I/O error
	682B	bad read I/O pers request
	682C	bad execute diag request
	6840	ASCII input xfer state
	6841	ASCII output xfer state
	6842	I/O input comm. state
	6843	I/O output comm. state
	6844	ASCII abort comm. state
	6845	ASCII pause comm. state
	6846	ASCII input comm. state
	6847	ASCII output comm. state
	6849	building 10 byte packet
	684A	building 12 byte packet
684B	building 16 byte packet	
684C	illegal I/O drop number	
3	6729	984 interface bus ack stuck high
4	6616	coax cable initialization error
	6617	coax cable dma xfer error
	6619	coax cable dumped data error
	681A	coax cable DRQ line hung
	681C	coax cable DRQ hung
5	6503	ram address test error
6	6402	ram data test error
7	6300	prom checksum error (Exec not loaded)
	6301	prom checksum error
8	8001	Kernal prom checksum error
	8002	Flash prog / erase error
	8003	Unexpected executive return

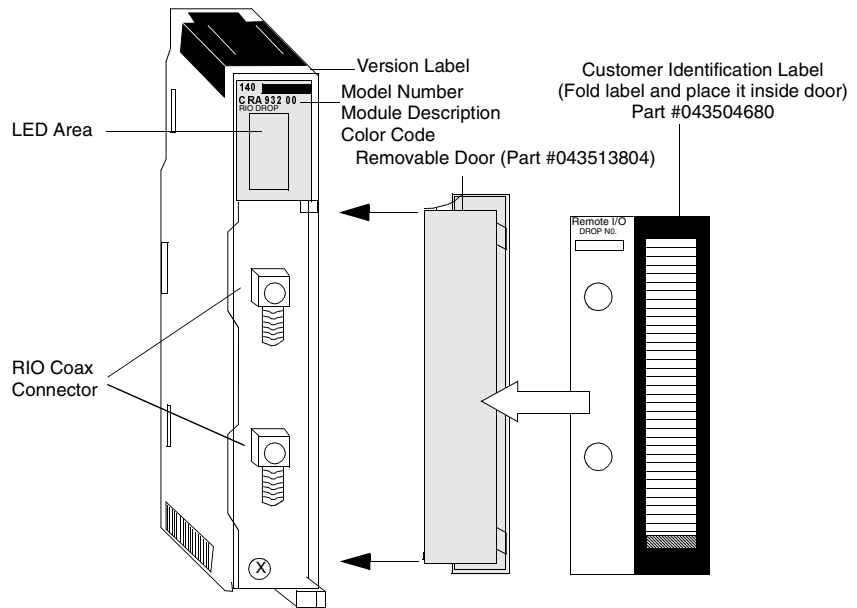
## 140CRA93X00 Quantum RIO Adapter Drop Single and Dual Channel Module

### Overview

The Remote I/O Drop Single and Dual Channel modules are used to transfer data bi-directionally over a coaxial cable network between I/O modules installed in the same (RIO drop) backplane and the RIO head installed in the CPU backplane.

### RIO Drop Module

The following figure shows the components of the Remote I/O (RIO) drop module. The specific module shown is the CRA93200.





**Specifications**

The following table shows the specifications for the Remote I/O Drop Single and Dual Channel modules.

<b>Specifications</b>		
I/O Type	Quantum	
Words/Drop	64 In / 64 Out	
Coax Termination	Internal 75 $\Omega$	
Coax Shield	Capacitor to ground	
Data Transfer Rate	1.544 mb	
Dynamic Range	35 dB	
Isolation	500 Vdc coaxial cable center conductor to ground	
<b>External Connections</b>		
One Channel (CRA93100)	One "F" type female connector with a right angle adapter	
Two Channels (CRA93200)	Two "F" type female connectors with a right angle adapter	
<b>General</b>		
Holdup Time	Software configurable <b>Note:</b> In the event of a communication loss with the remote processor, this is the time that output modules will retain their last operating state. Input module data will be held in the system controlling CPU. After this time, output modules will assume their predefined time-out states, and inputs will be zeroed by the CPU.	
<b>Diagnostics</b>	<b>Power Up</b>	<b>Power Up and Runtime</b>
	Dual Port Memory Check	Executive Checksum
	LAN Controller Check	RAM Address/Data
Bus Current Required (Typical)	Single Channel: 600 mA	
	Dual Channel: 750 mA	
Power Dissipation (Typical)	Single Channel: 3 W	
	Dual Channel: 3.8 W	



## CAUTION

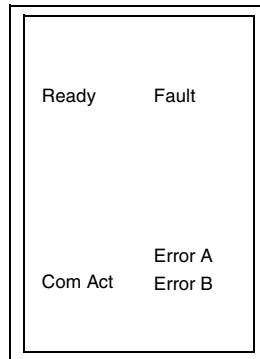
### Connection Compliance

To maintain CE compliance with the European Directive on EMC (89/336/EEC), the RIO Head module must be connected using quad shielded cable (see the Remote I/O Cable System Planning and Installation Guide, 890USE10100, V2.0).

**Failure to follow this precaution can result in injury or equipment damage.**

### LED Indicators and Description

The following figure shows the LED indicators for the Drop module.



The following table shows the RIO Drop module LED descriptions.

LED Descriptions		
LEDS	Color	Indication when On
Ready	Green	The module has passed power-up diagnostics.
Com Act	Green	The module is communicating on the RIO network.
Fault	Red	Unable to communicate with one or more I/O modules.
Error A	Red	Communication error on Channel A.
Error B	Red	Communication error on Channel B (dual cable only).

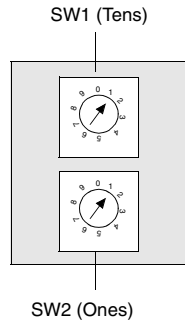
**LED Error Codes** Blinking Com Act LED error codes for the RIO Drop module table show the number of times the Com Act LED on the RIO Drop module blinks for each type of error and the crash codes for each (all codes are in hex).

<b>LED Error Codes</b>		
<b>Number of Blinks</b>	<b>Code</b>	<b>Description of Error</b>
3	6701H	asic test failure
4	6601H	power down interrupt
	6602H	82588 lan chip test error
	6603H	receive abort timeout
	6604H	transmission loop timeout
	6605H	transmission dma error
	6606H	cable a initialization error
	6607H	cable a dma xfer error
	6608H	cable b dma xfer error
	6609H	cable a dumped data error
	660AH	cable a DRQ line hung
	660BH	cable b DRQ line hung
	660CH	cable a or b DRQ hung
	660DH	power-up lan controller error
5	6501H	ram address test error
6	6401H	ram data test error
7	6301H	prom checksum error

## Rear Panel Switches

Two rotary switches are located on the rear panel of the RIO Drop Modules and are used for setting RIO drop addresses (refer to the following illustration and table).

SW1 (top switch) sets the upper digit (tens); SW2 (bottom switch) sets the lower digit (ones). The illustration below shows the correct setting for an example address of 11.



The following table shows the node addresses of the SW1 and SW2 switches.

SW1 and SW2 Address Settings		
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

**Note:** If "0" or an address greater than 32 is selected, the module displays a flashing ERROR A and ERROR B LED indicating an error condition. Only addresses 2 - 32 are valid.

# Quantum Modbus Plus Network Option Modules

11

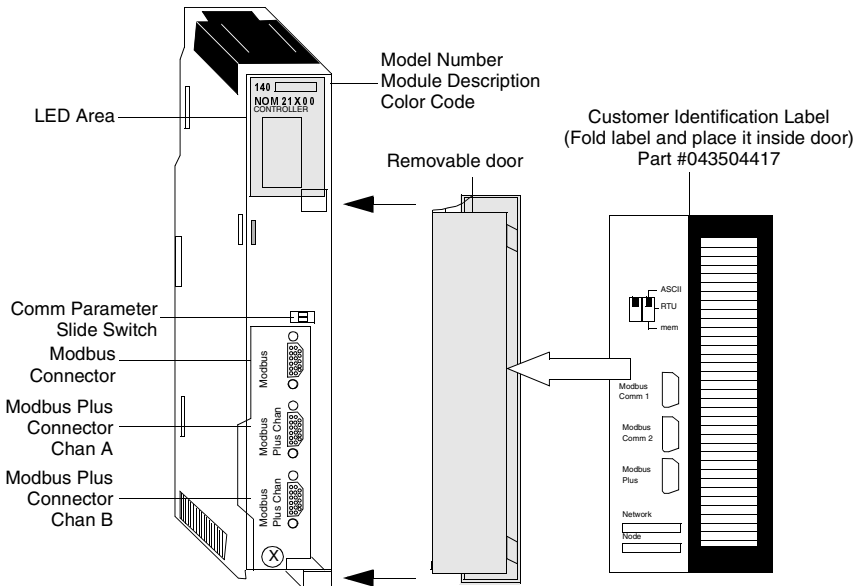
## 140NOM21X00 Quantum Modbus Plus Network Option Modules

### Overview

The following information describes the single and dual channel twisted-pair cable NOM21X00 modules, which provide interface to Modbus Plus networks.

### Modbus Plus Module

The following figure shows the components of the Modbus Plus 140NOM21X00 modules.



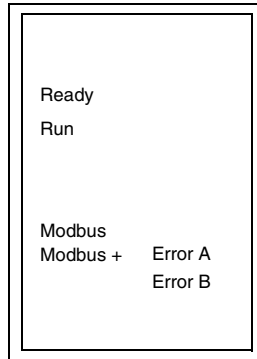
**Specifications**

The Modbus Plus Head Single and Dual Channel modules provide extended communication capabilities for the Quantum system within a Modbus Plus configuration. The following table shows the specifications show the Modbus Plus single and dual channel modules.

<b>Specifications</b>		
<b>Communication Ports</b>		
NOM21100	1 Modbus Plus network (RS-485) port (9-pin connector)	
NOM21200	2 Modbus Plus network (RS-485) ports (9-pin connectors) for dual connectivity on a single Modbus Plus network. These ports handle identical versions of all inbound and outbound transactions and keep track of the data paths used for these transactions.	
Both Modules	1 Modbus (RS-232) serial port (9-pin connector)  A bridge mode capability in the module permits a panel device connected to this port to access nodes on the Modbus Plus network or to access the local PLC directly without having to go out onto the network.	
<b>Diagnostics</b>	<b>Power Up</b>	<b>Runtime</b>
	RAM	RAM
	RAM Address	RAM Address
	Executive Checksum	Executive Checksum
	Processor	
<b>Power Dissipation (Typical)</b>	4 W	
<b>Bus Current Required</b>		
NOM21100	780 mA	
NOM21200	780 mA	

## LED Indicators and Descriptions

The following figure shows the Modbus Plus NOM LED indicators.



The following table shows the Modbus Plus NOM LED Descriptions.

LED Descriptions		
LEDs	Color	Indication when On
Ready	Green	The module has passed power-up diagnostics.
Run	Green	Indicates that the unit is in kernel mode—should always be OFF during normal operations.
Modbus	Green	Indicates communication is active on the single RS-232 serial port.
Modbus+	Green	Indicates communication is active on the Modbus Plus port.
Error A	Red	There is an error condition on Cable A of a dual cable Modbus Plus network (140NOM21200 only).
Error B	Red	There is an error condition on Cable B of a dual cable Modbus Plus network (140NOM21200 only).

**LED Error Codes** The blinking Run LED error codes for the NOM module shows the number of times the Run LED on the NOM module blinks for each type of error and the crash codes for each (all codes are in hex).

<b>LED Error Codes</b>		
<b>Number of Blinks</b>	<b>Code</b>	<b>Error</b>
Steady	014H	normal power down event
2	815	ram sequence error
3	49H	illegal data command received by bypass code
	4BH	diagnostics test pattern invalid in the icb block
	4CH	diagnostics test pattern invalid in the page 0
	4DH	icb address not the same as found in hcb
	4EH	bad code selected for mstrout_sel proc
	52H	config table exec_id is different than the sys table exec_id
	53H	got a pupinit hook for neither S985 nor S975 addr
	56H	did not get bus ack form 984 interface within 400 ms
	59H	unexpected modbus port state in send command to 680 proc
	5AH	system table missing
	5BH	bad DPM critical byte write
4	616h	bad or unexpected interrupt
	617h	loopback error on modbus port 1
	618h	parity error
	619h	set port greater than 21
	61AH	controller ram size is less than 8k
	621H	modbus cmd-buffer overflow
	622H	modbus cmd-length is zero
	623H	modbus abort command error
	624H	bad modbus state trn-int
	625H	bad modbus state rcv-int
	626H	bad comm state trn_asc
	627H	transmit underflow error
	628H	bad comm state trn_tru
	629H	bad comm state rcv_asc
	62aH	bad comm state rcv_rtu
	62bH	bad transmit comm state
	62cH	bad receive comm state
62dH	bad modbus state tmr0_evt	

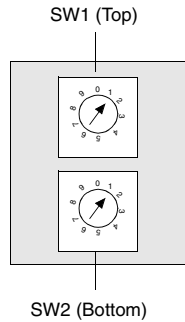


<b>LED Error Codes</b>		
<b>Number of Blinks</b>	<b>Code</b>	<b>Error</b>
	62eH	bad uart interrupt
	631H	UPI timeout error
	632H	bad UPI response opcode
	633H	UPI bus diagnostic error
	634H	mbp bus interference error
	635H	bad mbp response opcode
	636H	timeout waiting for mbp
	637H	mbp out of synchronization
	638H	mbp invalid path
	639H	peer did not respond with complement of the opcode
	63AH	peer unable to come out of transitions at power-up
	681h	bad master state
	682h	bad slave state
	683h	unknown routing failure to send
	684h	bad port number in set () proc
	685h	bad port number in reset () proc
	686h	bad port number in getport () proc
	687h	bad port number in bitpos () proc
	688h	bad port number in enable_transmit_interrupt () proc
	689h	bad port number in enable_receive_interrupt () proc
	68ah	bad port number in disable_transmit_interrupt () proc
	68bh	bad port number in
	691h	privilege flag is not reset in the session timeout proc
	692h	bad port number in chkfst_hdw () proc
	6A1h	unknown controller type in reset busy flag
	6A2h	unknown function code in generate_poll_cmd () proc
	6A3h	unknown function code in generate_logout_msg () proc
	6A4h	slave link timeout on port other than port #9
	6A5h	illegal bypass command received by bypass code
5	513h	ram address test error
6	412h	ram data test error
7	311h	prom checksum error

**Rear Panel Switches**

Two rotary switches are located on the rear panel of the modules. They are used together to set the Modbus Plus node and Modbus port address for the unit.

**Note:** The highest address that may be set with these switches is 64. Rotary SW1 (top switch) sets the upper digit (tens), and rotary SW2 (bottom switch) sets the lower digit (ones) of the Modbus Plus node address. The illustration below shows the setting for an example address of 11.



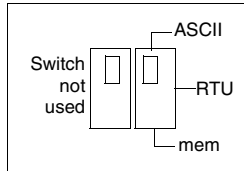
**Note:** If "0," or an address greater than 64 is selected, the Modbus + LED will be "on" steady, to indicate the selection of an invalid address.

The following table shows the address settings for the SW1 and SW2 switches.

<b>SW1 and SW2 Address Settings</b>		
<b>Node Address</b>	<b>SW1</b>	<b>SW2</b>
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	1 ... 4

## Front Panel Switches

Two, three-position slide switches are located on the front of the unit. The switch on the left is not used. The three-position slide switch on the right is used to select the comm parameter settings for the Modbus (RS-232) port provided with the Modbus Plus option module. Three options are available, as shown in the following illustration.



**Note:** The NOM hardware defaults to bridge mode when the front panel switch is set to RTU or ASCII mode. When networking controllers, a panel device connected to the NOM Modbus port can communicate with the controller to which it is connected, as well as log into any nodes on the Modbus Plus network.

Setting the slide switch to the top position assigns ASCII functionality to the port. The following comm parameters are set and cannot be changed.

ASCII Comm Port Parameters	
Baud	2,400
Parity	Even
Data Bits	7
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the middle position assigns remote terminal unit (RTU) functionality to the port; the following comm parameters are set and cannot be changed.

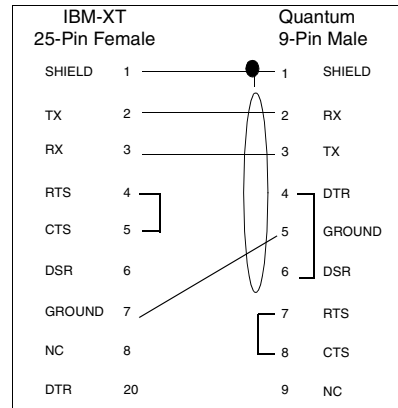
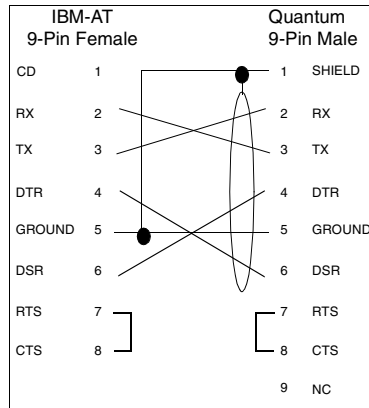
RTU Comm Port Parameters	
Baud	9,600
Parity	Even
Data Bits	8
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the bottom position gives you the ability to assign comm parameters to the port in software; the following parameters are valid.

Valid Comm Port Parameters		
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
Data Bits	7 / 8	
Stop Bits	1 / 2	
Parity	Enable/Disable Odd/Even	
Device Address	Rear panel rotary switch setting	

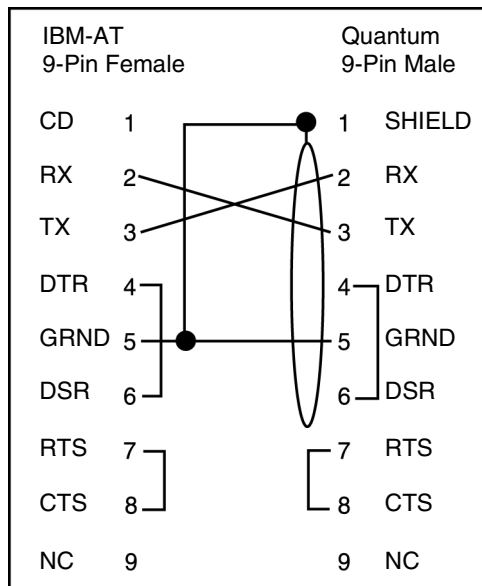
**Modbus Connector Pinouts**

The NOM modules are equipped with a nine-pin RS-232C connector that supports Modicon’s proprietary Modbus communication protocol. The following figure shows the Modbus port pinout connections for 9-pin (left) and 25-pin (right) connections.



**Modbus Ports  
Pinout  
Connections for  
Portable  
Computers**

The following figure shows the Modbus port pinout connections for nine-pin portable (laptop) computers.



The following is the abbreviation key for the above figures.

TX: Transmitted Data	DTR: Data Terminal Ready
RX: Received Data	CTS: Clear to Send
RTS: Request to Send	NC: No Connection
DSR: Data Set Ready	CD: Carrier Detect



---

# Quantum Modbus Plus Networking on Fiber Module

12

---

## 140NOM25200 Quantum Networking Modbus Plus on Fiber Module

---

### Overview

The following information pertains to the Modbus Plus on Fiber module, 140NOM25200. The Modbus Plus on Fiber module provides connectivity to Modbus Plus nodes by fiber cable.

There are many benefits that result from the use of fiber optics. Some of these include:

- Longer distances between nodes (up to 3 km), thereby, increasing the total length of the network.
- Fiber optic medium is not susceptible to the effects of electromagnetic interference, RF interference, and lightning.
- Intrinsically safe links that are required in many hazardous industrial environments.
- Total electrical isolation between terminal points on the link.

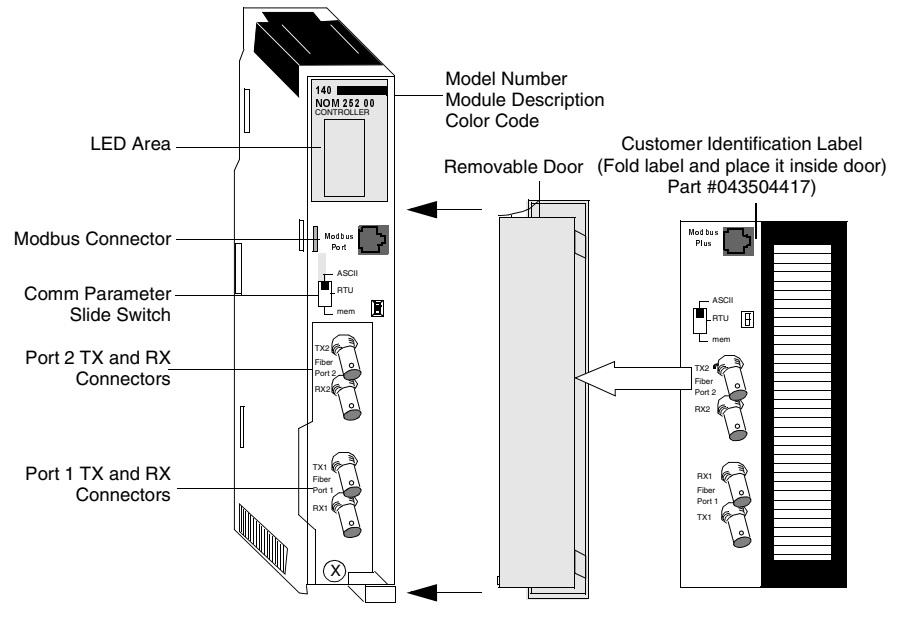
### Related Documentation

For more detailed information on fiber optic network repeaters, see the *Fiber Repeater User Guide* (GM-FIBR-OPT).

---

### Modbus Plus on Fiber Module

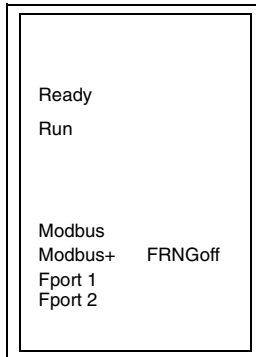
The following figure shows the parts of the Modbus Plus 140NOM25200 module.





## LED Indicators and Descriptions

The following figure shows the Modbus Plus on Fiber LED indicators.



The following table shows the Modbus Plus on Fiber LED descriptions.

LED Descriptions		
LEDs	Color	Indication when On
Ready	Green	The module has passed powerup diagnostics.
Run	Green	Indicates that the unit is in kernel mode – should always be OFF during normal operations. <b>Note:</b> The table for the NOM 21X 00 shows the number of times the RUN LED on the Modbus Plus on Fiber Module blinks for each type of error and the crash codes for each (all codes are in hex).
Modbus	Green	Indicates communication is active on the single RS-232 serial port.
Modbus+	Green	Indicates communication is active on the Modbus Plus port.
Fport1	Green	Indicates an optical signal has been received on fiber optic Port 1.
Fport2	Green	Indicates an optical signal has been received on fiber optic Port 2.
FRNGoff	Red	Indicates the first break in a self healing ring.

## Specifications

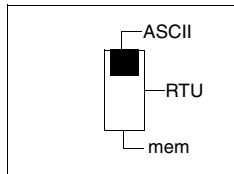
The following table shows the specifications for the NOM25200 module.

Specifications	
General Communication Ports	
Optical Ports	2 (consisting of an optical receiver and transmitter)
Modbus Port	1 RJ45 (phone jack-type) connector
Transmission/Data Rate	1 Mbit/second for Modbus Plus with Bi-Phase S encoded data
Optical Interface	ST-Type connectors
Pulse Width Distortions and Jitter	5 ns or better

<b>Specifications</b>		
Wavelength	820 nm	
Power Loss Budget (includes 3 dB of system margins).	50/125 micron fiber - 6.5 dB	
	62.5/125 micron fiber - 11 dB	
	100/140 micron fiber - 16.5 dB	
Maximum Distance for point-to-point connection	2 km over 50 micron fiber	
	3 km over 62.5 micron fiber	
	3 km over 100 micron fiber	
Maximum System Length in Self Healing Ring Configuration	10 km over 62.5 micron fiber	
<b>Optical Transmitter Specifications</b>		
Optical Power (Measured with 1 m test fiber)	-12.8 ... -19.8 dBm average power in 50/125 micron fiber cable	
	-9.0 ... -16 dBm average power in 62.5/125 micron fiber cable	
	-3,5 ... -10.5 dBm average power in 100/140 micron fiber cable	
Rise/Fall Time	20 ns or better	
Silence (OFF leakage)	-43 dBm	
<b>Optical Receiver Specifications</b>		
Receiver Sensitivity	-30 dBm average power	
Dynamic Range	-20 dB	
Detected Silence	-36 dBm	
<b>Miscellaneous Specifications</b>		
Diagnostics	<b>Power Up</b>	<b>Runtime</b>
	RAM	RAM
	RAM Address	RAM Address
	Executive Checksum	Executive Checksum
	Processor	
Power Dissipation	4 W	
Bus Current Required	750 mA max	
External Power	Not required for this module	

**Front Panel  
Switch**

A three-position slide switch is located on the front of the unit. This switch is used to select the comm parameter settings for the Modbus (RS-232) port. The three options that are available, as shown in the figure below, include setting the slide switch in the top position (ASCII), middle position (RTU), or bottom position (Valid mem comm port parameters).



Setting the slide switch to the top position assigns ASCII functionality to the port. The following table shows the ASCII comm port parameters, which are set and cannot be changed.

<b>ASCII Comm Port Parameters</b>	
Baud	2,400
Parity	Even
Data Bits	7
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the middle position assigns remote terminal unit (RTU) functionality to the port; the following RTU comm parameters are set and cannot be changed.

<b>RTU Comm Port Parameters</b>	
Baud	9,600
Parity	Even
Data Bits	8
Stop Bits	1
Device Address	Rear panel rotary switch setting

Setting the slide switch to the bottom position gives you the ability to assign comm parameters to the port in software. The following parameters are valid.

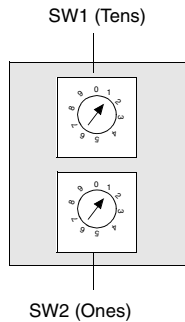
<b>Valid Mem Comm Port Parameters</b>		
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
	Data Bits	7 / 8
Stop Bits	1 / 2	
Parity	Enable/Disable Odd/Even	
Device Address	Rear panel rotary switch setting	

## Rear Panel Switches

Two rotary switches are located on the rear panel of the modules. They are used together to set the Modbus Plus node and Modbus port address for the unit.

**Note:** The highest address that may be set with these switches is 64.

Rotary SW1 (top switch) sets the upper digit (tens), and rotary SW2 (bottom switch) sets the lower digit (ones) of the Modbus Plus node address. The following illustration shows the setting for an example address of 11.



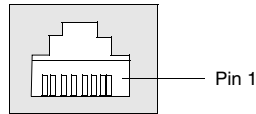
The following figure shows the node address settings for the SW1 and SW2 switches.

SW1 and SW2 Address Settings		
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	1 ... 4

**Note:** If "0" or an address greater than 64 is selected, the Modbus + LED will be "on" steady, to indicate the selection of an invalid address.

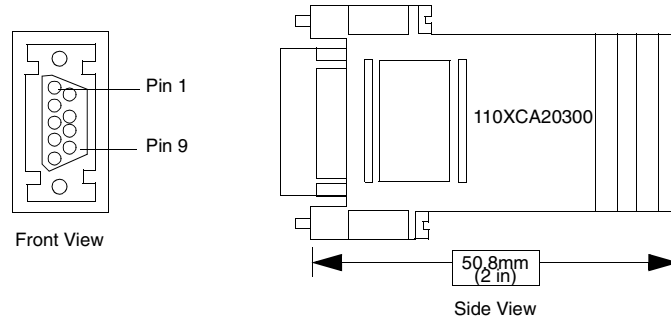
**Modbus Connector**

The NOM25200 module is equipped with an RS-232 port (see below) located on the front of the module. This port uses an eight-position RJ45 (phone jack-type) connector. The following figure shows the NOM25200 Pin 1 connector.



**Note:** A D-shell adapter is available from Modicon for NOM 252 00-to-computer connections: a (110 XCA 20 300) 9-pin adapter for PC-AT type computers (see the illustration pinout table below).

The following figures show the 9-pin adapter front view (left) and side view (right).

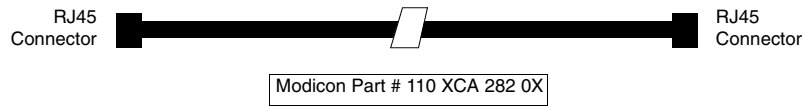


The following figure shows the 9-pin RJ45 connector schematic.

Connectors Pinouts	
RJ45 Connector	9-pin D-shell
1	1 DCD
TXD 3	2 RXD
RXD 4	3 TXD
DSR 2	4 DTR
GND 5	5 GDN
	6 DRS
CTS 7	7 RTS
RTS 6	8 CTS
	9 RI
Chassis Ground 8	Case of the Connector

**RJ45 Cable  
Types**

This following figure shows the RJ45 connector, Modicon Part #110XCA2820X cable. The table provides part numbers and cable lengths.

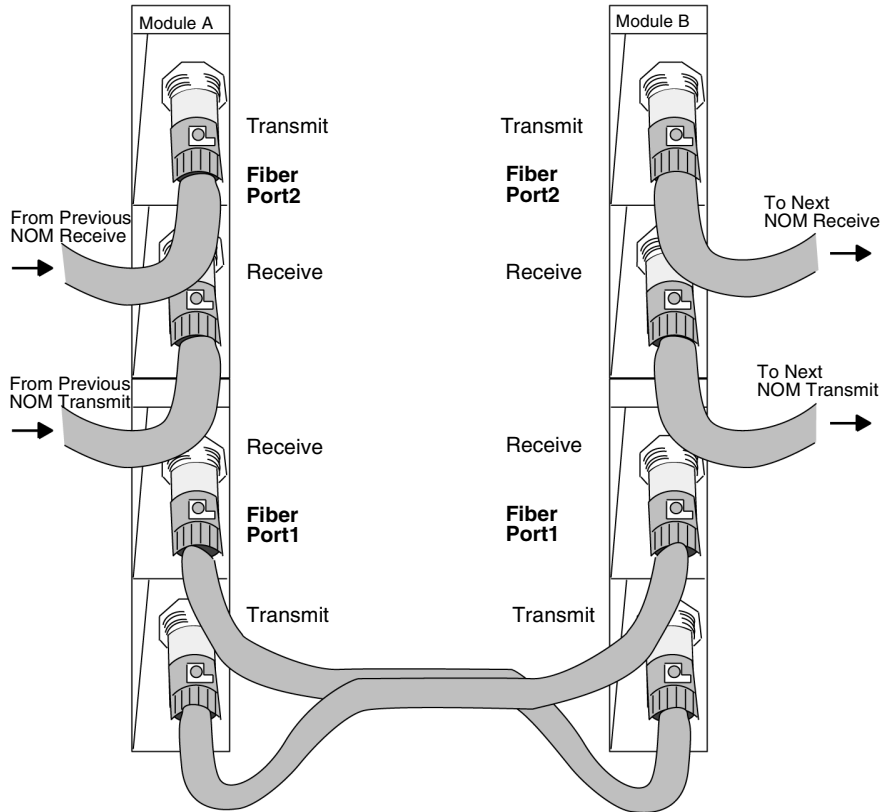


<b>Cable Part Numbers</b>	<b>Cable Lengths</b>
110XCA28201	3 ft. (0.91 m)
110XCA28202	10 ft. (3 m)
110XCA28203	20 ft. (6 m)

**Fiber Optic Cable Connections**

The NOM25200 module is connected in the Quantum system by a fiber optic cable (see the following figure). The cable has two strands. Each module transmits a signal in one direction. For this reason, each strand must be connected to the transmit port on one module and the receive port on the other.

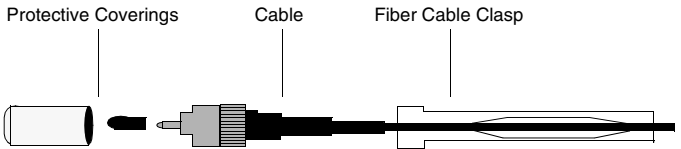
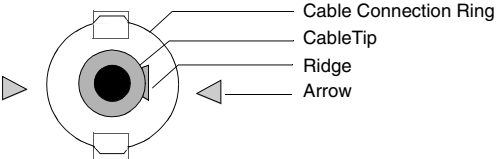
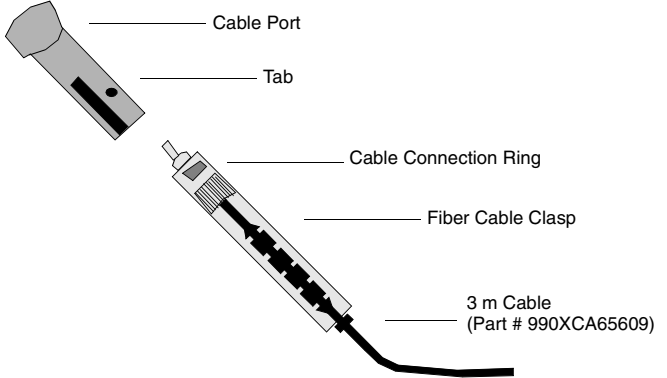
One strand of the fiber optic cable is labelled every 10 inches with the manufacturer's name and the cable specifications. This is the only way to distinguish the two strands.





**Connecting the Fiber Optic Cable**

The following steps show how to connect the fiber optic cable.

Step	Action
1	<p>Remove the protective plastic coverings from the cable ports and the tips of the cable. Snap one of the fiber cable clasps (shipped with the module) over the cable so that the wider end of the tool is closest to the cable end.</p>  <p>Protective Coverings      Cable      Fiber Cable Clasp</p>
2	<p>Turn the connection ring so that one of the arrows on the side of the ring lines up with the ridge inside.</p>  <p>Cable Connection Ring Cable Tip Ridge Arrow</p>
3	<p>a. Slide the tool up to the connection ring. b. Gripping the cable with the plastic cable clasp, slide the cable end onto the lower cable port. The arrow and the ridge on the connection ring should lineup with the slot on the left of the cable port. c. Use the clasp to push the cable over the tab on top of the port. d. Turn the cable to the right, so that the tab locks securely e. Remove the clasp. f. Repeat this process with the remaining strand of cable.</p>  <p>Cable Port Tab Cable Connection Ring Fiber Cable Clasp 3 m Cable (Part # 990XCA65609)</p>

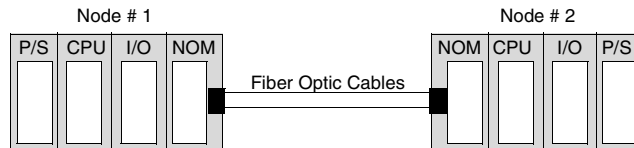
## Fiber Optic Configurations

The following represent four typical configurations that show the wide range of the network architecture:

- Point-to-Point connection
- Bus configuration
- Tree and Star configurations
- Self Healing Ring configuration

## Point-to-Point Configuration

Point-to-point configuration (see the following figure) allows communication over the distance of up to 3 km through harsh industrial environments. The following figure shows the point-to-point configuration.



## Bus Configuration

This type of configuration is used when it is required to connect a number of fiber nodes and can be used to increase the distance of a standard Modbus Plus network by changing to a fiber medium. This kind of network allows the connection of up to 32 Quantum NOM252 nodes over the distance of 5 km.

The following illustrations show the NOM25200 module in a mixed fiber optic/twisted pairs bus configuration network and a pure fiber optic bus configuration network.



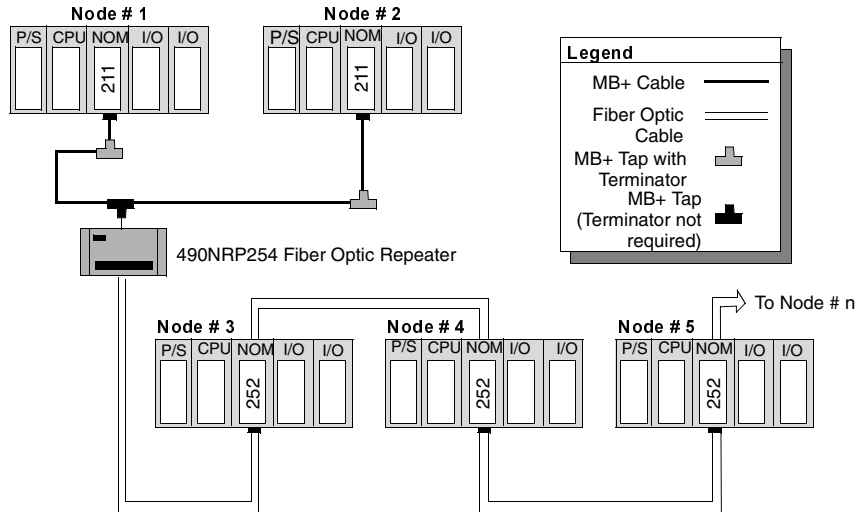
## CAUTION

### Equipment Failure

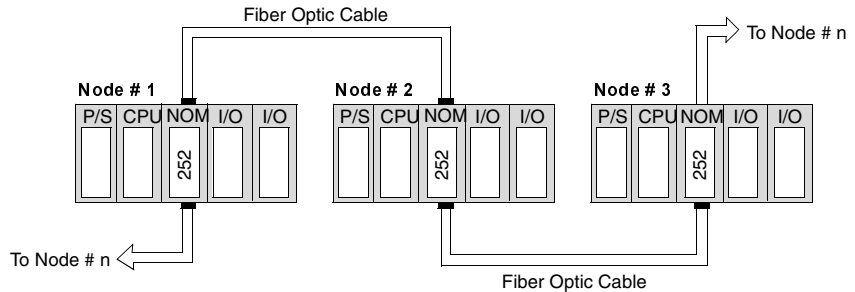
The loss of a single node in this configuration disables the rest of the network. It is suggested that the Self Healing Ring configuration be used to avoid this problem.

**Failure to follow this precaution can result in injury or equipment damage.**

The following figure shows the mixed fiber optic/copper network.



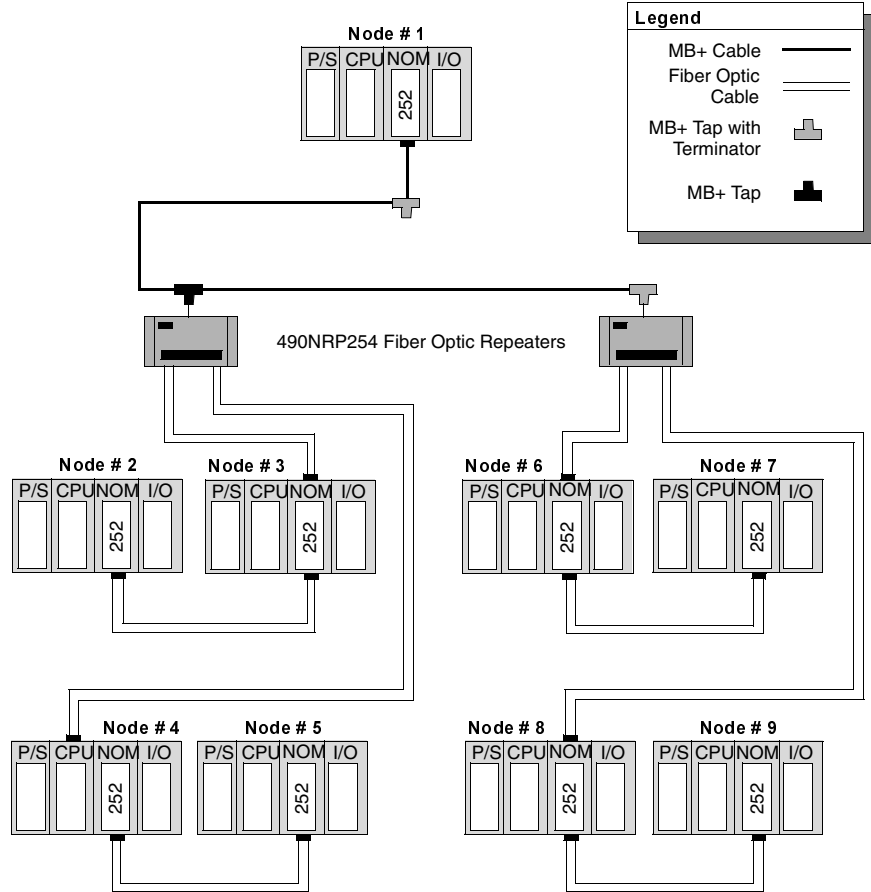
The following figure shows the pure fiber optic network.



**Note:** The distance between nodes on fiber is limited by the maximum allowable power loss from end-to-end (3 km over 62.5 mm fiber). Power loss includes the fiber optic cable attenuation, connector losses at the Fiber Optic Receiver and Transmitter ports, and the system margin of 3 dB. The end NOM25200 in this configuration will have the FRNGoff LED active and will display the Cable B Framing error in the MBPSTAT (in ladder logic).

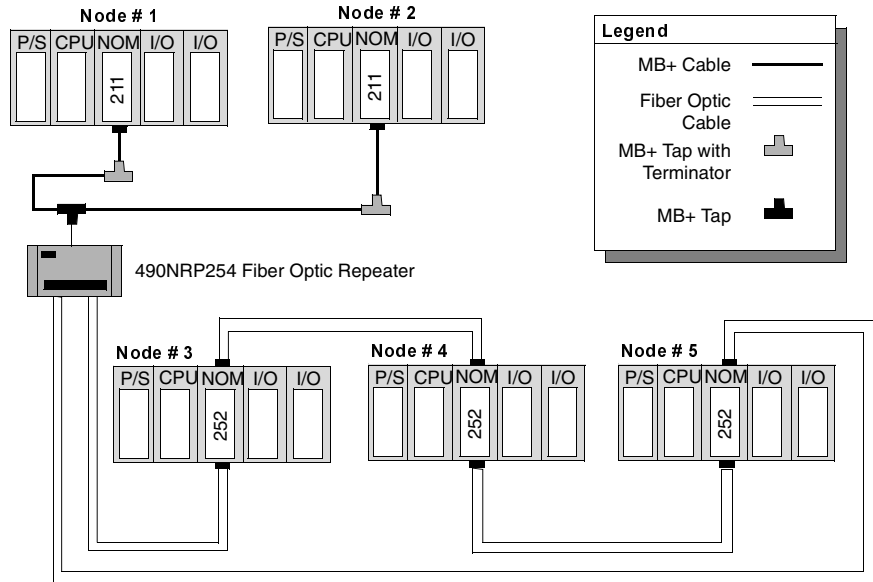
**Tree Configuration**

The use of a tree configuration can provide flexibility in the layout of Modbus Plus and NOM 25200 networks. The following illustration shows an example of a tree configuration. Additional repeaters can be connected in order to extend communication between electrical links.



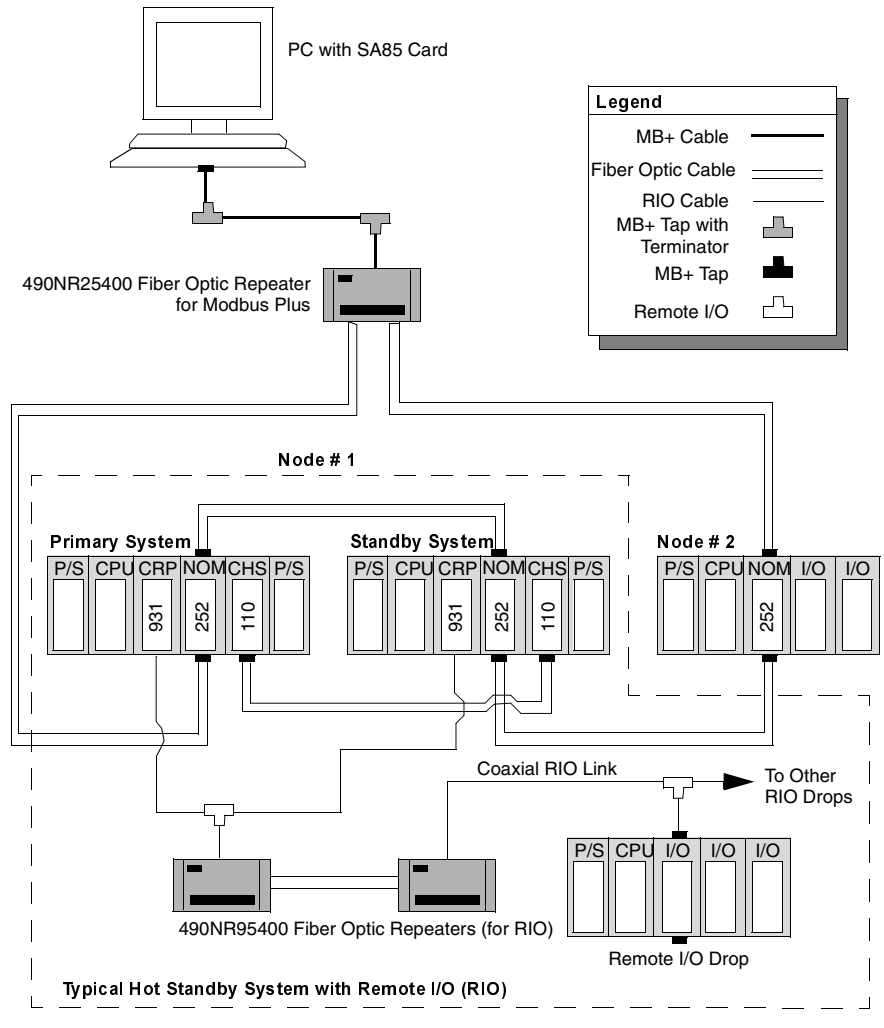
**Self Healing Ring Configuration**

This configuration can be achieved by connecting the unused fiber optic ports of the first and last NOM25200 directly or through the fiber optic repeater, if a mixed fiber optic/twisted pairs network is used. This type of connection has all the advantages of the previously described configurations, along with built-in redundancy. A broken connection between any two Quantum modules in the ring will automatically reconfigure the network to the Bus Configuration and continue the communication.



**Hot Standby Systems**

The following figure shows the self healing ring configuration for hot standby systems example.



**Network Status** The information about the condition of the network is presented in the form of Network Status. This information indicates the loss of connection (the first break in the self healing ring) and is similar to the way existing 140NOM21200 reports the loss of redundant cable.

The break of the fiber cable will be detected by the module not receiving the signal from the side where the cable is broken and will be reported as a Cable B Framing error by MBPSTAT. This condition will also activate the FRNGoff LED on the front of the module.

**Recommended Materials for Fiber Optic Links** Modicon does not manufacture fiber optic products such as cables, connectors, or special tools. However, we have experience with third party suppliers of materials and can give some guidelines on what will work with our products.

**Connectors** The following table shows the connector types

Connector Type	Part Number	Operating Temperature
ST Bayonet (Epoxy)	3M 6105	-40 ... +80° C
ST Bayonet (Hot Melt)	3M 6100	-40 ... +60° C
ST Bayonet (Epoxy)	AMP 501380-5 Series	-30 ... +70° C
ST Bayonet (Epoxy)	AMP 503415-1 Series	-20 ... +75° C
Light_Crimp ST Style	AMP 503453-1 Series	-20 ... + 60° C
Mechanical Line Splice (one size fits all)	3M 2529 Fiberlok1 II	-40 ... +80° C

**Note:** All connectors must have a short boot for strain relief.

**Termination Kits** The following table shows the termination kits.

Kit Type	Part Number	Description
Bayonet ST (Epoxy)	AMP 503746-1	For all epoxy type ST style
Light_Crimp XTC	AMP 50330-2	For all Light_Crimp
Mechanical Line Splice	3M 2530	Fiber Splice Prep Kit, complete with cleaving tool
3M Hot Melt	3M 05-00185 3M 05-00187	110 V Termination Kit 220 V Termination Kit

**Optical Star Passive Couplers** The AMP Model 95010-4 is a pig-tail option and must be used with an enclosure (use AMP Model 502402-4, a 19 in rack-mount enclosure, 1.7 in high).

**Other Tools**

The following table shows other tools that may be needed for fiber optic links.

Product	Part Number	Description/Use
3M (Photodyne) Optical Source Driver	9XT	Hand-held optical source driver (requires a light source)
3M (Photodyne) Optical Light Source	1700-0850-T	850 nm Light Source, ST Connectors for 9XT
3M (Photodyne) Power Meter	17XTA-2041	Hand-held Fiber Optic Power Meter
3M Optical Light Source, 660 nm, visible	7XE-0660-J	Use with 9XT to troubleshoot raw fiber, requires FC/ST patch cord
3M FC/ST Patch Cord	BANAV-FS-0001	Connects FC connector on 7XE to ST
3M Bare Fiber Adapter, ST-compatible	8194	Permits use of above source and meter to test raw fiber (two required)

**Cables**

It is recommended that you use 62.5/125  $\mu\text{m}$  cable (such as AMP 503016-1, AMP 502986-1, or equivalent) with a maximum attenuation of 3.5 dB/km in most of the configurations.

**Note:** Modicon recommends using the 990XCA65609 cable. When passive star couplers are used, 100/140 micron cable (such as AMP503016-3, AMP502986-3, or equivalent) with a maximum attenuation of 5.0 dB/km is recommended because higher optical power can be pumped in 100  $\mu\text{m}$  cable and as a result, greater distance (up to 1 km) between units can be achieved.

**Note:** All cables must have a maximum cable diameter of not more than 3 mm at the terminal side.



---

**Connections**

The following information discusses connecting the NOM25200 on fiber cable, adding a new node to the network, and repairing the break in the cable.

**Note:** When a new network is assembled, it is recommended that you connect all cables before powering up the system. Connect fiber optic cables as described previously in this section.

---

**Adding a New Node to the Network**

If a new node is added to an existing network in order to extend the network (at the end of any configuration), then a new node may be connected first by fiber cable and then hot-swapped to the backplane to avoid errors to the existing network.

If a new node is added to the middle of the network, the fiber optic cables need to be disconnected from one side of the existing NOM252 module and connected to port 1 or 2 of a new node. Additional fiber optic cable then needs to be connected to the second port of the new NOM252 and to the next NOM252 in the network, the new NOM252 then has to be hot-swapped to the backplane.

**WARNING****Hot Swapping Restriction**

Modules may be hot swapped when the area is known to be non-hazardous. Do not hot swap modules in a Class 1, Division 2 environment.

**Failure to follow this precaution can result in death, serious injury, or equipment damage.**

### Repairing the Break in the Cable

Because the NOM25200 will stop transmitting in the direction from which it is not receiving the signal, the replacement of a broken fiber optic cable and the reconnection of it will not re-establish communication over that segment. The hot swap of only one NOM252 at the repaired connections is required to complete the connection.

**Note:** The break of any fiber connectors or fiber optic cables is the equivalent to the break of the trunk cable in a Modbus Plus network on copper.

