



UNIT INFORMATION

Corp. 0926-L11
10/2014 (Supersedes4/2014)



M2 BACnet® Module

Service Literature

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General

This document is provided to assist in the integration of the prodigy controller to the building automation system.

This BACnet module does not require any Lennox proprietary software or interface in order for the BACnet module to function with the prodigy control system.

The M2 BACnet® Module (BM2) allows communication between the Lennox M2 Unit Controller and a BACnet® MS/TP network. This module is mounted directly to the M2 Unit Controller board.

The M2 BACnet® Module has been developed to communicate with building automation systems that support the BACnet Application Specific Controller (B-ASC) device profile.

M2 BACnet® module is certified to ANSI/ASHRAE 135-2008 and is BTL Listed.

Table 1. M2 BACnet® Module Specifications and Default Settings

Environment	
Operating temperature range	-40F to 155F
Storage temperature range	-40F to 185F
RH	10-95% RH non-condensing
Field Connections	
BACnet® MS/TP	See PIC statement on Page 38.
Transceiver	RS-485
Connector	Three-position terminal block (+ G -)
Baud Rate	Selectable 9.6, 19.2, 38.4, 76.8K
Cable Type	Twisted pair w/shield, 22AWG min. Belden type 88761 or 8761. Lennox 27M19, 94L63 or 68M25
Max. Cable Length	4000 ft. repeater is required for longer lengths.
Bus Termination	120 ohm resistor on last module in chain.
Default Values	
device Max_Master	127
device Max_Info_Frames	1
device Object_Identifier	MAC address
device Object_Name	"Lennox_M2_" + MAC address
device Location	"US"
device Description	"Lennox HVAC Controller"
baud rate	38.4k
recommended update rate	2 minutes (before software v7.08) at least once every 12 minutes (software v7.08 and later)
communication time-out	5 minutes (before software v7.08) 15 minutes (software v7.08 and later)

Cabling Guidelines

The M2 BACnet® Module is compatible with MS/TP EIA-485 daisy-chain networks communicating at 9.6, 19.2, 38.4, and 76.8 kbps. Connect the BACnet® MS/TP network cable to the M2 BACnet® module. It is compatible with twisted pair, shielded 22AWG minimum cable such as Belden 8761, 88761 and Lennox catalog numbers 27M19, 94L63 or 68M25. A maximum of 32 M2 BACnet® modules can be included per network segment. Up to 127 units can be connected per network segment by using repeater for every 32 devices.

The network cable should be routed using best practices to avoid induced noise. Do not route alongside high voltage wiring or in proximity to high-voltage or high-frequency devices, such as ignition controls and variable frequency drives. The BACnet MS/TP recommended maximum total bus length (without repeater) is 4000 ft. (1219m) applies to this device.

Network Bus Termination

When the M2 BACnet® Module is at the end of a daisy chain, connect a 120 ohm resistor across the '+' and '-' terminals. Every BACnet® MS/TP chain should have a termination at each end of the chain (exactly two terminations; see *Lennox BACnet Topology* on next page).

⚠ IMPORTANT

A qualified systems integrator with adequate training and experience is required to integrate and commission the M2 BACnet Module into a third party BACnet building automation system. A BACnet configuration software tool is required to commission the BACnet network.

M2 BACnet Module Installation

1. Connect the BACnet SmartWire™ connector as shown in figure 1.
2. No adjustment is necessary to the BACnet module unless the module is at the end of a daisy-chained configuration. In that case, it is recommended to place a 120 ohm resistor across the '+' and '-' terminals.
3. To configure Prodigy® Controller BACnet® options, refer to the Prodigy® M2 Unit Controller Installation and Setup guide (506215-01).
4. Upon power up, the M2 Unit Controller will recognize the BACnet module and begin communications provided the network has been correctly configured.

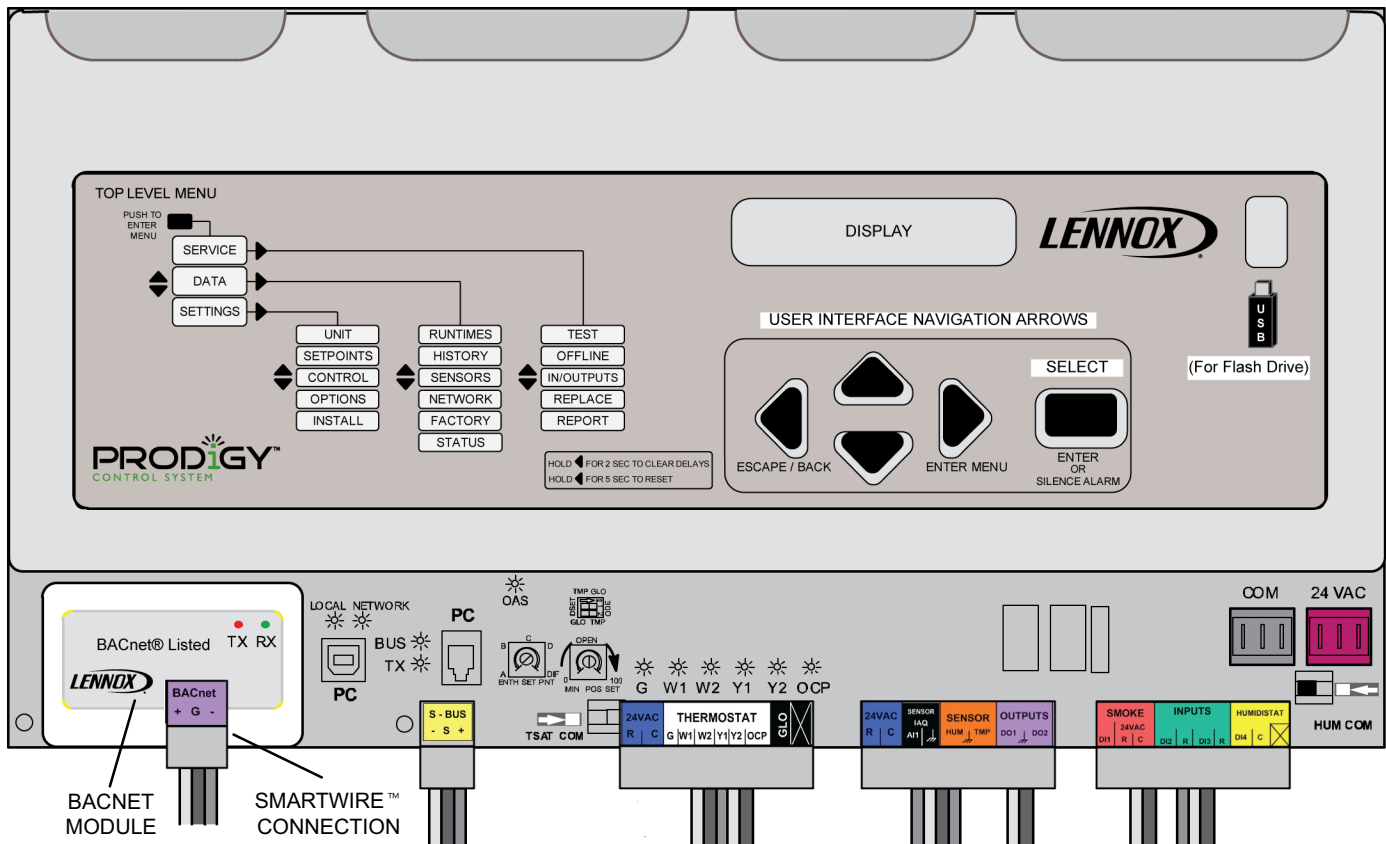
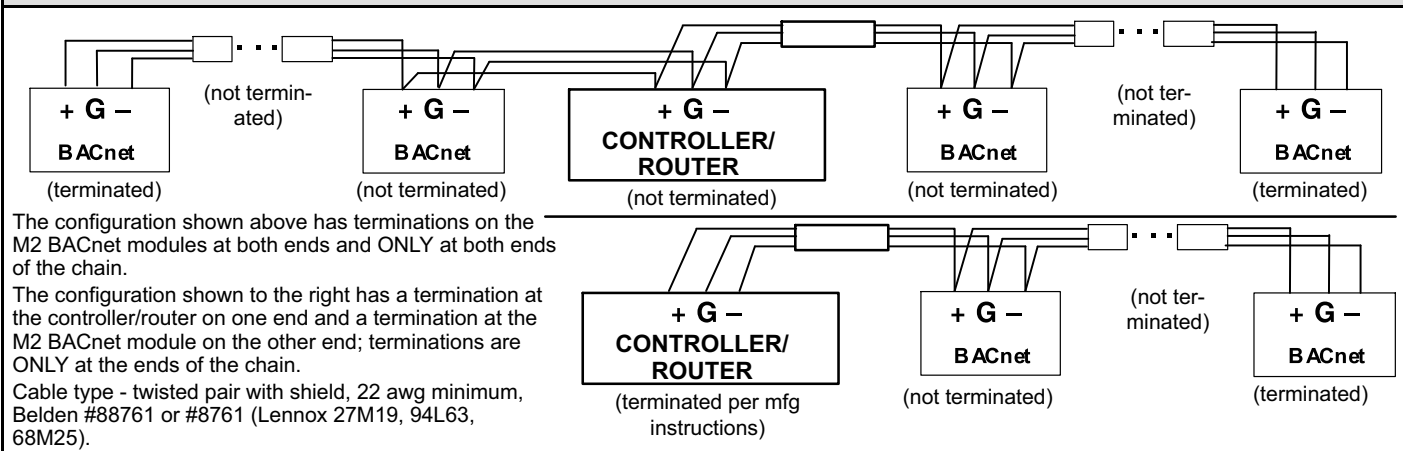


Figure 1. M2 BACnet® Module (BP1)

Lennox BACnet Topology



General BACnet MS/TP guidelines

1. Set all BACnet® devices on an MS/TP network to consecutive MAC addresses, starting at 1, so that there are no gaps between MAC address values.
2. Set Max_Master device property on all devices to match the largest MAC address on the network. Note, this could be larger than existing network to allow for adding devices to the network without the need to adjust the Max_Master property in the future. (Contact Lennox Technical Support for more detailed information).
3. Use ReadPropertyMultiple service instead of ReadProperty service when reading multiple analog inputs or values.

- Space Temp - AO113
- RH - property ID 536
- CO2 - property ID 537

If any of the following BACnet Points are being used, they must be updated every 8 minutes:

- AO101 (network thermostat remote demand mode only)
- AO109, AV130-133
- AO104 if not using setpoint control

M2 defaults to "occupied" state for local control following loss of network data. If you prefer default state to be "unoccupied" please change the value of ECTO 8.26 to 0. The M2 Controller does not require a JUMPER for occupancy at the M2 Controller terminals for ZONE/REMOTE modes of operations.

