MODBUS Protocol
User Manual
For use with ProComm Converter

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SAFETY

Safety Symbols
Throughout this manual are safety warning and caution information boxes. Each warning and caution box will be identified by a large symbol indicating the type of information contained in the box. The symbols are explained below:

Safety Warnings

This symbol indicates important safety information. Failure to follow the instructions can result in serious injury or death.

This symbol indicates important information. Failure to follow the instructions can result in permanent damage to the meter or installation site.

When installing, operating, and maintaining McCrometer equipment where hazards may be present, you must protect yourself by wearing Personal Protective Equipment (PPE) and be trained to enter confined spaces. Examples of confined spaces are manholes, pumping stations, pipelines, pits, septic tanks, sewage digesters, vaults, degreasers, storage tanks, boilers, and furnaces.

**WARNING!**
Incorrect installation or removal of FPI Mag meters can result in serious injury or death. Read the instructions in this manual on the proper procedures carefully.

**WARNING!**
Never enter a confined space without testing the air at the top, middle, and bottom of the space. The air may be toxic, oxygen deficient, or explosive. Do not trust your senses to determine if the air is safe. You cannot see or smell many toxic gases.

**WARNING!**
Never enter a confined space without the proper safety equipment. You may need a respirator, gas detector, tripod, lifeline, and other safety equipment.

**WARNING!**
Never enter a confined space without standby/rescue personnel within earshot. Standby/rescue personnel must know what action to take in case of an emergency.

**WARNING!**
Pressurized pipes should only be hot tapped, cut, or drilled by qualified personnel. If possible, depressurize and drain the pipe before attempting any installation.

**WARNING!**
Carefully read all safety warning tags attached to the meter.

At the end of its lifetime, this product shall be disposed of in full compliance with the environmental regulations of the state in which it is located.
1.0 Introduction

MODBUS is an application layer communication protocol for client/server communications between devices connected on different types of buses or networks.

A typical MODBUS network consists of one MASTER and up to 247 SLAVES, each with a unique SLAVE Address from 1 to 247. The Modbus protocol establishes the format of the manner in which the MASTER communicates with the SLAVE, referred to as the MASTER query. The SLAVE responds using the Modbus protocol. For the MODBUS protocol, the converter attached to the McCrometer flow meter has the function of the SLAVE device, and communicates with the MASTER via its RS485 serial port.

Important Note 1: MODBUS communication is only possible on converters factory configured with MODBUS, unless the converter was ordered with MODBUS installed the converter cannot communicate to the MODBUS network.

Important Note 2: McCrometer provides technical support for its MODBUS converter wired directly to the MODBUS network via an RS485 serial port. For any technical assistance for your MODBUS beyond the McCrometer MODBUS converter or for alternative connection methods such as USD or wireless consult the supplier of that equipment or these additional resources.

- Modbus.org
- Simplymodbus.ca
- Modbustools.com
- Wikipedia/modbus

2.0 Protocol Conventions

The MODBUS protocol defines a simple Protocol Data Unit (PDU), which is independent of the underlying communication layers.

The mapping of a MODBUS protocol on specific buses or networks introduces some additional fields in the Application Data Unit (ADU). (See Figure 1 below.)

```
ADU

1 byte  1 byte  n byte  2 byte
Additional Address Function Code Data Error Check

PDU

Figure 1. Data unit layers
```

2.1 A Modbus Query As Part Of The Application Data Unit

- SLAVE ID

The address of the SLAVE device to communicate with (0 broadcasts to all devices, 1-247 for individual devices). When the MASTER requests data, the first byte it sends is the SLAVE address. Each SLAVE in a network is assigned a unique unit address from 1 to 247 (excluding 232, which is reserved). This way each SLAVE knows after the first byte whether or not to ignore the message. In the graphic above the SLAVE ID is contained in the additional address.

NOTE: the converter cannot have the SLAVE ID of 0.
• **FUNCTION CODE**

The instruction to the SLAVE for the type of action to perform, e.g., write coils, read states, read registers, etc. The second byte sent by the MASTER is the Function code. It tells the SLAVE which table to access and whether to read from or write to it. The following table lists the function codes available in McCrometer MODBUS converters.

