



GREYSTONE
ENERGY SYSTEMS INC

CDD3 Series

Carbon Dioxide Transmitter

SETUP GUIDE BACnet® COMMUNICATION



BACnet Overview

Using the BACnet system software, only map the point objects that are installed and required. Excessive point mapping will lower the network performance. On the CDD some objects will not be available if the hardware option is not installed. For example, AI 4 will not be available if there is no Setpoint controls installed. This could also be the case is the device has no RH, temperature or relay options. This can be determined via BACnet by checking the Reliability property of the optional objects.

If the hardware is not installed, the Reliability property will return NO_SENSOR and the Event_State property will indicate FAULT if the related hardware is not installed. To reduce network traffic, these points should not be polled.

The CDD product has 15 BACnet objects to identify the device, read current values, configure the device, control the alarm and calibrate the sensors. There are five standard supported BACnet object types as shown below.

Object Type	Dynamically Creatable	Dynamically Deletable	Object Identifier	Object Name
Device	No	No	381003	CDD_CO2_Detector_003
Analog Input	No	No	AI 1 AI 2 AI 3 AI 4	CO2_Level Relative_Humidity Temperature Setpoint Control
Analog Value	No	No	AV 1 AV 2 AV 3 AV 4 AV 5 AV 6	Relay_Setpoint Relay_Hysteresis Temperature_Offset Relative_Humidity_Offset Sensor_Altitude Display_Modes
Binary Value	No	No	BV 1 BV 2 BV 3	Override_Switch Auto_Cal_Enable Celsius
Binary Input	No	No	BI 1	Relay_On

The BACnet Device object allows configuration of the CO2 device. Device object properties are shown below.

Property	Default Value	Property Data Type	Access
Object Identifier	381003	BACnetObjectIdentifier(numeric)	Read / Write
Object Name	CDD_CO2_Detector_003	CharacterString (32)	Read / Write
Object Type	DEVICE (8)	BACnetObjectType	Read
System Status	OPERATIONAL (0)	BACnetDeviceStatus	Read
Vendor Name	Greystone Energy Systems	CharacterString	Read
Vendor Identifier	381	Unsigned16	Read
Model Name	CDD2A	CharacterString	Read
Firmware Revision	1.4	CharacterString	Read
Application Software Version	V1.0	CharacterString	Read
Location	150 English Drive, Moncton, NB	CharacterString (32)	Read / Write
Description	Greystone CO2 Detector	CharacterString (32)	Read / Write
Protocol Version	1	Unsigned	Read
Protocol Revision	14	Unsigned	Read
Protocol Services Supported	See description below	BACnetServicesSupported	Read
Protocol Object Types Supported	See description below	BACnetObjectTypesSupported	Read
Object List	See description below	BACnetArray	Read
Maximum APDU Length Accepted	128, B'0010'	Unsigned	Read
Segmentation Supported	NO_SEGMENTATION (3)	BACnetSegmentation	Read
APDU Timeout	6,000	Unsigned	Read / Write
Number of APDU Retries	3	Unsigned	Read / Write
Max Master	127	Unsigned	Read / Write
Max Info Frames	1	Unsigned	Read
Device Address Binding	empty	BACnetAddressBinding	Read
Database Revision	0	Unsigned	Read
Property List		BACnetArray	Read

