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ABOUT THIS MANUAL

Definitions

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BACnet	A Data Communication Protocol for Building Automation and Control Networks
BBMD	BACnet/IP Broadcast Management Device
BTL	BACnet Testing Laboratory
DB	Daughterboard
FD	Foreign Device
MAC	Media Access Control
UDP	User Datagram Protocol
User Units	Defined by configuration of the meter's volume unit or flow unit

Scope

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

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

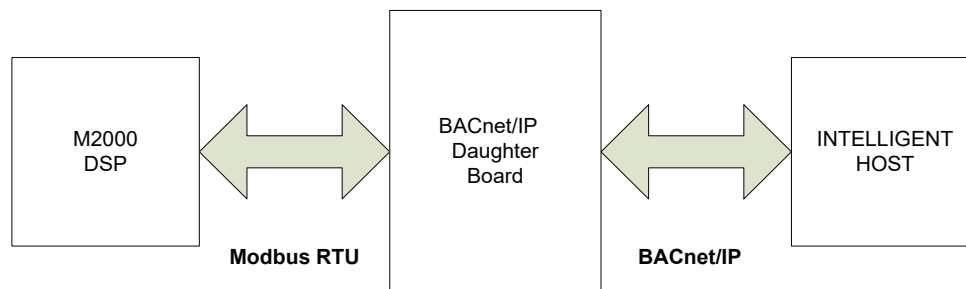


Figure 1: BACnet/IP-to-MODBUS RTU commands

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.

The most basic consideration is that BACnet/IP devices should behave conceptually like all other BACnet devices in terms of their network activities:

- They should be able to communicate directly with peer devices on their network;
- They should be able to make use of local broadcasts, received by all peer devices on their network;
- They should be able to send remote broadcasts to devices residing on networks with different network numbers;
- Global broadcasting should still work as it does today.

Two fundamental assumptions about BACnet devices that are commonly used are:

- Devices have a unique address, in this case an IP address, and the M2000 device knows what that address is, by configuring the IP address into the device's non-volatile memory.
- Devices do not know, or at least do not need to know, their BACnet network number (unless the device is a BACnet router).

BACnet/IP uses the User Datagram Protocol (UDP), a connectionless protocol. Here is why UDP was chosen:

- UDP is well supported and has a clean API for all operating systems.
- TCP, a connection-oriented protocol, has significantly more overhead than UDP and does not allow "one-too-many" messages.
- The definition of a new IP packet type (with a new protocol value) would provide no substantial advantage, and some potential disadvantages relative to the use of UDP.
- A new IP protocol type might not be routable.
- Current firewalls do not pass new packet types.

Foreign Device Registration

BACnet/IP allows "foreign devices" to join the BACnet internetwork from ANY subnet via SLIP or PPP, e.g. through an internet service provider. This means you can access a particular BACnet network (which the M2000 is a node on) over any internet enabled device from anywhere. That is the purpose of "foreign device registration" which can be carried out through any internet connection, static or dynamic.

Foreign devices can register with certain BBMDs to receive forwarded broadcast messages. A BBMD relays BACnet/IP broadcast messages within a BACnet/IP network that spans multiple IP subnets. By registering with a BBMD, the workstation in the graphic below becomes a member of the BACnet/IP network and will receive forwarded broadcast messages from the BBMD when they are available and can request that messages be broadcast by the BBMD on its behalf. The foreign device can, of course, talk with any BACnet device directly without registration but will only receive broadcasts if the registration procedure is followed.

