Senticon
SENTIENT CONTROL SOLUTIONS

Technical Data Sheet PS3.03
TDR04/CDR04

TDR04/CDR04 Modbus and BACnet Temperature and CO2 Sensors, Network IO Moduless

The TDR04/CDR04 Series Smart Temperature and CO2 Multi-Sensors have been designed for monitoring and control CO2, VOC, Temperature and Humidity in room spaces. The TDR04/CDR04 series sensors are wall surface mounted and have mounting locations for standard wall boxes. TDR04 have temperature measurement and CDR04 have temperature and CO2 measurement.

The sensors can have an optional colour display with high hardness glass front and one to three push buttons (setpoint, boost). The CDR04 sensors are connected to a BMS via Modbus or BACnet communications. The CDR04 CO2 sensors can be used as traffic light CO2 sensors to indicate alarm conditions in the room space. The CDR04 CO2 sensors support also legacy CDR-MOD sensor Modbus registers making service replacements easy.

Features

- Multi-Function Sensors for monitoring temperature (TDR04, CDR04) and CO2 (CDR04) with optional VOC, 2% accurate relative humidity and occupancy (2B versions)
- 3 x Analogue 0..10Vdc Outputs, max 2mA, 2 x 24Vac Triac Outputs for Network Control - Operates as Remote IO-modules
- 2 x Universal inputs (temperature/0-10V/digital) for remote monitoring over Modbus/BACnet
- BACnet MS/TP or Modbus RS485 RTU with up to 60V industrial isolation on RS485 for system integration
- Modbus register support for legacy CDR-MOD CO2 sensors (minimum engineering replacement solution), and TER-MOD Temperature Sensors
- Built-In PI 4-Stage Temperature Control Loop and CO2 Control Loop. Max VAV Functions to control VAV damper.
- User display language customisable using the language packs
- Colour LCD for displaying the measurements and for setpoint adjustment
- Traffic Light Alarms display function with configurable limits for CO2 (CDR04), temperature, humidity or VOC
- 2B two button versions have setpoint buttons up and down
- 1B single button version to activate timed Boost function
- 3B three button version for setpoint and boost button

- Optional occupancy (PIR) sensor for Non Button and 2 Button versions
- Configuration wirelessly through Device Configuration Tool Windows Software (wireless Bluetooth/wired/Modbus connection) or Smart Phone iOS App (using Bluetooth Dongle).

Technical Specifications

Power Supply:	Power:	24Vac/dc -10%/+15%, max 40mA with display
Measurements:	Temperature	
	Range:	0..50° (32..122°F)
	Accuracy:	+/-0.5°C
	CO2 (CDR04 Only)	
	Output Range:	0..10,000ppm
	Accuracy:	+/-30ppm + 3% of the reading (400..5,000ppm Range)
	Response Time:	60 seconds
	Humidity (RH Option)	
	Range:	0..100%rH
	Accuracy:	+/-2%rH (within 20 to 80%rH)
	PIR Movement (OE Option)	
	Type/Range:	Passive Infrared Movement Detection, Range up to 5m
Inputs:	Universal Inputs:	2 x Universal Inputs - RI/AI/DI Application Selected RI = NTC10 Measurement (10kOhms at 25°C, $B_{25/85}$ curve 3,977K) AI = 0..10Vdc Input DI = Digital Volt-Free Input
Outputs:	Analogue Outputs:	3 x 0..10Vdc, min. load resistance >5 kOhms (max. 2mA @ 10V)
	Digital Outputs:	2 x 24Vac Rated Triacs, Switching to 0V, Max 1A load (max 3. thermic actuators per triac)
Communication:	Physical Interface	1 x RS485 driver with up to 60V industrial Isolation, recommended max 63 devices
	Protocol:	Modbus RTU or BACnet MS/TP
	Addressing:	Via Bitswitch: 1..127 Via Software/Display: 1..247 for Modbus, 1..127 for BACnet MS/TP
	Settings:	Baud Rate: 9600/19200/38400/76800 (bitswitch), 57600/115200 (software) Modbus Parity: None/Even/Odd, Modbus Stop Bits: 1 or 2 (Default: 9600/None/1)
Display:	LCD (Option)	Colour LCD Display with Glass Overlay
User Adjustment:	Buttons:	1B Model: 1 Push Button for Boost 2B models: 2 Push Buttons for Setpoint Up and Down 3B models:3 Push Buttons for Setpoint Up/Down and Boost
Mechanical:	Wiring Terminals:	Rising Cage Screw Terminals, 0.2 to 2.5mm^2 / 26 to 12 AWG
	Enclosure:	ABS ULV0 Plastics - White
	Protection Class:	IP30 (when mounted on a wall or a junction box)
	Mounting:	Standard: Wall or Junction Box Mounting (60mm screw distance) Slimline: Junction Box Mounting (60mm screw distance)
	Dimensions	Standard: W86 x H86 x D24mm
Country of Origin:		United Kingdom

Model Selection

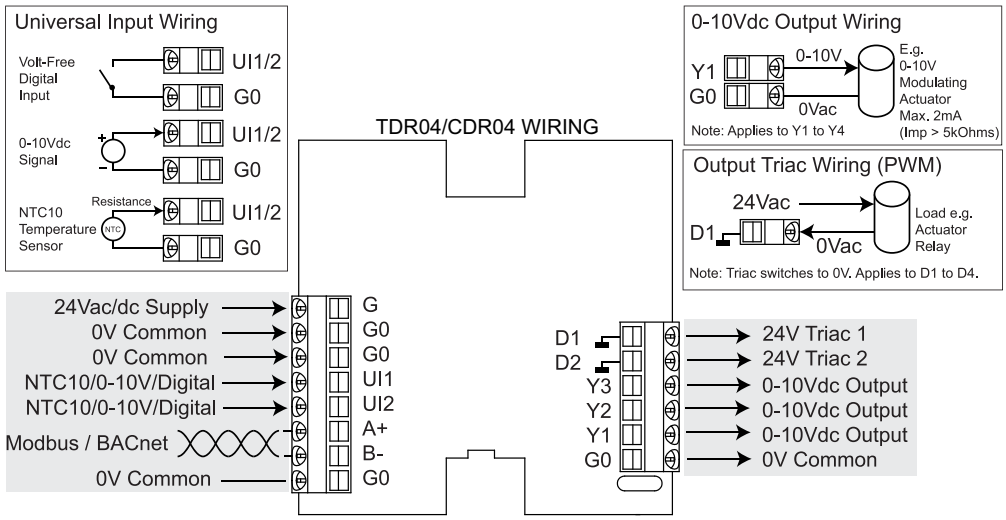
Refer to the below table to select the required model. The part number offers descriptive method for the product and options selection, and the SKU# number provides unique reference number.

Part Number			SKU# Number					
Example		CDR04-MOD-LCD-1B-W	1070	1	21	00	00	02
Product Name			Product		Product Options			
	CDR04	Room Temperature and CO2 Sensor with Control, 2UI, 3AO, 2DO	1070					
	TDR04	Room Temperature Sensor with Control, 2UI, 3AO, 2DO	1270					
Serial Communication Option								
	MOD	Modbus RS485		1				
	BAC	BACnet MS/TP		2				
Interface Options								
		No Interface (Blank Front)			00			
	LCD	Colour LCD Display			01			
	LCD-1B	Colour LCD Display with Boost Button			21			
	LCD-2B	Colour LCD Display with Two Buttons (Setpoint)			22			
	LCD-3B-BST	Colour LCD Display with Three Buttons, Setpoint Up and Down, Boost Button			33			
Measurement Options								
		No Extra Measurements				00		
	RH	Relative Humidity				01		
	OE	Passive Infrared Movement (PIR) - Not available with 1B & 3B Models				03		
	RH-OE	Relative Humidity and PIR				04		
Colour Options								
	W	White					00	02

Wiring Connections

CDR04 WIRING CONNECTIONS

The diagram below illustrates the wiring connections to the controllers.



WIRING TERMINATIONS

Terminal	Description
G	24Vac/dc -10/+15% Supply
G0	0V Common
UI1	NTC10/0-10V/Volt-Free Digital Input 1
UI2	NTC10/0-10V/Volt-Free Digital Input 2
A+	Modbus / BACnet RS485 A+
B-	Modbus / BACnet RS485 B-
G0	0V Common

Terminal	Description
D1	24Vac Triac, Max 1A
D2	24Vac Triac, Max 1A
Y3	0-10Vdc Output max. 2mA
Y2	0-10Vdc Output max. 2mA
Y1	0-10Vdc Output max. 2mA
G0	0V Common

CONNECTING LEGACY CDR-MOD/CDR-BAC CO2/TER-MOD/TER-BAC SENSORS

The table below describes where to connect the wires when using the TDR04/CDR04 is used to replace the legacy CDR-MOD/CDR-BAC CO2 and TER-MOD/TER-BAC temperature sensors.

CDR-MOD/CDR-BAC TERMINATIONS	
Terminal	**Description**
DO1	Digital Output 1
DO2	Digital Output 2
G	24Vac/dc Supply
G0	0V Common
Y1	Analogue 0..10Vdc
Y2	Analogue 0..10Vdc
Y3	Analogue 0..10Vdc
G0	0V Common
A+	RS485
B-	RS485 B-
G0	0V Common
RI1	NTC10 Resistive Input 1
DI1	Digital Input 1, Volt-Free
RI2	NTC10 Resistive Input 2
DI2	Digital Input 2, Volt-Free

CORRESPONDING CDR04 TERMINATIONS	
Terminal	**Description**
D1	24Vac Triac, Max 1A
D2	24Vac Triac, Max 1A
G	24Vac/dc -10/+15% Supply
G0	0V Common
Y1	0-10Vdc Output max. 2mA
Y2	0-10Vdc Output max. 2mA
Y3	0-10Vdc Output max. 2mA
G0	0V Common
A+	Modbus / BACnet RS485 A+
B-	Modbus / BACnet RS485 B-
G0	0V Common
UI1	NTC10/0-10V/Volt-Free Digital Input 1
UI2	NTC10/0-10V/Volt-Free Digital Input 2

NOTE: For CDR-MOD/TER-MOD specific Modbus communication registers please refer to CDR-MOD/TER-MOD Communications Registers chapter.

WIRING GUIDELINES

In order to wire the device, remove the front cover by pressing the clip on the bottom of the display e.g. using a flat headed screwdriver. Be careful not to use excess force. Whilst pressing the clip lift the front cover from the bottom edges of the enclosure.

Make sure that power is switched off and carry out wiring according to the wiring connections drawing and local wiring guidelines. Insert the front cover and power up the device.

