CWLP, CWXP

Wall Mounted Environmental CO_2 Sensors with Protocol Communication

Installation Guide
Z205597-0G
0316

VERIS INDUSTRIES™

CE*

** The CE mark indicates RoHS2 compliance. Please refer to the CE Declaration of Conformity for additional details.*

NOTICE

- **This product is not intended for life or safety applications.**
- **Do not install this product in hazardous or classified locations.**
- **Read and understand the instructions before installing this product.**
- **Turn off all power supplying equipment before working on it.**
- **The installer is responsible for conformance to all applicable codes.**

If this product is used in a manner not specified by the manufacturer, the protection provided by the product may be impaired. No responsibility is assumed by the manufacturer for any consequences arising out of the use of this material.

Product Identification

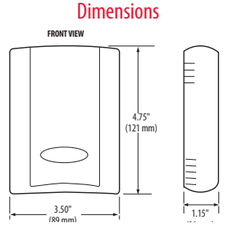
CW

Local Display	Protocol	RH Option	Temp. Option
L = LCD X = No display	P = Protocol	X = No RH 2 = RH 2% NIST H = RH 2%	X = No temp. option T = Temp. Transmitter

Temp. Cal. Cert.	Option	Housing
X = None 1 = 1 pt. cal. cert.* 2 = 2 pt. cal. cert.* 3 = 3 pt. cal. cert.*	Blank = None 1 = Pushbutton override 2 = Set point slider 3 = Pushbutton override + set point slider	Blank = Cloud white B = Black

** Only available if temperature option is selected.*

Dimensions



Specifications

Input Voltage	Class 2; 12 to 30 Vdc, 24 Vac; 100 mA max.
Operating Temperature Range	No humidity option: 0 to 50 °C (32 to 122 °F) With humidity option: 10 to 35 °C (50 to 95 °F)
Operating Humidity Range	0 to 95% RH non-condensing
Housing Material	High impact ABS plastic , UL 94 V0
Protocol	BACnet or Modbus (selectable)
Connection	2-wire RS-485
Data Rate	Modbus: 9600, 19200, 38400, 57600, bps (selectable) BACnet: 9600, 19200, 38400, 76800, bps (selectable)
Parity	Modbus: None/Odd/Even (selectable); BACnet: None
Address Range	1 to 127
CO_2 Transmitter:	
Sensor Type	Non-dispersive infrared (NDIR) diffusion sampling
Measurement Range	0 to 5000 ppm
Accuracy	± 30 ppm ±5% of measured value
Repeatability	±20 ppm ±1% of measured value
RH Transmitter Option:	
HS Sensor	Replaceable digitally profiled thin-film capacitive (32-bit mathematics); U.S. Patent 5,844,138
Accuracy*	±2% from 10 to 80% RH; NIST traceable multi-point calibration
Reset Rate**	24 hours
Stability	±1% @ 20 °C (68 °F) annually for two years
Hysteresis	1.5% typical
Temperature Coefficient	±0.1% RH/°C above or below 25 °C (typical)
Temperature Transmitter Option:	
Sensor Type	Solid-state, integrated circuit
Accuracy	±0.5 °C (±1 °F) typical
Resolution	0.1°C (0.2 °F)
Range	10 to 35 °C (50 to 95 °F)
Relay Contacts:	
1 Form C (SPDT)	1 A@30 Vdc, resistive; 30 W max.
Setpoint Slider Resolution Option	1% full scale
Override Button Option	Remotely readable and resettable

** Specified accuracy with 24 Vdc supplied power with rising humidity.*
*** Reset rate is the time required to recover to 50% RH after exposure to 90% RH for 24 hours.*
Note: Rough handling and transportation may cause a temporary reduction of CO_2 sensor accuracy. With time, the ABC function will tune the readings back to the correct accuracy range. The default tuning speed is limited to 30 ppm per week.

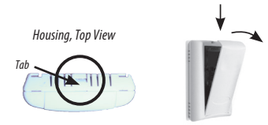
Operation

Veris' CWxP wall mounted sensors with protocol output measure the levels of CO_2, RH (if equipped), and temperature (if equipped) of air inside a room. The CO_2 sensor employs the Automatic Baseline Calibration (ABC) feature that enables the sensor to operate within accuracy specifications for the calibration interval of 5 years. RH equipped models feature a replaceable humidity element (HS2NX or HS2XX), available through Veris. LCD models continuously show the CO_2 reading in ppm on the first line of the display. The second line of the display alternates between %RH and temperature readings if the device is equipped with both of these features (RH, non-temperature models continuously show the RH reading; temperature transmitter, non-RH models continuously show the temperature reading). CWxP devices have an on-board relay that trips when the CO_2 level reaches the programmable setpoint. The user can override this relay remotely from the controller. On models with pushbutton override, press the button to change the state of BV4 from 0 to 1; this does not locally override the relay. To maintain accurate functionality, keep all vents free of dust, debris, etc.

