170 PNT Series
Modbus Plus Communication Adapters for Momentum User Guide

870 USE 103 00 Version 2.0

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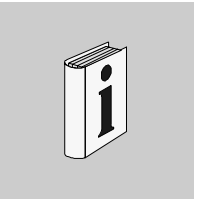
About the Book



At a Glance

Document Scope

This manual describes the functionality of the 170 PNT Series Modbus Plus Communication Adapters.

The following information is an introduction to this manual:

Function: The Modbus Plus Communication Adapters can be connected to any Momentum I/O base to create a functional I/O module.

The adapters provide direct connection to the Modbus Plus network, enabling a programmable controller to communicate with field devices wired to the I/O base terminals.

The controller on the network can read from the input terminals and write to the output terminals of the I/O base using Modbus Plus Peer Cop or MSTR Function Block messaging.

Data Format: Data bits are transferred in the IEC format. This is the standard data format for the Momentum product line.

Models:

Model 170 PNT 110 20 has one Modbus Plus port for connection to a network with a single trunk cable.

Model 170 PNT 160 20 has two ports for connection to either a single-cable or dual-cable network.

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Introduction

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At a Glance

Purpose

This chapter gives an overview of the Momentum Modbus Plus Communication Adapter models 170 PNT 110 20 and 170 PNT 160 20 and describes their status indicators, address switches, ports and cabling.

What's in this Chapter?

This chapter contains the following topics:

Product Overview

Overview

This section provides an overview of the features and function of the Momentum Modbus Plus Communication Adapters.

Function

The Modbus Plus Communication Adapters can be connected to any Momentum I/O base to create a functional I/O module.

The adapters provide direct connection to the Modbus Plus network, enabling a programmable controller to communicate with field devices wired to the I/O base terminals.

The controller on the network can read from the input terminals and write to the output terminals of the I/O base using Modbus Plus Peer Cop or MSTR Function Block messaging.

Data Format

Data bits are transferred in the IEC format. This is the standard data format for the Momentum product line.

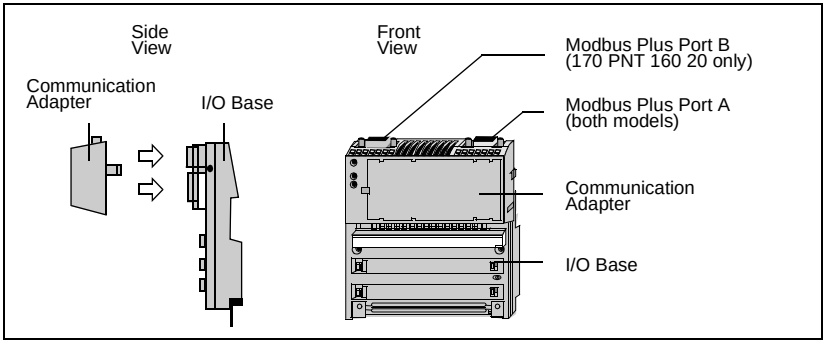
Models

Model 170 PNT 110 20 has one Modbus Plus port for connection to a network with a single trunk cable.

Model 170 PNT 160 20 has two ports for connection to either a single-cable or dual-cable network.

Diagram

The diagram below shows a Modbus Plus Communication Adapter mounted on a typical I/O base.



Environmental Specification

The adapter conforms to the environmental specification for the I/O base upon which it is mounted. For further information refer to the Momentum I/O Bases User Manual, part number 870 USE 002 00.

Status Indicators

Overview

This section describes the status indicators for each model, gives a diagram of the indicators, and explains how to interpret the indicator patterns.