<table>
<thead>
<tr>
<th>Function Code</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>03 (03 hex)</td>
<td>Read the Converter’s Process Data, Data Log, or Events Log</td>
</tr>
<tr>
<td>05 (05 hex)</td>
<td>Reset the Converter’s Totalizer, Data Log, or Events Log</td>
</tr>
<tr>
<td>08 (08 hex)</td>
<td>MODBUS Diagnostics (refer to the MODBUS organization for how to use these)</td>
</tr>
<tr>
<td>110 (6E hex)</td>
<td>Read/Write ETP Commands</td>
</tr>
</tbody>
</table>

• **DATA**

The additional information relative to the function code, e.g., discrete register addresses, quantity of items handled, etc.

MODBUS uses a ‘big-Endian’ representation for addresses and data items. This means that when a numerical quantity larger than a single byte is transmitted, the most significant byte is sent first. For example, if a 16-bit Register (2 bytes) has the value 1234 (hexadecimal) the first byte sent is 12 (hexadecimal) and the second byte sent is 34 (hexadecimal).

The MASTER of the MODBUS network sees the Converter as a set of registers of 1 bit or 16 bit. Information is stored in the SLAVE device in four different tables. Two tables store on/off discrete values (coils) and two store numerical values (registers). The coils and registers each have a read-only table and read-write table. Each table has 9999 values.

Single precision floating point data is stored and communicated following the IEEE-754 standard format.

### 2.2 Error Check

An error-check value calculated by the sending and the receiving devices from all the bits in the query.

The MASTER builds the message to send to the serial port and then adds two bytes (the Cyclic Redundancy Check, or CRC) to the end of every Modbus message for error detection. Every byte in the message is used to calculate the CRC using the standard CRC16 algorithm. (See Figure 2.)

![Figure 2. CRC process](image)
In normal operation the MASTER makes a request or sends a command to the SLAVE. The SLAVE then responds so that the response function code equals the request function code, e.g., address, function code, data, CRC, etc. (See Figure 3.)

![Figure 3. Example Of An Error Free MODBUS Transaction](image)

If an error is detected in the transmission an exception code is created to indicate the reason of the error. The exception function code is the sum of the request function code added to 80 (hexadecimal). In other words, the server returns a code equivalent to the original function code from the request PDU with its most significant bit set to logic 1. (See Figure 4.)

![Figure 4. Example Of A MODBUS Transaction With An Error](image)

### 2.2.1 Example Of A Mater Query Containing An Error

If the MASTER sends a request in the following form: “buff tx: [01][03][AB][CD][00][02][75][D0]”

**MASTER query elements:**
- SlaveID = [01]
- Function = [03]
- Start addr = [AB][CD]
- Num. reg. = [00][02]
- Crc 16 = [75][D0]

Assuming there is an error in the MASTER Query, the SLAVE will return the following response containing the modified function code with the appropriate error code (refer to the attached table for an explanation of error codes).

**buff rx:**[01][83][02][C0][F1]

**SLAVE response elements:**
- SlaveID = [01]
- Function = [83]
- Err. code = [02] **Exception Code:** Illegal Address
- Crc 16 = [C0][F1]

---

### MODBUS Exception Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Illegal Function</td>
</tr>
<tr>
<td>2</td>
<td>Illegal Address</td>
</tr>
<tr>
<td>3</td>
<td>Illegal Data Value</td>
</tr>
<tr>
<td>4</td>
<td>Server Device Failure</td>
</tr>
<tr>
<td>5</td>
<td>Acknowledge Error</td>
</tr>
<tr>
<td>6</td>
<td>Server Device Busy</td>
</tr>
<tr>
<td>7</td>
<td>Memory parity Error</td>
</tr>
</tbody>
</table>
3.0 Connecting the RS485 Cable to the Converter

The RS485 serial interface is used to connect the converter to a network of several instruments. The converter adopts the MASTER-SLAVE type format for communication. Up to 32 devices can be connected with this interface in a single network covering a length of up to 4000 feet with only two wires. It has excellent immunity to electrical disturbance. The RS485 port is suitable for even long distance and network connections because it is galvanically insulated from all other circuits.

