# Quantum with Unity Pro
## Experts and Communication
## Reference Manual

10/2014

35010574.11

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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, 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.

# 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 Unity Pro.

### Validity Note

This document is valid for Unity Pro V8.1 or later.

The technical characteristics of the devices described in this document also appear online. To access this 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.<br>● Do not include blank spaces in the model number/product range.<br>● 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.<br>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 data sheet. |
| 6 | To save or print a data sheet as a .pdf file, click **Download XXX product datasheet**. |

The characteristics that are presented in this manual 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 manual 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 www.schneider-electric.com.

## 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 | Chapter Name | Page |
|---|---|---|
| 1 | Module Configuration | 15 |
| 2 | Quantum Addressing Modes | 19 |

# 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:


| Topic | Page |
|---|---|
| Mapping a Local Quantum I/O Station | 16 |
| Open the Parameter Configuration | 17 |

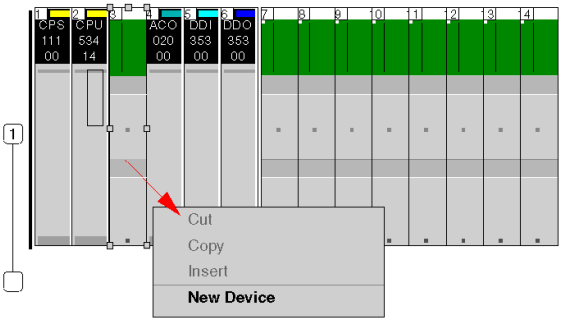
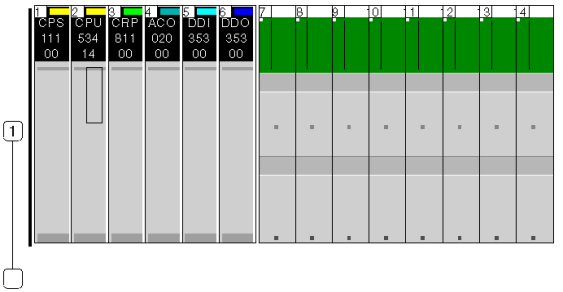
# Mapping a Local Quantum I/O Station

## 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<br>**Result:** A shortcut menu is opened<br> |
| 5 | Select **New Device**<br>**Result:** A dialog window opens that displays available modules |
| 6 | Select the desired module from the respective category in the Hardware catalog.<br>**Result:** The new module is inserted in the empty slot on the local station.<br> |

# Open the Parameter Configuration

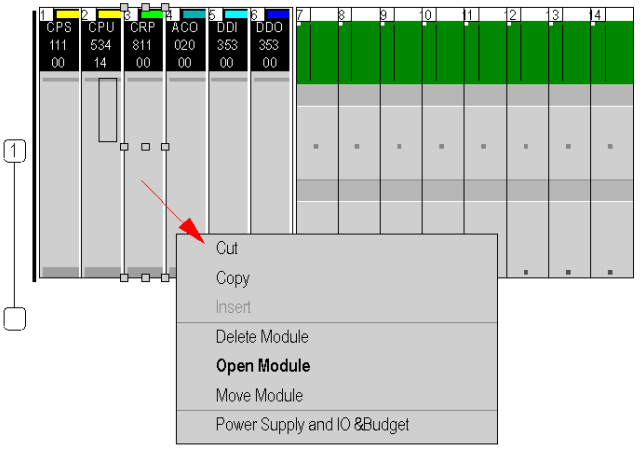
## Overview

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<br>**Result:** A shortcut menu is opened<br> |
| 4 | Select **Open Module**<br>**Result:** The module opens with the parameter configuration window |

# Chapter 2
# Quantum Addressing Modes

## Purpose

This chapter provides information on the three different modes Unity Pro 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:


| Topic | Page |
|---|---|
| Flat Addressing—800 Series I/O Modules | 20 |
| Topological Addressing—800 Series I/O Modules with Unity | 21 |
| IODDT Addressing | 22 |
| Quantum IODDTs | 23 |
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| I/O Module Status Byte | 27 |

# Flat Addressing—800 Series I/O Modules

## Introduction

800 series I/O modules follow a system of flat address mapping in Unity Pro. 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 Unity

## 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 Unity Pro 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 *Unity Pro 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 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

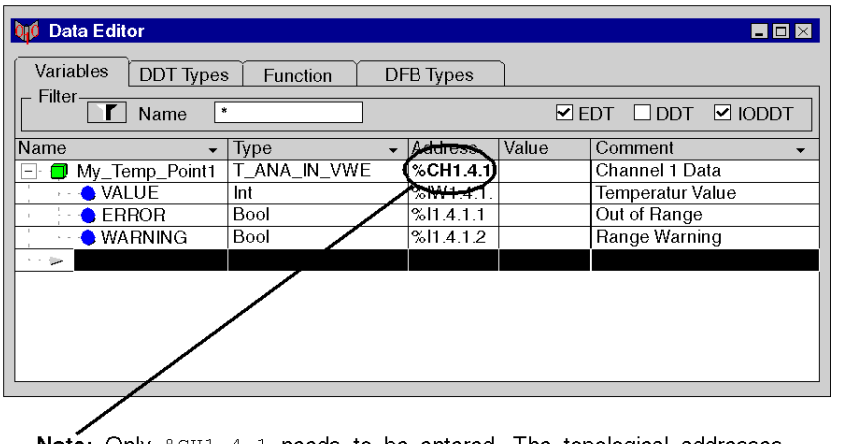
An IODDT allows all information (bits and registers) related to a channel to be handled through a user-defined variable. This variable is defined in the Unity Pro data editor by selecting the appropriate IODDT for the module as a data type and specifying the topological address of the module using the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

Unity Pro 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 *Unity Pro 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 **V**alue, **W**arning and **E**rror

| 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<br>"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<br>Bit 5 to be extracted by user logic |
| Channel 3 range warning | %IW209.13 | %I1.5.3.2 | My_Temp.WARNING | 300209<br>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.

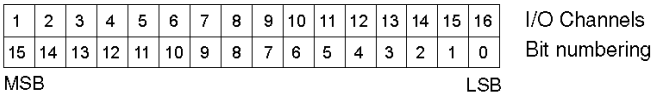
For comparison, the register addressing as used with Concept is added in the last column. As Concept does not support direct addressing of a bit in a word, the bit extraction has to be performed in the user program.

# 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:.




## 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

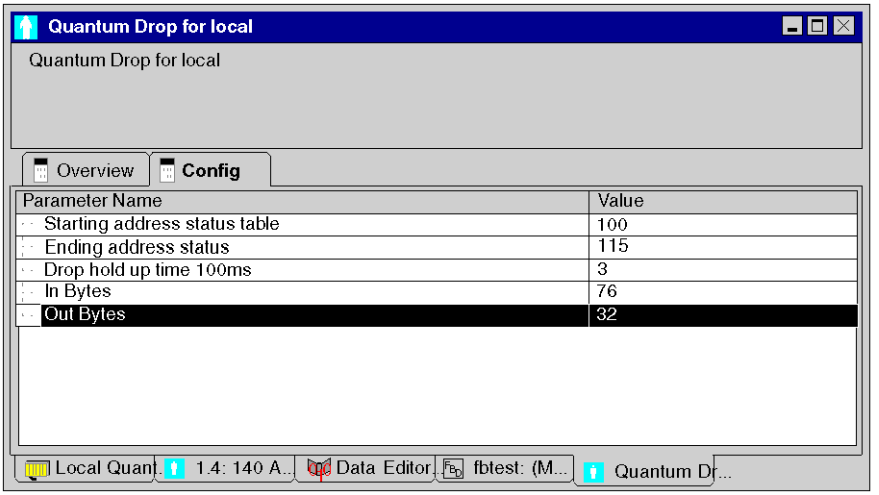
## Addressing Module Status Data

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.

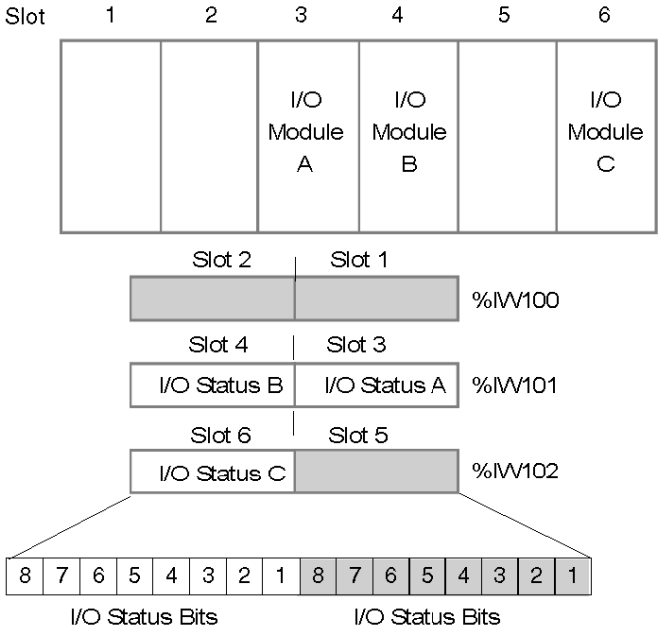
This information is not accessible through topological addressing.

**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:

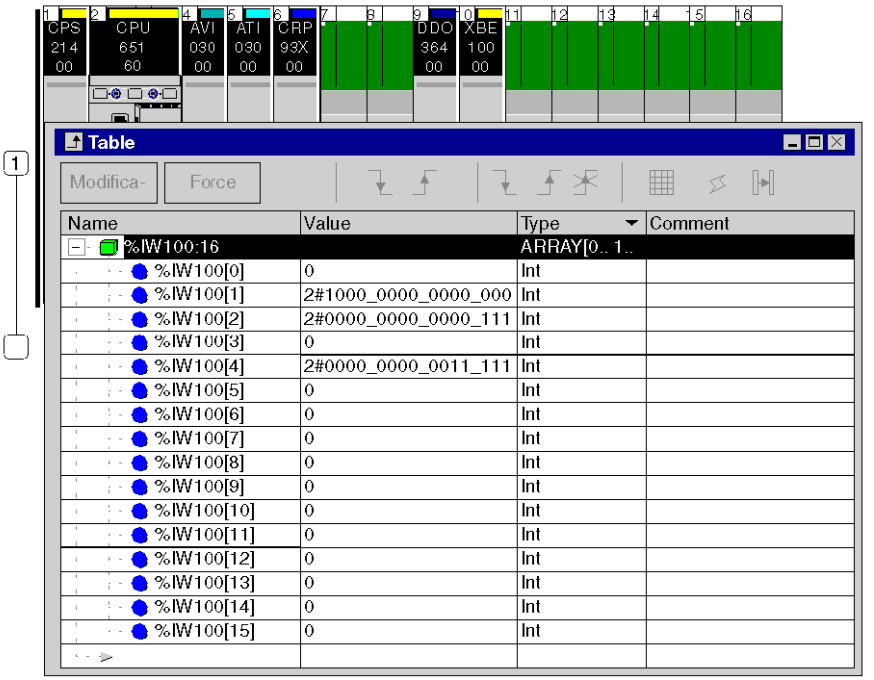


## Example

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:



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 12*, Modicon Remote I/O Cable System Planning and Installation Guide

## What Is in This Part?

This part contains the following chapters:


| Chapter | Chapter Name | Page |
|---|---|---|
| 3 | 140 CRP 931 00: Remote I/O (RIO) Head Module (single channel) | 33 |
| 4 | 140 CRP 932 00: Remote I/O (RIO) Head Module (dual channel) | 39 |
| 5 | 140 CRA 931 00: Remote I/O (RIO) Drop Module (single channel) | 45 |
| 6 | 140 CRA 932 00: Remote I/O (RIO) Drop Module (dual channel) | 51 |
| 7 | 140 NRP 954 00: Fiber Optic Repeater Module (Multimode) | 57 |
| 8 | 140 NRP 954 01C: Fiber Optic Repeater Module (Single-mode) | 75 |

# 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:


| Topic | Page |
|---|---|
| Presentation | 34 |
| Indicators | 35 |
| Error Codes | 36 |
| Specifications | 38 |

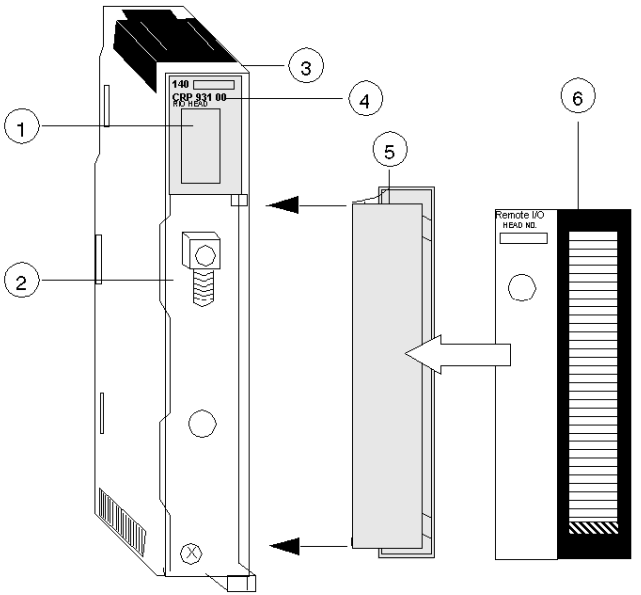
# Presentation

## 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.



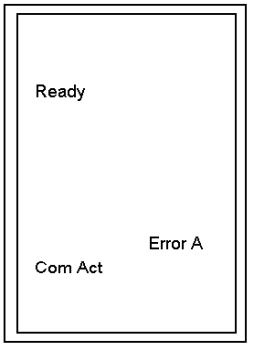

**1** LED Area
**2** RIO Coax Connector
**3** Version Label
**4** Model Number, Module Description, Color Code
**5** Removable Door
**6** Customer Identification Label (Fold label and place it inside door)

**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<br>200 Series<br>500 Series or<br>SY/MAX (any mix) |
| Drops | 31 max |
| Words/Drop | 64 In / 64 Out |
| ASCII | 2 ports/drop, 32 ports (16 drops) max<br>Requires the use of:<br>AS-P892-000<br>AS-J892-101/102 or<br>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<br>LAN Controller Check |
| Runtime | Executive Checksum<br>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:


| Topic | Page |
|---|---|
| Presentation | 40 |
| Indicators | 41 |
| Error Codes | 42 |
| Specifications | 44 |

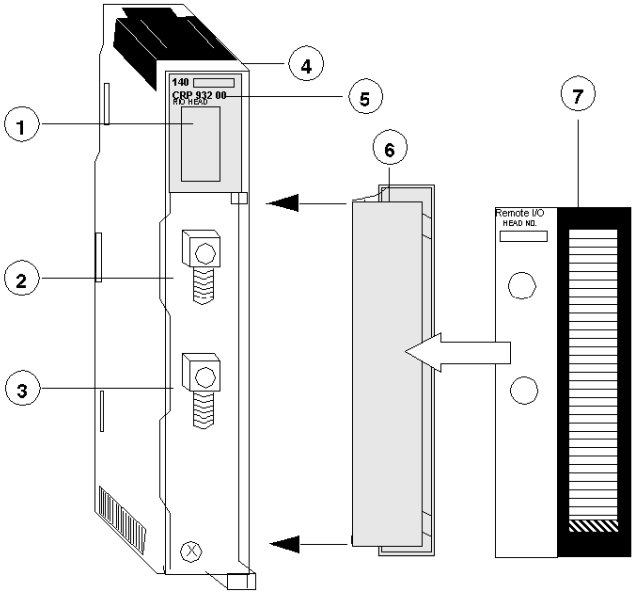
# Presentation

## 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.



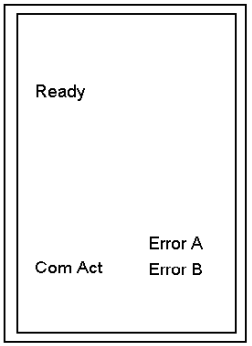

**1** LED Area
**2** RIO Coax Connector (Channel A)
**3** RIO Coax Connector (Channel B)
**4** Version Label
**5** Model Number, Module Description, Color Code
**6** Removable Door
**7** Customer Identification Label (Fold label and place it inside door)

**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 Unity Pro, OSLoader, 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<br>200 Series<br>500 Series<br>800 Series or<br>SY/MAX (any mix) |
| Drops | 31 max |
| Words/Drop | 64 In / 64 Out |
| ASCII | 2 ports/drop, 32 ports (16 drops) max<br>Requires the use of:<br>AS-P892-000<br>AS-J892-101/102 or<br>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<br>LAN Controller Check |
| Runtime | Executive Checksum<br>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:


| Topic | Page |
|---|---|
| Presentation | 46 |
| Indicators | 48 |
| Error Codes | 49 |
| Specifications | 50 |

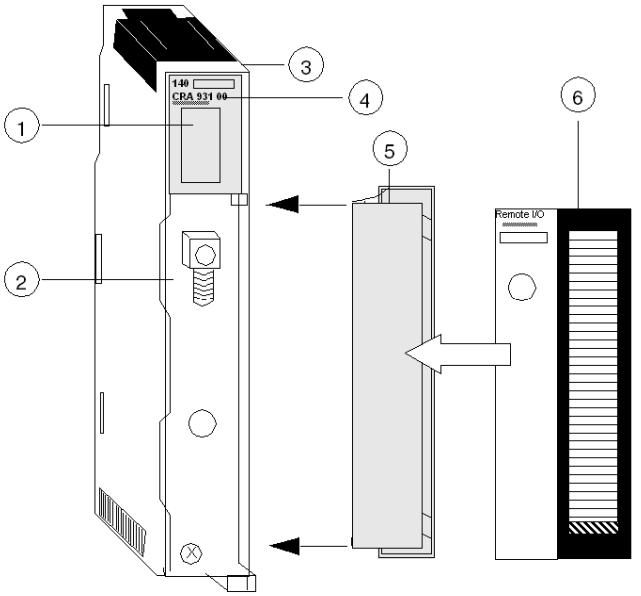
# Presentation

## 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).

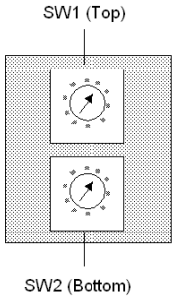
## Rear Panel Switches

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

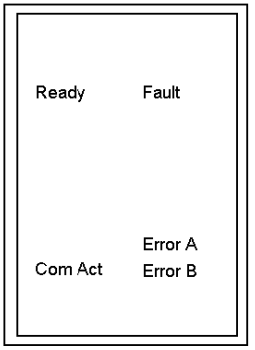
**NOTE:** If "0" or an address greater than 32 is selected, the RIO module displays a flashing "Error A"- and "Error B"-LED.

**NOTE:** 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.<br>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<br>LAN Controller Check | Executive Checksum<br>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:


| Topic | Page |
|---|---|
| Presentation | 52 |
| Indicators | 54 |
| Error Codes | 55 |
| Specifications | 56 |

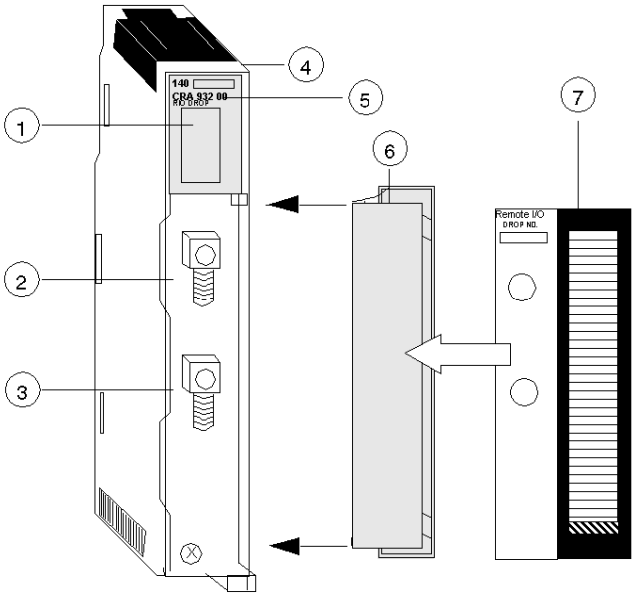
# Presentation

## 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).

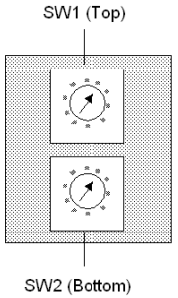
## Rear Panel Switches

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

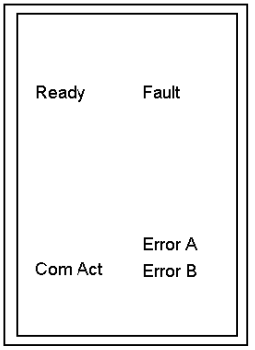
**NOTE:** If "0" or an address greater than 32 is selected, the RIO module displays a flashing "Error A"- and "Error B"- LED.

**NOTE:** 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.<br>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.<br>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<br>LAN Controller Check | Executive Checksum<br>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:


| Topic | Page |
|---|---|
| Presentation | 58 |
| LED Indicators and Diagnostic Relay Behavior | 61 |
| Module Connections | 63 |
| General Specifications | 73 |

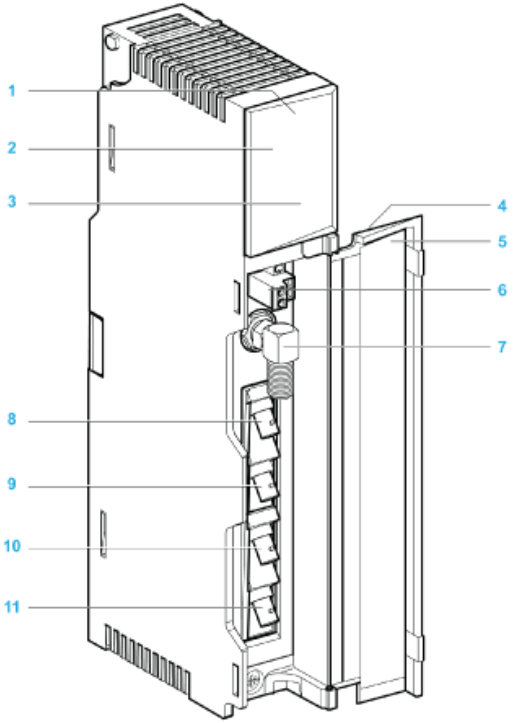
# Presentation

## 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.

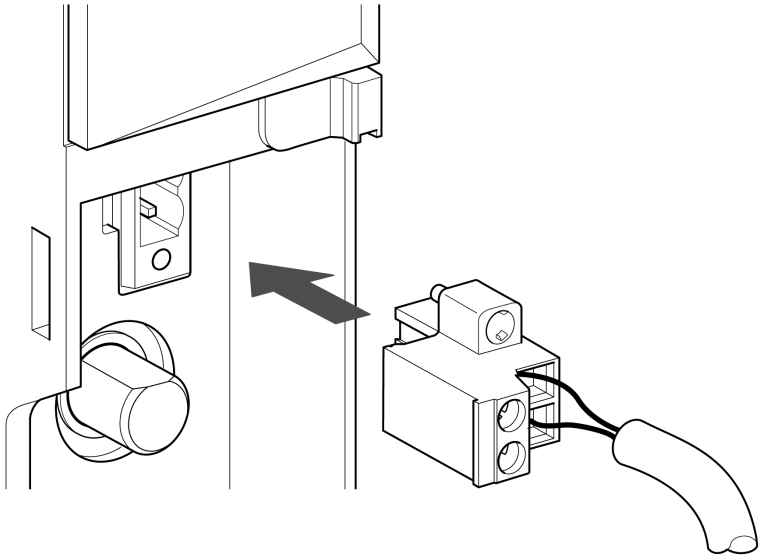



**1** Version label
**2** Model number, module description, color code
**3** LED area
**4** Removable door
**5** Customer identification label (Fold label and place it inside door)
**6** Diagnostic relay port
**7** Electrical coaxial port (“F” type connector)
**8** Transmitter optical fiber port - FPort 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 62)* 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**<br>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*).<br>**Failure to follow these instructions can result in injury or equipment damage.** |

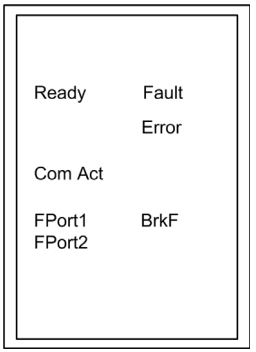
## Optical Ports

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

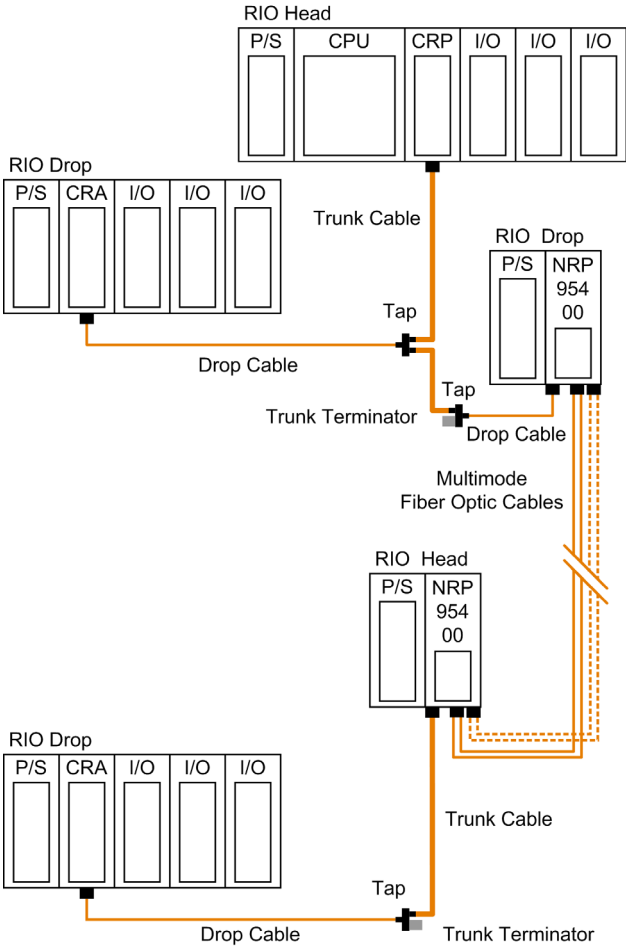
## Using Fiber Optics in a RIO System

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.