- Object_Identifier** Initial default number is 381003, where 381 is the vendor ID and 003 is the default network MAC address. When the MAC address is initially changed the value is updated and saved. For example, if the MAC address is set to 50 via the menu for startup, then the device instance will be set to 381050. This property is also writable via BACnet. If the Device:Object_Identifier is written to via BACnet then the MAC address is no longer appended to the vendor ID to create this value.
- Object_Name** Initial string is "CDD_CO2_Detector_003" where CDD is the device model name and 003 is the default network address. Can be written with a new string of maximum length of 32 characters and the value is saved. The "003" is the MAC address as set by the menu and is automatically changed if the MAC address is changed. Once written to via BACnet, the MAC address no longer gets appended to the value.
- Protocol_Services_Supported** readProperty, writeProperty, deviceCommunicationControl, who-Has, who-Is
Binary bit string = {00000000 00001001 01000000 00000000 01100000 0}
- Protocol_Object_Types_Supported** Analog_Input, Analog_Value, Binary_Input, Binary_Value, Device
Binary bit string = {10110100 10000000 00000000 00000000 00000000 00000000 00000000}
- Object_List** ((Device, Instance 3), (Analog Input, Instance 1), (Analog Input, Instance 2), (Analog Input, Instance 3), (Analog Input, Instance 4), (Analog Value, Instance 1), (Analog Value, Instance 2), (Analog Value, Instance 3), (Analog Value, Instance 4), (Analog Value, Instance 5), (Analog Value, Instance 6), (Binary Value, Instance 1), (Binary Value, Instance 2), (Binary Value, Instance 3), (Binary Input, Instance 1))
- APDU_Timeout** Value is 6,000. Can be modified from 1 to 10,000.
- Number_Of_APDU_Retries** Value is 3. Can be modified from 1 to 10.
- Max_Master** Value is 127. Value is saved. Can be modified from 1 to 127.
- Database_Revision** Value is 0 to 255.

The four analog input BACnet objects allow reading of current sensor values and indicate which optional sensors are present via the reliability property. Analog input object properties are shown below.

Analog input object CO2_Level (Present_Value is current CO2 sensor reading in ppm. Resolution is 1 ppm.)

Property	Default Value	Property Data Type	Access
Object Identifier	AI1 (Analog Input 1)	BACnetObjectIdentifier	Read
Object Name	CO2_Level	CharacterString (32)	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	current reading	Real	Read
Description	CO2 Level	CharacterString (32)	Read
Device Type	0-2000 ppm CO2 Sensor	CharacterString (32)	Read
Status Flags	{false, false, false, false} (0000)	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED (0)	BACnetReliability	Read
Out of Service	FALSE (0)	Boolean	Read
Units	parts-per-million (96)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Analog input object Relative_Humidity (Present_Value is current RH sensor reading in %RH. Resolution is 1 %RH.)

Property	Default Value	Property Data Type	Access
Object Identifier	AI2 (Analog Input 2)	BACnetObjectIdentifier	Read
Object Name	Relative_Humidity	CharacterString (32)	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	current reading	Real	Read
Description	Relative Humidity	CharacterString (32)	Read
Device Type	0-100 %RH Sensor	CharacterString (32)	Read
Status Flags	{false, false, false, false} (0000) or (1100) if no sensor	BACnetStatusFlags	Read
Event State	NORMAL (0) or FAULT (1) if no sensor	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED (0) or NO_SENSOR (1)	BACnetReliability	Read
Out of Service	FALSE (0)	Boolean	Read
Units	Percent-relative-humidity (29)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Analog input object Temperature (Present_Value is current temperature sensor reading in °F or °C.)

Property	Default Value	Property Data Type	Access
Object Identifier	AI3 (Analog Input 3)	BACnetObjectIdentifier	Read
Object Name	Temperature	CharacterString (32)	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	current reading	Real	Read
Description	Temperature	CharacterString (32)	Read
Device Type	0-50 C Temperature Sensor or 32-122 F Temp...Sensor	CharacterString (32)	Read
Status Flags	{false, false, false, false} (0000) or (1100) if no sensor	BACnetStatusFlags	Read
Event State	NORMAL (0) or FAULT (1) if no sensor	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED (0) or NO_SENSOR (1)	BACnetReliability	Read
Out of Service	FALSE (0)	Boolean	Read
Units	degrees-Fahrenheit (64) or degrees-Celsius (62)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Device_Type String value is either “0-50 C Temperature Sensor” or “32-122 F Temperature Sensor”. This value changes depending on the BV3 object (Fahrenheit) Present_Value property.

