

PS2.01 TCR/QCR10, TCR/QCR11, TCR/QCR12, TCR/QCR13, TCR/QCR14, TCR/QCR15 Series Touchscreen Room Controllers



The TCR/QCR Series Controllers have been designed to be wall mounted universal temperature, air quality, humidity controllers in room spaces. The controllers are suitable for a wide range of applications and have pre-defined application logic that covers most room control heating and cooling systems such as fan coil units, chilled ceilings, zone heating etc.

The xCR10 and xCR11 series controllers are wall surface mounted. xCR12, xCR13, xCR14 and xCR15 series controllers are Slim Line flush mounted with additional IOs to standard wall mounting boxes.

xCR14 and xCR15 Series controllers have 230V power supply, so they are ideal for applications where 24V is not available.

The room controllers are typically supplied with a sharp colour touchscreen display with glass front that provides intuitive user interface. An optional PIR sensor is available. The controllers have built-in Modbus RTU or BACnet MS/TP communication that allow interaction to the BMS systems. Optional Bluetooth wireless interface provides Smart Phone App interface (iOS). LoraWan option allows integration wirelessly to the LoraWan systems.

Features

- Advanced Room Controllers for wide variety of room control applications.
- Multi- and Single Stage PI Control Loops provide accurate control of Temperature, Humidity, CO₂, VOC or combination of them with high/low limit, summer/winter change-over, dew point, maximum demand etc. functions
- BACnet MS/TP and Modbus RS485 RTU with up to 60V industrial isolation on RS485 for system integration
- Optional LoraWan® long-range wireless communication interface
- 2.4" Colour Touchscreen for Indications, User Actions and Alarms. Blank version available for discreet installations
- QCR Models have Built-in CO₂ Measurement and Control
- 2x Universal inputs (temperature/0-10V/digital) offer application flexibility
- xCR10, xCR12 and xCR15 Models have 4x Analogue 0..10Vdc Outputs
- xCR11 Models have 1x Analogue 0..10Vdc Output and 4 x 24Vac Triacs
- xCR12 Models have 2 x 24Vac Triacs

- xCDR13 Models have 2 x 24Vac Triacs and 3 x 230Vac rated 5A relays (for fan control)
- xCR14 Models have 3x Analogue 0..10Vdc Outputs and 1x 230V relay output (7A res.)
- Configuration wirelessly through Smart Config Windows Software or Smart Phone iOS App (via Built-In Bluetooth or using Bluetooth Dongles). SmartView SmartPhone App for device interrogation for end users.
- Built-in extension timer / boost button (TS models)
- Optional 24V pilot relay (RL-option) with xCR10 and xCR12 versions
- Available in both White and Black. The display has number of different skin colour options for customisation.
- User display language customisable using the language packs

Technical Specifications

| | | |
|----------------------------|--|---|
| Power Supply: | Power: | xCR10: 24Vac/dc -10%/+15%, max 80mA with display xCR11: 24Vac/dc -10%/+15%, max 80mA with display xCR12: 24Vac/dc -10%/+15%, max 80mA with display xCR13: 24Vac/dc -10%/+15%, max 80mA with display Note: Triacs required 24Vac to operate xCR14/xCR15: 90-250VAC 50/60Hz, 0.15A |
| Measurements: | Temperature (All Models) | Range: 0..50° (32..122°F) Accuracy: +/-0.5°C |
| | CO2 (QCR Models) | Range: 0..10,000ppm Accuracy: +/-50ppm + 5% of the reading |
| | Humidity (Option) | Range: 0..100%rH Accuracy: +/-2%rH (within 20 to 80%rH) |
| | VOC (Volatile Organic Compound) (Option) | Range: 0..500 (Air Quality Index) |
| | PIR Movement (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 RI = Resistive kOhms Measurement, 0.1..500kOhms, Accuracy: 0.1+/-1% kOhms of the reading (1..80kOhms), resolution 0.1 kOhms AI = 0..10Vdc Input, display resolution 0.1 Volts DI = Digital Volt-Free Input Note: xCR14 has only 1 x UI |
| Outputs: | Analogue Outputs: | xCR10/xCR12/xCR15: 4 x 0..10Vdc, min. load resistance >5 kOhms (max. 2mA @ 10V) xCR11/xCR13: 1 x 0..10Vdc, min. load resistance >5 kOhms (max. 2mA @ 10V) xCR14: 3 x 0..10Vdc, min. load resistance >5 kOhms (max. 2mA @ 10V) |
| | Digital Outputs: | xCR11: 4 x 24Vac Rated Triacs, Switching to 0V, Max 1A load xCR12/xCR13: 2 x 24Vac Rated Triacs, Switching to 0V, Max 1A load (for thermic wax actuators or 3-point raise/lower actuators - max. 3 thermic actuators per triac) |
| | Relay Outputs: | xCR10 (RL Option): 1 x 24V Pilot Relay, max 0.5A xCR12 (RL Option): 1 x 24V Pilot Relay, max 0.5A. Note: Replaces Triacs (D1 & D2) xCR13: 3 x 230Vac, max 5A (res.) xCR14: 1 x 230Va, max 7A (res.) |
| Communication: | Physical Interface | 1 x RS485 driver with up to 60V industrial Isolation, recommended max 63 devices |
| | Protocol: | Modbus RTU or BACnet MS/TP (order relevant model) |
| | Addressing: | Via Bitswitch: 1..127 (xCR10 and xCR11 only) Via Software: 1..247 for Modbus, 1..127 for BACnet MS/TP Via Tauschreen (TS-models): 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) |
| Wireless Interface: | Bluetooth (Option): | Bluetooth Low Energy - iOS Smart Phone App Interface |
| | LoraWan (Option): | LoraWan® Wireless Interface (EU868, other bands available on request) Encrypted LoraWan® 1.0.3 Class C Device with secure OTAA activation with IPEX antenna for long-range communication. |
| Display: | Option | Optional 2.4" Full Colour Display with Glass Overlay, 240 x 320px |
| Mechanical: | Wiring Terminals: | Rising Cage Screw Terminals, 0.2 to 2.5mm ² / 26 to 12 AWG |
| | Enclosure: | ABS ULV0 Plastics - White or Black, IP20 |

Mounting: xCR10/xCR11: Wall or Junction Box Mounting (60mm screw distance)
 xCR12/xCR13/xCR14/xCR15: Junction Box Mounting (60mm screw distance)

Dimensions xCR10/XCR11: W86 x H86 x D24mm
 xCR12/xCR13/xCR14/xCR15: W86 x H86 x D14mm (Surface Part)
 W86 x H86 x D39mm (Total)

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. It is possible to order products using either.

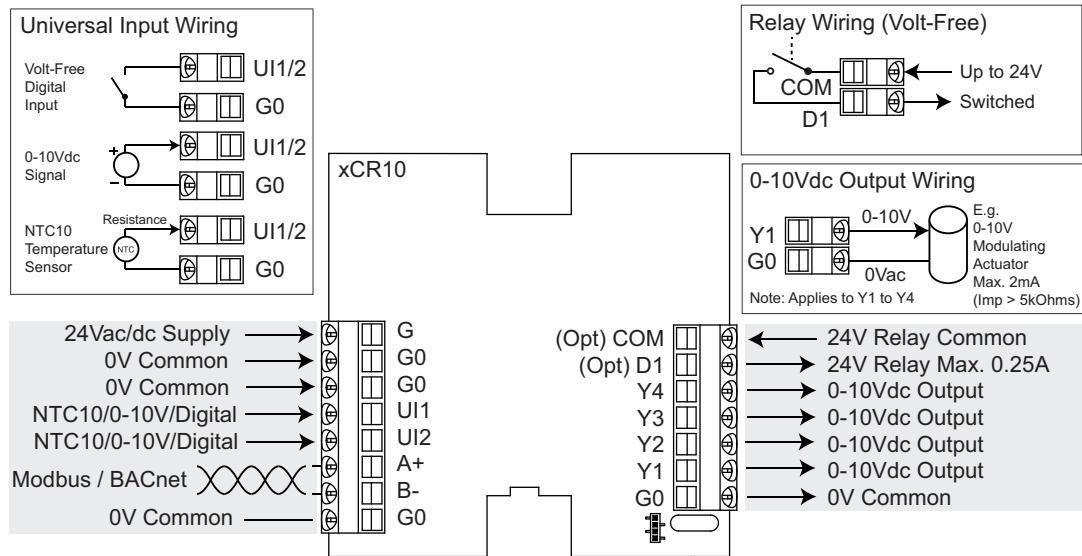
| Part Number | | SKU# Number | | | | | | |
|---------------------------------------|--|-------------|-----------------|----|----|----|----|---|
| Example | QCR10-BAC-TS-OE-W | 5000 | 2 | 02 | 03 | 00 | 0 | 2 |
| Product Name | | Product | Product Options | | | | | |
| TCR10 | Room Temperature Controller, 2UI, 4AO, 24V Supply | 5000 | | | | | | |
| QCR10 | Room Temperature and CO2 Controller, 2UI, 4AO, 24V Supply | 5100 | | | | | | |
| TCR11 | Room Temperature Controller, 2UI, 4DO, 1AO, 24V Supply | 5200 | | | | | | |
| QCR11 | Room Temperature and CO2 Controller, 2UI, 4DO, 1AO, 24V Supply | 5300 | | | | | | |
| TCR12 | SlimLine Room Temperature Controller, 2UI, 4AO, 2DO, 24V Supply | 5400 | | | | | | |
| QCR12 | SlimLine Room Temperature and CO2 Controller, 2UI, 4AO, 2DO, 24V Supply | 5500 | | | | | | |
| TCR13 | SlimLine Room Temperature Controller, 2UI, 2DO, 3RO (230V), 1AO, 24V Supply | 5600 | | | | | | |
| QCR13 | SlimLine Room Temperature and CO2 Controller, 2UI, 2DO, 3RO (230V), 1AO, 24V Supply | 5650 | | | | | | |
| TCR14 | SlimLine Room Temperature Controller, 1UI, 3AO, 1RO (230V), 90-250Vac Supply | 5700 | | | | | | |
| QCR14 | SlimLine Room Temperature and CO2 Controller, 1UI, 3AO, 1RO (230V), 90-250Vac Supply | 5750 | | | | | | |
| TCR15 | SlimLine Room Temperature Controller, 2UI, 4AO, 90-250Vac Supply | 5800 | | | | | | |
| QCR15 | SlimLine Room Temperature and CO2 Controller, 2UI, 4AO, 90-250Vac Supply | 5850 | | | | | | |
| Serial Communication Option | | | | | | | | |
| MOD | Modbus RS485 | | 1 | | | | | |
| BAC | BACnet MS/TP | | 2 | | | | | |
| Interface and Wireless Options | | | | | | | | |
| | No Interface | | | | 00 | | | |
| TS | Colour Capacitive Touchscreen | | | | 02 | | | |
| BLE | Bluetooth App Interface | | | | 03 | | | |
| TS-BLE | Touchscreen and Bluetooth | | | | 05 | | | |
| LRA | LoraWan Wireless Interface | | | | 06 | | | |
| TS-LRA | LoraWan Wirelss Interface with Touchscreen | | | | 08 | | | |
| Measurement Options | | | | | | | | |
| | No Extra Measurements | | | | | 00 | | |
| RH | Relative Humidity | | | | | 01 | | |
| RH-VOC | Volatile Organic Compound and Humidity | | | | | 02 | | |
| OE | Passive Infrared Movement (PIR) | | | | | 03 | | |
| RH-OE | Relative Humidity and Movement (PIR) | | | | | 04 | | |
| RH-VOC-OE | VOC, Relative Humidity and Movement (PIR) | | | | | 05 | | |
| Output Options | | | | | | | | |
| | No Output Options | | | | | | 00 | |
| RL | 24V Relay Output (Only for TC10/QCR10/TCR12/QCR12) *1 | | | | | | 01 | |
| Region (LoraWan) | | | | | | | | |
| | Non Lora or EU868MHz LoraWan | | | | | | | 0 |
| US | US915MHz LoraWan | | | | | | | 1 |
| AS | AS923MHz LoraWan | | | | | | | 2 |
| IN | IN815MHz LoraWan | | | | | | | 3 |
| Colour Options | | | | | | | | |
| B | Black | | | | | | | 1 |
| W | White | | | | | | | 2 |

Note 1. RL-option only available for xCR10 and xCR12 Series. With xCR12 series RL replaces triacs (D1 & D2). xCR13 and xCR14 have built-in 230V relays.

Wiring Connections

TCR10/QCR10 CONTROLLER WIRING

The diagram below illustrates the wiring connections to the controllers.

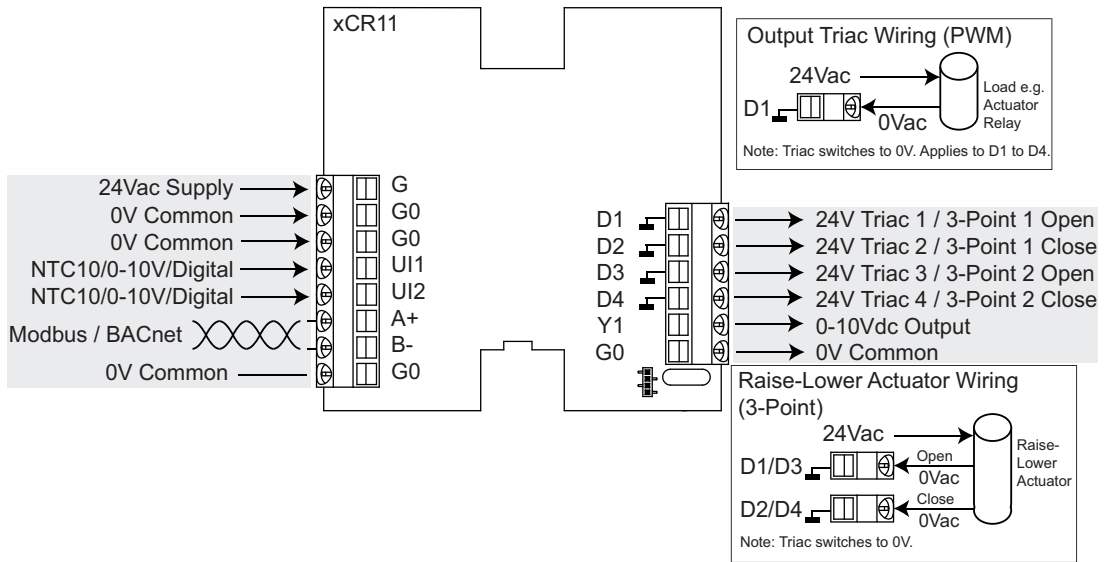


QCR10/TCR10 WIRING TERMINATIONS

| 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 |
|----------|--|
| COM | 24V Relay Common (Option) |
| D1 | 24V Relay Max 0.25A (Option) |
| Y4 | 0-10Vdc Output max. 2mA (Default: CO2 Control) |
| Y3 | 0-10Vdc Output max. 2mA (Default: EC Fan Speed) |
| Y2 | 0-10Vdc Output max. 2mA (Default: Cooling Stage 1) |
| Y1 | 0-10Vdc Output max. 2mA (Default: Heating Stage 1) |
| G0 | 0V Common |

TCR11/QCR11 CONTROLLER WIRING



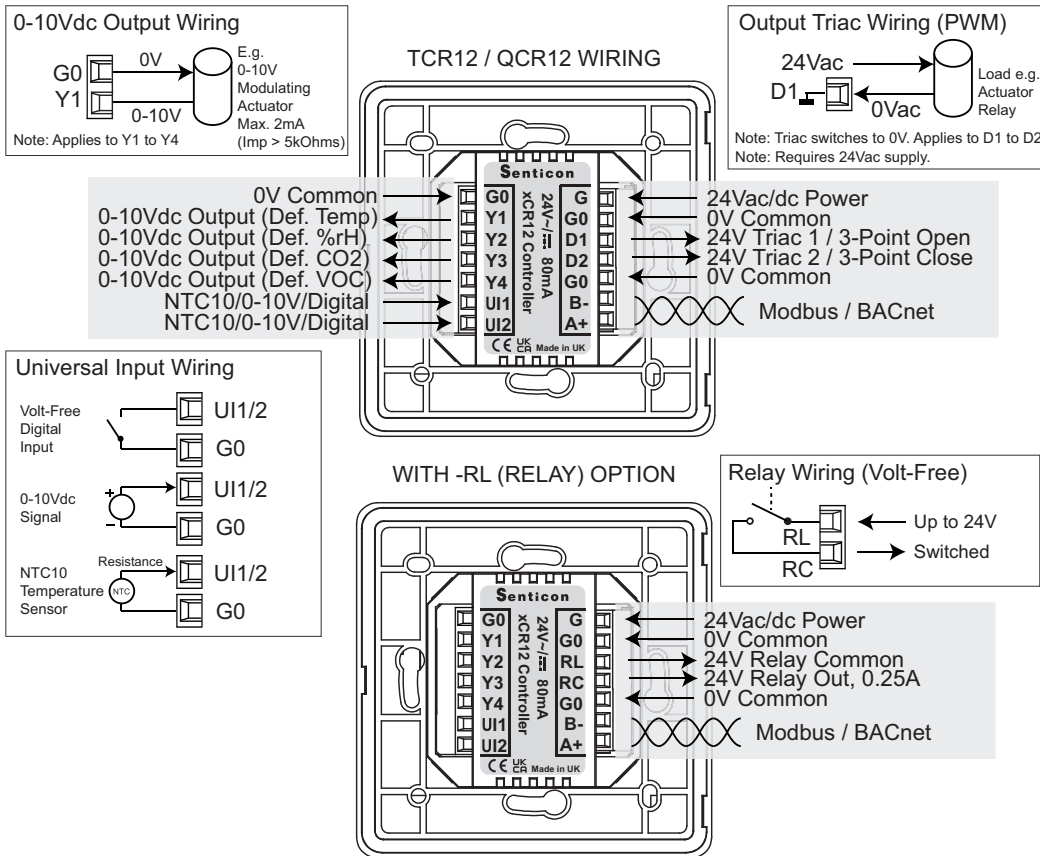
QCR11/TCR11 WIRING TERMINATIONS

| Terminal | Description |
|----------|---------------------------------------|
| G | 24Vac -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 |
|----------|--|
| COM | Not Applicable |
| D1 | 24Vac Triac, Max 1A (Default: Heating Stage 1) |
| D2 | 24Vac Triac, Max 1A (Default: Cooling Stage 1) |
| D3 | 24Vac Triac, Max 1A (Default: Heating Stage 2) |
| D4 | 24Vac Triac, Max 1A (Default: Cooling Stage 1) |
| Y1 | 0-10Vdc Output max. 2mA |
| G0 | 0V Common |

TCR12/QCR12 CONTROLLER WIRING

xCR12 series controllers are flush mounted to junction box. The diagrams below illustrate the wiring.

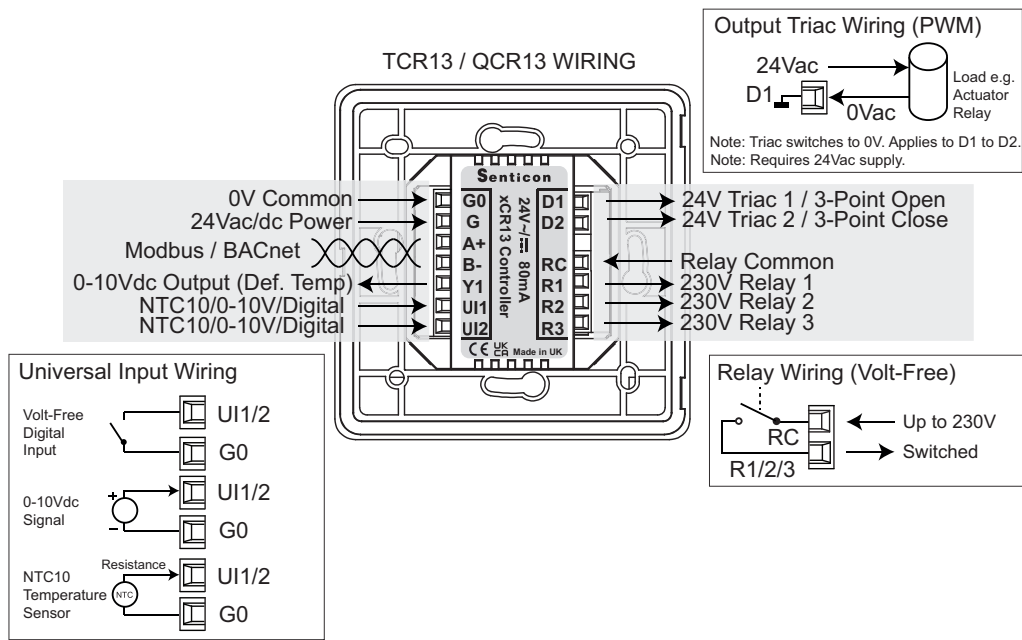


| Terminal | Description |
|----------|---|
| G0 | 0V Common |
| Y1 | 0-10Vdc Output 1, max. 2mA (Default: Heating Stage 1) |
| Y2 | 0-10Vdc Output 2, max. 2mA (Default: Cooling Stage 1) |
| Y3 | 0-10Vdc Output 3, max. 2mA (Default: EC Fan Speed) |
| Y4 | 0-10Vdc Output 4, max. 2mA (Default: CO2 Control) |
| UI1 | NTC10/0-10V/Volt-Free Digital Input 1 |
| UI2 | NTC10/0-10V/Volt-Free Digital Input 2 |

| Terminal | Description |
|----------|---|
| G | 24Vac/dc -10/+15% Supply Note: Triacs need 24Vac |
| G0 | 0V Common |
| D1 | 24Vac Triac, Max 1A |
| RL | 24V Relay (RL-option) |
| D2 | 24Vac Triac, Max 1A |
| RC | 24V Relay Common (RL-option) |
| G0 | 0V Common |
| B- | Modbus / BACnet RS485 B- |
| A+ | Modbus / BACnet RS485 A+ |

TCR13/QCR13 CONTROLLER WIRING

xCR13 series controllers are flush mounted to junction box. The diagram below illustrates the wiring.

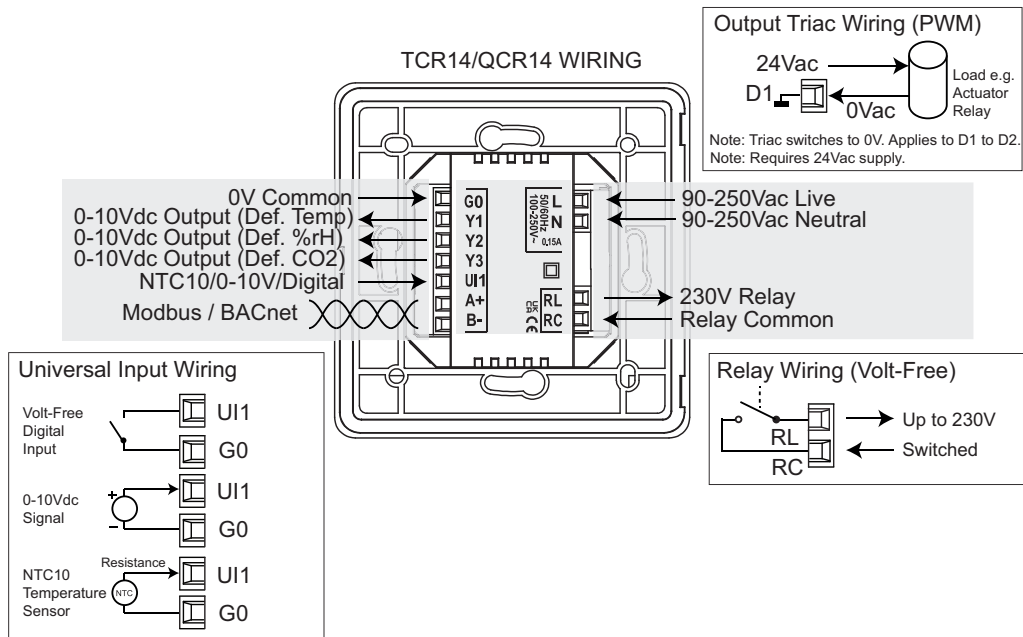


| Terminal | Description |
|----------|---|
| G0 | 0V Common |
| G | 24Vac/dc -10/+15% Supply Note: Triacs need 24Vac |
| A+ | Modbus / BACnet RS485 A+ |
| B- | Modbus / BACnet RS485 B- |
| Y1 | 0-10Vdc Output 1, max. 2mA (Default: Heating Stage 1) |
| UI1 | NTC10/0-10V/Volt-Free Digital Input 1 |
| UI2 | NTC10/0-10V/Volt-Free Digital Input 2 |

| Terminal | Description |
|----------|-----------------------------------|
| D1 | 24Vac Triac, Max 1A |
| D2 | 24Vac Triac, Max 1A |
| RC | Relay Common, max. 230Vac, 5A |
| R1 | Relay 1 (Fan Speed 1), 230Vac, 5A |
| R2 | Relay 2 (Fan Speed 2), 230Vac, 5A |
| R3 | Relay 3 (Fan Speed 3), 230Vac, 5A |

TCR14/QCR14 CONTROLLER WIRING

xCR14 series controllers are flush mounted to junction box. The diagram below illustrates the wiring.