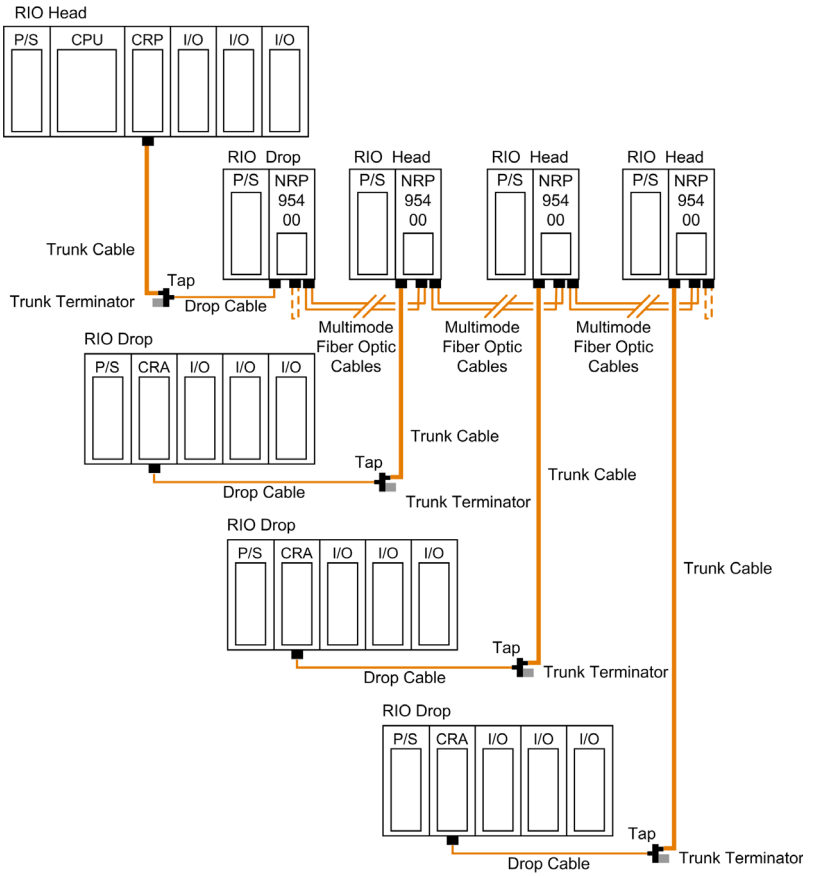
**NOTE:** For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

## 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.

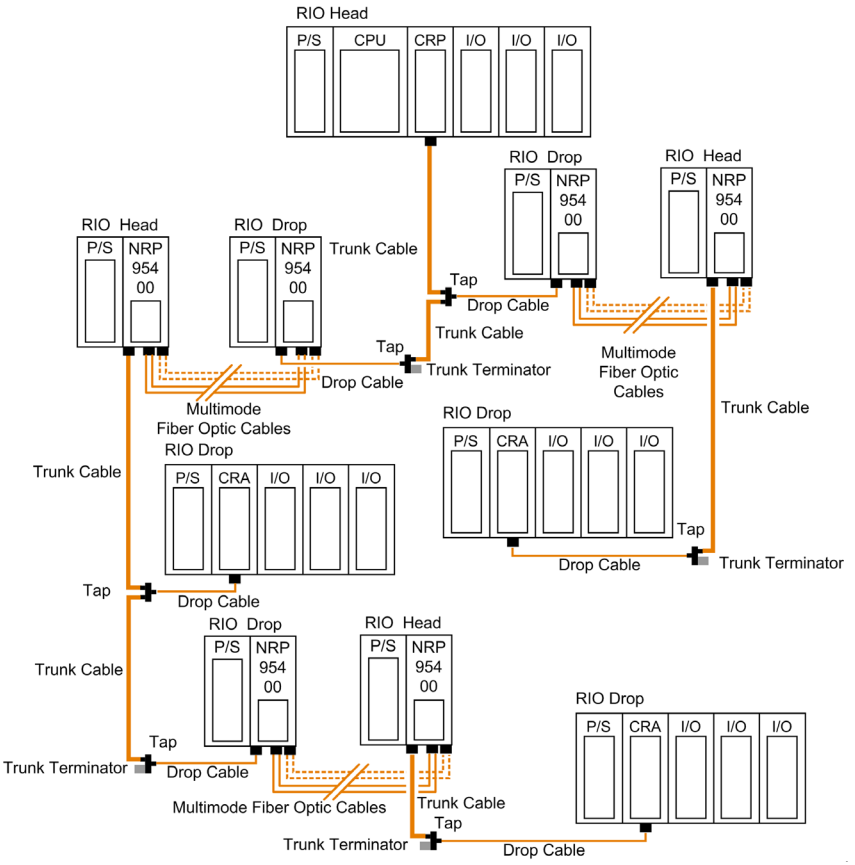
**NOTE:** At each end of the bus, looping back the unused optical ports with a short fiber helps using the diagnostics. For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

## 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 73)* 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:**

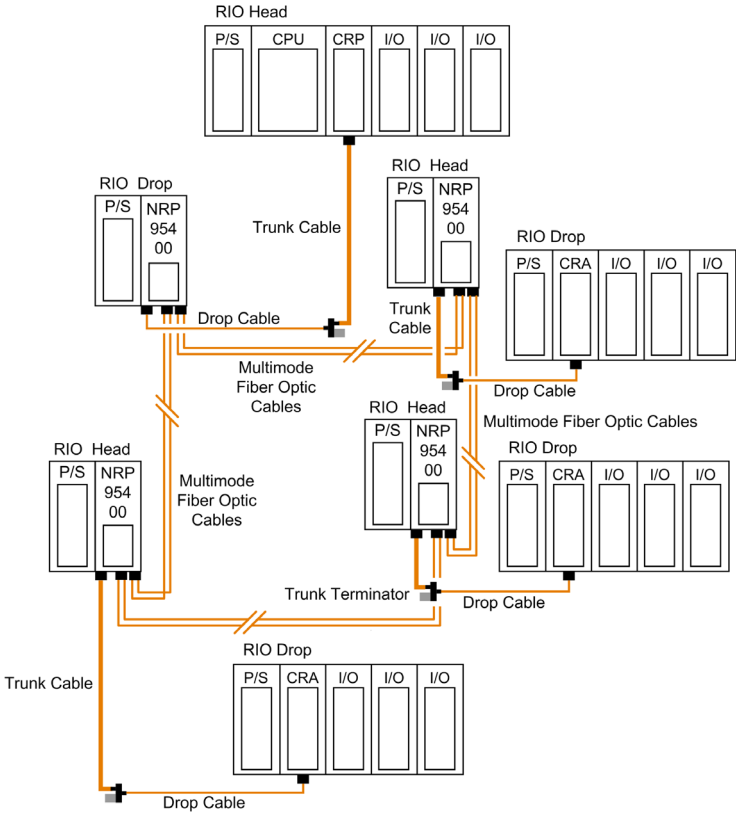
- Using 2 optical fiber pairs provides a better service and diagnostics.
- Using only one fiber pair, looping back the unused optical ports with a short fiber helps using the diagnostics.

**NOTE:** 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

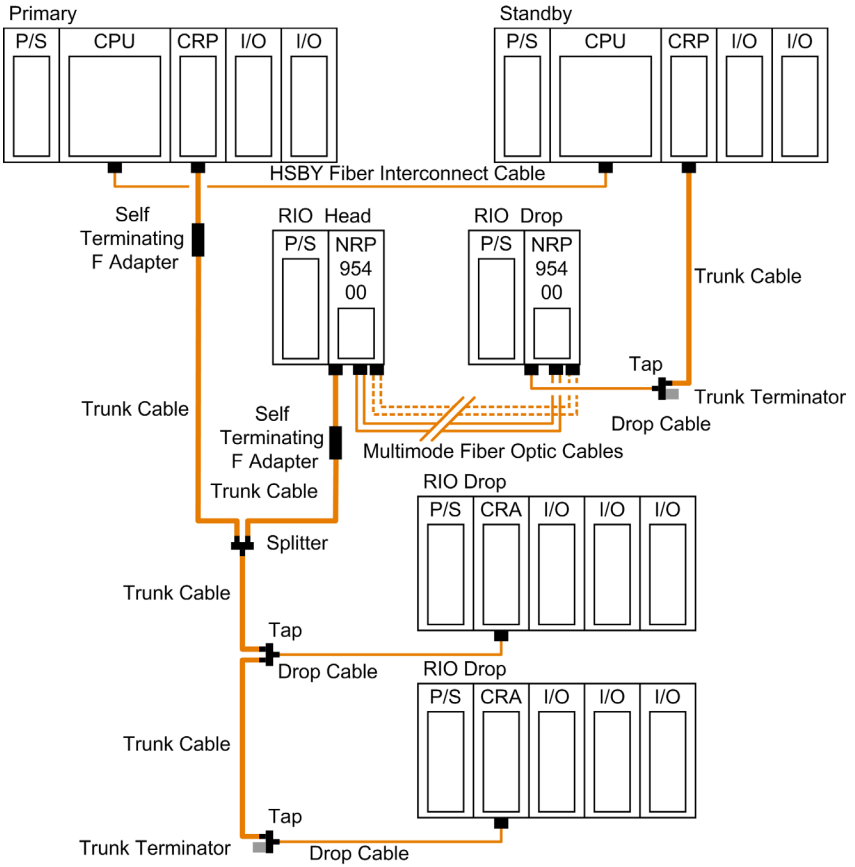
This configuration can be achieved by connecting the unused fiber optic ports of the first and last 140 NRP 954 00 directly or through the fiber optic repeater. This type of connection has all the advantages of the previously described configurations, along with built-in redundancy. A broken connection 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:**

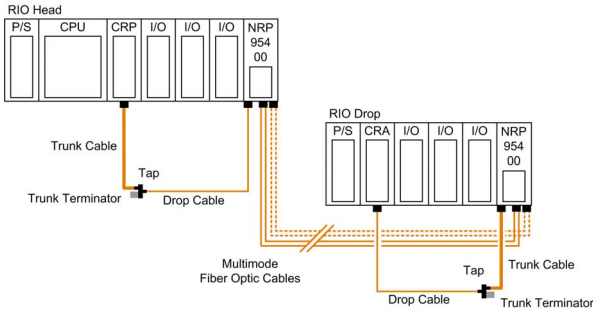
- Using 2 optical fiber pairs provides a better service and diagnostics.
- Using only one fiber pair, looping back the unused optical ports with a short fiber helps using the diagnostics.

**NOTE:** 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.

**NOTE:** 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.

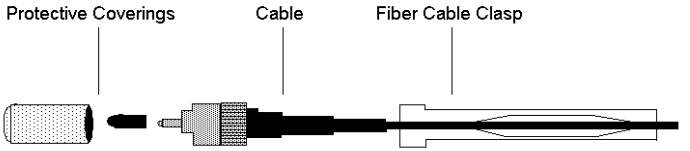
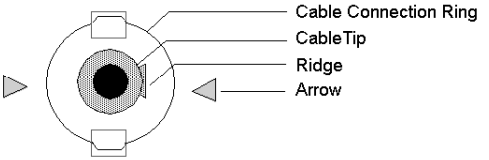
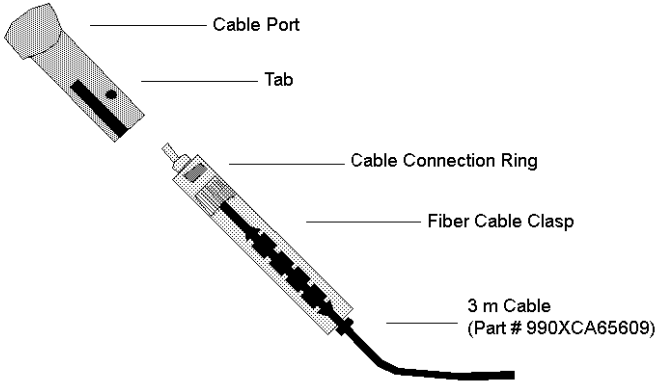
To prepare optic cables:

- 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.<br><br> |
| 2 | Turn the connection ring so that one of the arrows on the side of the ring lines up with the ridge inside.<br><br> |
| 3 | a. Slide the tool up to the connection ring.<br>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.<br>c. Use the clasp to push the cable over the tab on top of the port.<br>d. Turn the cable to the right, so that the tab locks securely<br>e. Remove the clasp.<br>f. Repeat this process with the remaining strand of cable.<br><br> |

# General Specifications

## Introduction

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

| ⚠ WARNING |
|---|
| **UNINTENDED EQUIPMENT OPERATION**<br>Do not exceed any of the rated values specified in the following tables.<br>**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<br>62.5/125 µm fiber –11 dB<br>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<br>3 km over 62.5/125 µm fiber @ 3.5 dB/km<br>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).<br>**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<br>**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<br>–10.0...–16 dBm average power in 62.5/125 µm fiber cable<br>–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:


| Topic | Page |
|---|---|
| Presentation | 76 |
| LED Indicators and Diagnostic Relay Behavior | 79 |
| Module Connections | 81 |
| General Specifications | 91 |

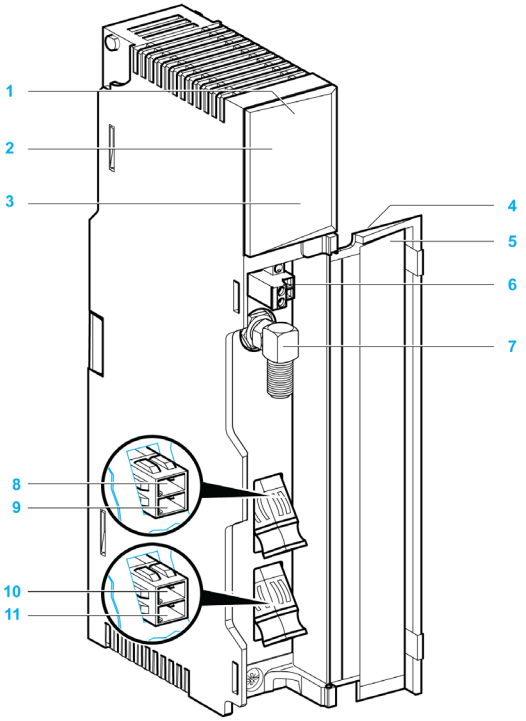
# Presentation

## 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.

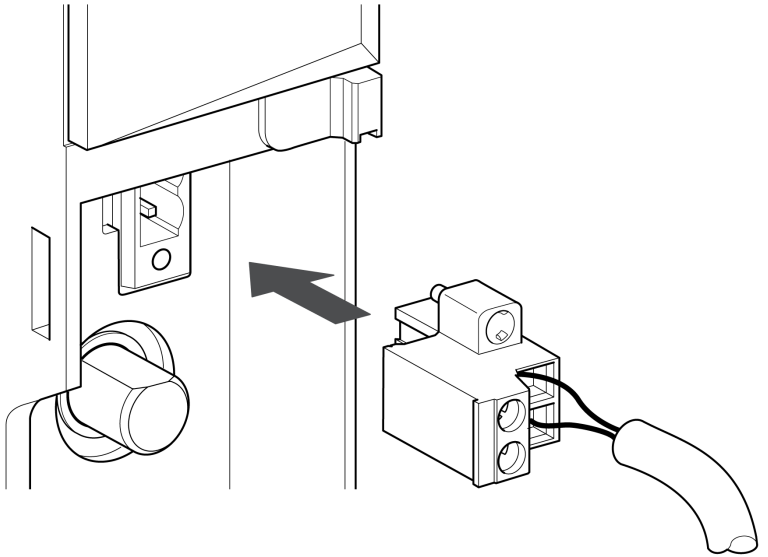



**1** Version label
**2** Model number, module description, color code
**3** LED area
**4** Removable door
**5** Customer identification label (Fold label and place it inside door)
**6** Diagnostic relay port
**7** Electrical coaxial port (“F” type connector)
**8** Receiver optical fiber port - FPort 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 62)* 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**<br>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*).<br>**Failure to follow these instructions can result in injury or equipment damage.** |

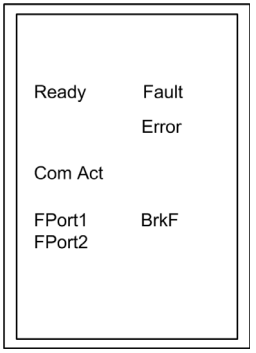
## Optical Ports

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

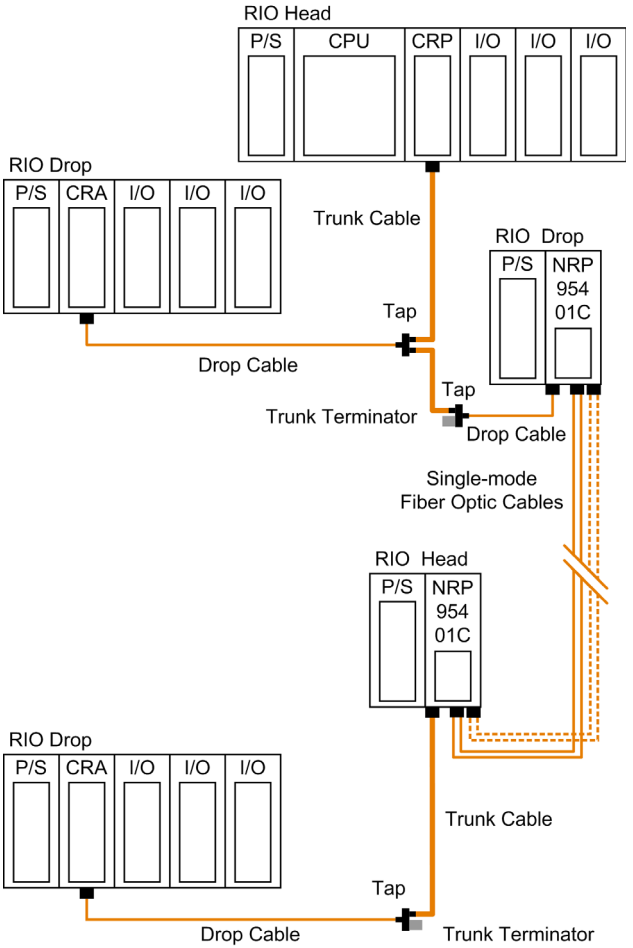
## Using Fiber Optics in a RIO System

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.

**NOTE:** 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.

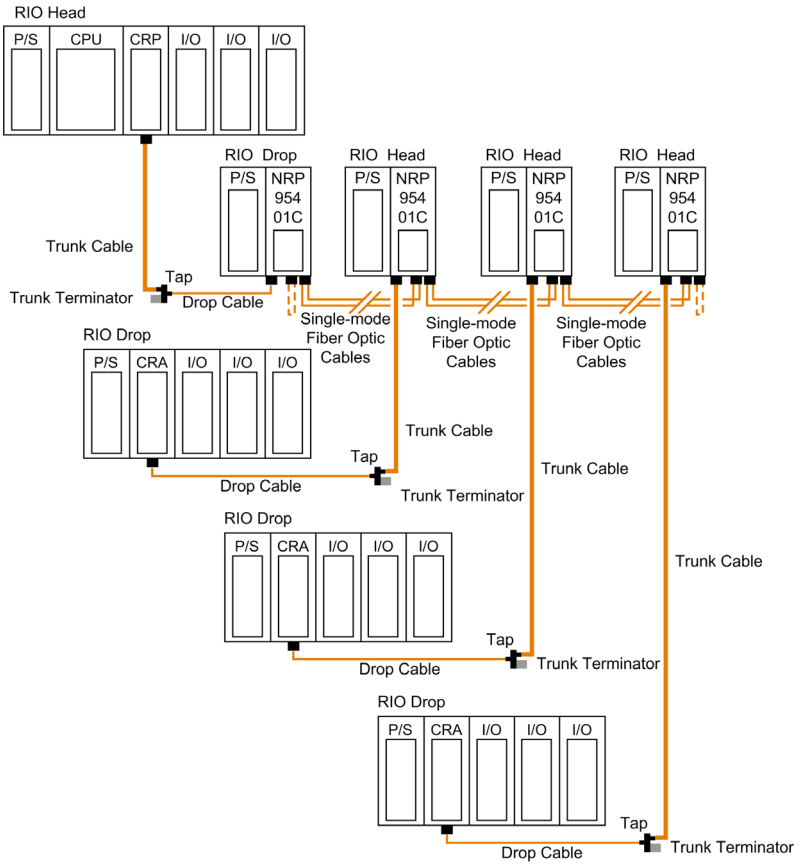
**⚠ CAUTION**

**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.

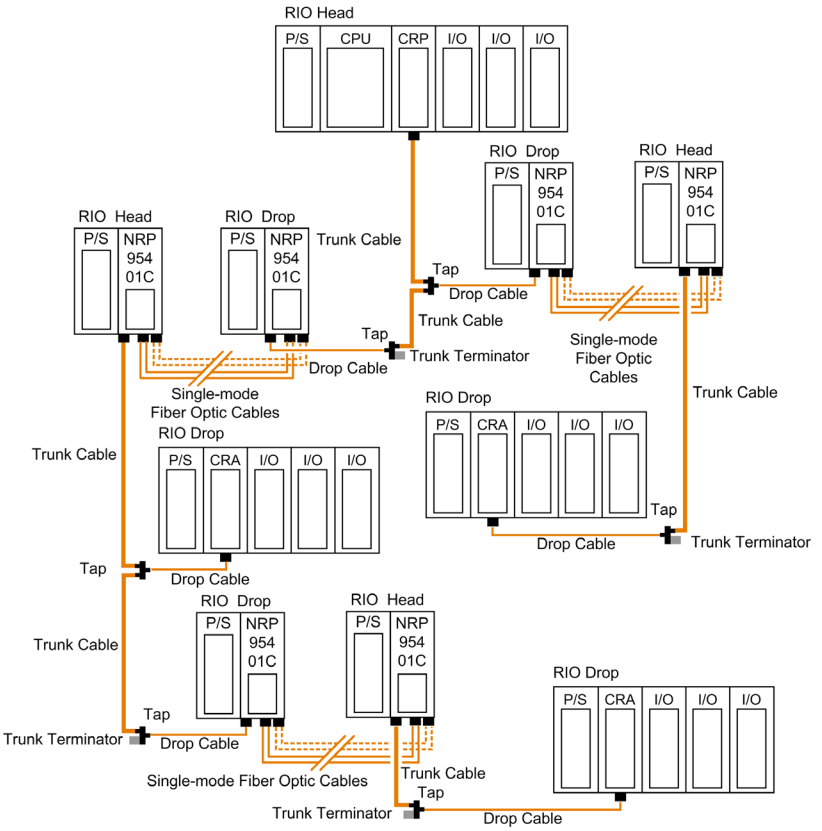
**NOTE:** At each end of the bus, looping back the unused optical ports with a short fiber helps using the diagnostics. For more details on the diagnostics, refer to the *Modicon 140 NRP 954 00 and 140 NRP 954 01C Fiber Optic Repeater Modules User Guide*.

## 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 91)* 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:**

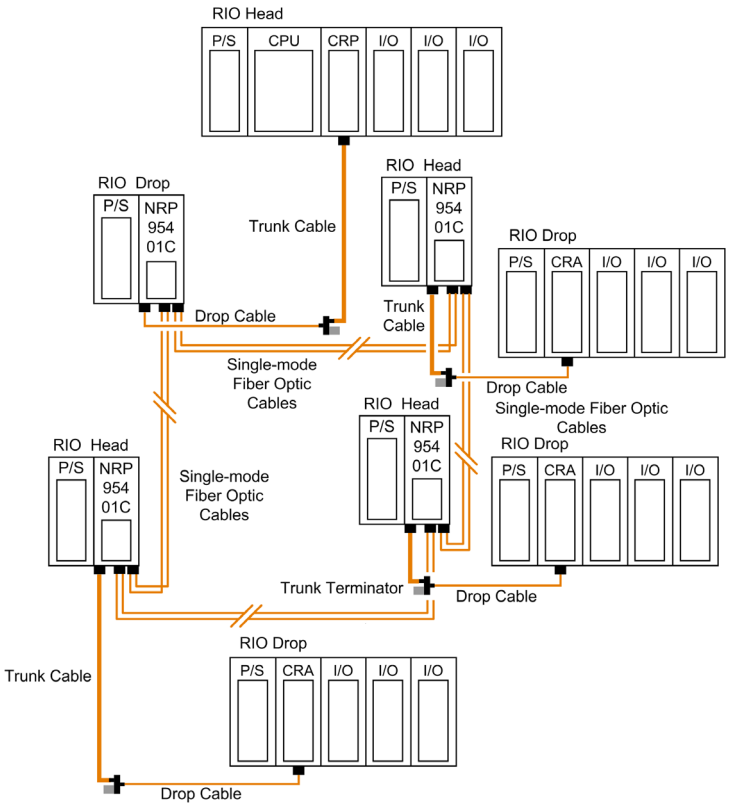
- Using 2 optical fiber pairs provides a better service and diagnostics.
- Using only one fiber pair, looping back the unused optical ports with a short fiber helps using the diagnostics.

