

## MM2BACQ12

- The MM2 BACnet controller range employs the **BACnet MS/TP** data link protocol, and uses **EIA-485** as the physical layer.
- The **Baud Rate** is fixed at **38400 baud**, with a maximum of 128 (MAC 0 -127) controllers per LAN.
- Physical factors normally limit the maximum number of controllers to 64 per LAN.
- The MAC address can be set using onboard dip switches, and can be in the range of 0 – 127, and should be unique in its local 485 network.
- The default Device Instance (DeviceID) is 99000 + MAC Address.
- DeviceID can be in the range of 0 – 4194304, and should be unique for the entire BACnet infrastructure.
- The device instance is part of the *device object*, and is writeable.
- The device instance of the device object is also mapped to Analog Value 7.

### Object List

Object Instance	Object Name	Units	Default Value	Min	Max	Description
<b>Analog Input</b>						
<b>AI 0</b>	<i>Room Temp</i>	°C	32767 <sup>(1)</sup>	-	-	Return air temperature sensor
<b>AI 1</b>	<i>Disch Air Temp</i>	°C	32767 <sup>(1)</sup>	-	-	Supply air temperature sensor
<b>AI 2</b>	<i>Wall Temp</i>	°C	32767 <sup>(1)</sup>	-	-	Wall unit temperature sensor
<b>AI 3</b>	<i>Wall Setpoint</i>	°C	23	AV 15	AV 14	Wall unit setpoint
<b>AI 4</b>	<i>Wall Fan Speed</i>	%	33	AV 28	AV 27	Wall unit fans speed
<b>AI 5</b>	<i>0-10V Input</i>	V	0	0	10	0-10V analog input
<b>Analog Output</b>						
<b>AO 0</b>	<i>Space Temperature</i>	°C	AI 0 or AI 2 <sup>(2)</sup>	-	-	Space temperature used for room control
<b>AO 1</b>	<i>Fan Out</i>	%	AV 1	AV 28	AV 27	Fan speed output
<b>AO 2</b>	<i>Heat Out</i>	%	0	0	100	Electrical heating output
<b>AO 3</b>	<i>Valve Out</i>	%	0	0	100	Valve output

**(1): If no sensor is plugged in the object will default to 32767**

**(2): AV 37 (Sensor Mode) is used to switch between RoomTemp sensor and WallTemp sensor**

**(3): Writing to an analog output 1-3 will result in the controller being overridden, i.e “HVAC TEST” mode.**

Object Instance	Object Name	Units	Default Value	Min	Max	Description
<i>Analog Value</i>						
<b>AV 0</b>	Setpoint	°C	23 <sup>(3)</sup>	AV 14	AV 13	Temperature setpoint used for room control
<b>AV 1</b>	Fan Speed	%	33	AV 28	AV 27	Setpoint used for fan speed
<b>AV 2</b>	Water temperature	°C	-1 <sup>(4)</sup>	-	-	Network water temperature
<b>AV 3</b>	Aux Heat Enable	%	-1	-1	100	Maximum % energy allowed for electrical heating
<b>AV 4</b>	Energy Hold Off	%	-1	-1	100	Total % energy saving (electrical heating & valve)
<b>AV 5</b>	Heat Energy <sup>(5)</sup>	Min	0	0	65535	Energy used by electrical heating (AO 2)
<b>AV 6</b>	Valve Energy <sup>(5)</sup>	Min	0	0	65535	Energy used by valve (AO 3)
<b>AV 7</b>	Device Instance	-	99000+MAC	0	4194304	BACnet Device Object ID
<b>AV 8</b>	MAC Address	-	63	0	127	BACnet MAC Address
<b>AV 9</b>	Analog Value	-	0	0	65535	Out Of Service <sup>(6)</sup>
<b>AV 10</b>	Cool Down Time	Sec	180	0	600	Fan runtime after power off & electrical heating on
<b>AV 11</b>	Cycle Delay	Sec	180	120	600	Switching delay between heating and cooling modes
<b>AV 12</b>	Stroke Time	Sec	90	0	600	Not implemented on any controllers
<b>AV 13</b>	RunTime	Min	0	0	180	Controller run down time <sup>(7)</sup>
<b>AV 14</b>	Setpoint Max	°C	28	14	30	Maximum setpoint
<b>AV 15</b>	Setpoint Min	°C	16	14	30	Minimum setpoint
<b>AV 16</b>	SP UnOcc Cool	°C	25	16	28	Unoccupied setpoint for cooling
<b>AV 17</b>	SP UnOcc Heat	°C	19	16	28	Unoccupied setpoint for heating
<b>AV 18</b>	Cooling Gain	-	100	0	1000	Gain used for cooling
<b>AV 19</b>	Heating Gain	-	100	0	1000	Gain used for heating
<b>AV 20</b>	Space Temp Gain	-	100	0	1000	Room temperature sensor gain

