6 Reference

6.1 Product Specifications

The MVI56E Enhanced Modbus Master/Slave Communication Modules allow Rockwell Automation® ControlLogix® processors to easily interface with devices using the Modbus RTU/ASCII serial communications protocol.

The MVI56E-MCM and MVI56E-MCMXT act as input/output modules on the ControlLogix backplane, making Modbus data appear as I/O data to the processor. Data transfer to and from the processor is asynchronous from the communications on the Modbus network. Two independently configurable serial ports can operate on the same or different Modbus networks. Each port can be configured as a Modbus Master or Slave, sharing the same user-controlled, 10,000-word database.

The two modules are functionally the same. The MVI56E-MCM is designed for standard process applications. The MVI56E-MCMXT is designed for the Logix-XT™ control platform, allowing it to operate in extreme environments. It can tolerate higher operating temperatures, and it also has a conformal coating to protect it from harsh or caustic conditions.

6.1.1 General Specifications

- Backward-compatible with previous MVI56-MCM version
- Single Slot - 1756 ControlLogix® backplane compatible
- 10/100 MB Ethernet port for network configuration and diagnostics with Auto Cable Crossover Detection
- User-definable module data memory mapping of up to 10,000 16-bit registers
- CIPconnect®-enabled network diagnostics and monitoring using ControlLogix 1756-ENxT modules and EtherNet/IP® pass-thru communications
- Sample Ladder Logic or Add-On Instruction (AOI) used for data transfers between module and processor and for module configuration
- 4-character, scrolling, alphanumeric LED display of status and diagnostic data in plain English
- ProSoft Discovery Service (PDS) software finds the module on the network and assigns a temporary IP address to facilitate module access

6.1.2 General Specifications - Modbus Master/Slave

Specification	Description
Communication Parameters	Baud rate: 110 to 115K baud Stop bits: 1 or 2 Data size: 7 or 8 bits Parity: None, Even, Odd RTS timing delays: 0 to 65535 milliseconds
Modbus Modes	RTU mode (binary) with CRC-16 ASCII mode with LRC error checking
Floating-Point Data	Floating-point data movement supported, including configurable support for Enron, Daniel®, and other implementations
Modbus Function Codes Supported	1: Read Coil Status 2: Read Input Status 3: Read Holding Registers 4: Read Input Registers 5: Force (Write) Single Coil 6: Preset (Write) Single Holding Register 8: Diagnostics (Slave Only, Responds to Subfunction 00) 15: Force(Write) Multiple Coils 16: Preset (Write) Multiple Holding Registers 17: Report Slave ID (Slave Only) 22: Mask Write Holding Register (Slave Only) 23: Read/Write Holding Registers (Slave Only)

6.1.3 Functional Specifications

The MVI56E-MCM will operate on a Local or Remote rack (For remote rack applications with smaller data packet size please refer to the MVI56E-MCMR product)

- CIPconnect® enabled for module and network configuration using 1756-ENxT module with EtherNet/IP pass-through communications
- Supports Enron version of Modbus protocol for floating-point data transactions
- 4-digit LED Display for English based status and diagnostics information
- PCB includes powerful Modbus network analyzer
- Error codes and port status data available in user data memory

Slave Specifications

The MVI56E-MCM module accepts Modbus function code commands of 1, 2, 3, 4, 5, 6, 8, 15, 16, 17, 22, and 23 from an attached Modbus Master unit. A port configured as a Modbus Slave permits a remote Master to interact with all data contained in the module. This data can be derived from other Modbus Slave devices on the network, through a Master port, or from the ControlLogix processor.

Master Specifications

A port configured as a virtual Modbus Master device on the MVI56E-MCM module actively issues Modbus commands to other nodes on the Modbus network. 325 commands are supported on each port. Additionally, the Master ports have an optimized polling characteristic that polls slaves with communication problems less frequently. The ControlLogix processor ladder logic can issue commands directly from ladder logic or actively select commands from the command list to execute under ladder logic control.

Note: To use up to 325 commands, your MVI56E-MCM module needs to have firmware version 3.01 or higher, and your MVI56E-MCM Add-On Instruction needs to be version 2.8 or higher. Earlier versions support up to 100 commands.

