

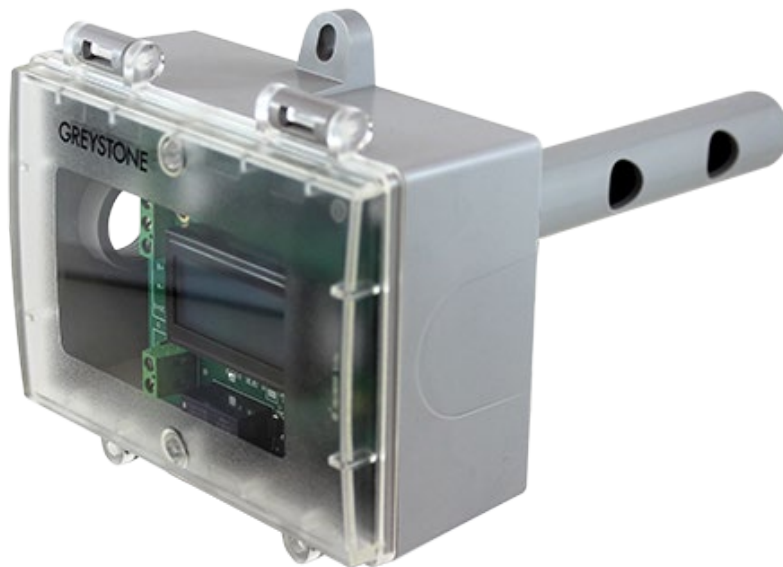


**GREYSTONE**  
ENERGY SYSTEMS INC

CHT Series

CO2/ RH/T Sensor

**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 CHTDT some objects will not be available if the hardware option is not installed. For example, AI 2 will not be available if there is no RH sensor installed. This could also be the case is the device has no T, 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 CHT product has BACnet objects to identify the device, read current values, configure the device, control the alarm and calibrate the sensors. There are six standard supported BACnet object types as shown below.

Object Type	Object Identifier	Object Name	Description	Default
Device	381003	CHTDT 003		
Analog Input	AI 1	CO2 Value	0 to 10,000ppm, resolution = 1ppm	
	AI 2	RH Value	0 to 100%RH, resolution = 0.1%RH	
	AI 3	Temperature Value	0 to 50°C with resolution = 0.1°C, or 32-122°F with resolution = 0.1°F	
Analog Value	AV 1	Relay Setpoint	500 to 1500 ppm, resolution=1ppm	1000 ppm
	AV 2	Relay Hysteresis	25 to 200 ppm, resolution=1ppm	50 ppm
	AV 3	Relay ON Delay	0 to 255s, resolution=1s	15s
	AV 4	Temperature Offset	-5.0 to 5.0 °C, or -10.0 to 10.0 °F, resolution= 0.1°C/F	0.0°C/F
	AV 5	RH Offset	-10 to 10%RH, resolution= 1%RH	0%RH
	AV 6	Altitude	0 to 2550 m, resolution=50m	0m
Binary Value	BV 1	Temperature Units	0 = °C, 1 = °F	0
	BV 2	Auto Cal Enable	0 = Disable Auto Cal, 1 = Enable	1
	BV 3	Relay Test	0 = Turn Relay Off ,1 =Turn Relay On	0
Binary Input	BI 1	Relay Status	0 = Inactivated, 1 = Activated	
Multi-state Value	MSV 1	LCD Backlight	0=AUTO, 1= OFF, 2= ON	0
	MSV 2	Display Modes	0=CO2, 1=CO2+RH+T	

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	CHTDT 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	CHTDT	CharacterString	Read
Firmware Revision	1.00	CharacterString	Read
Application Software Version	V1.0	CharacterString	Read
Location	150 English Drive, Moncton, NB	CharacterString (32)	Read / Write
Description	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 "CHTDT 003" where CHTDT 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, readPropertyMultiple, writeProperty, deviceCommunicationControl, who-Has, who-Is, subscribeCOV, subscribeCOVProperty  
Binary bit string = {00000100 00001011 01000000 00000000 01100010 0}

**Protocol\_Object\_Types\_Supported** Analog\_Input, Analog\_Value, Binary\_Value, Binary\_Input, Device, Multi-State\_Value  
Binary bit string = {10110100 10000000 00010000 00000000 00000000 00000000 00000000}

**Object\_List** ((Device, Instance 3), (AI1..AI3), (AV1..AV6), (BV1..BV3), (BI1 (MSV1..MSV2))  
**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.

