Quantum using EcoStruxure™ Control Expert

Experts and Communication Reference Manual

Original instructions

10/2019

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

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

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

Failure to observe this information can result in injury or equipment damage.

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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, service, 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 a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING
WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION
CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE
NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

⚠ WARNING

UNGUARDED EQUIPMENT

- Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.
- Do not reach into machinery during operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

This automation equipment and related software is used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

NOTE: Coordination of safeties and mechanical/electrical interlocks for point-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

START-UP AND TEST

Before using electrical control and automation equipment for regular operation after installation, the system should be given a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such a check be made and that enough time is allowed to perform complete and satisfactory testing.

⚠ WARNING

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About the Book

At a Glance

Document Scope

This document is the reference for the networking, communication, and special purpose modules of the Quantum automation system with Control Expert.

Validity Note

This document is valid for EcoStruxure™ Control Expert 14.1 or later.

The technical characteristics of the devices described in the present document also appear online. To access the information online:

Step	Action
1	Go to the Schneider Electric home page *www.schneider-electric.com*.
2	In the **Search** box type the reference of a product or the name of a product range. ● Do not include blank spaces in the reference or product range. ● To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the **Product Datasheets** search results and click on the reference that interests you. If you entered the name of a product range, go to the **Product Ranges** search results and click on the product range that interests you.
4	If more than one reference appears in the **Products** search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the datasheet.
6	To save or print a datasheet as a .pdf file, click **Download XXX product datasheet**.

The characteristics that are presented in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Related Documents

Title of Documentation	Reference Number
Modicon Modbus Plus Network, Planning and Installation Guide	31003525

You can download these technical publications and other technical information from our website at https://www.schneider-electric.com/en/download

Product Related Information

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter, and apply this product. Follow all local and national safety codes and standards. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Part I
Software Configuration

Introduction

This part provides information on the Software Configuration of the networking and intelligent/special purpose modules.

What Is in This Part?

This part contains the following chapters:

Chapter 1
Module Configuration

Purpose

This chapter provides information on software configuration of the module.

What Is in This Chapter?

This chapter contains the following topics:

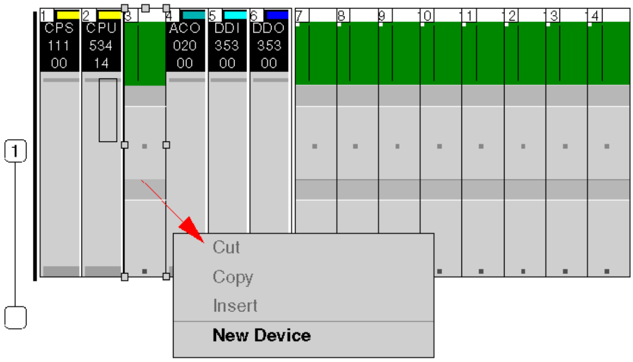
Mapping a Local Quantum I/O Station

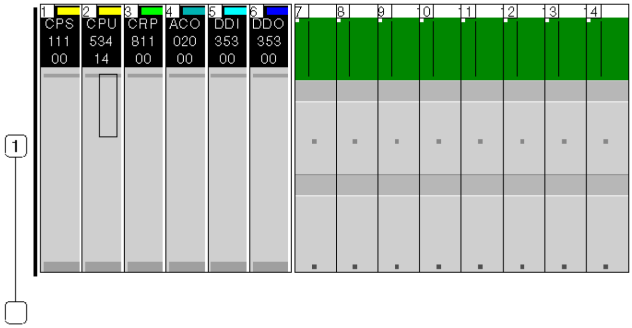
Overview

Use the following dialog to map an existing local Quantum I/O station with a new module.

Inserting a module (local)

This table shows the steps required for inserting a module in a local station.

Step	Action
1	Call the Bus Editor
2	Mark a free slot in the local station (left mouse button)
3	Move the mouse pointer over the marked slot
4	Click on the right mouse button **Result:** A shortcut menu is opened 
5	Select **New Device** **Result:** A dialog window opens that displays available modules

Step	Action
6	Select the desired module from the respective category in the Hardware catalog. **Result:** The new module is inserted in the empty slot on the local station. 

Open the Parameter Configuration

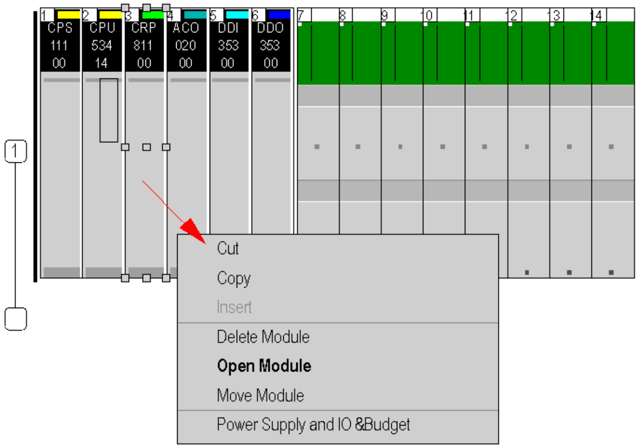
Overview

The following dialog box enables you to call the parameter configuration for a module.

An explanation of the individual parameters can be found in the respective module chapters.

Open the Parameter Configuration

This table shows the steps required to open the parameter configuration.

Step	Action
1	Call the Bus Editor
2	Select the module
3	Click on the right mouse button **Result:** A shortcut menu is opened 
4	Select **Open Module** **Result:** The module opens with the parameter configuration window

Chapter 2
Quantum Addressing Modes

Purpose

This chapter provides information on the three different modes Control Expert allows to address the I/O data from a Quantum I/O module:

- Flat Addressing
- Topological Addressing
- IODDT Addressing

NOTE: Topological addresses overlapping (%IWr.m.c) is not supported by Quantum application, use flat addressing (%IWx) when memory overlapping control is needed.

NOTE: The different addressing modes refer to the same physical location in the PLC memory for a given data point.

While Flat Addressing and Topological Addressing are available for all Quantum I/O modules, IODDTs are only provided for modules that deliver information in addition to the I/O values (e.g. errors or warnings).

Also provided is information about I/O module status bytes and bit order.

What Is in This Chapter?

This chapter contains the following topics:

Flat Addressing—800 Series I/O Modules

Introduction

800 series I/O modules follow a system of flat address mapping in Control Expert. To work properly. each module requires a determinate number of bits and/or words. The IEC addressing system is equivalent to the 984LL register addressing. Use the following assignments:

- 0x is now `%Mx`
- 1x is now `%Ix`
- 3x is now `%IWx`
- 4x is now `%MWx`

The following table shows the relationship between 984LL notation and IEC notation.

Outputs and Inputs	984LL Notation Register Addresses	IEC Notation		
		System Bits and Words	Memory Addresses	I/O Addresses
output	0x	System Bit	%Mx	%Qx
input	1x	System Bit	%Ix	%Ix
input	3x	System Word	%IWx	%IWx
output	4x	System Word	%MWx	%QWx

To access the I/O data of a module,

Step	Action
1	Enter the address range in the configuration screen.

Examples

The following examples show the relationship between 984LL register addressing and IEC addressing:

000001 is now `%M1`

100101 is now `%I101`

301024 is now `%IW1024`

400010 is now `%MW10`

Topological Addressing—800 Series I/O Modules with Control Expert

Accessing I/O Data Values

Use topological addressing to access I/O data items. Identify the topological location of the module within an 800 series I/O module with Control Expert using the following notation:

`%<Exchangetype><Objecttype>[\b.e\]r.m.c[.rank]`

where:

- b = bus
- e = equipment (drop)
- r = rack
- m = module slot
- c = channel

NOTE: When addressing,
1. The [\b.e\] defaults to \1.1\ in a local rack and does not need to be specified.
2. The rank is an index used to identify different properties of an object with the same data type (value, warning level, error level).
3. The rank numbering is zero-based, and if the rank is zero, omit the entry.

For detailed information on I/O variables, please refer to the *EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual*.

Reading Values: An Example

To read	Action
input value (rank = 0) from channel 7 of an analog module located in slot 6 of a local rack:	Enter `%IW1.6.7[.0]`
input value (rank = 0) from channel 7 of an analog module located in slot 6 of drop 3 of RIO bus 2:	Enter `%IW\2.3\1.6.7[.0]`
'out of range' value (rank = 1) from channel 7 of an analog module located in slot 6 of a local rack:	Enter `%I1.6.7.1[.0]`

IODDT Addressing

IODDT Addressing

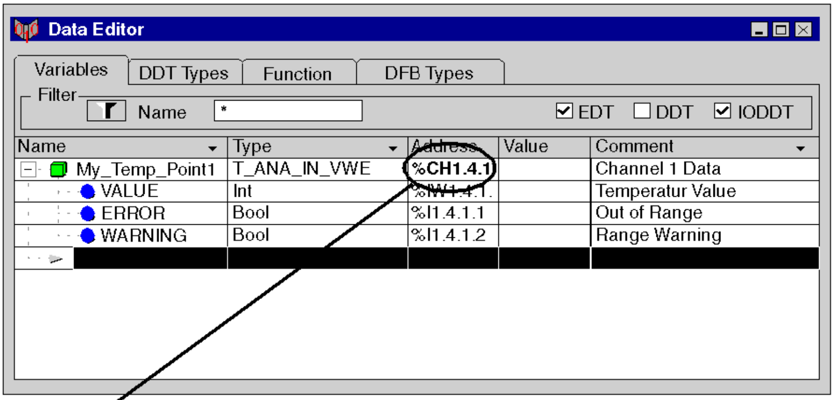
An IODDT allows all information (bits and registers) related to a channel to be handled through a user-defined variable. This variable is defined in the Control Expert data editor by selecting the appropriate IODDT for the module as a data type and specifying the topological address of the module using the following syntax:

`%CH[\b.e\]r.m.c`

where:

- b = bus
- e = equipment (drop)
- r = rack
- m = module slot
- c = channel

Here is an example of an IODDT for a thermocouple input module in slot 4 of a local rack:



Note: Only `%CH1.4.1` needs to be entered. The topological addresses related to this channel (`%IW..` and `%I..`) are generated automatically.

Variables in the User Program

You can access all information related to channel 1 of the module using the following variables:

- `My_Temp_Point1.VALUE` for the measured value
- `My_Temp_Point1.ERROR` indicating an out-of-range condition
- `My_Temp_Point1.WARNING` indicating an over-range condition

Quantum IODDTs

Introduction

Control Expert provides a couple of IODDTs which are either generic and can be used for several I/O modules or belong to one specific module.

NOTE: Deviating from the general description of the data types in the Direct Addressing Data Instances chapter in the *EcoStruxure™ Control Expert Reference Manual*, in Quantum IODDTs for analog modules and expert modules the data type **Bool** is used for `%I` and `%Q`.

T_ANA_IN_VE

`T_ANA_IN_VE` is used with all channels of the following I/O modules:

- ACI 030 00
- AII 330 10
- ACI 040 00
- ACI 040 00

IODDT for analog input modules supporting **V**alue and **E**rror

Object	Symbol	Rank	Description
%IW	VALUE	0	Input value
%I	ERROR	1	Input error

T_ANA_IN_VWE

`T_ANA_IN_VWE` is used with all channels of the following I/O modules:

- ARI 030 10,
- AVI 030 00
- ATI 030 00
- AII 330 00
  and
- Channels 3 and 4 of AMM 090 00

IODDT for analog input modules supporting **V**alue, **W**arning and **E**rror

Object	Symbol	Rank	Description
%IW	VALUE	0	Input value
%I	ERROR	1	Input error
%I	WARNING	2	Input warning

T_ANA_BI_VWE

`T_ANA_BI_VWE` is used with the following I/O modules:

- Channels 1 and 2 of AMM 090 00

IODDT for bidirectional analog modules supporting Value, Warning and Error

Object	Symbol	Rank	Description
%IW	VALUE_IN	0	Input value
%QW	VALUE_OUT	0	Output value
%I	ERROR_IN	1	Input error
%I	WARNING	2	Input warning
%I	ERROR_OUT	3	Output error

T_CNT_105

`T_CNT_105` is used with all channels of the following I/O modules:

- EHC 105

Specific IODDT for high speed counter module EHC 105

Object	Symbol	Rank	Description
%IW	VALUE_L	1	Input value: Low word
%IW	VALUE_H	2	Input value: High word
%I	ERROR	1	Error in Counter
%I	SP_FINAL	2	Final Set Point signal
%I	SP_FIRST	3	First Set Point signal
%I	SP_SECOND	4	Second Set Point signal
%QW	STOP_VALUE	1	For CNT_DIR="0", final set point value
%QW	INITIAL_VALUE	2	For CNT_R="1", initial set point value
%Q	LS	1	"1", Counter load/start (controlled by the rising edge)
%Q	RSTART	2	"1", Counter restart (controlled by the rising edge)
%Q	OUT_OFF	3	"1", Counter output switch-off
%Q	CNT_DIR	4	"0" Counter counts up "1" Counter counts down
%Q	OM1	5	Operating Mode bit 1
%Q	OM2	6	Operating Mode bit 2
%Q	OM3	7	Operating Mode bit 3
%Q	OM4	8	Operating Mode bit 4

Addressing Example

Comparing the 3 Addressing Modes

The following example compares the 3 possible addressing modes. An 8-channel thermocouple 140 ATI 030 00 module with the following configuration data is used:

- mounted in slot 5 of the CPU rack (local rack)
- starting input address is 201 (input word `%IW201`)
- end input address is 210 (input word `%IW210`)

To access the I/O data from the module you can use the following syntax:

Module data	Flat Addressing	Topological Addressing	IODDT Addressing	Concept Addressing
Channel 3 temperature	%IW203	%IW1.5.3	My_Temp.VALUE	300203
Channel 3 out of range	%IW209.5	%I1.5.3.1	My_Temp.ERROR	300209 Bit 5 to be extracted by user logic
Channel 3 range warning	%IW209.13	%I1.5.3.2	My_Temp.WARNING	300209 Bit 13 to be extracted by user logic
Module internal temperature	%IW210	%IW1.5.10	not accessible through IODDT	300210

NOTE: For the IODDT the data type `T_ANA_IN_VWE` is used and the variable `My_Temp` with the address `%CH1.5.10` was defined.

For comparison, the register addressing as used with Concept is added in the last column. As Concept does not support direct addressing of a bit in a word, the bit extraction has to be performed in the user program.

Discrete I/O Bit Numbering

Introduction

The numbering of channels of an I/O module usually starts with 1 and counts up to the maximum number of supported channels. The software however starts numbering with a 0 for the least significant bit in a word (LSB). The Quantum I/O modules have their lowest channel mapped to the most significant bit (MSB).

The following figure shows the mapping of I/O channels related to the bits in a word:.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	I/O Channels
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit numbering
MSB															LSB	

Word Addressing Versus Bit Addressing

Mainly discrete I/O modules can be configured to deliver their I/O data either in word format or in bit format. This can be selected during configuration by selecting either `%IW` (`%MW`) or `%I` (`%M`). If you need to access a single bit from an I/O module configured to use an I/O word, you can use the syntax `%word.bit`. The following table gives you the connection between I/O point number and the associated I/O address in bit and word addressing.

The table shows a 32-point input module in the main rack, slot 4 configured with starting address `%I1` or `%IW1`:

I/O channel	Bit address (flat addressing)	Bit address (topological addressing)	Bit address extracted from word (flat addressing)	Bit address extracted from word (topological addressing)
1	%I1	%I1.4.1[.0]	%IW1.15	%IW1.4.1.1.15
2	%I2	%I1.4.2[.0]	%IW1.14	%IW1.4.1.1.14
3	%I3	%I1.4.3[.0]	%IW1.13	%IW1.4.1.1.13
• • •				
15	%I15	%I1.4.15[.0]	%IW1.1	%IW1.4.1.1.1
16	%I16	%I1.4.16[.0]	%IW1.0	%IW1.4.1.1.0
17	%I17	%I1.4.17[.0]	%IW2.15	%IW1.4.1.2.15
18	%I18	%I1.4.18[.0]	%IW2.14	%IW1.4.1.2.14
• • •				
31	%I31	%I1.4.31[.0]	%IW2.1	%IW1.4.1.2.1
32	%I32	%I1.4.32[.0]	%IW2.0	%IW1.4.1.2.0

I/O Module Status Byte

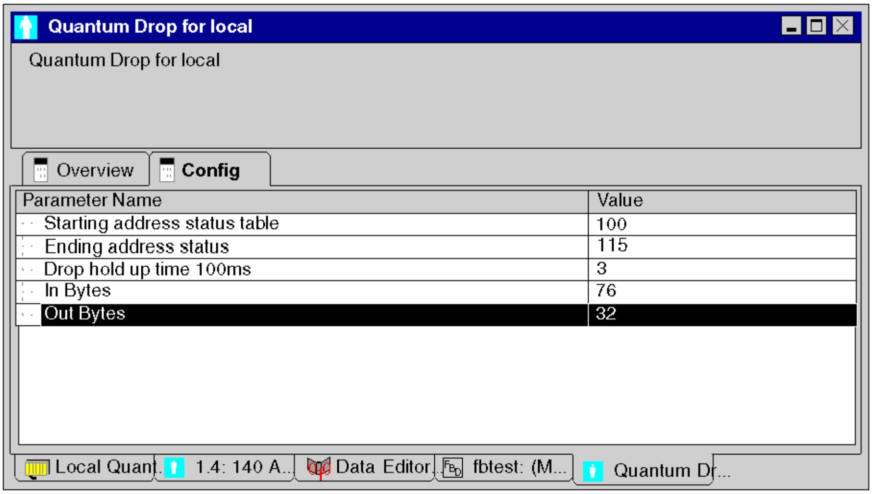
Addressing Module Status Data

In addition to possible channel related diagnostics data, a module related status byte may be used. The status information of all modules in a drop is administered by a table of `%IW` words. The starting address of this table can be entered in the configuration screen for the drop.

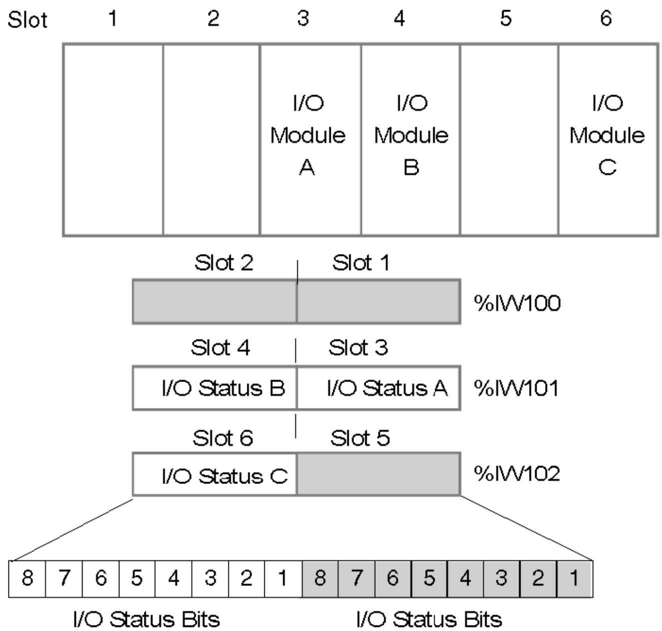
This information is not accessible through topological addressing.

NOTE: The status information is only available if the module supports a status byte. For the meaning of the status byte, check the module descriptions.

Example of a drop configuration screen with the starting address of the status table set to 100:



The following illustration shows how one word of the table conveys the status information for two modules:

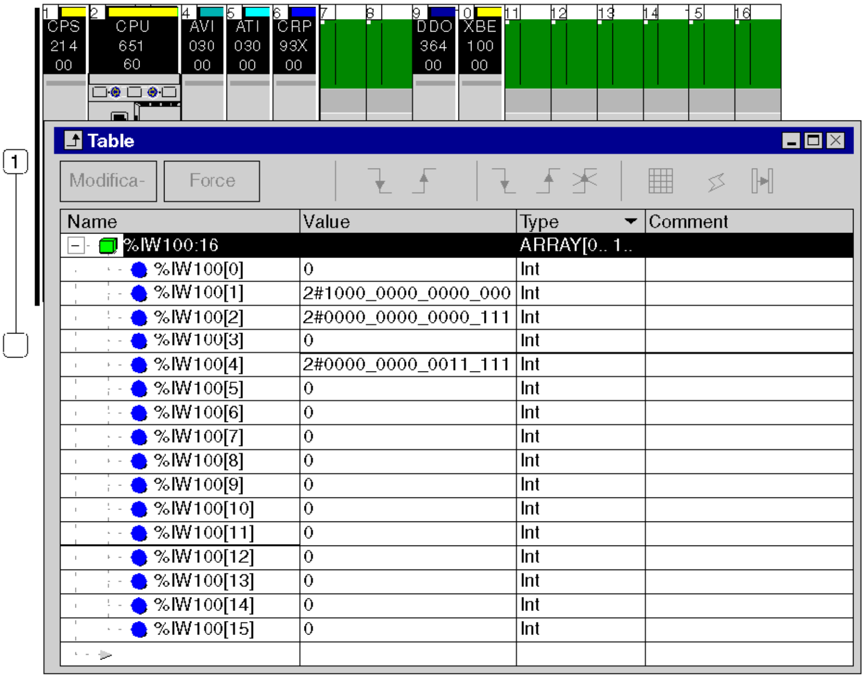


Example

The following example shows a rack and the corresponding I/O status bytes displayed in an animation table. The drop is configured to start at word `%IW100` and allocates 16 words. This represents the local and expansion rack, and assumes they are 16 slot racks.

If a module does not have have a status byte associated with the module or the slot is empty, then the byte = 0.

Rack configuration and animation table:



Name	Value	Type	Comment
%IW100:16		ARRAY[0.. 1..	
%IW100[0]	0	Int	
%IW100[1]	2#1000_0000_0000_000	Int	
%IW100[2]	2#0000_0000_0000_111	Int	
%IW100[3]	0	Int	
%IW100[4]	2#0000_0000_0011_111	Int	
%IW100[5]	0	Int	
%IW100[6]	0	Int	
%IW100[7]	0	Int	
%IW100[8]	0	Int	
%IW100[9]	0	Int	
%IW100[10]	0	Int	
%IW100[11]	0	Int	
%IW100[12]	0	Int	
%IW100[13]	0	Int	
%IW100[14]	0	Int	
%IW100[15]	0	Int	

Relation between slot, input word and status byte. The byte related to the module is marked:

Slot	Input Word	Value	Module	Module
1	%IW[0]	0	power supply	no status byte
2		0	CPU	no status byte
3	%IW[1]	2#1000_0000_**0000_0000**	CPU	no status byte
4		2#**1000_0000**_0000_0000	AVI	At least one channel is not operating correctly.
5	%IW[2]	2#0000_0000_**0000_1111**	ATI	Channels 1 ... 4 are not operating correctly.
6		2#**0000_0000**_0000_1111	140 CRP 93• 00	no status byte
NOTE: If you install a 140 CRP 312 00 remote I/O head module on the local rack instead of a 140 CRP 93• 00 module, then:		2#**1101_1110**_0000_0000	140 CRP 312 00	CRP status byte[1]
7	%IW[3]	0	empty	
8		0	empty	
9	%IW[4]	2#0000_0000_**0011_1111**	DDO	All channels are not operating correctly.
10		2#**0000_0000**_0011_1111	XBE	no status byte
• • •				

[1] If you install a 140 CRP 312 00 remote I/O head module on the local rack instead of a 140 CRP 93• 00 module, the status byte is the **ETH_STATUS** detailed in the *Device DDT Names* topic in the *Quantum EIO Remote I/O Modules Installation and Configuration Guide*.

Part II
Quantum Remote I/O (RIO) Modules

Introduction

This part provides information on the following Quantum RIO modules:

RIO Module	Drop Location	Communication Channels	Bus Current Required
140 CRA 931 00	Remote (Drop)	1	600 mA
140 CRA 932 00	Remote (Drop)	2	750 mA
140 CRP 931 00	Local (Head)	1	600 mA
140 CRP 932 00	Local (Head)	2	750 mA
140 NRP 954 00	Local (Head) or Remote (Drop)	2, multimode fiber optic (ST type); 1 coaxial (F type)	700 mA
140 NRP 954 01C	Local (Head) or Remote (Drop)	2, single-mode fiber optic (LC type); 1 coaxial (F type)	750 mA

NOTE: For detailed information see also *Product Related Information*, *page 14*, Modicon Remote I/O Cable System Planning and Installation Guide

What Is in This Part?

This part contains the following chapters:

Chapter 3
140 CRP 931 00: Remote I/O (RIO) Head Module (single channel)

Purpose

This chapter contains information of the 140 CRP 931 00 Module.

What Is in This Chapter?

This chapter contains the following topics:

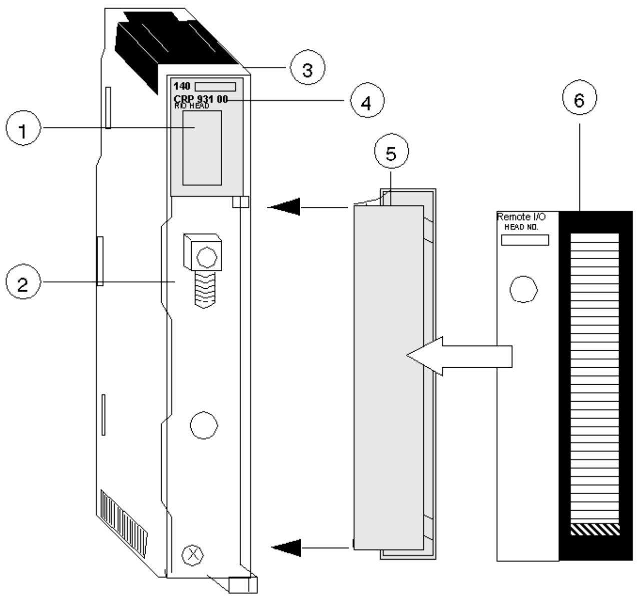
Presentation

Function

The Remote I/O Head single 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.

Illustration

The following figure shows the Remote I/O (RIO) module's parts.



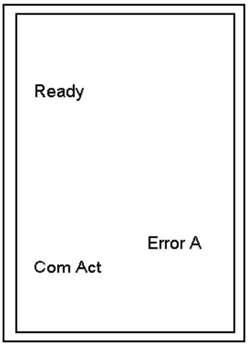
1 LED Area
2 RIO Coax Connector
3 Version Label
4 Model Number, Module Description, Color Code
5 Removable Door
6 Customer Identification Label (Fold label and place it inside door)

NOTE: To mantain 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).

Indicators

Illustration

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



Description

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

LEDS	Color	Indication When On
Ready	Green	The module has passed powerup diagnostics.
Com Act	Green	The module is communicating on the RIO network (see the following table for LED error codes).
Error A	Red	There is a loss of communication on Channel A with one or more of the drops.

Error Codes

Error Codes Table

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).

The following table shows the blinking Com Act LED error codes for the RIO Head module.

Number of Blinks	Code	Error
Slow (steady)	0000	Requested Kernal 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

Specifications

General Specifications

General Specifications

Bus Current required	600 mA
Power Dissipation (Typical)	3 W
Maximum Number of CRPs supported by the controller	1
Drop Type	Quantum 200 Series 500 Series or SY/MAX (any mix)
Drops	31 max
Words/Drop	64 In / 64 Out
ASCII	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

Connection / Transmission

Connection / Transmission

Coax Termination	Internal 75 ohms
Coax Shield	Tied to chassis ground
Data Transfer Rate	1.544 Mb
Dynamic Range	35 dB
External Connections	One "F" type female connector with a right angle adapter

Diagnostics

Diagnostics

Power Up	Dual Port Memory Check LAN Controller Check
Runtime	Executive Checksum RAM Address/Data

Chapter 4
140 CRP 932 00: Remote I/O (RIO) Head Module (dual channel)

Purpose

This chapter contains information of the 140 CRP 932 00 Module.

What Is in This Chapter?

This chapter contains the following topics:

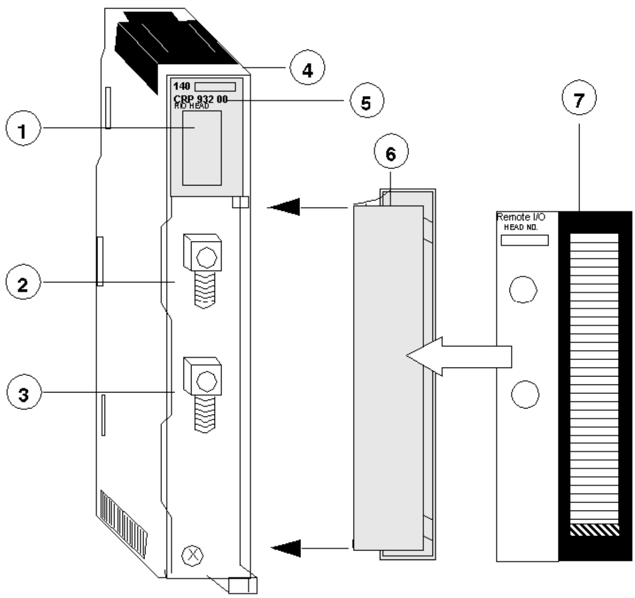
Presentation

Function

The Remote I/O Head 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.

Illustration

The following figure shows the Remote I/O (RIO) module's parts.



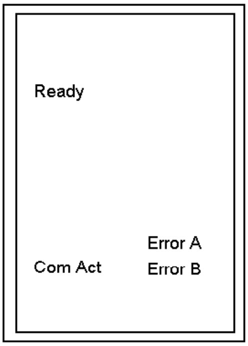
1 LED Area
2 RIO Coax Connector (Channel A)
3 RIO Coax Connector (Channel B)
4 Version Label
5 Model Number, Module Description, Color Code
6 Removable Door
7 Customer Identification Label (Fold label and place it inside door)

NOTE: To mantain 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).

Indicators

Illustration

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



Description

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

LEDS	Color	Indication When On
Ready	Green	The module has passed powerup diagnostics.
Com Act	Green	The module is communicating on the RIO network (see the following table for LED error codes).
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

Error Codes

Error Codes Table

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).

The following table shows the blinking Com Act LED error codes for the RIO Head module.

Number of Blinks	Code	Error
Slow (steady)	0000	Requested Kernal 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

NOTE: Error codes are available in the **File and Device info** screen (**Crash Code** field *(see EcoStruxure™ Control Expert, OS Loader, User Manual)*) when using OS Loader.

Specifications

General Specifications

General Specifications

Bus Current required	600 mA
Power Dissipation (Typical)	3 W
Maximum Number of CRPs supported by the controller	1
Drop Type	Quantum 200 Series 500 Series 800 Series or SY/MAX (any mix)
Drops	31 max
Words/Drop	64 In / 64 Out
ASCII	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

Connection / Transmission

Connection / Transmission

Coax Termination	Internal 75 ohms
Coax Shield	Tied to chassis ground
Data Transfer Rate	1.544 Mb
Dynamic Range	35 dB
External Connections	Two "F" type female connector with a right angle adapter

Diagnostics

Diagnostics

Power Up	Dual Port Memory Check LAN Controller Check
Runtime	Executive Checksum RAM Address/Data

Chapter 5
140 CRA 931 00: Remote I/O (RIO) Drop Module (single channel)

Purpose

This chapter contains information of the 140 CRA 931 00 Module.

What Is in This Chapter?

This chapter contains the following topics:

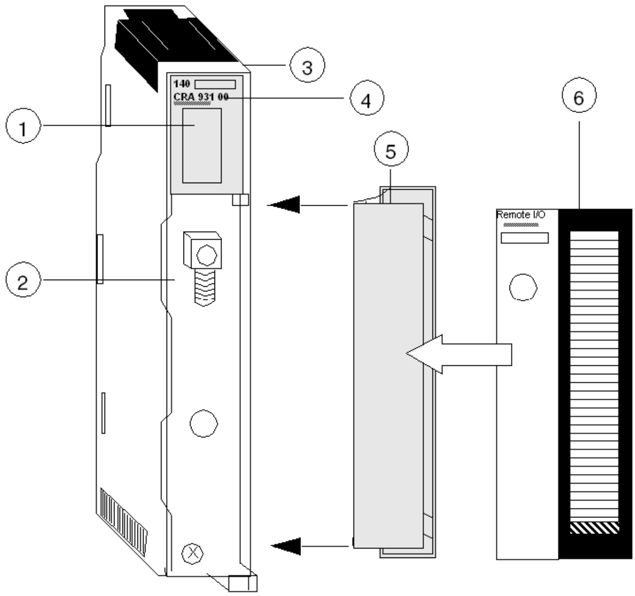
Presentation

Function

The Remote I/O Drop Single 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.

Illustration

The following figure shows the Remote I/O (RIO) module's parts.



1 LED Area
2 RIO Coax Connector
3 Version Label
4 Model Number, Module Description, Color Code
5 Removable Door
6 Customer Identification Label (Fold label and place it inside door)

NOTE: 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).

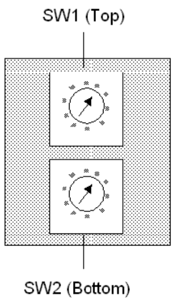
Rear Panel Switches

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 illustration and table below).

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.

Rear Panel Switches Figure

The following figure shows the SW1 top and SW2 bottom switches.



SW1 and SW2 Switches Table

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

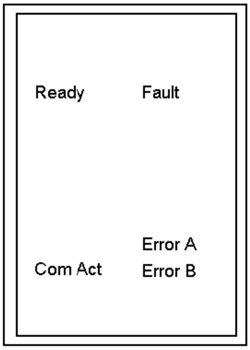
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 32	3	0 ... 2

NOTE: Only addresses from 2 to 32 are valid
If "0" or an address greater than 32 is selected, the RIO module displays a flashing "Error A"- and "Error B"-LED.
With Address "1" you don’t have flashing "Error A"- and "Error B"-LED.

Indicators

Illustration

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



Description

The following table shows the RIO Drop module 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 (see the following table for LED error codes).
Fault	Red	Unable to communicate with one or more I/O modules.
Error A	Red	Communication error on Channel A.
Error B	Red	In combination with "Error A" to indicate an invalid Node address.

Error Codes

Error Codes Table

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).

The following table shows the blinking Com Act LED error codes for the RIO Drop module.

Number of Blinks	Code	Description of Error
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

Specifications

General Specifications

General Specifications

Bus Current required	600 mA
Power Dissipation (Typical)	3 W
I/O Type	Quantum
Modules/Drop	14 max. 28 max. with Backplane expander (XBE)
Words/Drop	64 IN / 64 OUT
Holdup Time	Software configurable

NOTE: You can specify a monitoring time of 3 - 65 535 in this text box. With communication interruptions with the remote processor, the output modules will maintain their last operating condition during that time. Once the monitoring time has expired, the output modules will reset to their default timeout status. The monitoring time does not influence input modules. The CPU will immediately set the input value to zero.

Connection / Transmission

Connection / Transmission

Coax Termination	Internal 75 ohms
Coax Shield	Capacitor to ground
Data Transfer Rate	1.544 Mb
Dynamic Range	35 dB
External Connections	One "F" type female connector with a right angle adapter

Diagnostics

Diagnostics

Power Up	Runtime
Dual Port Memory Check LAN Controller Check	Executive Checksum RAM Address/Data

Chapter 6
140 CRA 932 00: Remote I/O (RIO) Drop Module (dual channel)

Purpose

This chapter contains information of the 140 CRA 932 00 Module.

What Is in This Chapter?

This chapter contains the following topics:

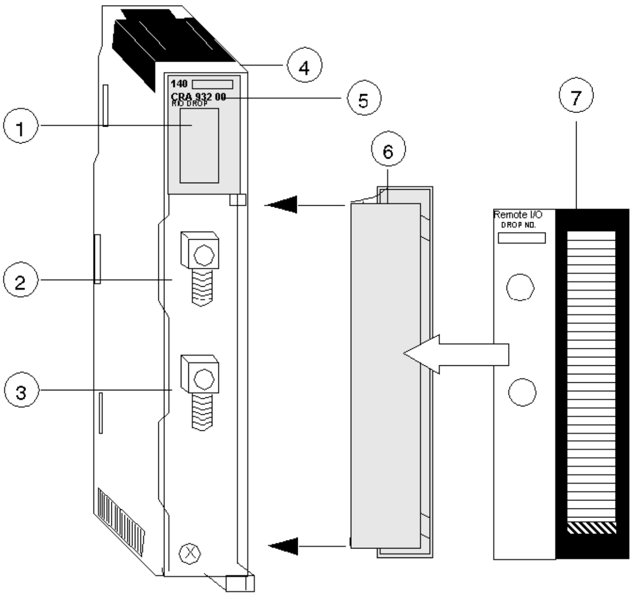
Presentation

Function

The Remote I/O Drop 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.

Illustration

The following figure shows the Remote I/O (RIO) module's parts.



1 LED Area
2 RIO Coax Connector (Channel A)
3 RIO Coax Connector (Channel B)
4 Version Label
5 Model Number, Module Description, Color Code
6 Removable Door
7 Customer Identification Label (Fold label and place it inside door)

NOTE: 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).

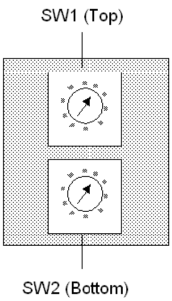
Rear Panel Switches

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 illustration and table below).

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.

Rear Panel Switches Figure

The following figure shows the SW1 top and SW2 bottom switches.