**NOTE:** 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

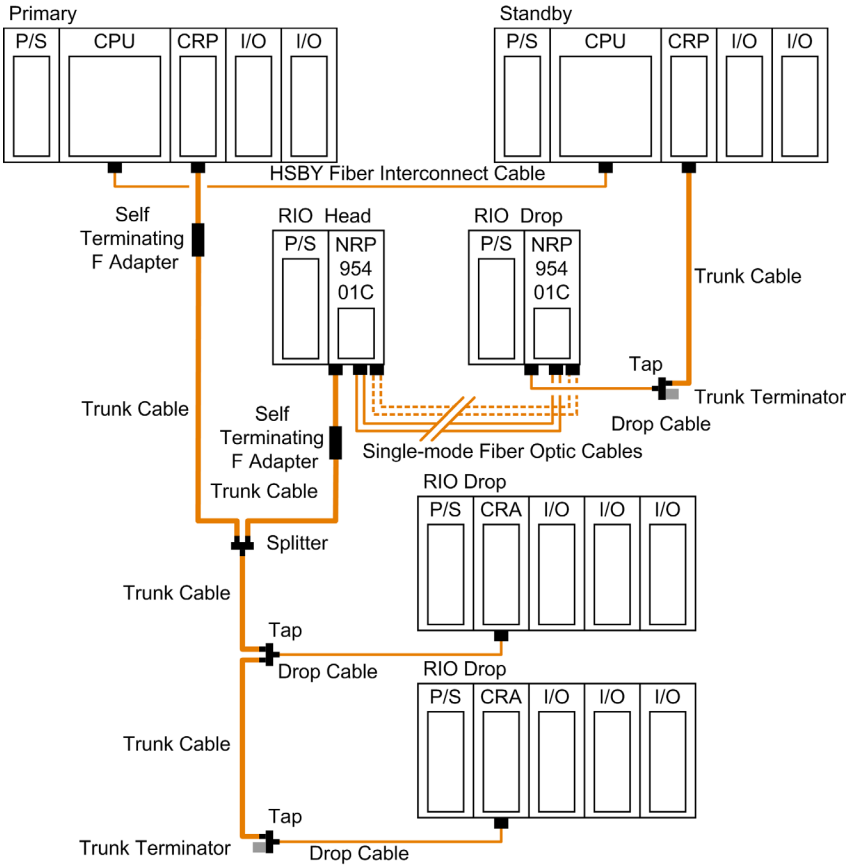
This configuration can be achieved by connecting the unused fiber optic ports of the first and last 140 NRP 954 01C directly or through the fiber optic repeater. This type of connection has all the advantages of the previously described configurations, along with built-in redundancy. A broken connection 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:**

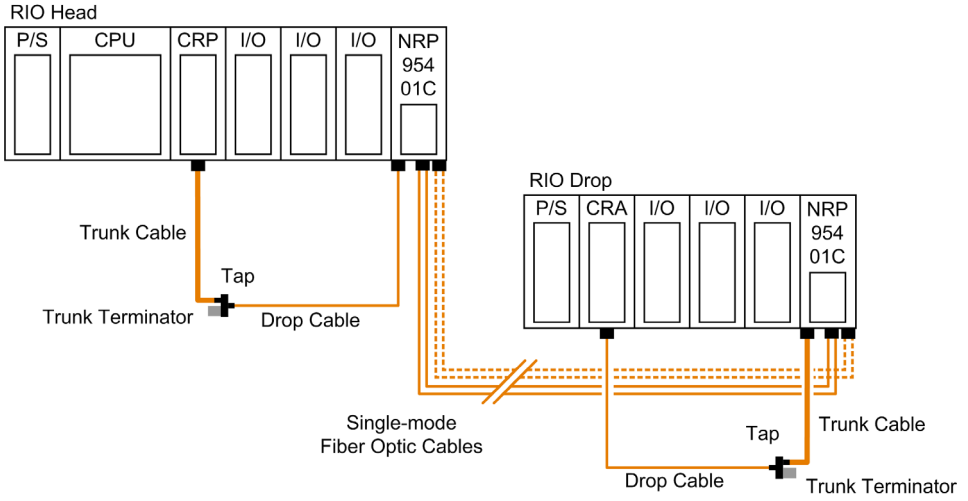
- Using 2 optical fiber pairs provides a better service and diagnostics.
- Using only one fiber pair, looping back the unused optical ports with a short fiber helps using the diagnostics.

**NOTE:** 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.

**NOTE:** 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.

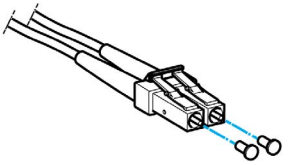
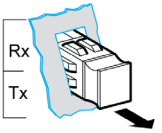
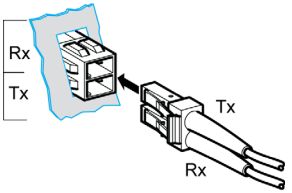
To prepare optic cables:

- 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.<br> |
| 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:<br> |
| 4 | Immediately attach the fiber optic cable to the LC duplex connector of the module as shown in the following figure:<br> |

## 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 | 2.1 | Yes | No(2) |

**PV** Product version
**SV** Software version

**(1)** An upgrade of the SV to 2.1 makes the module communication compatible.
**NOTE:** Upgrading the software version of the CRA module from 2.0 to 2.1 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 Unity Pro 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).<br>**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<br>**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**<br>● 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.<br>● During tightening be sure to maintain the connector securely.<br>● 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.<br>● Do not tighten the right-angle F adapter beyond the specified torque.<br>**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 | Chapter Name | Page |
|---|---|---|
| 9 | Software Configuration | 95 |
| 10 | 140 CRA 211 10: DIO Drop Module 115/230 VAC (single channel) | 99 |
| 11 | 140 CRA 212 10: DIO Drop Module 115/230 VAC (dual channel) | 107 |
| 12 | 140 CRA 211 20: DIO Drop Module 24 VDC (single channel) | 115 |
| 13 | 140 CRA 212 20: DIO Drop Module 24 VDC (dual channel) | 121 |

# 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.

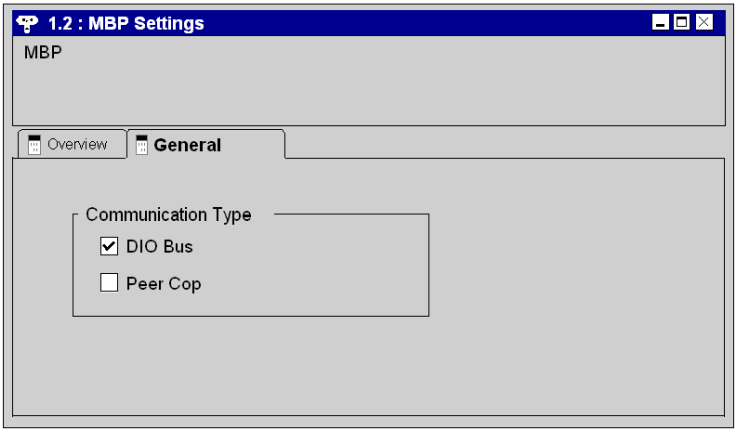
A DIO Bus can either be connected to the Modbus Plus connection on the CPU, or to a 140 NOM 2•• 00 communication module.

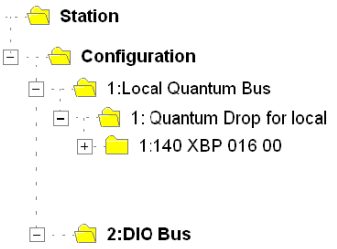
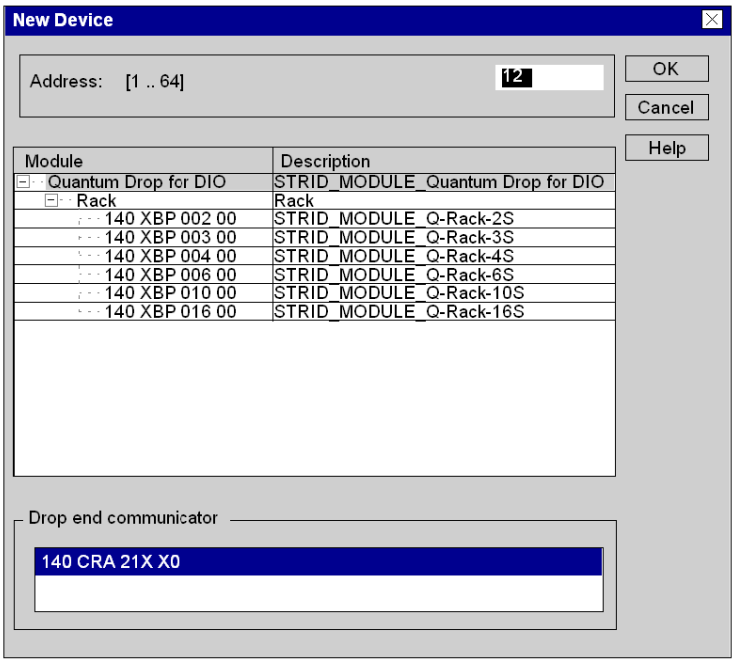
**NOTE:** The Quantum DIO Drop Modules 140 CRA 2•• ••• have no health bits.

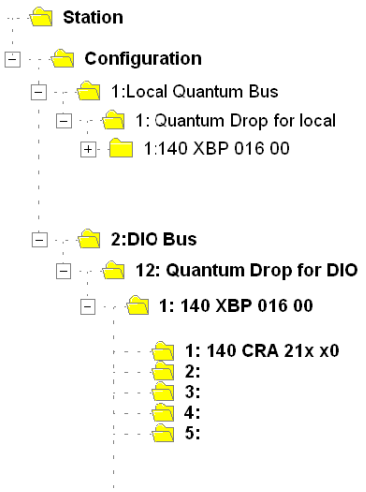
**NOTE:** For this reason the status for a properly functioning DIO Drop is always ZERO and not ONE as it is for other modules!

### 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.<br>The following configuration window is opened:<br> |

| Step | Action |
|---|---|
| 2 | Activate the **DIO Bus** check box in the configuration window and confirm your entry.<br>A DIO Bus is placed in the Project Browser:<br> |
| 3 | Open the DIO Bus and select add module rack and select **New Device**.<br>The module rack selection list is opened:<br> |

| Step | Action |
|---|---|
| 4 | Select the desired module rack and enter the Modbus Plus address in the address field. Confirm with OK.<br>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:<br> |
| 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:


| Topic | Page |
|---|---|
| Presentation | 100 |
| Indicators | 102 |
| Specifications | 103 |
| Wiring Diagram | 105 |

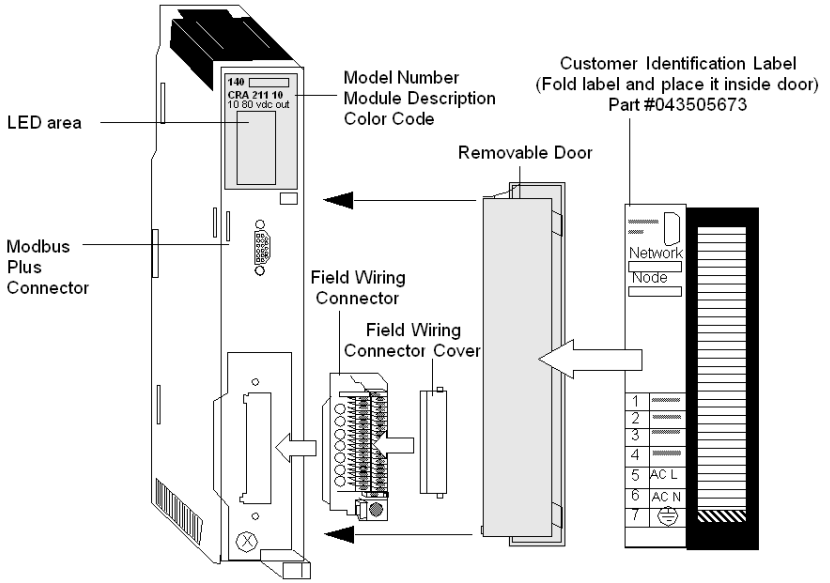
# Presentation

## 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.



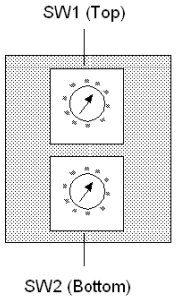

## Rear Panel Switches

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 |

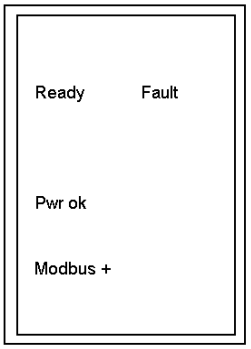
**NOTE:** Only addresses from 1 to 64 are valid.

**NOTE:** 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

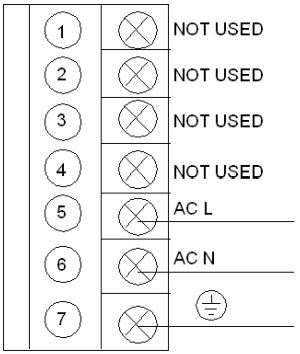
Diagnostics

| | |
|---|---|
| Power Up | RAM<br>RAM Address<br>Executive Checksum |
| Runtime | RAM<br>RAM Address<br>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 Hardware Reference Manual and the Grounding and Electromagnetic Compatibility of PLC Systems manual 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:


| Topic | Page |
|---|---|
| Presentation | 108 |
| Indicators | 110 |
| Specifications | 111 |
| Wiring Diagram | 113 |

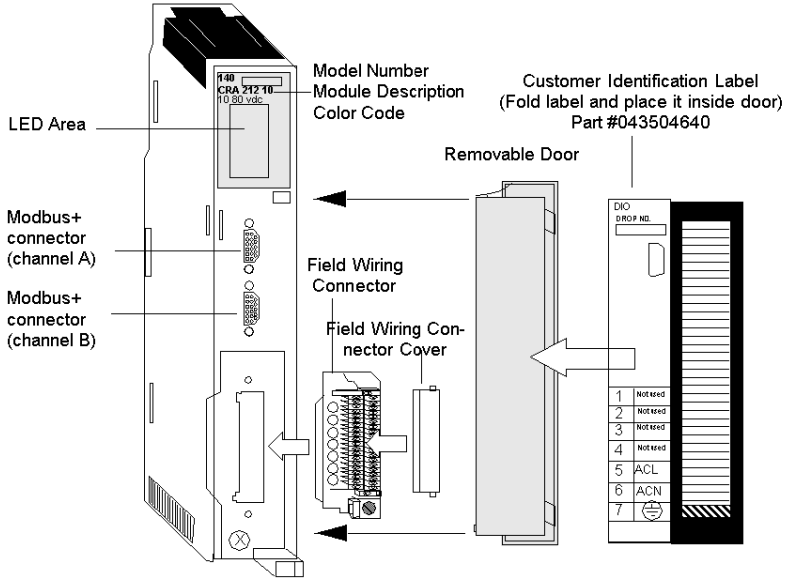
# Presentation

## 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.



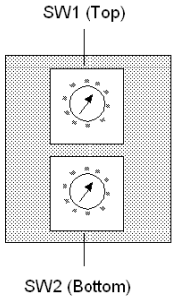

## Rear Panel Switches

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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 |

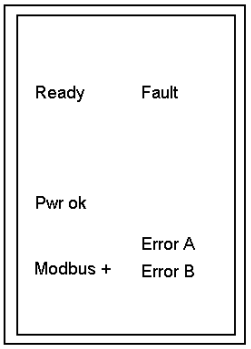
**NOTE:** Only addresses from 1 to 64 are valid.

**NOTE:** 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

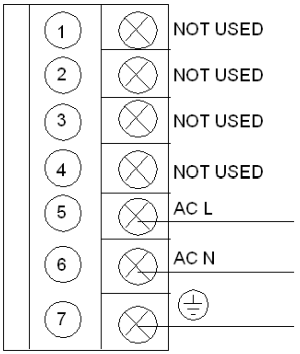
Diagnostics

| | |
|---|---|
| Power Up | RAM<br>RAM Address<br>Executive Checksum |
| Runtime | RAM<br>RAM Address<br>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 Hardware Reference Manual and the Grounding and Electromagnetic Compatibility of PLC Systems manual 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:


| Topic | Page |
|---|---|
| Presentation | 116 |
| Indicators | 118 |
| Specifications | 119 |
| Wiring Diagram | 120 |

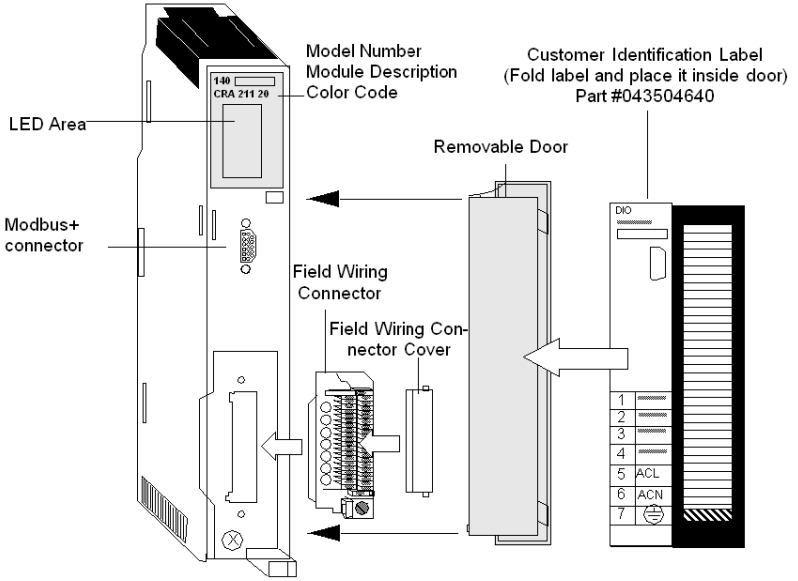
# Presentation

## 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.



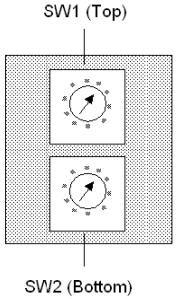

## Rear Panel Switches

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 |

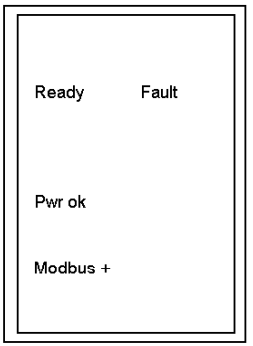
**NOTE:** Only addresses from 1 to 64 are valid.

**NOTE:** 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

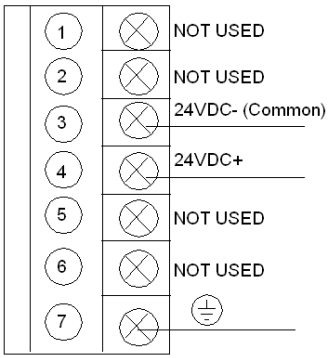
Diagnostics

| | |
|---|---|
| Power Up | RAM<br>RAM Address<br>Executive Checksum |
| Runtime | RAM<br>RAM Address<br>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 Hardware Reference Manual and the Grounding and Electromagnetic Compatibility of PLC Systems manual 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:


| Topic | Page |
|---|---|
| Presentation | 122 |
| Indicators | 124 |
| Specifications | 125 |
| Wiring Diagram | 126 |

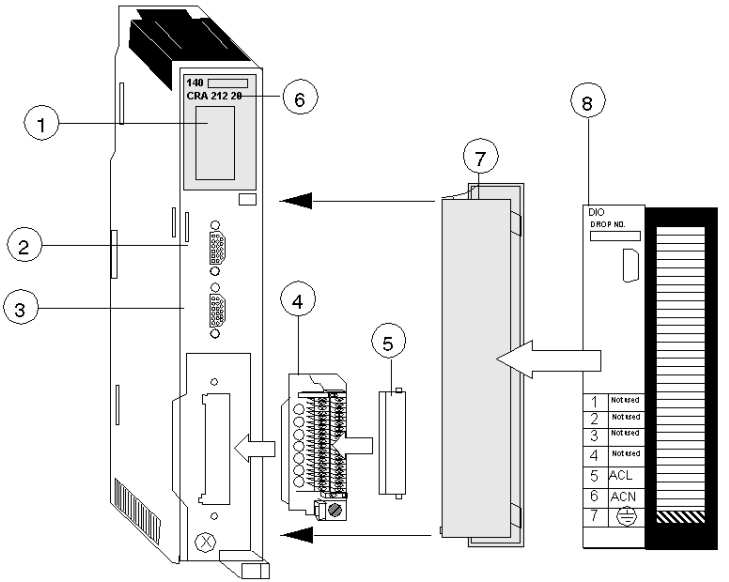
# Presentation

## 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)

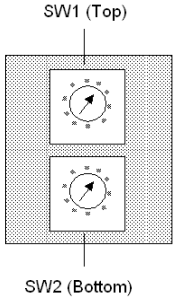
## Rear Panel Switches

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 |

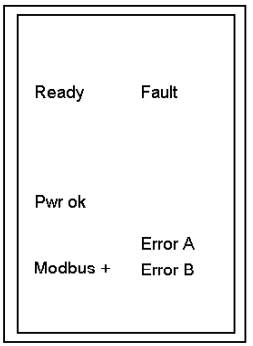
**NOTE:** Only addresses from 1 to 64 are valid.

**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.

# 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

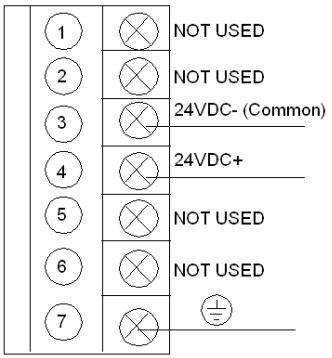
Diagnostics

| | |
|---|---|
| Power Up | RAM<br>RAM Address<br>Executive Checksum |
| Runtime | RAM<br>RAM Address<br>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 Hardware Reference Manual and the Grounding and Electromagnetic Compatibility of PLC Systems manual 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<br>1 Modbus Plus network (RS-485) port | 780 mA |
| 140 NOM 212 00 | 1 Modbus (RS-232) serial port<br>2 Modbus Plus network (RS-485) ports | 780 mA |
| 140 NOM 252 00 | 1 Modbus (RJ45) port<br>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.

## What Is in This Part?

This part contains the following chapters:


| Chapter | Chapter Name | Page |
|---|---|---|
| 14 | 140 NOM 211 00: Modbus Plus Option Module | 129 |
| 15 | 140 NOM 212 00: Modbus Plus Option Module | 141 |
| 16 | 140 NOM 252 00: Modbus Plus Option Module 10Base-FL | 153 |

# 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:


| Topic | Page |
|---|---|
| Presentation | 130 |
| Indicators | 136 |
| Error Codes | 137 |
| Specifications | 139 |

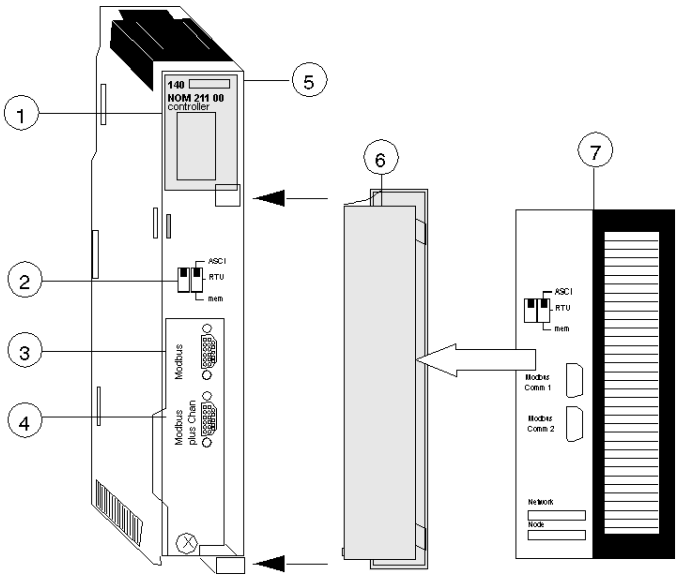
# Presentation

## 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.

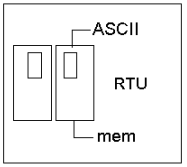



**1** LED Area
**2** Comm Parameter Slide Switch
**3** Modbus Connector
**4** Modbus Plus Connector
**5** Model Number, Module Description, Color Code
**6** Removable door
**7** Customer Identification Label, (Fold label and place it inside door)

## 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.

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

## Rear Panel Switches

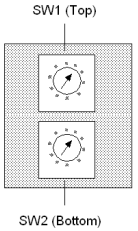
Two rotary switches are located on the rear panel of the modules. They are used together to set the Modbus Plus node and Modbus port address for the unit.