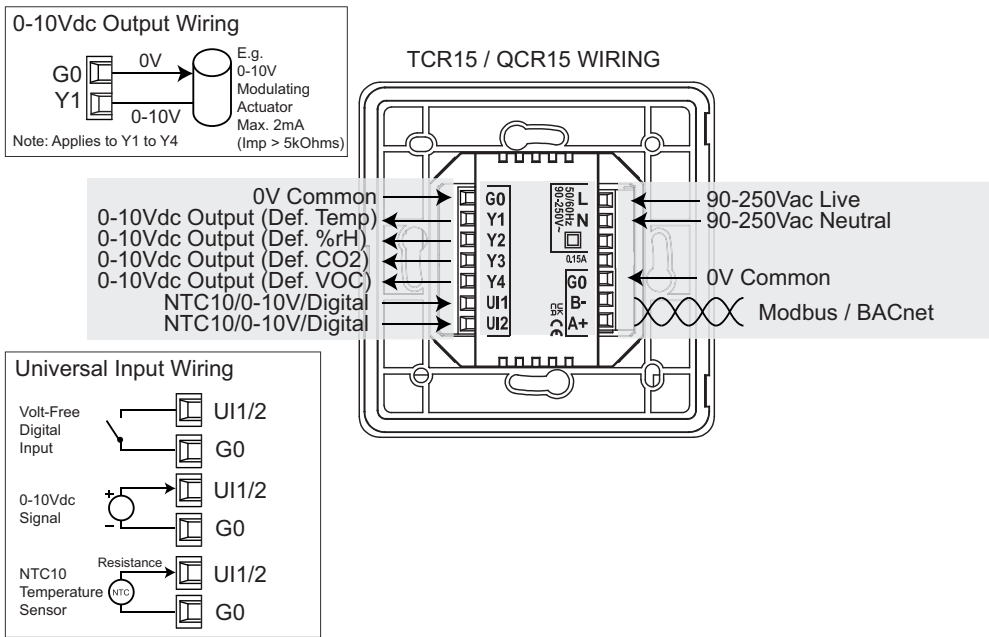


| Terminal | Description |
|----------|---|
| G0 | 0V Common |
| Y1 | 0-10Vdc Output 1, max. 2mA (Default: Heating Stage 1) |
| Y2 | 0-10Vdc Output 2, max. 2mA (Default: Cooling Stage 1) |
| Y3 | 0-10Vdc Output 3, max. 2mA (Default: EC Fan Speed) |
| UI1 | NTC10/0-10V/Volt-Free Digital Input 1 |
| A+ | Modbus / BACnet RS485 A+ |
| B- | Modbus / BACnet RS485 B- |

| Terminal | Description |
|----------|----------------------------------|
| L | 90-250Vac Live, 50/60Hz |
| N | 90-250Vac Neutral, 50/60Hz |
| RL | Relay Out, 230Vac, max 7A (res.) |
| RC | Relay Common, max. 230Vac |

TCR15/QCR15 CONTROLLER WIRING

xCR15 series controllers are flush mounted to junction box. The diagram below illustrates the wiring.



| Terminal | Description |
|----------|---|
| G0 | 0V Common |
| Y1 | 0-10Vdc Output 1, max. 2mA (Default: Heating Stage 1) |
| Y2 | 0-10Vdc Output 2, max. 2mA (Default: Cooling Stage 1) |
| Y3 | 0-10Vdc Output 3, max. 2mA (Default: EC Fan Speed) |
| Y4 | 0-10Vdc Output 4, max. 2mA (Default: CO2 Control) |
| UI1 | NTC10/0-10V/Volt-Free Digital Input 1 |
| UI2 | NTC10/0-10V/Volt-Free Digital Input 2 |

| Terminal | Description |
|----------|----------------------------|
| L | 90-250Vac Live, 50/60Hz |
| N | 90-250Vac Neutral, 50/60Hz |
| G0 | 0V Common |
| B- | Modbus / BACnet RS485 B- |
| A+ | Modbus / BACnet RS485 A+ |

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.

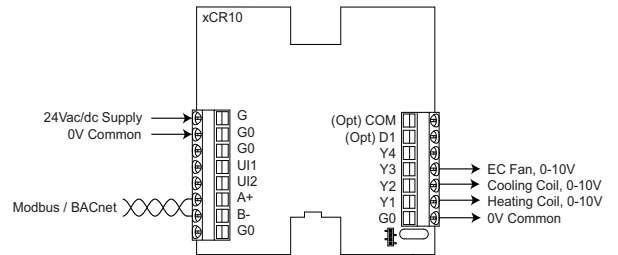
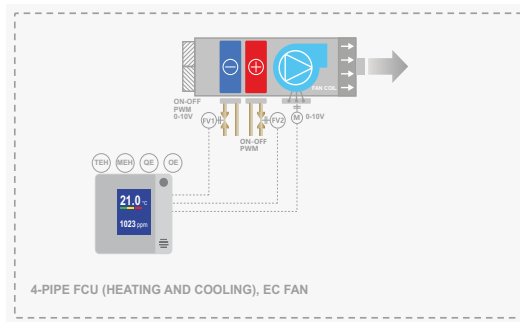
Controller Applications

The xCR10/11/12/13/14/15 controllers have flexible software design that allows them to be tailored to most room control applications. Each controller can be configured from default settings using the Smart Configuration tools or via the network. The unused inputs and outputs are available for Building Management Systems for additional control functions.

DEFAULT APPLICATION

As factory default, the controller has been configured to provide single stage heating and cooling control with modulating EC Fan control. Typical application for this configuration is 4-pipe Fan Coil Unit with EC Fan. The diagram below illustrates the this application and wiring connections.

NOTE: The TCR/QCR controllers can be tailored to wide variety of even complex control applications. The default application is designed to use the very basic features of the product as a starting point for the application development.



Control Functions

CONTROL MODES

The controllers have three control modes:-

- Occupied (Comfort)
- Unoccupied (Relaxed)
- Off (Night)

The controller operating mode is changed via the touchscreen, via PIR Occupancy Sensor (-OE option), via hardware inputs, via Modbus/BACnet network or via SmartPhone app (iOS). On transition from Occupied to Unoccupied/Off modes the Multi-Stage, Auxiliary and Humidity Loop user setpoint adjustments can be automatically reset to nominal values (enable *Reset User Adjustment* parameter)

NOTE: The control mode change happens when the controller sees the transition on the state of the command signal. This means that e.g if Digital Input 1 (UI1) overrides the controller to unoccupied mode, the mode can be changed e.g. via network regardless of the current DI1 state.

NOTE: The PIR movement sensor (-OE option) changes the controller mode both with On and Off transitions.

The control loop outputs (demand signals) are set in different modes as per the below table.

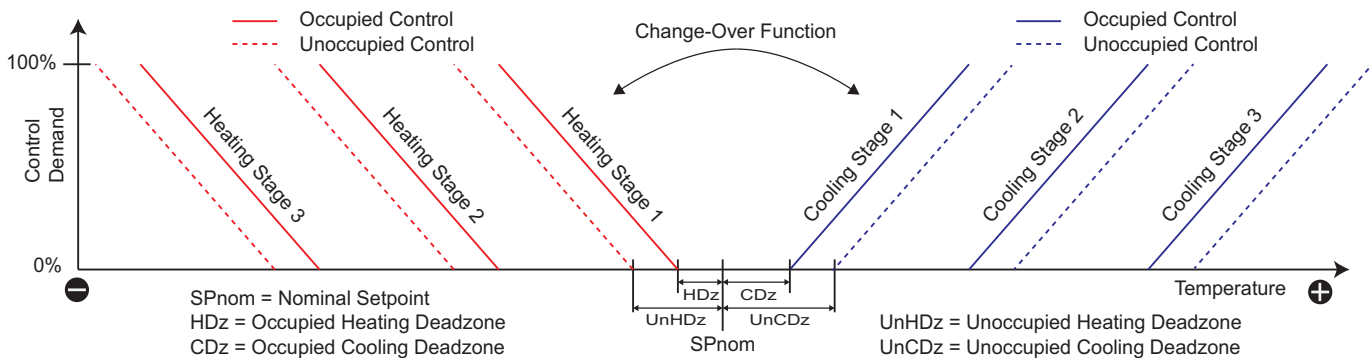
| Control Mode | Heating and Cooling Stages 1/2/3 Demand | Auxiliary Control Loop Demand | Air Quality CO2 and VOC Control Demand | Humidity and Dehumidity Control Demand, Fan Demand |
|--------------|---|---|--|--|
| Occupied | Based on control loop with occupied deadzone settings | Based on control loop | Based on control loop | Based on control loop |
| Unoccupied | Based on control loop with unoccupied deadzone settings | Based on control loop | Based on control loop | Based on control loop |
| Off | 0% (Frost logic enables heating stages to 100%) | 0% (Frost logic enables heating to 100%) | 0% | 0% |

NOTE: On power up the controller starts in Occupied (Comfort) mode.

MULTI-STAGE TEMPERATURE CONTROL

The controllers have multi-stage temperature control logic that meets requirements for advanced temperature control applications using PI-control (Proportional + Integral). Up to three (3) heating and up to three (3) 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 temperature control is operating in Occupied (comfort) / Unoccupied and Off modes. In unoccupied mode the temperature control is relaxed by increasing the heating and cooling deadzones. In the Off mode the temperature control is switched off (with frost protection active).



The multi-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:-

$$SP_{calc} = SP_{nom} + User_Adjustment + Reset_Function_Adjustment$$

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

FROST PROTECTION (OFF MODE)

In the Night Off mode, the controller automatically monitors the control sensor for low temperature protection (Frost Setpoint). If temperature drops below the frost setpoint, the heating stages are switched on to 100% until temperature rises 2° above the Frost Setpoint.

| 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 6 = Average (Average Function) |
| Main Loop Nominal Setpoint (SPnom) | Main Control Loop Nominal Setpoint Note: The control loop setpoint can be shifted by the high/low limit reset (cascade) control function indicated by limit icon. | 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 3 = 3-Stages |
| No of Cooling Stages | Sets the number of cooling stages. | 0 = None 1 = 1-Stage (Default) 2 = 2-Stages 3 = 3-Stages |
| Occupied Heating Deadzone (HDz) | Occupied Mode Heating Deadzone | 0.0..30.0 (Default 0.5) |
| Occupied Cooling Deadzone (CDz) | Occupied Mode Cooling Deadzone | 0.0..30.0 (Default 0.5) |
| Unoccupied Heating Deadzone (UnHDz) | Unoccupied Mode Heating Deadzone | 0.0..30.0 (Default 3.0) |
| Unoccupied Cooling Deadzone (UnCDz) | Unoccupied Mode Cooling Deadzone | 0.0..30.0 (Default 3.0) |
| Frost Setpoint | Off Mode Frost Setpoint | 0.0..60.0 (Default 10.0) |
| DZ Mode | Deadzone Mode. In standard mode the Integral Action element modulates to zero within the deadzone providing energy savings. In Hold mode the integral action element is held within the deadzone maintaining the output level fixed. | 0 = Standard (Default) 1 = Hold |

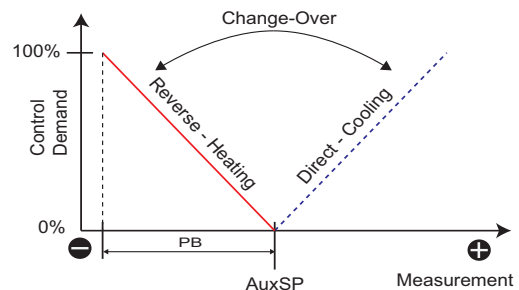
NOTE: If Change-Over function is activated, it can override the Heating Stage1 to operate as Cooling Stage1.

NOTE: Proportional Band is for each stage. E.g. if 3-stages of heating had been selected, and if the Proportional Band has been set as 5, then the Proportional Band across 3-stages of heating is 15.

AUXILIARY CONTROL LOOP

The controller has auxiliary PI-control (Proportional + Integral) loop where the control source can be configured to be built-in temperature, UI1, UI2 or Network value. The auxiliary control loop is normally used as a second temperature control zone (e.g. bathroom), but can also be used for generic purposes (setting UI1/UI2 mode to 0..10V).

The control loop operation operates as default in reverse (heating) mode i.e when measurement drops away from the setpoint the output increases. The loop can also operate in direct (cooling) mode. The direction of the operation can be reversed automatically using the change-over function (see change-over section).



FROST PROTECTION (OFF MODE)

In the Off mode, if the Aux Control Loop sensor source is set to Network/NTC10 and the sensor readings drops below the Frost Setpoint (set under Multi Stage Control loop) and the Aux Mode is set to Heating (reverse), the Aux Loop Demand is set to 100% until the temperature reaches 2 degrees above the Frost Setpoint.

| Parameter | Description | Value Range / Enumerations |
|-------------------------|--|--|
| Auxiliary Source | Sets the Source for the Auxiliary Control. 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. | 0 = Network Value (Reg 538) 1 = Temperature (Built-In, Default) 2 = UI1 - NTC10 3 = UI2 - NTC10 4 = UI1 - 0..10Vdc 5 = UI2 - 0..10Vdc 6 = Average (Average Function) |
| 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) |
| Aux Setpoint | Auxiliary Control Loop Setpoint | 0.0..212.0 (Default 21.0) |
| Aux Setpoint Resolution | Aux Setpoint Adjustment Resolution | 0.1..10.0 (default 0.1) |
| Aux PB | Auxiliary Control Proportional Band | 0.0..100.0 (Default 5.0) |
| Aux IA | Auxiliary Control Integral Action Time (Set to 0 to disable) | 0..3600s (Default 600s) |
| Aux Mode | Auxiliary Loop Control Mode Note: Change-Over mode can override the mode. | 0 = Reverse (Heating) 1 = Direct (Cooling) |

CHANGE-OVER FUNCTION

The controller can have a change-over function that reverses the multi-stage temperature control loop Heating Stage1 (and Cooling Stage1) operation, or the auxiliary control loop operation. The control loop that is affected by the change-over function is configured in the settings.

The change-over function is activated by the digital input (UI1/UI2 digital input), via temperature (UI1/UI2 NTC10 temperature), or via network. If temperature is selected, the change-over is active (cooling mode is active) if temperature drops below the change-over low temperature until temperature reaches the change-over high temperature (heating mode becomes active).

| Parameter | Description | Value Range / Enumerations |
|------------------------------|--|--|
| Change-Over Source | Sets the Source for the Change-Over Function. Note: As default the Network Command is Off i.e. no change-over function is active. Note: When using Digital Inputs set the corresponding universal input mode to '4 - Network'. | 0 = Network Command (Reg 721, Default) 1 = UI1 - NTC10 2 = UI2 - NTC10 3 = Digital Input 1 (UI1) 4 = Digital Input 2 (UI2) |
| Change-Over Target | Target of the Change-Over Control. | 0 = None (Default) 1 = Multi-Stage Control Loop 2 = Auxiliary Control Loop 3 = Multi-Stage and Aux Loops |
| Change-Over Low Temperature | Temperature below which the change-over is active (cooling stage active). Note: Relevant only for NTC Input 1/2 options. | 0..100.0° (32..212°F) Default 18°C |
| Change-Over High Temperature | Temperature above which the change-over is off (heating stage active, no override on control). Note: Relevant only for NTC Input 1/2 options. | 0..100.0° (32..212°F) Default 22°C |
| Network Change-Over Override | Heating / Cooling Mode Command from Network. Note: Requires change-over source to be set as Network. | 0 = Heating (Default) 1 = Cooling |

NOTE: Change-over function is not active in Off Mode.

NOTE: Typically configure the control output (Y1 to Y4) to Heating Stage1. In normal operation the output provides heating control (i.e. when temperature is below setpoint, there is heating demand). When the change-over is active, the same output provides cooling control (i.e. when temperature is above setpoint, there is cooling demand).

LOW/HIGH LIMIT RESET (CASCADE) CONTROL FUNCTION

The controller has a low/high limit reset control function that is typically used to protect floor surfaces in case of high underfloor heating temperatures, or prevent condensation in case of cool floor temperatures in high humidity environments such as bathrooms.

When active low / high limit is indicated with the Limit Icon on the status bar.

NOTE: Low/high limit function only operates in Occupied and Unoccupied modes.

| Parameter | Description | Value Range / Enumerations |
|----------------------|--|--|
| Reset Control Source | Sets the Temperature Source for the Reset Control Function. | 0 = Network Value (Reg 538) 1 = UI1 - NTC10 2 = UI2 - NTC10 |
| Reset Control Target | Target of the Reset Control Logic. The reset logic resets the target control loop setpoint as per calculated by the logic. | 0 = None (Default) 1 = Multi-Stage Control Loop Setpoint 2 = Auxiliary Control Loop Setpoint |
| High Limit Setpoint | High Limit Setpoint. Above this limit the setpoint is reduced proportionally according to the ratio and temperature difference. | 0.0..100.0° (32..212°F) Default 35°C |
| Low Limit Setpoint | Low Limit Setpoint. Below this limit the setpoint is increased proportionally according to the ratio and temperature difference. | 0.0..100.0° (32..212°F) Default 15°C |
| Reset Ratio | Reset ratio used to calculated the setpoint reset. | 0.0..10.0 (Default 1.0) |

MAX FUNCTION / PRIORITY LEVEL FUNCTION

MAX FUNCTION

The controller has two max functions that have two inputs. Using the Max Functions it is possible to, for example, configure how fan is controlled (Max 1 Default Settings), or take maximum of cooling control and CO2 control to control fresh air dampers (Max 2 Default Settings).

| Parameter | Description | Value Range / Enumerations |
|-------------------------|---|--|
| Max Function 1 Source 1 | Sets the Source for Input 1 of Maximum Function 1 Max Function 1 Source 1 Default: Heating Stage 1 | 0 = Network Value (Reg 538) 1 = Heating Stage 1 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity/DeHum Demand 11 = Max Function 1 12 = Max Function 2 13 = Fan Demand |
| Max Function 2 Source 1 | Sets the Source for Input 1 of Maximum Function 2 Max Function 2 Source 1 Default: Cooling Stage 1 | |
| Max Function 1 Source 2 | Sets the Source for Input 2 of Maximum Function 1 Max Function 1 Source 2 Default: Cooling Stage 1 | 0 = Network Value (Reg 538) 1 = Heating Stage 1 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity/DeHum Demand 11 = Max Function 1 12 = Max Function 2 13 = Fan Demand 14 = DI1 (UI1) PriLevel 15 = DI2 (UI2) PriLevel |
| Max Function 2 Source 2 | Sets the Source for Input 2 of Maximum Function 2 Max Function 1 Source 2 Default: CO2 Demand | |
| Priority Level | Sets the Max Function output level when the Priority Input (DI1 (UI1)/DI2(UI2)) is active. | 0..100% |

EXPLANATION MAX1 DEFAULT OPERATION

As default the Max1 function reads the Heating Stage 1 and Cooling Stage 1 demand values from the Multi-Stage Control loop. Maximum of these values is then used in the fan control loop to set the fan speed (as Fan Control Source = Max Function 1) i.e. the fan is running when there is either heating or cooling demand.

PRIORITY LEVEL FUNCTION (from Fw1.74 onwards)

Priority level function allows the Max Function output to be set on a defined fixed level when the corresponding Digital Input (Universal input in digital mode) is active. The output level is defined by the 736: *Priority Level* parameter. When the digital input is not active, the Max Function output takes the Source 1 value.

This is an useful function e.g. to override output when a switch or external contact activates.

Note: Please set the corresponding Universal Input mode (UI1 Mode/UI2 Mode) to 4: Digital Network or any of the 6-11: Digital Modes. The digital input polarity can also be reversed from parameters 527/528.

AVERAGE FUNCTION

Average Function can be used to average multiple measurements, and then used the average value as the Multi-Stage Control Loop or Auxiliary Control source. .

| Parameter | Description | Value Range / Enumerations |
|---------------|--|--|
| Measurement 1 | Sets the Source for Average Measurement 1. | 0 = Disabled (Default) 1 = UI1 2 = UI2 3 = Internal Temperature |
| Measurement 2 | Sets the Source for Average Measurement 2. | |
| Measurement 3 | Sets the Source for Average Measurement 3. | |
| Measurement 4 | Sets the Source for Average Measurement 4. | |

EC FAN AND 3-SPEED FAN CONTROL

Fan control logic is used to control EC fans and 3-Speed fans (using Triacs on xCR11/xCR12 models, or 0-10Vdc outputs on xCR10/11/12 models). Fan control logic can follow Continous or Stepped control. In Continous control when the source (e.g. heating and cooling demand) increases the fan speed increases linearly between speed settings.

When under automatic control if the input demand is less than the minimum level (*Min Fan Speed*) the output will be held at the minimum level. The only exception to this is when the *Fan Off Mode* is set to Off and the input demand is 0% in which case the output will be 0%. The *Max Auto Fan Speed* parameter sets the maximum fan speed in automatic mode. This can be overdriven manually by setting the *Fan Speed 1/2/3* levels above the *Max Auto Fan Speed*.

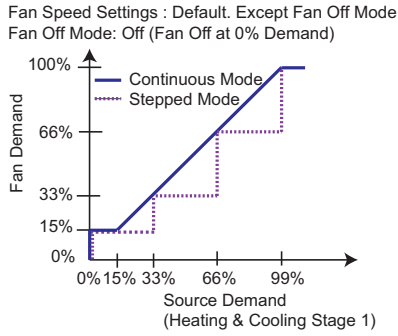
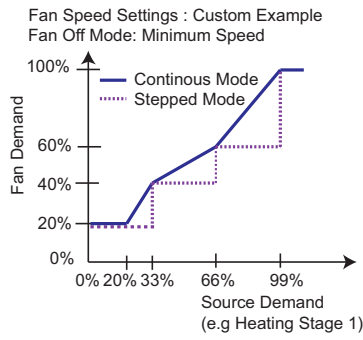
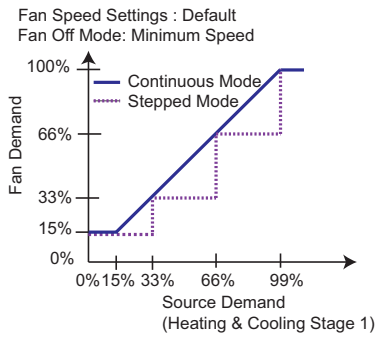
When the fan control source activates (increases above 0%) the Fan Speed is switched to '*Fan Speed 1*' Level for adjustable delay time ('*Fan Startup Delay*') regardless of the *Min Fan Speed* setting. This allows EC Fans to start to run properly before resuming normal control.