SW1 and SW2 Switches Table

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

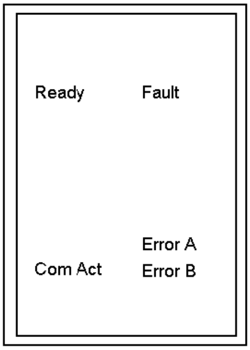
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 32	3	0 ... 2

NOTE: Only addresses from 2 to 32 are valid
If "0" or an address greater than 32 is selected, the RIO module displays a flashing "Error A"- and "Error B"- LED.
With address “1” you don’t have flashing “Error A”- and “Error B”- LED.

Indicators

Illustration

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



Description

The following table shows the RIO Drop module 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 (see the following table for LED error codes).
Fault	Red	Unable to communicate with one or more I/O modules. This LED appears also when CRA is in bad position.
Error A	Red	Communication error on Channel A.
Error B	Red	Communication error on Channel B.

Error Codes

Error Codes Table

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).

The following table shows the blinking Com Act LED error codes for the RIO Drop module.

Number of Blinks	Code	Description of Error
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

Specifications

General Specification

General Specification

Bus Current required	750 mA
Power Dissipation (Typical)	3.8 W
I/O Type	Quantum
Modules/Drop	14 max. 28 max. with Backplane expander (XBE)
Words/Drop	64 IN / 64 OUT
Holdup Time	Software configurable

NOTE: You can specify a monitoring time of 3 - 65 535 in this text box. With communication interruptions with the remote processor, the output modules will maintain their last operating condition during that time. Once the monitoring time has expired, the output modules will reset to their default timeout status. The monitoring time does not influence input modules. The CPU will immediately set the input values to zero.

Connection / Transmission

Connection / Transmission

Coax Termination	Internal 75 ohms
Coax Shield	Capacitor to ground
Data Transfer Rate	1.544 Mb
Dynamic Range	35 dB
External Connections	Two "F" type female connector with a right angle adapter

Diagnostics

Diagnostics

Power Up	Runtime
Dual Port Memory Check LAN Controller Check	Executive Checksum RAM Address/Data

Chapter 7
140 NRP 954 00: Fiber Optic Repeater Module (Multimode)

Purpose

This chapter contains information of the 140 NRP 954 00 Module.

What Is in This Chapter?

This chapter contains the following topics:

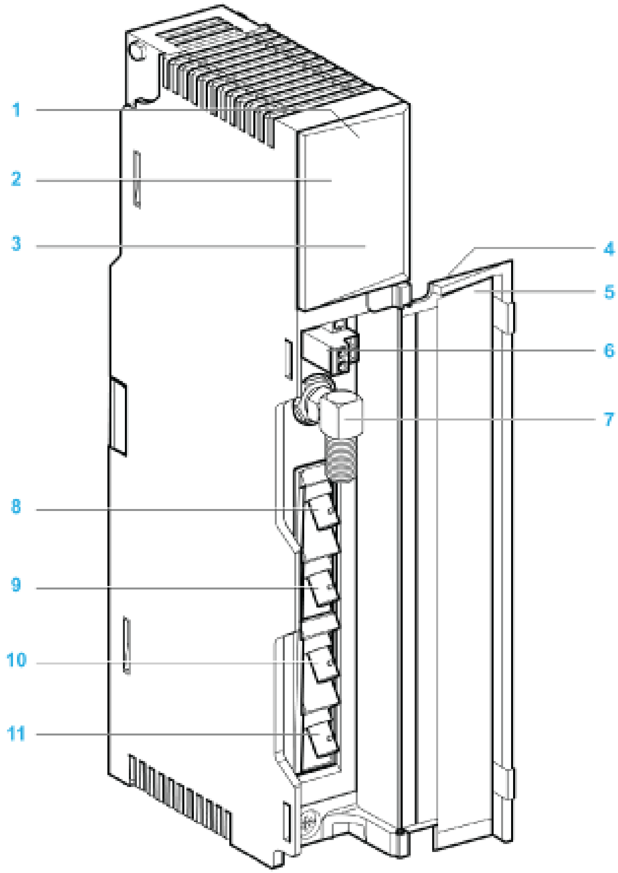
Presentation

Function

The 140 NRP 954 00 fiber optical repeater module provides communication between two or more RIO nodes or segments of networks over a multimode fiber optic medium. Each repeater contains one electrical RIO interface and two fiber optic transceivers.

Illustration

The following figure shows the 140 NRP 954 00 (NRP) module parts.



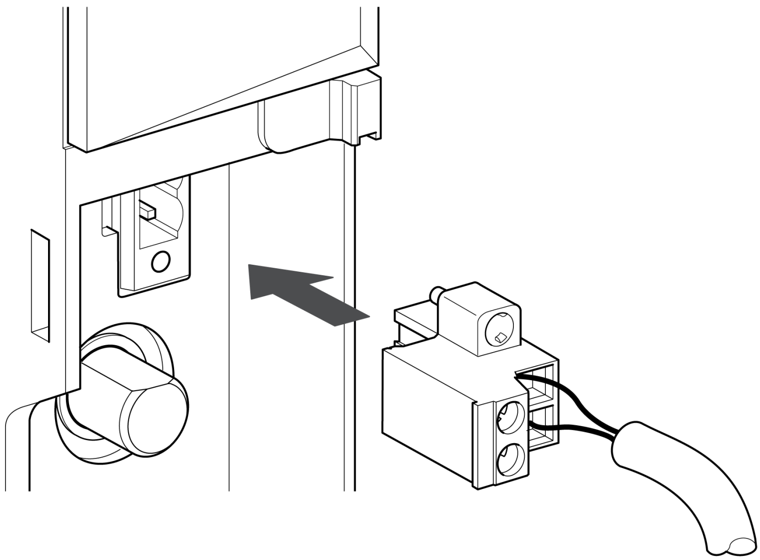
1 Version label
2 Model number, module description, color code
3 LED area
4 Removable door
5 Customer identification label (Fold label and place it inside door)

6 Diagnostic relay port
7 Electrical coaxial port (“F” type connector)
8 Transmitter optical fiber port - FPort 1 Tx (ST type connector)
9 Receiver optical fiber port - FPort 1 Rx (ST type connector)
10 Receiver optical fiber port - FPort 2 Rx (ST type connector)
11 Transmitter optical fiber port - FPort 2 Tx (ST type connector)

Diagnostic Relay Port

A normally closed relay contact, rated at 220 Vac 6 A or 30 Vdc 5 A, is available on the terminals of the diagnostic relay port via its connector. This allows to use the diagnostic relay behavior *(see page 64)* in the application.

The following figure shows the 2 terminals of the diagnostic relay connector:



Electrical Coaxial Port

The 140 NRP 954 00 fiber optic repeater module is equipped with an electrical coaxial RIO interface using an "F"-style connector. In order to maintain bend radius tolerance on coaxial cable the electrical coaxial port is equipped with a right-angle F adapter.

The electrical coaxial port has the same network connections, specifications and restrictions as other remote I/O devices, and must be treated accordingly. See the *Remote I/O Cable System Planning and Installation Guide* for information regarding planning your network configuration as well as the installation of the network electrical coaxial cable.

CAUTION

CONNECTIVITY COMPLIANCE

To maintain CE compliance with the European Directive on EMC (89/336/EEC), the 140 NRP 954 00 module must be connected using quad shielded cable (see the *Remote I/O Cable System Planning and Installation Guide*).

Failure to follow these instructions can result in injury or equipment damage.

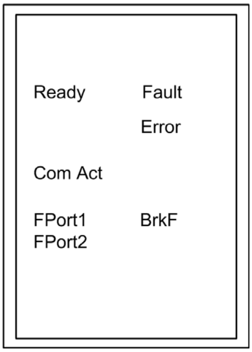
Optical Ports

The 140 NRP 954 00 fiber optic repeater module is equipped with two optical ports (FPort1 and FPort2). One pair of fiber optic cables are connected to one fiber optic port using two low-loss industrial ST-type connectors (one for the transmitter signal (Tx) and one for the receiver signal (Rx)).

LED Indicators and Diagnostic Relay Behavior

Illustration

The following figure shows the LED indicators for the 140 NRP 954 00 fiber optic repeater module:



LED Indicators

The following table describes the status LEDs of the 140 NRP 954 00 module:

LED	Color	State	Indication
Ready	Green	OFF	The module is unpowered or the internal logic is out of order.
		ON	The module is powered and the internal logic is available.
ComAct	Green	OFF	No activity on the coaxial cable.
		ON	Activity is detected on the coaxial cable.
FPort1	Green	OFF	No activity on the optical fiber port 1 reception.
		ON	Activity is detected on the fiber port 1 reception.
FPort2	Green	OFF	No activity on the optical fiber port 2 reception.
		ON	Activity is detected on the fiber port 2 reception.
Fault	Red	OFF	No error (internal or external) detected.
		ON	An error (internal or external) has been detected.
Error	Red	OFF	No internal error detected.
		ON	An internal error has been detected.
BrkF	Red	OFF	Activity is detected on both optical port inputs OR no activity has ever been detected on any optical port input.
		ON	One of the optical fiber port input is inactive (see FPort• LED OFF) while activity is detected or has been detected on the other optical port input (see FPort• LED ON).

Diagnostic Relay Behavior

The contacts of the relay are open whenever an error is detected (internal or external), and the Fault LED is ON. In fact the status of the diagnostic relay provides an electric information when the Fault LED status provides a visual status when an error is detected (internal or external).

Futhermore when the contacts of the diagnostic relay are open,

- if the detected error is internal the Error LED is ON.
- if the detected error is external the BrkF LED is ON.

NOTE: When the 140 NRP 954 00 is not powered, the contacts of the diagnostic relay are open.

Module Connections

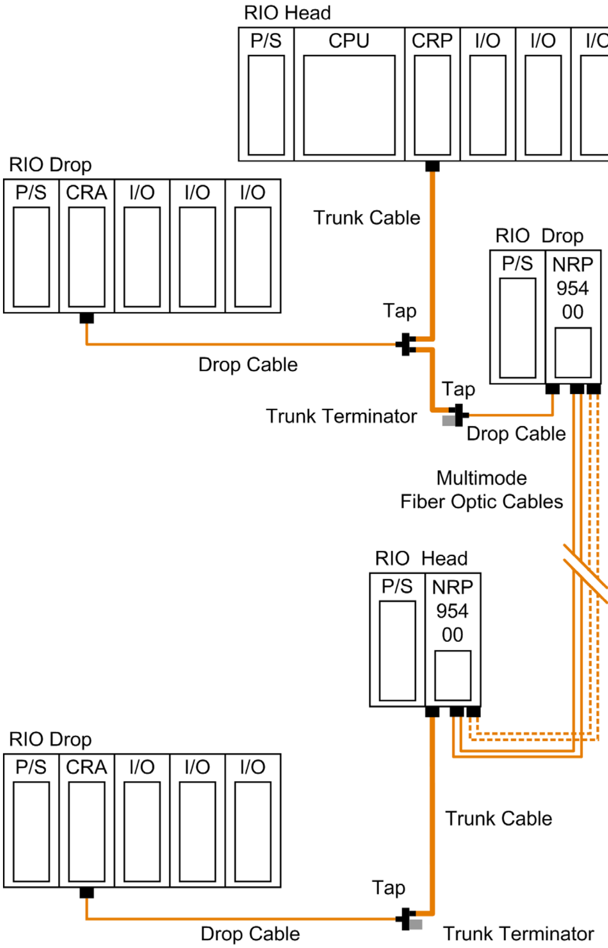
Using Fiber Optics in a RIO System

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

- Point-to-Point topology
- Bus topology
- Tree topology
- Self Healing Ring topology

Point-to-Point Topology with Fiber Optic Repeater

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.



NOTE:

- Using 2 optical fiber pairs provides a better service and diagnostics.
- Using only one fiber pair, looping back the unused optical ports with a short fiber helps using the diagnostics.

For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

Bus Topology with Fiber Optic Repeater

This type of configuration is used when it is required to increase the length of the fiber link and increase the distance between drops on the RIO network.

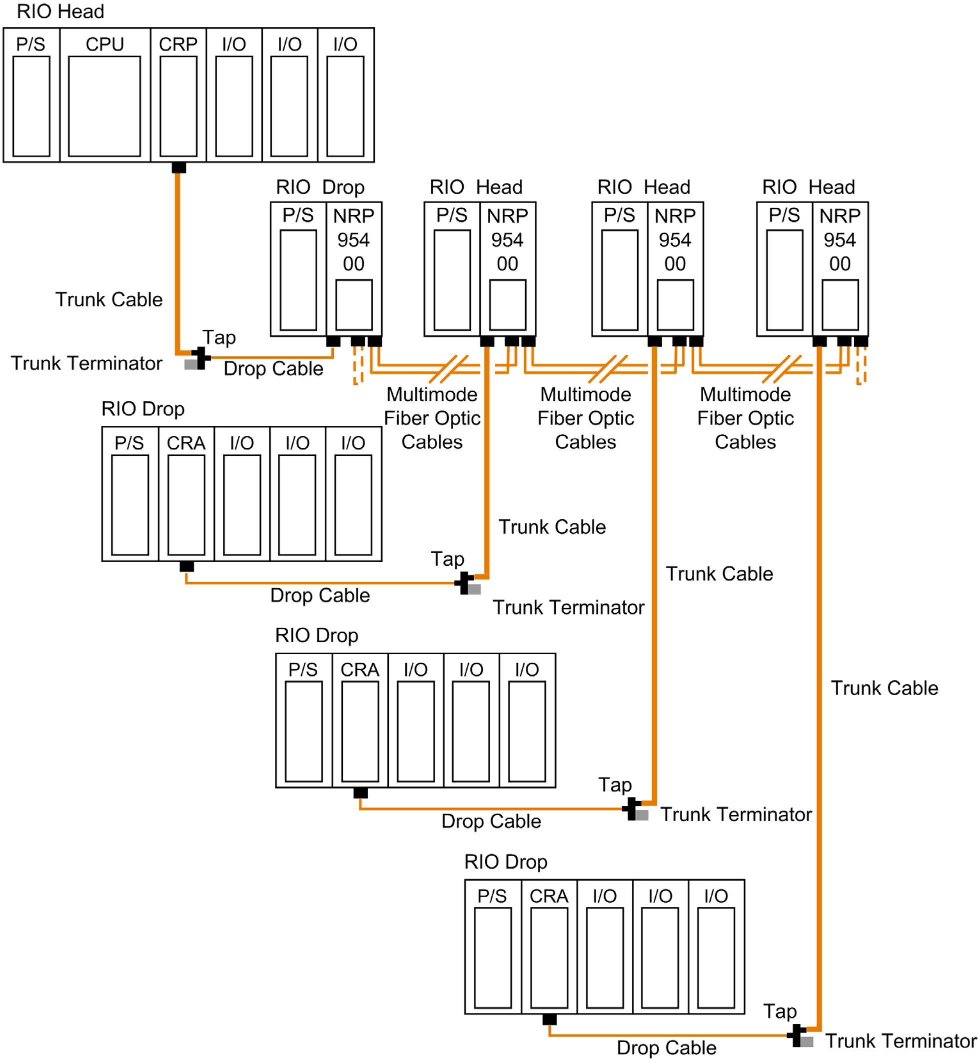
⚠ CAUTION

EQUIPMENT FAILURE

The loss of a single fiber optic repeater 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 these instructions can result in injury or equipment damage.

The following figure shows the bus topology:



NOTE: The distance between nodes on fiber is limited by the maximum allowable power loss from end-to-end (3 km over 62.5 µm 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.

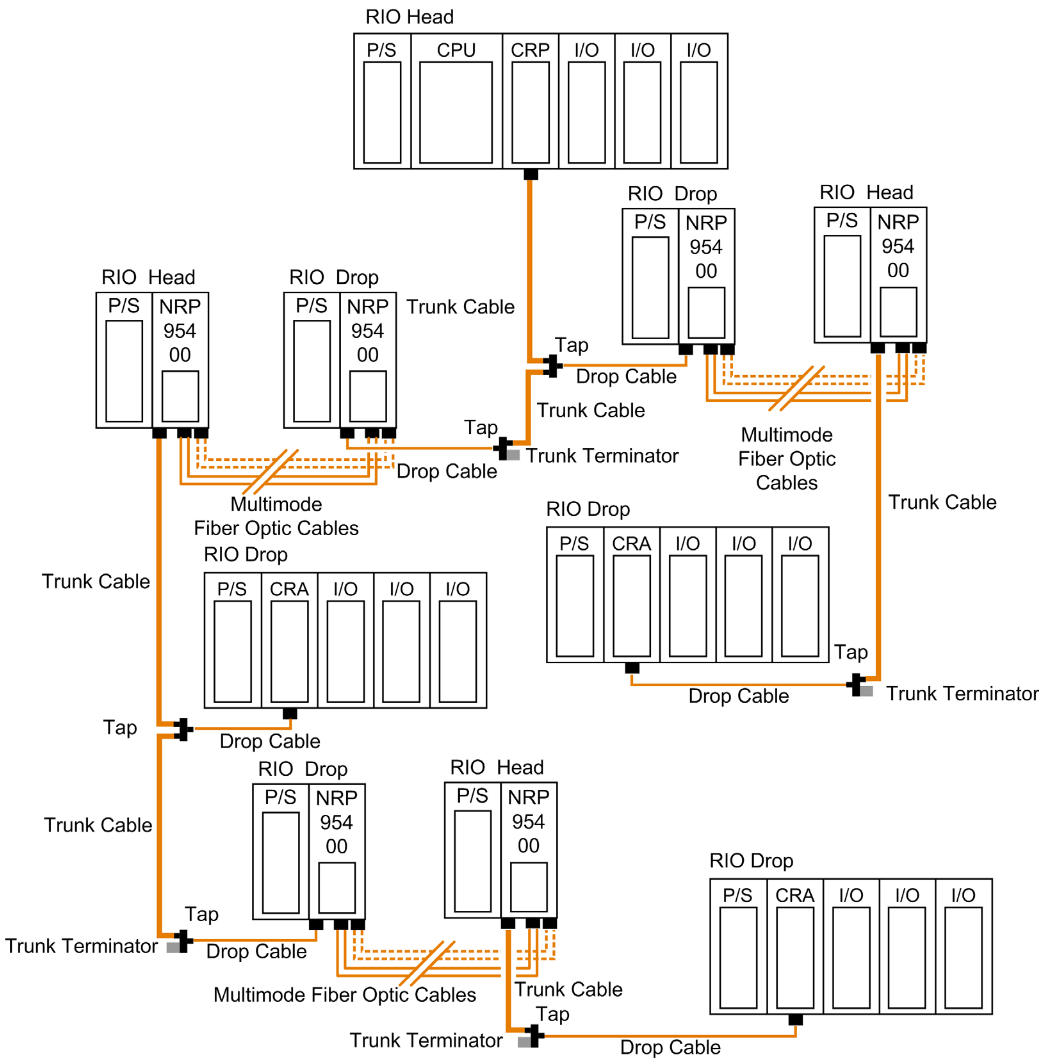
NOTE: At each end of the bus, looping back the unused optical ports with a short fiber helps using the diagnostics. For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

Tree Topology with Fiber Optic Repeater

Tree topologies, which cannot be established with coaxial cable alone can be built legally using fiber optic repeaters.

NOTE: The limitations *(see page 76)* in bus and self-healing configurations are applicable for each drop in tree topology.

The following illustration shows an example of a tree topology:



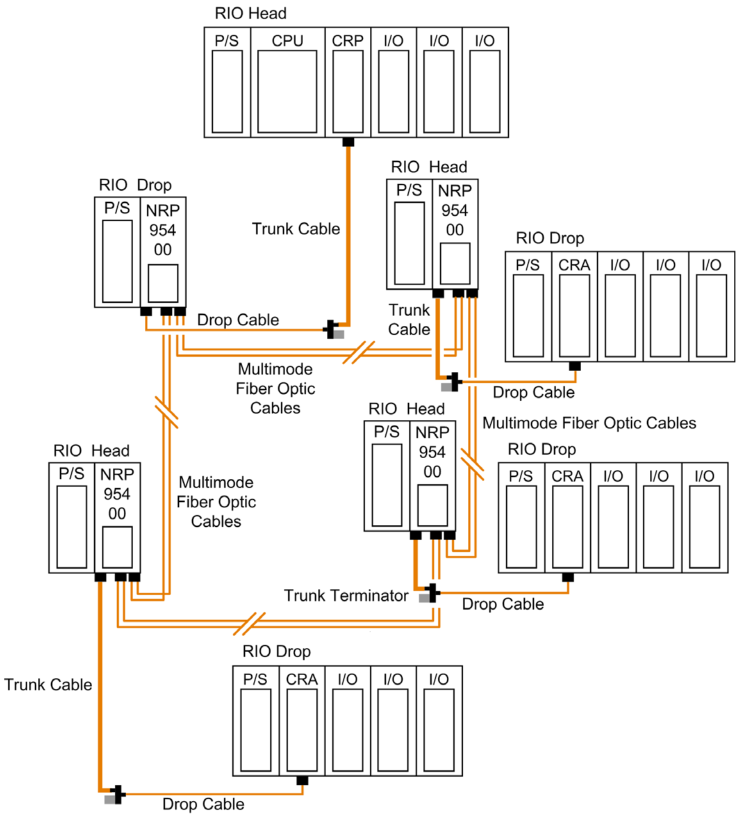
NOTE:
- Using 2 optical fiber pairs provides a better service and diagnostics.
- Using only one fiber pair, looping back the unused optical ports with a short fiber helps using the diagnostics.

For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

Self-Healing Ring Topology with Fiber Optic Repeater

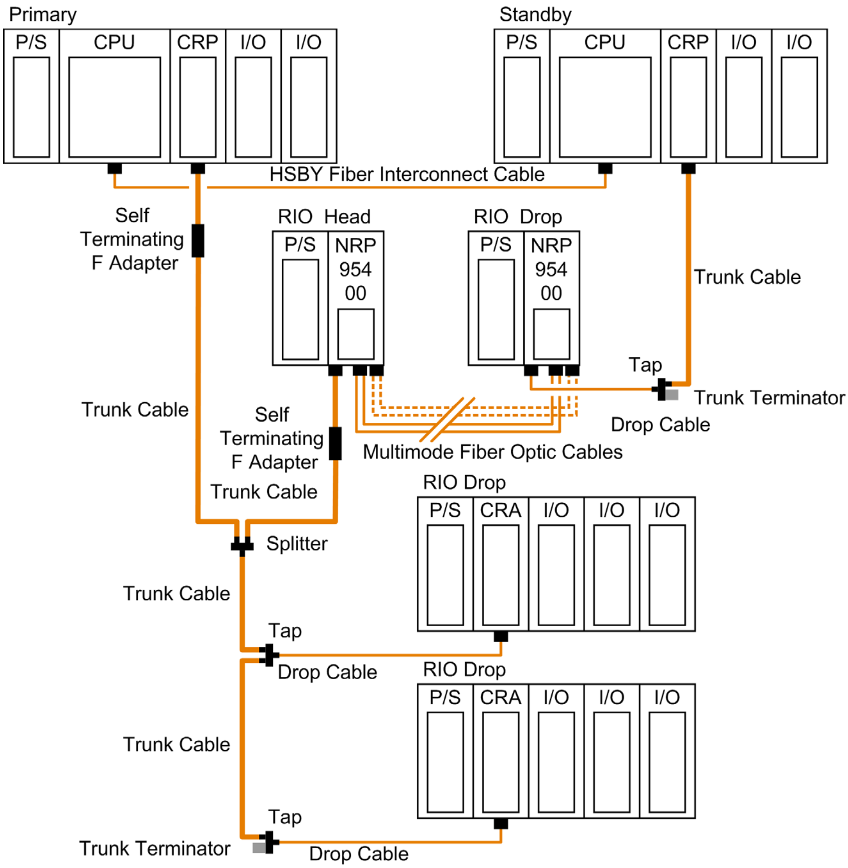
This configuration can be achieved by connecting the unused fiber optic ports of the first and last 140 NRP 954 00 directly or through the fiber optic repeater. This type of connection has all the advantages of the previously described configurations, along with built-in redundancy. A broken connection between any two Quantum NRP modules in the ring will automatically reconfigure the RIO network and continue the communication.

NOTE: The maximum length of the fiber cable in a ring configuration, 16 km, is calculated in the the case of a break that occurs anywhere.



Hot Standby Systems with Fiber Optic Repeater

The following figure shows an example of hot standby systems using fiber optic repeaters:



NOTE:

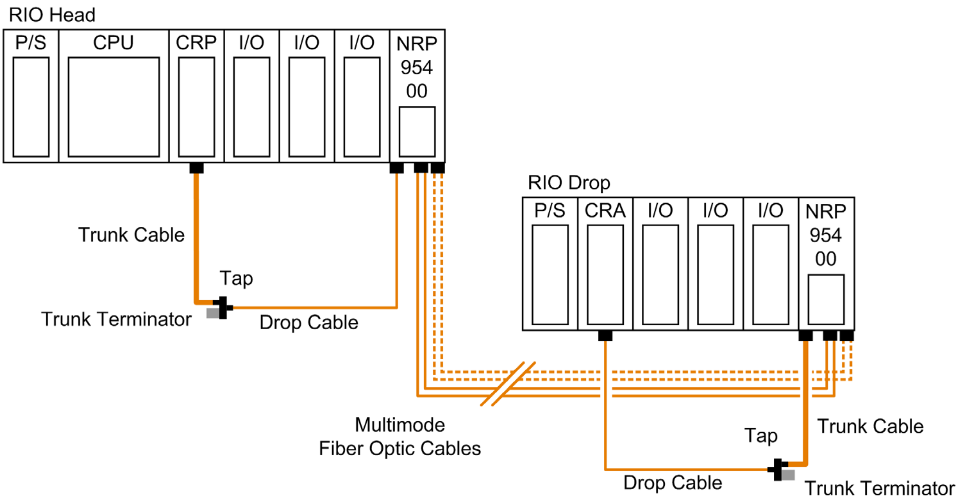
- Using 2 optical fiber pairs provides a better service and diagnostics.
- Using only one fiber pair, looping back the unused optical ports with a short fiber helps using the diagnostics.

For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

Backplane Integration

Instead of placing each fiber optic repeater modules with its own power supply module(s) in a standalone backplane, you can take the advantage of the quantum form factor.

The following figure shows two segments of RIO coaxial cable connected point-to-point by two 140 NRP 954 00 fiber optic repeaters placed on the Quantum racks where the RIO head and RIO drop modules are located:



NOTE:
- Using 2 optical fiber pairs provides a better service and diagnostics.
- Using only one fiber pair, looping back the unused optical ports with a short fiber helps using the diagnostics.

For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

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 (–40...+176 °F)
ST Bayonet (Hot Melt)	3M 6100	–40...+80 °C (–40...+176 °F)
ST Bayonet (Epoxy)	AMP 501380 Series	–30...+70 °C (–22...+158 °F)
ST Cleave and Crimp	AMP 504034 Series	–40...+65 °C (–40...+149 °F)
Mechanical Line Splice (one size fits all)	3M 2529 Fiberlok™ II	–40...+80 °C (–40...+176 °F)

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 or Push-Pull ST (Hot Melt)	3M 6355	110 Vac, only for 3M connectors
Bayonet ST (Epoxy)	AMP 501258-7	110 Vac, only for AMP connectors
Bayonet ST (Epoxy)	AMP 501258-8	220 Vac, only for AMP connectors
Mechanical Line Splice	3M 2530	Fiber Splice Prep Kit, complete with cleaving tool

Light Sources, Power Meters

For Photodyne light sources and power meter products, contact 3M Telecom Systems Division.

Observing Safety Precautions

Before installing the 140 NRP 954 00 fiber optic repeater module, read the warning messages below. Follow them at all times during the installation of the fiber optic repeater.

⚠ DANGER

SEVERE EYE DAMAGE

Do not view the ends of fiber optic cable under magnification while a transmit signal is present on the cable.

Failure to follow these instructions will result in death or serious injury.

NOTICE

INOPERABLE EQUIPMENT

Do not remove the protective coverings from the optical cable port and optical cable tips until immediately fiber cable connection to the cable port.

After removing the protective coverings, never touch exposed parts such as the ferrule.

After connecting the fiber cable, retain the protective coverings for future use.

Do not remove the protective covering from the unused connector.

Failure to follow these instructions can result in equipment damage.

Before Starting

Prior to installing 140 NRP 954 00 fiber optic repeater, network cables must be prepared and installed to the repeater's site with their connectors.

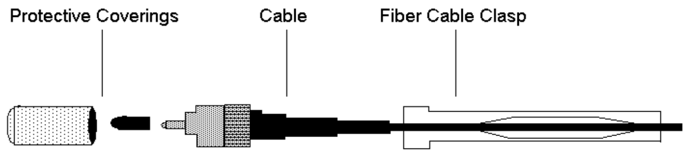
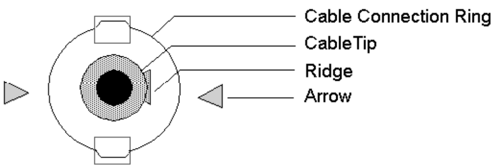
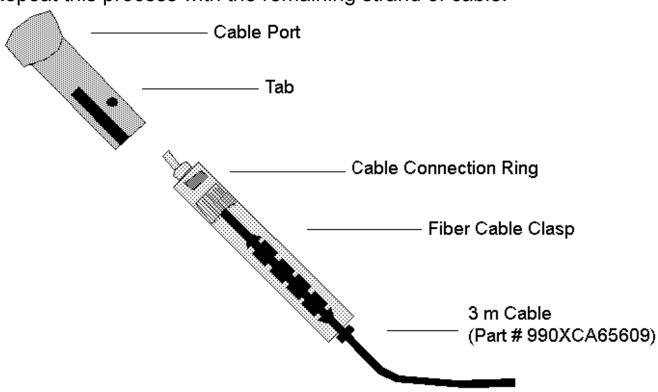
To prepare optic cables:

- Follow the cable manufacturer's recommendations for routing, installing, and testing the cable. Take care when terminating the ends of each fiber optic cable in order to minimize loss of optical signal. Follow the manufacturer's guidelines for installing optical connectors.
- Test the cable for proper attenuation prior to the connection of the fiber optic repeaters. The cable ends should be accessible at each fiber optic installation site. Allow sufficient cable length for a service loop and strain reliefs.
- Label each cable end to facilitate future maintenance.

To prepare and install coaxial cables, refer to *Remote I/O Cable System Planning and Installation Guide*.

Connecting the Fiber Optic Cable

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

Step	Action
1	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. 
2	Turn the connection ring so that one of the arrows on the side of the ring lines up with the ridge inside. 
3	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. 

General Specifications

Introduction

This section gives the 140 NRP 954 00 fiber optic repeater module specifications.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
Do not exceed any of the rated values specified in the following tables.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

General Specifications

Bus Current Required	700 mA
Power Dissipation (Typical)	5 W
Inrush Current	1 A typical @ 5 Vdc
Data Transfer Rate	1.544 Mb for remote I/O with Manchester encoded data
Bit Error Rate	10^{-9} over specified Optical Receiver Dynamic Range
Optical Interface	ST-Type connector
Wavelength	820 nm
Power Loss Budget (includes 3 dB of system margin)	50/125 µm fiber –7.0 dB 62.5/125 µm fiber –11 dB 100/140 µm fiber –16.5 dB
Maximum Distance for Point–to–Point Connection	2 km over 50/125 µm fiber @ 3.5 dB/km 3 km over 62.5/125 µm fiber @ 3.5 dB/km 3 km over 100/140 µm fiber @ 5 dB/km
Limits in Bus or Self-Healing Ring Configurations	12 fiber optic repeater modules with a maximum length of fiber optic cables of 16 km (back-loop included in Self-healing ring configuration). **NOTE:** The maximum length is between the CRP module (the farther one in a Hot Standby (HSBY) system) and the last CRA module.
Coaxial Interface	F type female connector with a right-angle F adapter connector **NOTE:** Required torque to fasten the right-angle F adapter is 0.46...0.60 N•m (4.1...5.3 lbf-in).
Coaxial Termination	Internal 75 ohms
Coaxial Shield	Tied to ground
Coaxial Dynamic Range	35 dB
Coaxial Sensitivity	70 mV pk-pk max
Relay Diagnostic	Rated at 220 Vac 6 A / 30 Vdc 5 A

NOTICE

DESTRUCTION OF ADAPTER

- Before tightening the locknut to the torque 0.46...0.60 N•m (4.1...5.3 lbf-in) be sure to properly position the right-angle F adapter connector.
- During tightening be sure to maintain the connector securely.
- The locknut must be loosened before handling the connector. For this reason, it is recommended to attach the S908 coaxial cable to the chassis to avoid any mechanical stress on the right-angle F adapter connector.
- Do not tighten the right-angle F adapter beyond the specified torque.

Failure to follow these instructions can result in equipment damage.

Optical Transmitter Specifications

Optical Power (Measured with 1 m test fiber)	–13.0...–20.0 dBm average power in 50/125 μm fiber cable –10.0...–16 dBm average power in 62.5/125 μm fiber cable –4.0...–10.5 dBm average power in 100/140 μm fiber cable
Rise/Fall Time	20 nsec or better
Silence (OFF Leakage)	–43 dBm

Optical Receiver Specifications

Receiver Sensitivity	–30 dBm average power
Dynamic Range	20 dB
Detected Silence	–36 dBm

Reliability

MTBF	1,300,000 hours (minimum) @ 30 °C, assuming fixed ground and component stress within maximum specifications.

Chapter 8
140 NRP 954 01C: Fiber Optic Repeater Module (Single-mode)

Purpose

This chapter contains information of the 140 NRP 954 01C Module.

What Is in This Chapter?

This chapter contains the following topics:

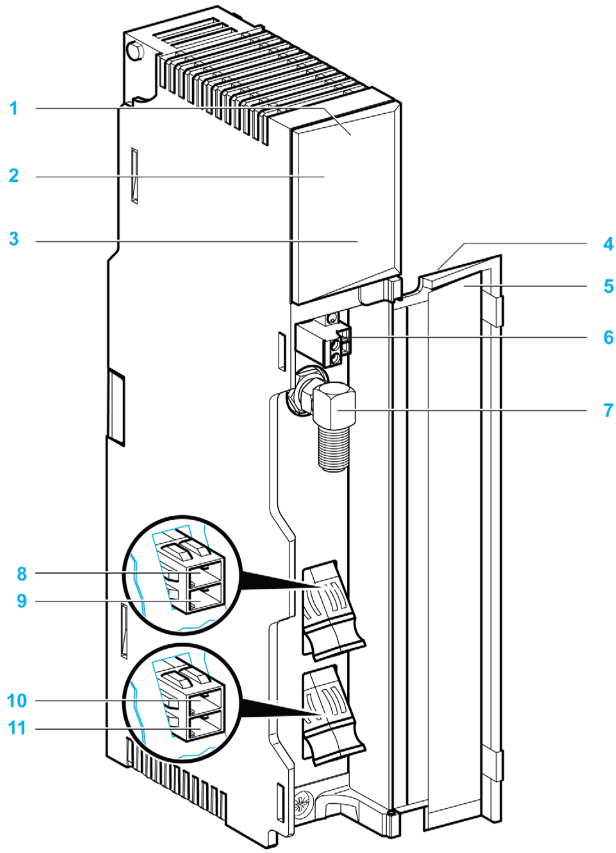
Presentation

Function

The 140 NRP 954 01C fiber optical repeater module provides communication between two or more RIO nodes or segments of networks over a single-mode fiber optic medium. Each repeater contains one electrical RIO interface and two fiber optic transceivers.

Illustration

The following figure shows the 140 NRP 954 01C (NRP) module parts.



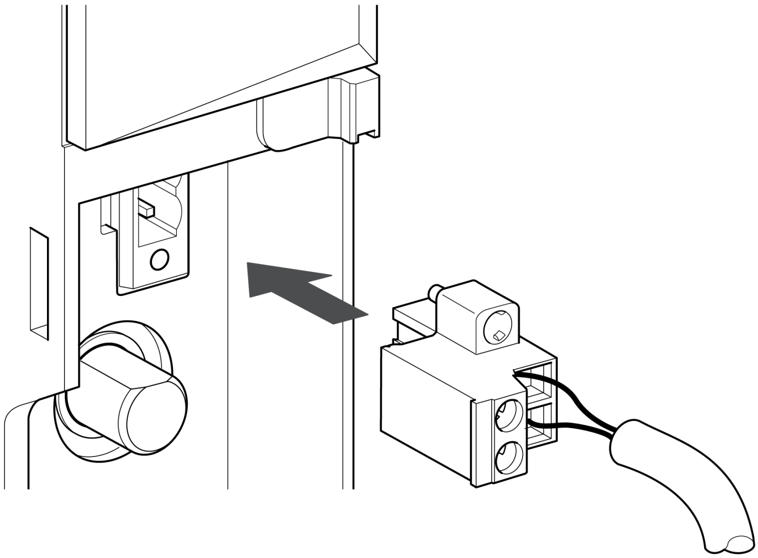
1 Version label
2 Model number, module description, color code
3 LED area
4 Removable door
5 Customer identification label (Fold label and place it inside door)
6 Diagnostic relay port

7 Electrical coaxial port (“F” type connector)
8 Receiver optical fiber port - FPort 1 Rx (LC type connector)
9 Transmitter optical fiber port - FPort 1 Tx (LC type connector)
10 Receiver optical fiber port - FPort 2 Rx (LC type connector)
11 Transmitter optical fiber port - FPort 2 Tx (LC type connector)

Diagnostic Relay Port

A normally closed relay contact, rated at 220 Vac 6 A or 30 Vdc 5 A, is available on the terminals of the diagnostic relay port via its connector. This allows to use the diagnostic relay behavior *(see page 64)* in the application.