Analog input object Setpoint_Control (Default Present_Value is current value from 0-100 %. Resolution is 10 %.)

Property	Default Value	Property Data Type	Access
Object Identifier	AI4 (Analog Input 4)	BACnetObjectIdentifier	Read
Object Name	Setpoint_Control	CharacterString (32)	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	current reading	Real	Read
Description	Setpoint Value	CharacterString (32)	Read
Device Type	0-100 % Setpoint	CharacterString (32)	Read
Status Flags	{ false, false, false, false } (0000) or (1100) if no sensor	BACnetStatusFlags	Read
Event State	NORMAL (0) or FAULT (1) if no sensor	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED (0) or NO_SENSOR (1)	BACnetReliability	Read
Out of Service	FALSE (0)	Boolean	Read
Units	percent (98)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Device_Type and Units can be changed via the local menu to several different values. The device type can be changed to "18-24 C Setpoint", "10-45 C Setpoint", "67-73 F Setpoint", "50-113 F Setpoint", "40-60 %RH Setpoint" or "500-1500 ppm Setpoint" and the Units will change to the correct units for the selected range; °C (62) , °F (64), %RH (29) or ppm (96).

The six analog value BACnet objects allow configuration of the relay parameters, calibration of the temperature and RH readings, setting the CO2 elevation parameter and configuring the LCD display information. Analog value object properties are shown below.

Analog value object Relay_Setpoint (Present_Value defaults to 1000 ppm. Can be set from 500 to 1500 ppm. Resolution is 1 ppm.)

Property	Default Value	Property Data Type	Access
Object Identifier	AV1 (Analog Value 1)	BACnetObjectIdentifier	Read
Object Name	Relay_Setpoint	CharacterString (32)	Read
Object Type	ANALOG_VALUE (2)	BACnetObjectType	Read
Present Value	1000	Real	Read / Write
Description	Relay Setpoint	CharacterString (32)	Read
Status Flags	{ false, false, false, false } (0000)	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Out of Service	FALSE (0)	Boolean	Read
Units	Parts-per-million (96)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Analog value object Relay_Hysteresis (Present_Value defaults to 50 ppm. Can be set from 25 to 200 ppm. Resolution is 1 ppm.)

Property	Default Value	Property Data Type	Access
Object Identifier	AV2 (Analog Value 2)	BACnetObjectIdentifier	Read
Object Name	Relay_Hysteresis	CharacterString (32)	Read
Object Type	ANALOG_VALUE (2)	BACnetObjectType	Read
Present Value	50	Real	Read / Write
Description	Relay Hysteresis	CharacterString (32)	Read
Status Flags	{ false, false, false, false } (0000)	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Out of Service	FALSE (0)	Boolean	Read
Units	Parts-per-million (96)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Analog value object Temperature_Offset (Present_Value defaults to 0 for no offset. Can be set from -10 to +10°F.)

Property	Default Value	Property Data Type	Access
Object Identifier	AV3 (Analog Value 3)	BACnetObjectIdentifier	Read
Object Name	Temperature_Offset	CharacterString (32)	Read
Object Type	ANALOG_VALUE (2)	BACnetObjectType	Read
Present Value	0	Real	Read / Write
Description	Temperature Offset Calibration	CharacterString (32)	Read
Status Flags	{false, false, false, false} (0000)	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Out of Service	FALSE (0)	Boolean	Read
Units	delta-degrees-Fahrenheit (120)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Analog value object Relative_Humidity_Offset (Present_Value defaults to 0 for no offset. Can be set from -10 to +10 %.)