Prodigy Control Mode Options

These are the control mode descriptions from the M2 controller menu (SETTINGS > CONTROL > BACNET > CONTROL MODE):

MONITOR ONLY - In this mode, the rooftop unit is controlled by M2 thermostat inputs. The M2 will not respond to set points or application mode demands related to heating/cooling sent over the network.

ZONE - In this mode, the rooftop unit is controlled by zone temperature setpoints (AO109, AV130 - AV133) and

4. Do not exceed the maximum recommended length (1200 M / 4000 ft.) for any MS/TP segment.
5. All MS/TP network segment ends should be terminated per control provider's instructions.
6. To minimize communication compatibility problems, BACnet gateways or BACnet devices that are NOT BTL listed should be avoided.

Lennox Control Requirements

Since the M2 controller does not "store" any commands sent, all BACnet control points utilized must be updated after every M2 controller reset.

If any of the following BACnet Points are being used, they must be updated every 2 minutes:

occupancy state (AO104). Zone temperature is monitored and compared to the appropriate zone temperature setpoints. Zone temperature can be provided by local sensor or network value (AO113).

REMOTE - In this mode, the rooftop unit is controlled by network demands for heating/cooling in the form of application mode commands (AO101). This mode assumes a remote thermostat sending remote demands AO101 values 208, 209, and 224 - 236.

ZONE and REMOTE - Occupancy demands must be sent using AO103, AO104 or AO107. See Appendix C for further details.

Backup Sensor Modes

Under certain conditions, the Prodigy controller will go into one of the backup modes of operation as described in Prodigy M2 Controller manual (506215-01).

When backup sensor mode is entered, a code 93 will be broadcast over BACnet as well as displayed at the prodigy controller display. Backup mode options available are:

- RAT: (Return Air Temperature) sensor located on all prodigy controlled equipment is the secondary sensor resource
- TSTAT: (Thermostat) inputs are the secondary sensor input source - requires equipment reset in order to recover once primary sensor data is corrected.
- NONE: Unit Idle / Off

Control Mode Descriptions

Select control modes via menu options: **SETTINGS > CONTROL > BACNET > ... > CONTROL MODE > ZONE**

LENNOX ZONE SENSOR CONTROL

ECTO values are expected to be as follows:

- ECTO 6.01 option range 1-3
(M2 Menu selection: CONTROL MODE > ZONE)
- ECTO 5.27 equal to 0
(M2 Menu selection: NETWORK SENSOR > TEMP > NO)

Lennox Zone Sensor must be installed and wired to the M2 SENSOR inputs (see Figure 1). M2 may be controlled using BACnet commands AO109 or AV130-133.

Lennox zone sensor must be installed and wired to M2 sensor inputs. After power up, the rooftop unit (RTU) will be in IDLE mode for up to 2 minutes (specified by ECTO 5.25, defaults to 2 minutes), unless set points are sent over BACnet.

Controller sequence:

1. Setpoints not sent: Lennox zone sensor must be installed and wired to M2 sensor inputs. After power up, RTU will be in IDLE mode for up to 2 minutes (specified by ECTO 5.25, defaults to 2 minutes), unless set points are sent over BACnet. RTU will
- ECTO 6.01 option range 1-3 (CONTROL MODE > ZONE)
 - ECTO 5.27 equal to 2. (Other sensor data options are available. Please refer to Insert reference to M2 manual document)

Controller sequence:

1. Network sensor data not sent: Lennox zone sensor must be installed and wired to M2 sensor inputs. After power up, RTU will be in IDLE mode for up to 5 minutes awaiting network sensor data (Alarm 110 WAITING FOR NETWORK SENSOR DATA). After 5 minutes, M2 will enter backup sensor mode of operation displaying Alarm 93. M2 will utilize specified temperature setpoints and available sensor data for normal operation.
- ECTO 6.01 range 4-7 (CONTROL MODE > ZONE)
 - ECTO 5.27 equal to 0 (NETWORK SENSOR > TEMP > NO)

Controller sequence:

1. Network demands not sent: After power up, RTU will be in IDLE mode for up to 5 minutes awaiting network demand data (AO101 range 208, 209, 224 – 236). After 5 minutes, M2 will enter backup sensor mode of operation displaying "Alarm 93 BACKUP MODE" and also broadcast Alarm 93 over BACnet. M2 will utilize specified temperature setpoints and available sensor data for backup mode operation.

switch over to Zone sensor mode operation specified in ECTO 6.01. Base on ECTO 8.26 (Unit_Run_Options), M2 will utilize specified temperature setpoints and zone sensor data for normal operation. M2 will switch over to Zone sensor backup mode operation if there is no Lennox zone temperature input.

2. Set points are sent over BACnet before 2 minutes startup delay: RTU will operate based on these set points and the temperature read from the Lennox zone sensor. In the event of a subsequent network communication failure (no application level BACnet packets for 15 minutes), RTU will reset.

NETWORK ZONE SENSOR CONTROL

ECTO values are expected to be as follows:

2. Network sensor data are sent over BACnet before 5 minute delay: RTU will operate based on specified set points and the network sensor data. In the event of a subsequent network communication failure (no network sensor data for 5 minutes), RTU will display Alarm 73 (NETWORK SENSOR ERROR). If and when all the BACnet network sensor inputs are received, Alarm 73 will be removed.

NETWORK REMOTE THERMOSTAT CONTROL

ECTO values are expected to be as follows:

2. Network demands are sent over BACnet before 5 minute delay: RTU will operate based on these network demands. In the event of a subsequent network communication failure (no BACnet network demand packets for 15 minutes), RTU will switch over to Remote Demand backup mode operation specified in ECTO 6.01 and the RTU will display "Alarm 93 BACKUP MODE".

Troubleshooting

Use table 2 as a guide once the BACnet network is set up and operating.

LED	Action
BACnet communication transmit and receive LEDs flash.	None. Indicates normal communication.
BACnet communication LEDs are off or intermittently go off for periods of 1 second or longer.	<ol style="list-style-type: none"> 1. Check BACnet network connections. 2. Make sure BACnet network is commissioned. 3. Make sure each unit has a unique MAC address in the range of 0 to 127. 4. Verify same baud rate on all devices.
GREEN only	ON BACNET NETWORK NO SEND/RECIEVE = Action - none
YELLOW only	NOT ON NETWORK - 1. Check BACnet network connections.

Control following a connection failure depends on where the failure occurs, and which input device has been used.

Property name	Property Value	Data type	Access
Description	"Lennox RTU HVAC Controller"	Char String	RW
Object_Identifier	2 (default value)	Integer (1-4194302)	RW
Object_Name	Lennox_M2_2 (default value)	Char String (32 char. max.)	RW
Vendor name	"Lennox"	Char String	R
Model name	"M2"	Char String	RW
Firmware revision	Firmware version dependent	Char String	R
Application software revision	Firmware version dependent	Char String	R
Location	"Location"	Char String (32 char. max.)	RW
Vendor identifier	255	Integer	R
Max APDU length accepted	480	Integer	R
Max Master	480	Integer (1-127)	RW
Segmentation supported	FALSE	Boolean	R
Max Info frames	1	Integer (1-65535)	RW
Unit serial number	Factory set	Integer	R

Lennox Proprietary Objects		Device Objects						
Property	Description	Compressor	Heating	Blower	Economizer	Space Air	Discharge Air	Outdoor Air
Object_Identifier	Object_Identifier is a Read Only (RO) property, used to identify the Object and it is unique within Lennox BACnet Device.	•	•	•	•	•	•	•
Object_Name	Object_Name is a Read Only (RO) property use to name the Object and is unique within the BACnet Device. The minimum length of the string is one character.	•	•	•	•	•	•	•
Object_Type	Object_Type is a Read Only (RO) property and is one of the following: OBJECT_LNX_COMPRESSOR, OBJECT_LNX_HEATING, OBJECT_LNX_BLOWER, OBJECT_LNX_ECONOMIZER, OBJECT_LNX_INDOOR_AIR, OBJECT_LNX_DISCHARGE_AIR, OBJECT_LNX_OUTDOOR_AIR.	•	•	•	•	•	•	•
Out_Of_Service	Out_Of_Service is a Read Only (RO) property that indicates whether the physical component that the object represents is in service or not.	•	•	•	•			
Lennox_Object_Installed	Lennox_Object_Installed is a Read Only (RO) property that indicates whether the physical component that the object represents is installed in the RTU or not. Unless the value of this property is TRUE, all other properties of the Compressor, Heat Stage, or Economizer object instance are invalid.	•	•		•			
Lennox_Object_Running	Lennox_Object_Running is a Read Only (RO) property that indicates that the component is not running if the value is zero and that the component is running if a value greater than zero (range: 0, 100). Components capable of reporting values of more granular detail, i.e. all the integer values in the range of 0 – 100, as percent capacity utilization, then that value is reported by this property. Other components will only show ON or OFF.	•	•	•	•			
Lennox_Object_Run_Time	Lennox_Object_Run_Time is a Read Only (RO) property that indicates in minutes the time the corresponding component has been running (range: 0, 4294967295). Internally the time that the compressor has been running is stored into EEPROM once every hour. Therefore, in the event power turns off, the value returned when power turns back on will be the last stored value. This can result in a loss of run-time value up to an hour for each power cycle event.	•	•	•	•			
Lennox_Object_Min_Cycle_Time	Lennox_Object_Min_Cycle_Time is a Read Only (RO) property that indicates in seconds the minimum time the corresponding component must run in any given cycle (range: 0, 4294967295). This prevents short cycles to help protect the component. (This property does not apply to Electric Heat Stage components.)	•	•					
Lennox_Object_Cycle_Count	Lennox_Object_Cycle_Count is a Read Only (RO) property that indicates the number of cycles the corresponding component has been running (range: 0, 4294967295).	•	•	•	•			
Lennox_Object_Error	Lennox_Object_Error is a Read Only (RO) property that reports any error code the corresponding component may have encountered (range: 0, 255). A value of 0 means no error while any non-zero value represent an error.	•	•	•	•			
Lennox_Object_Heat_Type	Lennox_Object_Heat_Type is a Read Only (RO) property that indicates the source of power used to run the component (range: 0, 255). The interpreted values are: 1-Gas; 2-Electric; 3-Heat Pump mode.		•					
Object_Temperature	Object_Temperature is a Read Write (RW) property that Indicates the temperature. The units of measurement for this property are Degrees Fahrenheit.					•	•	•
Object_Relative_Humidity	Object_Relative_Humidity is a Read Write (RW) property that represents relative humidity of space air, measured as a percentage.					•		
Object_CO2_Level	Object_CO2_Level is a Read Write (RW) property that indicates the CO2 levels in the space air, measured in PPM.					•		
Object_Duct_Static_Pressure_Setpoint	Object_Duct_Static_Pressure_Setpoint is a Read Only (RO) property that represents the Duct Static Pressure Setpoint of Discharge Air, measured in inches of water column (range: 0, 5).					•		