The following figure shows the 2 terminals of the diagnostic relay connector:



Electrical Coaxial Port

The 140 NRP 954 01C fiber optic repeater module is equipped with an electrical coaxial RIO interface using an "F"-style connector. In order to maintain bend radius tolerance on coaxial cable the electrical coaxial port is equipped with a right-angle F adapter.

The electrical coaxial port has the same network connections, specifications and restrictions as other remote I/O devices, and must be treated accordingly. See the *Remote I/O Cable System Planning and Installation Guide* for information regarding planning your network configuration as well as the installation of the network electrical coaxial cable.

⚠ CAUTION
CONNECTIVITY COMPLIANCE To maintain CE compliance with the European Directive on EMC (89/336/EEC), the 140 NRP 954 01C module must be connected using quad shielded cable (see the *Remote I/O Cable System Planning and Installation Guide*). **Failure to follow these instructions can result in injury or equipment damage.**

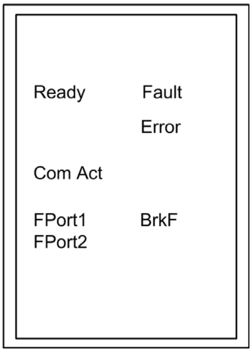
Optical Ports

The 140 NRP 954 01C fiber optic repeater module is equipped with two optical ports (FPort1 and FPort2). One pair of fiber optic cables are connected to one fiber optic port using a duplex LC-type connector.

LED Indicators and Diagnostic Relay Behavior

Illustration

The following figure shows the LED indicators for the 140 NRP 954 01C fiber optic repeater module:



LED Indicators

The following table describes the status LEDs of the 140 NRP 954 01C module:

LED	Color	State	Indication
Ready	Green	OFF	The module is unpowered or the internal logic is out of order.
		ON	The module is powered and the internal logic is available.
ComAct	Green	OFF	No activity on the coaxial cable.
		ON	Activity is detected on the coaxial cable.
FPort1	Green	OFF	No activity on the optical fiber port 1 reception.
		ON	Activity is detected on the fiber port 1 reception.
FPort2	Green	OFF	No activity on the optical fiber port 2 reception.
		ON	Activity is detected on the fiber port 2 reception.
Fault	Red	OFF	No error (internal or external) detected.
		ON	An error (internal or external) has been detected.
Error	Red	OFF	No internal error detected.
		ON	An internal error has been detected.
BrkF	Red	OFF	Activity is detected on both optical port inputs OR no activity has ever been detected on any optical port input.
		ON	One of the optical fiber port input is inactive (see FPort• LED OFF) while activity is detected or has been detected on the other optical port input (see FPort• LED ON).

Diagnostic Relay Behavior

The contacts of the relay are open whenever an error is detected (internal or external), and the Fault LED is ON. In fact the status of the diagnostic relay provides an electric information when the Fault LED status provides a visual status when an error is detected (internal or external).

Futhermore when the contacts of the diagnostic relay are open,
- if the detected error is internal the Error LED is ON.
- if the detected error is external the BrkF LED is ON.

NOTE: When the 140 NRP 954 01C is not powered, the contacts of the diagnostic relay are open.

Module Connections

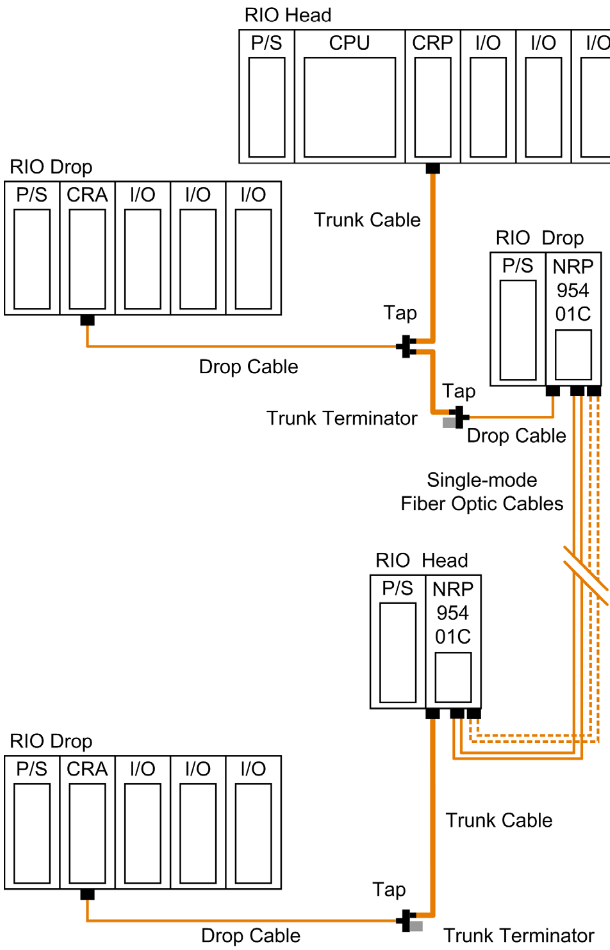
Using Fiber Optics in a RIO System

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

- Point-to-Point topology
- Bus topology
- Tree topology
- Self Healing Ring topology

Point-to-Point Topology with Fiber Optic Repeater

Point-to-point configuration (see the following figure) allows communication over the distance of up to 16 km through harsh industrial environments. The following figure shows the point-to-point configuration.



NOTE:
- Using 2 optical fiber pairs provides a better service and diagnostics.
- Using only one fiber pair, looping back the unused optical ports with a short fiber helps using the diagnostics.

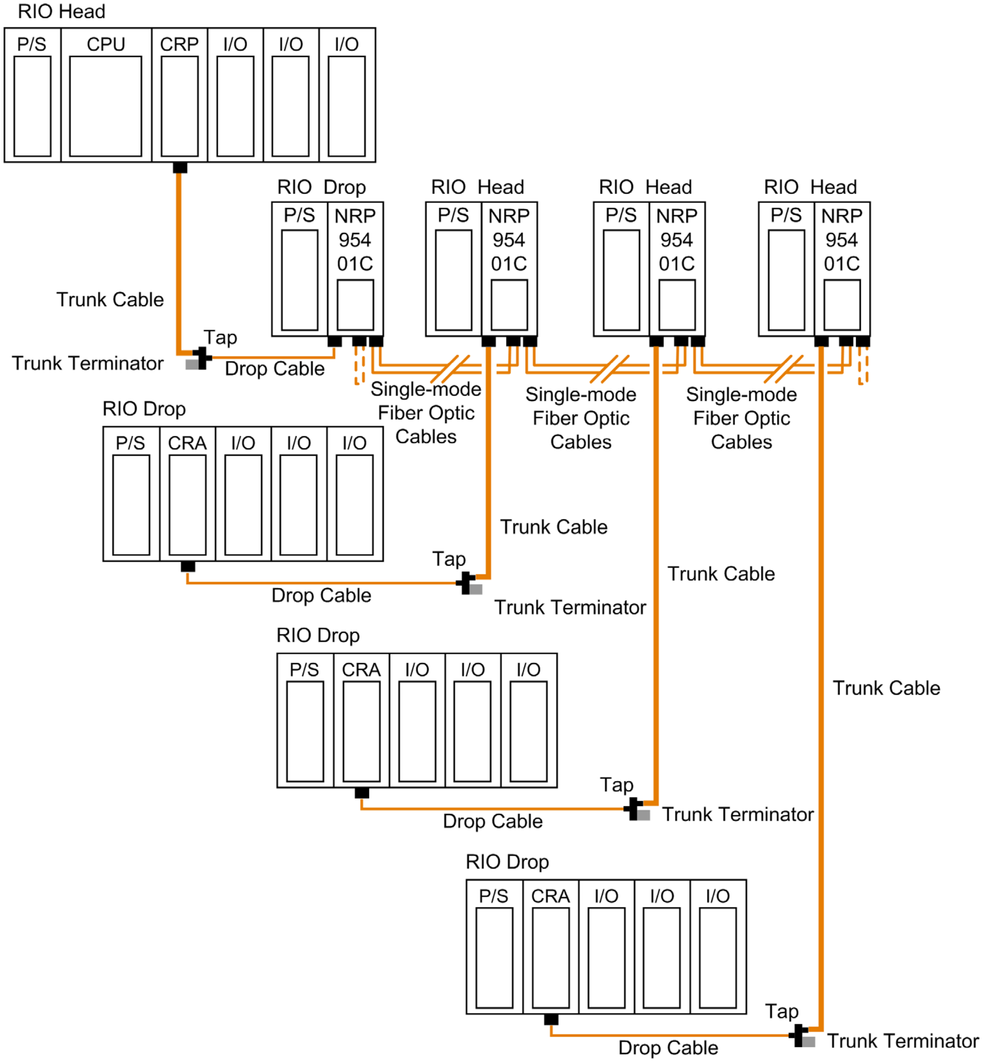
For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

Bus Topology with Fiber Optic Repeater

This type of configuration is used when it is required to increase the length of the fiber link and increase the distance between drops on the RIO network.

⚠ CAUTION
EQUIPMENT FAILURE The loss of a single fiber optic repeater 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 these instructions can result in injury or equipment damage.**

The following figure shows the bus topology:



NOTE: The total distance between the first and the last fiber optic repeater is limited by the maximum allowable power loss from end-to-end (16 km over 9/125 µm 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.

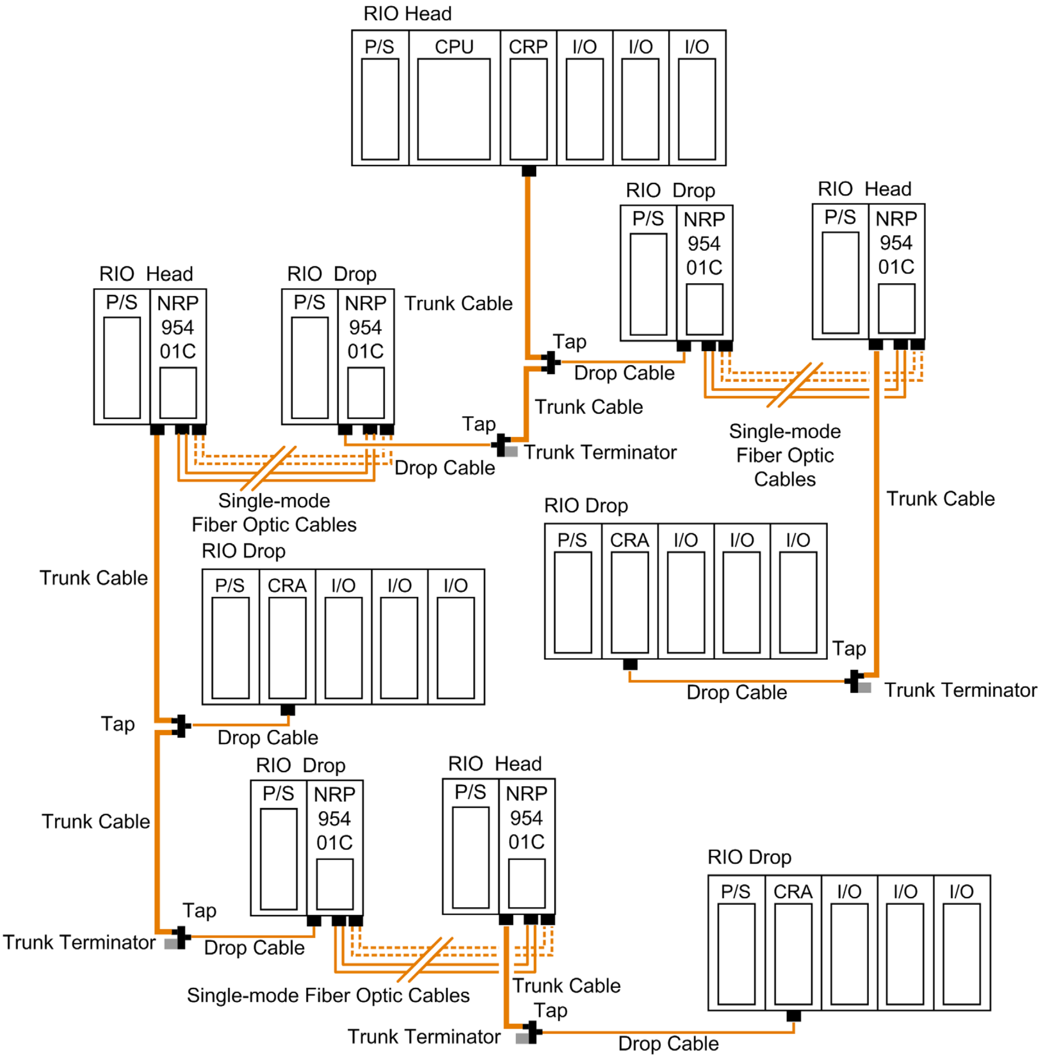
NOTE: At each end of the bus, looping back the unused optical ports with a short fiber helps using the diagnostics. For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

Tree Topology with Fiber Optic Repeater

Tree topologies, which cannot be established with coaxial cable alone can be built legally using fiber optic repeaters.

NOTE: The limitations *(see page 97)* in bus and self-healing configurations are applicable for each drop in tree topology.

The following illustration shows an example of a tree topology:



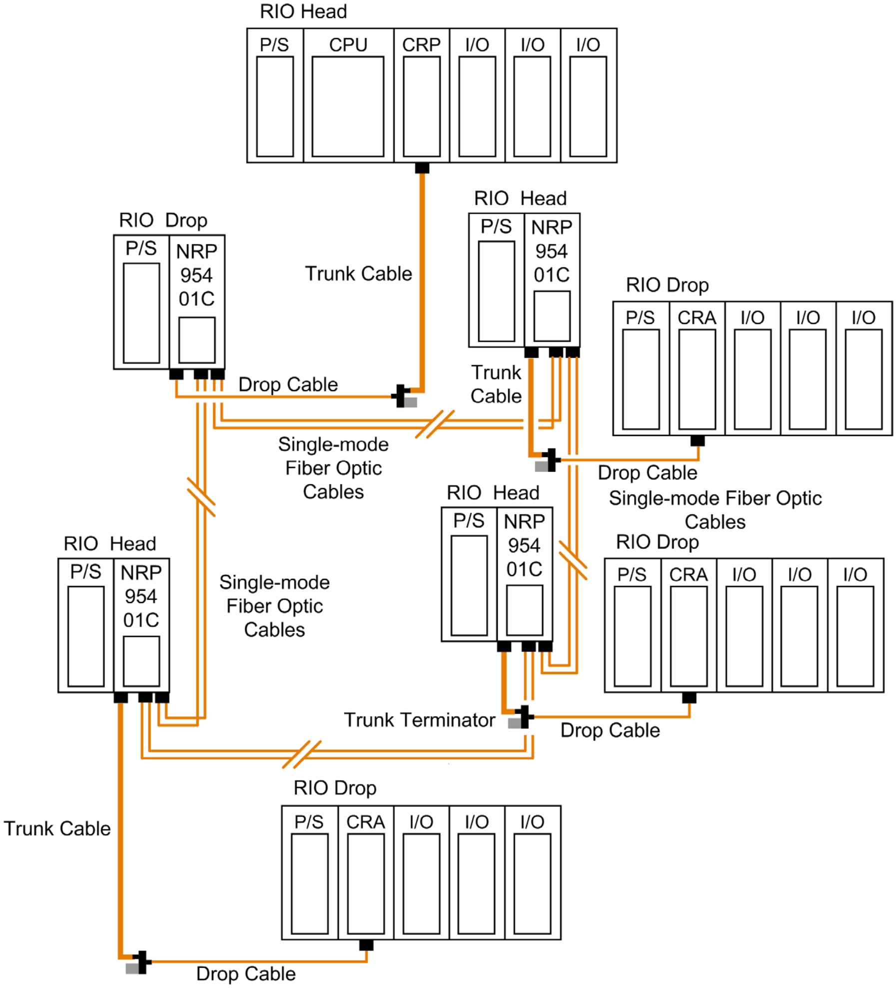
NOTE:
- Using 2 optical fiber pairs provides a better service and diagnostics.
- Using only one fiber pair, looping back the unused optical ports with a short fiber helps using the diagnostics.

For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

Self-Healing Ring Topology with Fiber Optic Repeater

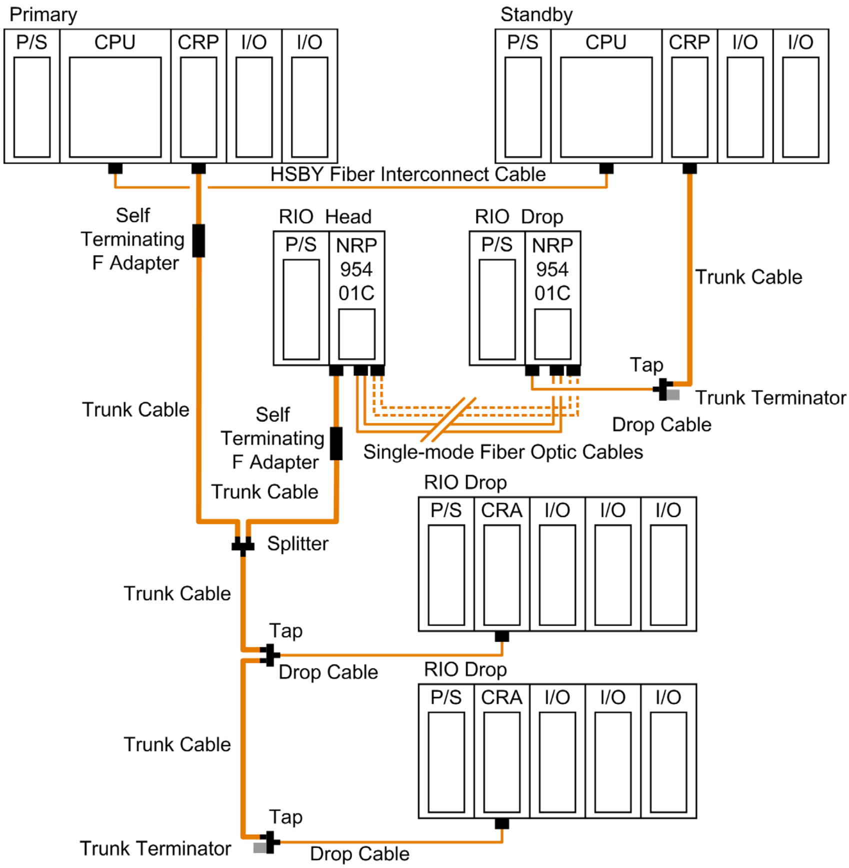
This configuration can be achieved by connecting the unused fiber optic ports of the first and last 140 NRP 954 01C directly or through the fiber optic repeater. This type of connection has all the advantages of the previously described configurations, along with built-in redundancy. A broken connection between any two Quantum NRP modules in the ring will automatically reconfigure the RIO network and continue the communication.

NOTE: The maximum length of the fiber cable in a ring configuration, 16 km, is calculated in the the case of a break that occurs anywhere (back-loop included).



Hot Standby Systems with Fiber Optic Repeater

The following figure shows an example of hot standby systems using fiber optic repeaters:



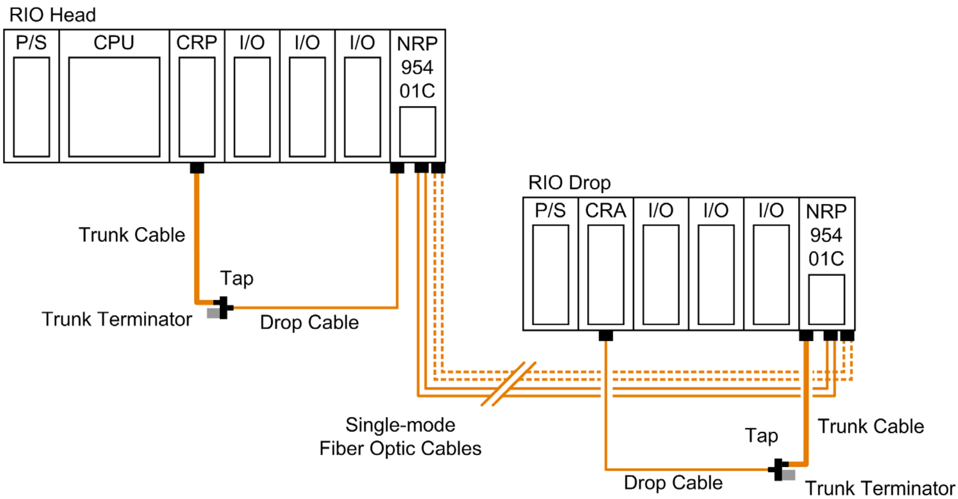
NOTE:
- Using 2 optical fiber pairs provides a better service and diagnostics.
- Using only one fiber pair, looping back the unused optical ports with a short fiber helps using the diagnostics.

For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

Backplane Integration

Instead of placing each fiber optic repeater modules with its own power supply module(s) in a standalone backplane, you can take the advantage of the quantum form factor.

The following figure shows two segments of RIO coaxial cable connected point-to-point by two 140 NRP 954 01C fiber optic repeaters placed on the Quantum racks where the RIO head and RIO drop modules are located:



NOTE:
- Using 2 optical fiber pairs provides a better service and diagnostics.
- Using only one fiber pair, looping back the unused optical ports with a short fiber helps using the diagnostics.

For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

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.

Observing Safety Precautions

Before installing the 140 NRP 954 01C fiber optic repeater module, read the warning messages below. Follow them at all times during the installation of the fiber optic repeater.

⚠ DANGER
SEVERE EYE DAMAGE
Do not view the ends of fiber optic cable under magnification while a transmit signal is present on the cable.
Failure to follow these instructions will result in death or serious injury.

NOTICE
INOPERABLE EQUIPMENT
Do not remove the protective coverings from the optical cable port and optical cable tips until immediately fiber cable connection to the cable port.
After removing the protective coverings, never touch exposed parts such as the ferrule.
After connecting the fiber cable, retain the protective coverings for future use.
Do not remove the protective covering from the unused connector.
Failure to follow these instructions can result in equipment damage.

Before Starting

Prior to installing 140 NRP 954 01C fiber optic repeater, network cables must be prepared and installed to the repeater's site with their connectors.

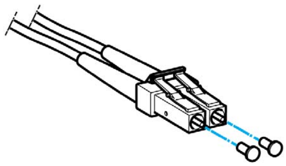
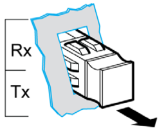
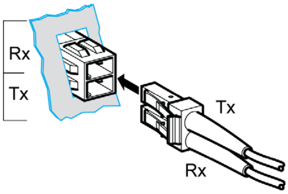
To prepare optic cables:

- Follow the cable manufacturer's recommendations for routing, installing, and testing the cable. Take care when terminating the ends of each fiber optic cable in order to minimize loss of optical signal. Follow the manufacturer's guidelines for installing optical connectors.
- Test the cable for proper attenuation prior to the connection of the fiber optic repeaters. The cable ends should be accessible at each fiber optic installation site. Allow sufficient cable length for a service loop and strain reliefs.
- Label each cable end to facilitate future maintenance.

To prepare and install coaxial cables, refer to *Remote I/O Cable System Planning and Installation Guide*.

Connecting the Fiber Optic Cable

Install the fiber optic cable to the 140 NRP 954 01C module's LC duplex connectors as described in the following table:

Step	Action
1	Remove the dust plugs from the LC connectors of the fiber optic cable as shown in the following figure. Save the dust plugs for future use. 
2	Inspect and clean the fiber optic end faces of the LC connectors.
3	Remove the dust plugs from the LC duplex connector as shown in the following figure: 
4	Immediately attach the fiber optic cable to the LC duplex connector of the module as shown in the following figure: 

Compatibility Rules

Depending on the PV (Product Version) and SV (Software Version) of the CRA modules, the 140 NRP 954 01C may be incompatible.

The following table gives the compatibility rules between the 140 NRP 954 01C and CRA modules:

CRA Module Reference	PV	SV	Compatibility	
			Communication	Remote OS Update via S908 Bus
140 CRA 93• 00	≤ 08	2.0	Yes	Yes
	09	2.0	No(1)	No(2)
	≥ 10	2.01	Yes	No(2)

PV Product version
SV Software version

(1) An upgrade of the SV to 2.01 makes the module communication compatible.
NOTE: Upgrading the software version of the CRA module from 2.0 to 2.01 for CRA modules PV 09 is mandatory before using 140 NRP 954 01C in the RIO network.

(2) For CRA module with SV ≥2.0, OS update is only possible out of the RIO network.

The 140 CRA 93• 00 firmware upgrade is done through Modbus or Modbus Plus using the Control Expert OS loader tool. The procedure to follow is described in the *Quantum Operating System Upgrade and Update Procedure*.

General Specifications

Introduction

This section gives the 140 NRP 954 01C fiber optic repeater module specifications.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
Do not exceed any of the rated values specified in the following tables.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

General Specifications

Bus Current Required	750 mA
Power Dissipation (Typical)	5 W
Inrush Current	1.8 A typical @ 5 Vdc
Data Transfer Rate	1.544 Mb for remote I/O with Manchester encoded data
Bit Error Rate	10^{-9} over specified Optical Receiver Dynamic Range
Optical Interface	LC-Type connector
Wavelength	1300 nm
Power Loss Budget (includes 3 dB of system margin)	9/125 µm fiber –8.0 dB
Maximum Distance for Point–to–Point Connection	16 km over 9/125 µm fiber @ 0.45 dB/km
Limits in Bus or Self-Healing Ring Configurations	12 fiber optic repeater modules with a maximum length of fiber optic cables of 16 km (back-loop included in Self-healing ring configuration). **NOTE:** The maximum length is between the CRP module (the farther one in a Hot Standby (HSBY) system) and the last CRA module.
Coaxial Interface	F type female connector with a right-angle F adapter connector **NOTE:** Required torque to fasten the right-angle F adapter is 0.46...0.60 N•m (4.1...5.3 lbf-in).
Coaxial Termination	Internal 75 ohms
Coaxial Shield	Tied to ground
Coaxial Dynamic Range	35 dB
Coaxial Sensitivity	70 mV pk-pk max
Relay Diagnostic	Rated at 220 Vac 6 A / 30 Vdc 5 A

NOTICE

DESTRUCTION OF ADAPTER

- Before tightening the locknut to the torque 0.46...0.60 N•m (4.1...5.3 lbf-in) be sure to properly position the right-angle F adapter connector.
- During tightening be sure to maintain the connector securely.
- The locknut must be loosened before handling the connector. For this reason, it is recommended to attach the S908 coaxial cable to the chassis to avoid any mechanical stress on the right-angle F adapter connector.
- Do not tighten the right-angle F adapter beyond the specified torque.

Failure to follow these instructions can result in equipment damage.

Optical Transmitter Specifications

Optical Power (Measured with 1 m test fiber)	–8.0...–15.0 dBm average power in 9/125 µm fiber cable
Rise/Fall Time	20 nsec or better
Silence (OFF Leakage)	–45 dBm

Optical Receiver Specifications

Receiver Sensitivity	–25 dBm average power
Dynamic Range	20 dB
Detected Silence	–45 dBm

Reliability

MTBF	1,300,000 hours (minimum) @ 30 °C, assuming fixed ground and component stress within maximum specifications.

Part III
Quantum Distributed I/O (DIO) Drop Modules

Introduction

This part provides information on the following Quantum DIO modules:

DIO Module	Source Voltage	Communication Channels	Bus Current Required
140 CRA 211 10	115/230 VAC	1	3 A
140 CRA 212 10	115/230 VAC	2	3 A
140 CRA 211 20	24 VDC	1	3 A
140 CRA 212 20	24 VDC	2	3 A

Quantum DIO is implemented over a Modbus Plus network. The CPU or NOM modules may be the network head via their Modbus Plus ports. 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.

NOTE: In the DIO rack with 140 CRA 211 x0 module, 140 DSI 353 00 module must not be used.

What Is in This Part?

This part contains the following chapters:

Chapter 9
Software Configuration

Configuring a Quantum DIO Drop

Introduction

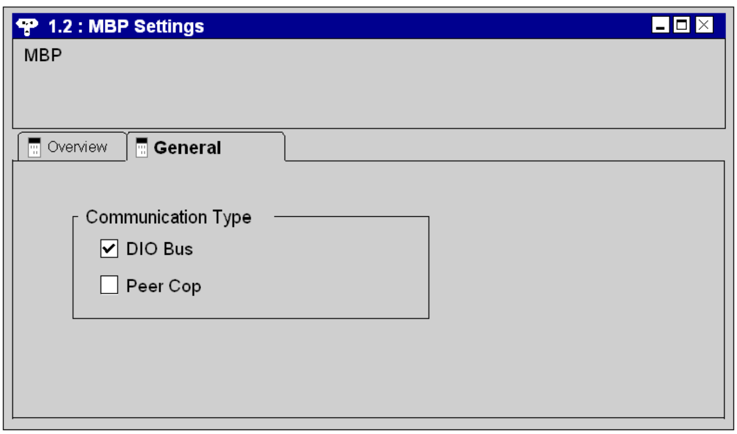
A Quantum DIO Drop consists of a standard module rack installed with I/O modules and a 140 CRA 21• •0 Modbus Plus communication module.

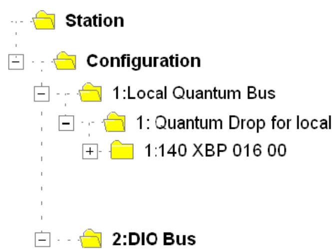
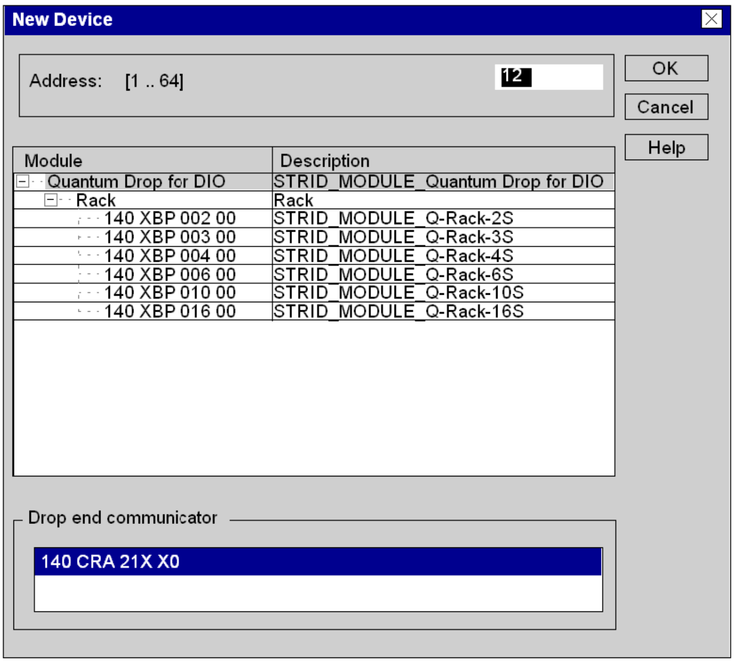
A DIO Bus can either be connected to the Modbus Plus connection on the CPU, or to a 140 NOM 2•• 00 communication module.

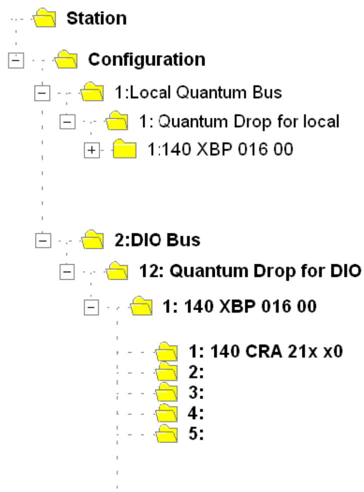
NOTE: The Quantum DIO Drop Modules 140 CRA 2•• ••• have no health bits.
For this reason the status for a properly functioning DIO Drop is always ZERO and not ONE as it is for other modules!

Adding a DIO Bus

The following table describes the procedure for adding a DIO Bus.

Step	Action
1	Select the Modbus Plus connection that you want to configure as a DIO Bus from the Project Browser or in the hardware configuration window. The following configuration window is opened: 

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>2</td><td>Activate the DIO Bus check box in the configuration window and confirm your entry.
A DIO Bus is placed in the Project Browser:

</td></tr>
<tr><td>3</td><td>Open the DIO Bus and select add module rack and select New Device.
The module rack selection list is opened:

</td></tr>
</table>

Step	Action
4	Select the desired module rack and enter the Modbus Plus address in the address field. Confirm with OK. A DIO Drop is placed in the Project Browser. The number set, 12 in our example, states the Modbus Plus address of the Drop. The Modbus Plus Coupler 140 CRA 21X X0 is automatically entered in slot 1: 
5	To continue configuring the RIO Drop you can carry on as with configuring a local I/O.

Modbus Plus Address

Ensure that the Modbus Plus Station Address that you have entered in the software configuration matches the hardware addresses of the modules used.

Chapter 10
140 CRA 211 10: DIO Drop Module 115/230 VAC (single channel)

Purpose

This chapter contains information of the 140 CRA 211 10 Module.

What Is in This Chapter?

This chapter contains the following topics:

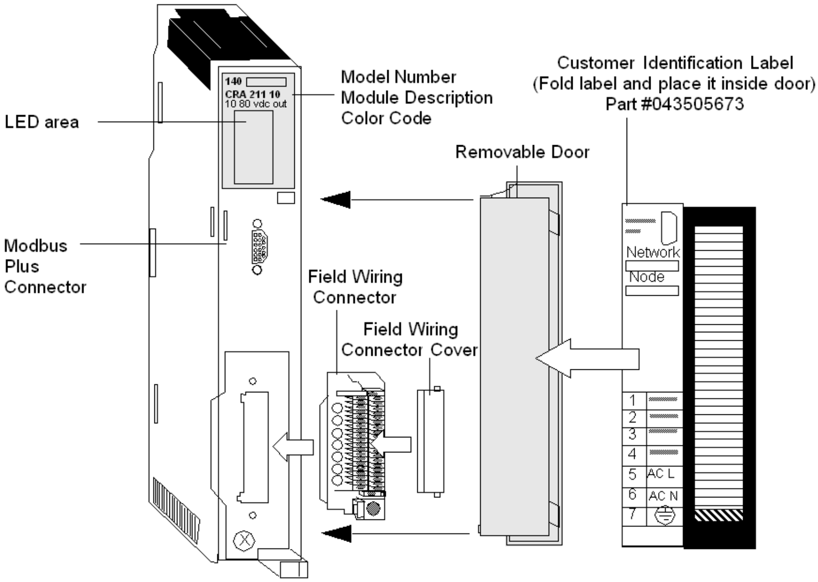
Presentation

Function

The 140 CRA 211 10 is a single channel Distributed I/O Interface, connected via a twisted pair Modbus Plus cable network. This DIO Drop Module provides the I/O with power from a 115/230 VAC source.

Illustration

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



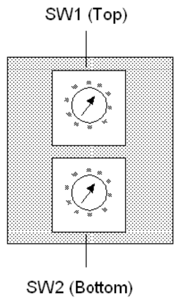
Rear Panel Switches

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 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.

Rear Panel Switches Figure

The following figure shows the SW1 top switch and the SW2 bottom switch.



Rear Panel Switches Table

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

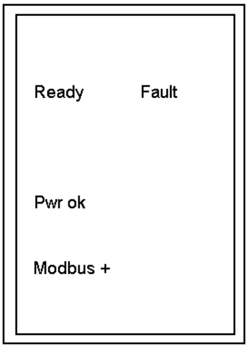
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

NOTE: Only addresses from 1 to 64 are valid.
If "0" or an address greater than 64 is selected, the "Modbus+" LED comes ON, steady, indicating that an invalid address was selected.

Indicators

Illustration

The following figure shows the LED panel.



Description

The following table shows the DIO LED indicators and 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.

Specifications

General Specifications

General Specifications

Operating Mode	Standalone or not powered
Internal Power Dissipation	2.0 W + 3.0 V x I_{BUS} (where I_{BUS} is in Amperes)
Protection	Over Current, Over Voltage
Communication	1 Modbus Plus port (single cable)
Field Wiring Connector	7 point terminal strip (Part # 043506326)
I/O Type	Quantum
Modules/Drop	Depends on bus current loading and word count
Words	30 IN / 32 OUT. (Two additional IN words are reserved for drop status.)

Input

Input

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.

Output to Bus

Output to Bus

Voltage	5.1 VDC
Current	3 A
Minimum Load	0 A
Fusing (external)	1.5 A (Part # 043502515 or equivalent)

Diagnostics

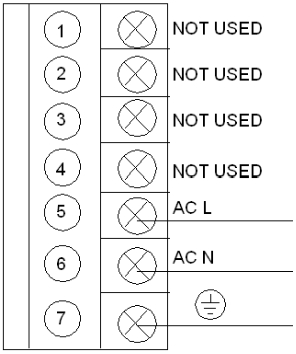
Diagnostics

Power Up	RAM RAM Address Executive Checksum
Runtime	RAM RAM Address Executive Checksum

Wiring Diagram

Illustration

The following figure shows the wiring diagram for the 140 CRA 211 10



NOTE: Follow the Power and Grounding Guidelines of the *Quantum using EcoStruxure™ Control Expert, Hardware Reference Manual* and *Electrical installation guide* recommendations.

Chapter 11
140 CRA 212 10: DIO Drop Module 115/230 VAC (dual channel)

Purpose

This chapter contains information of the 140 CRA 212 10 Module.