6.1.4 Hardware Specifications

General	
Specification	**Description**
Backplane Current Load	800 mA @ 5 VDC 3 mA @ 24 VDC
Operating Temperature	0°C to 60°C (32°F to 140°F)
Storage Temperature	-40°C to 85°C (-40°F to 185°F)
Extreme/Harsh Environment	MVI56E-MCMXT comes with conformal coating
Shock	30 g operational 50 g non-operational Vibration: 5 g from 10 to 150 Hz
Relative Humidity	5% to 95% (without condensation)
LED Indicators	Application Status (APP) Module Status (OK)
4-Character, Scrolling, Alpha-Numeric LED Display	Shows Module, Version, IP, Port Client/Server Setting, Port Status, and Error Information
Communication Ethernet port	
Ethernet Port	10/100 Base-T, RJ45 Connector, for CAT5 cable Link and Activity LED indicators Auto-crossover cable detection

6.2 Functional Overview

6.2.1 About the Modbus Protocol

Modbus is a widely-used protocol originally developed by Modicon in 1978. Since that time, the protocol has been adopted as a standard throughout the automation industry.

The original Modbus specification uses a serial connection to communicate commands and data between Master and Slave devices on a network. Later enhancements to the protocol allow communication over other types of networks.

Modbus is a Master/Slave protocol. The Master establishes a connection to the remote Slave. When the connection is established, the Master sends the Modbus commands to the Slave. The MVI56E-MCM module can work as a Master and as a Slave.

The MVI56E-MCM module also works as an input/output module between itself and the Rockwell Automation backplane and ControlLogix processor. The module uses an internal database to pass data and commands between the processor and Master and Slave devices on Modbus networks.

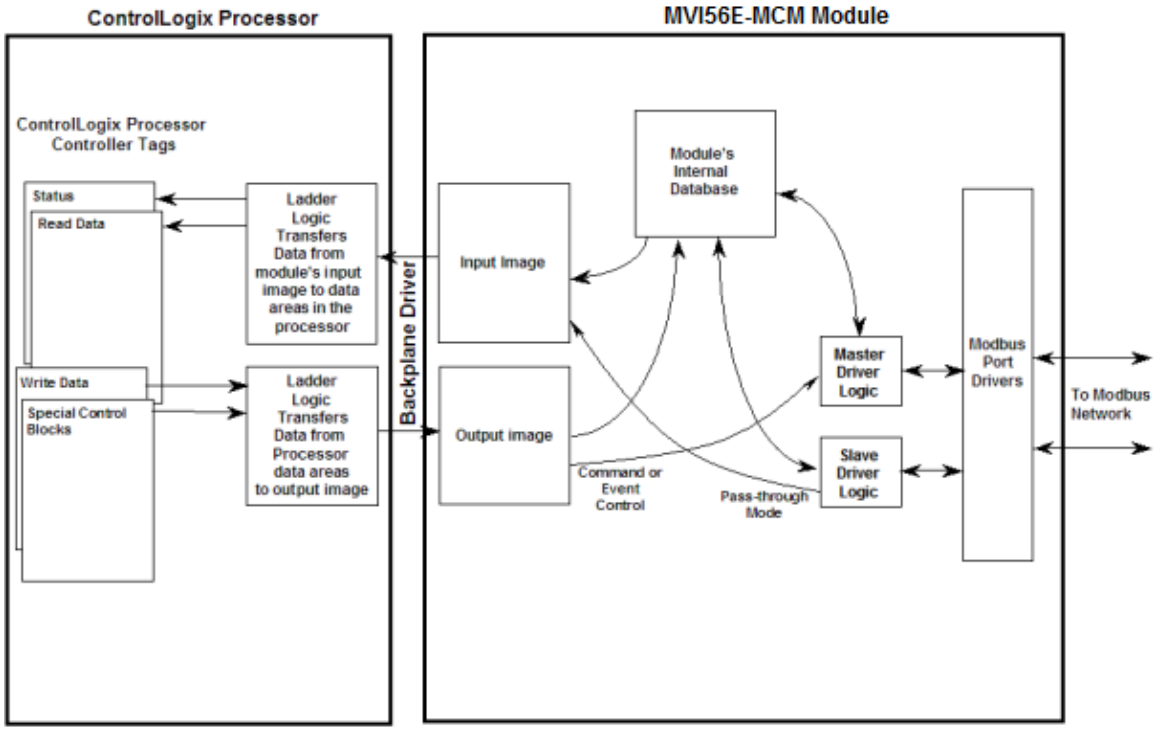
6.2.2 Backplane Data Transfer

The MVI56E-MCM module communicates directly over the ControlLogix backplane. Data is paged between the module and the ControlLogix processor across the backplane using the module's input and output images. The update frequency of the images is determined by the scheduled scan rate defined by the user for the module and the communication load on the module. Typical updates are in the range of 2 to 10 milliseconds.

This bi-directional transference of data is accomplished by the module filling in data in the module's input image to send to the processor. Data in the input image is placed in the Controller Tags in the processor by the ladder logic. The input image for the module is set to 250 words. This large data area permits fast throughput of data between the module and the processor.