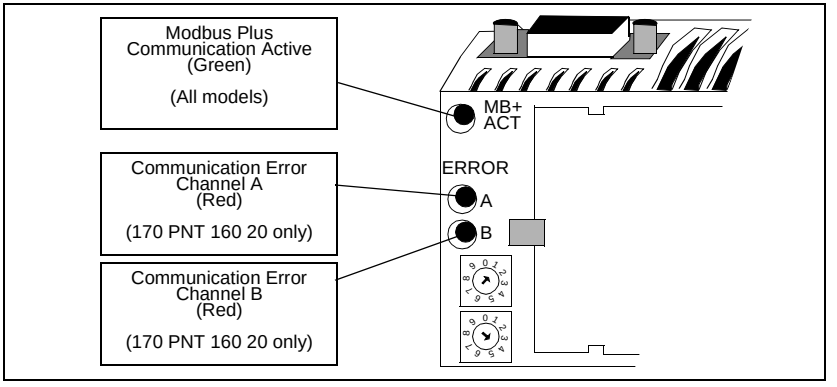
Indicators

Each model has a front panel indicator showing its network communication status.

The dual-cable model has two additional indicators which identify communication errors on the two cable paths.

Diagram

The communication status and error indicators are shown in the diagram below



Modbus Plus Active Indicator Patterns

The table below describes the status associated with each active indicator pattern.

Indicator Pattern (Green)	Status
Six flashes/second	Normal operating state. All nodes on a healthy network flash this pattern.
One flash/second	The node is off-line. After being in this state for 5 seconds, the node attempts to go to its normal operating state.
Two flashes, then OFF for 2 seconds	The node detects the network token being passed among other nodes, but it never receives the token.
Three flashes, then OFF for 1.7 seconds	The node does not detect any token passing on the network.
Four flashes, then OFF for 1.4 seconds	The node has detected another node using the same address.

Modbus Plus Channel Error Indicators

Model 170 PNT 160 20 displays the following error indicator patterns:

Indicator (Red)	Status
Channel A Error	Communications error at network port A.
Channel B Error	Communications error at network port B.

Address Switches

Overview

This section describes the address switches and explains how to use them to set the module address.

Two Rotary Switches

Each Modbus Plus Communication Adapter has two rotary switches on the lower left portion of the front panel. These switches are used to set the Modbus Plus node address.

Guidelines for Node Addresses

Follow these guidelines when setting node addresses:

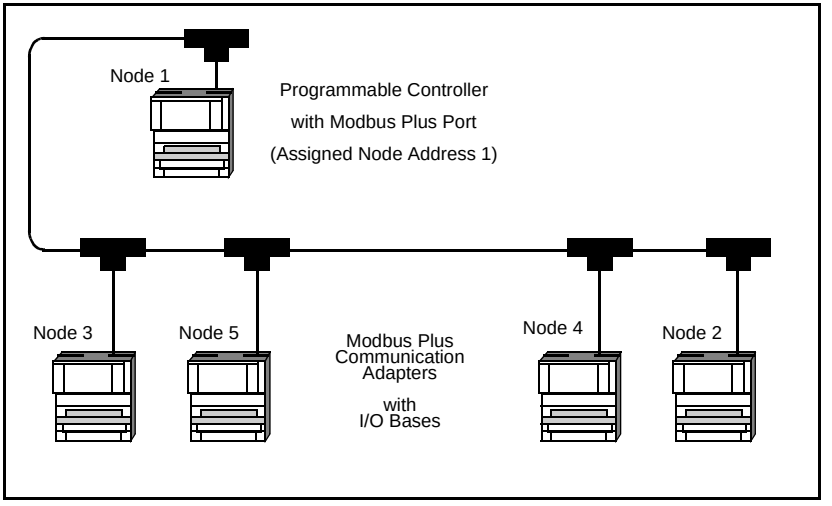
- The node address should be assigned by your network administrator.
- Each node must have a unique address in the range 1... 64.
- Duplicate addresses are not allowed.
- Addresses are assigned logically and are not dependent upon the physical locations of the node devices.
- Starting at address 1, the lowest addresses should be assigned to programmable controllers. Communication adapters should be assigned the next addresses in direct sequence.

Addresses Must Match

The node address is also defined in the Peer Cop Table and MSTR function blocks of the user's application program. The address defined in the application program must match the one set by the adapter's front panel switches.