What Is in This Chapter?

This chapter contains the following topics:

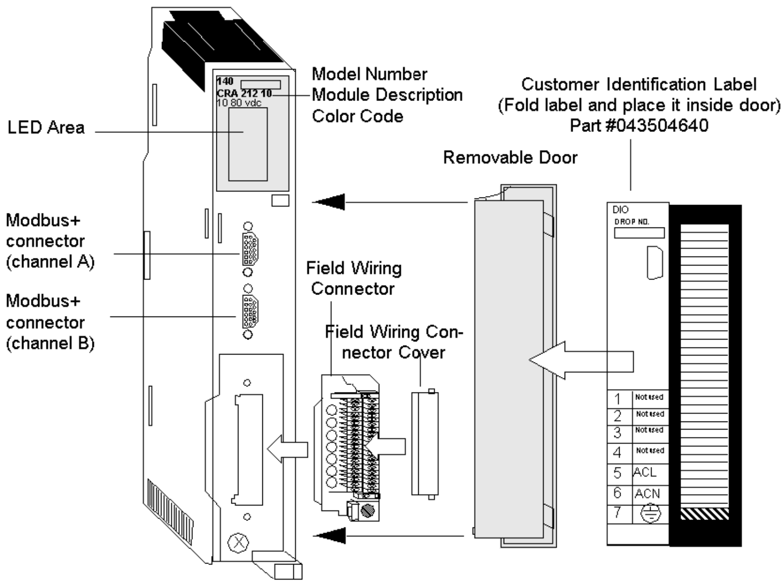
Presentation

Function

The 140 CRA 212 10 is a dual channel Distributed I/O Interface, connected via a twisted pair Modbus Plus cable network. This DIO Drop Module provides the I/O with power from a 115/230 VAC source.

Illustration

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



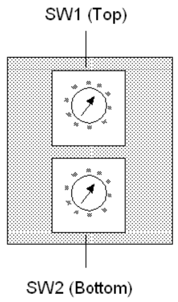
Rear Panel Switches

Two rotary switches (refer to the illustration and table below) are located on the rear panel of the CPU. Use them to set 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 the sample address of 11.

Rear Panel Switches Figure

The following figure shows the SW1 top switch and the SW2 bottom switch.



Rear Panel Switches Table

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

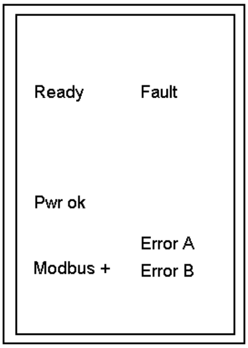
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

NOTE: Only addresses from 1 to 64 are valid.
If "0" or an address greater than 64 is selected, the "Modbus+" LED comes ON, steady, indicating that an invalid address was selected.

Indicators

Illustration

The following figure shows the LED panel.



Description

The following table shows the DIO LED indicators and 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
Error B	Red	Communication error on the Modbus Plus Channel B

Specifications

General Specifications

General Specifications

Operating Mode	Standalone or not powered
Internal Power Dissipation	2.0 W + 3.0 V x I_{BUS} (where I_{BUS} is in Amperes)
Protection	Over Current, Over Voltage
Communication	2 Modbus Plus ports (dual cable)
Field Wiring Connector	7 point terminal strip (Part # 043506326)
I/O Type	Quantum
Modules/Drop	Depends on bus current loading and word count
Words	30 IN / 32 OUT. (Two additional IN words are reserved for drop status.)

Input

Input

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.

Output to Bus

Output to Bus

Voltage	5.1 VDC
Current	3 A
Minimum Load	0 A
Fusing (external)	1.5 A (Part # 043502515 or equivalent)

Diagnostics

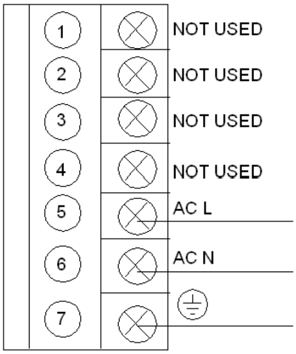
Diagnostics

Power Up	RAM RAM Address Executive Checksum
Runtime	RAM RAM Address Executive Checksum

Wiring Diagram

Illustration

The following figure shows the wiring diagram for the 140 CRA 212 10



NOTE: Follow the Power and Grounding Guidelines of the *Quantum using EcoStruxure™ Control Expert, Hardware Reference Manual* and *Electrical installation guide* recommendations.

Chapter 12
140 CRA 211 20: DIO Drop Module 24 VDC (single channel)

Purpose

This chapter contains information of the 140 CRA 211 20 Module.

What Is in This Chapter?

This chapter contains the following topics:

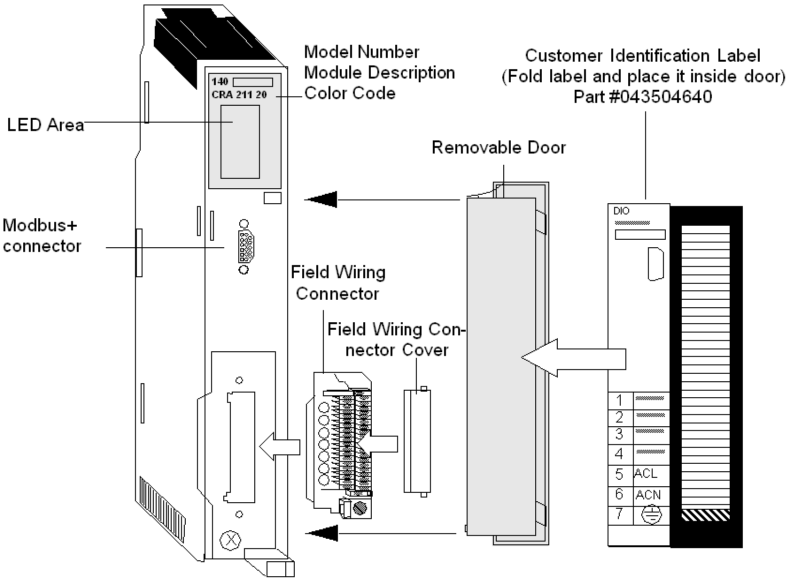
Presentation

Function

The 140 CRA 211 20 is a single channel Distributed I/O Interface, connected via a twisted pair Modbus Plus cable network. This DIO Drop Module provides the I/O with power from a 24 VDC source.

Illustration

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



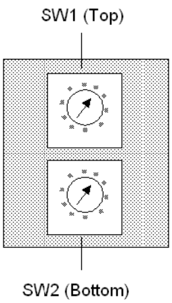
Rear Panel Switches

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 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.

Rear Panel Switches Figure

The following figure shows the SW1 top switch and the SW2 bottom switch.



Rear Panel Switches Table

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

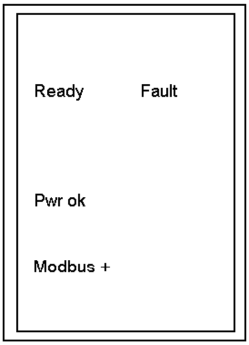
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

NOTE: Only addresses from 1 to 64 are valid.
If "0" or an address greater than 64 is selected, the "Modbus+" LED comes ON, steady, indicating that an invalid address was selected.

Indicators

Illustration

The following figure shows the LED panel.



Description

The following table shows the DIO LED indicators and 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.

Specifications

General Specifications

General Specifications

Operating Mode	Standalone
Internal Power Dissipation	2.0 W + 3.0 V x I_{BUS} (where I_{BUS} is in Amperes)
Protection	Over Current, Over Voltage
Communication	1 Modbus Plus ports (single cable)
Field Wiring Connector	7 point terminal strip (Part # 043506326)
I/O Type	Quantum
Modules/Drop	Depends on bus current loading and word count
Words	30 IN / 32 OUT. (Two additional IN words are reserved for drop status.)

Input

Input

Input Voltage	20 ... 30 VDC
Input Current	1.6 A
Inrush Current	30 A
Input Power Interruption	1.0 ms max.

Output to Bus

Output to Bus

Voltage	5.1 VDC
Current	3 A
Minimum Load	0 A
Fusing (external)	2.5 A (Part # 043502515 or equivalent)

Diagnostics

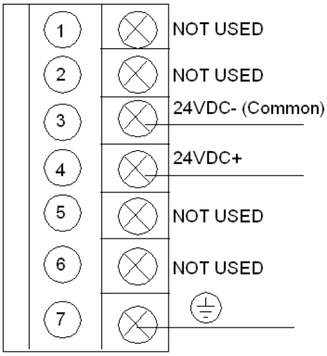
Diagnostics

Power Up	RAM RAM Address Executive Checksum
Runtime	RAM RAM Address Executive Checksum

Wiring Diagram

Illustration

The following figure shows the wiring diagram for the 140 CRA 211 20 module



NOTE: Follow the Power and Grounding Guidelines of the *Quantum using EcoStruxure™ Control Expert, Hardware Reference Manual* and *Electrical installation guide* recommendations.

Chapter 13
140 CRA 212 20: DIO Drop Module 24 VDC (dual channel)

Purpose

This chapter contains information of the 140 CRA 212 20 Module.

What Is in This Chapter?

This chapter contains the following topics:

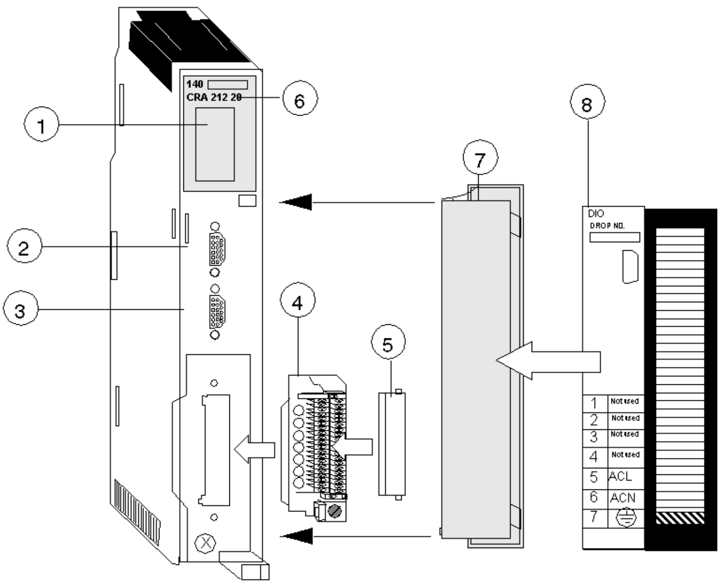
Presentation

Function

The 140 CRA 212 20 is a dual channel Distributed I/O Interface, connected via a twisted pair Modbus Plus cable network. This DIO Drop Module provides the I/O with power from a 24 VDC source.

Illustration

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



1 LED Area
2 Modbus Plus Connector (Channel A)
3 Modbus Plus Connector (Channel B)
4 Field Wiring Connector
5 Field Wiring Connector Cover
6 Model Number, Module Description, Color Code
7 Removable Door
8 Customer Identification Label (Fold label and place it inside door)

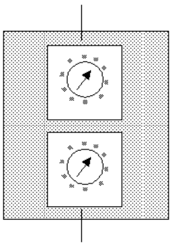
Rear Panel Switches

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 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.

Rear Panel Switches Figure

The following figure shows the SW1 top switch and the SW2 bottom switch.



Rear Panel Switches Table

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

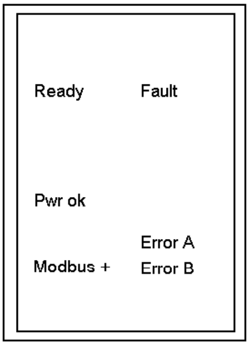
Node Address	SW1	SW2
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

NOTE: Only addresses from 1 to 64 are valid.
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.

Indicators

Illustration

The following figure shows the LED panel.



Description

The following table shows the DIO LED indicators and 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
Error B	Red	Communication error on the Modbus Plus Channel B

Specifications

General Specifications

General Specifications

Operating Mode	Standalone
Internal Power Dissipation	2.0 W + 3.0 V x I_{BUS} (where $_{IBUS}$ is in Amperes)
Protection	Over Current, Over Voltage
Communication	2 Modbus Plus ports (dual cable)
Field Wiring Connector	7 point terminal strip (Part # 043506326)
I/O Type	Quantum
Modules/Drop	Depends on bus current loading and word count
Words	30 IN / 32 OUT. (Two additional IN words are reserved for drop status.)

Input

Input

Input Voltage	20 ... 30 VDC
Input Current	1.6 A
Inrush Current	30 A
Input Power Interruption	1.0 ms max.

Output to Bus

Output to Bus

Voltage	5.1 VDC
Current	3 A
Minimum Load	0 A
Fusing (external)	2.5 A (Part # 043502515 or equivalent)

Diagnostics

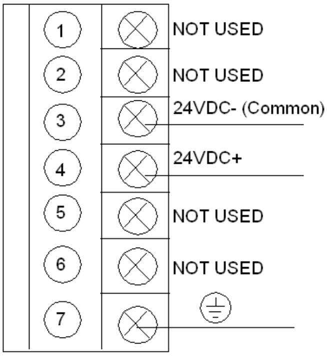
Diagnostics

Power Up	RAM RAM Address Executive Checksum
Runtime	RAM RAM Address Executive Checksum

Wiring Diagram

Illustration

The following figure shows the wiring diagram for the 140 CRA 212 20 module



NOTE: Follow the Power and Grounding Guidelines of the *Quantum using EcoStruxure™ Control Expert, Hardware Reference Manual* and *Electrical installation guide* recommendations.

Part IV
Modbus Plus Network Option Modules (NOM)

Introduction

This part provides information on the following Quantum Network Option modules:

Module	Communication Channels	Bus Current Required
140 NOM 211 00	1 Modbus (RS-232) serial port 1 Modbus Plus network (RS-485) port	780 mA
140 NOM 212 00	1 Modbus (RS-232) serial port 2 Modbus Plus network (RS-485) ports	780 mA
140 NOM 252 00	1 Modbus (RJ45) port 2 Modbus Plus on fiber (consisting of optical receiver and transmitter)	750 mA

NOTE: More information is provided in the Modicon Modbus Plus Network, Planning and Installation Guide *(see page 13)*.

What Is in This Part?

This part contains the following chapters:

Chapter 14
140 NOM 211 00: Modbus Plus Option Module

Purpose

This chapter contains information of the 140 NOM 211 00 Module.

What Is in This Chapter?

This chapter contains the following topics:

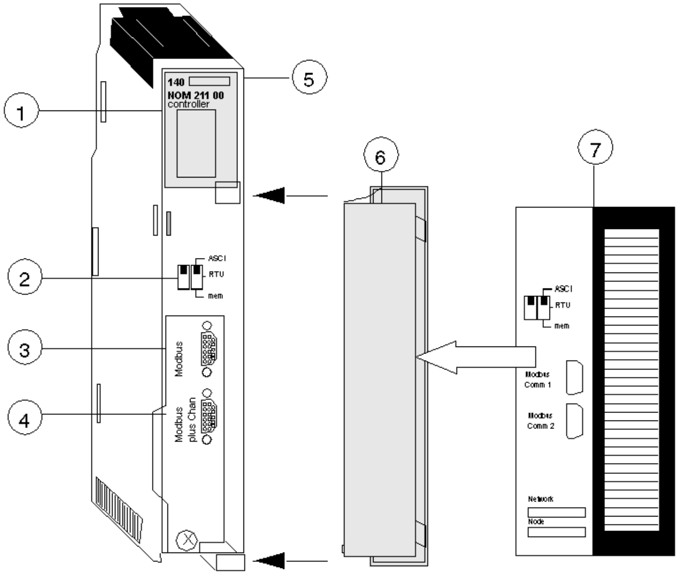
Presentation

Function

The 140 NOM 211 00 is a single channel Network Option Modul (NOM), connected via a twisted pair Modbus Plus cable network

Illustration

The following figure shows the parts of the Modbus Plus 140 NOM 211 00 modules.

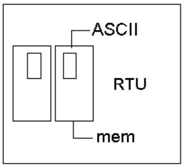


1 LED Area
2 Comm Parameter Slide Switch
3 Modbus Connector
4 Modbus Plus Connector
5 Model Number, Module Description, Color Code
6 Removable door
7 Customer Identification Label, (Fold label and place it inside door)

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 below.

The following figure shows the front panel switches.



NOTE: If the left-hand switch is in the upper position and right-hand switch is set to mem then, as of firmware version 2.20, bridge mode is deactivated. This means that the network connection between Modbus and Modbus Plus is locked.
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 conected, as well as log into any nodes on the Modbus Plus network.

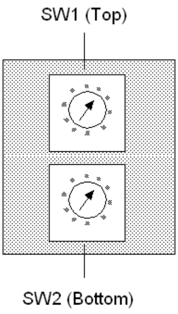
Rear Panel Switches

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.

SW1 and SW2 Switches Figure

The following figure shows the SW1 and SW2 switches.



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.

SW1 and SW2 Address Settings

The following table shows the address settings for the 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	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.

ASCII Comm Port Parameters

The following table shows the fixed setting of the 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

The following table shows the 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

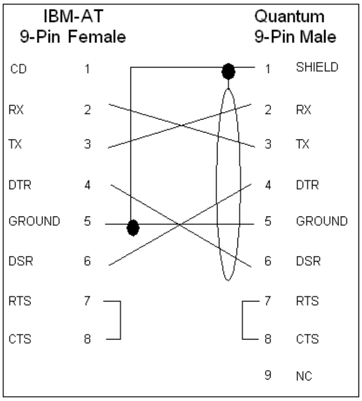
The following table shows the valid comm port parameters.

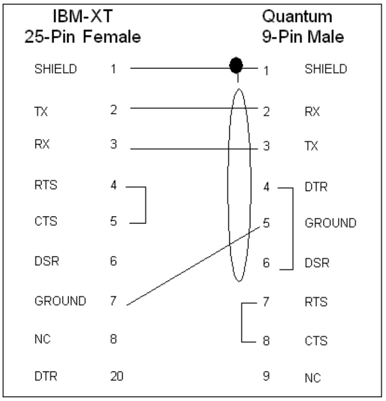
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
Data Bits	7 / 8	
Stop Bits	1 / 2	
Parity	Enable/Disable Odd/Even	
Device Address	Rear panel rotary switch setting	

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 is the Modbus port pinout connections for 9-pin and 25-pin connections.

The following figures show the Modbus port pinout connections for 9-pin (left) and 25-pin (right).



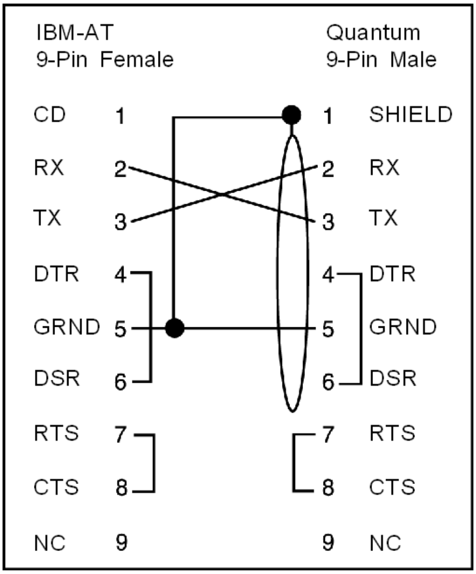


The following is the abbreviation key for the above figure.

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

Modbus Ports Pinout Connections for Portable Computers

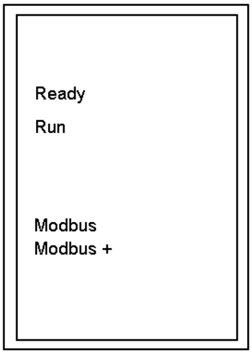
The following figure shows the Modbus port pinout connections for 9-pin portable computers.



Indicators

Illustration

The following figure shows the Modbus Plus NOM LED indicators.



Description

The following table shows the Modbus Plus NOM 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.
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 Codes

Error Codes Table

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).

The following table shows the blinking run LED error codes for the NOM module.

Number of Blinks	Code	Error
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
	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 powerup
	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 chkmst_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

Specifications

General Specifications

General Specifications

Power Dissipation	4 W
Bus Current required	750 mA (max.)

Communication Ports

Communication Ports

1 Modbus Plus network (RS-485) port (9-pin connector)	
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.

Diagnostics

Diagnostics

Power Up	RAM RAM Address Executive Checksum Processor
Runtime	RAM RAM Address Executive Checksum Processor

Chapter 15
140 NOM 212 00: Modbus Plus Option Module

Purpose

This chapter contains information of the 140 NOM 212 00 Module.

What Is in This Chapter?

This chapter contains the following topics:

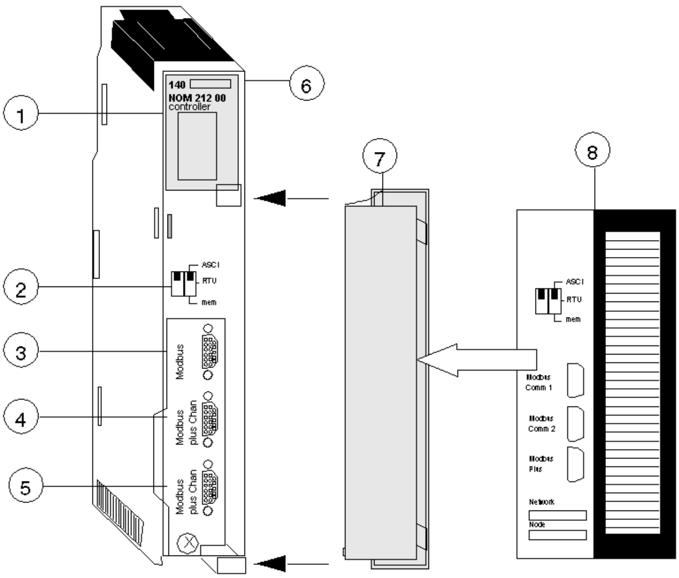
Presentation

Function

The 140 NOM 212 00 is a dual channel Network Option Modul (NOM), connected via a twisted pair Modbus Plus cable network

Illustration

The following figure shows the parts of the Modbus Plus 140 NOM 212 00 modules.

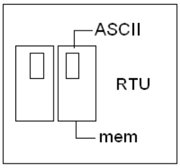


1 LED Area
2 Comm Parameter Slide Switch
3 Modbus Connector
4 Modbus Plus Connector (Chan A)
5 Modbus Plus Connector (Chan B)
6 Model Number, Module Description, Color Code
7 Removable door
8 Customer Identification Label, (Fold label and place it inside door)

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 below.

The following figure shows the front panel switches.



NOTE: If the left-hand switch is in the upper position and right-hand switch is set to mem then, as of firmware version 2.20, bridge mode is deactivated. This means that the network connection between Modbus and Modbus Plus is locked.
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 conected, as well as log into any nodes on the Modbus Plus network.

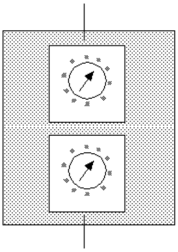
Rear Panel Switches

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.

SW1 and SW2 Switches Figure

The following figure shows the SW1 and SW2 switches.



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.

SW1 and SW2 Address Settings

The following table shows the address settings for the 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	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.

ASCII Comm Port Parameters

The following table shows the fixed setting of the 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

The following table shows the 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

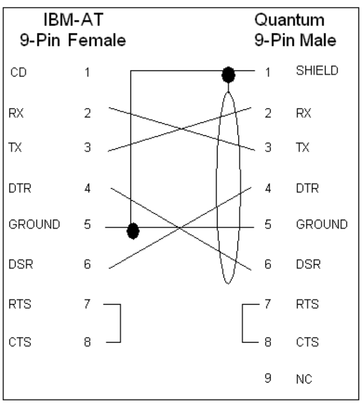
The following table shows the valid comm port parameters.

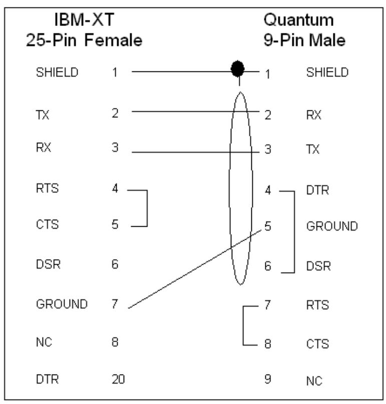
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
Data Bits	7 / 8	
Stop Bits	1 / 2	
Parity	Enable/Disable Odd/Even	
Device Address	Rear panel rotary switch setting	

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 is the Modbus port pinout connections for 9-pin and 25-pin connections.

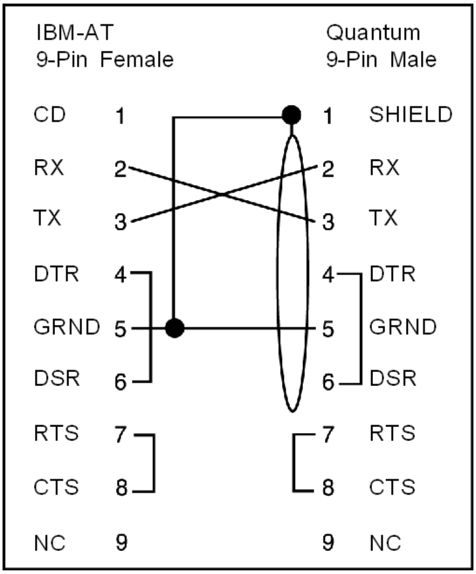
The following figures show the Modbus port pinout connections for 9-pin (left) and 25-pin (right).





Modbus Ports Pinout Connections for Portable Computers

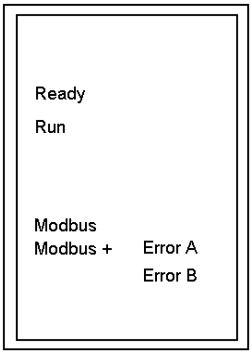
The following figure shows the Modbus port pinout connections for 9-pin portable computers.



Indicators

Illustration

The following figure shows the Modbus Plus NOM LED indicators.



Description

The following table shows the Modbus Plus NOM 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.
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
Error B	Red	There is an error condition on Cable B

Error Codes

Error Codes Table

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).

The following table shows the blinking run LED error codes for the NOM module.

Number of Blinks	Code	Error
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
	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 powerup
	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 chkmst_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

Specifications

General Specifications

General Specifications

Power Dissipation	4 W (typical)
Bus Current required	780 mA

Communication Ports

Communication Ports

2 Modbus Plus network (RS-485) port (9-pin connector)	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
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.

Diagnostics

Diagnostics

Power Up	RAM RAM Address Executive Checksum Processor
Runtime	RAM RAM Address Executive Checksum Processor

Chapter 16
140 NOM 252 00: Modbus Plus Option Module 10Base-FL

Purpose

This chapter contains information of the 140 NOM 252 00 Module.

What Is in This Chapter?

This chapter contains the following topics:

Presentation

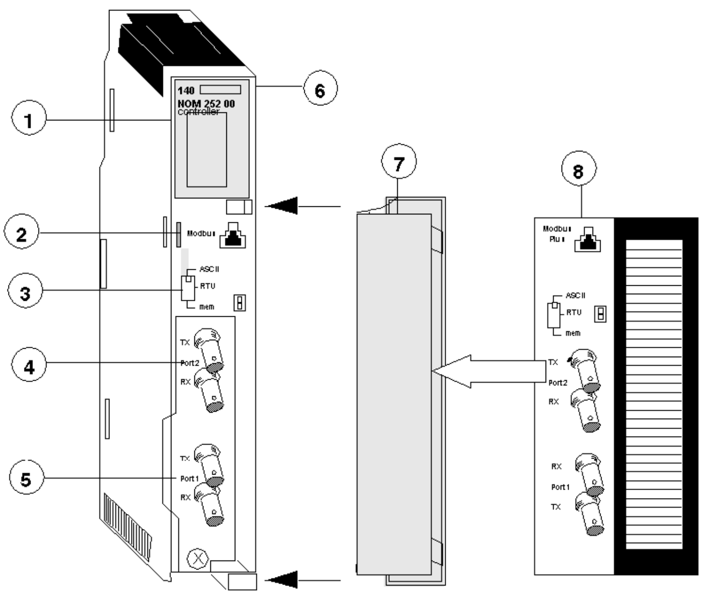
Overview

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 benefits 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

Illustration

The following figure shows the parts of the Modbus Plus 140 NOM 252 00 module.

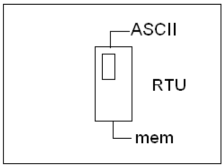


1 LED Area
2 Modbus Connector
3 Comm Parameter Slide Switch
4 Port 2 TX and RX Connectors
5 Port 1 TX and RX Connectors
6 Model Number, Module Description, Color Code
7 Removable door
8 Customer Identification Label, (Fold label and place it inside door)

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. Three options are available, as shown below.

The following figure shows the front panel switch.



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

The following table shows the fixed setting of the 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

The following table shows the 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

The following table shows the 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	

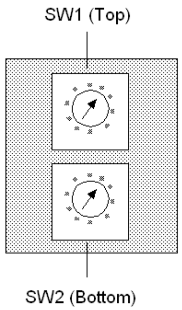
Rear Panel Switches

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.

SW1 and SW2 Switches Figure

The following figure shows the SW1 (top) and SW2 (bottom) switches.



SW1 and SW2 Address Settings

The following figure shows the node address settings for the 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	1 ... 4

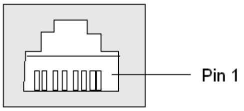
NOTE: If "0" or an address greater than 64 is selected, the Modbus + LED will be "on" steady, to indicate the selection of an invalid address.

Modbus Connector

The NOM 252 00 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.

Modbus pin 1 Figure

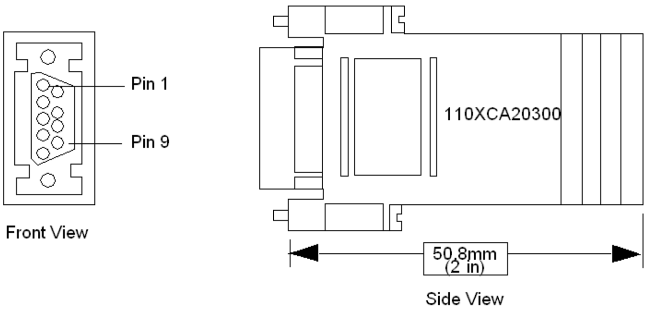
The following figure shows the NOM 252 00 Pin 1 connector.



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).

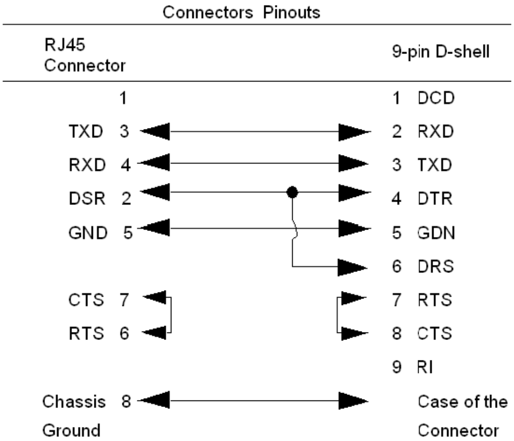
Pinouts Figures

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



Connector Pinouts Figure

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

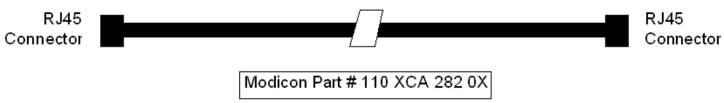


BJ45 Cable Types

This following shows an example of the 110 XCA 282 0X cable. A table is also provided which includes part numbers and cable lengths.

RJ45 Connector Figure

The following figure shows the RJ45 connector (Modicon Part # 110 XCA 282 OX).



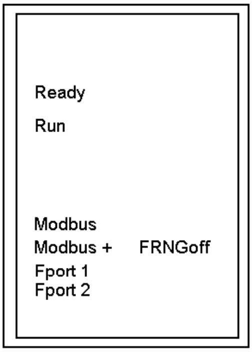
BJ45 Cable Part Numbers Table

Cable Part Numbers	Cable Lengths
110 XCA 282 01	3 ft. (0.91 m)
110 XCA 282 02	10 ft. (3 m)
110 XCA 282 03	20 ft. (6 m)

Indicators

Illustration

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



Description

The following table shows the Modbus Plus on fiber 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. Note: 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.

Fiber Optic Cable Connections

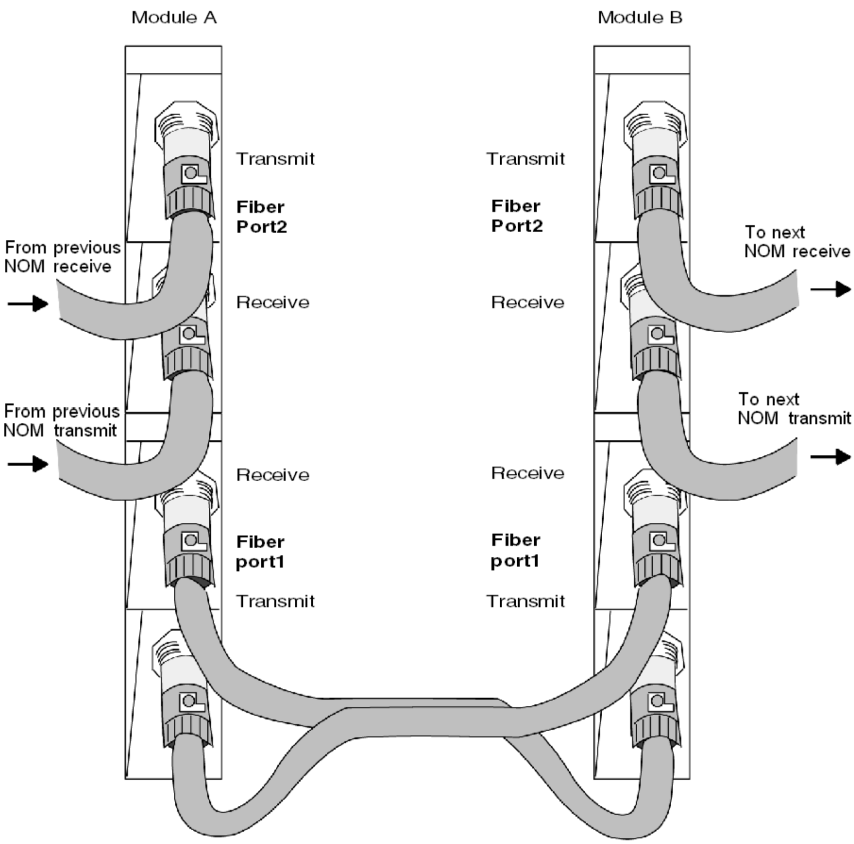
Fiber Optic Cable Connections

The NOM 252 00 module is connected in the Quantum system by a fiber optic cable (see below). The cable has two strands. Each module transmits a uni-directional signal. 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 marked at 10-inch (25 cm) intervals with the manufacturer's name and the cable specifications. This is the only way to distinguish the two strands.

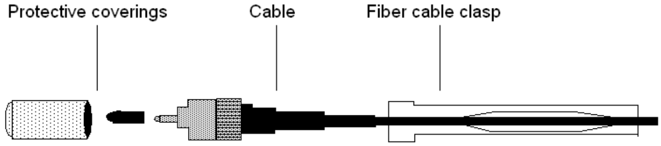
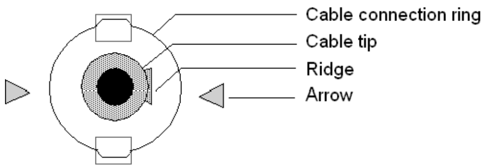
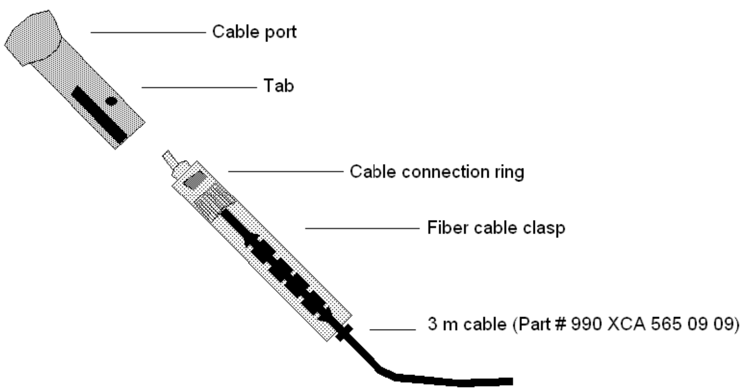
Fiber Optic Cable Connections Figure

The following figure shows the fiber optic cable connections.



Connecting the Fiber Optic Cable

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

Step	Action
1	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. 
2	Turn the connection ring so that one of the arrows on the side of the ring lines up with the ridge inside. 
3	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 line up 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. 

Fiber Optic Configurations

Here are four typical configurations that show the wide range of the network architecture:

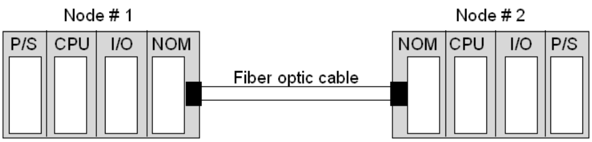
- Point-to-point connection
- Bus configuration
- Tree configuration
- Self-healing ring configuration

Point-to-Point Configuration

This type of configuration (see below) allows communication over the distance of up to 3 km through harsh industrial environments.

Point-to-Point Configuration Example Figure

The following figure shows the point-to-point configuration.