NOTE: For opening and mounting the enclosure please refer to the Dimensions and Installation Chapter.

Measurements

CO2 (CARBON DIOXIDE) MEASUREMENT

CO2 (Carbon Dioxide) measurement is available via Modbus (Input Register 0, Holding Register 402) and BACnet communication network. The CO2 measurement can also shown on the display on the LCD models.

The CO2 sensor provides Automatic Self Calibration logic keeping the measurements accurate over the time. For more details refer to Senticon Room Range CO2 Calibration Operation document. The Automatic calibration can be disabled and the sensor can be manually calibrated (see Calibration Settings).

CO2 measurement can also be used for built-in CO2 control and maximum demand control. For more details refer to Control Functions section.

TEMPERATURE MEASUREMENT

Temperature measurement is available over Modbus (Input Register 1, Holding Register 400) or BACnet, and it can be displayed on the LCD display.

It is also possible to connect NCT10 sensors (10kOhms at 25°C, $B_{25/85}$ curve 3,977K) to UI1 and UI2 for measurement over Modbus/BACnet network, and for local heating/cooling control - for more details refer to Control Functions section.

HUMIDITY MEASUREMENT (RH OPTION)

The CDR Sensors can also measure relative humidity (2% accuracy). The measurements are available over Modbus (Holding Register 401, Input Register 2) and BACnet AV16 object, and can be shown on the display.

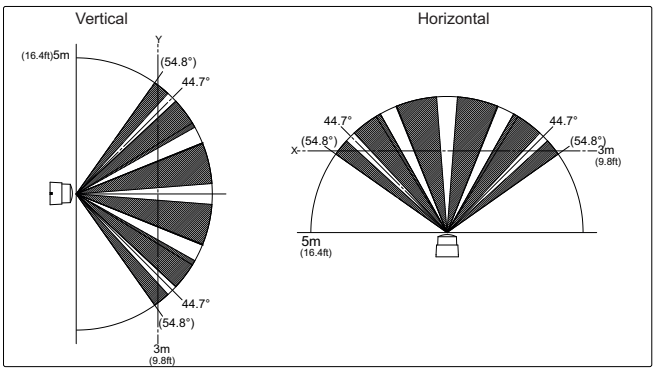
NOTE: If Temperature. Humidity or CO2 measurements are required on the Y1 0-10Vdc outputs, please use QER10 range 0-10Vdc sensors, or QER10 Range Smart Multi-Sensors.

OCCUPANCY DETECTION USING PASSIVE INFRARED SENSOR (OE OPTION)

The CDR sensors can be fitted with an optional pyroelectric infrared motion sensor for the occupancy and movement detection. The sensor element is designed for optimal usability and reliability with low power consumption, better sensitivity and signal-to-noise ratio reducing the false detections.

The occupancy sensor status is available over the network.

The diagram illustrates the detection area.



The movement sensor *PIR Off Delay* (10..28,800 seconds) parameter sets the time that the status latches ON after detection of movement.

NOTE: Any new detected movement resets the timer. The movement sensor has 30 seconds warm-up delay on power up.

MULTI-TRIGGER MODE

The PIR mode can be changed to multi-trigger mode. In this mode during the *Trigger Period* the number of movement detections must reach the *PIR Trigger Count* amount for the sensor to activate the PIR Detection. If within the *Trigger Period* the trigger count is not reached, it is reset to 0. After each movement detection, there is delay of 10 seconds until further movement is registered to the trigger count. This feature can be used, for example, prevent the system to switch on if a person enters temporarily to the room space.

LCD Display (Option)

The TDR/ CDR CO2 sensors have colour LCD display and up to three push buttons for the user operation. The LCD screen can be configured to display the measurements and can act as the interface to change the setpoint (local control loop setpoint, or setpoint for the BMS - operating as room interface panel).

The TDR/CDR CO2 sensor display can also function as so called traffic light alarm indicator with amber and red alarm stages.

LCD DISPLAY

The display has area for controller status indication and main area for the temperature / CO2 / RH and setpoint display. The display main are can be configured to show information in 4 locations:-

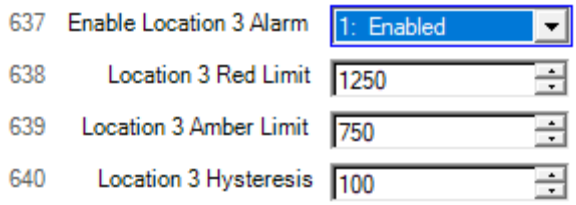
- 0 = Temperature Measurement Only (large text)
- 1 = Temperature Setpoint Only (large text)
- 2 = CO2 Measurement Only (large text)
- 3 =Temperature Measurement and Large Setpoint (Default)
- 4 = Large Temperature and CO2 Measurement
- 5 = Temperature and CO2 Measurement, Large Temperature Setpoint
- 6 = Large Temperature Display and Setpoint
- 7 = Large Temperature Display, Setpoint and CO2
- 8 = Large Temperature and Relative Humidity
- 9 = Setpoint, Temperature and Relative Humidity
- 10 = Large Temperature, Setpoint and Relative Humidity
- 11 = Large Temperature, CO2 and Relative Humidity
- 12 = Setpoint, Temperature, CO2 and Relative Humidity
- 13 = Temperature, Setpoint, CO2 and Relative Humidity

Temperature value displayed follows on the 4-stage temperature control loop source configuration i.e. built-in temperature, UI1 NTC10 or UI2 NTC10. Configuring the 4-stage control loop source to e.g. UI1 NTC10, then external NTC10 sensor value can displayed on the screen.

TRAFFIC LIGHT ALARM FUNCTION

The display can display information in up to 4 locations. The CDR CO2 sensors have traffic light alarm function where the background colour can be changed from normal white, to amber and red based on the amber / red alarm limits.

For example, if location 3 displays CO2 information by activating location 3 alarm, the background colours are changed when the CO2 reading exceeds the Amber and Red limits (see below image). The background colour returns back to normal colour when the CO2 drops below limit minus hysteresis.



User Push Buttons

SETPOINT ADJUSTMENT BUTTONS

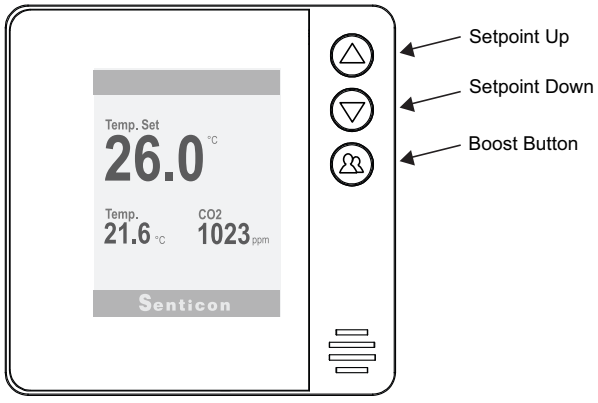
Pressing the setpoint button upwards or downwards, the current calculated setpoint is displayed and can be adjusted. With Modbus variants the calculated setpoint is available via Holding Register 420, or Input Register 6 (CDR-MOD/TER-MOD legacy register).

BOOST BUTTON

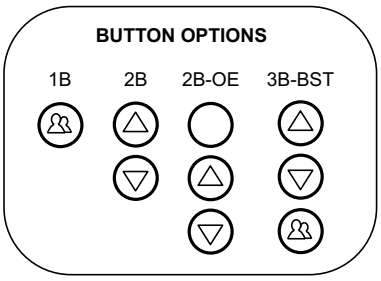
With1B models the first button becomes Boost button. With 3B models the third button becomes Boost button.

When the Boost button is pressed the selected control output demand is set to 100% for the specified time (or toggle boost on/off). The Boost Status is also displayed in Modbus Discrete Input and Discrete Input 204.

Button Variations



3B 3-BUTTON VERSION

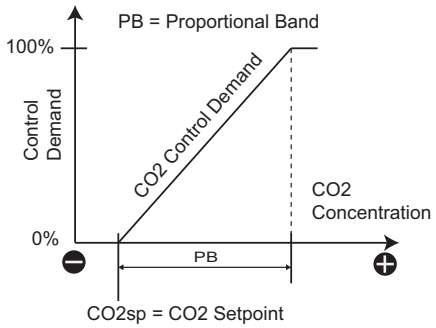


Control Functions

CO2 (CARBON DIOXIDE) CONTROL

CDR04 sensors have built-in CO2 measurement and control functionality. The CO2 measurement is typically used to boost the ventilation in case of higher concentration. The CDR provides CO2 control using PI (Proportional + Integral) control logic. The control loop output can be connected to the physical outputs to e.g. control the fresh air damper using analogue outputs.

With Proportional Control when the CO2 measurement increases above the *CO2 Setpoint,* the CO2 control demand (and control output) increases proportionally based on the Proportional Band (PB) setting - see image.

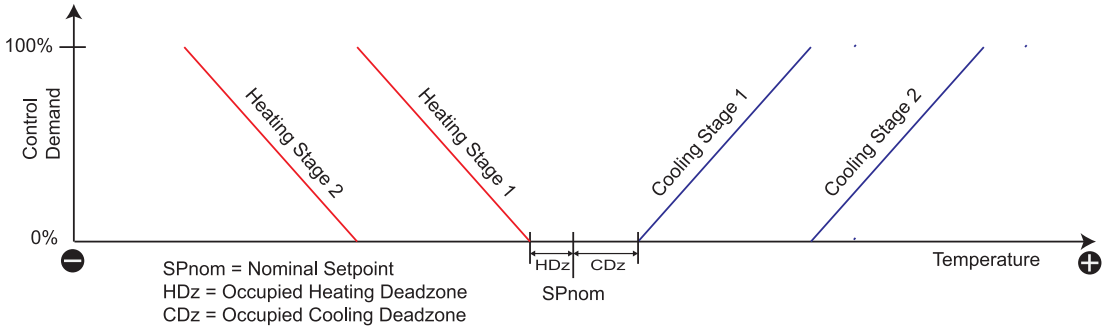


Often fresh air damper is also used to provide cool air to the building. In this case the damper is linked to both Cooling Stage temperature control and CO2 control. This can be achieved using so called 'Maximum VAV' logic (set output to *Maximum VAV*).