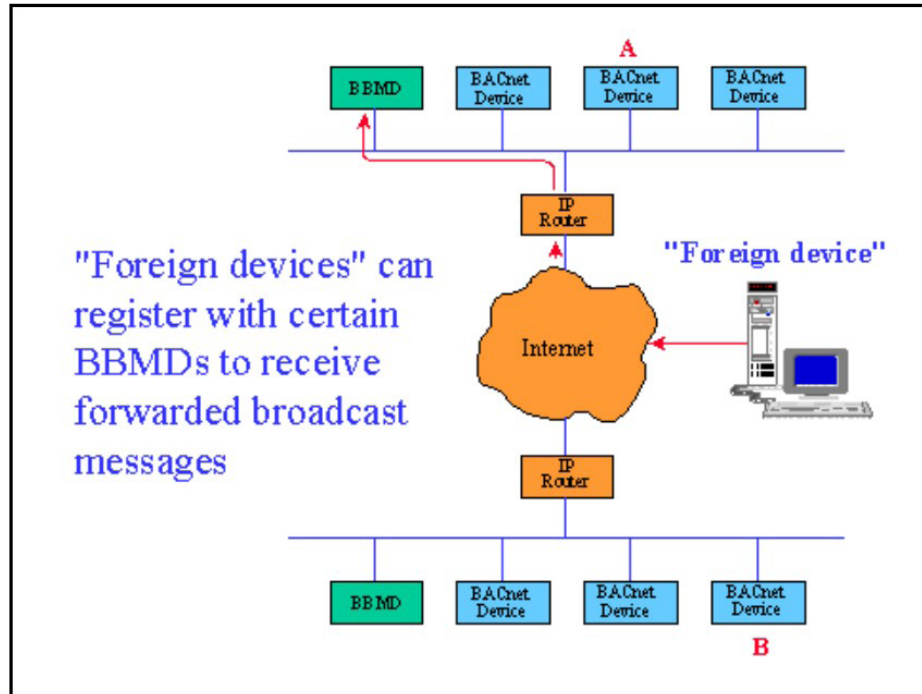


Figure 2: Foreign devices

On the M2000, all the foreign device registration parameters can be set up and configured using the integrated Web-based User Interface (see ["Webserver User Interface" on page 20](#)). The IP address and Port are kept as separate settings on the webserver, but they are combined in BACnet as expected. To disable the M2000 foreign device mode and put the meter into "Normal Mode" (non-foreign device) you must set any one of the following parameters to a value of zero via the BACnet/IP Configuration page on the webserver interface.

- FD BBMD Address
- FD BBMD UDP Port
- FD TTL (seconds)

BACnet/IP Configuration

BACnet UDP Port:	<input type="text" value="47808"/>	0-65535
BACnet Instance:	<input type="text" value="10027"/>	0-4194302
FD BBMD Address:	<input type="text" value="3232235853"/>	0-4294967295
FD BBMD UDP Port:	<input type="text" value="47808"/>	0-65535
FD TTL (Seconds):	<input type="text" value="5"/>	0-65535

New saved settings will be applied after power is cycled to the device.

Figure 3: BACnet/IP configuration

As usual, any changes to the BACnet/IP configuration settings will require a power cycle to the device for the new values to become active.

INSTALLATION

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/IP 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.
3. This time is typically 3 seconds or less. If the BACnet/IP daughterboard is not recognized, cycle the M2000 power.
4. Navigate in the menu to at *Main Menu > Communications > Daughterbrd Config.*
5. Configure the settings in the table below to what is required for the BACnet/IP network.

Parameter	Default Value	Comments
DHCP Enable	Enabled	When enabled the IP address is dynamically assigned.
IP Address	192.168.0.1	Unique address that identifies this M2000 on the BACnet network. Valid entries for each octet are 0...255. This address is only used if the DHCP enable is turned off.
Subnet Mask	255.255.0.0	By default the Subnet mask is configured as Class B. Valid entries for each octet are 0...255. This number is only used if the DHCP enable is turned off.
Gateway IP	10.0.1.1	Default Gateway address when no other route specification matches the destination IP address of the IP packet. Valid entries for each octet are 0...255.
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.
BACnet UDP Port	47808	The default UDP port for BACnet traffic is 47808 (0xBAC0), but depending on the project specification other ports are also possible. LLC: BACnet Ethernet uses LLC atop Ethernet as its transport protocol, and BACnet ARCNET uses LLC atop ARCNET as its transport protocol. For BACnet traffic, DSAP is 0x82, SSAP is 0x82.
Ethernet MAC Address	00:16:0F:80:XX:XX	A unique identifier for the connected M2000 daughterboard. <ul style="list-style-type: none"> • Where XX:XX is the unique serial number used within the unique MAC Address. "EthernetMACAddr" in the data map. • 00:16:0F corresponds to Badger Meter's OUI. • 80 corresponds to the M2000 Product line.
Webserver Access	Enabled	This enables or disables the access to the proprietary webserver for viewing device configuration and meter data. Enter the M2000 device IP address into the address bar within a browser window on a PC which is on the same network/subnet to view the webserver. When this is disabled access to this webserver interface is prohibited.

