

## PS2.04 TCR81/82/83 Series Ceiling Mounted Room Controllers



TCR80 SERIES CONTROLLER



UP TO 2 x TDR20/QDR20  
ROOM INTERFACE  
PANELS

The TCR80 Series Controllers are ceiling mounted room controllers for controlling up to two rooms. The controllers have IP65 rated enclosure with cable glands, and are available with 24V or 230V power supply. The controllers can be connected to up to two room display panels using the USB-C cables, making installation and connection simple. The controller built-in universal inputs can be used with cable sensors. The room interface panels have temperature measurement, setpoint, fan speed, boost function and operating mode selection (configurable). In addition the room interface panels can have optional humidity, VOC, CO2 and occupancy measurements.

The controllers have built-in Modbus RTU or BACnet MS/TP communication that allow interaction to the BMS systems. The controllers can be configured using Windows Configuration Tool over the USB-SERIAL or wireless Bluetooth BLE-TOOLSET. The controllers can also be configured over the Modbus/BACnet, or using iOS Mobile Phone/iPad application.

### Features

- Advanced Room Controllers for wide variety of room control applications.
- Controls up to 2 rooms - connection up to 2 Room Display Interfaces (via communication bus using USB-C cable)
- BACnet MS/TP and Modbus RS485 RTU with up to 60V industrial isolation on RS485 for system integration
- 24V and 240V Power Supply versions
- TCR81/TCR83: 2 x Universal Inputs (temperature/0-10V/digital)
- TCR82: 4 x Universal Inputs (temperature/0-10V/digital) offer application flexibility
- 4 x Analogue 0..10Vdc Outputs, max 2mA
- TCR81/83: 2 x 24Vac Triacs, TCR82: 4 x 24Vac Triacs (require 24Vac or 240V supply), TCR83: 3 x240V
- Sensor Bus for Connecting up to two Room Interface Panels (TCR81: 1x, TCR82: 2x)
- Configuration wirelessly through Smart Configuration Windows Software or Smart Phone iOS App (using Bluetooth Dongles). SmartView SmartPhone App for device interrogation for end users.
- IP65 Wall/Ceiling Mounted Enclosure with 4 x M16 6-12mm Conduit Entries, 4 x M16 4-8mm Conduit Entries
- Designed for Installers in mind with Spring Loaded pluggable spring-loaded terminal blocks and Sufficient Wiring Space

## Technical Specifications

|                                |                     |   |
|--------------------------------|---------------------|---|
| <b>Power Supply:</b>           | Power:              | 24V Models: 24Vac/dc -10%/+15%, max 180mA with two Room Interface Panels<br>240V Models: 240Vac   |
| <b>Inputs:</b>                 | Universal Inputs:   | TCR81: 2 x Universal Inputs - RI/AI/DI Application Selected<br>TCR82: 4 x Universal Inputs - RI/AI/DI Application Selected<br>RI = NTC10 Measurement / Resistive<br>AI = 0..10Vdc Input<br>DI = Digital Volt-Free Input   |
| <b>Outputs:</b>                | Analogue Outputs:   | 4 x 0..10Vdc, min. load resistance >5 kOhms (max. 2mA @ 10V)  |
|                                | Digital Outputs:    | TCR81: 2 x 24Vac Rated Triacs, Switching to 0V, Max 1A load<br>TCR82: 4 x 24Vac Rated Triacs, Switching to 0V, Max 1A load<br>(for thermic wax actuators or 3-point raise/lower actuators)<br>Note: Requires 24VAC or 240V Power Supply<br>Note: 240Vac variants can provide up to 8VA for the thermic actuators. |
|                                | Relay Outputs:      | TCR83: 3 x 250VAC Relays, max switching power 90W (Fan Motor Control)   |
| <b>Communication:</b>          | 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<br>Via Software: 1..247 for Modbus, 1..127 for BACnet MS/TP   |
|                                | Settings:           | Baud Rate: 9600/19200/38400/76800 (bitswitch), 57600/115200 (software)<br>Modbus Parity: None/Even/Odd, Modbus Stop Bits: 1 or 2  |
| <b>Wireless Communication:</b> | Bluetooth (Option): | Bluetooth Interface to SmartPhone App or BLE USB Dongle (Device Config Tool)  |
|                                | LoraWan (Option):   | LoraWan® Wireless Interface (EU868, US915, AS923)<br>Encrypted LoraWan® 1.0.3 Class C Device with secure OTAA activation with IPEX antenna for long-range communication.<br>Configurable Uplink and Downlink Messages.  |
| <b>Sensor Bus:</b>             | Physical Interface  | TCR81: 1 x USB-C Connector for the Room Interface Panels (TDR/QDR20)<br>TCR82: 2 x USB-C Connector for the Room Interface Panels (TDR/QDR20)<br>Each connector provides RS485, 0V and 5Vdc<br>Option: 5V, 0V, TX, RX Spring Loaded Terminals Block  |
| <b>Mechanical:</b>             | Wiring Terminals:   | Spring Loaded Push Fit Terminals, 0.2 to 2.5mm <sup>2</sup> / 26 to 12 AWG<br>4 x M16 and 4 x M20 Cable Glands  |
|                                | Enclosure:          | ABS Plastics - White, IP65 Rating   |
|                                | Mounting:           | Wall or Ceiling Mounting  |
|                                | Dimensions          | W220 x H140 x D75mm   |

## Model Selection

Refer to the below table to select the required model.

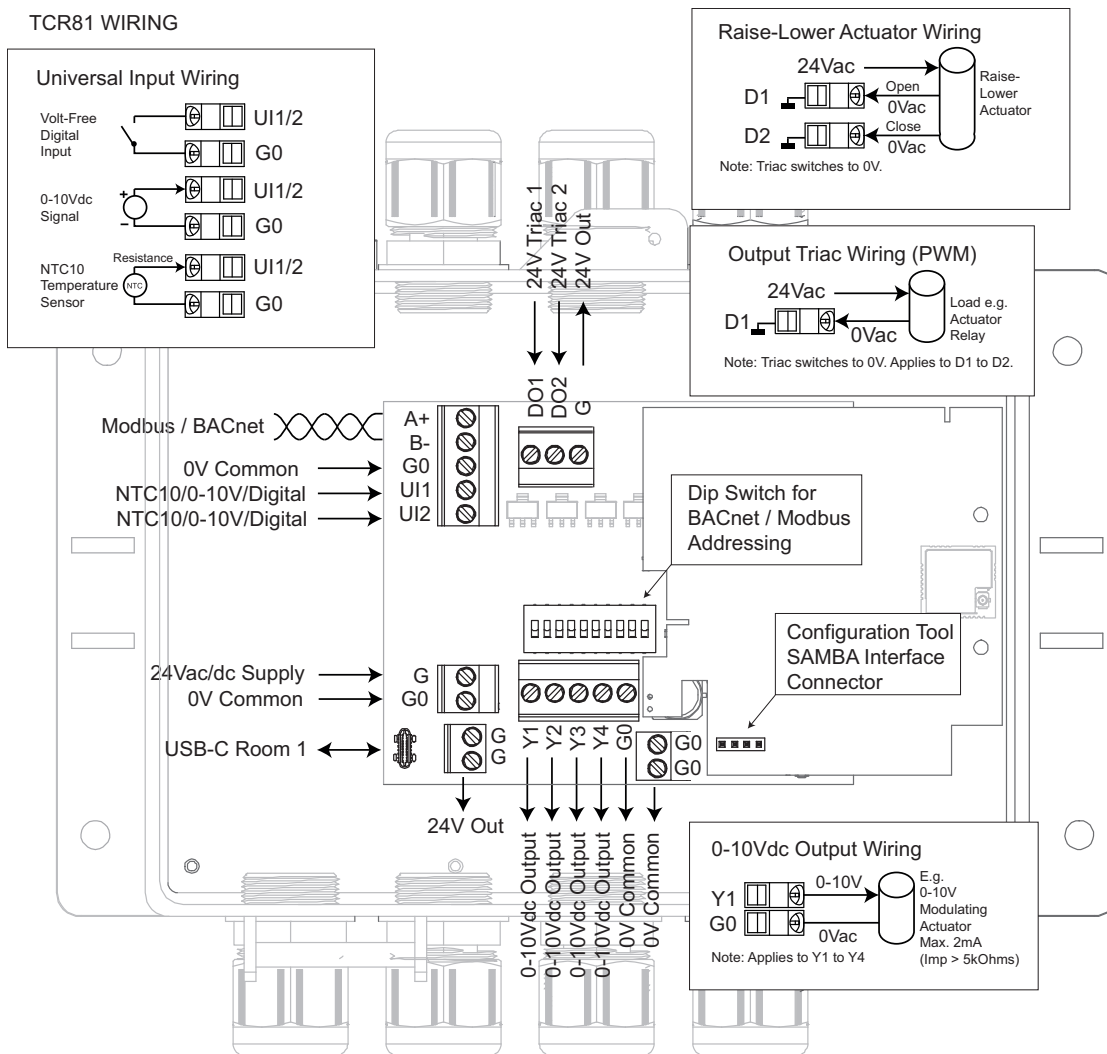
| Part Number                    |   | SKU# Number |                 |    |    |    |     |
|--------------------------------|---|-------------|-----------------|----|----|----|-----|
| Example                        | TCR82-MOD-24-W  | 8200        | 1               | 00 | 60 | 10 | 0 2 |
| Product Name                   |   | Product     | Product Options |    |    |    |     |
| TCR81                          | Ceiling Mounted Room Controller, 2UI, 4AO, 2DO, 1 x Room Interface Units    | 8100        |                 |    |    |    |     |
| TCR82                          | Ceiling Mounted Room Controller, 4UI, 4AO, 4DO, 2 x Room Interface Units    | 8200        |                 |    |    |    |     |
| TCR83                          | Ceiling Mounted Room Controller, 2UI, 2AO, 2DO, 3RO, 1 x Room Interface     | 8300        |                 |    |    |    |     |
| Serial Communication Option    |   |             |                 |    |    |    |     |
|                                | No communication (select when using LoraWan)                                | 0           |                 |    |    |    |     |
| MOD                            | Modbus RS485  | 1           |                 |    |    |    |     |
| BAC                            | BACnet MS/TP  | 2           |                 |    |    |    |     |
| Wireless Communication Options |   |             |                 |    |    |    |     |
|                                | No Interface  | 00          |                 |    |    |    |     |
| BLE                            | Bluetooth App Interface   | 03          |                 |    |    |    |     |
| LRA                            | LoraWan Wireless Interface (select Lora region below)                       | 06          |                 |    |    |    |     |
| BLE-LRA                        | Bluetooth App Interface and LoraWan Wireless Interface (select Lora region) | 09          |                 |    |    |    |     |
| Zone Sensor Supply             |   |             |                 |    |    |    |     |
|                                | USB-C Connector   |             |                 |    | 60 |    |     |
| 5V                             | 5V+ Zone Sensor Communications Spring Loaded Terminals                      |             |                 |    | 61 |    |     |
| Power Supply Option            |   |             |                 |    |    |    |     |
| 24                             | 24V Power Supply  |             |                 |    |    | 10 |     |
| 240                            | 240V Power Supply, 24Vac 8VA available for actuators                        |             |                 |    |    | 11 |     |
| Region Options (Lora)          |   |             |                 |    |    |    |     |
|                                | Non Lora & EU868MHz Lora (Default)  |             |                 |    |    |    | 0   |
| US                             | US915MHz Lora   |             |                 |    |    |    | 1   |
| AS                             | AS923MHz Lora   |             |                 |    |    |    | 2   |
| Colour Options                 |   |             |                 |    |    |    |     |
| W                              | White   |             |                 |    |    |    | 2   |

| Part Number | Description   | SKU# Number       |
|-------------|---|-------------------|
| Accessories |   |                   |
| USB-C-CAB-6 | 6m USB-C Male to USB-C Male for Room Interface Units, Black | 8510 0 00 0005 01 |
| USB-C-EXT-6 | 5m USB-C Female to USB-C Male Extension Cable, Black        | 8520 0 00 0006 01 |