Bus Configuration

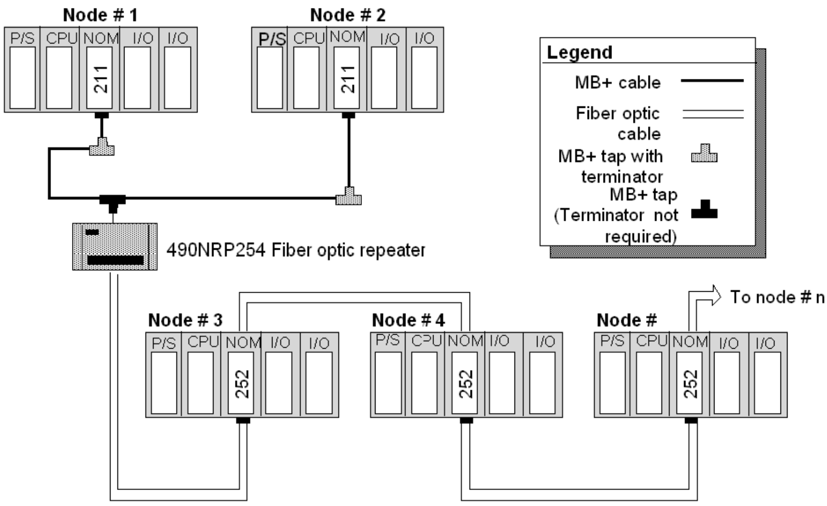
This type of configuration is used when it is required to connect a number of fiber nodes and can be used to increase the distance of a standard Modbus Plus network by changing to a fiber medium. This kind of network allows the connection of up to 32 Quantum NOM 252 nodes over the distance of 5 km.

The following illustrations show the NOM 252 00 module in a mixed fiber optic/twisted pairs bus configuration network and a straight fiber optic bus configuration network.

NOTE: The loss of a single node in this configuration disables the rest of the network.

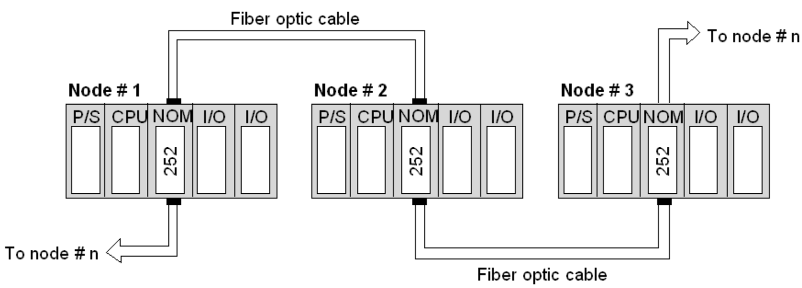
Bus Configuration Example 1

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



Bus Configuration Example 2

The following figure shows the straight fiber optic network.



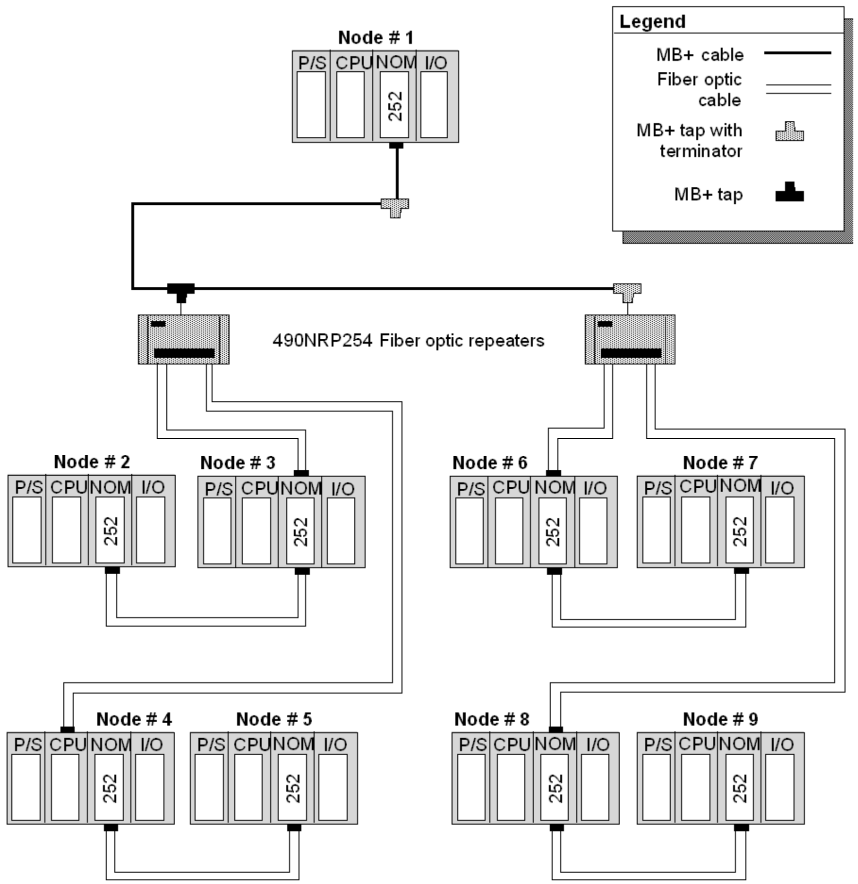
NOTE: The distance between nodes on fiber is limited by the maximum allowable power loss from end-to-end (3 km over 62.5 mm fiber). Power loss includes the fiber optic cable attenuation, connector losses at the Fiber Optic Receiver and Transmitter ports, and the system margin of 3 dB. In this configuration, the end NOM 252 00 in this configuration will have the FRNGoff LED active. It also displays the Cable B Framing error in the MBPSTAT (in ladder logic).

Tree Configuration

Using tree configurations allows for greater flexibility in the layout of Modbus Plus and NOM 252 00 networks. The following illustrations are samples tree configurations. Additional repeaters may be connected in order to extend communication between electrical links.

Tree Configuration Example

The following figure shows the tree configuration.

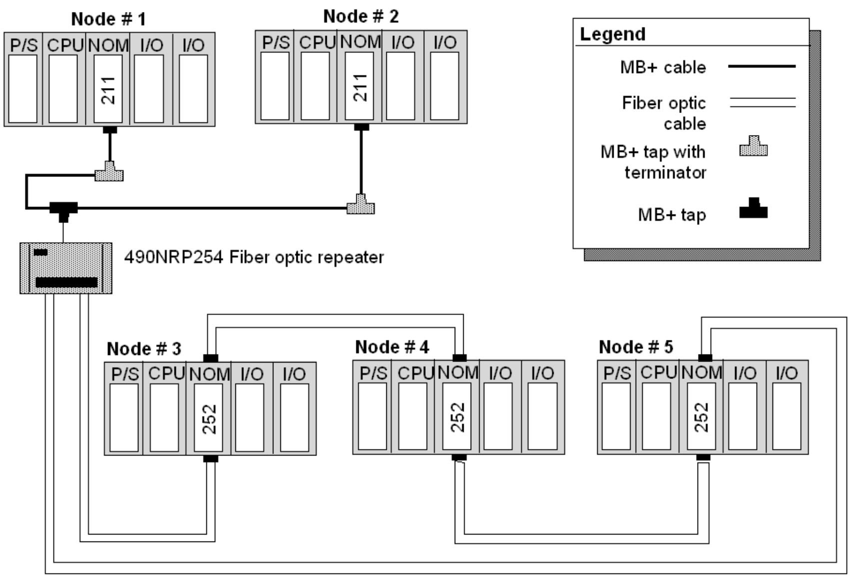


Self-healing Ring Configuration

This configuration can be achieved by connecting the unused fiber optic ports of the first and last NOM 252 00 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 maintain communication.

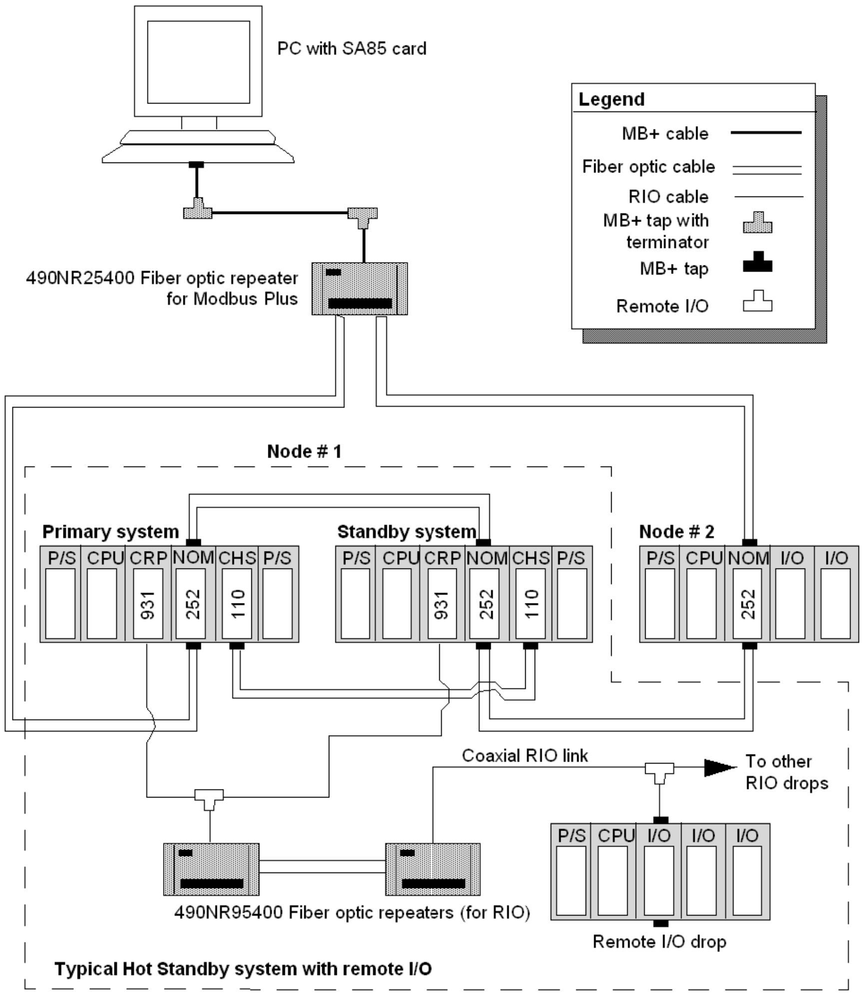
Self-healing Ring Configuration Example

The following figure shows a self-healing ring configuration example.



Hot Standby Systems Figure

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



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 the existing 140 NOM 212 00 reports the loss of the redundant cable.

The break in the fiber cable will be detected by the module not receiving the signal from the cable break side. The incident will be reported by MBPSTAT as a Cable B Framing error. This condition also activates the FRNGoff LED on the module front.

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 are able to provide guidelines on product compatibility.

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 (eoxy)	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

Other Tools Table

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	Allows the use of above source and meter to test raw fiber (two required)

Cables

It is recommended that you use 62.5/125 mm 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 52-0370-000 cable.

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 NOM 252 00 on fiber cable, adding a new mode 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, disconnect the fiber optic cables from one side of the existing NOM 252 module, and connect to port 1 or 2 of the new node. Additional fiber optic cable then needs to be connected to the second port of the new NOM 252 and to the next NOM 252 in the network. Finally, hot-swap the new NOM 252 to the backplane.

Repairing the Break in the Cable

Because the NOM 252 00 will stop transmitting in the direction from which it receives no signal, replaceing a broken fiber optic cable and reconnectioning do not suffice to re-establish communication over that segment. Hot-swapping only one NOM 252 at the repaired connections is required to complete the connection.

NOTE: Breakage of any fiber connectors or fiber optic cables is the equivalent to breaking the trunk cable in a copper-based Modbus Plus network.

For the self-healing ring configuration, repairing the first break in the fiber optic network has to be scheduled when one of the units on either side of the repaired break can be hot-swapped, without creating further problems by disconnecting the node.

NOTE: Self-healing configurations are not considered as redundant networks. Redundant networks yield a high system availability.

Calculations

Use the following formula to calculate the number of NOM 252 00 modules in a fiber network:

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 NOM 252 is 5 nsec max.
3	Jitter contributed by fiber optic repeaters (if used) is 40 nsec.
4	Use the following formula to determine the number (N) of chained repeaters: $N = \frac{200\text{nsec} - X(L)\text{nsec} - 40\text{nsec}}{5n\text{sec}} + 1$ 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 micron meters 5 ns/km for 62.5/125 micron meters 7.5 ns/km for 100/140 micron meters

Specifications

General Specifications

General Specifications

Power Dissipation	4 W (typical)
Bus Current required	780 mA
External Power	Not required

Communication Ports

Communication Ports

Optical Ports	2 (consisting of an optical receiver and transmitter)
Modbus Port	1 RJ45 (phone jack-type) connector

Diagnostics

Diagnostics

Power Up	RAM RAM Address Executive Checksum Processor
Runtime	RAM RAM Address Executive Checksum

Optical Transmission

Optical Transmission

Interface	ST-Type connector
PulseWidth Disstortion and Jitter	5 ns or better
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

Optical Transmitter Specifications

Optical Transmitter Specifications

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

Optical Receiver Specifications

Optical Receiver Specifications

Receiver Sensitivity	-30 dBm average power
Dynamik range	-20 dB
Detected Silence	-36 dBm

Part V
Quantum Ethernet Modules

Introduction

This part provides information about the different Ethernet modules of the Quantum product series.

What Is in This Part?

This part contains the following chapters:

Chapter 17
140 NOE xxx xx: Ethernet Module General Overview

At a Glance

This chapter contains general information about the 140 NOE ••• •• and 140 NWM 100 00 Ethernet modules.

What Is in This Chapter?

This chapter contains the following topics:

General Information

Introduction

This part provides information on the following Quantum Ethernet Modules:

Ethernet Module	Communication Channels	Bus Current Required
140 NOE 211 00	1 10Base-T Ethernet network (RJ-45) port	1 A
140 NOE 251 00	1 10Base-FL Ethernet network (ST-45) port	1 A
140 NOE 311 00	One 10BASE-T Ethernet network (RJ45) port.	1 A
140 NOE 351 00	Two 10BASE-FL Ethernet network (ST-style) port.	1 A
140 NOE 771 00	100 BASE-FX Fiber optics (MT-RJ) port 10/100BASE-T (RJ-45) port	750 mA
140 NOE 771 01	100 BASE-FX Fiber optics (MT-RJ) port 10/100BASE-T (RJ-45) port	750 mA
140 NOE 771 10 FactoryCast	100 BASE-FX Fiber optics (MT-RJ) port 10/100BASE-T (RJ-45) port	750 mA
140 NOE 771 11 FactoryCast	100 BASE-FX Fiber optics (MT-RJ) port 10/100BASE-T (RJ-45) port	750 mA
140 NWM 100 00	100 BASE-FX Fiber optics (MT-RJ) port 10/100BASE-T (RJ-45) port	900 mA

TCP/IP Ethernet Modules

Quantum TCP/IP Ethernet 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.

Sy/Max Ethernet Modules

Quantum Sy/Max Ethernet modules are Interfaces that can be placed in a Quantum backplane, to connect Quantum controllers to Sy/Max devices and applications.

Modicon Quantum Ethernet Modules Overview

Overview

The following information provides overviews of all Modicon Quantum Ethernet modules.

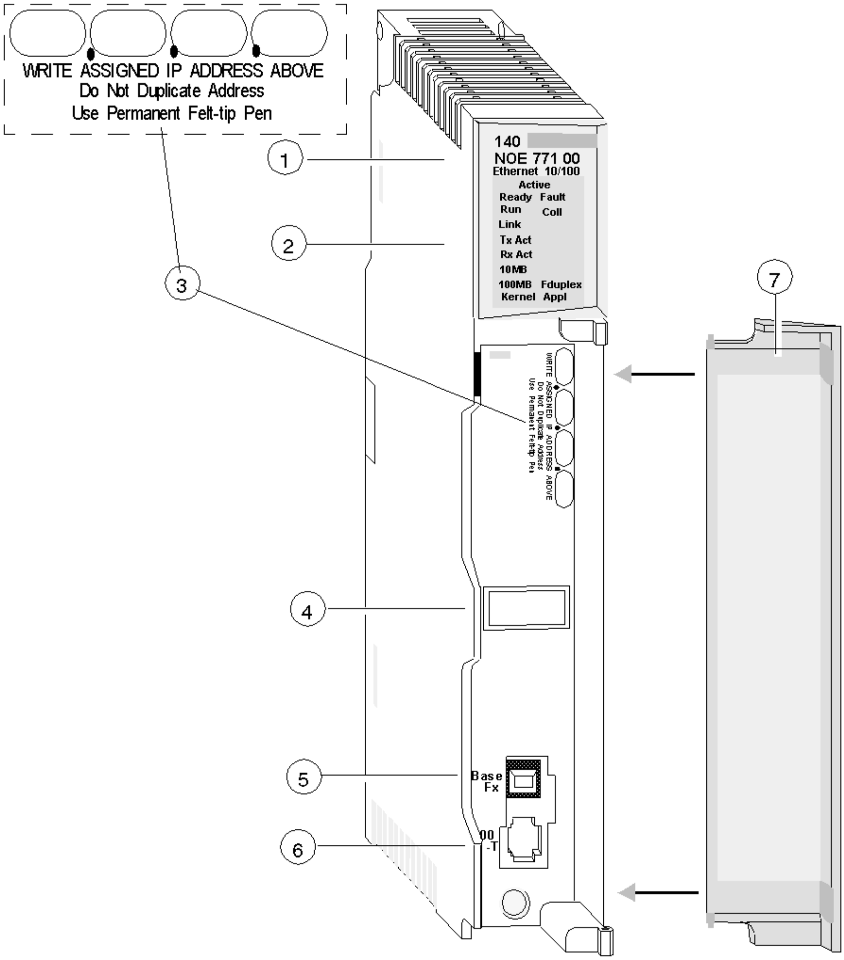
General Description

The Modicon Quantum Ethernet module, shown below, is one of the latest models in a line of Modicon Quantum Ethernet TCP/IP modules designed to make it possible for a Modicon Quantum PLC to communicate with devices over an Ethernet network. The electronics for the Ethernet modules are contained in a standard Modicon Quantum single-width case that takes up one slot in a Modicon Quantum backplane. The module, which is capable of being hot swapped, can be plugged into any available slot in the backplane.

The NOE 771 *x*0 and NOE 771 *x*1 modules provide real-time peer-to-peer communications and I/O scanning and a Modbus/TCP server. The included HTTP services provide maintenance and configuration utilities to the module.

Front View

The following figure shows the front of the NOE 771 00 Ethernet module as an example for all Ethernet modules.



1 model number, module description, color code
2 LED display
3 IP Address writable area
4 Global address label
5 100 BASE-FX MT-RJ cable connector
6 10/100 BASE-T RJ45 cable connector
7 removable door

Key Ethernet Services

The key Ethernet services of the 140 NOE 771 (-00, -01, -10, -11) and 140 NWM 100 00 models are listed below:

Service	-00	-01	-10	-11	NWM
HTTP Server *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*	X	X	X	X	X
FTP Server *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*	X	X	X	X	X
Flash File System *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*	X	X	X	X	X
BOOTP Client *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*	X	X	X	X	X
Address Server *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*	X	X	X	X	
SNMP V2 Agent (Network Management Service) *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*	X	X	X	X	X
Modbus Messaging *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*	X	X	X	X	X
I/O Scanner *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*	X	X		X	
Hot Standby		X		X	
Global Data (Publish/Subscribe) *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*		X		X	
Bandwidth Monitoring *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*		X		X	
Fast Device Replacement (Server) *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*		X		X	
Enhanced Web Diagnosis *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*		X		X	X

Service	-00	-01	-10	-11	NWM
Schneider Private MIB *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*		X		X	X
FactoryCast Application *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*			X	X	X
User-programmed Web pages			X	X	X
JAVA Virtual Machine					X
Fiber optic connection	X	X	X	X	
RJ45 connection	X	X	X	X	
Time Synchronization Service *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*				X	
Electronic Mail Notification Service *(see Quantum using EcoStruxure™ Control Expert, Ethernet Network Modules, User Manual)*		X		X	

NOTE: In the detailed description of the key features, only modules in the NOE family are named. The features are also available for the 140 NWM 100 00 module, depending on the listed properties in the above table.

NOTE: In Control Expert software, the 140 NWM 100 00 module is set in the TCP/IP Regular Network family, although it belongs to the TCP/IP FactoryCast network family. So, the services listed above (I/O scanning, Global Data, address server, Bandwidth monitoring) are not supported by the module. However, they can be selected in the TCP/IP regular network configuration in Control Expert. (Even if they are configured, those services won't work with the module.)

Maximum Number of Networks Per CPU

The following table summarizes the maximum number of networks per CPU, where "networks" means the sum of NOE, Modbus+ and any other communication modules:

Modicon Quantum CPU Type	Supported Number of Networks
140 CPU 311 10	2
140 CPU 434 12A	6
140 CPU 534 14A	6
140 CPU 651 50	6
140 CPU 651 50	6
140 CPU 652 60	6
140 CPU 658 60	6
140 CPU 670 60	3
140 CPU 671 60	6
140 CPU 672 60	6
140 CPU 672 61	6
140 CPU 678 61	6

Front Panel Components

The front panel of the Ethernet modules contains identification markings, color codes, and LED displays. A writable area for an IP address, a global address label, and two Ethernet cable connectors is located behind the removable front panel door.

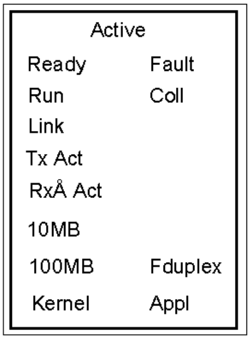
The following table provides a description of the front panel components that are shown in following figure:

Component	Description
LED Indicator Panel *(see page 192)*	Indicates the operating status of the module, and the fiber optic or Ethernet communications network to which it is connected.
IP Address Area	Provides a writable area to record the module's assigned IP address.
Global Address Label	Indicates the module's global Ethernet MAC address assigned at the factory.
100 BASE-FX Connector	Provides an MT-RJ socket for connection to a 100-megabit fiber-optic Ethernet cable.
10/100 BASE-T Connector	Provides an RJ45 socket for connection to a shielded, twisted pair Ethernet cable.

Indicators for Ethernet Modules

Illustration

The following figure shows the NOE 771 00 LED indicators as a placeholder for all other Ethernet modules:



Description

The following table shows the LED descriptions:

LED	Color	Description
Active	Green	Indicates the backplane is configured.
Ready	Green	Indicates module is healthy.
Fault	Red	Flashes when the NOE is in crash state.
Run	Green	Flashes to indicate diagnostic code, as described below.
Coll.	Red	Flashes when Ethernet collisions occur.
Link	Green	On when Ethernet link is active.
Tx Act	Green	Flashes to indicate Ethernet transmission.
Rx Act	Green	Flashes to indicate Ethernet reception.
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		On when Ethernet is operating in the full duplex mode.
Kernel	Amber	On when in Kernel Mode. Flashing while in download 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 in both the 140 NOE 771x1 module and the 140 NWM 100 module.

Indicator State	Status for 140NOE771x1	Status for 140NWM100
On (steady)	Normal operation: The NOE module is ready for network communication.	Normal operation: The NOE module is ready for network communication.
Number of flashes in sequence		
1	Not used	Not used
2	Not used	Not used
3	No Link: the network cable is not connected or is defective	No Link: the network cable is not connected or is defective
4	Duplicate IP address: The module will be set to its default IP address.	Duplicate IP address: The module will stay off-line.
5	No IP address: The module is attempting to obtain an IP address from a BOOTP server. Module is set to its default IP address.	No IP address: The module is attempting to obtain an IP address from a BOOTP server.
6	Invalid IP configuration. (Likely cause: Default gateway is not on the same subnet mask.) Module is set to its default IP address.	Using default IP address
7	No valid executive NOE present	No valid executive NOE present
8	Not used	Not used
9	-	Flash file system inoperative.

Chapter 18
140 NOE 211 x0: TCP/IP 10Base-T Ethernet Module

Purpose

This chapter contains information of the 140 NOE 211 x0 Module.

NOTE: For detailed information see also *Product Related Information,* *page 14*, User Guide for the Quantum NOE 211/251 Ethernet Module

What Is in This Chapter?

This chapter contains the following topics:

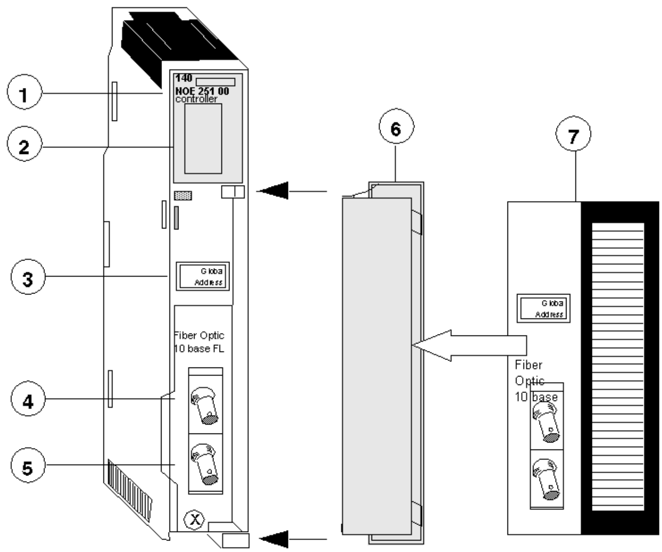
Presentation

Function

The Ethernet TCP/IP module for twisted pair cabling provides an interface to Ethernet networks for the Quantum Automation Series system.

Illustration

The following figure shows the Ethernet TCP/IP NOE 211 x0 module.

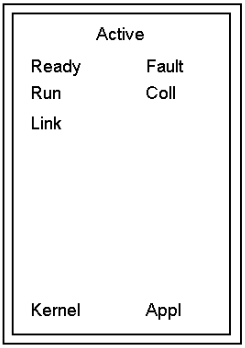


1 Model Number, Module Description, Color Code
2 LED Display
3 Global Address Label
4 Transmit Cable Connector
5 Receive Cable Connector
6 Removable door
7 Customer Identification Label, (Fold label and place it inside door)

Indicators

Illustration

The following figure shows the NOE 211 x0 LED indicators.



Description

The following table shows the NOE 211 x0 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.

Specifications

Specifications Table

Specifications Table

Power Dissipation	5 W
Bus Current required	1 A
Protocol	Ethernet ports transmit and receive Modbus commands encapsulated in TCP/IP protocol.
Ports	One 10BASE-T Ethernet network (RJ-45) port.
Data Transfer Frequency	10 Mbps
Compatibility with Quantum Controllers	All, V2.0 at a minimum
Factory Cast	140 NOE 211 10 only

Installation

Installing the NOE Module

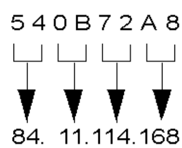
Quantum Ethernet TCP/IP modules come fully configured. However, before installing your module, you should make sure the default configuration is appropriate for your network.

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

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. **IEEE GLOBAL ADDRESS** 0000540B72A8
2	Note the rightmost eight digits. 
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.

Step	Action
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

UNEXPECTED EQUIPMENT BEHAVIOR

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 these instructions can result in injury or equipment damage.

CAUTION

UNEXPECTED EQUIPMENT BEHAVIOR

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 these instructions can result in injury or equipment damage.

Chapter 19
140 NOE 251 x0: TCP/IP 10Base-FL Ethernet Module

Purpose

This chapter contains information of the 140 NOE 251 x0 Module.

NOTE: For detailed information see also *Product Related Information,* *page 14*, User Guide for the Quantum NOE 211/251 Ethernet Module

What Is in This Chapter?

This chapter contains the following topics:

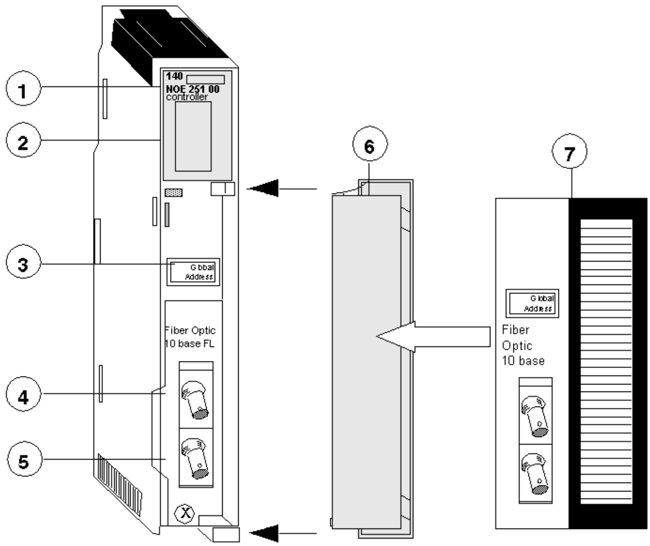
Presentation

Function

The Ethernet TCP/IP modules for fiber optic cabling provide an interface to Ethernet networks for the Quantum Automation Series system.

Illustration

The following figure shows the Ethernet TCP/IP NOE 251 x0 module.

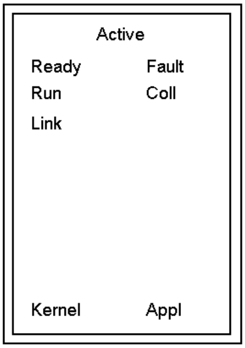


1 Model Number, Module Description, Color Code
2 LED Display
3 Global Address Label
4 Transmit Cable Connector
6 Receive Cable Connector
5 Removable door
6 Customer Identification Label, (Fold label and place it inside door)

Indicators

Illustration

The following figure shows the NOE 251 x0 LED indicators.



Description

The following table shows the NOE 251 x0 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.

Specifications

Specifications Table

Specifications Table

Power Dissipation	5 W
Bus Current required	1 A
Protocol	Ethernet ports transmit and receive Modbus commands encapsulated in TCP/IP protocol
Ports	One 10BASE-FL Ethernet network (ST-style) port.
Data Transfer Frequency	10 Mbps
Compatibility with Quantum Controllers	All, V2.0 at a minimum
Factory Cast	140 NOE 251 10 only

Installation

Installing the NOE Module

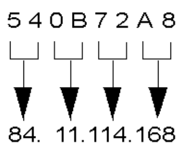
Quantum Ethernet TCP/IP modules come fully configured. However, before installing your module, you should make sure the default configuration is appropriate for your network.

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

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. **IEEE GLOBAL ADDRESS** 0000540B72A8
2	Note the rightmost eight digits. 
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.

Step	Action
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

UNEXPECTED EQUIPMENT BEHAVIOR

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 these instructions can result in injury or equipment damage.

⚠ CAUTION

UNEXPECTED EQUIPMENT BEHAVIOR

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 these instructions can result in injury or equipment damage.

Chapter 20
140 NOE 311 00: SY/MAX 10Base-T Ethernet Module

Purpose

This chapter contains information of the 140 NOE 311 00 Module.

NOTE: For detailed information see also *Product Related Information*, *page 14*, Quantum Sy/Max Ethernet Network Option Module Guide

What Is in This Chapter?

This chapter contains the following topics:

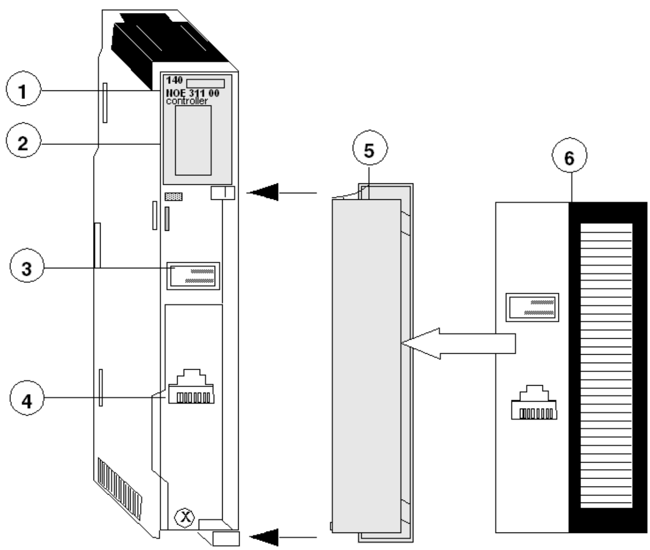
Presentation

Function

The Quantum SY/MAX Ethernet module for twisted pair cabling provides an interface for the Quantum Automation Series system to SY/MAX devices via Ethernet.

Illustration

The following figure shows the NOE 311 00 SY/MAX Ethernet module.



1 Model Number, Module Description, Color Code
2 LED Display
3 Global Address Label
4 RJ-45 Connector
5 Removable door
6 Customer Identification Label, (Fold label and place it inside door)

SY/MAX Addressing

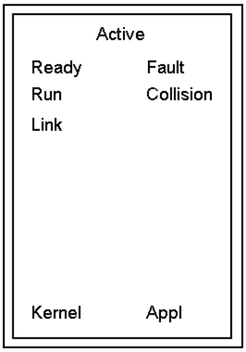
Be sure that the module is assigned a unique SY/MAX drop number during configuration.

⚠ WARNING
UNEXPECTED APPLICATION BEHAVIOR
Do assign a unique SY/MAX drop number during configuration.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Indicators

Illustration

The following figure shows the NOE 311 00 LED indicators.



Description

The following figure shows the NOE 311 00 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.

Specifications

General Specification

General Specification

Bus Current required	1 A
Communication Port	One 10BASE-T Ethernet network (RJ45) port.
Backplane Compatibility (Requires Quantum CPU)	3, 4, 6, 10, and 16 position backplanes
Compatibility SY/MAX 802.3 Devices and Software	Model 450 Model 650 SFI160 SFW390-VAX Streamline Version 1.3

Cable Type

Cable Type

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)

Wire Size

Wire Size

10Base-2 or ThinWire Ethernet	20 AWG
10Base-T (twisted pair)	22, 24, 26 AWG

Topology

Topology

10Base-2 or ThinWire Ethernet	Bus
10Base-T (twisted pair)	Star

Connector

Connector

10Base-2 or ThinWire Ethernet	BNC (UG-274)
10Base-T (twisted pair)	Modular RJ-45 (4 pins of 8 are used by 10Base- T

Chapter 21
140 NOE 351 00: SY/MAX 10Base-FL Ethernet Module

Purpose

This chapter contains information of the 140 NOE 351 00 Module.

NOTE: For detailed information see also *Product Related Information*, *page 14*, Quantum Sy/Max Ethernet Network Option Module Guide

What Is in This Chapter?

This chapter contains the following topics:

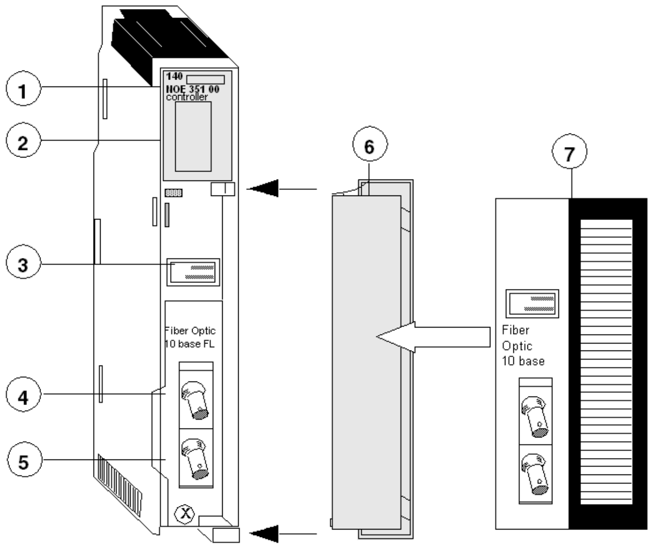
Presentation

Function

The Quantum SY/MAX Ethernet module for fiber optic cabling provides an interface for the Quantum Automation Series system to SY/MAX devices via Ethernet.

Illustration

The following figure shows the NOE 351 00 SY/MAX Ethernet module.



1 Model Number, Module Description, Color Code
2 LED Display
3 Global Address Label
4 Transmit Cable Connector
5 Receive Cable Connector
6 Removable door
7 Customer Identification Label, (Fold label and place it inside door)

SY/MAX Addressing

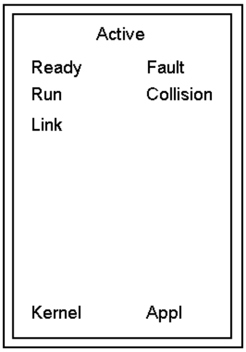
Be sure that the module is assigned a unique SY/MAX drop number during configuration.

⚠ WARNING
UNEXPECTED APPLICATION BEHAVIOR
Do assign a unique SY/MAX drop number during configuration.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Indicators

Illustration

The following figure shows the NOE 351 00 LED indicators.



Description

The following figure shows the NOE 351 00 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.

Specifications

General Specification

General Specification

Bus Current required	1 A
Communication Port	Two 10BASE-FL Ethernet network (ST-style) port.
Backplane Compatibility (Requires Quantum CPU)	3, 4, 6, 10, and 16 position backplanes
Compatibility SY/MAX 802.3 Devices and Software	Model 450 Model 650 SFI160 SFW390-VAX Streamline Version 1.3

Chapter 22
140 NOE 771 00: TCP/IP 10/100 Ethernet Module

Purpose

This chapter contains information of the 140 NOE 771 00 Module.

NOTE: For detailed information see also *Product Related Information*, *page 14*, User Guide for the Quantum NOE 771 Ethernet Module

What Is in This Chapter?