For the self healing ring configuration, the repair of the first break in the fiber optic network has to be scheduled to the time when one of the units on either side of the repaired break can be hot-swapped without creating the problem by disconnecting the node.

**Note:** Self healing configurations are not considered redundant networks. High system availability can be achieved with redundant networks.

### Calculating Number of Modules in a Fiber Network

Calculate the number of NOM25200 modules in a fiber network using the following method:

Step	Action
1	The total allowable pulse width distortions and jitter are limited to 20% of the bit period and is 200 nsec for the full fiber optic network.
2	The jitter contributed by the NOM252 is 5 nsec max.
3	Jitter contributed by fiber optic repeaters (if used) is 40 nsec.
4	<p>The formula to determine the number (N) of chained repeaters is:</p> $N = \frac{200\text{nsec} - X(L)\text{nsec} - 40\text{nsec}}{5\text{nsec}} + 1$ <p>where "L" is the total cable length (km), and "X" is the jitter (added by the fiber optic cable) in nsec/km:            X = 3 ns/km for 50/125 μm            5 ns/km for 62.5/125 μm            7.5 ns/km for 100/140 μm</p>

---

# Quantum Ethernet Modules

# 13

---

## At a Glance

### Introduction

This chapter provides information on the NOE2X1 TCP/IP, NOE3X1 SY/MAX, NOE5X100 MMS, and NOE771xx Ethernet modules.

### What's in this Chapter?

This chapter contains the following topics:

Topic	Page
140NOE2X100 Quantum Ethernet TCP/IP Module	266
140NOE3X100 Quantum Ethernet SY/MAX Modules	270
140NOE5X100 Quantum Ethernet MMS Modules	273
140NOE771xx Ethernet Modules	276

---

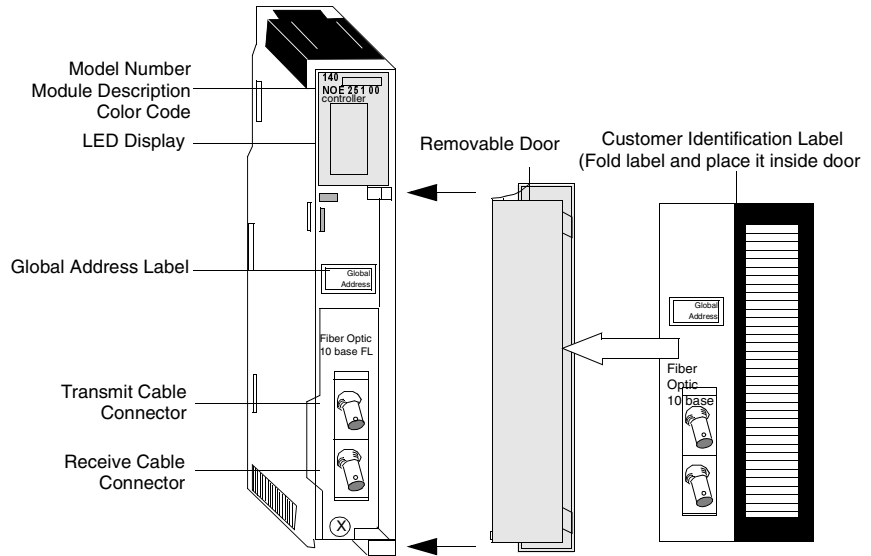
## 140NOE2X100 Quantum Ethernet TCP/IP Module

### Overview

The Quantum NOE2X1TCP/IP is described in this section. This includes specifications for the NOE21 100 and NOE25100 modules.

### Ethernet TCP/IP Module

The following figure shows the Ethernet TCP/IP NOE2X100 module.



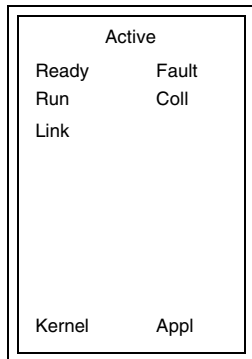
### Specifications

The Ethernet TCP/IP modules for twisted pair and fiber optic cabling provide an interface to Ethernet networks for the Quantum Automation Series system.

Specifications	
<b>Communication Ports</b>	
Ethernet ports transmit and receive Modbus commands encapsulated in TCP/IP protocol: NOE 211 00 1, 10BASE-T Ethernet network (RJ-45) port. NOE 251 00 1, 10BASE-FL Ethernet network (ST-style) port	
Data Transfer Frequency	10 mb
Power Dissipation	5 W
Bus Current Required	1 A
<b>Compatibility</b>	
Programming Software	Modsoft V2.32 or Concept 2.0 at a minimum
Quantum Controllers	All, V2.0 at a minimum

## LED Indicators and Descriptions

The following figure shows the NOE2X100 LED indicators.



The following table describes the meaning of each NOE2X100 LED indicator.

LED Descriptions		
LEDs	Color	Indication when On
Active	Green	Module is communicating with backplane.
Ready	Green	Module has passed internal diagnostic tests.
Run	Green	Flashes during normal operation.
Link	Green	Ethernet link to hub is ok.
Kernel	Amber	If steady, module is operating in kernel mode. If flashing, module is waiting for download.
Fault	Red	An error has been detected, a download has failed or a reset is in process.
Coll	Red	If steady, cable is not connected. If flashing, Ethernet collisions are occurring.
Appl	Amber	Entry exists in crash log.

## Installing the NOE Module

Quantum Ethernet TCP/IP modules come fully configured. However, before installing your module, you should make sure the default configuration is appropriate for your network.

If the module will be communicating on an open network, consult your network administrator to obtain a unique IP network address. You must enter this address in the Modsoft Ethernet TCP/IP configuration extension screen before installing the module.

If the module will be communicating on a local network, make sure the default IP network address is not already in use on that network. To determine the default IP network address, locate the global address label on the front panel of the module. Convert the rightmost eight digits from hexadecimal to decimal. The result should be a decimal number in the form, 84.xxx.xxx.xxx, where each group of xxx is a number from 0 to 255. This is the default IP network address.

### Installation Example: Discovering the Default IP Network Address

The following example shows the steps for discovering the default IP network address.

Step	Action
1	Locate the global address label on the front panel of the module.  <b>IEEE GLOBAL ADDRESS</b>  0000540B72A8
2	Note the rightmost eight digits.  <div style="text-align: center;">           5 4 0 B 7 2 A 8            ┌┐ ┌┐ ┌┐ ┌┐            │ │ │ │            ▼ ▼ ▼ ▼            84.11.114.168         </div>
3	Convert them from hexadecimal to decimal. Each pair of hexadecimal numbers will result in a decimal number between 0 and 255. This is the default IP address.
4	If you use the default IP network address and if your network uses Ethernet II framing and if you do not need to specify the default gateway or a subnet mask, then you may install the module without changing the default configuration.

**CAUTION****System Error**

Do not connect this module to your network until you have ensured that its IP address will be unique on the network.

**Failure to follow this precaution can result in injury or equipment damage.**

**CAUTION****Hardware Restrictions**

The cable for an Ethernet module must be routed through an Ethernet hub for the network to function properly. Do not connect the module directly to another device.

**Failure to follow this precaution can result in injury or equipment damage.**

---

## 140NOE3X100 Quantum Ethernet SY/MAX Modules

### Overview

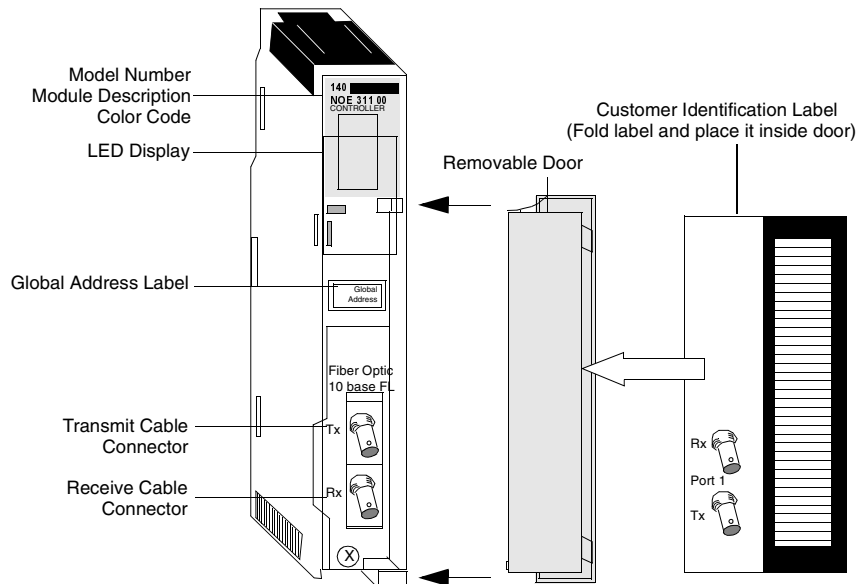
This section includes information for the NOE31100 and 35100 SY/MAX Ethernet modules. The Quantum SY/MAX Ethernet modules for twisted pair and fiber optic cabling provide an interface for the Quantum Automation Series system to SY/MAX devices via Ethernet.

### Related Documentation

For more detailed information, see *Quantum-SY/MAX-Ethernet Module User Guide* (840 USE 111 00).

### Ethernet SY/MAX Module

The following figure shows the NOE3X100 SY/MAX Ethernet modules.



**Note:** The NOE31100 is equipped with one RJ-45 connector instead of the fiber optic connectors (as shown above on the NOE35100).



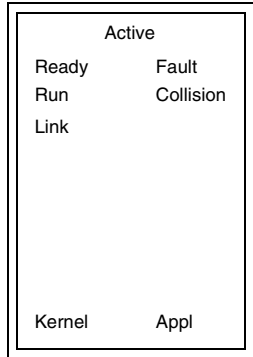
**Specifications**

The following table shows the specifications for the SY/MAX Ethernet modules NOE31100 and 35100.

<b>Specifications</b>	
<b>Communication Ports</b>	
NOE31100	1 10BASE-T Ethernet network (RJ-45) port
NOE35100	2 10BASE-FL Ethernet network (ST-style) ports
<b>Cable Type</b>	
10Base-2 or ThinWire Ethernet	RG58a/u or RG58C/U coaxial (Belden 9907/82907 or equivalent)
10Base-T (twisted pair)	2, 3, 4, or 6 twisted pairs with a solid copper core
<b>Wire Size</b>	
10Base-2 or ThinWire Ethernet	20 AWG
10Base-T (twisted pair)	22, 24, 26 AWG
<b>Topology</b>	
10Base-2 or ThinWire Ethernet	Bus
10Base-T (twisted pair)	Star
<b>Connector</b>	
10Base-2 or ThinWire Ethernet	BNC (UG-274)
10Base-T (twisted pair)	Modular RJ-45 (4 pins of 8 are used by 10Base-T)
Backplane Compatibility (Requires Quantum CPU)	3, 4, 6, 10, and 16 position backplanes
Compatible SY/MAX 802.3 Devices and Software	Model 450 Model 650 SFI160 SFW390-VAX Streamline Version 1.3
Bus Current Required	1 A

**LED Indicators and Descriptions**

The following figure shows the NOE3X100 LED indicators.




The following table describes the meaning of each NOE3X100 indicator.

LED Descriptions		
LEDs	Color	Indication when On
Active	Green	Module is communicating with backplane.
Ready	Green	Module has passed internal diagnostic tests.
Run	Green	Flashes during normal operation.
Link	Green	Ethernet connection is made.
Kernel	Amber	On during download.
Fault	Red	An error condition has occurred.
Collision	Red	If steady, an error condition exists. If flashing, packet collisions are occurring on the network during data transmission.
Appl	Amber	A fatal error has occurred.

**SY/MAX Addressing**

Be sure that the module is assigned a unique SY/MAX drop number during configuration.


WARNING

**Personal injury or equipment damage**

Failure to assign a unique SY/MAX drop number during configuration can cause severe personal injury or equipment damage.

**Failure to follow this precaution can result in death, serious injury, or equipment damage.**

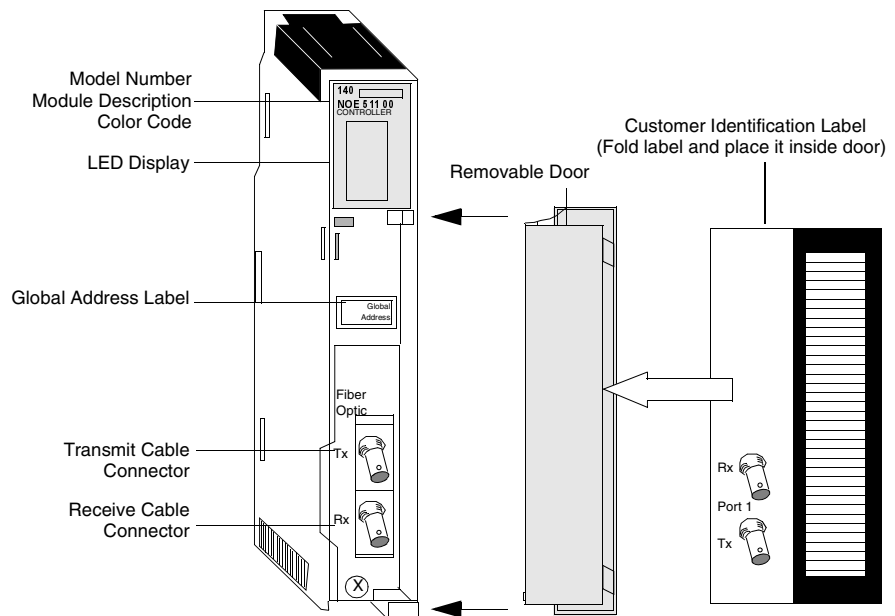
## 140NOE5X100 Quantum Ethernet MMS Modules

### Overview

The section includes information for the NOE5X100 MMS Ethernet modules, NOE51100 and NOE55100. The Quantum MMS Ethernet modules for twisted pair and fiber optic cabling provide an interface for the Quantum Automation Series system to MMS devices via Ethernet.

### Ethernet MMS Module

The following figure shows the NOE5X100 MMS Ethernet modules.



**Note:** The NOE51100 is equipped with one RJ45 connector instead of the fiber optic connectors (as shown above on the NOE55100).

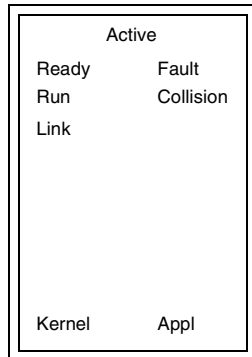
**Specifications**

The following table shows the MMS Ethernet specifications.

<b>Specifications</b>	
<b>Communication Ports</b>	
NOE51100	1 10BASE-T Ethernet network (RJ-45) port
NOE55100	2 10BASE-FL Ethernet network (ST-style) ports
<b>Cable Type</b>	
10Base-2 or ThinWire Ethernet	2, 3, 4, or 6 twisted pairs with a solid copper core
10Base-T (twisted pair)	RG58a/u or RG58C/U coaxial (Belden 9907/82907 or equivalent)
<b>Wire Size</b>	
10Base-2 or ThinWire Ethernet	20 AWG
10Base-T (twisted pair)	22, 24, 26 AWG
<b>Topology</b>	
10Base-2 or ThinWire Ethernet	Bus
10Base-T (twisted pair)	Star
<b>Connector</b>	
10Base-2 or ThinWire Ethernet	BNC (UG-274)
10Base-T (twisted pair)	Modular RJ-45 (4 pins of 8 are used by 10Base-T)
Backplane Compatibility (Requires Quantum CPU)	3, 4, 6, 10, and 16 position backplanes
Data Transfer Frequency	10 mb
Bus Current Required	1 A

## LED Indicators and Descriptions

The following table shows the NOE5X100 LED indicators.



The following table describes the meaning of each NOE5X100 indicator.

LED Descriptions		
LEDs	Color	Indication when On
Active	Green	Module is communicating with backplane.
Ready	Green	Module has passed internal diagnostic tests.
Run	Green	Flashes during normal operation.
Link	Green	Ethernet connection is made.
Kernel	Amber	On during download.
Fault	Red	An error condition has occurred.
Collision	Red	If steady, an error condition exists. If flashing, packet collisions are occurring on the network during data transmission.
Appl	Amber	A fatal error has occurred.

## 140NOE771xx Ethernet Modules

### Overview

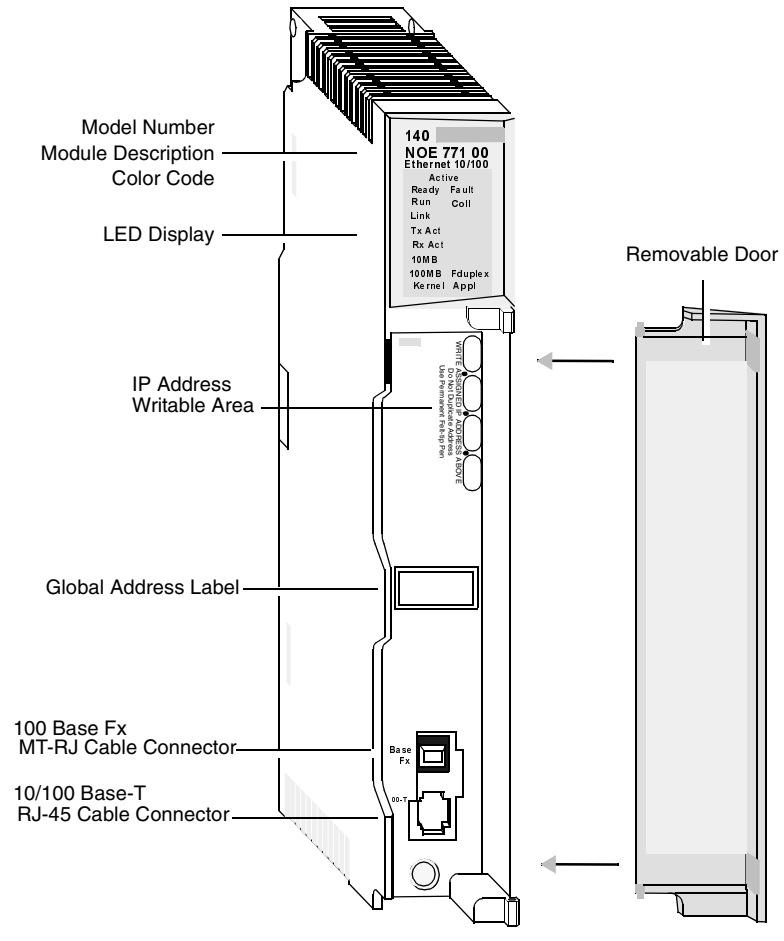
The following provides information on the Quantum ethernet modules 140NOE77100, 140NOE77101, 140NOE77110, and 140NOE77111.

### Related Documentation

Refer to *Quantum NOE 771 xx Ethernet Modules User Guide (840 USE 116 00)* for more detailed information on the installation and use of Quantum ethernet modules.

### Ethernet Module

The following figure shows the NOE77100 Ethernet module. The other NOE771xx Ethernet modules are the same in appearance except for the model number.



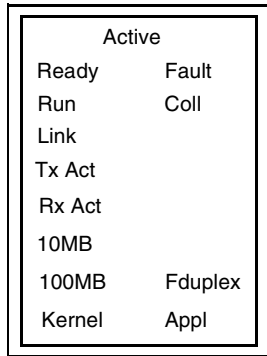
**Specifications**

The main specifications for the Quantum 140NOE771xx Ethernet Modules are described in the following table

<b>Specifications</b>	
Communication Ports	One auto-sensing 10/100Base-T shielded twisted pair (RJ-45 connector) port and one 100Base-FX (MT-RJ connector) port. Both ports transmit and receive Modbus commands encapsulated in TCP/IP protocol. Only one port can be used at a time.
Bus Current Required	750 mA
Power Dissipation	3.8 W
Fuse	None
<b>Programming Software</b>	
Type and version	Concept, Ver. 2.2 or higher (NOE77100/10)
	Concept, Ver 2.5 or higher (NOE77101/11)
	Modsoft, Ver. 2.6 or higher (NOE77100/10)
	ProWORX NxT, Ver 2.1 or higher (NOE77100/10)
	ProWORX NxT, Ver 2.2 or higher (NOE77101/11)
<b>Firmware</b>	
CPU Type and version	Quantum Executive, Ver. 2.0, or higher
NOE Upgradeable	Field Upgradeable via FTP or Programming Panel.
<b>Operating Conditions</b>	
Temperature	0 to +60° C
Humidity	0 to 95% Rh non-condensing @ 60° C
Altitude	15,000 ft (4500 m)
Vibration	10-57 Hz @ 0.0075 mm d.a
	57-150 Hz @ 1 g
<b>Storage Conditions</b>	
Temperature	-40 to +85°C
Humidity	0 to 95% Rh non condensing @ 60°C
Free Fall	1 m unpackaged
Shock	3 shocks / axis, 15 g, 11 ms

**LED Indicators and Descriptions**

The following figure shows the NOE771xx LED indicators.



The following table describes the meaning of each NOE771xx LED indicator.

LED Descriptions		
LED	Color	Description
Active	Green	Indicates the backplane is configured.
Ready	Green	Indicates module is healthy.
Fault	Red	During a crash while going through a reset. If Duplicate IP address is detected. If no link is available. While going through BOOTP sequence.
Run	Green	Flashes to indicate diagnostic code, as described in "Run LED Status" (following table).
Coll.	Red	Flashes when Ethernet collisions occur.
Link	Green	On when Ethernet link is active.
TxAct	Green	Flashes to indicate Ethernet transmission.
RxAct	Green	Flashes to indicate Ethernet reception.
Kernel	Amber	On when in Kernel Mode. Flashing while in download mode.
10MB	Green	On when the module is connected to a 10 Megabit network.
100MB	Green	On when the module is connected to a 100 Megabit network.
Fduplex	Green	On when Ethernet is operating in the full duplex mode.
Appl	Green	On when crash log entry exists.



**Run LED Status** The following table lists each available state of the Run LED indicator and provides diagnostic information for that state

Indicator State	Status
On (steady)	Normal operation: The NOE module is ready for network communication.
<b>Number of flashes in sequence</b>	
one	Not used
two	Not used
three	No Link: the network cable is not connected or is defective.
four	Duplicate IP address: The module will stay off-line.
five	No IP address: The module is attempting to obtain an IP address from a BOOTP server.
six	Using default IP address
seven	No valid executive NOE present
eight	Invalid IP configuration. Likely cause: Default gateway is not on the same subnet mask as the NOE>

**Key Features** The key features of the **140 NOE 771 (-00, -01, -10, -11)** models are listed below:

	-00	-01	-10	-11
HTTP Server	X	X	X	X
FTP Server	X	X	X	X
Flash File System	X	X	X	X
BOOTP Client	X	X	X	X
BOOTP Server	X	X	X	X
SNMP V2 Agent	X	X	X	X
MODBUS Messaging	X	X	X	X
I/O Scanner	X	X		X
Hot Standby	X	In Version 2.0	X	In Version 2.0
Global Data - Publish / Subscribe		X		X
Bandwidth Monitoring		X		X
Faulty Device Replacement (DHCP Server)		X		X
Enhanced Web Diagnostics		X		X
Schneider Private MIB		X		X
FactoryCast Application			X	X
User Programmable Web Pages			X	X

## MODBUS I/O Scanner

The functionality of the NOE771xx module is further enhanced by the addition of a MODBUS I/O Scanner that can be configured with either the Modsoft, Concept, or ProWorx programming panel. This allows the user a means to transfer data between network nodes without using the MSTR instruction.

The NOE771 MODBUS I/O Scanner can be configured by either of the following two methods:

- Peer Cop (Available on NOE77100 only)
- Ethernet I/O Scanner

**Note:** It is recommended that the enhanced MODBUS I/O Scanner be used for all new installations. Peer Cop functionality is provided only as an easy migration path for an existing installation. The enhanced MODBUS I/O Scanner provides greater functionality than the Peer Cop based I/O scanner.

## Peer Cop Based I/O Scanner

The following table lists the characteristics of the Peer Cop based MODBUS I/O Scanner, which is available only on the NOE77100.

Parameter	Value
Max. No. of Devices	64
Max. No. of Input Words	500
Max. No. of Output Words	500
HealthTimeout Value	Global Setting (20 Msec to 2 Secs in 20 mSec increments)
Input TimeOutState	Global Setting (Zero or Hold)
IP Address	Derived from MODBUS Address (must be on NOE's Subnet)
Remote Register Reference	Not configurable - 400001 is used

### Enhanced Modbus I/O Scanner

The following table lists the characteristics of the Enhanced based MODBUS I/O Scanner, which is available on the NOE77100, NOE77101, and NOE77111.

Parameter	Value
Max. No. of Devices	128: NOE77100, NOE77101 and NOE77111.
Max. No. of Input Words	4000
Max. No. of Output Words	4000
HealthTimeout Value	Individual Setting (1 Msec to 2 Secs in 1 mSec increments)
Input TimeOutState	Individually Settable
IP Address	Individually Settable
Remote Register Reference	Configurable
Min. Update Rate	Settable

Refer to the *Quantum NOE 771 xx Ethernet Modules User Guide (840 USE 116 00)* to learn how to configure the MODBUS I/O Scanner.

### MODBUS/TCP Server

The following information describes the functionality of the MODBUS/TCP Server.

#### Introduction – Client

All NOE771xx Quantum Ethernet TCP/IP modules provide the user with the capability of transferring data to and from nodes on a TCP/IP network through the use of a communication instruction. All PLCs that support networking communication capabilities over Ethernet can use the MSTR Ladder Logic instruction to read or write controller information or can also use IEC communication blocks.

#### Introduction – Server

All NOE771xx Quantum Ethernet TCP/IP modules provide the user with the ability to access data from the controller using the standard MODBUS/TCP protocol. Any device: PC, HMI package, another PLC, or any MODBUS/TCP compliant device can access data from the PLC. The MODBUS/TCP Server also allows programming panels to log into the controller over Ethernet.

**Limitations**

The NOE771xx supports up to 64 simultaneous MODBUS/TCP Server connections. The NOE771xx allows only one Programming Panel to be logged in at a time to guarantee consistency of changes to the controller configuration.

The following MODBUS/TCP commands are supported by the NOE:

- Read Data
- Write Data
- Read/Write Data
- Get Remote Statistics
- Clear Remote Statistics
- MODBUS 125 Commands (used by programming panels to download a new Exec to the NOE)

**Performance**

The following table shows the performance characteristics of the NOE771xx's MODBUS/TCP Server.

Parameter	Value
Typical Response Time (ms)	0.6
Number of MODBUS connections (Client and Server)	64 (-01, -11) 16 (Client -00) 32 (Server -10)
Number of simultaneous login channels	1

**Note:** NOE771xx MODBUS/TCP performance measurements are made with Quantum 140CPU53414 PLC.

**FTP and HTTP Server**

The following information describes services provided by the FTP and HTTP servers.

**FTP Server**

The NOE771xx's File Transfer Protocol (FTP) Server is available as soon as the module receives an IP address. Any FTP client can log on to the module, if the client uses the correct user name and password.

The FTP Server provides the following services:

- Update the NOE's firmware by downloading a new Exec
- Provides error log visibility by uploading error log files
- Upload/download BOOTP Server and SNMP configuration files

The default user name is USER, and the default password is USERUSER. Both the user name and password are case sensitive. Refer to the *Quantum NOE 771 xx Ethernet Modules User Guide* for instructions about how to change the password, and how to add or delete user names to the FTP Server.

There should be only one FTP client per module.

---

## HTTP Server

The NOE771xx's HyperText Transport Protocol (HTTP) Server is available as soon as the module receives an IP address. It can be used with version 4.0 or greater of either the Internet Explorer or Netscape browser.

The NOE771xx's HyperText Transport Protocol (HTTP) Server allows you to view the following information:

- Module's Ethernet statistics
- Controller and I/O information
- BOOTP/DHCP/FDR (Faulty Device Replacement) Server information
- Global Data (Publish / Subscribe)

The HTTP Server's HTML pages allow you to configure the module's BOOTP/DHCP/FDR Server and SNMP Agent.

The HTTP Server is protected with a default name and password. The default name and password are both USER, and both are case sensitive. They can both be changed via the Configuration page on the NOE 771 0x's Web Embedded Pages (see the *Installing the Module* chapter in the *Quantum NOE 771 xx Ethernet Modules User Guide* ).

For the NOE7711x modules, they can be changed via the FactoryCast Configurator.

The NOE771xx supports a maximum of 32 HTTP simultaneous connections.

**Note:** Browsers may open multiple connections so 32 HTTP connections does not indicate 32 simultaneous users.

**Note:** The NOE7710x module does not support user downloaded Web pages. You will need to purchase the 140NOE7711x module to support that requirement.

---

## Address Servers

The following information describes the services provided by the Address Servers:

- BOOTP Server
  - DHCP Server
-

## BOOTP Server

**Note:** The BOOTP Server is available on the 140NOE771 -00 and -10 models.

The BOOTstrap Protocol (BOOTP) software, compliant with RFC 951, is used to assign IP addresses to nodes on an Ethernet network. Devices (hosts) on the network issue BOOTP requests during their initialization sequence, and a BOOTP Server that receives the request will extract the required IP address information from its database and place it in BOOTP response messages to the requesting devices. The devices will use the assigned IP addresses, received from the BOOTP Server, for all communication occurring on the network.

---

## Your NOE BOOTP Server

Your NOE x0 module comes supplied with a BOOTP Server. This feature allows you to provide IP addresses to all the I/O devices being serviced by the NOE771x0. Providing a BOOTP Server that is built into your NOE771x0 module eliminates the need for you to have a dedicated PC on your I/O network acting as a BOOTP Server.

**Note:** The NOE771x0's BOOTP Server cannot be used to provide its own IP address.

You can configure your NOE771x0's BOOTP Server from the module's HTTP Web page. Using this feature allows you to add, remove, and edit devices to the BOOTP Server's database, which is maintained on the modules non-volatile memory.

---

## DHCP Server

**Note:** The DHCP Server is available on the 140NOE771x1 models.

Dynamic Host Configuration Protocol (DHCP) is a superset of the BOOTP Protocol. Your 140NOE771x1 has a DHCP Server. The DHCP Server is compliant with RFC 1531. The DHCP Server can be used to provide the IP configuration to devices using BOOTP or devices using DHCP.

The DHCP Server has entries that use the MAC address to serve the IP configuration and entries in the Server that use the role name to serve the IP configuration. See the *Address Server Configuration/Faulty Device Replacement* chapter in the *Quantum NOE 771 xx Ethernet Modules User Guide* for details on configuring your NOE's address Server.

If you are migrating a BOOTP configuration from a 140NOE771x0 module to the new 140 NOE 771 x1 module, see the *Address Server Configuration/Faulty Device Replacement* chapter in the *Quantum NOE 771 xx Ethernet Modules User Guide* for details on automatic upgrade of your configuration for the new DHCP Server.

**Note: OPERATING ON A CORPORATE NETWORK**

Before placing the NOE on a corporate network, Schneider Automation recommends that you discuss the installation with your MIS department. It is likely that your company's corporate network has at least one DHCP Server running already. If the NOE's DHCP Server is running on the same network, it may disturb the network.

To avoid any possible problem related to the NOE's DHCP Server on the corporate network, you must ensure that the DHCP Server is not running in the NOE by not having address entries in the configuration. If there are no configured devices in the address Server configuration page, then the NOE will not start the DHCP Server.

## Global Data

Global Data service is a real time Publisher/Subscriber mechanism providing the most efficient data exchange for PLC application coordination.

Devices supporting Global Data are arranged in a distribution group for the purpose of application variable exchange and synchronization. Each Global Data device can publish up to one network (application) variable and subscribe up to 64 network (application) variables.

The Quantum NOE's embedded **Web Global Data Configuration Page** provides a configuration screen to determine which and how many application variables are exchanged with this service. After configuration, the exchanges between all stations belonging to the same distribution group are done automatically.

The Global Data service uses the 4x register space for Global Data exchanges.

---

## Key Features of Global Data

The main features for Global Data are:

- One Publisher and many Subscribers
- A device can publish one network variable of up to 512 registers
- A device can subscribe to several network variables of up to 2048 4x registers
- A device subscribes to the complete network variable
- One distribution group per network IP address
- Application defined publication rate
- Up to 64 Global Data network variables (numbered from 1 to 64) can be part of the data distribution group
- An NOE has only one multicast address; consequently, it can only publish and subscribe inside the group
- A device can participate in several distribution groups by using multiple NOEs in the rack

Global Data has an advantage over Client/Server services when more than one Subscriber is receiving the same data since only one transaction is necessary for all Subscribers to receive the data.

This advantage offers two benefits:

- Reduce overall network traffic
  - Ensure tighter synchronization of multiple subscribers
- 

## Bandwidth Monitoring

Bandwidth Monitoring allows you to monitor the NOE's CPU allocation for each of the following services: Global Data, I/O Scanning, and Messaging. The Bandwidth Monitoring service retrieves workload data and returns one of two pieces of information: whether the module has free resources or whether the module is working at capacity. Knowing the resource allocation helps you:

- Decide about allocating your resources
  - Determine the number of NOEs needed in a system
-



**Available Services**

The services accessed and monitored are:

- Global Data
- I/O Scanner
- Modbus Messaging

If you use Bandwidth Monitoring, you do not need to develop a new set of access functions. The actual NOE CPU load is computed each second.

**Bandwidth Monitoring Load Rates**

The Bandwidth Monitoring service checks once a second and computes four (4) values in private data:

- Percentage of NOE's CPU allocated to **Global Data**
- Percentage of NOE's CPU allocated to the **I/O Scanner**
- Percentage of NOE's CPU allocated to **Messaging**
- Percentage of NOE's CPU allocated to other services and idle

Results are returned as percentages. CPU time spent in other services is shown as "Other" or "Free." Bandwidth Monitoring uses the same functions as used by SNMP.

The three service rates, Global Data, I/O Scanner, and Messaging, are computed using the following formula:

$$(\text{Current load} * 100) / \text{Maximum Load}$$

Table of **Maximum Load Rates**

<b>Diagnostic Service</b>	<b>Workload Data Returned</b>	<b>Maximum load for NOE 771 x1</b>
Global Data	Number of published variables per second	800
I/O Scanner	Number of transactions per second	4200
Messaging	Number of messages treated per second	410

The current load is computed dynamically.

**Note:** The loads are dependent on controller scan time. Each application has an expected scan time. Therefore, when evaluating the loads, you should ensure that the controller scan time is set to the expected scan time for the application being modelled.

## Enhanced Web Diagnostics

**Note:** These services are available on the 140NOE771x1 modules.

The embedded Web server provides Web pages that you may use to diagnose Transparent Factory / Real Time services.

Those diagnostic services are listed below:

1. Global Data diagnostics
  - Status of all Global Data services
  - Status of all subscribed and published variables
  - Publication / Subscription rate
2. I/O Scanning diagnostics
  - Status of all I/O Scanning services
  - Status of individual scanned devices
  - Actual I/O scanning rate
3. Messaging diagnostics
  - Diagnostic information for Port 502 messaging
4. Bandwidth Monitoring
  - Throughput measurement of NOE by service

**Note:** All these pages are protected by the general HTTP password.

---

---

# Intelligent/Special Purpose Modules for the Quantum

14

---

## At a Glance

### Introduction

This chapter provides information on the following intelligent/special purpose modules:

- Five Channel High Speed Counter Module
- Two Channel High Speed Counter Module
- ASCII Interface Module
- High Speed Interrupt Module
- Single Axis Motion Modules
- Hot Standby Module

### What's in this Chapter?

This chapter contains the following topics:

Topic	Page
140EHC10500 High Speed Counter Module	290
I/O Configuration for 140EHC20200	294
140EHC20200 High Speed Counter Module	319
140ESI06210 ASCII Interface Module	332
140HLI34000 High Speed Interrupt Module	338
140MSB/MSX10100 Quantum MSX Motion Modules	342
140XBE10000 Backplane Expander and Cable	352
140CHS11000 Hot Standby Module	357

## 140EHC10500 High Speed Counter Module

### Overview

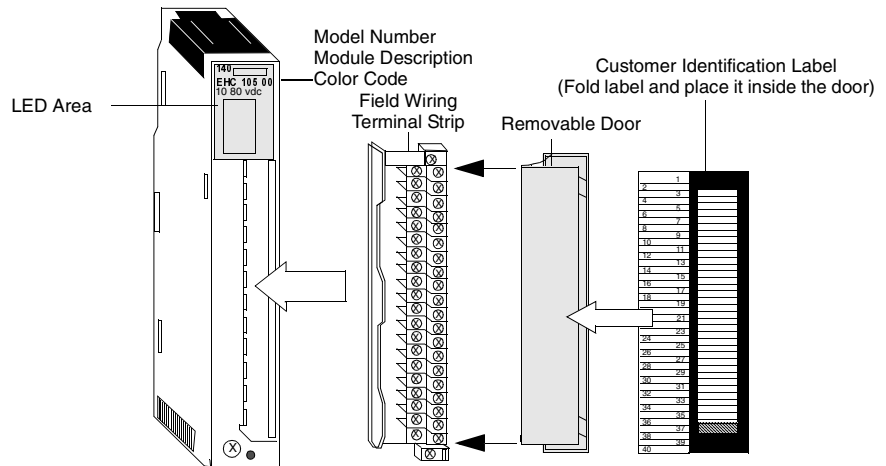
This section provides specifications and descriptions of the high speed counter modules EHC10500, Five Channel Discrete High Speed Counter. The High Speed Counter module is a discrete counter for proximity and magnetic pickups.

### Related Documentation

For more detailed information on the planning, installation and use of this module, refer to the *Quantum Automation Series 140EHC10500 Module User Guide* (840 USE 443 00).

### EHC10500 Counter Module

The following figure shows the EHC10500 Five Channel Discrete High Speed Counter module.



**Specifications**

The following table shows the specifications for the EHC10500 high speed counter.

<b>Specifications</b>		
<b>Number of Channels</b>	5 counter inputs, 8 digital inputs, and 8 digital outputs	
<b>LEDs</b>	<b>Active</b>	
	<b>F</b>	
	<b>R (Green) -</b>	Module is ready
	<b>1 ... 8 (Green - left column) -</b>	Discrete Inputs (IN1 ... IN8)
	<b>C1 ... C5 (Green - middle column) -</b>	Discrete Counter Inputs (C1 ... C5)
	<b>1 ... 8 (Green - right column) -</b>	Discrete Outputs (OUT1 ... OUT8)
	<b>P (Green) -</b>	24 Vdc is present
<b>Required Addressing</b>	13 Words In 13 Words Out	
<b>Discrete Counter Inputs</b>		
Count Frequency	100 kHz max @ 5Vdc 35 kHz max @ 24Vdc	
Input Thresholds	<u>On</u> +3.1 ... +5V +15 ... +30V	<u>Off</u> 0 ... 1.15V@5 Vdc -3 ... +5V@24 Vdc
Input Current	7 mA	
Duty Cycle	1 : 1	
Data Formats	16 Bit Counter: 65,535 Decimal 32 Bit Counter: 2,147,483,647 Decimal	
Operation Modes	Discrete incremental counter	
Max Continuous Input Voltage	30 Vdc	
<b>Discrete Inputs</b>		
VREF Supply + 24 Vdc	<u>On State (Vdc)</u> -3.0 ... 5.0.	<u>Off State (Vdc)</u> 15.0 ... 30.0
Input Current (typical)	5 mA	
<b>Discrete Outputs</b>		
FET Switch ON	20 ... 30 Vdc	
FET Switch OFF	0 Vdc (ground reference)	
Max Load Current (each output)	210 mA max	
Output Off State Leakage	0.1 mA max @ 30 Vdc	

<b>Specifications</b>	
Output On State Voltage Drop	1.25 Vdc @ 0.5 A
<b>Miscellaneous</b>	
Isolation (Channel to Bus)	500 Vac rms for 1 minute
Fault Detection	Loss of output field power, output short circuit
Power Dissipation	≤ 6 W
Bus Current Required	250 mA
External 24 Vdc Power Supply	19.2 ... 30 Vdc, 24 Vdc nominal, 60 mA required plus the load current for each output
External Fusing	User discretion
Compatibility	Programming Software: Modsoft V2.32 or Concept 2.0 at a minimum Quantum Controllers: All, V2.0 at a minimum

### LED Indicators and Descriptions

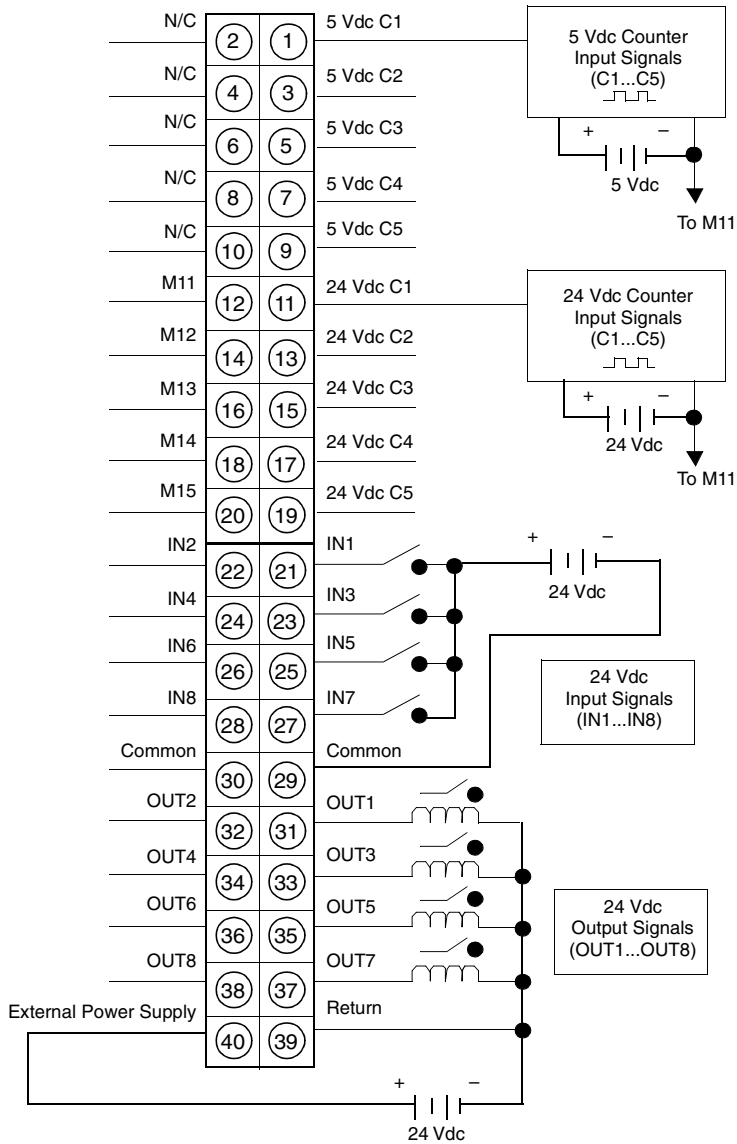
The following figure shows the LED indicators for the EHC10500 high speed counter.

R	Active	F
1	C1	1 P
2	C2	2
3	C3	3
4	C4	4
5	C5	5
6		6
7		7
8		8

The following table shows the LED descriptions for the EHC10500 high speed counter.

<b>LED Descriptions</b>		
<b>LEDs</b>	<b>Color</b>	<b>Indication when On</b>
Active	Green	Bus communication is present
F	Red	Lights upon any defined hardware, firmware, and process error.
R	Green	Indicates firmware initialization is complete and the module is ready for service.
1 ... 8 (left column)	Green	Digital inputs IN1 ... IN8
C1 ... C5	Green	Counter inputs xxC1 ... xxC5 (xx=5/24)
1 ... 8 (right column)	Green	Digital outputs OUT1 ... OUT8
P	Green	24 Vdc is present

**Wiring Diagram** The following figure show the EHC10500 wiring diagram.



**Note:**  
 1. N / C = Not Connected.  
 2. Terminals 29 and 30 are common and are jumpered together.

## I/O Configuration for 140EHC20200

---

### Overview

This section describes configuration of the 140EHC20200 high speed counter module which operates in pulse or quadrature mode and accepts single ended or differentiated inputs.

---

### I/O Map Register Assignment

The 140EHC20200 high speed counter requires six contiguous output (4X) and six contiguous input (3X) registers in the I/O map.

The 4X registers perform the same configuration tasks as the Modzoom screen-assigned parameters. Also, the preset and the enable inputs connected to the field wiring terminal block perform the same functions as those software command control bits. When both methods are used to:

- Preset a counter—the last preset executed has precedence.
- Enable/disable a counter—it will only be enabled when both the hardware enable input and software enable control bit are in the enable state.

For simple applications, the zoom screens rather than the I/O mapped registers can be used to configure the module. Zoom screens are used only while the PLC is stopped. The selected parameters take effect when the PLC is set to run. For applications that require that module parameters be changed while the system is running, user logic can modify the I/O map-assigned registers to override the previously selected zoom parameters.

When using either zoom screens or I/O map registers, the maximum values specified in the Load Values Command section are the largest values that can be used by the module.

The I/O Mapped registers discussed in this section are

#### **4x output registers** that:

- Preset and enable/disable input counters.
- Load setpoint and maximum values to define output turn on points.
- Set mode of operation, count, or rate sample.
- Enable output switches and configures their mode of operation.

#### **3X input registers** that:

- Hold count or rate sample data.
  - Display field power status.
  - Echo 4X command data after the command is executed by the module.
-



## EHC20200 Operations

Four operations can be performed:

- Command 1 CONFIGURES the Module
- Command 2 LOADS VALUES
- Command 3 READ INPUT COUNTER
- Command 4 READS RATE SAMPLE or LAST INPUT COUNT BEFORE PRESET

Each operation uses one or more of both types of registers assigned to the module. In addition to the command definition byte, the first 4X register for all commands contain control bits to preset and enable/disable counters of either channel.

## Command 1 CONFIGURES the Module

Command 1 uses three 4X registers and six 3X registers as shown in the following figure.

4X	3X
4X+1	3X+1
4X+2	3X+2
	3X+3
	3X+4
	3X+5

This command does the following:

- Sets up the module for pulse or quadrature input.
- Sets up the module for count or rate-sample mode. Counters cannot be separately configured.
- Defines counter register length—16 or 32 bit.
- Enables output assertion including module communication loss state. Output assertion is available if configured for two 16 bit, or one 32 bit counter. No output assertion is available if two 32 bit counters are defined, or in rate-sample mode.
- Defines output assertion point.

**Command 2  
LOAD VALUES**

There are four formats for this command. It uses up to six 4X registers and six 3X registers as shown in the following figure.

4X	3X
4X+1	3X+1
4X+2	3X+2
4X+3	3X+3
4X+4	3X+4
4X+5	3X+5

Values loaded may be:

- Maximum count and setpoint (i.e., output turn on times).
  - Output assertion ON time duration (one input only).
  - Rate sample time interval.
- 

**Command 3  
READ INPUT  
COUNTER**

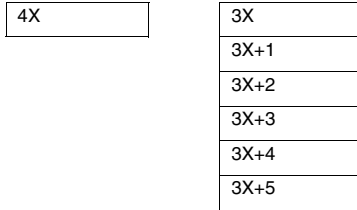
Command 3 uses one 4X register and six 3X registers as shown in the following figure.

4X	3X
	3X+1
	3X+2
	3X+3
	3X+4
	3X+5

---

**Command 4  
READS RATE  
SAMPLE or LAST  
INPUT COUNT  
BEFORE  
PRESET**

Command 4 uses one 4X register and six 3X registers as shown in the following figure.



**Note:** 4X register formats for the commands are described first. The 3X register contents after issuing Command 1 or 2 are listed after the 4X register description for Command 2, since the responses are the same for both. The 3X responses for Commands 3 and 4 immediately follow those commands.

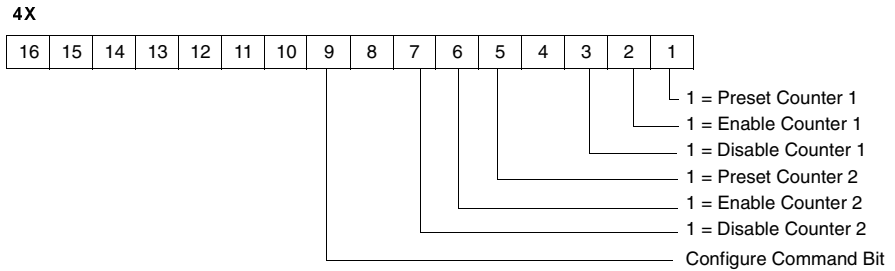
**Note:** When Command 0 (4X = 00XX) or any other undefined commands are asserted in the 4X register, the 3X registers will contain the count inputs if in count mode (same as Command 3) and the rate sample values when in rate-sample mode (same as Command 4).

**Command  
Words Described**

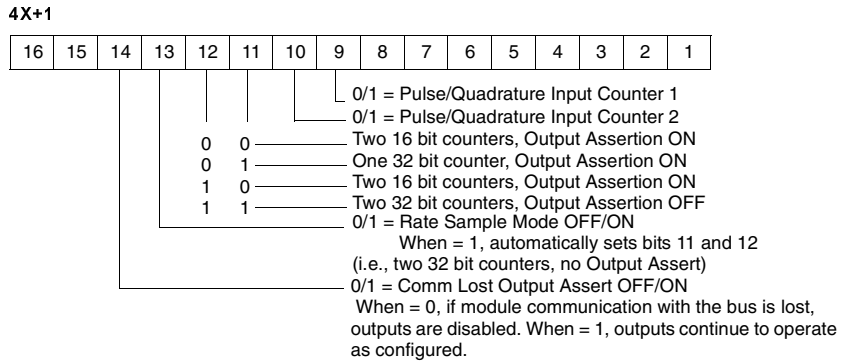
The following describes the command words and responses.

**Command 1 -  
CONFIGURE,  
Output Register  
Format  
(4X = 01XX hex)**

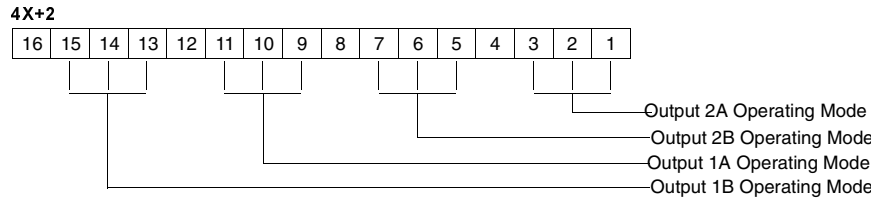
The following figure shows the 4x output register for command 1.



The following figure shows the 4x+1 output register for command 1 (4X+1).



The following figure shows the 4x+2 output register for command 1.



