ModMAG®

M-Series® | B-MAG Electromagnetic Flow Meters

Electromagnetic Flow Meters

M2000 BACnet MS/TP Communication Protocol

Badger Meter

User Manual

CONTENTS

ABOUT THIS MANUAL

Definitions

BACnet	Building Automation and Control Networks
DB	Daughterboard
MS/TP	Master-Slave/Token-Passing
PTP	Point-to-Point
SPS	Alternate abbreviation for PLC (Programmable Logic Controller)
User Units	Defined by configuration of the meter's volume unit or flow unit

Scope

This document discusses the supported features of serial BACnet MS/TP, how these features are related to the M2000, and the special considerations and type of data that is accessible over BACnet MS/TP. This document assumes general understanding of the BACnet MS/TP protocol by the reader. For further information regarding the BACnet Protocol, refer to *www.bacnet.org*.

The M2000 BACnet MS/TP daughterboard supports BACnet MS/TP protocol, Revision 19. The BACnet MS/TP daughterboard acts as a BACnet MS/TP master node (Data Link Layer) with the device profile of BACnet-Smart Actuator (B-SA). It interfaces directly to MS/TP based systems.

INTRODUCTION

BACnet is a Data Communication Protocol for Building Automation and Control Networks. Developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), BACnet is an American national standard, a European standard, a national standard in more than 30 countries, and an ISO global standard. The protocol is supported and maintained by ASHRAE Standing Standard Project Committee 135.
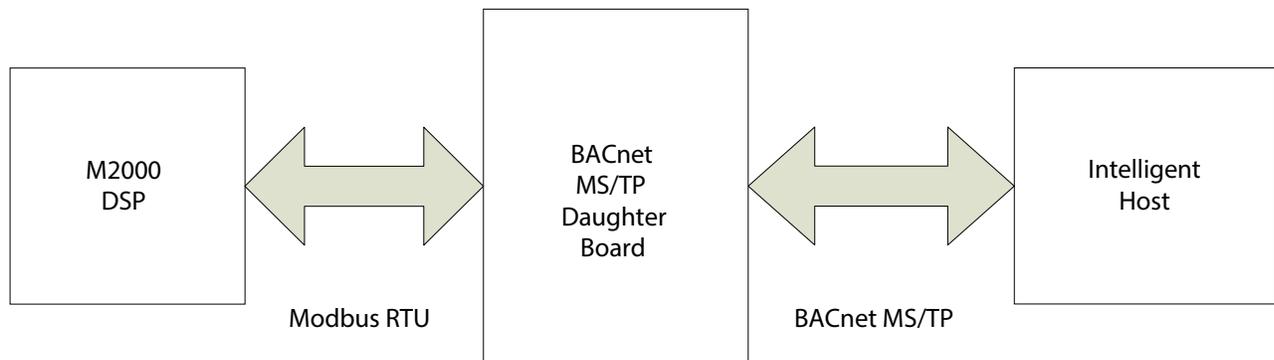

Figure 1: BACnet MS/TP-to-Modbus RTU commands

INSTALLATION

Pre-Installed Daughterboard

Most daughterboard installations will be completed in the factory and shipped pre-installed into the main board. Follow these steps to set up your M2000 BACnet MS/TP device.

1. Power on the M2000.
2. Allow time for the daughterboard to properly power up and be recognized by the M2000 before navigating the menus. This time is typically 3 seconds or less. If the BACnet MS/TP daughterboard is not recognized, cycle the M2000 power.
3. Navigate in the menu to *Main Menu > Communications > Daughterbrd Config*.
4. Configure the settings in the table below to what is required for the BACnet MS/TP network.

Parameter	Default Value	Comments
BACnet MS/TP Baud	9600	Baud Rate of the BACnet MS/TP network. Common settings are 9600, 19200, 38400 and 76800.
BACnet MS/TP MAC ID	1	Sets BACNET MS/TP Device ID of module/meter. Max value = 127
BACnet Max Master	127	Sets the max master variable for the device. Max value = 127
BACnet Instance	10001	Sets the BACnet Instance number. The instance number is an unsigned decimal number that can range from 0 to 4,194,302. Every device on a BACnet network gets an instance number, and two devices must not have the same number.

5. After configuration of all parameters, exit the menu system back to the M2000 Home screen.
6. Cycle power to the M2000 meter for any daughterboard configuration changes to take place.