Example of Node Address Assignment

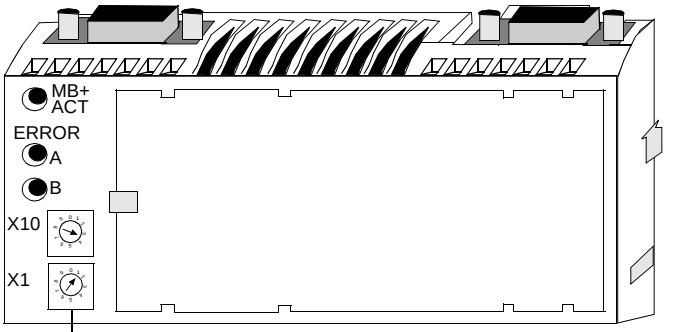
The figure below shows typical address assignments for a network with one controller and four communication adapters.



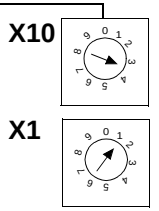
Setting the Switches

The figure below illustrates how to set a Modbus Plus Node Address.

Do not install any adapter unless you have set its Modbus PLus address for your application.



See your network administator to get the node address for each adapter.



Node Address	Upper Switch	Lower Switch
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

This example sets the address to 31.

Ports and Cabling

Overview

This section provides information about ports and cabling for the Momentum Modbus Plus Communication Adapters.

Ports

Model 170 PNT 110 20 has one Modbus Plus port for connection to a network with a single trunk cable.

Model 170 PNT 160 20 has two ports for connection to either a single-cable or dual-cable network.

Cabling

Network port connections are compatible with standard Modbus Plus drop cables. Drop cables are available from Schneider Automation in three standard lengths: 2.4m (8ft), 3m (10ft), and 6m (20ft).

Assembling a Communications Adapter and I/O Base

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At a Glance

Purpose

This chapter explains how a Communication Adapter connects with an I/O base, how to assemble a module, and how to label the assembled module. It also includes a procedure for disassembling a module.

What's in this Chapter?

This chapter contains the following topics:

Connections Between the Adapter and I/O Base

Overview

This section explains the connections between a Communication Adapter and an I/O base.

Physical Connections

A Communication Adapter can be snapped directly onto a Momentum I/O base, making connections at three points:

- The plastic snap extensions on the two sides of the adapter unit fit into the two slots on the sides of the I/O base
- The ATI connectors on the two units mate together

Clips lock the adapter in place. The clips can be released with a common screwdriver to remove the adapter.

Electrical Connections

Each adapter connects to the internal communication connector of its I/O base. The adapter receives its operating voltage from the I/O base through this internal connection.

The adapter monitors its voltage and goes offline to the Modbus Plus network if the voltage is not within tolerance.

Assembling the I/O Base and the Adapter

Overview

This section contains safety precautions for handling components and a procedure for assembling an I/O base and an adapter.

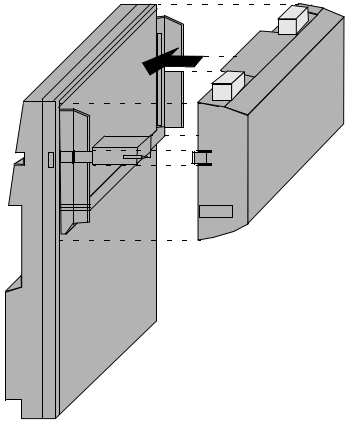
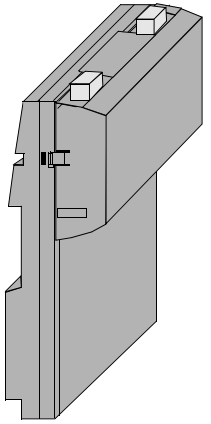
	**CAUTION** **ADAPTER MAY BE DAMAGED BY STATIC ELECTRICITY** Use proper ESD procedures when handling the adapter, and do not touch the internal elements. The adapter's electrical elements are sensitive to static electricity. **Failure to observe this precaution can result in injury or equipment damage.**

	**CAUTION** **ELECTRICAL CIRCUITRY MAY BE EXPOSED** Electrical circuitry on the I/O base may be exposed when a Momentum adapter is not mounted. Make sure that the I/O base is not under power when it does not have an adapter mounted on it. To make sure that power is not present, do not insert the wiring connectors to the I/O base until after the adapter has been mounted. **Failure to observe this precaution can result in injury or equipment damage.**

Procedure: Assembling an I/O Base and an Adapter

Follow the steps in the table below to assemble an I/O base and an adapter.