Connect the RS485 cable to the terminal block in the converter as shown in Figure 5. Pin 29 is B, pin 28 is A, and pin 26 is common.

The RS485 network must be terminated by the last device on the network. If the ProComm converter is the last device, set the termination switch to the ON position.

![Figure 5. RS485 Data Cable Wiring Diagram For The Flow Meter Converter](image-url)
Establishing Communication

4.0 Establishing Communication

4.1 Data Word Format

The data bytes travelling in serial form on the communication line are enclosed in words which have a fixed length of 10 bits: 1 START BIT, 8 DATA BITS (1 BYTE), and 1 STOP BIT. NOTE: a byte commonly consists of 8 bits.

Each word contains one byte of data plus additional bits which serve to synchronize communication and make it safer. These extra bits are added automatically in the transmission phase by the transmitter integrated circuit. In the reception phase, the reverse operation is executed by the receiver integrated circuit: the eight data bits are extracted and the others are eliminated. These operations are executed entirely on a hardware level. Note that the 8 data bits must be serialized, starting from bit 0 (the least significant bit). NOTE: communication Flow Control is set to none; no control lines or XON/ XOFF characters are used.

4.2 Converter Parameter Settings

The settings indicated below must be entered in the Communications menu of the converter to establish serial communication after the serial port is wired. Refer to the ProComm Electromagnetic Flow Meter Installation, Operation and Maintenance manual for complete instructions (literature number 30124-62). (See Figure 6 below.)

- **Device Address [Dev.Addr=]**: establishes the address of the converter in the MODBUS network. Options are 1 through 247 (excluding 232, which is reserved).
- **Speed [Speed=bps]**: establishes serial line communication speed. Options are 1200, 2400, 4800, 9600, 19200, 22800, 38400, 57600, 76800 and 115200
- **Parity [Parity=]**: establishes parity for the byte frame in MODBUS communication. Options are EVEN (0), NONE (1), and ODD (2). Set to match the parity of the MODBUS network’s MASTER device.
- **Delay [Delay=ms]**: establishes converter delay (how long it will wait to answer the MODBUS network’s MASTER). Options, in milliseconds, are 0 (0), 20 (1), 4 (2), 60 (3), 80 (4), 100 (5), 120 (6) and 140 (7). Typically, set to 0.
- **Timeout [C.timeout=]**: Maximum delay between chars (frames) MODBUS

![Figure 6. ProComm Series Converter Communications Screen](image)

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**Important Notes Regarding RS485 Networks:**

An RS485 network is comprised of a certain number of devices, each one identified by a unique address number.

Each of these devices is designated a SLAVE with one device in the network, the network “referee”, designated the MASTER. The MASTER interrogates all of the other instruments connected to the network (the SLAVES) in turn. The maximum number of devices that can be connected to the network is 32. Information requests sent from the MASTER are received simultaneously by all the SLAVES, but only the one addressed in the communication replies.

For this reason, it is absolutely necessary that each SLAVE has a different address. As the MASTER establishes the time scheduling by which the information must transit the network, there must be only one MASTER in the network; two MASTERS would create conflicts in the communication, making the entire system unusable. MASTER devices can be PCs, PLCs, or other terminals that collect measurement data from the instruments. The converter is always a SLAVE.

When more than 32 instruments must be networked, the network must be divided into separate groups of a maximum of 32 devices. Each group connects to the next through a repeater which has the task of regenerating the necessary electric signals. In any case, given that the converter sets a maximum number of addresses that can be assigned to 247, networks with more than 246 elements cannot be created (note that address 232 is reserved).
# 5.0 Transmitting / Receiving Commands & Data via MODBUS

As described earlier, in the MODBUS protocol the converter functions as a SLAVE device. The MASTER of the network sees the converter as a set of registers of 1 bit or 16 bit. These registers are addressed and grouped in tables with different length. The data in these registers are accessed specific function calls.

A transmission from the MASTER to a SLAVE on the MODBUS network has the form as shown in the table below.