Wiring the RS-485 Connections

NOTE: Power off the M2000 before making the RS-485 wiring connections.

Use the following information to wire signals to the 6-pin customer connector. See *Figure 2*.

| Terminal Number	Pin Description	Comments
71	RS-485 B+	RS-485 Non-Inverting I/O 15kV HBM ESD Protected RS-485 level
72	RS-485 A-	RS-485 Inverting I/O15kV HBM ESD Protected RS-485 level
73	Analog GND	0/4…20 mA (Terminal 15-)
74	Analog Output	0/4…20 mA (Terminal 16+)
75	24V DC Ext	24V DC Output
76	GND	Isolated Ground (GND)
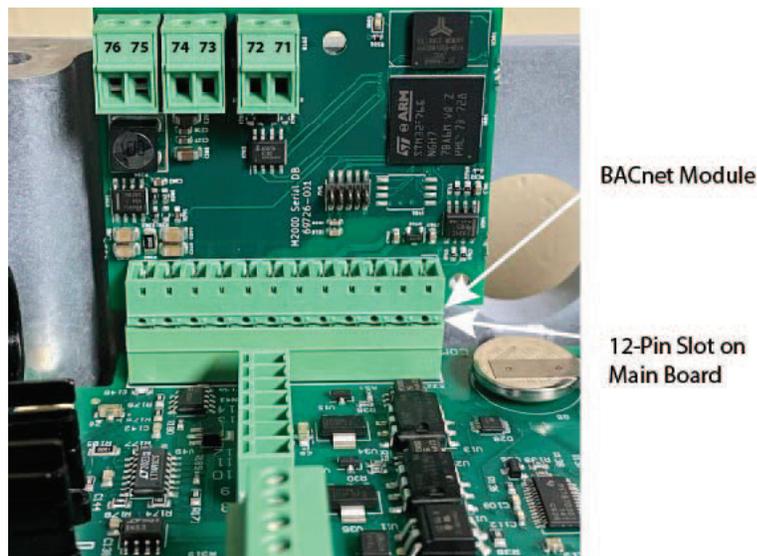
Figure 2: Signal wiring diagram

In-Field Upgrade

Prerequisites

- Installing a BACnet MS/TP daughterboard into an M2000 requires firmware revision v1.22 or later.

- The main board (revision 2 or later) must have a 12-pin connector for this interface.

Installing the Daughterboard

The BACnet MS/TP daughterboard connects to the 12-pin connector labeled COMMUNICATION on the main board.
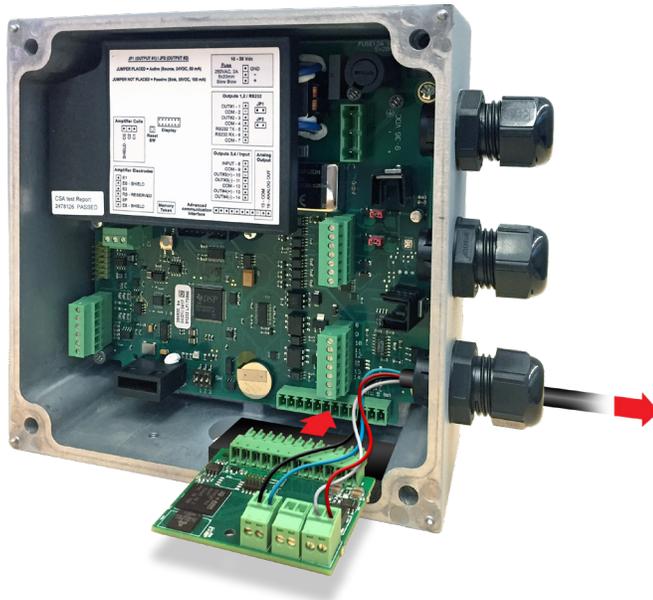
Figure 3: Daughterboard connection

Follow these steps to install the daughterboard hardware.

1. Prior to installing the daughterboard, verify or configure the M2000 Communication Port B Settings.

   The Port B Settings are located at *Main Menu > Communications > Port B Settings.*

Parameter	Value
Port Address	1
Ext. Port Address	126
Baud Rate	9600
Data Bits	8 bits
Parity	Even
Stop Bits	1 bit

2. Exit the communications menu back to the M2000 Home screen.
3. Power off the M2000.

⚠CAUTION

DISCONNECT THE INPUT POWER BEFORE ACCESSING THE EQUIPMENT.
This step is important for the M2000 to properly recognize the BACnet MS/TP daughterboard.