Table 4. Lennox Proprietary Objects - Compressor (Object ID: 136)

Property	Property ID	Data type and range	Access	Description
Object_Identifier	75	Integer (0-4194302)	Read Only	Numeric code that identifies the object (unique within Lennox BACnet Device).
Object_Name	77	character string of 1 character (min.) to 32 characters (max.)	Read Only	Identifies the Object and is unique within the BACnet Device.
Object_Type	79	136 (OBJECT_LNX_COMPRESSOR)	Read Only	Indicates membership in a particular object type class.
Out_Of_Service	81	TRUE or FALSE	Read Only	Indicates whether the compressor is in service or not.
Lennox_Object_Installed	513	TRUE or FALSE	Read Only	Indicates whether the compressor is installed or not. Unless the value of this property is TRUE, all other properties of the Compressor object instance are invalid.
Lennox_Object_Running	514	Integer (0 - 100)	Read Only	Indicates that the compressor is not running if the value is zero and that the compressor is running if a value greater than zero (range: 0, 100).
Lennox_Object_Run_Time	515	Integer (0 - 4294967295) minutes	Read Only	Indicates the time the compressor has been running. Internally, the time that the compressor has been running is stored into EEPROM once every hour. Therefore, in the event power turns off, the value returned when power turns back on will be the last stored value. This can result in a loss of run-time value up to an hour for each power cycle event.
Lennox_Object_Min_Cycle_Time	516	Integer (0 - 4294967295) seconds	Read Only	Indicates the minimum time the compressor must run in any given cycle. This prevents short cycles to help protect the compressor.
Lennox_Object_Cycle_Count	517	Integer (0 - 4294967295) cycles	Read Only	Indicates the number of cycles the compressor has been running.
Lennox_Object_Error	518	Integer (0 - 255)	Read Only	Reports any error code the compressor may have encountered. A value of 0 means no error while any non-zero value represent an error.

Table 5. Lennox Proprietary Objects - Blower (Object ID: 129)

Property	Property ID	Data type and range	Access	Description
Object_Identifier	75	Integer (0-4194302)	Read Only	Numeric code that identifies the object (unique within Lennox BACnet Device)
Object_Name	77	character string of 1 character (min.) to 32 characters (max.)	Read Only	Identifies the Object and is unique within the BACnet Device.
Object_Type	79	129 (OBJECT_LNX_BLOWER)	Read Only	Indicates membership in a particular object type class.
Out_Of_Service	81	TRUE or FALSE	Read Only	Indicates whether the blower is in service or not.
Lennox_Object_Running	514	Integer (0 - 100)	Read Only	Indicates that the blower is not running if the value is zero and that the blower is running if a value greater than zero (range: 0, 100 or possible values).
Lennox_Object_Run_Time	515	Integer (0 - 4294967295) minutes	Read Only	Indicates the time the blower has been running. Internally, the time that the blower has been running is stored into EEPROM once every hour. Therefore, in the event power turns off, the value returned when power turns back on will be the last stored value. This can result in a loss of run-time value up to an hour for each power cycle event.
Lennox_Object_Cycle_Count	517	Integer (0 - 4294967295) cycles	Read Only	Indicates the number of cycles the blower has been running
Lennox_Object_Error	518	Integer (0 - 255)	Read Only	Reports any error code the blower may have encountered. A value of 0 means no error while any non-zero value represent an error.

Table 6. Lennox Proprietary Objects - Heating (Object ID: 130)

Property	Property ID	Data type and range	Access	Description
Object_Identifier	75	Integer (0-4194302)	Read Only	Numeric code that identifies the object (unique within Lennox BACnet Device).
Object_Name	77	character string of 1 character (min.) to 32 characters (max.)	Read Only	Identifies the Object and is unique within the BACnet Device.
Object_Type	79	130 (OBJECT_LNX_HEATING)	Read Only	Indicates membership in a particular object type class.
Out_Of_Service	81	TRUE or FALSE	Read Only	Indicates whether the heating device is in service or not.
Lennox_Object_Installed	513	TRUE or FALSE	Read Only	Indicates whether the heating device is installed or not. Unless the value of this property is TRUE, all other properties of the heating object instance are invalid.
Lennox_Object_Running	514	Integer (0 - 100)	Read Only	Indicates that heating is not running if the value is zero and that heating is running if a value greater than zero (range: 0, 100 or possible values).
Lennox_Object_Run_Time	515	Integer (0 - 4294967295) minutes	Read Only	Indicates the time heating has been running. Internally, the time that heating has been running is stored into EEPROM once every hour. Therefore, in the event power turns off, the value returned when power turns back on will be the last stored value. This can result in a loss of run-time value up to an hour for each power cycle event.
Lennox_Object_Min_Cycle_Time	516	Integer (0 - 4294967295) seconds	Read Only	Indicates the minimum time heating must run in any given cycle. This prevents short cycles to help protect the compressor (This property does not apply to Electric Heat Stage components).
Lennox_Object_Cycle_Count	517	Integer (0 - 4294967295) cycles	Read Only	Indicates the number of cycles heating has been running.
Lennox_Object_Error	518	Integer (0 - 255)	Read Only	Reports any error code heating may have encountered. A value of 0 means no error while any non-zero value represent an error.
Lennox_Object_HeatType	533	Integer: Values are: 1-Gas; 2-Electric; 3-Heat Pump mode	Read Only	Indicates the source of power used for heating (range: 0, 255).

Table 7. Lennox Proprietary Objects - Economizer (Object ID: 131)

Property	Property ID	Data type and range	Access	Description
Object_Identifier	75	Integer (0-4194302)	Read Only	Numeric code that identifies the object (unique within Lennox BACnet Device).
Object_Name	77	character string of 1 character (min.) to 32 characters (max.)	Read Only	Identifies the Object and is unique within the BACnet Device.
Object_Type	79	131 (OBJECT_LNX_ECONOMIZER)	Read Only	Indicates membership in a particular object type class.
Out_Of_Service	81	TRUE or FALSE	Read Only	Indicates whether the economizer is in service or not.
Lennox_Object_Installed	513	TRUE or FALSE	Read Only	Indicates whether the economizer is installed or not. Unless the value of this property is TRUE, all other properties of the economizer object instance are invalid.
Lennox_Object_Running	514	Integer (0 - 100)	Read Only	Indicates that the economizer is not running if the value is zero and that the economizer is running if a value greater than zero (range: 0, 100 or possible values).
Lennox_Object_Run_Time	515	Integer (0 - 4294967295) minutes	Read Only	Indicates the time the economizer has been running. Internally, the time that the economizer has been running is stored into EEPROM once every hour. Therefore, in the event power turns off, the value returned when power turns back on will be the last stored value. This can result in a loss of run-time value up to an hour for each power cycle event.
Lennox_Object_Cycle_Count	517	Integer (0 - 4294967295) cycles	Read Only	Indicates the number of cycles the economizer has been running.
Lennox_Object_Error	518	Integer (0 - 255)	Read Only	Reports any error code the compressor may have encountered. A value of 0 means no error while any non-zero value represent an error.

Table 8. Lennox Proprietary Objects - Discharge Air (Object ID: 133)

Property	Property ID	Data type and range	Access	Description
Object_Identifier	75	Integer (0-4194302)	Read Only	Numeric code that identifies the object (unique within Lennox BACnet Device)
Object_Name	77	character string of 1 character (min.) to 32 characters (max.)	Read Only	Identifies the Object and is unique within the BACnet Device.
Object_Type	79	133 (OBJECT_LNX_DISCHARGE_AIR)	Read Only	Indicates membership in a particular object type class.
Object_Temperature	534	Real: Degrees Fahrenheit	Read Only	Indicates the temperature of the discharge air.
Object_Duct_Static_Pressure_Setpoint	535	Integer: Values are 0 - 5 (inches of water column)	Read Only	Represents the Duct Static Pressure Setpoint of discharge air.

Table 9. Lennox Proprietary Objects - Space Air (Object ID: 133)

Property	Property ID	Data type and range	Access	Description
Object_Identifier	75	Integer (0-4194302)	Read Only	Numeric code that identifies the object (unique within Lennox BACnet Device)
Object_Name	77	character string of 1 character (min.) to 32 characters (max.)	Read Only	Identifies the Object and is unique within the BACnet Device.
Object_Type	79	133 (OBJECT_LNX_INDOOR_AIR)	Read Only	Indicates membership in a particular object type class.
Object_Temperature	534	Real: Degrees Fahrenheit	Read Write	Indicates the temperature of the space air.
Object_Relative_Humidity	536	Real: Values are 30 to 100 (%RH)	Read Write	Represents relative humidity of space air.
Object_CO2_Level	537	Real: Values are 30 to 100 (PPM)	Read Write	Indicates the CO2 levels in the space air.

Table 10. Lennox Proprietary Objects - Outdoor Air (Object ID: 133)

Property	Property ID	Data type and range	Access	Description
Object_Identifier	75	Integer (0-4194302)	Read Only	Numeric code that identifies the object (unique within Lennox BACnet Device)
Object_Name	77	character string of 1 character (min.) to 32 characters (max.)	Read Only	Identifies the Object and is unique within the BACnet Device.
Object_Type	79	133 (OBJECT_LNX_OUTDOOR_AIR)	Read Only	Indicates membership in a particular object type class.
Object_Temperature	534	Real: Degrees Fahrenheit	Read Write	Indicates the temperature of the outdoor air.

Analog Output Objects

Optional Properties Supported: Min_Pres_Value, Max_Pres_Value

Optional Writable Properties: Out_Of_Service

Analog output object's Overridden status flag set if the equivalent setpoint in the M2 is written to by some Sbus device.

Table 11. Analog Output Objects List

Object ID	Object Name	Units	Min. Value	Max. Value	Valid Values within Range
101	Application Mode Control	None	0	255	0,1,3,6,9,208,209,216,217,218,224-254,255*
102	Outdoor Air Min Pos Control	Percent	0	255	all
103	Occupancy Override Control	None	0	255	all
104	Occupancy Scheduler Control	None	0	255	all
107	Occupancy Sensor Input	None	0	255	all
108	Space Dehumidification Setpoint	Percent	0	100	all
109	Temperature Setpoint (abs)	Deg. F	36.25	100	all
110	Temperature Setpoint Offset	Deg. F	-32	31.75	all
113	Space Temperature Input	Deg. F	36.25	100	all
114	Emergency Override Control	None	0	255	all
115	Compressor Enable Control	None	0	255	all
117	Primary Heat Enable Control	None	0	255	all
119	Auxiliary Heat Enable Control	None	0	255	all
123	Duct Static Setpoint	In. of water	0	5	all
124	Building Static Setpoint	In. of water	-0.5	0.5	all
125	Discharge Air Cooling Setpoint	Deg. F	40	100	-9,40-80*
126	Discharge Air Heating Setpoint	Deg. F	60	140	-9,80-140*
127	Supply Fan Capacity Input	Percent	33	255	all*
128	Exhaust Fan Capacity Input	Percent	33	255	all
129	Set Economizer Outdoor Air Suitable	None	0	255	all

* see Application Details section for limitations on data ranges.

