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OVERVIEW

The M3000 meter supports Modbus RTU communications using RS232/RS485 (P.N. 65778-008). Modbus RTU communication options must be selected at time of order. See the M3000 parts list, available at www.badgermeter.com.

The tables on the following pages identify the Modbus registers and attributes in the M3000 flow meter.

For RS232/RS485 wiring, see the M3000 user manual, available at www.badgermeter.com.

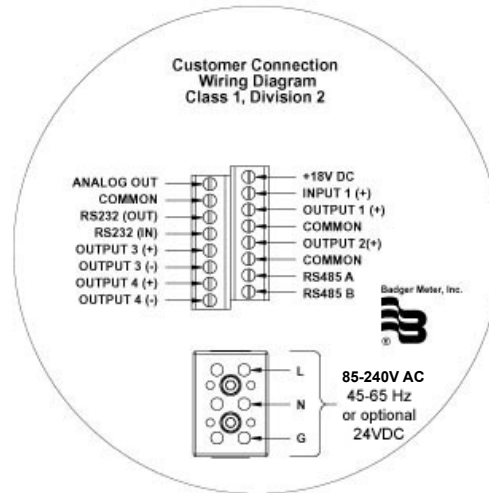


Figure 1: Output wire terminal block connections

DEFINITIONS

Register Name

When applicable, describes the parameter so it can be associated within the display menu items. Please note, not all registers are directly modifiable via the menu manager. Also, some registers are not accessible via the menu manager.

Register Address

Register Address defines the physical address that is required to be transmitted over the Modbus RTU serial link.

Register Type

Register Type identifies the number of registers the parameter requires. Each register is 16 bits. Supported Register Types include:

Register Type	Description	Number of Modbus Registers
UCHAR16[x]	Unsigned Character Array	x
UINT16	Unsigned Integer (16 bits)	1
FLOAT32	Floating Point (32 bits)	2

For FLOAT32 register types, these registers make use of IEEE-754 floating point standard. For example, 1.0 is transmitted as 0x3F800000. Modbus serial link will transmit the most significant byte first, 0x3F, followed by 0x80, 0x00, 0x00.

M3000 MEMORY MAP BY CATEGORY

Product Identification

No.	Write Security	Register Name	Register Address	Register Type	Read / Write
1	FIRMWARE	Product Code	0x0000	UINT16	Read-Only
2	FIRMWARE	Product Name	0x0001	UCHAR16[8]	Read-Only
3	FIRMWARE	Firmware Name	0x0009	UCHAR16[16]	Read-Only
4	FACTORY	Application Version	0x0019	UCHAR16[10]	Read-Only
5	FIRMWARE	Compile Date [MM:DD:YYYY]	0x0023	UCHAR16[16]	Read-Only
6	FIRMWARE	Compile Time [HH:MM:SS]	0x0033	UCHAR16[16]	Read-Only

Meter Calibration

No.	Write Security	Register Name	Register Address	Register Type	Read / Write
7	ADMIN	Detector Diameter	0x006F	UINT16	—
8	ADMIN	Detector Factor	0x0071	FLOAT32	—

Meter Measurement Settings

No.	Write Security	Register Name	Register Address	Register Type	Read / Write
9	USER	Flow Unit	0x0083	UINT16	—
10	USER	Volume Unit	0x0084	UINT16	—
11	USER	Full Scale Velocity [m/s]	0x0086	FLOAT32	—
12	USER	Low Flow Cutoff [%]	0x008E	FLOAT32	—
13	USER	Flow Direction	0x0092	UINT16	—
14	USER	Period of Measurement	0x200	UINT16	—

Digital Input

No.	Write Security	Register Name	Register Address	Register Type	Read / Write
15	SERVICE	Digital Input: Input Operation	0x0094	UINT16	—
16	FIRMWARE	Digital Input: Status	0x0155	UINT16	Read-Only

Digital Output #1

No.	Write Security	Register Name	Register Address	Register Type	Read / Write
17	SERVICE	Output #1: Pulses Per Unit [User Units]	0x0222	FLOAT32	—
18	SERVICE	Output #1: Pulse Width [ms]	0x0204	UINT16	—
19	SERVICE	Output #1: Flow Alarm Minimum [%]	0x0205	UINT16	—
20	SERVICE	Output #1: Flow Alarm Maximum [%]	0x0206	UINT16	—
21	SERVICE	Output #1: Output Mode	0x00A3	UINT16	—
22	SERVICE	Output #1: Output Operation	0x00A4	UINT16	—

Digital Output #2

No.	Write Security	Register Name	Register Address	Register Type	Read / Write
23	SERVICE	Output #2: Output Mode	0x00B0	UINT16	—
24	SERVICE	Output #2: Output Operation	0x00B1	UINT16	—