4. Prior to inserting the daughterboard, install the foam insulation pad as shown in *Figure 4 on page 6*. Be sure to align the groove with the two screws attaching the detector or wall mount bracket to the enclosure. The primary purpose of this pad is to ensure the daughterboard is insulated from the enclosure wall. It is important to install this pad flush with the top of the enclosure wall.

Apply insulation pad
flush with the
top of the housing.
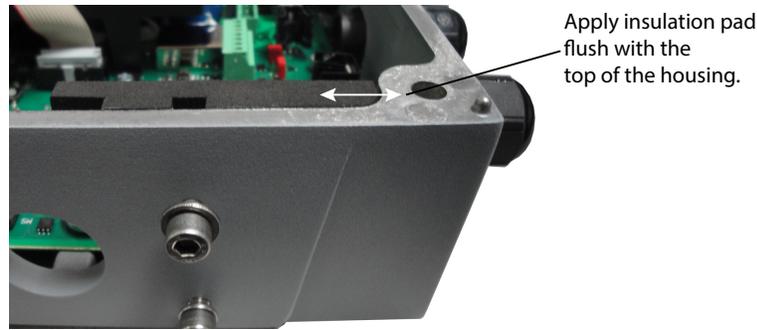
Figure 4: Installing foam insulation pad

5. Insert the 12-pin daughterboard into the 12 pin-connector.

6. Power on the M2000.

7. Allow time for the daughterboard to properly power up and be recognized by the M2000 before navigating the menus. This time is typically 3 seconds. If the BACnet MS/TP daughterboard is not recognized, cycle the M2000 power.

8. Verify recognition of the BACnet MS/TP daughterboard. Navigate to Main Menu > Info/Help. The Daughterboard Info field indicates the Daughterboard Type is BACnet MS/TP (Bn_mstp).

9. From this point, follow the typical installation procedure.

SYSTEM CONFIGURATION

BACnet Protocol Implementation Conformance Statement

Date: March 4, 2022

Vendor Name: Badger Meter (Vendor 306)

Product Name: M2000 Mag Meter

Product Model Number: M2000

Application Software Version: M-Series v1.22

Firmware Revision: v1.02

BACnet Protocol Revision: 1.19

Product Description

The ModMAG M2000 Electromagnetic flow meter has a wide selection of liner and electrode materials to help ensure maximum compatibility and minimum maintenance over a long operating period.

BACnet Standardized Device Profiles Supported (Annex L)

•   BACnet Smart Actuator (B-SA)

BACnet Interoperability Building Blocks Supported (Annex K)

•   Data Sharing-ReadProperty-B (DS-RP-B)

•   Data Sharing-ReadPropertyMultiple-B (DS-RPM-B)

•   Data Sharing-WriteProperty-B (DS-WP-B)

•   Device Management-Dynamic Device Binding-B (DM-DDB-B)

•   Device Management-Dynamic Object Binding-B (DM-DOB-B)

•   Device Management-ReinitializeDevice-B (DM-RD-B)

Standard Object Types Supported

Object-Type	Dynamically Createable	Dynamically Deleteable	Optional Properties Supported	Writable Properties
Device	No	No	Description, Max Master, Max Info Frames	Max Master, Max Info Frames
Network Port	No	No	Link Speed Link Speeds MAC Address Max Master Max Info Frames	Link Speed MAC Address Max Master Max Info Frames
Analog Value	No	No	—	Present Value
Character String	No	No	—	Present Value

Range Restrictions for the Device Object

Object-Type	Property	Range Restriction
Device	Max Master	1 ~ 127
	Max Info Frames	1 ~ 255
Network Port	Link Speed	9600, 19200, 38400, 57600, 76800
	MAC Address	1 ~ 127
	Max Master	1 ~ 127
	Max Info Frames	1 ~ 255

Data Link Layer Option Supported

MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800

Segmentation Capability Supported

None

Character Sets Supported

ISO 10646 (UTF-8)

DATA MANAGEMENT

The BACnet MS/TP interface is based on BACnet Protocol Revision 19 and supports the following objects:

- One Device Object – contains parameters pertaining to the M2000 device
- 170 Analog Value Objects – contains parameters pertaining to meter specific parameters
- 17 Custom String Values – contains device specific string data pertaining to the connected meter
- One Network Port Object - Contains all BACnet network options and status

Device Object

Every BACnet device must have a Device Object, the Properties of which fully describe the BACnet device to the network. The Object_List Property of the Device Object, for example, provides a list of every Object contained within the BACnet device. The Vendor_Name, Vendor_Identifier and Model_Name Properties provide the manufacturer name and model of the device.