Analog Input Objects

Optional Properties Supported:

None

Optional Writable Properties:

Out_Of_Service (AI239 - AI252, AI274 - AI285 only)

Table 12. Analog Input Objects List

Object ID	Object Name	Units	Data Range
198	Mac Address	None	0 - 127
199	IMC Address	None	1-31
200*	IMC Version[4]	None	0 - 127
201*	IMC Version[5]	None	0 - 127
202*	IMC Version[6]	None	0 - 127
203*	IMC Version[7]	None	0 - 127
204*	IMC Version[8]	None	0 - 127
205*	IMC Version[9]	None	0 - 127
206*	IMC Version[10]	None	0 - 127
207*	IMC Version[11]	None	0 - 127
231	Unit ID	None	0 - 127
232	Unit Status	None	0 - 255
239	Space Temperature	Deg. F	63.75 - 100.00
240	Discharge Air Temperature	Deg. F	-8.7 – 164.4
241	Effective Occupancy	None	0 - 2
242	Local Outside Air Temperature	Deg. F	-30.6 – 131.6
243	Local Space Temperature	Deg. F	63.75 – 100.00
244	Outside Air Damper	Percent	0 - 100, 255
245	Heat Primary	Percent	0 – 100
246	Heat Secondary	Percent	0 – 100
247	Cool Primary	Percent	0 – 100
248	Economizer Enabled	Percent	0, 1, 255
250	Supply Fan Status	Percent	0 - 100
252	Space Temperature Set Point (Effective)	Deg. F	40.0 – 95.0
253	Current Error	None	0 - 255
254	Error Pointer	None	0 – 83
255	Most recent Error 1	None	1 - 255
256	Most recent Error 2	None	1 - 255
257	Most recent Error 3	None	1 - 255
258	Most recent Error 4	None	1 - 255
259	Most recent Error 5	None	1 - 255
260	Most recent Error 6	None	1 - 255
261	Most recent Error 7	None	1 - 255
262	Most recent Error 8	None	1 - 255
263	Most recent Error 9	None	1 - 255
264	Most recent Error 10	None	1 - 255
274	Space CO2 Sensor (Effective)	Parts-per-million	0 - 2000
275	Space CO2 Sensor (Local)	Parts-per-million	0 - 2000
276	Space Humidity (Effective)	Percent	0 - 100
277	Space Humidity (Local)	Percent	0 - 100
278	Dehumidification Set Point (Effective)	Percent	0 - 100
279	Dehumidification Status	None	0 - 2
281	Return Air Temperature	Deg. F	-8.7 – 164.4
282	Building Static Pressure	Inches of water	-0.5 - 0.5
283	Duct Static Pressure	Inches of water	0 – 5.00
285	Exhaust Fan Status	Percent	0 - 100
286	Supply airflow status	CFM	0 - 480 cfm/ton**
287	Blower motor speed	RPM	0 - 1500
288	Blower motor torque	Percent	0 - 100
289	Outdoor airflow	CFM	0 - 480 cfm/ton**

* Not recommended for new installations; legacy support only

** Multiply the tonnage of the RTU with the value in CFM/ton to derive the value in CFM units.

Analog Value Objects

Optional Properties Supported: None
 Optional Writable Properties: Present_Value

Table 13. Analog Value Objects List

Object ID	Object Name	Units	Min. Value	Max. Value	Valid Values within Range	Note
1	Baud Rate Setting	None	9600	76800	9600, 19200, 38400, 76800	
130	Heating Occupied Setpoint	Deg. F	40	95	all	For occupied and unoccupied setpoints considered separately, the heating setpoint must be lower than the cooling setpoint by at least the auto-changeover dead-band value set in M2 ECTO 6.15 (default 3 degF).
131	Cooling Occupied Setpoint	Deg. F	40	95	all	
132	Heating Unoccupied Setpoint	Deg. F	40	95	all	
133	Cooling Unoccupied Setpoint	Deg. F	40	95	all	
134	Supply airflow Low Speed Target	CFM				
135	Supply airflow High Speed Target	CFM				1. These objects are applicable only if SmartAirflow™ is installed in the system. 2. Object IDs 136 and 137 are not applicable to an A box 3. Multiply the tonnage of the RTU with the value in CFM/ton to derive the value in CFM units.
136	Supply airflow Medium Low Speed Target	CFM				
137	Supply airflow Medium High Speed Target	CFM				
138	Supply airflow Heat Mode Target	CFM				
139	Ventilation airflow Target	CFM				
140	Smoke airflow Target	CFM				
141	Outdoor airflow target	CFM	0 cfm/ton	150 cfm/ton	All	

Zone Sensor Setpoints

The M2 typically uses four setpoints and the zone temperature to operate the unit when a zone sensor is installed.

When using the AO:109 single setpoint input, the M2 will use the zone temperature setpoint and ECTO 6.15 to determine the heat / cool setpoint in the occupied mode. During the unoccupied mode, the M2 will use the zone temperature setpoint and the difference between ECTO 6.05 and 6.03.

See figure 2 for an example of setpoints when the M2 is operating using ECTO default values.

As an alternative, the individual setpoints AV:130-133 may be used. The M2 uses whatever were the last setpoints received, whether from AO:109-110, or AV:130-133.

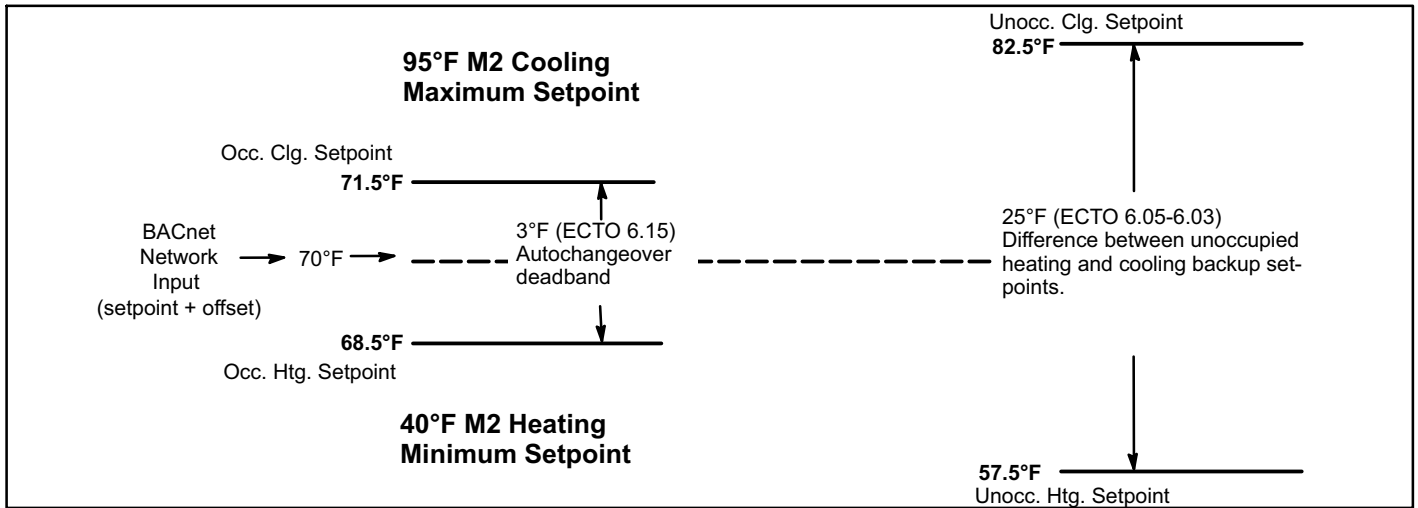


Figure 2. M2 Default Setpoint Example (Zone Sensor Installed)

M2 Alarm Codes See the M2 user guide for a list of alarm codes.

Application Details

Object Name: **Application Mode Control**
Object Type: AO (Analog Output)
Object ID: 101
Object Units: (95) No_Units

Value = (See tables below)

Set the application mode input to Value.

The M2 controller can be set locally during commissioning to operate in either of two modes: remote zone sensor control mode (with local or remote zone sensor), or remote thermostat control mode. Several application mode command values are recognized by either M2 mode, while some can only be used when the M2 is in the remote thermostat control mode.

Common Application Mode Values

Value	Mode	Description
0 \$00	AUTO	Heating or cooling. Default after reset.
1 \$01	HEAT	Heating only.
3 \$03	COOL	Cooling only.
6 \$06	OFF	Unit off.
9 \$09	FAN ONLY	No heating or cooling allowed.
255 \$FF	NUL	Same as AUTO.
208 \$D0	FAN AUTO	Main fan (blower) auto. Default after reset.
209 \$D1	FAN ON	Main fan (blower) on.
216 \$D8	EXHAUST AUTO	Power exhaust fan auto. Default after reset.
217 \$D9	EXHAUST1 ON	1st stage power exhaust fan on.
218 \$DA	EXHAUST1 OFF	1st stage power exhaust fan off.
219 \$DB	EXHAUST2 ON	2nd stage power exhaust fan on.
220 \$DC	EXHAUST2 OFF	2nd stage power exhaust fan off.
221 \$DD	EXHAUST ON	Both stages of power exhaust fan on.
222 \$DE	EXHAUST OFF	Both stages of power exhaust fan off.
254 \$FE	RESET	Force controller reset.

The four command groups (0-9), (208-209), (216-222), and (224-236, see below) are independent of each other. Selecting a command from one group does not affect any previously sent command from another group. Except for OFF and RESET, which also set FAN AUTO, EXHAUST AUTO, and heat/cool demand IDLE.

AUTO is the default application mode input. When in a remote zone sensor mode, AUTO allows the M2 control to generate heating and cooling demands based on zone temperature and zone temperature setpoint. Auxiliary functions such as dehumidification or emergency override (i.e. smoke mode) will still operate as needed. Also the blower and exhaust fan functions operate.

HEAT and COOL allow the servicing of only heating or cooling demands. These set a mode only, and do not generate a demand.

Application mode OFF is a unit-disable state, causing the controller to become idle, and clearing all outputs and timers. All outputs are kept off while application mode is OFF. Since this is a complete unit-disable command, it should not be used to turn off heating and cooling demands as part of remote thermostat operation - use 224 IDLE for that purpose. See below.

Application mode FAN ONLY disables heating and cooling operation. No effect on fan operation. Return to normal operation with AUTO, HEAT, or COOL.

Application modes FAN ON and FAN AUTO are used to turn on the main unit fan (blower), or return it to automatic operation.

Application modes for EXHAUST ON are used to turn on/off a power exhaust fan, or to return it to automatic operation. The M2 may delay up to 30 seconds before responding to an exhaust command. These commands apply to single-, two-, and variable-speed power exhausts. A variable-speed exhaust is enabled here, while the speed is adjusted using AO:128, the Exhaust Fan Capacity Input.