6. After configuration of all parameters, exit the menu system back to the M2000 *Home* screen.
7. Cycle power to the M2000 for the new settings to take effect.

Wiring the Terminal Connections

Power off the M2000 before making any wiring connections.

⚠CAUTION

DISCONNECT THE INPUT POWER BEFORE ACCESSING THE EQUIPMENT.

This step is important for the M2000 to properly recognize the BACnet/IP daughterboard.

Use the following information to make appropriate wiring of signals to the daughterboard. See [Figure 4](#).

Pin Number	Pin Description	Comments
81	RJ-45 (Ethernet)	Physical connection to the BACnet/IP network
82	Analog Output GND	Return (-) terminal used for the analog 0/4...20 mA output (Terminal 15 -)
83	Analog Output Source	Source (+) terminal used for the analog 0/4...20 mA output (Terminal 16+)
84	24V DC Ext	24V DC Output
85	GND	24V DC GND

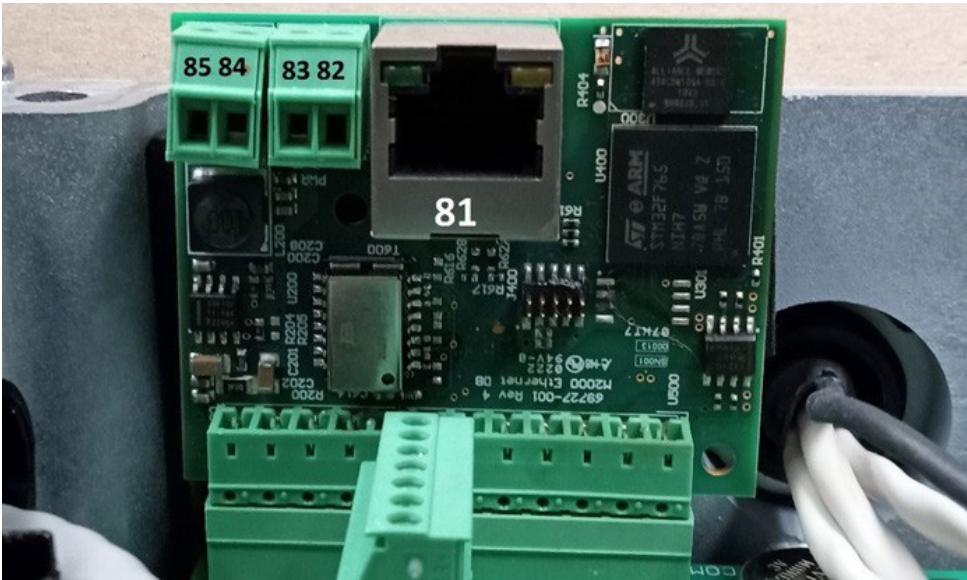


Figure 4: Signal wiring diagram

INSTALLATION (IN-FIELD UPGRADE)

Prerequisites

- Installing a BACnet/IP 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/IP daughterboard connects to the 12-pin connector labeled *COMMUNICATION* on the main board.

