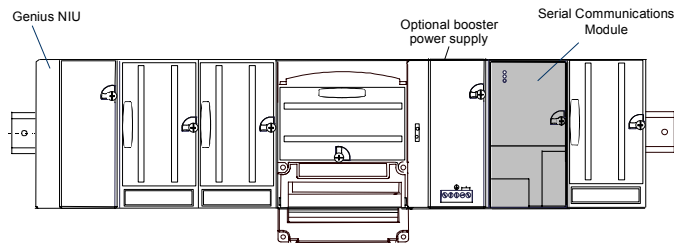## Product Description

The VersaMax Serial Communications Module, IC200CMM020, operates as a Modbus RTU Master in a VersaMax I/O Station controlled by a Genius Network Interface Unit.

Serial Communications Modules may be installed at any location in the I/O Station. Up to two Serial Communications modules can be used per I/O Station.

The module will support communication baud rates of 1200, 2400, 4800, 9600, and 19200, and half or full duplex operation.

Serial Communications Port

The RS-485 serial port is a 15-pin subminiature 'D' connector. For RS-232 communications, an RS-485 to RS-232 adapter such as IC690ACC901 can be used. Adapter IC690ACC901 can be installed with its right-angle cable hanging down.

Serial Port Pin Assignments

Pin	Signal	Direction	Function
1	Shield	--	Shield drain wire connection
2	NC		
3	NC		
4	ATTACH	Input	
5	P5V	Output	5V to power external adapters
6	RTS(A)	Output	Request-to-Send (A) output
7	0V	--	Ground reference
8	CTS(B)	Input	Clear-to-Send (B) input
9	RT	--	Termination for RDA
10	RD(A)	Input	Receive Data (A) input
11	RD(B)	Input	Receive Data (B) input
12	SD(A)	Output	Transmit Data (A) output
13	SD(B)	Output	Transmit Data (B) output
14	RTS(B)	Output	Request to Send (B) output
15	CTS(A)	Input	Clear to Send (A) input
Shell	Shield	--	Shield for 100% (continuous) coverage

This port supports both 2-wire and 4-wire electrical interfaces:

- Two-Wire Interface (single shielded twisted pair, half-duplex mode only) – Connect D1 to RD(A) at pin-10, D0 to RD(B) at pin-11, and the shield to frame ground at pin-1.

- Four-Wire Master Interface (two shielded twisted pairs, full-duplex mode) – Slaves receive data from the RTU master over the MODBUS master pair RXD1 & RXD0. At the same time, the RTU receives data from the slaves over the MODBUS slave-pair TXD1 & TXD0. Connect RXD1 to SD(A) at pin-12, RXD0 to SD(B) at pin 13, TXD1 to RD(A) at pin 10, TXD0 to RD(B) at pin 11, and both shields to the frame ground at pin 1.

5V Power

The module supplies 5V power to external devices via the serial port. The amount of power available to external devices is approximately 100mA, and varies depending on how the serial device(s) are wired. The module itself requires 10mA, and a half-duplex line terminated with 120 Ohms at each end requires an additional 83mA. The actual current draw depends on serial line terminations, duplex mode, serial line activity, and use of external adapters that may require additional 5V power. (This module does not use 3.3V.)

If the total load exceeds 200mA, an internal current-limit switch prevents damage and shuts down serial communication and external power flow. The module's OK LED will be amber. The user must alleviate the overdraw condition. Communication and power flow will resume when the condition is resolved.

Specifications

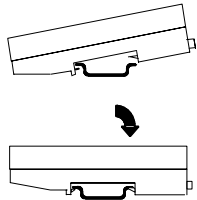| Number of Serial Communications Modules	Up to 2 per Genius NIU I/O Station
Number of RTU slaves per Serial Communications Module	1 to 247
COMMREQ command memory (%AQ) required in the GENERIC_COMM module hardware configuration	Depends on individual COMMREQ content. Minimum: 22 words Maximum: 64 words
COMMREQ response memory (%AI) required	Minimum: 2 words Maximum: 64 words for Genius NIU
RTU Master Commands	As described in *Modbus RTU Communications Manual*, GFK-2220. Minor differences as described below. 65520, Initialize RTU Master Port 8000, Clear RTU Master Diag. Status 8001, Read RTU Master Diag. Status 8002, Send RTU Read/Force/Preset Query 8003, Send RTU Diagnostic Query

[*] The minimum of 22 words is the required amount of memory that needs to be configured in the GENERIC_COMM module configuration to execute the Initialize RTU Master Port Command (65520). The minimum for all other commands is dependent on the size of the command and the amount data requested (if any).