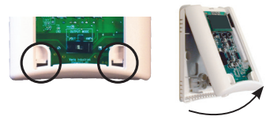
Installation

Observe precautions for handling static sensitive devices to avoid damage to the circuitry that is not covered under the factory warranty.

1. Locate the tab at the top of the sensor housing. Using only the minimum required force, press this tab down and pull the cover outward from the top. Set the cover aside.



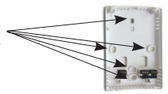
2. Locate the tabs at the bottom corners of the sensor housing. Press these tabs and pivot the sensor outward to remove the sensor and expose the backplate. Set the sensor aside.



3. Punch out desired wire openings in the backplate.

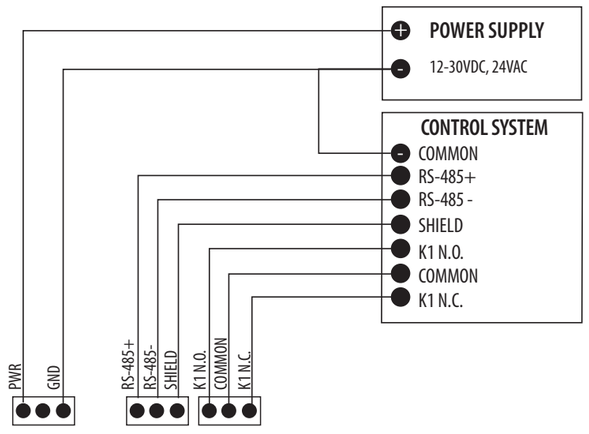
4. Position the sensor vertically on the wall, 4½ feet above the floor. Locate away from windows, vents, and other sources of draft. If possible, do not mount on an external wall, as this might cause inaccurate temperature readings.

5. Mount the backplate onto the wall using the screws provided.



6. Wire the backplate.

Wire the RS-485 connections with shielded, twisted-pair wire. Connect the shield at one end only to the RS-485 SHIELD terminal.

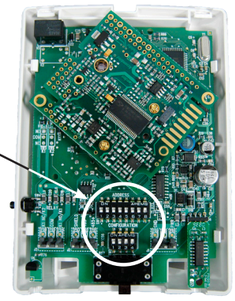


Ground each unit via the power supply GND terminal. Grounding is necessary to minimize common mode voltage on the signal lines and to minimize radio frequency emissions that can interfere with the operation of nearby radio equipment.

Daisy-chain devices with 120Ω termination resistors between RS-485+ and RS-485- on the last device at each end of the chain. Maximum of 63 devices on one daisy chain.

The relay is designated as K1. Both N.O. and N.C. contacts are available.

1. Configure the sensor.
Set the DIP switches on the backside of the board.



Select Address DIP switches

1. Up for Modbus, Down for BACnet.
2. Up to add 64 to network address.
3. Up to add 32 to network address.
4. Up to add 16 to network address.
5. Up to add 8 to network address.
6. Up to add 4 to network address.
7. Up to add 2 to network address.
8. Up to add 1 to network address.

The network address is the sum of the values selected by placing switches 2 through 8 in their UP position. E.g.: If switches are D D D U D U D D, then BACnet communication is selected, and the address is 16 + 4, for a total of 20. Valid Modbus addresses are 1 to 127, and valid BACnet addresses are 0 to 127. Each device on the daisy chain must have a unique address.

Select Configuration DIP switches

Configuration DIP switches 1 and 2 control the parity settings for Modbus and have no effect on BACnet communication, which never has parity.

Switch 1	Switch 2	Parity
Down	Down	None (2 stop bits)
Down	Up	Odd
Up	Up	Even
Up	Down	None (1 stop bit; common but non-standard)

Configuration DIP switches 3 and 4 control the data rate for both Modbus and BACnet modes.

Switch 3	Switch 4	Data Rate
Down	Down	9600 bps
Down	Up	19200 bps
Up	Down	38400 bps
Up	Up	Modbus: 57600 bps; BACnet: 76800 bps

Modbus Configuration

The list of supported Modbus function codes and the Modbus Point Map are in the Point Map section of this document. The capabilities for controlling the CWxP are identical with those for BACnet. The functions are summarized here.

Function	Description
Coils	Used to set temperature (Fahrenheit scale), relay override, override button coil, and local calibration lockout. *
Discrete input	Indicates whether the relay is on.
Input registers	Used to configure the sensor options: CO_2 level (in ppm), RH (in units of 0.1%), temperature (in units of 0.1°), and the slider (in units of %full scale). **
Holding registers	Used to specify the CO_2 setpoint for the relay, the deadband,auto-calibration, temperature offset, and RH offset. Initial settings are 800 ppm, 50 ppm, Normal, 0°F, and 0%, respectively. Settings are retained if power is lost.