Application mode RESET causes the system to reset itself and go through the controller's startup and initialization routines. This takes about 8 seconds in an M2 controller, during which time the analog and digital inputs are settling to correct values. The controller will return to AUTO operation.

AUTO, FAN AUTO and EXHAUST AUTO are the defaults after reset.

Application Modes Specific To Remote Thermostat Operation

These values are only recognized if the M2 control is placed in a remote thermostat mode of operation (set locally during commissioning).

Value	Mode	Y2	Y1	W2	W1	Description
224 \$E0	IDLE	0	0	0	0	Heat / Cool off. Default after reset.
228 \$E4	COOL1	0	1	0	0	Cool 1.
232 \$E8	COOL2	1	0	0	0	Cool 2.
236 \$EC	COOL3	1	1	0	0	Cool 3. Full cooling.
225 \$E1	HEAT1	0	0	0	1	Heat 1.
226 \$E2	HEAT2	0	0	1	0	Heat 2.
227 \$E3	HEAT3	0	0	1	1	Heat 3. Full heating.
229 \$E5	REHEAT LO	0	1	0	1	Supermarket Reheat (lo)
230 \$E6	REHEAT HI	0	1	1	1	Supermarket Reheat (hi)

For all \$Ex values the fan runs if it is already on, otherwise the fan turns on after a fan on-delay. For \$E0 the fan turns off after a fan off-delay.

COOL2 and COOL3 are equivalent unless 3-stage cooling has been selected locally at the controller during commissioning.

HEAT2 and HEAT3 are equivalent except in heat pump equipment types, when HEAT2 acts as "emergency heat", running auxiliary strip heat and turning off the compressor(s). So in a heat pump, normal heating is commanded using HEAT1 or HEAT3. REHEAT LO and REHEAT HI can only be used if Supermarket Reheat is enabled for the M2 using ECTO 4.24.

If a mode not defined in the above list is sent, then the application mode is not changed.

When an M2 is commissioned for BACnet® gateway remote thermostat operation, it will wait for 5 minutes following startup to receive application mode data. The M2 will remain in AUTO mode until data is received, or until the 5 minute period has expired.

If 5 minutes passes without data being received, then the M2 will enter the backup mode of operation (set locally during commissioning).

It is recommended that the application mode data be updated at intervals of no more than 2 minutes to be sure that a single missed-data event will not constitute an application mode data failure. Any application mode data will serve as a valid update; either common or remote thermostat values.

If application mode data appears while the M2 is in a backup mode, then the M2 will reset and normal operation will resume.

Object Name: **Outdoor Air Min Pos Control**

Object Type: AO (Analog Output)

Object ID: 102

Object Units: (98) Percent

Value = 0 - 255

0 -100: Set the minimum position of the outdoor air economizer damper; % open.

101 - 255: Relinquish to local control. Min damper position depends on the setting in M2 ECTO 5.24:
ECTO 5.24

=101: Min damper position set by potentiometer on economizer control.

<101: Min damper position set by ECTO 5.24.

The minimum damper position is only effective when the system is occupied and the main blower is running. Otherwise the damper remains closed. Default value following reset is 101 (local).

Object Name: **Occupancy Override Control**
Object Type: AO (Analog Output)
Object ID: 103
Object Units: (95) No_Units
Value = 0-255
0: space occupied
1: space unoccupied
2: refresh space occupied timer defined at local controller
3-255: auto; clear timer and return to occupancy scheduler state
Default value following reset is 255 (auto).
For "Effective Occupancy" see Appendix C for further details.

Object Name: **Occupancy Scheduler Control**
Object Type: AO (Analog Output)
Object ID: 104
Object Units: (95) No_Units
Value = 0 - 255
0: space occupied
1-255: space unoccupied
Default value following reset is determined by ECTO 8.26.
Once a value for AO:104 is received, the ECTO 8.26 value is ignored.
For "Effective Occupancy" see Appendix C for further details.

Object Name: **Occupancy Sensor Input**
Object Type: AO (Analog Output)
Object ID: 107
Object Units: (95) No_Units
Value = 0 - 255
0: occupancy sensor indicates space occupied
1: occupancy sensor indicates space unoccupied
2-255: auto; return to occupancy scheduler state
Default value following reset is 255 (auto).
For "Effective Occupancy" see Appendix C for further details.

Object Name: **Space Dehumidification Setpoint**
Object Type: AO (Analog Output)
Object ID: 108
Object Units: (98) Percent
Value = 0 - 100
0-100: % relative humidity setpoint
Dehumidification begins when the effective space relative humidity rises to this setpoint value. The default following reset is local control. Once an executive controller has sent a setpoint for AO:108, there is no way to return to the local setpoint except by controller reset.
Dehumidification ends when the effective space relative humidity falls below this setpoint value minus a dehumidification deadband that is typically 3%. The deadband value is set locally during commissioning.

Object Name: **Temperature Setpoint (abs)**
Object Type: AO (Analog Output)
Object ID: 109
Object Units: (64) Degrees-Fahrenheit
Value = 36.25 – 100.00 degF, in 0.25 degF increments

The single-point "Temperature Setpoint (abs)" (including offset; see below) is converted locally to occupied and unoccupied heating and cooling setpoints. The occupied and unoccupied heating and cooling setpoints are computed to be centered (if possible) on the effective single-point setpoint. This is done while preserving the occupied and unoccupied deadbands, as well as any local restrictions on minimum or maximum values. The default following reset is 70 degF, but local values are used for the heating and cooling (occupied and unoccupied) setpoints until a value is received for AO:109.

As an alternative method of establishing setpoints, the individual setpoints AV:130-133 may be used. The M2 uses whatever were the last setpoints received, whether from AO:109-110, or AV:130-133.

The occupied heat/cool auto-changeover deadband value is set locally during commissioning.

The unoccupied heat/cool auto-changeover deadband value is set locally during commissioning by adjusting the backup unoccupied heating and cooling setpoints. The difference between these setpoints will be used as the unoccupied heat/cool auto-changeover deadband value.

Object Name: **Temperature Setpoint Offset**
Object Type: AO (Analog Output)
Object ID: 110
Object Units: (64) Degrees-Fahrenheit
Value = -32.00 – 31.75 degF, in 0.25 degF increments

A signed value added to the Temperature Setpoint (abs) value to provide an effective temperature setpoint. See above regarding deadbands and limits. The default following reset is 0.

Object Name: **Space Temperature Input**
Object Type: AO (Analog Output)
Object ID: 113
Object Units: (64) Degrees-Fahrenheit
Value = 36.25 – 100.00 degF, in 0.25 degF increments

A network value for the space temperature. Heating and cooling demands are generated based on the "Space Temperature Input", and the "Temperature Setpoint (abs)" and "Temperature Setpoint Offset" values. See above. The default following reset is 72.5 degF.

When an M2 is commissioned for BACnet® gateway remote room sensor operation, it will wait for 5 minutes following startup to receive space temperature data. The M2 will remain in a no-run mode until data is received, or until the 5 minute period has expired.

If 5 minutes passes without data being received, then the M2 begins to use local data for the space temperature. If a local sensor is connected then it will be used. If not, then a failed-sensor error is recorded and the M2 will enter the backup mode of operation (set locally during commissioning).

It is recommended that network data be updated at intervals of no more than 2 minutes to be sure that a single missed-data event will not constitute a data update failure.

If data appears after a sensor failure is processed, it will be treated as an intermittent sensor. Normal operation will resume. If the M2 is in a backup mode, then it will reset before resuming.

Object Name: **Emergency Override Control**
 Object Type: AO (Analog Output)
 Object ID: 114
 Object Units: (95) No_Units
 Value = 0 - 255

Set the emergency mode defined by value, decoded as:

Value	Mode	Supply Fan	Exhaust Fan	Outdoor Damper
0	NORMAL	auto	auto	auto
1	PRESSURIZE	on	off	open
2	DEPRESSURIZE	off	on (speed)	closed
3	PURGE	on	on (speed)	open
4	SHUTDOWN	off	off	closed
5	FIRE			
6	DEPRESSURIZE	off	on (pressure)	closed
7	PURGE	on	on (pressure)	open
>7	NUL (normal)	auto	auto	auto

auto - normal operation
 (speed) - exhaust fan runs at speed pre-selected at equipment
 (pressure) - exhaust fan runs to maintain building press setpoint; local or remote

Mode 5, FIRE, is a locally defined operation (set at commissioning).

For units without VFD exhaust fans, modes 6-7 are the same as 2-3.

"Emergency Override Control" input takes precedence over local smoke input. The default following reset is 0 (NORMAL).

Object Name: **Compressor Enable Control**
 Object Type: AO (Analog Output)
 Object ID: 115
 Object Units: (98) Percent
 Value = 0 - 255

0: output disabled
 1-100: output limited to 1 – 100% of maximum
 101-255: maximum output permitted

The following table shows the value where the indicated compressor stage is disabled, for equipment having the indicated maximum number of compressor stages:

Maximum Stages	Stage Disabled When Value < x			
	1	2	3	4
1	Value < 50			
2	Value < 33	Value < 66		
3	Value < 25	Value < 50	Value < 75	
4	Value < 20	Value < 40	Value < 60	Value < 80

Free cooling using an economizer with outdoor air is not considered a stage. Only compressors are considered to be stages. All compressors installed are included, however they are being used; sensible cooling, condenser reheat (latent cooling), or heat pump heating. The default following reset is 100%.

Disabled stages are re-enabled at the above values plus 3% hysteresis.

Object Name: **Primary Heat Enable Control**
Object Type: AO (Analog Output)
Object ID: 117
Object Units: (98) Percent

Value = 0 - 255

0: output disabled
1-100: output limited to 1 – 100% of maximum
101-255: maximum output permitted

The table shown above for "Compressor Enable Control" can also be applied here to the "Primary Heat Enable Control". It shows the value where the indicated primary heating stage is disabled, for equipment having the indicated maximum number of primary heating stages. The default following reset is 100%.

In heat pump systems during heating operation, the lower value of "Compressor Enable Control" and "Primary Heat Enable Control" is used to establish the compressors that can run.

Object Name: **Auxiliary Heat Enable Control**
Object Type: AO (Analog Output)
Object ID: 119
Object Units: (98) Percent

Value = 0 - 255

0: output disabled
1-100: output limited to 1 – 100% of maximum
101-255: maximum output permitted

The table shown above for "Compressor Enable Control" can also be applied here to the "Auxiliary Heat Enable Control". It shows the value where the indicated auxiliary heating stage is disabled, for equipment having the indicated maximum number of auxiliary heating stages. The default following reset is 100%.

The "Auxiliary Heat Enable Control" is only used in heat pump systems.