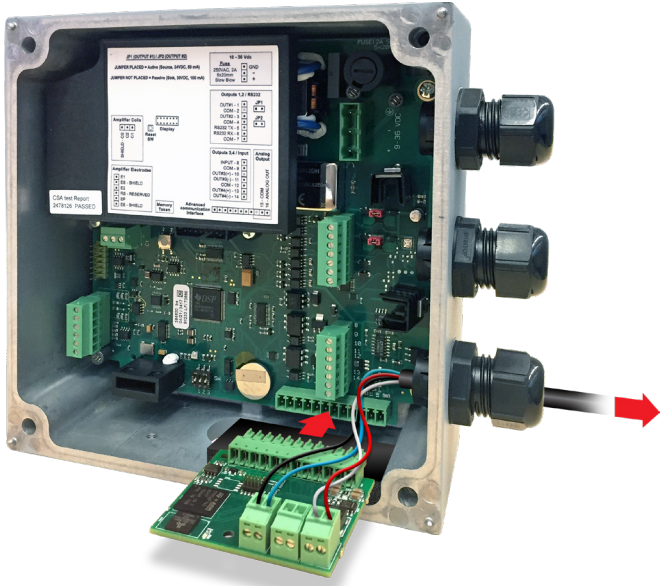


Figure 5: Signal wiring diagram

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/IP daughterboard.

4. Prior to inserting the daughterboard, install the foam insulation pad as shown in [Figure 6 on page 9](#). 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.

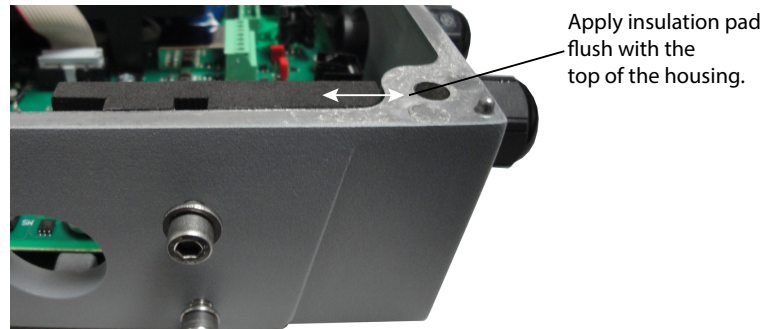


Figure 6: Installing foam insulation pad

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.
8. This time is typically 3 seconds or less. If the BACnet/IP daughterboard is not recognized, cycle the M2000 power.
9. Verify recognition of the BACnet/IP daughterboard. Navigate to *Main Menu > Info/Help*. The Daughterboard Info field indicates the Daughterboard Type is BACnet/IP (BAC_IP).
10. From this point, follow the typical installation procedure.

SYSTEM CONFIGURATION

BACnet/IP PIC Statement

BACnet Protocol Implementation Conformance Statement

Date: July 1, 2022

Vendor Name: Badger Meter (Vendor 306)

Product Name: ModMAG M2000

Product Model Number: M2000

Application Software Version: M-Series v1.22

Firmware Revision: 1.0

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)

Segmentation Capability

NONE

Standard Object Types Supported

An object type is supported if it may be present in the device. For each standard Object Type supported provide the following data:

Device Object

1. Whether objects of this type are dynamically creatable using the CreateObject service? No
2. Whether objects of this type are dynamically deletable using the DeleteObject service? No
3. List of the optional properties supported: Description
4. List of all properties that are writable: N/A
5. List of proprietary properties and for each its property identifier, datatype, and meaning: N/A
6. List of any property range restrictions: N/A

Network Port Object

1. Whether objects of this type are dynamically creatable using the CreateObject service? No
2. Whether objects of this type are dynamically deletable using the DeleteObject service? No
3. List of the optional properties supported: N/A
4. List of all properties that are writable: IP_Address, IP_Subnet_Mask, IP_Default_Gateway, IP_DNS_Server
5. List of proprietary properties and for each its property identifier, datatype, and meaning: N/A
6. List of any property range restrictions: N/A