Bits	Mode	Description
000	0	Disable Output
001	1	ON if Count = Setpoint
010	2	Latched ON if Count = Setpoint. Hardware RESET required to turn OFF
011	3	ON if Count = Maximum Count
100	4	Latched ON if Count = Maximum Count. Hardware RESET required to turn OFF
101	5	ON when Count = Setpoint for time specified in Command 2 register
110	6	ON when Count = Maximum Count for time specified in Command 2 register
111	7	Not Used



## CAUTION

### Module disable possibility

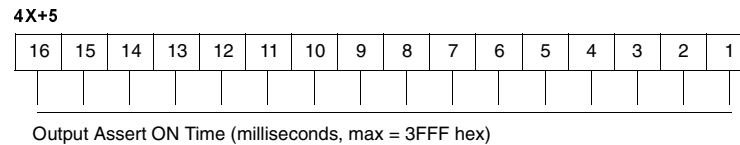
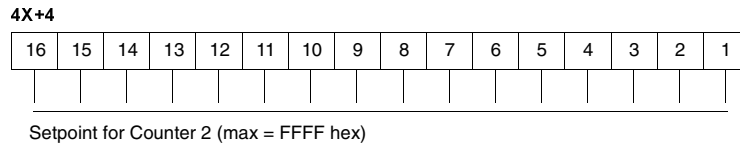
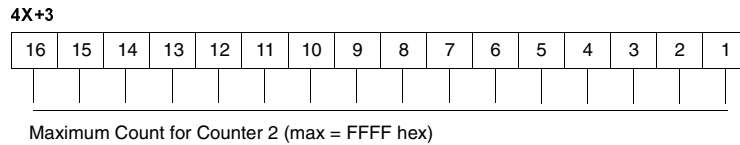
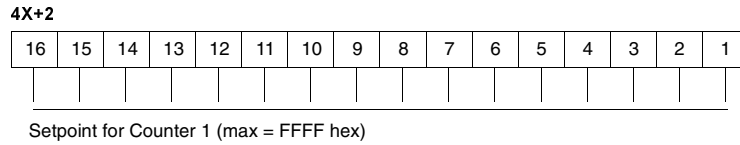
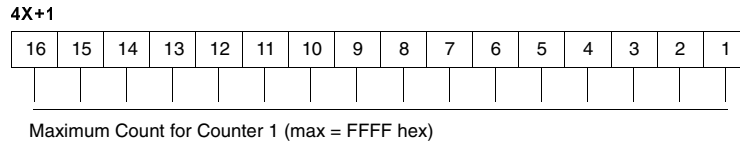
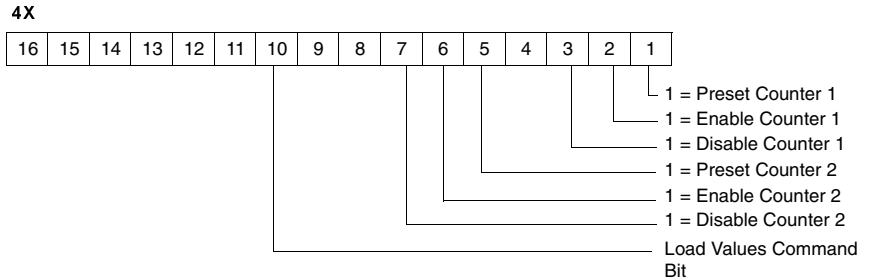
The Output ON time specified in the Command 2 registers may be used by only one of the four outputs. When more than one output is set to mode 5 or 6, the module firmware will operate the first one encountered, and disable the other outputs set to modes 5 or 6.

**Failure to follow this precaution can result in injury or equipment damage.**

**Command 2.  
LOAD VALUES,  
Output Register  
Format  
(4X = 02XX hex)**

The LOAD VALUES 4X register format depends on the Counter/Rate Sample mode selected in Command 1, Register 4X+1, bits 11 and 12.

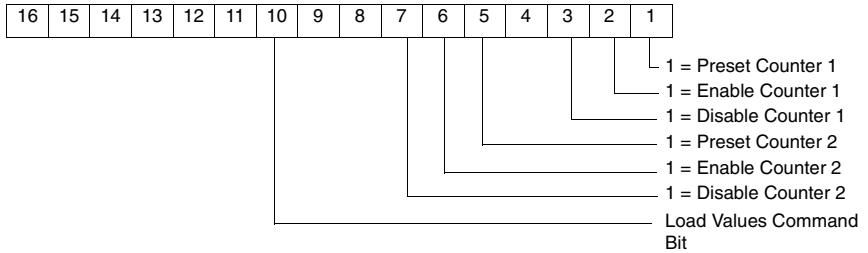
If configured for two 16 bit Counters, Output Assert ON, the following figures, which shows counters for registers 4X through 4X+5, are displayed.



**Note:** Zero set into any 4X register means no change.

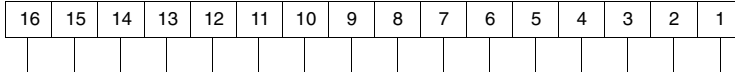
If configured for one 32 bit Counter, Output Assert ON, the following figures, which show the counters for registers 4X through 4X+5, with low and high word, are displayed.

4X



4X+1 (Low Word)

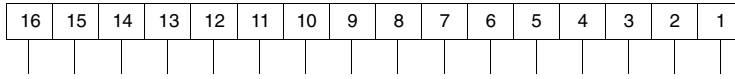
4X+2 (High Word)



Maximum Count for Counter 1 (max = 7FFFFFFF hex)

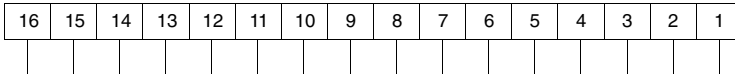
4X+3 (Low Word)

4X+4 (High Word)



Setpoint for Counter 1 (max = 7FFFFFFF hex)

4X+5

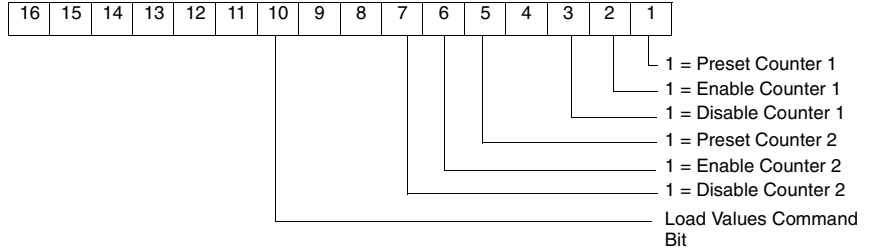


Output Assert ON Time (milliseconds, max = 3FFF hex)

**Note:** Zero set into any 4X register pair for 32 bit values or any 4X register means no change.

If configured for two 32 bit Counters - NO Output Assert, the following figures, which show the 4X through 4X+4 counters, with low and high word, are displayed.

4X



4X+1 (Low Word)

4X+2 (High Word)

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

Maximum Count for Counter 1 (max = 7FFFFFFF hex)

4X+3 (Low Word)

4X+4 (High Word)

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

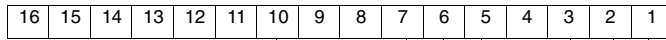
Maximum Count for Counter 2 (max = 7FFFFFFF hex)

**Note:** Zero set into any 4X register pair for 32 bit values or any 4X register means no change.



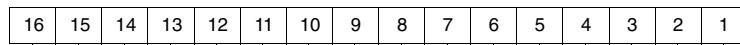
If configured for Rate Sample Mode, the following figures, which show the 4X through 4X+2 counters, are displayed.

4X



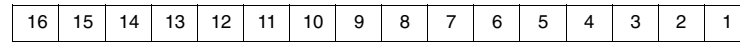
- 1 = Preset Counter 1
- 1 = Enable Counter 1
- 1 = Disable Counter 1
- 1 = Preset Counter 2
- 1 = Enable Counter 2
- 1 = Disable Counter 2
- Load Values Command Bit

4X+1



Rate Sample Timer Value, Counter 1 (milliseconds, max = 3FFF hex)

4X+2



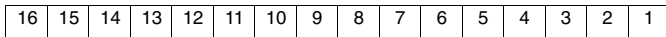
Rate Sample Timer Value, Counter 2 (milliseconds, max = 3FFF hex)

**Note:** Zero set into any 4X register or any 4X register pair for 32 bit values means no change.

**Command 1 and  
Command 2  
Response  
Formats**

The following figures show the 3X through 3X+5 response formats.

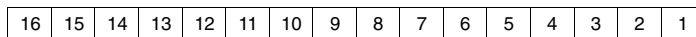
3X



Configure or  
Load Values  
Command Byte

3X+1 to 3X+4 echoes 4X+1 to 4X+4 register contents.

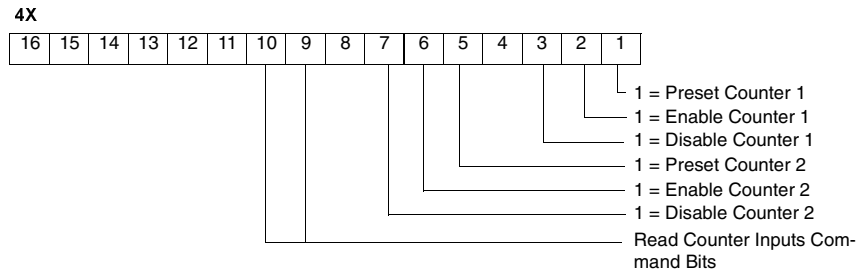
3X+5



1 = Field Power Lost

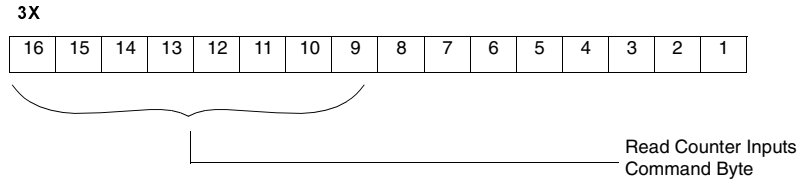
**Command 3,  
READ INPUT  
COUNTER,  
Output Register  
Format (4X =  
03XX hex)**

The following figure shows the 4X register for Command 3, READ INPUT COUNTER, output register format.

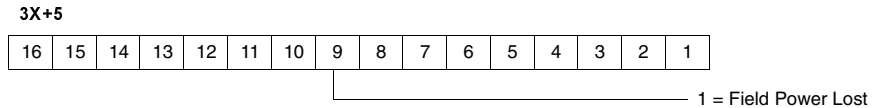


**Command 3  
Response  
Format**

The following figure shows the Command 3 response format.

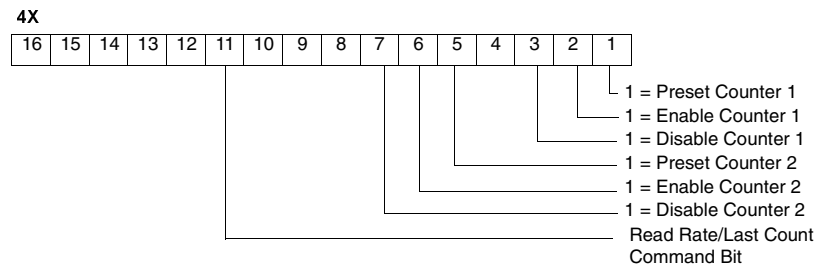


3X+1 and 3X+2 = Counter 1's 16 or 32 bit Current Count.  
 3X+3 and 3X+4 = Counter 2's 16 or 32 bit Current Count.



**Command 4,  
READ RATE  
SAMPLE or  
READ LAST  
COUNT VALUE  
BEFORE MOST  
RECENT  
PRESET, Output  
Register Format  
(4X = 04XX hex)**

The following figure shows the 4x counters for Command 4.

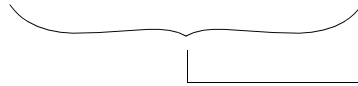


**Command 4  
Response  
Format**

The following figures show the counters for  $3X$  through  $3X+5$  for command 4.

$3X$

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

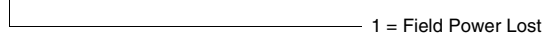


Read Rate Sample/  
Last Count  
Command Byte

$3X+1$  and  $3X+2$  = Counter 1's 32 bit Rate Sample / Last Count Before Preset.  
 $3X+3$  and  $3X+4$  = Counter 2's 32 bit Rate Sample / Last Count Before Preset.

$3X+5$

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

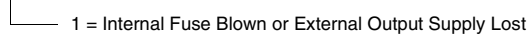


1 = Field Power Lost

**I/O Map Status  
Byte**

The most significant bit in the I/O Map status byte is used for the 140EHC20200 High Speed Counter Module. The following figure shows the map status byte register.

8	7	6	5	4	3	2	1
---	---	---	---	---	---	---	---



1 = Internal Fuse Blown or External Output Supply Lost

## Using I/O Mapped Registers to Operate the High Speed Counter

### COUNT UP Example

Field connections for this example are illustrated in the EHC202 wiring diagrams 1–4 in this section. The maximum allowable Vref value is 30 Vdc. Input pulse on-off threshold levels for the 5 ... 24 Vdc Vref range are listed in the module specification table. The minimum differential input is 1.8 V.

The following user logic:

- Configures the module to count up from zero.
- Turns an output on for one count at a setpoint value of 50.
- Continues counting to 100.
- Rolls over to zero and turn on a second output for one count.
- Repeats the operation.

See *p. 319* for counter timing diagrams illustrating output on times.

The following table shows the I/O Map register assignments.

Module	Input Ref	Output Ref	Description
140EHC20200	300001-300006	400001-400006	EHC20200 High Speed

In this example, block moves are used to load the operating parameters into the module. This requires pre-defined tables be established. Register values are in HEX format.

## Module Configuration

The following table shows the module configurations.

400101	0140	CONFIGURE command, Disable Counter 2
400102	0000	Pulse input, two 16 bit counters, output assert on Rate Sample OFF, disable outputs at bus communication loss
400103	3100	Output 1A on at setpoint, Output 1B on at maximum count +1 Output 2A and 2B are disabled
400104	0000	Not used by this command
400105	0000	
400106	0000	

**Load Values**

The following table shows the load values.

400201	0243	LOAD VALUES command, disable Counter 2, preset and enable Counter 1
400202	0064	Counter 1 maximum count, count after which Output 1B turns on
400203	0032	Counter 1 setpoint, count when Output 1A turns on
400204	0000	Counter 2 maximum count (not used in this example)
400205	0000	Counter 2 setpoint (not used in this example)
400206	0000	Output Assert Time (Not used in this example, one output only, if used)

Zeros in the 4X registers also mean no change. Setpoint, maximum count and assert time can only be set to zero using the Modzoom screens. When the registers in this example are echoed, zeros will appear but the actual content in the module will be unchanged from previous values. In this example, Counter 2 is disabled and its outputs and timed assert have not been selected. Registers 400204 - 6 have no meaning.

After the module executes the Configure and Load Value's commands, they are echoed in the I/O mapped 3X registers except for the command register's low 8 bits. Command execution time by the module is 1 ms. Actual time between the 4X register block move and the echo response display in the 3X registers is dependent on User Logic and hardware configuration. An echo of the Configuration command registers would appear as follows:

**Response for Configuration Command**

The following table shows the echo response for the configuration command.

Register	Value
300001	0100
300002	0000
300003	3100
300004	0000
300005	0000
300006	0000

**Read Input Counter Command**

The following table shows the read input registers.

40301	0300	READ INPUT COUNTER command
40302	0000	Not used by this command
40303	0000	
40304	0000	
40305	0000	
40306	0000	

When this command is issued, the content of the input pulse counter is retrieved. The 3X register content would appear as shown in the following table.

**3x Register Content**

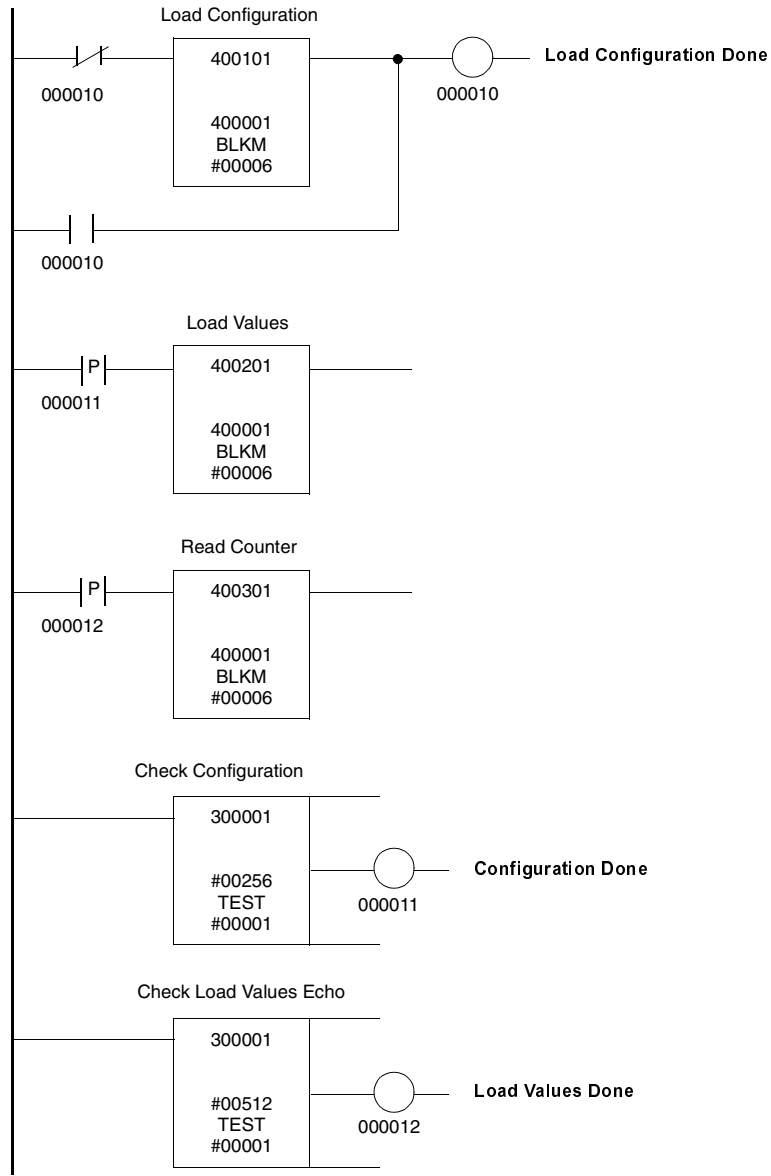
Register	Value	Description
300001	0300	Command echo
300002	XXXX	Current input count
300003	0000	Zeros as the count will not exceed 100. For counts above 65,536, this register is a multiplier. As an example: 30002 has a value of 324 and 30003 a value of 3. The total count is $(65,536 \times 3) + 324 = 196,932$
300004	0000	Counter 2 is disabled
300005	0000	Counter 2 is disabled
300006	0X00	X is the field power indicator

**Reset of Latched Outputs**

If register 400103 in the Module Configuration Table has been set to 4200, Output 1A would have been latched on at setpoint and Output 1B latched on at maximum count. Wiring Diagrams 2 and 4 show how the encoder Z outputs could be used to reset the latched outputs. The minimum pulse width to **reset** outputs is 1  $\mu$ s.

**User Logic**

The User Logic illustrated accomplishes the module's configuration and then causes the input counter to be displayed after the first three successive scans by the PLC when it is in RUN mode. The following figure shows the module's configuration in RUN mode.



**COUNT DOWN  
Example**

The COUNT DOWN example uses the same wiring as in the count up example, **except** the Input 1B+ level is changed to common (connected to Vref-) for Pulse Inputs illustrated in Wiring Diagrams 1 and 2. For Quadrature Inputs, no wiring change is required as the count direction is decoded internally by sensing the phase shift change between inputs A and B.

The User Logic is the same as for the count example. The actual operation of the module is different in that the output associated with maximum count turns on after zero count has been reached.

The example configures the module to decrement the input count from the maximum value, turn on an output at a setpoint value of 50, and turn on a second output after the input counter had reached zero and rolled over to the maximum count; the operation is then repeated. The initial loading of the maximum count will not cause its associated output to turn on.

**RATE SAMPLE  
Example for  
Either Pulse or  
Quadrature Input**

Field connections for this example are illustrated in Wiring Diagrams 1–4. The connections on terminals 15 and 16 are optional, depending on the use requirements of the outputs. Terminals 39 and 40 always require the 24 Vdc supply connections. The maximum allowable Vref value is 30 Vdc. Input pulse on-off threshold levels for the 5 ... 24 Vdc Vref range are listed in the module specification table. The minimum differential input is 1.8 V.

As with count examples, tables are set up and transferred to the module using block moves. The User Logic for Rate Sample is the same as that used for Pulse Input Count Up/Down.

**Module  
Configuration**

The following table shows the module configurations.

400101	0140	CONFIGURE command, Disable Counter 2
400102	1000	Pulse input, Rate Sample ON, disable outputs at bus communication loss (Note: Bits 11 and 12 were not required.)
400103	0000	Not used by this command
400104	0000	
400105	0000	
400106	0000	



**Load Values**

The following table shows the load values.

400201	0243	LOAD VALUES command, disable Counter 2, preset and enable Counter 1
400202	XXXX	Counter 1 Rate Sample Time in milliseconds
400203	0000	Counter 2 Rate Sample Time in milliseconds (Not used in this example)
400204	0000	Not used by this command
400205	0000	
400206	0000	

**Note:** Command echoes are the same as described in the Pulse Input Count Up/Down examples.

**Read Rate Sample**

The following table shows a read rate sample.

40030	0400	READ INPUT COUNTER command
400302	0000	Not used by this command
400303	0000	
400304	0000	
400305	0000	
400306	0000	

When this command is issued, the input pulse counter content is retrieved. The 3X register content is the count over the time period selected in the Load Values registers 4X + 1 and 4X + 2. The 3X response to the Read-Rate Sample command in register 40301 is as follows.

**Response to Read Rate Sample Command**

The following table shows the responses to the read rate sample command.

Register	Value	Description
300001	0400	Command echo
300002	XXXX	Counter 1 Input rate low word
300003	XXXX	Counter 1 Input rate high word: this register is a multiplier. As an example: 30002 has a value of 324 and 30003 a value of 3. The total count is $(65,536 \times 3) + 324 = 196,932$
300004	0000	Counter 2 is disabled
300005	0000	Counter 2 is disabled
300006	0X00	X is the field power indicator

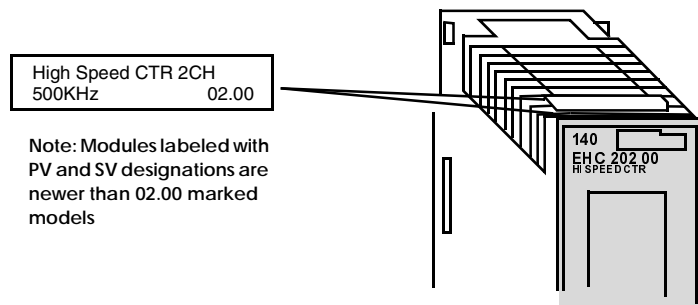
### Rate Sample Mode Caution

If a version 02.00 or higher module replaces a module which has a version number less than 02.00 in a Rate Sample mode application, extra software configuration may be required.

Rate Sample mode is set using Command 1, CONFIGURE (01XX), 4X+1 register, bit 13 = 1 (see the description of Command 1 in this section).

**Note:** To verify the version of the module, reference the indicated label found on the top front of the module.

The following figure shows the module's label.



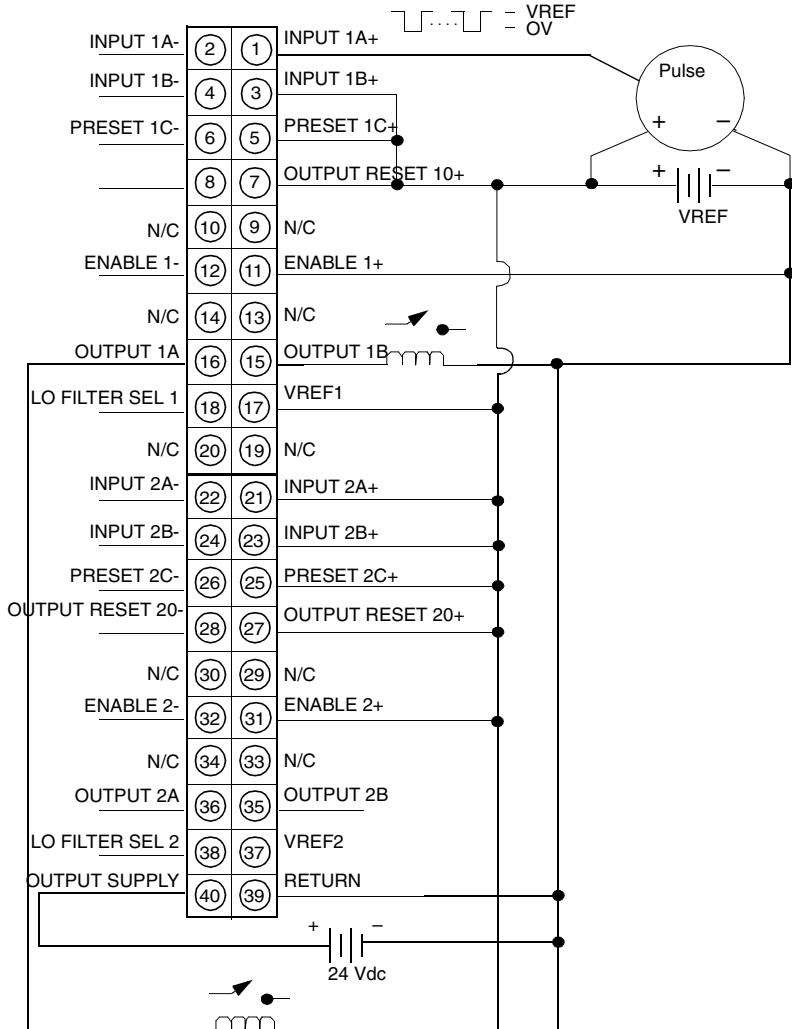
In modules prior to V02.00, when Rate Sample mode was selected, input was always handled as if it were generated by a pulse encoder. For example, 60 count per revolution encoders, either pulse or quadrature types, would give a rate of 60 for a one-second revolution when the interval was set for one second.

Users are cautioned that beginning with V2.00 modules, if a quadrature type encoder is used to provide count input and Pulse/Quadrature Input Counter 1 and 2, bits 9 or 10, are set to 1, the module will detect all edges. The result is four times the rate sample value as would be accumulated with an equivalent pulse encoder input. In the example in the above paragraph, the rate sample would be equal to 240.

Encoder type selection is set using Command 1, CONFIGURE (01XX), 4X+1 register, bits 9 or 10 (see the description of Command 1 in this section).

If the Encoder Type select bits are set to 0, either type of encoder will produce the Rate Sample, as did versions of the module that were lower than V02.00.

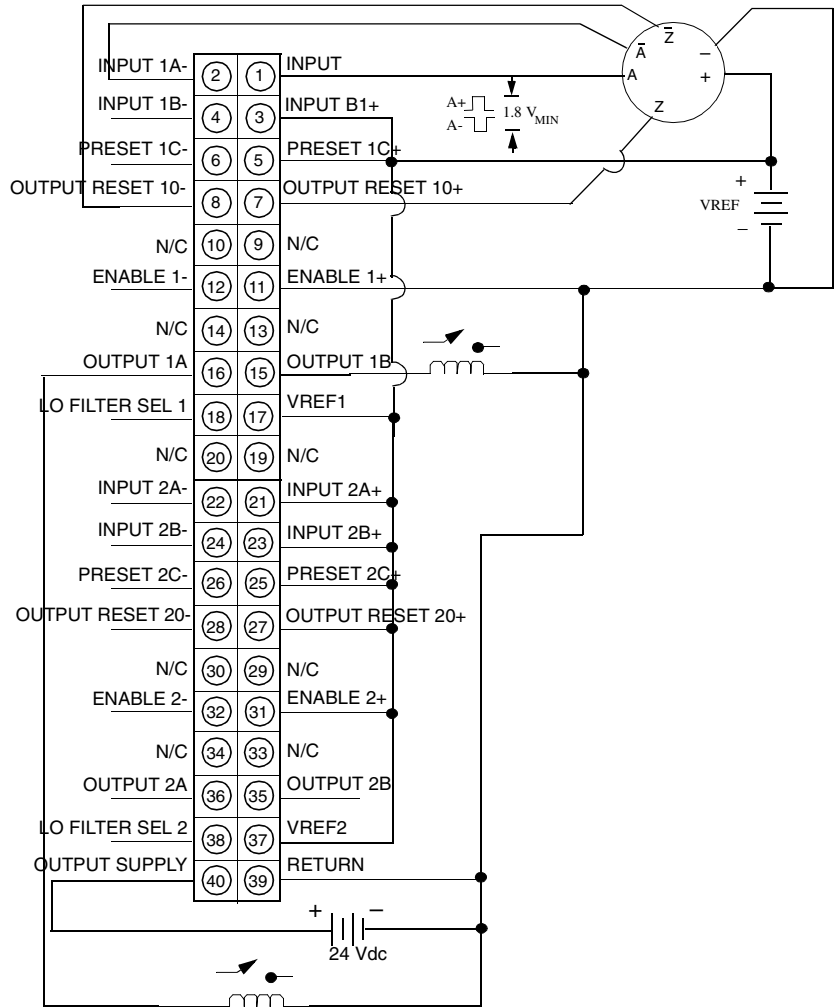
**Wiring Diagram 1** The following figure shows the EHC20200 wiring diagram 1.



**Note:** Notes on Wiring Diagram 1.

1. Single ended pulse input.
2. Constant enable.
3. Count up.
4. Outputs 1A and 1B operate relays.
5. Counter 2 not used.
6. N/C = Not Connected.

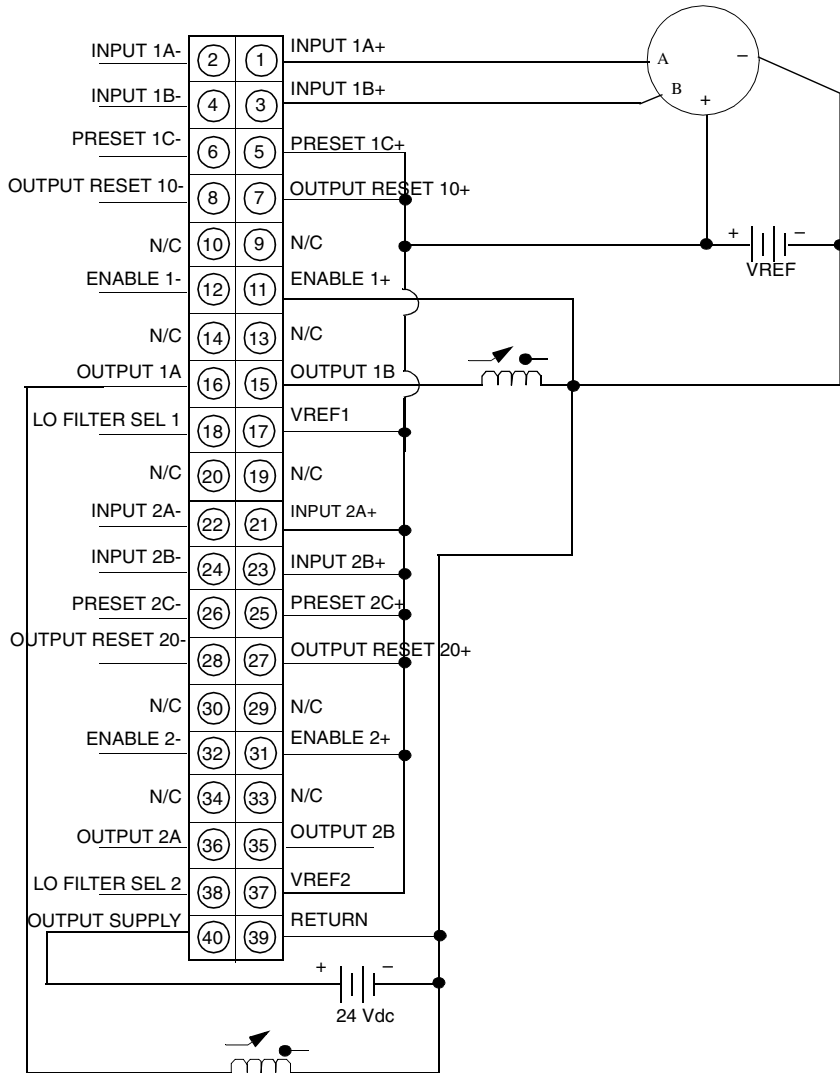
**Wiring Diagram 2** The following figure shows the EHC20200 wiring diagram 2.



**Note:** Notes on Wiring Diagram 2

1. Differential pulse input.
2. Constant enable.
3. Zero pulse resets outputs 1A and 1B.
4. Count up.
5. Outputs a and B operate relays.
6. Counter 2 not used.
7. N/C = Not Connected.

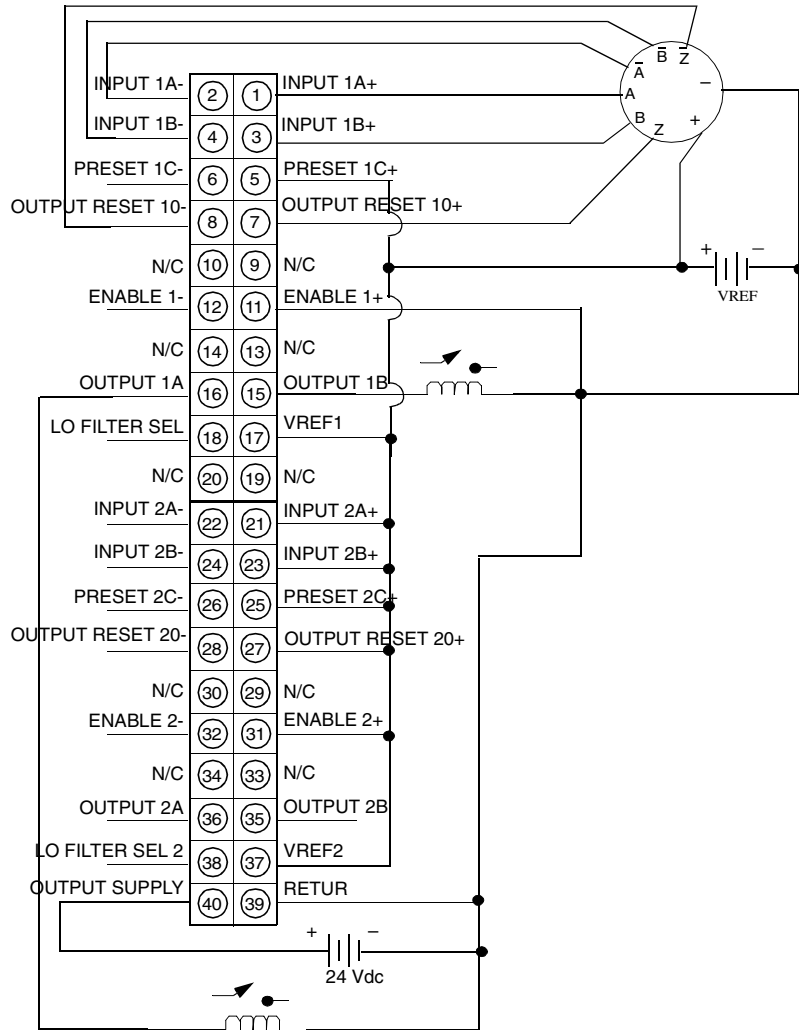
**Wiring Diagram 3** The following figure shows the EHC20200 wiring diagram 3.



**Note:** Notes on Wiring Diagram 3

1. Quadrature input.
2. Constant enable.
3. Outputs 1A and 1B operate relays.
4. Counter 2 not used
5. N/C = Not Connected.

**Wiring Diagram 4** The following figure shows the EHC20200 wiring diagram 4.



- Note:** Notes on Diagram 4.
- Differential quadrature input.
  - Constant enable.
  - Zero pulse reset Output 1A and 1B.
  - Output 1A and 1B operate relays.
  - Counter 2 not used.
  - N/C = Not Connected.

**Module Zoom Selections**

Push <Enter> to display and select applicable parameters.  
The following figure shows the module zoom selections.

Counter X mode control:

Incremental
Quadrature

Number of counters, output assertion:

2x16 w/ Output
2x32 w/ Output
2x32 No Output
Rate Sample Mode

Comm lost output assert override:

Off
On

**Note: When OFF, outputs are disabled when communication with the bus is lost. When ON, outputs continue to operate as configured.**

Counter X output mode  
Output Coil X mode:

Setpoint
Latched Setpoint
Terminal Count
Latched Terminal
Timed Setpoint
Timed Terminal

**Note: Only one output should be configured as timed (Setpoint or Terminal).**

Number of counters, output assertion:

2x16 Assert Outp
2x32 Assert Outp
2x32 No Assert
Rate Sample Mode

The next lines apply **ONLY IF** the counter is in 2x16, Output Assert Mode:

Counter X Maximum Count:	* 0 DEC
Counter X Setpoint (alarm):	* 0 DEC
Time Output On:	0 DEC milliseconds (16383 maximum)

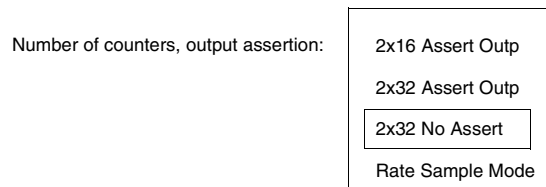
\*Refer to Load Values Command section for the maximum values that may be used by the module.

The next lines apply **ONLY IF** the counter is in 1x32, Output Assert Mode:

Counter 2 Maximum Count:	* 0 DEC
Counter 2 Setpoint (alarm):	* 0 DEC
Time Output On:	0 DEC milliseconds (16383 maximum)

\*Refer to Load Values Command section for the maximum values that may be used by the module.

The following figure shows the number of counters in output assertion.



The next lines apply **ONLY IF** the counter is in 2x32, No Output Assert Mode:

Words 2-3: Counter 1 Maximum Count:	* 0 DEC
Words 4-5: Counter 2 Maximum Count:	* 0 DEC

\*Refer to Load Values Command section for the maximum values that may be used by the module.

The next line applies **ONLY IF** the counter is in Rate Sample Mode:

Rate Sample Timer X:	0 DEC milliseconds (65535 maximum)
----------------------	------------------------------------

**Note:** Any *Number of counters, output assertion* selection pop-up menu can be used as they reflect each other.

---



## 140EHC20200 High Speed Counter Module

### Overview

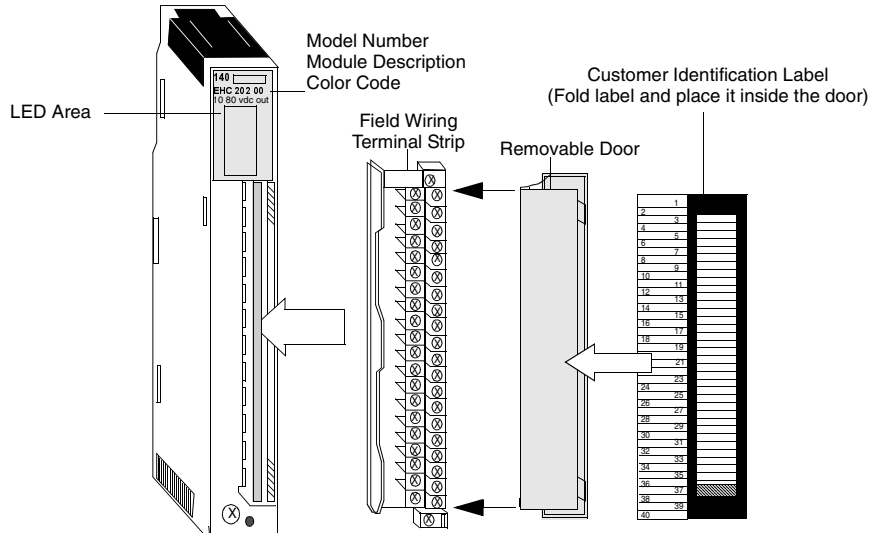
The EHC20200 offers the following features:

- Two counters that operate in pulse or quadrature mode and accept single-ended or differential inputs.
- Two FET output switches for each counter — turned on when the counter reaches programmed setpoint or maximum values, and turned off by changes in counter values, software commands, or a hard wired reset from the field.

See *p. 294* for configuring and operating the EHC20200 with Modsoft.

### EHC20200 High Speed Counter Module

The following figure shows the EHC20200 Two Channel High Speed Counter module.



**Specifications**

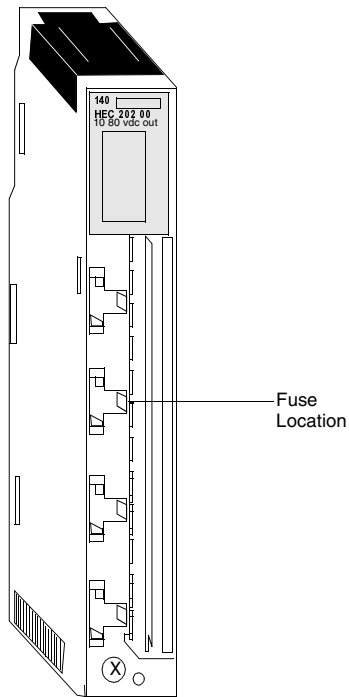
The following table shows the specifications for the EHC20200 High Speed Counter module.

<b>Specifications</b>		
<b>Number of Channels</b>	2 with 2 outputs each	
<b>LEDs</b>	Active	
	F	
	8 Input Status LEDs (Green)	
	4 Output Status LEDs (Green)	
<b>Count Frequency</b>	500 kHz max with differential inputs. 250 kHz max with single-ended inputs.	
<b>Registers Required</b>	6 Words In 6 Words Out	
<b>Data Formats</b>		
16 Bit Counter	65,535 Decimal	
32 Bit Counter	2,147,483,647 Decimal	
<b>Discrete Inputs</b>		
Operation Modes	Incremental Quadrature	
Max Continuous Input Voltage	30 Vdc	
Input Threshold		
<i>Single Ended Mode</i> <u>VREF Supply</u>	<u>On State (Vdc)</u>	<u>Off State (Vdc)</u>
+ 5 Vdc	0 ... 2.0	3.5 ... 5.0
+ 12 Vdc	0 ... 5.0	7.0 ... 12.0
+ 24 Vdc	0 ... 11.0	13.0 ... 24.0
Differential Mode (Minimum)	1.8 Vdc	
Input Resistance	10 k	
<b>Discrete Outputs</b>		
Output Levels (1A, 1B, 2A, 2B)		
FET Switch ON	Supply - 0.4 Vdc	
FET Switch OFF	0 Vdc (ground reference)	
Max Load Current (each output)	0.5 A	
Output Off State Leakage	0.4 mA max @ 30 Vdc	
Output On State Voltage Drop	0.4 Vdc @ 0.5 A	
Output Protection	36 V transorb for transient voltage suppression	
<b>Miscellaneous</b>		
Isolation (Channel to Bus)	1780 Vac rms for 1 minute	

Specifications	
Fault Detection	Blown fuse detect, loss of outputs 1A, 1B, 2A, 2B field power
Power Dissipation	4.0 W + 0.4 x total module load current
Bus Current Required	650 mA
External 24 Vdc Power Supply	19.2 ... 30 Vdc, 24 Vdc nominal, 50 mA required, plus the load current for each output
Fusing	Internal: 2.5 A fuse, (Part # 043503948 or equivalent) External: User discretion
Compatibility	Programming Software: Modsoft V2.32 or Concept 2.0 at a minimum Quantum Controllers: All, V2.0 at a minimum

### Fuse Location

The following figure shows the fuse location.



**Note:** Turn off power to the module and remove the field wiring terminal strip to gain access to the fuse.

**LED Indicators and Descriptions**

The following figure shows the LED indicators for the EHC20200 High Speed Counter module.

Active	F
In 1	In 2
En 1	En 2
Pre C1	Pre C2
Res 01	Res 02
Out 1A	Out 2A
Out 1B	Out 2B

The following table shows the LED descriptions for the EHC20200 high speed counter.

<b>LED Descriptions</b>		
<b>LEDs</b>	<b>Color</b>	<b>Indication when On</b>
Active	Green	Bus communication is present
F	Red	Indicates internal fuse blown or loss of output power supply
In 1	Green	Counter 1 input
En 1	Green	Enable Counter 1 input
Pre C1	Green	Preset Counter 1 input
Res 01	Green	Reset Output 1A, 1B
In 2	Green	Counter 2 input
En 2	Green	Enable Counter 2 input
Pre C2	Green	Preset Counter 2 input
Res 02	Green	Reset Output 2A, 2B
Out 1A	Green	Counter 1A output
Out 1B	Green	Counter 1B output
Out 2A	Green	Counter 2A output
Out 2B	Green	Counter 2B output

**Controlling the Module**

Hardware inputs from the field can be used to:

- Increment/decrement the input counters with serial pulses from encoders or other square wave sources.
- Set direction of count.
- Reset the outputs.

Hardware inputs from the field and software commands are used together to:

- Enable the count input.

Hardware inputs from the field or software commands can be used to:

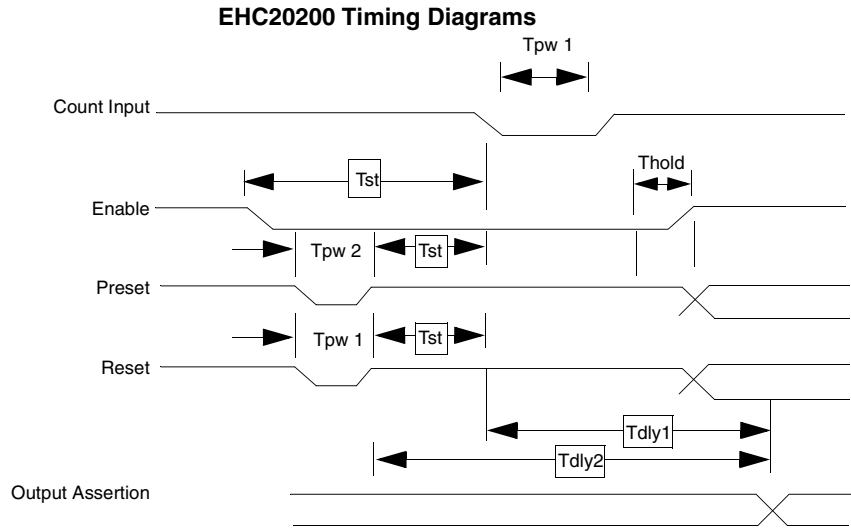
- Preset the input counter to zero or maximum count.

Software commands can be used to:

- Configure the counters for pulse (tachometer) or quadrature mode.
  - Configure for 16 or 32 bit counters, with or without output assertion.
  - Configure the module to operate in either count or rate-sample mode.
  - Option for outputs to operate or not operate if backplane bus communication is lost (i.e., a fault condition).
  - Option for outputs to switch on when setpoint and/or maximum values are reached.
  - Define the setpoint and maximum count values.
  - Define ON time for outputs.
  - Disable outputs.
  - Read the input counter totalizing or rate sample values.
  - Retrieve the old (previous) input counter value after the counter has been preset.
-

**Timing Diagrams and Parameters**

This section includes timing diagrams and parameters for the 140EHC20200 counter modules. Timing diagrams and a timing parameter table for the 140EHC20200 counter module are shown below.



The following table shows the EHC20200 timing parameters.

Timing Parameters		Limits	
		Filter 200 Hz	No Filter 500 khz
Tdly1	Count to Output Assertion Delay (MAX)	4.8 ms	40 μs
Tdly2	Preset/Reset to Output Delay (MAX)	4.8 ms	40 μs
Tpw1	Count/Reset Pulse Width (MIN)	2.5 ms	1 μs
Tpw2	Preset Pulse Width (MIN)	2.5 ms	500 μs
Tst	Enable/Reset/Preset to Count Setup Time (MIN)	2.5 ms	2 μs
Thold	Enable/Reset to Count Hold Time (MIN)	2.5 ms	2 μs

**Note:** The timing parameter limits are measures at the module field terminal connector at the logic low threshold level.

**Module Functions**

The following functions apply to the EHC202 high speed counter module.

---

<b>COUNT UP</b>	<p>The input counter is reset to zero if the count direction input is UP and a preset (hardware or software) or Load Value command is sent to the module.</p> <p>When counting in the UP direction, the input counter increments to the maximum value, the next input pulse sets the counter to zero and it continues counting back up to the maximum value.</p>
<b>COUNT DOWN</b>	<p>The input counter is set to maximum count if the count direction is down and a preset (hardware or software) or Load Value command is sent to the module.</p> <p>When counting in the DOWN direction, the input counter is decremented from the maximum value to zero. The next pulse resets the input counter to the Maximum value and the increment down starts again.</p>
<b>REMOVE ENABLE</b>	<p>This function disables the input counter, causing it to stop incrementing and hold the count accumulated prior to disabling.</p>
<b>OUTPUTS</b>	<p>When configured in the count mode, outputs will turn on for defined times when setpoints or maximum values have been reached.</p> <p>No output assertion in two 32 bit counter mode or rate sample.</p> <p>Programmed ON time for outputs can be set for one channel, one output and one trigger point only.</p> <p>In a running controller, latched outputs are turned off only by a hardware RESET input. If no reset is provided, the outputs latched on will turn off when the controller is stopped.</p>
<b>COUNTER PRESET</b>	<p>This is both a hardware and software function. In the event that both methods are used, the last one executed has precedence. An input counter will be automatically preset whenever a new maximum value or rate sample time is loaded.</p>
<b>COUNTER ENABLE</b>	<p>Both hardware and software enables are required for an input counter to operate. An input counter will be automatically software enabled whenever a new maximum value is loaded or a preset (hardware or software) is sent to it.</p>
<b>RATE SAMPLE VALUE</b>	<p>The rate sample value is held and may be accessed during count operations. The value read is from the last configured and completed rate sample interval.</p>

---

**QUADRATURE MODE**

When the module is configured for quadrature mode operation, the counter requires encoder pulses on inputs A and B.

In quadrature mode, all input signal edges are counted. A 60 count/revolution encoder will produce a count of 240 for one shaft rotation.

---

**Miscellaneous Information**

Field wire to Counter 2 inputs and outputs, when configured for one 32 bit counter with output assertion. The unused Counter 1 must have its + (plus) inputs connected to VREF+.

Input counts and parameters are not maintained in the module at power down. The rewrite of parameters at power up must be done with either user logic or Modzoom-type preset panel selections.

The 200 Hz filter for each counter can be activated by strapping the Lo Filter Sel terminal to the Return terminal. This function provides noise immunity for low frequency applications and can also be used for relay debounce.

---

**Operation**

The following information describes the operation of various module functions.