Preinstallation Check

Carefully inspect all shipping containers for damage. If any equipment is damaged, notify the delivery service immediately. Save the damaged shipping container for inspection by the delivery service. After unpacking the equipment, record all serial numbers. Save the shipping containers and packing material in case it is necessary to transport or ship any part of the system.
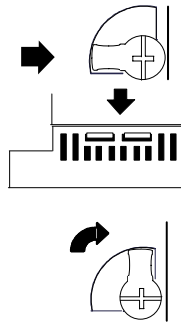
Quick Start Guide

1. **Install the Communications Carrier on the DIN Rail** by simply clicking it into place.

   Note: Connecting carriers must be installed on the same section of 35mm x 7.5mm DIN rail.

   The DIN rail must have a conductive (unpainted) finish for proper grounding.

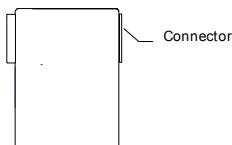2. **Install the Module on the Communications Carrier**.

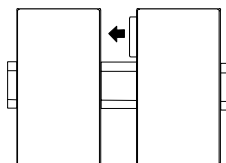   The latch on the module must be in the unlocked position.

   Align the connectors and the latch post and press the module down until the two tabs on the bottom of the module click into place.

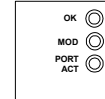   Turn the latch to the locked position to secure the module to the top of the carrier.

3. **Connect the communications bus to the** connector on the front of the module.

4. **Remove the connector cover on the right-hand side of the Communications Carrier**. Do not discard this cover; you will need to install it on the last carrier. It protects the connector pins from damage and ESD during handling and use.

   Connector

5. **Install additional modules** by mounting modules on their carriers and sliding them along the DIN rail to fully engage the connectors in the sides of the carriers.

6. **Power up the System, and Observe the Module LEDs**. The LEDs indicate the presence of power and show the operating mode and status of the module.

   OK ◎
   MOD ◎
   PORT ACT ◎

OK	OFF when the module has not yet started its powerup sequence.
	Green indicates the module has successfully completed powerup diagnostics.
	Amber means the module has detected overpower condition. No powerflow or communication activity will take place.
	Blinking amber means the module has failed powerup diagnostics. The number of blinks indicates the fault type.
	Blinking green indicates the module is in boot mode or its firmware is being updated.
MOD	OFF when the module is not powered.
	Green when the module is operating normally.
	Blinking amber indicates the module configuration is missing, incomplete, or incorrect.
PORT ACT	OFF when the module is not powered or no communication activity is occurring. For example, communication activity will not occur during an overpower condition.
	Blinking green indicates the module is online and communicating.

Installation in Hazardous Locations

- WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2;

- WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES; AND

- WARNING - EXPLOSION HAZARD - DO NOT CONNECT OR DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.

- Equipment labeled with reference to Class I, Div. 2, Groups A, B, C and D, Hazardous Locations is suitable for use in Class I, Div. 2, Groups A, B, C, D or non-hazardous locations only.

- Equipment labeled with reference to Class I, Zone 2, Groups A, B, C and D, hazardous locations is suitable for use in Class I, Zone 2, Groups A, B, C, D or non-hazardous locations only.

Configuration

The VersaMax Serial Communications module is configured using the GENERIC_COMM configuration feature of the programmer.

Initially, the module's default Reference Addresses for %AI and %AQ data have a length of zero. These data lengths must be changed, as shown in the example Proficy Machine Edition v5.50 screen illustrated below, before the module can communicate with the Ethernet NIU. The %I and %Q lengths must stay zero. The module cannot communicate on the serial network until it receives a valid configuration.

Enter the value 10 for the module ID when configuring the module as a "GENERIC_COMM" module in the Genius NIU system. The "GENERIC_COMM" module configuration will display the value "FFFF980A" for the Module ID parameter

Operational Notes and Open Issues

- Application programs should use the "Command Ready" indication to synchronize the first command to the module upon Genius NIU system power up.

- Do not set the serial port baud rate higher than 19200 baud.

- The Data Length parameter is ignored for function codes 5 and 6. The Data Start and Data Length parameters are ignored for function codes 7 and 17. For function code 67, the Data Start parameter must be set to 1 and the Data Length parameter must be set to 62.