Analog Value Object

1. Whether objects of this type are dynamically creatable using the CreateObject service? No
2. Whether objects of this type are dynamically deletable using the DeleteObject service? No
3. List of the optional properties supported: N/A
4. List of all properties that are writable: Present_Value
5. List of proprietary properties and for each its property identifier, datatype, and meaning: N/A
6. List of any property range restrictions: N/A

Character String Value Object

1. Whether objects of this type are dynamically creatable using the CreateObject service? No
2. Whether objects of this type are dynamically deletable using the DeleteObject service? No
3. List of the optional properties supported: N/A
4. List of all properties that are writable: Present_Value
5. List of proprietary properties and for each its property identifier, datatype, and meaning: N/A
6. List of any property range restrictions: N/A

BACnet Data Link Layer Options

☒ BACnet/IP, (Annex J)

Device Address Binding

Is static device binding supported? ☐ Yes ☒ No

Character Sets Supported

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

☒ ISO 10646 (UTF-8)

BACnet/IP Interface

The BACnet/IP interface is based on the BACnet/IP Revision 19 and supports the following objects:

- One Device Object – contains parameters pertaining to the M2000 device
- One Network Port Object – Contains relevant data for the configured BACnet/IP Port
- 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

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.

BACnet Property	Value
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Analog Value Objects and Character String Value Objects

This list specifies all the analog and CSV values accessible by the BACnet/IP 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	DHCPUsed	INTEGER	READ_WRITE	AV149
169	IPAddress	INTEGER	READ_WRITE	AV150
170	SubnetMask	INTEGER	READ_WRITE	AV151
171	GatewayIPAddr	INTEGER	READ_WRITE	AV152
172	RESERVED	RESERVED	RESERVED	AV153
173	RESERVED	RESERVED	RESERVED	AV154
174	RESERVED	RESERVED	RESERVED	AV155
175	RESERVED	RESERVED	RESERVED	AV156
176	RESERVED	RESERVED	RESERVED	AV157
177	BacnetInstance	INTEGER	READ_WRITE	AV158
178	BacnetUDPPort	INTEGER	READ_WRITE	AV159
179	EthernetMACAddr	INTEGER	READ_ONLY	AV160
180	RESERVED	RESERVED	RESERVED	AV162
181	RESERVED	RESERVED	RESERVED	AV163
182	RESERVED	RESERVED	RESERVED	AV164
183	RESERVED	RESERVED	RESERVED	AV165
184	WebserverAccess	INTEGER	READ_WRITE	AV166
185	BacnetFDIPAddr	INTEGER	READ_WRITE	AV167
186	BacnetFDPort	INTEGER	READ_WRITE	AV168
187	BacnetFDTime	INTEGER	READ_WRITE	AV169

UNITS OF MEASURE ENUMERATIONS

Param ID	Param Name	Enumeration
12	ComBoardProdType	4 = Bacnet MS/TP (serial) 5 = BACnet/IP (Ethernet) 6 = Modbus TCP (Ethernet) 7 = EtherNet/IP (Ethernet)
18	DetDiamEnum	0 = Other 1 = DN6 2 = DN8 3 = DN10 4 = DN15 5 = DN20 6 = DN25 7 = DN32 8 = DN40 9 = DN50 10 = DN65 11 = DN80 12 = DN100 13 = DN125 14 = DN150 15 = DN200 16 = DN250 17 = DN300 18 = DN350 19 = DN400 20 = DN450 21 = DN500 22 = DN550 23 = DN600 24 = DN700 25 = DN750 26 = DN800 27 = DN900 28 = DN1000 29 = DN1050 30 = DN1200 31 = DN1400 32 = DN1600 33 = DN1800 34 = DN2000 35 = DN1500 36 = DN1350
28	PowerLineFreq	0 = 50 Hz 1 = 60 Hz
29	ExcitationFreq	0 = 1 Hz 1 = 3.125 Hz or 3.75 Hz, 2 = 6.25 Hz or 7.5 Hz, 3 = 12.5 Hz or 15 Hz
32	Flow Units	0 = LPS 1 = LPM 2 = LPH 3 = M3S 4 = M3M 5 = M3H 6 = F3S 7 = F3M 8 = F3H 9 = GPS 10 = GPM 11 = GPH 12 = MGD 13 = IPS 14 = IPM 15 = IPH 16 = LBM 17 = OZM 18 = BPM
33	Volume Units	0 = Liters 1 = Hectoliters 2 = Cubic meters 3 = Cubic feet 4 = US gallons 5 = Mega gallons 6 = UK gallons 7 = Pounds 8 = Ounces 9 = Acre feet 10 = Barrels 11 = Mega UK Gallons 12 = Second Foot-Day 13 = Kilo Gallons
34	UnitMultiplier	0 = Off 1 = 1 unit 10 = 10 units 100 = 100 units 1000 = 1000 units 10000 = 10000 units 32768 = 0.1 units 32769 = 0.01 units 32770 = 0.001 units 32771 = 0.0001 units
39	FlowDirectConfig	0 = uni-directional 1 = bi-directional