**(3): All setpoints are used as integer values**

**(4): If no value is send from the network, the controller will assume cold water**

**(5): The amount of time the given object was cooling/heating at 100%**

**(6): Object instance is not used in the internal control logic, present value is writable from the network**

**(7): Controller Run Down Time: inactive when set to '0'. Controller turns off after run down time has elapsed**

Object Instance	Object Name	Units	Default Value	Min	Max	Description
<b>Analog Value</b>						
AV 21	Space Temp Offset	°C	0	-10	10	Room temperature sensor offset
AV 22	Supply Temp Gain	-	100	0	1000	Supply temperature sensor gain
AV 23	Supply Temp Offset	°C	0	-10	10	Supply temperature sensor offset
AV 24	Wall Temp Offset	°C	-1	-10	10	Wall unit temperature sensor offset
AV 25	Dead Band	°C	0.5	0	10	Temperature control dead band
AV 26	Extra Heat Temp	°C	3	0	10	Temp difference between warm water and electrical heating
AV 27	Fan Speed Max	%	100	0	100	Maximum fan speed
AV 28	Fan Speed Min	%	0	0	100	Minimum fan speed
AV 29	Fan Voltage Max	V	10	0	10	Maximum voltage for analog fan (only for MM2BA30/70)
AV 30	Fan Voltage Min	V	0	0	10	Minimum voltage for analog fan (only for MM2BA30/70)
AV 31	Valve Voltage Max	V	10	0	10	Maximum voltage for analog valve (only for MM2BA50/70)
AV 32	Valve Voltage Min	V	0	0	10	Minimum voltage for analog valve (only for MM2BA50/70)
AV 33	Power Up Mode	-	0	0	2	Power status after reset - see "MODES"
AV 34	Fan Mode	-	0	0	1	Fan control mode (Manual / Auto)
AV 35	Valve Mode	-	0	0	1	Valve control mode (Normally Open / Normally Closed)
AV 36	Binary Input Mode	-	0	0	4	Binary Input (INP-1), see "MODES" table for more info
AV 37	Sensor Mode	-	0	0	1	Room temperature sensor selection mode
AV 38	Display Mode	-	0	0	1	Wall Unit temperature display mode, see "MODES" table
AV 39	Hardware Version	-	-	-	-	Controller hardware version <sup>(8)</sup>
AV 40	Warm Start	-	0	1	1	Re-initialize using a warm start (write a 1 to Present Value)
AV 41	Cold Start	-	0	33626	33626	Re-initialize using a cold start (write 33626 to Present Value)
AV 42	T2Mode	-	0	0	1	Mode used for T2 temperature sensor - see "MODES"
AV 43	Software Version	-	-	-	-	Controller software version <sup>(9)</sup>

(8): Hardware version of controller :

<b>MM2BA10</b>	-	<b>16</b>
<b>MM2BA20</b>	-	<b>32</b>
<b>MM2BA30</b>	-	<b>48</b>
<b>MM2BA50</b>	-	<b>80</b>
<b>MM2BA60</b>	-	<b>96</b>
<b>MM2BA70A</b>	-	<b>112</b>
<b>MM2BA70B</b>	-	<b>112</b>
<b>MM2BA70C</b>	-	<b>112</b>
<b>MM2BA70D</b>	-	<b>112</b>