Step	Action
1	Choose a clean environment to assemble the I/O base and adapter to protect the circuitry from contamination.
2	Make sure that the I/O base is not under power when you assemble the module.

Step	Action
3	Align the two plastic snap extensions on the Adapter with the slots on the sides of the I/O base. The ATI connectors will automatically line up when the units are in this position. The two devices should be oriented such that their communication ports are facing out on the back side of the assembly. 
4	Using the sidewalls of the I/O base as guides, carefully push the Adapter onto the base until the extensions snap into place. The ATI connectors on the two units will be mated to each other in the process. 

Labeling the Assembled Module

Overview

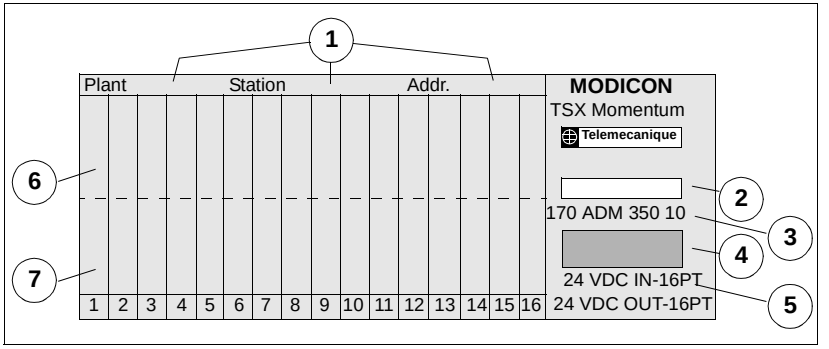
A front panel label is supplied with each I/O base. The user should fill out the label and affix it to the front panel of the adapter.

What Goes on the Label?

The user should fill out the label to identify the field wiring connections and application of the I/O base terminals.

Example of a Label

A fill-in label is illustrated in the diagram below. The numbered pointers in the diagram refer to the descriptions in the table that follows.



The following table describes the numbered pointers above.

No.	Description
1	Fields for plant name, station name and network address
2	Cutout–the model number of the Adapter shows through
3	Model Number of the I/O base
4	Color code of the I/O base
5	Short description of the I/O base
6	Field for the symbol name of inputs
7	Area for the symbol name of outputs

Where Does the Label Go?

The label should be affixed to the front panel of the adapter in such a way that the cutout area above the I/O model number allows the pre-screened model number of the adapter to show through.

Disassembling an Adapter from an I/O Base

Overview

This section contains safety precautions and a procedure for disassembling an adapter from an I/O base.

CAUTION

ELECTRICAL CIRCUITRY MAY BE EXPOSED

Before removing an adapter from the base, disconnect the wiring connectors. Make sure that the I/O base is not under power when it does not have a Momentum adapter mounted on it.

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

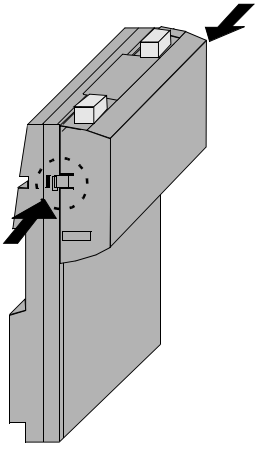
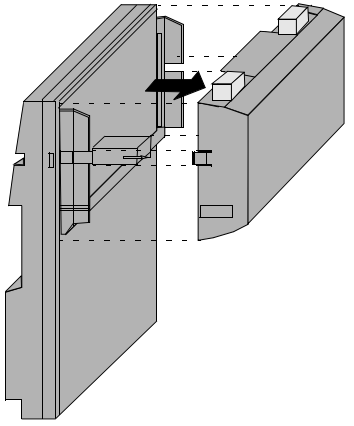
Tools Required

A flat-head screw driver may be needed to disassemble the unit.