BACnet Property	Value
Apdu Timeout	3000
Application Software Version	M-Series v1.22
Database Revision	0
Description	Magnetic Flow Meter
Device Address Binding	—
Firmware Revision	1.02
Location	—
Max Apdu Length Accepted	480
Max Info Frames	1
Max Master	127
Model Name	M2000
Number of Apdu Retries	3
Object Identifier	OBJECT_DEVICE: 10001
Object Name	M2000 Mag Meter
Object Type	8 : Object Device
Property List	Object Array
Protocol Object Types Supported	001000001000000000000000000000000000000010000000000000001000
Protocol Revision	19
Protocol Services Supported	0000000000001011010010000000000000011000000000
Protocol Version	1
Segmentation Supported	3 : None
System Status	0 : Operational
Vendor Identifier	306
Vendor Name	Badger Meter

Analog Value Objects & Character String Objects

This list specifies all the analog values accessible by the BACnet MS/TP network.

Measurements Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
31	VelocityUnits	INTEGER	READ_WRITE	AV13
32	FlowUnits	INTEGER	READ_WRITE	AV14
33	VolumeUnits	INTEGER	READ_WRITE	AV15
34	UnitMultiplier	INTEGER	READ_WRITE	AV16
35	ZeroScaleFlow	FLOAT	READ_WRITE	AV17
36	FullScalVelocity	FLOAT	READ_WRITE	AV18
37	FullScaleFlow	FLOAT	READ_WRITE	AV19
38	LowFlowCutoff	FLOAT	READ_WRITE	AV20
39	FlowDirection	INTEGER	READ_WRITE	AV21
40	DampingFactor	INTEGER	READ_WRITE	AV22

Product Identification Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
1	ProductCode	INTEGER	READ_ONLY	AV161
2	ProductName	STRING	READ_ONLY	CSV0
3	FirmwareName	STRING	READ_ONLY	CSV1
4	ApplicationVer	STRING	READ_WRITE	CSV2
5	CompileDate	STRING	READ_ONLY	CSV3
6	CompileTime	STRING	READ_ONLY	CSV4
7	PCBSerialNum	STRING	READ_WRITE	CSV5
8	OTPBootChecksum	STRING	READ_ONLY	CSV6
9	FlashOSChecksum	STRING	READ_ONLY	CSV7
10	BootVer	STRING	READ_ONLY	CSV8
11	OsVer	STRING	READ_ONLY	CSV9
12	ComBoardProdType	INTEGER	READ_ONLY	AV146
13	ComBoardMajorVer	INTEGER	READ_ONLY	AV147
14	ComBoardMinorVer	INTEGER	READ_ONLY	AV148
15	PwrOnSplashLn1	STRING	READ_WRITE	CSV10
16	PwrOnSplashLn2	STRING	READ_WRITE	CSV11
17	MeterTagName	STRING	READ_WRITE	CSV12

Meter Calibration Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
18	DetDiamEnum	INTEGER	READ_WRITE	AV0
19	DetDiamActual	INTEGER	READ_WRITE	AV1
20	DetectorFactor	FLOAT	READ_WRITE	AV2
21	FACT_DetFactor	FLOAT	READ_ONLY	AV3
22	DetectorOffset	FLOAT	READ_WRITE	AV4
23	FACT_DetOffset	FLOAT	READ_ONLY	AV5
24	AmplifierFactor	FLOAT	READ_WRITE	AV6
25	FACT_AmpFactor	FLOAT	READ_ONLY	AV7
26	DetectorCurrent	FLOAT	READ_WRITE	AV8
27	FACT_DetCurrent	FLOAT	READ_ONLY	AV9
28	PowerLineFreq	INTEGER	READ_WRITE	AV10
29	ExcitationFreq	INTEGER	READ_WRITE	AV11
30	ScaleFactor	FLOAT	READ_WRITE	AV12