---

**Rate Sample**

To rate sample, the module must be:

- Configured for pulse or quadrature mode.
  - Configured for Rate Sample mode.
  - Loaded with the Rate Sample time value.
  - Enabled to count, using hardwired input and software control bits.
- 

**Pulse Count**

To count pulses, the module must be:

- Configured for pulse or quadrature mode.
  - Configured for counter display: two 16 bit, one 32 bit, or two 32 bit counters.
  - Loaded with the maximum count.
  - Enabled to count, using hardwired input and software control bits.
- 

**Pulse Count and Turning Outputs On/Off**

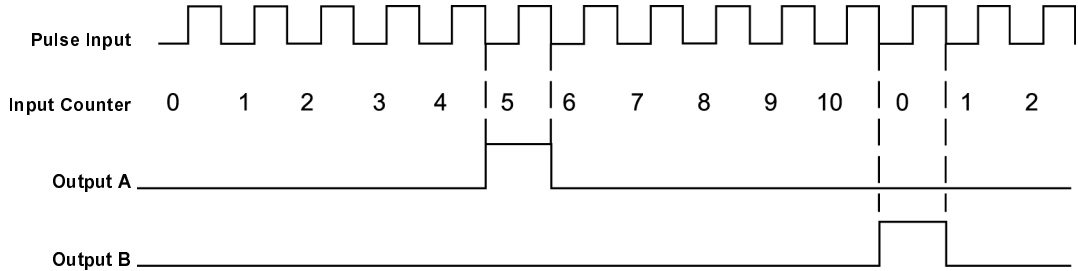
To count pulses and turn outputs on and off, the module must be:

- Configured for pulse or quadrature mode.
  - Configured for two 16 bit or one 32 bit counter.
  - Configured to assert or not assert outputs at the programmed count values when the module loses communication with the bus (fault condition).
  - Configured to specify if outputs turn on at a setpoint or maximum count, turn on at those points for a specific amount of time, or remain latched. If latched, outputs can only be reset by a hard wired input.
  - Loaded with setpoint values, maximum count values, and output assert time.
  - Enabled to count using hardwired input and software control bits.
-



## Counter Rollover Examples for Pulse Input

### Example 1 - Count Up

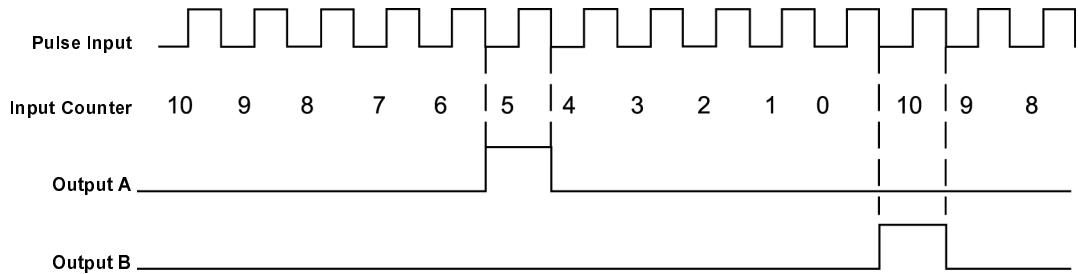


Count is from 0 -> 10 (Maximum Count)

Output A turns on at Setpoint = 5

Output B turns on after Input Count = Maximum (Terminal) Count = 10

### Example 2 - Count Down



Count is from 10 (Maximum Count) -> 0

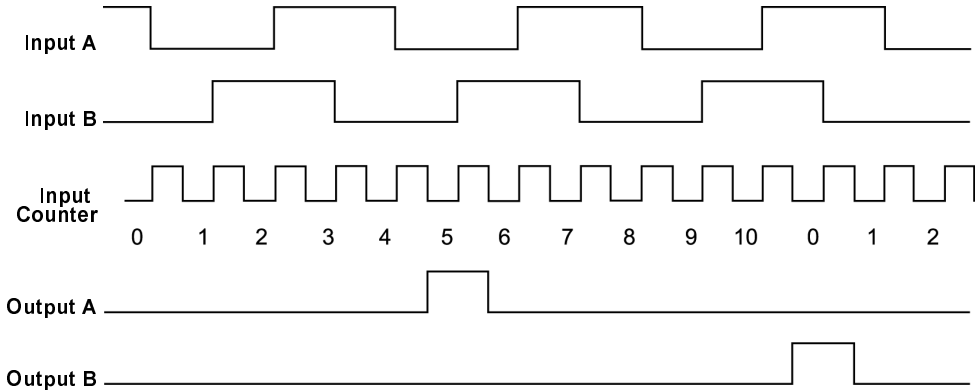
Output A turns on at Setpoint = 5

Output B turns on after Input Count = 0

**Note:** Outputs are not latched.

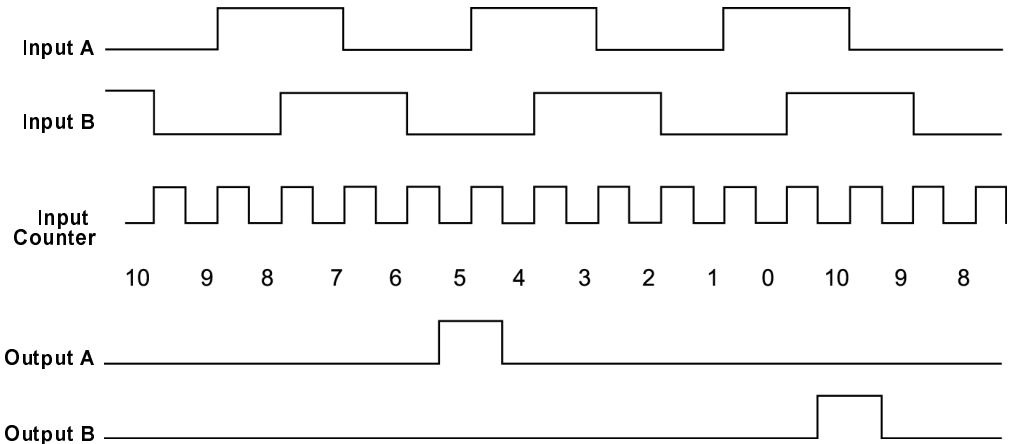
**Counter Rollover  
Examples for  
Quadrature Input**

**Example 1 - Count Up**



Count is from 0 -> 10 (Maximum Count)  
 Output A turns on at Setpoint = 5. Output B turns on after Input Count = Maximum (Terminal) Count = 10

**Example 2 - Count Down**



Count is from 10 (Maximum Count) -> 0  
 Output A turns on at Setpoint = 5  
 Output B turns on after Input Count = 0

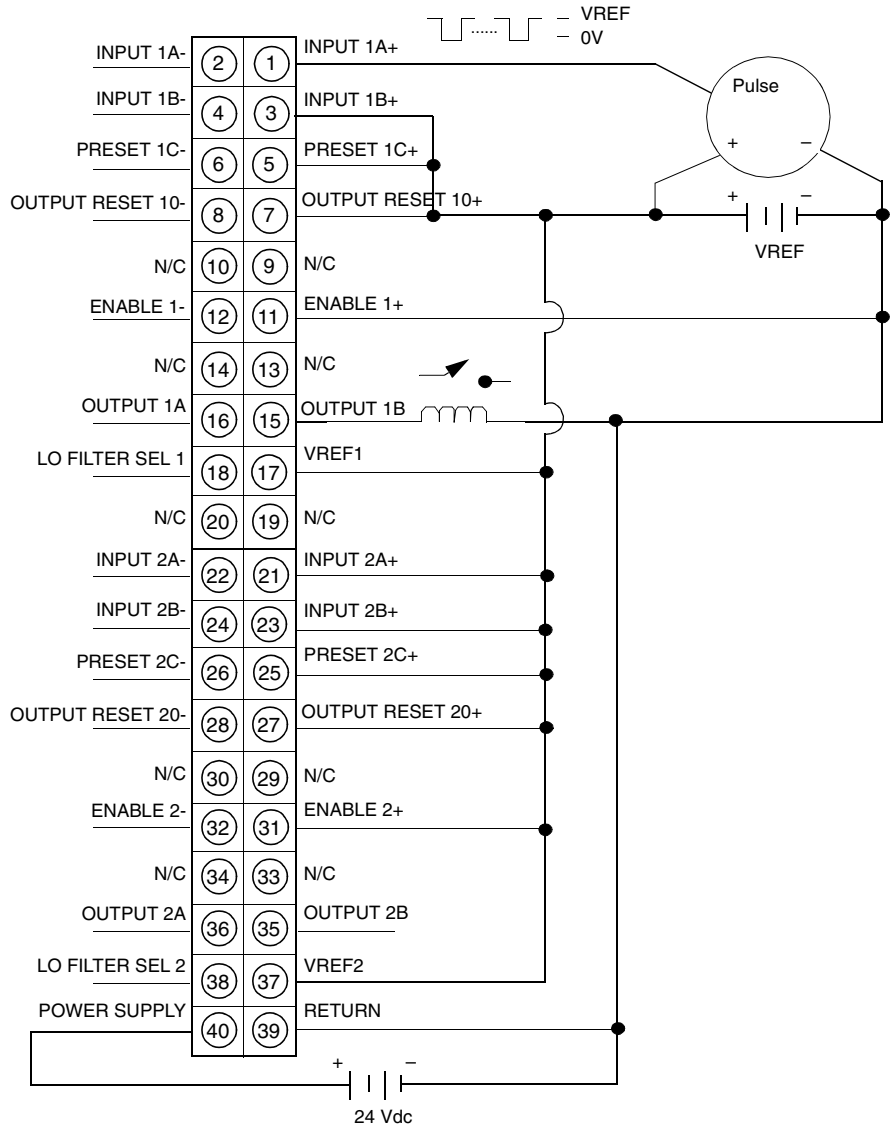
**Note:** Outputs are not latched.

## Wiring Diagram Signal Descriptions

The following table shows the wiring diagram for signal descriptions.

Parameter	Description/Usage
INPUT A	Single ended or differential count input or Phase A for quadrature mode.
	Single ended (active low only) uses Input 1A+ and/or Input 2A+.
	Input 1A- and/or Input 2A- are not connected. Differential input encoders use both plus (+) and minus (-) inputs.
INPUT B	Direction level for non-quadrature devices or Phase B for quadrature mode.
	Direction inputs for non-quadrature input devices are: Count Up = High Voltage Level Count Down = Low Voltage Level
	For single ended Input devices, only Input 1B+ and/or Input 2B+ are used. Input 1B- and 2B- are not connected. Differential input encoders use both plus (+) and minus (-) inputs.
PRESET C	Presets count register(s). Low level causes preset.
	For single ended Preset inputs, only Preset 1C+ and/or Preset 2B+ are used. Preset 1C- and 2C- are not connected. Differential input encoders use both plus (+) and minus (-) inputs.
OUTPUT RESET 0	Low level resets Outputs 1A, 1B, 2A, and 2B to OFF if latched.
	For single ended Reset inputs, only Reset 10+ and/or Reset 20+ are used. Reset 10- and 20- are not connected. Differential input encoders use both plus (+) and minus (-) inputs.
ENABLE	Low level enables counting.
	For single ended Enable inputs, only Enable 1+ and/or Enable 2+ are used. Enable 1- and 2- are not connected. Differential input encoders use both plus (+) and minus (-) inputs.
VREF	Field input device power source connection. Also, connect any unused (+) inputs to the group VREF terminal or the one in use (30 Vdc max). Group A = Terminal 17 Group B = Terminal 37 Group A and Group B VREF supplies can be different voltage levels.
LO FILTER SEL	Enables the internal 200 Hz filter when connected to Return Terminal 39.
OUTPUT	Internal FET switches connect the output supply wired to Terminal 40 to the Output 1A, 1B, 2A, 2B terminals at output assert times.
POWER SUPPLY	External 24 Vdc power supply (+) connection. Required for the module interface and for Outputs 1A, 1B, 2A, and 2B.
RETURN	External 24 Vdc power supply (-) connection. Required for the module interface and for Outputs 1A, 1B, 2A, and 2B.

**Wiring Diagram** The following figure shows the 140EHC20200 wiring diagram.



The preceding wiring diagram shows single ended connections for:

<b>Terminal 1</b>	Pulse encoder input (sinking device)
<b>Terminal 3</b>	Input 1B count UP direction
<b>Terminal 5</b>	Unused hardwire Preset tied high
<b>Terminal 7</b>	Output Reset tied high, not required; outputs not used
<b>Terminal 11</b>	Hardware enabled (software enable also required using predefined Modzoom or 4X register)
<b>Terminal 17</b>	Required Vref+ connection
<b>Terminal 21</b> <b>Terminal 23</b> <b>Terminal 25</b> <b>Terminal 27</b> <b>Terminal 31</b> <b>Terminal 37</b>	Counter 2 not used. These terminals must be connected VREF+.
<b>Terminal 39</b>	Required Output Supply Return
<b>Terminal 40</b>	Required Output Supply

See *p. 294* for both differential pulse encoder input and single ended or differential quadrature encoder input wiring diagrams.

## 140ESI06210 ASCII Interface Module

### Overview

The ASCII Interface Two Channel module is a Quantum communications interface module used to:

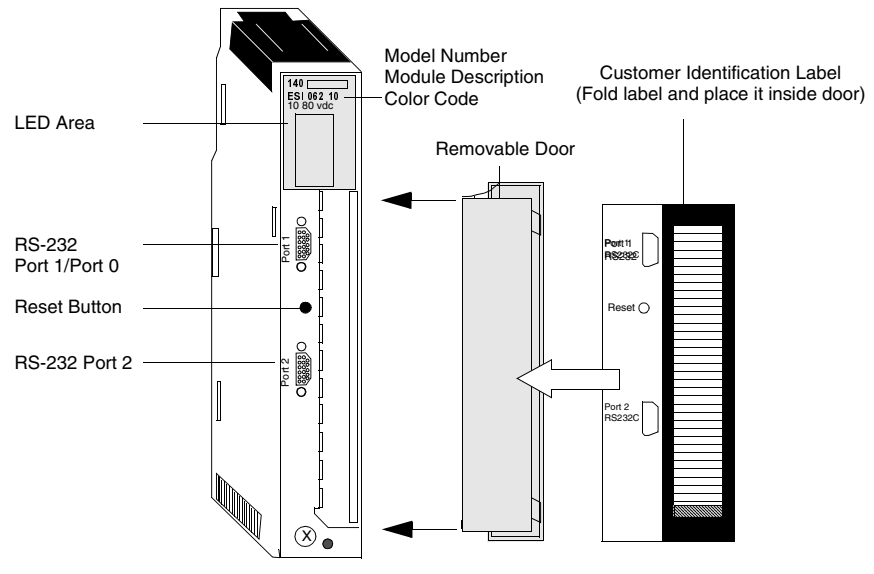
- Input messages and/or data from an ASCII device to the CPU.
- Output messages and/or data from the CPU to an ASCII device.
- Bi-directionally exchange messages and/or data between an ASCII device and the CPU.

### Related Documentation

For more detailed information on use of the ASCII interface module, refer to the *Quantum Automation Series 140ESI06210 ASCII Interface Module User Guide* (840 USE 108 00).

### ASCII Interface Module

The following figure shows the ESI06210 ASCII interface module components.



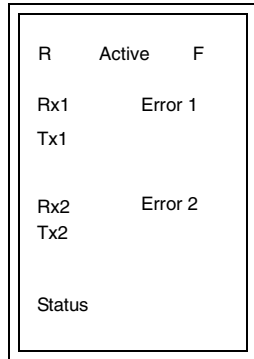
**Specifications**

The following table shows the specifications for the ASCII interface two channel module.

<b>Specifications</b>	
<b>Data Interface</b>	
RS-232C	2 serial ports (9-pin D-shell), non-isolated
Cabling (Maximum cable length 20 m shielded)	990NAA26320, Modbus Programming Cable, RS-232, 12 ft. (2.7 m)
	990NAA26350, Modbus Programming Cable, RS-232, 50 ft. (15.5 m)
<b>Firmware Specifications</b>	
Port Performance	Burst Speed: 19.2 k baud each port. Continuous Speed: Application dependent
Depth of Nested Messages	8
Buffer Size	255 Input. 255 Output
Number of Messages	255
Maximum Message Length	127 characters plus 1 checksum
<b>Memory</b>	
RAM	256 kb for data and program + 2 kb dual port ram
Flash-ROM	128 kb for program and firmware
Power Dissipation	2 W max
Bus Current Required	300 mA
<b>Fusing</b>	
Internal	None
External	User discretion
Required Addressing	12 Words In 12 Words Out
<b>Compatibility</b>	
Programming Software	Modsoft V2.4 or Concept 2.0 at a minimum
Data Formats Supported	Text, Decimal, Fixed Point, Nested Write Message, Set Register Pointer, Print Time/Date, Repeat, Space, Newline, Control Code, Flush Buffer
Quantum Controllers	All, Executive V2.0 at a minimum
Battery Backup Module	140XCP90000

**LED Indicators and Descriptions**

The following figure shows the ESI06210 LED indicators.



The following table shows the ESI06210 LED descriptions.

LEDs	Color	Indication when On
R	Green	The module has passed powerup diagnostics
Active	Green	Bus communication is present
F	Red	The module has detected a fault
Rx1	Green	Received data on RS-232C Port 1
Tx1	Green	Transmitted data on RS-232C Port 1
Rx2	Green	Received data on RS-232C Port 2
Tx2	Green	Transmitted data on RS-232C Port 2
Status	Yellow	Status
Error 1	Red	There is an error condition on Port 1
Error 2	Red	There is an error condition on Port 2



**LED Blinking Sequence**

The following table shows the blinking sequence of the F, Status, Error 1, and Error 2 LEDs.

<b>LEDs and Blinking Sequence</b>				
<b>F</b>	<b>Status</b>	<b>Error 1</b>	<b>Error 2</b>	<b>Description</b>
F	Status	Error 1	Error 2	Description
OFF	ON	OFF	OFF	Programming mode
OFF	OFF	ON	N/A	Serial Port 1 incurred a buffer overrun
OFF	OFF	N/A	ON	Serial Port 2 incurred a buffer overrun
N/A	Blinking (See the next table)	OFF	OFF	The ASCII module is in kernal mode and may have an error

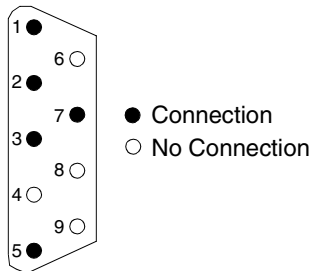
**Status LED Crash Codes**

The following table shows a table of Status LED crash codes.

<b>Number of Blinks (one per second)</b>	<b>Code (in hex)</b>	<b>Error</b>
Steady	0000	Requested kernal mode
4	6631	Bad micro controller interrupt
5	6503	RAM address test error
6	6402	RAM data test error
7	6300	PROM checksum error (EXEC not loaded)
	6301	PROM checksum error
	630A	Flash-message checksum error
	630B	Executive watchdog timeout error
8	8000	Kernal other error
	8001	Kernal PROM checksum error
	8002	Flash program error
	8003	Unexpected executive return

### Front Panel Connectors and Switches

The ESI has two serial ports which it uses to communicate with serial devices. The following is the pinout connections for the ASCII module serial ports.



### RS-232C Serial Ports

The following table shows the pin number and description for the RS-232C serial ports.

Pin Number	Signal Name	Description
1	DCD	Carrier Detect
2	RXD	Receive Data
3	TXD	Transmit Data
4	N/A	Not Connected
5	GND	Signal Ground
6	N/A	Not Connected
7	RTS	Request to Send
8	N/A	Not Connected
9	N/A	Not Connected
Shield	N/A	Chassis Ground

The serial port interface allows the user to configure the module and to program the ASCII messages into the module. This is only activated when the module enters into its programming mode via the front panel push button.

**Note:** The serial port is capable of communicating with either a dumb terminal or a PC using terminal emulation software (i.e., PROCOMM).

**Serial Port Setup** When programming mode is entered, one of the RS-232 serial ports is set to a standard terminal communication's configuration to communicate with the user on the programming terminal via a Modbus. This communication configuration consists of the following.

<b>Baud rate:</b>	<b>9600</b>
Data bits:	8
Stop bits:	1
Parity bit:	None (disabled)
Keyboard Mode:	ON (Character echo)
XON/XOFF:	ON

The serial port configuration has been set this way so that the configuration of the port is a known configuration and may or may not be the same configuration that is used when the module is running.

**Front Panel  
Reset Push  
Button**

A recessed push button on the front of the module is used to reset the module.



## 140HLI34000 High Speed Interrupt Module

### Overview

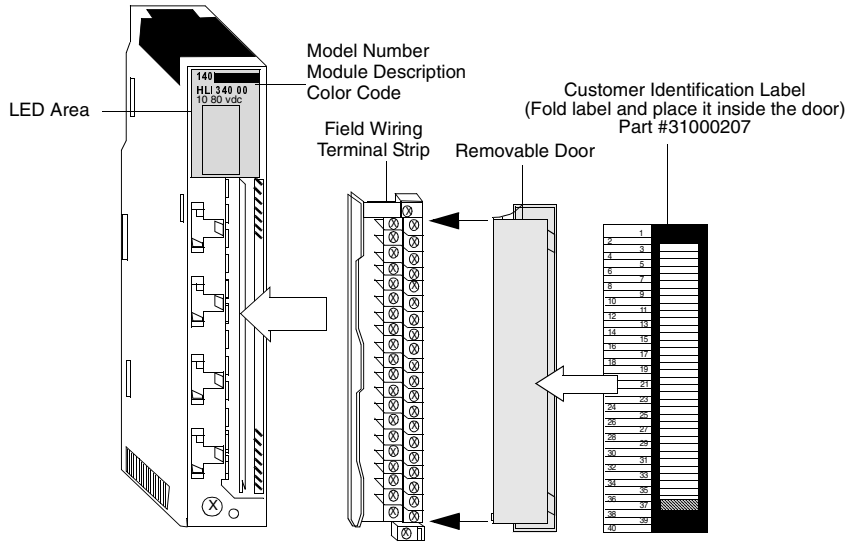
The High Speed Latch and Interrupt 24 Vdc 16x1 Sink/Source Input module accepts 24 Vdc inputs and is for use with 24 Vdc sink/source input devices.

### Related Documentation

For more detailed information on the use of a Quantum High Speed Interrupt module, refer to the *Quantum Automation Series 140HLI34000 High Speed Interrupt I/O Module User Guide* (840 USE 112 00).

### High Speed Interrupt Module

The following figure shows the components of the HLI34000 high speed interrupt module.



**Specifications**

The following table shows the specifications for the HLI34000 high speed interrupt module.

<b>Specifications</b>	
<b>Number of Input Points</b>	16 isolated points
<b>LEDs</b>	Active 1 ... 16 (Green) - Indicates point status
<b>Required Addressing</b>	1 Word In
<b>Operating Voltages and Currents</b>	
ON (voltage)	15 ... 30 Vdc
OFF (voltage)	-3 ... +5 Vdc
ON (current)	2.0 ... 8.0 mA
OFF (current)	0 ... 0.5 mA
<b>Absolute Maximum Input</b>	
Continuous	30 Vdc
<b>Response</b>	
OFF - ON	30 $\mu$ s (max)
ON - OFF	130 $\mu$ s (max)
Input Protection	30 Vdc reverse polarity
<b>Isolation</b>	
Point to Point	500 Vac rms for 1 minute
Point to Bus	1780 Vac rms for 1 minute
<b>Fault Detection</b>	None
<b>Bus Current Required</b>	400 mA
<b>Power Dissipation</b>	2.0 W + 0.30 W x the number of points on
<b>External Power</b>	Not required for this module
<b>Fusing</b>	
Internal	None
External	User discretion

**LED Indicators and Descriptions**

The following figure shows the LED indicators for the HLI34000 high speed interrupt module.

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

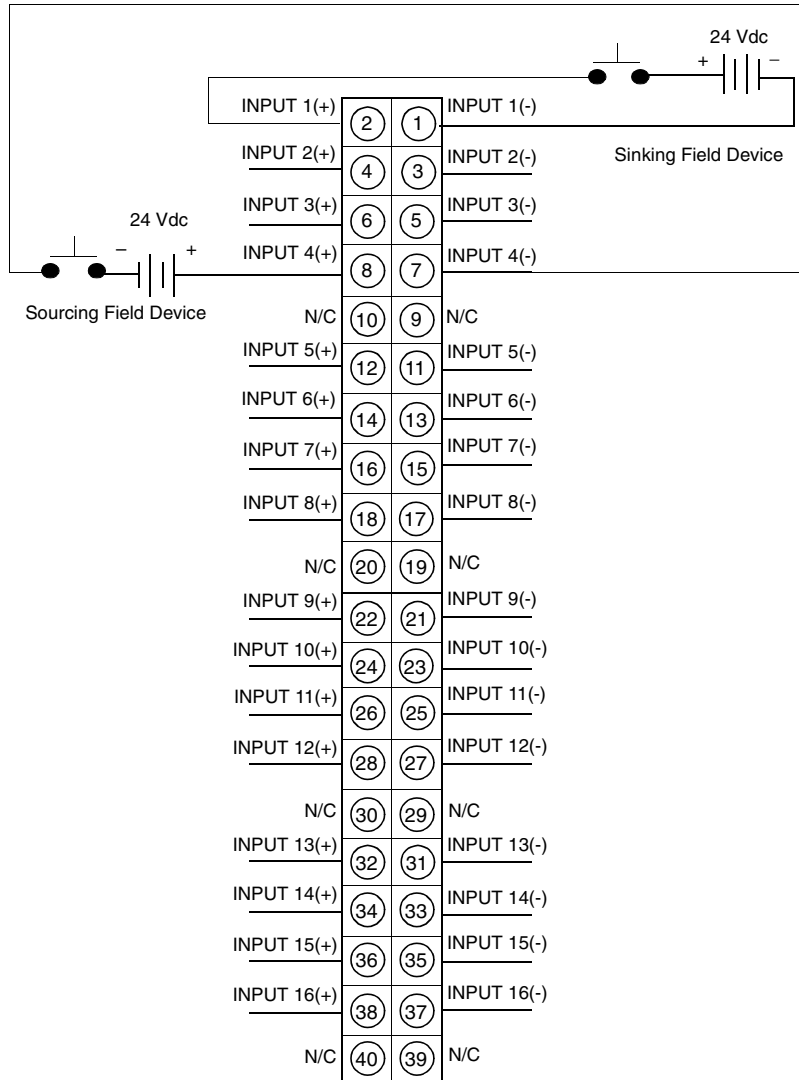
The following table shows the LED descriptions for the HLI34000 high speed interrupt module

LED Descriptions		
LEDs	Color	Indication when On
Active	Green	Bus communication is present.
1 ... 16	Green	The indicated point or channel is turned on.

**Note:** Due to the speed of the module, LED indications do not represent the state of the input signal, when the input signal is a short duration pulse.

**Wiring Diagram**

The following figure shows the wiring diagram for the HLI 340 00 High Speed Interrupt module.

**Note:**

1. Either shielded or unshielded signal cables may be used (the user should consider using shielded wire in a noisy environment). Shielded types should have a shield tied to earth ground near the signal source end.
2. N / C = Not Connected

## 140MSB/MSC10100 Quantum MSX Motion Modules

### Overview

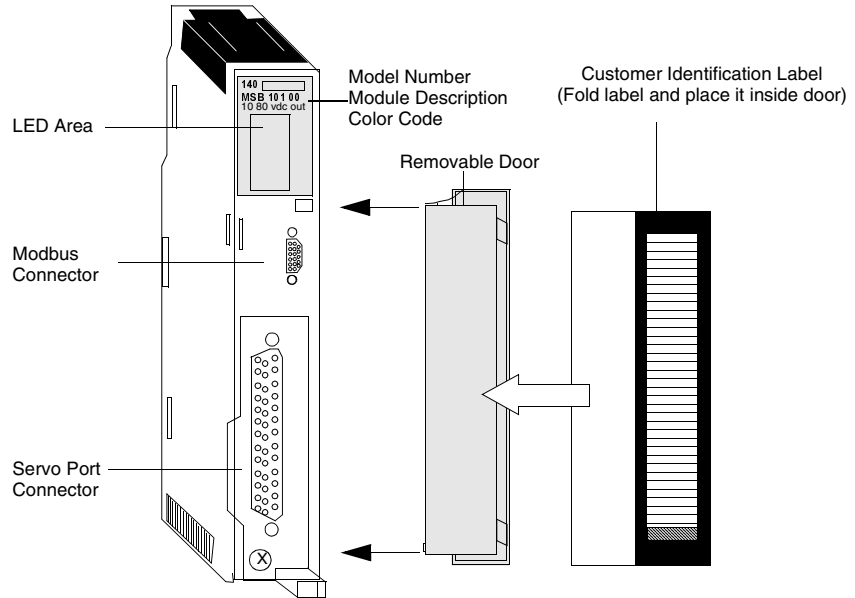
The Quantum single axis motion (MSX) modules are incremental encoder (140MSB10100) or resolver and encoder (140MSB/MSC10100) feedback-only modules contained in a single-width housing. It works with servo motors that use Cyberline drives and other types of DC and brushless drives from other manufacturers.

### Related Documentation

For detailed information on the use of MSX motion modules, refer to the *Quantum Automation Series 140MSX10100 Single Axis Motion Module Reference Guide* (840 USE 105 00).

### MSX Motion Modules

The following figure shows the components of the MSX motion modules.





**Operational Specifications**

The following table shows the operational specifications for the servo.

<b>Servo</b>	
Commutation Update Rate	0.25 ms
Velocity Loop Update Rate	0.5 ms
Velocity Loop Bandwidth	> 100 Hz
Velocity Range	0 - 6000 rpm
Position Loop Update rate	1 ms
Position Accuracy - Resolver	+/- 10 arc minutes typical, +/- 15 arc minutes max
Position Repeatability - Resolver	+/- 5 arc minutes max
Position Accuracy - Encoder	Encoder dependent, 0.5 arc minutes max

The following table shows the operations specifications for communication.

<b>Communication</b>	
Protocol	Modbus
Address (set by software)	1 default
Required Addressing	6 Words In, 6 Words Out
Baud Rate (set by software)	300 - 19200 baud, 9600 default

The following table shows the operational specifications for the application program.

<b>Application Program</b>	
Execution Rate	See note below
Storage	650 instructions

**Note:** A majority of the instructions typically take 1 ms to execute. The execution time of an instruction, though, is not constant. The execution time can increase due to factors such as: if the Sync Ratio Mode is on, how often the position generator must execute to plan out new moves, how many "whenever"s are enabled, and the number of sources requesting commands to be executed (e.g., backplane, internal program, Modbus port), etc. If timing is extremely critical to an application, actual time must be determined experimentally by running the actual application program.

The following table shows the operational specifications for high speed input.

<b>High Speed Input</b>	
Position Capture Time	250 $\mu$ s max
Isolation	500 V to system bus
Pulse Width	25 $\mu$ s
Minimum Time Between Successive Captures	20 ms

The following table shows the operational specifications for discrete inputs.

<b>Discrete Inputs</b>	
Number	7
Scan Time	1.5 ms
Isolation	500 V to system bus

The following table shows the operational specifications for discrete outputs.

<b>Discrete Outputs</b>	
Number	3
Update Time	10 ms max
Isolation	500 V to system bus
Reset State	0 V, nominal
On State	24 V, nominal
Output Type	Totem pole (sink/source)
Protection	Short circuit, overvoltage
Fault	Overcurrent detected

The following table shows the operational specifications for analog input.

<b>Analog Input</b>	
Number	1
Scan Time	15 ms
Data	User configurable
Range	+/- 10 V
Accuracy	+/- 100 mV, plus offset

The following table shows the operational specifications for analog output.

<b>Analog Output</b>	
Number	1
Scan Time	20 ms
Data	User configurable
Range	+/- 10 V
Accuracy	+/- 50 mV, plus offset

The following table shows the operational specifications for the resolver feedback (fully configured version).

<b>Resolver Feedback (Fully Configured Version)</b>	
Conversion Method	Tracking
Resolver Style	Transmit
Excitation Frequency	5 kHz
Excitation Amplitude	Automatically adjusted
Excitation Current	120 mA
Loss of Feedback	Detected within 40 ms

The following table shows the operational specifications for the incremental encoder feedback.

<b>Incremental Encoder Feedback</b>	
Resolution	4 times line count
Signals	A, B, Mark
Signal Frequency	200 kHz, up to 500 kHz with reduced noise immunity
Encoder Output style	Differential, 5 V
Loss of Feedback	Detected within 40 ms

The following table shows the operational specifications for compatibility.

<b>Compatibility</b>	
Programming Software	Modsoft V2.32 or Concept 2.0 at a minimum
Quantum Controllers	All, V2.0 at a minimum

**Electrical Specifications**

The following table shows the electrical specifications for discrete inputs and high speed input.

<b>Discrete Inputs and High Speed Input</b>	
Input Impedance	3.5 k $\Omega$
Inputs On	15 Vdc min
Inputs Off	5 Vdc max
Isolation	500 Vac to system bus

The following table shows the electrical specifications for discrete output.

<b>Discrete Output</b>	
Drive Capability	150 mA at user supplied. 19.2 ... 30 Vdc resistive
Protection	Current limit, thermal
Isolation	500 Vac to system bus

The following table shows the electrical specifications for analog input.

<b>Analog Input</b>	
Resolution	10 bits
Input Impedance	30 k $\Omega$
Offset	+/- 50 mV
Accuracy	+/- 100 mV, plus offset

The following table shows the electrical specifications for analog output.

<b>Analog Output</b>	
Resolution	12 bits
Drive Capability	3 mA
Offset	+/- 50 mV
Accuracy	+/- 50 mV, plus offset

The following table shows the electrical specifications for the resolver interface.

<b>Resolver Interface</b>	
Reference	5 +/- 0.05 kHz, 1.6 ... 5.5 V rms. 50 mA drive capability
Sine / Cosine Input Impedance	3 k $\Omega$
Resolution	16 bits to 300 rpm. 14 bits to 1350 rpm. 12 bits to 6000 rpm
Accuracy	10 arc minutes, typical, resolver dependent

The following table shows the electrical specifications for the motor temperature input.

<b>Motor Temperature Input</b>	
Normal State	Short circuit, 2 mA sink max
Fault State	Open circuit
Isolation	500 Vac to system bus

The following table shows the electrical specifications for the encoder feedback interface.

<b>Encoder Feedback Interface</b>	
Input Range	-0.7 ... 7 Vdc
Input Impedance	145 $\Omega$ , nominal
Differential Signals, High	+2 V differential, min
Differential Signals, Low	-2 V differential, min
Maximum Encoder Frequency	200 kHz square wave (55% ... 45% with less than 15 degrees of quadrature error)
Isolation	500 Vac to system bus with external power supply
Minimum Encoder Pulse Width	1 ms

The following table shows the electrical specifications for the drive interface.

<b>Drive Interface</b>	
Drive Fault Input	True high, TTL compatible relative to remote common, 10 K internal pull-up resistor
Drive Enable Relay	Form C contacts. 120 Vac @ 0.1 A resistive. 30 Vdc @ 0.5 A resistive
Current Command Voltages	+/- 10 Vdc
Current Command Summing Accuracy	0 +/- 0.1 Vdc
Current Commands	3 mA drive capability

The following table shows the electrical specifications for power requirements.

<b>Power Requirements</b>	
Main Power Input	5 V +/- 5% @ 750 mA (with no encoders or resolvers attached, output off)
Main Power Input	5 V +/- 5% @ 1000 mA (with maximum encoder and resolver load, outputs on)
Hot Swap Surge Current	Less than 5 A
Bus Current Required	MSB Module: 700 mA. MSC Module: 1000 mA

## Front Panel Indicators and Descriptions

There are 17 LED indicators visible on the front panel. The following figure shows the front panel LED indicators.

Active	
Ready	Drv Flt
+ Lim ok	Drv En
- Lim ok	Out 1
Home	Out 2
In 4	Out 3
In 5	Modbus
In 6	Moving
In 7	In Pos

The following table shows the 140MSX10100 LED descriptions.

LEDs	Color	Indication when On
Active	Green	Bus communication is present.
Ready	Green	The module has passed powerup diagnostics.
+ Lim ok	Green	Digital Input 1 active.
- Lim ok	Green	Digital Input 2 active.
Home	Green	Digital Input 3 active.
In 4	Green	Digital Input 4 active.
In 5	Green	Digital Input 5 active.
In 6	Green	Digital Input 6 active.
In 7	Green	Digital Input 7 active.
Drv Flt	Red	Fault signal from drive.
Drv En	Green	Drive enabled.
Out 1	Green	Digital Output 1 active.
Out 2	Green	Digital Output 2 active.
Out 3	Green	Digital Output 3 active.
Modbus	Green	Communications are active on the Modbus port.
Moving	Amber	Motor is moving.
In Pos	Amber	Motion is within the in position of the final target.

## Front Panel Connectors

There are two connectors located on the front of the module: the Modbus Connector and the Servo Connector.

## Modbus Connectors

The MSX modules are equipped with a 9-pin, RS-232C connector that supports Modicon's proprietary Modbus communication protocol. The following is the Modbus port pinout connections for 9-pin and 25-pin connections. The following figure shows the MSX Modbus port pinouts to 9-pin connectors (AS-W956-xxx).

Signal	MSx Pin		Computer Pin	Signal	Function
	1	No Connection	1		Shield
TXD	2	_____	3	RXD	Serial data
RXD	3	_____	2	TXD	Serial data
GND	4	_____	5	GND	Ground
DTR	5	_____	6	DSR	Control line
DSR	6	_____	4	DTR	Control line
RTS	7	□	7	RTS	Control line
CTS	8	□	8	CTS	Control line

The following figure shows the MSX Modbus port pinouts for 25-pin connectors (AS-W955-xxx).

Signal	MSx Pin		Computer Pin	Signal	Function
	1	No Connection	1		Shield
TXD	2	_____	2	RXD	Serial data
RXD	3	_____	3	TXD	Serial data
GND	4	_____	7	GND	Ground
DTR	5	_____	6	DSR	Control line
DSR	6	_____	20	DTR	Control line
RTS	7	□	4	RTS	Control line
CTS	8	□	5	CTS	Control line

## Servo Connector

The MSX is also equipped with a 50-pin servo connector for communication with feedback devices.

**Note:** The tables below show the 50-pin servo connector signals. Pin numbers correspond to both the MSB and MSC modules. When the signals differ from each other, they are shown separated by a slash (i.e., Pin Number 34, MSB/MSC).

**Server Connector Signals**

The following figure shows the server connector signals (from left to right) 50 - 34.

50	N/C
49	N/C /Reference Output Low
48	N/C /Reference Output High
47	N/C /Sine Input Low
46	N/C /Sine Input High
45	N/C /Cosine Input Low
44	N/C /Cosine Input High
43	Overtemp Low
42	Overtemp High
41	Drive Enable Common
40	Drive Enable Contact (NC)
39	Drive Enable Contact (NO)
38	Drive Fault
37	Velocity - / Phase Common
36	N/C / Phase C
35	N/C / Phase B
34	Velocity + / Phase A

The following figure shows the server connector signals (from left to right) 33 - 18.

33	Analog Input
32	Analog Common
31	Analog Output
30	High Speed Input
29	Auxiliary Input 7
28	Auxiliary Input 6
27	Auxiliary Input 5
26	Auxiliary Input 4
25	Home (Auxiliary Input 3)
24	Limit CCW (Auxiliary Input 2)
23	Limit CW (Auxiliary Input 1)
22	Auxiliary Output 3
21	Auxiliary Output 2
20	Brake Output (Auxiliary Output 1)
19	24 V Common
18	24 Vdc

The following figure shows the server connector signals (from left to right) 17 - 1.

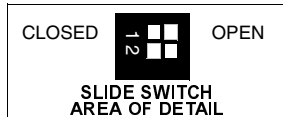
17	N/C (Not Connected)
16	N/C
15	N/C
14	N/C
13	N/C
12	Encoder 2 Mark-
11	Encoder 2 Mark+
10	Encoder 2 Phase B-
9	Encoder 2 Phase B+
8	Encoder 2 Phase A-
7	Encoder 2 Phase A+
6	Encoder 1 Mark-
5	Encoder 1 Mark+
4	Encoder 1 Phase B-
3	Encoder 1 Phase B+
2	Encoder 1 Phase A-
1	Encoder 1 Phase A+



## Rear Panel Switches

The MSX has an RS-232 serial port to connect the module to an IBM PC (or compatible) running the Modicon Motion Development Software (MMDS). A two-position Dip switch is located on the rear panel of the module (see the following illustration). SW1 is used to specify the module's operating mode (984 or MMDS control). SW2 is used to specify the communication characteristics of the Modbus port upon power-up.

The following figure shows the two-position Dip switch.



The following table shows the settings for the Dip switch settings.

Switch	Setting	Function
SW1	*Closed	MMDS control
	Open	PLC control
SW2	Closed	Programmed baud
	*Open	Modbus default
*Factory setting		

**Note:** SW1 and SW2 are open when they are switched away from the internal PCB of the module.

## 140XBE10000 Backplane Expander and Cable

---

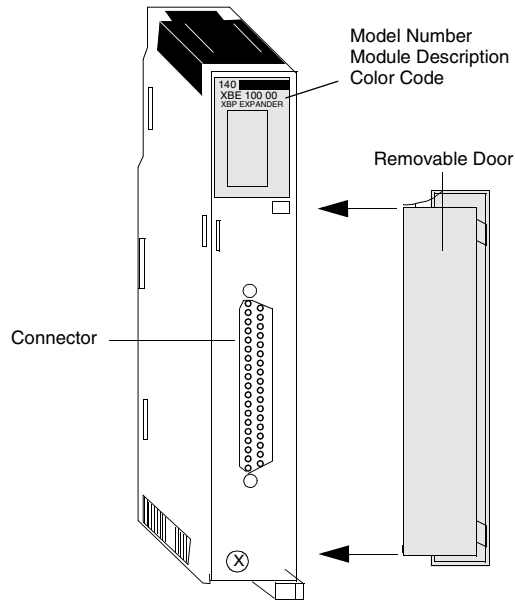
### Backplane Expander

With the 140XBE10000 Backplane Expander you can add a second backplane to a local or remote drop. A custom communications cable, 3.0 meters maximum, provides the data communication transfer.

---

### Backplane Expander Illustration

The following figure shows the components of the backplane expander.



**Specifications**

Specifications for the 140XBE10000 Backplane Expander are below.

<b>Specifications</b>	
<b>Number of Connected Backplanes</b>	2
<b>Maximum Distance</b>	3 meters
<b>Backplane Requirements</b>	
Size	All backplane sizes – 3, 4, 6, 10 and 16 slot.
Slots used	1
Number of Backplane Expander modules allowed	1 per backplane
<b>LEDs</b>	None.
<b>Required Addressing</b>	The Backplane Expander will look like an unfilled slot in the PLC I/O map.
<b>Power Requirements</b>	
Power Consumption	2.5 watts
Bus Current Required	500 mA
<b>Connector</b>	37 pin D-type
<b>Compatibility</b>	
Primary Backplane	No restrictions
Secondary Backplane	All types of Quantum I/O modules can be used in the secondary backplane, unless otherwise noted in the I/O documentation.
Programming Software	Modsoft V 2.6 or Concept V 2.2 at a minimum
Executive Firmware	140CPUX130X - Version 2.2 140CPUX341X - Version 1.03 140CPUx341xA - Any version 140CPU42402 - Version 2.15 140CRA93X0X - Version 1.2

**Words per Drop**

The following tables shows Words per drop.

<b>Maximum words per drop</b>	
Local I/O	64 in /64 out
Remote I/O	64 in /64 out

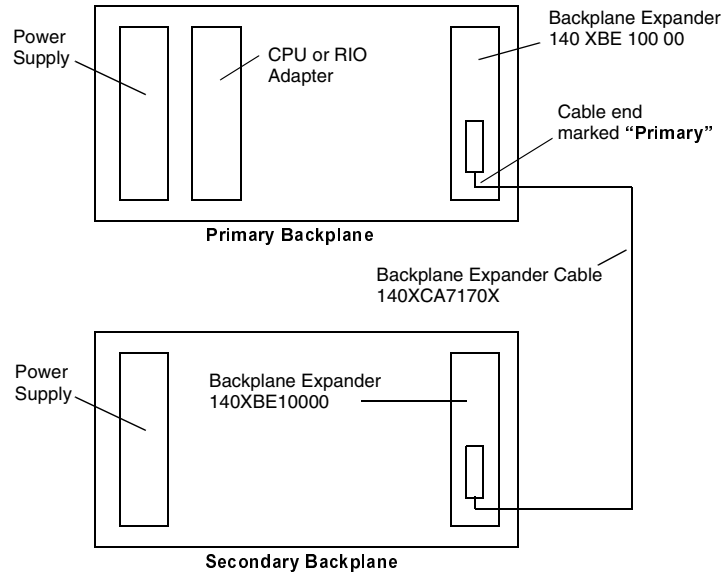
**Cable Specifications**

Specifications for the the three possible Expander Cables are below.


Part Number	Length
140 XCA 71703	1 meter
140 XCA 71706	2 meters
140 XCA 71709	3 meters

**Basic Configuration**

The backplane containing the the CPU or RIO drop adapter is designated the 'Primary' backplane and the adjacent backplane is designated the 'Secondary' backplane. Each backplane requires its own power supply.



**Note:** Cable must be installed before powering up the backplanes.


CAUTION

**Possible communications cable failure**

Do not Hot Swap a Backplane Expander module into a powered backplane unless the communications cable has first been connected to the module.

**Failure to follow this precaution can result in injury or equipment damage.**



## CAUTION

### **Possible communications failure.**

The cable is polarized. Ensure that the cable end marked "Primary" is connected to the backplane that has the CPU or RIO adapter.

**Failure to follow this precaution can result in injury or equipment damage.**



## WARNING

### **Hot Swapping Restriction**

Modules may be hot swapped when the area is known to be non-hazardous. Do not hot swap modules in a Class 1, Division 2 environment.

**Failure to follow this precaution can result in death, serious injury, or equipment damage.**



## CAUTION

### **User Defined Outputs**

If the primary backplane power supply goes OFF and the secondary backplane power supply remains ON the behavior of the outputs on the secondary backplane is not guaranteed. Outputs could either go to off state or take their Time out state as defined by the user. If the power supply of the secondary backplane goes OFF and the primary backplane power supply remains ON , the IO Health bit of the modules located in this backplane could indicate a healthy module. It is recommended that all modules in the secondary backplanes, regardless of configuration, have their Time out state configured as USER DEFINED with VALUE 0. Additionally using the same primary power source for primary and secondary backplanes could reduce the effect of this issue.

**Failure to follow this precaution can result in injury or equipment damage.**

**Backplane  
Expander  
Guidelines**

- The same 140XBE10000 Backplane Expander modules are used for the primary and secondary backplanes. The end of the Backplane Expander cable marked "Primary" always connects to the Backplane Expander module in the Primary Backplane.
  - The system can use any Quantum type power supply. Each backplane can have a different type of power supply.
  - Loss of power in the secondary backplane will not shut down the entire drop. Only modules located in the Secondary backplane will lose power.
  - Backplane expander modules can be located in any slot in the backplane and do not have to be placed in corresponding slots in the primary and secondary backplanes.
  - I/O modules that have downloadable executive firmware, such as the ESI module, are allowed in the secondary backplane except when downloading their execs. Executive firmware cannot be downloaded to modules in the secondary backplane.
  - It may be necessary to update the CPU or RIO drop executive firmware. See **Executive Firmware** section in the **Specifications** table.
  - The Backplane Expander will not be recognized by the programming panel software. It will look like an unfilled slot in the PLC I/O map.
  - The Backplane Expander will allow configuration or I/O mapping of additional modules in the local drop containing a CPU or RIO drop adapter up to the drop word limit or physical slot address limitation.
  - Option modules, such as NOMs, NOEs and CHSs must reside in the primary backplane.
  - Any Interrupt module can be located in the secondary backplane, but the interrupt mode is not supported.
  - The Backplane Expander module cannot be Hot Swapped into a powered backplane without first attaching the communications cable. To install the Backplane Expander in a powered backplane, first connect the cable to the Backplane Expander module, then mount the module into the powered backplane.
-

## 140CHS11000 Hot Standby Module

### Overview

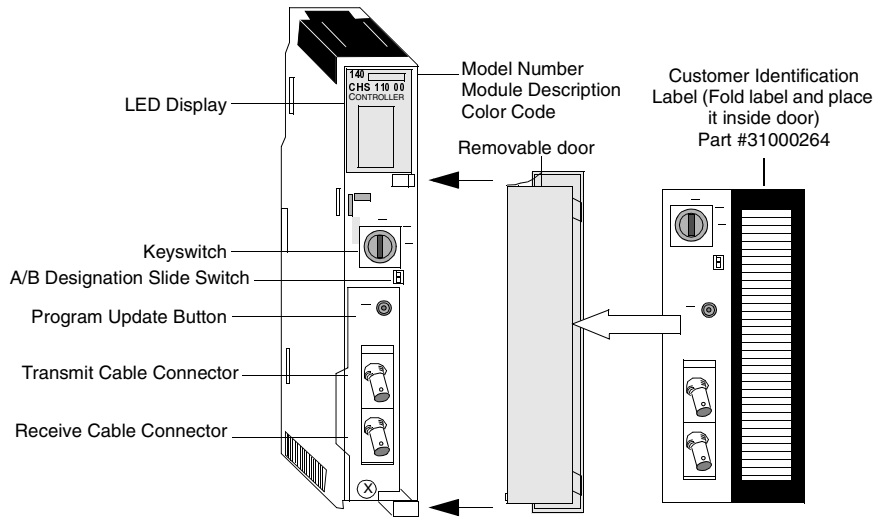
This section describes the Hot Standby Module 140CHS11000. The Quantum Hot Standby system is designed for use with remote I/O networks when downtime cannot be tolerated.

### Related Documentation

For more detailed information on the use of the Hot Standby module, refer to the *Quantum Automation Hot Standby System Planning and Installation Guide* (840 USE 106 00).

### Hot Standby Module

The following figure shows the Hot Standby Module components.

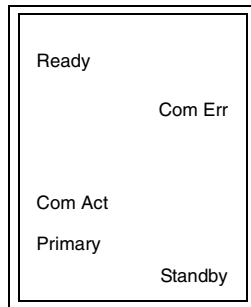


**Specifications** The following table shows the specifications for the Quantum Hot Standby system.

<b>Specifications</b>	
<b>I/O Type</b>	Quantum
<b>Fiber Optic Communication Ports</b>	2 (Transmit and Receive)
<b>Compatibility</b>	
Programming Software	Modsoft V2.32 or Concept 2.0 at a minimum
Quantum Controllers	All, V2.0 at a minimum. (Check the version label of the top front of the module for the proper revision level.)
<b>Bus Current Required (Typical)</b>	700 mA

### LED Indicators and Descriptions

The following figure shows the LED indicators.



The following table shows the LED descriptions.

<b>LEDs</b>	<b>Color</b>	<b>Indication when On</b>
Ready	Green	If steady: Power is being supplied to the module and it has passed initial internal diagnostic tests. If blinking: Module is trying to recover from an interface error.
Com Act	Green	If steady: CHS 110 modules are communicating. If blinking: An error has been detected.
Primary	Green	Module is supporting primary controller.
Com Err	Red	Module is retrying communications or communications failure has been detected.
Standby	Amber	If steady: Module is supporting the standby controller, which is ready to assume the primary role if needed. If blinking: Program update is in progress.