If the *Fan Off Mode* setting is set to Off, the Fan output switches OFF after an adjustable '*Fan Off Delay*' Time.

3-SPEED FAN CONTROL - STEPPED FAN MODE

In stepped mode the Fan Speed is set in steps (for EC Fans or 3-Speed Fans) with 5% switching OFF hysteresis. With xCR11 controllers the Triacs can be switched on the selected fan speeds (Speed 1, Speed 2, Speed 3).

The current Fan Speed can also be configured to trigger 0-10V outputs (Y1-Y4) to be 100% when the corresponding fan speed is active. Set the *Y1/2/3/4 Mode = Fan Speed 1/2/3* to activate this. It is also possible to configure 0-30s switching delay between the Fan Speed 1/2/3 using parameter 751 = *Stepped Fan Y Delay* (applies only for the 0-10V stepped fan).



| Parameter | Description | Value Range / Enumerations |
|--------------------|--|---|
| Fan Control Source | Sets the Source Demand for the Fan Control Function. | 0 = Network Value (Reg 538) 1 = Heating Stage 1 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity/DeHum Demand 11 = Max Function 1 (Default) 12 = Max Function 2 |
| Min Fan Speed | Sets the Minimum Fan Speed for EC Fans | 0..100% (Default 15%) |
| Fan Speed 1 | Sets the Fan Speed 1 for EC Fans (when source 33%) | 0..100% (Default 33%) |
| Fan Speed 2 | Sets the Fan Speed 2 for EC Fans (when source 66%) | 0..100% (Default 66%) |
| Fan Speed 3 | Sets the Fan Speed 3 for EC Fans (when source 99%) | 0..100% (Default 100%) |
| Fan Mode | Sets the EC Fan Mode. Continuous Mode scales the fan demand based on the source and Fan Speed 1/2/3 settings. In Stepped mode the fan speed steps according to Fan Speed 1/2/3 settings. In stepped mode the Fan Speed switching hysteresis is 5%. | 0 = Continuous Mode (Default) 1 = Stepped Mode |
| Fan Off Mode | Configures if the Fan is running at minimum level or is off when the fan control demand is at 0%. 1 - Minimum Speed: Running at Minimum Speed at Occupied and UnOccupied (0% in OFF mode). 2 - Minimum Occupied: Running at Min Speed in Occupied Only | 0 = Off (Default) 1 = Minimum Speed 2 = Minimum Occupied |
| Fan Off Delay | Switch OFF delay when the source demand drops to 0 (and Fan Off Mode is set to Off) | 0..600 seconds (Default 0) |
| Fan Startup Delay | Fan Startup when the source demand increases above 0%. During the delay the fan runs at Fan Speed 1 setting. | 0..600 seconds (Default 10) |
| Fan Level Override | Current Fan Level that can be set from the touchscreen or network (last command prevails). Note: If Fan Levels = 0-1-A, options 2, 3 and 4 override to Automatic control. Note: If Fan Levels = 0-1-2-A, then Level 2 overrides to Speed 3. Both 3 and 4 override to Automatic control | 0 = Off 1 = Level 1 2 = Level 2 3 = Level 3 4 = Automatic |
| Fan Levels | Sets the available Fan Override levels for the Touch button on the display and the Fan Network Override | 0 = 0-1-A 1 = 0-1-2-A 2 = 0-1-2-3-A (Default) |

| | | |
|--------------------------------|---|----------------------------|
| Alternate Fan Adjust | Alternative Fan Speed Adjustment setting. Uses the temperature setpoint adjustment location with +/- buttons | 0 = Disable 1 = Enabled |
| Stepped Fan Y Delay (xCR10/12) | Set the switching delay between Fan Speeds 1, 2 and 3 for the Y Analogue Outputs when Fan Mode = Stepped.(from Fw 1.52) | 0..30 seconds (Default 0) |
| xCR13: Fan Relay Delay | Delay between Fan Level Relays switching on the xCR13 Controllers | 0..30s (0s default) |
| Max Auto Fan Speed | Maximum Fan Speed in Automatic Control Mode (from Fw 1.57) | 0..100% (Default 100%) |

3-SPEED FAN RELAY CONTROL (xCR13 MODELS)

xCR13 models are equipped with 3 x 230Vac relays that are as default configured as 3-speed fan control (under *Relay Output Settings*). These outputs are controlled as ON/OFF based on the 740: *Fan Control Source* demand. *FanSpeed1* is ON when source > Fan Speed 1 Level, *FanSpeed2* when source > Fan Speed Level 2 and *FanSpeed3* when source > Fan Speed Level 3. Hysteresis of 5% applies.

Parameter 751: *Fan Relay Delay* can be used to delay each relay ON switching 0..30seconds (default 0s).

NOTE: To activate stepped fan control set 745: *Fan Mode* = *Stepped*.

MANUAL FAN SPEED CONTROL

The touchscreen fan speed manual override buttons set the Fan speed as per Fan Speed 1, 2 and 3 settings (see *Fan Speed Adjustment* section under Touchscreen chapter for details). In order for the controller to return back to automatic control the user needs to select Automatic mode.

The controller fan output level can also be override from the network by using the *Fan Override Level* parameter.

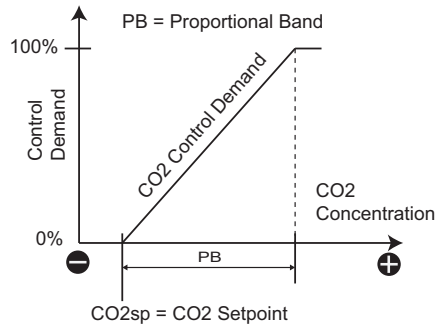
The available levels for manual and network control are set by the *Fan Levels* configuration parameter.

NOTE: In case of 0-1-2-A configuration if the user selects manual fan speed 2 from the touchscreen, the controller also uses Fan Speed 3 setting.

CO2 (CARBON DIOXIDE) CONTROL

QCR controllers have built-in CO2 measurement and control functionality. The CO2 measurement is typically used to boost the ventilation in case of higher concentration. The QCR 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. With QCR the Max Function can be used to take the maximum of Cooling and CO2 demands and link it to an output (*Max Function 2* is configured as default for this).

To set the minimum output position for the damper, the *Min Analogue Output* settings can be used.

The *CO2 Setpoint Setback Parameter (764)* allows the CO2 Setpoint to be increased in the Unoccupied mode for the amount set in the parameter 764. For example, the CO2 setpoint can be changed from 750 (default) in Occupied mode to 1000 in the Unoccupied mode by setting *CO2 Setpoint Setback Parameter (764)* to 250 (ppm).

The CO2 measurement can be displayed on the screen and the measurement is available via Modbus and BACnet communication network (please refer to Touchscreen and Modbus/BACnet Communications sections for further details).

The CO2 sensor provides Automatic Self Calibration logic keeping measurement accurate over the time. The Automatic calibration can be disabled and the sensor can be manually calibrated (see Calibration Settings).

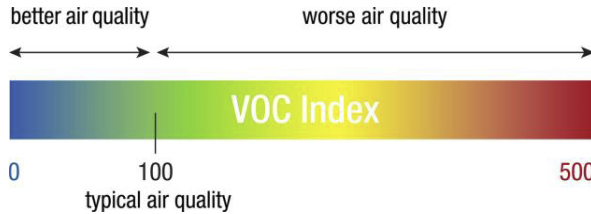
| Parameter | Description | Value Range / Enumerations |
|--------------------|--|---|
| CO2 Control Source | Sets the Source for the CO2 Control Note: If set to UI1/UI2, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters 523-526. | 0 = Network Value (Reg 539) 1 = Built-In 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) |
| CO2 Setpoint Setback | CO2 Control Setpoint SetBack in Unoccupied mode | 0..2,000 (Default 0) |
| CO2 Control Mode | Configures the CO2 Control Loops Mode. | 0 = Reverse 1 = Direct (Default) |

NOTE: Please note that it is possible to use the CO2 control loop for other generic control purposes by configuring the CO2 Control Source to be Network Value or U11/UI2 (no CO2 measurement required).

VOC AIR QUALITY CONTROL (WITH RH-VOC OPTION)

The RH-VOC control option measures Volatile Organic Compounds with automatic humidity compensation providing relative indoor air quality index signal (see below diagram) between 0 to 500



Measured air pollutants include harmful gases (acetone from paints and glues, toluene from furniture, mattresses and building products), other gases (ethanol from alcohol, perfumes and cleaners), odours (hydrogen sulfide and volatile sulfuric compounds from rotten food and farts; ammonia and amines from pet urine), smoke (benzene and nitrosamines from cigarette smoke).

With VOC PI (Proportional + Integral) control logic it is possible to control the air quality by e.g. increasing ventilation on high VOC concentration. The VOC control logic operates in Direct sequence ie. when the VOC Index increases the VOC Control Demand increases proportionally. For typical control applications set the VOC Index Setpoint = 100. This way when the VOC sensor senses deterioration in air quality, the controller output will automatically compensate by increasing the VOC demand signal.

WELL Building Standard® Compliant TVOC Concentration

According to the Performance Guidebook v.2 of the WELL Building Standard®, performance of an IAQ monitor can be assessed by using ethanol as calibration gas and the Mølhave gas mixture to convert the ethanol concentration into the Mølhave equivalent of TVOC or TVOC_{Mølhave}. The xCR controllers can calculate and display TVOC_{Mølhave} by selecting 529 VOC Measurement Mode = TVOC Mølhave from the Calibration and VOC Mode Settings Menu. The maximum value is or 5482 ug/m³.

Now Parameter 403 VOC Sensor (index) shows the TVOC concentration based on the TVOC_{Mølhave} index. .

RESET® Air compliant TVOC concentration

The xCR controllers can calculate and display TVOC_{isobutylene} by selecting VOC Measurement Mode/TVOC Isobutylene from the Calibration and VOC Mode Settings Menu. TVOC_{isobutylene} setting provides RESET® Air compliant TVOC concentration. The maximum value is 5482 ug/m³.

| Parameter | Description | Value Range / Enumerations |
|--------------------------|--|---|
| VOC Setpoint | VOC Control Setpoint | 0..500 (Default 100) |
| VOC PB | VOC Control Proportional Band | 1..500 (Default 100) |
| VOC IA | VOC Control Integral Action Time (Set to 0 to disable) | 0..3600s (Default 0s) |
| VOC Mode | VOC Measurements Mode | 0 = VOC Index 1 = TVOC Mølhave, ug/m3 2 = TVOC Isobutylene, ug/m3 |
| VOC Learning Time Offset | VOC Learning Time Offset, set to 12 for Index mode, and 720 Building Standards Mode (Reset/Well) | 1..1000 hours (Default 12) |

NOTE: The VOC Learning Time Offset parameter defines over what time span the VOC algorithm builds and updates its internal baseline (offset) from recent sensor history. Set to 720 for Building Standards.

HUMIDITY CONTROL (WITH RH-OPTION)

The controller has a single stage humidity / dehumidity PI-control loop that calculates the loop demand based on the built-in or external humidity measurement. Set the Humidity Mode to Humidify for humidifying action and to De-Humidify for dehumidifying action.

| Parameter | Description | Value Range / Enumerations |
|-------------------|--|--|
| Humidity Source | Sets the Source for the Humidity Control. Note: If set to U11/UI2, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters 523-526. | 0 = Network Value (Reg 538) 1 = Built-In Humidity (Default) 2 = U11 - 0..10V 3 = UI2 - 0..10V |
| Humidity Setpoint | Humidity Control Loop Setpoint | 0..100% (Default 50%) |

| | | |
|---------------|---|--|
| Humidity PB | Humidity Control Proportional Band | 1..100% (Default 20%) |
| Humidity IA | Humidity Control Integral Action Time (Set to 0 to disable) | 0..3600s (Default 0s) |
| Humidity Mode | Humidity Loop Control Mode | 0 = Humidify (Reverse) 1 = De-Humidify (Direct) |

DEHUMIDIFICATION USING COOLING

In addition the controller has dehumidification function where the multi-stage temperature control Cooling Stage 2 is overridden to 100% when the dehumidification demand is 50% (and the Humidity Interlock function is enabled). The Cooling Stage 2 returns to automatic control after dehumidification demand drops to 0%. To control the switch on humidity and switch off humidity, it is recommended that the humidity PI-control loop is set to operate in P-mode (set Integral Action to 0 to disable it). Using this function it is possible to condition the supply air simultaneously with heat and cool (and dehumidify in the process, ref Mollier Diagram).

| Parameter | Description | Value Range / Enumerations |
|--------------------|--|---------------------------------------|
| Humidity Interlock | Enables Cooling Stage 2 Interlock on High Humidity (at 50% humidity loop demand) | 0 = Disabled (Default) 1 = Enabled |

NOTE: Register 425 can be used to indicate the current cooling mode status.

CONDENSATION CONTROL

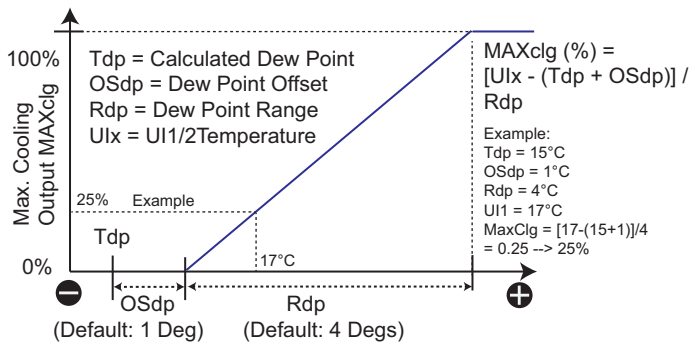
CONDENSATION SENSOR INPUTS

In cooling systems (e.g. chilled beam) when the pipe surface temperature drops reaching the dew point, this creates a condensation risk. The xCR controller have 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 multi-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%

DEW POINT CONDENSATION CONTROL

If humidity sensor is fitted (-RH option), the dew point temperature can be calculated by the relative humidity and temperature. The xCR controllers have unique function, where the room temperature and humidity is used in calculation of the dew point temperature. This temperature is then compared to the pipe temperature (set UI1 or UI2 to Dew Point mode) and when pipe temperature is dropping closer to the dew point temperature, the cooling outputs are **proportionally limited**, until the dew point danger has dissipated. The diagram on the right illustrates the maximum cooling output as a function of Dew Point temperature and Pipe temperature (calculated by *Dew Point Offset - OSdp* and *Dew Point Range - Rdp* parameters).



Alternatively by changing the *Dew Point Mode* parameter to **On/Off**, the cooling outputs are switched OFF at $Tdp + OSdp$ and return back to normal control at $Tdp + OSdp + Rdp$.

NOTE: The controller uses approximation method for the dew point temperature calculation. This only works when the relative humidity is more than 50% rH.

BOOST FUNCTION

If the Boost Button has been activated on the Touchscreen, the controller output or mode can be boosted for the *Boost Time* by pressing the button. For more details refer to Boost Button section in the Touchscreen chapter.

MOVEMENT DETECTION AND CONTROL (OE OPTION)

The controllers can be fitted with an optional pyroelectric infrared motion sensor for the movement and occupancy 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 diagram illustrates the false detection area.

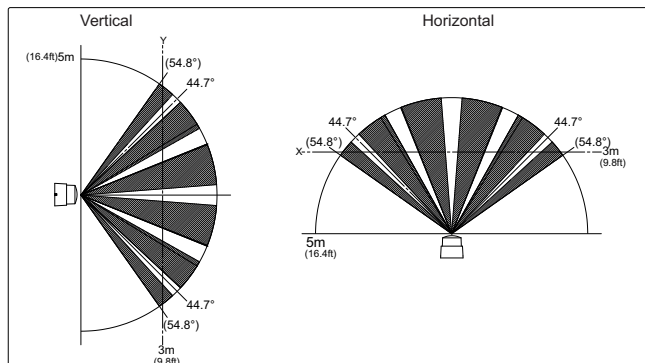
In Standard mode when the controller detects Occupancy it switches to Occupied Mode. The *PIR Delay Off Timer* (10..28,800 seconds) parameter sets the time that the status latches ON after detection of movement.

Once the timer has counted down the PIR status switches Off and the Controller Mode is switched to Unoccupied mode or Off mode depending on the configuration below.

NOTE: The PIR movement sensor has 30s warm-up time on reset.

NOTE: If the controller mode is overridden via the display or network to OFF mode, and the *Inactive PIR Control Mode* is set to *Unoccupied*, the PIR operation does not have impact.

NOTE: If *PIR Op. Mode Control* is set to Off, the PIR measurement does not have any impact on the control logic.



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 controller to activate the Occupied. Mode. If within the *Trigger Period* the trigger count is not reached, it is reseted 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.

| Parameter | Description | Value Range / Enumerations |
|---------------------------|--|---|
| PIR Tigger Mode | Selects the MOde of the PIR Sensor | 0 - Standard (default) 1 - Multi-Trigger |
| PIR Trigger Count | Trigger Count in Multi-Trigger Mode | 1..10 (default 600 secs) |
| Trigger Period | Trigger Period for monitoring Trigger Count | 30..1,800 seconds (default 300 secs) |
| PIR Off Delay | Delay Off Timer for the PIR Movement/Occupancy sensor | 10..28,800 seconds (default 600 secs) |
| Inactive PIR Control Mode | Activated Controller Mode when the PIR (OE-option) does not detect movement. If Option 0 = Unoccupied is selected, and the controller is in the OFF operating mode the PIR is disabled - no impact. | 0 = Unoccupied Mode (Default) 1 = Off Mode |
| PIR Op. Mode Control | PIR influence on the operation mode. If set to Off, the PIR only shows the status on the network i.e. effectively is disabled. | 0 = On (Default) 1 = Off |

Universal Input Configuration

Universal Input can be configured to operate as NCT10 (resistive), resistive (kOhms), Dew Point Sensor, 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. For control loops to use NTC10, select NTC10 in the control loop source parameters.

Dew Point Sensor: Uses the NTC10 Sensor for Dew Point Calculation Logic.

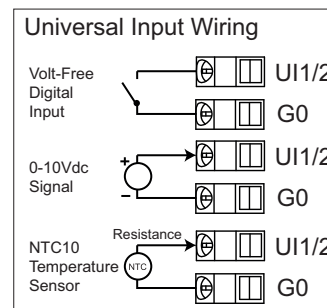
Resistive - kOhms : Measures the input resistance in kOhms (used e.g. for leak detection sensors) - measurement available over network. Note: the measurement resolution is 0.1 kOhms

Digital Modes: Select as appropriate to override the controller operation modes.

NOTE: It is possible to reverse the polarity of Universal Inputs in Digital Mode using Parameters 527 and 528.

NOTE:xCR14 has only 1 x UI.

Condesation Sensor Option (Option 5): Uses resistive condensation sensor.



| Parameter | Description | Value Range / Enumerations |
|----------------------|--|--|
| UI1 Mode | Sets the Universal Input 1 Mode. | 0 = Not Used 1 = 0..10V (0..100%) |
| UI2 Mode | Sets the Universal Input 2 Mode. Note: Option 6 remembers the last state and when the input opens the controller returns to this state (OFF or Unoccupied) Note: Options 7 and 8 override to selected controller mode on OFF to ON transition. Note: Option 9 overrides to Occupied Mode on ON transition and Unoccupied Mode on OFF transition (if the controller is in the OFF operating mode the input is disabled - no impact). Note: Option 10 overrides to Occupied Mode on ON transition and Off Mode on OFF transition. Note: Digital - Off / UI State overrides the controller at ON transition to the state of the other Digital Input. | 2 = NTC10 (Default) 3 = Dew Point (NTC10) 4 = Digital - Network 5 = Digital - Disable Cooling / Resistive Condensation Sensor 6 = Digital - Occupied 7 = Digital - Unoccupied 8 = Digital - Off 9 = Digital - Unoccupied / Occupied 10 = Digital - Off / Occupied 11 = Digital - Off / UI State 12 = Resistive - kOhms |
| 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 Digital Polarity | UI1 Digital Input Polarity Setting - allows the polarity of the input operation to be reversed when used in digital modes. | 0 = Normal (Default) 1 = Reverse |
| UI2 Digital Polarity | UI2 Digital Input Polarity Setting - allows the polarity of the input operation to be reversed when used in digital modes. | 0 = Normal (Default) 1 = Reverse |

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: Using the scaling it is possible also connect pressure sensors to the controller. The controllers have also 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/Y4 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).

NOTE: xCR11 controllers have only Y1 available.

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

NOTE: At Night Off mode the outputs switch to 0V (or 10V if reverse mode has been activated).

NOTE: Setting the *Y1/Y2/Y3/Y4 Output Mode = Network Value*, it is possible to override the output level using *Y1/Y2/Y3/Y4 Override Value* parameter. With Modbus models it is also possible to use Commissioning Overrides for the outputs. With BACnet use AV objects to override the outputs.

| Parameter | Description | Value Range / Enumerations |
|-----------|-------------|----------------------------|
|-----------|-------------|----------------------------|

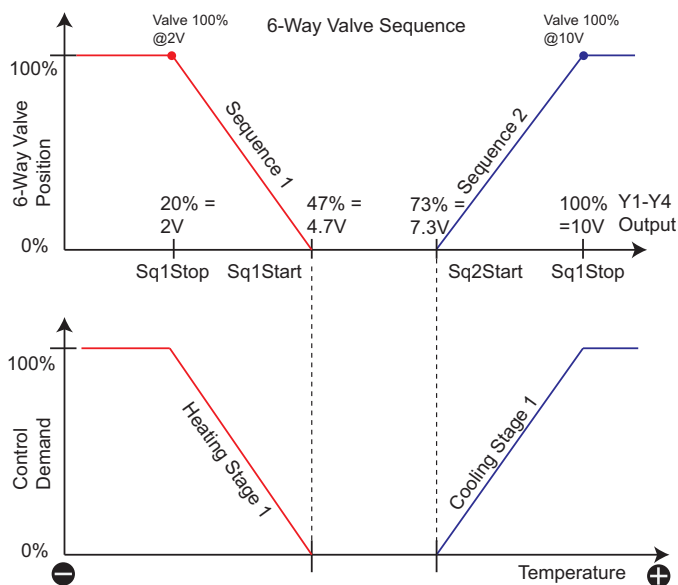
| | | |
|----------------|--|---|
| Y1 Output Mode | Y1 Output Configuration Default: Heating Stage 1 | 0 = Network Value 1 = Heating Stage 1 |
| Y2 Output Mode | Y2 Output Configuration (only xCR10/12/14/15) Default: Cooling Stage 1 | 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 |
| Y3 Output Mode | Y3 Output Configuration (only xCR10/12/14/15) Default: Fan Speed Control | 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand |
| Y4 Output Mode | Y4 Output Configuration (only xCR10/12/15) Default: CO2 Control Note: For Modus to override the output from the network set the mode to network. Note: For BACnet the output can be overridden using corresponding AV objects. Note: Options 16,17,18; by setting the Fan Mode = Stepped, the output is overridden to 100% (10V) when at the selected speed. | 8 = CO2 Demand 9 = VOC Demand 10 = Humidity/DeHum Demand 11 = Max Function 1 12 = Max Function 2 13 = Fan Demand 14 = 6-Way Valve 15 = Reverse 6-Way Valve 16 = Fan Speed 1 (10V) 17 = Fan Speed 2 (10V) 18 = Fan Speed 3 (10V) |
| 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%) |
| Y4 Minimum | Y4 Output Minimum Level | 0.0..100.0% (Default 0%) |
| Y4 Maximum | Y4 Output Maximum Level | 0.0..100.0% (Default 100%) |

6-WAY VALVE CONTROL

The 6-way valve option allows the controller to control 6-way valves that can be used for both heating and cooling control, simplifying heating/cooling coil structure. The principle of 6-way valve control is shown in the diagram. To activate the 6-way valve control the 0..10V output (Y1..Y4) is set to '6-way valve'. It is possible to modify the 6-way valve control parameters to suit the different 6-way valve manufacturers. The default settings are provided for Belimo 6-way valve.