# Wiring Connections

## TCR81 WIRING CONNECTIONS

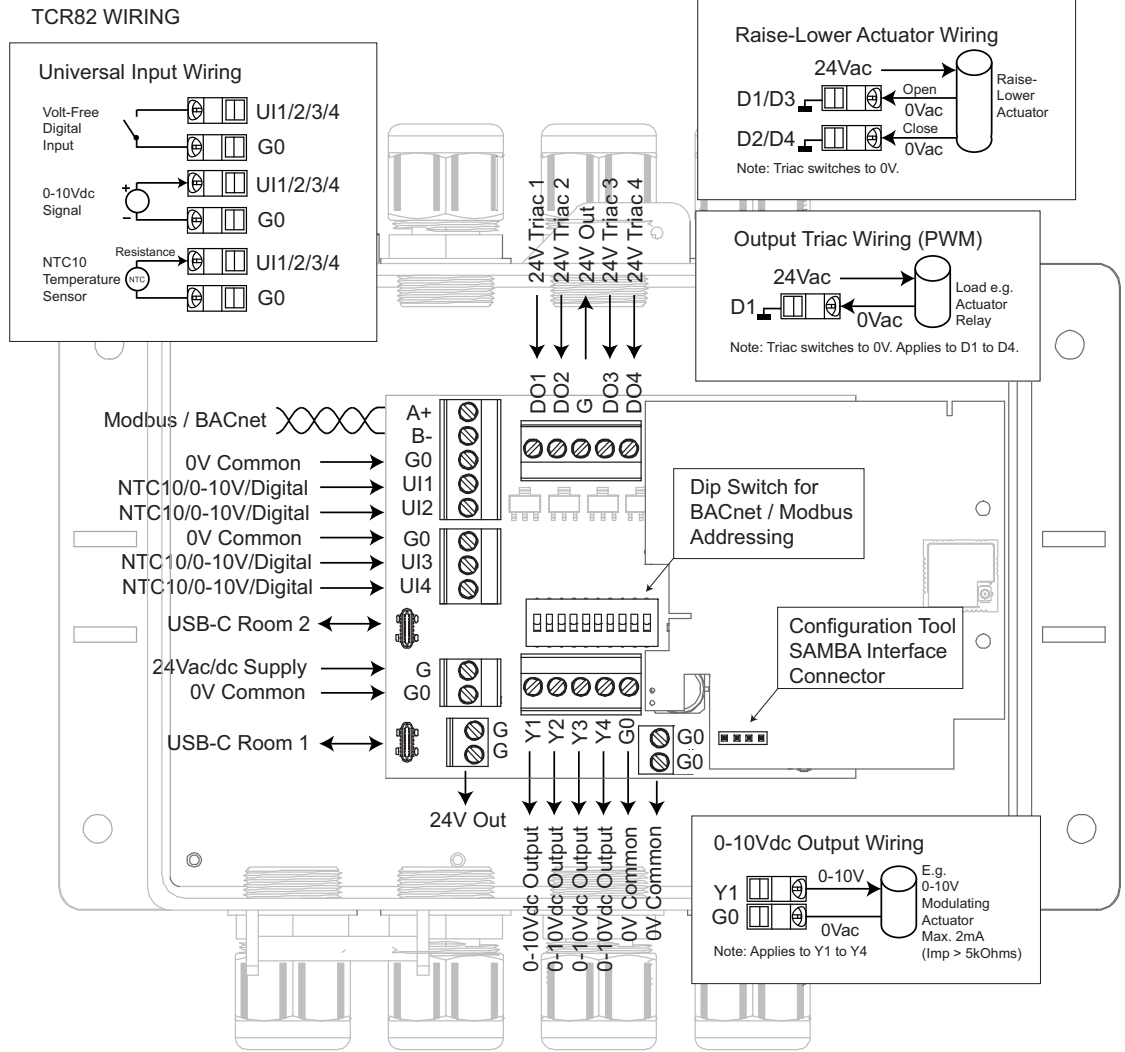
The diagram below illustrates the wiring connections to the TCR81 controllers.



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

| Terminal | Description             |
|----------|-------------------------|
| DO1      | 24Vac Triac, Max 1A     |
| DO2      | 24Vac Triac, Max 1A     |
| G        | 24Vac Output            |
|          |                         |
|          |                         |
| G        | 24Vac Output            |
| Y1       | 0-10Vdc Output max. 2mA |
| Y2       | 0-10Vdc Output max. 2mA |
| Y3       | 0-10Vdc Output max. 2mA |
| Y4       | 0-10Vdc Output max. 2mA |
| G0       | 0V Common               |

**TCR82 WIRING CONNECTIONS**

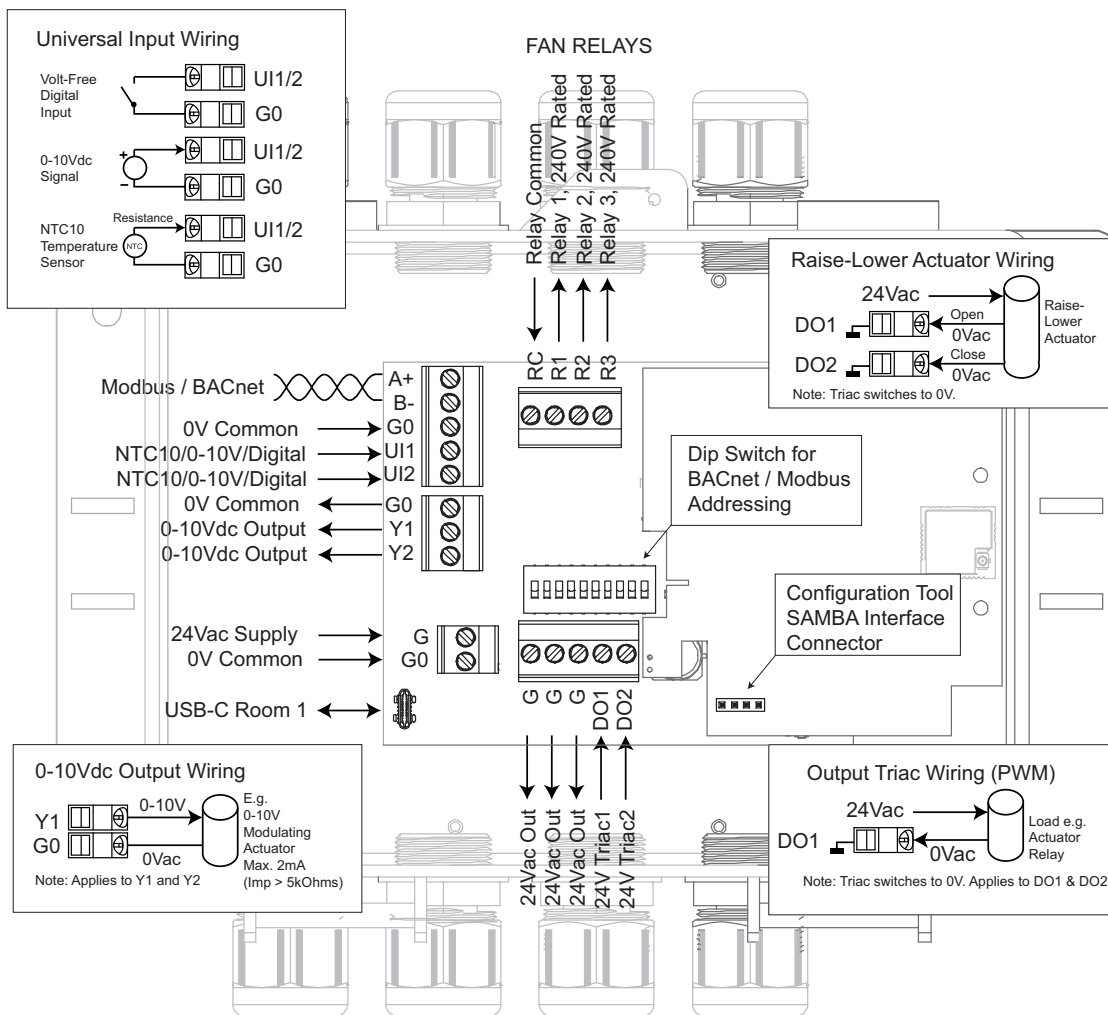


| Terminal | Description                           |
|----------|---------------------------------------|
| A+       | Modbus / BACnet RS485 A+              |
| B-       | Modbus / BACnet RS485 B-              |
| G0       | 0V Common                             |
| UI1      | NTC10/0-10V/Volt-Free Digital Input 1 |
| UI2      | NTC10/0-10V/Volt-Free Digital Input 2 |
| G0       | 0V Common                             |
| UI3      | NTC10/0-10V/Volt-Free Digital Input 3 |
| UI4      | NTC10/0-10V/Volt-Free Digital Input 4 |
| G        | 24Vac -10/+15% Supply                 |
| G0       | 0V Common                             |

| Terminal | Description             |
|----------|-------------------------|
| DO1      | 24Vac Triac, Max 1A     |
| DO2      | 24Vac Triac, Max 1A     |
| G        | 24Vac Output            |
| DO3      | 24Vac Triac, Max 1A     |
| DO4      | 24Vac Triac, Max 1A     |
| G        | 24Vac Output            |
| Y1       | 0-10Vdc Output max. 2mA |
| Y2       | 0-10Vdc Output max. 2mA |
| Y3       | 0-10Vdc Output max. 2mA |
| Y4       | 0-10Vdc Output max. 2mA |
| G0       | 0V Common               |

**TCR83 WIRING CONNECTIONS**

TCR83 WIRING



| Terminal | Description                           |
|----------|---------------------------------------|
| A+       | Modbus / BACnet RS485 A+              |
| B-       | Modbus / BACnet RS485 B-              |
| G0       | 0V Common                             |
| UI1      | NTC10/0-10V/Volt-Free Digital Input 1 |
| UI2      | NTC10/0-10V/Volt-Free Digital Input 2 |
| G0       | 0V Common                             |
| Y1       | 0-10Vdc Output max. 2mA               |
| Y2       | 0-10Vdc Output max. 2mA               |
|          |                                       |
| G        | 24Vac -10/+15% Supply                 |
| G0       | 0V Common                             |

| Terminal | Description             |
|----------|-------------------------|
| RC       | Relay Common, Max 3A    |
| R1       | 250VAC Relay 1, Max 90W |
| R2       | 250VAC Relay 2, Max 90W |
| R3       | 250VAC Relay 3, Max 90W |
|          |                         |
| G        | 24Vac Output            |
| G        | 24Vac Output            |
| G        | 24Vac Output            |
| DO1      | 24Vac Triac, Max 1A     |
| DO2      | 24Vac Triac, Max 1A     |

NOTE: The fan relays (R1, R2 and R3) are interlocked, only one relay is active any given time.