- Firmware update occurs at 19200 baud. If the module is configured for operation at a different baud rate and you wish to perform a firmware update, first change the Genius NIU's serial port configuration and select 19200 baud. Then, when running the Winloader update utility, select 19200 baud. Then return the GNIU's baud rate setting to its original value.

- If the Genius bus scan rate is slower than the PLC CPU's sweep time, a command may be written into %AQ memory at the PLC CPU, but overwritten with a newer command before the original command is transferred to the GNIU for processing. It will appear that the original command has been "dropped".

- When executing a Communications Restart Query, a timeout status will be returned if the Query is sent to a single RTU Slave address and the Slave is currently in Force Listen Only Mode. No timeout will occur if the RTU Broadcast Address is used.

- When incrementing the sequence number to send a new command, a rollover of the 16-bit integer value from 65535 to 0 will not result in a new command being sent since zero is not recognized as a valid sequence number.

Modbus RTU Communications

The VersaMax Serial Communications module supports Modbus RTU Master protocol. To operate as a Master, the Serial Communications module must receive commands from a remote host. For example, the remote host could be an RX7i PLC that communicates with the I/O Station's VersaMax Genius NIU via a Genius Bus Controller module.

Receiving Commands from a Remote Host

The Serial Communications module exchanges commands with the remote host via the input and output memory areas of the I/O Station's Genius NIU. The commands used for these communications are referred to as "memory mapped COMMREQs" because their format is similar to the existing GE Fanuc Modbus RTU COMMREQ (Communication Request) commands. These commands are defined in the document *Modbus RTU Communications,* GFK-2220C or later, which is available at GEFanuc.com, and on the *Infolink for PLC* CD set.

Commands from the remote host to the module are sent via %AQ memory. The module returns the command response in the first two %AI registers that have been configured for the module. The content of the command status response is shown below.

%AI Word Location	Description
Word 1	Command Status Word
Word 2	Sequence Number of Command
Word 3-n	Data (if any)

Because the status information is mapped into memory, the COMMREQ status address segment selector (Word 3) and offset (Word 4) in the COMMREQ command block are ignored.

The module forms the requested RTU Master command and exchanges data with an RTU Slave device. The data is returned to the remote host starting at the third %AI register configured for the module (see table above).

The status values used for the Command Status Word are identical to the values listed in the *Modbus RTU Communications Manual,* with one additional status value added to indicate that the module is ready to receive commands.

Major Error Code	Minor Error Code	Numeric Status Value	Description
COMMAND_READY	None	0002h	The RTU Master is ready to accept I/O commands.

Flow Control and Command Sequencing

The remote host's application program initiates a COMMREQ by executing a COMMREQ function block to the communication module in the remote host such as a RX7i PLC.   The communication module then sends the COMMREQ block as data to the Genius NIU. At the remote host, the COMMREQ function block causes the COMMREQ command/data block to be sent to the module once each time the COMMREQ is executed.

When the Genius NIU receives the incoming command/data block, it sends the block to the Serial Communications Module during the next output scan.   The memory-mapped command uses a sequence number in the second word of the COMMREQ structure (the NOWAIT mode parameter) to indicate that a new command has been sent. After power-up, the module indicates when it is ready to receive commands by returning a Command Status Word value of "COMMAND_READY".   Until the module is ready to receive commands, changing the sequence number has no effect. Once the module has issued a status value of "COMMAND_READY", any change to the value of the sequence number prompts the module to process the current command in the module's %AQ memory. The application program can send the command multiple times by simply changing the sequence number.

The sequence number value of zero has a special meaning – it is interpreted as a request to clear the module's input values. Upon receipt of a 0 sequence number, the CMM020 will check if the entire %AQ memory area is set to zero. If so, the module's %AI memory area will be cleared and the "COMMAND_READY" value will be returned in the status. *Note*: Any time the Genius NIU is not receiving data from the Genius Bus Controller, it sends default data (all zeroes) to the CMM020. Therefore, the default data is interpreted as a "clear" request.

Note that if there is non-zero data in the PLC CPU's %AQ memory when the Genius NIU powers up, that data will be transferred to the CMM020 after the Genius NIU joins the Genius Bus. Since the initial default data sent to the CMM020 is all zeroes, the non-zero data is interpreted as a command. This may result in behavior that the application creator did not intend.

The Serial Communications module will only process one command at a time. Therefore, the remote host's application program must monitor the sequence number location in %AI memory for the return of the sequence number sent with the command. After the module returns the sequence number, the program logic should check the status value returned in %AI memory before sending a new command. The module ignores any new commands that have been sent by incrementing the sequence number before the command is completed. Likewise, no new command is sent to the module until the sequence number is changed. When the current command is complete, the module will again process incoming commands when the sequence number is changed.