** The temperature scale and local calibration lockout settings are maintained if power is lost. When delivered, temperature in Farenheit and calibration lockout is on. Pressing the override button turns the override button coil on. It can only be turned off remotely.*

*** If any sensor option is not installed, the reading for that sensor will be 0.*

The various registers are still present even without the corresponding options installed. In particular, the discrete input function can be used to see if the CO_2 setpoint has been reached even if the relay is not in use.

BACnet Configuration

The list of BACnet objects and their implemented properties is in the BACnet Descriptions section of this document. The capabilities for controlling the CWxP are identical with those for the Modbus configuration. However, BACnet has some additional protocol-related settings.

The Device Object must have a unique name. This is set at the factory to the model name, followed by the device's serial number. The name can be changed if desired. The device object must also have a unique object identifier number. By default, this is 133nnn where nnn is the current network address. This number can be changed and the new number will be remembered. Setting the number to -1 (normally not allowed) will reset the device to the default.

The Reliability property of the analog inputs for temperature, relative humidity, and slider can be read to determine whether the device has these options installed.

ABC Calibration Algorithm

ABC (Automatic Baseline Calibration) is a patented self-calibration feature that automatically adjusts the CO_2 sensor to compensate for drift. When ABC is enabled, the lowest reading within every 24-hour period is recorded and analyzed over a running 7-day or 28-day period. If a statistically significant amount of drift is detected, an automatic correction factor is applied. This enables the sensor to operate within specifications for the 5-year calibration interval.

There are three settings (Modbus holding register 3 or BACnet Auto_Cal):

0. Normal – recommended setting! Use for applications in which the building is unoccupied within a 24 hour timeframe. This is the default.
1. Low – use for buildings occupied 24 hours a day.
2. Off – Not Recommended

2. Install the sensor onto the backplate.

3. When installation is complete, install the cover and snap into place.

No-LCD version *LCD version*

Visual Indicators

The CAL light will be on continuously during calibration.

The RX light will flash while data is being received. If it isn't blinking, it can indicate a bad connection or that the RS-485+ and RS-485– wires are connected backwards.

The TX light will flash while data is being transmitted. For Modbus, if this light isn't blinking it can mean that the device isn't being selected (wrong address) or the communication parity or bit rate is set improperly.

In a BACnet installation, both the RX and TX lights will flash repeatedly even if no communication is being performed. In a Modbus installation, no lights will flash if there is no communication activity.

Modbus Point Map

Function codes:

Function code	Function
01	Read coils
02	Read discrete inputs
03	Read holding registers
04	Read input registers (if any sensor is not installed, the reading for that sensor will be 0)
05	Write single coil
06	Write single register
07	Diagnostics (sub-function 00 returns query data)
15	Write multiple coils
16	Write multiple registers
17	Report slave ID (returns manufacturer, model name, and serial number)

All of these values correspond to BACnet objects with the same name. See the BACnet Descriptions section for definitions.

Discrete Inputs	
1	Relay On (due to reaching setpoint, not due to override)
Coils	
1	Fahrenheit (else Celsius)
2	Relay override
3	Cal Lockout
4	Override (use override button to turn on, if present)
Input Registers	
1	CO_2 level (in ppm)
2	Humidity (in tenths of a percent) or 0 if not installed
3	Temperature (in tenths of a degree; units set by coil 1) or 0 if not installed
4	Slider (in percent) or 0 if not installed
Holding Registers	
1	CO_2 setpoint (in ppm CO_2)
2	CO_2 deadband (in ppm CO_2)
3	Auto Cal (0=normal; 1=low; 2=off)
4	Temp Offset (in tenths of a degree, current units)
5	RH offset (in tenths of a percent)

BACnet Descriptions

All properties read-only unless otherwise noted. Preserved means it is non-volatile.

Present_Value Range Restrictions

Object Name	Minimum Value	Maximum Value
Device_Instance	0 (but see description, above)	4,194,302
CO2_Setpoint	500	2,500
CO2_Deadband	10	500
Auto_Cal	0	2
Temp_Offset	-5	5
RH_Offset	-10	10

Standard Object Types Supported

Object Type	Supported Optional Properties	Writable Properties
Analog Input -- AI	Description*, Reliability	
Analog Value -- AV	Description*	Present_Value
Binary Input – BI	Description*	
Binary Value – BV	Description*	Present_Value
Device -- DEV	Description*, Location	APDU_Timeout, Description, Location, Max_Master, Object_Identifier, Object_Name

** Description is the same as the Object_Identifier. Reliability is "No Sensor" if no sensor is installed (applies to humidity, temperature, and slider).*