Parameter	Description	Value Range / Enumerations
CO2 Control Source	Sets the Source for the CO2 Control Note: If set to UI1/UI2, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters 523-526.	0 = Network Value (Reg 539) 1 = Built-In CO2 (Default) 2 = UI1 - 0..10V 3 = UI2 - 0..10V
CO2 Setpoint	CO2 Control Setpoint	0..10,000 (Default 750)
CO2 PB	CO2 Control Proportional Band	1..10,000 (Default 500)
CO2 IA	CO2 Control Integral Action Time (Set to 0 to disable)	0..3600s (Default 0s)

TEMPERATURE CONTROL

The TDR04/CDR04 sensors have 4-stage temperature control logic that meets requirements for advanced temperature control applications using PI-control (Proportional + Integral). Up to two (2) heating and up to two (2) cooling stages are available. Between the heating and cooling stages is a dead-zone where the heating and cooling outputs modulate to closed position providing energy savings in the building when the temperature reaches the setpoint. The heating and cooling deadzones can be separately set to provide asymmetrical control for increased energy savings.



The 4-stage temperature control loop can be configured to control built-in temperature, Universal Input 1 temperature/voltage, Universal Input 2 Temperature/voltage, or network value (network temperature).

The loop controls to the Calculated Setpoint. The calculated setpoint uses the following formula:-

SPcalc = SPnom + User_Adjustment

NOTE: Network value can only be used in systems where the measurement changes slowly.

NOTE:

Parameter	Description	Value Range / Enumerations
Main Loop Source	Sets the Control Source for the Multi-Stage Control Loop. Note: If UI mode is NTC, the control value is as measured temperature. If the UI mode is 0-10V, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters 523-526.	0 = Network Value (Reg 538) 1 = Temperature (Built-In, Default) 2 = UI1 - NTC10 3 = UI2 - NTC10 4 = UI1 - 0..10Vdc 5 = UI2 - 0..10Vdc
Main Loop Nominal Setpoint (SPnom)	Main Control Loop Nominal Setpoint	0.0..212.0 (Default 21.0)

Main Setpoint Resolution	Main Setpoint Adjustment Resolution	0.1..10.0 (Default 0.1)
Min Adjustment	User Setpoint Adjustment Min Limit	-30.0..0.0 (Default -3.0)
Max Adjustment	User Setpoint Adjustment Max Limit	0..0..30.0 (Default 3.0)
Main Loop PB	Main Control Loop Proportional Band (for each stage)	1..500 (Default 5)
Main IA	Main Control Loop Integral Action Time (Set to 0 to disable)	0..3600s (Default 600s)
No of Heating Stages	Sets the number of heating stages.	0 = None 1 = 1-Stage (Default) 2 = 2-Stages
No of Cooling Stages	Sets the number of cooling stages.	0 = None 1 = 1-Stage (Default) 2 = 2-Stages
Occupied Heating Deadzone (HDz)	Occupied Heating Deadzone	0.0..30.0 (Default 0.5)
Occupied Cooling Deadzone (CDz)	Occupied Cooling Deadzone	0.0..30.0 (Default 0.5)

NOTE: Proportional Band is for each stage. E.g. if 2-stages of heating had been selected, and if the Proportional Band has been set as 5, then the Proportional Band across 2-stages of heating is 10.

CONDENSATION CONTROL

CONDENSATION SENSOR INPUTS

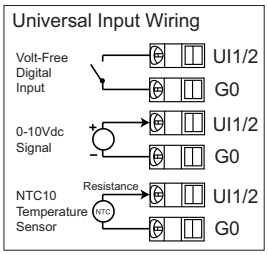
In cooling systems (e.g. chilled beam) when the pipe surface temperature drops reaching the dew point, this creates a condensation risk. The CDR sensor has protection logic to minimise the condensation. This can be activated by enabling '*Digital Cooling Disable*' on the Universal Inputs. In this mode the universal input operates as volt-free digital input. When the input closes the controller switches the 4-stage control loop Cooling Stage Demands to 0% until the volt-free input is off (open contact).

Alternative method is to use resistive condensation sensors where the resistance drops when condensation occurs, and resistance increases when the sensor is dry. To activate this function set the Universal Input mode to '*Digital Cooling Disable*'. When resistance drops approximately below 100kOhms the condensation risk is active and when the resistance increases above approx. 150kOhms, there is no condensation risk. In case of condensation risk the multi-stage Cooling Stage Outputs are set to 0%

Universal Input Configuration

Universal Input can be configured to operate as NCT10 (resistive), Analogue (0..10V), Condensation Sensor (Resistive) or Digital On/Off. Configure and wire inputs as required by the application operation using the below diagram as guidance.

NTC10: Use this option to measure temperature using NTC10 temperature sensors (10kOhms at 25°C, $B_{25/85}$ curve 3,977K). For control loops to use NTC10, select NTC10 in the control loop source parameters.



Parameter	Description	Value Range / Enumerations
UI1 Mode	Sets the Universal Input 1 Mode.	0 = Not Used 1 = 0..10V (0..100%) 2 = NTC10 (Default) 3 = Digital - Network 4 = Digital - Disable Cooling / Resistive Condensation Sensor
UI2 Mode	Sets the Universal Input 2 Mode.	
UI1 Scale Min.	Sets the scaling for Min. Measurement when UI1 @ 0V (0%)	0.0..3000.0 (Default 0)
UI1 Scale Max.	Sets scaling for the Max. Measurement when UI1 @ 10V (100%)	0.0..3000.0 (Default 100.0)
UI2 Scale Min.	Sets the scaling for Min. Measurement when UI2 @ 0V (0%)	0.0..3000.0 (Default 0)
UI2 Scale Max.	Sets scaling for the Max. Measurement when UI2 @ 10V (100%)	0.0..3000.0 (Default 100.0)

UI1/UI2 Input Minimum and Maximum scaling parameters are used to scale 0..10V signal to the measurement. E.g. typical humidity transmitters scaled 0..100%rH measurement to 0..10V on their output. In this case set the *Scale Min.* parameter to 0 and *Scale Max.* parameter to 100.

In case of CO2 transmitter, these scale the 400..2,000ppm reading to 0..10V. In this case set the *Scale Min.* parameter to 400 and *Scale Max.* parameter to 2,000.

NOTE: The controllers have advanced UI1/UI2 voltage clamping settings that can be used to scale e.g. input voltage for e.g. 0..10V = 0..5000ppm CO2 sensors.

Analogue Output and Valve Control Options

0 - 10V OUTPUT CONFIGURATION AND SCALING

The Y1/Y2/Y3 0..10V outputs can be configured to control based on the options in the below table. In addition each output can be scaled between minimum and maximum limits. Reversing the limits is also possible which will reverse the output voltage (e.g. for situations where the 0..10V valve signal closes the valve instead of opening it).

TIP: By setting minimum output position it is possible e.g. set minimum fresh air level to air dampers.

As default outputs are set to *Output Mode = Network Value*. In this mode the outputs are controlled from the Modbus or BACnet network. With Modbus there are multiple registers to allow use e.g. to replace legacy CDR-MOD CO2 sensors.

Parameter	Description	Value Range / Enumerations
Y1 Output Mode	Y1 Output Configuration Default: Network	0 = Network Value 1 = Heating Stage 1 2 = Heating Stage 2 3 = Cooling Stage 1 4 = Cooling Stage 2 5 = CO2 Demand 6 = Maximum VAV
Y2 Output Mode	Y2 Output Configuration Default: Network	
Y3 Output Mode	Y3 Output Configuration Default: Network	
Y1 Minimum	Y1 Output Minimum Level	0.0..100.0% (Default 0%)
Y1 Maximum	Y1 Output Maximum Level	0.0..100.0% (Default 100%)
Y2 Minimum	Y2 Output Minimum Level	0.0..100.0% (Default 0%)
Y2 Maximum	Y2 Output Maximum Level	0.0..100.0% (Default 100%)
Y3 Minimum	Y3 Output Minimum Level	0.0..100.0% (Default 0%)
Y3 Maximum	Y3 Output Maximum Level	0.0..100.0% (Default 100%)

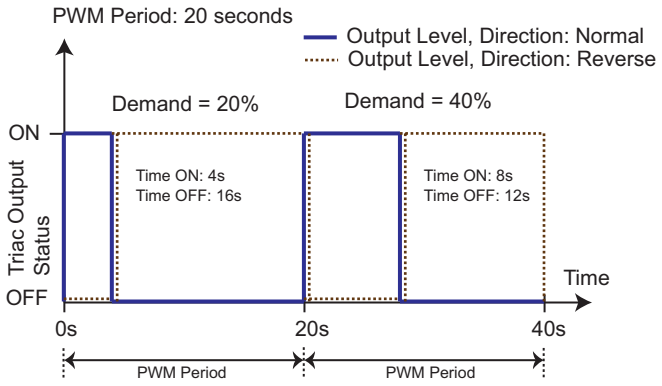
Digital Output Control Options

DIGITAL TRIAC OUTPUT CONTROL OPTIONS

The TDR04/CDR04 series sensors have 2 x 24Vac Triacs. The triacs can operate in On/Off and PWM (Pulse-Width Modulation) configurations.

As default the Triacs are configured to be controlled from the Modbus/BACnet network i.e. they operate as Network Outputs that can be controlled from the BMS.

In the PWM mode the output is modulated using pulse-width-modulation sequence. With On/Off Mode the outputs are switched ON at 'DO On Value' and OFF at 'DO Off Value'.



Parameter	Description	Value Range / Enumerations
TR1 Output Mode	Triac Output 1 Configuration Default: Network	0 = Network Value 1 = Heating Stage 1 2 = Heating Stage 2 3 = Cooling Stage 1 4 = Cooling Stage 2 5 = CO2 Demand 6 = Maximum VAV
TR2 Output Mode	Triac Output 2 Configuration Default: Network Triac Output: Options 1-6 is controlled using either PWM or ON/Off Modes	
PWM Period	PWM Control Logic Period. The controller calculates the new sequence at these intervals. Setting the PWM period to 0, configures the output to operate as On/Off	0..180s (Default 20s)
TR/RL ON Value	The value at the Triac (or Relay) Output Switches ON. Only applied when PWM Period is set to 0.	0..100% (Default 50%)
TR/RL OFF Value	The value at the Triac (or Relay) Output Switches OFF	0..100% (Default 0%)
TR1 Direction	Triac Output 1 Direction	0 = Normal (Default) 1 = Reverse
TR2 Direction	Triac Output 2 Direction	
TR1 Type	Triac 1 Type	0 = On-Off 1 = PWM (Default)
TR2 Type	Triac 2 Type	

Output Exercise Function

The TDR04/CDR04 series controllers have Valve/Output Exercise function that allows each of the outputs (Analogue, Digital) to be exercised automatically in case of inactivity (meaning output remains at 0% or 100% for the specified time). The inactivity setting can be set between 0..255 days. Each of the outputs can be individually enabled by setting the Exercise Duration parameter.