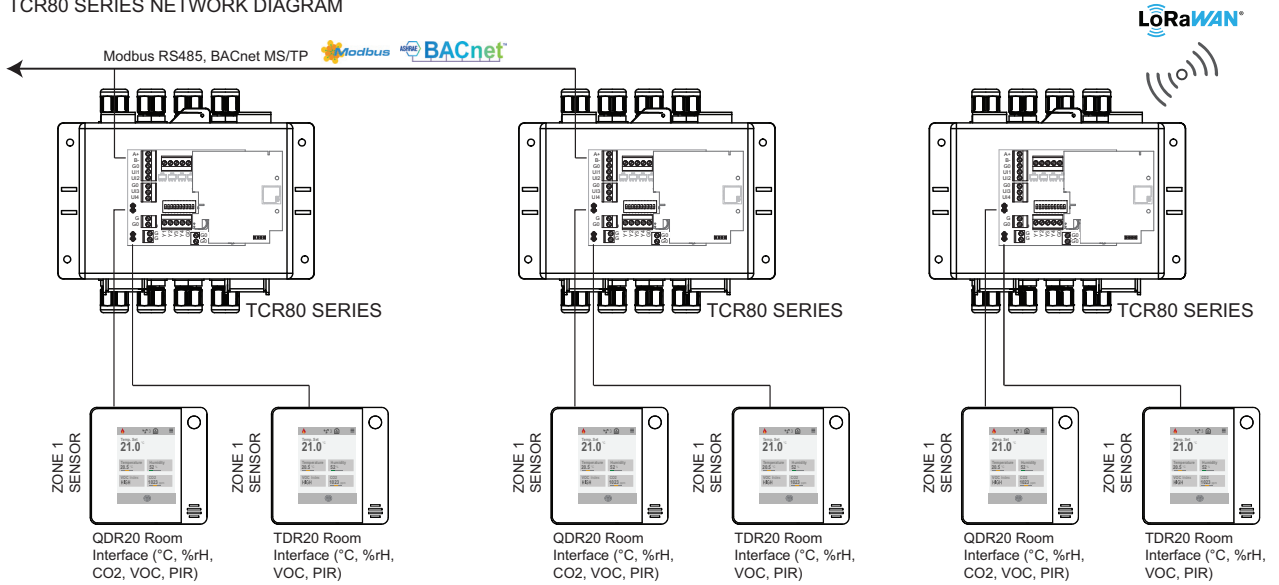
**WIRING GUIDELINES**

Make sure that power is switched off and carry out wiring according to the wiring connections drawing and local wiring guidelines.

## Room Display Interfaces

The TCR80 series controllers are complemented with the TDR/QDR20 series room display interfaces (up to 2 zones). TDR20/QDR20 interfaces offer measurement of temperature, CO2, humidity, VOC and occupancy (movement). The interfaces allow the user to adjust the temperature setpoint, fan speed, operating mode and also boost the operation. The interfaces can be also used to convey the TCR80 series controller status information as well as utility meter information to the user. The diagram below illustrates the setup.

TCR80 SERIES NETWORK DIAGRAM



The TCR80 series controllers communicate to the TDR/QDR20 room interfaces using Modbus communication protocol. Zone 1 interface uses Address 1 and Zone 2 interface uses address 2. After connecting the zone interface via USB-C cable (or through optional wiring terminals), activate the interface from the System settings.

The TCR80 series controllers read the following measurements from the TDR/QDR20 Devices.

| Parameter                | Description   | TCR Zone 1 Regs | TCR Zone 2 Regs |
|--------------------------|---|-----------------|-----------------|
| <b>ZONE MEASUREMENTS</b> |   |                 |                 |
| Temperature Sensor       | TDR/QDR temperature measurement.                    | 400             | 405             |
| Humidity Sensor          | TDR/QDR humidity measurement.                       | 401             | 406             |
| CO2 Sensor               | QDR CO2 reading.                                    | 402             | 407             |
| VOC Sensor               | TDR/QDR VOC (Volatile Organic Compound) Index Value | 403             | 408             |
| Dew Point                | Calculated Dew Point (calculated at TCR80)          | 404             | 409             |

TCR80 controllers can operate up to two control zones. These control zones use the measurements and overrides from the zone sensors (if enabled). These include the following:-

| Parameter           | Description   | TCR Zone 1 Regs | TCR Zone 2 Regs |
|---------------------|---|-----------------|-----------------|
| Calculated Setpoint | Current Calculated Setpoint for the Zone (can be adjusted from the zone sensor)                             | 420             | 430             |
| Control Mode        | Current Control Mode for the Zone (can be changed from the TDR20/QDR20 interface)                           | 423             | 433             |
| Fan Mode            | Current Fan Level / Control Mode. Manual Off - Manual Speed 1 - Manual Speed 2, Manual Speed 3 or Automatic | 429             | 439             |

Each Zone Sensor (TDR20/QDR20) can be used to display additional information such as outside air temperature, water and energy consumption figures. These values can be changed via the following registers.

| Parameter       | Description  | TCR Zone 1 Regs | TCR Zone 2 Regs |
|-----------------|--|-----------------|-----------------|
| Network Value 1 | Network Value 1 (for displaying network single decimal value). | 600             | 602             |
| Network Value 2 | Network Value 2 (for displaying network integer value).        | 601             | 603             |

## Control Functions

TCR80 series controllers have flexible control functionality to control up to two control zones, with temperature, CO<sub>2</sub>, humidity, VOC and occupancy control. The full functionality is achieved by connecting TDR/QDR20 Room Display Interfaces. TCR81 series controllers support one TDR/QDR20 interface whereas TCR82 series support two Room Display Interfaces. The TCR80 series controllers have duplicate functionality for both zone 1 and 2.

### ZONE 1 AND ZONE 2 CONTROL MODES

Both Zone 1 and Zone 2 have three control modes:-

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

The controller operating mode is changed via Modbus/BACnet network, via Universal Inputs or via corresponding TDR20/QDR20 Touchscreen Room Interface Unit (Status read from Modbus Slave 1/2, Reg 424, written to Reg 604). The TDR/QDR20 Room Display Interfaces allow the user to change the operating mode via the display, or if the Interface has been fitted with Occupancy sensor, the occupancy detection can change the mode.

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 684 / 2684)

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.

The control loop outputs (demand signals) are set in different modes as per the below table. Each zone has corresponding control loops and control loop outputs.

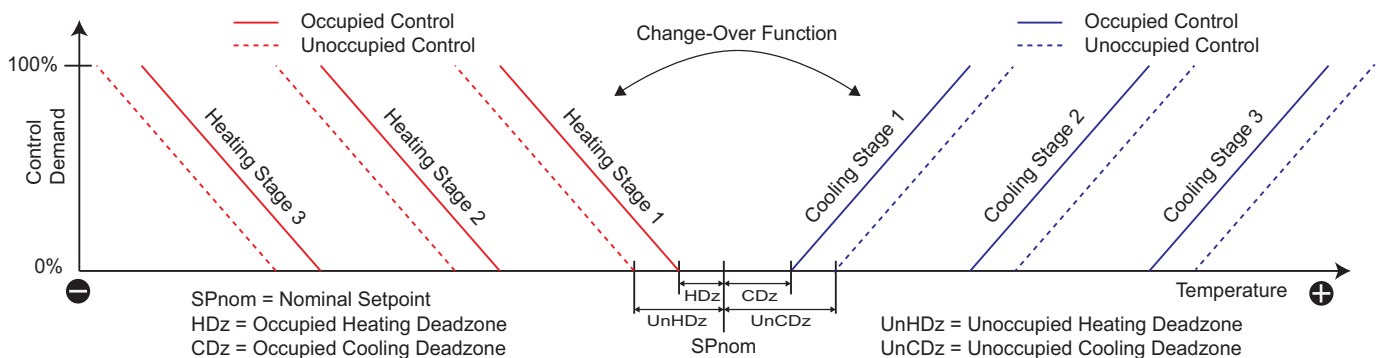
| Control Mode | Zone 1 and Zone 2 Heating and Cooling Stages 1/2/3 Demand | Air Quality CO <sub>2</sub> and VOC Control Demand | Humidity and Dehumidify Control Demand, Fan Demand |
|--------------|---|--|--|
| Occupied     | Based on control loop with occupied deadzone settings     | Based on control loop                              | Based on control loop                              |
| Unoccupied   | Based on control loop with unoccupied deadzone settings   | Based on control loop                              | Based on control loop                              |
| Off          | 0%<br>(Frost logic enables heating stages to 100%)        | 0%   | 0%   |

NOTE: On power up the controller both zones start in Occupied (Comfort) mode.

### ZONE 1 AND ZONE 2 MULTI-STAGE TEMPERATURE CONTROL

The each zone of the controller has a 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 loops (Zone 1 and Zone 2) can be configured to control Universal Input 1/2/3/4 temperature/voltage, network value (network temperature), TVD/QDR20 Room Display Temperature or average temperature.



NOTE: TDR20/QDR20 Device ID 1 is automatically linked to Zone 1 (Modbus Slave 1) and Device ID 2 (Modbus Slave 2) is automatically linked to Zone 2.

NOTE: Corresponding TDR20/QDR20 Room Display Interface is required to be activated in the System Settings menu.

The each zone's control loop controls to the Calculated Setpoint. The calculated setpoint is set to nominal setpoint when the nominal setpoint is changed over the Modbus/BACnet network. If the user changes the setpoint on the Room Display (Modbus Reg 418), the new setpoint is automatically read to the TCR80 series controller. In case the Room Display for the Zone 1 is active, and the BMS changes the nominal setpoint, this is also sent to the Room Display.