Fan Type	Valve Type	Heater Type
3 Step	On/Off	On/Off
3 Step	On/Off	PWM
0-10V	On/Off	On/Off
3 Step	0-10V	On/Off
3 Step	6-way Belimo	None
0-10V	0-10V	0-10V
0-10V	On/Off	PWM
0-10V	0-10V	On/Off
0-10V	On/Off	0-10V

Object Instance	Object Name	Units	Default Value	Min	Max	Description
<b>Binary Input</b>						
<b>BI 0</b>	<i>Binary Input</i>	-	0	0	1	Binary Input (INP-1), by default acts as occupancy input
<b>Binary Output</b>						
<b>BO 0</b>	<i>Binary Output</i>	-	0	0	1	Binary Output, by default acts as occupancy output
<b>Binary Value</b>						
<b>BV 0</b>	<i>Extra Heat</i>	-	1	0	1	Use electrical heating together with warm water
<b>BV 1</b>	<i>Power</i>	-	AV 33	0	1	Power state of device (on/off)
<b>Multi State Input</b>						
<b>MSI 0</b>	<i>HVAC Status</i>	-	5	0	10	HVAC mode of controller, see "MODES" table for more info

## MODES

Object Instance	Object Name	Mode	Value	Description
<b>AV 33</b>	<i>Power Up Mode</i>	POWER AUTO	0	Power remains the same after reset
		POWER ON	1	Always on after reset
		POWER OFF	2	Always off after reset
<b>AV 34</b>	<i>Fan Mode</i>	MANUAL	0	Manual fan speed
		AUTO	1	Automatic fan speed
<b>AV 35</b>	<i>Valve Mode</i>	NORMAL	0	Normally closed valve
		REVERSE	1	Normally open valve
<b>AV 36</b>	<i>Binary Input Mode</i>	OCCUPANCY	0	Binary input used as occupnacy sensor input
		FAN ONLY	1	Inactive input results in fan only mode
		ON/OFF	2	Inactive input turns system power on or off
		HEATER INTERLOCK	3	Binary input used as heater interlock
		DEHUMIDIFICATION	4	Humidistat function for dehumidification
<b>AV 37</b>	<i>Sensor Mode</i>	T1 SENSOR	0	Room temp sensor used as space temp
		WALL UNIT SENSOR	1	Wall unit sensor used as sapce temp
<b>AV 38</b>	<i>Display Mode</i>	SETPOINT DISPLAY	0	Wall unit displays Setpoint as default
		SENSOR DISPLAY	1	Wall unit displays SpaceTemp as default
<b>MSI 0</b>	<i>HVAC Status</i>	HVAC_NULL	1	No status to report – not used
		HVAC_AUTO	2	Auto status – not used
		HVAC_HEAT	3	Controller is heating
		HVAC_COOL	4	Controller is cooling
		HVAC_OFF	5	Controller is off
		HVAC_TEST	6	Analog output override
		HVAC_FAN_ONLY	7	Only fans are running
		HVAC_CYCLEDELAY	8	Switching delay between cooling & heating
		HVAC_COOLDOWN	9	Cooldown delay after electrical heating
		HVAC_DEHUMIDIFY	10	Humidistat input forces controller into dehumidification mode

## **BACnet object properties supported**

*\* Only properties mentioned in this section are supported, all other properties will return a “Unsupported Property” error.*

### **Device Object Properties**

<b>Property Identifier</b>	<b>Property Datatype</b>	<b>Conformance Code</b>
Object_Identifier	BACnetObjectIdentifier – ObjID	Read/Write
Object_Name <sup>(1)</sup>	CharacterString	Read/Write
Object_Type	BACnetObjectType – Enumerated	Read-Only
System_Status	BACnetDeviceStatus – Enumerated	Read-Only
Vendor_Name	CharacterString	Read-Only
Vendor_Identifier	Unsigned 16	Read-Only
Model_Name	CharacterString	Read-Only
Firmware_Revision	CharacterString	Read-Only
Application_Software_Revision	CharacterString	Read-Only
Protocol_Version	Unsigned	Read-Only
Protocol_Revision	Unsigned	Read-Only
Protocol_Services_Supported	BACnetServicesSupported – BitString	Read-Only
Protocol_Object_Type_Supported	BACnetObjectTypeSupported – BitString	Read-Only
Object_List	BACnetArray[n]	Read-Only
Max_APDU_Length_Accepted	Unsigned	Read-Only
Segmentation_Supported	BACnetSegmentation – Enumerated	Read-Only
APDU_Timeout	Unsigned	Read-Only
Number_Of_APDU_Retries	Unsigned	Read-Only
Max_Master <sup>(2)</sup>	Unsigned (1 ... 127)	Read/Write
Max_Info_Frames	Unsigned	Read-Only