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

**NOTE:** 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

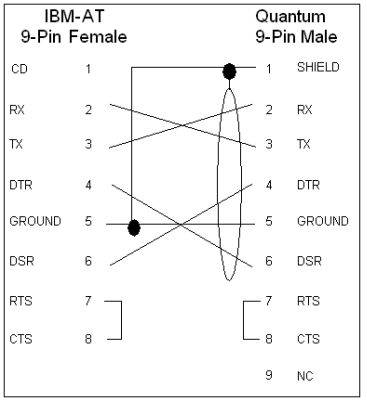
The following table shows the valid comm port parameters.

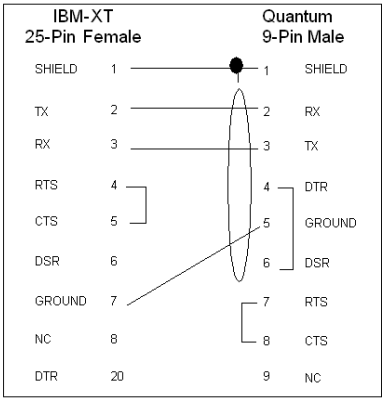
| | | |
|---|---|---|
| Baud | 19,200 | 1,200 |
| | 9,600 | 600 |
| | 7,200 | 300 |
| | 4,800 | 150 |
| | 3,600 | 134.5 |
| | 2,400 | 110 |
| | 2,000 | 75 |
| | 1,800 | 50 |
| Data Bits | 7 / 8 | |
| Stop Bits | 1 / 2 | |
| Parity | Enable/Disable Odd/Even | |
| Device Address | Rear panel rotary switch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



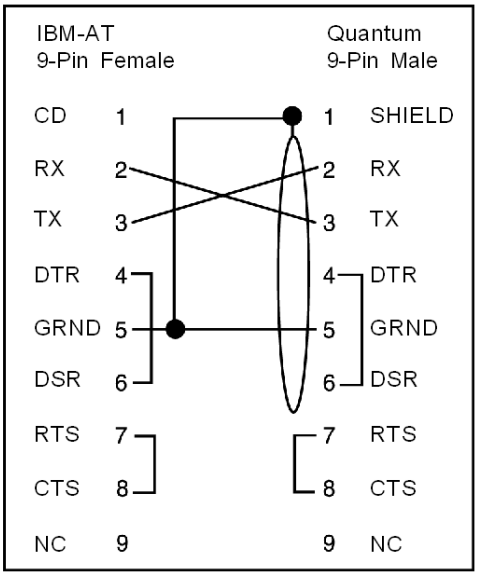




The following is the abbreviation key for the above figure.

| | |
|---|---|
| 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

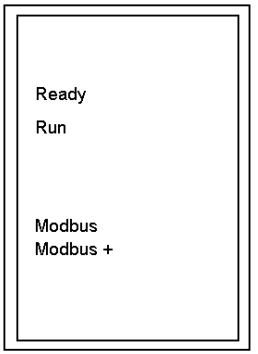
The following figure shows the Modbus port pinout connections for 9-pin portable computers.



# 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<br>RAM Address<br>Executive Checksum<br>Processor |
| Runtime | RAM<br>RAM Address<br>Executive Checksum<br>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:


| Topic | Page |
|---|---|
| Presentation | 142 |
| Indicators | 148 |
| Error Codes | 149 |
| Specifications | 151 |

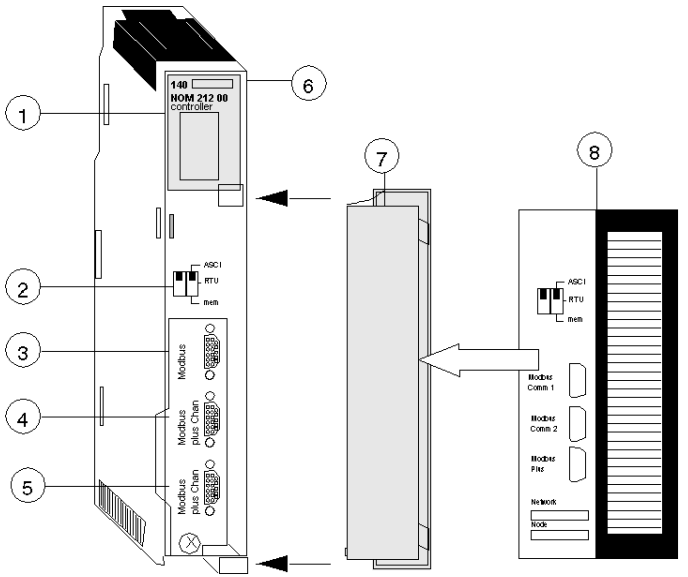
# Presentation

## 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.

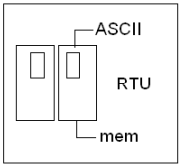



**1** LED Area
**2** Comm Parameter Slide Switch
**3** Modbus Connector
**4** Modbus Plus Connector (Chan A)
**5** Modbus Plus Connector (Chan B)
**6** Model Number, Module Description, Color Code
**7** Removable door
**8** Customer Identification Label, (Fold label and place it inside door)

## 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.

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

## Rear Panel Switches

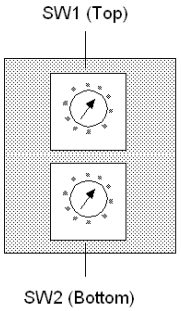
Two rotary switches are located on the rear panel of the modules. They are used together to set the Modbus Plus node and Modbus port address for the unit.

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

**NOTE:** 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

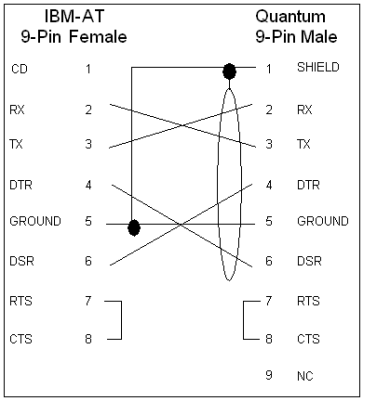
The following table shows the valid comm port parameters.

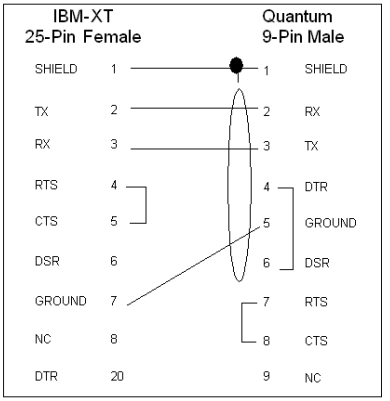
| | | |
|---|---|---|
| Baud | 19,200 | 1,200 |
| | 9,600 | 600 |
| | 7,200 | 300 |
| | 4,800 | 150 |
| | 3,600 | 134.5 |
| | 2,400 | 110 |
| | 2,000 | 75 |
| | 1,800 | 50 |
| Data Bits | 7 / 8 | |
| Stop Bits | 1 / 2 | |
| Parity | Enable/Disable Odd/Even | |
| Device Address | Rear panel rotary switch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

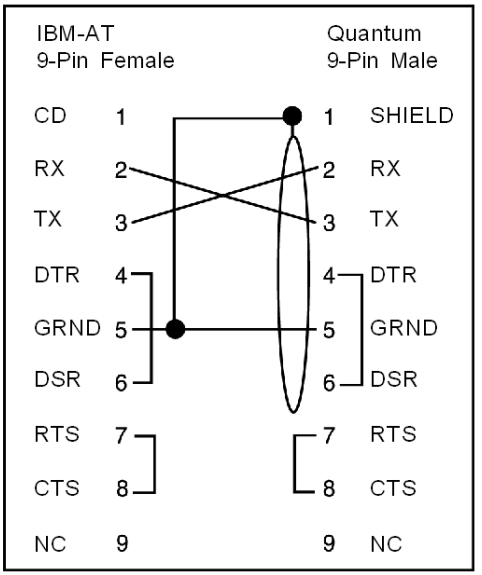
The following figures show the Modbus port pinout connections for 9-pin (left) and 25-pin (right).



## Modbus Ports Pinout Connections for Portable Computers

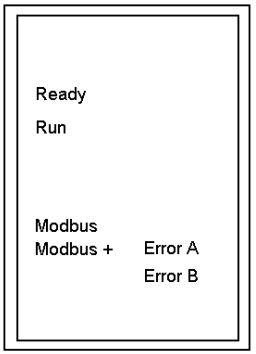
The following figure shows the Modbus port pinout connections for 9-pin portable computers.



# 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<br>RAM Address<br>Executive Checksum<br>Processor |
| Runtime | RAM<br>RAM Address<br>Executive Checksum<br>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:


| Topic | Page |
|---|---|
| Presentation | 154 |
| Indicators | 160 |
| Fiber Optic Cable Connections | 161 |
| Specifications | 171 |

# Presentation

## Overview

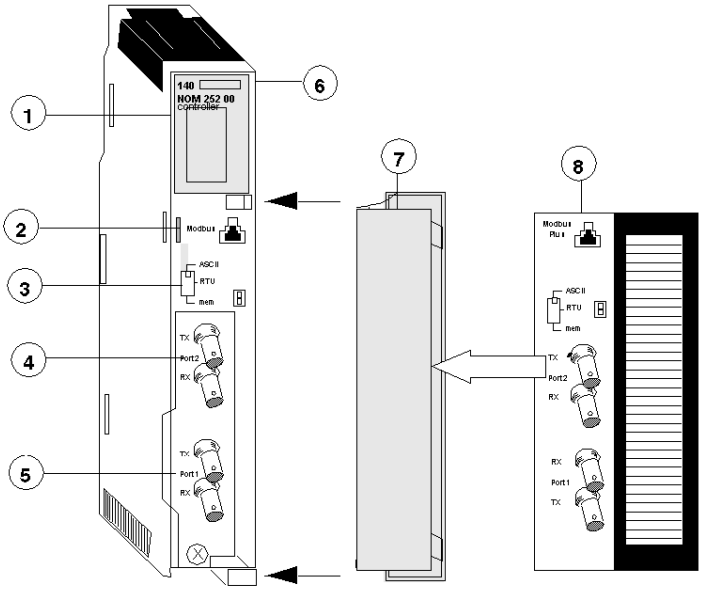
The Modbus Plus on Fiber module provides connectivity to Modbus Plus nodes by fiber cable.

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.

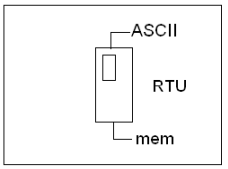



**1** LED Area
**2** Modbus Connector
**3** Comm Parameter Slide Switch
**4** Port 2 TX and RX Connectors
**5** Port 1 TX and RX Connectors
**6** Model Number, Module Description, Color Code
**7** Removable door
**8** Customer Identification Label, (Fold label and place it inside door)

## 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

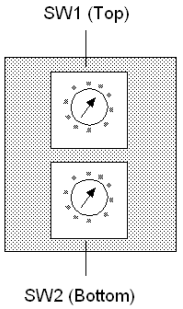
Two rotary switches are located on the rear panel of the modules. They are used together to set the Modbus Plus node and Modbus port address for the unit.

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

**NOTE:** 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 |

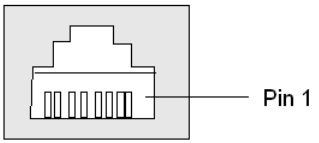
**NOTE:** If "0" or an address greater than 64 is selected, the Modbus + LED will be "on" steady, to indicate the selection of an invalid address.

## 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

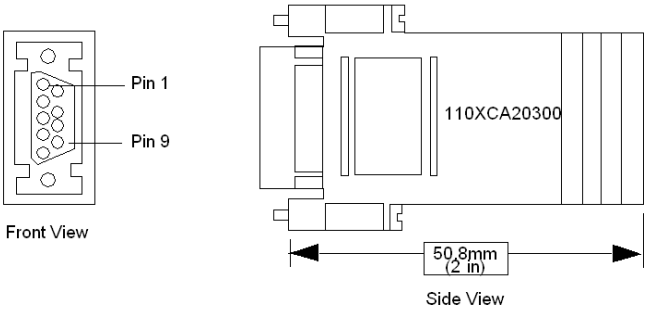
The following figure shows the NOM 252 00 Pin 1 connector.




**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).

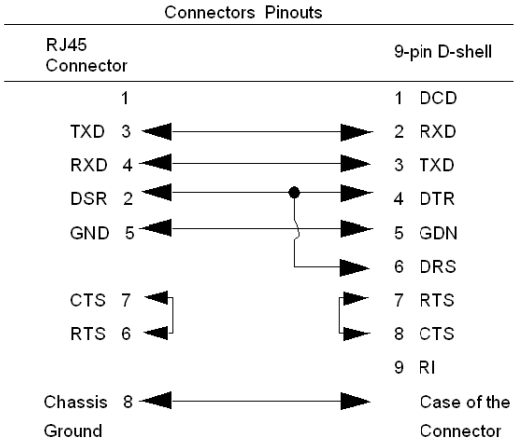
## Pinouts Figures

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.

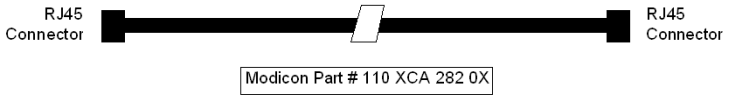



## BJ45 Cable Types

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).



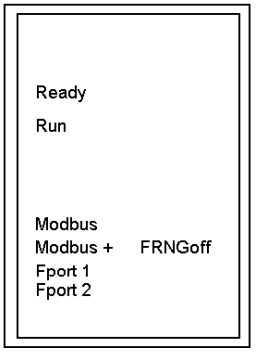

## BJ45 Cable Part Numbers Table

| 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

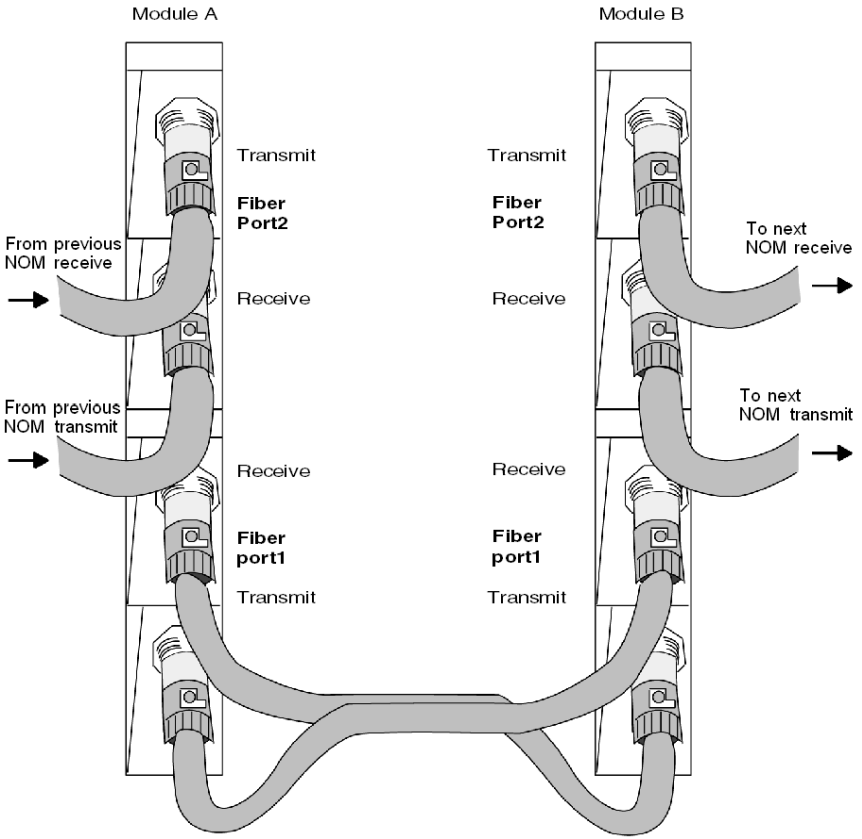
## Fiber Optic Cable Connections

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.

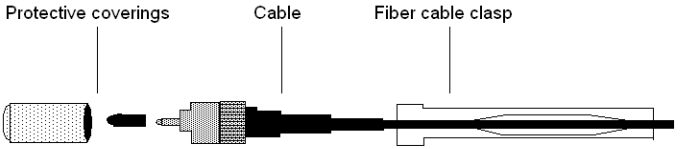
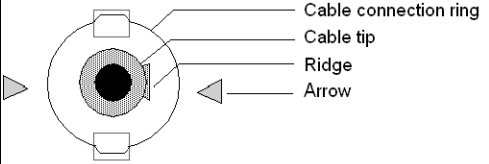
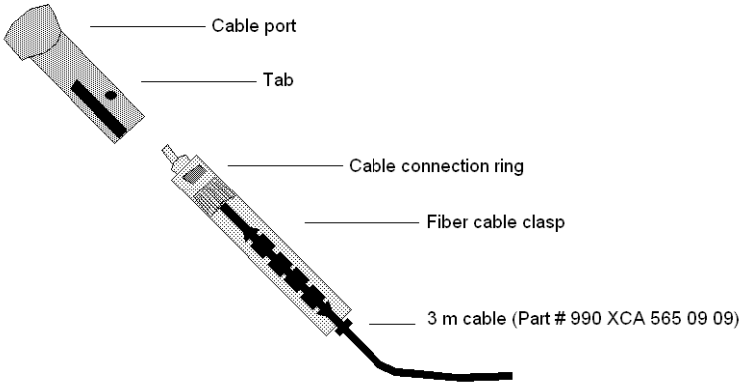
## Fiber Optic Cable Connections Figure

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.<br> |
| 2 | Turn the connection ring so that one of the arrows on the side of the ring lines up with the ridge inside.<br> |
| 3 | a. Slide the tool up to the connection ring.<br>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.<br>c. Use the clasp to push the cable over the tab on top of the port.<br>d. Turn the cable to the right, so that the tab locks securely<br>e. Remove the clasp.<br>f. Repeat this process with the remaining strand of cable.<br> |

## Fiber Optic Configurations

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

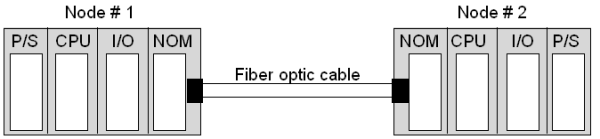
- Point-to-point connection
- Bus configuration
- Tree configuration
- Self-healing ring configuration

## 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

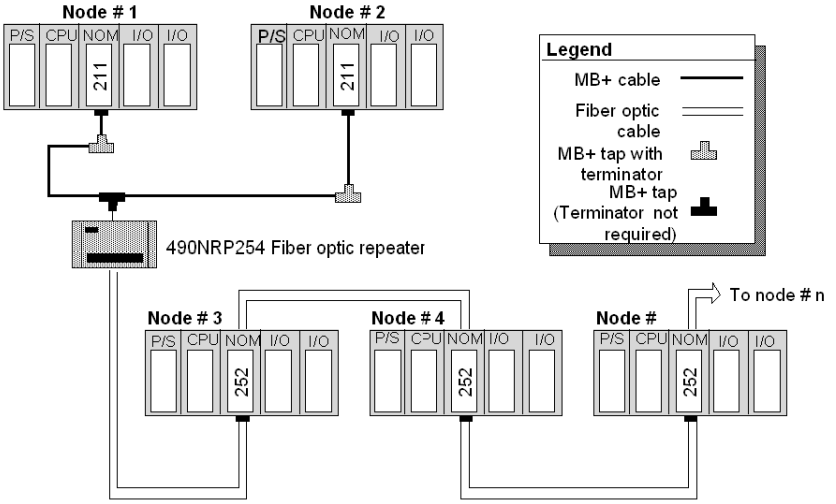
This type of configuration is used when it is required to connect a number of fiber nodes and can be used to increase the distance of a standard Modbus Plus network by changing to a fiber medium. This kind of network allows the connection of up to 32 Quantum NOM 252 nodes over the distance of 5 km.

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.

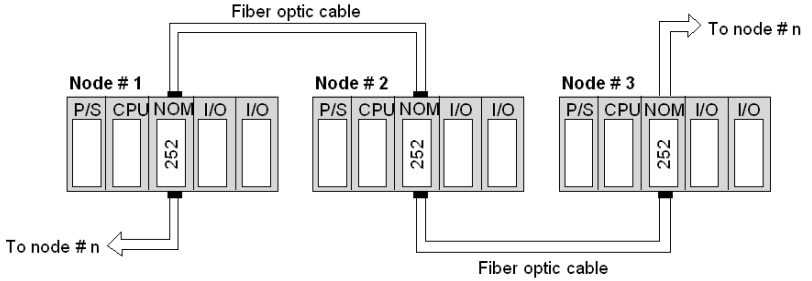
## Bus Configuration Example 1

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.

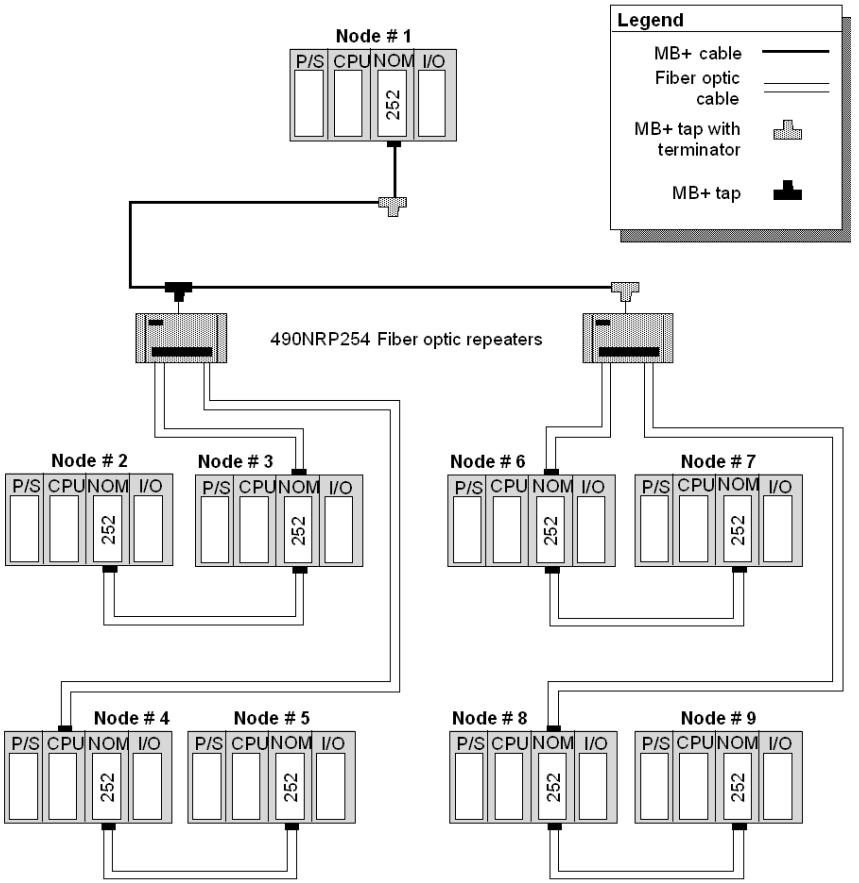
**NOTE:** In this configuration, the end NOM 252 00 in this configuration will have the FRNGoff LED active. It also displays the Cable B Framing error in the MBPSTAT (in ladder logic).

## 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.

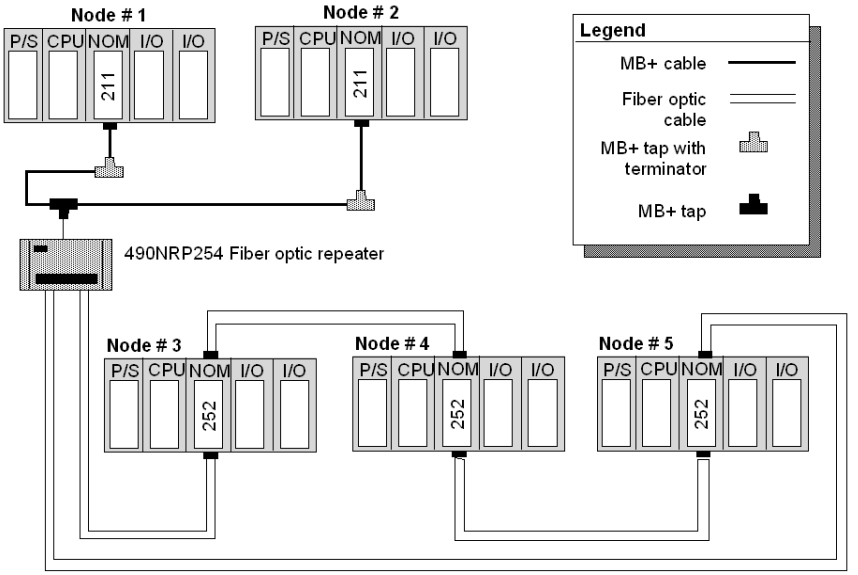


## Self-healing Ring Configuration

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.