NOTE: *Source: 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 for the zone are switched on to 100% until temperature rises 2° above the Frost Setpoint.

| Parameter                              | Description  | Value Range / Enumerations  |
|--|--|---|
| <b>ZONE 1 PARAMETERS</b>               |  |   |
| Z1 Loop Source                         | Sets the Control Source for the Multi-Stage Control Loop for Zone 1.<br><br>Zone 1 Temperature is read from the Room Device 1 (Modbus Slave 1, Reg 400).<br><br>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.<br><br>Average Function allows temperature averaging. | 0 = Network Value (Reg 600)<br>1 = Zone Temperature (Default)<br>2 = UI1 - NTC10<br>3 = UI2 - NTC10<br>4 = UI3 - NTC10<br>5 = UI4 - NTC10<br>6 = UI1 - 0..10Vdc<br>7 = UI2 - 0..10Vdc<br>8 = UI3 - 0..10Vdc<br>9 = UI4 - 0..10Vdc<br>10 = Average Value |
| Z1 Nominal Setpoint                    | Zone 1 Control Loop Nominal Setpoint<br>Note: The control loop setpoint can be shifted by the high/low limit reset function.   | 0.0..212.0 (Default 21.0)   |
| Z1 Loop PB                             | Zone 1 Control Loop Proportional Band (for each stage)   | 1..500 (Default 5)  |
| Z1 IA                                  | Zone 1 Control Loop Integral Action Time (Set to 0 to disable)   | 0..3600s (Default 600s)   |
| Z1 No of Heating Stages                | Sets the number of heating stages for Zone 1.  | 0 = None<br>1 = 1-Stage (Default)<br>2 = 2-Stages<br>3 = 3-Stages   |
| Z1 No of Cooling Stages                | Sets the number of cooling stages for Zone 1.  | 0 = None<br>1 = 1-Stage (Default)<br>2 = 2-Stages<br>3 = 3-Stages   |
| Z1 Occupied Heating Deadzone (HDz)     | Occupied Mode Heating Deadzone for Zone 1.   | 0.0..30.0 (Default 0.5)   |
| Z1 Occupied Cooling Deadzone (CDz)     | Occupied Mode Cooling Deadzone for Zone 1.   | 0.0..30.0 (Default 0.5)   |
| Z1 Unoccupied Heating Deadzone (UnHDz) | Unoccupied Mode Heating Deadzone for Zone 1.   | 0.0..30.0 (Default 3.0)   |
| Z1 Unoccupied Cooling Deadzone (UnCDz) | Unoccupied Mode Cooling Deadzone for Zone 1.   | 0.0..30.0 (Default 3.0)   |
| Z1 Frost Setpoint                      | Off Mode Frost Setpoint for Zone 1   | 0.0..60.0 (Default 10.0)  |

| Parameter                              | Description  | Value Range / Enumerations   |
|--|--|--|
| <b>ZONE 2 PARAMETERS</b>               |  |  |
| Z2 Loop Source                         | Sets the Control Source for the Multi-Stage Control Loop for Zone 2.<br><br>Zone Temperature is read from the Room Display 2 (Modbus Slave 2, Reg 400)<br><br>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.<br><br>Average Function allows temperature averaging. | 0 = Network Value (Reg 602)<br>1 = Zone Temperature (Default)<br>2 = UI1 - NTC10<br>3 = UI2 - NTC10<br>4 = UI3 - NTC10<br>5 = UI4 - NTC10<br>6 = UI1 - 0..10Vdc<br>7 = UI2 - 0..10Vdc<br>8 = UI3 - 0..10Vdc<br>9 = UI4 - 0..10Vdc<br>10 = Average Function |
| Z2 Nominal Setpoint                    | Zone 2 Control Loop Nominal Setpoint<br>Note: The control loop setpoint can be shifted by the high/low limit reset function.   | 0.0..212.0 (Default 21.0)  |
| Z2 Loop PB                             | Zone 2 Control Loop Proportional Band (for each stage)   | 1..500 (Default 5)   |
| Z2 IA                                  | Zone 2 Control Loop Integral Action Time (Set to 0 to disable)   | 0..3600s (Default 600s)  |
| Z2 No of Heating Stages                | Sets the number of heating stages for Zone 2.  | 0 = None<br>1 = 1-Stage (Default)<br>2 = 2-Stages<br>3 = 3-Stages  |
| Z2 No of Cooling Stages                | Sets the number of cooling stages for Zone 2.  | 0 = None<br>1 = 1-Stage (Default)<br>2 = 2-Stages<br>3 = 3-Stages  |
| Z2 Occupied Heating Deadzone (HDz)     | Occupied Mode Heating Deadzone for Zone 2.   | 0.0..30.0 (Default 0.5)  |
| Z2 Occupied Cooling Deadzone (CDz)     | Occupied Mode Cooling Deadzone for Zone 2.   | 0.0..30.0 (Default 0.5)  |
| Z2 Unoccupied Heating Deadzone (UnHDz) | Unoccupied Mode Heating Deadzone for Zone 2.   | 0.0..30.0 (Default 3.0)  |
| Z2 Unoccupied Cooling Deadzone (UnCDz) | Unoccupied Mode Cooling Deadzone for Zone 2.   | 0.0..30.0 (Default 3.0)  |
| Z2 Frost Setpoint                      | Off Mode Frost Setpoint for Zone 2   | 0.0..60.0 (Default 10.0)   |

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.

**ZONE 1 AND ZONE 2 CHANGE-OVER FUNCTION**

The controller can have a change-over function for each zone that reverses the corresponding temperature control loop Heating Stage1 (and Cooling Stage1) operation.

The change-over function is activated by the digital input (UI1/UI2/UI3/UI4 digital input), via temperature (UI1/UI2/UI3/UI4 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  |
|--------------------------|---|---|
| <b>ZONE 1 PARAMETERS</b> |   |   |
| Z1 Change-Over Source    | Sets the Source for the Zone 1 Change-Over Function.<br><br>Note: As default the Network Command is Off i.e. no change-over function is active.<br><br>Note: When using Digital Inputs set the corresponding universal input mode to '5 - Digital Network'. | 0 = Network Command<br>1 = UI1 - NTC10<br>2 = UI2 - NTC10<br>3 = UI3 - NTC10<br>4 = UI4 - NTC10<br>5 = Digital Input 1 (UI1)<br>6 = Digital Input 2 (UI2)<br>7 = Digital Input 3 (UI3)<br>8 = Digital Input 4 (UI4) |

|                                 |  |                                      |
|---------------------------------|--|--------------------------------------|
| Z1 Change-Over Low Level        | Temperature below which the change-over is active for Zone 1 (cooling stage active). Note: Relevant only for NTC Input 1/2/3/4 options.                      | 0..100.0° (32..212°F) Default 18°C   |
| Z1 Change-Over High Level       | Temperature above which the change-over is off for Zone 1 (heating stage active, no override on control). Note: Relevant only for NTC Input 1/2/3/4 options. | 0..100.0° (32..212°F) Default 22°C   |
| Z1 Network Change-Over Override | Heating / Cooling Mode Command from Network for Zone 1. Note: Requires change-over source to be set as Network.  | 0 = Heating (Default)<br>1 = Cooling |

| Parameter                       | Description   | Value Range / Enumerations  |
|---------------------------------|---|---|
| <b>ZONE 2 PARAMETERS</b>        |   |   |
| Z2 Change-Over Source           | Sets the Source for the Zone 2 Change-Over Function.<br><br>Note: As default the Network Command is Off i.e. no change-over function is active.<br>Note: When using Digital Inputs set the corresponding universal input mode to '5 - Digital Network'. | 0 = Network Command<br>1 = UI1 - NTC10<br>2 = UI2 - NTC10<br>3 = UI3 - NTC10<br>4 = UI4 - NTC10<br>5 = Digital Input 1 (UI1)<br>6 = Digital Input 2 (UI2)<br>7 = Digital Input 3 (UI3)<br>8 = Digital Input 4 (UI4) |
| Z2 Change-Over Low Level        | Temperature below which the change-over is active for Zone 2 (cooling stage active). Note: Relevant only for NTC Input 1/2/3/4 options.   | 0..100.0° (32..212°F) Default 18°C  |
| Z2 Change-Over High Level       | Temperature above which the change-over is off for Zone 2 (heating stage active, no override on control). Note: Relevant only for NTC Input 1/2/3/4 options.  | 0..100.0° (32..212°F) Default 22°C  |
| Z2 Network Change-Over Override | Heating / Cooling Mode Command from Network for Zone 2. Note: Requires change-over source to be set as Network.   | 0 = Heating (Default)<br>1 = Cooling  |

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

TIP: Typically configure the control output (Y1 to Y4) to Z1/Z2 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).

**ZONE 1 AND ZONE 2 LOW/HIGH LIMIT RESET (CASCADE) CONTROL FUNCTION**

The controller has a low/high limit reset control function for each zone 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.

NOTE: Low/High limit function only applies in Occupied and Unoccupied modes.

| Parameter                | Description   | Value Range / Enumerations   |
|--------------------------|---|--|
| <b>ZONE 1 PARAMETERS</b> |   |  |
| Z1 Reset Control Source  | Sets the Temperature Source for the Reset Control Function for Zone 1.  | 0 = Network Value (Reg 600)<br>1 = UI1 - NTC10<br>2 = UI2 - NTC10<br>3 = UI3 - NTC10<br>4 = UI4 - NTC10<br>5 = Disable (Default) |
| Z1 High Limit Setpoint   | High Limit Setpoint for Zone 1. 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   |
| Z1 Low Limit Setpoint    | Low Limit Setpoint for Zone 1. 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   |
| Z1 Reset Ratio           | Reset ratio used to calculated the Zone 1 Multi-Stage Setpoint reset for Zone 1.  | 0.0..10.0 (Default 1.0)  |

| Parameter                | Description   | Value Range / Enumerations   |
|--------------------------|---|--|
| <b>ZONE 2 PARAMETERS</b> |   |  |
| Z2 Reset Control Source  | Sets the Temperature Source for the Reset Control Function for Zone 2.  | 0 = Network Value (Reg 602)<br>1 = UI1 - NTC10<br>2 = UI2 - NTC10<br>3 = UI3 - NTC10<br>4 = UI4 - NTC10<br>5 = Disable (Default) |
| Z2 High Limit Setpoint   | High Limit Setpoint for Zone 2. 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   |
| Z2 Low Limit Setpoint    | Low Limit Setpoint for Zone 2. 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   |
| Z2 Reset Ratio           | Reset ratio used to calculated the Zone 2 Multi-Stage Setpoint reset for Zone 2.  | 0.0..10.0 (Default 1.0)  |

**ZONE 1 AND ZONE 2 MAX FUNCTION**

Each zone of 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   |
|----------------------------|--|--|
| <b>ZONE 1 PARAMETERS</b>   |  |  |
| Z1 Max Function 1 Source 1 | Sets the Source for Input 1 of Z1 Maximum Function 1<br>Default: Heating Stage 1 | 0 = Network Value (Reg 600)  |
| Z1 Max Function 1 Source 2 | Sets the Source for Input 2 of Z1 Maximum Function 1<br>Default: Cooling Stage 1 | 1 = Z1 Heating Stage 1<br>2 = Z1 Heating Stage 2<br>3 = Z1 Heating Stage 3   |
| Z1 Max Function 2 Source 1 | Sets the Source for Input 1 of Z1 Maximum Function 2<br>Default: Cooling Stage 1 | 4 = Z1 Cooling Stage 1<br>5 = Z1 Cooling Stage 2<br>6 = Z1 Cooling Stage 3   |
| Z1 Max Function 2 Source 2 | Sets the Source for Input 2 of Z1 Maximum Function 2<br>Default: CO2 Demand      | 7 = Z1 CO2 Demand<br>8 = Z1 VOC Demand<br>9 = Z1 Humidity/DeHum Demand<br>10 = Z1 Max Function 1<br>11 = Z1 Max Function 2<br>12 = Z1 Fan Demand |
| <b>ZONE 2 PARAMETERS</b>   |  |  |
| Z2 Max Function 1 Source 1 | Sets the Source for Input 1 of Z2 Maximum Function 1<br>Default: Heating Stage 1 | 0 = Network Value (Reg 602)  |
| Z2 Max Function 1 Source 2 | Sets the Source for Input 2 of Z2 Maximum Function 1<br>Default: Cooling Stage 1 | 1 = Z2 Heating Stage 1<br>2 = Z2 Heating Stage 2<br>3 = Z2 Heating Stage 3   |
| Z2 Max Function 2 Source 1 | Sets the Source for Input 1 of Z2 Maximum Function 2<br>Default: Cooling Stage 1 | 4 = Z2 Cooling Stage 1<br>5 = Z2 Cooling Stage 2<br>6 = Z2 Cooling Stage 3   |
| Z2 Max Function 2 Source 2 | Sets the Source for Input 2 of Z2 Maximum Function 2<br>Default: CO2 Demand      | 7 = Z2 CO2 Demand<br>8 = Z2 VOC Demand<br>9 = Z2 Humidity/DeHum Demand<br>10 = Z2 Max Function 1<br>11 = Z2 Max Function 2<br>12 = Z2 Fan Demand |