Disassembling an Adapter from an I/O Base

Follow the steps in the table below to remove an adapter from an I/O base.

Step	Action
1	Choose a clean environment to disassemble the unit, in order to protect the circuitry from contamination.
2	Make sure that the I/O base is not under power by removing the terminal connectors from the I/O base.

Step	Action
3	Use a screwdriver to push the clips on both sides of the adapter inward, as shown in the illustration below. 
4	Lift off the adapter. 

Using Modbus Plus for Distributed I/O Servicing

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At a Glance

Purpose

This chapter explains how best to configure a network for efficient servicing of distributed I/O.

What's in this Chapter?

This chapter contains the following topics:

Strategies for Distributed I/O Servicing

Overview	Modbus Plus networks can be used to service multi-purpose control applications, or they can be organized for the most efficient servicing of distributed I/O devices. This section compares the two approaches.
Network Function	In multi-purpose control applications, the network is designed to allow communication between in programmable controllers, operator interfaces, and other kinds of devices. For efficient servicing of distributed I/O, the network is designed to allow communication between one programmable controller and a group of I/O modules.
Message Timing	In multi-purpose control applications, timing can vary according to the current processing requirements of each node's internal program. In efficient distributed I/O servicing applications, the timing of message transactions must be predictable to allow deterministic timing of the I/O control process.
Size	In general applications, up to five networks can be joined by Bridge Plus devices to extend the cable length to 2250 m (7500ft) and the node count to 320 nodes. In distributed I/O applications, messages are transacted on the local network only. BridgePlus devices are not applicable to networks used for distributed I/O.
Recommen-dation	Multi-purpose networks are not recommended for servicing I/O control applications in which I/O timing must be deterministic.

Network Configuration

Overview

This section contains guidelines for configuring a Modbus Plus network for distributed I/O servicing.

Limit Types of Devices on Network

To ensure deterministic timing, the network should consist of just one programmable controller node and the required group of I/O nodes.

Non-I/O devices, such as additional controllers, programmers, or operator interfaces, should communicate with the I/O network controller through a separate Modbus Plus network or other type of connection.

Maximum Configuration

The table below summarizes the Modbus Plus network's maximum configuration for a distributed I/O application consisting of Momentum products.

Parameter	Specification
max. number of nodes	64 including Controller
max. distance between two nodes	450 m (1500ft)
min. distance between two nodes	3 m (10ft)
max. length of network	450 m (1500ft)
max. number of data words (16-bit words)	500 input, 500 output
max. number of I/O points (16 bits/word)	8000 input, 8000 output