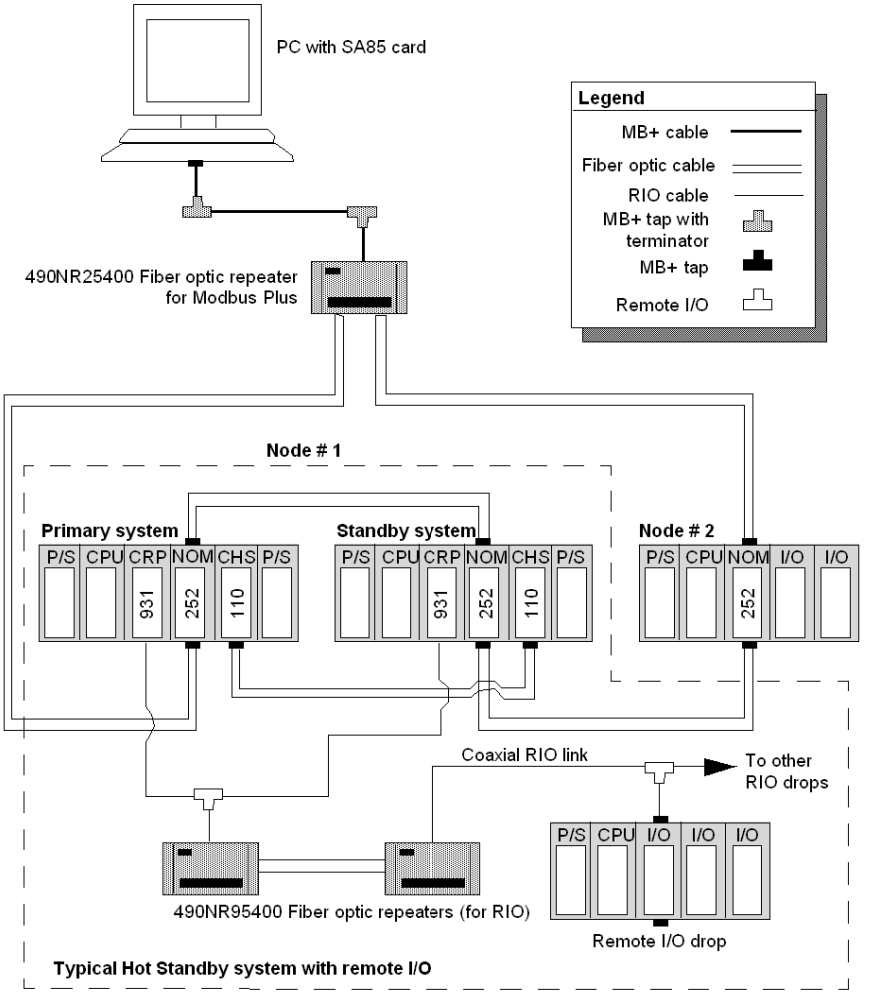
## Self-healing Ring Configuration Example

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<br>3M 05-00187 | 110 V termination kit<br>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:<br>$N = \frac{200\text{nsec} - X(L)\text{nsec} - 40\text{nsec}}{5 n\text{sec}} + 1$<br>where "L" is the total cable length (km), and "X" is the jitter (added by the fiber optic cable) in nsec/km:<br>X = 3 ns/km for 50/125 micron meters<br>5 ns/km for 62.5/125 micron meters<br>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<br>RAM Address<br>Executive Checksum<br>Processor |
| Runtime | RAM<br>RAM Address<br>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<br>62.5/125 micron fiber -11 dB<br>100/140 micron fiber -16.5 dB |
| Maximum distance for point-to-point connection | 2 km over 50 micron fiber<br>3 km over 62.5 micron fiber<br>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<br>-9.0 ... -16 dBm average power in 62.5/125 micron fiber cable<br>-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 | Chapter Name | Page |
|---|---|---|
| 17 | 140 NOE xxx xx: Ethernet Module General Overview | 175 |
| 18 | 140 NOE 211 x0: TCP/IP 10Base-T Ethernet Module | 185 |
| 19 | 140 NOE 251 x0: TCP/IP 10Base-FL Ethernet Module | 191 |
| 20 | 140 NOE 311 00: SY/MAX 10Base-T Ethernet Module | 197 |
| 21 | 140 NOE 351 00: SY/MAX 10Base-FL Ethernet Module | 203 |
| 22 | 140 NOE 771 00: TCP/IP 10/100 Ethernet Module | 209 |
| 23 | 140 NOE 771 01: TCP/IP 10/100 Ethernet Module | 215 |
| 24 | 140 NOE 771 10: TCP/IP 10/100 FactoryCast Ethernet Module | 221 |
| 25 | 140 NOE 771 11: TCP/IP 10/100 FactoryCast Ethernet Module | 229 |
| 26 | 140 NWM 100 00: TCP/IP 10/100 FactoryCast HMI Ethernet Module | 235 |

# 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:


| Topic | Page |
|---|---|
| General Information | 176 |
| Modicon Quantum Ethernet Modules Overview | 177 |
| Indicators for Ethernet Modules | 182 |

# 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<br>10/100BASE-T (RJ-45) port | 750 mA |
| 140 NOE 771 01 | 100 BASE-FX Fiber optics (MT-RJ) port<br>10/100BASE-T (RJ-45) port | 750 mA |
| 140 NOE 771 10<br>FactoryCast | 100 BASE-FX Fiber optics (MT-RJ) port<br>10/100BASE-T (RJ-45) port | 750 mA |
| 140 NOE 771 11<br>FactoryCast | 100 BASE-FX Fiber optics (MT-RJ) port<br>10/100BASE-T (RJ-45) port | 750 mA |
| 140 NWM 100 00 | 100 BASE-FX Fiber optics (MT-RJ) port<br>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.

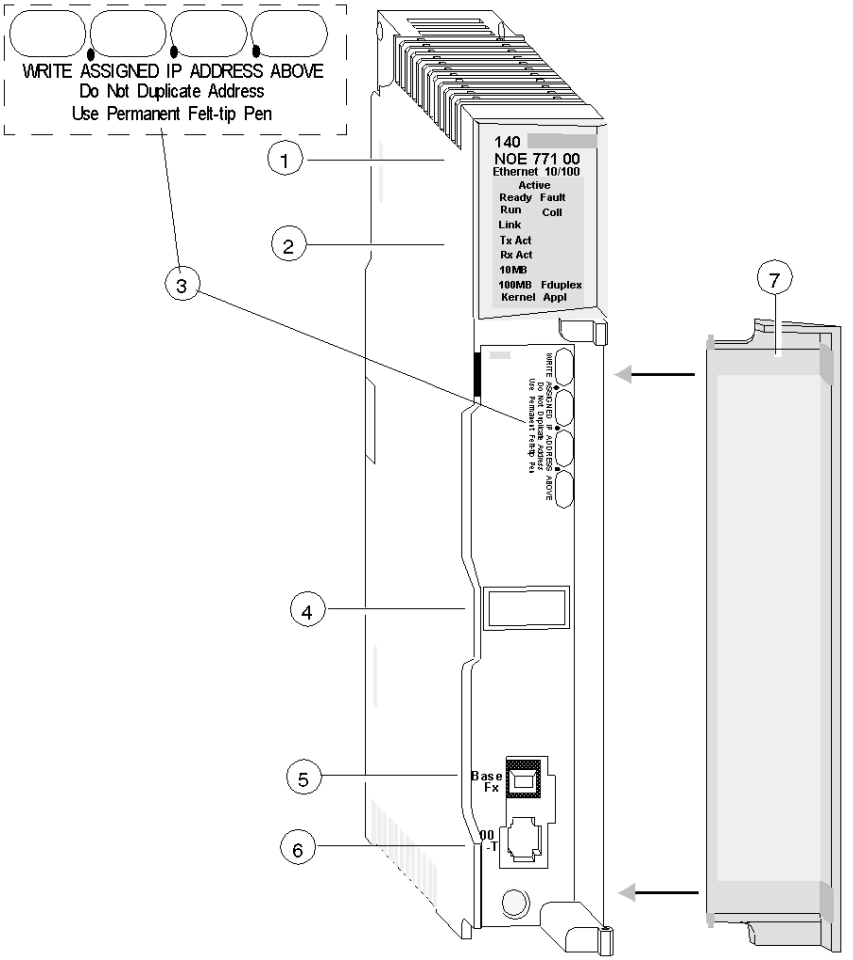
## General Description

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 RJ-45 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 Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | X | X | X | X | X |
| FTP Server *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | X | X | X | X | X |
| Flash File System *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | X | X | X | X | X |
| BOOTP Client *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | X | X | X | X | X |
| Address Server *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | X | X | X | X | |
| SNMP V2 Agent (Network Management Service) *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | X | X | X | X | X |
| Modbus Messaging *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | X | X | X | X | X |
| I/O Scanner *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | X | X | | X | |
| Hot Standby | | X | | X | |
| Global Data (Publish/Subscribe) *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | | X | | X | |
| Bandwidth Monitoring *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | | X | | X | |
| Faulty Device Replacement (Server) *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | | X | | X | |
| Enhanced Web Diagnosis *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | | X | | X | X |
| Schneider Private MIB *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | | X | | X | X |
| FactoryCast Application *(see Modicon Quantum with Unity, 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 | |
| RJ-45 connection | X | X | X | X | |

| Service | -00 | -01 | -10 | -11 | NWM |
|---|---|---|---|---|---|
| Time Synchronization Service *(see Modicon Quantum with Unity, Ethernet Network Modules, User Manual)* | | | | X | |
| Electronic Mail Notification Service *(see Modicon Quantum with Unity, 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 Unity Pro 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 Unity Pro. (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.

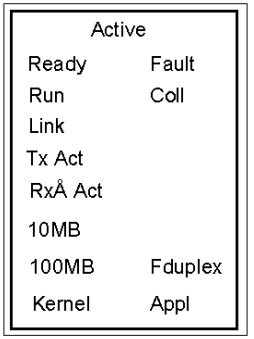
The following table provides a description of the front panel components that are shown in following figure:

| Component | Description |
|---|---|
| LED Indicator Panel *(see page 182)* | 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 RJ-45 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.<br>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 12*, User Guide for the Quantum NOE 211/251 Ethernet Module

## What Is in This Chapter?

This chapter contains the following topics:


| Topic | Page |
|---|---|
| Presentation | 186 |
| Indicators | 187 |
| Specifications | 188 |
| Installation | 189 |

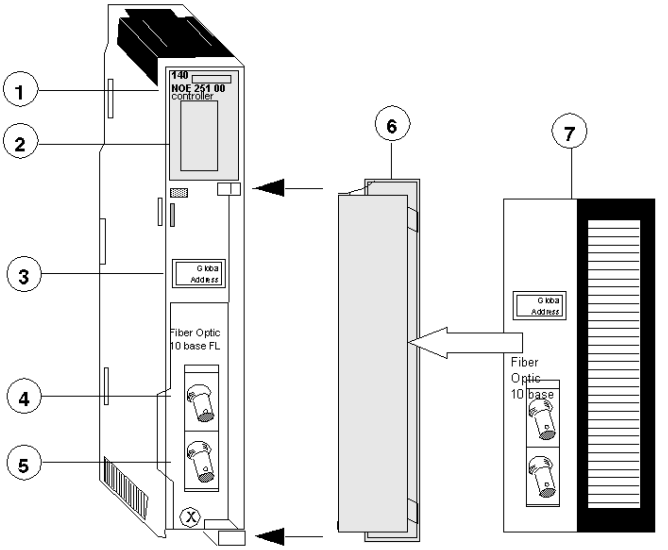
# Presentation

## 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.

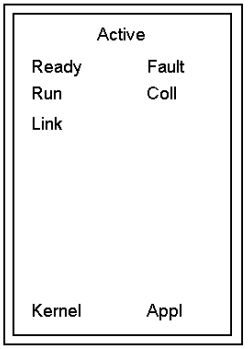



**1** Model Number, Module Description, Color Code
**2** LED Display
**3** Global Address Label
**4** Transmit Cable Connector
**5** Receive Cable Connector
**6** Removable door
**7** Customer Identification Label, (Fold label and place it inside door)

# 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

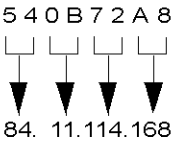
Quantum Ethernet TCP/IP modules come fully configured. However, before installing your module, you should make sure the default configuration is appropriate for your network.

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.<br><br>IEEE GLOBAL ADDRESS<br><br>0000540B72A8 |
| 2 | Note the rightmost eight digits.<br><br> |
| 3 | Convert them from hexadecimal to decimal. Each pair of hexadecimal numbers will result in a decimal number between 0 and 255. This is the default IP address. |
| 4 | If you use the default IP network address and if your network uses Ethernet II framing and if you do not need to specify the default gateway or a subnet mask, then you may install the module without changing the default configuration. |

| Step | Action |
|---|---|

**⚠ 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 12*, User Guide for the Quantum NOE 211/251 Ethernet Module

## What Is in This Chapter?

This chapter contains the following topics:


| Topic | Page |
|---|---|
| Presentation | 192 |
| Indicators | 193 |
| Specifications | 194 |
| Installation | 195 |

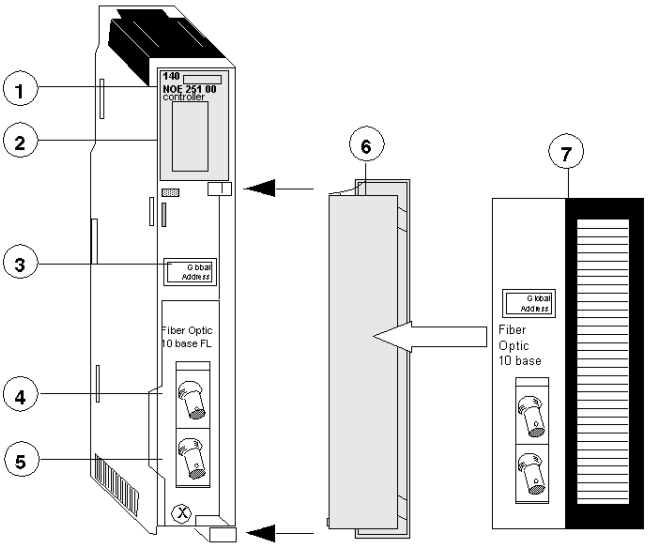
# Presentation

## 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.

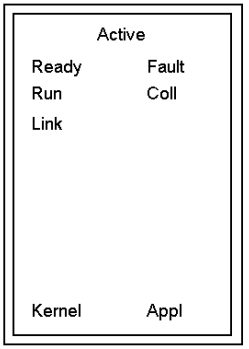



**1** Model Number, Module Description, Color Code
**2** LED Display
**3** Global Address Label
**4** Transmit Cable Connector
**6** Receive Cable Connector
**5** Removable door
**6** Customer Identification Label, (Fold label and place it inside door)

# 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

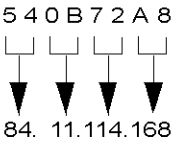
Quantum Ethernet TCP/IP modules come fully configured. However, before installing your module, you should make sure the default configuration is appropriate for your network.

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.<br><br>IEEE GLOBAL ADDRESS<br><br>0000540B72A8 |
| 2 | Note the rightmost eight digits.<br><br> |
| 3 | Convert them from hexadecimal to decimal. Each pair of hexadecimal numbers will result in a decimal number between 0 and 255. This is the default IP address. |
| 4 | If you use the default IP network address and if your network uses Ethernet II framing and if you do not need to specify the default gateway or a subnet mask, then you may install the module without changing the default configuration. |

| Step | Action |
|---|---|

**⚠ 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 12*, Quantum Sy/Max Ethernet Network Option Module Guide

## What Is in This Chapter?

This chapter contains the following topics:


| Topic | Page |
|---|---|
| Presentation | 198 |
| Indicators | 200 |
| Specifications | 201 |

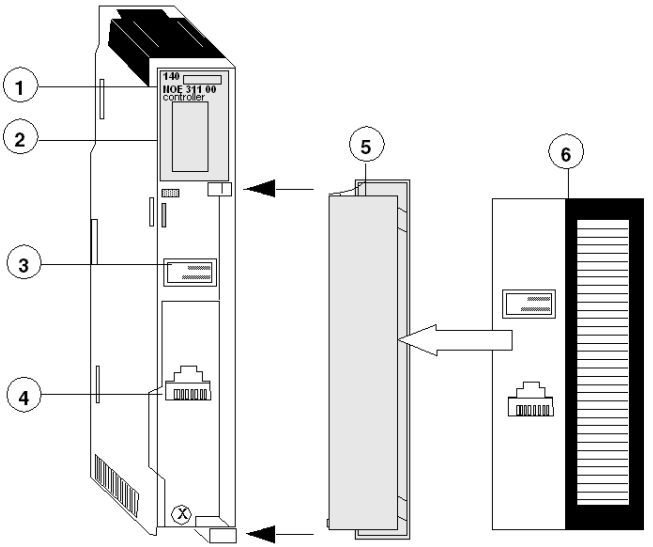
# Presentation

## 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

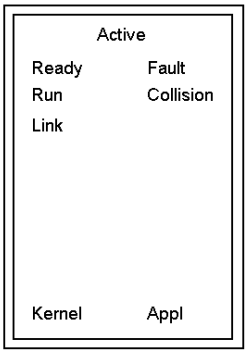
Be sure that the module is assigned a unique SY/MAX drop number during configuration.

| ⚠ WARNING |
| --- |
| **UNEXPECTED APPLICATION BEHAVIOR**<br>Do assign a unique SY/MAX drop number during configuration.<br>**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<br>Model 650<br>SFI160<br>SFW390-VAX<br>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 12*, Quantum Sy/Max Ethernet Network Option Module Guide

## What Is in This Chapter?

This chapter contains the following topics:


| Topic | Page |
|---|---|
| Presentation | 204 |
| Indicators | 206 |
| Specifications | 207 |

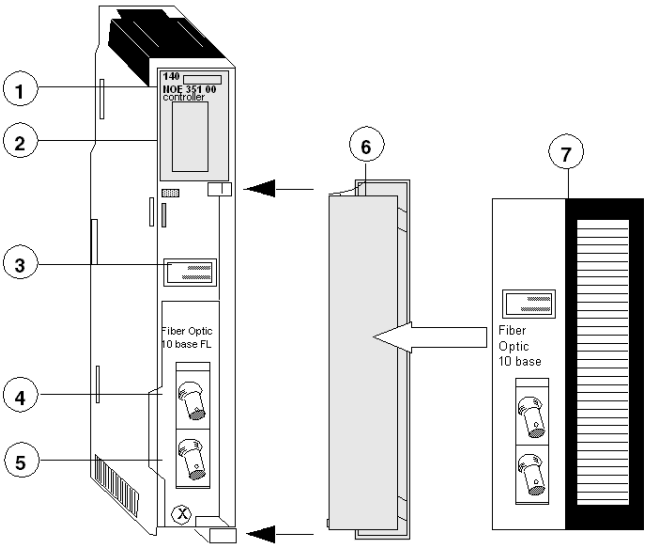
# Presentation

## 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

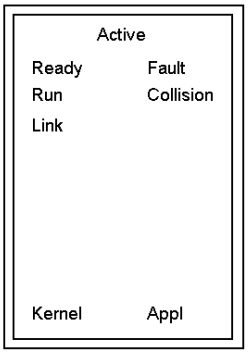
Be sure that the module is assigned a unique SY/MAX drop number during configuration.

| ⚠ WARNING |
| --- |
| **UNEXPECTED APPLICATION BEHAVIOR**<br>Do assign a unique SY/MAX drop number during configuration.<br>**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<br>Model 650<br>SFI160<br>SFW390-VAX<br>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 12*, User Guide for the Quantum NOE 771 Ethernet Module

## What Is in This Chapter?

This chapter contains the following topics:


| Topic | Page |
|---|---|
| Presentation | 210 |
| Indicators | 213 |
| Specifications | 214 |

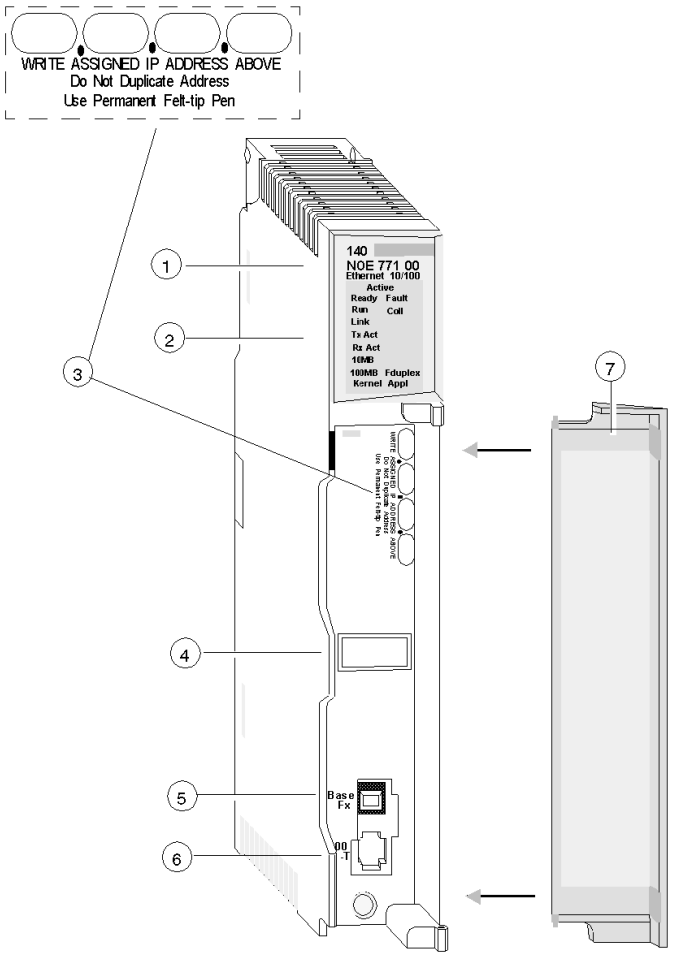
# Presentation

## 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.

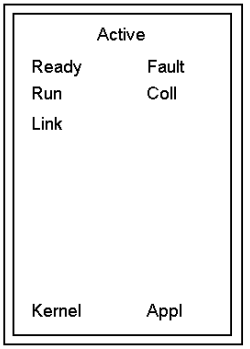
The following table provides a description of the front panel components which are shown in front view figure.

| 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 213*) |
| 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.<br>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:


| Topic | Page |
|---|---|
| Presentation | 216 |
| Indicators | 217 |
| Specifications | 219 |

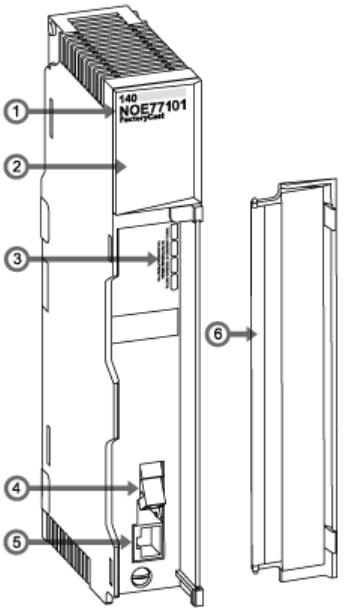
# Presentation

## 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.

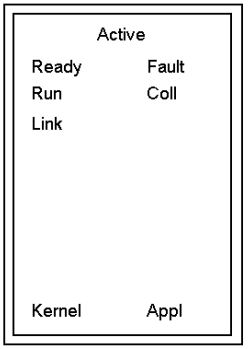



**1** model number, module description, color code
**2** LED display
**3** global address label
**4** MT-RJ fiber optic connector
**5** RJ-45 connector
**6** removable door

# 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.<br>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:


| Topic | Page |
|---|---|
| Presentation | 222 |
| Indicators | 225 |
| Specifications | 227 |

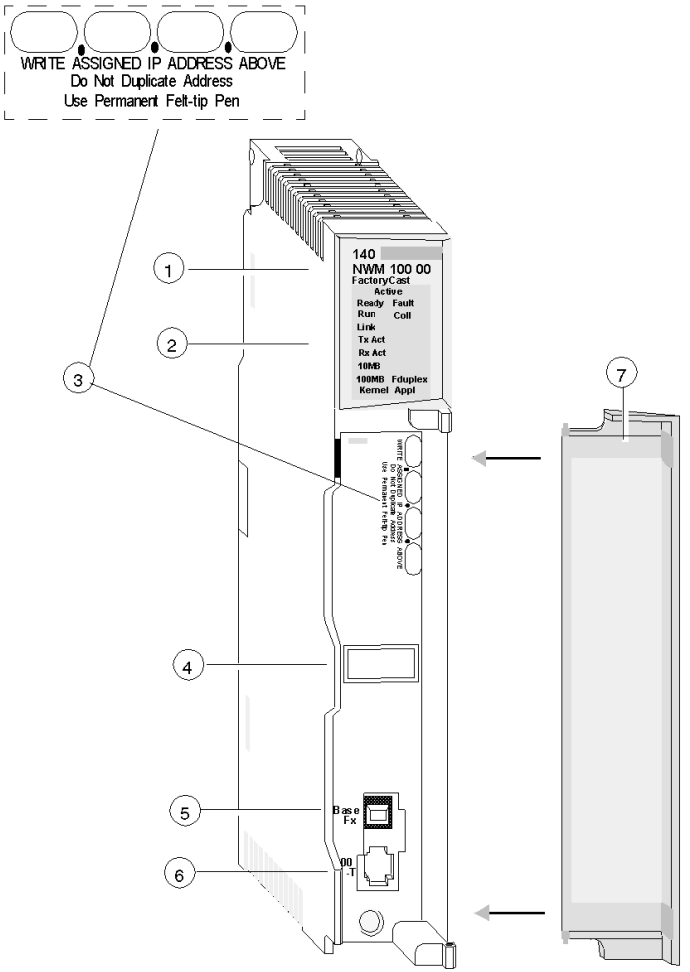
# Presentation

## 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.

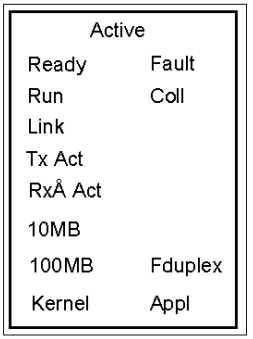
The following table provides a description of the front panel components which are shown in front view figure.