Meter Measurement Settings Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
101	T1_Tplus_m3	FLOAT	READ_ONLY	AV82
102	T1_Tplus_User	FLOAT	READ_ONLY	AV83
103	T1_TplusDispStr	STRING	READ_ONLY	CSV14
104	T2_Tminus_m3	FLOAT	READ_ONLY	AV84
105	T2_Tminus_User	FLOAT	READ_ONLY	AV85
106	T2_TminusDispStr	STRING	READ_ONLY	CSV15
107	T3_TNet_m3	FLOAT	READ_ONLY	AV86
108	T3_TNet_User	FLOAT	READ_ONLY	AV87
109	T3_TNetDispStr	STRING	READ_ONLY	CSV16
110	T1_TplusRollCtr	INTEGER	READ_ONLY	AV88
111	T2_TminusRollCtr	INTEGER	READ_ONLY	AV89
112	FlowVelocity_MS	FLOAT	READ_ONLY	AV90
113	FlowVelocity_Usr	FLOAT	READ_ONLY	AV91
114	FlowRate_m3	FLOAT	READ_ONLY	AV92
115	FlowRate_User	FLOAT	READ_ONLY	AV93
116	RelFlowRatePerc	FLOAT	READ_ONLY	AV94
117	PresBatchTot_m3	FLOAT	READ_ONLY	AV95
118	PresBatchTot_Usr	FLOAT	READ_ONLY	AV96
119	FlowDirection	INTEGER	READ_ONLY	AV97

Digital Input Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
41	DigInOperation	INTEGER	READ_WRITE	AV23
42	DigInStatus	INTEGER	READ_ONLY	AV24

Output 1 Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
56	Out1_PPUnit_m3	FLOAT	READ_WRITE	AV37
57	Out1_PPUnit_user	FLOAT	READ_WRITE	AV38
58	Out1_PulseWidth	INTEGER	READ_WRITE	AV39
59	Out1_FS_Freq	INTEGER	READ_WRITE	AV40
60	Out1_AlarmMin	INTEGER	READ_WRITE	AV41
61	Out1_AlarmMax	INTEGER	READ_WRITE	AV42
62	Out1_Mode	INTEGER	READ_WRITE	AV43
63	Out1_Operation	INTEGER	READ_WRITE	AV44

Output 2 Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
64	Out2_PPUnit_m3	FLOAT	READ_WRITE	AV45
65	Out2_PPUnit_user	FLOAT	READ_WRITE	AV46
66	Out2_PulseWidth	INTEGER	READ_WRITE	AV47
67	Out2_FS_Freq	INTEGER	READ_WRITE	AV48
68	Out2_AlarmMin	INTEGER	READ_WRITE	AV49
69	Out2_AlarmMax	INTEGER	READ_WRITE	AV50
70	Out2_Mode	INTEGER	READ_WRITE	AV51
71	Out2_Operation	INTEGER	READ_WRITE	AV52

Output 3 Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
72	Out3_FS_Freq	INTEGER	READ_WRITE	AV53
73	Out3_AlarmMin	INTEGER	READ_WRITE	AV54
74	Out3_AlarmMax	INTEGER	READ_WRITE	AV55
75	Out3_Mode	INTEGER	READ_WRITE	AV56
76	Out3_HW_Select	INTEGER	READ_WRITE	AV57
77	Out3_Operation	INTEGER	READ_WRITE	AV58

Output 4 Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
78	Out4_AlarmMin	INTEGER	READ_WRITE	AV59
79	Out4_AlarmMax	INTEGER	READ_WRITE	AV60
80	Out4_Mode	INTEGER	READ_WRITE	AV61
81	Out4_HW_Select	INTEGER	READ_WRITE	AV62
82	Out4_Operation	INTEGER	READ_WRITE	AV63
77	Out3_Operation	INTEGER	READ_WRITE	AV58