Param ID	Param Name	Enumeration
40	DampingFactor	0 = 0 seconds 1 = 1 second 2 = 2 seconds 3 = 3 seconds 4 = four seconds 5 = five seconds 10 = 10 seconds 20 = 20 seconds 30 = 30 seconds
41	DigInOperation	0 = Off 1 = Remote reset 2 = Positive zero return 3 = Batch reset
43	AnalogOutRange	1 = 4...20 mA 2 = 0...20 mA 3 = 0...10 mA 4 = 2...10 mA
54	AOutAlarmMode	0: Meter error has no influence on analog output 1: Meter error drives output 2 mA below minimum range 2: Meter error drives output 2 mA above maximum range
58	Out1_PulseWidth	0 = 50% duty cycle
62	Out1_Mode	0 = Normally open 1 = Normally closed
63	Out1_Operation	0 = Off 1 = Flow alarm 2 = Empty pipe alarm 3 = Error alarm 4 = Forward pulse 5 = AMR pulse 6 = Reverse pulse 7 = Frequency output 8 = Preset batch output 9 = Flow direction 10 = Verification test 11 = 24V DC supply 12 = ADE 13 = Totalizer Alarm
66	Out2_PulseWidth	0 = 50% duty cycle
70	Out2_Mode	0 = Normally open 1 = Normally closed
71	Out2_Operation	0 = Off 1 = Flow alarm 2 = Empty pipe alarm 3 = Error alarm 4 = Forward pulse 5 = Not Supported 6 = Reverse pulse 7 = Frequency output 8 = Preset batch output 9 = Flow direction 10 = Verification test 11 = 24V DC supply 12 = Not Supported 13 = Totalizer Alarm
75	Out3_Mode	0 = Normally open 1 = Normally closed
76	Out3_HW_Select	0 = Relay 1 = Open collector