**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.

**ZONE 1 AND ZONE 2 EC FAN AND 3-SPEED FAN CONTROL**

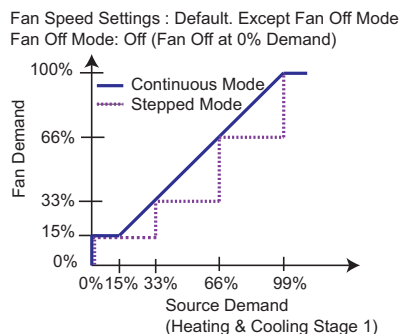
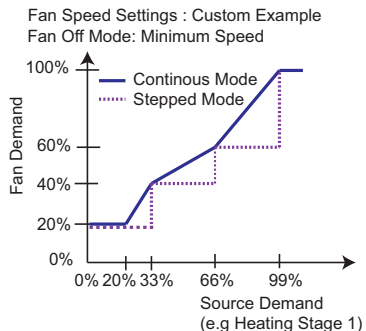
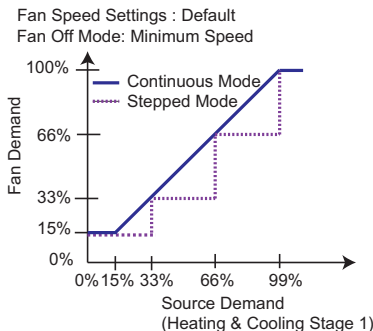
Fan control logic is used to control EC fans and 3-Speed fans. Fan control logic can follow Continuous or Stepped control. In Continuous control when the source (e.g. heating and cooling demand) increases the fan speed increases linearly between speed settings. The controller has fan control loop for each of the zones.

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 set 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*.

In stepped mode the Fan Speed is set in steps (for EC Fans or 3-Speed Fans) with 5% switching OFF hysteresis.

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.



| Parameter                | Description   | Value Range / Enumerations  |
|--------------------------|---|---|
| <b>ZONE 1 PARAMETERS</b> |   |   |
| Z1 Fan Control Source    | Sets the Source Demand for the Z1 Fan Control Function.   | 0 = Network Value (Reg 600)<br>1 = Z1 Heating Stage 1<br>2 = Z1 Heating Stage 2<br>3 = Z1 Heating Stage 3<br>4 = Z1 Cooling Stage 1<br>5 = Z1 Cooling Stage 2<br>6 = Z1 Cooling Stage 3<br>7 = Z1 CO2 Demand<br>8 = Z1 VOC Demand<br>9 = Z1 Humidity/DeHum Demand<br>10 = Z1 Max Function 1 (Default)<br>11 = Z1 Max Function 2 |
| Z1 Min Fan Speed         | Sets the Z1 Minimum Fan Speed for EC Fans   | 0..100% (Default 15%)   |
| Z1 Fan Speed 1           | Sets the Z1 Fan Speed 1 for EC Fans (when source 33%)   | 0..100% (Default 33%)   |
| Z1 Fan Speed 2           | Sets the Z1 Fan Speed 2 for EC Fans (when source 66%)   | 0..100% (Default 66%)   |
| Z1 Fan Speed 3           | Sets the Z1 Fan Speed 3 for EC Fans (when source 99%)   | 0..100% (Default 100%)  |
| Z1 Fan Mode              | Sets the Z1 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)<br>1 = Stepped Mode   |
| Z1 Fan Off Mode          | Configures if the Fan is running at minimum level or is off when the fan control demand is at 0% for Z1.  | 0 = Off (Default)<br>1 = Minimum Speed  |

|                       |  |   |
|-----------------------|--|---|
| Z1 Fan Off Delay      | Switch OFF delay when the source demand drops to 0 (and Fan Off Mode is set to Off) for Z1   | 0..600 seconds (Default 0)  |
| Z1 Fan Startup Delay  | Z1 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)   |
| Z1 Fan Level Override | Z1 Current Fan Level that can be set from the network. The value is also automatically sent to the corresponding Room Display Interface. | 0 = Off<br>1 = Level 1<br>2 = Level 2<br>3 = Level 3<br>4 = Automatic |
| Z1 Max Auto Fan Speed | Z1 Maximum Fan Speed in Automatic Control Mode   | 0..100% (Default 100%)  |

| Parameter                | Description   | Value Range / Enumerations  |
|--------------------------|---|---|
| <b>ZONE 2 PARAMETERS</b> |   |   |
| Z2 Fan Control Source    | Sets the Source Demand for the Z2 Fan Control Function.   | 0 = Network Value (Reg 602)<br>1 = Z2 Heating Stage 1<br>2 = Z2 Heating Stage 2<br>3 = Z2 Heating Stage 3<br>4 = Z2 Cooling Stage 1<br>5 = Z2 Cooling Stage 2<br>6 = Z2 Cooling Stage 3<br>7 = Z2 CO2 Demand<br>8 = Z2 VOC Demand<br>9 = Z2 Humidity/DeHum Demand<br>10 = Z2 Max Function 1 (Default)<br>11 = Z2 Max Function 2 |
| Z2 Min Fan Speed         | Sets the Z2 Minimum Fan Speed for EC Fans   | 0..100% (Default 15%)   |
| Z2 Fan Speed 1           | Sets the Z2 Fan Speed 1 for EC Fans (when source 33%)   | 0..100% (Default 33%)   |
| Z2 Fan Speed 2           | Sets the Z2 Fan Speed 2 for EC Fans (when source 66%)   | 0..100% (Default 66%)   |
| Z2 Fan Speed 3           | Sets the Z2 Fan Speed 3 for EC Fans (when source 99%)   | 0..100% (Default 100%)  |
| Z2 Fan Mode              | Sets the Z2 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)<br>1 = Stepped Mode   |
| Z2 Fan Off Mode          | Configures if the Fan is running at minimum level or is off when the fan control demand is at 0% for Z2.  | 0 = Off (Default)<br>1 = Minimum Speed  |
| Z2 Fan Off Delay         | Switch OFF delay when the source demand drops to 0 (and Fan Off Mode is set to Off) for Z2  | 0..600 seconds (Default 0)  |
| Z2 Fan Startup Delay     | Z2 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)   |
| Z2 Fan Level Override    | Z2 Current Fan Level that can be set from the network. The value is also automatically sent to the corresponding Room Display Interface Reg 606.  | 0 = Off<br>1 = Level 1<br>2 = Level 2<br>3 = Level 3<br>4 = Automatic   |
| Z2 Max Auto Fan Speed    | Z2 Maximum Fan Speed in Automatic Control Mode  | 0..100% (Default 100%)  |

**MANUAL FAN SPEED CONTROL**

If TDR20/QDR20 Room Display Interface is connected to the controller, the TCR80 controller reads the current fan level from the Room Display and sets the fan control logic to follow this. In essence values 0..3 are indicating manual fan speed overrides (no automatic control), and value 4 indicates automatic fan speed control..

The Fan Level override parameter (from BMS) allows the fan speed to be overridden from the network. If this value is changed, it will also be sent to the TDR20/QDR20 room interface device.

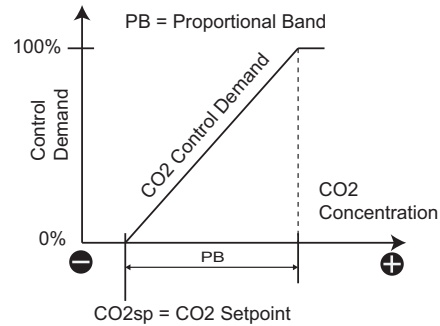
NOTE: The TCR83 controllers have 3 x 230V Fan Relays. The Y3 is inter-connected to the fan relays. Relay 1 comes on at approximately 30%, relay 2 at 65% and relay 3 at 99%. Configure Y3 to follow the Z1 Fan Speed, for the fan relays to follow the fan speed control logic.

**ZONE 1 AND ZONE 2 CO2 (CARBON DIOXIDE) CONTROL**

TCR80 series provides CO2 control loop for each zone 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.

The CO2 measurement can be read from the QDR20 Room Display Interface, from Universal Input or from the network.

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 TCR80 Series 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 for Zones 1 and 2).

| Parameter                | Description  | Value Range / Enumerations  |
|--------------------------|--|---|
| <b>ZONE 1 PARAMETERS</b> |  |   |
| Z1 CO2 Control Source    | Sets the Source for the CO2 Control for Zone 1<br><br>Zone CO2 Measurement is from Room Display Interface 1.<br><br>Note: If set to UI1/UI2/UI3/UI4, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters.                          | 0 = Network Value (Reg 601)<br>1 = Zone CO2 Measurement (Default)<br>2 = UI1 - 0..10V<br>3 = UI2 - 0..10V<br>4 = UI3 - 0..10V<br>5 = UI4 - 0..10V |
| Z1 CO2 Setpoint          | CO2 Control Setpoint for Zone 1  | 0..10,000 (Default 750)   |
| Z1 CO2 PB                | CO2 Control Proportional Band for Zone 1   | 1..10,000 (Default 500)   |
| Z1 CO2 IA                | CO2 Control Integral Action Time (Set to 0 to disable) for Zone 1  | 0..3600s (Default 0s)   |
| <b>ZONE 2 PARAMETERS</b> |  |   |
| Z2 CO2 Control Source    | Sets the Source for the CO2 Control for Zone 2<br><br>Zone CO2 Measurement is from Room Display Interface 2 (Modbus Slave 2, Reg 402)<br><br>Note: If set to UI1/UI2/UI3/UI4, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters. | 0 = Network Value (Reg 603)<br>1 = Zone CO2 Measurement (Default)<br>2 = UI1 - 0..10V<br>3 = UI2 - 0..10V<br>4 = UI3 - 0..10V<br>5 = UI4 - 0..10V |
| Z2 CO2 Setpoint          | CO2 Control Setpoint for Zone 2  | 0..10,000 (Default 750)   |
| Z2 CO2 PB                | CO2 Control Proportional Band for Zone 2   | 1..10,000 (Default 500)   |
| Z2 CO2 IA                | CO2 Control Integral Action Time (Set to 0 to disable) for Zone 2  | 0..3600s (Default 0s)   |

**ZONE 1 AND ZONE 2 VOC AIR QUALITY CONTROL**

TCR80 Series controllers can also control VOC (Organic Volatile Compound). 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. Each zone VOC measurement is received from the corresponding Room Display Interface, or from Network.