Object Name: **Duct Static Setpoint**
Object Type: AO (Analog Output)
Object ID: 123
Object Units: (58) Inches-of-water

Value = 0.0 - 5.0 inWC

The setpoint for control of duct static pressure, in inches of water column. The main blower speed or bypass damper setting is varied to maintain this value. The setpoint can be selected from the range of 0.0 to 5.0 inches of water column. The default following reset is local control. Once an executive controller has sent a setpoint for AO:123, there is no way to return to the local setpoint except by controller reset.

Object Name: **Building Static Setpoint**
Object Type: AO (Analog Output)
Object ID: 124
Object Units: (58) Inches-of-water

Value = -0.5 - 0.5 inWC

The setpoint for control of building static pressure, in inches of water column. The exhaust blower is cycled or, if a VFD is used, its speed is varied to maintain this value. The setpoint can be selected from the range of -0.5 to +0.5 inches of water column. The default following reset is local control. Once an executive controller has sent a setpoint for AO:124, there is no way to return to the local setpoint except by controller reset.

Object Name: **Discharge Air Cooling Setpoint**
Object Type: AO (Analog Output)
Object ID: 125
Object Units: (64) Degrees-Fahrenheit
Value = 40 - 80 degF, and -9 degF

The setpoint for control of discharge (or supply) air temperature during cooling. When the controller is in the correct mode of operation, sending this setpoint will cause cooling components to cycle, or vary their output, in order to maintain this temperature in the leaving air stream. The setpoint can be selected from the range of 40 to 80 degrees Fahrenheit. Selecting a value of -9 degF causes the control to revert to the use of its locally programmed setpoint. Default value following reset is -9 (local).

Object Name: **Discharge Air Heating Setpoint**
Object Type: AO (Analog Output)
Object ID: 126
Object Units: (64) Degrees-Fahrenheit
Value = 80 - 140 degF, and -9 degF

The setpoint for control of discharge (or supply) air temperature during heating. When the controller is in the correct mode of operation, sending this setpoint will cause heating components to cycle, or vary their output, in order to maintain this temperature in the leaving air stream. The setpoint can be selected from the range of 80 to 140 degrees Fahrenheit. Selecting a value of -9 degF causes the control to revert to the use of its locally programmed setpoint. Default value following reset is -9 (local).

Object Name: **Supply Fan Capacity Input**
Object Type: AO (Analog Output)
Object ID: 127
Object Units: (98) Percent
Value = 33 - 255

33 - 100: Set the supply fan capacity as a % of maximum speed.
101 - 255: Relinquish to local control. Supply fan capacity depends on M2 ECTO values.

Supply fan capacity is only effective when the main blower is running.

if compressor(s) are on or heat is on, min. value is limited to ECTO 0.06 or ECTO 0.07, respectively.

Maximum supply air is limited by M2 ECTO value 0.08, although the relinquish default range of 101-255 is always available. Default value following reset is 255 (local).

Object Name: **Exhaust Fan Capacity Input**
Object Type: AO (Analog Output)
Object ID: 128
Object Units: (98) Percent
Value = 33 - 255

33 - 100: Set the exhaust fan capacity as a % of maximum speed.
101 - 255: Relinquish to local control. Exhaust fan capacity depends on M2 ECTO values.

Exhaust fan capacity is only effective when the exhaust fan is running. Default value following reset is 255 (local).

Object Name: **Set Economizer Outdoor Air Suitable**
Object Type: AO (Analog Output)
Object ID: 129
Object Units: (95) No_Units
Value = 0-255

0: Economizer disable
1: Economizer enable
>1: Economizer to auto

When outdoor air is determined to be suitable for free cooling, the economizer feature will operate (if installed) on a first stage cooling call to use outdoor air instead of mechanical cooling. AO:129 is used to allow an executive controller to set the state of outdoor air suitability (OAS). It can be enabled, disabled, or left for the local controller to determine.

BACnet control of the economizer requires the the M2 to have DIP switches selected to TMP temperature mode. See the M2 manual for additional information on economizer operation. Default value following reset is 255 (auto).

Object Name: **MAC Address**
Object Type: AI (Analog Input)
Object ID: 198
Object Units: (95) No_Units
Value = 0-127

Selectable BACnet MAC address. By default, this value equals the L Connection address.

Object Name: **IMC Address**
Object Type: AI (Analog Input)
Object ID: 199
Object Units: (95) No_Units
Value = 1-31

Selectable L Connection address (1-31). This address is used for L Connection network.

Object Name: **IMC Version[04], IMC Version[05], ..., IMC Version[11]**
Object Type: AI (Analog Input)
Object ID: 200, 201, ..., 207
Object Units: (95) No_Units
Value = 0, 46, 48 - 57

0: end of string
46: "."
48: "0"
...
57: "9"

Each value is the ASCII code of a character in the M2 version number. The version number is found in a null-terminated string, most-significant-character first, beginning in IMC Version[04]. Maximum length is 8 chars, including null.

NOTE - Not recommended for new installations. Read device object property Application_Software_Version instead. For BACnet version read device object property Firmware_Revision.

Object Name: **Unit ID**
Object Type: AI (Analog Input)
Object ID: 231
Object Units: (95) No_Units
Value = 0 - 255
48-63: gas heat, electric cool
64-79: electric heat, electric cool
80-95: electric heat pump, with or without electric resistive heat

These are the currently defined M2 unit types.

Object Name: **Unit Status**
Object Type: AI (Analog Input)
Object ID: 232
Object Units: (95) No_Units
Value = 0 - 255

0 – HVAC idle.
1 – HVAC heat.
2 – HVAC morning warmup.
3 – HVAC cool.
5 – HVAC pre-cool.
6 – HVAC off.
7 – HVAC test.
8 – HVAC emergency heat.
9 – HVAC fan only.
12 – HVAC max heat.
14 – HVAC dehumidification.
129 – HVAC fresh air heating.
131 – HVAC fresh air cooling.
145 – HVAC defrost compressor 1.
161 – HVAC defrost compressor 2.
177 – HVAC defrost compressor 1 & 2.

These are the currently defined M2 unit status.

Object Name: **Space Temperature**
Object Type: AI (Analog Input)
Object ID: 239
Object Units: (64) Degrees-Fahrenheit
Value = 63.75 – 100.00 degF, in 0.25 degF increments

Space temperature from local M2 sensor, or from "Space Temperature Input".

This is the actual value being used by the M2. Its source is either a locally wired temperature sensor (see "Local Space Temperature") or the network input (see "Space Temperature Input").

Object Name: **Discharge Air Temperature**
Object Type: AI (Analog Input)
Object ID: 240
Object Units: (64) Degrees-Fahrenheit
Value = -8.7 – 164.4 degF, in 0.7 degF increments

Discharge air temperature measurement from M2 sensor.

Object Name: **Effective Occupancy**
Object Type: AI (Analog Input)
Object ID: 241
Object Units: (95) No_Units
Value = 0 - 2

0: space occupied
1: space unoccupied
2: space occupied (timed override)

The occupancy override timer is established locally for each controller during system commissioning.

The "Effective Occupancy" depends on the "Occupancy Scheduler Control", the "Occupancy Override Control", and the "Occupancy Sensor Input. For "Effective Occupancy" see Appendix C for further details.

The local M2 occupied input is ignored when a BACnet® module is used.

Object Name: **Local Outside Air Temperature**
Object Type: AI (Analog Input)
Object ID: 242
Object Units: (64) Degrees-Fahrenheit
Value = -30.6 – 131.6 degF, in 0.6 degF increments

Outdoor air temperature measurement from M2 sensor.

Object Name: **Local Space Temperature**
Object Type: AI (Analog Input)
Object ID: 243
Object Units: (64) Degrees-Fahrenheit
Value = 63.75 – 100.00 degF, in 0.25 degF increments

Space temperature from M2 sensor.

Object Name: **Outdoor Air Damper**
Object Type: AI (Analog Input)
Object ID: 244
Object Units: (98) Percent
Value = 0 – 100, 255

0 - 100: Outdoor air damper position. Percent-open.
255: No damper.

Object Name: **Heat Primary**
Object Type: AI (Analog Input)
Object ID: 245
Object Units: (98) Percent
Value = 0 – 100

0 - 100: Current level of the primary heating capacity.

This is based on the number of gas stages operating in a gas/electric unit, or compressors operating in a heat pump, or electric resistance stages operating in an electric/electric unit.

Object Name: **Heat Secondary**
Object Type: AI (Analog Input)
Object ID: 246
Object Units: (98) Percent

Value = 0 – 100

0 - 100: Current level of the secondary heating capacity.

This is auxiliary (electric resistance "strip") heat in a heat pump. Whether it is on in addition to the primary heat (compressor), or as emergency heat while the compressor is locked-out.

Object Name: **Cool Primary**
Object Type: AI (Analog Input)
Object ID: 247
Object Units: (98) Percent

Value = 0 – 100

0 - 100: Current level of the primary cooling capacity.

This is based on the number of compressors operating.

There is no secondary cooling.

Object Name: **Economizer Enabled**
Object Type: AI (Analog Input)
Object ID: 248
Object Units: (95) No_Units

Value = 0 – 1, 255

0: Economizer is disabled.

1: Economizer is enabled (outdoor air is suitable for free cooling).

255: No economizer.

The enabled state only indicates that the M2 has determined that the outdoor air is suitable for free cooling. The unit is actually executing free cooling operation if "Economizer Enabled" is 1, and "Unit Status" is 3, 5, or 131.

Object Name: **Supply Fan Status**
Object Type: AI (Analog Input)
Object ID: 250
Object Units: (98) Percent

Value = 0 – 100

0: Supply fan off.

1: Supply fan on (single-speed fan).

2 - 100: Supply fan on (variable-speed fan; percent of full speed).

Object Name: **Space Temperature Setpt (Eff)**
Object Type: AI (Analog Input)
Object ID: 252
Object Units: (64) Degrees-Fahrenheit
Value = 40.0 – 95.0 degF, in 0.25 degF increments

The effective space temperature setpoint, which depends on:

- current "Temperature Setpoint (abs)",
- current "Temperature Setpoint Offset",
- current "Effective Occupancy",
- most recent heating or cooling demand indicated by "Unit Status",
- any local setpoint adjustment,
- and heating and cooling deadbands and differentials set at system commissioning.

Object Name: **Current Error**
Object Type: AI (Analog Input)
Object ID: 253
Object Units: (95) No_Units
Value = 0 - 255

This is the code for the currently occurring alarm condition, if any. If no alarm is currently in progress, then the value is 0. If the value is not zero, then "Current Error" and "Most Recent Error 1" (see below) will be equal.

Refer to the M2 User's Guide for alarm code descriptions.

Object Name: **Error Pointer**
Object Type: AI (Analog Input)
Object ID: 254
Object Units: (95) No_Units
Value = 0 - 83

This value points to the next available alarm code location. It runs from 0 to 83, and then rolls-over to 0. Tracking this value and using the ten-most-recent-error-codes (see below) allows an application to determine when new errors are logged by the M2, what those errors are, and if any errors have been missed due to network delays or for any other reason.