**Error Codes**

The following table shows the number of times the Com Act LED blinks for each type of error and the codes possible for that group (all codes are in hex).

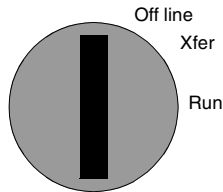
Number of Blinks	Code	Error
1	6900	error in additional transfer calculation
2	6801	ICB frame pattern error
	6802	head control block error
	6803	bad diagnostic request
	6804	greater than 128 MSL user loadables
4	6604	powerdown interrupt error
	6605	UART initialization error
5	6503	RAM address test error
6	6402	RAM data test error
7	6301	PROM checksum error
8	C101	no hook timeout
	C102	read state RAM timeout
	C103	write state RAM timeout
	C200	powerup error

**Front Panel Controls**

The Hot Standby module has three controls on the front panel: a function keyswitch, a designation slide switch, and an update button.

### Keyswitch and Program Update Button

The following figure shows the keyswitch and program update button.



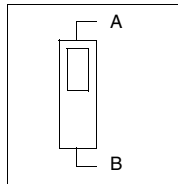
The keyswitch has three positions: off line, xfer, and run:

- **Off line** – Putting the key in this position takes the controller out of service.
- **Xfer** – When the key on the standby unit is in this position, the standby is prepared to receive a full program update from the primary controller. The update is initiated by pressing the program update button, which is located on the front panel between the function keyswitch and the cable connectors. If you turn the key on the primary unit to xfer, the system will ignore your action.
- **Run** – The switch should be in this position except when initiating a full program update or taking the module off line.

---

### A/B Designation Slide Switch

The slide switch is used to designate the controller as A or B. The slide switch on one Hot Standby module in every pair must be set to A; the switch on the other must be set to B. The controller designated A will begin as the primary controller as long as it reaches the ready state before or at the same time as controller B. If the switches are set to the same position, the system will refuse to recognize the second controller at startup. The following figure shows the A/B designation slide switch.



---

# Quantum Intrinsically Safe Analog/Digital, Input/Output Modules

15

---

## At a Glance

### Introduction

This chapter provides information on the Intrinsically Safe Analog Input/Output, and Digital Input/Output Modules.

### What's in this Chapter?

This chapter contains the following sections:

Section	Topic	Page
15.1	Intrinsically Safe Modules - General Information	362
15.2	Intrinsically Safe Analog Modules	366
15.3	Intrinsically Safe Discrete Modules	399

---

## 15.1 Intrinsically Safe Modules - General Information

---


### Intrinsically Safe Modules – General Description

---

<b>Introduction</b>	The following information is specifically concerned with the application of intrinsic safety with regards to the installation and field wiring of the Quantum Intrinsically Safe series of modules. It provides a general description of intrinsic safety and how it is accomplished in Quantum modules, how they should be installed, precautions that should be observed, and wiring and grounding practices that must be followed.
<b>Intrinsic Safety</b>	Intrinsic safety is a technique for ensuring that electrical energy supplied to circuits in a hazardous area is too low to ignite volatile gases either by spark or thermal means. Intrinsically safe circuits use energy limiting devices known as intrinsically safe barriers to prevent excess electrical energy from being applied to electrical equipment located in the hazardous area.
<b>Module Location</b>	The Quantum Intrinsically Safe family of modules are entity certified to be installed in safe areas to monitor/control intrinsically safe apparatus located in hazardous areas.
<b>Intrinsically Safe Barriers</b>	All Quantum Intrinsically Safe modules use galvanic isolation to provide the intrinsically safe barrier between them and the field devices located in hazardous areas. Opto-isolators are located within the modules between the field side and the Quantum backplane bus circuitry. The maximum agency specified intrinsically safe parameters are:  $V_{oc} \leq 28 \text{ Vdc}$ and $I_{sc} \leq 100\text{mA}$
<b>Intrinsically Safe Power Supply</b>	DC/DC converters in Quantum Intrinsically Safe modules provide intrinsically safe power to field devices located in hazardous areas. No external field power is required where these modules are installed.
<b>Installation of Quantum Intrinsically Safe Modules</b>	Quantum Intrinsically Safe modules are designed to fit into a standard 140XBPOXX00 Quantum backplane. The modules can be installed in any slot position in the backplane. (The first slot is normally reserved for the power supply module.)

---

**Hot Swapping** Hot swapping Quantum Intrinsically Safe modules is not allowed per intrinsic safety standards.

 <b>WARNING</b>
<p><b>Hot Swap</b> Do not attempt to hot swap a Quantum Intrinsically Safe module. <b>Failure to follow this precaution can result in death, serious injury, or equipment damage.</b></p>

**Safe Area Wiring Practices** Intrinsically safe wiring between Quantum Intrinsically Safe modules and the field devices located in the hazardous area must be separated from all other wiring. This can be accomplished by the following methods:

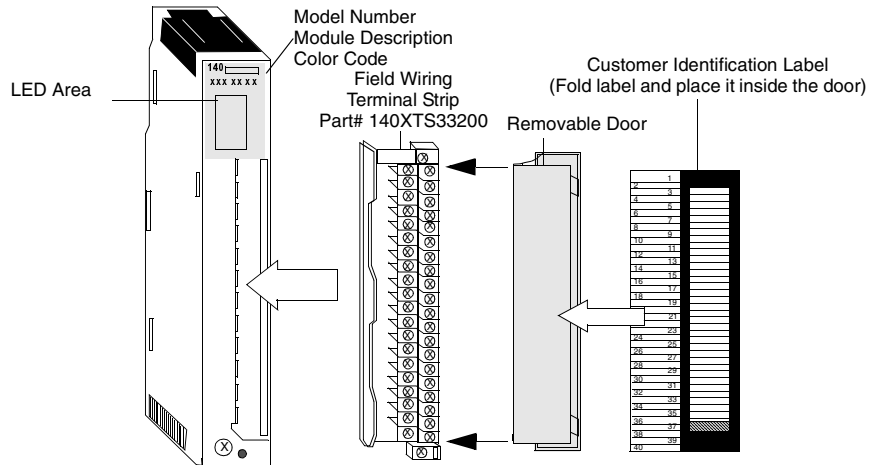
- Separate blue wire ducts, raceways or conduits
- Grounded metal or insulated partitions between the intrinsically safe and non-intrinsically safe wiring
- a separation of two inches (50 mm) of air space between the intrinsically safe and non-intrinsically safe wiring. With this method, the intrinsically safe and non-intrinsically safe wires must be tied down in separate bundles to maintain the required separation.

**Identification and Labeling** Intrinsically safe wiring must be properly identified and labeled. Light blue color coding should be used for all intrinsically safe wiring. The terminal strip wiring connector on all Quantum Intrinsically Safe modules is colored blue to distinguish it from all non-intrinsically safe modules.

All wire ducts, raceways, cable trays, and open wiring must be labeled "Intrinsically Safe Wiring" with a maximum spacing of 25 ft. between labels.

**Wiring Type and Grounding** Shielded twisted pair wires shall be used for each of the input or output pairs connected to the Quantum Intrinsically Safe module blue terminal strip. The wire gauge size can be between AWG 20 and AWG 12. Each twisted pair wire shield must be connected to the ground screws on the backplane, at the module end, and left open at the field device connection end in the hazardous area. The instruction sheet packaged with each Quantum Intrinsically Safe module contains a wiring diagram applicable to that type of module.

**Module Figure** The following diagram is a view of a typical input or output module.

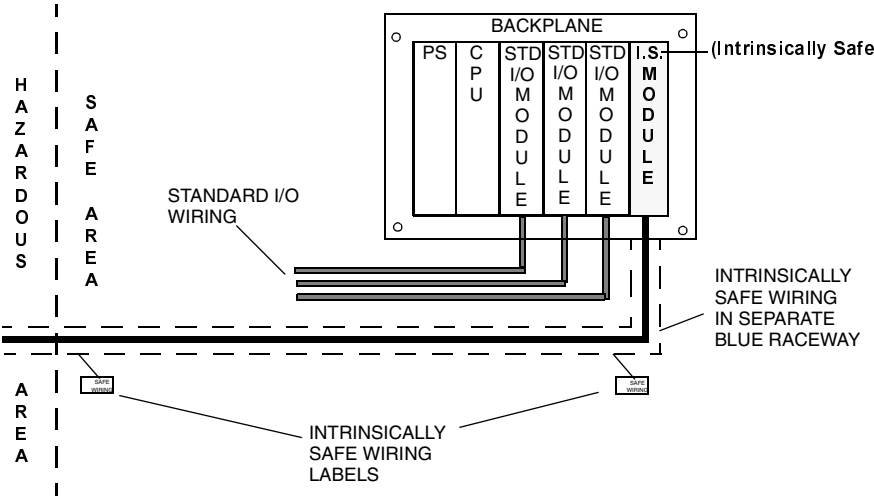


**Agency Approvals**

- CENELEC Zone 1, Gas Group IIC, IIB, and IIA
- CSA Class 1, Div 1, Gas groups A, B, C, and D
- FM Class 1, Div 1, Gas groups A, B, C, and D
- UL Class 1, Div 1, Gas groups A, B, C and D

**Intrinsically Safe Wiring Diagram**

The following diagram illustrates a Quantum Intrinsically Safe module using a separate raceway to isolate its external wiring to the hazardous area. This is just one of the possible ways of field wiring the module. Other methods would include bundling and laying the intrinsically safe wires in the same wiring trough with the bundled non-intrinsically safe wires, with each bundle tied down and separated by minimum of two inches of air space through out the wiring runs.



**Questions Regarding Intrinsically Safe Wiring Practices**

The information concerning intrinsic safety wiring practices, is general in nature and is not intended to cover installation requirements for any specific site. Questions regarding intrinsic safety wiring requirements for your site should be referred to the approval agencies listed.

## 15.2 Intrinsically Safe Analog Modules

---

### At a Glance

---

**Overview** This section provides information on the intrinsically safe analog modules, 140AI33000, 140AI33010, and 140AIO33000.

---

**What's in this Section?** This section contains the following topics:

Topic	Page
I/O Configuration for Intrinsically Safe Analog Modules	367
140AI33000 Intrinsically Safe Analog Input Module	375
140AI33010 Intrinsically Safe Current Input Module	387
140AIO33000 Intrinsically Safe Analog Output Module	393

---



## I/O Configuration for Intrinsically Safe Analog Modules

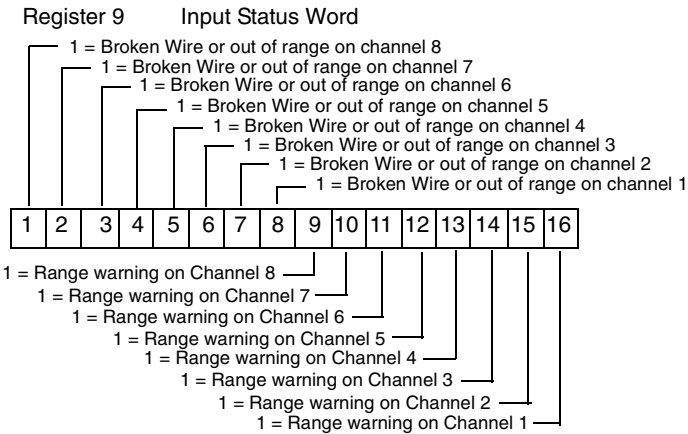
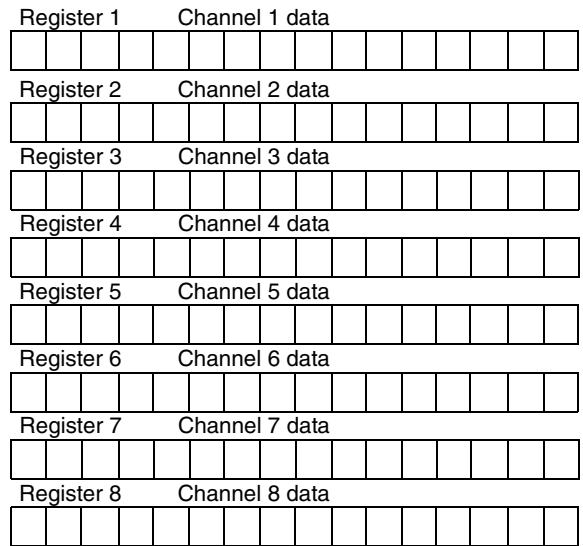
---

<b>Overview</b>	This section provides information on the I/O configuration of the intrinsically safe analog modules, 140AI33000, 140AI33010, and 140AIO33000.
<b>140AI33000</b>	The following information pertains to configuration of the 140AI33000 intrinsically safe analog input module.
<b>I/O Map register Assignment</b>	Register assignments depend on module configuration. This module may be configured as an RTD/Resistance or a Thermocouple input module.

---

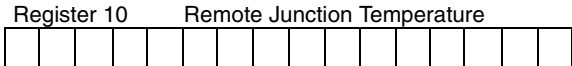
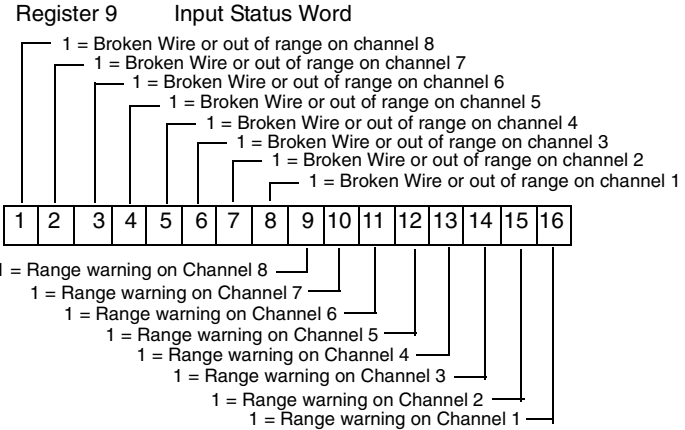
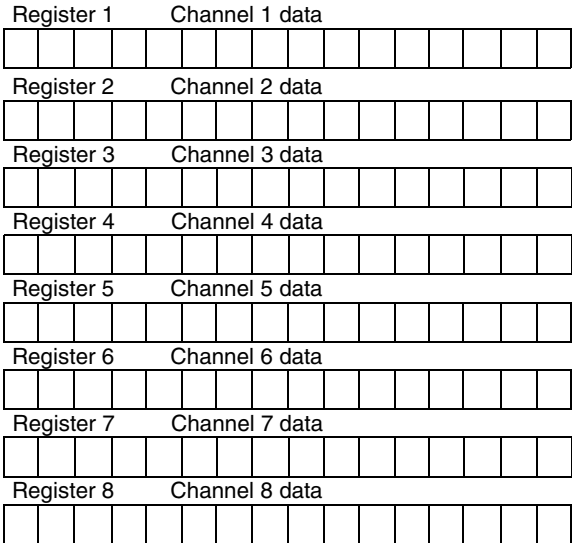
**RTD I/O Map  
Register  
Assignments**

When the 140AI33000 is configured as a RTD/Resistance input module, it requires nine contiguous input (3x) registers assigned as follows.



**Thermocouple/  
Millivolt Map  
Register  
Assignments**

When the 140All33000 is configured as a Thermocouple/Millivolt input module, it requires ten contiguous input (3x) registers assigned as follows.





Configure each channel (1 through 8) appropriate to the module input type selected.

**For RTD Module Input:**

Channel Enable/Disable:  Enable  
 Disable

4-Wire /3-Wire /2-Wire:  4 Wire  
 3 Wire  
 2 Wire

RTD Type (Pt, Ni, R, A Pt)

Pt100,	-200 to 850
Pt200,	-200 to 850
Pt500,	-200 to 850
Pt1000,	-200 to 850
Ni 100,	-60 to 180
Ni 200,	-60 to 180
Ni 500,	-60 to 180
Ni1000,	-60 to 180
R, 0 to 766.66 OHM	
R, 0 to 4000 OHM	
APt100,	-100 to 450
APt200,	-100 to 450
APt500,	-100 to 450
APt1000,	-100 to 450

**For TC / mV Module Input:**

Thermocouple Type: Undefined  
 J, gain=25  
 K, gain=25  
 E, gain=25  
 T, gain=100  
 S, gain=100  
 R, gain=100  
 B, gain=100

Open circuit test:  No  
 Yes

Raw output, amplifier gain: (see Note)  25  
 100

This channel installed:  Yes  
 No

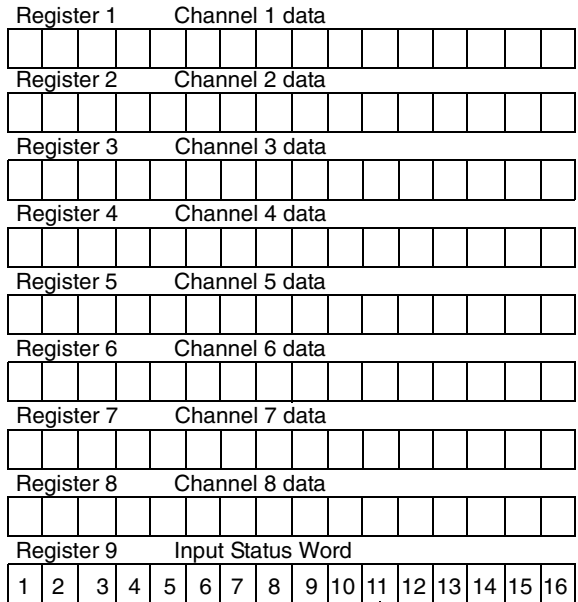
**Note:** A gain of 25 produces readings with + 100mV.  
 A gain of 100 produces readings with + 25mV.

**140AI33010**

The following information pertains to configuration of the 140AI33010 intrinsic safe analog input module.

**I/O Map Register Assignments**

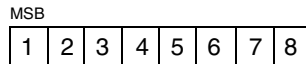
The 140AI133010 module requires nine contiguous input (3x) registers assigned as follows.



- 1 = Broken Wire (4 ... 20 mA only) or out of range on Channel 8
- 1 = Broken Wire (4 ... 20 mA only) or out of range on Channel 7
- 1 = Broken Wire (4 ... 20 mA only) or out of range on Channel 6
- 1 = Broken Wire (4 ... 20 mA only) or out of range on Channel 5
- 1 = Broken Wire (4 ... 20 mA only) or out of range on Channel 4
- 1 = Broken Wire (4 ... 20 mA only) or out of range on Channel 3
- 1 = Broken Wire (4 ... 20 mA only) or out of range on Channel 2
- 1 = Broken Wire (4 ... 20 mA only) or out of range on Channel 1

**I/O Map Status Byte (Inputs)**

The most significant bit in the I/O map status byte is used for this module.



1 = Broken wire (4 ... 20 mA only) on one or more input channels

**Modsoft Module Zoom Selections**

Use Modsoft's Module Zoom feature to display and select the input range.

Channel x Range Selection

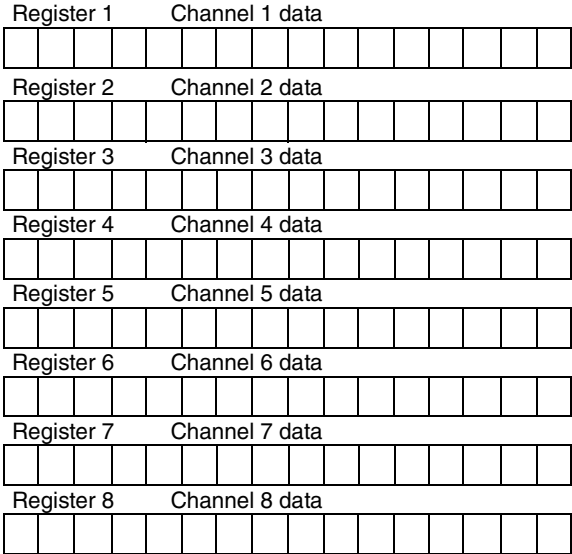
4 to 20mA	0 - 16,000
4 to 20mA	0 - 4095
0 to 20mA	0 - 20,000
0 to 25mA	0 - 25,000

**140AIO33000**

The following information pertains to configuration of the 140AIO33000 intrinsic safe analog output module.

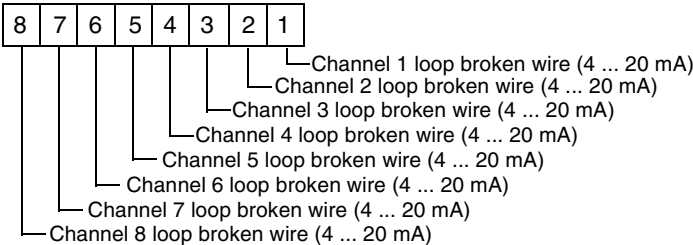
**I/O Register Assignments**

The 140AIO33000 module requires eight contiguous output (4x) registers assigned as follows:



**I/O Map Status Byte**

The I/O map status byte for this module is as follows.



**Modsoft Module  
Zoom Selections**

Use Modsoft's Module Zoom feature to display and select the module channel ranges and time-out state. Time-out state is assumed when system control of the module is stopped.

The following figure shows the time-out state for the Modsoft module zoom feature.

Channel X Range Selection:

4 to 20 mA	0 - 16,000
4 to 20 mA	0 - 4,095
0 to 20 mA	0 - 20,000
0 to 25 mA	0 - 25,000

Channel X Time-out State:

Disabled
Last Value
User Defined

User Defined Time Out Value is in Percentage:  
50.00% should be entered as 5000:

Channel X User Defined Time Out Value:  DEC

---



## 140AI133000 Intrinsically Safe Analog Input Module

### Overview

The Quantum 140AI133000 Intrinsically Safe Analog Input module will interface with eight intrinsically safe analog inputs, which are software-configurable on a module basis with either RTD/Resistance or thermocouple/millivolt inputs.

When it is configured as an RTD/Resistance Input module, it supports 100Ω, 200Ω, 500Ω, and 1000Ω platinum (American or European) and nickel sensors. The module also allows any mix and match of sensor type or resistance inputs that can be configured by the software.

When it is configured as a Thermocouple/Millivolt Input module, it accepts B, J, K, E, R, S and T type thermocouples. The module also allows any mix and match of thermocouple or millivolt inputs that can be configured by the software.

### RTD/Resistance Module Specifications

Specifications for the Quantum140AI133000 module configured as an Intrinsically Safe RTD/Resistance input module are as follows.

<b>RTD/Resistance Module Specifications</b>	
<b>Number of Channels</b>	8
<b>LEDs</b>	Active (Green) F (Red) 1 - 8 (Red) Indicated channel is out of range - includes broken wire and short circuit conditions.
<b>RTD Types (Configurable)</b>	
Platinum (American and European) – PT100, PT200, PT500, PT1000	-200° C to +850° C
Nickel – N100, N200, N500, N1000	-60° C to +180° C
<b>Measurement Current</b>	
PT100, PT200, N100, N200 PT500, PT1000, N500, N1000	2.5 mA 0.5 mA
<b>Input Impedance</b>	>10 MΩ
<b>Linearity</b>	+/- 0.003% of full scale (0 ... 60° C)
<b>Resolution</b>	12 bits plus sign (0.1° C)
<b>Absolute Accuracy</b>	+/- 0.5 °C (25° C) +/- 0.9 °C (0 .. 60° C)
<b>Accuracy Error @ 25°C</b>	Typical: +/- 0.05% of full scale Maximum: +/- 0.1% of full scale
<b>Input Filter</b>	> 100 dB @ 50/60 Hz
<b>Isolation</b>	

<b>RTD/Resistance Module Specifications</b>	
Channel to Channel Channel to Bus	None 1780 Vac @ 47-63 Hz or 2500 Vdc for 1 min.
<b>Update Time (All Channels)</b>	
3-wire 2 or 4-wire	1.35 sec. 750 m sec.
<b>Bus Current Required</b>	400 mA
<b>Power Dissipation</b>	2 W
<b>External Power</b>	Not required for this module
<b>Fault Detection</b>	Out of range or broken wire conditions
<b>Hot Swap</b>	Not allowed per intrinsic safety standards
<b>Fusing</b>	Internal-not user accessible
<b>Programming Software</b>	Modsoft Ver. 2.61 or higher

**Thermocouple/  
Millivolt Module  
Specifications**

The following table shows the specifications for the Thermocouple/Millivolt module.

<b>Thermocouple/Millivolt Module Specifications</b>	
<b>Number of Channels</b>	8
<b>LEDs</b>	Active (Green) F (Red) 1 ... 8 (Red). Indicated channel is out of range - Broken wire condition is detected.
<b>TC Types and Ranges</b>	
Types J K E T S R B	Ranges (°C) -210 ... +760 -270 ... +1370 -270 ... +1000 -270 ... +400 -50 ... +1665 -50 ... +1665 +130 ... +1820
<b>Millivolt Ranges</b>	-100 mV ... +100 mV* -25 mV ... +25 mV* *Open circuit detect can be disabled on these ranges
<b>TC Circuit Resistance/Max Source Resistance</b>	200Ω max for rated accuracy
<b>Input Impedance</b>	>1MΩ
<b>Input Filter</b>	Single low pass @ nominal 20 Hz. Plus notch filter at 50/60 Hz
<b>Normal Noise Rejection</b>	120 dB min @ 50 or 60 Hz

<b>Thermocouple/Millivolt Module Specifications</b>	
<b>Cold Junction Compensation (CJC)</b>	Internal CJC operates 0 ... 60° C (errors are included in the accuracy specification). The connector door must be closed. Remote CJC can be implemented by connecting the TC (which monitors the external junction block temperature) to channel 1. Types J, K, and T are recommended for best accuracy.
<b>Programming Software</b>	Modsoft Ver. 2.61 or higher
<b>Resolution</b>	
TC Ranges	Choice of: 1° C (Default) 0.1° C 1° F 0.1° F
Millivolt Ranges	+/- 100 mV range, 3.05 $\mu$ V (16 bits) +/- 25 mV range, 0.76 $\mu$ V (16 bits)
<b>TC Absolute Accuracy (see Note 1)</b>	
Types J, K, E, T (see Note 2)	+/- 2° C +/- 0.1% of reading
Types S, R, B (see Note 3)	+/- 4° C +/- 0.1% of reading
<b>Millivolt Absolute Accuracy</b>	
@ 25°C	+/- 20 $\mu$ V +/- 0.1% of reading
Accuracy Drift w/ Temperature	0.15 $\mu$ V/°C + 0.0015% of reading/°C max.
<b>Isolation</b>	
Channel to Channel Channel to Bus	None 1780 Vac @ 47-63 Hz or 2500 Vdc for 1 min.
<b>Update Time</b>	1 sec. (all channels)
<b>Fault Detection</b>	Out of range or broken wire
<b>Bus Current Required</b>	400 mA
<b>Power Dissipation</b>	2 W
<b>External Power</b>	Not required for this module
<b>Hot Swap</b>	Not allowed per intrinsic safety standards
<b>Fusing</b>	Internal - not user accessible
<b>Programming Software</b>	Modsoft Ver. 2.6 or higher or Concept Ver. 2.2 or higher
<b>Notes:</b>	
1. Absolute accuracy includes all errors from the internal CJC, TC curvature, offset plus gain, for module temperature of 0 ... 60° C. User-supplied TC errors not included.	
2. For type J and K, add 1.5° C inaccuracy for temperatures below -100° C.	
3. Type B cannot be used below 130° C.	
4. All TC ranges have an open TC detect and upscale output. This results in a reading 7FFFh or 32767 decimal when an open TC is detected.	

**Field Wiring**

Field wiring to the module shall consist of separate shielded twisted pair wires. The acceptable field wire gauge shall be AWG 20 to AWG 12. In a 2-wire field configuration, the maximum field wire length is a function of the required accuracy. Wiring between the module and the intrinsically safe field device should follow intrinsically safe wiring practices to avoid the transfer of unsafe levels of energy to the hazardous area.

---

**RTD/Resistance Input Wiring**

When the Universal Input module is configured as a RTD/Resistance Input module, the maximum wire length (distance to a sensor) for a 3 or 4-wire configuration is 200 meters.

---

**Thermocouple/ Millivolt Input Wiring**

When the module is configured as a Thermocouple/Millivolt Input module, the sum of thermocouple source or voltage source impedance and wire resistance should not exceed 200 ohms for rated accuracy.

---

**Fixed Wiring System**

The Quantum140AI133000 Intrinsically Safe Analog Input module is designed with a fixed wiring system where the field connections are made to a 40-pin, fixed position, blue terminal strip which is plugged into the module.

---

**Terminal Strip Color and Keying Assignment**

The module's 140XTS33200 field wiring terminal strip is color-coded blue to identify it as an intrinsically safe connector. The terminal strip is keyed to prevent the wrong connector from being applied to the module. The keying assignment is given below.

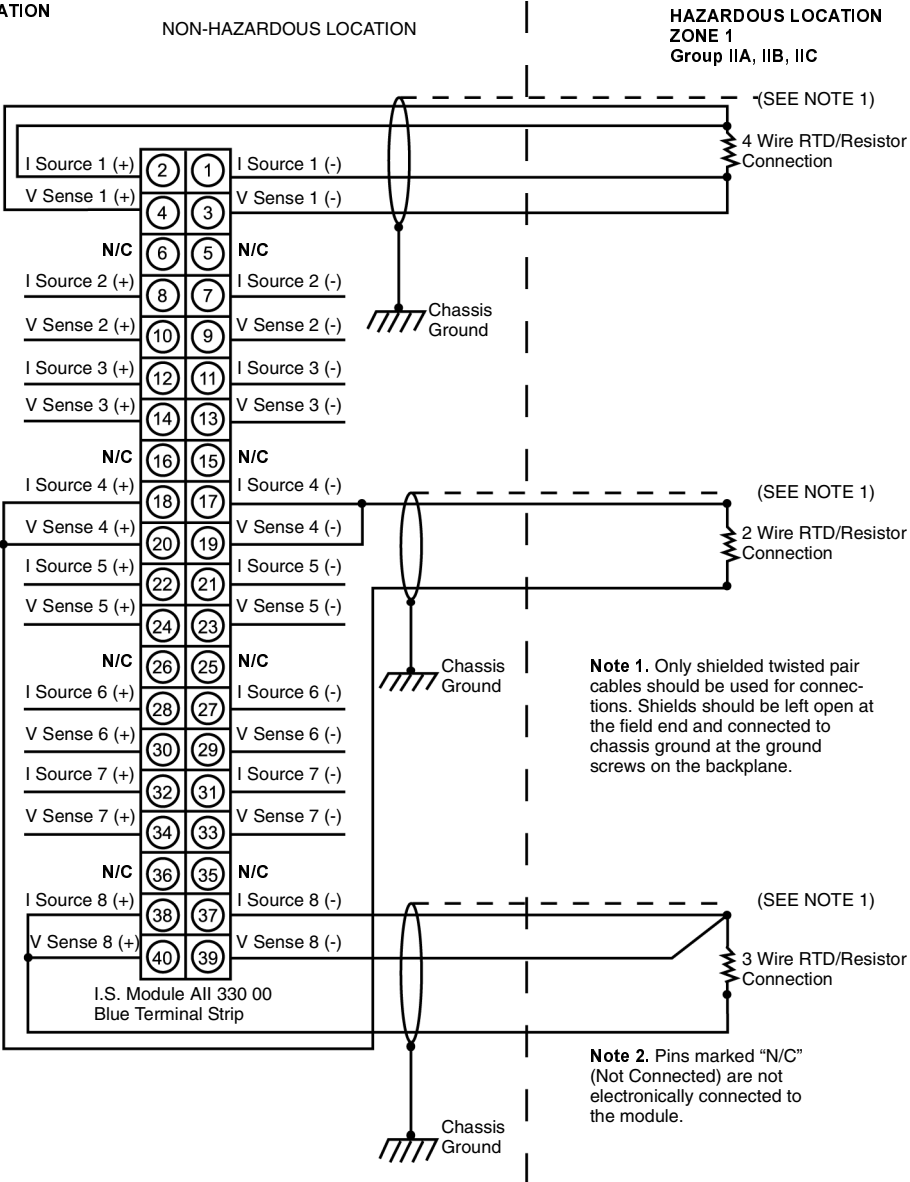
Module Class	Module Part Number	Module Coding	Terminal Strip Coding
Intrinsically Safe	140AI133000	CDF	ABE

---

**Agency Approved Wiring Diagrams**

The following is a Cenelec certified wiring diagram for this module configured with an RTD/Resistance connection.

**GENELEC CERTIFICATION Entity Parameters per Channel:**  
 $V_o = 15.5 \text{ Vdc}$   
 $I_o = 276 \text{ mA/ch}$   
 $P_o = 1.07 \text{ W/ch}$   
 $C_o = 0.508 \text{ }\mu\text{F/ch}$   
 $L_o = 466 \text{ }\mu\text{H/ch}$



31001362 Rev 00

140 All 330 00 RTD Wiring Diagram

The following is a Cenelec certified wiring diagram for this module when configured with a Thermocouple connection.

**CENELEC CERTIFICATION**

**Entity Parameters**

**per Channel:**

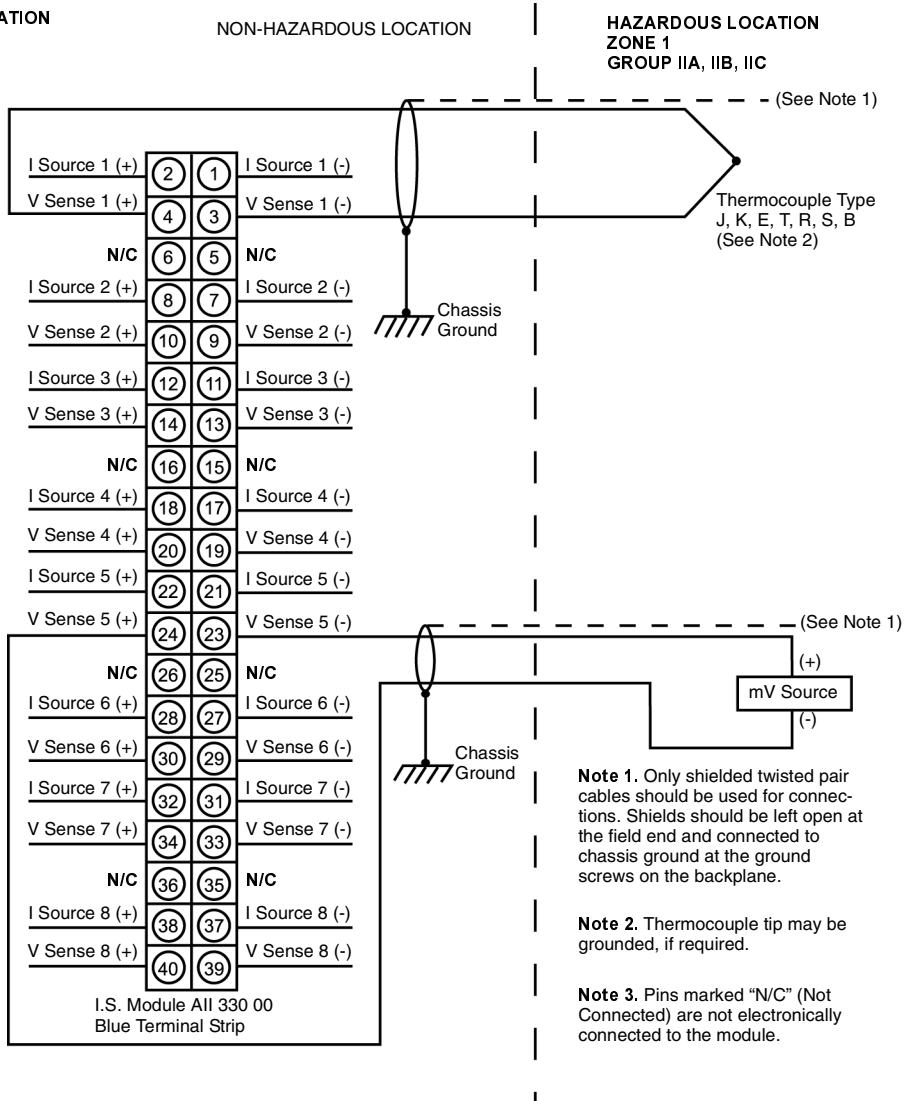
$V_o = 15.5 \text{ Vdc}$

$I_o = 276 \text{ mA/ch}$

$P_o = 1.07 \text{ W/ch}$

$C_0 = 0.508 \text{ }\mu\text{F/ch}$

$L_o = 466 \text{ }\mu\text{H/ch}$



The following is a CSA certified wiring diagram for this module when configured with an RTD/resistor connection.

**Notes related to CSA certification for this module**

**Note 1.** Entity parameters per channel:  $V_{oc} = 15.5\text{ V}$   
 $I_{sc} = 123\text{ mA}$   
 $C_a = 0.47\text{ }\mu\text{f}$   
 $L_a = 1.0\text{ mH}$

**Note 2.** Maximum non-hazardous area voltage must not exceed 250 V.

**Note 3.** Install in accordance with Canadian Electrical Code, Part I for installation in Canada.

**Note 4.** Install in accordance with the NEC (ANSI/NFPA 70) and ANSI/ISA RP 12.6 for installation in the United States.

**Note 5.** To maintain intrinsic safety, shield for each cable must be grounded and must extend as close to the terminals as possible.

**Note 6.** Intrinsically Safe (I.S) cables of one module must be routed separately from I.S. cables of another module.

**Note 7.** I.S. devices when connected to I.S. terminals must satisfy the following conditions:

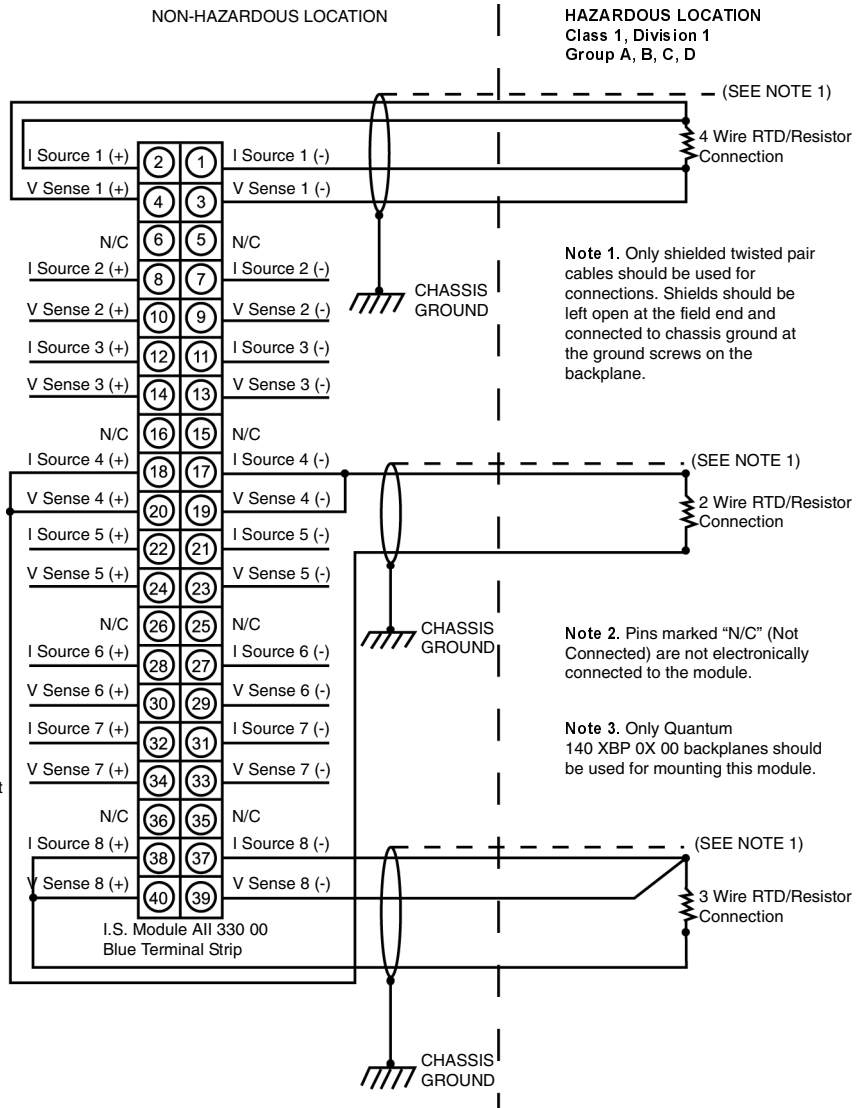
$$V_{oc} < V_{max}$$

$$I_{sc} < I_{max}$$

$$C_a > C_1 + C_{cable}$$

$$L_a > L_1 + L_{cable}$$

**Note 8.** This module is certified as a component for mounting in a suitable enclosure where the suitability of the final combination is subject to acceptance by CSA or an inspection authority having the jurisdiction.



31001362 Rev 00

140 All 330 00 RTD Wiring Diagram

The following is a CSA certified wiring diagram for this module when configured with a thermocouple connection.

**Notes related to CSA certification for this module.**

**Note 1.** Entity parameters per channel:  
 $V_{oc} = 15.5\text{ V}$   
 $I_{sc} = 123\text{ mA}$   
 $C_a = 0.47\text{ }\mu\text{F}$   
 $L_a = 1.0\text{ mH}$

**Note 2.** Maximum non-hazardous area voltage must not exceed 250 V.

**Note 3.** Install in accordance with Canadian Electrical Code, Part I for installation in Canada.

**Note 4.** Install in accordance with the NEC (ANSI/NFPA 70) and ANSI/ISA RP 12.6 for installation in the United States.

**Note 5.** To maintain intrinsic safety, shield for each cable must be grounded and must extend as close to the terminals as possible.

**Note 6.** Intrinsically Safe (I.S.) cables of one module must be routed separately from I.S. cables of another module.

**Note 7.** I.S. devices when connected to I.S. terminals must satisfy the following conditions:

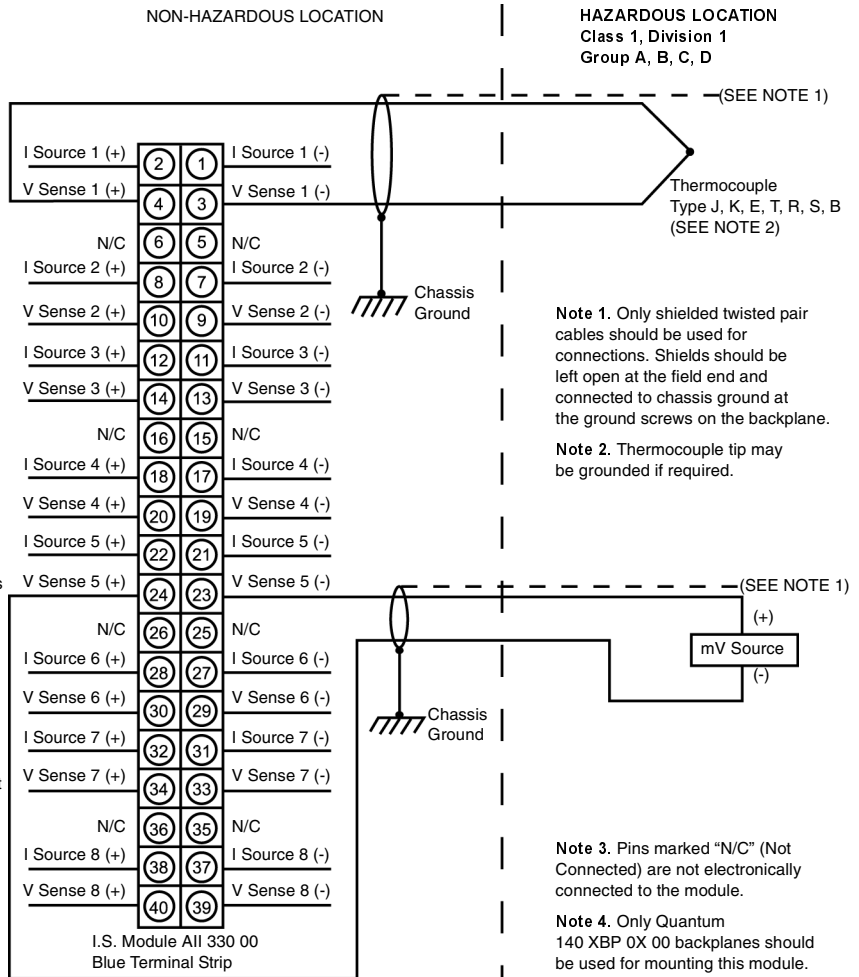
$$V_{oc} < V_{max}$$

$$I_{sc} < I_{max}$$

$$C_a > C_i + C_{cable}$$

$$L_a > L_i + L_{cable}$$

**Note 8.** This module is certified as a component for mounting in a suitable enclosure where the suitability of the final combination is subject to acceptance by CSA or an inspection authority having the jurisdiction.



31001362 Rev 00 140 All 330 00 TC Wiring Diagram



The following is a FM certified wiring diagram for this module when configured as a RTD/resistor connection.

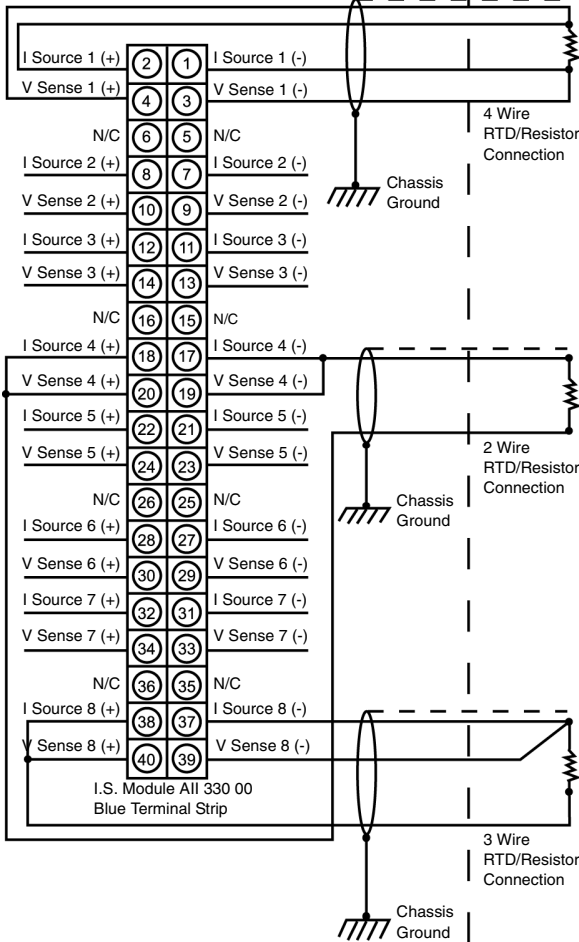
**Notes Related to FM Certification**

This IS field device should meet Note 5 or should be FM approved with entity concept in Note 4 appropriate for connection with RTD/TC IN Module with Concept Parameters listed below. The entity parameters are per Channel.

Voc = 15.5 VDC  
 Isc = 276 mA/Ch  
 Ca = 500 nF/Ch  
 La = 0.3 mH/Ch  
 Po = 1070 mW/Ch

**HAZARDOUS LOCATION,**  
 Class I, Div 2 Group A, B, C, D

**HAZARDOUS LOCATION**  
 Class I, Div I Group A, B, C, D  
 Class II Div I Group E, F, G  
 Class III Div I



**Note 1.** Only shielded cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the Module end.

**Note 2.** Pins marked N/C are not electronically connected to the Module.

**Note 3.** Only 140XBP0xx00 backplanes should be used for mounting this module.

**Note 4.** The Entity Concept allows interconnection of intrinsically safe apparatus with associated apparatus not specifically examined in combination as a system when the approved values of Voc and Isc for the associated apparatus are less than or equal to Vmax and Imax for the intrinsically safe apparatus and the approved values of Ca and La for the associated apparatus must be equal to or are greater than Ci and Li for the intrinsically safe apparatus plus all cable parameters.

$$Ca \geq Ci + C_{cable}; La \geq Li + L_{cable}; Voc \leq V_{max}; Isc \leq I_{max}$$

**Note 5.** Simple Apparatus is defined as a device which will neither generate nor store more than 1.2V, 0.1A, 20uJ, or 25 mW. For examples, switches, Thermocouples, LEDs and RTDs, etc.

**Note 6.** Wiring methods must be in accordance with National Electrical Code NFPA 70, Article 504 and ANSI/ISA RP 12.6 "Wiring Practices for Hazardous (classified) Locations Instrumentation Part I: Intrinsic Safety."

**Note 7.** Control room equipment connected to associated apparatus should not use or generate more than 250 Vrms.

**Note 8.** All modules must be installed in an enclosure that meets the requirements of ANSI/ISA S82.01.

**Note 9.** No revision to this drawing without prior FMRC approval.

**Note 10.** For Schneider Electric internal use only. For control sheet, refer to 19-100986 Rev 1.

**Note 11.** For Division 2 installation, the apparatus shall be installed in compliance with the enclosure, mounting, spacing, and segregation requirements of the ultimate application, including access only by the use of a tool and provision for Division 2 wiring methods.

31001362 Rev 01

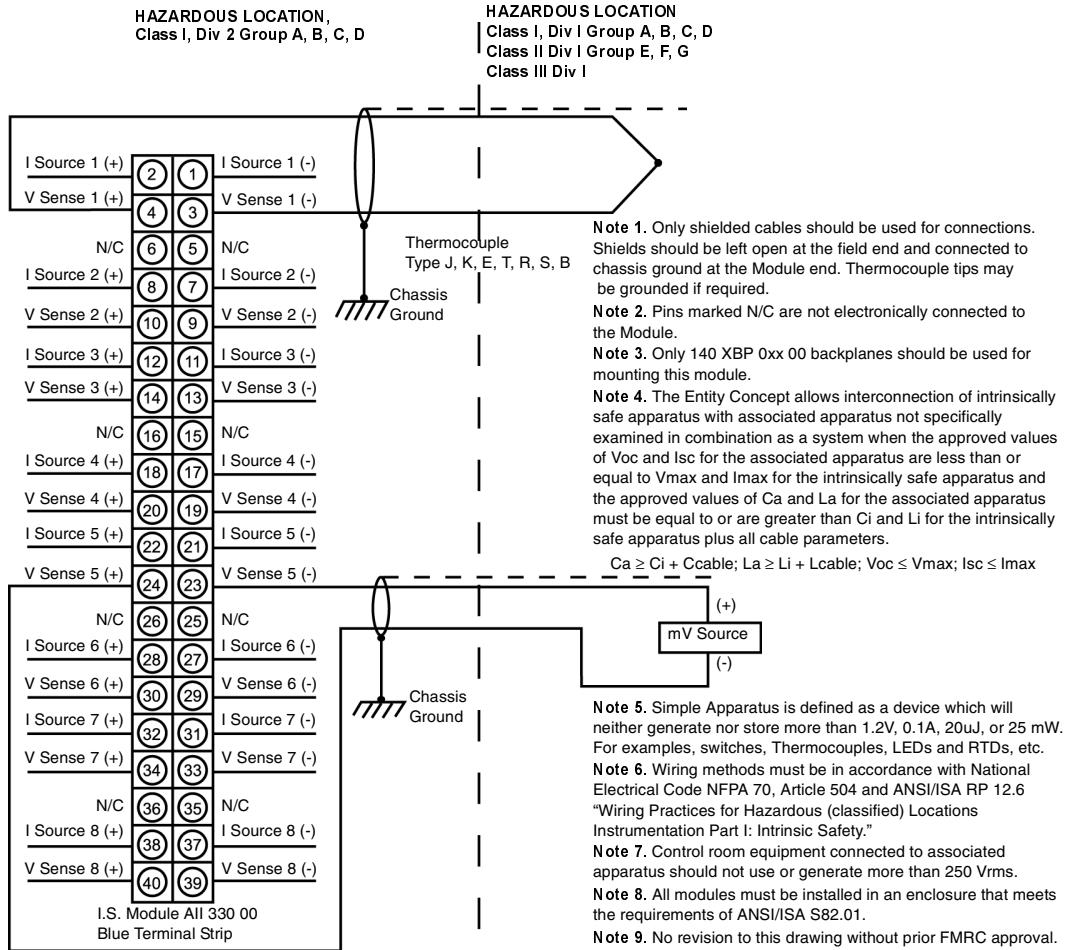
140AII33000 RTD Wiring Diagram

The following is a FM certified wiring diagram for this module when configured with a thermocouple connection.