Analog Output Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
43	AnalogOutRange	INTEGER	READ_WRITE	AV25
44	AnalogOutOffset	FLOAT	READ_ONLY	AV26
45	AnalogOutCalPtA	FLOAT	READ_WRITE	AV27
46	AnalogOutCalPtB	FLOAT	READ_WRITE	AV28
47	FACT_AOutCalPtA	FLOAT	READ_ONLY	AV29
48	FACT_AOutCalPtB	FLOAT	READ_ONLY	AV30
49	AnalogOutSlope	FLOAT	READ_ONLY	AV31
50	AnalogOffset4MA	FLOAT	READ_WRITE	AV32
51	AnalogOffset20MA	FLOAT	READ_WRITE	AV33
52	AnalogOutCurrent	FLOAT	READ_ONLY	AV34
53	AOutCurrentStr	STRING	READ_ONLY	CSV13
54	AlarmMode	INTEGER	READ_WRITE	AV35
55	FixedCurrentMode	FLOAT	READ_ONLY	AV36

Port A Diagnostic Counters Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
83	A_PacketsProc	INTEGER	READ_ONLY	AV64
84	A_BcastPackets	INTEGER	READ_ONLY	AV65
85	A_CRCErrs	INTEGER	READ_ONLY	AV66
86	A_PacketsRcvd	INTEGER	READ_ONLY	AV67
87	A_PacketsSent	INTEGER	READ_ONLY	AV68
88	A_ParityErrs	INTEGER	READ_ONLY	AV69
89	A_FramingErrs	INTEGER	READ_ONLY	AV70
90	A_OverrunErrs	INTEGER	READ_ONLY	AV71
91	A_BreakDets	INTEGER	READ_ONLY	AV72

Port B Diagnostic Counters Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
92	B_PacketsProc	INTEGER	READ_ONLY	AV73
93	B_BcastPackets	INTEGER	READ_ONLY	AV74
94	B_CRCErrs	INTEGER	READ_ONLY	AV75
95	B_PacketsRcvd	INTEGER	READ_ONLY	AV76
96	B_PacketsSent	INTEGER	READ_ONLY	AV77
97	B_ParityErrs	INTEGER	READ_ONLY	AV78
98	B_FramingErrs	INTEGER	READ_ONLY	AV79
99	B_OverrunErrs	INTEGER	READ_ONLY	AV80
100	B_BreakDets	INTEGER	READ_ONLY	AV81

Daughterboard Configuration Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
174	BacnetMSTPBaud	LONG	READ_WRITE	AV155
175	BacnetMSTPMacId	INTEGER	READ_WRITE	AV156
176	BacnetMaxMaster	INTEGER	READ_WRITE	AV157
177	BacnetInstance	LONG	READ_WRITE	AV158
182	BacnetMaxInfoFrm	INTEGER	READ_WRITE	AV164

Miscellaneous Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
137	PowerLossTot_s	LONG	READ_ONLY	AV115
138	DispBklightMode	INTEGER	READ_WRITE	AV116
139	PreBatchAmt	FLOAT	READ_WRITE	AV117
140	MenuResetAllowed	INTEGER	READ_WRITE	AV118
141	MenuLangSetting	INTEGER	READ_WRITE	AV119
142	FileSysNumRecsRd	INTEGER	READ_WRITE	AV120
143	ConfigStatus	INTEGER	READ_ONLY	AV121
144	PortBExtAddr	INTEGER	READ_ONLY	AV122
157	SoftwreMedianFlt	INTEGER	READ_WRITE	AV135
158	IIRCoefActualVal	FLOAT	READ_ONLY	AV136
159	IIRActualState	INTEGER	READ_WRITE	AV137
160	IIRCoefMin	FLOAT	READ_WRITE	AV138
161	IIRCoefMax	FLOAT	READ_WRITE	AV139
162	IIRHysteresis	FLOAT	READ_WRITE	AV140
163	IIRSensitivity	FLOAT	READ_WRITE	AV141
164	ZFlowStabSize	FLOAT	READ_WRITE	AV142
165	ZFlowStabExp	INTEGER	READ_WRITE	AV143
166	ZFlowStabAcc	FLOAT	READ_ONLY	AV144
167	ZFlowStabTimer	INTEGER	READ_ONLY	AV145

Verification Tool Support

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
145	AnalogInMeasVal	FLOAT	READ_ONLY	AV123
146	AnalogInMeasCtr	INTEGER	READ_WRITE	AV124
147	EmptyPipeActRes	FLOAT	READ_ONLY	AV125