| 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.<br>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:


| Topic | Page |
|---|---|
| Presentation | 230 |
| Indicators | 231 |
| Specifications | 233 |

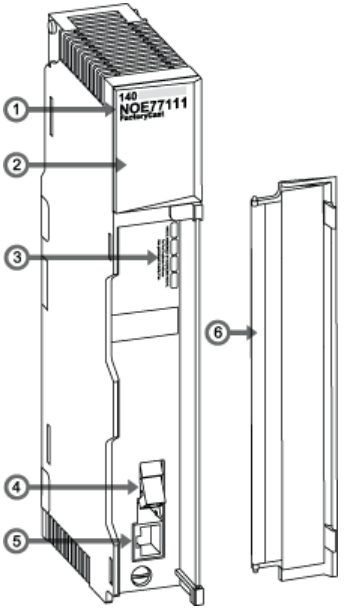
# Presentation

## 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.

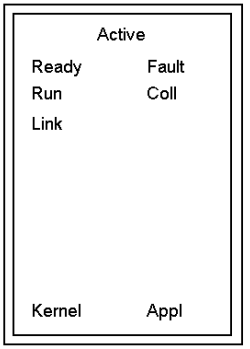



**1** model number, module description, color code
**2** LED display
**3** global address label
**4** MT-RJ fiber optic connector
**5** RJ-45 connector
**6** removable door

# 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.<br>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:


| Topic | Page |
|---|---|
| Presentation | 236 |
| Indicators | 237 |
| Specifications | 238 |

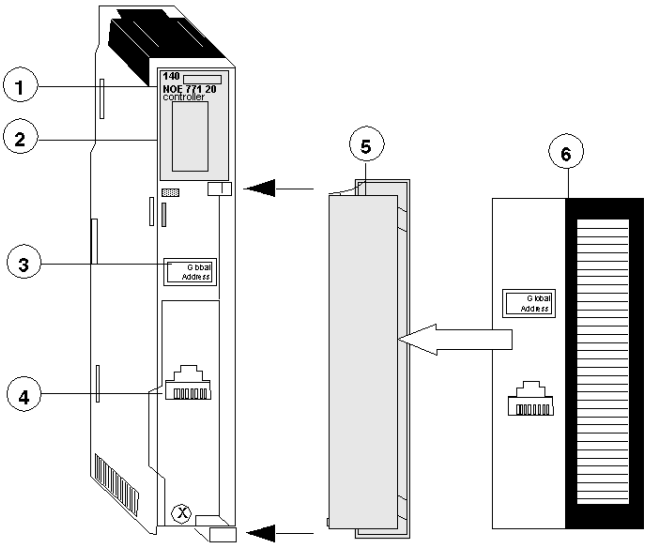
# Presentation

## 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.

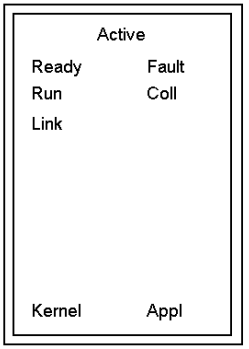



**1** Model Number, Module Description, Color Code
**2** LED Display
**3** IP Address Writable Area
**4** Global Address Label
**5** 100 Base Fx MT-RJ Cable Connector
**6** 10/100 Base-T RJ-45 Cable Connector
**7** Removable door

# 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.<br>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 12*, Modicon Quantum AS-i Master Module EIA 921 00

## What Is in This Chapter?

This chapter contains the following topics:


| Topic | Page |
|---|---|
| Presentation | 242 |
| Indicators | 245 |
| Wiring Diagram | 248 |
| Specifications | 249 |
| Parameter Configuration | 250 |

# 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.

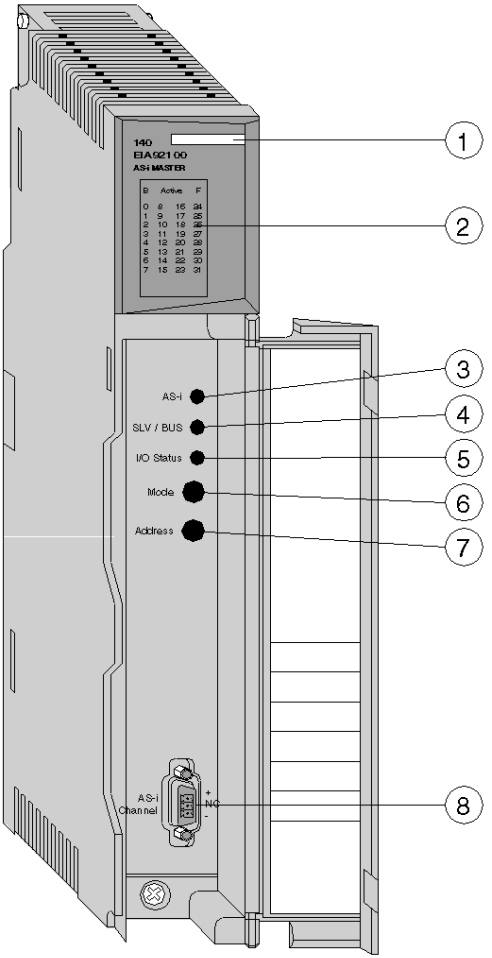
These sensor/actuators can be in the local CPU, an RIO, or a DIO drop adapter.

**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.

**NOTE:** For detailed information see Modicon Quantum AS-i Master Module EIA 921 00 book *Product Related Information, page 12*

## 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:<br>● B (green, 1 LED): Indicates, when on, data exchange between module and slave.<br>● Active (green, 2 LEDs): when on, indicates AS-i module being services by the local CPU, RIO, or DIO drop adapter.<br>● 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 |

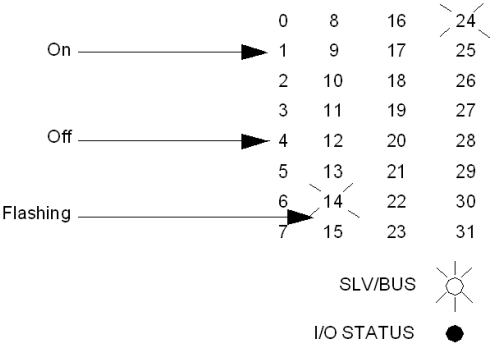
## Description

| LED | Color | Description |
|---|---|---|
| Active | Green | Bus communication is present. |
| F | Red | Fault on the AS-i bus.<br>Steady: module fault<br>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

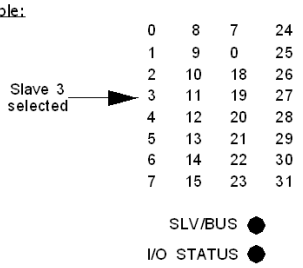
Slave mode (SLV) figure:

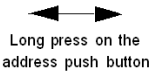
Display of the address of the selected slave:

- 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

Example:

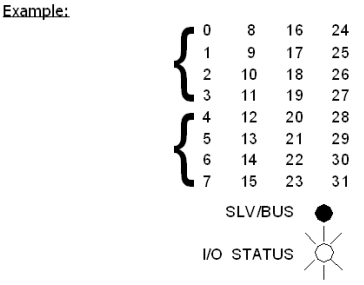



Display of the state of the I/O bits of the selected slave:

- 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:



## 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.<br>2. Check the continuity of the AS-i bus cable. |
| ⊗ | ⊗ | ⊗ | Module self-tests in progress. | æ |

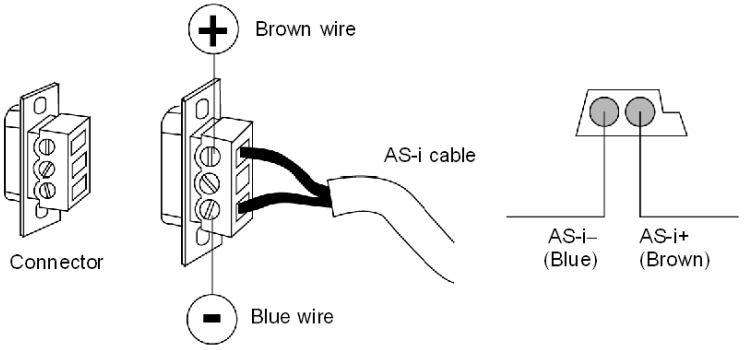
● Indicator lamp is on. ○ Indicator lamp is off. ⊗ Indicator lamp is flashing. X Indicator lamp is in indeterminate state.

(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

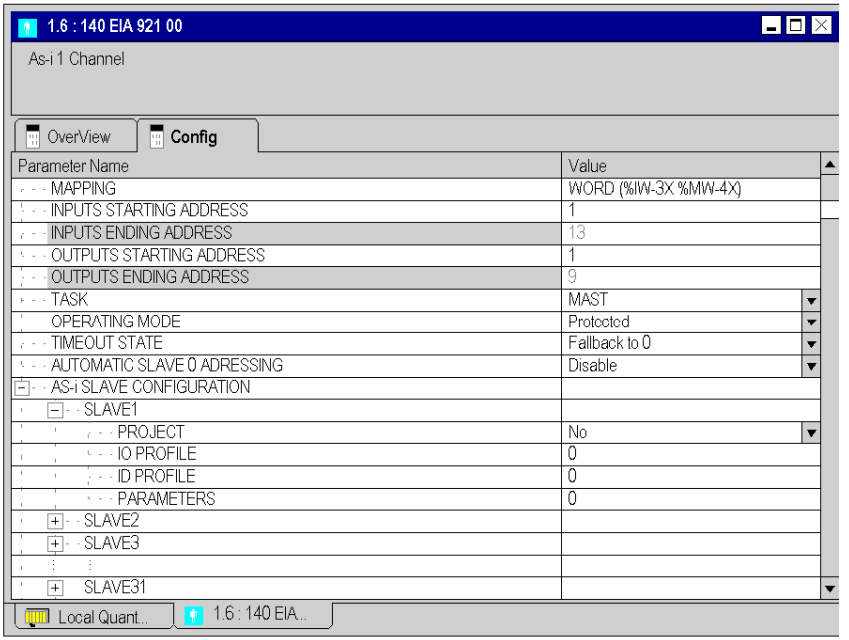
Specifications for the 140 EIA 921 00 AS-i module:

| | |
|---|---|
| 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<br>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<br>(Grayed if module in other than local) | MAST | FAST<br>AUX0<br>AUX1<br>AUX2<br>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.<br>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 | Chapter Name | Page |
|---|---|---|
| 28 | 140 HLI 340 00: High Speed Latch and Interrupt Module | 255 |
| 29 | 140 EHC 202 00: High Speed Counter Module | 267 |
| 30 | 140 EHC 105 00: High Speed Counter Module | 311 |

# 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:


| Topic | Page |
|---|---|
| Presentation | 256 |
| Indicators | 258 |
| Specifications | 259 |
| Wiring Diagram | 261 |
| Addressing | 263 |
| Parameter Configuration | 264 |

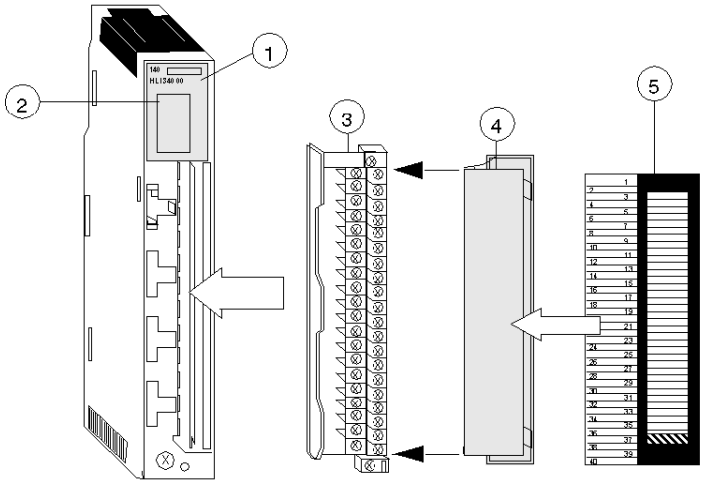
# Presentation

## 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**

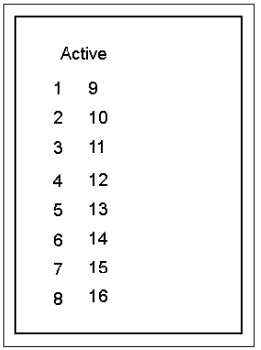
- Before tightening the locknut to the torque 0.50...0.80 Nm, be sure to properly position the right-angle F adapter connector.
- During tightening, be sure to maintain the connector securely.
- Do not tighten the right-angle F adapter beyond the specified torque.

**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 |

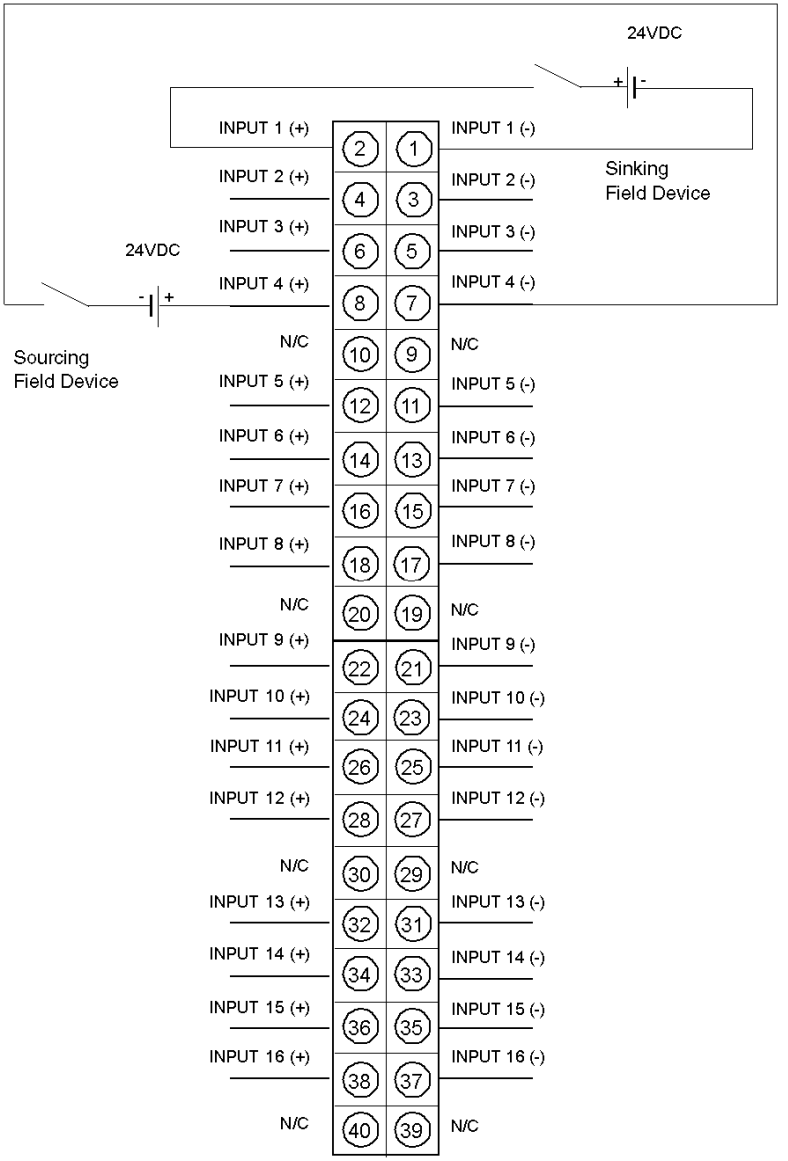
## Module Keying

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.

**NOTE:** 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 26*.

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.

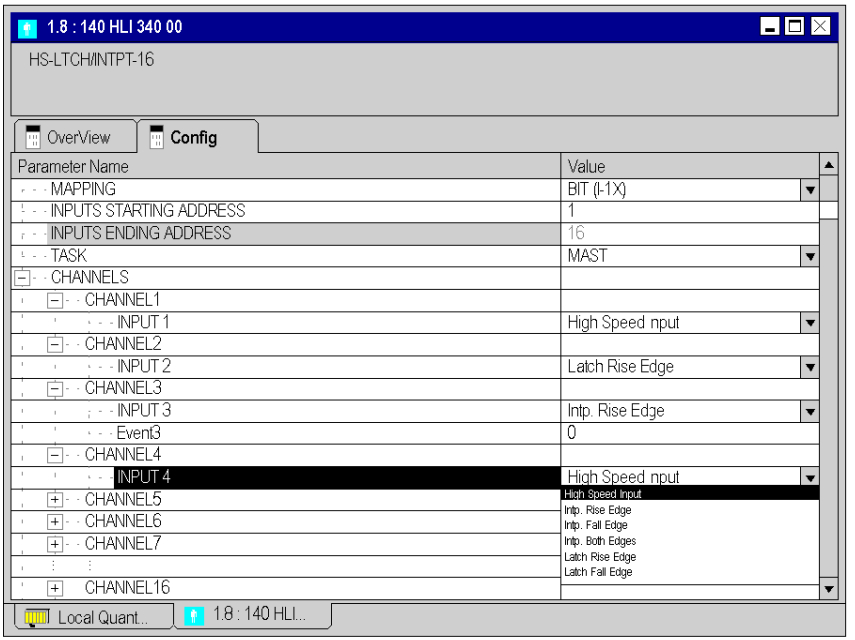
The following list shows the available modes depending on the location:

- **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<br>AUX0<br>AUX1<br>AUX2<br>AUX3 | |
| Channels | | | |
| Input n | High Speed Input | Intp. Rise Edge<br>Intp. Fall Edge<br>Intp. Both Edges<br>Latch Rise Edge<br>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:


| Topic | Page |
|---|---|
| Presentation | 268 |
| Specifications | 270 |
| Controlling and Timing | 272 |
| Functions | 274 |
| Operating Conditions and Examples | 276 |
| Addressing | 279 |
| I/O Map and Commands | 280 |
| Indicators | 298 |
| Wiring | 299 |
| Maintenance | 306 |
| Parameter Configuration | 307 |

# 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:

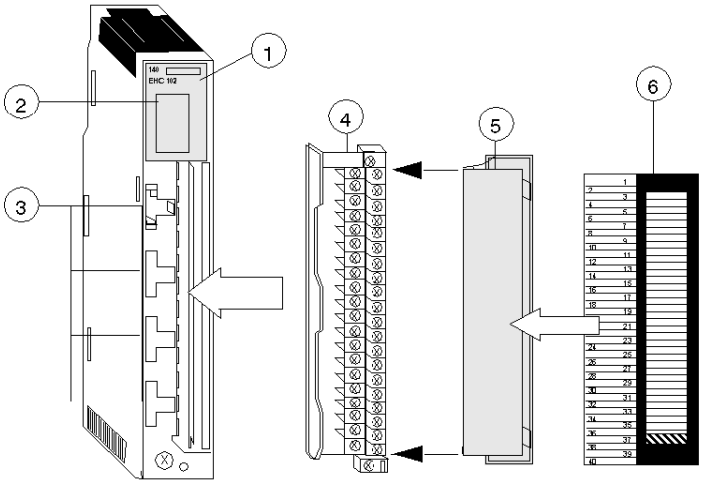
- Output latched on at setpoint
- Output latched on at a terminal count
- Output timed on at setpoint, with a time range of 0 ... 16 383 ms (only one of the four possible outputs can be configured for this mode)
- Output timed on at a terminal count, with a time range of 0 ... 16 383 ms (only one of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

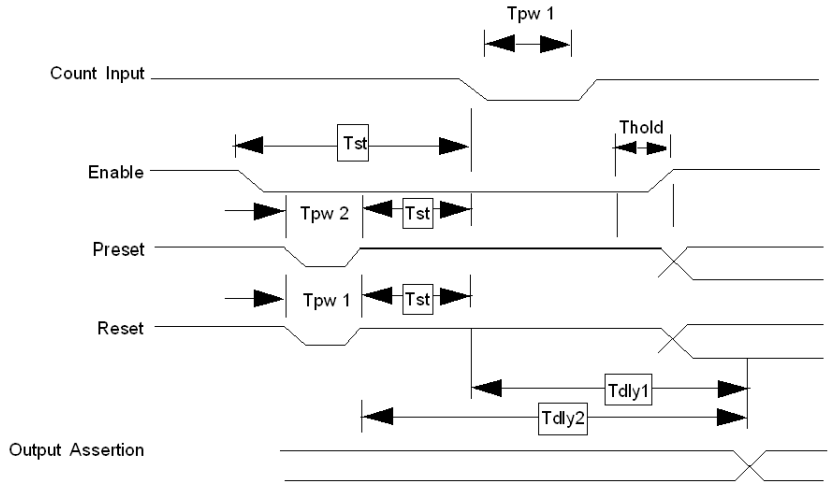
- Preset the input counter to zero or maximum count.

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.

### 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

unt pulses, the module must be:

- Configured for pulse or quadrature mode.
- Configured for counter display: two, 16 bit, one, 32 bit, or two, 32 bit counters.
- Loaded with the maximum count.
- Enabled to count, using hardwired input and software control bits.

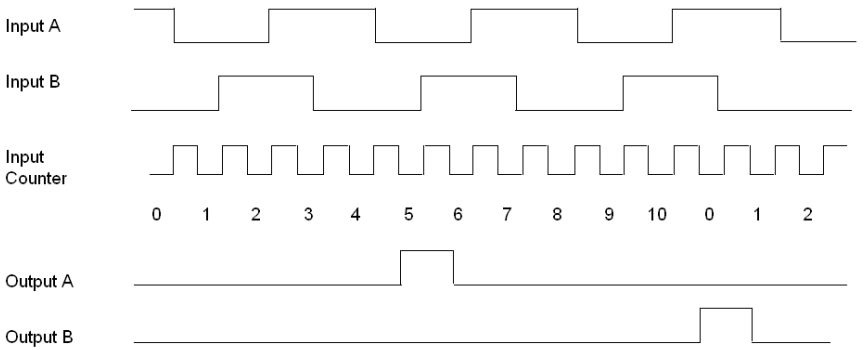
### Pulse Count and Turning Outputs On/Off

To count pulses and turn outputs on and off, the module must be:

- Configured for pulse or quadrature mode.
- Configured for two, 16 bit or one, 32 bit counter.
- Configured to assert or not assert outputs at the programmed count values when the module loses communication with the bus (fault condition).
- Configured to specify if outputs turn on at a setpoint or maximum count, turn on at those points for a specific amount of time, or remain latched. If latched, outputs can only be reset by a hard wired input.
- Loaded with setpoint values, maximum count values, and output assert time.
- Enabled to count using hardwired input and software control bits.

## Counter Rollover Examples for Pulse Input

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

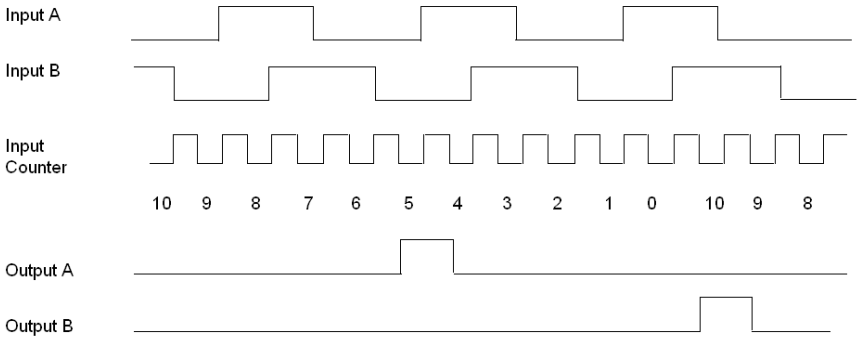



Count is from 0 -> 10 (Maximum Count)

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

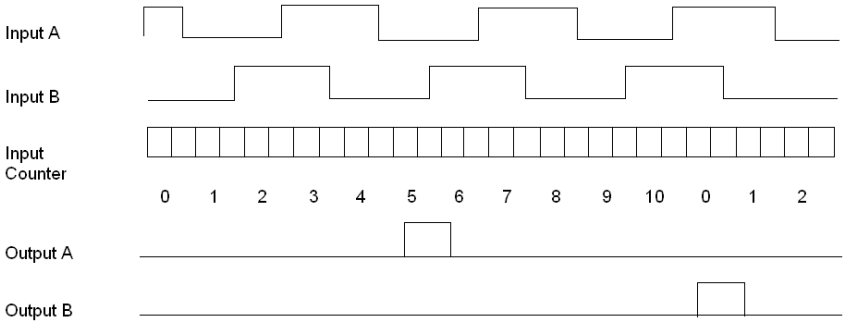
Output A turns on at Setpoint = 5

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.