<table>
<thead>
<tr>
<th>SLAVE ID</th>
<th>Function</th>
<th>Address from which to Start Reading</th>
<th>Number of Registers to Read</th>
<th>CRC16 Error Check Number (see above)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte:</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>[01]</td>
<td>[03]</td>
<td>[00]</td>
<td>[00]</td>
<td>[00]</td>
</tr>
</tbody>
</table>

Transmission example, buff tx:

Device 1  Function 3  Start at address 0000 (hexadecimal)  Read 2 Registers  CRC16: C40B (hexadecimal)

A transmission from the SLAVE to a MASTER on the MODBUS network has the form as shown in the table below.

<table>
<thead>
<tr>
<th>SLAVE ID</th>
<th>Function</th>
<th>Number of Bytes (n)</th>
<th>Data from the first Register Queried (1)</th>
<th>Data from the Last Register Queried (1)</th>
<th>CRC16 Error Check Number (see above)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte:</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>[01]</td>
<td>[03]</td>
<td>[04]</td>
<td>[42]</td>
<td>[47]</td>
<td>[FF]</td>
</tr>
</tbody>
</table>

Reply example, buff tx:

Device 1  Function 3  4 Bytes  Data in first register: 4247 (hexadecimal)  Data in Last Register: FFCF Hexadecimal  CRC16: 5FFA (hexadecimal)
6.0 **Converter Data Map**

Process data, data logger data, and data logger events are contained in the converter's memory at specific addresses or registers and can be accessed by the MODBUS function codes. Following are the maps for process data.

6.1 **RS485 Hardware Connection**

For the hardware connection see the relative section in this manual and MODBUS manual.

6.2 **Data Word Format**

The data bytes travelling in serial form on the communication line are enclosed in words which have a fixed length of 10 bits:

1 START BIT
8 DATA BITS = 1 DATA BYTE
1 STOP BIT

Each word contains one byte of data plus additional bits which serve to synchronies and make the communication safer. These extra bits added automatically in the transmission phase by the transmitter integrated circuit. In the reception phase, the reverse operation is executed by the receiver integrated circuit: the eight data bits are extracted and the others eliminated. These operation are executed entirely on a hardware level. The 8 data bits must be serialised staring from bit 0 (the least significant one).

6.3 **Communication Speed**

The millennium series instruments have 4 communication speeds: 4800 bps
9600 bps
19200 bps
38400 bps

6.4 **Serial Port Settings**

Serial port setting:
Data bits: 8
Parity: Manu < 7-Comunication >, function - < Parity > Stop bits: 1
Flow control: none (no control lines no xon/xoff characters used)

6.5 **Data Register Format**

All data are sent in group of 16 bits registers. The format used is BIG ENDIAN, MSB byte is sent first, LSB is sent last. When a variable is more than 16 bits in size, it uses two adjacent registers. The totalizer values are expressed as integer numbers. For the correct representation of the value in case there is a fractional part, the decimal dot must be placed in the position specified by the next variable register following the totalized value. All values relative to the flow rate are averaged. The number of samples that compose the average value varies depending on the measure sample rate and the MODBUS reading requests. Example: measure sample rate = 50 Hz, MODBUS reading frequency = 10 Hz, Number of samples used for average calculation = 50/10 = 5.
### Converter Data Map