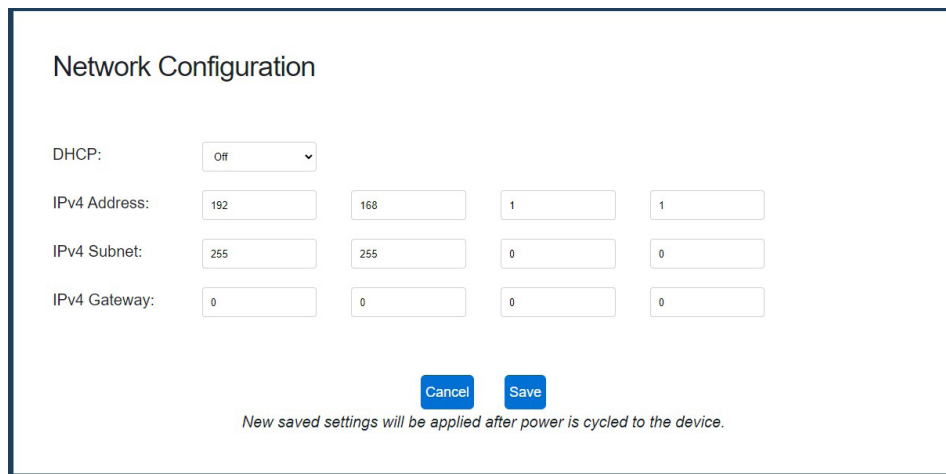
Param ID	Param Name	Enumeration
77	Out3_Operation	0 = Off 1 = Flow alarm 2 = Empty pipe alarm 3 = Error alarm 4 = Not Supported 5 = Not Supported 6 = Not Supported 7 = Frequency output 8 = Preset batch output 9 = Flow direction 10 = Verification test 11 = Not Supported 12 = Not Supported 13 = Totalizer Alarm
80	Out4_Mode	0 = Normally open 1 = Normally closed
81	Out4_HW_Select	0 = Relay 1 = Open collector
82	Out4_Operation	0 = Off 1 = Flow alarm 2 = Empty pipe alarm 3 = Error alarm 4 = Not Supported 5 = Not Supported 6 = Not Supported 7 = Not Supported 8 = Preset batch output 9 = Flow direction 10 = Verification test 11 = Not Supported 12 = Not Supported 13 = Totalizer Alarm
119	FlowDirecStatus	0 = No Flow 1 = Forward Flow 2 = Reverse Flow
138	DispBklightMode	0 = Forced On 1 = Forced Off 2 = Timed Off

Param ID	Param Name	Enumeration
140	MenuResetAllowed	1 = All totalizers are resettable 0 = otherwise
141	MenuLangSetting	0 = English 1 = Alternate Language (Spanish OR French OR German, etc.)
151	EmptyPipeMode	0 = Off 1 = On 2-5 = Reserved
152	CmdActionReq	0 = No action 1 = Save RAM to EEPROM 2 = Load EEPROM to RAM 3-5 = Reserved 6 = Save totalizers to EEPROM 7 = Clear T1 or T+ 8 = Clear T2 or T- 9 = Clear Tn 10 = Clear all totalizers 11 = Clear port A diagnostics 12 = Clear port B diagnostics 13 = Clear all error counts 14-20 = Reserved 21 = Clear power off totalizer 22 = Reserved 23 = Remote reset 24 = Restore factory calibration data 25 = Reserved 26 = Reserved 27 = Reset batch amount 28 = Remote logoff 29 = Save RAM to EEPROM (port B only)
153	FlowSimulation	-101 = Flow Sim Toggle Enable -128 = Disable
168	DHCP Enable	0 = DHCP Disabled 1 = DHCP Enabled
184	WebserverAccess	0 = Webserver Disabled 1 = Webserver Enabled

WEBSERVER USER INTERFACE

The following settings are accessible using the user interface provided by the webserver:

- Network Configuration: Gives configuration access to the IP Address, Subnet Mask, Gateway IP Address, DHCP. Cycle power after making changes to these settings for new values to take effect.
- BACnet/IP Configuration settings: Cycle power after making changes to these settings for new values to take effect.
- Data Mapping: Sortable list of all application-specific parameters accessible via the BACnet/IP network. Must refresh webpage to update values.
- Process Values: Sortable list of process variables. Values will update automatically every 1 to 2 seconds.
- Network Diagnostics (for advanced users/troubleshooting).



Network Configuration

DHCP:

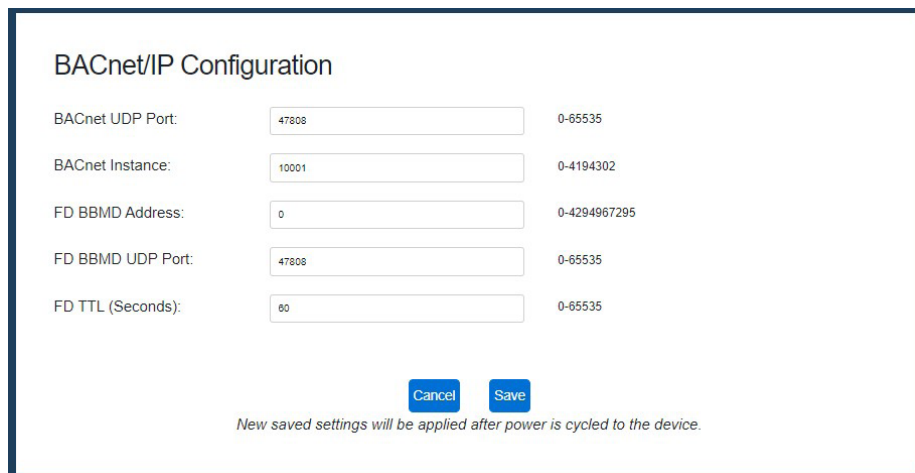
IPv4 Address:

IPv4 Subnet:

IPv4 Gateway:

New saved settings will be applied after power is cycled to the device.

Figure 7: Webserver network configuration setup



BACnet/IP Configuration

BACnet UDP Port: 0-65535

BACnet Instance: 0-4194302

FD BBMD Address: 0-4294967295

FD BBMD UDP Port: 0-65535

FD TTL (Seconds): 0-65535

New saved settings will be applied after power is cycled to the device.

Figure 8: BACnet/IP configuration webserver settings

Data Mapping

All

Data Location	Name	Value	Unit
400001	ProductCode	1	no-units
400002 - 400009	ProductName	M2000	no-units
400010 - 400025	FirmwareName	M2000_TMS320F2811	no-units
400026 - 400035	ApplicationVer	M-Series v1.22	no-units
400036 - 400051	CompileDate	May 4 2022	no-units
400052 - 400067	CompileTime	13:39:11	no-units
400068 - 400072	PCBSerialNum	40140146	no-units
400073 - 400075	OTPBootChecksum	BEFF	no-units
400076 - 400078	FlashOSChecksum	F2D4	no-units
400079 - 400083	BootVer	v1.001	no-units
400084 - 400087	OsVer	v1.22	no-units

Figure 9: Webserver device data map

Process Values

Flow Measurements


ID	Location	Name	Value	Unit
101	400247	T1_Tplus_m3	1548.301	cubic-meters
102	400248	T1_Tplus_User	409017.688	us-gallons
104	400250	T2_Tminus_m3	0.004	cubic-meters
105	400253	T2_Tminus_User	0.964	us-gallons
107	400255	T3_TNet_m3	1548.297	cubic-meters
108	400256	T3_TNet_User	409016.781	us-gallons
110	400258	T1_TplusRollCtr	0	no-units
111	400259	T2_TminusRollCtr	0	no-units
112	400263	FlowVelocity_MS	0.000	meters-per-second
113	400264 - 400265	FlowVelocity_Usr	0.000	no-units
114	400266	FlowRate_m3	0.000	cubic-meters-per-second

Figure 10: Process Values

BTL CERTIFICATION

For more information regarding this listing, go to the [BTL website](#).

BACnet CONFORMANCE CERTIFICATE



No. BTL-30886

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 (IBBs) 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 VG 2022_1010857 of MBS.

Product name (B-SA)
ModMAG M2000
Model(s)* M2000-y-y-y-yy-V-yyy
Firmware version
v1.00
Vendor
Badger Meter Inc.
4545 W Brown Deer Rd
Milwaukee, WI 53224, USA

* where y is according to listing information

This certificate is valid until **31-Mar-2028**.

29-Jun-2022
Date of Initial Certification


Dipl.-Ing. G. Weinmann
Head of Certification Body

Issued on behalf of BACnet International
2500 Dahl Road, Suite 700, PMB 321
Marietta, GA 30067, USA

Certification by WSPCert
Dr.-Ing. Frank Bittner
Kapuzinerweg 7, 70374 Stuttgart, Germany
Phone: +49 (0)711 9638220, email: info@wspcert.de

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