Using the 'Reverse 6-Way Valve' option the Sequence 1 and Sequence 2 are swapped. This allows the controller to be configured to suit regardless of the 6-way valve piping.

The table below illustrates the switching parameters for the 6-way control.



| Parameter | Description | Value Range / Enumerations |
|-----------------------------------|---|------------------------------|
| Sequence 1 Start Value (Sq1Start) | 6-Way Valve Sequence 1 Start Voltage. With setting '6-Way Valve' Main Loop Heating Stage 1 at 0% Demand. | 0..100% (Default 47% = 4.7V) |
| Sequence 1 Stop Value (Sq1Stop) | 6-Way Valve Sequence 1 Stop Voltage. With setting '6-Way Valve' Main Loop Heating Stage 1 at 100% Demand. | 0..100% (Default 20% = 2V) |
| Sequence 2 Start Value (Sq2Start) | 6-Way Valve Sequence 2 Start Voltage. With setting '6-Way Valve' Main Loop Cooling Stage 1 at 0% Demand. | 0..100% (Default 73% = 7.3V) |
| Sequence 2 Stop Value (Sq2Stop) | 6-Way Valve Sequence 2 Stop Voltage. With setting '6-Way Valve' Main Loop Cooling Stage 1 at 100% Demand. | 0..100% (Default 100% = 10V) |

Digital Output Control Options

DIGITAL TRIAC OUTPUT CONTROL OPTIONS (XCR11/XCR12/XCR13)

The xCR11 controllers have 4 x 24Vac Triacs and xCR12/xCR13 controllers have 2 x 24Vac Triacs. The triacs can operate in On/Off and PWM (Pulse-Width Modulation) and 3-Point (Raise-Lower) configurations.

3-POINT MODE

If the ThreePoint1 is activated then TR1 and TR2 are used for 3-Point control (raise-lower). TR1 is used to drive the actuator open and TR2 is used to drive the actuator close. The actuator running time and run on times are adjustable.

ThreePoint2 activates the TR3 (open) and TR4 (close) - xCR11 controllers only.

After controller reset the threepoint function drives the close triac for the run time period after which it resumes in normal operation.

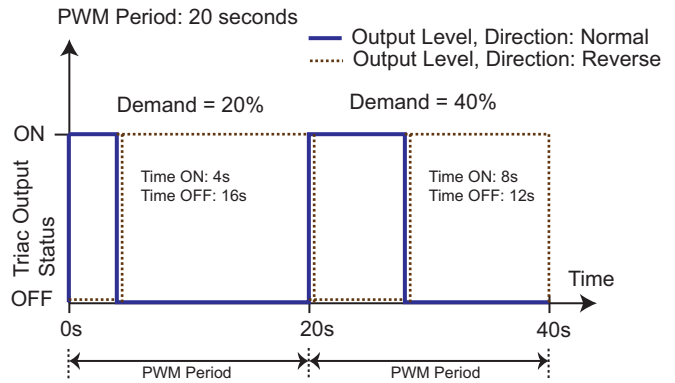
PWM MODE

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'.

Use TRs Direction parameter to reverse the PWM / ON-Off output.

ON/OFF MODE

Set the PWM period to 0 to make the outputs to operate On/Off. The output is switched On when the demand exceeds DO ON Value. Output switches Off below DO OFF Value.



NOTE: Setting the TR1/TR2/TR3/TR4 Mode = Network, it is possible to override the output level using TR1/TR2/TR3/TR4 Override Value parameter. With Modbus models it is also possible to use Commissioning Overrides for overriding the triac output levels. With BACnet use the AV objects to override the PWM demand levels.

| Parameter | Description | Value Range / Enumerations |
|-----------------------|--|--|
| ThreePoint1 Mode | Threepoint 1 Mode (=Source) Note: Available with xCR11, xCR12 and xCR13. | 0 = None 1 = Network |
| ThreePoint2 Mode | Threepoint 2 Mode (=Source) Note: xCR11 controllers only. Note: 3-Point Control available from Fw1.38 onwards. | 2 = Heating Stage 1 3 = Heating Stage 2 4 = Heating Stage 3 5 = Cooling Stage 1 6 = Cooling Stage 2 7 = Cooling Stage 3 8 = Auxiliary Demand 9 = CO2 Demand 10 = VOC Demand 11 = Humidity Demand 12 = Max Function 1 13 = Max Function 2 14 = Fan Demand |
| ThreePoint Run Time | ThreePoint Actuator Run Time (set to match the actuator run time) | 10..2400 seconds (default 90 secs) |
| ThreePoint RunOn Time | ThreePoint Actuator RunOn Time (overrun time when the actuator position reaches 0 or 100%) | 10..240 seconds (default 10 secs) |

| | | |
|---------------------------------|---|--|
| TR1 Output Mode | Triac Output 1 Configuration Default: Heating Stage 1 | 0 = Network Value 1 = Heating Stage 1 |
| TR2 Output Mode | Triac Output 2 Configuration Default: Cooling Stage 1 | 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 |
| TR3 Output Mode (xCR11 only) | Triac Output 3 Configuration Default: Heating Stage 2 | 5 = Cooling Stage 2 6 = Cooling Stage 3 |
| TR4 Output Mode (xCR11 only) | Triac Output 4 Configuration Default: Cooling Stage 2 Triac Output: Options 1-12 and 16 is controlled using either PWM or ON/Off Modes Triac Output: Options 13-15 is controlled as ON/OFF based on the fan demand (Set Fan Mode = Stepped). At Fan Stage 1, Fan Speed 1 is ON. At Fan Stage 2, Fan Speed 2 is ON. Option 18 makes the triac switch on when the device is in occupied mode. In OFF/Unoccupied modes the triac is OFF. | 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity/DeHum Demand 11 = Max Function 1 12 = Max Function 2 13 = Fan Speed 1 14 = Fan Speed 2 15 = Fan Speed 3 16 = Fan Demand 17 = None 18 = Occupied Mode |
| 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) |
| DO 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%) |
| DO 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 | |
| TR3 Direction | Triac Output 3 Direction (xCR11 only) | |
| TR4 Direction | Triac Output 4 Direction (xCR11 only) | |
| TR1 Type | Triac 1 Type, Pulse Width Modulation or On/Off | 0 = On/Off 1 = PWM (Default) |
| TR2 Type | Triac 2 Type, Pulse Width Modulation or On/Off | |
| TR3 Type | Triac 3 Type, Pulse Width Modulation or On/Off (xCR11 only) | |
| TR4 Type | Triac 4 Type, Pulse Width Modulation or On/Off (xCR11 only) | |

OCCUPANCY MODE

By setting the *TR Output Mode* to *Occupied Mode*, the triac output is On when the controller operates in Occupied Mode. The triac output is Off when the controller is either in Unoccupied or Off mode. The controller mode can be changed e.g. with the built-in PIR sensor.

NOTE: The switching is delayed by the time set in the *PWM Period* parameter.

Relay Output Control Options (xCR10, xCR12, xCR13, xCR14 Models)

SINGLE 24V RELAY (XCR10/XCR12) AND 230V RELAY (XCR14) CONTROL

The xCR10/xCR12 controllers can have optional 24V relay (RL-option). The xCR14 controllers have built-in 230V relay. The relay output can be configured with the following options.

| Parameter | Description | Value Range / Enumerations |
|--------------|---|--|
| Relay Output | Relay Output Configuration By setting Relay = 1..12, the relay output is ON when the Demand is at 'DO On Value' and OFF when the Demand is 'DO Off Value' - See Digital Triac Output Control chapter below. By setting Relay = Fan Stage 1, the relay in ON when the Fan Demand Reaches Fan Stage 1. The relay is switched OFF when the Fan Demand is 5% less than Fan Stage 1 Demand. By Setting Relay = Occupied, the relay is ON when the controller is in Occupied Mode. By Setting Relay = Digital Input 1/2 (UI1/UI2), the relay follows the DI1/DI2 state (Set UI Mode to 4, 6, 7, 8, 9 or 10) | 0 = None 1 = Heating Stage 1 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity/DeHum Demand 11 = Max Function 1 12 = Max Function 2 13 = Fan Stage 1 14 = Occupied Mode 15 = Digital Input 1 16 = Digital Input 2 |
| DO ON Value | The value at the Relay (or Triac) Output Switches ON. Only applied whne PWM Period is set to 0. | 0..100% (Default 50%) |
| DO OFF Value | The value at the Relay (or Triac) Output Switches OFF | 0..100% (Default 0%) |

The relay output can be overridden from the network using the register 582 or using BV3 on BACnet.

3-RELAY OUTPUT CONTROL OPTIONS (XCR13 MODELS ONLY)

xCR13 models have 3 x 230Vac relays that can be used for control purposes. The relays are as default configured for 3-speed fan control, but can also be independently controlled for other purposes. The relays are configured under *Relay Output Settings*.

The relays are switched on when the control source value exceed TR/RL ON Value, and the relays are switched OFF when the control source value is less than TR/RL OFF Value.

NOTE: When controlling relays using (default) *Fan Speed 1/2/3* settings, it is possible to apply delay between relay switching using *751: Fan Relay Delay* parameter (under *Fan Control*).

| Parameter | Description | Value Range / Enumerations |
|-----------------|---|--|
| RL1 Output Mode | Relay 1 Output Control Source Configuration Default: Fan Speed 1 | 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 7 = Fan Demand 8 = 6-Way Valve 9 = Reverse 6-Way Valve 10 = Fan Speed 1 11 = Fan Speed 2 12 = Fan Speed 3 |
| RL2 Output Mode | Relay 2 Output Control Source Configuration Default: Fan Speed 2 | |
| RL3 Output Mode | Relay 3 Output Control Source Configuration Default: Fan Speed 3 | |
| TR/RL ON Value | The value at the Relay (or Triac) Output Switches ON. | 0..100% (Default 50%) |
| TR/RL OFF Value | The value at the Relay (or Triac) Output Switches OFF | 0..100% (Default 0%) |

The Relay outputs can be overridden in Modbus using the Commissioning Overrides (Auto, 0%-OFF, 100%-ON), and in BACnet using the AV objects.

Output Exercise Function

The xCR10 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% or 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.

| Parameter | Description | Value Range / Enumerations |
|-------------------|--|--|
| Exercise Active | Parameter reporting Exercise Mode status. | 0 = None, 1=Y1, 2=Y2, 3=Y3, 4=Y4, 5=TR1, 6=TR2, 7=TR3, 8=TR4 |
| Exercise Interval | Sets the period of inactivity to activate the corresponding output. | 0..255 days (Default 0 days) |
| Y1 Duration | Analogue Output 1 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y1 Duration Time | 0..255 Minutes (Default: 0) 0 = Disabled |
| Y2 Duration | Analogue Output 2 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y2 Duration Time | 0..255 Minutes (Default: 0) 0 = Disabled |
| Y3 Duration | Analogue Output 3 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y3 Duration Time | 0..255 Minutes (Default: 0) 0 = Disabled |
| Y4 Duration | Analogue Output 4 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y4 Duration Time | 0..255 Minutes (Default: 0) 0 = Disabled |
| TR1 Duration | Triac Output 1 Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR1 Duration Time | 0..255 Minutes (Default: 0) 0 = Disabled |
| TR2 Duration | Triac Output 2 Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR2 Duration Time | 0..255 Minutes (Default: 0) 0 = Disabled |
| TR3 Duration | Triac Output 3 Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR3 Duration Time (Only xCR11) | 0..255 Minutes (Default: 0) 0 = Disabled |
| TR4 Duration | Triac Output 4 Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR4 Duration Time (Only xCR11) | 0..255 Minutes (Default: 0) 0 = Disabled |

NOTE: xCR10/12/15 Series models have Y1/2/3/4, xCR11 Series Y1 and xCR14 Series Y1/2/3.

NOTE: xCR14/15 Series do not have any triacs (TR1/2/3/4).

Capacitive Touchscreen (TS Option)

The controllers can have optional full colour 240 x 320 pixel high resolution glass fronted display. The touchscreen indicates the controller status and measurements and provides the user interface. The touchscreen display elements can be tailored to the site specific requirements..

**TOUCHSCREEN DISPLAY
(SKIN COLOUR SELECTABLE)**

STATUS BAR ICONS

- ☰ Menu Icon (Access to settings and dimming)
- 3 Fan Speed Indication
- 🏠 / 🏠 / ⏻ Occupied / Unoccupied / Night - Off
- 🔒 Screen Locked
- 🔥 / ❄️ Heating / Cooling
- 🔧 / ❄️ Limit Function / Frost Mode
- 💧 Condensation

MAIN DISPLAY LOCATIONS

- 🟢 🟡 🟠 Alarm Indication
- VOC Index HIGH Descriptive Text Indication (Low / Normal / High)

TOP MENU BUTTONS

- ☰ Menu Icon (Access to settings, screen lock and dimming)
- ⚙️ Access to Configuration
- 🌑 Button to Dim (no backlight)
- 🔒 Button to Lock Screen (no access)

ACTION BAR BUTTONS

- 🌀 Fan Speed Selection Button
- ⏻ Mode Selection Button
- 👤 Boost (Timed) Button

TOUCHSCREEN DISPLAY (SKIN COLOUR SELECTABLE)

Menu Icon - Press For Settings, Dim and Lock

Additional Icons Displayed after Pressing Menu

Action Bar with Buttons

Alternative Setpoint Adjustment View displayed on the main screen

Text 'Set' indicating setpoint (press to change) As default shows the Setpoint Slider Screen

The touchscreen is divided to three different main elements; Status Bar, Measurement/Setpoint Display Locations and Buttons (accessible on the Action Bar on the bottom or via the Menu Icon on the top).

The Status Bar Indicates the controller status.

- Heating / Cooling Mode
- Limit Function / Frost Mode
- Unoccupied / Occupied / Off
- Fan Speed
- Lock Icon
- Condensation Icon
- Menu

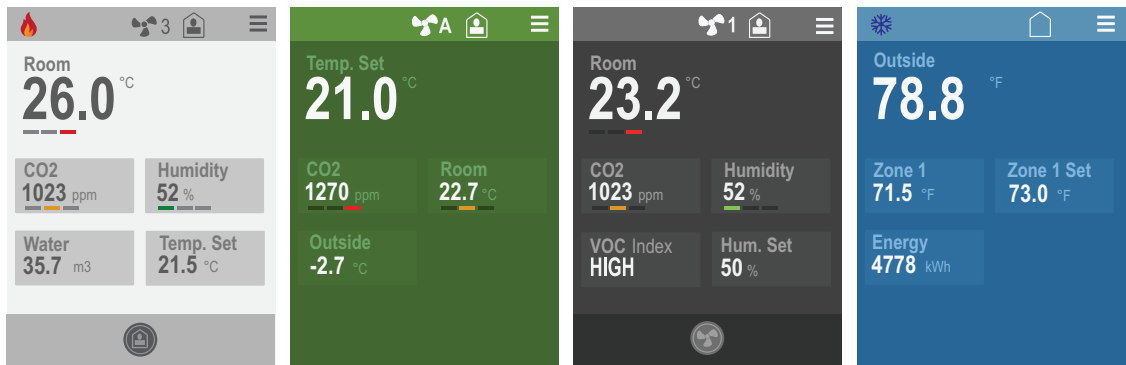
The Controller has up to 5 different Measurement/Display Locations that can be tailored to show different measurements and setpoints. The display locations can also show alarm indications and additional information (energy, water usage) from the network. It is also possible to configure actual measurements to be in 'Descriptive Text' mode that makes the measurement information descriptive.

Each of the four display locations can be configured to show

- Main Temperature Loop, Auxiliary Loop or Humidity Setpoints
- CO2, VOC, Temperature, or Humidity Measurement
- Universal Input Measurements (0..10Vdc or NTC10)
- Network Signals (e.g. Energy, Water Consumption, Pressure, Light)
- Alarm Conditions of the Measurements (Green, Amber, Red Alarm Bar or Skin Colour Change)
- Descriptive Text instead of Measurement Value (Low / Normal / High)

- The description and units of each location can be customised
- Each location can be individually made as Read-Only (from Fw1.61)
- Using Language Pack it is possible to change the text language
- The skin colour of the display can be changed according to the preference; White, Blue, Green, Grey and Black
- Brightness of the display can be adjusted
- Action Bar can have Boost button with an adjustable timer (overrides the controller output as configured), Fan speed adjustment option (A - 0 - 1 - 2 - 3), and/or Mode Button (selecting between Occupied / Unoccupied and Night Off modes)
- The display can be dimmed through the Menu button
- The display can be locked from unauthorised access through the Menu button
- Menu Button provides access to the Configuration Menu (network settings)

The screen skin colours can be changed according to the site requirements (see below examples).

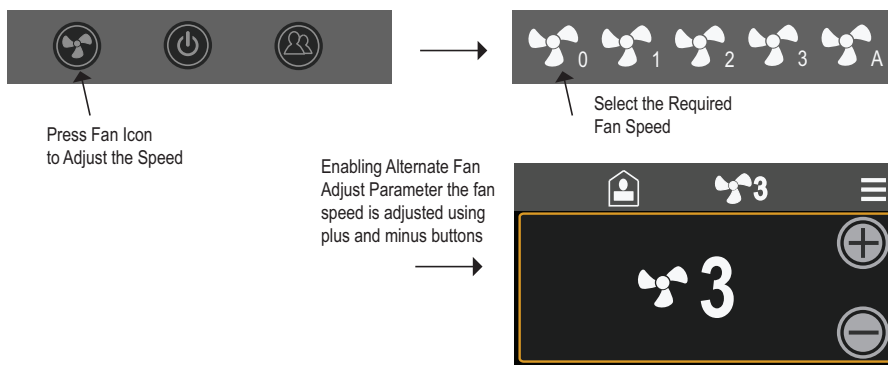


FAN SPEED ADJUSTMENT

By pressing the Fan button the fan speed adjustment options are displayed on the bottom Action Bar - select the required speed. The number of fan speeds is configurable. The current fan speed is displayed on the status bar on the top.

The Fan Speed button activation and number of fan speeds can be selected through the configuration parameters.

Enabling *Alternate Fan Adjust* parameter, the fan speed is adjusted using plus and minus buttons.



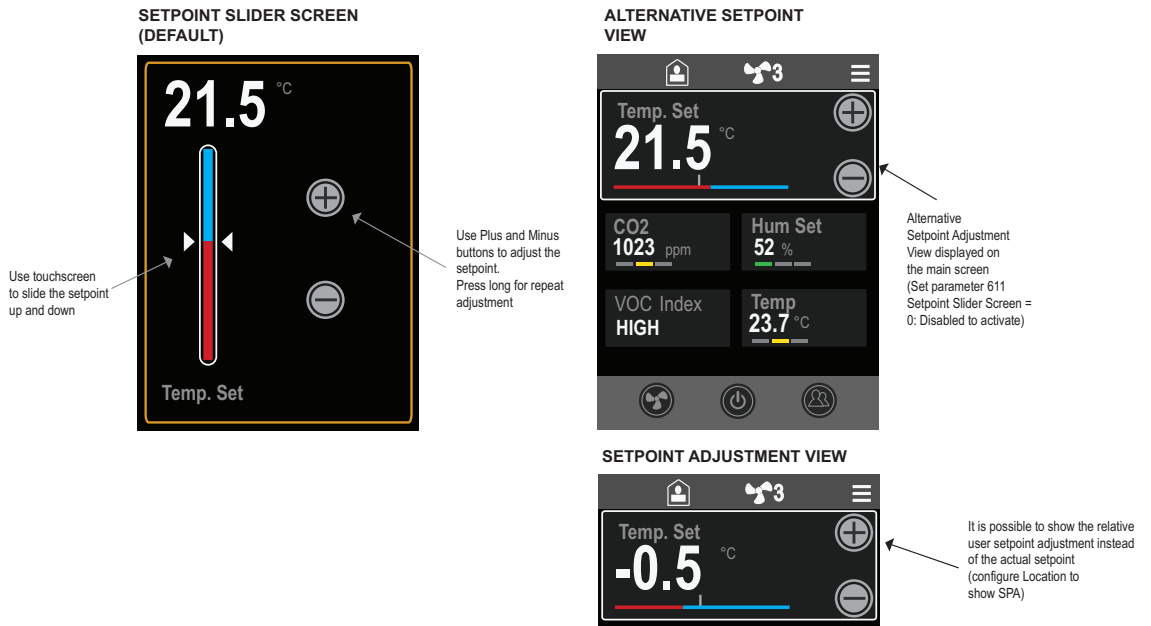
SETPOINT ADJUSTMENT

Any of the five display locations can be configured to show the main zone, the auxiliary control loop or humidity control loop setpoint. It is also possible to show the setpoint adjustment (e.g. -3 to + 3 degrees) instead of the actual calculated setpoint. As default (from Fw1.62) by pressing the setpoint field, the setpoint slider display is showed allowing it to be altered by pressing plus and minus buttons, or by using the slider. Pressing the plus or minus button continuously repeats the change with accelerating pace.

It is also possible to show the setpoint adjustment overlay on the main screen, by setting the parameter *611 Setpoint Slider Screen* : 0 = Disabled.

The User Setpoint Adjustment can be reset to 0, when the controller moves away from the Occupied mode. This can be activated by setting *684 Reset User Adjustment*: 1 = On.

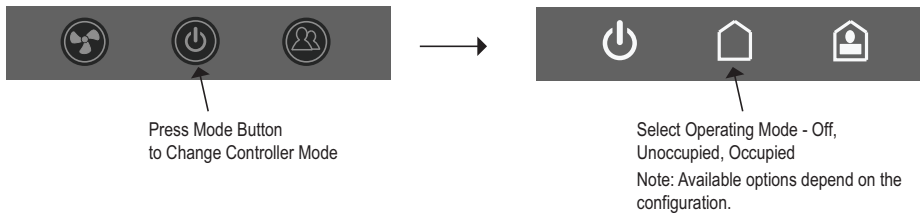
The User Setpoint Adjustment can be stored in the non-volatile memory by setting *689 Store User Adjustment* : 1 = Enabled (from Fw 1.65 onwards)



OPERATING MODE BUTTON

Pressing the Operating Mode Button the user can change the device operating mode. The operating mode button menu can be configured to show the following options for the user:

- Disabled; Button is not visible
- Occupied / Unoccupied Options Only
- Occupied / Unoccupied / Off Options (default)
- Occupied / Off Options Only



BOOST BUTTON/EXTENSION TIMER

Pressing the Boost Button (or Boost Location display with multi-step boost) the controller output or device mode (*Boost Target*) can be overridden for a timed period (*Boost Time*). Once the boost is active, the Boost Button colour changes to green indicating active boost. The boost button has adjustable timer between 0..28,800 seconds and can have multiple steps i.e. it can operate as a multi-step extension timer. Maximum Boost time is 900 minutes i.e. 15 hours.

Any of the display locations can also configured to show the current remaining boost time in minutes.

The boost can be configured to have 1..5 steps (*Boost Steps*). If the Boost button is pressed and the Boost has multiple steps, the Multi-Step Boost adjustment window is displayed. This is also displayed if the Boost time is pressed on any of the display locations. Press + Button to extend the boost by the amount of the *Boost Time* parameter.