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 Value	CharacterString (32)	Read
Object Type	ANALOG INPUT (0)	BACnetObjectType	Read
Present Value	current reading	Real	Read
Description	0 to 10,000ppm,resolution=1ppm	CharacterString (32)	Read
Device Type	CO2 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	parts-per-million (96)	BACnetEngineeringUnits	Read
COV Increment	200	Real	Read
Property List		BACnetArray	Read

Note, if CO2 error, CO2 Value=-1000

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	RH Value	CharacterString (32)	Read
Object Type	ANALOG INPUT (0)	BACnetObjectType	Read
Present Value	current reading	Real	Read
Description	0 to 100%%, resolution=0.1%%RH	CharacterString (32)	Read
Device Type	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
COV Increment	10	Real	Read
Property List		BACnetArray	Read

Note, if RH error, RH Value=-1000

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 Value	CharacterString (32)	Read
Object Type	ANALOG INPUT (0)	BACnetObjectType	Read
Present Value	current reading	Real	Read
Description	0 to 50C,resolution=0.1C, or 32 to 122F,resolution=0.1F	CharacterString (32)	Read
Device Type	Temperature 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
COV Increment	5	Real	Read
Property List		BACnetArray	Read

Note, if T error, T Value=-1000

Description: This value change is depending on the BV1 object (Fahrenheit) Present\_Value property.

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	500 to 1500ppm,resolution=1ppm	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	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	25 to 200ppm,resolution=1ppm	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	Parts-per-million (96)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Analog value object Relay On Delay (Present Value defaults to 15s. Can be set from 0 to 255s, resolution 1s)

Property	Default Value	Property Data Type	Access
Object Identifier	AV3 (Analog Value 3)	BACnetObjectIdentifier	Read
Object Name	Relay ON Delay	CharacterString (32)	Read
Object Type	ANALOG VALUE (2)	BACnetObjectType	Read
Present Value	15	Real	Read / Write
Description	0 to 255s,resolution=1s	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	Seconds (73)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Analog value object Temperature\_Offset (Present Value defaults to 0 for no offset. Can be set from -5 to 5C or -10 to +10°F resolution 0.1C/F.)

Property	Default Value	Property Data Type	Access
Object Identifier	AV4 (Analog Value 4)	BACnetObjectIdentifier	Read
Object Name	Temperature Offset	CharacterString (32)	Read
Object Type	ANALOG VALUE (2)	BACnetObjectType	Read
Present Value	0	Real	Read / Write
Description	-5.0 to 5.0C,resolution=0.1C or -10.0 to 10.0F,resolution=0.1F	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	delta-degrees-Celsius Δ°C (121) or 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 %, resolution 1%RH.)

Property	Default Value	Property Data Type	Access
Object Identifier	AV5 (Analog Value 5)	BACnetObjectIdentifier	Read
Object Name	RH Offset	CharacterString (32)	Read
Object Type	ANALOG VALUE (2)	BACnetObjectType	Read
Present Value	0	Real	Read / Write
Description	-10 to 10%RH,resolution=1%RH	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 value object Sensor Altitude (Present Value defaults to 0 feet. Can be set from 0 to 2550m. Resolution is 50m.)

Property	Default Value	Property Data Type	Access
Object Identifier	AV6 (Analog Value 6)	BACnetObjectIdentifier	Read
Object Name	Altitude	CharacterString (32)	Read
Object Type	ANALOG VALUE (2)	BACnetObjectType	Read
Present Value	0	Real	Read / Write
Description	0 to 2550m,resolution=50m	CharacterString (32)	Read
Status Flags	{false, false, false, false} (0000)	BACnetStatusFlags	Read
Event State	NORMAL (0) or FAULT	BACnetEventState	Read
Reliability	NO FAULT DETECTED (0)	BACnetReliability	Read
Out of Service	FALSE (0)	Boolean	Read
Units	meters (31)	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Binary value object Temperature Units (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	BV1 (Binary Value 1)	BACnetObjectIdentifier	Read
Object Name	Temperature Units	CharacterString (32)	Read
Object Type	BINARY_VALUE (5)	BACnetObjectType	Read
Present Value	INACTIVE (0)	BACnetBinaryPV	Read / Write
Description	0=Celsius, 1=Fahrenheit	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

Binary value object Auto\_Cal\_Enable (Present Value defaults to 0 (INACTIVE) for Disable Auto Cal. Can be set to 1 (ACTIVE) for Enable Auto Cal