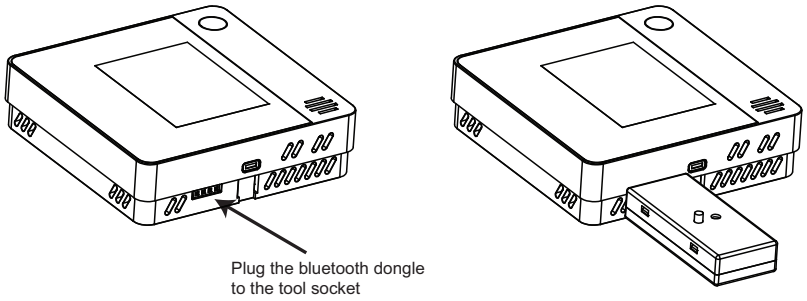
During the exercise the output remains at 0% ro 100% depending on the inactivity level. After the exercise time, the next output is held off for the exercise time duration, allowing the exercise output to return under normal control. For list of parameters available please refer to OUTPUT AUTO-EXERCISE parameter table.

Device Setup and Modbus/BACnet Communications

The devices are available with Modbus RTU or BACnet MS/TP communication for system integration. Please also note that the devices can configured via Modbus or via BACnet MS/TP. Alternatively the devices can be configured locally using via PC Based Smart Config Tool or via iOS Smart Phone Application. Using any of these methods the device settings can be altered to suit the site requirements and the current device status can be interrogated.

Modbus and BACnet communication is carried out over RS485 serial network.

The Windows Smart Config Tool and iOS Smart Phone Application are connected to the device using Bluetooth dongle set (BLE-TOOLSET) that are plugged into the PC USB port and to the device (connection to device illustrated below).



MODBUS / BACNET NETWORK SETUP

NOTE: Modbus RS485 or BACnet MS/TP versions are hardware specific models. It is not possible to change the communication protocol on the device. Please make sure to order the required model.

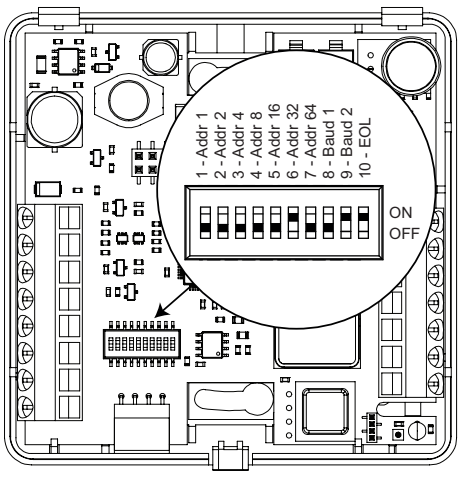
The devices can operate either as Modbus RTU RS485 slave device, or BACnet MS/TP Server. The device (slave/MAC) address and baud rate (limited) are set up through Windows Smart Configuration Tool / iOS Smart Phone App, through display or using bit switches.. .

Bit switches 1-7 act as a binary decoder to set the (slave/MAC) address. Set these bit switches to OFF position if the address is configured by the software.

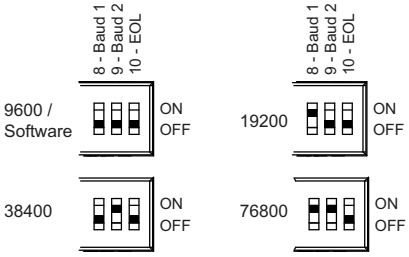
Bit switches 8 and 9 are used to set the baud rate. Set these bit switches to OFF position if the baud rate is configured by the software.

Bit switch EOL is used to activate 120 Ohm RS485 network End of Line termination (only used on the end of line devices).

NOTE: Once bit switches are changed the device will automatically carry out soft reset to activate the new settings.

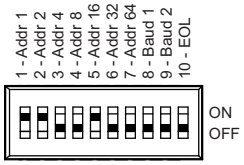


Baud Rate Setup



Address Setup Example

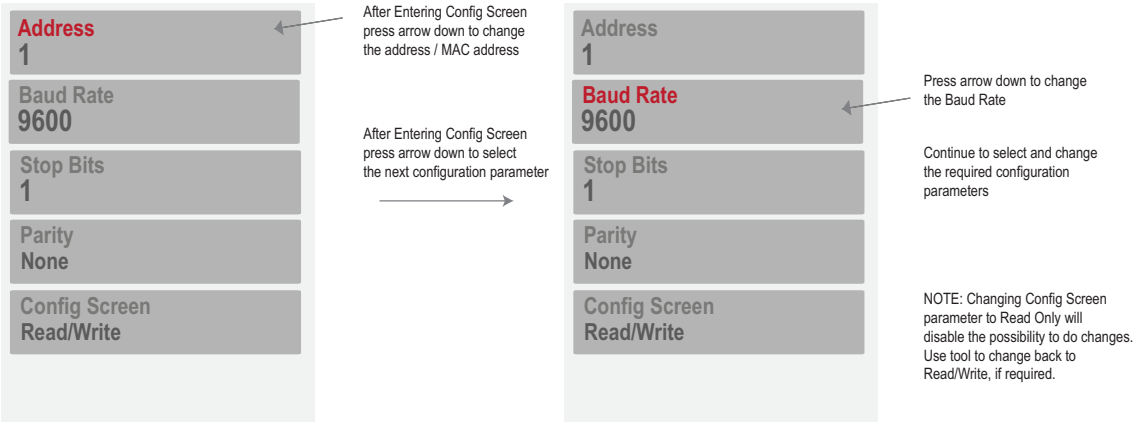
Bit switches 1 - 7 with binary decoding set the address. E.g.
Address 19 = Bit switches 1, 2 and 5 ON
(1 + 2 + 16 = 19)



ADDRESS CONFIGURATION VIA DISPLAY (2B/3B VERSIONS)

It is possible to change the device Modbus/MAC address via the display with 2 and 3 button versions. Press UP and DOWN arrows at the same time continuously down for approx. 5 seconds to enter the address configuration screen. Follow the instructions on the below diagram to change the settings.

NOTE: With CDR04 series the Config Screen mode has been set Read Only as default. The mode is configurable through parameter 816 under *Display Settings*.



DEVICES CONFIGURATION PARAMETERS

NOTE: Please note that Modbus register addresses start with 0 (0-based). If your Modbus master addresses start from one (1), then you will need to add one to the register values. If your Modbus master uses zero based addressing then the registers can be used as is.

NOTE: BACnet configuration parameter addresses are split to multiple instances of the Device Configuration object.

NOTE: Reg Field shows the Modbus register offset. The Reg field number is also the same with BACnet Device Configuration Objects.

NOTE: Legacy Modbus registers are provided for CDR-MOD/TER-MOD sensors (please refer to corresponding section)

NOTE: If the configuration parameters are changed over the Modbus or BACnet using third party tools usch as Modbus clients or Yabe for BACnet, please ensure that System Parameter 811 - Persist is applied after the configuration to store the new settings permanently.

LIVE DATA						
		MODBUS INPUT REGISTERS - FUNCTION CODE 04 MODBUS HOLDING REGISTER - FUNCTION CODES 03, 16				
Parameter	**Description**	**Reg**	**Type**	**Data Range (multiplier)**	**Value Range / Enumerations**	**R/W**
INPUTS						
Temperature Sensor	Displays current temperature measurement reading (built-in sensor) Note: Value depends on the temperature unit °C/°F selection	**400**	int16	-400..2480 (x10)	-40.0..120.0°C / -40.0..248.0°F	R
Humidity Sensor	Displays current humidity measurement reading (With RH option)	**401**	int16	0..1000 (x10)	0..100%rH	R
CO2 Sensor	Displays current measurement CO2 reading (CDR04 only)	**402**	uint16	0..10,000 (x1)	0..10,000ppm	R
UI1	Universal Input 1 Measurement Note: Value depends on the temperature / mode selection	**410**	int16	-400..2480 (x10)	NTC Mode: -40..120° AI Mode: 0..100% = 0..10V	R
UI2	Universal Input 2 Measurement Note: Value depends on the temperature / mode selection	**411**	int16	-400..2480 (x10)	NTC Mode: -40..120° AI Mode: 0..100% = 0..10V	R
		DISCRETE INPUTS - FUNCTION CODE 02				
DI1	Digital Input 1 Status	**200**		0..1	0..1	R
DI2	Digital Input 2 Status	**201**		0..1	0..1	R
PIR Status	PIR (OE Option) Status	**202**		0..1	0..1	R
Boost Status	Boost Status	**204**		0..1	0..1	R
OUTPUTS						

		MODBUS INPUT REGISTERS - FUNCTION CODE 04 MODBUS HOLDING REGISTER - FUNCTION CODES 03, 16				
Y1	Analogue Output 1 Value	**412**	uint16	0..1000 (x10)	0..100% = 0..10V	R
Y2	Analogue Output 2 Value	**413**	uint16	0..1000 (x10)	0..100% = 0..10V	R
Y3	Analogue Output 3 Value	**414**	uint16	0..1000 (x10)	0..100% = 0..10V	R
Exercise Active	Reports Output that is in the Exercise Mode	**418**	unit16	0..6 (x1)	0 = None, 1=Y1, 2=Y2, 3=Y3, 5=TR1, 6=TR2	R
		DISCRETE INPUTS - FUNCTION CODE 02				
Triac 1 Status	Triac 1 Output Status	**206**		0..1	0..1	R
Triac 2 Status	Triac 2 Output Status	**207**		0..1	0..1	R
DEMAND SIGNALS						
		MODBUS INPUT REGISTERS - FUNCTION CODE 04 MODBUS HOLDING REGISTER - FUNCTION CODES 03, 16				
Calculated Multi-Stage Setpoint	Calculated Setpoint (Nominal Network Setpoint + User Adjustment) for 4-Stage Control Loop **Note:** Read/write Modbus parameter. Writing to Reg420 sets 701 Nominal Setpoint to this value, and the user adjustment is reset to 0.	**420**	int16	-32000..32000 (x10)	-3200.0..3200.0	R/W
Heating Demand	Heating Stage Demand (4-Stage Loop Heating Stage 1/2/3)	**422**	int16	0..1000 (x10)	0..100%	R
Cooling Demand	Cooling Stage Demand (4-Stage Loop Cooling Stage 1/2/3)	**423**	int16	0..1000 (x10)	0..100%	R
Current Control Mode	Current Control Mode Status	**424**	int16	0..2 (x1)	0 = Occupied 1 = Unoccupied 2 = Night	R
Cooling Status	Main Loop Cooling Stage Override Status	**425**	int16	0..1 (x1)	0 = Normal Operation 1 = Digital Input Disable (Condensation)	R
CO2 Demand	CO2 Loop Demand	**428**	int16	0..1000 (x10)	0..100%	R
Triac 1 PWM Demand	Triac Output 1 PWM Demand Note: For On/Off or 3-Point Modes shows 0% when Off and 100% when On.	**431**	int16	0..1000 (x10)	0..100%	R
Triac 2 PWM Demand	Triac Output 2 PWM Demand	**432**	int16	0..1000 (x10)	0..100%	R