**(1): Object\_Name**

**1: Default Name → MM2BAC Device  
Writable with max 16 characters  
Name stored in non-volatile ROM**

**(2): Max\_Master**

**2: The value of max master specifies the highest possible address for master nodes,  
and shall be less than or equal to 127**

### Analog Input Properties

Property Identifier	Property Datatype	Conformance Code
Object_Identifier	BACnetObjectIdentifier – ObjID	Read-Only
Object_Name	CharacterString	Read-Only
Object_Type	BACnetObjectType – Enumerated	Read-Only
Present_Value	REAL	Read (writable when out of service)
Status_Flags <sup>(3)</sup>	BACnetStatusFlags – BitString	Read-Only
Event_State	BACnetEventState – Enumerated	Read-Only
Out_Of_Service	BOOLEAN	Read-Only
Units	BACnetEngineeringUnits – Enumerated	Read-Only

### Analog Output Properties

Property Identifier	Property Datatype	Conformance Code
Object_Identifier	BACnetObjectIdentifier – ObjID	Read-Only
Object_Name	CharacterString	Read-Only
Object_Type	BACnetObjectType – Enumerated	Read-Only
Present_Value <sup>(4)</sup>	REAL	Read/Write (commandable)
Status_Flags <sup>(3)</sup>	BACnetStatusFlags – BitString	Read-Only
Event_State	BACnetEventState – Enumerated	Read-Only
Out_Of_Service	BOOLEAN	Read-Only
Units	BACnetEngineeringUnits – Enumerated	Read-Only
Priority_Array	BACnetPriorityArray – Complex	Read-Only
Relinquish_Default <sup>(5)</sup>	REAL	Read-Only

**(3): Status\_Flags**

**4-bit string → { IN\_ALARM, FAULT, OVERRIDEN, OUT\_OF\_SERVICE }**

**(4): Present\_Value**

***If an attempt is made to write to a commandable present value without explicitly specifying the priority, a default priority of 16 (the lowest priority) shall be used. Except if the object is Out\_Of\_Service, then the prioritization mechanism will be bypassed and the value will be placed directly into the Present\_Value property***

**(5): Relinquish\_Default**

***The controllers internal logic is written to Relinquish\_Default. Present\_Value will be equal to Relinquish\_Default only if the Priority\_Array is empty***

### Analog Value Properties

Property Identifier	Property Datatype	Conformance Code
Object_Identifier	BACnetObjectIdentifier – ObjID	Read-Only
Object_Name	CharacterString	Read-Only
Object_Type	BACnetObjectType – Enumerated	Read-Only
Present_Value	REAL	Read (writable when out of service)
Status_Flags	BACnetStatusFlags – BitString	Read-Only
Event_State	BACnetEventState – Enumerated	Read-Only
Out_Of_Service	BOOLEAN	Read-Only
Units	BACnetEngineeringUnits – Enumerated	Read-Only

### Binary Input Properties

Property Identifier	Property Datatype	Conformance Code
Object_Identifier	BACnetObjectIdentifier – ObjID	Read-Only
Object_Name	CharacterString	Read-Only
Object_Type	BACnetObjectType – Enumerated	Read-Only
Present_Value	BACnetBinaryPV – Enumerated	Read (writable when out of service)
Status_Flags	BACnetStatusFlags – BitString	Read-Only
Event_State	BACnetEventState – Enumerated	Read-Only
Out_Of_Service	BOOLEAN	Read-Only
Inactive_Text	CharacterString	Read-Only
Active_Text	CharacterString	Read-Only