Digital Output #3

No.	Write Security	Register Name	Register Address	Register Type	Read / Write
25	SERVICE	Output #3: Output Mode	0x00B5	UINT16	—
26	SERVICE	Output #3: Output Operation	0x00B7	UINT16	—

Digital Output #4

No.	Write Security	Register Name	Register Address	Register Type	Read / Write
27	SERVICE	Output #4: Output Mode	0x00BA	UINT16	—
28	SERVICE	Output #4: Output Operation	0x00BC	UINT16	—

Measurements

No.	Write Security	Register Name	Register Address	Register Type	Read / Write
29	FIRMWARE	T1 + [M3]	0x0207	FLOAT32	Read-Only
30	FIRMWARE	T1 - [M3]	0x0209	FLOAT32	Read-Only
31	FIRMWARE	T1 N [M3]	0x020B	FLOAT32	Read-Only
32	FIRMWARE	T1 + [Unit]	0x0216	FLOAT32	Read-Only
33	FIRMWARE	T1 - [Unit]	0x0218	FLOAT32	Read-Only
34	FIRMWARE	TN [Unit]	0x021A	FLOAT32	Read-Only
35	FIRMWARE	Flow Velocity [M/S]	0x00E9	FLOAT32	Read-Only
36	FIRMWARE	Flow Rate [M3/S]	0x00ED	FLOAT32	Read-Only
37	FIRMWARE	Flow Rate [User Units]	0x00F1	FLOAT32	Read-Only

MEMORY MAP BY REGISTER ADDRESS

PLC Register (Base 1)	Register Address	Register Name	Value Definition	Register Type	Read / Write
40001	0x0000	Product Code	9:	UINT16	Read-Only
40002	0x0001	Product Name	M3000_MODBUS	UCHAR16[8]	Read-Only
40010	0x0009	Firmware Name	M3000_320F28374S	UCHAR16[16]	Read-Only
40026	0x0019	Application Version	—	UCHAR16[10]	Read-Only
40036	0x0023	Compile Date [MM:DD:YYYY]	—	UCHAR16[16]	Read-Only
40052	0x0033	Compile Time [HH:MM:SS]	—	UCHAR16[16]	Read-Only
40112	0x006F	Detector Diameter	1: DN6 (1/4 in.) 2: DN8 (5/16 in.) 3: DN10 (3/8 in.) 4: DN15 (1/2 in.) 5: DN20 (3/4 in.) 6: DN25 (1 in.) 7: DN32 (1-1/4 in.) 8: DN40 (1-1/2 in.) 9: DN50 (2 in.) 10: DN65 (2-1/2 in.) 11: DN80 (3 in.) 12: DN100 (4 in.) 13: DN125 (5 in.) 14: DN150 (6 in.) 15: DN200 (8 in.) 16: DN250 (10 in.) 17: DN300 (12 in.) 18: DN350 (14 in.) 19: DN400 (16 in.) 20: DN450 (18 in.) 21: DN500 (20 in.) 22: DN550 (22 in.) 23: DN600 (24 in.) 24: DN700 (28 in.) 25: DN750 (30 in.) 26: DN800 (32 in.) 27: DN900 (36 in.) 28: DN1000 (40 in.) 29: DN1050 (42 in.) 30: DN1200 (48 in.) 31: DN1400 (54 in.) 32: DN1600 (60 in.) 33: DN1800 (72 in.) 34: DN2000 (80 in.)	UINT16	Read/Write
40114	0x0071	Detector Factor	—	FLOAT32	Read/Write
40132	0x0083	Flow Unit	0: Liters Per Second 1: Liters Per Minute 2: Liters Per Hour 3: Cubic Meters Per Second 4: Cubic Meters Per Minute 5: Cubic Meters Per Hour 7: Cubic Feet Per Minute 10: Gallons Per Minute 12: Million Gallons Per Day 14: Imperial Gallons Per Minute 16: Fluid Oz Per Minute 17: Pounds Per Minute 18: Barrels Per Minute 19: Barrels Per Day	UINT16	Read/Write
40133	0x0084	Volume Unit	0: Liters 2: Cubic Meters 3: Cubic Feet 4: Gallons 5: Million Gallons 6: Imperial Gallons 7: Pounds 8: Fluid Oz 9: Acre Feet 10: Barrels	UINT16	Read/Write