**Notes Related to FM Certification**

This IS field device should meet Note 5 or should be FM approved with entity concept in Note 4 appropriate for connection with IS RTD/TC IN Module with Concept Parameters listed below. The entity parameters are per Channel.

Voc = 15.5 VDC  
 Isc = 276 mA/Ch  
 Ca = 500 nF/Ch  
 La = 0.3 mH/Ch  
 Po = 1070 mW/Ch



- Note 1.** Only shielded cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the Module end. Thermocouple tips may be grounded if required.
- Note 2.** Pins marked N/C are not electronically connected to the Module.
- Note 3.** Only 140 XBP 0xx 00 backplanes should be used for mounting this module.
- Note 4.** The Entity Concept allows interconnection of intrinsically safe apparatus with associated apparatus not specifically examined in combination as a system when the approved values of Voc and Isc for the associated apparatus are less than or equal to Vmax and Imax for the intrinsically safe apparatus and the approved values of Ca and La for the associated apparatus must be equal to or are greater than Ci and Li for the intrinsically safe apparatus plus all cable parameters.  
 $Ca \geq Ci + Ccable$ ;  $La \geq Li + Lcable$ ;  $Voc \leq Vmax$ ;  $Isc \leq Imax$

- Note 5.** Simple Apparatus is defined as a device which will neither generate nor store more than 1.2V, 0.1A, 20uJ, or 25 mW. For examples, switches, Thermocouples, LEDs and RTDs, etc.
- Note 6.** Wiring methods must be in accordance with National Electrical Code NFPA 70, Article 504 and ANSI/ISA RP 12.6 "Wiring Practices for Hazardous (classified) Locations Instrumentation Part I: Intrinsic Safety."
- Note 7.** Control room equipment connected to associated apparatus should not use or generate more than 250 Vrms.
- Note 8.** All modules must be installed in an enclosure that meets the requirements of ANSI/ISA S82.01.
- Note 9.** No revision to this drawing without prior FMRC approval.
- Note 10.** For Schneider Electric internal use only. For control sheet, refer to 19-100986 Rev 1.
- Note 11.** For Division 2 installation, the apparatus shall be installed in compliance with the enclosure, mounting, spacing, and segregation requirements of the ultimate application, including access only by the use of a tool and provision for Div 2 wiring methods.

140AII33000 TC Wiring Diagram  
31001362 Rev 01

The following is a UL certified wiring diagram for this module when configured with an RTD/resistor connection.

**Notes related to UL certification for this module.**

**Note 1.** Entity parameters per channel:  $V_{oc} = 15.5\text{ V}$   
 $I_{sc} = 123\text{ mA}$   
 $C_a = 0.47\text{ }\mu\text{f}$   
 $L_a = 466\text{ }\mu\text{H}$

**Note 2.** Maximum non-hazardous area voltage must not exceed 250 V.

**Note 3.** If the electrical parameters of the cable are unknown, the following values must be used for  $C_{\text{cable}}$  and  $L_{\text{cable}}$ :  
 Capacitance 60 Pf/ft  
 Inductance 0.20 uH/ft

**Note 4.** Install in accordance with the NEC (ANSI/NFPA 70) and ANSI/ISA RP 12.6 for installation in the United States.

**Note 5.** To maintain intrinsic safety, shield for each cable must be grounded and must extend as close to the terminals as possible.

**Note 6.** Intrinsically Safe (I.S.) cables of one module must be routed separately from I.S. cables of another module.

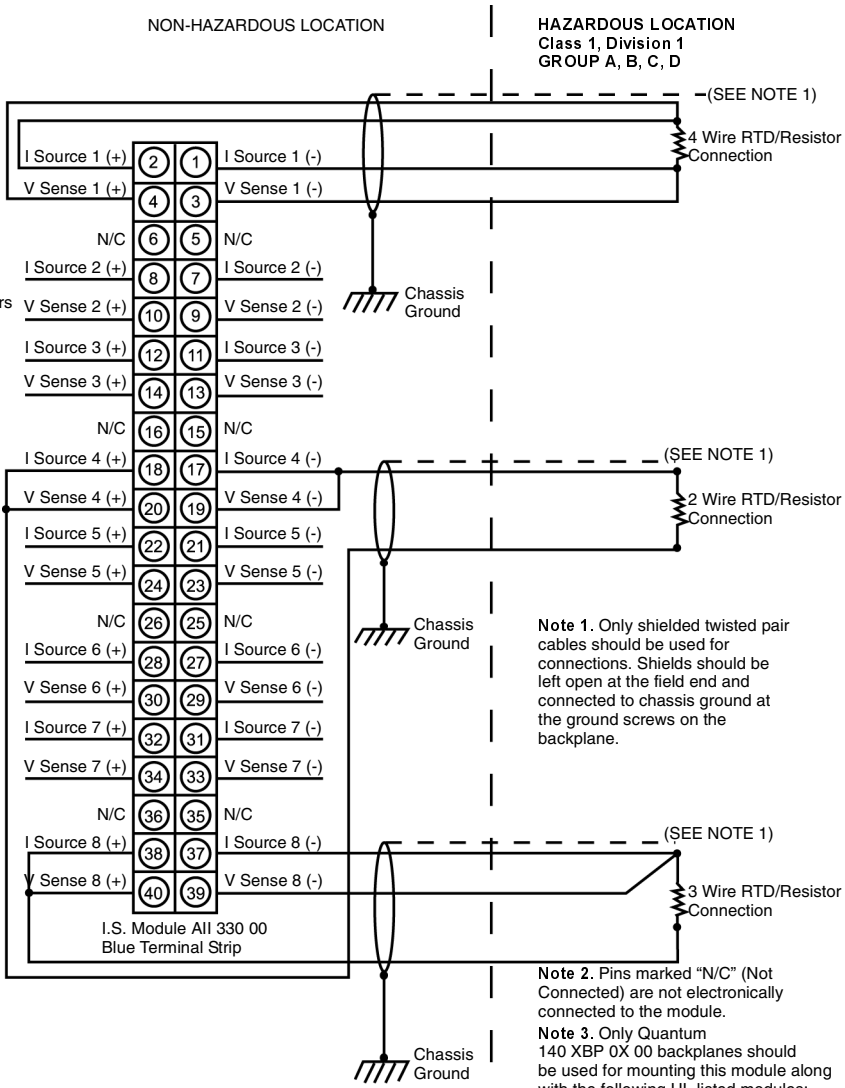
**Note 7.** I.S. devices when connected to I.S. terminals must satisfy the following conditions:

$$V_{oc} < V_{\text{max}}$$

$$I_{sc} < I_{\text{max}}$$

$$C_a > C_i + C_{\text{cable}}$$

$$L_a > L_i + L_{\text{cable}}$$



**Note 1.** Only shielded twisted pair cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the ground screws on the backplane.

**Note 2.** Pins marked "N/C" (Not Connected) are not electronically connected to the module.

**Note 3.** Only Quantum 140 XBP 0X 00 backplanes should be used for mounting this module along with the following UL listed modules:  
 140 CPU xxx xx  
 140 CPS xxx xx

31001362 Rev 00 140 All 330 00 RTD Wiring Diagram

The following is a UL certified wiring diagram for this module when configured with a thermocouple connection.

**Notes related to UL certification for this module.**

**Note 1.** Entity parameters per channel:  $V_{oc} = 15.5\text{ V}$   
 $I_{sc} = 123\text{ mA}$   
 $C_a = 0.47\text{ }\mu\text{f}$   
 $L_a = 466\text{ }\mu\text{H}$

**Note 2.** Maximum non-hazardous area voltage must not exceed 250 V.

**Note 3.** If the electrical parameters of the cable are unknown, the following values must be used for  $C_{cable}$  and  $L_{cable}$ :

Capacitance 60 Pf/ft  
 Inductance 0.20 uH/ft

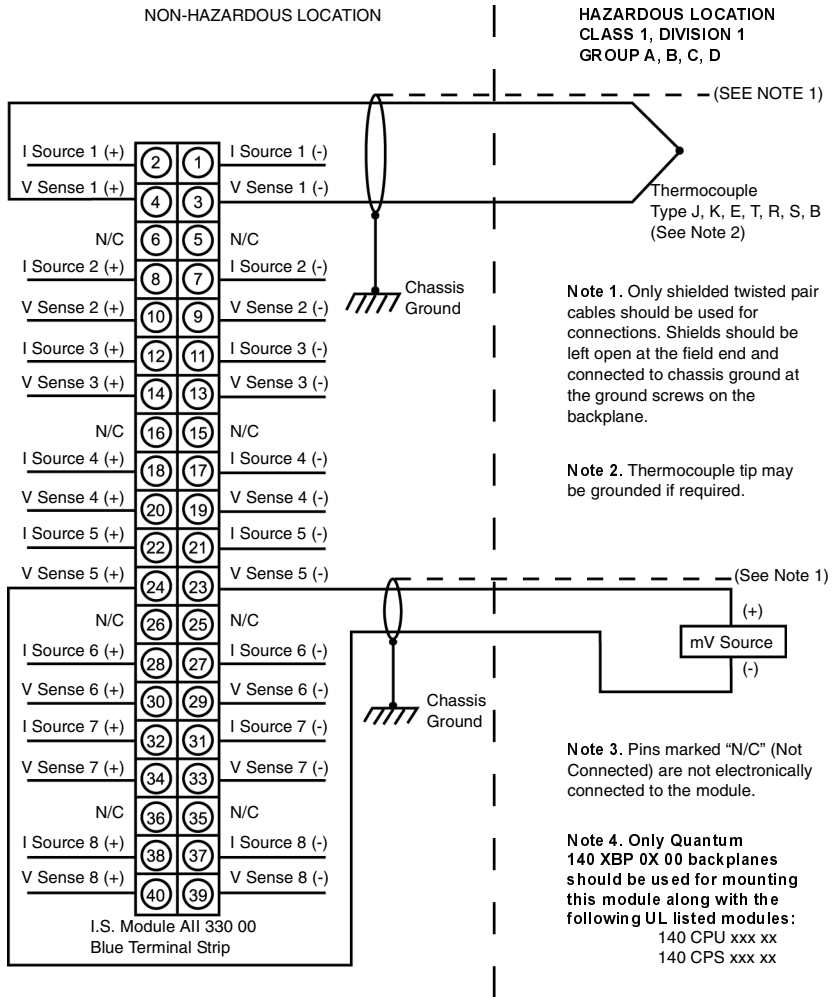
**Note 4.** Install in accordance with the NEC (ANSI/NFPA 70) and ANSI/ISA RP 12.6 for installation in the United States.

**Note 5.** To maintain intrinsic safety, shield for each cable must be grounded and must extend as close to the terminal as possible.

**Note 6.** Intrinsically Safe (I.S.) cables of one module must be routed separately from I.S. cables of another module.

**Note 7.** I.S. devices when connected to I.S. terminals must satisfy the following conditions:

$V_{oc} < V_{max}$   
 $I_{sc} < I_{max}$   
 $C_a > C_i + C_{cable}$   
 $L_a > L_i + L_{cable}$



31001362 Rev 00

140 All 330 00 TC Wiring Diagram

## 140AI133010 Intrinsically Safe Current Input Module

### Overview

The Quantum 140AI133010 Intrinsically Safe Current Input module interfaces with eight intrinsically safe analog inputs which are software-configurable. The module accepts 0 ... 20 mA, 0 ... 25 mA, and 4 ... 20 mA inputs. The module allows any mix and match of current input ranges that can be configured by the software. The module provides power to intrinsically safe transmitters located in hazardous areas.

### Specifications

Specifications for the Quantum 140AI133010 Intrinsically Safe Current Input module are as follows.

Specifications	
<b>Number of Channels</b>	8
<b>LEDs</b>	Active (Green) F (Red) 1 ... 8 (Red), 1 per channel <b>Note:</b> This module produces a fault signal F if any one channel detects a broken wire condition or an out-of-range condition (4 ... 20 mA only).
<b>Current Input</b>	
Linear Measuring Range	4 ... 20 mA 0 ... 20 mA 0 ... 25 mA
Absolute Maximum Input	25 mA internally limited
Input Impedance	100 $\Omega$ +/- 0.1% between V+ and signal terminals
Resolution	4 ... 20 mA, 0 to 4,095 counts 4 ... 20 mA0 to 16,000 counts 0 ... 20 mA, 0 to 20,000 counts 0 ... 25 mA, 0 to 25,000 counts
<b>Available Voltage</b>	Terminals V+, V-, :~ 14.5 Vdc at 25 mA Terminals V+, Signal :~ 13.6 Vdc at 20 mA
<b>Accuracy Error @ 25°C</b>	Typical: +/- 0.05% of full scale Maximum: +/- 0.1% of full scale
<b>Linearity</b>	+ 0.003% of full scale
<b>Accuracy Drift w/ Temperature</b>	Typical: +/- 0.0025% of full scale /°C Maximum: +/- 0.005% of full scale /°C
<b>Common Mode Rejection</b>	> 100 dB @ 50/60 Hz
<b>Input Filter</b>	Single pole low pass, -3 dB cutoff @ 15 Hz, +/- 20%
<b>Isolation</b>	
Channel to Channel	None

<b>Specifications</b>	
Channel to Bus	1780 Vac @ 47-63 Hz or 2500 Vdc for 1 min.
<b>Update Time</b>	750 ms for all channels
<b>Fault Detection</b>	Broken wire (4 ... 20 mA mode)
<b>Bus Current Required</b>	1.5 A
<b>Power Dissipation</b>	7.5 W
<b>External Power</b>	Not required
<b>Hot Swap</b>	Not allowed per intrinsic safety standards
<b>Fusing</b>	Internal-not user accessible
<b>Programming Software</b>	Modsoft Ver. 2.61 or higher

---

**Field Wiring**

Field wiring to the module consists of separate shielded, twisted pair wires. The acceptable field wire gauge is AWG 20 to AWG 12. Wiring between the module and the intrinsically safe field device should follow intrinsically safe wiring practices to avoid the transfer of unsafe levels of energy to the hazardous area.

---

**Fixed Wiring System**

The Quantum 140AI33010 Intrinsically Safe Current Input module is designed with a fixed wiring system, where the field connections are made to a 40-pin, fixed position, blue terminal strip which is plugged into the module.

---

**Terminal Strip Color and Keying Assignment**

The module's 140XTS33200 field wiring terminal strip is color-coded blue to identify it as an intrinsically safe connector. The terminal strip is keyed to prevent the wrong connector from being applied to the module. The keying assignment is given below.

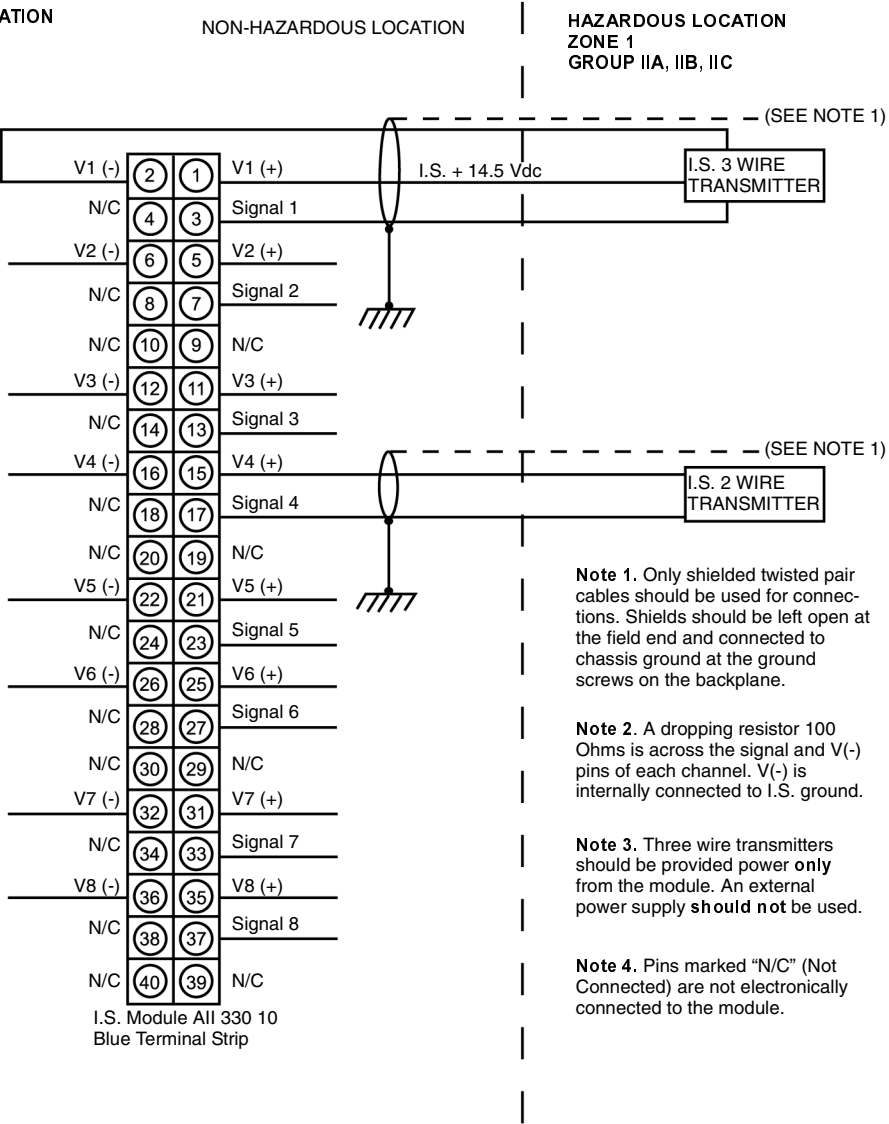
<b>Module Class</b>	<b>Module Part Number</b>	<b>Module Coding</b>	<b>Terminal Strip Coding</b>
Intrinsically Safe	140AI33010	CEF	ABD

---

**Agency  
Approved Wiring  
Diagrams**

The following is a Cenelec certified wiring diagram for this module.

**GENELEC CERTIFICATION**  
Entity Parameters  
per Channel:  
Vo = 23.8 Vdc  
Io = 112 mA/ch  
Po = 622 mW/ch  
Co = 127 nF/ch  
Lo = 2.9 mH/ch



**Note 1.** Only shielded twisted pair cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the ground screws on the backplane.

**Note 2.** A dropping resistor 100 Ohms is across the signal and V(-) pins of each channel. V(-) is internally connected to I.S. ground.

**Note 3.** Three wire transmitters should be provided power only from the module. An external power supply **should not** be used.

**Note 4.** Pins marked "N/C" (Not Connected) are not electronically connected to the module.

The following is a CSA certified wiring diagram for this module.

Notes related to CSA certification for this module.

Note 1. Entity parameters per channel:

$$V_{oc} = 23.8 \text{ V}$$

$$I_{sc} = 112 \text{ mA}$$

$$C_a = 127 \text{ nf}$$

Note 2. Maximum non-hazardous area voltage must not exceed 250 V.

Note 3. Install in accordance with Canadian Electrical Code, Part I for installation in Canada.

Note 4. Install in accordance with the NEC (ANSI/NFPA 70) and ANSI/ISA RP 12.6 for installation in the United States.

Note 5. To maintain intrinsic safety, shield for each cable must be grounded and must extend as close to the terminals as possible.

Note 6. Intrinsically Safe (I.S.) cables of one module must be routed separately from I.S. cables of another module.

Note 7. I.S. devices when connected to I.S. terminals must satisfy the following conditions:

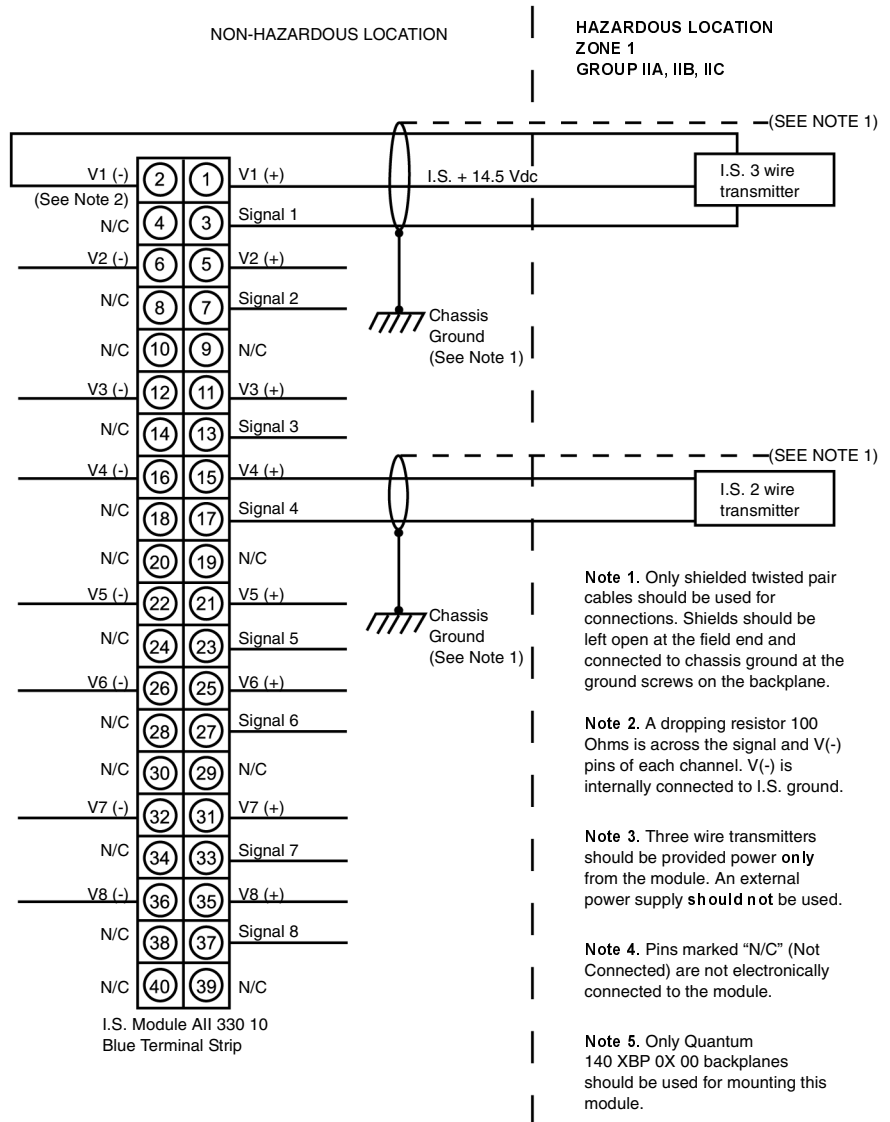
$$V_{oc} < V_{max}$$

$$I_{sc} < I_{max}$$

$$C_a > C_i + C_{cable}$$

$$L_a > L_i + L_{cable}$$

Note 8. This module is certified as a component for mounting in a suitable enclosure where the suitability of the final combination is subject to acceptance by CSA or an inspection authority having the jurisdiction.



31001363 Rev 00

140 All 330 10 Wiring Diagram



The following is a FM certified wiring diagram for this module.

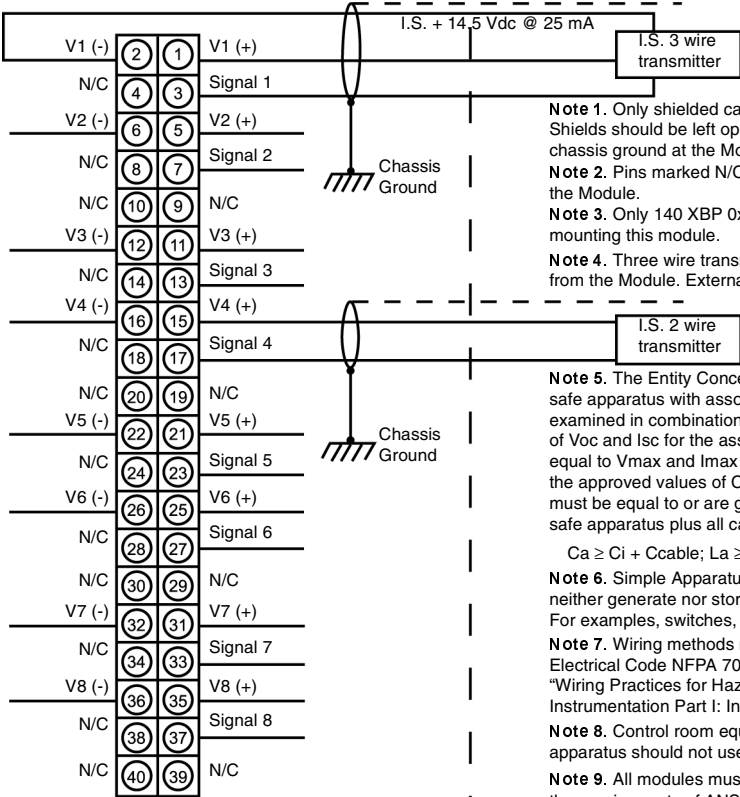
**Notes Related to FM Certification**

This IS field device should meet note 6 or should be FM approved with entity concept in Note 5 appropriate for connection with IS Analog Current IN Module with Concept Parameters listed below. The entity parameters are per channel.

Voc = 23.8 VDC  
 Isc = 112 mA/Ch  
 Ca = 127 nF/Ch  
 La = 2.9 mH/Ch  
 Po = 622 mW/CH

HAZARDOUS LOCATION,  
 Class I, Div 2 Group A, B, C, D

HAZARDOUS LOCATION  
 Class I Div I Group A, B, C, D  
 Class II Div I Group E, F, G  
 Class III Div I



**Note 1.** Only shielded cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the Module end.

**Note 2.** Pins marked N/C are not electronically connected to the Module.

**Note 3.** Only 140 XBP 0xx 00 backplanes should be used for mounting this module.

**Note 4.** Three wire transmitters should be provided power only from the Module. External Power Supply should not be used.

**Note 5.** The Entity Concept allows interconnection of intrinsically safe apparatus with associated apparatus not specifically examined in combination as a system when the approved values of Voc and Isc for the associated apparatus are less than or equal to Vmax and Imax for the intrinsically safe apparatus and the approved values of Ca and La for the associated apparatus must be equal to or are greater than Ci and Li for the intrinsically safe apparatus plus all cable parameters.

$Ca \geq Ci + C_{cable}; La \geq Li + L_{cable}; Voc \leq V_{max}; Isc \leq I_{max}$

**Note 6.** Simple Apparatus is defined as a device which will neither generate nor store more than 1.2V, 0.1A, 20uJ, or 25 mW. For examples, switches, Thermocouples, LEDs and RTDs, etc.

**Note 7.** Wiring methods must be in accordance with National Electrical Code NFPA 70, Article 504 and ANSI/ISA RP 12.6 "Wiring Practices for Hazardous (classified) Locations Instrumentation Part I: Intrinsic Safety."

**Note 8.** Control room equipment connected to associated apparatus should not use or generate more than 250 Vrms.

**Note 9.** All modules must be installed in an enclosure that meets the requirements of ANSI/ISA S82.01.

**Note 10.** No revision to this drawing without prior FMRC approval.

**Note 11.** For Schneider Electric internal use only. For control sheet, refer to 19-100986 Rev 1.

**Note 12.** For Division 2 installation, the apparatus shall be installed in compliance with the enclosure, mounting, spacing, and segregation requirements of the ultimate application, including access only by the use of a tool and provision for Division 2 wiring methods.

31001363 Rev 01  
 140 All 330 10 Wiring Diagram

The following is a UL certified wiring diagram for this module.

**Notes related to UL certification for this module.**

**Note 1.** Entity parameters per channel:  
 $V_{cc} = 24.3 \text{ V}$   
 $I_{sc} = 112 \text{ mA}$   
 $C_a = 127 \text{ nf}$   
 $L_a = 1.5 \text{ mH}$

**Note 2.** Maximum non-hazardous area voltage must not exceed 250 V.

**Note 3.** If the electrical parameters of the cable are unknown, the following values must be used for  $C_{cable}$  and  $L_{cable}$ :  
 Capacitance 60Pf/ft  
 Inductance 0.20 uH/ft

**Note 4.** Install in accordance with the NEC (ANSI/NFPA 70) and ANSI/ISA RP 12.6 for installation in the United States.

**Note 5.** To maintain intrinsic safety, shield for each cable must be grounded and must extend as close to the terminals as possible.

**Note 6.** Intrinsically Safe (I.S) cables of one module must be routed separately from I.S. cables of another module.

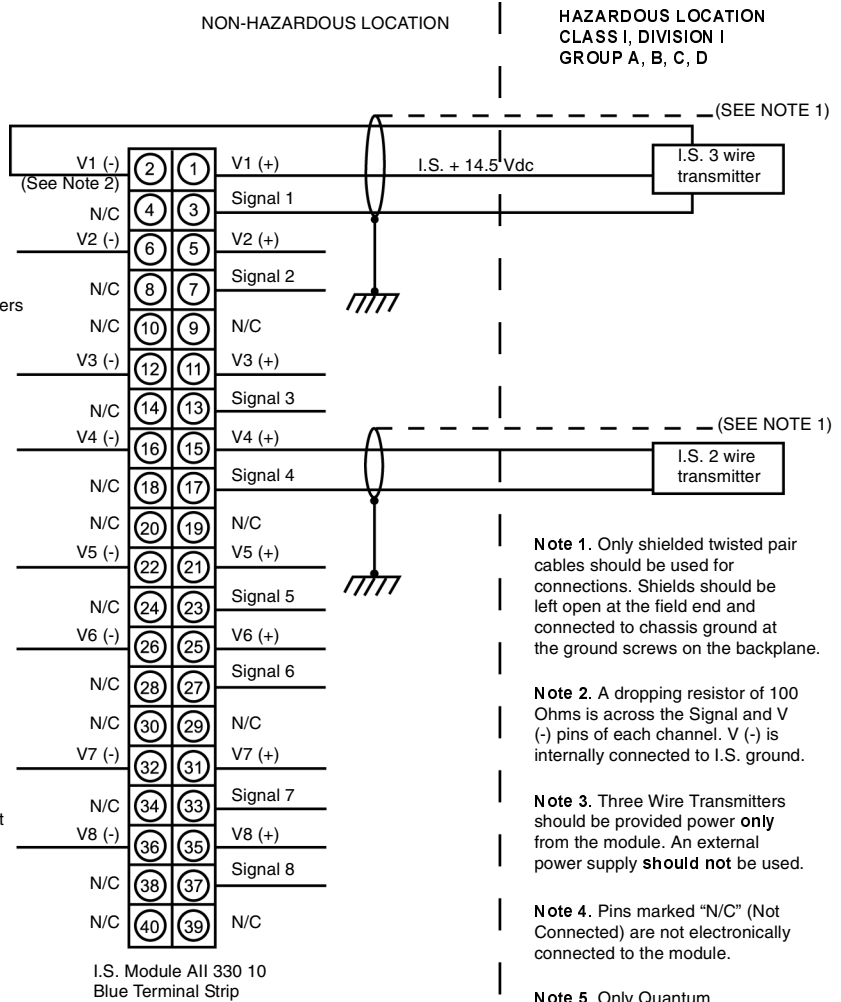
**Note 7.** I.S. devices when connected to I.S. terminals must satisfy the following conditions:

$$V_{cc} < V_{max}$$

$$I_{sc} < I_{max}$$

$$C_a > C_i + C_{cable}$$

$$L_a > L_i + L_{cable}$$



**Note 1.** Only shielded twisted pair cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the ground screws on the backplane.

**Note 2.** A dropping resistor of 100 Ohms is across the Signal and V (-) pins of each channel. V (-) is internally connected to I.S. ground.

**Note 3.** Three Wire Transmitters should be provided power **only** from the module. An external power supply **should not** be used.

**Note 4.** Pins marked "N/C" (Not Connected) are not electronically connected to the module.

**Note 5.** Only Quantum 140 XBP 0X 00 backplanes should be used for mounting this module along with the following UL listed modules:  
 140 CPU xxx xx  
 140 CPS xxx xx

## 140AIO33000 Intrinsically Safe Analog Output Module

### Overview

The Quantum 140AIO33000 Intrinsically Safe Analog Output module controls and monitors current loops in intrinsically safe applications. The module provides 8 dual-ended output channels that are referenced over sense resistors to a single Common. The output ranges are 4 ... 20 mA, 0 ... 20 mA, and 0 ... 25 mA. This module detects broken wires on a per-channel basis indicates their location on the front panel LEDs, and transmits the status to the PLC.

### Specifications

Specifications for the Quantum 140AIO33000 Intrinsically Safe Analog Output module are as follows.

Specifications	
<b>Number of Channels</b>	8
<b>LEDs</b>	Active (Green) F (Red) 1 ... 8 (Green) - Module output switched ON 1 ... 8 (Red) - Broken wire on indicated Channel (4 ... 20 mArange)
<b>Loop Resistance</b>	500 ohms maximum
<b>Ranges</b>	4 ... 20 mA (0 to 4095)    4 ... 20 mA (0 to 16000) 0 ... 20 mA (0 to 20000)    0 ... 25mA (0 to 25000)
<b>Resolution</b>	15 bits within 4 ... 20 mA
<b>Accuracy Drift w/ Temperature</b>	Typical: 40 PPM/°C. Maximum: 70 PPM/°C
<b>Accuracy Error @ 25°C</b>	+/- 0.2% of full scale
<b>Linearity</b>	+/- 1 LSB
<b>Isolation</b>	
Channel to Channel	None
Channel to Bus	1780 Vac RMS for 1 minute
<b>Update Time</b>	4 ms - for all channels
<b>Settling Time</b>	1 ms to +/- 0.1% of the final value
<b>Bus Current Required</b>	2.5 Amp
<b>Power Dissipation</b>	12.5 W
<b>External Power</b>	Not required for this module
<b>Fault Detection</b>	Open circuit in 4 ... 20 mA range
<b>Voltmeter Monitor Specifications</b>	
Range	0.250 ... 1.250 V

<b>Specifications</b>	
Scaling	$V_{OUT} \text{ (Volts)} = I_{LOOP} \text{ (mA)} \times 0.0625$
Output Impedance	62.5 W Typical
Wire Length	1 m maximum
<b>Hot Swap</b>	Not allowed per intrinsic safety standards
<b>Fusing</b>	Internal - not user accessible
<b>Programming Software</b>	Modsoft Ver. 2.61 or higher

---

**Field Wiring**

Field wiring to the module should consist of separate shielded, twisted pair wires. The acceptable field wire gauge should be AWG 30 to AWG 18. Wiring between the module and the intrinsically safe field device should follow intrinsically safe wiring practices to avoid the transfer of unsafe levels of energy to the hazardous area.

---

**Fixed Wiring System**

The Quantum140AIO33000 Intrinsically Safe Analog Output module is designed with a fixed wiring system where the field connections are made to a 40-pin, fixed position, blue terminal strip which is plugged into the module.

---

**Terminal Strip Color and Keying Assignment**

The module's 140XTS33200 field wiring terminal strip is color-coded blue to identify it as an intrinsically safe connector. The terminal strip is keyed to prevent the wrong connector from being applied to the module. The keying assignment is given below.

<b>Module Class</b>	<b>Module Part Number</b>	<b>Module Coding</b>	<b>Terminal Strip Coding</b>
Intrinsically Safe	140AIO33000	CEF	ABD

---

**Agency Approved Wiring Diagrams**

The following is a CSA certified wiring diagram for this module.

Notes related to CSA certification for this module.

**Note 1.** Entity parameters per channel:  $V_{cc} = 29.42 V$   
 $I_{sc} = 93 mA$   
 $C_a = 71 nF$   
 $L_a = 2.0 mH$

**Note 2.** Maximum non-hazardous area voltage must not exceed 250 V.

**Note 3.** Install in accordance with Canadian Electrical Code, Part I for installation in Canada.

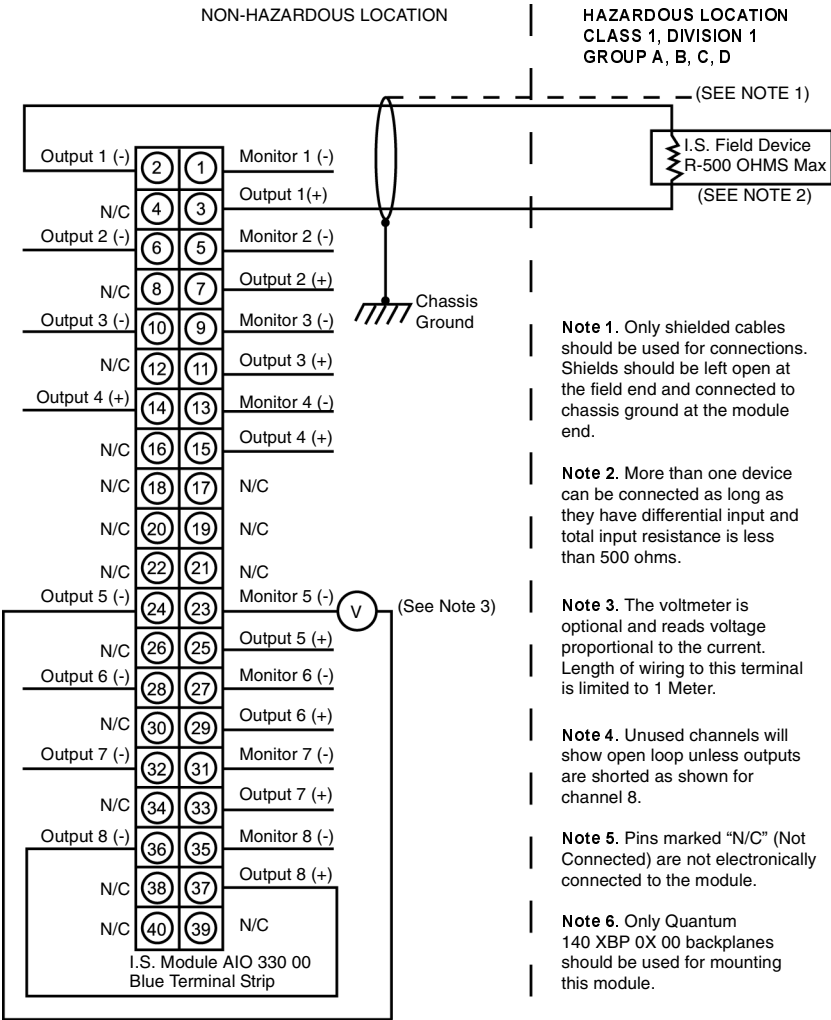
**Note 4.** Install in accordance with the NEC (ANSI/NFPA 70) and ANSI/ISA RP 12.6 for installation in the United States.

**Note 5.** To maintain intrinsic safety, shield for each cable must be grounded and must extend as close to the terminals as possible.

**Note 6.** Intrinsically Safe (I.S.) cables of one module must be routed separately from I.S. cables of another module.

**Note 7.** I.S. devices when connected to I.S. terminals must satisfy the following conditions:  
 $V_{cc} < V_{max}$   
 $I_{sc} < I_{max}$   
 $C_a > C_i + C_{cable}$   
 $L_a > L_i + L_{cable}$

**Note 8.** This module is certified as a component for mounting in a suitable enclosure where the suitability of the final combination is subject to acceptance by CSA or an inspection authority having the jurisdiction.



**Note 1.** Only shielded cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the module end.

**Note 2.** More than one device can be connected as long as they have differential input and total input resistance is less than 500 ohms.

**Note 3.** The voltmeter is optional and reads voltage proportional to the current. Length of wiring to this terminal is limited to 1 Meter.

**Note 4.** Unused channels will show open loop unless outputs are shorted as shown for channel 8.

**Note 5.** Pins marked "N/C" (Not Connected) are not electrically connected to the module.

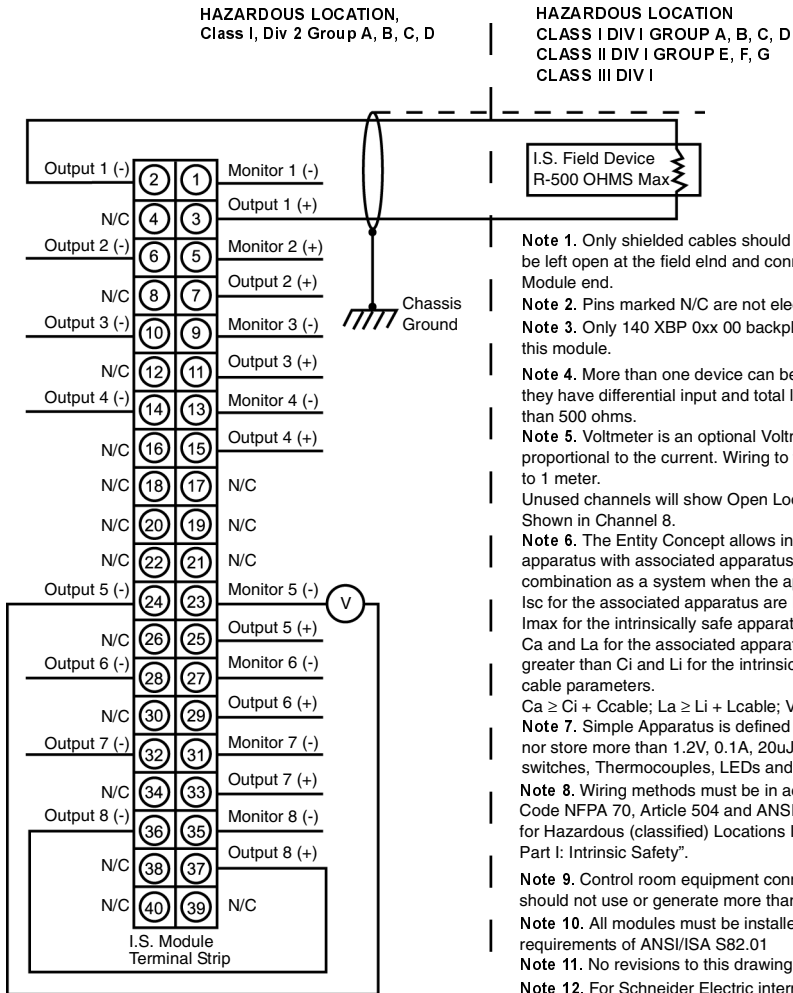
**Note 6.** Only Quantum 140 XBP 0X 00 backplanes should be used for mounting this module.

The following is a FM certified wiring diagram for this module.

**Notes Related to FM Certification**

This IS field device should meet Note 7 or should be FM approved with entity concept in Note 6 appropriate for connection with IS RTD/TC IN Module with concept parameters listed below. The entity parameters listed are per channel.

Voc = 29.5 VDC  
 Isc = 94 mA/Ch  
 Ca = 68 nF/Ch  
 La = 4.2 mH/Ch  
 Po = 520 mW/Ch



**Note 1.** Only shielded cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the Module end.

**Note 2.** Pins marked N/C are not electronically connected to the Module.

**Note 3.** Only 140 XBP 0xx 00 backplanes should be used for mounting this module.

**Note 4.** More than one device can be connected in series as long as they have differential input and total load resistance is less than 500 ohms.

**Note 5.** Voltmeter is an optional Voltmeter shown to read voltage proportional to the current. Wiring to this terminal is limited to 1 meter.

Unused channels will show Open Loop unless shorted as Shown in Channel 8.

**Note 6.** The Entity Concept allows interconnection of intrinsically safe apparatus with associated apparatus not specifically examined in combination as a system when the approved values of Voc and Isc for the associated apparatus are less than or equal to Vmax and Imax for the intrinsically safe apparatus and the approved values of Ca and La for the associated apparatus must be equal to or are greater than Ci and Li for the intrinsically Safe apparatus plus all cable parameters.

Ca ≥ Ci + Ccable; La ≥ Li + Lcable; Voc ≤ Vmax; Isc ≤ Imax

**Note 7.** Simple Apparatus is defined as a device which will neither generate nor store more than 1.2V, 0.1A, 20uJ, or 25 mW. For examples switches, Thermocouples, LEDs and RTDs, etc.

**Note 8.** Wiring methods must be in accordance with National Electrical Code NFPA 70, Article 504 and ANSI/ISA RP12.6, "Wiring Practices for Hazardous (classified) Locations Instrumentation Part I: Intrinsic Safety".

**Note 9.** Control room equipment connected to associated apparatus should not use or generate more than 250Vrms.

**Note 10.** All modules must be installed in an enclosure that meets the requirements of ANSI/ISA S82.01

**Note 11.** No revisions to this drawing without prior FMRC Approval.

**Note 12.** For Schneider Electric internal use only. For control sheet, refer to 19-100986 Rev 1.

**Note 13.** For Division 2 installation, the apparatus shall be installed in compliance with the enclosure, mounting, spacing, and segregation requirements of the ultimate application, including access only by the use of a tool and provision for Division 2 wiring methods.

140 AIO 330 00 Wiring Diagram  
31001364 Rev 01

The following is a UL certified wiring diagram for this module.

**Notes related to UL certification for this module.**

**Note 1.** Entity parameters per channel:  
 $V_{cc} = 29.5\text{ V}$   
 $I_{sc} = 93\text{ mA}$   
 $C_a = 68\text{ nF}$   
 $L_a = 2.0\text{ mH}$

**Note 2.** Maximum non-hazardous area voltage must not exceed 250 V.

**Note 3.** If the electrical parameter of the cable are unknown, the following values must be used for  $C_{cable}$  and  $L_{cable}$ :

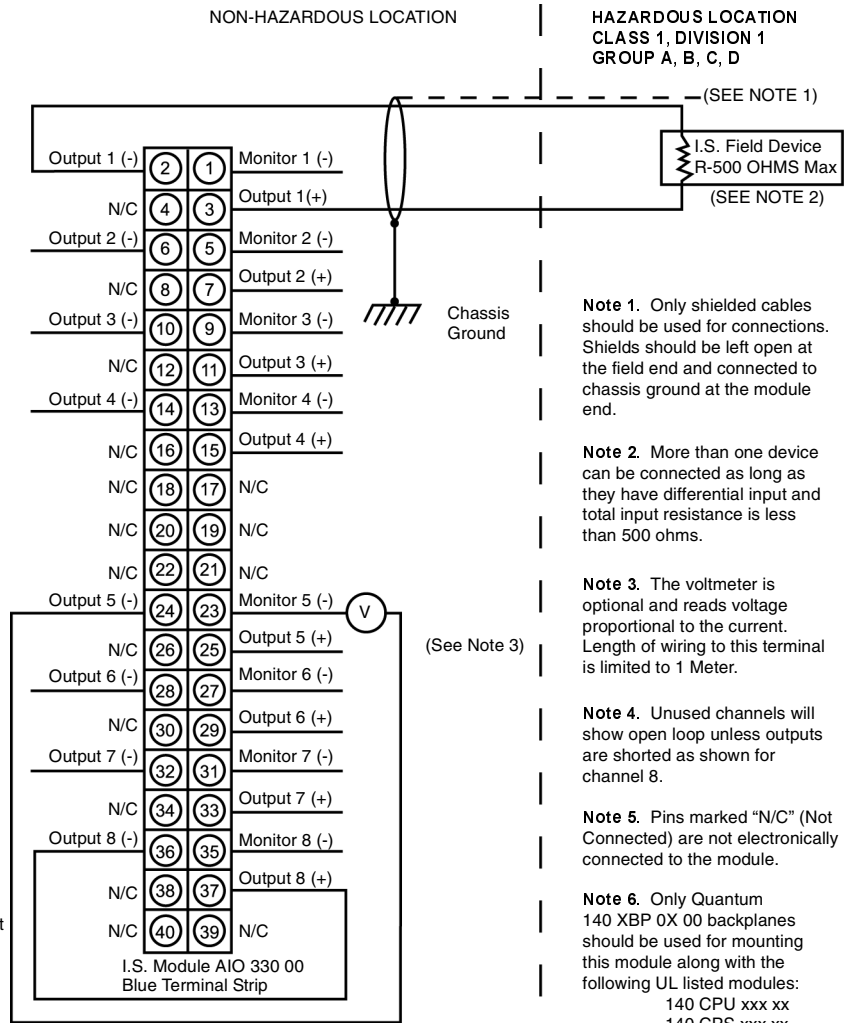
Capacitance 60 Pf/ft  
 Inductance 0.20 uH/ft

**Note 4.** Install in accordance with the NEC (ANSI/NFPA 70) and ANSI/ISA RP 12.6 for installation in the United States.

**Note 5.** To maintain intrinsic safety, shield for each cable must be grounded and must extend as close to the terminals as possible.

**Note 6.** Intrinsically Safe (I.S.) cables of one module must be routed separately from I.S. cables of another module.

**Note 7.** I.S. devices when connected to I.S. terminals must satisfy the following conditions:  
 $V_{cc} < V_{max}$   
 $I_{sc} < I_{max}$   
 $C_a > C_i + C_{cable}$   
 $L_a > L_i + L_{cable}$



**Note 1.** Only shielded cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the module end.

**Note 2.** More than one device can be connected as long as they have differential input and total input resistance is less than 500 ohms.

**Note 3.** The voltmeter is optional and reads voltage proportional to the current. Length of wiring to this terminal is limited to 1 Meter.