This chapter contains the following topics:

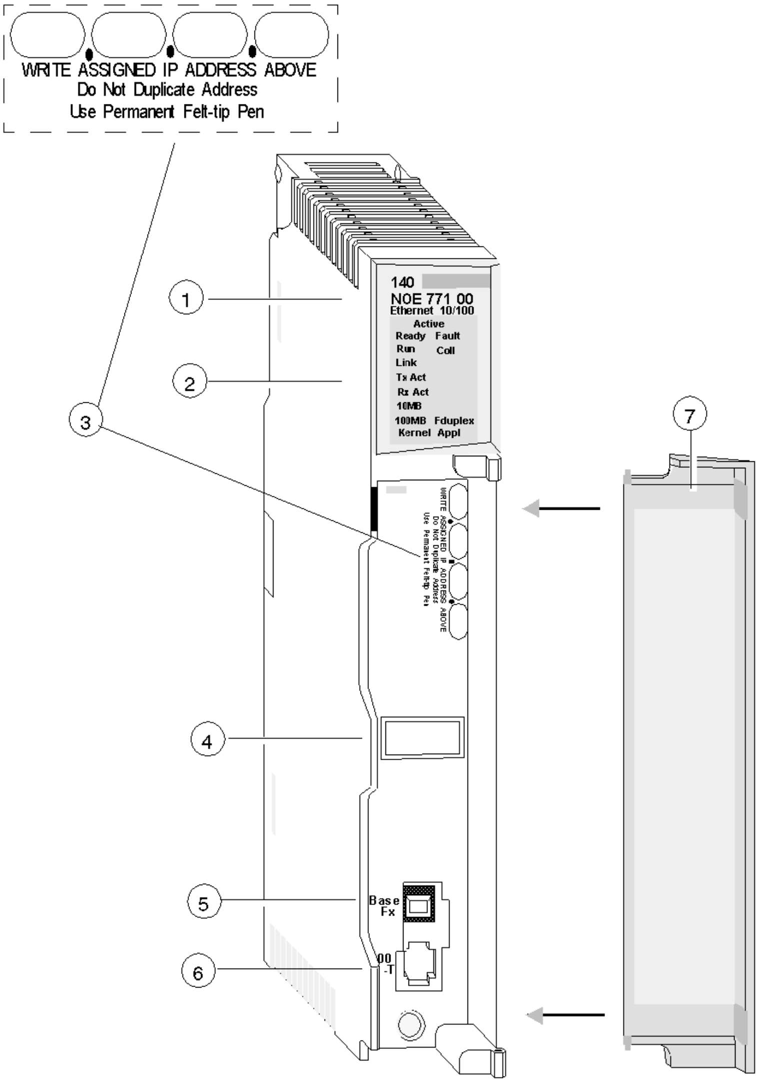
Presentation

Function

The Quantum 140 NOE 771 00,10/100 Ethernet module is the latest model in a line of Quantum Ethernet TCP/IP modules designed to make it possible for a Quantum Programmable Logic Controller (PLC) to communicate with devices over an Ethernet network.

Illustration

The following figure shows the front of the NOE 771 00 Ethernet module.



1 Model Number, Module Description, Color Code
2 LED Display
3 IP Address Writable Area
4 Global Address Label
5 100 Base Fx MT-RJ Cable Connector
6 10/100 Base-T RJ-45 Cable Connector
7 Removable door

Front Panel Components

The front panel of the NOE 771 00 module contains identification marking, color code, and LED display. A writable area for an Internet Protocol (IP) address, a global address label, and two Ethernet cable connectors is located behind the removable front panel door.

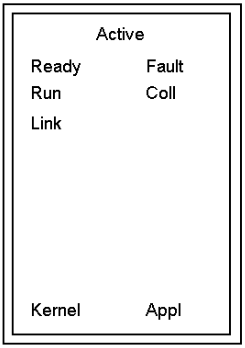
The following table provides a description of the front panel components which are shown in front view figure.

Component	Description
LED indicator Panel	Indicates the operating status of the module, and the fiber optic and Modbus communications networks it is connected to. (See *Indicators, page 223*)
IP Address Writable Area	Provides a writable area to record the module's assigned IP address.
Global Address Label	Indicates the module's global Ethernet MAC address assigned at the factory.
100 BASE-FX Connector	Provides an MT-RJ receptacle for connection to a 100 megabit fiber optic Ethernet cable.
10/100BASE-T Connector	Provides an RJ-45 receptacle for connection to a shielded, twisted pair Ethernet cable.

Indicators

Illustration

The following figure shows the 140 NOE 771 00 LED indicators.



Description

The following table shows the 140 NOE 771 00 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.

Specifications

Specifications Table

Specifications Table

Power Dissipation	3.8 W
Bus Current required	750 mA
Protocol	Ethernet ports transmit and receive Modbus commands encapsulated in TCP/IP protocol
Ports	One 100 BASE-FX Fiber optics (MT-RJ) port. One 10/100BASE-T (RJ-45) port.
Fuse	none
Factory Cast	no
I/O Scanner	yes

Chapter 23
140 NOE 771 01: TCP/IP 10/100 Ethernet Module

Purpose

This chapter contains information of the 140 NOE 771 01 Module.

What Is in This Chapter?

This chapter contains the following topics:

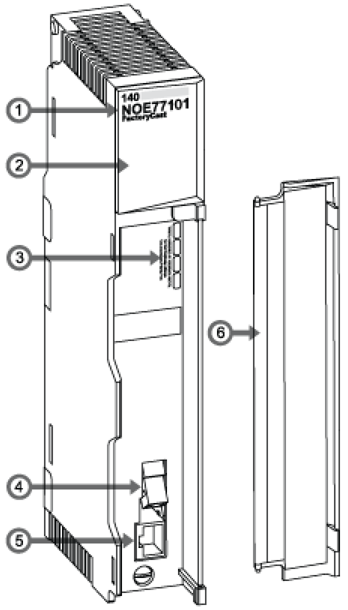
Presentation

Function

The Ethernet TCP/IP module for twisted pair cabling provides an interface to Ethernet networks for the Quantum Automation Series system.

Illustration

The following figure shows the Ethernet TCP/IP 140 NOE 771 01 module.

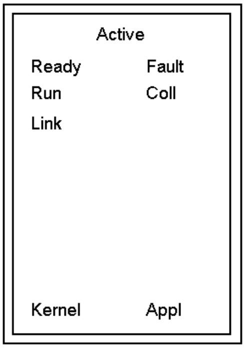


1 model number, module description, color code
2 LED display
3 global address label
4 MT-RJ fiber optic connector
5 RJ-45 connector
6 removable door

Indicators

Illustration

The following figure shows the 140 NOE 771 01 LED indicators.



Description

The following table shows the 140 NOE 771 01 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.

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.
Number of flashes in sequence	
one	Not used
two	Not used
three	No link. The network cable is not connected or is defective.
four	Duplicate IP address. The module is set to its default IP address.
five	No IP address. The module is attempting to obtain an IP address from a BootP server. The module is set to its default IP address.
six	Invalid IP configuration. (Likely cause: Default gateway is not on the same subnet mask. The module is set to its default IP address.)
seven	No valid executive NOE is present.

Specifications

Specifications Table

Specifications Table

Power Dissipation	3.8 W
Bus Current required	750 mA
Protocol	Ethernet ports transmit and receive Modbus commands encapsulated in TCP/IP protocol.
Ports	One 100 BASE-FX Fiber optics (MT-RJ) port. One 10/100BASE-T (RJ-45) port.
Compatibility with Quantum Controllers	All, V2.0 at a minimum
Factory Cast	no
I/O Scanner	yes

Chapter 24
140 NOE 771 10: TCP/IP 10/100 FactoryCast Ethernet Module

Purpose

This chapter contains information about the 140 NOE 771 10 Module.

What Is in This Chapter?

This chapter contains the following topics:

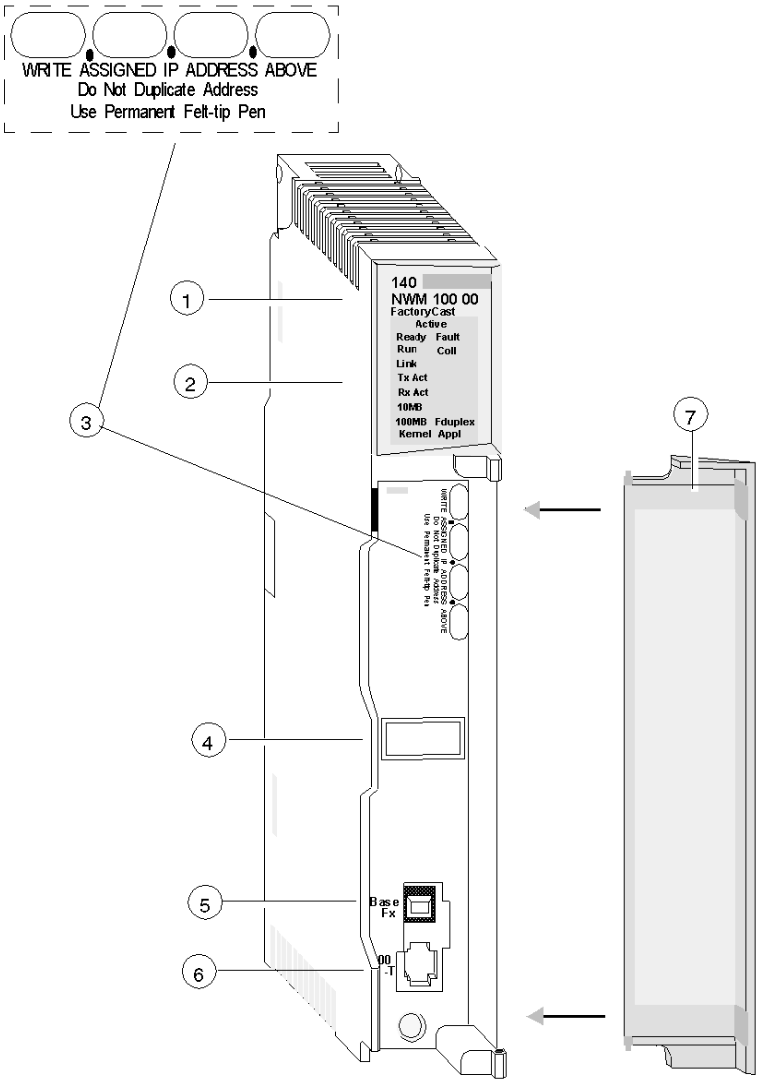
Presentation

Function

The Quantum 140 NOE 771 10,10/100 Ethernet module is the latest model in a line of Quantum Ethernet TCP/IP modules designed to make it possible for a Quantum Programmable Logic Controller (PLC) to communicate with devices over an Ethernet network.

Illustration

The following figure shows the front of the NOE 771 10 Ethernet module.



1 Model Number, Module Description, Color Code
2 LED Display
3 IP Address Writable Area
4 Global Address Label
5 100 Base Fx MT-RJ Cable Connector
6 10/100 Base-T RJ-45 Cable Connector
7 Removable door

Front Panel Components

The front panel of the NOE 771 10 module contains identification marking, color code, and LED display. A writable area for an Internet Protocol (IP) address, a global address label, and two Ethernet cable connectors is located behind the removable front panel door.

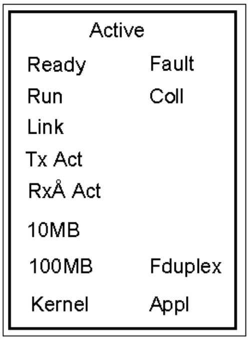
The following table provides a description of the front panel components which are shown in front view figure.

Component	Description
LED indicator Panel	Indicates the operating status of the module, and the fiber optic and Modbus communications networks it is connected to. (See Indicators in this
IP Address Writable Area	Provides a writable area to record the module's assigned IP address.
Global Address Label	Indicates the module's global Ethernet MAC address assigned at the factory.
100 BASE-FX Connector	Provides an MT-RJ receptacle for connection to a 100 Megabit fiber optic Ethernet cable.
10/100BASE-T Connector	Provides an RJ-45 receptacle for connection to a shielded, twisted pair Ethernet cable.

Indicators

Illustration

The following figure shows the NOE 771 10 LED indicators.



Description

The following table shows the NOE 771 10 LED descriptions.

LED	Color	Description
Active	Green	Indicates the backplane is configured.
Ready	Green	Indicates module is healthy.
Fault	Red	Flashes when Ethernet collisions occur.
Run	Green	Flashes to indicate diagnostic code, as described in "Run LED Status" (below).
Coll.	Red	Flashes when Ethernet collisions occur.
Link	Green	On when Ethernet link is active.
Tx Act	Green	Flashes to indicate Ethernet transmission.
Rx Act	Green	Flashes to indicate Ethernet reception.
Kernel	Amber	On when in Kernel Mode.
10MB	Green	On when the module is connected to a 10 Megabit network.
100MB	Green	
Fduplex		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 it provides diagnostic information for that state

Indicator State	Status
On (steady)	Normal operation: The NOE module is ready for network communication.
Number of flashes in sequence	
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

Specifications

Specifications Table

Specifications Table

Power Dissipation	3.8 W
Bus Current required	750 mA
Protocol	Ethernet ports transmit and receive Modbus commands encapsulated in TCP/IP protocol
Ports	One 100 BASE-FX Fiber optics (MT-RJ) port. One 10/100BASE-T (RJ-45) port.
Fuse	none
Factory Cast	yes
I/O Scanner	no

Chapter 25
140 NOE 771 11: TCP/IP 10/100 FactoryCast Ethernet Module

Purpose

This chapter contains information about the 140 NOE 771 11 Module.

What Is in This Chapter?

This chapter contains the following topics:

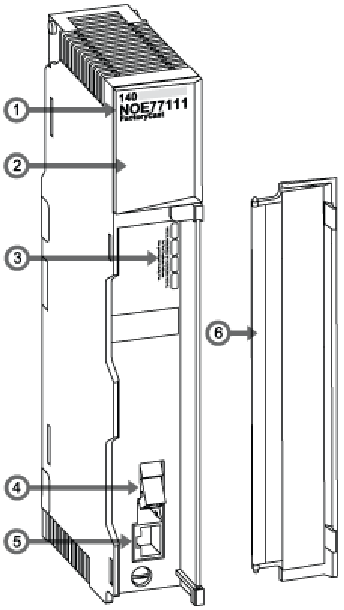
Presentation

Function

The Ethernet TCP/IP module for twisted pair cabling provides an interface to Ethernet networks for the Quantum Automation Series system.

Illustration

The following figure shows the Ethernet TCP/IP 140 NOE 771 11 module.

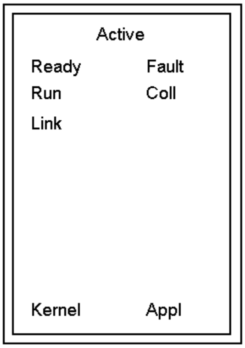


1 model number, module description, color code
2 LED display
3 global address label
4 MT-RJ fiber optic connector
5 RJ-45 connector
6 removable door

Indicators

Illustration

The following figure shows the 140 NOE 771 11 LED indicators.



Description

The following table shows the 140 NOE 771 11 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.

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.
Number of flashes in sequence	
one	Not used
two	Not used
three	No link. The network cable is not connected or is defective.
four	Duplicate IP address. The module is set to its default IP address.
five	No IP address. The module is attempting to obtain an IP address from a BootP server. The module is set to its default IP address.
six	Invalid IP configuration. (Likely cause: Default gateway is not on the same subnet mask. The module is set to its default IP address.)
seven	No valid executive NOE is present.

Specifications

Specifications Table

Specifications Table

Power Dissipation	3.8 W
Bus Current required	750 mA
Protocol	Ethernet ports transmit and receive Modbus commands encapsulated in TCP/IP protocol.
Ports	One 100 BASE-FX Fiber optics (MT-RJ) port. One 10/100BASE-T (RJ-45) port.
Compatibility with Quantum Controllers	All, V2.0 at a minimum
Factory Cast	yes
I/O Scanner	yes

Chapter 26
140 NWM 100 00: TCP/IP 10/100 FactoryCast HMI Ethernet Module

Purpose

This chapter contains information about the 140 NWM 100 00 Module.

What Is in This Chapter?

This chapter contains the following topics:

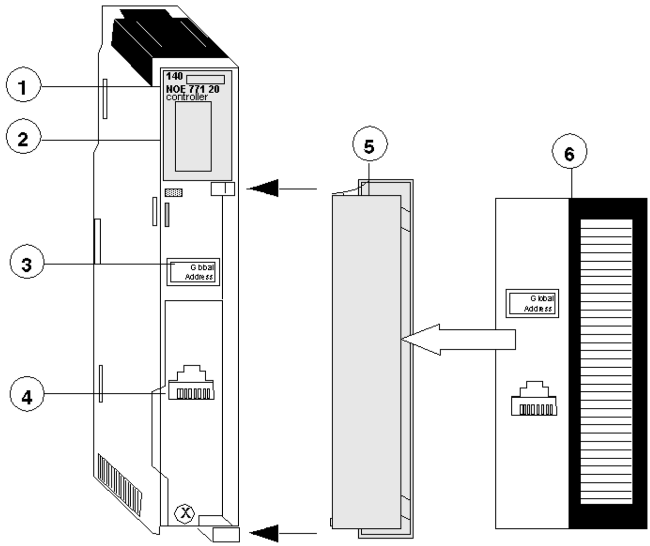
Presentation

Function

The Ethernet TCP/IP module for twisted pair cabling provides an interface to Ethernet networks for the Quantum Automation Series system.

Illustration

The following figure shows the Ethernet TCP/IP 140 NWM 100 00 module.

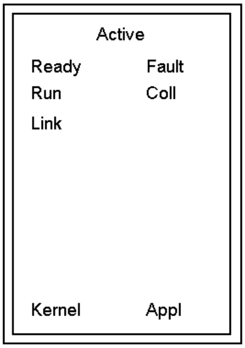


1 Model Number, Module Description, Color Code
2 LED Display
3 IP Address Writable Area
4 Global Address Label
5 100 Base Fx MT-RJ Cable Connector
6 10/100 Base-T RJ-45 Cable Connector
7 Removable door

Indicators

Illustration

The following figure shows the 140 NWM 100 00 LED indicators.



Description

The following table shows the 140 NWM 100 00 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.

Specifications

Specifications Table

Specifications Table

Power Dissipation	4.5 W
Bus Current required	900 mA
Protocol	Ethernet ports transmit and receive Modbus commands encapsulated in TCP/IP protocol.
Ports	One 100 BASE-FX Fiber optics (MT-RJ) port. One 10/100BASE-T (RJ-45) port.
Compatibility with Quantum Controllers	All, V2.0 at a minimum
Factory Cast	yes
I/O Scanner	no

Part VI
Quantum Field Bus Modules

Chapter 27
140 EIA 921 00: AS-i Master Communication Module

Purpose

This chapter contains information on the 140 EIA 921 00 AS-i master communications module.

NOTE: For detailed information see also *Product Related Information,* *page 14*, Modicon Quantum AS-i Master Module EIA 921 00

What Is in This Chapter?

This chapter contains the following topics:

Presentation

Function

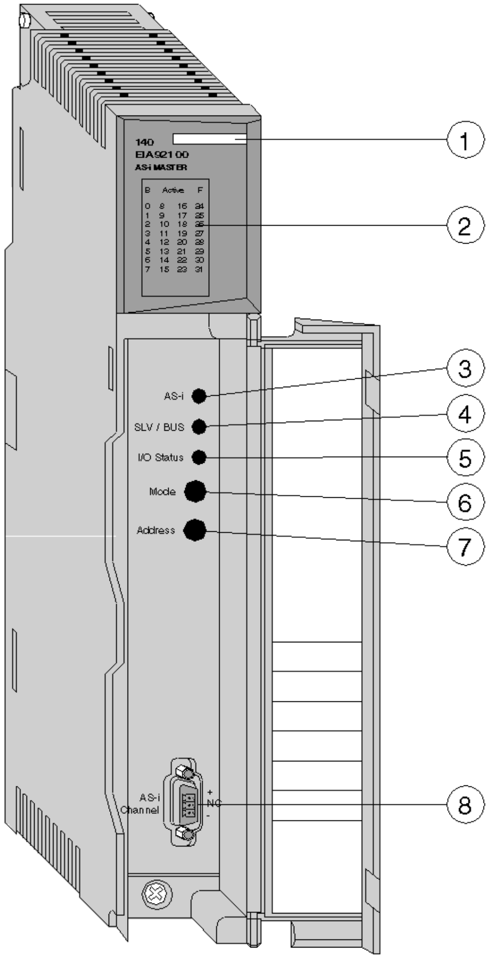
The Quantum AS-i Master Module provides AS-i communications between the bus master module and the sensor/actuator slaves. One master module can control 31 slaves. Multiple master modules can be used in a single control system.

These sensor/actuators can be in the local CPU, an RIO, or a DIO drop adapter.

NOTE: This module is not available to directly exploit analog slaves (profile 7.1, 7.2, 7.3, 7.4) on an AS-i bus.
For detailed information see Modicon Quantum AS-i Master Module EIA 921 00 book *Product Related Information,* *page 14*

Illustration

Front view of the AS-i module with LED Matrix detail and legend numbers:



Legend

The following table provides a description of the functions of the equipment LEDs.

Item	Description
1	Display block comprising 4 status indicator lamps (LEDs) for displaying the module operating modes: ● B (green, 1 LED): Indicates, when on, data exchange between module and slave. ● Active (green, 2 LEDs): when on, indicates AS-i module being services by the local CPU, RIO, or DIO drop adapter. ● F (red, 1 LED): indicates, when on steady, module fault. Flashing shows external I/O fault (could indicate slave with address 0 or an AS-i bus configuration fault.
2	Display block of 32 indicator lamps (0 - 31, green) for diagnostics of the AS-i bus and display of the state of each slave connected to the bus.
3	AS-i (red): ON shows AS-i line not properly powered. Flashing shows automatic addressing enabled and a slave is "prévu" but not connected. OFF shows normal module function.
4	SLV/BUS (green): ON shows the LEDs 0-31 are in BUS display mode. Displays the slaves on the bus.
5	I/O Status (green): On shows the LEDs 0-31 are in SLV display mode. Displays the state of a selected slave.
6	Mode (Push Button): provides local diagnostics of the AS-i bus. Press this button longer than 1 sec. to change the mode. In slave mode use the Address Push Button to scroll among the 32 addresses.
7	Address (Push Button): Pressing this button (in slave mode) scrolls through the slaves. Press longer than 1 sec. to reverse direction of the scroll.
8	AS-i Channel cable connector - connects module to AS-i cable and AS-i power supply.

Indicators

Ilustration

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

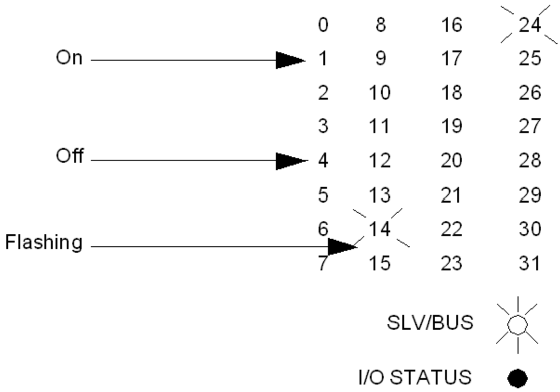
Description

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.

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 Status

Slave mode (SLV) figure:

Display of the address of the selected slave:

- On: number of the selected slave

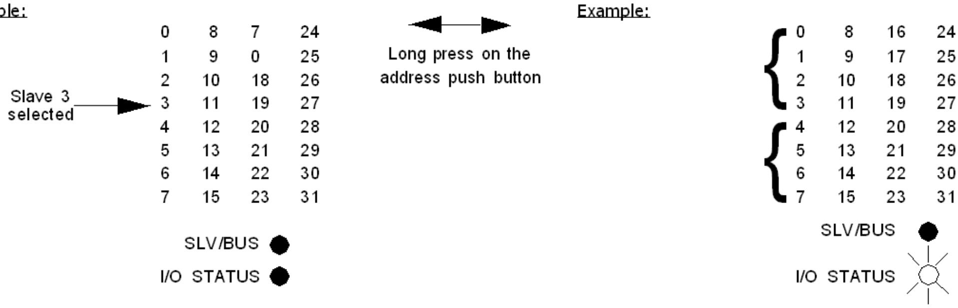
A short press on the address button will change the selected slave.
A long press on the address button will determine whether the next slave address will be calculated by an increment or a decrement to the slave

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

Example:

Example:



LED Diagnostics

State of Indicator Lamps:

B	Active	F	Meaning	Corrective Action
○	○	○	Module switched off.	Switch the device on.
○	●	○	Operating in Protected Mode (normal). Displaying Outputs.	æ
●	●	○	Operating in Protected Mode (normal). Displaying Inputs.	æ
○	●	⊗ (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.	æ

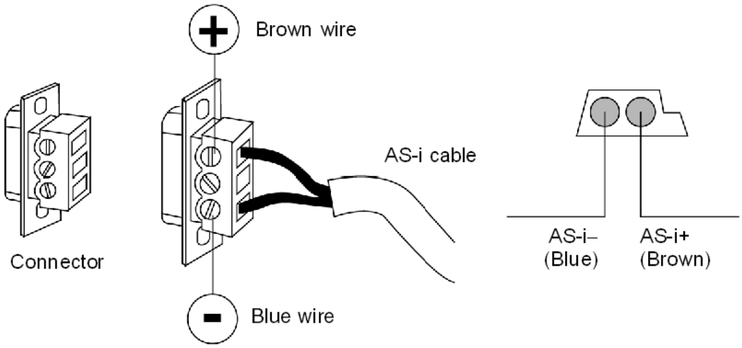
●	Indicator lamp is on.	○	Indicator lamp is off.	⊗	Indicator lamp is flashing.	X	Indicator lamp is in indeterminate state.

(1) Faulty slave ID is flashing.
(2) No slave ID numbers are flashing.

Wiring Diagram

AS-i Cable Connection

Diagram for the AS-i cable connection



Specifications

AS-i Specifications

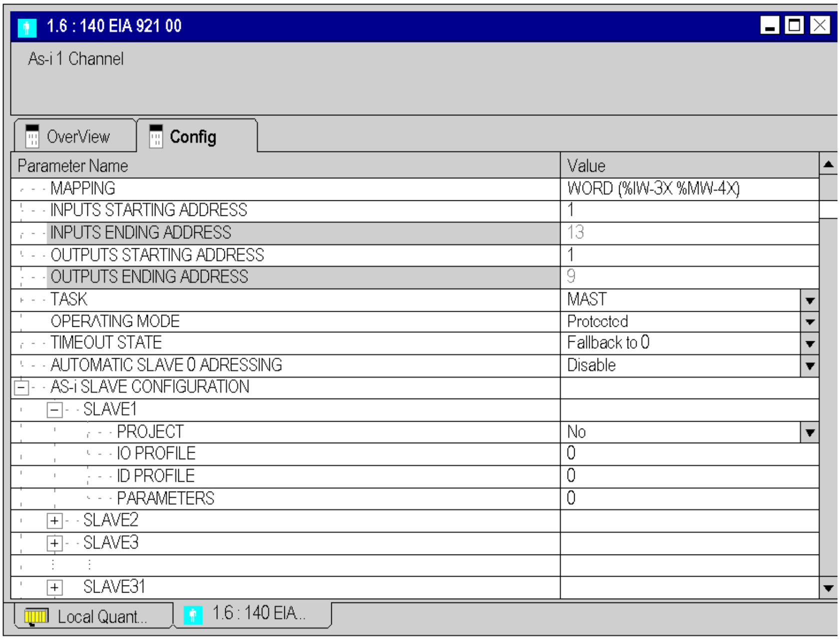
Specifications for the 140 EIA 921 00 AS-i module:

Master profile	M2
Bus length	100m max, no repeaters
I/O	124 IN / 124 OUT
# 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

Parameter Configuration

Parameter and Default Values

Parameter Configuration Window



Name	Default Value	Options	Description
MAPPING	WORD (`%IW-3x %MW-4X`)		
INPUTS STARTING ADDRESS	1	1-65522	Address area where the input information from the AS-i modules is mapped
INPUTS ENDING ADDRESS	13		
OUTPUTS STARTING ADDRESS	1	1-65526	Address area where the output information to the AS-i modules is mapped
OUTPUTS ENDING ADDRESS	9		

Name	Default Value	Options	Description
TASK (Grayed if module in other than local)	MAST	FAST AUX0 AUX1 AUX2 AUX3	Fixed to MAST if module in other than local
OPERATING MODE	Protected	Configuration	Configuration Mode: all slaves are activated, i.e. writing on outputs as well as reading from inputs is done directly. Protected Mode: Only those slaves with a configuration on the AS-i bus which matches the reference configuration are activated.
TIMEOUT STATE	Fallback to 0	HOLD LAST VALUE	Determines the state of the I/O points in case of an communication error
AUTOMATIC SLAVE 0 ADDRESSING	Disable	Enable	When this function is enabled a faulty slave can be replaced by a slave of the same type without stopping the AS-i bus.
AS-i SLAVE CONFIGURATION			
AS-i SLAVE 1			
PROJECT	No	Yes	When "Yes", the configuration is downloaded to the slave and the slave is added to the list of configured slaves
IO PROFILE	0		Refer to indications of the slave manufacturer about slave profiles and capabilities.
ID PROFILE	0		
PARAMETERS	0		
AS-i SLAVE 2-31	see AS-i SLAVE 1		

Part VII
Quantum Special Purpose / Intelligent Modules

Introduction

This part provides information of the Quantum Special Purpose / Intelligent Modules

What Is in This Part?

This part contains the following chapters:

Chapter 28
140 HLI 340 00: High Speed Latch and Interrupt Module

Purpose

The following chapter provides information of the Quantum 140 HLI 340 00 Module.

What Is in This Chapter?

This chapter contains the following topics:

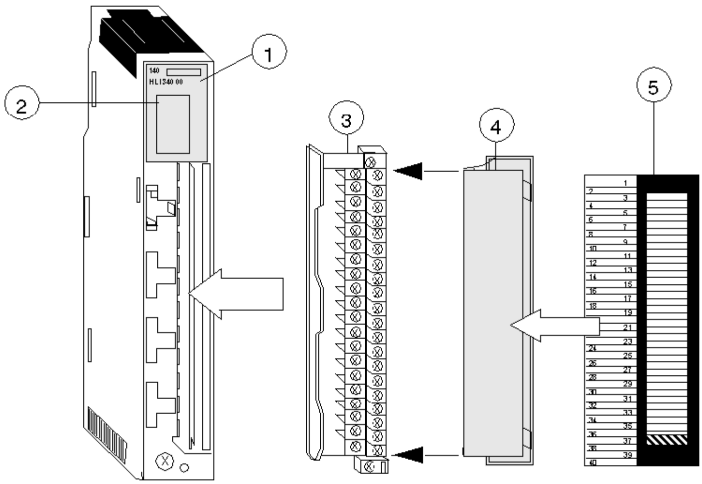
Presentation

Function

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.

Illustration

The following figure shows the 140 HLI 340 00 module and its components.



1 Model Number, Module Description, Color Code
2 LED Display
3 Field Wiring Terminal Strip
4 Removable Door
5 Customer Identification Label (Fold label and place it inside door)

NOTE: The field wiring terminal strip (Modicon #140 XTS 002 00) must be ordered separately. (The terminal strip includes the removable door and label.)

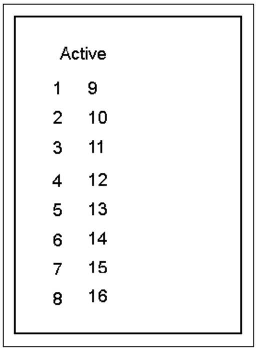
NOTE: The tightening torque must be between 0.5 Nm and 0.8 Nm.

NOTICE
DESTRUCTION OF ADAPTER ● Before tightening the locknut to the torque 0.50...0.80 Nm, be sure to properly position the right-angle F adapter connector. ● During tightening, be sure to maintain the connector securely. ● Do not tighten the right-angle F adapter beyond the specified torque. **Failure to follow these instructions can result in equipment damage.**

Indicators

Illustration

The following table shows the LED indicators for the 140 HLI 340 00 module.



Descriptions

The following table shows the LED descriptions for the 140 HLI 340 00 module.

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.

Specifications

General Specifications

General Specifications

Module Type	16 IN individually isolated
External Power	Not required for this module
Power Dissipation	2.0 W/0.30 W x the number of points ON
Bus Current required	400 mA
I/O map	1 input word
Fault Detection	None

Indicators

Indicators

LEDs	Active 1...16 (green)-indicates point status

Operating Voltage and Input Current

Operating Voltage and Input Current

ON (voltage)	15...30 Vdc
OFF (voltage)	-3...+5 Vdc
ON (current)	2.0...8.0 mA
OFF (current)	0...0.5 mA

Maximum Input

Absolute Maximum Input Voltage

Continuous	30 Vdc

Input Protection

Input Protection

30 Vdc reverse polarity (diode protection)

Isolation

Isolation

Point to Point	500 Vac rms for 1 minute
Point to Bus	1780 Vac rms for 1 minute

Response

Response

OFF - ON	30 μs (max)
ON - OFF	130 μs (max)

Fuses

Fuses

Internal	None
External	User discretion

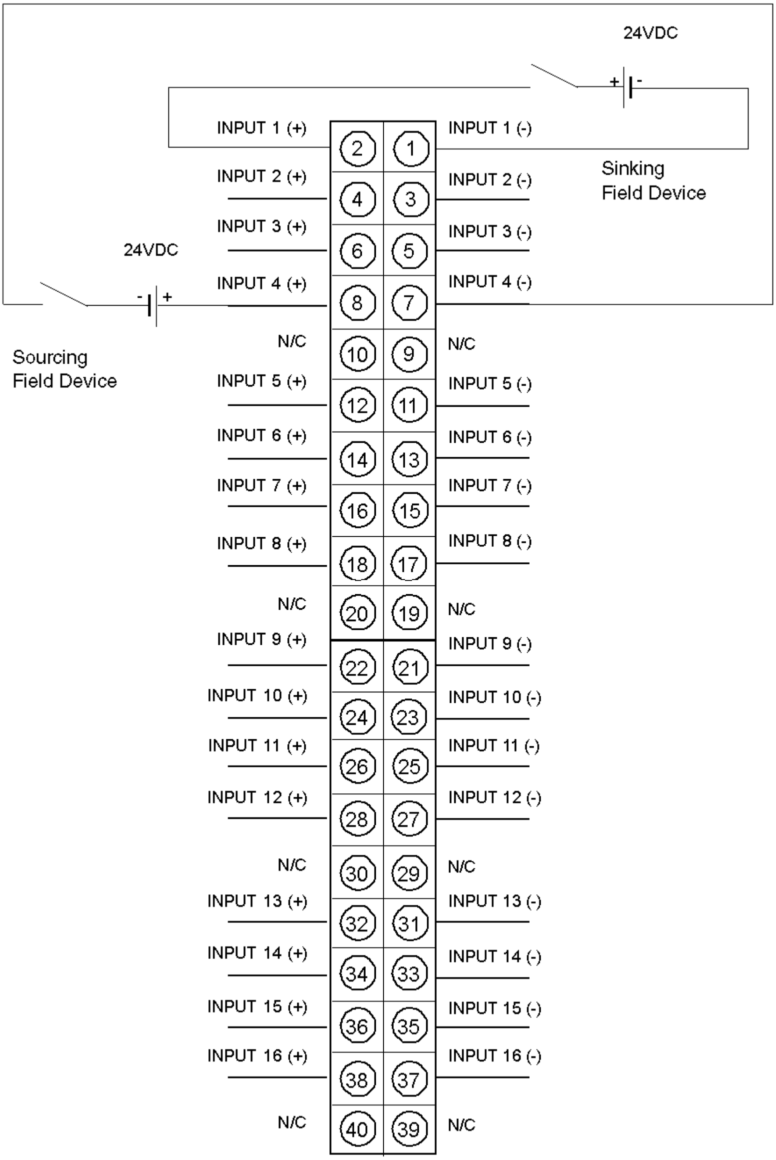
Module Keying

Field Wiring Terminal Strip/Module Keying

Module Coding	ABE
Terminal Strip Coding	CDF

Wiring Diagram

Illustration



NOTE: 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 ground.
N / C = Not Connected.

NOTE: The tightening torque must be between 0.5 Nm and 0.8 Nm.

NOTICE
DESTRUCTION OF ADAPTER ● Before tightening the locknut to the torque 0.50...0.80 Nm, be sure to properly position the right-angle F adapter connector. ● During tightening, be sure to maintain the connector securely. ● Do not tighten the right-angle F adapter beyond the specified torque. **Failure to follow these instructions can result in equipment damage.**

Addressing

Flat Addressing

This module requires either 16 contiguous %I references or one %IW word. For a description of how to access the input points, please refer to *Discrete I/O Bit Numbering*, *page 28*.

MSB

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

Topological Addressing

The following tables show the topological addresses for the 140HLI34000 module.

Topological addresses in Bit Mapping format:

Point	I/O Object	Comment
Input 1	%I[\b.e\]r.m.1	Value
Input 2	%I[\b.e\]r.m.2	Value
• • •		
Input 15	%I[\b.e\]r.m.15	Value
Input 16	%I[\b.e\]r.m.16	Value

Topological addresses in Word Mapping format:

Point	I/O Object	Comment
Inputword 1	%IW[\b.e\]r.m.1.1	Value

Used abbreviations: **b** = bus, **e** = equipment (drop), **r** = rack, **m** = module slot.