| Parameter                | Description   | Value Range / Enumerations  |
|--------------------------|---|---|
| <b>ZONE 1 PARAMETERS</b> |   |   |
| Z1 VOC Control Source    | Sets the Source for the VOC Control for Zone 1<br><br>Zone VOC Measurement is from Room Display Interface 1 (Modbus Slave 1, Reg 403) | 0 = Network Value (Reg 601)<br>1 = Zone VOC Measurement (Default) |
| Z1 VOC Setpoint          | Z1 VOC Control Setpoint   | 0..500 (Default 100)  |
| Z1 VOC PB                | Z1 VOC Control Proportional Band  | 1..500 (Default 100)  |
| Z1 VOC IA                | Z1 VOC Control Integral Action Time (Set to 0 to disable)   | 0..3600s (Default 0s)   |



| <b>ZONE 2 PARAMETERS</b> |   |   |
|--------------------------|---|---|
| Z2 VOC Control Source    | Sets the Source for the VOC Control for Zone 2<br><br>Zone VOC Measurement is from Room Display Interface 2 (Modbus Slave 2, Reg 403) | 0 = Network Value (Reg 603)<br>1 = Zone VOC Measurement (Default) |
| Z2 VOC Setpoint          | Z2 VOC Control Setpoint   | 0..500 (Default 100)  |
| Z2 VOC PB                | Z2 VOC Control Proportional Band  | 1..500 (Default 100)  |
| Z2 VOC IA                | Z2 VOC Control Integral Action Time (Set to 0 to disable)   | 0..3600s (Default 0s)   |

**ZONE 1 AND ZONE 2 HUMIDITY CONTROL**

The controller has a single stage humidity / dehumidity PI-control loop that calculates the loop demand based on the TDR/QDR20 humidity measurement or external humidity sensor measurement. Set the *Humidity Mode* to *Humidify* for humidifying action and to *De-Humidify* for dehumidifying action. Humidity measurement is received from the Room Display Interface from corresponding zone, or from Universal Input/Network.

| <b>Parameter</b>         | <b>Description</b>  | <b>Value Range / Enumerations</b>  |
|--------------------------|---|--|
| <b>ZONE 2 PARAMETERS</b> |   |  |
| Z1 Humidity Source       | Sets the Source for the Z1 Humidity Control.<br><br>Zone Humidity Measurement is from Room Display Interface 1 (Modbus Slave 1, Reg 401)<br><br>Note: If set to UI1/UI2/UI3/UI4, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters. | 0 = Network Value (Reg 600)<br>1 = Zone Humidity Measurement (Default)<br>2 = UI1 - 0..10V<br>3 = UI2 - 0..10V<br>4 = UI3 - 0..10V<br>5 = UI4 - 0..10V |
| Z1 Humidity Setpoint     | Z1 Humidity Control Loop Setpoint   | 0..100% (Default 50%)  |
| Z1 Humidity PB           | Z1 Humidity Control Proportional Band   | 1..100% (Default 20%)  |
| Z1 Humidity IA           | Z1 Humidity Control Integral Action Time (Set to 0 to disable)  | 0..3600s (Default 0s)  |
| Z1 Humidity Mode         | Z1 Humidity Loop Control Mode   | 0 = Humidify (Reverse)<br>1 = De-Humidify (Direct)   |
| <b>ZONE 2 PARAMETERS</b> |   |  |
| Z2 Humidity Source       | Sets the Source for the Z2 Humidity Control.<br><br>Zone Humidity Measurement is from Room Display Interface 2 (Modbus Slave 2, Reg 401)<br><br>Note: If set to UI1/UI2/UI3/UI4, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters. | 0 = Network Value (Reg 602)<br>1 = Zone Humidity Measurement (Default)<br>2 = UI1 - 0..10V<br>3 = UI2 - 0..10V<br>4 = UI3 - 0..10V<br>5 = UI4 - 0..10V |
| Z2 Humidity Setpoint     | Z2 Humidity Control Loop Setpoint   | 0..100% (Default 50%)  |
| Z2 Humidity PB           | Z2 Humidity Control Proportional Band   | 1..100% (Default 20%)  |
| Z2 Humidity IA           | Z2 Humidity Control Integral Action Time (Set to 0 to disable)  | 0..3600s (Default 0s)  |
| Z2 Humidity Mode         | Z2 Humidity Loop Control Mode   | 0 = Humidify (Reverse)<br>1 = De-Humidify (Direct)   |

**DEHUMIDIFICATION USING COOLING**

In addition the controller has dehumidification function where the corresponding zone 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).

| <b>Parameter</b>         | <b>Description</b>  | <b>Value Range / Enumerations</b>     |
|--------------------------|---|---------------------------------------|
| <b>ZONE 1 PARAMETERS</b> |   |                                       |
| Z1 Humidity Interlock    | Enables Cooling Stage 2 Interlock on High Humidity (at 50% humidity loop demand) for Zone 1 Humidity Loop | 0 = Disabled (Default)<br>1 = Enabled |
| <b>ZONE 2 PARAMETERS</b> |   |                                       |
| Z2 Humidity Interlock    | Enables Cooling Stage 2 Interlock on High Humidity (at 50% humidity loop demand) for Zone 2 Humidity Loop | 0 = Disabled (Default)<br>1 = Enabled |

NOTE: Register 424 (Zone 1) / 2424 (Zone 2) can be used to indicate the current cooling mode status.



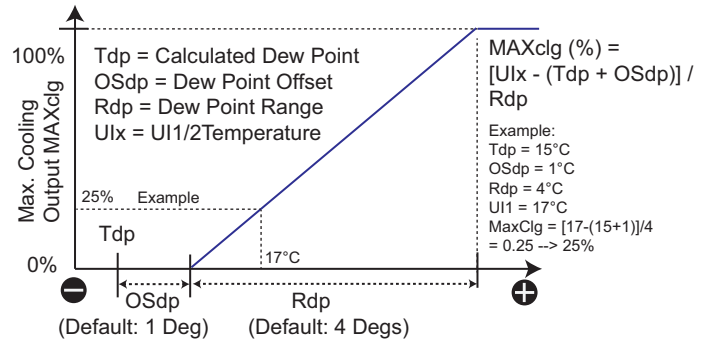
**ZONE 1 AND ZONE 2 CONDENSATION CONTROL**

In cooling systems (e.g. chilled beam) when the pipe surface temperature drops reaching the dew point, this creates a condensation risk. The TCR80 Series controller have protection logic to minimise the condensation. This can be activated by enabling 'Zone 1 Digital Cooling Disable' or 'Zone 2 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 corresponding Zone multi-stage control loop Cooling Stage Demands to 0% until the volt-free input is off (open contact).

Alternative method is to use a resistive condensation sensor 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 'Zone 1 Digital Cooling Disable' or 'Zone 2 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) on the TDR20/QDR20 Room Display Interfaces, the dew point temperature can be calculated by the relative humidity and temperature. The TCR80 series 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 UI1/2/3/4 to corresponding Zone 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.

NOTE: It is possible to use UI measurements to calculate the Dew Point. To activate this set the Multi-Stage Control Loop Source to corresponding temperature sensor, and Humidity Control Loop Source to corresponding remote humidity sensor measurement.

| Parameter                | Description  | Value Range / Enumerations               |
|--------------------------|--|--|
| <b>ZONE 1 PARAMETERS</b> |  |  |
| Z1 Dew Point Range       | Z1 Dew Point calculation range where the Dew Point based cooling max. position calculates linearly from 100% to 0% | 0..10 Degrees (Default 4)                |
| Z1 Dew Point Mode        | Z1 Dew Point Mode Selection  | 0 = On-Off<br>1 = Proportional (Default) |
| Z1 Dew Point Offset      | Z1 Dew Point Offset (from the calculated Dew Point) where the Dew Point based calculated max. position is 0%       | 0..5.0 Degrees (Default 1.0)             |
| <b>ZONE 2 PARAMETERS</b> |  |  |
| Z2 Dew Point Range       | Z2 Dew Point calculation range where the Dew Point based cooling max. position calculates linearly from 100% to 0% | 0..10 Degrees (Default 4)                |
| Z2 Dew Point Mode        | Z2 Dew Point Mode Selection  | 0 = On-Off<br>1 = Proportional (Default) |
| Z2 Dew Point Offset      | Z2 Dew Point Offset (from the calculated Dew Point) where the Dew Point based calculated max. position is 0%       | 0..5.0 Degrees (Default 1.0)             |

**ZONE 1 AND ZONE 2 BOOST FUNCTION**

The TCR80 series controller mode can be Boosted to Occupied by TDR20/QDR20 user interfaces. Please refer to TDR20/QDR20 documentation.

**ZONE 1 ECONOMISER (OUTSIDE AIR FREE COOLING)**

The controller has outside air Economiser function that allows the outdoor damper to be controlled by the cooling stage demand (*Economiser Source*) when the outside air temperature (*Economiser Limit Temp Source*) is below the *Economiser Limit Setpoint*. When the outside temperature exceeds the *Economiser Limit Setpoint + 2 degrees* the economiser output is set to be at the *Economiser Min Output* level.

To activate Economiser on the analogue output, set the corresponding analogue output to 29:*Economiser*.

NOTE: In the Off controller mode the economiser output is set to 0%.

| Parameter                    | Description  | Value Range / Enumerations   |
|------------------------------|--|--|
| Ecomiser Source              | Sets the Economiser Control Source (typically Cooling Stage 1)                                     | 0 = Z1_Cooling1 (Default)<br>1 = Z1_Cooling2<br>2 = Z1_Cooling3                        |
| Economiser Limit Temp Source | Temperature that the Economiser function is monitoring (typically outside air temperature sensor). | 0 = None (Default)<br>1 = UI1-NTC10<br>2 = UI2-NTC10<br>3 = UI3-NTC10<br>4 = UI4-NTC10 |
| Economiser Limit Temp        | Temperature Limit for the Economiser Output to Modulate  | 0..2120.0 (Default 15.0)   |
| Economiser Min. Output       | Minimum Output Level for the Economiser (min. damper position)                                     | 0..1000 (Default 15)   |

**MINIMUM DISCHARGE TEMPERATURE CONTROL**

The economiser function can also monitor the Air Discharge Temperature (set *Discharge Temp Source* to activate). If the discharge temp drops below *Discharge Min Temp*, the output is reduced by the amount set in the *Discharge Limit Band*. E.g. if Discharge Limit Band is 2 degrees then if Discharge Air Temp is 2 degrees below the Discharge Min Temp, the damper position is limited to the *Economiser Min Output* level.

| Parameter             | Description   | Value Range / Enumerations   |
|-----------------------|---|--|
| Discharge Temp Source | Discharge Temperature to be monitored                                     | 0 = None (Default)<br>1 = UI1-NTC10<br>2 = UI2-NTC10<br>3 = UI3-NTC10<br>4 = UI4-NTC10 |
| Discharge Min Temp    | Min. Temperature Limit for Discharge Temperature                          | 0..2120.0 (Default 15.0)   |
| Discharge Limit Band  | Discharge Limit Band (to modulate the economiser output to min. position) | 0..500.0 (Default 2.0)   |

**HEATING STAGE LOCKOUT FUNCTIONS**

**COMPRESSOR LOCKOUT (HEATING STAGE 1 & HEATING STAGE 2 LOCKOUT)**

The controller can monitor outside air temperature (791 Economiser Limit Temp Source). If the outside air temperature drops below the Compressor OAT Limit temperature, the heating stages 1 and 2 are force to 0% (stage 1 and stage 2 outputs are switched off). The logic has 2 degrees hysteresis.