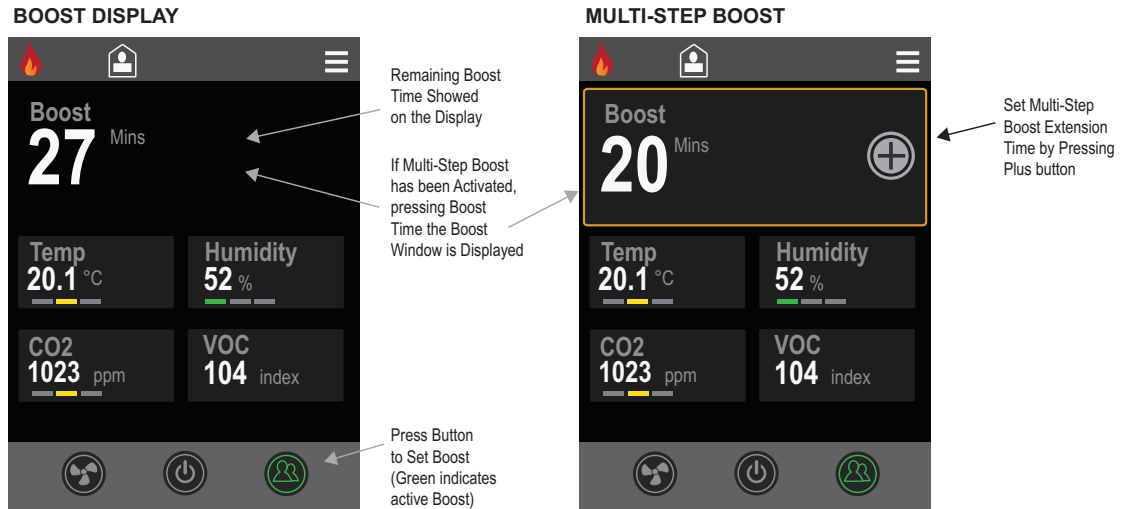
If only one step has been set, the boost will be activated/deactivated by pressing the Boost Button.

By setting *Boost Time* to 0 seconds, the Boost is permanent (the number of steps has no impact). The boost can be cancelled by pressing the boost button again.

The available Boost Targets are:-

- Heating Stage 1, 2 or 3 - target demand is overridden to 100% for the *Boost Time*
- Cooling Stage 1, 2 or 3 - target demand is overridden to 100% for the *Boost Time*
- Auxiliary Demand, CO2 Demand, VOC Demand, Humidity/DeHum Demand or Fan Demand - target demand is overridden to 100% for the *Boost Time*
- Occupancy Mode. Occupancy Boost overrides the controller mode to occupied period for the *Boost Time*. After the *Boost Time* the controller returns to the mode that was applied prior to the boost. If during the boost user or network overrides the controller mode, the boost is automatically cancelled.

The *Boost Time*, the *Boost Steps* and the *Boost Target* are set through the configuration parameters (*Control/Control Modes and Overrides*).



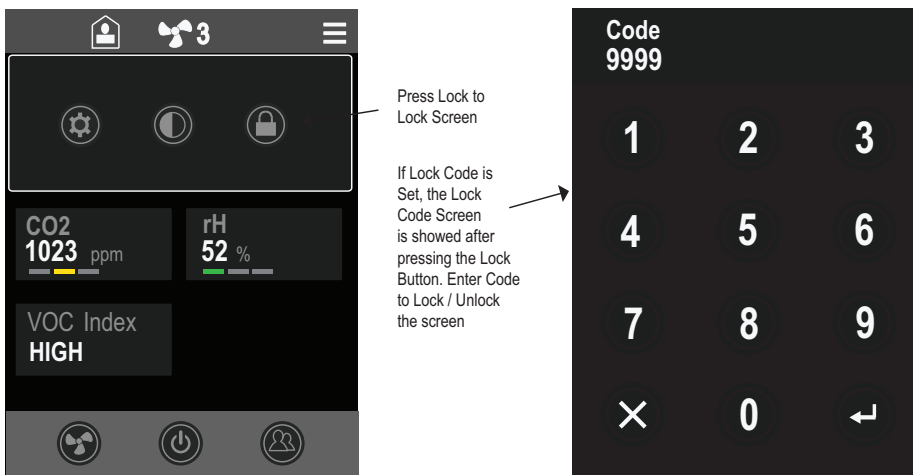
SCREEN LOCK

By selecting the Lock icon from the menu bar the screen is locked (buttons disabled, except menu and lock icons). If the Lock code is 0000, no code is required to lock and unlock the screen. By setting the lock code to any other value, the user needs to enter the code to lock and unlock the screen. From F1.78 screen can also be automatically locked after timeout.

Note: The screen can also be locked and unlocked over the Modbus or BACnet network.

Note: The controller remembers the previous lock state after power cycle or soft reset (from Fw1.61).

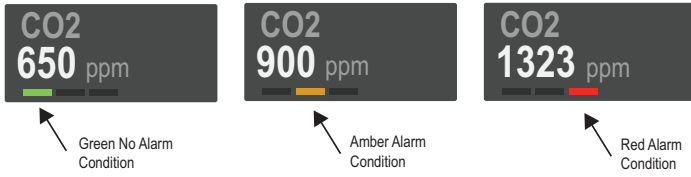
Note: Using parameter 612 *Autolock* it is possible to configure the screen to be automatically locked after approx. 3 minutes after unlocking (from Fw 1.78)



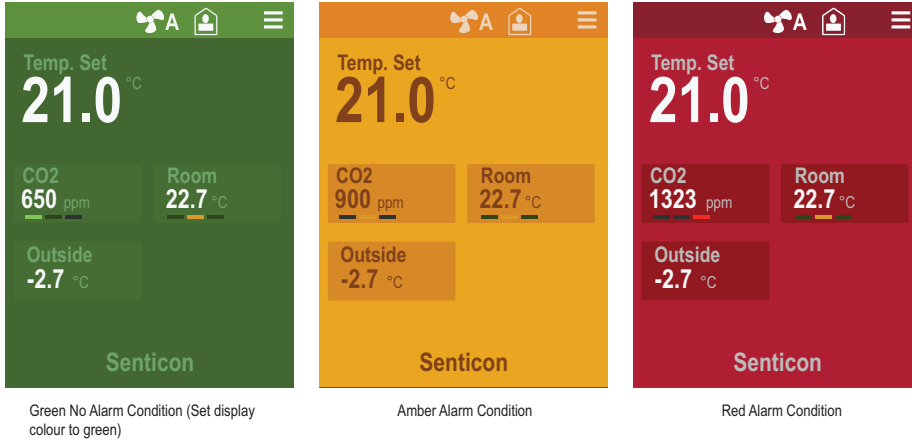
TRAFFIC LIGHT ALARM FUNCTION

Each of the 4 locations can be activated to display alarm condition based on the Amber and Red Limits. When measurement is above the Amber Limit, the location goes to Amber alarm (amber bar icon, or amber skin colour). When measurement is above the Red Limit, the location goes to Red Alarm (red bar icon or red skin colour).

ALARMING USING BAR DISPLAY

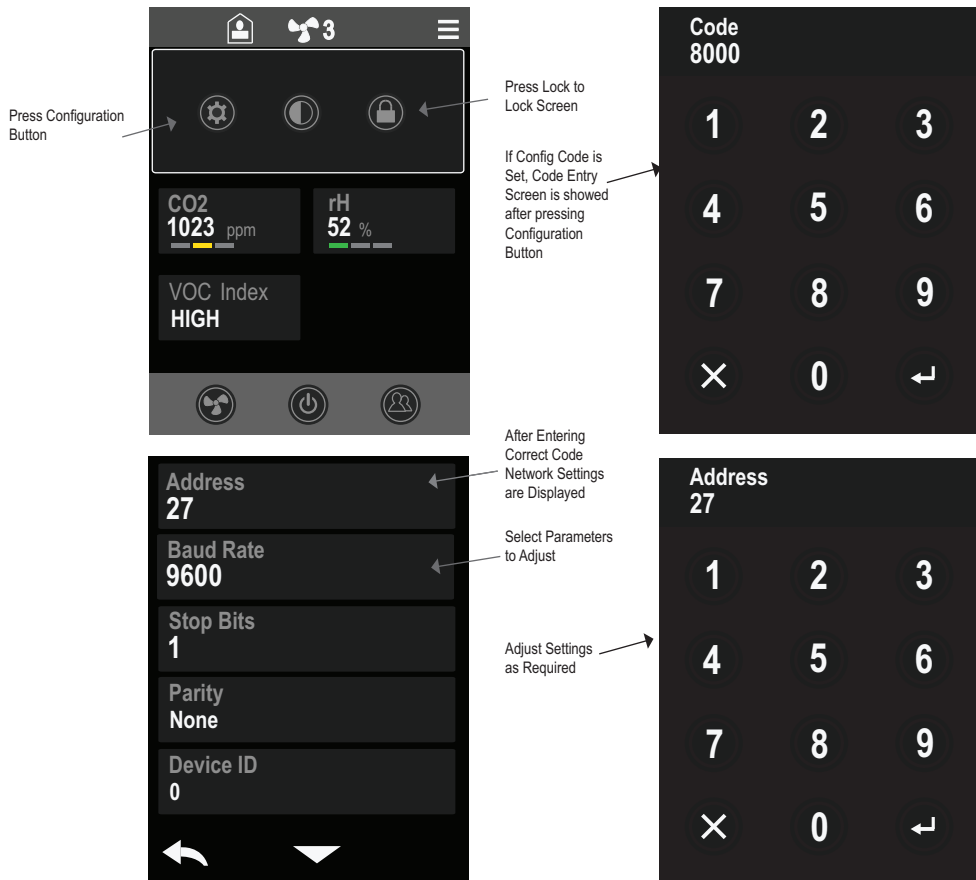


ALARMING USING SKIN COLOUR



CONFIGURATION SCREEN

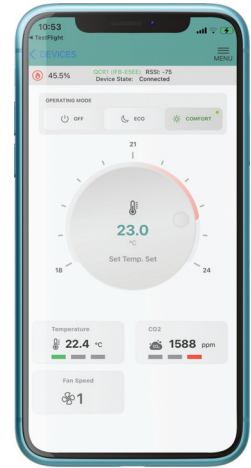
To access the Configuration Screen (for network settings), Press the Configuration Icon. If the configuration code is set (anything else than 0000), the Network Settings Configuration Menu is displayed.



Wireless Interfaces

BLUETOOTH WIRELESS INTERFACE

With the -BLE option the devices are fitted with integrated Bluetooth Low Energy. The Bluetooth interface provides wireless connection point to SmartPhone app (iOS) to be able to interrogate and change the controller settings. Using the SmartView application the end users can change the device settings and see the current measurements. The SmartView application can be used as a complement to the display, or with non-display versions it can be used as the user interface.



NOTE: The SmartView application uses the device's display configuration to create the user view. If the device has no display, the display configuration settings can still be used to customise the user views on the App.

NOTE: With SmartConfig app you can change the devices Bluetooth name. This is also visible via the touchscreen through configuration menu (from Fw1.61).

LORAWAN® WIRELESS INTERFACE

With the -LRA option the devices are fitted with LoraWan® interface. The LoraWan® interface allows the devices to be connected to the LoraWan system wirelessly using Senticon's standard payload format.



The LoraWan® enabled devices will automatically connect to the network on power up. The connection attempts are staggered automatically based on the device serial number to ensure network performance on large systems. The devices will automatically send the device information (temperature, humidity, CO2, VOC, input and output levels and setpoints) on Senticon's Standard Payload format (up to 12 values) on scheduled intervals (1 to 60 minutes, default 10 minutes). The content of the payload message can be configured to include any controller parameter. It is also possible to write to any parameter on the device using Senticon's packaged write message - please refer to Senticon LoraWan Payload Specification for further details.

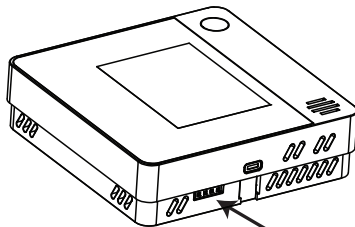
LoraWan network settings can be adjusted for maximised wireless network performance. These settings include Transmission interval, Confirmed Message Interval, Number of Failed Uplink Messages, Burst Reconnect Mode and ADR disable.

Device Setup and Modbus/BACnet Communications

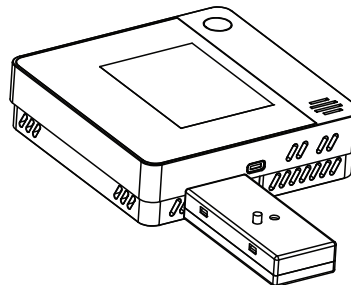
The devices are available with Modbus RTU or BACnet MS/TP communication for system integration. Please also note that the devices can be configured via Modbus or via BACnet MS/TP. Alternatively the devices can be configured locally using via PC Based Smart Config Tool or via iOS Smart Phone Application. 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). If the device is supplied with Built-In Bluetooth App interface (an option), then this can also be used for the tool communication connection



Plug the bluetooth dongle to the tool socket



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 from display or through Windows Smart Configuration Tool / iOS Smart Phone App, or via bit switches for xCR10/xCR11 series.

xCR10/xCR11 SERIES BIT SWITCH

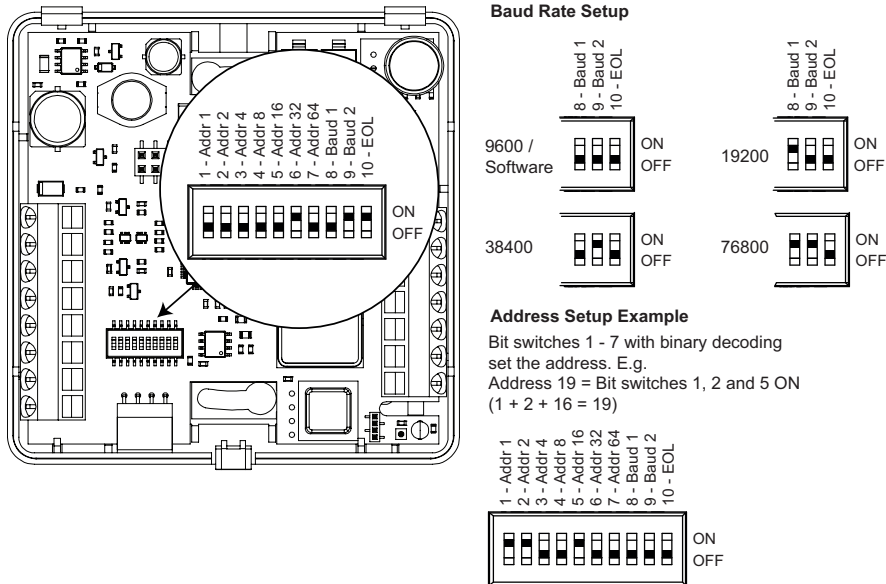
With xCR10/xCR11 series the address is also possible to set up using the bit switch. Follow the below guidelines.

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.



DEVICES CONFIGURATION PARAMETERS

NOTE: Reg Field shows the Modbus register offset. The Reg field number is also the same with BACnet Device Configuration Objects. The register numbers are also used with the tools and LoRaWAN communications.

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: If the configuration parameters are changed over the Modbus or BACnet using third party tools such 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, (06), 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 | Diplays current humidity measurement reading (With RH option) | 401 | uint16 | 0..1000 (x10) | 0..100%rH | R |
| CO2 Sensor | Displays current measurement CO2 reading (QCR controllers) | 402 | uint16 | 0..10,000 (x1) | 0..10,000ppm | R |
| VOC Sensor | Display current VOC (Volatile Organic Compound) Index Value | 403 | uint16 | 0..500 (x1) | 0..500 index | R |
| Dew Point | Dew Point Temperature (requires RH option) | 404 | int16 | -400..1200 (x10) | -40.0..120.0°C | 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 kOhms Mode: 0.2..500kOhms | 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 kOhms Mode: 0.2..500kOhms | R |
| Average Temperature | Calculated Average Temperature | 419 | int16 | -400..2480 (x10) | NTC Mode: -40..120° | 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 Button Status (TS Option) - Shows if Boost Button has been activated by the user. | 204 | | 0..1 | 0 = No Boost 1 = Boost | R |
| Screen Lock Status | Screen Lock Status | 205 | | 0..1 | 0 = Not Locked 1 = Locked | R |
| OUTPUTS | | | | | | |
| Y1 | Analogue Output 1 Value | 412 | uint16 | 0..1000 (x10) | 0..100% = 0..10V | R |
| Y2 | Analogue Output 2 Value (xCR10/xCR12/xCR14/xCR15) | 413 | uint16 | 0..1000 (x10) | 0..100% = 0..10V | R |
| Y3 | Analogue Output 3 Value (xCR10/xCR12/xCR14/xCR15) | 414 | uint16 | 0..1000 (x10) | 0..100% = 0..10V | R |
| Y4 | Analogue Output 4 Value (xCR10/xCR12/xCR15) | 415 | uint16 | 0..1000 (x10) | 0..100% = 0..10V | R |
| ThreePoint1 Position | Three Point 1 valve control current target position (Drives TR1 open and TR2 close) | 416 | uint16 | 0..1000 (x10) | 0..100% | R |
| ThreePoint2 Position | Three Point 2 valve control current target position (Drives TR3 open and TR4 close) - xCR11 only. | 417 | uint16 | 0..1000 (x10) | 0..100% | R |
| Exercise Active | Reports Output that is in the Exercise Mode | 418 | uint16 | 0..8 (x1) | 0 = None, 1=Y1, 2=Y2, 3=Y3, 4=Y4, 5=TR1, 6=TR2, 7=TR3, 8=TR4 | R |
| DISCRETE INPUTS - FUNCTION CODE 02 | | | | | | |
| Relay Status | Relay Output Status (RL Option) - xCR10/xCR12/xCR14 | 203 | | 0..1 | 0..1 | R |
| Triac 1 Status | Triac 1 Output Status (xCR11/xCR12) | 206 | | 0..1 | 0..1 | R |
| Triac 2 Status | Triac 2 Output Status (xCR11/xCR12) | 207 | | 0..1 | 0..1 | R |
| Triac 3 Status | Triac 3 Output Status (xCR11 Only) | 208 | | 0..1 | 0..1 | R |
| Triac 4 Status | Triac 4 Output Status (xCR11 Only) | 209 | | 0..1 | 0..1 | R |
| DEMAND SIGNALS | | | | | | |
| Calculated Multi-Stage Setpoint | Calculated Setpoint (Nominal Network Setpoint + User Adjustment) for Multi-Stage Control Loop Note: Read/write Modbus parameter. Writing to Reg420 sets 701 Nominal Setpoint to this value, and the user adjustment Reg790 is reset to 0. | 420 | int16 | -32000..32000 (x10) | -3200.0..3200.0 | R/W |
| Calculated Aux Setpoint | Calculated Setpoint (Nominal Network Setpoint + User Adjustment) for Auxiliary Control Loop Note: Read/write Modbus parameter. Writing to Reg421 sets 715 Nominal Setpoint to this value, and the user adjustment is reset to 0. | 421 | int16 | -32000..32000 (x10) | -3200.0..3200.0 | R/W |
| Heating Demand | Heating Stage Demand (Multi-Loop Heating Stage 1/2/3) | 422 | int16 | 0..1000 (x10) | 0..100% | R |
| Cooling Demand | Cooling Stage Demand (Multi-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..3 (x1) | 0 = Normal Operation 1 = Digital Input Disable (Condensation) 2 = Dew Point Disable (Condensation) 3 = Dehumidify (Cooling Stage 2 Overridden ON) | R |
| Aux Demand | Auxiliary Loop Demand | 426 | int16 | 0..1000 (x10) | 0..100% | R |

| | | | | | | |
|--------------------|--|-----|-------|---------------|---|---|
| Fan Demand | Fan Loop Demand | 427 | int16 | 0..1000 (x10) | 0..100% | R |
| CO2 Demand | CO2 Loop Demand | 428 | int16 | 0..1000 (x10) | 0..100% | R |
| Humidity Demand | Humidity Control Loop Demand | 429 | int16 | 0..1000 (x10) | 0..100% | R |
| VOC Demand | VOC Control Loop Demand | 430 | int16 | 0..1000 (x10) | 0..100% | R |
| Triac 1 PWM Demand | Triac Output 1 PWM Demand (xCR11/12 Series) Note: For On/Off Mode 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 (xCR11/12 Series) | 432 | int16 | 0..1000 (x10) | 0..100% | R |
| Triac 3 PWM Demand | Triac Output 3 PWM Demand (xCR11 Series) | 433 | int16 | 0..1000 (x10) | 0..100% | R |
| Triac 4 PWM Demand | Triac Output 4 PWM Demand (xCR11 Series) | 434 | int16 | 0..1000 (x10) | 0..100% | R |
| 3-Point 1 Demand | ThreePoint 1 Demand | 435 | int16 | 0..1000 (x10) | 0..100% | R |
| 3-Point 2 Demand | ThreePoint 2 Demand (xCR11 Series) | 436 | int16 | 0..1000 (x10) | 0..100% | R |
| Fan Mode | Current Fan Mode | 437 | int16 | 0..4 (x1) | 0 = Off 1 = Manual Speed 1 2 = Manual Speed 2 3 = Manual Speed 3 4 = Auto | R |
| Boost Time | Remaining Boost Time (Fw 1.76) | 438 | int16 | 0..480 (x1) | 0..480 minutes | R |

| ALARM STATUS (from Fw1.77) | | | | | | |
|-----------------------------------|--|---|---|-----------|-----------------------------------|---|
| | | Modbus Register / BACnet Property | MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16 | | | |
| Location 1 Status | Display Location 1 Alarm Status Note: Set Amber and Red Alarm limits in display settings. | 461 | int16 | 0..2 (x1) | 0 = Green 1 = Amber 2 = Red | R |
| Location 2 Status | Display Location 2 Alarm Status | 462 | int16 | 0..2 (x1) | | R |
| Location 3 Status | Display Location 3 Alarm Status | 463 | int16 | 0..2 (x1) | | R |
| Location 5 Status | Display Location 4 Alarm Status | 464 | int16 | 0..2 (x1) | | R |
| Location 5 Status | Display Location 5 Alarm Status | 465 | int16 | 0..2 (x1) | | R |
| | | DISCRETE INPUTS - FUNCTION CODE 02 | | | | |
| Loc 1 Red Alarm | Location 1 Red Alarm Status Note: Set Red Alarm limit and hysteresis in display settings. | 211 | | 0..1 | 0 = No Red Alarm 1 = Red Alarm | R |
| Loc 2 Red Alarm | Location 2 Red Alarm Status | 212 | | 0..1 | 0 = No Red Alarm 1 = Red Alarm | R |
| Loc 3 Red Alarm | Location 3 Red Alarm Status | 213 | | 0..1 | 0 = No Red Alarm 1 = Red Alarm | R |
| Loc 4 Red Alarm | Location 4 Red Alarm Status | 214 | | 0..1 | 0 = No Red Alarm 1 = Red Alarm | R |
| Loc 5 Red Alarm | Location 5 Red Alarm Status | 215 | | 0..1 | 0 = No Red Alarm 1 = Red Alarm | R |