Property	Default Value	Property Data Type	Access
Object Identifier	AV4 (Analog Value 4)	BACnetObjectIdentifier	Read
Object Name	Relative_Humidity_Offset	CharacterString (32)	Read
Object Type	ANALOG_VALUE (2)	BACnetObjectType	Read
Present Value	0	Real	Read / Write
Description	RH Offset Calibration	CharacterString (32)	Read
Status Flags	{false, false, false, false} (0000)	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Out of Service	FALSE (0)	Boolean	Read
Units	percent-relative-humidity (29)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Analog value object Sensor_Altitude (Present_Value defaults to 0 feet. Can be set from 0 to 5000 ft. Resolution is 500 ft.)

Property	Default Value	Property Data Type	Access
Object Identifier	AV5 (Analog Value 5)	BACnetObjectIdentifier	Read
Object Name	Sensor_Altitude	CharacterString (32)	Read
Object Type	ANALOG_VALUE (2)	BACnetObjectType	Read
Present Value	0	Real	Read / Write
Description	CO2 Sensor Altitude	CharacterString (32)	Read
Status Flags	{false, false, false, false} (0000)	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Out of Service	FALSE (0)	Boolean	Read
Units	feet (33)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Analog value object Display_Modes

Property	Default Value	Property Data Type	Access
Object Identifier	AV6 (Analog Value 6)	BACnetObjectIdentifier	Read
Object Name	Display_Modes	CharacterString (32)	Read
Object Type	ANALOG_VALUE (2)	BACnetObjectType	Read
Present Value	0	Real	Read / Write
Description	CO2 LCD Display Modes	CharacterString (32)	Read
Status Flags	{false, false, false, false} (0000)	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Out of Service	FALSE (0)	Boolean	Read
Units	no-units (95)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Present_Value Real value. The default value depends on the hardware installed. It will default to display all available input signals. Can be set to either 0, 1, 2 or 3 to indicate various LCD display modes.
 0 = CO2 only, 1 = CO2 + RH, 2 = CO2 + T, 3 = CO2 + RH + T

The three binary value BACnet objects allow configuration of the auto-cal feature of the CO2 sensor, changing units from °F to °C and reading the override switch status. Binary value object properties are shown below.

Binary value object Override_Switch

Property	Default Value	Property Data Type	Access
Object Identifier	BV1 (Binary Value 1)	BACnetObjectIdentifier	Read
Object Name	Override_Switch	CharacterString (32)	Read
Object Type	BINARY_VALUE (5)	BACnetObjectType	Read
Present Value	INACTIVE (0)	BACnetBinaryPV	Read / Write
Description	Override Switch	CharacterString (32)	Read
Status Flags	{ false, false, false } (0000) or (1100) if no switch	BACnetStatusFlags	Read
Event State	NORMAL (0) or FAULT (1) if no switch	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED (0) or NO_SENSOR (1)	BACnetReliability	Read
Out of Service	FALSE (0)	Boolean	Read
Property List		BACnetArray	Read

Present_Value, Value is 1 (ACTIVE) if the override switch has been pressed. This value is not saved. To reset, change to 0.

Binary value object Auto_Cal_Enable (Present_Value defaults to 0 (INACTIVE) for Celsius. Can be set to 1 (ACTIVE) for Fahrenheit. It is recommended that the Auto Cal feature remain ENABLED.

Property	Default Value	Property Data Type	Access
Object Identifier	BV2 (Binary Value 2)	BACnetObjectIdentifier	Read
Object Name	Auto_Cal_Enable	CharacterString (32)	Read
Object Type	BINARY_VALUE (5)	BACnetObjectType	Read
Present Value	ACTIVE (1)	BACnetBinaryPV	Read / Write
Description	Auto Calibration Enable	CharacterString (32)	Read
Status Flags	{ false, false, false, false } (0000)	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED (0)	BACnetReliability	Read
Out of Service	FALSE (0)	Boolean	Read
Property List		BACnetArray	Read

Binary value object Fahrenheit (Present_Value defaults to 1 (INACTIVE) for Celsius. Can be set to 1 (ACTIVE) for Fahrenheit.)