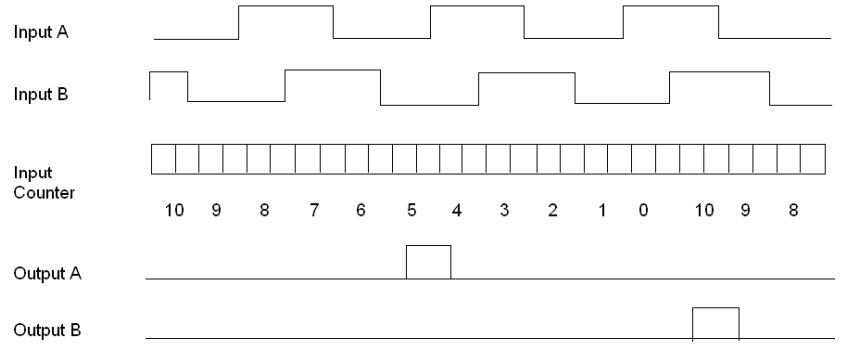



Count is from 0 -> 10 (Maximum Count)

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 |
|---|
| 4X+1 |
| 4X+2 |

| 3X |
|---|
| 3X+1 |
| 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 |
|---|
| 4X+1 |
| 4X+2 |
| 4X+3 |
| 4X+4 |
| 4X+5 |

| 3X |
|---|
| 3X+1 |
| 3X+2 |
| 3X+3 |
| 3X+4 |
| 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.

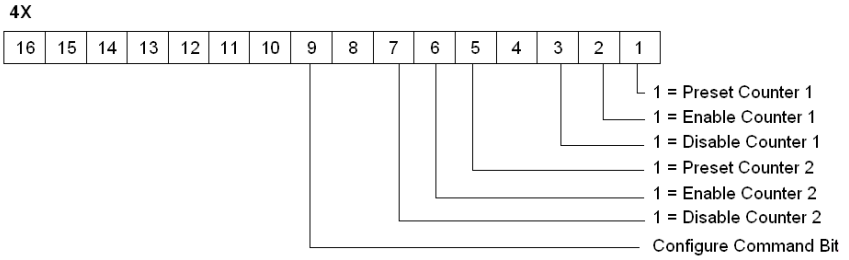
**NOTE:** When Command 0 (4X = 00XX) or any other undefined commands are asserted in the 4X register, the 3X registers will contain the count inputs if in count mode (same as Command 3) and the rate sample values when in rate-sample mode (same as Command 4).

## Command Words Described

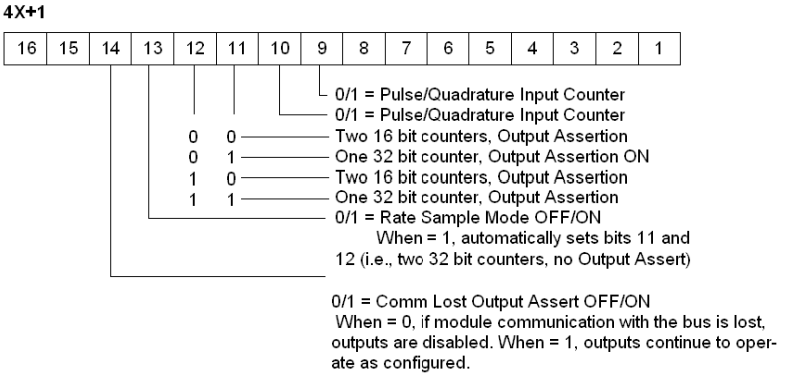
The following details the command words and responses.

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

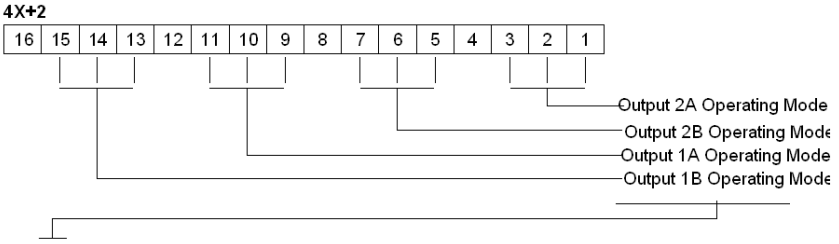
The following figure shows the 4x output register for command 1.




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.

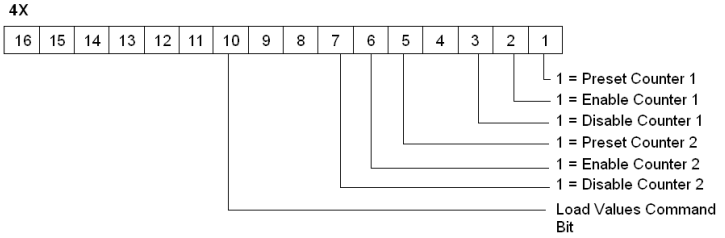
### Command 2. LOAD VALUES, Output Register Format (4X = 02XX hex)

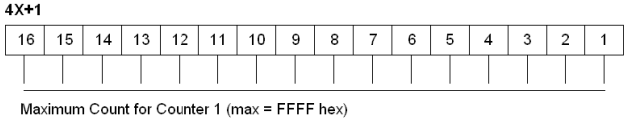
The LOAD VALUES 4X register format depends on the Counter/Rate Sample mode selected in Command 1, Register 4X+1, bits 11 and 12.

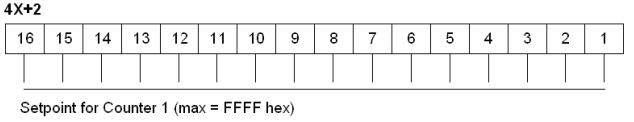
## Two 16 Bit Counters

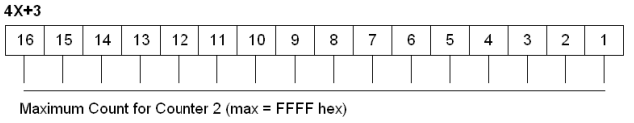
If configured for two, 16 bit Counters - Output Assert ON, the following information is displayed.

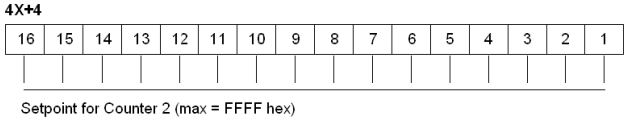
The following figures show the counters for registers 4X through 4X+5 modules.

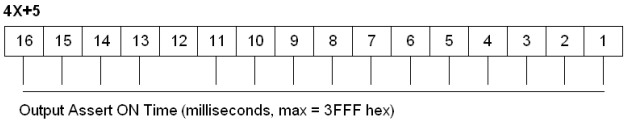


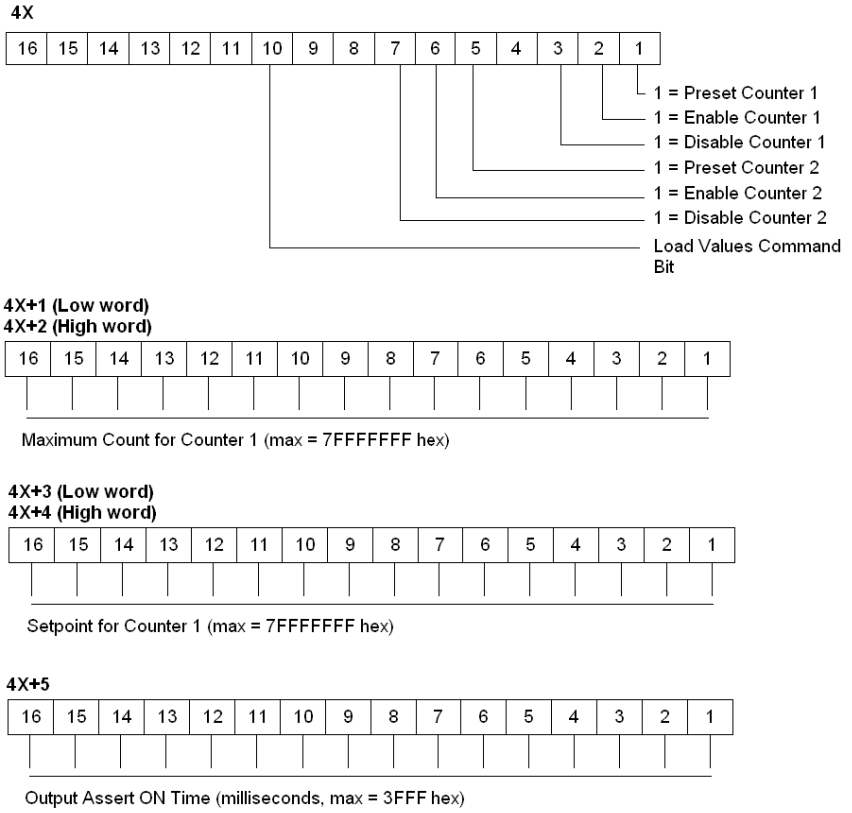




**NOTE:** Zero set into any 4X register means no change.

## 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.

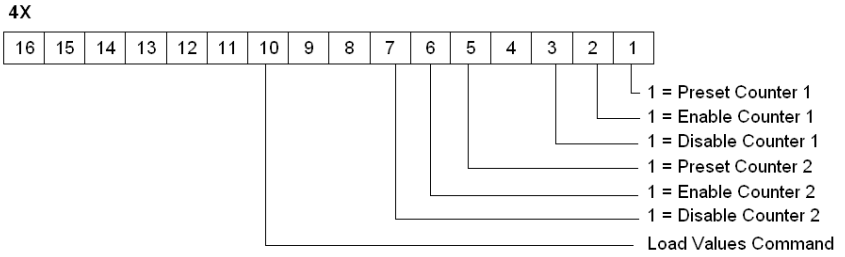


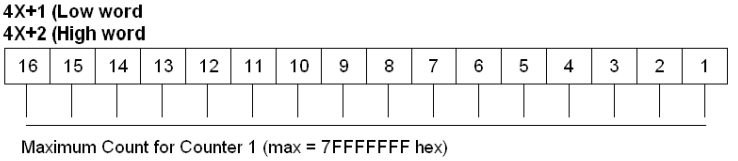

**NOTE:** Zero set into any 4X register pair for 32 bit values or any 4X register means no change.

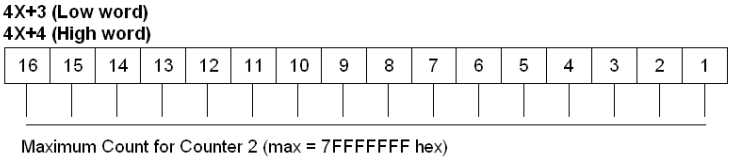
## Two 32 Bit Counters

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.



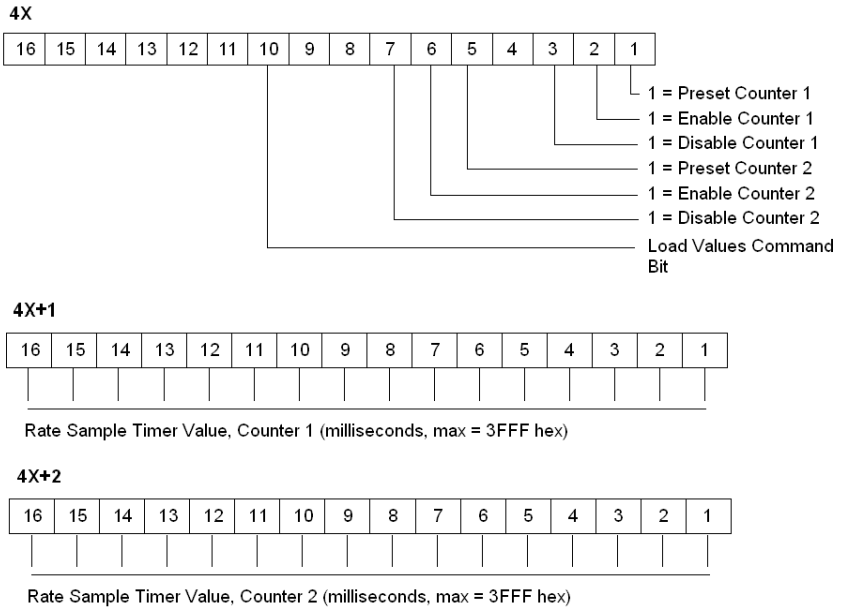




**NOTE:** Zero set into any 4X register pair for 32 bit values or any 4X register means no change.

## Rate Sample Mode

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

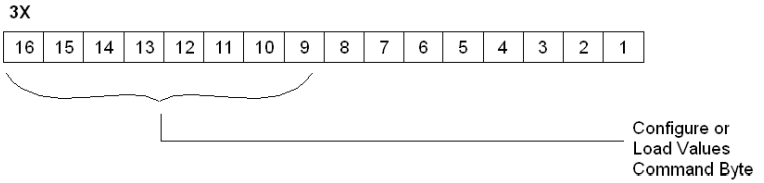
The following figure shows the 4X through 4X+2 counters.



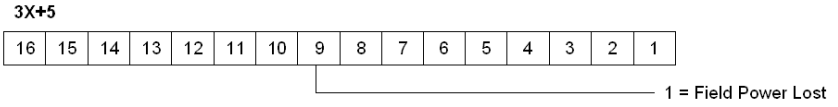

**NOTE:** Zero set into any 4X register or any 4X register pair for 32 bit values means no change.

## Command 1 and Command 2 Response Formats

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

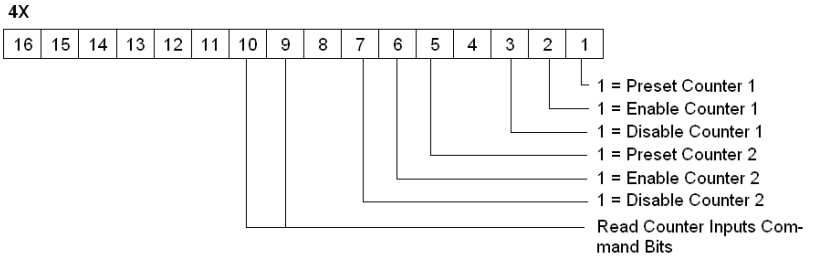



3X+1 to 3X+4 echoes 4X+1 to 4X+4 register contents.



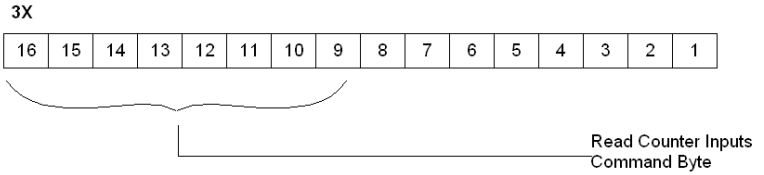

## Command 3, READ INPUT COUNTER, Output Register Format (4X = 03XX hex)

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

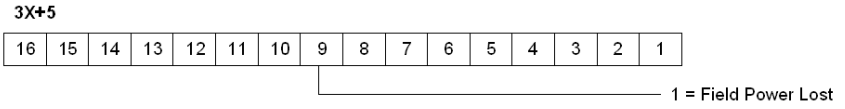


## Command 3 Response Format

The following figure shows the command 3 response format.

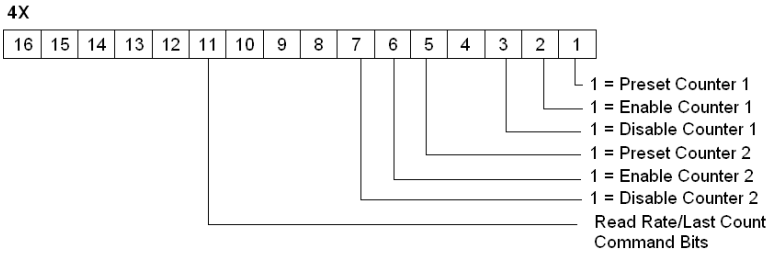



3X+1 and 3X+2 = Counter 1's 16 or 32 bit Current Count.
3X+3 and 3X+4 = Counter 2's 16 or 32 bit Current Count.



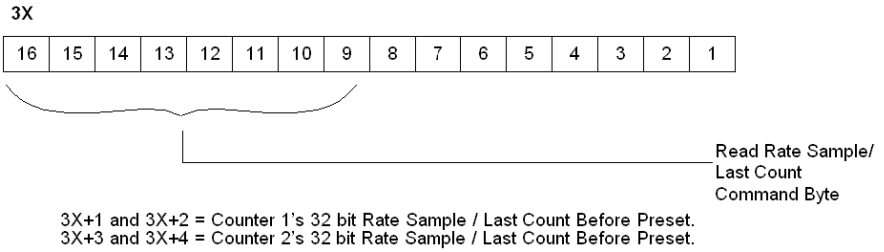

## Command 4, READ RATE SAMPLE or READ LAST COUNT VALUE BEFORE MOST RECENT PRESET, Output Register Format (4X = 04XX hex)

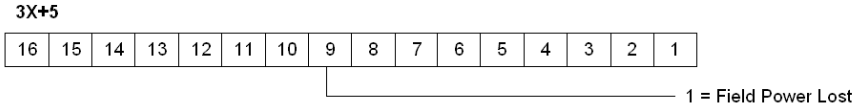
The following figure shows the 4x counters for command 4.



## Command 4 Response Format

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

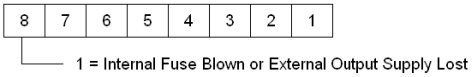



## I/O Map Status Byte

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 |

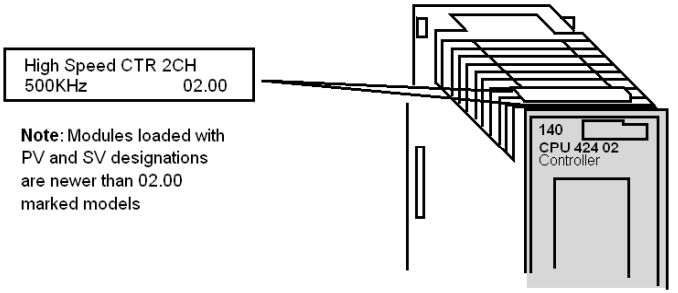
## Rate Sample Mode

**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.

**NOTE:** Rate Sample mode is set using Command 1, CONFIGURE (01XX), 4X+1 register, bit 13 = 1 (see the description of Command 1 in this section).

**NOTE:** To verify the version of the module, reference the indicated label found on the top front of the module.

The following figure shows the module's label.




In modules prior to V02.00, when Rate Sample mode was selected, input was always handled as if it were generated by a pulse encoder. For example, 60 count per revolution encoders, either pulse or quadrature types, would give a rate of 60 for a one-second revolution when the interval was set for one second.

**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.

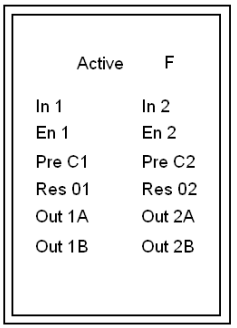
Encoder type selection is set using Command 1, CONFIGURE (01XX), 4X+1 register, bits 9 or 10 (see the description of Command 1 in this section).

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

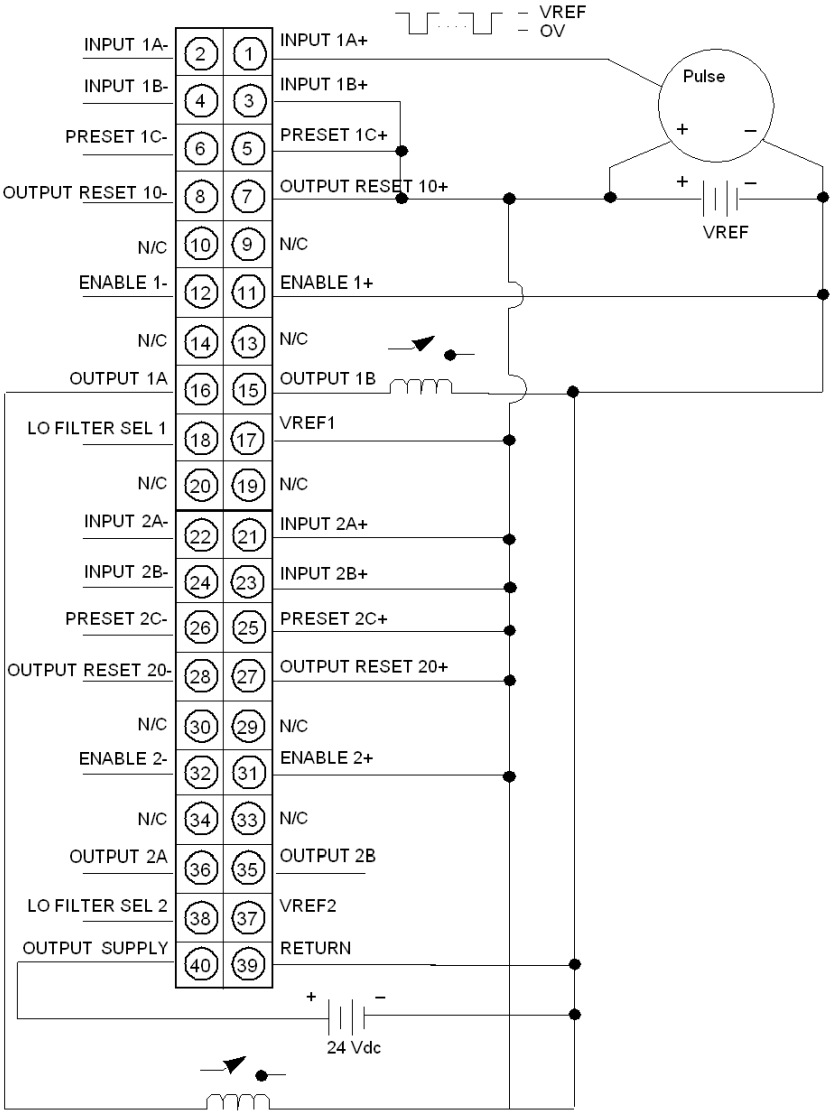
Field wire to Counter 2 inputs and outputs, when configured for one, 32 bit counter with output assertion. The unused Counter 1 must have its + (plus) inputs connected to VREF+.

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.

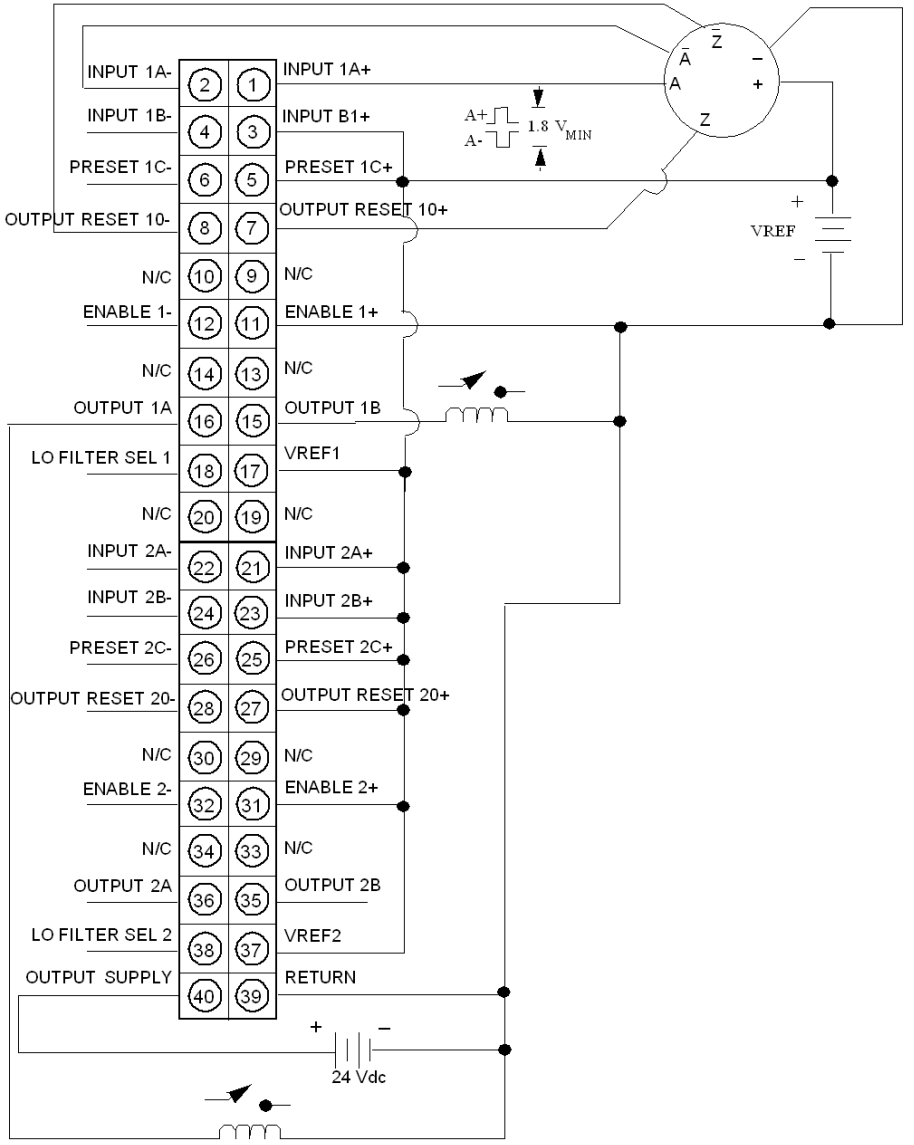


**NOTE:** Terminal description:

- 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

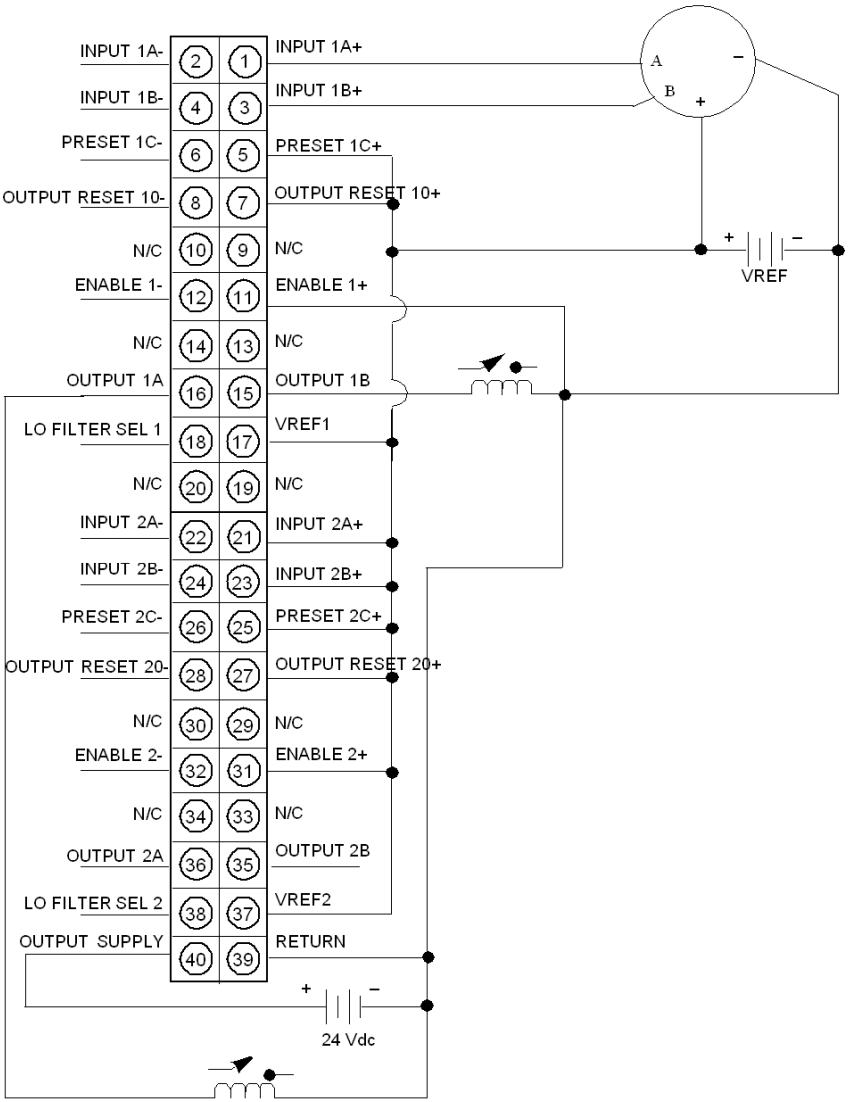
Wiring diagram showing differential pulse input, counting up and constant enable.