INPUT/OUTPUT SETTINGS						
		Modbus Register / BACnet Property	**MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16**			
Parameter	**Description**		**Type**	**Data Range (multiplier)**	**Value Range / Enumerations**	**R/W**
UNIVERSAL INPUTS						
UI1 Voltage Min.	Sets Min. Clamp Voltage for UI1.	**516**	unit16	0..100 (x10)	0..10.0 (Default 0)	R/W
UI1 Voltage Max.	Sets Max. Clamp Voltage for UI1. Use only if the connected device upper range is more than 3000.	**517**	unit16	0..100 (x10)	0..10.0 (Default 10.0)	R/W
UI2 Voltage Min.	Sets Min. Clamp Voltage for UI2. Advanced Setting.	**518**	unit16	0..100 (x10)	0..10.0 (Default 0)	R/W
UI2 Voltage Max.	Sets Max. Clamp Voltage for UI2. Use only if the connected device upper range is more than 3000.	**519**	unit16	0..100 (x10)	0..10.0 (Default 10.0)	R/W
UI1 Mode	Sets the Universal Input 1 Mode	**520**	unit16	0..4 (x1)	0 = Not Used 1 = 0..10V (0..100%) 2 = NTC10 (Default) 3 = Digital - Network 4 = Digital - Disable Cooling / Resistive Condensation Sensor	R/W
UI2 Mode	Sets the Universal Input 2 Mode.	**521**	unit16	0..4 (x1)		R/W

Temperature Units	Sets the temperature measurement and display to operate in Celcius or Fahrenheit. Note: To show Fahrenheit on display set the correct Unit setting on the display.	**522**	unit16	0..1 (x1)	0 = Celcius (Default) 1 = Fahrenheit	R/W
UI1 Scale Min.	Sets the scaling for Min. Measurement when UI1 @ 0V (0%)	**523**	unit16	0..30000 (x10)	0.0..3000.0 (Default 0)	R/W
UI1 Scale Max.	Sets scaling for the Max. Measurement when UI1 @ 10V (100%)	**524**	unit16	0..30000 (x10)	0.0..3000.0 (Default 100.0)	R/W
UI2 Scale Min.	Sets the scaling for Min. Measurement when UI2 @ 0V (0%)	**525**	unit16	0..30000 (x10)	0.0..3000.0 (Default 0)	R/W
UI2 Scale Max.	Sets scaling for the Max. Measurement when UI2 @ 10V (100%)	**526**	unit16	0..30000 (x10)	0.0..3000.0 (Default 100.0)	R/W
UI1 Digital Polarity	UI1 Digital Input Polarity Setting - allows the polarity of the input operation to be reversed when used in digital modes.	**527**	unit16	0..1 (x1)	0 = Normal (Default) 1 = Reverse	R/W
UI2 Digital Polarity	UI2 Digital Input Polarity Setting - allows the polarity of the input operation to be reversed when used in digital modes..	**528**	unit16	0..1 (x1)	0 = Normal (Default) 1 = Reverse	R/W

ANALOGUE OUTPUTS						
Y1 Mode	Y1 Output Configuration Default: Network	**530**	unit16	0..6 (x1)	0 = Network Value 1 = Heating Stage 1 2 = Heating Stage 2 3 = Cooling Stage 1 4 = Cooling Stage 2 5 = CO2 Demand 6 = Maximum VAV	R/W
Y2 Mode	Y2 Output Configuration Default: Network	**531**	unit16	0..6 (x1)		R/W
Y3 Mode	Y3 Output Configuration Default: Network	**532**	unit16	0..6 (x1)		R/W
Y1 Override	Analogue Output Y1 Override Value. Note: Only applicable when source is set to Network.	**534**	unit16	0..1000 (x10)	0.0..100.0% (Default 0)	R/W
Y2 Override	Analogue Output Y2 Override Value Note: Only applicable when source is set to Network.	**535**	unit16	0..1000 (x10)	0.0..100.0% (Default 0)	R/W
Y3 Override	Analogue Output Y3 Override Value Note: Only applicable when source is set to Network.	**536**	unit16	0..1000 (x10)	0.0..100.0% (Default 0)	R/W
Y1 Minimum	Y1 Output Minimum Level	**540**	unit16	0..1000 (x10)	0.0..100.0% (Default 0%)	R/W
Y1 Maximum	Y1 Output Maximum Level	**541**	unit16	0..1000 (x10)	0.0..100.0% (Default 100%)	R/W
Y2 Minimum	Y2 Output Minimum Level	**542**	unit16	0..1000 (x10)	0.0..100.0% (Default 0%)	R/W
Y2 Maximum	Y2 Output Maximum Level	**543**	unit16	0..1000 (x10)	0.0..100.0% (Default 100%)	R/W
Y3 Minimum	Y3 Output Minimum Level	**544**	unit16	0..1000 (x10)	0.0..100.0% (Default 0%)	R/W
Y3 Maximum	Y3 Output Maximum Level	**545**	unit16	0..1000 (x10)	0.0..100.0% (Default 100%)	R/W

DIGITAL INPUTS						
DI1 Off Delay	Delay Off Timer for the Universal Input 1 in Digital Input Mode	**560**	uint16	0..28,800 (x1)	0..28,800 seconds (default 0 secs)	R/W
DI2 Off Delay	Delay Off Timer for the Universal Input 2 in Digital Input Mode	**561**	uint16	0..28,800 (x1)	0..28,800 seconds (default 0 secs)	R/W
PIR Tigger Mode	Selects the Mode of the PIR Sensor	**685**	uint16	0..1 (x1)	0 - Standard (default) 1 - Multi-Trigger	R/W
PIR Trigger Count	Trigger Count in Multi-Trigger Mode	**686**	uint16	1..10 (x1)	1..10 (default 3)	R/W
Trigger Period	Trigger Period for monitoring Trigger Count	**687**	uint16	30..1,800 (x1)	30.1,800 seconds (default 300 secs)	R/W
PIR Off Delay	Delay Off Timer for the PIR Movement/Occupancy sensor	**562**	uint16	10..28,800 (x1)	10..28,800 seconds (default 600 secs)	R/W

DIGITAL (TRIAC) OUTPUTS						
TR1 Output Mode	Triac Output 1 Configuration Default: Network	**570**	uint16	0..6 (x1)	0 = Network 1 = Heating Stage 1 2 = Heating Stage 2 3 = Cooling Stage 1 4 = Cooling Stage 2 5 = CO2 Demand 6 = Maximum VAV	R/W
TR2 Output Mode	Triac Output 2 Configuration Default: Network Triac Output: Options 1-6 is controlled using either PWM or ON/Off Modes.	**571**	uint16	0..6 (x1)		R/W
PWM Period	PWM Control Logic Period. The controller calculates the new sequence at these intervals. Setting the PWM period to 0, configures the output to operate as On/Off using 'DO ON' and 'DO OFF' Values.	**574**	uint16	0..180 (x1)	0..180s (Default 20s)	R/W
TR1 Direction	Triac Output 1 Direction	**577**	uint16	0..1 (x1)	0 = Normal (Default) 1 = Reverse	R/W
TR2 Direction	Triac Output 2 Direction	**578**	uint16	0..1 (x1)	0 = Normal (Default) 1 = Reverse	R/W

Triac 1 Level Override	Triac 1 Output (PWM) Network Override Note: Set output to Network	**583**	uint16	0..100 (x1)	0% = OFF (default) 100% = ON 1%.99% = ON/OFF based on Pulse Width Modulation Settings	R/W
Triac 2 Level Override	Triac 2 Output (PWM) Network Override Note: Set output to Network	**584**	uint16	0..100 (x1)		R/W
TR1 Type	Triac 1 Type	**555**	uint16	0..1 (x1)	0 = On-Off (Default) 1 = PWM	R/W
TR2 Type	Triac 2 Type	**556**	uint16	0..1 (x1)		R/W
TR/RL ON Value	The value at the Triac Output Switches ON	**575**	unit16	0..100 (x1)	0..100% (Default 50%)	
TR/RL OFF Value	The value at the Triac Output Switches OFF	**576**	unit16	0..100 (x1)	0..100% (Default 0%)	R/W

OUTPUT AUTO EXERCISE						
Exercise Interval	Sets the period of inactivity to activate the corresponding output.	**500**	uint16	0..255 (x1)	0..255 days (Default 0 days)	R/W
Y1 Duration	Analogue Output 1 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y1 Duration Time	**501**	uint16	0..255 (x1)	0..255 Minutes (Default: 0) 0 = Disabled	R/W
Y2 Duration	Analogue Output 2 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y2 Duration Time	**502**	uint16	0..255 (x1)	0..255 Minutes (Default: 0) 0 = Disabled	R/W
Y3 Duration	Analogue Output 3 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y3 Duration Time	**503**	uint16	0..255 (x1)	0..255 Minutes (Default: 0) 0 = Disabled	R/W
TR1 Duration	Triac Output 1 Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR1 Duration Time	**505**	uint16	0..255 (x1)	0..255 Minutes (Default: 0) 0 = Disabled	R/W
TR2 Duration	Triac Output 2 Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR2 Duration Time	**506**	uint16	0..255 (x1)	0..255 Minutes (Default: 0) 0 = Disabled	R/W

COMMISSIONING OVERRIDES (Modbus Versions Only)						
Y1 Commission Override	Y1 Commissioning Override Parameter	**690**	uint16	0..3 (x1)	0 = Auto (Default) 1 = Manual Override 2 = 0% 3 = 100%	R/W
Y2 Commission Override	Y2 Commissioning Override Parameter	**691**	uint16	0..3 (x1)		R/W
Y3 Commission Override	Y3 Commissioning Override Parameter	**692**	uint16	0..3 (x1)		R/W
Y1 Override	Analogue Output Y1 Override Value (used when 690 = Manual)	**534**	unit16	0..1000 (x10)	0.0..100.0% (Default 0)	R/W
Y2 Override	Analogue Output Y2 Override Value (used when 691 = Manual)	**535**	unit16	0..1000 (x10)	0.0..100.0% (Default 0)	R/W
Y3 Override	Analogue Output Y3 Override Value (used when 692 = Manual)	**536**	unit16	0..1000 (x10)	0.0..100.0% (Default 0)	R/W
TR1 Commissioning Override	TR1 Commissioning Override Parameter	**694**	uint16	0..3 (x1)	0 = Auto (Default) 1 = Manual Override 2 = 0% 3 = 100%	R/W
TR2 Commissioning Override	TR2 Commissioning Override Parameter	**695**	uint16	0..3 (x1)		R/W
Triac 1 Level Override	Triac 1 Output (PWM) Network Override Note: Set output to Network	**583**	uint16	0..100 (x1)	0% = OFF (default) 100% = ON 1%.99% = ON/OFF based on Pulse Width Modulation Settings	R/W
Triac 2 Level Override	Triac 2 Output (PWM) Network Override Note: Set output to Network	**584**	uint16	0..100 (x1)		R/W