## **Binary Output Properties**

<b>Property Identifier</b>	<b>Property Datatype</b>	<b>Conformance Code</b>
Object_Identifier	BACnetObjectIdentifier – ObjID	Read-Only
Object_Name	CharacterString	Read-Only
Object_Type	BACnetObjectType – Enumerated	Read-Only
Present_Value	BACnetBinaryPV – Enumerated	Read/Write (commandable)
Status_Flags	BACnetStatusFlags – BitString	Read-Only
Event_State	BACnetEventState – Enumerated	Read-Only
Out_Of_Service	BOOLEAN	Read-Only
Polarity <sup>(6)</sup>	BACnetPolarity	Read/Write
Inactive_Text	CharacterString	Read-Only
Active_Text	CharacterString	Read-Only
Priority_Array	BACnetPriorityArray – Complex	Read-Only
Relinquish_Default	BACnetBinaryPV – Enumerated	Read-Only

### **(6): Polarity**

***This property, of BACnetBinaryPV, reflects the logical state of the binary output object. The logical state of the output shall be either INACTIVE or ACTIVE. The relationship between the present value and the physical state of the output is determined by the Polarity property. The possible states are summarized below:***

<b>Present Value</b>	<b>Polarity</b>	<b>Physical State of Output</b>	<b>Physical State of Device</b>
INACTIVE	NORMAL	OFF or INACTIVE	NOT running
ACTIVE	NORMAL	ON or ACTIVE	Running
INACTIVE	REVERSE	ON or ACTIVE	NOT running
ACTIVE	REVERSE	OFF or INACTIVE	Running

### **Binary Value Properties**

<b>Property Identifier</b>	<b>Property Datatype</b>	<b>Conformance Code</b>
Object_Identifier	BACnetObjectIdentifier – ObjID	Read-Only
Object_Name	CharacterString	Read-Only
Object_Type	BACnetObjectType – Enumerated	Read-Only
Present_Value	REAL	Read (writable when out of service)
Status_Flags	BACnetStatusFlags – BitString	Read-Only
Event_State	BACnetEventState – Enumerated	Read-Only
Out_Of_Service	BOOLEAN	Read-Only

### **Multi State Input Properties**

<b>Property Identifier</b>	<b>Property Datatype</b>	<b>Conformance Code</b>
Object_Identifier	BACnetObjectIdentifier – ObjID	Read-Only
Object_Name	CharacterString	Read-Only
Object_Type	BACnetObjectType – Enumerated	Read-Only
Present_Value	REAL	Read (writable when out of service)
Status_Flags	BACnetStatusFlags – BitString	Read-Only
Event_State	BACnetEventState – Enumerated	Read-Only
Out_Of_Service	BOOLEAN	Read-Only
Number_Of_States	Unsigned	Read-Only
State_Text	BACnetArray[n] of characters	Read-Only

## MAC Addressing

The MAC address is set via onboard DIPswitches. The configuration of the DIP switches is such that switch 1 = LSB, and switch 7 = MSB with a value of 1 = ON and a value of 0 = OFF. The MAC address of the device must be unique within its network, and must be in the range 0 to 127. It is an integer value, and cannot be changed over the network.

DIP switch configuration

MAC	1	2	3	4	5	6	7
0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0
2	0	1	0	0	0	0	0
3	1	1	0	0	0	0	0
4	0	0	1	0	0	0	0
5	1	0	1	0	0	0	0
6	0	1	1	0	0	0	0
7	1	1	1	0	0	0	0
8	0	0	0	1	0	0	0
9	1	0	0	1	0	0	0
10	0	1	0	1	0	0	0
11	1	1	0	1	0	0	0
12	0	0	1	1	0	0	0
13	1	0	1	1	0	0	0
14	0	1	1	1	0	0	0
15	1	1	1	1	0	0	0
16	0	0	0	0	1	0	0
17	1	0	0	0	1	0	0
18	0	1	0	0	1	0	0
19	1	1	0	0	1	0	0
20	0	0	1	0	1	0	0
21	1	0	1	0	1	0	0
22	0	1	1	0	1	0	0
23	1	1	1	0	1	0	0
24	0	0	0	1	1	0	0
25	1	0	0	1	1	0	0
26	0	1	0	1	1	0	0