Property	Default Value	Property Data Type	Access
Object Identifier	BV3 (Binary Value 3)	BACnetObjectIdentifier	Read
Object Name	Fahrenheit	CharacterString (32)	Read
Object Type	BINARY_VALUE (5)	BACnetObjectType	Read
Present Value	ACTIVE (1)	BACnetBinaryPV	Read / Write
Description	Fahrenheit (1) or Celsius (0)	CharacterString (32)	Read
Status Flags	{ false, false, false, false } (0000) or (1100) if no sensor	BACnetStatusFlags	Read
Event State	NORMAL (0) or FAULT (1) if no temperature sensor	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED (0) or NO_SENSOR (1)	BACnetReliability	Read
Out of Service	FALSE (0)	Boolean	Read
Property List		BACnetArray	Read

The binary input BACnet object indicates the relay status. Binary input object properties are shown below.

Binary input object Relay_On (Present_Value is 1 (ACTIVE) if the relay is energized, 0 (INACTIVE) if not energized.)

Property	Default Value	Property Data Type	Access
Object Identifier	BI1 (Binary Input 1)	BACnetObjectIdentifier	Read
Object Name	Relay_On	CharacterString (32)	Read
Object Type	BINARY_INPUT (3)	BACnetObjectType	Read
Present Value	INACTIVE (0)	BACnetBinaryPV	Read
Description	Relay Status	CharacterString (32)	Read
Device Type	Indicates On/Off Status of Relay	CharacterString (32)	Read
Status Flags	{false, false, false, false} (0000) or (1100) if no relay	BACnetStatusFlags	Read
Event State	NORMAL (0) or FAULT (1) if no relay	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED (0) or NO_SENSOR (1)	BACnetReliability	Read
Out of Service	FALSE (0)	Boolean	Read
Polarity	NORMAL (0)	BACnetPolarity	Read
Property List		BACnetArray	Read

BACnet Trouble-shooting

The CO2 device operates as a slave. It will not communicate unless a master is connected to the network and sends a request for information, then the slave will answer. If the device does not communicate properly, first check that the communication wires are not reversed. Then check communication parameters set in the menu.

The default BACnet MAC address is 3 and each device must have a unique address to communicate properly. Use the Setup menu to change the MAC address to a unique number for each unit. Ensure the device object name and device object identifier are unique on the entire BACnet network, not just on the MS/TP sub-network. Both of these properties are writable in the device object.

The CDD automatically selects a device object name for itself using the format CDD_CO2_Detector_xxx, where xxx is the MS/TP MAC address (000 to 127) as set in the menu. If this name is changed by writing to the device Object_Name property via BACnet, then the MAC number will no longer be appended to the object name.

The CDD also automatically selects a device object identifier for itself using the format 381xxx, where xxx is the MS/TP MAC address (000 to 127) as set by the menu. If this ID is changed by writing to the device Object_Identifier property via BACnet, then the MAC number will no longer be appended to the object ID.

The default BACnet baud rate is 9600. Use the Setup menu to change the baud rate to the correct setting.

Ensure the application software (graphical interface) is not set to poll the devices too frequently. For example, if the software is polling the devices every 500 mS, the network could be heavily congested with the network traffic and may not operate reliably. A slower polling rate such as 5 to 10 seconds will usually produce better results on a typical network segment. Also consider that the CDD device only updates it's values on a 4 second period due to the time required to do CO2 sampling and analysis.

Use care when setting the MS/TP MAC address (via the menu) and the device object Max_Master property since both can have a significant effect on the network efficiency. Some MAC address and Max_Master combinations will operate more efficiently than others. MAC addresses should be selected sequentially, starting at the lowest possible value.

For example, on a five node segment, the CDD MAC addresses should be set to 1, 2, 3, 4 and 5. In this case, if the Max_Master property value is left at the 127 default, then there will be a lot of wasted time on the network polling for masters that are not present. In this example, the five CDD nodes should be set such that Max_Master is equal to 5. The Max_Master value initially defaults to 127 so that any master can be found when the CO2 device first starts.