| INPUT/OUTPUT SETTINGS | | | | | | |
|-------------------------|---|-----------------------------------|---|-------------------------|--|-----|
| Parameter | Description | Modbus Register / BACnet Property | MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16 | | Value Range / Enumerations | R/W |
| | | | Type | Data Range (multiplier) | | |
| 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..12 (x1) | 0 = Not Used | R/W |
| UI2 Mode | Sets the Universal Input 2 Mode. Note: Option 6 remembers the last state and when the input opens the controller returns to this state (OFF or Unoccupied) Note: Options 7 and 8 override to selected controller mode on OFF to ON transition. Note: Option 9 overrides to Occupied Mode on ON transition and Unoccupied Mode on OFF transition (if the controller is in the OFF operating mode the input is disabled - no impact). Note: Option 10 overrides to Occupied Mode on ON transition and Off Mode on OFF transition. Note: Digital - Off / UI State overrides the controller at ON transition to the state of the other Digital Input (DI1/DI2) If DI is OFF then the controller goes to unoccupied, and if ON the controller goes to occupied mode. | 521 | unit16 | 0..12 (x1) | 1 = 0..10V (0..100%) 2 = NTC10 (Default) 3 = Dew Point (NTC10) 4 = Digital - Network 5 = Digital - Disable Cooling / Resistive Condensation Sensor 6 = Digital - Occupied 7 = Digital - Unoccupied 8 = Digital - Off 9 = Digital - Unoccupied / Occupied 10 = Digital - Off / Occupied 11 = Digital - Off / UI State 12 = Resistive - kOhms | 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: Heating Stage 1 | 530 | unit16 | 0..15 (x1) | 0 = Network Value 1 = Heating Stage 1 | R/W |
| Y2 Mode | Y2 Output Configuration (xCR10/xCR12/xCR14/xCR15) Default: Cooling Stage 1 | 531 | unit16 | 0..15 (x1) | 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 | R/W |
| Y3 Mode | Y3 Output Configuration (xCR10/xCR12/xCR14/xCR15) Default: Fan Speed Control | 532 | unit16 | 0..15 (x1) | 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand | R/W |
| Y4 Mode | Y4 Output Configuration (xCR10/xCR12/xCR15) Default: CO2 Control Note: For Modus to override the output from the network set the mode to network. Note: For BACnet the output can be overridden using corresponding AV objects. Note: Options 16,17,18; by setting the Fan Mode = Stepped, the output is overridden to 100% (10V) when at the selected speed. | 533 | unit16 | 0..18 (x1) | 8 = CO2 Demand 9 = VOC Demand 10 = Humidity Demand 11 = Max Function 1 12 = Max Function 2 13 = Fan Demand 14 = 6-Way Valve 15 = Reverse 6-Way Valve 16 = Fan Speed 1 (10V) 17 = Fan Speed 2 (10V) 18 = Fan Speed 3 (10V) | R/W |
| Y1 Override | Analogue Output Y1 Override Value | 534 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0) | R/W |
| Y2 Override | Analogue Output Y2 Override Value (xCR10/12/14/15) | 535 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0) | R/W |
| Y3 Override | Analogue Output Y3 Override Value (xCR10/12/14/15) | 536 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0) | R/W |

| | | | | | | |
|-----------------------------------|---|-----|--------|-------------------|----------------------------|-----|
| Y4 Override | Analogue Output Y4 Override Value (xCR10/12/15) | 537 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0) | R/W |
| Network Value 1 | Network Value 1. Used for control loop external measurements and display functions. | 538 | int16 | -9990..9990 (x10) | -999.0..999.0 (Default 0) | R/W |
| Network Value 2 | Network Value 2 (for displaying network integer value e.g. energy measurements) | 539 | uint16 | 0..65535 (x1) | 0..65535 (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 (xCR10/12/14/15) | 542 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0%) | R/W |
| Y2 Maximum | Y2 Output Maximum Level (xCR10/12/14/15) | 543 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 100%) | R/W |
| Y3 Minimum | Y3 Output Minimum Level (xCR10/12/14/15) | 544 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0%) | R/W |
| Y3 Maximum | Y3 Output Maximum Level (xCR10/12/14/15) | 545 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 100%) | R/W |
| Y4 Minimum | Y4 Output Minimum Level (xCR10/12/15) | 546 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0%) | R/W |
| Y4 Maximum | Y4 Output Maximum Level (xCR10/12/15) | 547 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 100%) | R/W |
| Sequence 1 Start Value (Sq1Start) | 6-Way Valve Sequence 1 Start Voltage. With setting '6-Way Valve' Main Loop Heating Stage 1 at 0% Demand. | 548 | unit16 | 0..100 (x10) | 0..100% (Default 47%) | R/W |
| Sequence 1 Stop Value (Sq1Stop) | 6-Way Valve Sequence 1 Stop Voltage. With setting '6-Way Valve' Main Loop Heating Stage 1 at 100% Demand. | 549 | unit16 | 0..100 (x10) | 0..100% (Default 20%) | R/W |
| Sequence 2 Start Value (Sq2Start) | 6-Way Valve Sequence 2 Start Voltage. With setting '6-Way Valve' Main Loop Cooling Stage 1 at 0% Demand. | 550 | unit16 | 0..100 (x10) | 0..100% (Default 73%) | R/W |
| Sequence 2 Stop Value (Sq2Stop) | 6-Way Valve Sequence 2 Stop Voltage. With setting '6-Way Valve' Main Loop Cooling Stage 1 at 100% Demand. | 551 | unit16 | 0..100 (x10) | 0..100% (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 MOfde 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 OUTPUTS | | | | | | |
|-----------------------|---|-----|--------|----------------|--|-----|
| ThreePoint1 Mode | Threepoint 1 Mode (=Source) (xCR11/xCR12 Series) | 566 | uint16 | 0..14 (x1) | 0 = None 1 = Network | R/W |
| ThreePoint2 Mode | Threepoint 2 Mode (=Source) Note: xCR11 Series only. Note: 3-Point Control available from Fw1.38 onwards. | 567 | uint16 | 0..14 (x1) | 2 = Heating Stage 1 3 = Heating Stage 2 4 = Heating Stage 3 5 = Cooling Stage 1 6 = Cooling Stage 2 7 = Cooling Stage 3 8 = Auxiliary Demand 9 = CO2 Demand 10 = VOC Demand 11 = Humidity Demand 12 = Max Function 1 13 = Max Function 2 14 = Fan Demand | R/W |
| ThreePoint Run Time | ThreePoint Actuator Run Time (set to match the actuator run time) | 568 | uint16 | 10..2,400 (x1) | 10..2400 seconds (default 90 secs) | R/W |
| ThreePoint RunOn Time | ThreePoint Actuator RunOn Time (overrun time when the actuator position reaches 0 or 100%) | 569 | uint16 | 10..240 (x1) | 10..240 seconds (default 10 secs) | R/W |

| | | | | | | |
|---------------------------------------|--|-----|--------|-------------|--|-----|
| TR1 Output Mode | Triac Output 1 Configuration (xCR11/xCR12) Default: Heating Stage 1 | 570 | uint16 | 0..18 (x1) | 0 = Network 1 = Heating Stage 1 | R/W |
| TR2 Output Mode | Triac Output 2 Configuration (xCR11/xCR12) Default: Cooling Stage 1 | 571 | uint16 | 0..18 (x1) | 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 | R/W |
| TR3 Output Mode (xCR11) | Triac Output 3 Configuration (xCR11 only) Default: Heating Stage 2 | 572 | uint16 | 0..18 (x1) | 5 = Cooling Stage 2 6 = Cooling Stage 3 | R/W |
| TR4 Output Mode | Triac Output 4 Configuration (xCR11 only) Default: Cooling Stage 2 Triac Output: Options 1-12 and 16 is controlled using either PWM or ON/Off Modes Triac Output: Options 13-15 is controlled as ON/OFF based on the fan demand (Set Fan Mode = Stepped). At Fan Stage 1, Fan Speed 1 is ON. At Fan Stage 2, Fan Speed 2 is ON. Option 18 makes the triac switch on when the device is in occupied mode. In OFF/Unoccupied modes the triac is OFF. | 573 | uint16 | 0..18 (x1) | 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity Demand 11 = Max Function 1 12 = Max Function 2 13 = Fan Speed 1 14 = Fan Speed 2 15 = Fan Speed 3 16 = Fan Demand 17 = None 18 = Occupied Mode | 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 |
| TR/RL ON Value | The value at the Triac (or Relay) Output Switches ON | 575 | uint16 | 0..100 (x1) | 0..100% (Default 50%) | |
| TR/RL OFF Value | The value at the Triac (or Relay) Output Switches OFF | 576 | uint16 | 0..100 (x1) | 0..100% (Default 0%) | R/W |
| TR1 Direction | Triac Output 1 Direction (xCR11/xCR12) | 577 | uint16 | 0..1 (x1) | 0 = Normal (Default) 1 = Reverse | R/W |
| TR2 Direction | Triac Output 2 Direction (xCR11/xCR12) | 578 | uint16 | 0..1 (x1) | 0 = Normal (Default) 1 = Reverse | R/W |
| TR3 Direction | Triac Output 3 Direction (xCR11 only) | 579 | uint16 | 0..1 (x1) | 0 = Normal (Default) 1 = Reverse | R/W |
| TR4 Direction | Triac Output 4 Direction (xCR11 only) | 580 | uint16 | 0..1 (x1) | 0 = Normal (Default) 1 = Reverse | R/W |
| Triac 1 / ThreePoint 1 Level Override | Triac 1 Output (PWM) Network Override (xCR11 Range Only) or 3-Point Actuator Override Level Note: Set output to Network | 583 | uint16 | 0..100 (x1) | PWM: 0% = OFF (default) 100% = ON | R/W |
| Triac 2 Level Override | Triac 2 Output (PWM) Network Override (xCR11 Range Only) Note: Set output to Network | 584 | uint16 | 0..100 (x1) | 1%.99% = ON/OFF based on Pulse Width Modulation Settings | R/W |
| Triac 3 / ThreePoint2 Level Override | Triac 3 Output (PWM) Network Override (xCR11 Range Only) or 3-Point Actuator Override Level Note: Set output to Network | 585 | uint16 | 0..100 (x1) | 3-Point: 0..100% | R/W |
| Triac 4 Level Override | Triac 4 Output (PWM) Network Override (xCR11 Range Only) Note: Set output to Network | 586 | uint16 | 0..100 (x1) | | R/W |
| TR1 Type | Triac 1 Type (xCR11/xCR12) | 555 | uint16 | 0..1 (x1) | 0 = On-Off 1 = PWM (Default) | R/W |
| TR2 Type | Triac 2 Type (xCR11/xCR12) | 556 | uint16 | 0..1 (x1) | | |
| TR3 Type | Triac 3 Type (xCR11 only) | 557 | uint16 | 0..1 (x1) | | |
| TR4 Type | Triac 4 Type (xCR11 only) | 558 | uint16 | 0..1 (x1) | | |

| xCR10/xCR12/xCR14 RELAY OUTPUT SETTINGS | | | | | | |
|---|---|-----|--------|------------|---|-----|
| Relay Control Mode | Relay Output Configuration (RL Option) By setting Relay = 1..13, the relay output is ON when the Demand is at 'DO On Value' and OFF when the Demand is 'DO Off Value' - See PWM - ON/Off Control By Setting Relay = Occupied, the relay is ON when the controller is in Occupied Mode. By Setting Relay = Digital Input 1/2 (UI1/UI2), the relay follows the DI1/DI2 state (Set UI Mode to 4, 6, 7, 8, 9 or 10). | 581 | uint16 | 0..16 (x1) | 0 = None (default) 1 = Heating Stage 1 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity Demand 11 = Max Function 1 12 = Max Function 2 13 = Fan Demand 14 = Occupied Mode 15 = Digital Input 1 16 = Digital Input 2 | R/W |

| | | | | | | |
|-----------------|---|-----|--------|-------------|--|-----|
| Relay Override | Overrides the current output status of the relay permanently (overrides the local control, RL Option xCR10 Range Only). | 582 | uint16 | 0..2 (x1) | 0 = No override (default) 1 = Override OFF 2 = Override ON | R/W |
| TR/RL ON Value | The value at the Relay (or triac) Output Switches ON Note: Used also for triac outputs. | 575 | unit16 | 0..100 (x1) | 0..100% (Default 50%) | |
| TR/RL OFF Value | The value at the Relay (or triac) Output Switches OFF Note: Used also for triac outputs. | 576 | unit16 | 0..100 (x1) | 0..100% (Default 0%) | R/W |

| xCR13 RELAY OUTPUT SETTINGS | | | | | | |
|-----------------------------|--|-----|--------|---------------|--|-----|
| RL1 Output Mode | Relay 1 Output Source Configuration (xCR13 Only) Default: Fan Speed 1 | 531 | uint16 | 0..12 (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 7 = Fan Demand 8 = 6-Way Valve 9 = Reverse 6-Way Valve 10 = Fan Speed 1 11 = Fan Speed 2 12 = Fan Speed 3 | R/W |
| RL2 Output Mode | Relay 2 Output Source Configuration (xCR13 Only) Default: Fan Speed 2 | 532 | uint16 | 0..12 (x1) | | R/W |
| RL3 Output Mode | Relay 3 Output Source Configuration (xCR13 Only) Default: Fan Speed 3 | 533 | uint16 | 0..12 (x1) | | R/W |
| TR/RL ON Value | The value at the Relay (or triac) Output Switches ON Note: Used also for triac outputs. | 575 | unit16 | 0..100 (x1) | 0..100% (Default 50%) | |
| TR/RL OFF Value | The value at the Relay (or triac) Output Switches OFF Note: Used also for triac outputs. | 576 | unit16 | 0..100 (x1) | 0..100% (Default 0%) | R/W |
| RL1 Override | RL1 Control Source Override Value (xCR13 only). Note: Only applicable when source is set to Network. | 535 | uint16 | 0..1000 (x10) | 0.0..100.0% (Default 0) | R/W |
| RL2 Override | RL2 Control Source Override Value (xCR13 only). Note: Only applicable when source is set to Network. | 536 | uint16 | 0..1000 (x10) | 0.0..100.0% (Default 0) | R/W |
| RL3 Override | RL3 Control Source Override Value (xCR13 only). Note: Only applicable when source is set to Network. | 537 | uint16 | 0..1000 (x10) | 0.0..100.0% (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 |
| Y4 Duration | Analogue Output 4 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y4 Duration Time | 504 | 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 |
| TR3 Duration | Triac Output 3 Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR3 Duration Time | 507 | uint16 | 0..255 (x1) | 0..255 Minutes (Default: 0) 0 = Disabled | R/W |
| TR4 Duration | Triac Output 4 Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR4 Duration Time | 508 | uint16 | 0..255 (x1) | 0..255 Minutes (Default: 0) 0 = Disabled | R/W |

| Parameter | Description | Modbus Register | MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16 | | Value Range / Enumerations | R/W |
|---|-------------|-----------------|---|-------------------------|----------------------------|-----|
| | | | Type | Data Range (multiplier) | | |
| 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 |
| Y4 Commission Override | Y4 Commissioning Override Parameter | 693 | 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 |
| Y4 Override | Analogue Output Y4 Override Value (used when 693 = Manual) | 537 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0) | R/W |
| TR1 Override | TR1 Commissioning Override Parameter (xCR11/xCR12/xCR13) | 694 | uint16 | 0..3 (x1) | 0 = Auto (Default) 1 = Manual Override 2 = 0% 3 = 100% | R/W |
| TR2 Override | TR2 Commissioning Override Parameter (xCR11/xCR12/xCR13) | 695 | uint16 | 0..3 (x1) | | R/W |
| TR3 Override | TR3 Commissioning Override Parameter (xCR11 only) | 696 | uint16 | 0..3 (x1) | | R/W |
| TR4 Override | TR4 Commissioning Override Parameter (xCR11 only) | 697 | uint16 | 0..3 (x1) | | R/W |
| RL1 Commission Override | Relay 1 Commissioning Override Parameter (xCR13 only) | 691 | uint16 | 0..3 (x1) | 0 = Auto (Default) 1 = not applicable 2 = 0% 3 = 100% | R/W |
| RL2 Commission Override | Relay 2 Commissioning Override Parameter (xCR13 only) | 692 | uint16 | 0..3 (x1) | | |
| RL3 Commission Override | Relay 3 Commissioning Override Parameter (xCR13 only) | 693 | uint16 | 0..3 (x1) | | |
| Triac 1 Level Override | Triac 1 Output (PWM) Network Override (xCR11/xCR12/xCR13) Note: When 694 = Manual | 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 (xCR11/xCR12/xCR13) Note: When 695 = Manual | 584 | uint16 | 0..100 (x1) | | R/W |
| Triac 3 Level Override | Triac 3 Output (PWM) Network Override (xCR11 Range Only) Note: When 696 = Manual | 585 | uint16 | 0..100 (x1) | | |
| Triac 4 Level Override | Triac 4 Output (PWM) Network Override (xCR11 Range Only) Note: When 697 = Manual | 586 | uint16 | 0..100 (x1) | | |

| AVERAGE FUNCTION | | | | | | |
|------------------|---|-----------------------------------|---|-------------------------|--|-----|
| Parameter | Description | Modbus Register / BACnet Property | MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16 | | Value Range / Enumerations | R/W |
| | | | Type | Data Range (multiplier) | | |
| Measurement 1 | Measurement 1 for Average Calculation | 755 | uint16 | 0..3 (x1) | 0 = Disabled (Default) 1 = UI1 2 = UI2 3 = Internal Temperature | R/W |
| Measurement 2 | Measurement 2 for Average Calculation | 756 | uint16 | 0..3 (x1) | | R/W |
| Measurement 3 | Measurement 3 for Average Calculation | 757 | uint16 | 0..3 (x1) | | R/W |
| Measurement 4 | Measurement 4 for Average Calculation NOTE: Options 1-4 use Register 460-463 values allowing averaging to be done both NTC10 and voltage | 758 | uint16 | 0..3 (x1) | | R/W |

| CALIBRATION AND VOC MODE SETTINGS | | | | | | |
|-----------------------------------|-------------|-----------------------------------|---|-------------------------|----------------------------|-----|
| Parameter | Description | Modbus Register / BACnet Property | MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16 | | Value Range / Enumerations | R/W |
| | | | Type | Data Range (multiplier) | | |

| | | | | | | |
|--------------------------|---|-----|--------|-----------------|--|-----|
| Temperature Offset | Built-In Temperature Single Point Sensor Calibration Offset | 590 | int16 | -100..100 (x10) | -10.0..+10.0deg (Default 0) | R/W |
| Humidity Offset | Humidity Single Point Calibration Offset | 591 | int16 | -100..100 (x10) | -10.0..+10.0%rH (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 |
| CO2 Calibration Persist | Store CO2 Calibration Settings in the Permanent Memory | 596 | uint16 | 0..1 | 0 = None 1 = Save Data | R/W |
| VOC Measurement Mode | VOC Measurement Mode Selection (Index, Well Standard, Reset Air Standard) | 529 | uint16 | 0..2 | 0 = VOC Index 1 = TVOC Molhave, ug/m3 (Well) 2 = TVOC Isobutylene, ug/m3 (Reset) | R/W |
| VOC Learning Time Offset | VOC Learning Time Offset. Set to 12 for Index mode and 720 for Building Standards Mode | 598 | uint16 | 1..1,000 (x1) | 1..1,000hours (Default 12) | R/W |

| TOUCHSCREEN AND GENERAL SETTINGS | | | | | | |
|----------------------------------|---|-----------------------------------|---|-------------------------|--|-----|
| Parameter | Description | Modbus Register / BACnet Property | MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16 | | Value Range / Enumerations | R/W |
| | | | Type | Data Range (multiplier) | | |
| GENERAL | | | | | | |
| Display Colour | Sets the display colour (display skin). | 600 | uint16 | 0..4 | 0 = White 1 = Green 2 = Blue 3 = Grey (default) 4 = Black | R/W |
| Display Brightness | Controls display brightness. By setting to Off, the display switches off after the timeout. Display wakes up when it is touched. | 601 | uint16 | 0..6 | 0 = Off 1 = 5% 2 = 10% 3 = 25% 4 = 50% (default) 5 = 75% 6 = 100% | R/W |
| Mode Icon Display | Activates Mode Icon display on the top status bar (Occupied / Unoccupied / Off). | 602 | uint16 | 0..1 | 0 = Disabled (default) 1 = Enabled | R/W |
| Heat/Cool Icon | Activates Heat/Cool icon on the top status bar. | 603 | uint16 | 0..1 | 0 = Disabled (default) 1 = Enabled | R/W |
| Enable Fan Display | Enables Fan Speed Display and/or Fan Speed Button. | 604 | uint16 | 0..3 | 0 = Disabled (default) 1 = Icon Only 2 = Touch | R/W |
| Enable Mode Button | Enables the Mode Button on the action bar. | 605 | uint16 | 0..3 | 0 = Disabled 1 = Occupied / Unoccupied 2 = Occupied / Unocc/ Off (default) 3 = Occupied / Off | R/W |
| Enable Boost Button | Enables Boost Button on the bottom action bar | 606 | uint16 | 0..1 | 0 = Disabled (default) 1 = Enabled | R/W |
| Lock Code | Screen Lock Code - 0000 = User requires no code to lock the screen | 607 | unit16 | 0..9,999 (x1) | 0..9,999 (Default 0000) | R/W |
| Auto Lock | Enables Auto Lock of the Screen (approx 3 minutes after unlocking the screen) | 612 | uint16 | 0..1 | 0 = Disabled (default) 1 = Enabled | R/W |
| Screen Lock Override | Overrides the Current State of the Screen Lock Note: If Override is on (i.e. set to 1 or 2), it is not possible to change the lock status from the screen. | 608 | unit16 | 0..2 (x1) | 0 = No Override 1 = Unlock Screen 2 = Lock Screen | R/W |
| Config Code | Code to Enter Configuration Screen, Set to 0000 to bypass the requirement to enter the code. | 609 | unit16 | 0..9,999 (x1) | 0..9,999 (Default 8000) | R/W |
| Alternate Fan Adjust | Alternative Fan Speed Adjustment setting. Uses the temperature setpoint adjustment location with +/- buttons | 610 | unit16 | 0..1 (x1) | 0 = Disabled 1 = Enabled | R/W |

| | | | | | | |
|------------------------|--|-----|--------|-----------|---------------------------------------|-----|
| Setpoint Slider Screen | When enabled shows the Setpoint Slider Screen when adjusting setpoint. Disabled shows setpoint on the main screen. | 611 | uint16 | 0..1 (x1) | 0 = Disabled 1 = Enabled (Default) | R/W |
|------------------------|--|-----|--------|-----------|---------------------------------------|-----|

DISPLAY LOCATION 1 (PRIMARY DISPLAY LOCATION)

| | | | | | | |
|------------------------|--|-----|--------|-------|---|-----|
| Location 1 Display | Location 1 Display Source. Sets what is displayed in Location 1. Options 15 & 16 show the user setpoint adjustment instead of the calculated setpoint (from Fw 1.56) | 620 | uint16 | 0..18 | 0 = None 1 = Network Decimal Value 2 = Network Integer Value 3 = Temperature 4 = Universal Input 1 5 = Universal Input 2 6 = Humidity 7 = CO2 8 = VOC Index 9 = Main Loop Setpoint (default) 10 = Aux Loop Setpoint 11 = Humidity Setpoint 12 = Heating Demand 13 = Cooling Demand 14 = Fan Demand 15 = Main Loop SPA 16 = Aux Loop SPA 17 = Average Temp 18 = Boost Timer | R/W |
| Location 1 Description | Location 1 Description. Sets description for Location 1. | 621 | uint16 | 0..28 | 0 = None 1 = Temperature 2 = Humidity 3 = CO2 4 = VOC 5 = Light Level 6 = Pressure 7 = Room 8 = Outside 9 = Fan 10 = Energy 11 = Water 12 = Electricity 13 = Heating 14 = Cooling 15 = Zone 1 16 = Zone 2 17 = Temp. Set (Default) 18 = Hum. Set 19 = CO2 Set 20 = Aux. Set 21 = Room Set 22 = Zone 1 Set 23 = Zone 2 Set 24 = Windows 25 = Blinds 26 = TVOC 27 = Flow 28 = Boost | R/W |
| Location 1 Unit | Location 1 Unit. Sets unit for Location 1. | 622 | uint16 | 0..15 | 0 = None 1 = °C (Default) 2 = °F 3 = ppm 4 = Lux 5 = Pa 6 = kWh 7 = m3 8 = % 9 = index (air quality index) 10 = l/s 11 = m3/h 12 = cfm 13 = ppb 14 = ug/m3 15 = Mins | R/W |
| Location 1 Alarm | Activates Location 1 Alarm Bar or Descriptive Text indication. Using 1=Bar activates Green, Amber, Red alarm icon indication underneath the current displayed parameter. Using 1=Text activates LOW, NORMAL, HIGH text indication instead of the measurement. | 623 | uint16 | 0..3 | 0 = Disabled (default) 1 = Bar 2 = Text 3 = Skin Colour | R/W |

| | | | | | | |
|------------------------------|---|------------|--------|----------------|--|-----|
| Location 1 Red Alarm Limit | Red Limit for Alarm 1 / High Limit for Descriptive Display | 624 | uint16 | 0..10,000 (x1) | 0..10,000 (default 1250) | R/W |
| Location 1 Amber Alarm Limit | Amber Limit for Alarm 1 / Medium Limit for Descriptive Displays | 625 | uint16 | 0..10,000 (x1) | 0..10,000 (default 750) | R/W |
| Location 1 Hysteresis | Hysteresis for Alarm 1 / Low Limit for Descriptive Displays | 626 | uint16 | 0..10,000 (x1) | 0..10,000 (default 100) | R/W |
| Location 1 Read Only | Sets the location 1 to be Read Only, Read/Write or Read-Write-NoLock. In Read Only mode touch functions are disabled for this location. In Read-Write-NoLock mode the touch actions are enabled even if the screen is locked. | 655 | uint16 | 0..2 | 0 = Read-Write (default) 1 = Read Only 2 = Read-Write-NoLock | R/W |