CALIBRATION SETTINGS						
		Modbus Register / BACnet Property	**MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16**			
Parameter	**Description**		**Type**	**Data Range (multiplier)**	**Value Range / Enumerations**	**R/W**
Temperature Offset	Built-In Temperature Single Point Sensor Calibration Offset	**590**	int16	-100..100 (x10)	-10.0..+10.0deg (Default 0)	R/W
CO2 Offset	CO2 Single Point Calibration Offset (adjusts CO2 reading the specified amount)	**592**	int16	-500..500 (x1)	-500..+500ppm (Default 0)	R/W
CO2 Auto-Calibration	Shows if the auto-calibration of the CO2 has been Activated	**593**	uint16	0..1	0 = Disabled 1 = Enabled (Default)	R/W
CO2 Calibration Value	Single Point Calibration Value for the CO2 Sensor. Note: Writing this value will reset the calibration settings of the sensor to the value set. Only recommended for advanced users.	**594**	uint16	350..3,000 (x1)	350..3,000ppm (Default 400)	R/W
Force CO2 Calibration	Forces CO2 Calibration to the CO2 Calibration Value. Use when CO2 level known e.g with calibration gas or outside air.	**595**	uint16	0..1	0 = None 1 = Force Calibration	R/W
Store CO2 Calibration	Store CO2 Calibration Settings in the Permanent Memory	**596**	uint16	0..1	0 = None 1 = Save Data	R/W

USER INTERGFACE SETTINGS						
		Modbus Register / BACnet Property	MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16			
Parameter	**Description**		**Type**	**Data Range (multiplier)**	**Value Range / Enumerations**	**R/W**
GENERAL						
Display Mode	Selects the display mode.	**600**	uint16	0..13	0 = Temperature Measurement Only 1 = Temperature Setpoint Only 2 = CO2 Measurement Only 3 =Temperature Measurement and Large Setpoint (Default) 4 = Large Temperature and CO2 Measurement 5 = Temperature and CO2 Measurement, Large Temperature Setpoint 6 = Setpoint and Large Temperature 7 = Setpoint, CO2 and Large Temperature 8 = Large Temperature and Relative Humidity 9 = Setpoint, Temperature and Relative Humidity 10 = Large Temperature, Setpoint and Relative Humidity 11 = Large Temperature, CO2 and Relative Humidity 12 = Setpoint, Temperature, CO2 and Relative Humidity 13 = Temperature, Setpoint, CO2 and Relative Humidity	R/W
Display Brightness	Controls display brightness. Display wakes up to full brightness when one of the buttons is pressed.	**601**	uint16	0..6	0 = Off 1 = 5% 2 = 10% 3 = 25% 4 = 50% (default) 5 = 75% 6 = 100%	R/W
Heat/Cool Icon	Activates Heat/Cool icon display.	**603**	uint16	0..1	0 = Disabled (default) 1 = Enabled	R/W
Enable Fan Display	Enables Fan Speed Display.	**604**	uint16	0..2	0 = Disabled 1 = Enabled (default)	R/W
Show Logo	Show Logo on the Screen	**606**	unit16	0..1	0 = Disabled 1 = Enabled (Default)	R/W
Setpoint Mode	Setpoint Display Mode. Temperature = shows the actual setpoint. Adjustment = shows the +/- adjustment of setpoint.	**610**	unit16	0..1	0 = Temperature (Default) 1 = Adjustment	R/W
Config Screen	Configuration Screen Mode (enter Config Screen by pressing UP & DOWN arrow for 5 seconds)	**816**	unit16	0..1	0 = Read/Write (Default) 1 = Write Only	R/W

ALARMS						
Enable Location 1 Alarm	Activates Location 1 Alarm Colours based on the Alarm Limits.	**623**	uint16	0..1	0 = Disabled 1 = Enabled	R/W
Location 1 Red Alarm Limit	Red Limit for Alarm 1 (exceeding value display background changes to red)	**624**	uint16	0..10,000 (x1)	0..10,000 (default 1250)	R/W
Location 1 Amber Alarm Limit	Amber Limit for Alarm 1 (exceeding value display background changes to amber)	**625**	uint16	0..10,000 (x1)	0..10,000 (default 750)	R/W
Location 1 Hysteresis	Hysteresis for Alarm 1	**626**	uint16	0..10,000 (x1)	0..10,000 (default 100)	R/W

Enable Location 2 Alarm	Activates Location 2 Alarm Colours based on the Alarm Limits.	**630**	uint16	0..1	0 = Disabled 1 = Enabled	R/W
Location 2 Red Alarm Limit	Red Limit for Alarm 2 (exceeding value display background changes to red)	**631**	uint16	0..10,000 (x1)	0..10,000 (default 30)	R/W
Location 2 Amber Alarm Limit	Amber Limit for Alarm 2 (exceeding value display background changes to amber)	**632**	uint16	0..10,000 (x1)	0..10,000 (default 25)	R/W
Location 2 Hysteresis	Hysteresis for Alarm 2	**633**	uint16	0..10,000 (x1)	0..10,000 (default 1)	R/W
Enable Location 3 Alarm	Activates Location 3 Alarm Colours based on the Alarm Limits.	**637**	uint16	0..1	0 = Disabled 1 = Enabled	R/W
Location 3 Red Alarm Limit	Red Limit for Alarm 3 (exceeding value display background changes to red)	**638**	uint16	0..10,000 (x1)	0..10,000 (default 1250)	R/W
Location 3 Amber Alarm Limit	Amber Limit for Alarm 3 (exceeding value display background changes to amber)	**639**	uint16	0..10,000 (x1)	0..10,000 (default 750)	R/W
Location 3 Hysteresis	Hysteresis for Alarm 3	**640**	uint16	0..10,000 (x1)	0..10,000 (default 100)	R/W
Enable Location 4 Alarm	Activates Location 4 Alarm Colours based on the Alarm Limits.	**644**	uint16	0..1	0 = Disabled 1 = Enabled	R/W
Location 4 Red Alarm Limit	Red Limit for Alarm 4 (exceeding value display background changes to red)	**645**	uint16	0..10,000 (x1)	0..10,000 (default 80)	R/W
Location 4 Amber Alarm Limit	Amber Limit for Alarm 4 (exceeding value display background changes to amber)	**646**	uint16	0..10,000 (x1)	0..10,000 (default 60)	R/W
Location 4 Hysteresis	Hysteresis for Alarm 4	**647**	uint16	0..10,000 (x1)	0..10,000 (default 10)	R/W

CONTROL SETTINGS						
		Modbus Register / BACnet Property	**MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16**			
Parameter	**Description**		**Type**	**Data Range (multiplier)**	**Value Range / Enumerations**	**R/W**
TEMPERATURE CONTROL						
Source	Sets the Control Source for the 4-Stage Control Loop. Note: If UI mode is NTC, the control value is as measured. If the UI mode is 0-10V, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters 523-526.	**700**	uint16	0..5 (x1)	0 = Network Value (Reg 538) 1 = Temperature (Built-In, Default) 2 = UI1 - NTC10 3 = UI2 - NTC10 4 = UI1 - 0..10Vdc 5 = UI2 - 0..10Vdc	R/W
Nominal Setpoint (SPnom)	Temperature Control Loop Nominal Setpoint Note: The control loop setpoint can be shifted by the high/low limit (cascade) control function indicated by limit icon.	**701**	uint16	0..2120 (x10)	0.0..212.0, Default 21.0	R/W
Setpoint Resolution	Setpoint Adjustment Resolution	**702**	uint16	1..100 (x10)	0.1..10.0 (default 0.1)	R/W
Min Adjustment	User Setpoint Adjustment Min Limit	**703**	int16	-300..0 (x10)	-30.0..0.0 (Default -3.0)	R/W
Max Adjustment	User Setpoint Adjustment Max Limit	**704**	unit16	0..300 (x10)	0..0..30.0 (Default 3.0)	R/W
Main Loop PB	Main Control Loop Proportional Band (for each Stage	**705**	uint16	1..500 (x1)	1..500 (Default 5)	R/W
Main IA	Main Control Loop Integral Action Time (Set to 0 to disable)	**706**	uint16	0..3600 (x1)	0..3600s (Default 600s) 0 = Disabled	R/W
No of Heating Stages	Sets the number of heating stages.	**707**	uint16	0..2 (x1)	0 = None 1 = 1-Stage (default) 2 = 2-Stages	R/W
No of Cooling Stages	Sets the number of cooling stages.	**708**	uint16	0..2 (x1)		R/W
Occ Heating Deadzone	Occupied Mode Heating Deadzone	**709**	unit16	0..300 (x10)	0.0..30.0 (Default 0.5)	R/W
Occ Cooling Deadzone	Occupied Mode Cooling Deadzone	**710**	uint16	0..300 (x10)	0.0..30.0 (Default 0.5)	R/W

Network Write (Temp)	Network Write for 4-Stage Control Loop Temperature (Source = Network Value)	**538**	int16	-9990..9990 (x10)	-999.0..999.0 (Default 0)	R/W
Calc Setpoint Mode	Sets the Calculated Setpoint Display Mode (Modbus registers 6 and 306)	**793**	uint16	0..1	0 = Absolute 1 = Relative (Default)	R/W