The processor inserts data to the module's output image to transfer to the module. The module's program extracts the data and places it in the module's internal database. The output image for the module is set to 248 words. This large data area permits fast throughput of data from the processor to the module.

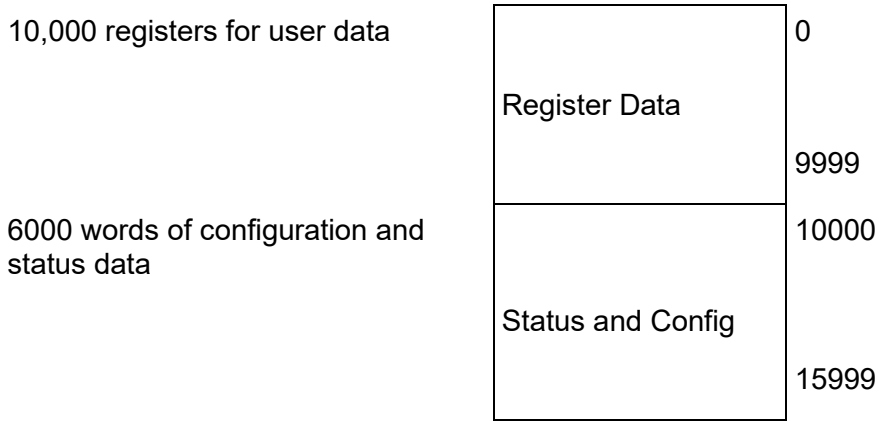
The following illustration shows the data transfer method used to move data between the ControlLogix processor, the MVI56E-MCM module and the Modbus Network.



As shown in the illustration above, all data transferred between the module and the processor over the backplane is through the input and output images. Ladder logic must be written in the ControlLogix processor to interface the input and output image data with data defined in the Controller Tags. All data used by the module is stored in its internal database. This database is defined as a virtual Modbus data table with addresses from 0 to 15999.

The database is translated into a Modbus data table, according to which a Modbus command is received or sent. Refer to Modbus Memory Map (page 63) for more information.

The following illustration shows the layout of the module's internal database structure:



Data contained in this database is paged through the input and output images by coordination of the ControlLogix ladder logic and the MVI56E-MCM module's program. Up to 248 words of data can be transferred from the module to the processor at a time. Up to 247 words of data can be transferred from the processor to the module. Each image has a defined structure depending on the data content and the function of the data transfer as defined below.

6.2.3 Normal Data Transfer

Normal data transfer includes the paging of the user data found in the module's internal database in registers 0 to 9999 and the status data. These data are transferred through read (input image) and write (output image) blocks. Refer to Using the Sample Program in an Existing Application (page 198) for a description of the data objects used with the blocks and the ladder logic required. The structure and function of each block is discussed below.

Read Block

These blocks of data transfer information from the module to the ControlLogix processor. The following table describes the structure of the input image.

Read Block from Module to Processor

Word Offset	Description	Length
0	Reserved	1
1	Write Block ID: -1 to 50	1
2 to 201	Read Data	200
202	Program Scan Counter	1
203 to 204	Product Code	2
205 to 206	Product Version	2
207 to 208	Operating System	2
209 to 210	Run Number	2
211 to 217	Port 1 Error Status	7
218 to 224	Port 2 Error Status	7
225 to 230	Data Transfer Status	6
231	Port 1 Current Error/Index	1
232	Port 1 Last Error/Index	1
233	Port 2 Current Error/Index	1
234	Port 2 Last Error/Index	1
235 to 248	Spare	14
249	Read Block ID	1

The Read Block ID is an index value used to determine the location of where the data will be placed in the ControlLogix processor controller tag array of module read data. Each transfer can move up to 200 words (block offsets 2 to 201) of data. In addition to moving user data, the block also contains status data for the module. This last set of data is transferred with each new block of data and is used for high-speed data movement.

The Write Block ID associated with the block requests data from the ControlLogix processor. Under normal program operation, the module sequentially sends read blocks and requests write blocks. For example, if the application uses three read and two write blocks, the sequence will be as follows:

R1W1→R2W2→R3W1→R1W2→R2W1→R3W2→R1W1→

This sequence will continue until interrupted by other write block numbers sent by the controller or by a command request from a node on the Modbus network or operator control through the module's Configuration/Debug port.

Write Block

These blocks of data transfer information from the ControlLogix processor to the module. The following table describes the structure of the output image.

Write Block from Processor to Module

Word Offset	Description	Length
0	Write Block ID: -1 to 50	1
1 to 200	Write Data	200
201 to 247	Spare	47

The Write Block ID is an index value used to determine the location in the module's database where the data will be placed. Each transfer can move up to 200 words (block offsets 1 to 200) of data.