**Note 4.** Unused channels will show open loop unless outputs are shorted as shown for channel 8.

**Note 5.** Pins marked "N/C" (Not Connected) are not electronically connected to the module.

**Note 6.** Only Quantum 140 XBP 0X 00 backplanes should be used for mounting this module along with the following UL listed modules:  
 140 CPU xxx xx  
 140 CPS xxx xx

31001364 Rev 00

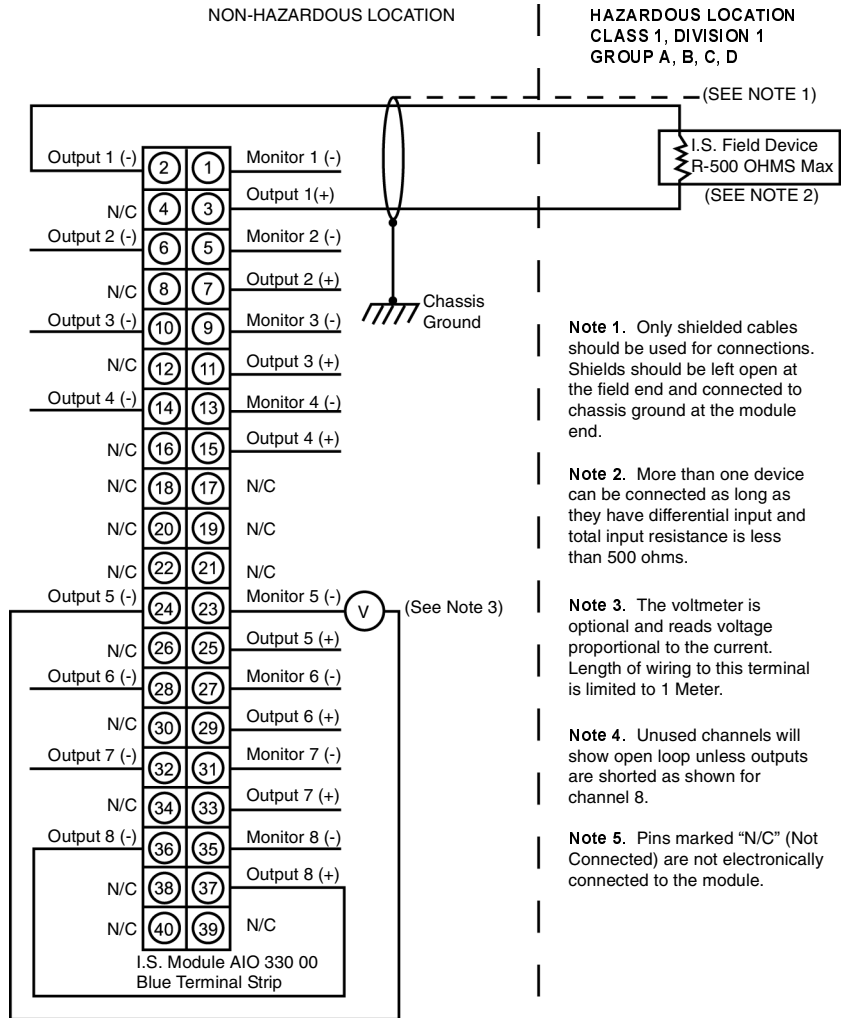
140 AIO 330 00 Wiring Diagram

The following is a Cenelec certified wiring diagram for this module.

**CENELEC CERTIFICATION**

**Entity Parameters**

per channel:  
 $V_o = 29.5 \text{ Vdc}$   
 $I_o = 94 \text{ mA/Ch}$   
 $P_o = 520 \text{ mW/ch}$   
 $C_o = 68 \text{ nf/ch}$   
 $L_o = 4.2 \text{ mH/ch}$



31001364 Rev 00

AIO 330 00 Wiring Diagram (Analog Output)



---

# 15.3 Intrinsically Safe Discrete Modules

---

## At a Glance

---

**Overview** This section provides information on the intrinsically safe discrete modules, 140DII33000 and 140DIO33000.

---

**What's in this Section?** This section contains the following topics:

Topic	Page
I/O Configuration for Intrinsically Safe Discrete Modules	400
140DII33000 Intrinsically Safe Discrete Input Module	402
140DIO33000 Intrinsically Safe Discrete Output Module	408

---

## I/O Configuration for Intrinsically Safe Discrete Modules

---

### Overview

This section provides information on the I/O configuration of the intrinsically safe discrete modules, 140DII33000 and 140DIO33000.

---

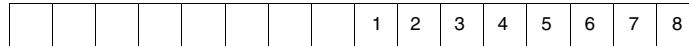
### Intrinsically Safe Discrete Input Module

The following is the intrinsically safe discrete input module:

- 140DII33000 (DC, intrinsic safe)
- 

### I/O Map Register Assignment

This 8-point input module can be configured as either 8 contiguous discrete input (1x) references or as one 3x register. The following figure shows an I/O map register.



## CAUTION

### I/O Mapping Rules

When I/O mapping input modules using discrete (1x) references in remote drops, users should not split discrete words between drops. The lowest discrete reference for a drop should start on a word boundary.

**Failure to follow this precaution can result in injury or equipment damage.**

---

### I/O Map Status Byte

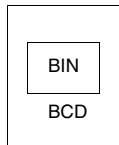
There is no I/O map status byte associated with this module.

---

### Modsoft Module Zoom Selections

Push <Enter> to display and select the input type. The following figure shows the input type display.

input Type:



**Intrinsically Safe Discrete Output Module**

The following shows the 8-point discrete output module:

- 140DIO33000 (DC, Intrinsic Safe)

**I/O Map Register Assignment**

The output modules listed above can be configured as either eight contiguous discrete output (0x) references or as one output (4x) register. The following figure shows the format for the output modules.

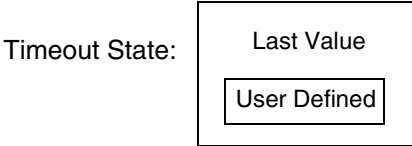
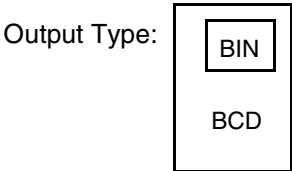


**I/O Map Status Byte**

There is no I/O Map status byte associated with this module.

**Module Zoom Selections**

Push <Enter> to display and select the output type and timeout state for the module. Timeout state is assumed when system control of the module is stopped.



User Defined Timeout State Points 1- 8: 00000000

## 140DII33000 Intrinsically Safe Discrete Input Module

### Overview

The Quantum 140DII33000 Intrinsically Safe Discrete Input module provides safe power to dry contact closures e.g., push buttons, selector switches, float switches, flow switches, limit switches, etc., in a hazardous area, and receives the proportional current to indicate an on/off state. The received current is converted into digital signals that is transferred to the PLC.

### Specifications

The following table provides specifications for the DII33000 Intrinsically Safe Discrete Input module.

<b>Specifications</b>	
Number of Input Points	8
LEDs	Active (Green) 1 ... 8 (Green) – Indicates point status
Operating Voltages and Currents	
No load voltage (between input + and input -)	8 Vdc
Short circuit current	8 mA
Switching point	1.2 mA ... 2.1 mA
Switching hysteresis	0.2 mA
Switching Frequency	100 Hz maximum
Response	
OFF-ON	1 ms
ON-OFF	1 ms
Isolation	
Channel to Channel	None
Channel to Bus	1780 Vac, 47-63 Hz or 2500 Vdc for 1 min.
Internal Resistance	2.5 K $\Omega$
Input Protection	Resistor limited
Fault Detection	None
Bus Current Required	400 mA
Power Dissipation	2 W
External Power	Not required
Hot Swap	Not allowed per intrinsic safety standards
Fusing	Internal - not user accessible
Programming Software	Modsoft Ver. 2.61 or higher

**Fixed Wiring System**

The DII33000 module is designed with a fixed wiring system where the field connections are made to a 40-pin, fixed position, blue terminal strip which is plugged into the module.

**Field Wiring**

Field wiring to the module consists of separate shielded twisted pair wires. The acceptable field wire gauge is AWG 20 to AWG 12. Wiring between the module and the intrinsically safe field device should follow intrinsically safe wiring practices, to avoid the transfer of unsafe levels of energy to the hazardous area.

**Terminal Strip Color and Keying Assignment**

The module's 140XTS33200 field wiring terminal strip is color-coded blue to identify it as an intrinsically safe connector. The terminal strip is keyed to prevent the wrong connector from being applied to the module. The keying assignment is given below.

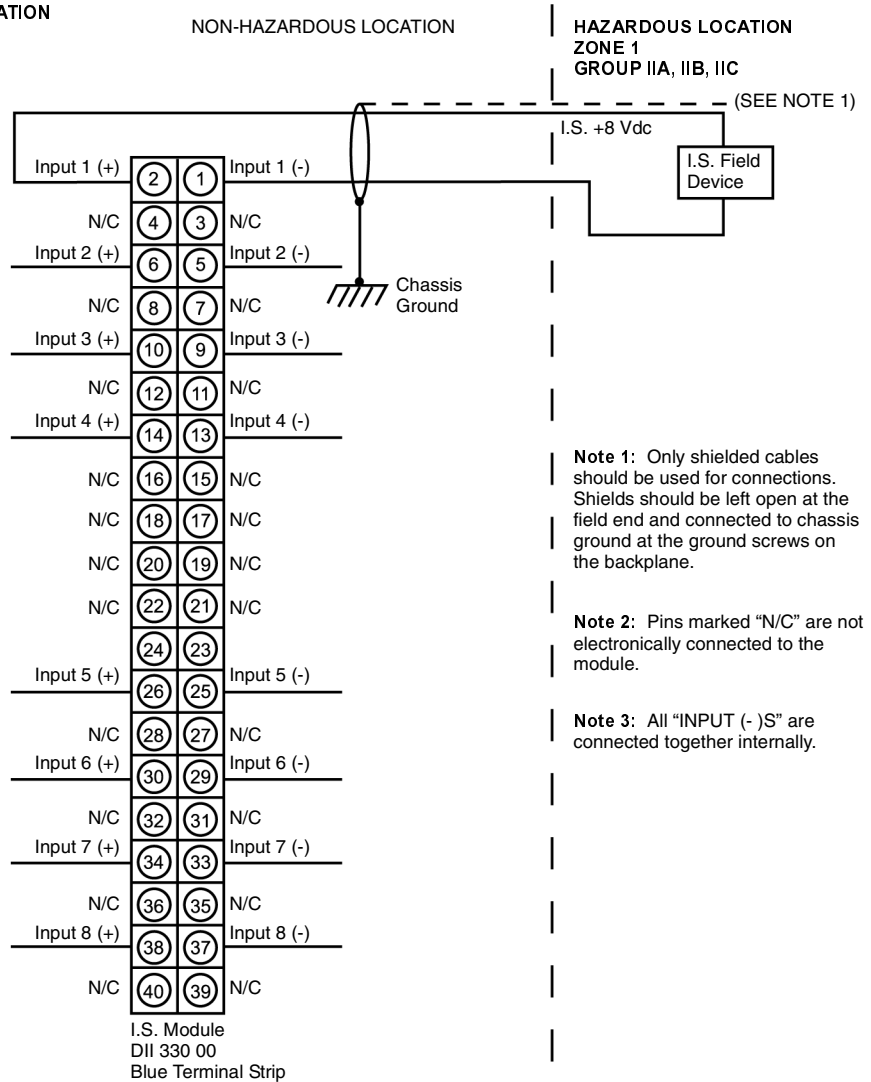
Module Class	Module Part Number	Module Coding	Terminal Strip Coding
Intrinsically Safe	140 DII 330 00	CDE	ABF

**Agency  
Approved Wiring  
Diagrams**

The following is a Cenelec certified wiring diagram for this module.

**CENELEC CERTIFICATION**

**Entity Parameters  
per Channel:**  
 $V_o = 9.6 \text{ Vdc}$   
 $I_o = 80 \text{ mA/ch}$   
 $P_o = 192 \text{ mW/ch}$   
 $C_o = 450 \text{ nF/ch}$   
 $L_o = 694 \text{ microH/ch}$



31001365 Rev 00    140 DII 330 00 Wiring Diagram

The following is a CSA certified wiring diagram for this module.

**Notes related to CSA certification for this module.**

**Note 1.** Entity parameters per module:  $V_{oc} = 9.6\text{ V}$   
 $I_{sc} = 80\text{ mA}$   
 $C_a = 450\text{ nf}$   
 $L_a = 694\text{ mH}$

**Note 2.** Maximum non-hazardous area voltage must not exceed 250 V.

**Note 3.** Install in accordance with Canadian Electrical Code, Part I, for installation in Canada.

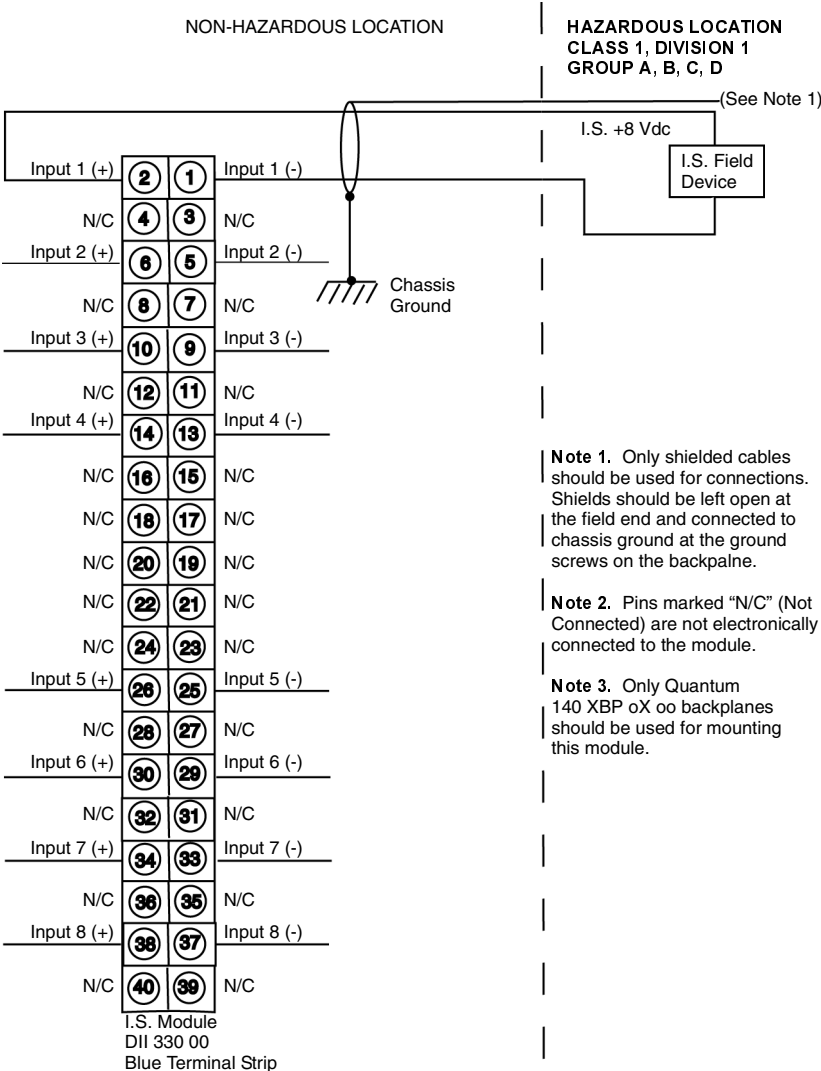
**Note 4.** Install in accordance with the NEC (ANSI/NFPA 70) and ANSI/ISA RP 12.6 for installation in the United States.

**Note 5.** To maintain intrinsic safety, shield for each cable must be grounded and must extend as close to the terminals as possible.

**Note 6.** Intrinsically Safe (I.S.) cables of one module must be routed separately from I.S. cables of another module.

**Note 7.** I.S. devices when connected to I.S. terminals must satisfy the following conditions:  
 $V_{oc} < V_{max}$   
 $I_{sc} < I_{max}$   
 $C_a > C_i + C_{cable}$   
 $L_a > L_i + L_{cable}$

**Note 8.** This module is certified as a component for mounting in a suitable enclosure where the suitability of the final combination is subject to acceptance by CSA or an inspection authority having the jurisdiction.



**Note 1.** Only shielded cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the ground screws on the backplane.

**Note 2.** Pins marked "N/C" (Not Connected) are not electronically connected to the module.

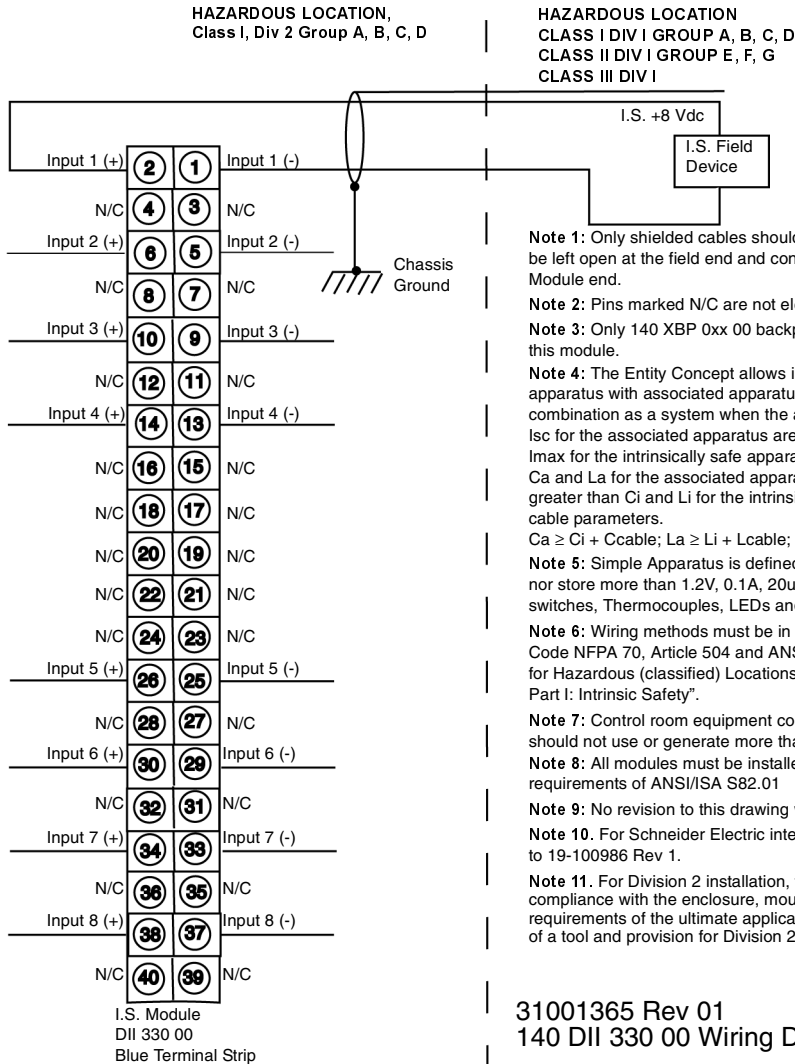
**Note 3.** Only Quantum 140 XBP oX oo backplanes should be used for mounting this module.

31001365 Rev 00 140 DII 330 00 Wiring Diagram

The following is a FM certified wiring diagram for this module.

**Notes Related to FM Certification**

This IS field device should meet Note 5 or should be FM approved or connection with IS RTD/TC IN Modules with Concept Parameters listed below. The entity parameters are per Channel.  
 Voc = 9.6 VDC  
 Isc = 80 mA/Module  
 Ca = 450 nF/Ch  
 La = 0.694 mH/Ch  
 Po = 192 mW/Module



- Note 1:** Only shielded cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the Module end.
- Note 2:** Pins marked N/C are not electronically connected to the Module.
- Note 3:** Only 140 XBP 0xx 00 backplanes should be used for mounting this module.
- Note 4:** The Entity Concept allows interconnection of intrinsically safe apparatus with associated apparatus not specifically examined in combination as a system when the approved values of Voc and Isc for the associated apparatus are less than or equal to Vmax and Imax for the intrinsically safe apparatus and the approved values of Ca and La for the associated apparatus must be equal to or are greater than Ci and Li for the intrinsically Safe apparatus plus all cable parameters.  
 $Ca \geq Ci + Ccable$ ;  $La \geq Li + Lcable$ ;  $Voc \leq Vmax$ ;  $Isc \leq Imax$
- Note 5:** Simple Apparatus is defined as a device which will neither generate nor store more than 1.2V, 0.1A, 20uJ, or 25 mW. For examples switches, Thermocouples, LEDs and RTDs, Etc.
- Note 6:** Wiring methods must be in accordance with National Electrical Code NFPA 70, Article 504 and ANSI/ISA RP12.6, "Wiring Practices for Hazardous (classified) Locations Instrumentation Part I: Intrinsic Safety".
- Note 7:** Control room equipment connected to associated apparatus should not use or generate more than 250Vrms.
- Note 8:** All modules must be installed in an enclosure that meets the requirements of ANSI/ISA S82.01
- Note 9:** No revision to this drawing without prior FMRC Approval.
- Note 10:** For Schneider Electric internal use only. For control sheet, refer to 19-100986 Rev 1.
- Note 11:** For Division 2 installation, the apparatus shall be installed in compliance with the enclosure, mounting, spacing, and segregation requirements of the ultimate application, including access only by the use of a tool and provision for Division 2 wiring methods.

31001365 Rev 01  
 140 DII 330 00 Wiring Diagram



The following is a UL certified wiring diagram for this module.

**Notes related to UL certification for this module.**

**Note 1.** Entity parameters per channel:  $V_{oc} = 9.5\text{ V}$   
 $I_{sc} = 80\text{ mA}$   
 $C_a = 450\text{ nf}$   
 $L_a = 0.175\text{ mH}$

**Note 2.** Maximum non-hazardous area voltage must not exceed 250 V.

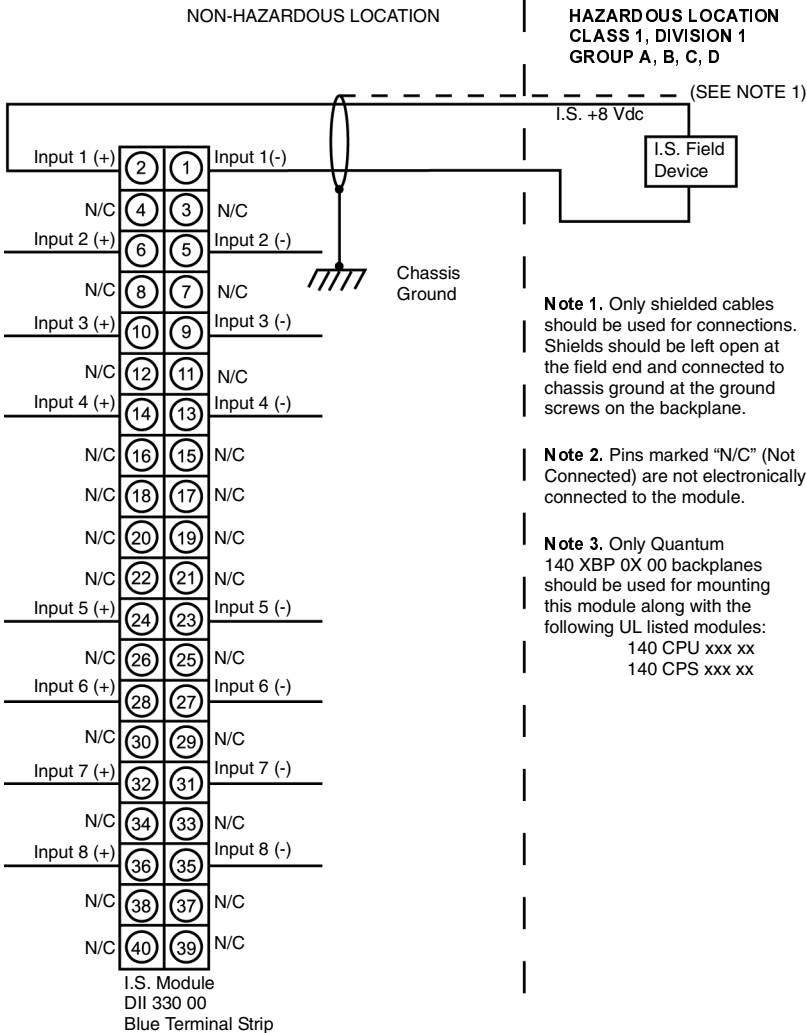
**Note 3.** If the electrical parameters of the cable are unknown, the following values must be used for  $C_{\text{cable}}$  and  $L_{\text{cable}}$ :  
 Capacitance 60 Pf/ft  
 Inductance 0.20 uH/ft

**Note 4.** Install in accordance with the NEC (ANSI/NFPA 70) and ANSI/ISA RP 12.6 for installation in the United States.

**Note 5.** To maintain intrinsic safety, shield for each cable must be grounded and must extend as close to the terminals as possible.

**Note 6.** Intrinsically Safe (I.S.) cables of one module must be routed separately from I.S. cables of another module.

**Note 7.** I.S. devices when connected to I.S. terminals must satisfy the following conditions:  
 $V_{oc} < V_{\text{max}}$   
 $I_{sc} < I_{\text{max}}$   
 $C_a > C_i + C_{\text{cable}}$   
 $L_a > L_i + L_{\text{cable}}$



## 140DIO33000 Intrinsically Safe Discrete Output Module

### Overview

The Quantum 140DIO33000 Intrinsically Safe Discrete Output module switches intrinsically safe power to a variety of components such as solenoid valves, LEDs, etc., that are located in a hazardous area. This module is for use with sink devices only.

### Specifications

Specifications for the DIO33000 module are as follows.

<b>Specifications</b>	
<b>Number of Output Points</b>	<b>8</b>
<b>LEDs</b>	Active-1 (Green) 1 ... 8 (Green) – Indicates point status
<b>Output Voltage</b>	24 V (open)
<b>Maximum Load Current</b>	
Each Point	45 mA
Per Module	360 mA
Off State Leakage/Point	0.4 mA
<b>Response (Resistive Loads)</b>	
OFF-ON	1 ms
ON-OFF	1 ms
Output Protection (Internal)	Transient voltage suppression
<b>Isolation</b>	
Channel to Channel	None
Channel to Bus	1780 Vac, 47-63 Hz or 2500 Vdc for 1 min.
<b>Fault Detection</b>	None
<b>Bus Current Required</b>	2.2 Amp (full load)
<b>Power Dissipation</b>	5 W (full load)
<b>External Power</b>	Not required
<b>Hot Swap</b>	Not allowed per intrinsic safety requirements
<b>Fusing</b>	Internal - not user accessible
<b>Programming Software</b>	Modsoft Ver. 2.61 or higher

---

**Fixed Wiring System**

The DIO33000 module is designed with a fixed wiring system where the field connections are made to a 40-pin, fixed position, blue terminal strip, which is plugged into the module.

---

**Field Wiring**

Field wiring to the module consists of separate shielded, twisted pair wires. The acceptable field wire gauge is AWG 20 to AWG 12. Wiring between the module and the intrinsically safe field device should follow intrinsically safe wiring practices, to avoid the transfer of unsafe levels of energy to the hazardous area.

---

**Terminal Strip Color and Keying Assignment**

The module's 140XTS33200 field wiring terminal strip is color-coded blue to identify it as an intrinsically safe connector. The terminal strip is keyed to prevent the wrong connector from being applied to the module. The keying assignment is given below.

Module Class	Module Part Number	Module Coding	Terminal Strip Coding
Intrinsically Safe	140DIO33000	CDE	ABF

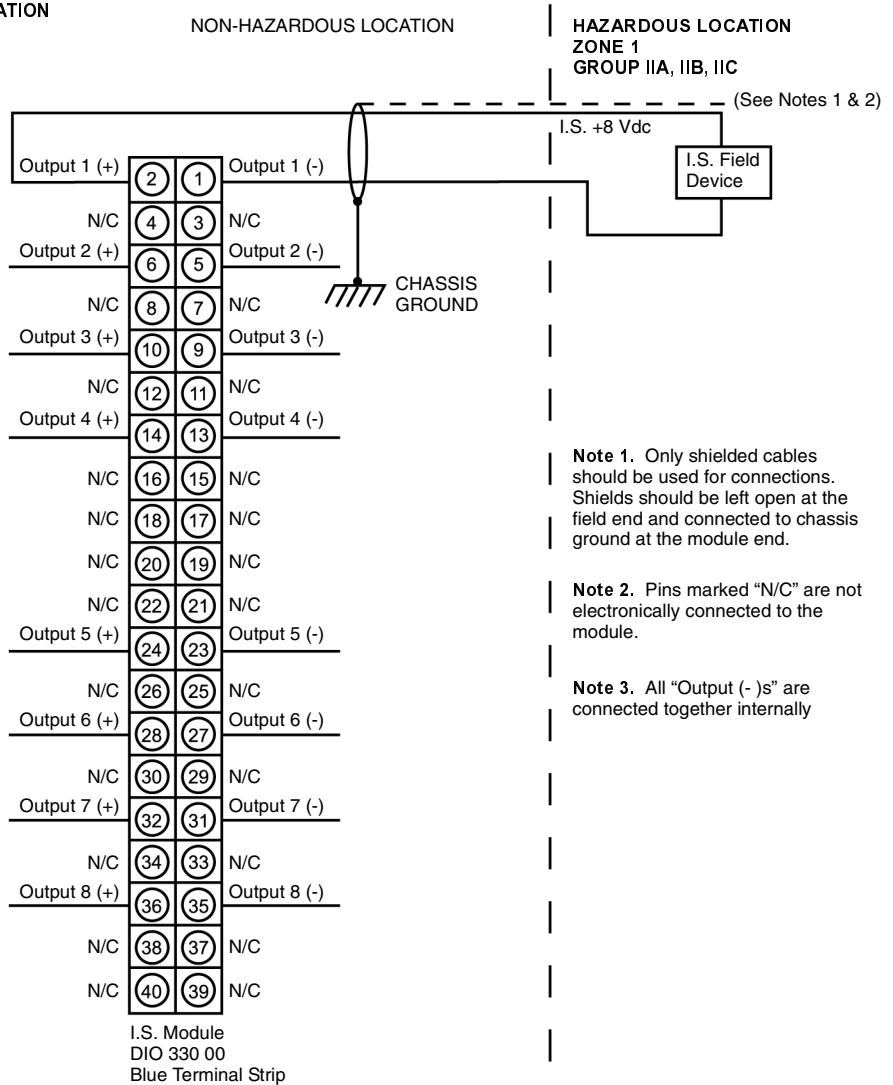
---

**Agency  
Approved Wiring  
Diagrams**

The following is a Cenelec certified wiring diagram for this module.

**CENELEC CERTIFICATION**

**Entity Parameters  
per Channel:**  
 $V_o = 27.9 \text{ Vdc}$   
 $I_o = 121 \text{ mA/ch}$   
 $P_o = 840 \text{ mW/ch}$   
 $C_o = 84 \text{ nf/ch}$   
 $L_o = 2.2 \text{ mH/ch}$



31001366 Rev 00

140 DIO 330 00 Wiring Diagram

The following is a CSA certified wiring diagram for this module.

**Notes related to CSA certification for this module.**

**Note 1.** Entity parameters per channel:  $V_{oc} = 27.9\text{ V}$   
 $I_{sc} = 119\text{ mA}$   
 $C_a = 84\text{ nf}$   
 $L_a = 1.0\text{ mH}$

**Note 2.** Maximum non-hazardous area voltage must not exceed 250 V.

**Note 3.** Install in accordance with Canadian Electrical Code, Part I, for installation in Canada.

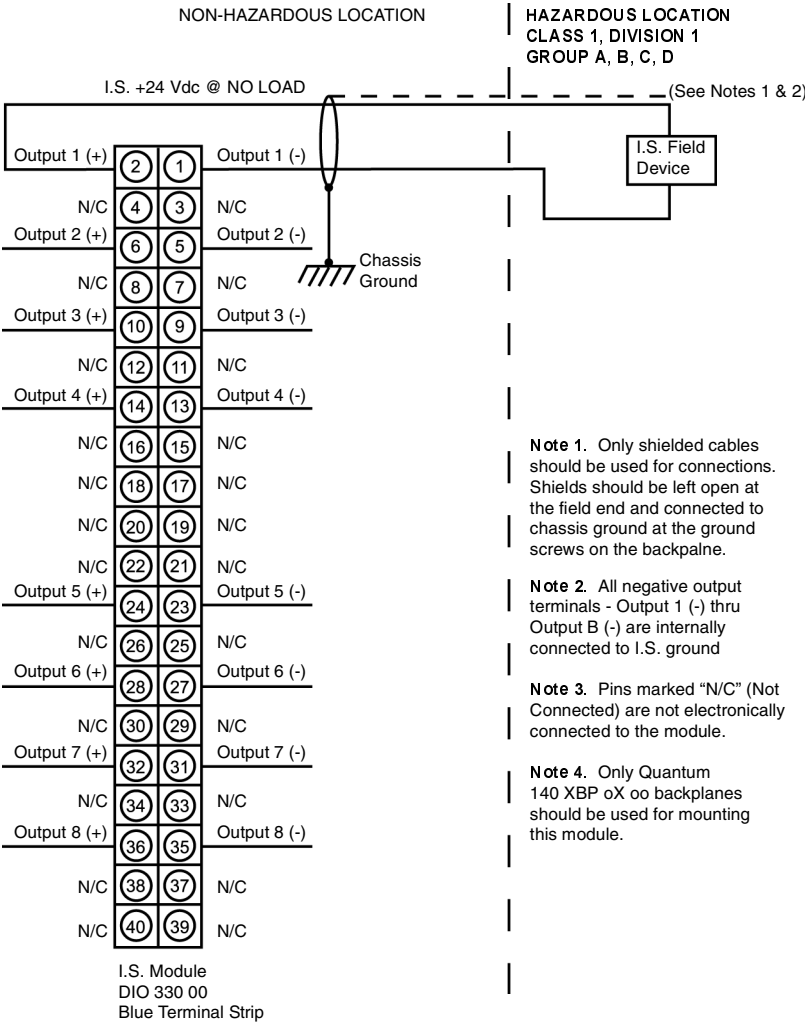
**Note 4.** Install in accordance with the NEC (ANSI/NFPA 70) and ANSI/ISA RP 12.6 for installation in the United States.

**Note 5.** To maintain intrinsic safety, shield for each cable must be grounded and must extend as close to the terminals as possible.

**Note 6.** Intrinsically safe (I.S.) cables of one module must be routed separately from I.S. cables of another module.

**Note 7.** I.S. devices when connected to I.S. terminals must satisfy the following conditions:  
 $V_{oc} < V_{max}$   
 $I_{sc} < I_{max}$   
 $C_a > C_i + C_{cable}$   
 $L_a > L_i + L_{cable}$

**Note 8.** This module is certified as a component for mounting in a suitable enclosure where the suitability of the final combination is subject to acceptance by CSA or an inspection authority having the jurisdiction.



**Note 1.** Only shielded cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the ground screws on the backplane.

**Note 2.** All negative output terminals - Output 1 (-) thru Output 8 (-) are internally connected to I.S. ground

**Note 3.** Pins marked "N/C" (Not Connected) are not electronically connected to the module.

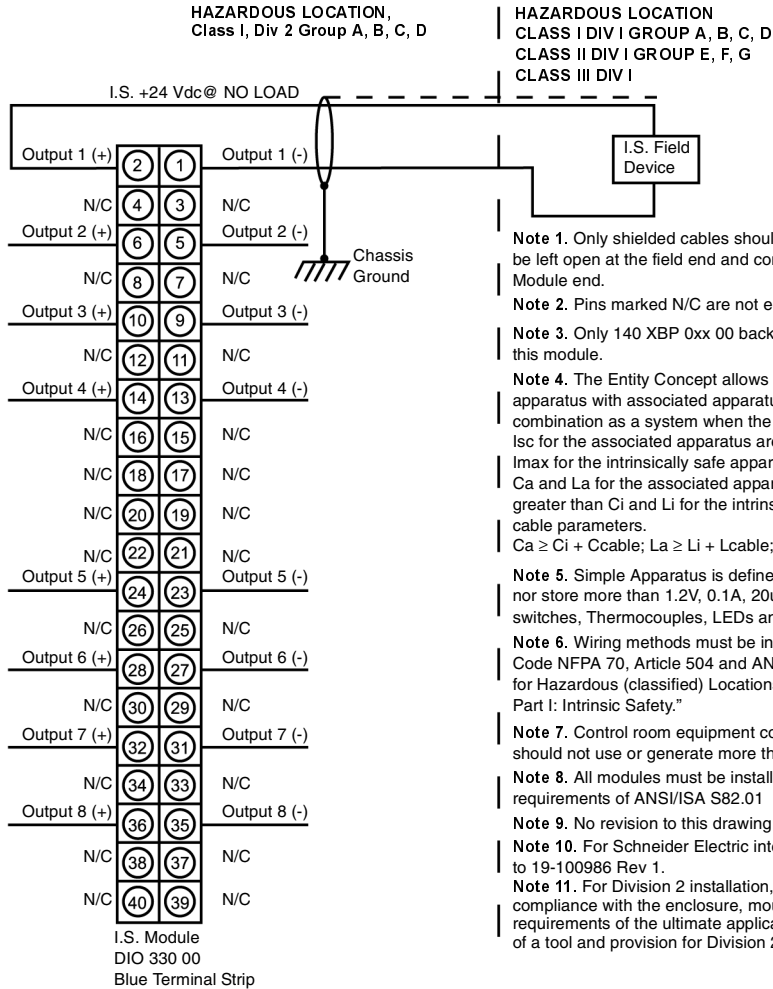
**Note 4.** Only Quantum 140 XBP oX oo backplanes should be used for mounting this module.

31001366 Rev 00 140 DIO 330 00 Wiring Diagram

The following is a FM certified wiring diagram for this module.

**Notes Related to FM Certification**

This IS field device should meet Note 5 or should be FM approved with entity concept in Note 4 appropriate for connection with IS RTD/TC IN Module with Concept Parameters Listed below. The entity parameters are per Channel.  
 Voc = 27.9 VDC  
 Isc = 121 mA/Ch  
 Ca = 84 nF/Ch  
 La = 2.2 mH/Ch  
 Po = 840 mW/Ch



- Note 1.** Only shielded cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the Module end.
- Note 2.** Pins marked N/C are not electronically connected to the Module.
- Note 3.** Only 140 XBP 0xx 00 backplanes should be used for mounting this module.
- Note 4.** The Entity Concept allows interconnection of intrinsically safe apparatus with associated apparatus not specifically examined in combination as a system when the approved values of Voc and Isc for the associated apparatus are less than or equal to Vmax and Imax for the intrinsically safe apparatus and the approved values of Ca and La for the associated apparatus must be equal to or are greater than Ci and Li for the intrinsically Safe apparatus plus all cable parameters.  
 $Ca \geq Ci + Ccable$ ;  $La \geq Li + Lcable$ ;  $Voc \leq Vmax$ ;  $Isc \leq Imax$
- Note 5.** Simple Apparatus is defined as a device which will neither generate nor store more than 1.2V, 0.1A, 20uJ, or 25 mW. For examples switches, Thermocouples, LEDs and RTDs, Etc.
- Note 6.** Wiring methods must be in accordance with National Electrical Code NFPA 70, Article 504 and ANSI/ISA RP1.2.6, "Wiring Practices for Hazardous (classified) Locations Instrumentation Part I: Intrinsic Safety."
- Note 7.** Control room equipment connected to associated apparatus should not use or generate more than 250Vrms.
- Note 8.** All modules must be installed in an enclosure that meets the requirements of ANSI/ISA S82.01
- Note 9.** No revision to this drawing without prior FMRC Approval.
- Note 10.** For Schneider Electric internal use only. For control sheet, refer to 19-100986 Rev 1.
- Note 11.** For Division 2 installation, the apparatus shall be installed in compliance with the enclosure, mounting, spacing, and segregation requirements of the ultimate application, including access only by the use of a tool and provision for Division 2 wiring methods.

31001366 Rev 01

140 DIO 330 00 Wiring Diagram

The following is a UL certified wiring diagram for this module.

**Notes related to UL certification for this module.**

**Note 1.** Entity parameters per channel:  $V_{oc} = 27.9\text{ V}$   
 $I_{sc} = 119\text{ mA}$   
 $C_a = 84\text{ nF}$   
 $L_a = 1.0\text{ mH}$

**Note 2.** Maximum non-hazardous area voltage must not exceed 250 V.

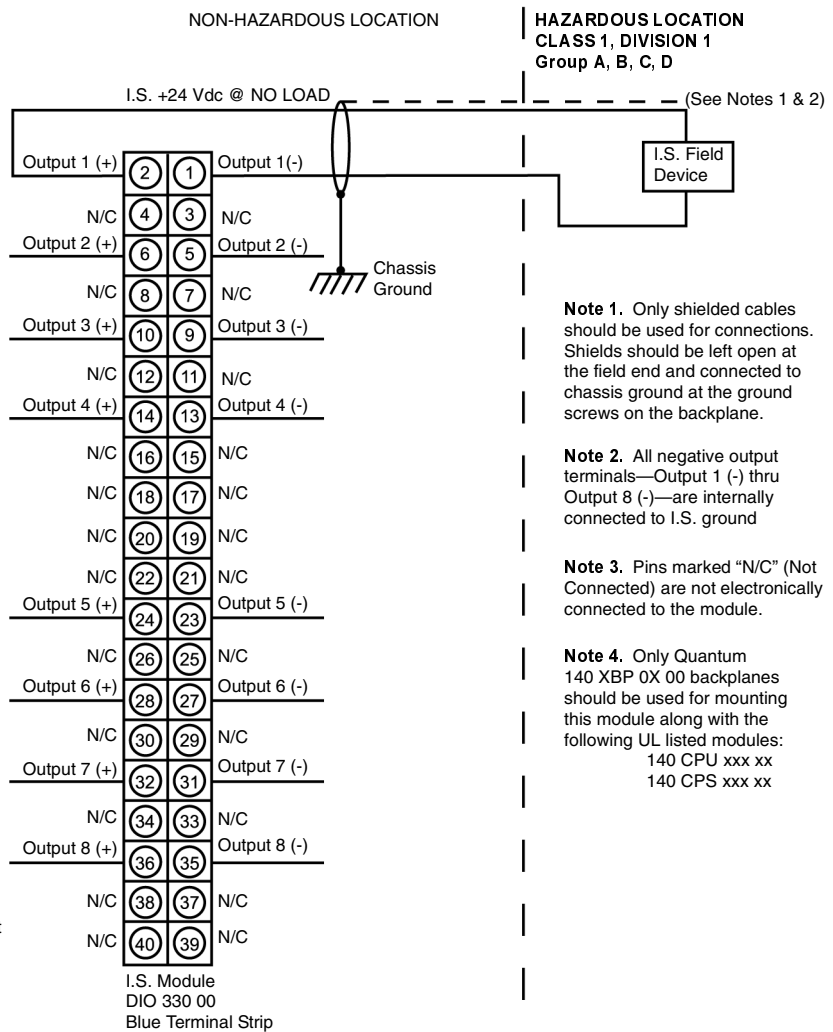
**Note 3.** If the electrical parameters of the cable are unknown, the following values must be used for C<sub>cable</sub> and L<sub>cable</sub>:  
 Capacitance 60 Pf/ft  
 Inductance 0.20 uH/ft

**Note 4.** Install in accordance with the NEC (ANSI/NFPA 70) and ANSI/ISA RP 12.6 for installation in the United States.

**Note 5.** To maintain intrinsic safety, shield for each cable must be grounded and must extend as close to the terminals as possible.

**Note 6.** Intrinsically Safe (I.S.) cables of one module must be routed separately from I.S. cables of another module.

**Note 7.** I.S. devices when connected to I.S. terminals must satisfy the following conditions:  
 $V_{cc} < V_{max}$   
 $I_{sc} < I_{max}$   
 $C_a > C_i + C_{cable}$   
 $L_a > L_i + L_{cable}$



**Note 1.** Only shielded cables should be used for connections. Shields should be left open at the field end and connected to chassis ground at the ground screws on the backplane.

**Note 2.** All negative output terminals—Output 1 (-) thru Output 8 (-)—are internally connected to I.S. ground

**Note 3.** Pins marked “N/C” (Not Connected) are not electronically connected to the module.

**Note 4.** Only Quantum 140 XBP 0X 00 backplanes should be used for mounting this module along with the following UL listed modules:  
 140 CPU xxx xx  
 140 CPS xxx xx

31001366 Rev 00 140 DIO 330 00 Wiring Diagram





---

# Quantum Simulator Modules

# 16

---

## At a Glance

### Introduction

This chapter provides information on discrete and analog simulator modules.

### What's in this Chapter?

This chapter contains the following topics:

Topic	Page
140XSM00200 Quantum Point Discrete Simulator Module	416
140XSM01000 Analog Simulator Module	417

---

## 140XSM00200 Quantum Point Discrete Simulator Module

### Overview

The 140XSM00200 module consists of 16 toggle switches which are used to generate up to 16 binary input signals to the 140DAI54000 and the 140DAI74000 AC input modules.



### CAUTION

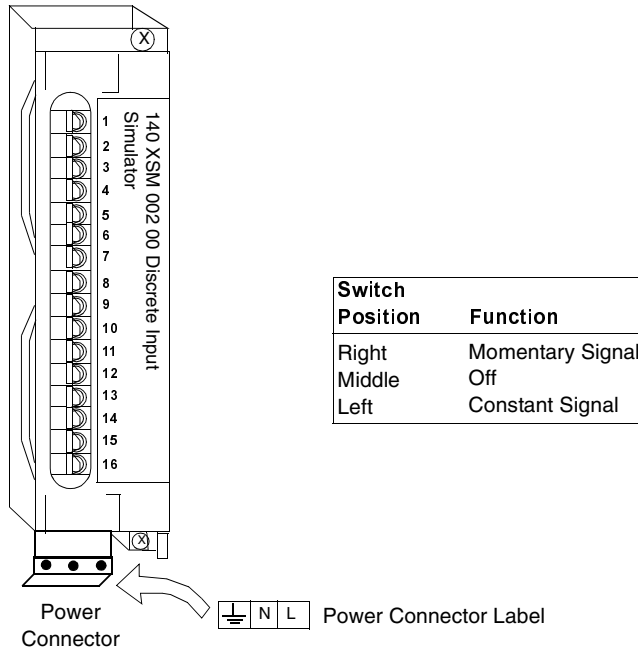
#### Electrical Shock Hazard

When using this simulator module with the 140DAI54000 or 140DAI74000 input modules, you should be careful not to come in contact with the supplied 115 or 230 VAC located at the bottom of the simulator module.

**Failure to follow this precaution can result in injury or equipment damage.**

### 16 Point Discrete Simulator Module

The following figure shows the 140XSM00200 16 Point Discrete Simulator module.



**Note:** Voltage source range is 24 ... 230 Vac.

## 140XSM01000 Analog Simulator Module

### Overview

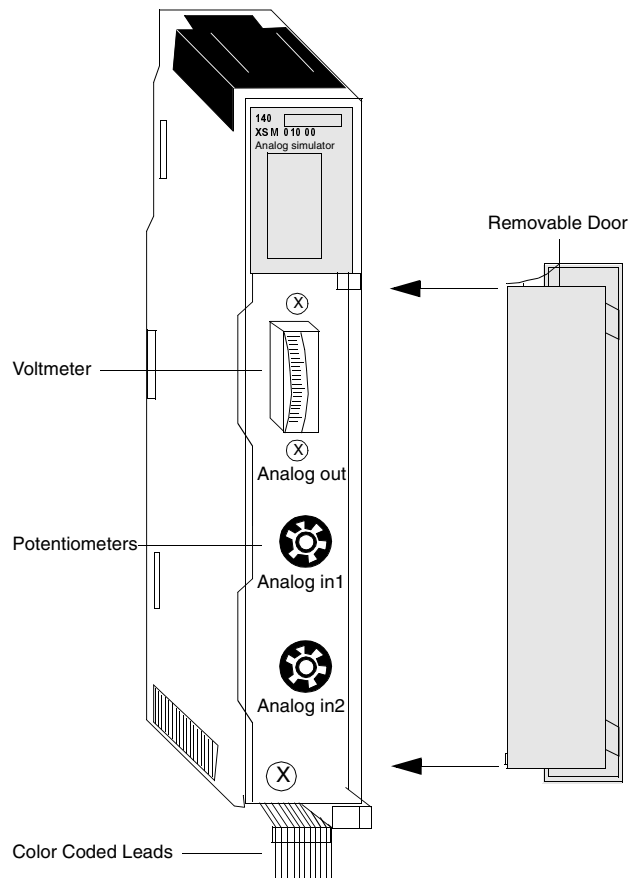
The 140XSM010module is used for simulating 4 ... 20 mA field current loops used with current input Quantum modules. It provides two adjustable 4 ... 20 mA analog signals and one fixed 24 Vdc output. The simulator also measures and displays voltages from 0 ... 5 Vdc.

The simulator module includes the following:

- An internal 24 Vdc power supply
- A 0 ... 5 Vdc meter
- Two 10-turn potentiometers

### Analog Simulator Module

The following figure shows the XSM01000 Analog Simulator module.



**Note:** The 140XSM01000 can be placed in any slot in the Quantum.

**Note:** The 140XSM01000 is not a functional module and should be used only for testing, simulating, and calibrating current input Quantum modules.

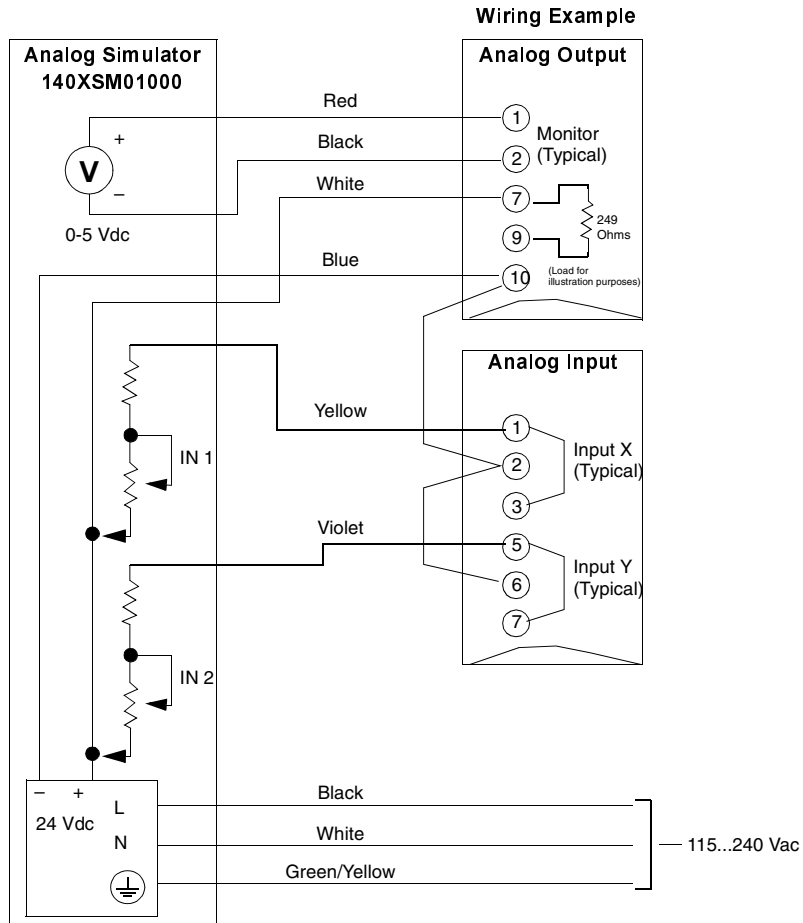
**Specifications**

The following table shows the specifications for the XSM 010 00 analog simulator module.