Modbus Plus Network Layouts

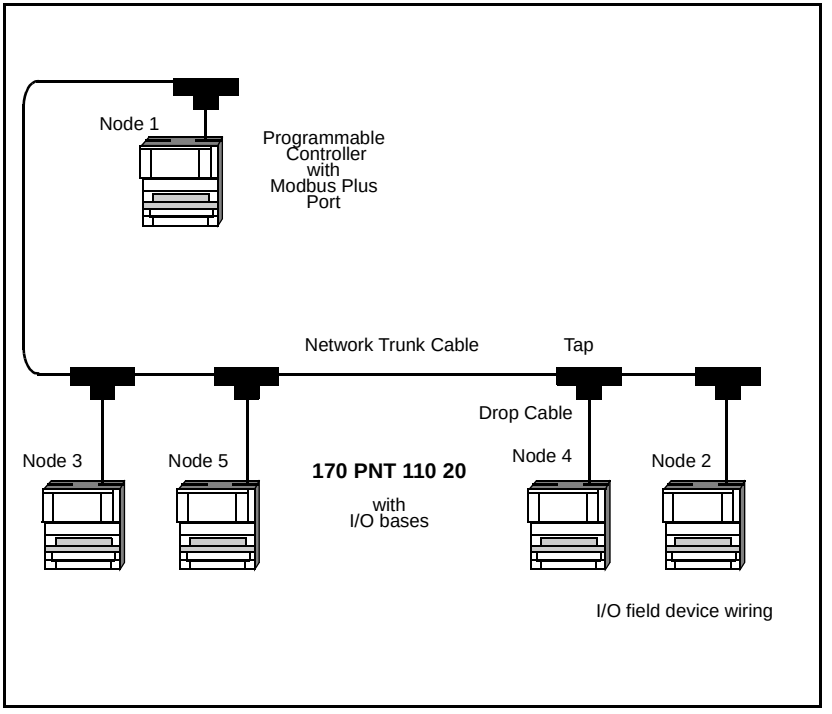
Overview

This section provides two examples of Modbus Plus network layouts using communication adapters in a distributed I/O control application.

Note that only one programmable controller and the required I/O nodes are present in this kind of application.

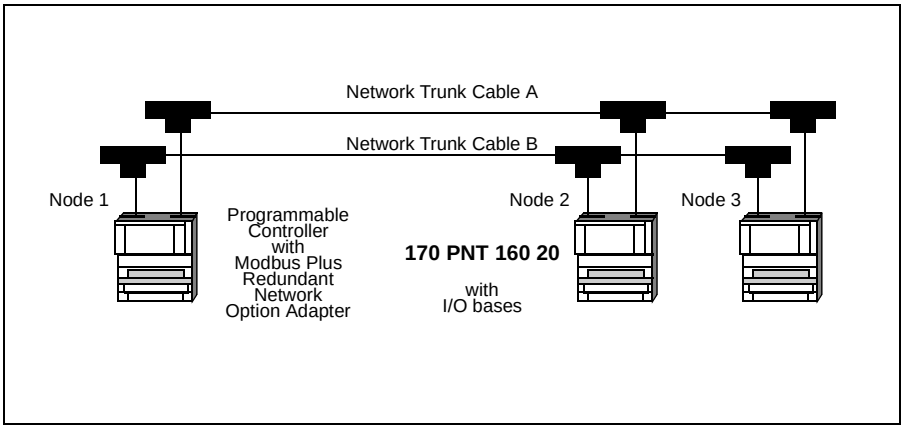
Single Cable Example

The figure below illustrates a single cable configuration.



Dual Cable Example

The example below illustrates a dual cable configuration.



How Communication Adapters Handle Messages

4

At a Glance

Purpose

This chapter describes how messages are defined in the application and how messages are transacted on the network.

What's in this Chapter?

This chapter contains the following topics:

How Messages Are Defined in the Application

Overview	This section describes where and how messages are defined in the application.
Peer Cop Table	The user defines I/O message transactions in the Peer Cop table of the controller. Entries to the table are made using panel software, such as Schneider's Concept or Modsoft software. The Peer Cop table specifies the controller registers that are to be used for the I/O data storage. It also specifies the Communication Adapter node addresses which will handle that data.
MSTR Blocks	I/O data messages can also be transacted using Modbus Plus MSTR function blocks in the controller's application program.
Addresses Must Match	Principle: The address defined for each adapter in the Peer Cop table and in MSTR blocks must be identical to the address switch settings on the front panel of the adapter.
Mapping Data to I/O Bases	Mapping of data between the controller's data registers and the field terminals of I/O bases is unique to each model of I/O base. Mapping is described in the Momentum I/O Bases User Manual, part number 870 USE 002 00.

How Messages are Transacted

Overview

This section explains how a Communication Adapter relays information between its I/O base and a programmable controller.

The Right to Transmit

A token frame is passed from node to node in a rotating address sequence. The node currently holding the token has the sole right to transmit. All other nodes monitor the network and extract messages addressed to them.

Messages from Communication Adapters

When a Communication Adapter at an input base module acquires the token, it transmits its message to the programmable controller node. The message data describes the current states of the signals at the base's field input terminals.