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	0=Disable, 1=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 Relay Test (Present Value defaults to 0 (INACTIVE) for Relay OFF. Can be set to 1 (ACTIVE) for Relay ON

Property	Default Value	Property Data Type	Access
Object Identifier	BV3 (Binary Value 3)	BACnetObjectIdentifier	Read
Object Name	Relay Test	CharacterString (32)	Read
Object Type	BINARY_VALUE (5)	BACnetObjectType	Read
Present Value	INACTIVE (0)	BACnetBinaryPV	Read / Write
Description	0=Turn OFF, 1=Turn ON	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
Property List		BACnetArray	Read

Binary input object Relay Status (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 Status	CharacterString (32)	Read
Object Type	BINARY_INPUT (3)	BACnetObjectType	Read
Present Value	INACTIVE (0)	BACnetBinaryPV	Read
Description	0=Inactivated, 1=Activated	CharacterString (32)	Read
Device Type	Indicates Relay Status	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

Multi-State value object: LCD Backlight

Property	Default Value	Property Data Type	Access
Object Identifier	MSV1	BACnetObjectIdentifier	Read
Object Name	LCD Backlight	CharacterString (32)	Read
Object Type	MULTISTATE_VALUE (19)	BACnetObjectType	Read
Present Value	See Below	Real	Read / Write
Description	0=Auto,1=OFF,2=ON	CharacterString (32)	Read
Status Flags	{false, false, false, false} (0000) or (1100) if no backlight	BACnetStatusFlags	Read
Event State	NORMAL (0) or FAULT (1) if no backlight	BACnetEventState	Read
Reliability	NO_FAULT_DETECTED (0) or NO_SENSOR (1)	BACnetReliability	Read
Out of Service	FALSE (0)	Boolean	Read
Number of States	3	BACnetEngineeringUnits	Read
Property List		BACnetArray	Read

Present\_Value Real value. The default value is set to AUTO.  
0 = AUTO, 1 = OFF, 2 = ON

Multi-State value object: Display Modes

Property	Default Value	Property Data Type	Access
Object Identifier	MSV2	BACnetObjectIdentifier	Read
Object Name	Display Modes	CharacterString (32)	Read
Object Type	MULTISTATE_VALUE (19)	BACnetObjectType	Read
Present Value	See Below	Real	Read / Write
Description	0-1=CO2, CO2+RH+T	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
Number of States	4	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, or 1 to indicate various LCD display modes.  
0 = CO2 only, 1 = CO2 + RH + T



## **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 CHTDT automatically selects a device object name for itself using the format CHTDT\_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 CHTDT 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 CHTDT device only updates its 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 CHTDT 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 CHTDT 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.

## BACnet Protocol Implementation Conformance Statement (PICS)

**Date :** June 13, 2022  
**Vendor Name :** Greystone Energy Systems  
**Product Name :** CO2/RH/T Sensor  
**Product Model Number :** CHTXXXBAC  
**Application Software Version :** 1.0  
**Firmware Revision :** 1.4  
**BACnet Protocol Revision :** 14

**Product Description :** The Greystone CO2/RH/T sensors with native BACnet MS/TP protocol for network communication. They measure CO2, humidity and temperature and reports values back to a building automation system (BAS). The device features an LCD to display measured values and for setup.

**BACnet Standardized Device Profile (Annex L) :** BACnet Application Specific Controller (B-ASC)

**BACnet Interoperability Building Blocks Supported (Annex K) :** DS-RP-B, DS-WP-B,  
DM-DDB-B, DM-DOB-B  
DM-DCC-B

**Segmentation Capability :** Not supported

### Standard Object Types Supported :

Object Type	Dynamically Creatable	Dynamically Deletable	Optional Properties Supported	Writable Properties
Device	No	No	Location, Description, Max_Master, Max_Info_Frames	Object_Identifier, Object_Name, Location, Description, APDU_Timeout, Max_Master, Number_Of_APDU_Retries
Analog Input	No	No	Description, Reliability, Device_Type	
Analog Value	No	No	Description	Present_Value
Binary Value	No	No	Description, Reliability	Present_Value

**Data Link Layer Options :** MS/TP master (Clause 9),  
Baud rates : 9600, 19200, 38400, 57600, 76800, 115200

**Device Address Binding :** Not supported

**Networking Options :** None

**Character Set Supported :** ISO 10646 (UTF-8)