I/O Map Status Byte

There is no I/O map status byte associated with this module.

Parameter Configuration

Module Placement

The 140 HLI 340 00 High Speed Interrupt module’s functionality depends on its location.

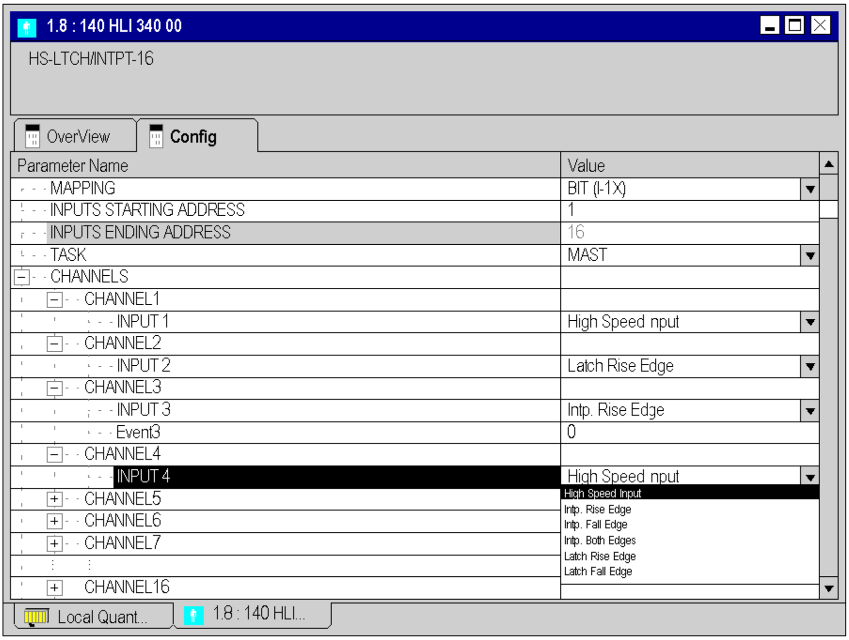
The following list shows the available modes depending on the location:

- **Local Rack:** High Speed Inputs, Latch Inputs, Interrupts,
- **Remote Rack:** High Speed Inputs.

NOTE: The 140 HLI 340 00 module cannot be connected to a secondary rack.

Parameters and Default Values

Parameter Configuration Window



Parameter Description

Name	Default Value	Options	Description
Mapping	BIT (%I-1x)	WORD (%IW-3X)	
Inputs Starting Address	1		
Inputs Ending Address	16		
Task	MAST	FAST AUX0 AUX1 AUX2 AUX3	
Channels			
Input n	High Speed Input	Intp. Rise Edge Intp. Fall Edge Intp. Both Edges Latch Rise Edge Latch Fall Edge	Interrupt modes only available in local rack, latch only in local- and expansion rack
Event n	0	1 - 127	

Chapter 29
140 EHC 202 00: High Speed Counter Module

Purpose

The following chapter provides information of the Quantum 140 EHC 202 00 High Speed Counter Module.

What Is in This Chapter?

This chapter contains the following topics:

Presentation

Function

The 140 EHC 202 00 is a two-channel module best suited for high-speed counting applications up to 500 kHz or for applications that require a quadrature counter interface.

Operating Modes

The following operating modes are possible:

- 16-bit counters on one or both channels with two outputs, configurable for incremental or quadrature mode
- 32-bit counter that uses both channels with two outputs, configurable for incremental or quadrature mode
- 32-bit counters on one or both channels with no outputs, configurable for incremental or quadrature mode
- 16-bit counters on one or both channels with no outputs, in rate-sample mode for incremental or quadrature encoders

Outputs

Two FET output switches exist for each counter. They turn on when the counter reaches programmed setpoint or maximum values in up-count/down-count operations.

The outputs can be turned off by changes in counter values, software commands, or a hard wired reset from the field.

Each of the outputs can be configured as follows:

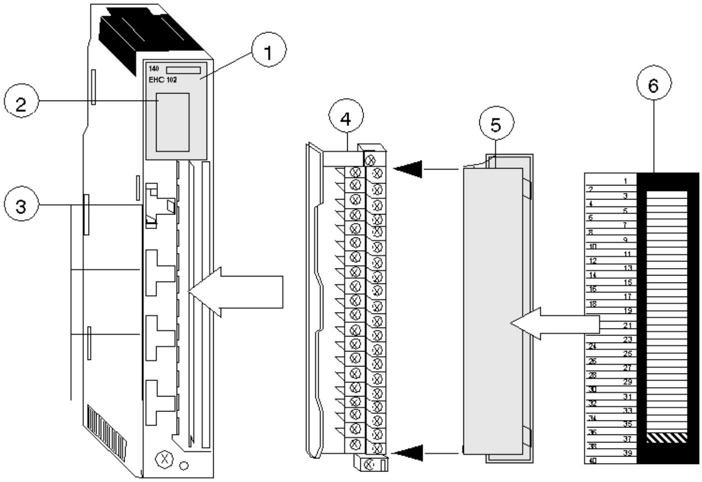
- Output latched on at setpoint
- Output latched on at a terminal count
- Output timed on at setpoint, with a time range of 0 ... 16 383 ms (only one of the four possible outputs can be configured for this mode)
- Output timed on at a terminal count, with a time range of 0 ... 16 383 ms (only one of the four possible outputs can be configured for this mode)

Inputs

- Single ended or differential

Illustration

The following figure shows the EHC 102 module and its components.



1 Model Number, Module Description, Color Code
2 LED Display
3 Fuse Cutouts
4 Field Wiring Terminal Strip
5 Removable Door
6 Customer Identification Label (Fold label and place it inside door)

NOTE: The field wiring terminal strip (Modicon #140 XTS 002 00) must be ordered separately. (The terminal strip includes the removable door and label.)

Specifications

General Specifications

General Specifications

Module Type	High Speed Counter Module
Number of Channels	2
External Power	19,2 ... 30 VDC, 24 VDC nominal, 50 mA reqired plus the load current for each output.
Power Dissipation	4+(0.4 x total modul load current)
Bus Current required	650 mA
I/O Map	6 words IN, 6 words OUT
Isolation (channel to bus)	1780 VAC rms for 1 minute
Fault detection	Blown fuse detect; loss of 1A, 1B, 2A, 2B output field power
Fusing	internal: 2.5 (P/N 043503948 or equivalent) external: user discretion
Backplane Support	Local, remote or distributed

Counter Inputs

Counter inputs

Operating mode	incremental or quadratur
Input voltage	30 V max. continuous
Data formats	16 bit counter: 65.535 Decimal 32 bit counter: 2.147.483.647 Decimal

Discrete Inputs

Discrete inputs

Operating mode	incremental or quadratur
Input voltage	30 V max. continuous
Input resistence	10 kohms

Input threshold

Input threshold

single ended mode	VREF supply	On state	Off state
	5 VREF DC	0 ... 2 V	3.5 ... 5.0 V
	12 VREF DC	0 ... 5 V	7 ... 12 V
	24 VREF DC	0 ... 11 V	13 ... 24 V
differential mode		1.8 VDC minimum	

Discrete Outputs

Discrete outputs

FET Switch ON	supply - 0.4 V
FET Switch OFF	0 VDC (ground reference)
Max. load current (each output)	0,5 A
Output off state Leackage	0,4 A max @ 30 VDC
Output on state voltage drop	0.4 VDC @ 0,5 A
Output Levels	1A, 2A, 1B, 2B
Output Protection	36 V transorb for transient voltage suppression

Controlling and Timing

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:

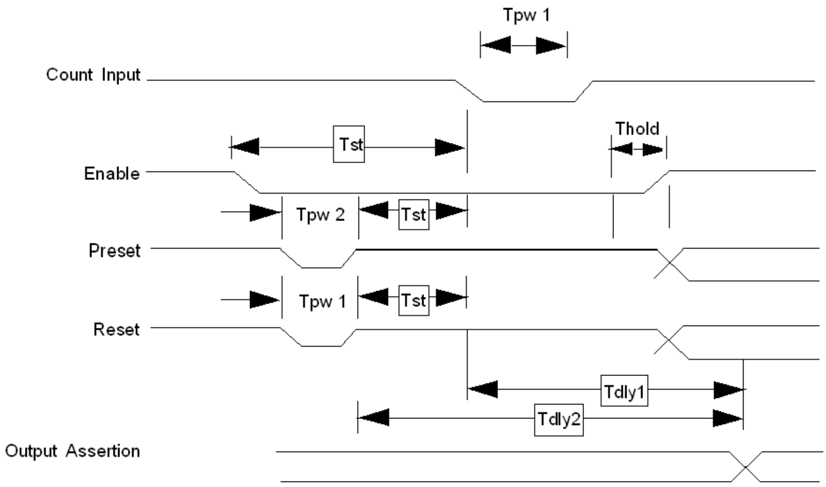
- Preset the input counter to zero or maximum count.

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

The following figure shows the EHC20200 timing diagrams.



Timing Parameter Table

The following table shows the EHC20200 timing parameters.

Timing Parameters		Limits	
	Filter 200 Hz	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.

Functions

COUNT UP

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.

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.

COUNT DOWN

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.

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.

REMOVE ENABLE

This function disables the input counter, causing it to stop incrementing and hold the count accumulated prior to disabling.

OUTPUTS

When configured in the count mode, outputs will turn on for defined times when setpoints or maximum values have been reached.

No output assertion in two, 32 bit counter mode or rate sample.

Programmed ON time for outputs can be set for one channel, one output and one trigger point only.

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.

OUTPUT COIL MODE available values:
- SETPOINT: ON when set point is reached, back to 0 automatically when the reference is exceeded.
- LATCHED SETPOINT: ON when you reach the set point, it remains ON until no hardware reset applied (input).
- TERMINAL COUNT: ON when it exceeds the max.
- LATCHED TERMINAL: ON when it exceeds the max and will be maintained as long as no hardware reset (input).
- TIMED SETPOINT: ON from a set point and held ON during a defined time.
- TIMED TERMINAL: ON when it exceeds the max and held ON for a defined time.

COUNTER PRESET

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.

COUNTER ENABLE

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.

RATE SAMPLE VALUE

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.

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.

Operating Conditions and Examples

Rate Sample

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

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 set point 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 set point values, maximum count values, and output assert time.
- Enabled to count using hardwired input and software control bits.

OUTPUT COIL MODE available values

SETPOINT: ON when set point is reached, back to 0 automatically when the reference is exceeded.

LATCHED SETPOINT: ON when you reach the set point, it remains ON until no hardware reset applied (input).

TERMINAL COUNT: ON when it exceeds the max.

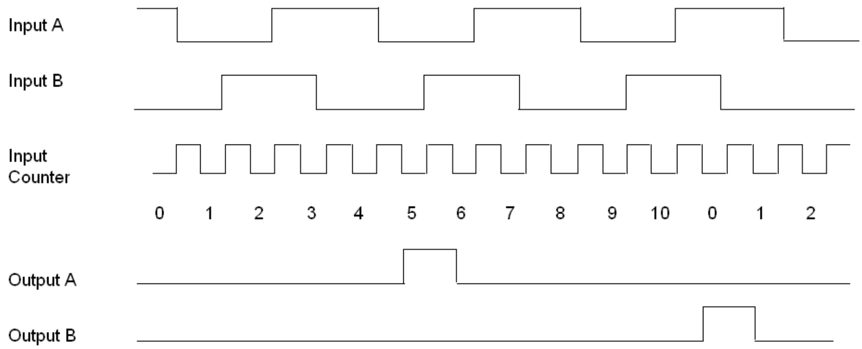
LATCHED TERMINAL: ON when it exceeds the max and will be maintained as long as no hardware reset (input).

TIMED SETPOINT: ON from a set point and held ON during a defined time.

TIMED TERMINAL: ON when it exceeds the max and held ON for a defined time.

Counter Rollover Examples for Pulse Input

The following figure is an example of a counter rollover with pulse input, counting up.

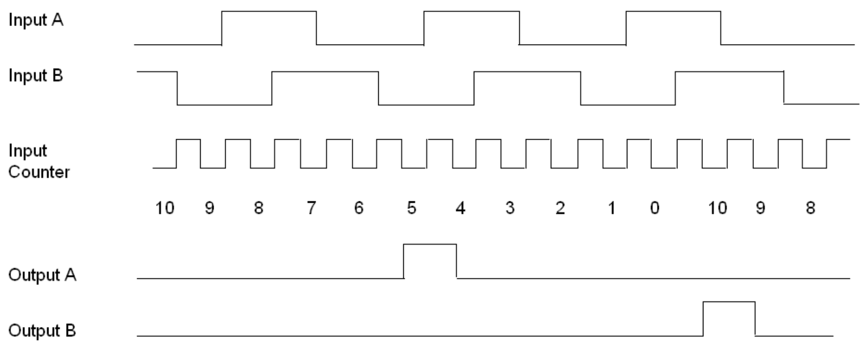


Count is from 0 -> 10 (Maximum Count)

Output A turns on at Setpoint = 5

Output B turns on after Input Count = Maximum (Terminal) Count = 10

The following figure is an example of a counter rollover with pulse input, counting down.



Count is from 10 (Maximum Count) -> 0

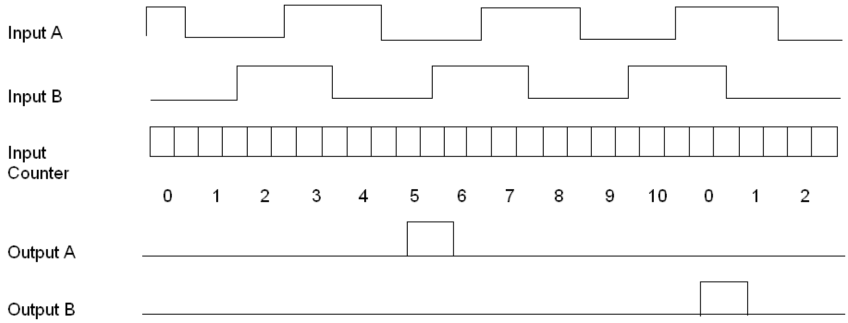
Output A turns on at Setpoint = 5

Output B turns on after Input Count = 0

NOTE: Outputs are not latched.

Counter Rollover Examples for Quadrature Input

The following figure is an example of a counter rollover with quadrature input, counting up.

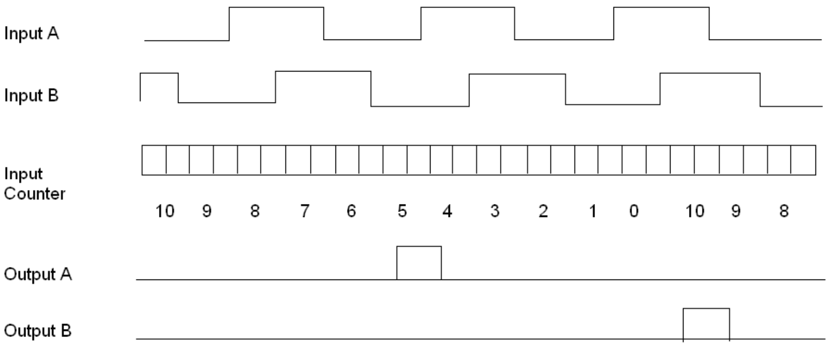


Count is from 0 -> 10 (Maximum Count)

Output A turns on at Setpoint = 5

Output B turns on after Input Count = Maximum (Terminal) Count = 10

The following figure is an example of a counter rollover with quadrature input, counting 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.

Addressing

Flat Addressing

The 140EHC20200 high speed counter requires six contiguous 16-bit input words (%IW) and six contiguous 16-bit output words (%QW).

Topological Addressing

Point	I/O Object	Comment
Input 1	%IW[\b.e\]r.m.1.1	Data
	• • •	
Input 6	%IW[\b.e\]r.m.1.6	Data
Output 1	%QW[\b.e\]r.m.1.1	Data
	• • •	
Output 6	%QW[\b.e\]r.m.1.6	Data

where:

- b = bus
- e = equipment (drop)
- r = rack
- m = module slot

I/O Map and Commands

Overview

The 140 EHC 202 00 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 in the Parameter Configuration. 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 parameter configuation rather than the I/O mapped registers can be used to configure the module. Parameter configuration is only possible 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 parameters.

When using either parameter configuration 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.

Commands

There are four command that can be performed. Each 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

Command 1 uses three 4X registers and six 3X registers (see below).

The following figure shows the 4X and 3X registers for command 1.

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 2, 16 bit, or 1, 32 bit counter. No output assertion is available if 2, 32 bit counters are defined, or in rate-sample mode.
- Defines output assertion point.

Command 2 - LOADS VALUES

There are four formats for this command. It uses up to six 4X registers and six 3X registers.

The following figure shows the format for registers 4X and 3X for command 2.

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 the following.

- 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 (see below).

The following figure shows the 4X and 3X registers for command 3.

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 (see below).

The following figure shows the 4X and 3X registers for command 4.

4X	3X
	3X+1
	3X+2
	3X+3
	3X+4
	3X+5

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.

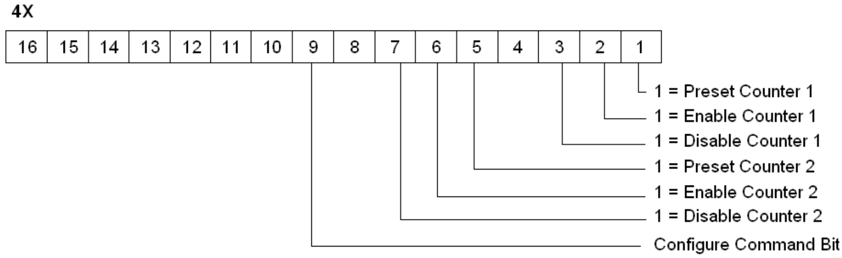
NOTE: When Command 0 (4X = 00XX) or any other undefined commands are asserted in the 4X register, the 3X registers will contain the count inputs if in count mode (same as Command 3) and the rate sample values when in rate-sample mode (same as Command 4).

Command Words Described

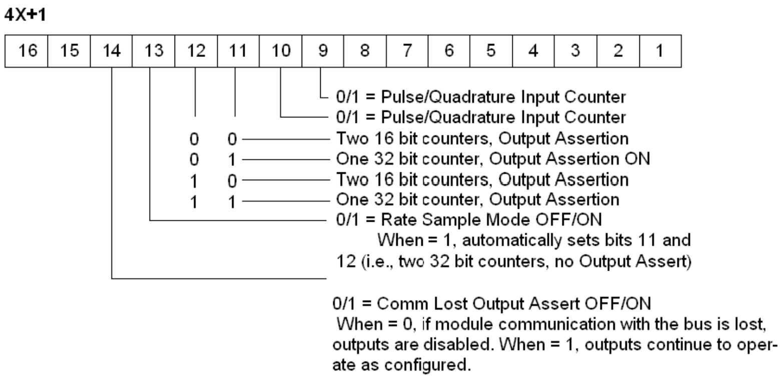
The following details the command words and responses.

Command 1 - CONFIGURE, Output Register Format (4X = 01XX hex)

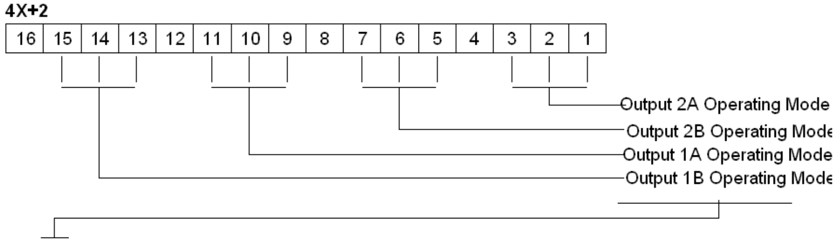
The following figure shows the 4x output register for command 1.



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

NOTE: 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.

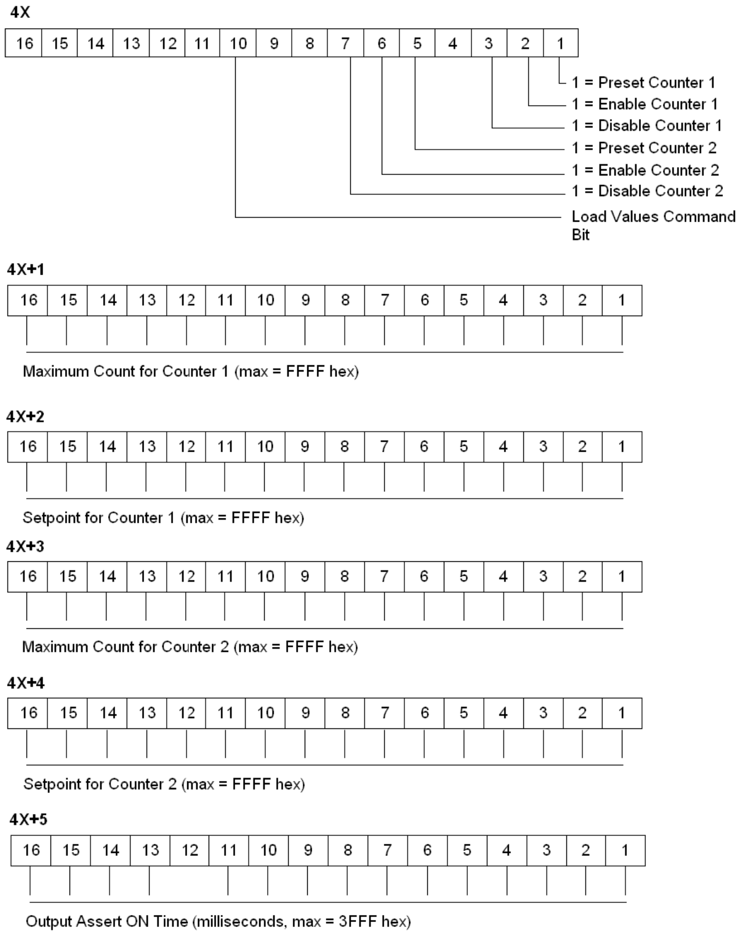
Command 2. LOAD VALUES, Output Register Format (4X = 02XX hex)

The LOAD VALUES 4X register format depends on the Counter/Rate Sample mode selected in Command 1, Register 4X+1, bits 11 and 12.

Two 16 Bit Counters

If configured for two, 16 bit Counters - Output Assert ON, the following information is displayed.

The following figures show the counters for registers 4X through 4X+5 modules.

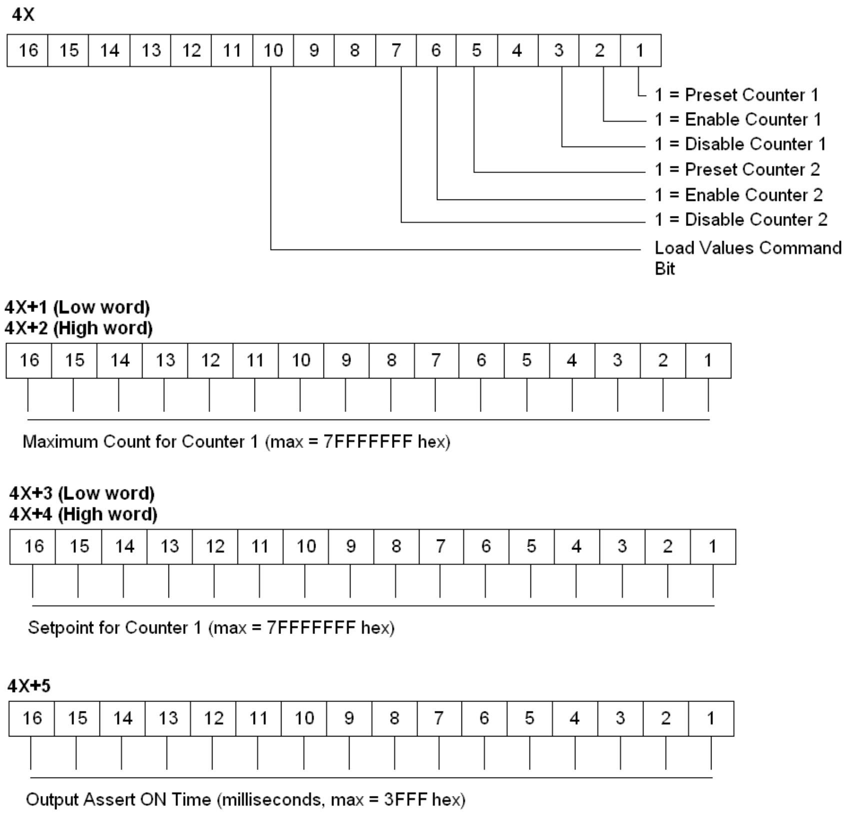


NOTE: Zero set into any 4X register means no change.

One 32 Bit Counter

If configured for one, 32 bit Counter - Output Assert ON, the following information is displayed.

The following figure shows the counters for registers 4X through 4X+5, with low and high word.

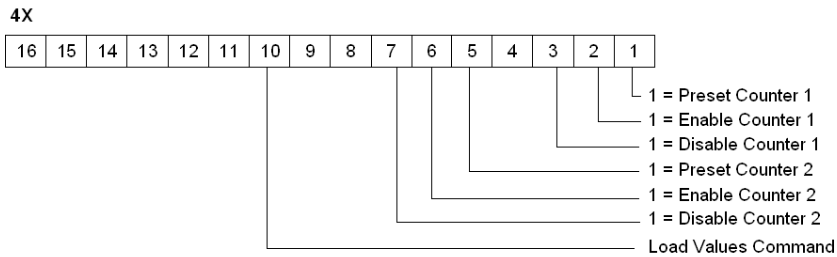


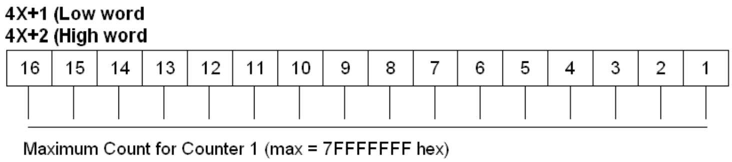
NOTE: Zero set into any 4X register pair for 32 bit values or any 4X register means no change.

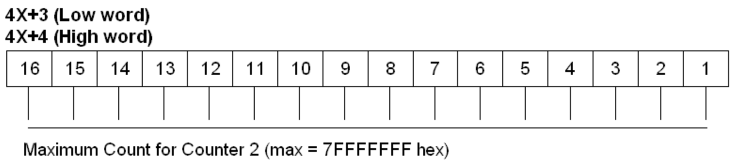
Two 32 Bit Counters

If configured for 2, 32 bit Counters - NO Output Assert, the following information is displayed.

The following figures show the 4X through 4X+4 counters, with low and high word.





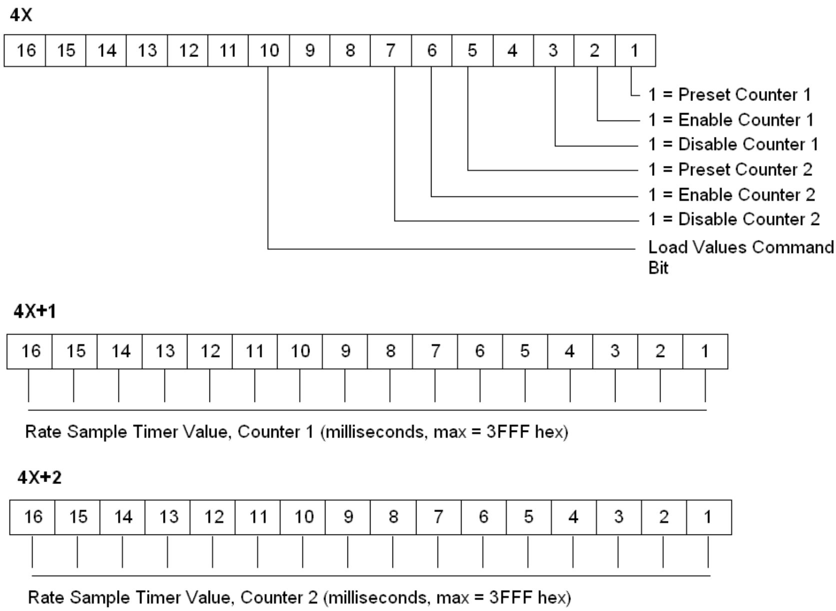


NOTE: Zero set into any 4X register pair for 32 bit values or any 4X register means no change.

Rate Sample Mode

If configured for Rate Sample Mode, the following information is displayed.

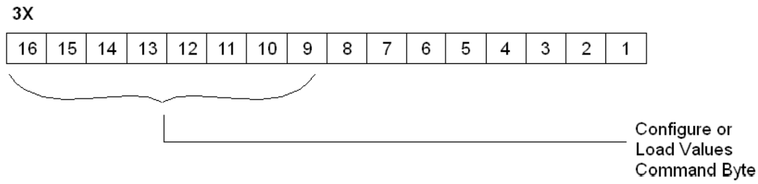
The following figure shows the 4X through 4X+2 counters.



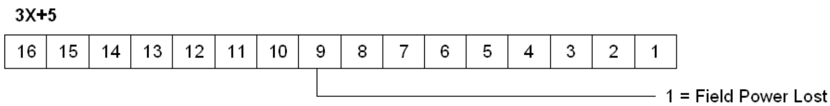
NOTE: Zero set into any 4X register or any 4X register pair for 32 bit values means no change.

Command 1 and Command 2 Response Formats

The following figures show the 3X through 3X+5 response formats.

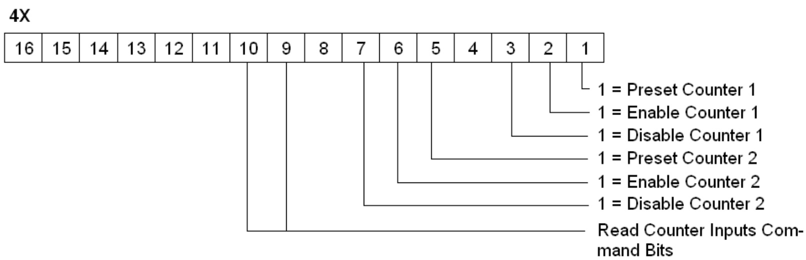


3X+1 to 3X+4 echoes 4X+1 to 4X+4 register contents.



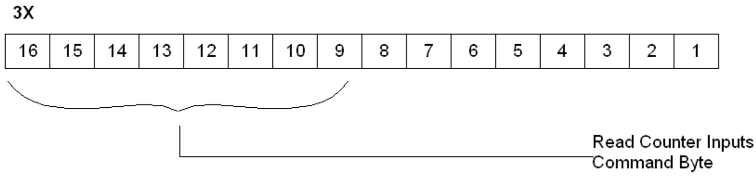
Command 3, READ INPUT COUNTER, Output Register Format (4X = 03XX hex)

The following figure shows the 4X register for command 3.

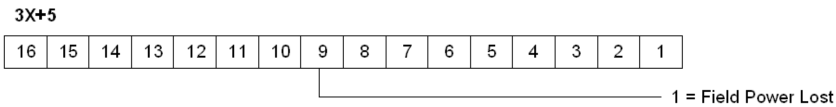


Command 3 Response Format

The following figure shows the command 3 response format.

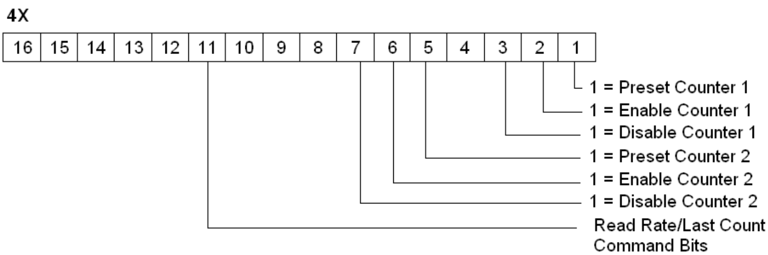


3X+1 and 3X+2 = Counter 1's 16 or 32 bit Current Count.
3X+3 and 3X+4 = Counter 2's 16 or 32 bit Current Count.



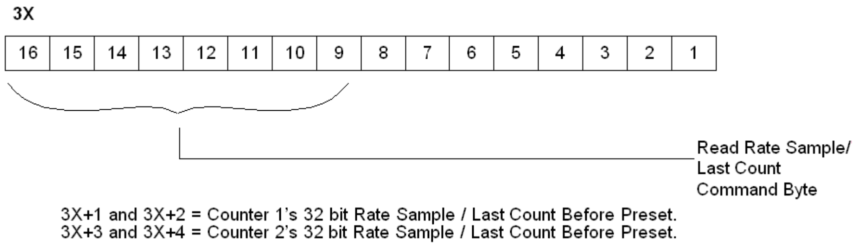
Command 4, READ RATE SAMPLE or READ LAST COUNT VALUE BEFORE MOST RECENT PRESET, Output Register Format (4X = 04XX hex)

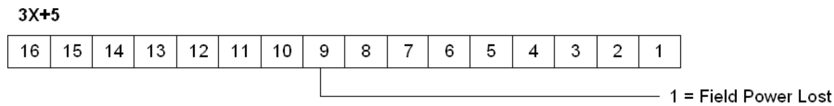
The following figure shows the 4x counters for command 4.



Command 4 Response Format

The following figures show the counters for 3X through 3X+5 for command 4.

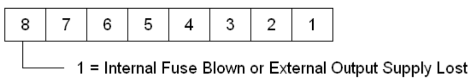




I/O Map Status Byte

The most significant bit in the I/O Map status byte is used for the 140 EHC 202 00 High Speed Counter Module.

The following figure shows the map status byte register.



COUNT UP Example

Field connections for this example are illustrated in the EHC 202 wiring diagrams 1-4. 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.

The following table shows the I/O Map register assignments.

Input Ref	Output Ref
300001-300006	400001-400006

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 Table

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 Table

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, fused

Zeros in the 4X registers also mean no change. Setpoint, maximum count and assert time can only be set to zero using the parameter configuration. 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 Table

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 Table

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 follows:

Response table

The following table shows the content of the registers.

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 x 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 ms.

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 the Wiring Diagrams1-4. 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 Table

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 Table

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 Table

The following table shows a read rate sample.

400301 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 Table

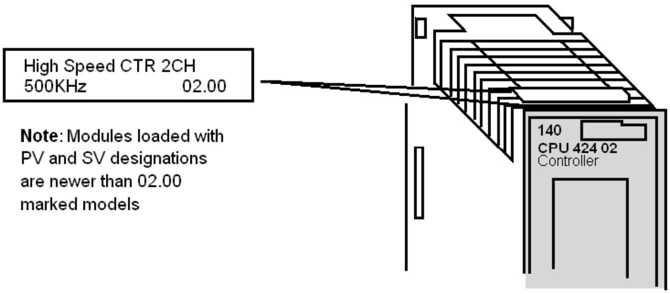
The following table shows the responses to the read rate sample command.

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 x 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

NOTE: 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).
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.

NOTE: 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.

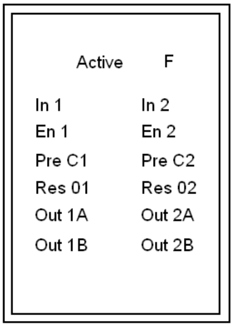
Encoder type selection is set using Command 1, CONFIGURE (01XX), 4X+1 register, bits 9 or 10 (see the description of Command 1 in this section).

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.

Indicators

Illustration

The following figure shows the LED indicators for the EHC20200 High Speed Counter module.



Descriptions

The following table shows the LED descriptions for the EHC 202 00 high speed counter.

LEDs	Color	Indication when On
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

Wiring

Signal overview

The following table shows the signal descriptions of the wiring diagram.

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.

Miscellaneous Information

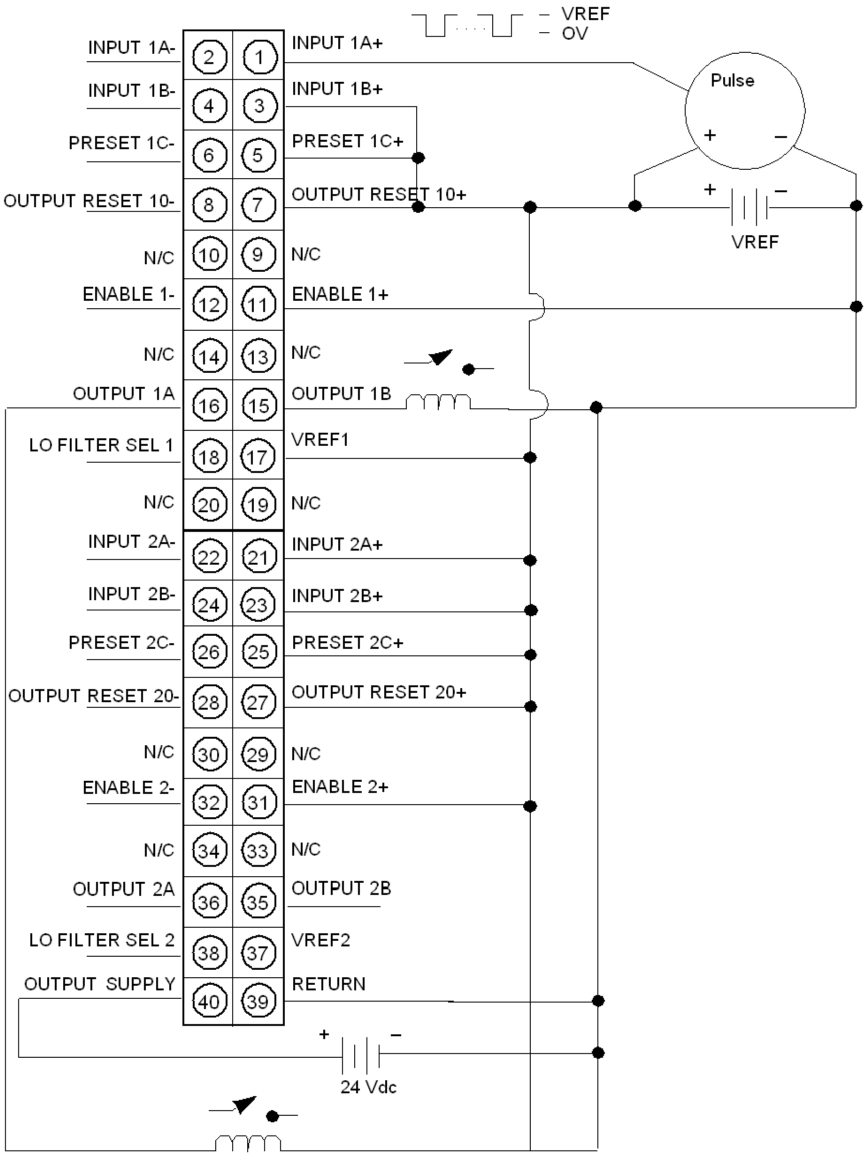
Field wire to Counter 2 inputs and outputs, when configured for one, 32 bit counter with output assertion. The unused Counter 1 must have its + (plus) inputs connected to VREF+.