DISPLAY LOCATION 2

| | | | | | | |
|------------------------|---|------------|--------|-------|---|-----|
| Location 2 Display | Location 2 Display Source. Sets what is displayed in Location 2. Options 15 & 16 show the user setpoint adjustment instead of the calculated setpoint (from Fw 1.56) | 627 | uint16 | 0..18 | 0 = None 1 = Network Decimal Value 2 = Network Integer Value 3 = Temperature (default) 4 = Universal Input 1 5 = Universal Input 2 6 = Humidity 7 = CO2 8 = VOC Index 9 = Main Loop Setpoint 10 = Aux Loop Setpoint 11 = Humidity Setpoint 12 = Heating Demand 13 = Cooling Demand 14 = Fan Demand 15 = Main Loop SPA 16 = Aux Loop SPA 17 = Average Temp 18 = Boost Timer | R/W |
| Location 2 Description | Location 2 Description | 628 | uint16 | 0..28 | 0 = None 1 = Temperature (Default) 2 = Humidity 3 = CO2 4 = VOC 5 = Light Level 6 = Pressure 7 = Room 8 = Outside 9 = Fan 10 = Energy 11 = Water 12 = Electricity 13 = Heating 14 = Cooling 15 = Zone 1 16 = Zone 2 17 = Temp. Set 18 = Hum. Set 19 = CO2 Set 20 = Aux. Set 21 = Room Set 22 = Zone 1 Set 23 = Zone 2 Set 24 = Windows 25 = Blinds 26 = TVOC 27 = Flow 28 = Boost | R/W |

| | | | | | | |
|------------------------------|---|-----|--------|----------------|---|-----|
| Location 2 Unit | Location 2 Unit | 629 | uint16 | 0..15 | 0 = None 1 = °C (default) 2 = °F 3 = ppm 4 = Lux 5 = Pa 6 = kWh 7 = m3 8 = % 9 = index (air quality index) 10 = l/s 11 = m3/h 12 = cfm 13 = ppb 14 = ug/m3 15 = Mins | R/W |
| Location 2 Alarm | Activates Location 2 Alarm Bar or Descriptive Text indication. Using 1=Bar activates Green, Amber, Red alarm icon indication underneath the current displayed parameter. Using 2=Text activates LOW, NORMAL, HIGH text indication instead of the measurement. | 630 | uint16 | 0..3 | 0 = Disabled 1 = Bar (default) 2 = Text 3 = Skin Colour | R/W |
| Location 2 Red Alarm Limit | Red Limit for Alarm 2 / High Limit for Descriptive Display | 631 | uint16 | 0..10,000 (x1) | 0..10,000 (default 30) | R/W |
| Location 2 Amber Alarm Limit | Amber Limit for Alarm 2 / Medium Limit for Descriptive Displays | 632 | uint16 | 0..10,000 (x1) | 0..10,000 (default 25) | R/W |
| Location 2 Hysteresis | Hysteresis for Alarm 2 / Low Limit for Descriptive Displays | 633 | uint16 | 0..10,000 (x1) | 0..10,000 (default 1) | R/W |
| Location 2 Read Only | Sets the location 2 to be Read Only, Read/Write or Read-Write-NoLock. In Read Only mode touch functions are disabled for this location. In Read-Write-NoLock mode the touch actions are enabled even if the screen is locked. | 656 | uint16 | 0..2 | 0 = Read-Write (default) 1 = Read Only 2 = Read-Write-NoLock | R/W |

| DISPLAY LOCATION 3 | | | | | | |
|--------------------|---|-----|--------|-------|--|-----|
| Location 3 Display | Location 3 Display Source. Sets what is displayed in Location 3. Options 15 & 16 show the user setpoint adjustment instead of the calculated setpoint (from Fw 1.56) | 634 | uint16 | 0..18 | 0 = None 1 = Network Decimal Value 2 = Network Integer Value 3 = Temperature 4 = Universal Input 1 5 = Universal Input 2 6 = Humidity 7 = CO2 (default) 8 = VOC Index 9 = Main Loop Setpoint 10 = Aux Loop Setpoint 11 = Humidity Setpoint 12 = Heating Demand 13 = Cooling Demand 14 = Fan Demand 15 = Main Loop SPA 16 = Aux Loop SPA 17 = Average Temp 18 = Boost Timer | R/W |

| | | | | | | |
|------------------------------|---|-----|--------|----------------|---|-----|
| Location 3 Description | Location 3 Description | 635 | uint16 | 0..28 | 0 = None 1 = Temperature 2 = Humidity 3 = CO2 (Default) 4 = VOC 5 = Light Level 6 = Pressure 7 = Room 8 = Outside 9 = Fan 10 = Energy 11 = Water 12 = Electricity 13 = Heating 14 = Cooling 15 = Zone 1 16 = Zone 2 17 = Temp. Set 18 = Hum. Set 19 = CO2 Set 20 = Aux. Set 21 = Room Set 22 = Zone 1 Set 23 = Zone 2 Set 24 = Windows 25 = Blinds 26 = TVOC 27 = Flow 28 = Boost | R/W |
| Location 3 Unit | Location 3 Unit | 636 | uint16 | 0..15 | 0 = None 1 = °C 2 = °F 3 = ppm (default) 4 = Lux 5 = Pa 6 = kWh 7 = m3 8 = % 9 = index (air quality index) 10 = l/s 11 = m3/h 12 = cfm 13 = ppb 14 = ug/m3 15 = Mins | R/W |
| Location 3 Alarm | Activates Location 3 Alarm Bar or Descriptive Text indication. Using 1=Bar activates Green, Amber, Red alarm icon indication underneath the current displayed parameter. Using 2=Text activates LOW, NORMAL, HIGH text indication instead of the measurement. | 637 | uint16 | 0..3 | 0 = Disabled 1 = Bar (default) 2 = Text 3 = Skin Colour | R/W |
| Location 3 Red Alarm Limit | Red Limit for Alarm 3 / High Limit for Descriptive Display | 638 | uint16 | 0..10,000 (x1) | 0..10,000 (default 1250) | R/W |
| Location 3 Amber Alarm Limit | Amber Limit for Alarm 3 / Medium Limit for Descriptive Displays | 639 | uint16 | 0..10,000 (x1) | 0..10,000 (default 750) | R/W |
| Location 3 Hysteresis | Hysteresis for Alarm 3 / Low Limit for Descriptive Displays | 640 | uint16 | 0..10,000 (x1) | 0..10,000 (default 100) | R/W |
| Location 3 Read Only | Sets the location 3 to be Read Only, Read/Write or Read-Write-NoLock. In Read Only mode touch functions are disabled for this location. In Read-Write-NoLock mode the touch actions are enabled even if the screen is locked. | 657 | uint16 | 0..2 | 0 = Read-Write (default) 1 = Read Only 2 = Read-Write-NoLock | R/W |

DISPLAY LOCATION 4

| | | | | | | |
|------------------------------|---|-----|--------|----------------|---|-----|
| Location 4 Display | Location 4 Display Source. Sets what is displayed in Location 4. Options 15 & 16 show the user setpoint adjustment instead of the calculated setpoint (from Fw 1.56) | 641 | uint16 | 0..18 | 0 = None 1 = Network Decimal Value 2 = Network Integer Value 3 = Temperature (default) 4 = Universal Input 1 5 = Universal Input 2 6 = Humidity 7 = CO2 8 = VOC Index 9 = Main Loop Setpoint 10 = Aux Loop Setpoint 11 = Humidity Setpoint 12 = Heating Demand 13 = Cooling Demand 14 = Fan Demand 15 = Main Loop SPA 16 = Aux Loop SPA 17 = Average Temp 18 = Boost Timer | R/W |
| Location 4 Description | Location 4 Description | 642 | uint16 | 0..28 | 0 = None 1 = Temperature 2 = Humidity (Default) 3 = CO2 4 = VOC 5 = Light Level 6 = Pressure 7 = Room 8 = Outside 9 = Fan 10 = Energy 11 = Water 12 = Electricity 13 = Heating 14 = Cooling 15 = Zone 1 16 = Zone 2 17 = Temp. Set 18 = Hum. Set 19 = CO2 Set 20 = Aux. Set 21 = Room Set 22 = Zone 1 Set 23 = Zone 2 Set 24 = Windows 25 = Blinds 26 = TVOC 27 = Flow 28 = Boost | R/W |
| Location 4 Unit | Location 4 Unit | 643 | uint16 | 0..15 | 0 = None 1 = °C 2 = °F 3 = ppm 4 = Lux 5 = Pa 6 = kWh 7 = m3 8 = % (default) 9 = index 10 = l/s 11 = m3/h 12 = cfm 13 = ppb 14 = ug/m3 15 = Mins | R/W |
| Location 4 Alarm | Activates Location 4 Alarm Bar or Descriptive Text indication. Using 1=Bar activates Green, Amber, Red alarm icon indication underneath the current displayed parameter. Using 2=Text activates LOW, NORMAL, HIGH text indication instead of the measurement. | 644 | uint16 | 0..3 | 0 = Disabled 1 = Bar (default) 2 = Text 3 = Skin Colour | R/W |
| Location 4 Red Alarm Limit | Red Limit for Alarm 4 / High Limit for Descriptive Display | 645 | uint16 | 0..10,000 (x1) | 0..10,000 (default 80) | R/W |
| Location 4 Amber Alarm Limit | Amber Limit for Alarm 4 / Medium Limit for Descriptive Displays | 646 | uint16 | 0..10,000 (x1) | 0..10,000 (default 60) | R/W |
| Location 4 Hysteresis | Hysteresis for Alarm 4 / Low Limit for Descriptive Displays | 647 | uint16 | 0..10,000 (x1) | 0..10,000 (default 10) | R/W |

| | | | | | | |
|-------------------------|---|-----|--------|------|--|-----|
| Location 4 Read Only | Sets the location 4 to be Read Only, Read/Write or Read-Write-NoLock. In Read Only mode touch functions are disabled for this location. In Read-Write-NoLock mode the touch actions are enabled even if the screen is locked. | 658 | uint16 | 0..2 | 0 = Read-Write (default) 1 = Read Only 2 = Read-Write-NoLock | R/W |
|-------------------------|---|-----|--------|------|--|-----|

| DISPLAY LOCATION 5 | | | | | | |
|---------------------------|--|--|--|-------|---|-----|
| | | Modbus Register / BACnet Property | MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16 | | | |
| Location 5 Display | Location 5 Display Source. Sets what is displayed in Location 5. | 648 | uint16 | 0..18 | 0 = None (default) 1 = Network Decimal Value 2 = Network Integer Value 3 = Temperature 4 = Universal Input 1 5 = Universal Input 2 6 = Humidity 7 = CO2 8 = VOC Index 9 = Main Loop Setpoint 10 = Aux Loop Setpoint 11 = Humidity Setpoint 12 = Heating Demand 13 = Cooling Demand 14 = Fan Demand 15 = Main Loop SPA 16 = Aux Loop SPA 17 = Average Temp 18 = Boost Timer | R/W |
| Location 5 Description | Location 5 Description | 649 | uint16 | 0..28 | 0 = None (default) 1 = Temperature 2 = Humidity 3 = CO2 4 = VOC 5 = Light Level 6 = Pressure 7 = Room 8 = Outside 9 = Fan 10 = Energy 11 = Water 12 = Electricity 13 = Heating 14 = Cooling 15 = Zone 1 16 = Zone 2 17 = Temp. Set 18 = Hum. Set 19 = CO2 Set 20 = Aux. Set 21 = Room Set 22 = Zone 1 Set 23 = Zone 2 Set 24 = Windows 25 = Blinds 26 = TVOC 27 = Flow 28 = Boost | R/W |
| Location 5 Unit | Location 5 Unit | 650 | uint16 | 0..15 | 0 = None (default) 1 = °C 2 = °F 3 = ppm 4 = Lux 5 = Pa 6 = kWh 7 = m3 8 = % 9 = index 10 = l/s 11 = m3/h 12 = cfm 13 = ppb 14 = ug/m3 15 = Mins | R/W |

| | | | | | | |
|------------------------------|--|-----|--------|----------------|--|-----|
| Location 5 Alarm | Activates Location 5 Alarm Bar, Alarm Skin Colour or Descriptive Text indication. Using 1=Bar activates Green, Amber, Red alarm icon indication underneath the current displayed parameter. Using 3=Text activates LOW, MEDIUM HIGH text indication instead of the measurement. Using 3= Skin activates the skin colour changing based on alarm condition. | 651 | uint16 | 0..3 | 0 = Disabled (default) 1 = Bar 2 = Text 3 = Skin | R/W |
| Location 5 Red Alarm Limit | Red Limit for Alarm 5 / High Limit for Descriptive Display | 652 | uint16 | 0..10,000 (x1) | 0..10,000 (default 140) | R/W |
| Location 5 Amber Alarm Limit | Amber Limit for Alarm 5 / Medium Limit for Descriptive Displays | 653 | uint16 | 0..10,000 (x1) | 0..10,000 (default 120) | R/W |
| Location 5 Hysteresis | Hysteresis for Alarm 5 / Low Limit for Descriptive Displays | 654 | uint16 | 0..10,000 (x1) | 0..10,000 (default 10) | R/W |
| Location 5 Read Only | Sets the location 5 to be Read Only, Read/Write or Read-Write-NoLock. In Read Only mode touch functions are disabled for this location. In Read-Write-NoLock mode the touch actions are enabled even if the screen is locked. | 659 | uint16 | 0..2 | 0 = Read-Write (default) 1 = Read Only 2 = Read-Write-NoLock | R/W |

| CONTROL SETTINGS | | | | | | |
|------------------------------------|--|-----------------------------------|---|-------------------------|---|-----|
| Parameter | Description | Modbus Register / BACnet Property | MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16 | | Value Range / Enumerations | R/W |
| | | | Type | Data Range (multiplier) | | |
| CONTROL MODES AND OVERRIDES | | | | | | |
| PIR Op. Mode Control | Built-in PIR influence on the operation mode. If set to Off, the built-in PIR only shows the status on the network and has no impact on the operating mode. | 679 | uint16 | 0..1 | 0 = On (Default) 1 = Off | R/W |
| Inactive PIR Control Mode | Controller Mode when the PIR (OE-option) does not detect movement. If Option 0 = Unoccupied is selected, and the controller is in the OFF operating mode the PIR is disabled - no impact. | 680 | uint16 | 0..1 | 0 = Unoccupied Mode (Default) 1 = Off Mode | R/W |
| Override Control Mode | Override Current Control Mode (last transition applies e.g. if overridden from network the user can change through the display) From V1.54 onwards will return automatically to 3 after override. | 681 | uint16 | 0..3 (x1) | 0 = Occupied 1 = Unoccupied 2 = Night 3 = No Override | R/W |
| Boost Time | Boost Step Time | 682 | uint16 | 0..28,800 (x1) | 0..28,800 seconds 0 = Timer disabled, toggle functionality (default) | R/W |
| Boost Steps | Number of Boost Steps. The boost time is extended by every press of the button up to number of Boost Steps (Fw 1.76). | 670 | uint16 | 1..5 (x1) | 1..5 steps (Default: 1) | R/W |
| Boost Target | Sets the boost operation target. With options 1..11 the output is boosted to 100% for the Boost Time (Param 682). With option 12 - Occupancy - the controller mode is changed to the 'Occupied' mode for the Boost Time. | 683 | uint16 | 0..12 (x1) | 0 = None 1 = Heating Stage 1 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity Demand 11 = Fan Demand 12 = Occupancy | R/W |
| Reset User Adjustment | Resets the user setpoint adjustments (multi-stage, aux and humidity loops and fan speed back to auto) when operating mode transitions away from the Occupied mode. | 684 | uint16 | 0..1 | 0 = Off (Default) 1 = On | R/W |
| Store User Adjustment | Stores the user setpoint adjustment in non-volatile memory (when adjusted through screen) | 689 | uint16 | 0..1 | 0 = Disabled(Default) 1 = Enabled | R/W |
| MULTI-STAGE CONTROL LOOP | | | | | | |

| | | | | | | |
|------------------------------------|--|------------|--------|----------------------|---|-----|
| 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. If the UI mode is 0-10V, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters 523-526. Option 6 - Average is the output of averaging function (Fw1.54 onwards) | 700 | uint16 | 0..6 (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 6 = Average | R/W |
| Main Loop Nominal Setpoint (SPnom) | Main 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 |
| Main Setpoint Resolution | Main 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 | uint16 | 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..3 (x1) | 0 = None 1 = 1-Stage (default) | R/W |
| No of Cooling Stages | Sets the number of cooling stages. | 708 | uint16 | 0..3 (x1) | 2 = 2-Stages 3 = 3-Stages | R/W |
| Occ Heating Deadzone | Occupied Mode Heating Deadzone | 709 | uint16 | 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 |
| Unocc Heating Deadzone | Unoccupied Mode Heating Deadzone | 711 | uint16 | 0..300 (x10) | 0.0..30.0 (Default 3.0) | R/W |
| Unocc Cooling Deadzone | Unoccupied Mode Cooling Deadzone | 712 | uint16 | 0..300 (x10) | 0.0..30.0 (Default 3.0) | R/W |
| Frost Setpoint | Off Mode Frost Setpoint | 713 | uint16 | 0..600 (x10) | 0.0..60.0 (Default 10.0) | R/W |
| User Setpoint Adjustment | Current User Setpoint Adjustment (Run time memory) | 790 | int16 | -300..0..300.0 (x10) | Param 703 to Param 704 | R/W |
| DZ Mode | Deadzone Mode. In standard mode the Integral Action modulates to zero within the deadzone providing energy savings. In Hold mode the integral action element is held within the deadzone. | 793 | uint16 | 0..1 (x1) | 0 = Standard (Default) 1 = Hold | R/W |

| AUXILIARY CONTROL LOOP | | | | | | |
|-------------------------------|---|------------|--------|----------------------|---|-----|
| Auxiliary Source | Sets the Source for the Auxiliary Control. 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. Option 6 - Average is the output of averaging function (Fw1.54 onwards) | 714 | uint16 | 0..6 (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 6 = Average | R/W |
| Aux Setpoint | Auxiliary Control Loop Setpoint | 715 | uint16 | 0..9999 (x10) | 0.0..999.9 (Default 21.0) | R/W |
| Aux Setpoint Resolution | Aux Setpoint Adjustment Resolution | 716 | uint16 | 1..100 (x10) | x10: 0.1..10.0 (default 0.1) | R/W |
| Min Adjustment | User Setpoint Adjustment Min Limit | 717 | int16 | -9999..0 (x10) | -999.9..0.0 (Default -99.9) | R/W |
| Max Adjustment | User Setpoint Adjustment Max Limit | 718 | uint16 | 0..9999 (x10) | 0.0..999.9 (Default 3.0) | R/W |
| Aux PB | Auxiliary Control Proportional Band | 719 | uint16 | 1..9999 (x1) | 1..9999 (Default 5) | R/W |
| Aux IA | Auxiliary Control Integral Action Time (Set to 0 to disable) | 720 | uint16 | 0..3600 (x1) | 0..3600s (Default 300s) 0 = Disabled | R/W |
| Aux Mode | Auxiliary Loop Control Mode Note: Change-Over mode can override the mode. | 721 | uint16 | 0..1 (x1) | 0 = Reverse (Heating) - Default 1 = Direct (Cooling) | R/W |
| User Setpoint Adjustment | Current User Setpoint Adjustment for Aux Loop (Run time memory) | 791 | int16 | -300..0..300.0 (x10) | Param 717 to Param 718 | R/W |
| CHANGE-OVER FUNCTION | | | | | | |

| | | | | | | |
|------------------------------|---|-----|--------|---------------|--|-----|
| Change-Over Source | Sets the Source for the Change-Over Function. Note: As default the Network Command is Off i.e. no change-over function is active. | 722 | uint16 | 0..4 (x1) | 0 = Network Command (Reg 726, Default) 1 = UI1 - NTC10 2 = UI2 - NTC10 3 = Digital Input 1 (UI1) 4 = Digital Input 2 (UI2) | R/W |
| Change-Over Target | Target of the Change-Over Control. | 723 | uint16 | 0..3 (x1) | 0 = None (Default) 1 = Multi-Stage Control Loop 2 = Auxiliary Control Loop 3 = Multi-Stage and Aux Loops | R/W |
| Change-Over Low Temperature | Temperature below which the change-over is active (cooling stage active). Note: Relevant only for NTC Input 1/2 options. | 724 | uint16 | 0..1000 (x10) | 0..100.0° Default 18° | R/W |
| Change-Over High Temperature | Temperature above which the change-over is off (heating stage active, no override on control). Note: Relevant only for NTC Input 1/2 options. | 725 | uint16 | 0..1000 (x10) | 0..100.0° Default 22° | R/W |
| Network Change-Over Override | Heating / Cooling Mode Command from Network. Note: Requires change-over source to be set as Network. | 726 | uint16 | 0..1 (x1) | 0 = Heating (Default) 1 = Cooling | R/W |

LOW/HIGH LIMIT RESET FUNCTION

| | | | | | | |
|----------------------|--|-----|--------|---------------|--|-----|
| Reset Control Source | Sets the Temperature Souce for the Reset Control Function. Note: Default: 0 - Network. | 727 | uint16 | 0..2 (x1) | 0 = Network (Reg 538) 1 = UI1 - NTC10 2 = UI2 - NTC10 | R/W |
| Reset Control Target | Target of the Reset Control Logic. The reset logic resets the target control loop setpoint as per calculated by the logic. | 728 | uint16 | 0..2 (x1) | 0 = None (Default) 1 = Multi-Stage Control Loop 2 = Auxiliary Control Loop | R/W |
| High Limit Setpoint | High Limit Setpoint. Above this limit the setpoint is reduced proportionally according to the ratio and temperature difference. | 729 | uint16 | 0..1000 (x10) | 0.0..100.0° Default 35° | R/W |
| Low Limit Setpoint | Low Limit Setpoint. Below this limit the setpoint is increased proportionally according to the ratio and temperature difference. | 730 | uint16 | 0..1000 (x10) | 0.0..100.0° Default 15° | R/W |
| Reset Ratio | Reset ratio used to calculated the setpoint reset. | 731 | uint16 | 0..100 (x10) | 0.0..10.0 (Default 1.0) | R/W |