CO2 CONTROL (ONLY CDR04)						
CO2 Control Source	Sets the Source for the CO2 Control Note: If set to UI1/UI2, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters 523-526.	**760**	uint16	0..3 (x1)	0 = Network Value (Reg 539) 1 = Builti-In CO2 (Default) 2 = UI1 - 0..10V 3 = UI2 - 0..10V	R/W
CO2 Setpoint	CO2 Control Setpoint	**761**	uint16	0..10000 (x1)	0..10,000 (Default 750)	R/W
CO2 PB	CO2 Control Proportional Band	**762**	uint16	1..10000 (x1)	1..10,000 (Default 500)	R/W
CO2 IA	CO2 Control Integral Action Time (Set to 0 to disable)	**763**	uint16	0..3600 (x1)	0..3600s (Default 0s)	R/W
Network Write (CO2)	Network write of CO2 measurement (CO2 Control Source = Network)	**539**	uint16	0..65535 (x1)	0..65535 (Default 0)	R/W
BOOST						
Boost Time	Sets the Boost Time. If set to 0, permanent boost, cancelled by pressing button again.	**682**	uint16	0..28,800 (x1)	0..28,800 secs 0 = default	R/W
Boost Target	Sets the Boost operation. Options 1..7 override the specific control outputs.	**683**	uint16	0..7 (x1)	0 = None (default) 1 = Heating Stage 1 2 = Heating Stage 2 3 = Heating_All 4 = Cooling Stage 1 5 = Cooling Stage 2 6 = Cooling_All 7 = CO2 Demand	R/W

SYSTEM AND COMMUNICATION SETTINGS						
		Modbus Register / BACnet Property	**MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16**			
Parameter	**Description**		**Type**	**Data Range (multiplier)**	**Value Range / Enumerations**	**R/W**
Address	Modbus Address BACnet MAC Address	**800**	uint16	1..247 (x1) 1..127 (x1)	Modbus: 1..247 BACnet: 1..127	R/W
Baud Rate	Baud Rate	**801**	uint16	0..5	0 = 9600 (default) 1 = 19200 2 = 38400 3 = 57600 4 = 76800 5 = 115200	R/W
Modbus Parity	Modbus Parity	**802**	uint16	0..2	0 = None (default) 1 = Odd 2 = Even	R/W
Modbus Stopbits	Modbus Stopbits	**803**	uint16	0..1	0 = 1 Stop Bit (default) 1 = 2 Stop Bits	R/W
Soft Reset	Soft Reset	**810**	uint16	0..1	0 = Normal 1 = Reset	R/W
Persist	Persist (Store Parameters in Non-Volatile Memory after changes) **NOTE: DO NOT WRITE FREQUNTLY TO THIS REGISTER. IT IS ONLY APPLIED AFTER CONFIGURATION CHANGES.**	**811**	uint16	0..1	0 = Normal 1 = Persist	R/W
Reload Defaults	Reload Defaults (NOTE: Resets all settings to factory defaults)	**812**	uint16	0..1	0 = Normal 1 = Factory Defaults	R/W
Service Pin	Service Pin (BACnet Only)	**813**	uint16	0..1	0 = Normal 1 = Service Pin	R/W
Language Pack Enable	Enables the Language Pack (using language pack it is possible to change the user text entries on the screen)	**814**	uint16	0..1	0 = English 1 = Language Pack Enabled	R/W
Firmware Version	Firmware Version	**820**	uint16	N/A	N/A	R
Serial Number	Serial Number	**821**	uint16	N/A	N/A	R
Date Code	Date Code	**822**	uint16	N/A	N/A	R
Product ID	Product ID	**823**	uint16	N/A	N/A	R

Device ID	BACnet Device ID. Set to 0 to use Automatically generated ID. Follow change with "Persist" and "Reset".	**825**	unit32	0..4,194,303 (x1)	0..4,194,303	R/W

MODBUS SPECIFIC COMMUNICATION REGISTERS

The following registers are available with Modbus only. The registers combine two parameters to a single 16-bit (2 Bytes) Modbus register.

MODBUS SPECIFIC COMBINATION REGISTERS						
		MODBUS INPUT REGISTERS - FUNCTION CODE 04 MODBUS HOLDING REGISTER - FUNCTION CODES 03, 16				
Parameter	**Description**		**Type**	**Data Range (multiplier)**	**Value Range / Enumerations**	**R/W**
Y1/Y2	Combined 16-Bit Register for Outputs Y1 and Y2. E.g. Y1=0x64 (100%), Y2=0x64 (100%) Register=0x6464 (25700)	**450**	unit16	0..25700 (x1) 0x0000..0x6464	Byte 1:Y1 (0x00..0x64), Byte 2:Y2 (0x00..0x64)	R
Y3	Combined 16-Bit Register for Outputs Y3	**451**	unit16	0..25700 (x1) 0x0000..0x6464	Byte 1: Y3 (0x00..0x64),	R
Htg/Clg	Combined 16-Bit Register for Heating and Cooling Demands	**452**	unit16	0..25700 (x1) 0x0000..0x6464	Byte 1: Htg (0x00..0x64), Byte 2: Clg (0x00..0x64)	R
Triac1/Triac2	Combined 16-Bit Register for Triac 1 and Triac 2 Demands	**453**	unit16	0..25700 (x1) 0x0000..0x6464	Byte 1: Triac 1 (0x00..0x64) Byte 2: Triac 2 (0x00..0x64)	R
Y1 Commission Override	Y1 Commissioning Override Parameter	**690**	uint16	0..3 (x1)	0 = Auto (Default) 1 = Manual Override 2 = 0% 3 = 100%	R/W
Y2 Commission Override	Y2 Commissioning Override Parameter	**691**	uint16	0..3 (x1)		R/W
Y3 Commission Override	Y3 Commissioning Override Parameter	**692**	uint16	0..3 (x1)		R/W
TR1 Commissioning Override	TR1 Commissioning Override Parameter	**694**	uint16	0..3 (x1)	0 = Auto (Default) 1 = Manual Override 2 = 0% 3 = 100%	R/W
TR2 Commissioning Override	TR2 Commissioning Override Parameter	**695**	uint16	0..3 (x1)		R/W

CDR-MOD/TER-MOD MODBUS COMMUNICATION REGISTERS

The below is the list of the Modbus registers for the legacy CDR-MOD CO2 and TER-MOD temperature sensors. Using these registers it is possible to use the CDR04 CO2 or TER-MOD temperature sensors as a direct replacement for CDR-MOD/TER-MOD without a need for configuration at the Modbus master (BMS).

NOTE: The legacy registers are not visible in the Modbus device configuration tool software.

LIVE DATA						
		MODBUS INPUT REGISTERS - FUNCTION CODE 04 MODBUS HOLDING REGISTER - FUNCTION CODES 03, 16 (Only Registers 300-313)				
Parameter	**Description**	**Reg**	**Type**	**Data Range (multiplier)**	**Value Range / Enumerations**	**R/W**
INPUTS						
CO2 Sensor	Displays current measurement CO2 reading (CDR04 only)	**0 or 300**	uint16	0..10,000 (x1)	0..10,000ppm	R
Temperature Sensor	Displays current temperature measurement reading (built-in sensor) Note: Value depends on the temperature unit °C/°F selection	**1 or 301**	int16	-400..2480 (x10)	-40.0..120.0°C / -40.0..248.0°F	R
Humidity Sensor	Displays current humidity measurement reading (With RH option)	**2 or 302**	int16	0..1000 (x10)	0..100%rH	R
Setpoint Adjustment / Calculated Setpoint	Parameter 793 defines the setpoint display mode, and value displayed in this register. Relative: Shows User Adjustment e.g. -3.0 to 3.0 Absolute: Shows Calculated Setpoint (Nominal Network Setpoint + User Adjustment) for 4-Stage Control Loop	**6 or 306**	int16	-32000..32000 (x10)	-3200.0..3200.0	R
Y1	Analogue Output 1 Value	**7 or 307**	uint16	0..1000 (x10)	0..100% = 0..10V	R
Y2	Analogue Output 2 Value	**8 or 308**	uint16	0..1000 (x10)	0..100% = 0..10V	R
Y3	Analogue Output 3 Value	**9 or 309**	uint16	0..1000 (x10)	0..100% = 0..10V	R
UI1	Universal Input 1 Measurement Note: Value depends on the temperature / mode selection	**12 or 312**	int16	-400..2480 (x10)	NTC Mode: -40..120° AI Mode: 0..100% = 0..10V	R
UI2	Universal Input 2 Measurement Note: Value depends on the temperature / mode selection	**13 or 313**	int16	-400..2480 (x10)	NTC Mode: -40..120° AI Mode: 0..100% = 0..10V	R
		DISCRETE INPUTS - FUNCTION CODE 02				
DI1	Digital Input 1 Status	**0**		0..1	0..1	R
DI2	Digital Input 2 Status	**1**		0..1	0..1	R
Triac 1 Status	Triac 1 Output Status	**2**		0..1	0..1	R
Triac 2 Status	Triac 2 Output Status	**3**		0..1	0..1	R
PIR Status	PIR (OE Option) Status	**4**		0..1	0..1	R
Boost Status	Boost Status	**5**		0..1	0..1	R
Triac 1 Status	Triac 1 Output Status	**206**		0..1	0..1	R
Triac 2 Status	Triac 2 Output Status	**207**		0..1	0..1	R

		Modbus Register / BACnet Property	**MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16**			
Parameter	**Description**		**Type**	**Data Range (multiplier)**	**Value Range / Enumerations**	**R/W**
Y1 Override	Analogue Output Y1 Override Value. Note: Only applicable when source is set to Network.	**0**	unit16	0..1000 (x10)	0.0..100.0% (Default 0)	R/W
Y2 Override	Analogue Output Y2 Override Value Note: Only applicable when source is set to Network.	**1**	unit16	0..1000 (x10)	0.0..100.0% (Default 0)	R/W
Y3 Override	Analogue Output Y3 Override Value Note: Only applicable when source is set to Network.	**2**	unit16	0..1000 (x10)	0.0..100.0% (Default 0)	R/W
Temprature Setpoint (SPnom)	Temperature Control Loop Nominal Setpoint	**15**	uint16	0..2120 (x10)	0.0..212.0, Default 21.0	R/W

Bacnet Protocol Implementation Statement (PICS) and BACnet Objects

The -BAC versions of the controllers come with BACnet MS/TP communication. The following tables describe the PICS (Protocol Implementation Conformance Statement) and BACnet Objects (Standard and Proprietary). The Proprietary Objects are used for the device configuration.