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.

Wiring diagram 1

Basic wiring diagram showing single ended pulse input, counting up and constant enable.

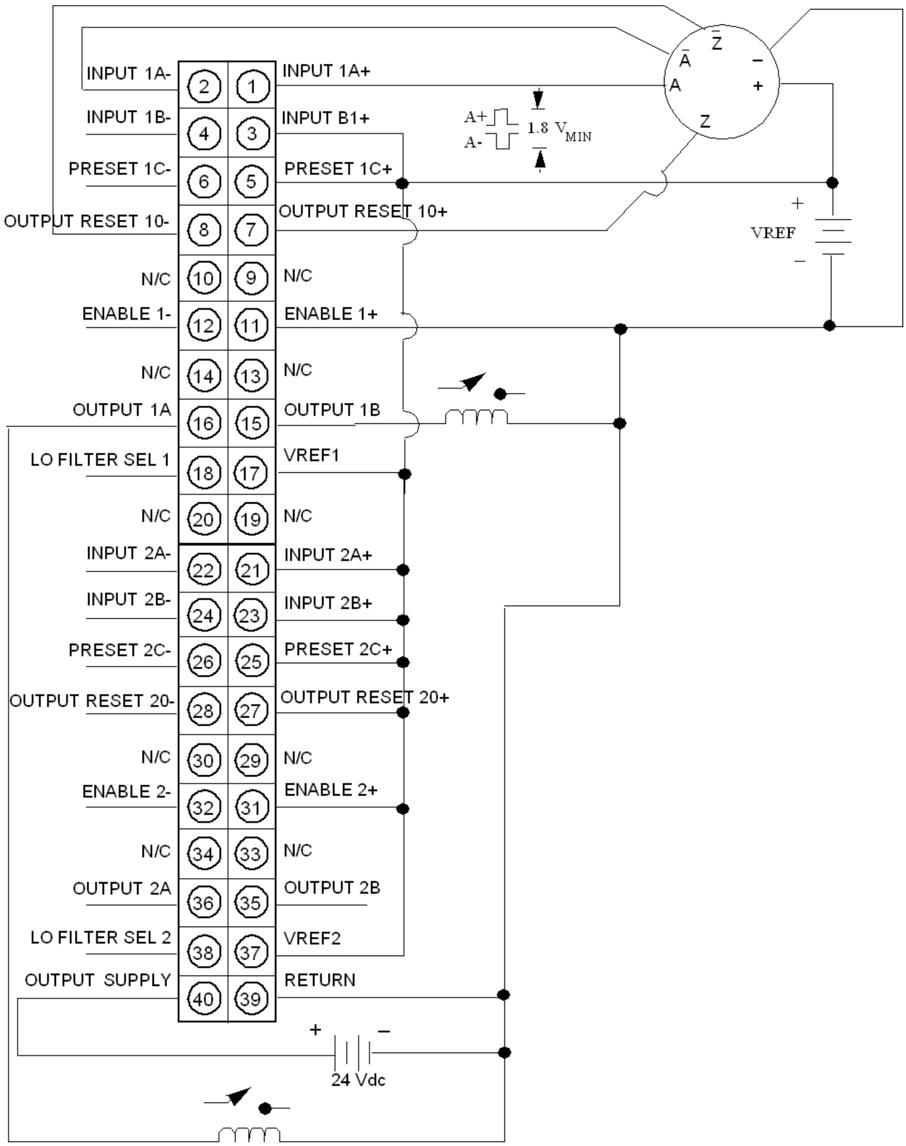


NOTE: Terminal description:

- Terminal 1 Pulse encoder input (sinking device)
- Terminal 3 Input 1B count UP direction
- Terminal 5 Unused hardwire Preset tied high
- Terminal 7 Output Reset tied high, not required; outputs not used
- Terminal 11 Hardware enabled
- Terminal 15, 16 Outputs 1A and 1B operate relays
- Terminal 17 Required VRef+ connection
- Terminals 21, 23, 25, 27, 31, 37 Counter 2 not used. These terminals must be connected VRef+
- Terminal 39 Required Output Supply Return
- Terminal 40 Required Output Supply
- N/C not connected

Wiring Diagram 2

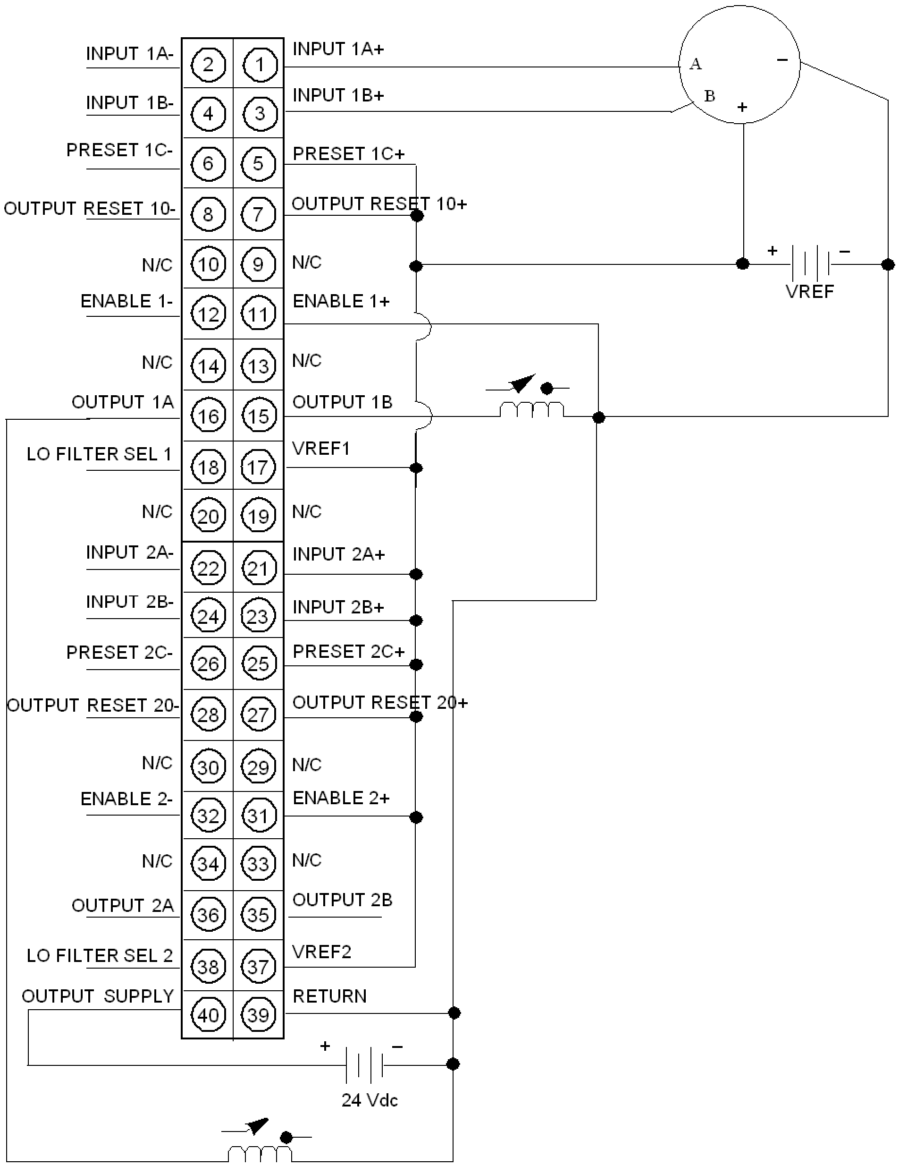
Wiring diagram showing differential pulse input, counting up and constant enable.



NOTE: Zero pulse resets Output 1A and 1B

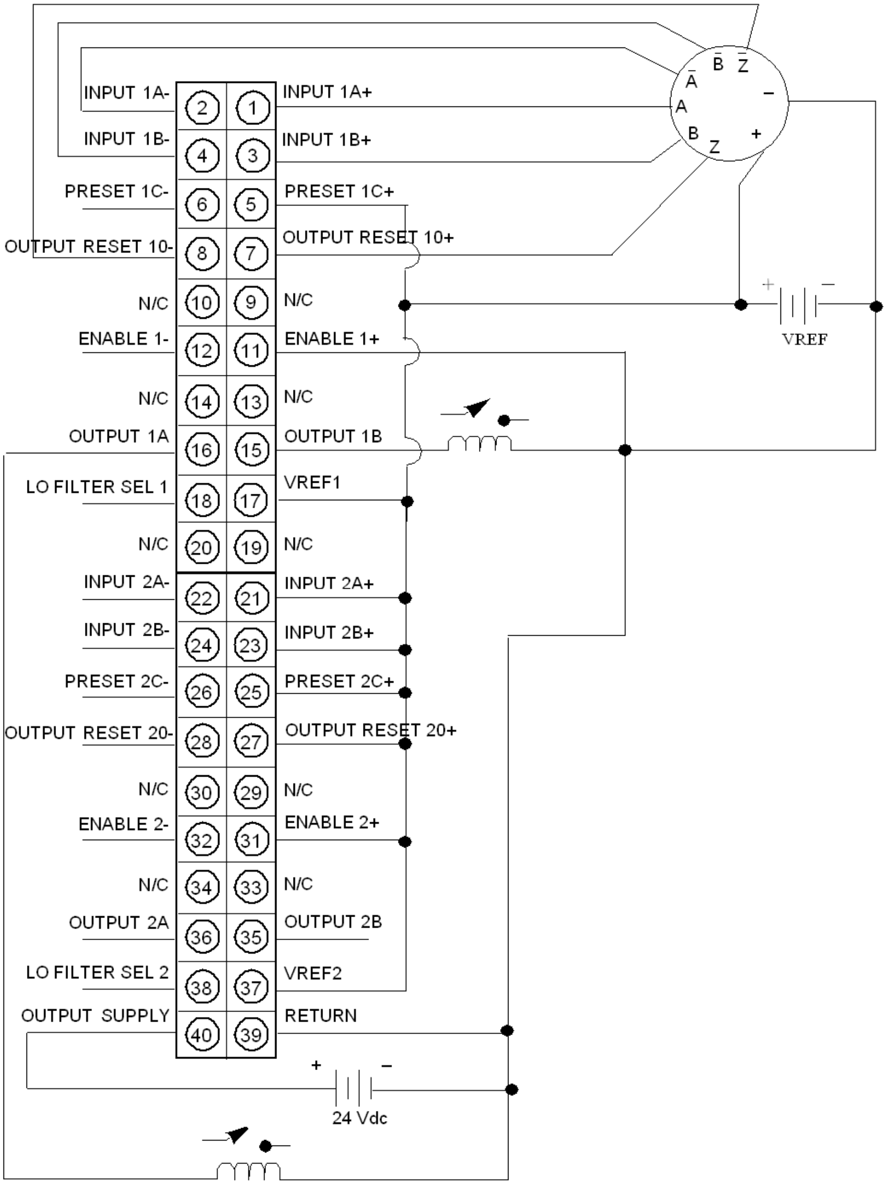
Wiring Diagram 3

Wiring diagram showing quadratur input with constant enable.



Wiring Diagram 4

Wiring diagram showing differential quadrature input with constant enable.



NOTE: Zero pulse resets Output 1A and 1B

Maintenance

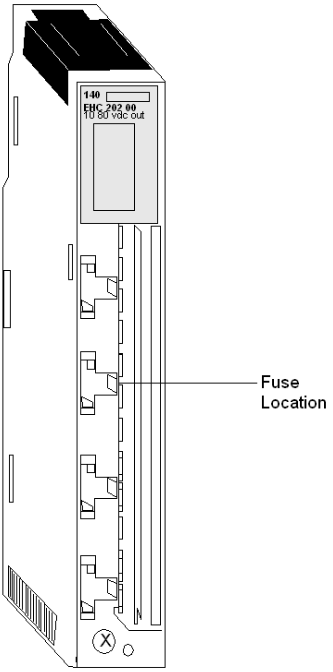
Fuses

Fuses

Internal	2.5 (P/N 043503948 or equivalent)
External	user discretion

Fuse Location Figure

The following figure shows the locations of the fuses for the EHC 202 module..



NOTE: Turn off power to the module and remove the field wiring terminal strip to gain access to the fuse.

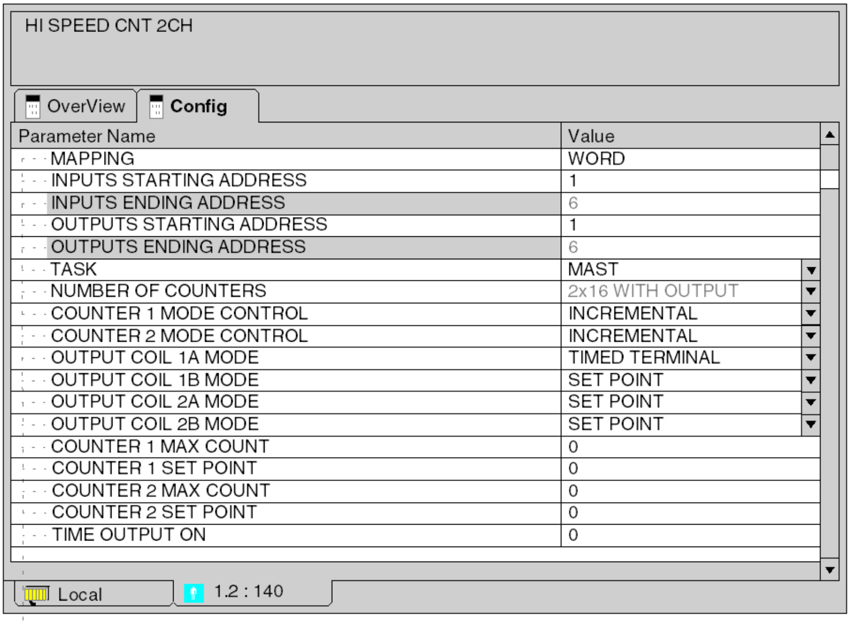
Parameter Configuration

Overview

This section provides information on the parameters, accessible in the Parameter Configuration Screen.

Parameter Configuration Default Screen

This diagram shows the Parameter Configuration default screen



Addressing and Task

This table shows the parameters for addressing and task with its values

Name	Value	Options
MAPPING	WORD	-
INPUTS STARTING ADDRESS	1	0-100000
INPUTS ENDING ADDRESS	6	-
OUTPUTS STARTING ADDRESS	1	0-100000
OUTPUTS ENDING ADDRESS	6	-
TASK (Grayed if module in other than local)	MAST	FAST AUX0 AUX1 AUX2 AUX3

NUMBER OF COUNTERS

This part of the parameter configuration screen depends on the choice made in the field: **NUMBER OF COUNTERS**. Therefore you find four tables accordingly.

This table shows the parameters configuration screen for the entry: **2x16 WITH OUTPUT**

Name	Value	Options
NUMBER OF COUNTERS	**2x16 WITH OUTPUT**	1x32 WITH OUTPUT 1x32 NO OUTPUT RATE SAMPLE MODE
COUNTER 1 MODE CONTROL	QUADRATURE	INCREMENTAL
COUNTER 2 MODE CONTROL	QUADRATURE	INCREMENTAL
OUTPUT COIL 1A MODE	SET POINT	TIMED SET POINT LATCHED SET POINT TERMINAL COUNT LATCHED TERMINAL TIMED TERMINAL
OUTPUT COIL 1B MODE		
OUTPUT COIL 2A MODE		
OUTPUT COIL 2B MODE		
COUNTER 1 MAX COUNT	0	0-65535
COUNTER 1 SET POINT		
COUNTER 2 MAX COUNT		
COUNTER 2 SET POINT		
TIME OUTPUT ON		

This table shows the parameters configuration screen for the entry: 1x32 WITH OUTPUT

Name	Value	Options
NUMBER OF COUNTERS	**1x32 WITH OUTPUT**	2x16 WITH OUTPUT 1x32 NO OUTPUT RATE SAMPLE MODE
COUNTER 2 MODE CONTROL	QUADRATURE	INCREMENTAL
OUTPUT COIL 2A MODE	SET POINT	TIMED SET POINT LATCHED SET POINT TERMINAL COUNT LATCHED TERMINAL TIMED TERMINAL
OUTPUT COIL 2B MODE		
COUNTER 2 MAX COUNT: LOW WORD	0	0-65535
COUNTER 2 MAX COUNT: HIGH WORD		
COUNTER 2 SET POINT: LOW WORD		
COUNTER 2 SET POINT: HIGH WORD		
TIME OUTPUT ON		

This table shows the parameters configuration screen for the entry: 1x32 NO OUTPUT

Name	Value	Options
NUMBER OF COUNTERS	**1x32 NO OUTPUT**	2x16 WITH OUTPUT 1x32 WITH OUTPUT RATE SAMPLE MODE
COUNTER 1 MODE CONTROL	QUADRATURE	INCREMENTAL
COUNTER 2 MODE CONTROL	QUADRATURE	INCREMENTAL
COUNTER 1 SET POINT: LOW WORD	0	0-65535
COUNTER 1 SET POINT: HIGH WORD		
COUNTER 2 SET POINT: LOW WORD		
COUNTER 2 SET POINT: HIGH WORD		

This table shows the parameters configuration screen for the entry: RATE SAMPLE MODE

Name	Value	Options
NUMBER OF COUNTERS	RATE SAMPLE MODE	2x16 WITH OUTPUT 1x32 WITH OUTPUT 1x32 NO OUTPUT
COUNTER 1 MODE CONTROL	QUADRATURE	INCREMENTAL
COUNTER 2 MODE CONTROL	QUADRATURE	INCREMENTAL
COUNTER 1 RATE SAMPLER TIMER	0	0-65535
COUNTER 2 RATE SAMPLER TIMER		

Chapter 30
140 EHC 105 00: High Speed Counter Module

Purpose

The following chapter provides information of the Quantum 140 EHC 105 00 High Speed Counter Module.

What Is in This Chapter?

This chapter contains the following topics:

Presentation

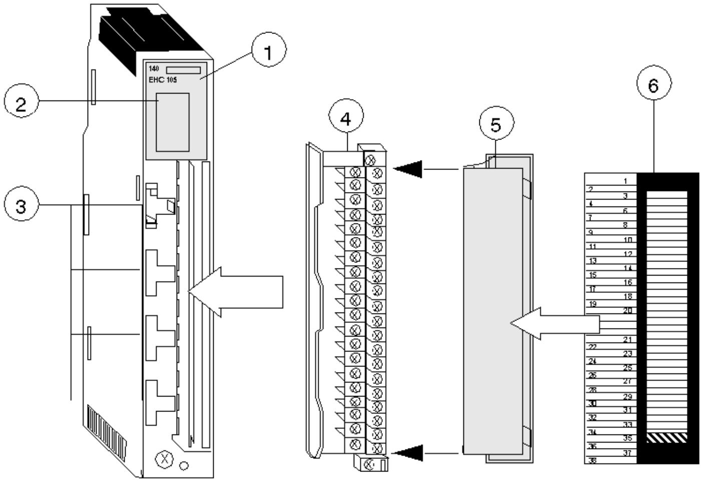
Function

The 140 EHC 105 00 is a highspeed counter module. It utilizes five equivalent, independently usable counters with the following functions:

- 32bit event counter with 6 modes
  - Event counter with parallel set point output activation
  - Event counter with parallel set point output activation and fast Final Set Point
  - Event counter with serial set point activation
  - Event counter with serial set point activation and fast final set point
  - Event counter with timed set point output activation
  - Event counter with latched set point output avtivation
- 32bit differential counter (2 configurable counter pairs) with 2 modes
  - Differential counter with serial set point output activation
  - Differential counter with parallel set point output activation
- 16bit repetitive counter
- 32bit (velocity counter, rate counter) with 2 modes
  - Rate counter with 100ms gate time
  - Rate counter with 1s gate time

Illustration

The following figure shows the EHC 105 module and its components.



1 Model Number, Module Description, Color Code
2 LED Display
3 Fuse Cutouts
4 Field Wiring Terminal Strip
5 Removable Door
6 Customer Identification Label (Fold label and place it inside door)

NOTE: The field wiring terminal strip (Modicon #140 XTS 002 00) must be ordered separately. (The terminal strip includes the removable door and label.)

Specifications

General Specifications

General Specifications

Module Type	High Speed Counter Module
Number of Channels	5
External Power	19,2 ... 30 VDC, 24 VDC nominal, 60 mA required plus the load current for each output.
Power Dissipation	Maximum 6W
Bus Current required	250 mA
I/O Map	12 words IN, 13 words OUT
Isolation (channel to bus)	500 VAC rms for 1 minute
Fault detection	Loss of output field power, output short circuit
Fusing	internal: none external: user discretion
Backplane Support	Local, remote or distributed
Compatibility	All Quantum Controllers, V2.0 at a minimum

NOTE: The 5Cx and 24Cx counter inputs may be used alternatively.

Counter Inputs

Counter Inputs

Counter Inputs	5V	24V
Count frequency	100 kHz	20 kHz
Count to output assertion delay (Max)	3ms	
Input voltage	OFF state (VDC) :1,0 ... +1,15 ON state (VDC): 3,1 ... 5,5	OFF state (VDC): -3,0 ... +5,0 ON state (VDC):15,0 ... 30,0
Input current	8 mA for 3,1VDC	7 mA for 24 VDC
Duty cycle	1 : 1	
Data formats	16 bit counter: 65.535 Decimal 32 bit counter: 2.147.483.647 Decimal	
Delay time (typical)	t = 0,002 ms	
Operating mode	discrete incremental counter	

Discrete Inputs

Discrete Inputs

Discrete Inputs	24V
VREF supply +24VDC	Off State (VDC): -3,0 ... +5,0 ON State (VDC):15,0 ... 30,0
Delay time (typical) IN1 ... IN6 IN7, IN8	 ton = 2,2 ms, toff = 1 ms ton = 0,006 ms, toff = 0,3 ms
Input current (typical)	5 mA

Input Threshold

Input Threshold

single ended mode	5 VREF DC	-
	12 VREF DC	-
	24 VREF DC	-3 ... 5 V on state/15 ... 30 off state
differential mode		-

Discrete Outputs

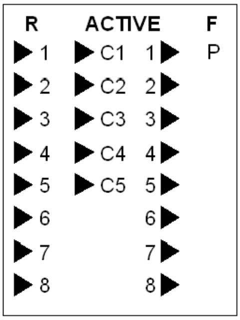
Discrete Outputs

Output Voltage	24V
FET Switch ON	20 ... 30 VDC
FET Switch OFF	0 VDC (ground reference)
Max load current (each output)	0,5 A
Output off state Leackage	0,1 mA max @ 30 VDC
Output on state voltage drop	1,5 VDC @ 0,5 A

Indicators

Illustration

The following table shows the LED indicators for the EHC 105 module.



Description

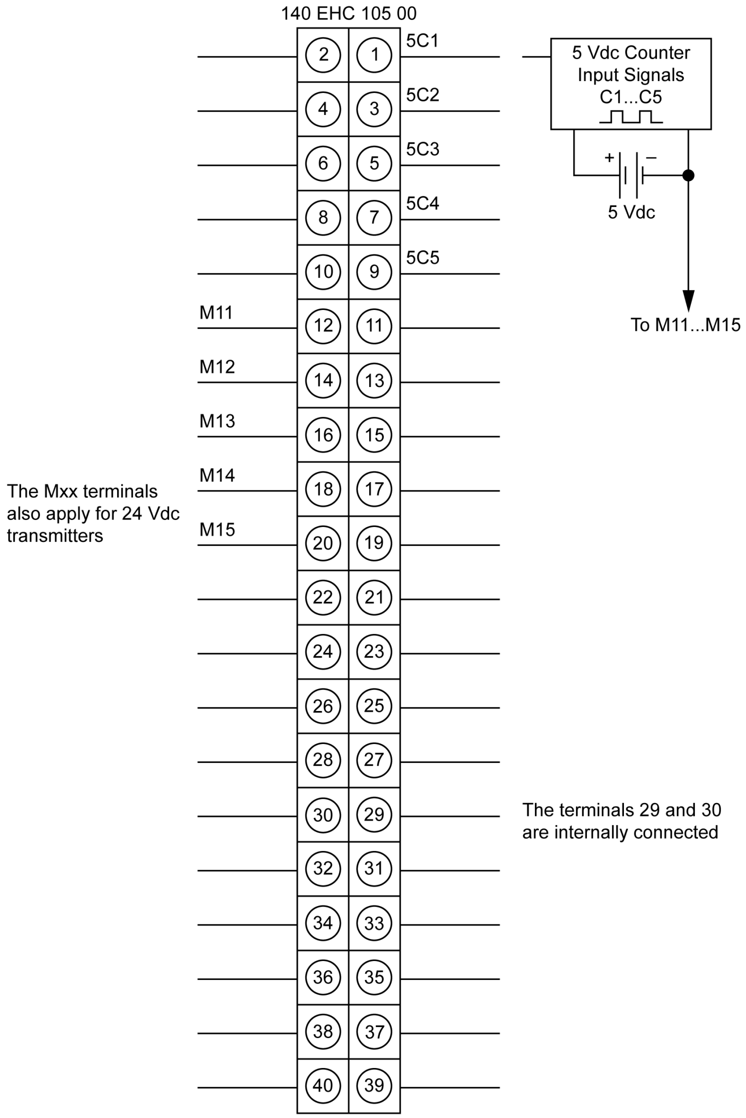
The following table shows the LED descriptions for the EHC 105 module

LED	Color	Description
R	green	Module is READY (firmware initialization has been completed).
P	green	POWER - the US24 working voltage is present.
F	red	The red F-LED (F = fault) lights on the following faults: ● 24 VDC supply voltage (US24) not present ● Short circuit on one of the OUTn outputs ● Pulse monitoring has tripped (indicate bit = 1 and ERRx = 1) ● Counter overflow (indicate bit = 0 and ERRx = 1)
ACTIVE	green	The PLC communication becomes active.
1 to 8	green	Displays the signal states of the discrete inputs IN1...IN8.
1 to 8	green	Displays the signal states of the discrete outputs OUT1...OUT8.
C1 to C5	green	Lights with the clock frequency applied to clock-inputs 5C1 to 5C5 respectively 24C1 to 24C5.

Wiring

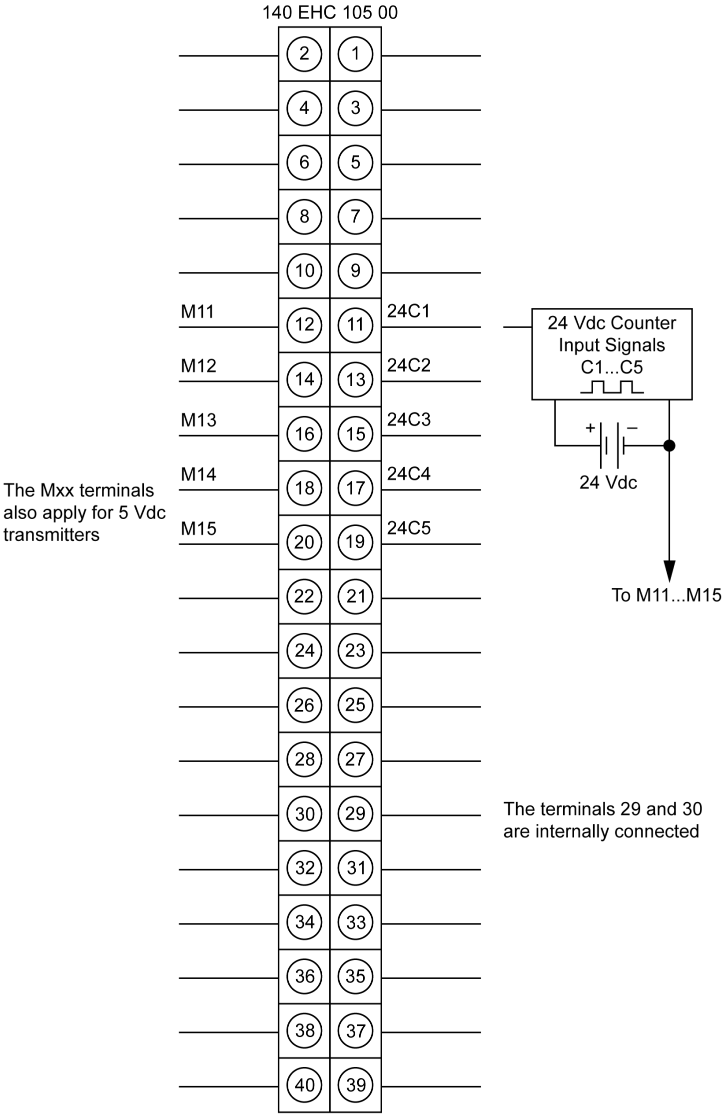
5Cx Counter Inputs

Wiring diagram for 5Cx counter inputs:



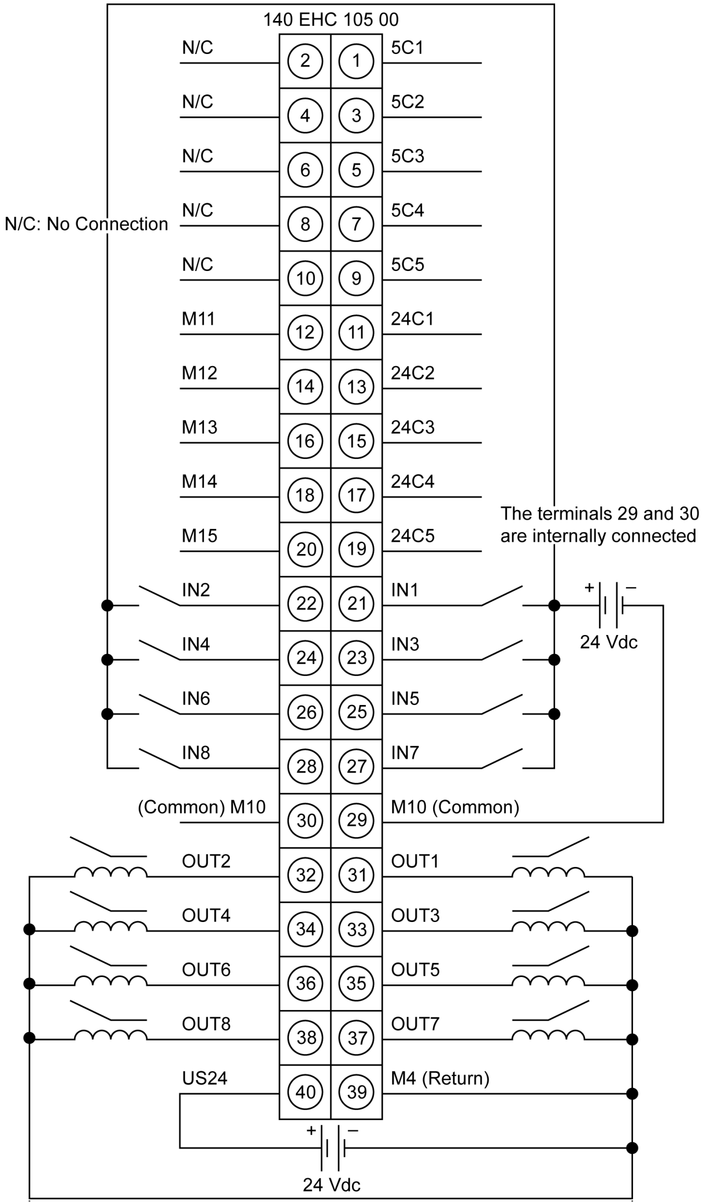
24Cx Counter Inputs

Wiring diagram for 24Cx counter inputs:



Discrete Inputs and Outputs

Wiring diagram for discrete inputs and outputs:



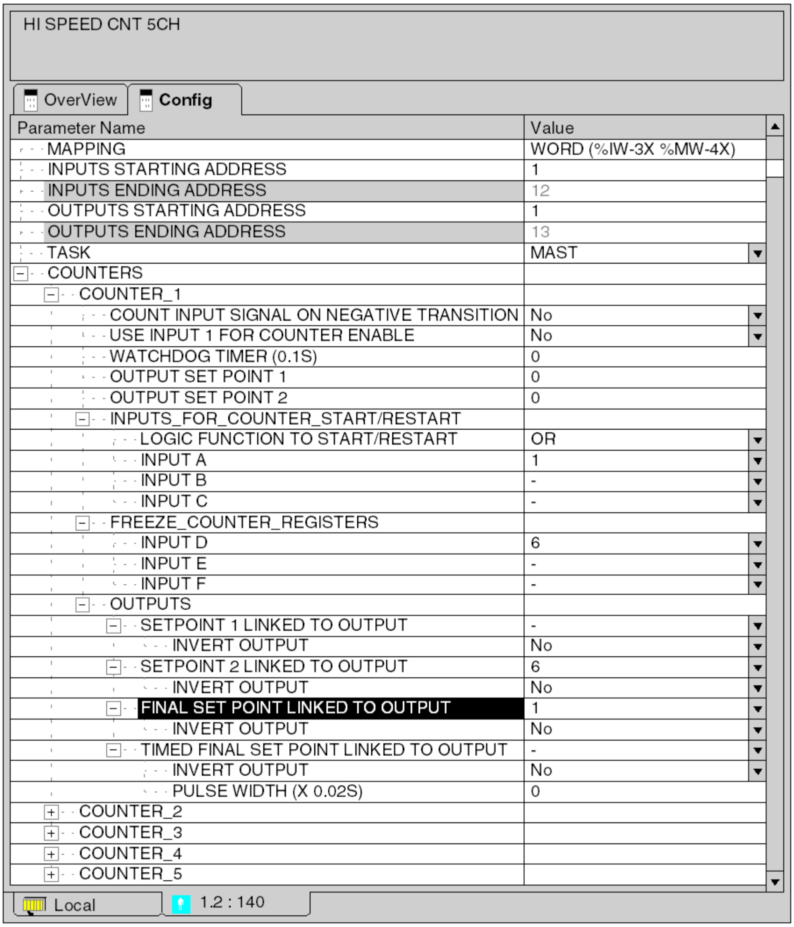
Parameter Configuration

Overview

This section provides information on the parameters, accessible in the Parameter Configuration Screen.

Parameter Configuration Default Screen

This diagram shows the Parameter Configuration default screen



Addressing and Task

This table shows the parameters for addressing and task with its values

Name		Default Value	Options
MAPPING		WORD (%IW-3X%MW-4x)	-
INPUTS STARTING ADDRESS		1	-
INPUTS ENDING ADDRESS		12	-
OUTPUTS STARTING ADDRESS		1	-
OUTPUTS ENDING ADDRESS		13	-
TASK (Grayed if module in other than local)		MAST	FAST AUX0 AUX1 AUX2 AUX3

Counters

This table shows the parameters for the counters with its values

Name		Default Value	Options
COUNTER_1			
COUNT INPUT SIGNAL ON NEGATIVE TRANSITION		No	Yes
USE INPUT 1 FOR COUNTER ENABLE		No	Yes
WATCHDOG TIMER (0.1s)		0	0-255
OUTPUT SET POINT 1		0	0-65535
OUTPUT SET POINT 2		0	0-65535
INPUTS_COUNTER_START/RESTART	LOGIC FUNCTION TO START/RESTART COUNTER	OR	AND
	INPUT A	1	- 1-8
	INPUT B	-	- 1-8
	INPUT C	-	- 1-8
FREEZE_COUNTER_REGISTERS	INPUT D	6	- 1-8
	INPUT E	-	1-8
	INPUT F	-	1-8

Name		Default Value	Options
OUTPUTS	SETPOINT 1 LINKED TO OUTPUT	-	1-8
	● INVERT OUTPUT	No	Yes
	SETPOINT 2 LINKED TO OUTPUT	6	- 1-8
	● INVERT OUTPUT	No	Yes
	FINAL SETPOINT LINKED TO OUTPUT	1	- 1-8
	● INVERT OUTPUT	No	Yes
	TIMED FINAL SETPOINT LINKED TO OUTPUT	-	1-8
	● INVERT OUTPUT	No	Yes
	● PULSE WIDTH (x 0.02s)		0-255
COUNTER_2 COUNTER_3 COUNTER_4 COUNTER_5		See COUNTER_1	

Glossary

H

HTTP

A domain name given to a specific computer on a network and used to address that computer.

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