PLC Register (Base 1)	Register Address	Register Name	Value Definition	Register Type	Read / Write
40135	0x0086	Full Scale Velocity [m/s]	—	FLOAT32	Read-Only
40143	0x008E	Low Flow Cutoff [%]	—	FLOAT32	Read/Write
40147	0x0092	Flow Direction	0: Unidirectional 1: Bidirectional	UINT16	Read/Write
40149	0x0094	Digital Input: Input Operation	0: none 1: remote reset 2: positive zero return	UINT16	Read/Write
40164	0x00A3	Output #1: Output Mode	0: normally open 1: normally closed	UINT16	Read/Write
40165	0x00A4	Output #1: Output Operation	0: Off 1: Forward Pulse 4: Flow Set Point 5: Error Alarm 6: Empty Pipe Alarm 7: Flow Direction 8: AMR Pulse	UINT16	—
40177	0x00B0	Output #2: Output Mode	0: normally open 1: normally closed	UINT16	Read/Write
40178	0x00B1	Output #2: Output Operation	0: Off 1: Reverse pulse 2: Frequency 3: Preset 4: Flow Set Point 5: Error Alarm 6: Empty Pipe Alarm 7: Flow Direction	UINT16	—
40182	0x00B5	Output #3: Output Mode	0: normally open 1: normally closed	UINT16	Read/Write
40184	0x00B7	Output #3: Output Operation	0: None 3: Preset Output 4: Flow Set Point 5: Error Alarm 6: Empty Pipe Alarm 7: Flow Direction	UINT16	Read/Write
40187	0x00BA	Output #4: Output Mode	0: normally open 1: normally closed	UINT16	Read/Write
40189	0x00BC	Output #4: Output Operation	0: None 3: Preset Output 4: Flow Set Point 5: Error Alarm 6: Empty Pipe Alarm 7: Flow Direction	UINT16	Read/Write
40234	0x00E9	Flow Velocity [M/S]	—	FLOAT32	Read-Only
40238	0x00ED	Flow Rate [M3/S]	—	FLOAT32	Read-Only
40242	0x00F1	Flow Rate [User Units]	—	FLOAT32	Read-Only
40342	0x0155	Digital Input: Status	—	UINT16	Read-Only
40513	0x0200	Period of Measurement	Excitation Frequency 3.125 Hz = 979 3.75 Hz = 816 6.25 Hz = 489 7.5 Hz = 408 12.5 Hz = 244 15.0 Hz = 204	UINT16	Read/Write
40517	0x0204	Output #1: Pulse Width [ms]	—	FLOAT32	Read/Write
40518	0x0205	Output #1: Flow Alarm Minimum [%]	—	FLOAT32	Read/Write
40519	0x0206	Output #1: Flow Alarm Maximum [%]	—	FLOAT32	Read/Write
40520	0x0207	T1 + [M3]	—	FLOAT32	Read-Only
40522	0x0209	T1 - [M3]	—	FLOAT32	Read-Only
40524	0x020B	T1 N [M3]	—	FLOAT32	Read-Only
40535	0x0216	T1 + [Actual Unit]	—	FLOAT32	Read-Only
40537	0x0218	T1 - [Actual Unit]	—	FLOAT32	Read-Only
40539	0x021A	T1 N [Actual Unit]	—	FLOAT32	Read-Only
40547	0x0222	Output #1: Pulses Per Unit [User Units]	—	UINT16	Read/Write

TROUBLESHOOTING

Modbus transmissions can be rejected for various reasons:

- Write request received while menu navigation is in process
- Write request received with an invalid value (out-of range value)
- Write request received to a secured meter
- Invalid register address supplied in Modbus serial request
- Invalid number of registers supplied in Modbus serial request (too many or too few)
- Invalid function code supplied in Modbus serial request
- The following error response codes are returned

Error Response Code	Reason
0x01 – Illegal Function Code	Request received with invalid function code.
0x02 – Illegal Data Address	Write request received with invalid number of registers.
	Write request received with address not supported.
	Write request received to a read-only register.
0x03 – Illegal Data Value	Read request received with invalid number of registers.
	Write/Read request received has too many registers to read.
	Write request received with invalid value.
0x04 – Device Failure	Write request received to a protected parameter (secured device, menu navigation in progress).

Modbus transmissions may not be responded to for various reasons:

- Bad CRC: Verify serial link is properly shielded
- Framing / Parity Errors: Verify serial communication settings match for both the flow meter and application software
- Wrong port address: Verify the flow meter is properly programmed with the correct node address
- Duplicate port addresses on serial link: May cause collisions when multiple meters respond at the same time
- Wrong serial wiring: Verify wiring is appropriate
- For RS485, lack of termination on end devices or lack of biasing by Modbus Master: Flow meter does not provide RS485 biasing. This is assumed to be accomplished by the Modbus Master.

Control. Manage. Optimize.

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