#### Read process variable : COMMAND 04.

<table>
<thead>
<tr>
<th>Address</th>
<th>Size</th>
<th>Type of Data</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000-0001</td>
<td>2 REGISTERS 32 BITS</td>
<td>FLOAT</td>
<td>full scale flow rate in the unit of measure chosen (as can be seen in the display of the instrument)</td>
</tr>
<tr>
<td>0002-0003</td>
<td>2 REGISTERS 32 BIT</td>
<td>FLOAT</td>
<td>flow rate value in percentage</td>
</tr>
<tr>
<td>0004-0005</td>
<td>2 REGISTERS 32 BITS</td>
<td>FLOAT</td>
<td>flow rate value in the unit of measure chosen</td>
</tr>
<tr>
<td>0006-0007</td>
<td>2 REGISTERS 32 BITS</td>
<td>FLOAT</td>
<td>Flow speed in the unit of measure chosen (m/s or ft/s)</td>
</tr>
<tr>
<td>0008-0009</td>
<td>2 REGISTERS 32 BITS</td>
<td>UNSIGNED LONG</td>
<td>Totalizer T+ value</td>
</tr>
<tr>
<td>0010</td>
<td>1 REGISTER 8+8 BITS</td>
<td>TWO BYTES</td>
<td>First byte (MSB): number of overflows recorded, second byte (LSB): number of decimal places</td>
</tr>
<tr>
<td>0011-0012</td>
<td>2 REGISTERS 32 BITS</td>
<td>UNSIGNED LONG</td>
<td>Totalizer P+ value</td>
</tr>
<tr>
<td>0013</td>
<td>1 REGISTER 8+8 BITS</td>
<td>TWO BYTES</td>
<td>First byte (MSB): number of overflows recorded, second byte (LSB): number of decimal places</td>
</tr>
<tr>
<td>0014-0015</td>
<td>2 REGISTERS 32 BITS</td>
<td>UNSIGNED LONG</td>
<td>totalizer T- value</td>
</tr>
<tr>
<td>0016</td>
<td>1 REGISTER 8+8 BITS</td>
<td>TWO BYTES</td>
<td>First byte (MSB): number of overflows recorded, second byte (LSB): number of decimal places</td>
</tr>
<tr>
<td>0017-0018</td>
<td>2 REGISTERS 32 BITS</td>
<td>UNSIGNED LONG</td>
<td>Totalizer P- value</td>
</tr>
<tr>
<td>0019</td>
<td>1 REGISTER 8+8 BITS</td>
<td>TWO BYTES</td>
<td>First byte (MSB): number of overflows recorded, second byte (LSB): number of decimal places</td>
</tr>
<tr>
<td>0020</td>
<td>1 REGISTER 8+8 BITS</td>
<td>TWO BYTES</td>
<td>first byte (MSB): process flags 1, (LSB): process flags 2</td>
</tr>
<tr>
<td>0021</td>
<td>1 REGISTER 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>Number of measure samples used for to calculate the latest read average value of flow rate</td>
</tr>
<tr>
<td>0022</td>
<td>1 REGISTER 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>Equivalent resistance measured between electrode E1 and the common point, in kilo ohm</td>
</tr>
<tr>
<td>0023</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>equivalent resistance measured between electrode E2 and the common point, in kilo ohm</td>
</tr>
<tr>
<td>0024</td>
<td>1 REGISTER, 16 BITS</td>
<td>SIGNED SHORT</td>
<td>voltage measured between electrode E1 and the common point, in millVolts</td>
</tr>
<tr>
<td>0025</td>
<td>1 REGISTER, 16 BITS</td>
<td>SIGNED SHORT</td>
<td>voltage measured between electrode E2 and the common point, in millVolts</td>
</tr>
<tr>
<td>0026</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>voltage measured at rechargeable terminals, in millVolts</td>
</tr>
<tr>
<td>0027</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>residual battery capacity in percentage</td>
</tr>
<tr>
<td>0028</td>
<td>1 REGISTER, 16 BITS</td>
<td>SIGNED SHORT</td>
<td>CPU temperature in the unit of measure chosen</td>
</tr>
<tr>
<td>0029</td>
<td>1 REGISTER, 16 BITS</td>
<td>SIGNED SHORT</td>
<td>Board temperature T1 the unit of measure chosen</td>
</tr>
<tr>
<td>0030</td>
<td>1 REGISTER, 16 BITS</td>
<td>SIGNED SHORT</td>
<td>Board temperature T2 the unit of measure chosen</td>
</tr>
<tr>
<td>0031</td>
<td>1 REGISTER, 16 BITS</td>
<td>SIGNED SHORT</td>
<td>Flow sensor coil's temperature the unit of measure chosen</td>
</tr>
<tr>
<td>0032</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>latest sensor test result code</td>
</tr>
<tr>
<td>0033</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>number of alarms currently active</td>
</tr>
</tbody>
</table>
**Converter Data Map**