To correct for an error in some early versions, if the reported value is in the range of 164-247 then it is necessary to subtract it from 247 in order to get the 0-83 value described above.

Object Name: **Most recent Error 1,
Most recent Error 2
Most recent Error 10**

Object Type: AI (Analog Input)

Object ID: 255, 256, ..., 264

Object Units: (95) No_Units

Value = 1 - 255

These are the ten most recently occurring diagnostic codes; "Most recent Error 1" is the most recent.

This is a first-in first-out buffer. Error codes are stored as they occur, and no filtering is done with respect to duplication or error code severity or priority.

When another error code is logged at "Most recent Error 1", the value in "Most recent Error 10" is lost, being replaced by "Most recent Error 9".

Refer to the M2 User's Guide for alarm code descriptions.

Object Name: **Space CO2 Sensor (Eff)**

Object Type: AI (Analog Input)

Object ID: 274

Object Units: (96) Parts-per-million

Value = 0 - 2000

0 - 6: no sensor
7 - 1992: valid CO₂ measurement
1993 - 2000: sensor error

This is the actual value being used by the M2, and is the value measured at the M2.

Object Name: **Space CO2 Sensor (Local)**

Object Type: AI (Analog Input)

Object ID: 275

Object Units: (96) Parts-per-million

Value = 0 - 2000

0 - 6: no sensor
7 - 1992: valid CO₂ measurement
1993 - 2000: sensor error

This is the actual value being used by the M2, and is the value measured at the M2.

Object Name: **Space Humidity (Eff)**
Object Type: AI (Analog Input)
Object ID: 276
Object Units: (98) Percent

Value = 0 - 100

0: no sensor
1 - 99: valid relative humidity measurement
100: sensor error

This is the actual value being used by the M2, and is the value measured at the M2.

Object Name: **Space Humidity (Local)**
Object Type: AI (Analog Input)
Object ID: 277
Object Units: (98) Percent

Value = 0 - 100

0: no sensor
1 - 99: valid relative humidity measurement
100: sensor error

This is the actual value being used by the M2, and is the value measured at the M2.

Object Name: **Dehumidification Set Point (Eff)**
Object Type: AI (Analog Input)
Object ID: 278
Object Units: (98) Percent

Value = 0 - 100

Relative humidity setpoint for dehumidification operation.

Deadband is set locally during commissioning.

Object Name: **Dehumidification Status**
Object Type: AI (Analog Input)
Object ID: 279
Object Units: (95) No_Units

Value = 0 - 2

0: No dehumidification installed.
1: Dehumidification installed but not running.
2: Dehumidification installed and running.

Object Name: **Return Air Temperature**
Object Type: AI (Analog Input)
Object ID: 281
Object Units: (64) Degrees-Fahrenheit
Value = -8.7 – 164.4 degF, in 0.7 degF increments

Unit return air temperature measurement from M2 sensor.

Object Name: **Building Static Pressure**
Object Type: AI (Analog Input)
Object ID: 282
Object Units: (58) Inches-of-water
Value = -0.500 – 0.500 inWC, in 0.004 inWC increments

Building (space) static pressure measurement from M2 sensor.

Object Name: **Duct Static Pressure**
Object Type: AI (Analog Input)
Object ID: 283
Object Units: (58) Inches-of-water
Value = 0.00 – 5.00 inWC, in 0.02 inWC increments

Duct (supply) static pressure measurement from M2 sensor.

Object Name: **Exhaust Fan Status**
Object Type: AI (Analog Input)
Object ID: 285
Object Units: (98) Percent
Value = 0 – 100

0: Exhaust fan off.
1: Exhaust stage 1 on.
2: Exhaust stage 2 on.
33-100: Exhaust variable speed %on.
255: No exhaust.

Object Name: **Supply Airflow Status**
Object Type: AI (Analog Input)
Object ID: 286
Object Units: (84) Cubic Feet per Minute
Value = 0 – 480 cfm/ton

This object gives the current value of Supply Airflow as calculated by the Prodigy controller if SmartAirflow™ is installed.

Object Name: **Blower Motor Speed**
Object Type: AI (Analog Input)
Object ID: 287
Object Units: (104) Revolutions per Minute
Percent Value = 0 – 1500 RPM

This object gives the current speed of the Blower Motor if SmartAirflow™ is installed.

Object Name: **Blower Motor Torque**
Object Type: AI (Analog Input)
Object ID: 288
Object Units: (98) Percent Value = 0, 20 – 100
0: Blower is OFF.
20: Minimum Blower Torque.
100: Maximum Blower Torque

This object gives the current value of the blower PWM for an ECM type of Blower Motor if SmartAirflow™ is installed.

Object Name: **Outdoor Airflow**
Object Type: AI (Analog Input)
Object ID: 289
Object Units: (84) Cubic Feet per Minute
Value = 0 – 480 cfm/ton

The amount of outdoor airflow that is entering through the outdoor damper as calculated by Prodigy controller if SmartAirflow™ is installed.

Object Name: **Baud Rate Setting**
Object Type: AV (Analog Value)
Object ID: 1
Object Units: (95) No Units
Value = 9600, 19200, 38400, 76800

Baud rate change only takes affect after M2 resets. Default value following reset is 38400, but this can be changed at the unit. See M2 manual for details.

Object Name: **Heating Occupied Setpoint**
Object Type: AV (Analog Value)
Object ID: 130
Object Units: (64) Degrees-Fahrenheit
Value = 40 - 95

Occupied heating setpoint. Default value following reset is local (ECTO 6.02).

As an alternative method of establishing setpoints, the single setpoint AO:109 and offset AO:110 may be used. The M2 uses whatever were the last setpoints received, whether from AO:109-110, or AV:130-133.

To be considered in range the values for AV:130, 131, 132, and 133 must be in the range 40-95, and the heating setpoint must be less than the corresponding (occupied or unoccupied) cooling setpoint by at least the auto-changeover deadband value set in M2 ECTO 6.15 (default 3°F, 2-10°F range). If any of these condition is are violated, BACnet will return an out of range message. The AV's 130-133 can be used instead of the single setpoint and offset AO:109 and AO:110.

Object Name: **Cooling Occupied Setpoint**
Object Type: AV (Analog Value)
Object ID: 131
Object Units: (64) Degrees-Fahrenheit
Value = 40 - 95

Occupied cooling setpoint. Default value following reset is local (ECTO 6.04). See description for AV:130 for details on valid range.

Object Name: **Heating Unoccupied Setpoint**
Object Type: AV (Analog Value)
Object ID: 132
Object Units: (64) Degrees-Fahrenheit
Value = 40 - 95

Unoccupied heating setpoint. Default value following reset is local (ECTO 6.03). See description for AV:130 for details on valid range.

Object Name: **Cooling Unoccupied Setpoint**
Object Type: AV (Analog Value)
Object ID: 133
Object Units: (64) Degrees-Fahrenheit
Value = 40 - 95

Unoccupied cooling setpoint. Default value following reset is local (ECTO 6.05). See description for AV:130 for details on valid range.

Object Name: **Supply Airflow Low Speed Target**
Object Type: AV (Analog Value)
Object ID: 134
Object Units: (84)Cubic Feet per Minute

This object will set the default of Supply airflow Low Speed Target (ECTO 10.1) following a reset. This is applicable only for systems with SmartAirflow™ installed. See appendix B for the details on valid ranges.

Object Name: **Supply Airflow High Speed Target**
Object Type: AV (Analog Value)
Object ID: 135
Object Units: (84)Cubic Feet per Minute

This object will set the default of Supply airflow High speed target (ECTO 10.2) following a reset. This is applicable only for systems with SmartAirflow™ installed. See appendix B for the details on valid ranges.

Object Name: **Supply Airflow Medium Low Speed Target**
Object Type: AV (Analog Value)
Object ID: 136
Object Units: (84)Cubic Feet per Minute

This object will set the default of Supply airflow Medium Low Speed Target (ECTO 10.3) following a reset. This is applicable only for systems with SmartAirflow™ installed and for non A-box.

Object Name: **Supply Airflow Medium High Speed Target**
Object Type: AV (Analog Value)
Object ID: 137
Object Units: (84)Cubic Feet per Minute

This object will set the default of Supply airflow Medium High Speed Target (ECTO 10.4) following a reset. This is applicable only for systems with SmartAirflow™ installed and for non A-box.

Object Name: **Supply Airflow Heat Mode Target**
Object Type: AV (Analog Value)
Object ID: 138
Object Units: (84)Cubic Feet per Minute

This object will set the default of Supply airflow Heat Mode target (ECTO 10.5) following a reset. This is applicable only for systems with SmartAirflow™ installed. See appendix B for the details on valid ranges.

Object Name: **Ventilation Airflow Target**
Object Type: AV (Analog Value)
Object ID: 139
Object Units: (84)Cubic Feet per Minute

This object will set the default of Ventilation Airflow Target (ECTO 10.6) following a reset. This is applicable only for systems with SmartAirflow™ installed. See appendix B for the details on valid ranges.