Objects Table

Object Name	Type and Instance	Description of Present_Value Property
CO2_Level	AI 1	Gas concentration in ppm
Humidity	AI 2	Humidity in percent (if sensor installed)
Temperature	AI 3	Temperature in Fahrenheit or Celsius (if sensor installed)
Slider	AI 4	Slider position in percent (if present)
Device_ Instance	AV 1	Alternative way to change object_identifier property of device. A negative value will restore the default device instance (133nnn). Fractional values are truncated.
CO2_Setpoint	AV 2	Setpoint in ppm. Initial value 800. Fractional values are truncated.
CO2_ Deadband	AV 3	Relay deadband in ppm. Initial value is 50. Fractional values are truncated.
Auto_Cal	AV 4	Auto-calibration. Valid values are 0 (normal), 1 (low), or 2 (off). Initial value is 0.
Temp_Offset	AV 5	Temperature offset. Value rounded to nearest tenth of a degree. Units are current units. Initial value is zero. (if present)
RH_Offset	AV 6	Relative Humidity offset. Value rounded to the nearest tenth of a percent. Initial value is zero. (if present)
Relay_On	BI 1	1 if relay energized because of gas concentration. BV2 will not affect this value.
Fahrenheit	BV 1	1 if temperature in Fahrenheit, 0 if in Celsius. Initially 1. (if present)
Relay_ Override	BV 2	1 will force relay on. Initially 0. Volatile.
Cal_Lockout	BV 3	1 will lock-out calibration. Initially 1.
Override	BV 4	1 if override button pressed. Store 0 to reset. Initially 0. Volatile. (if present)

Device Objects Table

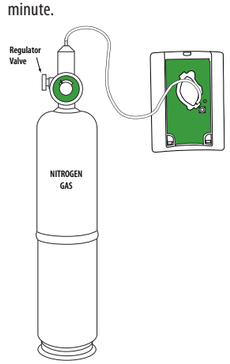
Object Name	Type and Instance	Object Property	Description
CWxPxxx	Device 133nnn	Object_Identifier (R/W)	Unique value where nnn initially is MS/TP
		Object_Name (R/W)	Unique name, initially a combination of model and serial number. Maximum length is 64 characters
		APDU_Timeout	Default is 3000, maximum value is 60000
		Max_Master	Default is 127
		Description	Maximum length is 64 characters
		Location	Maximum length is 64 characters

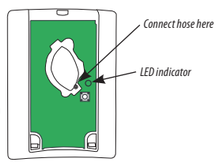
Calibration

CO_2 sensor calibration requires a gas calibration kit, available from Veris Industries. Performing calibration without the gas kit will cause erroneous readings.

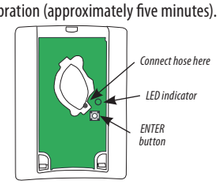
This product is factory-calibrated. The typical CO_2 sensor calibration interval is 5 years, dependent on specific site installation factors. As of the date of this document, compliance with ANSI/ASHRAE 62-2001 requires minimum on-site accuracy verification intervals of 6 months or per the building operation and maintenance manual. Perform accuracy verification using a comparison to either a known reference or to the CO_2 gas calibration kit available from Veris Industries (Model AA01).

1. Make sure that calibration is unlocked (Modbus/BACnet device setting)
2. Remove cover and connect gas cylinder hose to the plastic port located on sensing module. Only connect one sensor to the calibration gas cylinder at a time.
3. Start flowing nitrogen gas (0 ppm CO_2). Use a flow rate of 0.3 to 0.5 liter/minute.





4. Press and hold the CAL button until the calibration light turns on continuously (approximately five seconds). Once the light turns on, release the button. If the light does not come on, calibration is probably locked and needs to be unlocked first.
5. Wait for the light to turn off, signifying the end of calibration (approximately five minutes).



6. Turn off the gas, and remove the hose. Replace the cover.
7. Optional: lock-out calibration via Modbus/BACnet.

Conformance Statement

Vendor Name: Veris Industries
Product Name: Veris CWxP Environmental Sensor
Product Model Number: CWxPxxx
Application Software Version: 1
Firmware Revision: x.x
BACnet Protocol Revision: 2
Product Description: Environmental Sensor
BACnet Standardized Device Profile (Annex L): BACnet Application Specific Controller (B-ASC)
List all BACnet Interoperability Building Blocks Supported (Annex K):
DS-RP-B,DS-RPM-B,DS_WP-B,DM-DDB-B,DM-DOB-B,,DM-DCC-B
Segmentation Capability: Segmentation not supported
Standard Object Types Supported:
No dynamic creation or deletion supported
No proprietary properties or object types
(other information about objects on preceding pages)
Data Link Layer Options: MS/TP master (Clause 9), baud rates: 9600, 19200, 38400, 76800
Device Address Binding: Static device binding is not supported. (No client functionality is included).
Networking Options: None
Character Sets Supported: ANSI X3.4