**Meaning and value of the process flags 1 returned with the register 0020 (MSB):**
- bit 7 (MSB): flow rate alarm MIN (flow rate below the minimum threshold set)
- bit 6: flow rate alarm MAX (flow rate over the maximum threshold set)
- bit 5: flow rate sign (1 = negative)
- bit 4: flow rate below the cut-off value
- bit 3: measure range active (0= range 1, 1= range 2)
- bit 2: flow rate measure reset value status (1= measure is forcibly reset to zero)
- bit 1: volume counters lock status (1= counters are locked)
- bit 0 (LSB) : internal use, no meaning

**Meaning and value of the process flags 2 returned with the register 0020 (LSB):**
- bit 7 (MSB): flow rate overflow (value greater than full scale)
- bit 6: pulse channel #2 overflow (frequency greater than maximum possible for the given parameters)
- bit 5: pulse channel #1 overflow (frequency greater than maximum possible for the given parameters)
- bit 4: measure signal amplitude out of A/D converter range
- bit 3: measure signal amplitude out of amplifier capability
- bit 2: input signal error (out of input chain capability)
- bit 1: coils excitation error
- bit 0 (LSB) : pipe empty

**Meaning and value of the sensor test flags returned with the register 0021:**
- bit 15 (MSB): resistance at electrode E2 is outside the limits respect to the reference value
- bit 14 : resistance at electrode E1 is outside the limits respect to the reference value
- bit 13: coil time B is outside the limits respect to the reference value
- bit 12: coil time A is outside the limits respect to the reference value
- bit 11: coil temperature is outside the limits respect to the reference value
- bit 10: coil leakage current is outside the limit
- bit 09: coil driver output 2 voltage is out of tolerance during test phase 3
- bit 08: coil driver output 1 voltage is out of tolerance during test phase 3
- bit 07: coil driver output 2 voltage is out of tolerance during test phase 2
- bit 06: coil driver output 1 voltage is out of tolerance during test phase 2
- bit 05: coil driver output 2 voltage is out of tolerance during test phase 1
- bit 04: coil driver output 1 voltage is out of tolerance during test phase 1
- bit 03: coil driver power generator voltage is out of tolerance during test phase 2
- bit 02: coil driver power generator voltage is out of tolerance during test phase 1
- bit 01: coil driver power generator value is out of tolerance during test phase 2
- bit 00 (LSB): coil driver power generator value is out of tolerance during test phase 1
## Converter Data Map

### Reset totalizers: COMMAND 05.

<table>
<thead>
<tr>
<th>Address</th>
<th>Size</th>
<th>Type of Data</th>
<th>Command Value</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>0xFF00 (HEX)</td>
<td>Reset the enabled totalizers (same totalizer enabled for reset from digital input).</td>
</tr>
</tbody>
</table>

### Diagnostics: COMMAND 08.

<table>
<thead>
<tr>
<th>Address</th>
<th>Size</th>
<th>Type of Data</th>
<th>Function / Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>Return query data</td>
</tr>
<tr>
<td>0004</td>
<td>1 REGISTER, 16 BITS</td>
<td>SIGNED SHORT</td>
<td>Restart communication from listen mode</td>
</tr>
<tr>
<td>0010</td>
<td>1 REGISTER, 16 BITS</td>
<td>SIGNED SHORT</td>
<td>Activate listen mode</td>
</tr>
<tr>
<td>0011</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>Clear diagnostic counters</td>
</tr>
<tr>
<td>0012</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>Number of total received packets</td>
</tr>
<tr>
<td>0013</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>Number of received packets with CRC error</td>
</tr>
<tr>
<td>0014</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>Number of addressed or broadcast received packets</td>
</tr>
<tr>
<td>0015</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>Number of broadcast received packets</td>
</tr>
<tr>
<td>0016</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>Number of received packets with NAK flag</td>
</tr>
<tr>
<td>0017</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>Number of received packets with BUSY flag</td>
</tr>
<tr>
<td>0018</td>
<td>1 REGISTER, 16 BITS</td>
<td>UNSIGNED SHORT</td>
<td>Number of received packets with OVERRUN flag</td>
</tr>
</tbody>
</table>
OTHER McCROMETER PRODUCTS INCLUDE:

- Propeller Flowmeters
- Differential Pressure Flowmeters
- Magnetic Flowmeters
- Wireless Monitoring System

Contact your McCrometer representative for current pricing, technical data, and instructions.