**HEATING STAGE3 LOCKOUT (SUMMER LOCKOUT)**

The controller can monitor outside air temperature (791 Economiser Limit Temp Source). If the outside air temperature exceeds the Htg3 Lockout Temp limit, the Heating Stage 3 is switched to 0% (switched off).

| Parameter                 | Description  | Value Range / Enumerations            |
|---------------------------|--|---------------------------------------|
| Compressor Lockout Enable | Compressor Lockout (Heating Stage 1 and 2) Enable        | 0 = Disabled (Default)<br>1 = Enabled |
| Compressor OAT Low Limit  | Temperature Limit to Switch Heating Stages 1 and 2 to 0% | 0..2120.0 (Default 0)                 |
| Htg3 Lockout Enable       | Heating Stage 3 Lockout Enable                           | 0 = Disabled (Default)<br>1 = Enabled |
| Htg3 Lockout Temp         | Temperature Limit to Switch Heating Stage 3 to 0%        | 0..2120.0 (Default 15.0)              |

**AVERAGE FUNCTION**

Average Function can be used to average multiple measurements, and then use this value in the Z1 and Z2 control logic.

| Parameter     | Description   | Value Range / Enumerations   |
|---------------|---|--|
| Measurement 1 | Sets the Source for Average Measurement 1.  | 0 = Disabled (Default)<br>1 = UI1<br>2 = UI2<br>3 = UI3<br>4 = UI4<br>5 = Z1 Temperature<br>6 = Z2 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.<br>NOTE: Options 1-4 use Register 460-463 values allowing averaging to be done both NTC10 and voltage. |  |

**OUTPUT EXERCISE FUNCTION**

The TCR80 series controllers have Valve 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 1..15 days.

| Parameter             | Description   | Value Range / Enumerations                 |
|-----------------------|---|--|
| Valve Exercise Period | Sets the period of inactivity to activate the corresponding output.   | 0..15 days (Default 14 days)               |
| Y1 Exercise Time      | Analogue Output 1 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y1 Exercise Time          | 0..15 Minutes (Default: 0)<br>0 = Disabled |
| Y2 Exercise Time      | Analogue Output 2 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y2 Exercise Time          | 0..15 Minutes (Default: 0)<br>0 = Disabled |
| Y2 Exercise Time      | Analogue Output 3 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y3 Exercise Time          | 0..15 Minutes (Default: 0)<br>0 = Disabled |
| Y2 Exercise Time      | Analogue Output 4 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y4 Exercise Time          | 0..15 Minutes (Default: 0)<br>0 = Disabled |
| TR1 Exercise Time     | Triac Output 1 Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR1 Exercise Time | 0..15 Minutes (Default: 0)<br>0 = Disabled |
| TR2 Exercise Time     | Triac Output 2 Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR2 Exercise Time | 0..15 Minutes (Default: 0)<br>0 = Disabled |
| TR3 Exercise Time     | Triac Output 3 Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR3 Exercise Time | 0..15 Minutes (Default: 0)<br>0 = Disabled |
| TR4 Exercise Time     | Triac Output 4 Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR4 Exercise Time | 0..15 Minutes (Default: 0)<br>0 = Disabled |

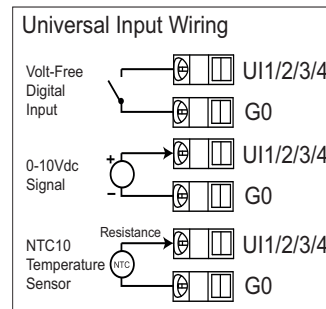
Universal Input can be configured to operate as NCT10 (resistive), Dew Point Sensor, Analogue (0..10V), Condensation Sensor (Resistive) or Digital On/Off. Configure and wire inputs as required by the application operation using the diagram as guidance.

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.

Z1/Z2 Dew Point Sensor: Uses the NTC10 Sensor for Dew Point Calculation Logic for the selected zone.

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

Condensation Sensor Option: Uses resistive condensation sensor.



| Parameter      | Description  | Value Range / Enumerations   |
|----------------|--|--|
| UI1 Mode       | Sets the Universal Input 1 Mode.   | 0 = Not Used<br>1 = 0..10V (0..100%)<br>2 = NTC10 (Default)<br>3 = Z1 Dew Point (NTC10)<br>4 = Z2 Dew Point (NTC10)<br>5 = Digital - Network<br>6 = Digital - Z1 Disable Cooling / Resistive Condensation Sensor<br>7 = Digital - Z2 Disable Cooling / Resistive Condensation Sensor<br>8 = Digital - Z1 Occupied<br>9 = Digital - Z1 Unoccupied<br>10 = Digital -Z1 Off<br>11 = Digital -Z1 Unocc/Occ<br>12 = Digital -Z1 Off / Occ<br>13 = Digital -Z2 Occupied<br>14 = Digital -Z2 Unoccupied<br>15 = Digital -Z2 Off<br>16 = Digital -Z2 Unocc / Occ<br>17 = Digital -Z2 Off / Occ |
| UI2 Mode       | Sets the Universal Input 2 Mode.   |  |
| UI3 Mode       | Sets the Universal Input 3 Mode.   |  |
| UI4 Mode       | Sets the Universal Input 4 Mode.<br><br>Note: Options 8,9,10, 13, 14 and 15 override to selected controller mode on OFF to ON transition.<br>Note: Option 11/16 overrides to Occupied Mode on ON transition and Unoccupied Mode on OFF transition.<br>Note: Option 12/17 overrides to Occupied Mode on ON transition and Off Mode on OFF transition.<br>Note: When setting Universal Input to Digital modes, reset (apply changes) is required after the change to activate the correct state. |  |
| 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)  |
| UI3 Scale Min. | Sets the scaling for Min. Measurement when UI3 @ 0V (0%)   | 0.0..3000.0 (Default 0)  |
| UI3 Scale Max. | Sets scaling for the Max. Measurement when UI3 @ 10V (100%)  | 0.0..3000.0 (Default 100.0)  |
| UI4 Scale Min. | Sets the scaling for Min. Measurement when UI4 @ 0V (0%)   | 0.0..3000.0 (Default 0)  |
| UI4 Scale Max. | Sets scaling for the Max. Measurement when UI4 @ 10V (100%)  | 0.0..3000.0 (Default 100.0)  |

UI1/UI2/UI3/UI4 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. Other example, if the CO2 transmitter uses range 0..5,000ppm, set *UI Scale Max.* to 3,000 and *UI Voltage Max* to 6V. This scales input to operate 0..6V = 0..3,000ppm.

NOTE: Using the scaling it is possible also connect pressure sensors to the controller. The controllers have also advanced UI1/UI2/UI3/UI4 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).

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) for the corresponding Zone related outputs.

NOTE: TCR83 controllers have 3 x 0-10Vdc analogue outputs. Output Y3 is linked to the 230V Fan Relay Control. For fan control set the Y3 Mode = Z1 Fan Demand (default).

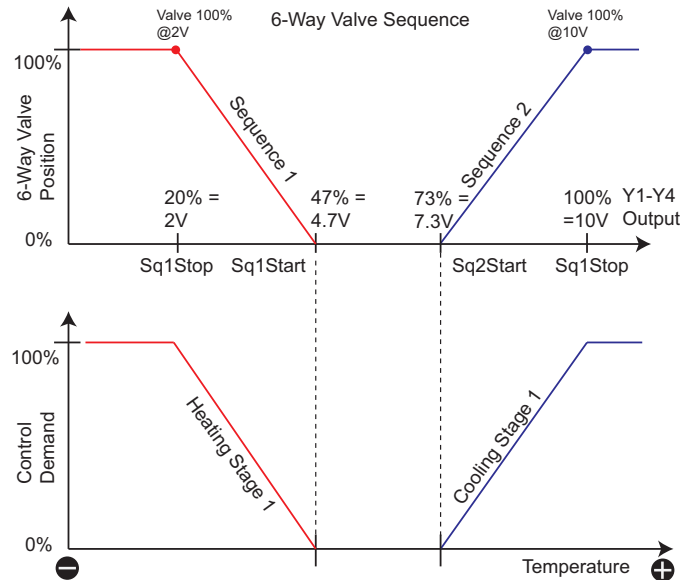
| Parameter      | Description  | Value Range / Enumerations   |
|----------------|--|--|
| Y1 Output Mode | Y1 Output Configuration<br>Default: Z1 Heating Stage 1   | 0 = Network Value<br>1 = Z1 Heating Stage 1  |
| Y2 Output Mode | Y2 Output Configuration<br>Default: Z1 Cooling Stage 1   | 2 = Z1 Heating Stage 2<br>3 = Z1 Heating Stage 3<br>4 = Z1 Cooling Stage 1   |
| Y3 Output Mode | Y3 Output Configuration<br>Default: Z1 Fan Speed Control   | 5 = Z1 Cooling Stage 2<br>6 = Z1 Cooling Stage 3<br>7 = Z1 CO2 Demand<br>8 = Z1 VOC Demand   |
| Y4 Output Mode | Y4 Output Configuration<br>Default: Z1 CO2 Control<br><br>Note: For Modbus to override the output from the network set the mode to network.<br><br>Note: For BACnet the output can be overridden using corresponding AV objects. | 9 = Z1 Humidity/DeHum Demand<br>10 = Z1 Max Function 1<br>11 = Z1 Max Function 2<br>12 = Z1 Fan Demand<br>13 = Z1 6-Way Valve<br>14 = Z1 Reverse 6-Way Valve<br>15 = Z2 Heating Stage 1<br>16 = Z2 Heating Stage 2<br>17 = Z2 Heating Stage 3<br>18 = Z2 Cooling Stage 1<br>19 = Z2 Cooling Stage 2<br>20 = Z2 Cooling Stage 3<br>21 = Z2 CO2 Demand<br>22 = Z2 VOC Demand<br>23 = Z2 Humidity/DeHum Demand<br>24 = Z2 Max Function 1<br>25 = Z2 Max Function 2<br>26 = Z2 Fan Demand<br>27 = Z2 6-Way Valve<br>28 = Z2 Reverse 6-Way Valve<br>29 = Economiser |
| 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 'Z1 6-way valve' or 'Z2 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 'Z1 Reverse 6-Way Valve' or 'Z1 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. The parameters apply for both Zone 1 and Zone 2.



| 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) |

**3-SPEED FAN CONTROL**

TCR83 controllers have 3 x 230V Fan Relays. The Y3 is inter-connected to the fan relays. Relay 1 comes on at approximately 30%, relay 2 at 65% and relay 3 at 99%. Configure Y3 to follow the Z1 Fan Speed, for the fan relays to follow the fan speed control logic. It also also recommended to set the

## Digital Output Control Options

### DIGITAL TRIAC OUTPUT CONTROL OPTIONS

The TCR81 series controllers have 2 x 24Vac Triac and TCR82 Series controllers have 4 x 24Vac Triac. 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).