Empty Pipe Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
148	EmptyPipeCal_V	FLOAT	READ_WRITE	AV126
149	EmptyPipeMeasVal	FLOAT	READ_ONLY	AV127
150	FullPipeCal_V	FLOAT	READ_WRITE	AV128
151	EmptyPipeMode	INTEGER	READ_WRITE	AV129

Control Commands Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
152	CmdActionReq	INTEGER	READ_WRITE	AV130
153	FlowSimulation	SIGNED INTEGER	READ_WRITE	AV131

Security Category

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
154	SecurityStatus	INTEGER	READ_ONLY	AV132
155	RandomVal	LONG	READ_ONLY	AV133
156	RemoteLogin	LONG	WRITE_ONLY	AV134

Software Filters

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
157	SoftwreMedianFlt	INTEGER	READ_WRITE	AV135
158	IIRCoefActualVal	FLOAT	READ_ONLY	AV136
159	IIRActualState	INTEGER	READ_WRITE	AV137
160	IIRCoefMin	FLOAT	READ_WRITE	AV138
161	IIRCoefMax	FLOAT	READ_WRITE	AV139
162	IIRHysteresis	FLOAT	READ_WRITE	AV140
163	IIRSensitivity	FLOAT	READ_WRITE	AV141
164	ZFlowStabSize	FLOAT	READ_WRITE	AV142
165	ZFlowStabExp	INTEGER	READ_WRITE	AV143
166	ZFlowStabAcc	FLOAT	READ_ONLY	AV144
167	ZFlowStabTimer	INTEGER	READ_ONLY	AV145

Communication Settings

Index	Parameter Name	Data Type	Network Access	BACnet Object ID
168	RESERVED	RESERVED	RESERVED	AV149
169	RESERVED	RESERVED	RESERVED	AV150
170	RESERVED	RESERVED	RESERVED	AV151
171	RESERVED	RESERVED	RESERVED	AV152
172	RESERVED	RESERVED	RESERVED	AV153
173	RESERVED	RESERVED	RESERVED	AV154
174	BacnetMSTPBaud	INTEGER	READ_WRITE	AV155
175	BacnetMSTPMacId	INTEGER	READ_WRITE	AV156
176	BacnetMaxMaster	INTEGER	READ_WRITE	AV157
177	BacnetInstance	INTEGER	READ_WRITE	AV158
178	RESERVED	RESERVED	RESERVED	AV159
179	RESERVED	RESERVED	RESERVED	AV160
180	RESERVED	RESERVED	RESERVED	AV162
181	RESERVED	RESERVED	RESERVED	AV163
182	RESERVED	RESERVED	RESERVED	AV164
183	RESERVED	RESERVED	RESERVED	AV165
184	RESERVED	RESERVED	RESERVED	AV166
185	RESERVED	RESERVED	RESERVED	AV167
186	RESERVED	RESERVED	RESERVED	AV168
187	RESERVED	RESERVED	RESERVED	AV169

TROUBLESHOOTING

Symptoms	Possible Causes	Recommended Actions
No communication	Transmit and receive are wired incorrectly.	Check the network wiring from the meter.
	Baud rate does not match master.	Check the baud rate of the master and ensure the baud rate of the meter matches the master. If it does not match, change the Baud Rate setting in the Communication menu.
	Check LED behavior on the daughterboard. There should be a "fast" blink (4 flashes per second).	If LED is solid green or is a slow blink (1 flash per second) the daughterboard is not communicating to the main M2000 board. Check that the daughterboard is properly installed and fully plugged into the terminal on the M2000 board.
		If there is still a slow blink on the daughterboard LED, remove the daughterboard, cycle power to the meter, and navigate to the communications menu on the M2000. Configure Port B to the following settings:
		Port Address: 1
		Data Bits: 8 bits
		Parity: Even
		Stop Bits: 1 bit
		The remaining port B settings are not factored into the discovery of the daughterboard and can be left as default values. Exit the menu system back to the M2000 main screen. Power off the meter, plug back in the daughterboard, and again power up the meter.
	MAC address is not unique. Another device is on the network with the same address.	Check the addresses of the other devices on the network. Check that the MAC address is not 1.
	Cable is not terminated properly.	For BACnet MS/TP on EIA-485 network, devices can be daisy chained together. The two devices on the end of the chain need to have terminated resistors to reduce reflections. Terminating resistors (typically 120 Ohm) must be applied externally across the A- and B+ terminals. In point-to-point, or point-to-multipoint (single driver on bus) networks, the main cable should be terminated in its characteristic impedance (typically 120 Ohms) at the end furthest from the driver. In multi-receiver applications, stubs connecting receivers to the main cable should be kept as short as possible. Multipoint (multi-driver) systems require that the main cable be terminated in its characteristic impedance at both ends. Stubs connecting a transceiver to the main cable should be kept as short as possible.
	Cable or chain longer than 100 ft.	RS-485 is intended for network lengths up to 4000 ft, but the maximum system data rate decreases as the transmission length increases. Devices (like this one) operating at 20 Mbps are limited to lengths less than 100 ft.