Example

In this example, an application program in a host PLC initializes the Master Serial Port Command Program Block, then sets up the Send RTU Preset Query Command (08002).
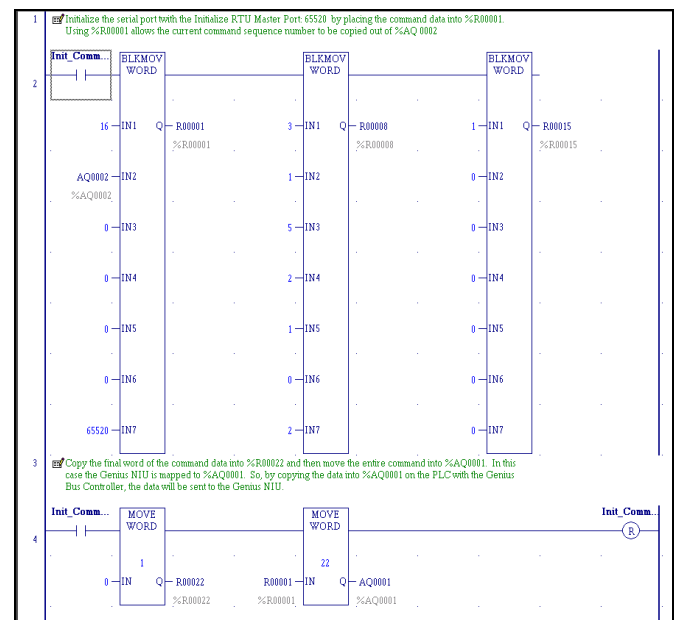
In the host PLC, the Genius Bus Controller is configured at %AQ0001. In the I/O Station, the VersaMax Serial Communications module is configured in the Genius NIU to have 48 %AQ references starting at %AQ0001 and 32 %AI references starting at %AI0001. In this example, the AQ memory reference offsets in the PLC are the same as those used in the Genius NIU. However, that is not necessary.

Note that no commands are sent until reference %AI0001 in the I/O Station's Genius NIU indicates the Command Ready Status value of 2.
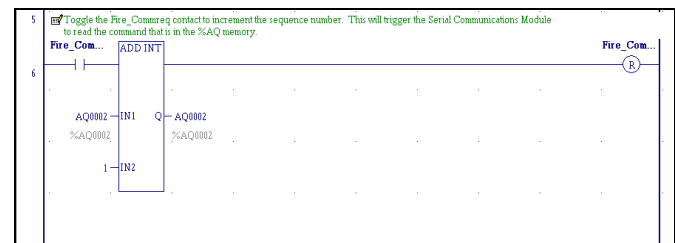
Part 1: Initialize the Master Serial Port Command Program Block

First, the serial port is configured with the Initialize Master Serial Port Command (65520)

- COMMREQ status value: Zero
- Sequence Number: set to current sequence value (%AQ0002)
- Protocol: Modbus RTU
- Mode: Master
- Data rate: 9,600 bits/Sec.
- Parity: Even
- Flow control: None
- Turnaround delay: Zero
- Response message time-out: STANDARD (0.5 Sec.)
- Bits per Character: 8 (Not configurable)
- Stop Bits: 1 (Not configurable)
- Port Interface: (Not configurable)
- Half-Duplex Mode: 2-Wire
- Character-gap time-out: Default
- RTS Drop Delay: Zero

To trigger the command, the sequence number, %AQ0002 must be incremented.

When the sequence number in %AI0002 matches the value sent in %AQ0002, it checks the command status value. If the command status value in %AI0001 is 1, the command has been successfully executed. The Serial Comm Module is configured as an RTU Master and ready to accept Modbus RTU commands.