DIP switch configuration

MAC	1	2	3	4	5	6	7
27	1	1	0	1	1	0	0
28	0	0	1	1	1	0	0
29	1	0	1	1	1	0	0
30	0	1	1	1	1	0	0
31	1	1	1	1	1	0	0
32	0	0	0	0	0	1	0
33	1	0	0	0	0	1	0
34	0	1	0	0	0	1	0
35	1	1	0	0	0	1	0
36	0	0	1	0	0	1	0
37	1	0	1	0	0	1	0
38	0	1	1	0	0	1	0
39	1	1	1	0	0	1	0
40	0	0	0	1	0	1	0
41	1	0	0	1	0	1	0
42	0	1	0	1	0	1	0
43	1	1	0	1	0	1	0
44	0	0	1	1	0	1	0
45	1	0	1	1	0	1	0
46	0	1	1	1	0	1	0
47	1	1	1	1	0	1	0
48	0	0	0	0	1	1	0
49	1	0	0	0	1	1	0
50	0	1	0	0	1	1	0
51	1	1	0	0	1	1	0
52	0	0	1	0	1	1	0
53	1	0	1	0	1	1	0

DIP switch configuration

MAC	1	2	3	4	5	6	7
54	0	1	1	0	1	1	0
55	1	1	1	0	1	1	0
56	0	0	0	1	1	1	0
57	1	0	0	1	1	1	0
58	0	1	0	1	1	1	0
59	1	1	0	1	1	1	0
60	0	0	1	1	1	1	0
61	1	0	1	1	1	1	0
62	0	1	1	1	1	1	0
63	1	1	1	1	1	1	0
64	0	0	0	0	0	0	1
65	1	0	0	0	0	0	1
66	0	1	0	0	0	0	1
67	1	1	0	0	0	0	1
68	0	0	1	0	0	0	1
69	1	0	1	0	0	0	1
70	0	1	1	0	0	0	1
71	1	1	1	0	0	0	1
72	0	0	0	1	0	0	1
73	1	0	0	1	0	0	1
74	0	1	0	1	0	0	1
75	1	1	0	1	0	0	1
76	0	0	1	1	0	0	1
77	1	0	1	1	0	0	1
78	1	0	1	0	0	0	1
79	1	1	1	1	0	0	1
80	0	0	0	0	1	0	1

DIP switch configuration

MAC	1	2	3	4	5	6	7
81	1	0	0	0	1	0	1
82	0	1	0	0	1	0	1
83	1	1	0	0	1	0	1
84	0	0	1	0	1	0	1
85	1	0	1	0	1	0	1
86	0	1	1	0	1	0	1
87	1	1	1	0	1	0	1
88	0	0	0	1	1	0	1
89	1	0	0	1	1	0	1
90	0	1	0	1	1	0	1
91	1	1	0	1	1	0	1
92	0	0	1	1	1	0	1
93	1	0	1	1	1	0	1
94	0	1	1	1	1	0	1
95	1	1	1	1	1	0	1
96	0	0	0	0	0	1	1
97	1	0	0	0	0	1	1
98	0	1	0	0	0	1	1
99	1	1	0	0	0	1	1
100	0	0	1	0	0	1	1
101	1	0	1	0	0	1	1
102	0	1	1	0	0	1	1
103	1	1	1	0	0	1	1
104	0	0	0	1	0	1	1
105	1	0	0	1	0	1	1
106	0	1	0	1	0	1	1
107	1	1	0	1	0	1	1

DIP switch configuration

MAC	1	2	3	4	5	6	7
108	0	0	1	1	0	1	1
109	1	0	1	1	0	1	1
110	0	1	1	1	0	1	1
111	1	1	1	1	0	1	1
112	0	0	0	0	1	1	1
113	1	0	0	0	1	1	1
114	0	1	0	0	1	1	1
115	1	1	0	0	1	1	1
116	0	0	1	0	1	1	1
117	1	0	1	0	1	1	1
118	0	1	1	0	1	1	1
119	1	1	1	0	1	1	1
120	0	0	0	1	1	1	1
121	1	0	0	1	1	1	1
122	0	1	0	1	1	1	1
123	1	1	0	1	1	1	1
124	0	0	1	1	1	1	1
125	1	0	1	1	1	1	1
126	0	1	1	1	1	1	1
127	1	1	1	1	1	1	1