Symptoms	Possible Causes	Recommended Actions
Intermittent communication	Cable is not properly shielded.	Communication cables must have shielding to protect the quality of the communication signals from electromagnetic interference (EMI). Check that the cable has a shield. Typically, one end of the shield drain is connected to a clean ground to dissipate EMI and prevent ground loops. However, depending on the ground quality, cable length and type of interference, other methods can be employed. Twisted pair is the cable of choice for RS-485 networks. Twisted pair cables tend to pick up noise and other electromagnetically induced voltages as common mode signals, which are effectively rejected by the differential receivers used in this application.
	Cable routed near power cables such a variable frequency drives.	Cables carrying high currents cause a high degree of electromagnetic interference that can interfere with the quality of the communication signals. Route signal cables away from power cables.
	Cable is not terminated properly.	For BACnet MS/TP on EIA-485 network, devices can be daisy chained together. The two devices on the end of the chain need to have terminated resistors to reduce reflections. Terminating resistors (typically 120 Ohm) must be applied externally across the A- and B+ terminals. In point-to-point, or point-to-multipoint (single driver on bus) networks, the main cable should be terminated in its characteristic impedance (typically 120 Ohms) at the end furthest from the driver. In multi-receiver applications, stubs connecting receivers to the main cable should be kept as short as possible. Multipoint (multi-driver) systems require that the main cable be terminated in its characteristic impedance at both ends. Stubs connecting a transceiver to the main cable should be kept as short as possible.
	Cable or chain longer than 4000 ft.	RS-485 is intended for network lengths up to 4000 ft, but the maximum system data rate decreases as the transmission length increases. Devices (like this one) operating at 20Mbps are limited to lengths less than 100 ft.
Unable to write specific parameters	Meter is set up with security that prevents changes to certain write-able values.	Enter the correct PIN to unlock the device. Refer to the M2000 user manual for more information on the different levels of security.

BTL CERTIFICATION

For more information regarding this listing, go to the *BTL website*.
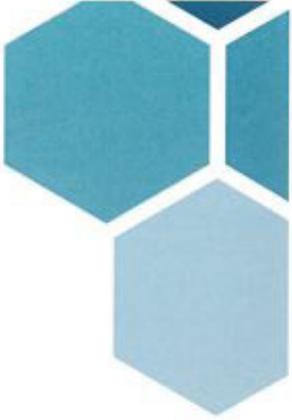
BACnet CONFORMANCE CERTIFICATE

No. BTL-30848

WSPCert attests the conformance of the following BACnet implementation to the BACnet standard ISO 16484-5 protocol revision 1.19. The attested conformance refers to the BACnet Interoperability Building Blocks (BIBBs) listed on the BTL Listing bearing the above-mentioned BTL-number.

The BACnet implementation has fulfilled the requirements according to the test standard ISO 16484-6, the BTL Test Plan 20.0 and the BTL Testing Policies, see Test Report number BAC01018 of TÜV SÜD Industrie Service GmbH.

Product name (B-SA)
M2000 Electromagnetic Flow Meter
Model(s)* M2000-*y-y-y-yy*-B-*yyy*
Software version
v1.01
Vendor
Badger Meter Inc.
4545 W Brown Deer Rd
Milwaukee, WI 53224-9536, USA

* where y is according to listing information

This certificate is valid until **31-Mar-2027**.

11-Apr-2022
Date of Initial Certification
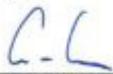
Dipl.-Ing. G. Weinmann
Head of Certification Body

Issued on behalf of BACnet International
2900 Delk Road, Suite 700, PMB 321
Marietta, GA 30067, USA

Certification by WSPCert
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