4

Part 2: Set Up the Send RTU Preset Query Command (08002)

- COMMREQ status value: Zero
- Sequence Number: set to current sequence value (%AQ0002)
- Address: RTU Slave Address 3
- RTU Function Code: 16
- RTU Data Address: 101
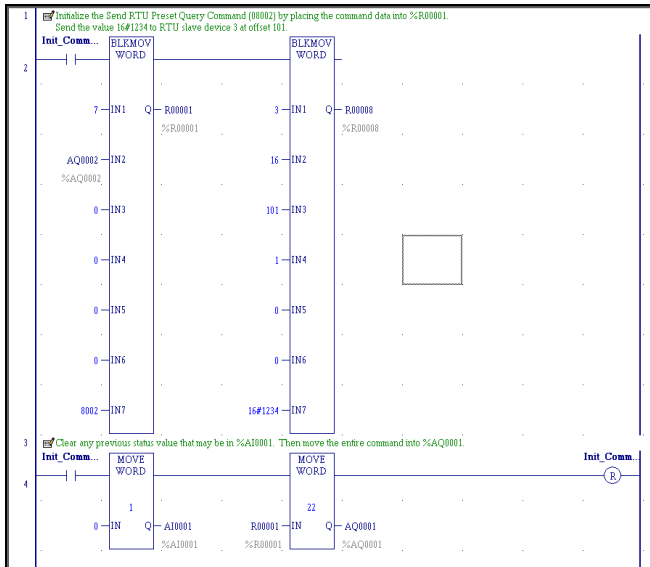- Number of Data Points: 1
- Data: 0x1234

As before, to trigger the command, the sequence number, %AQ0002 must be incremented.
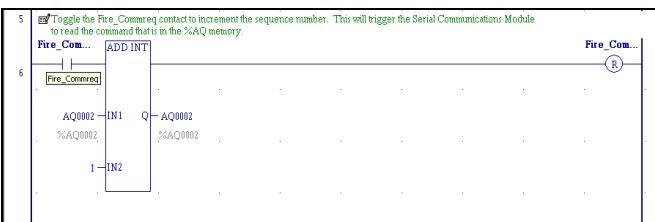

When the sequence number in %AI0002 matches the value sent in %AQ0002, it checks the command status value. If the command status value in %AI0001 is 1, the command has been successfully executed. The Serial Communications Module has successfully transmitted the Modbus RTU command to RTU Slave Device 3.

RTU Master Commands Supported

The Serial Communications module supports RTU Master command numbers 65520, 8000, 8001, 8002, and 8003 as described in the *Modbus RTU Communications Manual,* GFK-2220, with a few differences as described below.

Command 65520 – Initialize RTU Master Port

If it is necessary to change the serial port settings from the default values, the Initialize RTU Master Port command can be sent to the Serial Communications module by placing the values shown below into the module's configured %AQ memory references. The module returns the status of the request in the first word of its configured %AI

memory references and the command's sequence number in the second word.

Initialize RTU Master Port: 65520 (FFF0)		
%AQ Word Location	*Value*	*Description*
Word 1	16 for Modbus RTU Master	Port Setup Command/Data Block Length in words (includes Words 7 – 22, inclusive)
Word 2	0-65535	Command Sequence number that will be incremented any time a new command is being sent.
Word 3	0 (Ignored)	Status Word Memory Type (for memory mapped command, status will be returned in the first word %AI memory.)
Word 4	0 (Ignored)	Status Word Address – 1. (for memory mapped command; status will be returned in the first word %AI memory.)
Word 5	0 (Ignored)	N/A
Word 6	0 (Ignored)	WAIT Mode time-out values are unused (N/A for memory mapped command)
Word 7	65520	Command – Port Setup
Word 8	3	Protocol – Modbus RTU
Word 9	1	Mode – Master (New for Modbus RTU)
Word 10	2 = 1200, 3 = 2400, 4 = 4800, 5 = 9600†, 6=19200	Data Rate – Do not specify any values other than 2,3,4,5,6.
Word 11	0 = None, 1 = Odd, 2 = Even†	Parity
Word 12	0 = Hardware, 1 = None†	Flow Control
Word 13	0 (Ignored)	SNP Turnaround Delay
Word 14	0 = Long† (8 Seconds), 1 = Medium (2 Seconds), 2 = Standard (500ms), 3= Short (250ms), 4= Very Short (150ms)	Response message time-out– the specified value must be greater than the sum of the longest receive-to-transmit delay for all slaves plus the longest response message transmission time at the current data rate.
Word 15	1 (Ignored)	Bits per Character – Modbus RTU requires 8 bits.
Word 16	0 (Ignored)	Stop Bits – Modbus RTU forces 1 stop bit.
Word 17	0 (Ignored)	Port Interface – not software configurable only one port is available.
Word 18	0 – 1 0 = Default	Half-Duplex Mode – Setting the parameter to 0 configures the port to operate in 2-wire mode. Setting the parameter to 1 configures the port for 4-wire mode.
Word 19	0 – 65,535 (0 to 6.5535 seconds) 0 = Default	Character-gap time-out in 100-microsecond units.
Word 20	(0 to 6.5535 seconds) 0 = Default	RTS Drop Delay in 100 microsecond units.
Words 21 – 22	0 (Ignored)	The required minimum Port Setup command/data length includes these words. However, the Modbus RTU Master ignores their values.