The controller reads the message and steers its contents into the data registers defined for that adapter's address in the controller's Peer Cop table.

Messages to Communication Adapters

When the programmable controller acquires the token, it transmits its messages to the Communication Adapters. Messages are sent to the node addresses defined in the controller's Peer Cop table, with the message contents taken from the data registers defined in the table.

Each Communication Adapter at an Output base module uses its received message to control the field devices connected to the base's output terminals.

Communication Access Registers

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At a Glance

Purpose

This chapter describes the three types of communication access registers.

What's in this Chapter?

This chapter contains the following topics:

Overview of Register Types

Purpose

Each adapter contains three groups of internal registers that enable the application program to communicate with the I/O base module.

This section describes the three register types, their functions and how they are accessed.

Register Types

The three types of internal registers are:

- Data registers
- Configuration registers
- Status registers

Functions

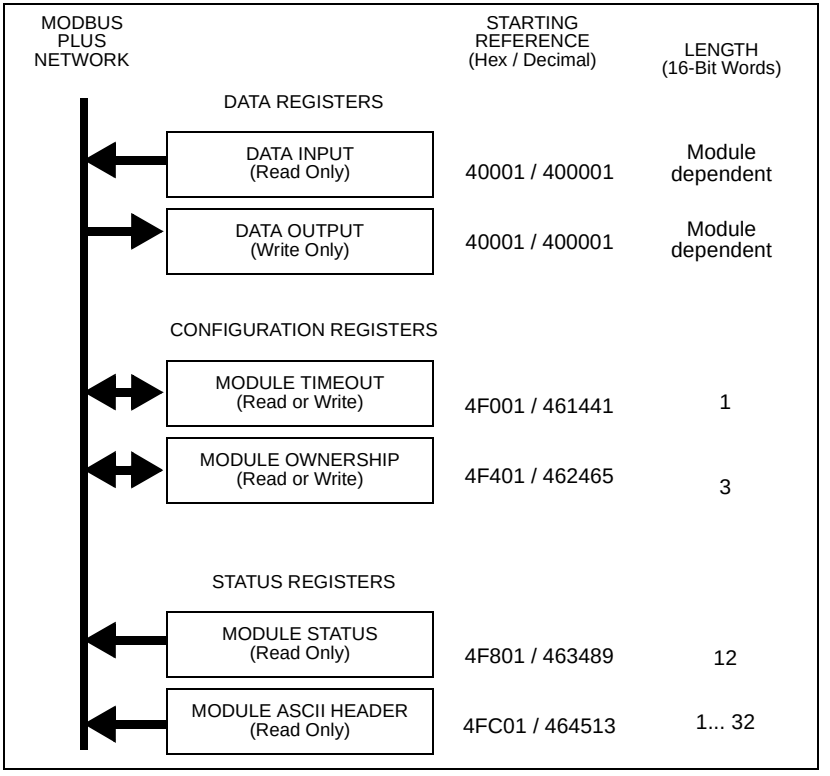
The application can access the registers through the network to transfer input or output data at the module's field terminals, to set or retrieve the module's configuration, or to monitor its status.

Access to Registers

The registers are accessed as 4XXXX references in a controller's application program. Note that the Data Registers are the only ones that can be accessed by the controller's Peer Cop table. All of the registers can be accessed by MSTR function blocks.

Diagram of Register Types

The three groups of internal registers are illustrated in the diagram below.



Data Registers

Overview	This section describes the use, field length and access to data registers.
Use	Starting reference 40001 (hex) is used to address input data from field inputs and output data to field outputs.
Field Length	The data field length is determined by the specific I/O base.
Access	This reference is the only one that is accessible through Peer Cop data transfers. All other registers can be accessed using MSTR blocks.

Configuration Registers

Overview

This section describes the function and parameters for module timeout and module ownership registers.

Module Timeout Register Function

The module timeout register specifies the amount of time that outputs will be held in their current state, if they are not updated by a new Modbus Plus Write command. If the module's holdup time expires before a new write command is received, all outputs are set to logical 0 (zero).