<b>Specifications</b>	
<b>Voltage</b>	
Operating Voltage	100 ... 240 Vac, 50/60 Hz
Output Continuous	24 Vdc, 400 mA max
<b>Operating Current</b>	300 mA @ 120 Vac
<b>Voltmeter Range</b>	0 ... 5 Vdc
<b>10-Turn Potentiometer Output Variable Current/Voltage</b>	4 ... 20 mA 1 ... 5 Vdc
<b>Internal Fusing</b>	None
<b>Bus Current Required</b>	None

**Wiring Diagram**

The following figure shows the 140XSM01000 generic wiring diagram for the 140AxI03000 input modules, 140AxO02000 output modules, and the 140AMM09000 input/output module.



140XSM01000 Generic Wiring Diagram for the 140AxI03000 Input Modules, 140AxO02000 Output Modules, and the 140AMM09000 Input/Output Module

**Note:** The preceding diagram shows a typical connection between the simulator, a 140ACI03000 input module, and a 140ACO02000 output module. The simulator provides a variable 4 ... 20 mA input to the analog in module. The input can then be read by a Quantum CPU, and, if required, outputted through an analog out module. For the output module to operate properly, the main current loop must be active, and, as shown above, 24 Vdc is supplied between terminals 9 and 10 with a 249 Ohms voltage drop resistor. (For a more detailed description of these modules, refer to p. 429)



---

# Quantum Battery Module

17

---

## At a Glance

### Overview

The following chapter provides information on the battery module, its installations and replacement considerations.

### What's in this Chapter?

This chapter contains the following topics:

Topic	Page
I/O Configuration for the 140XCP90000 Battery Module	422
140XCP90000 Quantum Battery Module	423

## I/O Configuration for the 140XCP90000 Battery Module

---

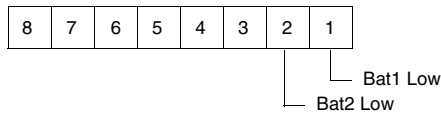
**Overview** The following provides information on the Battery module, 140XCP90000 (Battery Backup).

---

**I/O Map Register Assignment** There is no I/O Map register assignment associated with this module.

---

**I/O Map Status Byte** The two least significant bits in the I/O Map status byte are used as follows:



**Module Zoom Selections** There are no Module Zoom selections required for this module.

---



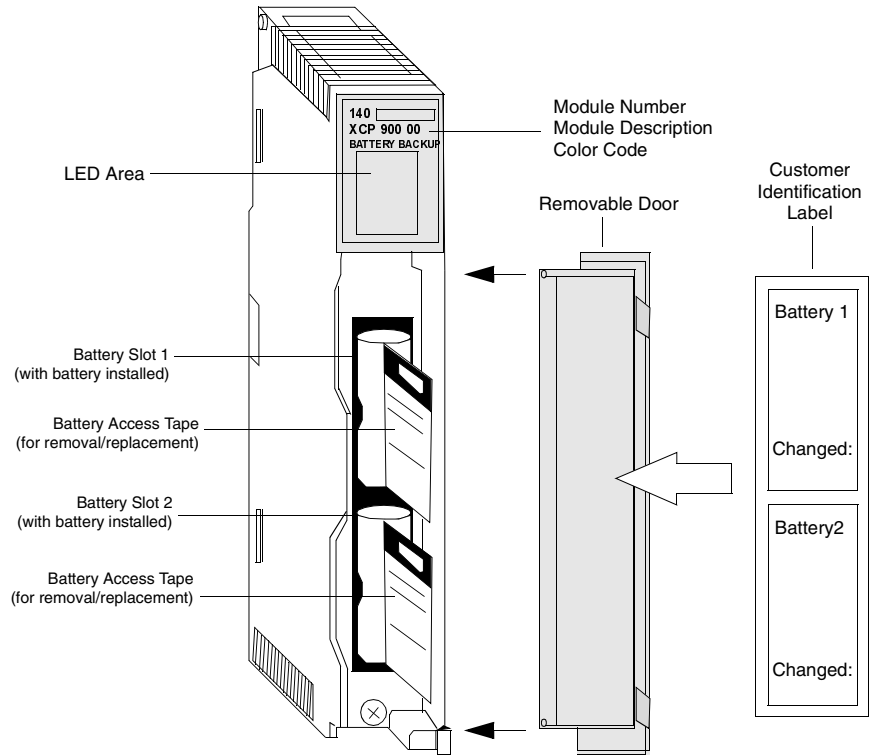
## 140XCP90000 Quantum Battery Module

### Overview

This section describes the battery module, its installation and replacement considerations.

### Battery Module

The following figure shows the battery module components.



**Battery Backup**

The 140XCP90000 provides RAM backup power for expert modules. One non-rechargeable 3.6 V lithium battery is provided and is accessible from the front of the module in Battery Slot 1 (the upper slot) for easy removal when it is necessary to change it.

**Note:** Extended backup protection is provided when a second battery is installed in Battery Slot 2 (the lower slot).

**Specifications**

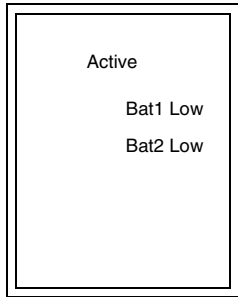
The following table shows the specifications for the battery module.

<b>Specifications</b>	
Battery Type	C, 3 V lithium
Maximum Load Current	100 mA
Service Life	8000 mAh
Shelf Life	10 years with 0.5% loss of capacity per year
Battery Part Number	990XCP99000

**Note:** The formula to calculate the life cycle of one battery in the battery module is:  
Life cycle =  $1 / (4 \times I)$  days  
where I (in Amps) is the total battery current load of all modules in the backplane.

**LED Indicators and Descriptions**

The following figure shows the LED indicators.



The following table shows the LED descriptions.

LED Descriptions		
LEDs	Color	Indication when On
Active	Green	Bus communication is present.
Bat1 Low	Red	Battery 1 voltage is low.
Bat2 Low	Red	Battery 2 voltage is low.

**Note:** The Bat1 Low and Bat2 Low LEDs turn ON when a battery is not installed, installed backwards, or in need of replacement.


**Battery Installation and Replacement Considerations**

The following procedure describes the installation of a battery.

Step	Action
1	Remove the insulating strip from the plus (+) pole of the battery before inserting it into the module. This strip is used to insulate the battery when on the shelf. Note: The battery installed in the module, when shipped, has the insulating strip in place. Remove this strip and re-install the battery before operation.
2	When single battery backup is required, install the battery in Battery Slot 1. The circuitry is designed so Battery 1 supplies the current until it is used up. Battery 2 (when installed) then assumes the load requirement without interruption. Battery status is indicated via LEDs and Modsoft status bytes.
3	When the controller is in operation, the batteries can be replaced at any time. Note: When the controller is powered OFF, battery replacement can be done without RAM loss only when a second functioning battery is installed.

**Installing/  
Removing a  
Battery**

The following procedure describes how to install or remove a battery.

Step	Action
1	Remove the insulating strip from the new battery.
2	<p>If necessary, remove the old battery. Detach it from its housing (on the front of the module), by pulling the battery access strip (see below) until the battery pops out.</p> 
3	Replace it with the new battery using the reverse of the procedure in step 2.



**WARNING**

**May cause personal injury or damage to equipment.**

Do not use any metallic tools (i.e., pliers, screwdriver, etc.) when removing or replacing a battery in this module. Using tools during removal and replacement may cause personal injury and/or damage to the battery and this module.

**Failure to follow this precaution can result in death, serious injury, or equipment damage.**



**WARNING**

**May cause personal injury of damage to equipment.**

Ensure that proper polarity is maintained when connecting and inserting new batteries into the XCP90000. Inserting the battery improperly may cause personal injury and/or damage to this module.

**Failure to follow this precaution can result in death, serious injury, or equipment damage.**



## CAUTION

**Hazardous waste.**

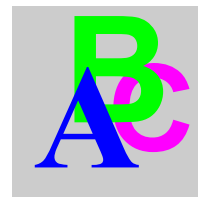
Used batteries (hazardous waste) must be disposed of according to local rules and regulations governing hazardous waste.

**Failure to follow this precaution can result in injury or equipment damage.**



---

# Index



---

## Numerics

- 140 CFA 040 00
  - application notes, 722
  - description, 722
  - dimensions, 723
  - terminal block illustration, 722
  - wiring diagram, 723
- 140 CFB 032 00
  - application notes, 724
  - description, 724
  - terminal block illustration, 724
  - wiring for input modules, 725
- 140 CFC 032 00
  - wiring diagram for 140 DDI 353 00, 729
- 140 CFC 032 00
  - application notes, 728
  - description, 727
  - dimensions, 728
  - terminal block illustration, 727
  - wiring diagram for 140 DAI 353 00, 729
  - wiring diagram for 140 DAI 453 00, 729
  - wiring diagram for 140 DAI 553 00, 729
  - wiring diagram for 140 DDI 153 10, 730
  - wiring diagram for 140 DDI 853 00, 729
  - wiring diagram for 140 DDO 153 10, 731
  - wiring for 140 DDO 353 0X, 732
  - wiring for output module, 726
- 140 CFD 032 00
  - application notes, 733
  - description, 733
  - dimensions, 733
  - terminal block illustration, 733
  - wiring diagram, 734
- 140 CFE 032 00
  - dimensions, 735
- 140 CFE 032 00
  - application notes, 735
  - description, 735
  - terminal block illustration, 735
  - wiring diagram, 736
- 140 CFG 016 00
  - application notes, 737
  - description, 737
  - dimensions, 737
  - terminal block illustration, 737
  - wiring diagram (grouped AC output mode), 740
  - wiring diagram (grouped DC output mode), 741
  - wiring diagram (isolated AC input mode), 738
  - wiring diagram (isolated output mode), 739

**140 CFH 008 00**

- application notes, 742
- description, 742
- dimensions, 742
- terminal block illustration, 742
- wiring diagram (chassis grounding), 745
- wiring diagram (instrument grounding), 744
- wiring diagram (source grounding), 743

**A****ACI03000**

- configuration, 445
- description, 461
- I/O map status byte, 447
- register assignment, 446
- specifications, 462
- wiring diagram, 463

**ACI04000**

- description, 464
- I/O map status byte, 448
- module zoom selections, 448
- register assignment, 447
- specifications, 465
- wiring diagram, 466

**ACO02000**

- configuration, 478
- description, 482
- I/O map status byte, 478
- module zoom selections, 479
- register assignments, 478
- specifications, 482
- voltmeter monitor specifications, 483
- wiring diagram, 484

**ACO13000**

- configuration, 479
- description, 486
- I/O map status byte, 480
- module zoom selections, 480
- register assignments, 479
- specifications, 486
- wiring diagram, 488

**Agency approvals**

- ASCII interface, 773
- backplane expander, 777
- backplanes, 776
- battery module, 774
- counters, 773
- CPUs, 770
- DIO drops, 770
- field bus modules, 771
- high speed interrupts, 773
- Hot Standby, 772
- I/O, 775
- intrinsically safe modules, 774
- NOEs, 772
- NOMs, 772
- power supplies, 769
- RIO heads and drops, 771
- simulators, 774
- single axis motion, 773

**All33000**

- configuration, 367
- description, 375
- field wiring, 378
- I/O map register assignment, 367
- I/O map status byte, 370
- module zoom selections, 370
- register assignment, 368
- RTD/resistance module specifications, 375
- terminal color and keying assignment, 378
- thermocouple/millivolt map register assignment, 369
- Thermocouple/Millivolt module specification, 376
- wiring diagram (Cenelec/RTD), 379
- wiring diagram (Cenelec/TC), 380
- wiring diagram (CSA/RTD), 381
- wiring diagram (CSA/TC), 382
- wiring diagram (FM/RTD), 383
- wiring diagram (FM/TC), 384
- wiring diagram (UL/RTD), 385
- wiring diagram (UL/TC), 386



- AI133010
  - configuration, 371
  - description, 387
  - field wiring, 388
  - fixed wiring, 388
  - map status byte (inputs), 372
  - module zoom selections, 372
  - register assignment, 372
  - specifications, 387
  - terminal strip color and keying assignment, 388
  - wiring diagram (Cenelec), 389
  - wiring diagram (CSA), 390
  - wiring diagram (FM), 391
  - wiring diagram (UL), 392
- AIO33000
  - configuration, 373
  - description, 393
  - field wiring, 394
  - fixed wiring system, 394
  - I/O map status byte, 373
  - module zoom selections, 374
  - register assignments, 373
  - specifications, 393
  - terminal strip color and keying assignment, 394
  - wiring diagram (Cenelec), 398
  - wiring diagram (CSA), 395
  - wiring diagram (FM), 396
  - wiring diagram (UL), 397
- AMM09000
  - 3x registers, 494
  - 4x registers, 496
  - common specifications, 501
  - configuration, 494
  - description, 498
  - I/O map status byte, 497
  - input specifications, 499
  - linear measuring ranges, 496
  - module zoom selections, 497
  - output specifications, 500
  - register assignments, 494
  - status warning, 495
  - topology specifications, 498
  - wiring diagram, 502
- analog input modules
  - configuration, 445
- analog input/output module AMM09000, 498
- analog output modules
  - configuration, 478
- analog simulator module XSM01000, 417
- ARI03010
  - configuration, 448
  - description, 467
  - I/O map status byte, 450
  - module zoom selections, 450
  - register assignment, 449
  - specifications, 468
  - wiring diagram, 469
- ASCII interface module ESI06210, 332
- AS-i master module EAI92100, 195
- ATI03000
  - configuration, 451
  - description, 470
  - I/O map status byte, 454
  - measurement ranges, 454, 455
  - module zoom selections, 456
  - register assignment, 452
  - specifications, 470
  - wiring diagram, 472
- AVI03000
  - configuration, 457
  - description, 473
  - I/O map status byte, 459
  - linear measuring ranges, 459, 475
  - module zoom selections, 460
  - register assignment, 457
  - specifications, 474
  - wiring diagram, 476
- AVO02000
  - configuration, 480
  - description, 489
  - module zoom selections, 481
  - register assignments, 481
  - specifications, 489
  - wiring diagram, 492

**B**

- backplane expander XBE10000, 352
- backplanes
  - four position, 677
  - mounting hardware specifications, 674
  - part numbers, 674
  - selecting, 674
  - six position, 678
  - sixteen position, 680
  - ten position, 679
  - three position, 676
  - two positions, 675
- battery module XCP90000, 423
- bus configuration, 256

**C**

- CableFast
  - cable lengths, 759
  - cable selections (XTS), 760
  - cable specifications, 758
  - description, 716
  - I/O connector for Quantum, 761
  - I/O connector illustration, 762
  - inner wire color codes, 759
  - quantum modules and backplane illustration, 716
  - specifications, 717
  - terminal block descriptions, 720
  - terminal block features, 721
  - terminal block selection, 718
  - terminal block stacking convention, 721
  - XCA102xx pigtail, 761
  - XTS102xx pigtail, 762
- CableFast accessories
  - jumper, fuse replacement, 763
  - part numbers, 763
  - terminal block common strip, 763
- cables
  - part numbers, 659
- CE closed system installation
  - AC & DC powered systems, 712
  - AC/DC installation illustration, 712
  - line filter connections, 713
  - protective cover, 713
- CFB03200
  - terminal block dimensions, 724
- CFI00800
  - application notes, 746
  - description, 746
  - dimensions, 746
  - wiring diagram (chassis grounding), 749
  - wiring diagram (instrument grounding), 748
  - wiring diagram (source grounding), 747
- CFJ00400
  - application notes, 750
  - description, 750
  - dimensions, 750
  - terminal block illustration, 750
  - wiring diagram (chassis grounding), 753
  - wiring diagram (instrument grounding), 752
  - wiring diagram (source grounding), 751
- CFK00400
  - application notes, 754
  - description, 754
  - dimensions, 754
  - terminal block illustration, 754
  - wiring diagram (chassis grounding), 757
  - wiring diagram (instrument grounding), 756
  - wiring diagram (source grounding), 755
- CHS11000
  - A/B designation slide switch, 360
  - blinking Com Act LED error codes, 359
  - description, 357
  - illustration, 357
  - keyswitch and update button, 359
  - LED descriptions, 358
  - LED indicators, 358
  - specifications, 358
- communication interface modules
  - Ethernet TCP/IP module, 9
  - InterBus interface modules, 10
  - LonWorks modules, 10
  - Modbus Plus on Fiber, 9
  - SY/MAX-Ethernet, 9
  - twisted-pair wiring, 9
  - types, 8

- 
- connector types, for fiber optic links, 261
  - CPS11100
    - description, 60
    - illustration, 60
    - LED description, 62
    - LED indicator, 62
    - wiring diagram, 62
  - CPS11100 (PV01 or greater)
    - description, 63
    - illustration, 63
    - LED description, 65
    - LED indicator, 65
    - wiring diagram, 65
  - CPS11400
    - description, 66
    - illustration, 66
    - LED description, 68
    - LED indicators, 68
    - specifications, 67
    - wiring diagram, 68
  - CPS11410
    - description, 69
    - illustration, 69
    - LED description, 71
    - LED indicator, 71
    - specifications, 70
    - wiring diagram, 71
  - CPS11420
    - description, 72
    - illustration, 72
    - LED description, 74
    - LED indicator, 74
    - specifications, 73
    - wiring diagram, 74
  - CPS12400
    - description, 75
    - illustration, 75
    - LED description, 77
    - LED indicator, 77
    - specifications, 76
    - wiring diagram, 77
  - CPS12420
    - description, 78
    - illustration, 78
    - LED description, 80
    - LED indicator, 80
    - specifications, 79
    - wiring diagram, 80
  - CPS21100
    - description, 81
    - illustration, 81
    - LED description, 82
    - LED indicator, 82
    - specifications, 82
    - wiring diagram, 83
  - CPS21400
    - description, 84
    - illustration, 84
    - LED description, 85
    - LED indicator, 85
    - specifications, 85
    - wiring diagram, 86
  - CPS22400
    - description, 87
    - illustration, 87
    - LED description, 88
    - LED indicator, 88
    - specifications, 88
    - wiring diagram, 89
  - CPS41400
    - description, 90
    - illustration, 90
    - LED description, 91
    - LED indicator, 91
    - operating curve and timing chart, 92
    - specifications, 91
    - wiring diagram, 92
  - CPS42400
    - illustration, 93
    - LED description, 94
    - LED indicator, 94
    - operating curve and timing chart, 95
    - specifications, 94
    - wiring diagram, 95

**CPS51100**

- description, 96
- illustration, 96
- LED description, 98
- LED indicator, 98
- specifications, 97
- wiring diagram, 98

**CPS52400**

- description, 99
- illustration, 99
- LED description, 101
- LED indicators, 101
- specifications, 100
- wiring diagram, 101

**CPU**

- description, 6
- hardware specifications, 50
- part numbers, 50

**CPU11302**

- ASCII communication port
  - parameters, 111
- description, 115
- front panel switches, 110
- illustration, 105
- LED descriptions, 108
- LED error codes, 109
- LED indicators, 108
- Modbus connector pinouts, 113
- Modbus ports pinout connections, 113
- Modbus ports pinout connections for portable computers, 114
- rear panel rotary switches, 112
- RTU communication port
  - parameters, 111
  - specifications, 106
- SW1 and SW2 address settings, 112
- SW1 and SW2 switches, 112
- valid communication port
  - parameters, 111

**CPU11303**

- ASCII communication port
  - parameters, 121
- illustration, 115
- LED descriptions, 118
- LED error codes, 119
- LED indicators, 118
- Modbus connector pinouts, 123
- Modbus ports pinout connections, 123
- Modbus ports pinout connections for portable computers, 124
- rear panel switches, 122
- RTU communication port
  - parameters, 121
  - specifications, 116
- SW1 and SW2 address settings, 122
- SW1 and SW2 switches, 122
- valid communication port
  - parameters, 121

**CPU21304**

- ASCII communication port
  - parameters, 131
- description, 125
- front panel switches, 130
- illustration, 125
- LED descriptions, 128
- LED error codes, 129
- LED indicators, 128
- Modbus connector pinouts, 133
- Modbus ports pinout connections, 133
- Modbus ports pinout connections for portable computers, 134
- rear panel switches, 132
- RTU communication port
  - parameters, 131
  - specifications, 126
- SW1 and SW2 address settings, 132
- SW1 and SW2 switches, 132
- valid communication port
  - parameters, 131

- CPU42402
  - ASCII communication port
    - parameters, 141
  - description, 135
  - front panel switches, 140
  - illustration, 135
  - LED descriptions, 138
  - LED error codes, 139
  - LED indicators, 138
  - Modbus connector pinouts, 143
  - Modbus ports pinout connections, 143
  - Modbus ports pinout connections for portable computers, 144
  - rear panel switches, 142
  - RTU communication port
    - parameters, 141
    - specifications, 136
  - SW1 and SW2 address settings, 142
  - SW1 and SW2 switches, 142
  - valid communication port
    - parameters, 141
- CPU43412, 150
  - ASCII comm port parameters, 151
  - description, 145
  - key switch, 153
  - LED description, 148
  - LED error codes, 149
  - LED indicators, 148
  - Modbus connector pinouts, 154
  - Modbus ports pinout connections, 155
  - Modbus ports pinout connections for portable computers, 155
  - rear panel rotary switches, 152
  - RTU comm port parameters, 151
  - specifications, 146
  - SW1 and SW2 address settings, 152
  - SW1 and SW2 switches, 152
  - valid comm port parameters, 151
- CPU43412A
  - ASCII communication port
    - parameters, 162
  - description, 156
  - front panel slide switch, 161
  - key switch, 163
  - LED descriptions, 159
  - LED error codes, 160
  - LED indicators, 159
  - Modbus connector pinouts, 165
  - Modbus pinout connections for portable computers, 166
  - Modbus ports pinout connections, 166
  - rear panel switches, 164
  - RTU communication port
    - parameters, 162
    - specifications, 157
  - SW1 and SW2 address settings, 164
  - valid communication port
    - parameters, 162
- CPU53414
  - ASCII communication port
    - parameters, 173
  - CPU front panel switches, 172
  - description, 167
  - key switch, 174
  - LED descriptions, 170
  - LED error codes, 171
  - LED indicators, 170
  - Modbus ports pinout connections, 176
  - Modbus ports pinout connections for portable computers, 177
  - rear panel switches, 175
  - RTU communication port
    - parameters, 173
    - specifications, 168
  - SW1 and SW2 address settings, 175
  - SW1 and SW2 switches, 175
  - valid communication port
    - parameters, 173

**CPU53414A**

- ASCII communication port
- parameters, 184
- description, 178
- front panel slide switch, 183
- illustration, 178
- key switch, 185
- LED descriptions, 181
- LED error codes, 182
- LED indicators, 181
- Modbus connector pinouts, 187
- Modbus ports pinout connections, 188
- Modbus ports pinout connections for portable computers, 188
- rear panel switches, 187
- RTU communication port
- parameters, 184
- specifications, 179
- SW1 and SW2 address settings, 187
- valid communication port
- parameters, 184

**CRA21X10**

- description, 214
- illustration, 214
- LED descriptions, 217
- LED indicators, 217
- rear panel switches, 218
- specifications, 215
- wiring diagram, 216, 221

**CRA21X20**

- description, 219
- illustration, 219
- LED descriptions, 222
- LED indicators, 222
- rear panel switches, 223
- specifications, 220

**CRA93200**

- illustration, 230

**CRA93X00**

- address settings, 234
- description, 230
- error codes, 233
- LED descriptions, 232
- LED indicators, 232
- rear panel switches, 234
- specifications, 231
- SW1 and SW2 address settings, 234

**CRP81100**

- description, 190
- illustration, 190
- LED descriptions, 191
- LED status, 191
- RS-232C port, 193
- RS-485 port, 192
- specifications, 194

**CRP93X00**

- description, 226
- error codes, 229
- LED descriptions, 228
- LED indicators, 228
- specifications, 227

**D****DAI34000**

- description, 509
- specifications, 510
- wiring diagram, 511

**DAI35300**

- description, 512
- specifications, 513
- wiring diagram, 514

**DAI44000**

- description, 515
- specifications, 516
- wiring diagram, 517

**DAI45300**

- description, 518
- specifications, 519
- wiring diagram, 520

**DAI54000**

- description, 521
- specifications, 522
- wiring diagram, 523

- DAI54300
  - description, 524
  - specifications, 524
  - wiring diagram, 525
- DAI55300
  - description, 527
  - specifications, 527
  - wiring diagram, 528
- DAI74000
  - description, 530
  - specifications, 531
  - wiring diagram, 532
- DAI75300
  - description, 533
  - specifications, 534
  - wiring diagram, 535
- DAM59000
  - common specifications, 642
  - description, 639
  - fuse locations, 643
  - input specifications, 640
  - output specifications, 641
  - topology specifications, 639
  - wiring diagram, 644
- DAO84000
  - description, 564
  - specifications, 564
  - wiring diagram, 566
- DAO84010
  - description, 568
  - specifications, 568
  - wiring diagram, 570, 575
- DAO84210
  - description, 572
  - specifications, 572
- DAO84220
  - description, 577
  - fuse locations, 579
  - specifications, 577
  - wiring diagram, 580
- DAO85300
  - description, 582
  - fuse locations, 584
  - specifications, 582
  - wiring diagram, 584
- DD035301
  - fuse locations, 595
- DD036400
  - recommended cables, 604
- DDI15310
  - description, 536
  - logic states, 537
  - specifications, 536
  - wiring diagram, 537
- DDI35300
  - description, 538
  - specifications, 538
  - wiring diagram, 539
- DDI35310
  - description, 540
  - specifications, 540
  - wiring diagram, 541
- DDI36400
  - color codes for input groups, 544
  - compatible connection sub-bases, 545
  - description, 542
  - front view illustration, 543
  - LEDs, 544
  - recommended cables, 544
  - specifications, 542
- DDI67300
  - description, 546
  - minimum version levels, 547
  - specifications, 546
  - wiring diagram, 549
- DDI84100
  - description, 550
  - specifications, 551
  - wiring diagram, 552
- DDI85300
  - description, 553
  - specifications, 554
  - wiring diagram, 555
- DDM39000
  - common specifications, 648
  - description, 646
  - fuse locations, 649
  - input specifications, 646
  - output specifications, 647
  - topology, 646
  - wiring diagram, 650

- DDM69000
  - common specifications, 653
  - description, 651
  - I/O map register (outputs), 636
  - I/O map status byte (outputs), 636
  - input specifications, 651
  - module zoom selections (inputs), 636
  - module zoom selections (outputs), 637
  - output specifications, 652
  - register assignments, 635
  - topology, 651
  - version levels, 654
  - wiring diagram, 655
- DDO15310
  - description, 586
  - fuse locations, 588
  - specifications, 587
  - wiring diagram, 589
- DDO35300
  - description, 590
  - fuse locations, 592
  - specifications, 590
  - wiring diagram, 593
- DDO35301
  - description, 594
  - specifications, 594
  - wiring diagram, 596
- DDO35310
  - description, 597
  - fuse locations, 599
  - specifications, 597
  - wiring diagram, 600
- DDO36400
  - color codes for input groups, 604
  - compatible output adapter sub-bases, 605
  - description, 601
  - front view illustration, 603
  - selecting point status indicator LEDs, 604
  - specifications, 601
- DDO84300
  - description, 606
  - fuse locations, 607
  - specifications, 606
  - wiring diagram, 608
- DDO88500
  - description, 609
  - fuse locations, 611
  - specifications, 609
  - wiring diagram, 612
- DII33000
  - description, 402
  - field wiring, 403
  - specifications, 402
  - terminal strip color and keying assignment, 403
  - wiring diagram (Cenelec), 404
  - wiring diagram (CSA), 405
  - wiring diagram (FM), 406
  - wiring diagram (UL), 407
- DIO configuration
  - description, 25
  - dual cable illustration, 26
  - part numbers, 27
  - single cable illustration, 25
- DIO modules CRA21X10 or CRA21X20, 214
- DIO33000
  - description, 408
  - specifications, 408
  - terminal strip color and keying assignment, 409
  - wiring diagram (Cenelec), 410
  - wiring diagram (CSA), 411
  - wiring diagram (FM), 412
  - wiring diagram (UL), 413
- direct CPU driver
  - network interface techniques, 33
- discrete I/O true high
  - illustration, 441
- discrete I/O true low
  - illustration, 441
- discrete input (16-point) modules
  - description, 505
  - module zoom selections, 505
  - register assignments, 505
- discrete input (24-point) modules
  - description, 505
  - I/O map register assignment, 506
  - module zoom selections, 506



- discrete input (32-point) modules
    - description, 506
    - I/O map register assignment, 507
    - module zoom selections, 507
  - discrete input (8-point) module
    - module zoom selections, 400
    - register assignments, 400
  - discrete input (96-point) modules
    - description, 507
    - module zoom selections, 508
    - register assignments, 508
  - discrete input modules
    - description, 505
  - discrete input/output (16/8 point) modules
    - I/O map assignments (outputs), 638
    - module zoom selections (inputs), 638
    - module zoom selections (outputs), 638
    - register assignments, 637
  - discrete input/output modules
    - configuration, 635
  - discrete output (12-point) module
    - description, 558
    - register assignments, 558
  - discrete output (16-point) modules
    - description, 559
    - module zoom selections, 560
    - register assignments, 559
  - discrete output (32-point) modules
    - description, 560
    - module zoom selections, 561
    - register assignments, 561
  - discrete output (8-point) modules
    - description, 401, 557
    - I/O map register assignment, 401, 557
    - module zoom selections, 401, 557
    - module zoom selections (outputs), 558
  - discrete output (96-point) module, 562
    - module zoom selections, 563
    - register assignment, 562
  - discrete simulator module XSM00200, 416
  - discrete verified output module
  - DVO85300, 625
  - distributed I/O
    - Quantum configurations, 18
  - DRA84000
    - description, 613
    - specifications, 613
    - wiring diagram, 615
  - DRC83000
    - description, 616
    - specifications, 616
    - wiring diagram, 618
  - DSI35300
    - description, 631
    - specifications, 632
    - wiring diagram, 633
  - dual cable configuration
    - RIO configuration, 22
    - RIO in a Hot Standby configuration, 24
  - DVO85300
    - configuration, 620
    - description, 625
    - Modsoft zoom screen selections, 621
    - register assignments, 620
    - specifications, 625
    - wiring diagram, 628
- ## E
- EHC10500
    - description, 290
    - illustration, 290
    - LED descriptions, 292
    - LED indicators, 292
    - specifications, 291
    - wiring diagram, 293

**EHC20200**

- 3x register content, 308
- Command 1, 295
- Command 1 and Command 2 response formats, 303
- Command 2, 296
- Command 3, 296
- Command 3 read input counter, 304
- Command 3 response format, 304
- Command 4, 297
- Command 4 output register format, 304
- Command 4 response format, 305
- command words, 297
- configuration, 294
- COUNT DOWN example, 310
- counting pulses, 326
- description, 319
- fuse location, 321
- I/O map register assignment, 294
- I/O map status byte, 305
- illustration, 319
- LED descriptions, 322
- load values, 307, 311
- module configuration, 306, 310
- module functions, 324
- module zoom selections, 317
- one 32 bit counter, 301
- operations, 295
- RATE SAMPLE example, 310
- rate sample mode, 303
- rate sample mode caution, 312
- rate sampling, 326
- read input counter command, 308
- read rate sample, 311
- reset latched outputs, 308
- response for configuration command, 307

- response to read rate sample command, 311
- signal descriptions, 329
- specifications, 320
- timing diagrams, 324
- timing parameters, 324
- two 16 bit counters, 300
- two 32 bit counters, 302
- user logic, 309
- using I/O mapped registers, 306
- wiring diagram, 330
- wiring diagram 1, 313
- wiring diagram 2, 314
- wiring diagram 3, 315
- wiring diagram 4, 316

**EIA92100**

- AS-i cable connection illustration, 200
- description, 195
- illustration, 196
- LED bus mode, 197
- LED descriptions, 197
- LED diagnostics, 199
- LED display, 197
- LED slave I/O mode, 198
- specifications, 200

**error stopped codes**

- definitions, 766
- list, 765

**ESI06210**

- description, 332
- front panel connectors and switches, 336
- front panel push button, 337
- illustration, 332
- LED blinking sequence, 335
- LED descriptions, 334
- LED indicators, 334
- RS-232 serial port setup, 337
- RS-232C serial port, 336
- specifications, 333
- Status LED crash codes, 335

Ethernet MMS modules NOE5X100, 273

Ethernet SY/MAX modules NOE3X100, 270

Ethernet TCP/IP module NOE2X100, 266

**F**

- fiber optic cable
  - cable types, 262
  - connecting, 255
  - ports, 254
  - repairing, 264
  - termination kits, 261
  - tools, 262
- fiber optic network
  - adding nodes, 263
  - bus configuration, 256
  - calculating number of modules, 264
  - point-to-point configuration, 256
  - self healing ring configuration, 259
  - tree configuration, 258
- fuses
  - description, 671

**H**

- hardware specifications
  - ASCII interface module, 52
  - counter modules, 52
  - CPU, 50
  - description, 49
  - DIO heads/drops, 51
  - Ethernet modules, 51
  - field bus modules, 50
  - high speed interrupt module, 52
  - Hot Standby module, 51
  - I/O modules (analog out), 56
  - I/O modules (discrete in), 53
  - I/O modules (discrete in/out), 55
  - I/O modules (discrete out), 54
  - intrinsic safe analog modules, 57
  - intrinsic safe discrete modules, 57
  - miscellaneous modules, 57
  - NOM modules, 51
  - power supplies for local and RIO drops, 49
  - RIO heads/drops, 50
  - single axis motion modules, 52
- high speed counter (5 channel)
  - EHC10500, 290

- high speed counter module (2 channel)
  - EHC20200, 319
- high speed interrupt modules HLI34000, 338
  - HLI34000
    - description, 338
    - illustration, 338
    - LED descriptions, 340
    - specifications, 339
    - wiring diagram, 341
- Hot Standby configuration
  - description, 22
- Hot Standby module CHS11000, 357

**I**

- I/O map interface
  - network interface techniques, 34
- I/O map status byte
  - description, 442
  - illustration, 442
  - table/module configuration, 443
- I/O modules
  - description, 7, 431
  - discrete I/O true high/true low circuit, 441
  - illustration, 431
  - LED descriptions, 431
  - LED descriptions for 16 point modules, 432
  - LED descriptions for 24 point input modules, 433
  - LED descriptions for 32 point I/O modules, 433
  - LED descriptions for bi-directional modules, 434
  - LED descriptions for discrete 12 point modules with fault indication, 436
  - LED indicators for 16 point modules, 432
  - LED indicators for 24 point input modules, 433
  - LED indicators for 32 point I/O modules, 433
  - LED indicators for bi-directional modules, 434

- LED indicators for discrete 12 point modules with fault indication, 436
- primary keys, 437
- secondary keying and backplane position codes, 439
- terminal strip key codes, 437
- terminal strip/module keying, 436
- intelligent/special purpose I/O modules
  - description, 11
- InterBus communication module
- NOA6XXXX, 201
- InterBus interface modules
  - communication interface modules, 10
- Intrinsically safe analog input module
- AI133000, 375
- intrinsically safe analog output module
- AIO33000, 393
- intrinsically safe current input module
- AI133010, 387
- intrinsically safe discrete input module
- DII33000, 402
- intrinsically safe discrete output module
- DIO33000, 408
- intrinsically safe modules
  - description, 362
  - identification and labeling, 363
  - illustration, 364
  - installation, 362
  - intrinsic safety, 362
  - safe barriers, 362
  - safe wiring practices, 363
  - wiring and grounding, 363
  - wiring diagram, 365

**L**

- local I/O
  - Quantum configurations, 18
- local I/O configuration
  - description, 20
  - illustration, 20
- LonWorks modules
  - communication interface modules, 10
- LonWorks NOL911X0, 208

**M**

- miscellaneous components
  - battery, 664
  - cable connector orientation, 660
  - cables, 659
  - coding kit, 660
  - CPU battery, 664
  - description, 659
  - empty module, 660
  - empty module with door cover, 661
  - field wiring terminal strip, 662
  - I/O conversion connector, 666
  - IP 20 compliant field wiring terminal strips, 663
  - Modbus Plus ruggedized tap, 665
  - Modbus Plus tap, 664
  - remote I/O BNC connector, 667
  - remote I/O splitter, 667
  - remote I/O tap, 666
  - RG-11 remote I/O F connector, 667
  - RG-6 remote I/O F connector, 667
  - terminal strip jumper kit, 661
- MMS interface
  - network modules, 10
- Modbus and Modbus Plus communications
  - features, 37
- Modbus communications
  - description, 37
- Modbus connector
  - 25-pin, 349
  - 9-pin, 349
- Modbus connector pinouts
  - 25-point connections, 176
  - nine-pin connections, 176
- MODBUS I/O Scanner
  - functionality, 280
- Modbus Plus communications
  - description, 38
- Modbus Plus network option modules
- NOM21X00, 235
- Modbus Plus on Fiber NOM25200, 245

- module mounting procedure
    - description, 686
    - I/O terminal strip mounting procedure, 689
    - illustration, 687
    - installing jumper clips, 688
    - removing Quantum module door, 690
  - mounting brackets
    - 125 mm, 682
    - 20 mm, 683
    - description, 681
    - part numbers, 681
  - MSB10100 MSX10100, 342
  - MSC10100 MSX10100, 342
  - MSX motion modules MSX10100, 342
  - MSX10100
    - analog input
      - (electrical specifications), 346
    - analog input
      - (operational specifications), 344
    - analog output
      - (electrical specifications), 346
    - analog output
      - (operational specifications), 345
    - application program
      - (operational specifications), 343
    - communications
      - (operational specifications), 343
    - compatibility
      - (operational specifications), 345
    - description, 342
    - DIP switch settings, 351
    - discrete inputs
      - (operational specifications), 344
    - discrete inputs and high speed input
      - (electrical specifications), 346
    - discrete output
      - (electrical specifications), 346
    - discrete outputs
      - (operational specifications), 344
    - drive interface
      - (electrical specifications), 347
    - electrical specifications, 346
    - encoder feedback interface
      - (electrical specifications), 347
    - front panel indicators, 348
    - high speed input (operational specifications), 344
    - illustration, 342
    - incremental encoder feedback, 345
    - LED descriptions, 348
    - Modbus connectors, 349
    - motor temperature input (electrical specifications), 347
    - operational specifications, 343
    - power requirements (electrical specifications), 347
    - rear panel switches, 351
    - resolver feedback (fully configured version), 345
    - resolver interface (electrical specifications), 346
    - servo, 343
    - servo connector, 349
    - servo connector signals, 350
- ## N
- network interface techniques
    - CPU interface support, 33
    - description, 33
    - direct CPU driver, 33
    - I/O map interface, 34
    - option module interface, 33
  - network modules
    - MMS interface, 10
  - network status, 261
  - NOA61110
    - seven segment display, 205
  - NOA611X0
    - LED descriptions, 203
    - LED indicators, 203
    - required loadables, 206
    - reset push button, 206
    - RS-232C port, 206
  - NOA62200
    - LED descriptions, 204
    - LED indicators, 204

**NOA6XXXX**

- comparison of features, 207
- description, 201
- front panel connections, 205
- illustration, 201
- InterBus port, 205
- specifications, 202

**NOE2X100**

- description, 266
- illustration, 266
- installation, 268
- installation example, 268
- LED descriptions, 267
- LED indicators, 267
- specifications, 266

**NOE3X100**

- description, 270
- illustration, 270
- LED descriptions, 272
- specifications, 271
- SY/MAX addressing, 272

**NOE5X100**

- description, 273
- illustration, 273
- LED descriptions, 275
- LED indicators, 275
- specifications, 274

**NOE77100**

- peer cop based I/O scanner, 280

**NOE771x0**

- BOOTP server, 284

**NOE771x1**

- Enhanced Web Diagnostics, 288

**NOE771xx**

- Bandwith Monitoring, 286
- DHCP server, 285
- enhanced MODBUS I/O scanner, 281
- FTP server, 282
- Global Data, 286
- HTTP server, 283
- illustration, 276
- key features, 279
- LED descriptions, 278
- LED indicators, 278
- MODBUS I/O scanner, 280
- MODBUS/TCP server, 282
- Quantum Ethernet TCP/IP modules, 281
- run LED status, 279
- services, 287
- specifications, 277

**NOL911X0**

- auxiliary LonWorks communication port, 212
- description, 208
- front panel connectors, 211
- front panel push buttons, 210
- illustration, 208
- LED descriptions, 209
- LED error codes, 210
- LED indicator status, 210
- LED indicators, 209
- media types, 212
- primary LonWorks communication port, 211
- RS-232 configuration port, 211
- specifications, 209

**NOM modules**

- Modbus Plus on Fiber, 9
- twisted-pair wiring, 9

**NOM21X00**

- ASCII comm port parameters, 241
- description, 235
- front panel switches, 241
- LED descriptions, 237
- LED error codes, 238
- LED indicators, 237
- Modbus connector pinouts, 242

- Modbus ports pinout connections for portable computers, 243
- rear panel switches, 240
- RTU comm port parameters, 241
- specifications, 236
- SW1 and SW2 address settings, 240
- valid comm port parameters, 242

## NOM25200

- adding nodes, 263
- address settings, 251
- ASCII comm port parameters, 249
- bus configuration, 256
- cables, 262
- calculating modules in a fiber network, 264
- comm port parameters, 250
- connecting, 255, 263
- description, 245
- fiber optic cable ports, 254
- fiber optic configurations, 256
- front panel switches, 249
- hot standby systems example, 260
- illustration, 246
- LED descriptions, 247
- LED topology and descriptions, 247
- materials for fiber optic links, 261
- mixed fiber optic/copper network, 256
- Modbus connector pinouts, 252
- network status, 261
- optical star passive couplers, 261
- point-to-point configuration, 256
- rear panel switches, 251
- RJ45 cable parts, 253
- RJ45 connector, 253
- RTU comm port parameters, 250
- self healing ring configuration, 259
- specifications, 247
- termination kits, 261
- tree configuration, 258

## O

- option module interface
  - network interface techniques, 33

## P

- part numbers
  - ASCII interface module, 52
  - counter modules, 52
  - CPU, 50
  - DIO heads/drops, 51
  - Ethernet modules, 51
  - high speed interrupt module, 52
  - Hot Standby module, 51
  - I/O modules, 53
  - NOM modules, 51
  - power supplies, 49
  - RIO heads/drops, 50
  - single axis motion modules, 52
- Peer Cop
  - MODBUS I/O Scanner
    - characteristics, 280
- point-to-point configuration, 256
- power and grounding considerations
  - 125 Vdc powered systems, 700
  - AC powered systems, 693
  - AC powered systems for CE compliance, 696
  - CE compliance installation instructions for AC systems, 695
  - CE compliance installation instructions for Vdc systems, 698
  - DC powered systems, 694
  - description, 692
- power and grounding guidelines
  - chassis grounding, 710
  - Modbus Plus communication tap installation for CE compliance, 710
  - other equipment grounding, 711
  - power supply ground connection, 710
  - systems with multiple power feeds, 711
- power supplies
  - compatibility issues, 709
  - description, 5, 703
  - modes, 5
  - redundant, 5
- Profibus CRP81100, 190

**Q**

- Quantum Automation Series
  - block diagram, 4
  - capabilities, 4
- Quantum configurations
  - description, 18
  - distributed I/O, 18
  - local I/O, 18
  - remote I/O, 18
- Quantum editors
  - description, 14
- Quantum network support
  - description, 30
  - supported networks, 31
- Quantum simulator modules
  - description, 12

**R**

- redundant power supplies
  - description, 707
- register assignment
  - ACI03000, 446
  - ACI04000, 447
  - All33000, 368
  - All33010, 372
  - ARI03010, 449
  - ATI03000, 452
  - AVI03000, 457
- remote I/O
  - Quantum configurations, 18
- RIO configuration
  - description, 21
  - dual cable illustration, 22
  - Hot Standby, 22
  - single cable illustration, 21
- RIO drop modules CRA93X00, 230
- RIO head modules CRP93X00, 226
- RIO in a Hot Standby configuration
  - dual cable configuration illustration, 24
  - single cable configuration illustration, 23
- RIO modules
  - communication interface modules, 9
- RJ45 connector, 253

**S**

- self healing ring configuration, 259
- signal descriptions
  - EHC20200, 329
- single cable configuration
  - RIO, 21
  - RIO in a Hot Standby configuration, 23
- spare parts
  - description, 670



- specifications
- ACI03000, 462
  - ACI04000, 465
  - ACO02000, 482
  - ACO13000, 486
  - AI133010, 387
  - AIO33000, 393
  - ARI030010, 468
  - ATI03000, 470
  - AVI03000, 474
  - AVO02000, 489
  - CableFast, 717
  - CHS11000, 358
  - CPS11100, 61
  - CPS11100 (PV01 or greater), 64
  - CPS11400, 67, 91
  - CPS11410, 70
  - CPS11420, 73
  - CPS12400, 76
  - CPS12420, 79
  - CPS21100, 82
  - CPS21400, 85
  - CPS22400, 88
  - CPS42400, 94
  - CPS51100, 97
  - CPS52400, 100
  - CPU11302, 106
  - CPU11303, 116
  - CPU21304, 126
  - CPU42402, 136
  - CPU43412, 146
  - CPU43412A, 157
  - CPU53414, 168
  - CPU53414A, 179
  - CRA21X10, 215
  - CRA21X20, 220
  - CRP81100, 194
  - CRP93X00, 227
  - DAI34000, 510
  - DAI35300, 513
  - DAI44000, 516
  - DAI45300, 519
  - DAI54000, 522
  - DAI54300, 524
  - DAI55300, 527
  - DAI74000, 531
  - DAI75300, 534
  - DAO84000, 564
  - DAO84010, 568
  - DAO84210, 572
  - DAO84220, 577
  - DAO85300, 582
  - DDI15310, 536
  - DDI35300, 538
  - DDI35310, 540
  - DDI36400, 542
  - DDI67300, 546
  - DDI84110, 551
  - DDI85300, 554
  - DDM39000, 646
  - DDM69000, 651
  - DDO15310, 587
  - DDO35300, 590
  - DDO35301, 594
  - DDO35310, 597
  - DDO36400, 601
  - DDO84300, 606
  - DDO88500, 609
  - DII33000, 402
  - DIO33000, 408
  - DRA84000, 613
  - DRC83000, 616
  - DSI35300, 632
  - DVO85300, 625
  - EHC10500, 291
  - EHC20200, 320
  - EIA92100, 200
  - ESI06210, 333
  - HLI34000, 339
  - NOA6XXX0, 202
  - NOE2X100, 266
  - NOE3X100, 271
  - NOE771xx, 277
  - NOL911X0, 209
  - NOM21X00, 236
  - NOM25200, 247
  - XCP90000, 424
  - XSM01000, 418
  - standalone power supplies  
models, 704
  - summable power supplies  
description, 705

- system configurations
  - local, RIO, and DIO, 18
- system space requirements
  - dimensions, 684
  - illustration, 685
  - locations, 684
  - minimum spacing, 684
- system specifications
  - AC/DC power supplies, 44
  - agency approvals, 46
  - description, 43
  - electrical, 43
  - I/O modules
    - (between 24 and 48 Vac or Vdc), 44
  - I/O modules
    - (greater than 48 Vac or Vdc), 44
  - I/O modules
    - (less than 24 Vac or Vdc), 44
  - mechanical, 43
  - operating conditions, 45
  - storage conditions, 45

## T

- Telefast Input DDI36400, 542
- Telefast Output DDO36400, 601
- terminal strip/module keying
  - description, 436
  - illustration, 437
  - primary keying, 436
  - secondary keying, 437
- termination kits, 261
- tree configuration, 258

## V

- version levels
  - DDM69000, 654

## W

- wiring diagram
  - 140 CFA 040 00, 723
  - 140 CFB 032 00, 725
  - 140 CFD 032 00, 734
  - 140 CFG 016 00, 738, 739, 740, 741
  - 140 CFH 008 00, 743
  - ACI03000, 463
  - ACI04000, 466
  - ACO02000, 484
  - ACO13000, 488
  - All33000, 379
  - All33010, 389
  - AIO33000, 395
  - AMM09000, 502
  - ARI03010, 469
  - ATI03000, 472
  - AVI03000, 476
  - AVO02000, 492
  - CFC03200, 729
  - CFI00800, 747
  - CFJ00400, 751
  - CFK00400, 755, 756, 757
  - CPS11100, 62
  - CPS11100 (PV01 or greater), 65
  - CPS11400, 68
  - CPS11410, 71
  - CPS11420, 74
  - CPS12400, 77
  - CPS12420, 80
  - CPS21100, 83
  - CPS21400, 86
  - CPS22400, 89
  - CPS41400, 92
  - CPS42400, 95
  - CPS51100, 98
  - CPS52400, 101
  - CRA21X10, 216, 221
  - DAI34000, 511
  - DAI35300, 514
  - DAI44000, 517
  - DAI45300, 520
  - DAI54000, 523
  - DAI54300, 525
  - DAI55300, 528

- DAI74000, 532
- DAI75300, 535
- DAM59000, 644
- DAO84000, 566
- DAO84010, 570, 575
- DAO84220, 580
- DAO85300, 584
- DDI15310, 537
- DDI35300, 539
- DDI35310, 541
- DDI67300, 549
- DDI84110, 552
- DDI85300, 555
- DDM39000, 650
- DDM69000, 655
- DDO15310, 589
- DDO35300, 593
- DDO35301, 596
- DDO35310, 600
- DDO84300, 608
- DDO88500, 612
- DII33000, 404
- DIO33000, 410
- DRA84000, 615
- DRC83000, 618
- DSI35300, 633
- DVO85300, 628
- EHC10500, 293
- EHC20200, 313, 330
- HLI34000, 341
- intrinsically safe modules, 365
- XSM01000, 419
- XCP90000
  - battery backup, 424
  - configuration, 422
  - description, 423
  - illustration, 423
  - installing and removing a battery, 425
  - LED descriptions, 425
  - LED indicators, 425
  - specifications, 424
- XSM00200
  - description, 416
  - illustration, 416
- XSM01000
  - description, 417
  - illustration, 417
  - specifications, 418
  - wiring diagram, 419

## X

- XBE10000
  - configuration illustration, 354
  - description, 352
  - expander cables, 354
  - guidelines, 356
  - illustration, 352
  - specifications, 353