**NOTE:** Zero pulse resets Output 1A and 1B

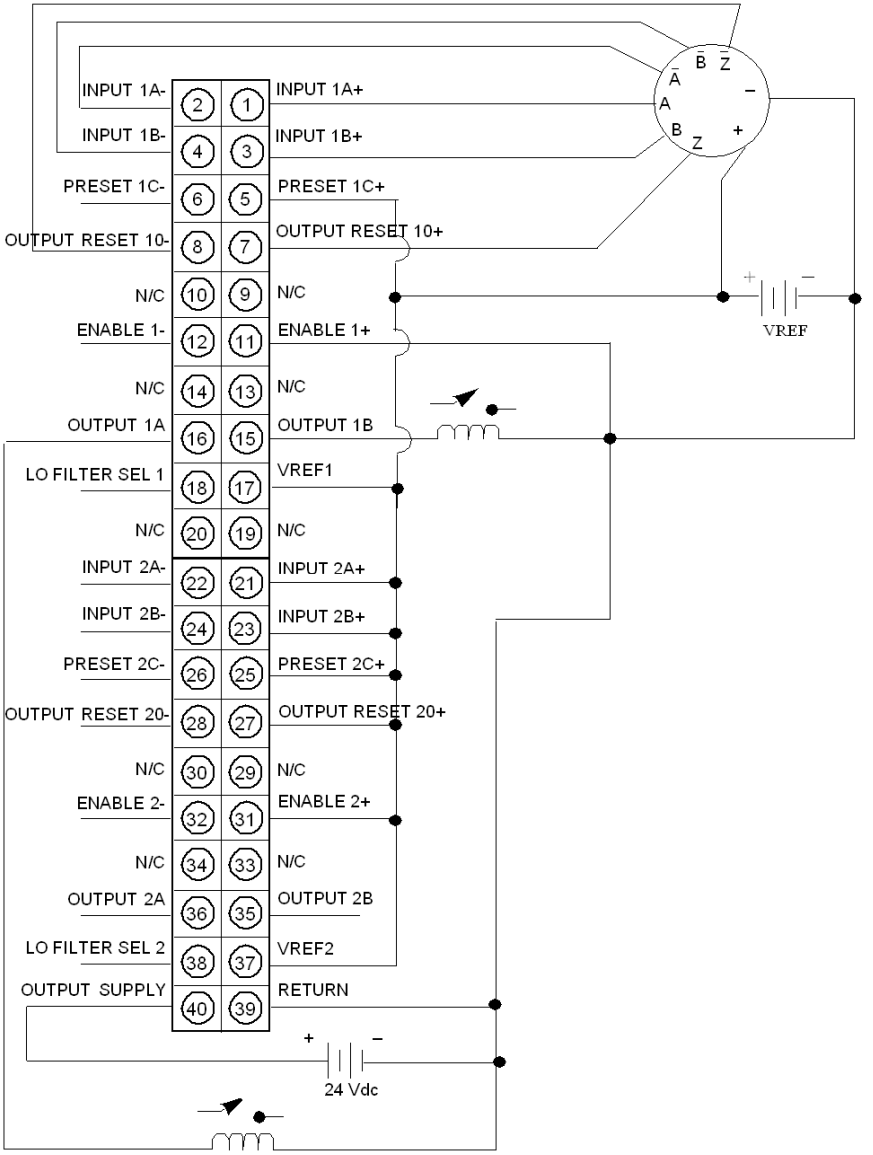
## Wiring Diagram 3

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

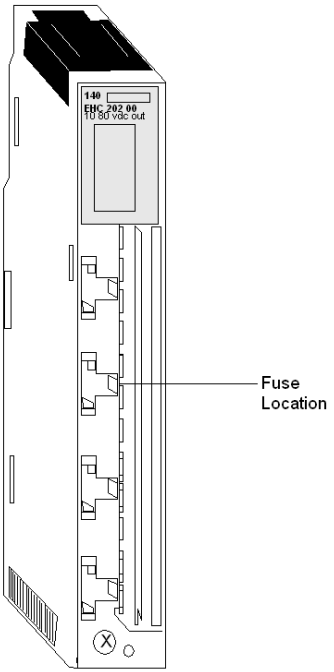
## Fuses

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.

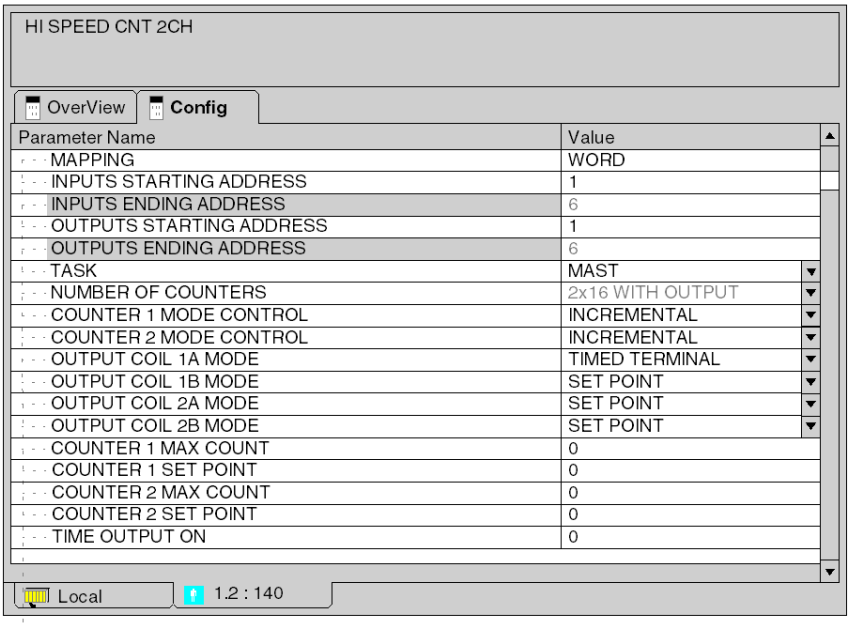
# Parameter Configuration

## 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<br>(Grayed if module in other than local) | MAST | FAST<br>AUX0<br>AUX1<br>AUX2<br>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<br>1x32 NO OUTPUT<br>RATE SAMPLE MODE |
| COUNTER 1 MODE CONTROL | QUADRATURE | INCREMENTAL |
| COUNTER 2 MODE CONTROL | QUADRATURE | INCREMENTAL |
| OUTPUT COIL 1A MODE | SET POINT | TIMED SET POINT<br>LATCHED SET POINT<br>TERMINAL COUNT<br>LATCHED TERMINAL<br>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<br>1x32 NO OUTPUT<br>RATE SAMPLE MODE |
| COUNTER 2 MODE CONTROL | QUADRATURE | INCREMENTAL |
| OUTPUT COIL 2A MODE | SET POINT | TIMED SET POINT<br>LATCHED SET POINT<br>TERMINAL COUNT<br>LATCHED TERMINAL<br>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<br>1x32 WITH OUTPUT<br>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<br>1x32 WITH OUTPUT<br>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:


| Topic | Page |
|---|---|
| Presentation | 312 |
| Specifications | 314 |
| Indicators | 316 |
| Wiring | 317 |
| Parameter Configuration | 320 |

# Presentation

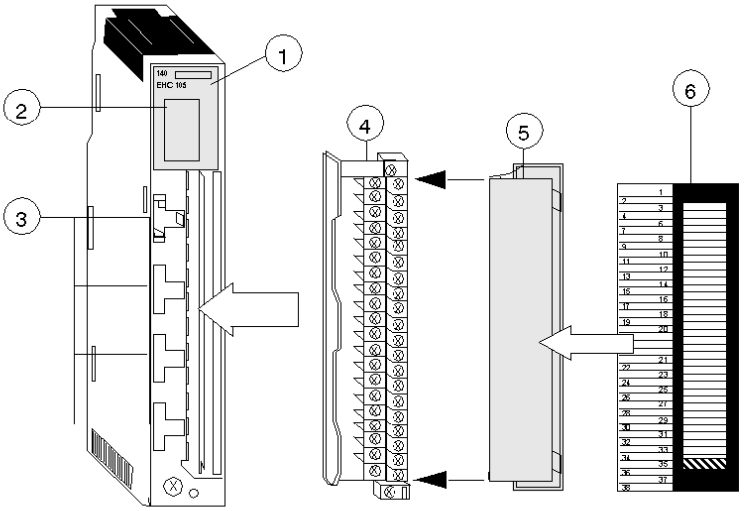
## Function

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<br>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<br>ON state (VDC): 3,1 ... 5,5 | OFF state (VDC): -3,0 ... +5,0<br>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<br>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<br>ON State (VDC):15,0 ... 30,0 |
| Delay time (typical)<br>IN1 ... IN6<br>IN7, IN8 | <br>ton = 2,2 ms, toff = 1 ms<br>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

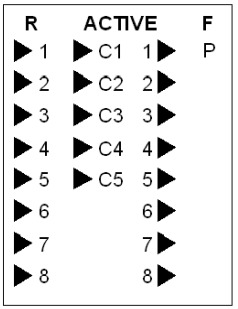
Discrete Outputs

| 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

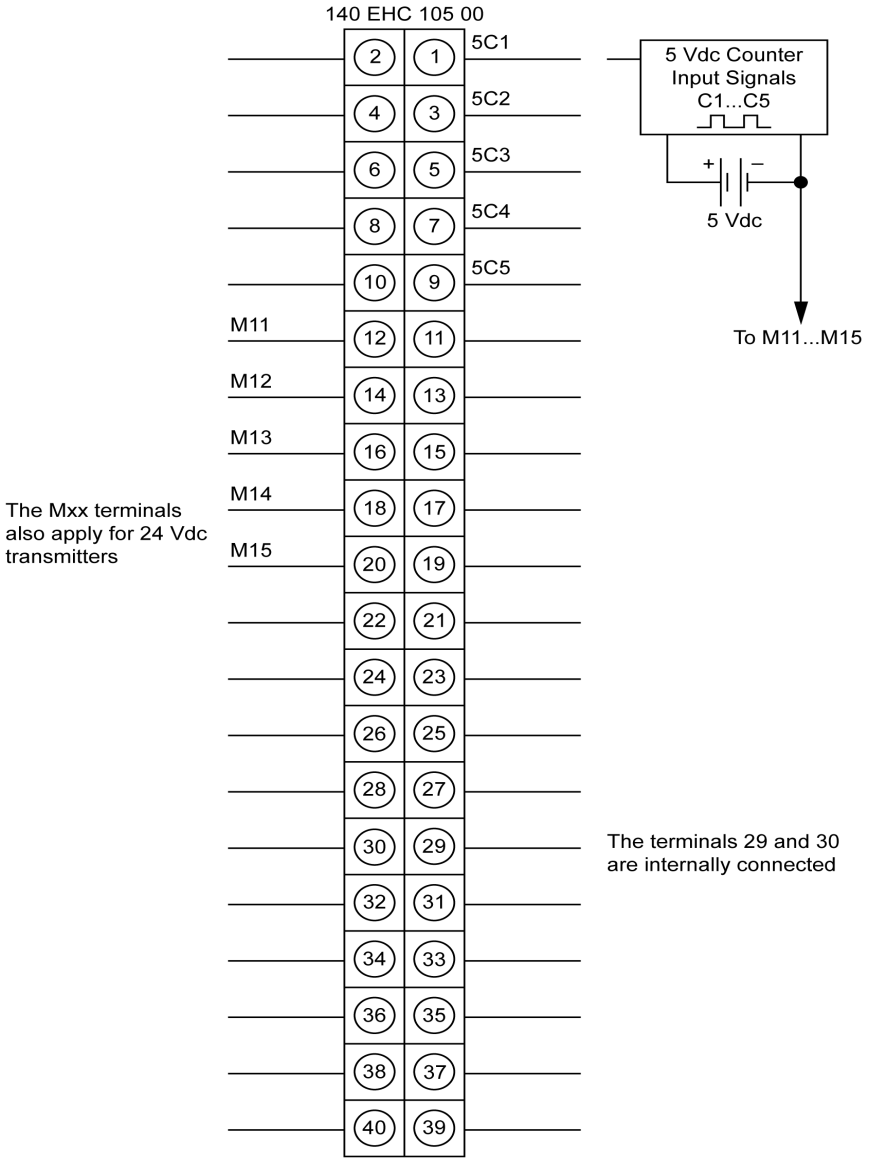
The following table shows the LED descriptions for the EHC 105 module

| 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:<br>● 24 VDC supply voltage (US24) not present<br>● Short circuit on one of the OUTn outputs<br>● Pulse monitoring has tripped (indicate bit = 1 and ERRx = 1)<br>● 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

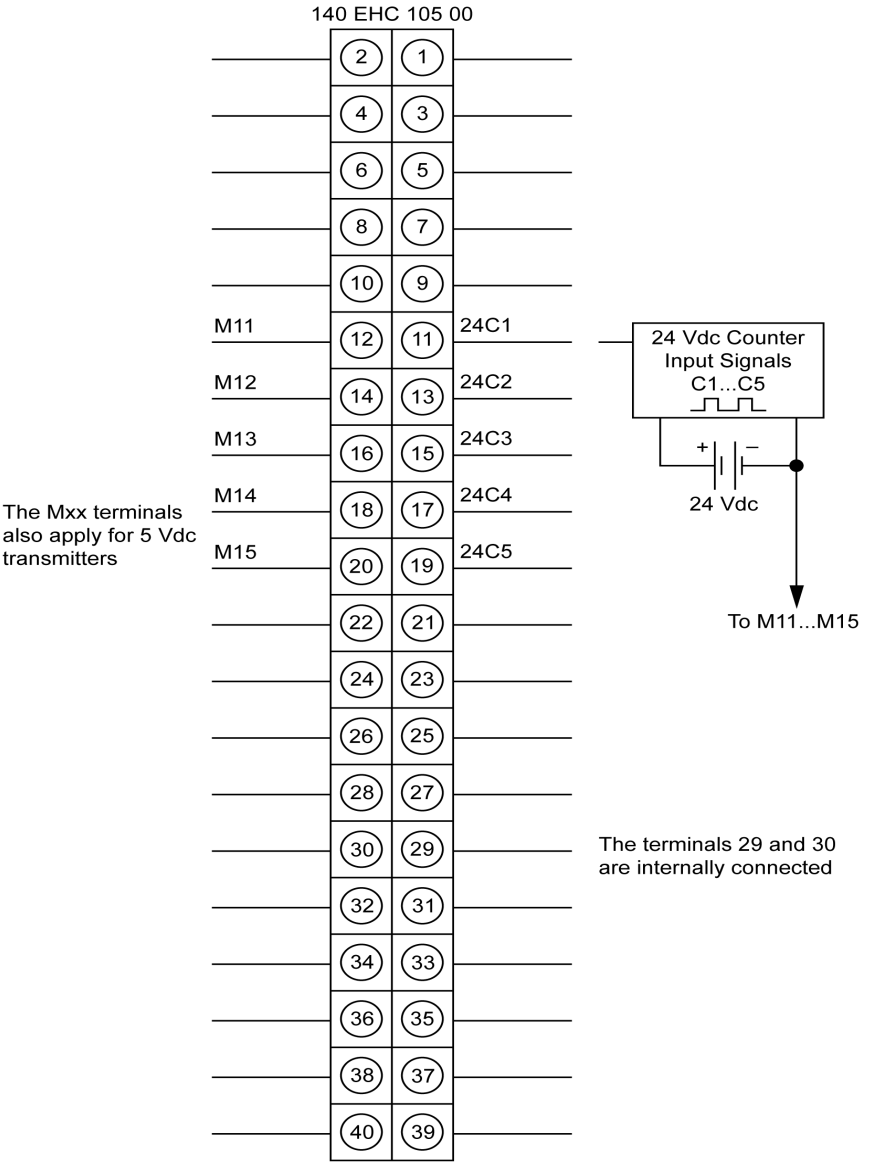
## 5Cx Counter Inputs

Wiring diagram for 5Cx counter inputs:



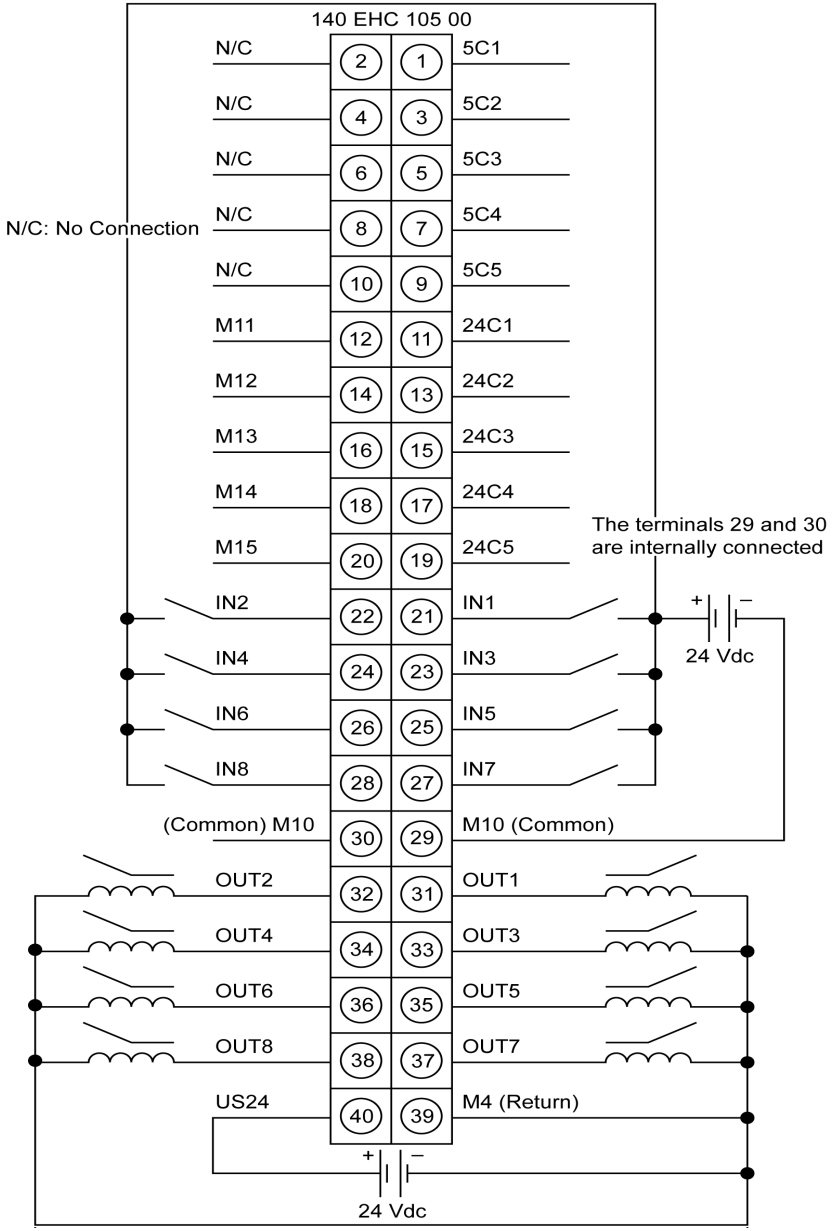
## 24Cx Counter Inputs

Wiring diagram for 24Cx counter inputs:



## Discrete Inputs and Outputs

Wiring diagram for discrete inputs and outputs:



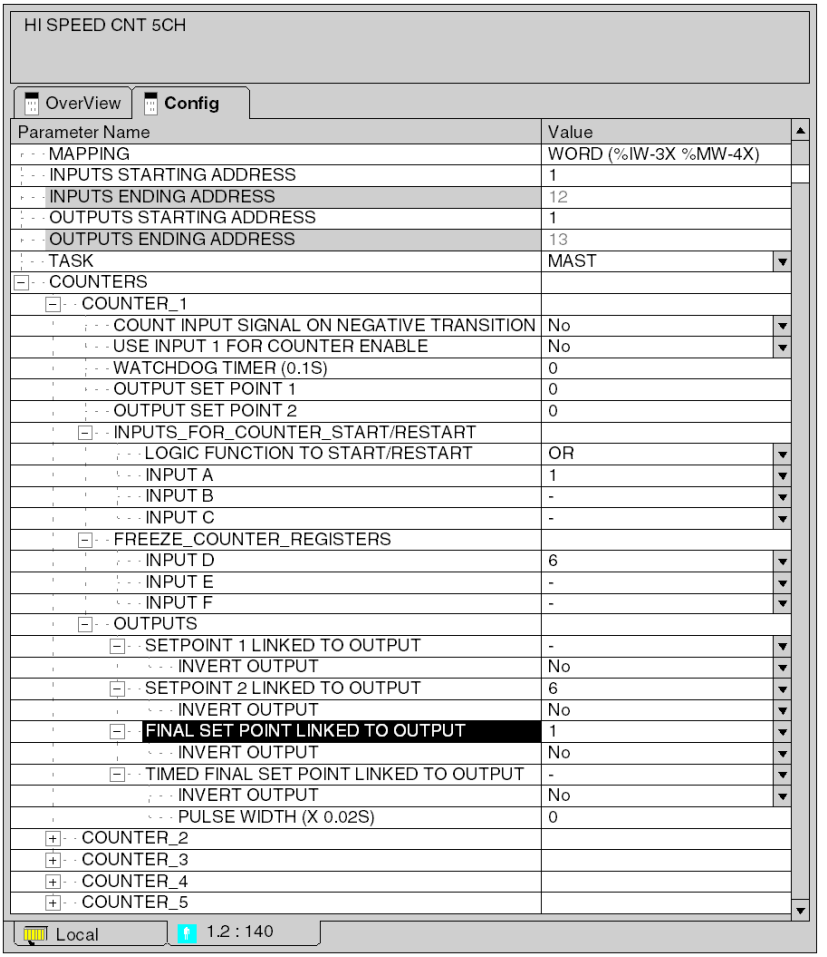
# Parameter Configuration

## 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<br>(Grayed if module in other than local) | | MAST | FAST<br>AUX0<br>AUX1<br>AUX2<br>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 | -<br>1-8 |
| | INPUT B | - | -<br>1-8 |
| | INPUT C | - | -<br>1-8 |

| Name | | Default Value | Options |
|---|---|---|---|
| FREEZE_COUNTER_REGISTERS | INPUT D | 6 | -<br>1-8 |
| | INPUT E | - | 1-8 |
| | INPUT F | - | 1-8 |
| OUTPUTS | SETPOINT 1 LINKED TO OUTPUT | - | 1-8 |
| | • INVERT OUTPUT | No | Yes |
| | SETPOINT 2 LINKED TO OUTPUT | 6 | -<br>1-8 |
| | • INVERT OUTPUT | No | Yes |
| | FINAL SETPOINT LINKED TO OUTPUT | 1 | -<br>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<br>COUNTER_3<br>COUNTER_4<br>COUNTER_5 | | See COUNTER_1 | |

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