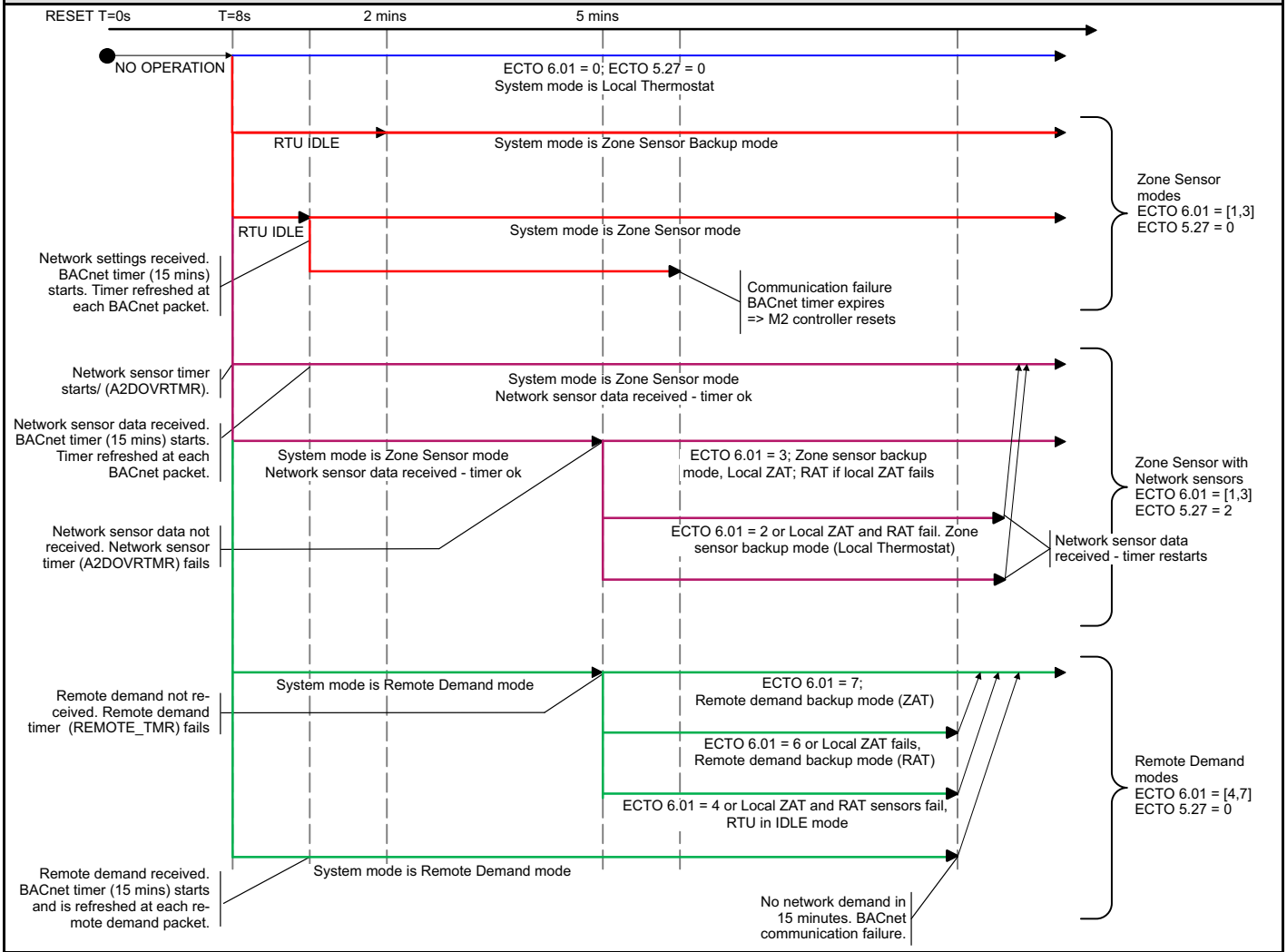
Object Name: **Smoke Airflow Target**
Object Type: AV (Analog Value)
Object ID: 140
Object Units: (84)Cubic Feet per Minute

This object will set the default of Smoke Airflow target (ECTO 10.8) following a reset. This is applicable only for systems with SmartAirflow™ installed. See appendix B for the details on valid ranges.

Object Name: **Outdoor Airflow Target**
Object Type: AV (Analog Value)
Object ID: 141
Object Units: (84)Cubic Feet per Minute

This object will set the default of Smoke Airflow target (ECTO 10.17) following a reset. This is applicable only for systems with SmartAirflow™ installed. See appendix B for the details on valid ranges.

Appendix A. Timeline of M2 startup sequences



APPENDIX B

The maximum and minimum values of Supply Airflow Targets in CFM units are as below.

UNIT SIZE	36	48	60
Maximum High Speed Target & Heat Mode Target (480 CFM/ton)	1440	1920	2400
Minimum High Speed Target (280 CFM/ton)	840	1120	1400
Minimum Low Speed Target (220 CFM/ton)	660	880	1100
Minimum Ventilation Target (150 CFM/ton)	450	600	750
Minimum Heat Mode Target Standard Gas Heat (S,W)	970	970	970
Minimum Heat Mode Target Medium Gas Heat (M, Q, U, Y)	1120	1120	1120
Minimum Heat Mode Target High Gas Heat Minimum (H, T, X, Z)	1310	1310	1310
Minimum Heat Mode Target Electric Heat	1080	1280	1600
Maximum Outdoor Airflow (150 cfm/ton)	450	600	750

Note:

1. Maximum Ventilation Target should be less than High Speed Target or Heat Mode Target
2. Maximum Low Speed Target should be less than High Speed Target

APPENDIX C — PRODIGY M2 UNIT CONTROLLER BLOWER OPERATIONS

This section describes how BACnet® occupancy signals are combined to produce effective occupancy.

The blower runs to service heat and cool demands, regardless of the space occupancy. But when there is no heating or cooling demand there are options for how the blower should operate in conjunction with occupancy signals to keep the space ventilated, or the air stirred.

In **SETTINGS > CONTROL** menus the option for **BLOWER ON OCP** is selected as **CYCLES** or **ALWAYS ON**. These correspond to ECTO 6.17 settings of 0 or 1, respectively. These settings govern whether the blower runs continuously when the space is considered occupied (=1), or cycles on/off with the heating and cooling demand (=0). ECTO 6.17 only applies to the room sensor control modes, and not to the local or network thermostat modes. In those modes the blower is controlled by the **G** thermostat or DDC signal.

To comply with the California Energy Commission Title 24 standard there are two additional blower/occupancy settings that are set directly by changing ECTO 6.17 from the **SETTINGS>CONTROL > ECTO** menu. These two additional options are available when using *LonTalk* or *BACnet* networks that supplies a room occupancy signal (in addition to the scheduled occupancy).

The same two options are also available when using the *Lennox L Connection* network with comfort sensors that have added an optional room occupancy sensor. If a room occupancy sensor is not installed and configured on the network, then options 0 and 1 for ECTO 6.17 as previously described should continue to be used.

The two new CEC Title 24 settings for ECTO 6.17 are options 2 and 3 and a description of both are provided in table 14.

Table 14. ECTO 6.17 Description

ECTO 6.17	Occupancy Blower Duty Description
0	Blower cycles on/off with demand. (Legacy usage.)
1	Blower runs when either the occupancy sensor or schedule, or both, indicates occupied. (Legacy usage.)
2	Blower runs when both the occupancy sensor and schedule indicate occupied.
3	The same as option 2, but blower runs for 30 minutes and is off for 90 minutes when schedule is occupied but the occupancy sensor is not occupied.

Table 15. BACnet Occupancy Points

	BACnet	Value
Manual	Occupancy Override Control AO 103	0: space occupied
		1: space unoccupied
		2: refresh space occupied override timer
		3-255: auto; clear timer and return to scheduler
Schedule	Occupancy Scheduler Control AO 104	0: space occupied
		1-255: space unoccupied
Sensor	Occupancy Sensor Input AO 107	0: space occupied
		1: space unoccupied
		2-255: auto; return to occupancy scheduler state
Effective Occupancy	Effective Occupancy AI 241	0: space occupied
		1: space unoccupied
		2: space occupied (timed override)

Table 16. Blower Operation Description

Blower Operation	Description
On	Blower runs continuously.
Cycles	Blower cycles on/off with demand.
Cycles w/Stir	Blower cycles on/off with demand; during off cycle blower is on 30 minutes of 120.

Table 17. Blower Operation Schedule

Manual	Schedule	Sensor	Effective Occupancy	M2 ECTO 6.17	Blower Operation
0, 2	n/a	n/a	OCCUPIED	0	Cycles
				1	On
				2	On
				3	On
1	n/a	n/a	UNOCCUPIED	0	Cycles
				1	Cycles
				2	Cycles
				3	Cycles
3-255	0	0, 2-255	OCCUPIED	0	Cycles
				1	On
				2	On
				3	On
3-255	0	1	OCCUPIED	0	Cycles
				1	On
				2	Cycles
				3	Cycles w/Stir
3-255	1-255	n/a	UNOCCUPIED	0	Cycles
				1	Cycles
				2	Cycles
				3	Cycles

BACnet® Protocol Implementation Conformance (PIC) Statement

Date July 11, 2011
Vendor Name Lennox Industries, Inc.
Product Name Prodigy Rooftop Unit Controller
Product Model Number M2
Firmware Revision 1.00h
Application Software Version . 7.08.xx
BACnet Protocol Revision ... 7

Product Description

HVAC controller designed to control Lennox commercial rooftop units.

BACnet® Standardized Device Profile (Annex L)

- | | |
|---|--|
| <input type="checkbox"/> BACnet Operator Workstation (B-OWS) | <input checked="" type="checkbox"/> BACnet Application Specific Controller (B-ASC) |
| <input type="checkbox"/> BACnet Building Controller (B-BC) | <input type="checkbox"/> BACnet Smart Sensor (B-SS) |
| <input type="checkbox"/> BACnet Advanced Application Controller (B-AAC) | <input type="checkbox"/> BACnet Smart Actuator (B-SA) |

BACnet® Interoperability Building Blocks (BIBBs) Supported (Annex K)

Data Sharing: DS-RP-B(ReadProperty), DS-RPM-B(ReadPropertyMultiple), DS-WP-B(WriteProperty)
Device Management: DM-DDB-B(Dynamic Device Binding), DM-DOB-B(Dynamic Object Binding),
DM-DCC-B(DeviceCommunicationControl), DM-RD-B(ReinitializeDevice)

Which of the following device binding methods does the product support? (check one or more)

- Send Who-Is, receive I-Am (BIBB DM-DDB-A)
 Receive Who-Is, send I-Am (BIBB DM-DDB-B)
 Send Who-Has, receive I-Have (BIBB DM-DOB-A)
 Receive Who-Has, send I-Have (BIBB DM-DOB-B)
 Manual configuration of recipient device's network number and MAC address
 None of the above

Standard Object Types Supported

- | | |
|---|---|
| <input checked="" type="checkbox"/> Device Object | <input type="checkbox"/> Binary Output |
| <input checked="" type="checkbox"/> Analog Input | <input type="checkbox"/> Binary Value |
| <input checked="" type="checkbox"/> Analog Output | <input type="checkbox"/> File |
| <input checked="" type="checkbox"/> Analog Value | <input type="checkbox"/> Multi-State Input |
| <input type="checkbox"/> Binary Input | <input type="checkbox"/> Multi-State Output |

Data Link Layer Options

- BACnet® IP, (Annex J)
 BACnet IP, (Annex J), Foreign Device
 ISO 8802-3, Ethernet (Clause 7)
 ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
 ANSI/ATA 878.1, RS-485 ARCNET (Clause 8), baud rate(s) _____
 MS/TP master (Clause 9), baud rate(s): 9.6K, 19.2K, 38.4K, 76.8K
 MS/TP slave (Clause 9), baud rate(s): _____
 Point-To-Point, EIA 232 (Clause 10), baud rate(s): _____
 Point-To-Point, modem, (Clause 10), baud rate(s): _____
 LonTalk, (Clause 11), medium: _____
 Other: _____

Dynamically Creatable Objects: None

Dynamically Deletable Objects: None

Proprietary Properties: None

Networking Options: None

Segmentation Capability: None

Character Sets Supported:

- | | |
|---|--|
| <input checked="" type="checkbox"/> ANSI X3.4 | <input type="checkbox"/> ISO 10646 (UCS-2) |
| <input type="checkbox"/> IBM™/Microsoft™ DBCS | <input type="checkbox"/> ISO 10646 (UCS-4) |
| <input type="checkbox"/> ISO 8859-1 | <input type="checkbox"/> JIS C 6226 |