MAX FUNCTION / PRIORITY LEVEL

| | | | | | | |
|----------------|---|-----|--------|------------|--|-----|
| Max1 Source 1 | Sets the Souce for Input 1 of Maximum Function 1 Default: Heating Stage 1 | 732 | uint16 | 0..13 (x1) | 0 = Network Value (Reg 538) 1 = Heating Stage 1 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity Demand 11 = Max Function 1 12 = Max Function 2 13 = Fan Demand | R/W |
| Max 1 Source 2 | Sets the Souce for Input 2 of Maximum Function 1 Default: Cooling Stage 1 Note: DI1 Priority Level / DI2 Priority Levels sets the input to use Parameter 736 Priority Level value, when active. | 733 | uint16 | 0..15 (x1) | 0 = Network Value (Reg 538) 1 = Heating Stage 1 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity Demand 11 = Max Function 1 12 = Max Function 2 13 = Fan Demand 14 = DI1 (UI1) Priority Level 15 = DI2 (UI2) Priority Level | R/W |

| | | | | | | |
|--------------------|--|-----|--------|-------------|--|-----|
| Max 2 Source 1 | Sets the Source for Input 1 of Maximum Function 2 Default: Cooling Stage 1 | 734 | uint16 | 0..13 (x1) | 0 = Network Value (Reg 538) 1 = Heating Stage 1 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity Demand 11 = Max Function 1 12 = Max Function 2 13 = Fan Demand | R/W |
| Max 2 Source 2 | Sets the Source for Input 2 of Maximum Function 2 Default: CO2 Demand Note: DI1 Priority Level / DI2 Priority Levels sets the input to use Parameter 736 Priority Level value, when active. | 735 | uint16 | 0..15 (x1) | 0 = Network Value (Reg 538) 1 = Heating Stage 1 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity Demand 11 = Max Function 1 12 = Max Function 2 13 = Fan Demand 14 = DI1 (UI1) Priority Level 15 = DI2 (UI2) Priority Level | R/W |
| Priority Level | Max Function Output Level when Source 2 = DI1/DI2 and the corresponding digital input is active. | 736 | uint16 | 0..15 (x1) | 0..100 (Default 0) | R/W |
| FAN CONTROL | | | | | | |
| Fan Control Source | Sets the Temperature Source for the Fan Control Function. | 740 | uint16 | 0..12 (x1) | 0 = Network Value (Reg 538) 1 = Heating Stage 1 2 = Heating Stage 2 3 = Heating Stage 3 4 = Cooling Stage 1 5 = Cooling Stage 2 6 = Cooling Stage 3 7 = Auxiliary Demand 8 = CO2 Demand 9 = VOC Demand 10 = Humidity Demand 11 = Max Function 1 (Default) 12 = Max Function 2 | R/W |
| Min Fan Speed | Sets the Minimum Fan Speed for EC Fans | 741 | uint16 | 0..100 (x1) | 0..100% (Default 15%) | R/W |
| Fan Speed 1 | Sets the Fan Speed 1 for EC Fans (when source 33%) | 742 | uint16 | 0..100 (x1) | 0..100% (Default 33%) | R/W |
| Fan Speed 2 | Sets the Fan Speed 2 for EC Fans (when source 66%) | 743 | uint16 | 0..100 (x1) | 0..100% (Default 66%) | R/W |
| Fan Speed 3 | Sets the Fan Speed 3 for EC Fans (when source 99%) | 744 | uint16 | 0..100 (x1) | 0..100% (Default 100%) | R/W |
| Fan Mode | Sets the EC Fan Mode. Continuous Mode scales the fan demand based on the source and Fan Speed 1/2/3 settings. In Stepped mode the fan speed steps according to Fan Speed 1/2/3 settings. | 745 | uint16 | 0..1 (x1) | 0 = Continuous Mode (Default) 1 = Stepped Mode | R/W |
| Fan Off Mode | Configures if the Fan is running at minimum level or is off when the fan control demand is at 0%. 1 - Minimum Speed: Running at Minimum Speed at Occupied and UnOccupied (0% in OFF mode). 2 - Minimum Occupied: Running at Min Speed in Occupied Only | 746 | uint16 | 0..2 (x1) | 0 = Off (Default) 1 = Minimum Speed 2 = Minimum Occupied | R/W |
| Fan Off Delay | Switch OFF delay when the source demand drops to 0 (and Fan Off Mode is set to Off) | 747 | uint16 | 0..600 (x1) | 0..600 seconds (Default 0) | R/W |
| Fan Start-Up Delay | Fan Start-Up when the source demand increases above 0%. During the delay the fan runs at Fan Speed 1 setting. | 748 | uint16 | 0..600 (x1) | 0..600 seconds (Default 10) | R/W |

| | | | | | | |
|------------------------|--|-----|--------|-------------|--|-----|
| Fan Level Override | Current Fan Level that can be set from the touchscreen or network (last command prevails). Note: If Fan Levels = 0-1-A, options 2, 3 and 4 override to Automatic control. Note: If Fan Levels = 0-1-2-A, then Level 2 overrides to Speed 3. Both 3 and 4 override to Automatic control. From V1.54 onwards will return automatically to 5 after override. | 749 | uint16 | 0..5 | 0 = Off 1 = Speed1 2 = Speed2 3 = Speed3 4 = Auto 5 = No Override | R/W |
| Fan Levels | Set the Fan Levels for the network override and for the touch button operation | 750 | uint16 | 0..2 | 0 = 0-1-A 1 = 0-1-2-A 2 = 0-1-2-3-A (Default) | R/W |
| Stepped Fan Y Delay | Set the switching delay between Fan Speeds 1, 2 and 3 for the Y Analogue Outputs when Fan Mode = Stepped.(from Fw 1.52) | 751 | uint16 | 0..30 (x1) | 0..30 seconds (Default 0) | R/W |
| xCR13: Fan Relay Delay | Delay between Fan Level Relays switching on the xCR13 Controllers | 751 | uint16 | 0..30 (x1) | 0..30 seconds (Default 0) | R/W |
| Max Auto Fan Speed | Maximum Fan Speed in Automatic Control Mode (from Fw 1.57) | 752 | uint16 | 0..100 (x1) | 0..100% (Default 100%) | R/W |

AIR QUALITY CONTROL

| | | | | | | |
|----------------------|--|-----|--------|---------------|---|-----|
| 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 = Built-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 |
| CO2 Setpoint Setback | CO2 Control Setpoint SetBack in Unoccupied mode | 764 | uint16 | 0..2000 (x1) | 0..2,000 (Default 0) | R/W |
| CO2 Control Mode | CO2 Control Loop Control Mode | 765 | uint16 | 0..1 (x1) | 0 = Reverse 1 = Direct | R/W |
| VOC Setpoint | VOC Control Setpoint | 770 | uint16 | 0..500 (x1) | 0..500 (Default 100) | R/W |
| VOC PB | VOC Control Proportional Band | 771 | uint16 | 1..500 (x1) | 1..500 (Default 100) | R/W |
| VOC IA | VOC Control Integral Action Time (Set to 0 to disable) | 772 | uint16 | 0..3600 (x1) | 0..3600s (Default 0s) | R/W |

HUMIDITY CONTROL

| | | | | | | |
|--------------------|--|-----|--------|--------------|--|-----|
| Humidity Source | Sets the Source for the Humidity Control. Note: If set to UI1/UI2, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters 523-526. | 780 | uint16 | 0..3 (x1) | 0 = Network Value (Reg 539) 1 = Built-In Humidity (Default) 2 = UI1 - 0..10V 3 = UI2 - 0..10V | R/W |
| Humidity Setpoint | Humidity Control Loop Setpoint | 781 | uint16 | 0..100 (x1) | 0..100% (Default 50%) | R/W |
| Humidity PB | Humidity Control Proportional Band | 782 | uint16 | 1..100 (x1) | 1..100% (Default 20) | R/W |
| Humidity IA | Humidity Control Integral Action Time (Set to 0 to disable) | 783 | uint16 | 0..3600 (x1) | 0..3600s (Default 0s) | R/W |
| Humidity Mode | Humidity Loop Control Mode Default: Humidify (Reverse) | 784 | uint16 | 0..1 (x1) | 0 = Humidify (Reverse) 1 = De-Humidify (Direct) | R/W |
| Humidity Interlock | Enables Cooling Stage 2 Interlock on High Humidity | 785 | uint16 | 0..1 (x1) | 0 = Disabled (Default) 1 = Enabled | R/W |
| Dew Point Range | Dew Point calculation range where the Dew Point based cooling max. position calculates linearly from 100% to 0% | 786 | uint16 | 0..10 (x1) | 0..10 Degrees (Default 4) | R/W |
| Dew Point Mode | Dew Point Mode Selection | 787 | uint16 | 0..1 (x1) | 0 = On-Off 1 = Proportional (Default) | R/W |
| Dew Point Offset | Dew Point Offset (from the calculated Dew Point) where the Dew Point based calculated max. position is 0% | 788 | uint16 | 0..5 (x10) | 0..5.0 Degrees (Default 1.0) | R/W |

SYSTEM AND COMMUNICATION SETTINGS

| Parameter | Description | Modbus Register / BACnet Property | MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16 | | | |
|-----------|--------------------------------------|-----------------------------------|---|----------------------------|----------------------------------|-----|
| | | | 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 |
| Last Reset | Last Controller Reset Status | 955 | unit | 0..5 | 0 = Powerup, 1 = Backup, 2 = Watchdog, 3 = Software, 4 = Hardware Pin | R |
| Persist | Persist (Store Parameters in Non-Volatile Memory after 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 |
| Logo Timer | Time after which the Logo is displayed on the Display after background level is activated. Set to 0 to disable the logo. | 815 | uint16 | 0..255 (x1) | 1..255 seconds 0 = Logo Disabled | 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 |

| LORA AUTOMATIC PAYLOAD CONFIGURATION (LORA MODELS ONLY) | | | | | | |
|--|---|-----------------------------------|---|-------------------------|----------------------------|-----|
| Parameter | Description | Modbus Register / BACnet Property | MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16 | | Value Range / Enumerations | R/W |
| | | | Type | Data Range (multiplier) | | |
| Uplink Register 1 | LoraWan Automatic Uplink Payload Register 1. Configure to be the register number to be read in the message. (Default: Temp) | 850 | uint16 | 1..1000 (x1) | 400..1000 (Default 400) | R/W |
| Uplink Reg 2 | LoraWan Automatic Uplink Payload Register 2 (Def: Humidity) | 851 | uint16 | 1..1000 (x1) | 400..1000 (Default 401) | R/W |
| Uplink Reg 3 | LoraWan Automatic Uplink Payload Register 3 (Def: CO2) | 852 | uint16 | 1..1000 (x1) | 400..1000 (Default 402) | R/W |
| Uplink Reg 4 | LoraWan Automatic Uplink Payload Register 4 (Def: VOC) | 853 | uint16 | 1..1000 (x1) | 400..1000 (Default 403) | R/W |
| Uplink Reg 5 | LoraWan Automatic Uplink Payload Register 5 (Def: UI1) | 854 | uint16 | 1..1000 (x1) | 400..1000 (Default 410) | R/W |
| Uplink Reg 6 | LoraWan Automatic Uplink Payload Register 6 (Def: UI2) | 855 | uint16 | 1..1000 (x1) | 400..1000 (Default 411) | R/W |
| Uplink Reg 7 | LoraWan Automatic Uplink Payload Register 7 (Def: Y1) | 856 | uint16 | 1..1000 (x1) | 400..1000 (Default 412) | R/W |
| Uplink Reg 8 | LoraWan Automatic Uplink Payload Register 8 (Def: Y2) | 857 | uint16 | 1..1000 (x1) | 400..1000 (Default 413) | R/W |
| Uplink Reg 9 | LoraWan Automatic Uplink Payload Register 9 (Def: Y3) | 858 | uint16 | 1..1000 (x1) | 400..1000 (Default 414) | R/W |
| Uplink Reg 10 | LoraWan Automatic Uplink Payload Register 10 (Def: Y4) | 859 | uint16 | 1..1000 (x1) | 400..1000 (Default 415) | R/W |
| Uplink Reg 11 | LoraWan Automatic Uplink Payload Register 11 (Def: Calc SP) | 860 | uint16 | 1..1000 (x1) | 400..1000 (Default 420) | R/W |
| Uplink Reg 12 | LoraWan Automatic Uplink Payload Register 12 (Def: Aux SP) | 861 | uint16 | 1..1000 (x1) | 400..1000 (Default 421) | R/W |
| Write Register 1 | LoraWan Packaged Write Payload Register 1. Configure to be the register number to be written. (Default: Nominal SP) | 862 | uint16 | 1..1000 (x1) | 400..1000 (Default 701) | R/W |
| Write Register 2 | LoraWan Packaged Write Payload Register 2. (Def: Aux SP) | 863 | uint16 | 1..1000 (x1) | 400..1000 (Default 681) | R/W |
| Write Register 3 | LoraWan Packaged Write Payload Register 3. (Def: None) | 864 | uint16 | 1..1000 (x1) | 400..1000 (Default 0) | R/W |
| Write Register 4 | LoraWan Packaged Write Payload Register 4. (Def: None) | 865 | uint16 | 1..1000 (x1) | 400..1000 (Default 0) | R/W |
| Write Register 5 | LoraWan Packaged Write Payload Register 5. (Def: None) | 866 | uint16 | 1..1000 (x1) | 400..1000 (Default 0) | R/W |
| Write Register 6 | LoraWan Packaged Write Payload Register 6. (Def: None) | 867 | uint16 | 1..1000 (x1) | 400..1000 (Default 0) | R/W |

| | | | | | | |
|-----------------------|--|------------|--------|--------------|--|-----|
| Transmission Interval | Lora Uplink Message Transmission Interval, minutes | 847 | uint16 | 1..9 (x1) | 0 = 1min 1 = 2min 2 = 3min 3 = 4min 4 = 5min 5 = 6min 6 = 10min (default) 7 = 15min 8 = 30min 9 = 60min | R/W |
| Lora Version | Reports the Lora Firmware Version | 875 | uint16 | 1..9999 (x1) | n/a (V2.03 latest as Apr25) | R |

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 | uint16 | 0..25700 (x1) 0x0000..0x6464 | Byte 1:Y1 (0x00..0x64), Byte 2:Y2 (0x00..0x64) | R |
| Y3/Y4 | Combined 16-Bit Register for Outputs Y3 and Y4 | 451 | uint16 | 0..25700 (x1) 0x0000..0x6464 | Byte 1: Y3 (0x00..0x64), Byte 2: Y4 (0x00..0x64) | R |
| Htg/Clg | Combined 16-Bit Register for Heating and Cooling Demands | 452 | uint16 | 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 | uint16 | 0..25700 (x1) 0x0000..0x6464 | Byte 1: Triac 1 (0x00..0x64) Byte 2: Triac 2 (0x00..0x64) | R |
| Triac1/Triac2 | Combined 16-Bit Register for Triac 3 and Triac 4 Demands | 454 | uint16 | 0..25700 (x1) 0x0000..0x6464 | Byte 1: Triac 1 (0x00..0x64) Byte 2: Triac 2 (0x00..0x64) | R |
| Device Status | Combined 16-Bit Register for Binary Status of the Device | 455 | uint16 | 0..25700 (x1) | Bit0 - DI1, Bit1 = DI2, Bit3 = PIR, Bit4 = Relay, Bit5= Boost, Bit6 = Screen Lock | 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 |
| Y4 Commission Override | Y4 Commissioning Override Parameter | 693 | uint16 | 0..3 (x1) | | R/W |
| TR1 Override | TR1 Commissioning Override Parameter | 694 | uint16 | 0..3 (x1) | | 0 = Auto (Default) 1 = Manual Override 2 = 0% 3 = 100% |
| TR2 Override | TR2 Commissioning Override Parameter | 695 | uint16 | 0..3 (x1) | R/W | |
| TR3 Override | TR3 Commissioning Override Parameter | 696 | uint16 | 0..3 (x1) | R/W | |
| TR4 Override | TR4 Commissioning Override Parameter | 697 | uint16 | 0..3 (x1) | 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: | Sep 1, 2022 |
| 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 Controller | | |
| 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 Subscriptions Max Master | Object Identifier Object Name APDU Timeout (0...60000) Number Of APDU Retries (0...10) Max Master (1...127) |
| <p><i>For all supported objects, device does not support CreateObject or DeleteObject.</i></p> <p><i>For Analog Value objects that are classified as read only, there is the following behavior:</i></p> <ul style="list-style-type: none"> - HVAC application overwrites the present value that has been written with the Write Property Service. - In this case, no error message will be sent. <p><i>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:</i></p> <ul style="list-style-type: none"> - 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_Identifier | | 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) | Humidity | 0..100.0 | - | RELATIVE_HUMIDITY | 0.0..100 (Default 5) | R |
| AV(2) | CO2 | 0..10,000 | - | PARTS_PER_MILLION | 0.0..100 (Default 50) | R |
| AV(3) | VOC | 0..1,000 | - | NO_UNITS | 0.0..100 (Default 10) | R |
| AV(4) | 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(5) | UI2 | -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(6) | Y1 | 0.0..100.0% | - | PERCENT | 5 | R/W |
| AV(7) | Y2_RL1 | 0.0..100.0% | - | PERCENT | 5 | R/W |
| AV(8) | Y3_RL2 | 0.0..100.0% | - | PERCENT | 5 | R/W |
| AV(9) | Y4_RL3 | 0.0..100.0% | - | PERCENT | 5 | R/W |
| AV(10) | Setpoint_Main | 0.0..212.0 | Nonvol_Setpoint | NO_UNITS | n/a | R/W |
| AV(11) | Setpoint_Aux | 0.0..212.0 | Nonvol_Setpoint | NO_UNITS | n/a | R/W |
| AV(12) | Setpoint_CO2 | 0..10000.0 | Nonvol_Setpoint | PARTS_PER_MILLION | n/a | R/W |
| AV(13) | Setpoint_VOC | 0..500.0 | Nonvol_Setpoint | NO_UNITS | n/a | R/W |
| AV(14) | Setpoint_Humidity | 0..100.0 | Nonvol_Setpoint | RELATIVE_HUMIDITY | n/a | R/W |
| AV(15) | Fan_Speed | 0..4.0 | Nonvol_FanSpeed | NO_UNITS | 1 | R/W |
| AV(16) | Operating_Mode (Occupied/Unocc/Off) | 0..2.0 | Nonvol_OpMode | NO_UNITS | 1 | R/W |
| AV(17) | Network_Decimal | -999.0..999.0 | Nonvol_Setpoint | NO_UNITS | n/a | R/W |
| AV(18) | Network_Integer | 0..65535.0 | Nonvol_Setpoint | NO_UNITS | n/a | R/W |
| AV(19) | Triac1_PWM | 0..100 | - | PERCENT | 5 | R/W |
| AV(20) | Triac2_PWM | 0..100 | - | PERCENT | 5 | R/W |
| AV(21) | Triac3_PWM | 0..100 | - | PERCENT | 5 | R/W |
| AV(22) | Triac4_PWM | 0..100 | - | PERCENT | 5 | R/W |

| | | | | | | |
|--------|----------------|-----------|-----------------|---|-----|-----|
| AV(23) | DZ_Unocc_HTG | 0..30.0 | Nonvol_Setpoint | DEGREES_CELCIUS or DEGREES_FAHRENHEIT or NO_UNITS | n/a | R/W |
| AV(24) | DZ_Unocc_CLG | 0..30.0 | Nonvol_Setpoint | DEGREES_CELCIUS or DEGREES_FAHRENHEIT or NO_UNITS | n/a | R/W |
| AV(25) | DZ_Occ_HTG | 0..30.0 | Nonvol_Setpoint | DEGREES_CELCIUS or DEGREES_FAHRENHEIT or NO_UNITS | n/a | R/W |
| AV(26) | DZ_Occ_CLG | 0..30.0 | Nonvol_Setpoint | DEGREES_CELCIUS or DEGREES_FAHRENHEIT or NO_UNITS | n/a | R/W |
| AV(27) | Setpoint_Frost | 0.0..60.0 | Nonvol_Setpoint | NO_UNITS | n/a | R/W |

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

NOTE: Writing to AV6-AV9, AV19-AV22 Priority Inputs 1-15 overrides the current value. Set Pri Inputs 1-15 to 'null' to release back to automatic control.

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

NOTE:AV23/AV24 available from Fw. 1.52 onwards.

| 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) | PIR | PIR Movement Sensor Status | 0: InActive (Off) 1: Active (On) | Binary_Inactive | R |
| BV(3) | DO_1 | Digital Output (Relay) Status | 0: InActive (Off) 1: Active (On) | Binary_Inactive | R/W |
| BV(4) | Boost | Boost Button Status (Active / non-active) | 0: InActive (No Boost) 1: Active (Boost) | Binary_Inactive | R |
| BV(5) | Cooling_Mode | Cooling Mode Override for Heating Stage 1 (Heating/Cooling) | 0: InActive (Heating) 1: Active (Cooling) | Binary_Inactive | R/W |
| BV(6) | Screen_Lock | Locks / Unlocks Screen | 0: InActive (Unlocked) 1: Active (Locked) | Binary_Inactive | R/W |

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_Display, 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 <i>Device Setup and Modbus/BACnet Communication</i> 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 objects 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.

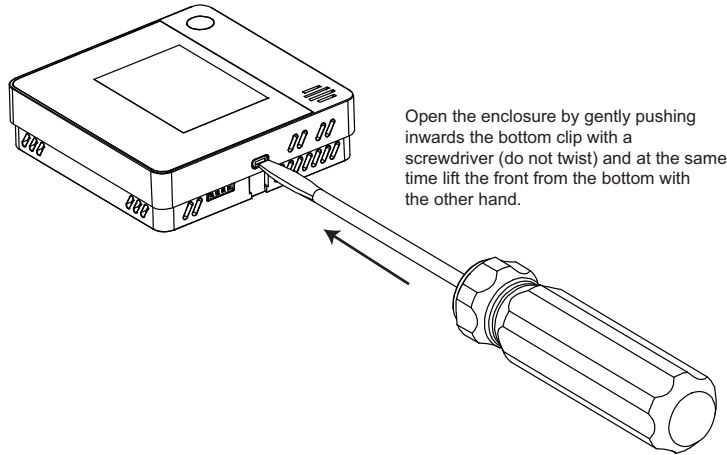
| BACNET COV OBJECT SETTINGS | | | | | | |
|----------------------------|---|-----------------|--------|-------------------------|-------------------------------------|-----|
| Parameter | Description | BACnet Property | Type | Data Range (multiplier) | Value Range / Enumerations | R/W |
| AVx COV | AV Object COV Enable Flag x = AV Object Number (AV0..AV9, A15..AV16, AV19..AV22) | 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..BV4) | 110x | uint16 | 0..1(x1) | 0 = COV Disabled 1 = COV Enabled | R/W |

Dimensions and Installation

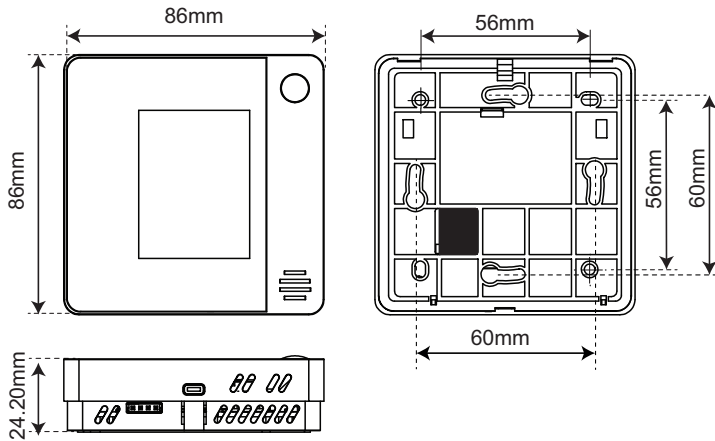
The devices typically mounted on the flat wall surfaces or on the junction boxes. The enclosure has 56/60mm screw distance for standard mounting boxes.

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.
- 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.



DIMENSIONS (xCR10 and xCR12 SERIES)



DIMENSIONS (xCR12/xCR13/xCR14/xCR15 SERIES)