GENERAL INFORMATION			
Date:	Feb 1, 2023		
Vendor Name:	Senticon Ltd		
Vendor ID:	1374		
Product Name:	xCR Smart Room Controller		
Product Models:	TCRxx, QCRxx		
Applications Software Version:	1.0		
Firmware Revision:	1.0.0		
BACnet Prorocol Revision	1.19		
Product Description:	Smart Room Sensors		
BACnet Standard Device Profile:	BACnet Application Specific Controller (B-ASC)		
BACnet Interoperability Blocks Supported:	Data Sharing - ReadProperty-B (DS-RP-B) Data Sharing - ReadPropertyMultiple-B (DS-RPM-B) Data Sharing - WriteProperty-B (DS-WP-B) Data Sharing - COV-B (DS-COVU-B) Device Management - DynamicDeviceBinding-B (DM-DDB-B) Device Management - DynamicObjectBinding-B (DM-DOB-B) Device Management - DeviceCommunicationControl-B (DM-DCC-B)		
Segmentation Capability:	No		
Data Link Layer Options:	MS/TP Master; Supported Baud 9600/19200/38400/57600/76800/115200		
Device Address Binding:	No static device binding supported		
Networking Options:	None		
Character Sets Supported:	ISO 10646 (UTF-8)		
Gateway Options:	None		
Network Security Options:	Non-Secure Device		
Standard Object Types Supported:	**Object Type:**	**Optional Properties**	**Writeable Properties**
	Analog Value:	Description, COV Increment, Relinquish Default	Present Value COV Increment
	Binary Value:	Description, Inactive_Text, Active_Text	Present Value
	Device Object:	Description Active COV Subsriptions Max Master	Object Identifier Object Name APDU Timeout (0...60000) Number Of APDU Retries (0...10) Max Master (1...127)
	For all supported objects, device does not support CreateObject or DeleteObject. *For Analog Value objects that are classified as read only, there is the following behavior:* *- HVAC application overwrites the present value that has been written with the Write Property Service.* *- In this case, no error message will be sent.* *The device application checks the ranges of the Present Value and the COV Increment of the Analog Objects. For this reason, there is the following behavior:* *- No error message, if the limits have been exceeded* *- Too high values are set to the range maximum* *- Too small values are set to the range minimum*		

OBJECT TYPE: DEVICE OBJECT				
Object Instance	**Property Identifier**	**Value Range**	**Default Value**	**R/W**
Device[x]	Object Identifier		MAC_Address	R/W
	Object Name	32 chars max.		R/W
	Object_Type		8	R
	System_Status		Status_Operational	R
	Vendor_Name		Senticon Ltd	R
	Vendor_Identifer		1374	R
	Model_Name		xCR	R
	Firmware_Revision		1.0.0	R
	Application_Software_Version		1.0	R
	Protocol_Version		1	R
	Protocol_Revision		19	R
	Protocol_Services_Supported		See General Information	R
	Protocol_Object_Types_Supporte		See General Information	R
	Object_List		See Objects List	R
	Max_APDU_Length_Accepted		480	R
	Segmentation_Supported		No	R
	APDU_Timeout		6000 ms	R/W
	Number_Of_APDU_Retries		3	R/W
	Max_Master		127	R/W
	Device_Address_Binding			R
	Database_Revision		0	R
	Property_List			R

OBJECT TYPE: ANALOGUE VALUE						
Object Instance	**Object Name**	**Value Range**	**Relinquish_Default**	**Units**	**COV Increment**	**R/W**
AV(0)	Temperature	-40.0..120.0°C / -40.0..248.0°F	-	DEGREES_CELCIUS or DEGREES_FAHRENHEIT	0.0..100 (Default 0.5)	R
AV(1)	CO2	0...10,000	-	PARTS_PER_MILLION	0.0..100 (Default 50)	R
AV(2)	UI1	-40.0..120.0°C / -40..248°F 0..100.0%	-	DEGREES_CELCIUS or DEGREES_FAHRENHEIT or NO_UNITS	0.0..100 Default 1.0	R
AV(3)	UI2	-40.0..120°C / -40..248°F 0..100.0%	-	DEGREES_CELCIUS or DEGREES_FAHRENHEIT or NO_UNITS	0.0..100 Default 1.0	R
AV(4)	Y1	0.0..100.0%	-	PERCENT	5	R/W
AV(5)	Y2_RL1	0.0..100.0%	-	PERCENT	5	R/W
AV(6)	Y3_RL2	0.0..100.0%	-	PERCENT	5	R/W
AV(7)	Setpoint_Main	0.0..212.0	Nonvol_Setpoint	NO_UNITS	n/a	R/W
AV(8)	Setpoint_CO2	0...10000.0	Nonvol_Setpoint	PARTS_PER_MILLION	n/a	R/W
AV(9)	Fan_Speed - Not Applicable					
AV(10)	Operating_Mode - Not Applicable					
AV(11)	Network_Decimal (Temp)	-999.0..999.0	Nonvol_Setpoint	NO_UNITS	n/a	R/W
AV(12)	Network_Integer (CO2)	0..65535.0	Nonvol_Setpoint	NO_UNITS	n/a	R/W
AV(13)	Triac1_PWM	0..100	-	PERCENT	5	R/W
AV(14)	Triac2_PWM	0..100	-	PERCENT	5	R/W
AV(15)	RL3 - not applicable					
AV(16)	Humidity	0...100.0	-	RELATIVE_HUMIDITY	0.0..100	R

NOTE: Priority Input 16 is reserved for internal value. If COV increment is set to 0.0 (default), the COV is disabled.

NOTE: R = Read Only, R/W = Read/Write

OBJECT TYPE: BINARY VALUE					
Object Instance	**Object Name**	**Description**	**Present Value Range / Active - Inactive Tex**	**Relinquish_Default**	**R/W**
BV(0)	DI_1	Digital Input 1 Status	0: InActive (Off) 1: Active (On)	Binary_Inactive	R
BV(1)	DI_2	Digital Input 2 Status	0: InActive (Off) 1: Active (On)	Binary_Inactive	R
BV(2)	Cooling_Mode	Cooling Mode Override for Stage 1 (Heating/Cooling Change-Over)	0: InActive 1: Active	Binary_Inactive	R/W
BV(3)	Occupancy	Occupancy	0: InActive 1: Active	Binary_Inactive	R
BV(4)	Boost	Boost Mode Status	0: InActive 1: Active	Binary_Inactive	R

NOTE: Priority Input 16 is reserved for Internal Value.

NOTE: BV(6) - Set Priority Inputs 1-15 to 'null' to allow the user to unlock/lock the device.

PROPRIETARY OBJECT **OBJECT NAME / TYPE: "CONFIGx" / 128**
The devices have six instances of proprietary Device Configuration objects split as with the configuration tools; Cfg_IO, Cfg_Calibration, Cfg_User_interface, Cfg_Control_1, Cfg_Control_2, Cfg_System. The devices can be fully configured using the properties of these configuration objects. Full list of available properties are listed in the *Device Setup and Modbus/BACnet Communication* section tables.

In addition to the generic parameters, the BACnet AV and BV objects have proprietary property to enable COV (Unsubscribed COV) function. For the AV objcts the COV increment can be changed from the defaults. For the BV objects data is transmitted when the state changes.

NOTE: Enabling COV increases network load as the messages are broadcasted to all devices. For efficient network performance limit the number of COV objects to minimal and configure routers to allow broadcasts only on the subnets.

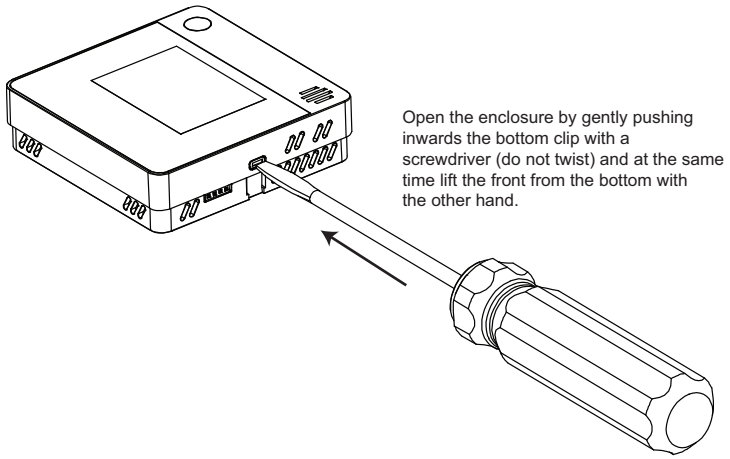
BACNET COV OBJECT SETTINGS						
Parameter	**Description**	**BACnet Property**	**Type**	**Data Range (multiplier)**	**Value Range / Enumerations**	**R/W**
AVx COV	AV Object COV Enable Flag x = AV Object Number (AV0..AV6, A9..AV10, AV13..AV14)	**100x**	uint16	0..1(x1)	0 = COV Disabled 1 = COV Enabled	R/W
BVx COV	BV Object COV Enable Flag x = BV Object Number (BV0..BV1)	**110x**	uint16	0..1(x1)	0 = COV Disabled 1 = COV Enabled	R/W

Installation

The devices typically mounted on the flat wall surfaces or on the junction boxes. The enclosure has 56/60mm screw distance for standard mounting boxes.

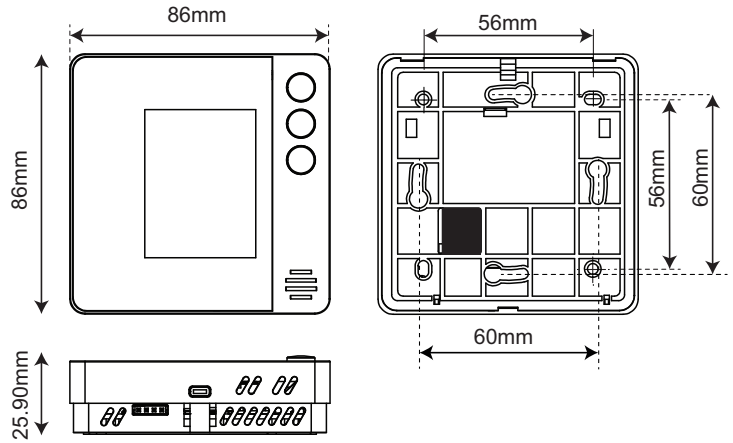
Installation Notes:

- Follow the diagram below to open the enclosure to access the mounting holes and the wiring terminals.
- Install the sensors away from the sources of heat and cool e.g. from direct sunlight or cold external walls.
- Do not install other heat producing devices under the sensor/controller as these will create measurement errors in temperature. Large devices under and above the controller/sensor also block the free air flow through the device causing measurement errors.
- Install the sensors at 120-150 cm height for optimal performance.
- For correct movement (PIR) sensor operation consider the location of the sensor carefully.
- Make sure that the cable entries and junction boxes are sealed from air flows. This is the most common reason for inaccuracies in temperature measurement.
- Bring the cables through the dedicated hole (black area) marked on the dimensions drawing.
- If surface mounted cable is required to be used, the top of the enclosure (center) has a thin wall section that can be cut.



Open the enclosure by gently pushing inwards the bottom clip with a screwdriver (do not twist) and at the same time lift the front from the bottom with the other hand.

Dimensions

The devices typically mounted on the flat wall surfaces or on the junction boxes. The enclosure has 56/60mm screw distance for standard mounting boxes.

DIMENSIONS