† Denotes serial port default settings

* **Modem Support:** The CMM020 allows the RTS serial port signal to be used as a modem keying signal. When 0 = HARDWARE is specified, the port asserts RTS and waits for CTS to become active before transmitting. If CTS does not become active within 2 seconds, a time-out error code is returned to the status location specified in the Send RTU Query COMMREQ. If CTS becomes active and then is de-asserted while the port is transmitting, up to 5 milliseconds may elapse before transmission stops. The maximum number of characters transmitted after CTS is de-asserted is proportional to the data rate. These values are in addition to the character that is being transmitted at the time CTS is de-asserted.

RTU Master Command 8000 – Clear RTU Master Diagnostic Status Words

As described in the *Modbus RTU Communications Manual,* with the exception that the Status Word Memory Type and location are ignored. The status is returned to the first word of %AI memory.

RTU Master Command 8001 - Read RTU Master Diagnostic Status Words

As described in the *Modbus RTU Communications Manual*, with the exception that the Status Word Memory Type and location are ignored. The status is returned to the first word of %AI memory.

RTU Master Command 8002 -Send RTU Read/Force/Preset Query

The Send RTU Read/Force/Preset Query command is sent to the Serial Communications module by placing the values shown below into the module's configured %AQ memory references. The module returns the status of the request in the first word of its configured %AI memory references and the command's sequence number in the second word.

Send RTU Preset Query: 08002 (1F42)		
%AQ Word Location	*Value*	*Description*
Word 1	7	Command/Data Block Length
Word 2	0-65535	Command Sequence number that will be incremented any time a new command is being sent.
Word 3	0 (Ignored)	Status Word Memory Type (N/A for memory mapped command, status will be returned in the first word %AI memory.)
Word 4	0 (Ignored)	Status Word Address – 1. (N/A for memory mapped command, status will be returned in the first word %AI memory.)
Word 5	0 (Ignored)	WAIT Mode time-out values are unused (N/A for memory mapped command)
Word 6	0 (Ignored)	WAIT Mode time-out values are unused (N/A for memory mapped command)
Word 7	8002	Command - Send RTU Master Read/Force/Preset Query
Word 8	0 – 247	Target RTU Device Address
Word 9	16	RTU Function Code
Word 10	0-65535 (Application dependent)	RTU Data Address/Start Address
Word 11	1 - 51	RTU Number of Points or 16-bit Registers
Word 12	0 (Ignored)	Data Memory Type of source (N/A for memory mapped command.)
Word 13	0 (Ignored)	Data Address of source (N/A for memory mapped command.)
Words 14 – (14 + Word 11 – 1)		Data to be sent in the Preset Command.

RTU Master Command 8003 – Send RTU Diagnostic Query

As described in the *Modbus RTU Communications Manual,* with the exception that the Status Word Memory Type and location are ignored. The status is returned to the first word of %AI memory.

RTU Function Codes Supported

The Serial Communications module supports the following RTU Function Codes.

Function Code Value		Function Name	RTU Master Command	Slave Reference Type	Valid as Broadcast Query?
Dec.	*Hex.*				
1	01	Read Output Table	Send RTU Read/Force/Preset Query	%Q	No
2	02	Read Input Table	Send RTU Read/Force/Preset Query	%I	No
3	03	Read Registers	Send RTU Read/Force/Preset Query	%R	No
4	04	Read Analog Inputs	Send RTU Read/Force/Preset Query	%AI	No
5	05	Force Single Output	Send RTU Read/Force/Preset Query	%Q	Yes
6	06	Preset Single Register	Send RTU Read/Force/Preset Query	%R	Yes
7	07	Read Exception Status	Send RTU Read/Force/Preset Query	%Q	No
8	08	Loopback/ Maintenance	Send RTU Diagnostic Query	N/A	No
15	0F	Force Multiple Outputs	Send RTU Read/Force/Preset Query	%Q	Yes
16	10	Preset Multiple Registers	Send RTU Read/Force/Preset Query	%R	Yes
17	11	Report Device Type	Send RTU Read/Force/Preset Query	N\A	No
67	43	Read Scratch Pad Memory	Send RTU Read/Force/Preset Query	N\A	No