Module Timeout Register Parameters

The table below gives the parameters for module timeout registers:

Parameters	
Sharing Reference	4F001 (hex)
Field Length	1 word
Access	Modbus Plus Read command
Units	1 = 10 milliseconds
Minimum Value	30 (300 milliseconds)
Maximum Value	6000 (60 seconds)
Default Value	100 (1 second)

Module Ownership Registers Function

Module ownership registers specify the addresses of up to three nodes which may concurrently own write privilege to the adapter.

When the adapter first receives power, it will give sole write privilege to the first node that writes to it. The adapter maintains an internal 60-second timer for handling the write privilege, and will reserve sole privilege to that node as long at the node continues to write within 60-second intervals to the adapter.

A node which currently owns the write privilege may write up to three words to the adapter starting at reference 4F401. Each of the three words must correspond to a valid node address in the range 1...64 decimal. With those addresses stored in the adapter, any of those three nodes may then write to the adapter. This allows up to three nodes to concurrently own write privilege to the adapter.

If writes continue to occur within the 60-second interval from any of the three privileged nodes, no other node may write to the adapter. If the timer is allowed to expire, any node may write to the adapter.

Note that this 60-second Write Privilege timer is separate from the Outputs Holdup timer, and applies only to the write privilege. Any node may read the input data or status information from the adapter. The 60-second time is a fixed value and is not accessible to the application.

Module Ownership Registers Parameters

The table below contains parameters for module ownership registers.

Parameters	
Starting Reference	4F401 (hex)
Field Length	3 words

Status Registers

Overview

This section describes the function and parameters of the module status block and the ASCII header block.

Module Status Block Function

These registers provide information about the module's revision level and current operating parameters.

Module Status Block Parameters

The module status block layout is described in the table below. The registers can be read, but cannot be written into.

Reference (hex)	Purpose	Contents
4F801	Length of status block (words)	12 decimal
4F802	I/O module quantity of input bytes	Module dependent
4F803	I/O module quantity of output bytes	Module dependent
4F804	I/O module ID number	Module dependent
4F805	I/O module revision number	Format: XRwhere:X = upper 4 bits, always 0000R = lower 12 bits, defining the revision as 3 hex characters.Example: 100 hex = Rev. 1.00 200 hex = Rev. 2.00
4F806	ASCII header block length (words)	Module dependent
4F807	Last node address to communicate	1...64 decimal
4F808	Remaining ownership reservation time	30...6000 decimal, in units of 10 ms (300 ms...60 s)
4F809	Remaining outputs holdup time	30...6000 decimal, in units of 10 ms (300 ms...60 s)
4F80A	I/O module health	8000 hex = healthy0000 hex = not healthy
4F80B	I/O module last error value	Module dependent
4F80B	I/O module error counter	Error count 0000...FFFF hex

ASCII Header Block Function

These registers contain an ASCII text description of the module.

ASCII Header Block Parameters

The block length depends upon the type of I/O base to which the adapter is connected. The maximum length is 64 bytes of ASCII characters, corresponding to a length of 8...32 words as specified in word 6 of the module status block (at reference 4F806).

The registers can be read, but cannot be written into.

The following table shows the header block layout as a string of ASCII characters as they are positioned from the starting reference 4FC01.

4FC01+Byte Offset	ASCIICharacters	Meaning
0...10	MODBUS PLUS	Modbus Plus network device
11	20 hex (32 decimal)	space
12	20 hex (32 decimal)	space
13 14 15	IEC	IEC data mode (Data bit order per IEC standard)
16	20 hex (32 decimal)	space
17 18 19	DIGEXPANA	Digital module (ID range: XX00...XX7F hex)Expert module (ID range: XX80...XXBF hex)Analog module (ID range: XXC0...XXFE hex)
20 21	HHLL	Module ID code(HH = high byte, LL = low byte)
22 23	I I OO	Module I/O words(I I = input words, OO = output words)
24...63	--	Reserved

Examples of an ASCII Header Block

The figure below shows two examples of an ASCII Header Block.