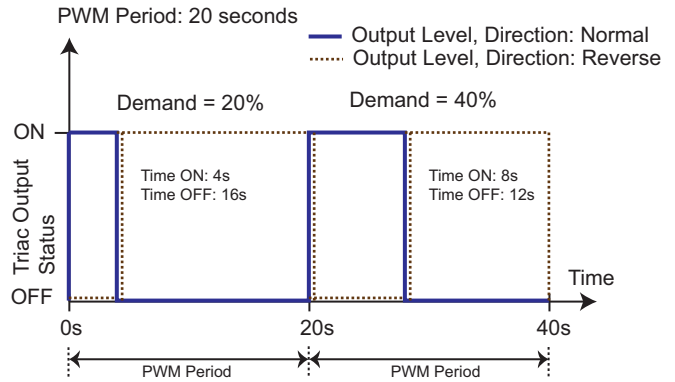
After controller reset the threepoint function drives the close triac for the run time period after which it resumes in normal operation.

NOTE: TR3 and TR4 are only available with the TCR81 Series.

#### 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.



| Parameter             | Description  | Value Range / Enumerations  |
|-----------------------|--|---|
| ThreePoint1 Mode      | Threepoint 1 Mode (=Source)  | 0 = None (Default)<br>1 = Network Value<br>2 = Z1 Heating Stage 1<br>3 = Z1 Heating Stage 2<br>4 = Z1 Heating Stage 3<br>5 = Z1 Cooling Stage 1<br>6 = Z1 Cooling Stage 2<br>7 = Z1 Cooling Stage 3<br>8 = Z1 CO2 Demand<br>9 = Z1 VOC Demand<br>10 = Z1 Humidity/DeHum Demand<br>11 = Z1 Max Function 1<br>12 = Z1 Max Function 2<br>13 = Z1 Fan Demand<br>14 = Z2 Heating Stage 1<br>15 = Z2 Heating Stage 2<br>16 = Z2 Heating Stage 3<br>17 = Z2 Cooling Stage 1<br>18 = Z2 Cooling Stage 2<br>19 = Z2 Cooling Stage 3<br>20 = Z2 CO2 Demand<br>21 = Z2 VOC Demand<br>22 = Z2 Humidity/DeHum Demand<br>23 = Z2 Max Function 1<br>24 = Z2 Max Function 2<br>25 = Z2 Fan Demand |
| ThreePoint2 Mode      | Threepoint 2 Mode (=Source)  |   |
| 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<br>Default: Z1 Heating Stage 1   | 0 = Network Value<br>1 = Z1 Heating Stage 1<br>2 = Z1 Heating Stage 2<br>3 = Z1 Heating Stage 3<br>4 = Z1 Cooling Stage 1<br>5 = Z1 Cooling Stage 2<br>6 = Z1 Cooling Stage 3<br>7 = Z1 CO2 Demand<br>8 = Z1 VOC Demand<br>9 = Z1 Humidity/DeHum Demand<br>10 = Z1 Max Function 1<br>11 = Z1 Max Function 2<br>12 = Z1 Fan Demand<br>13 = Z1 Fan Speed 1<br>14 = Z1 Fan Speed 2<br>15 = Z1 Fan Speed 3<br>16 = Z2 Heating Stage 1<br>17 = Z2 Heating Stage 2<br>18 = Z2 Heating Stage 3<br>19 = Z2 Cooling Stage 1<br>20 = Z2 Cooling Stage 2<br>21 = Z2 Cooling Stage 3<br>22 = Z2 CO2 Demand<br>23 = Z2 VOC Demand<br>24 = Z2 Humidity/DeHum Demand<br>25 = Z2 Max Function 1<br>26 = Z2 Max Function 2<br>27 = Z2 Fan Demand<br>28 = Z2 Fan Speed 1<br>29 = Z2 Fan Speed 2<br>30 = Z2 Fan Speed 3<br>31 = None<br>32 = Cooling Active<br>33 = Heating Active |
| TR2 Output Mode | Triac Output 2 Configuration<br>Default: Z1 Cooling Stage 1   |   |
| TR3 Output Mode | Triac Output 3 Configuration<br>Default: Z1 Heating Stage 2   |   |
| TR4 Output Mode | Triac Output 4 Configuration<br>Default: Z1 Cooling Stage 2   |   |
|                 | Note: Outputs are controlled using either PWM or On/Off Modes (set by TRx Mode parameters).<br><br>Note: With options 13-15 and 27-39, set Fan Mode = Stepped and corresponding Triac Output Type = On-Off. |   |
| 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 whne 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)<br>1 = Reverse   |
| TR2 Direction   | Triac Output 2 Direction  |   |
| TR3 Direction   | Triac Output 3 Direction  |   |
| TR4 Direction   | Triac Output 4 Direction  |   |



## 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 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.

### 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 data (temperature, humidity, CO2, VOC etc. - see below table for default configuration) on scheduled intervals (1 to 60 minutes, default 10 minutes).

| LoraWan Uplink Register | DEFAULT REGISTERS  |  |               |
|-------------------------|--------------------|--|---------------|
|                         | Parameter          | Description  | TCR80 Def Reg |
| 1 - 850                 | Temperature Sensor | Zone 1 TDR/QDR Sensor Temperature Measurement.       | 400           |
| 2 - 851                 | Humidity Sensor    | Zone 1 TDR/QDR Humidity Measurement.                 | 401           |
| 3 - 852                 | CO2 Sensor         | Zone 1 TDR/QDR CO2 Reading.                          | 402           |
| 4 - 853                 | VOC Sensor         | Zone 1 TDR/QDR VOC (Volatile Organic Compound) Index | 403           |
| 5 - 854                 | Temperature Sensor | Zone 2 TDR/QDR Sensor Temperature Measurement.       | 405           |
| 6 - 855                 | Humidity Sensor    | Zone 2 TDR/QDR Humidity Measurement.                 | 406           |
| 7 - 856                 | CO2 Sensor         | Zone 2 TDR/QDR CO2 Reading.                          | 407           |
| 8 - 857                 | VOC Sensor         | Zone 2 TDR/QDR VOC (Volatile Organic Compound) Index | 408           |
| 9 - 858                 | AO1                | Analogue Output Y1                                   | 464           |
| 10 - 859                | AO2                | Analogue Output Y2                                   | 465           |
| 11 - 860                | AO3                | Analogue Output Y3                                   | 466           |
| 12 - 861                | AO4                | Analogue Output Y4                                   | 467           |

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 DownLink Register | DEFAULT REGISTERS   |                         |               |
|---------------------------|---------------------|-------------------------|---------------|
|                           | Parameter           | Description             | TCR80 Def Reg |
| 1 - 862                   | Z1 Nominal Setpoint | Zone 1 Nominal Setpoint | 701           |
| 2 - 863                   | Disabled            | Disabled                | 0 - Disabled  |
| 3 - 864                   | Disabled            | Disabled                | 0 - Disabled  |
| 4 - 865                   | Disabled            | Disabled                | 0 - Disabled  |
| 5 - 866                   | Disabled            | Disabled                | 0 - Disabled  |
| 6 - 867                   | Disabled            | Disabled                | 0 - Disabled  |

## 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

### 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 using bit switches or through Windows Smart Configuration Tool / iOS Smart Phone App.

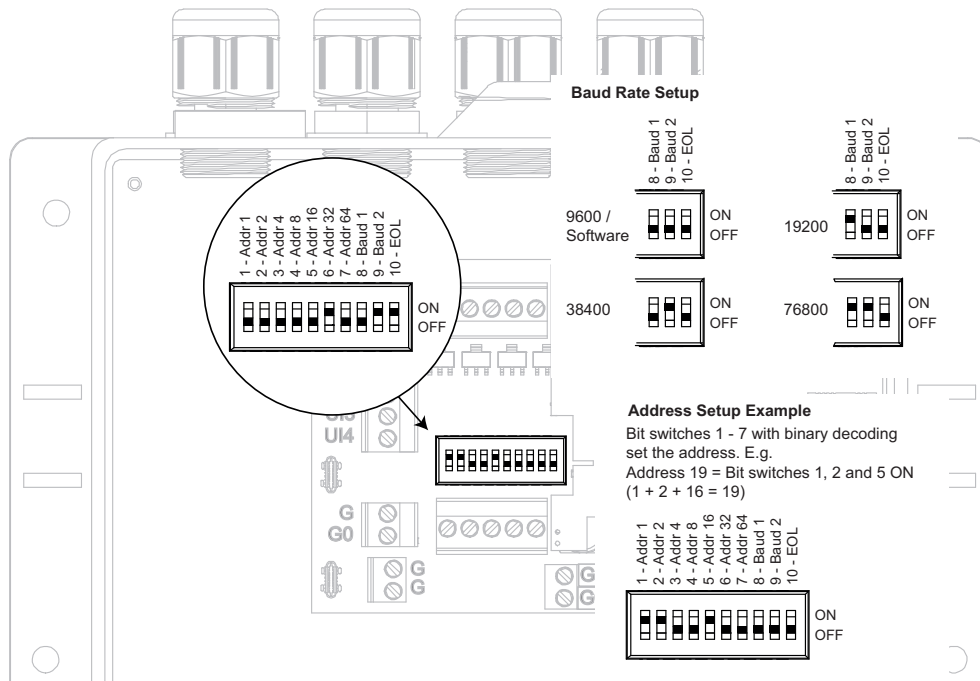
Bit switches 1-7 act as a binary decoder to set the (slave/MAC) address. Set these bit switches to OFF position if the address is configured by the software.

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: Default Modbus Baudrate is 9600, Parity None, 1 Stop Bit.

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



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

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

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

| LIVE DATA   |  |  |        |                            |   |     |
|---|--|--|--------|----------------------------|---|-----|
| Parameter   | Description  | MODBUS INPUT REGISTERS -<br>FUNCTION CODE 04<br>MODBUS HOLDING REGISTER -<br>FUNCTION CODES 03, (06), 16 |        |                            | Value Range /<br>Enumerations                       | R/W |
|   |  | Reg  | Type   | Data Range<br>(multiplier) |   |     |
| <b>ZONE MEASUREMENTS (FROM TDR20 AND QDR20 ROOM DISPLAY INTERFACES)</b> |  |  |        |                            |   |     |
| Z1 Temperature  | Displays current Zone 1 temperature measurement reading<br>Note: Value depends on the temperature unit °C/°F selection | 400  | int16  | -400..2480 (x10)           | -40.0..120.0°C /<br>-40.0..248.0°F                  | R   |
| Z1 Humidity Sensor  | Diplays current Zone 1 humidity measurement reading  | 401  | uint16 | 0..1000 (x10)              | 0..100%rH   | R   |
| Z1 CO2 Sensor   | Displays current measurement Zone 1 CO2 reading  | 402  | uint16 | 0..10,000 (x1)             | 0..10,000ppm  | R   |
| Z1 VOC Sensor   | Display current Zone 1 VOC Index Value   | 403  | uint16 | 0..500 (x1)                | 0..500 index  | R   |
| Z1 Dew Point  | Dew Point Temperature for Zone 1   | 404  | int16  | -400..1200 (x10)           | -40.0..120.0°C                                      | R   |
| Z2 Temperature  | Displays current Zone 2 temperature measurement reading<br>Note: Value depends on the temperature unit °C/°F selection | 405  | int16  | -400..2480 (x10)           | -40.0..120.0°C /<br>-40.0..248.0°F                  | R   |
| Z2 Humidity Sensor  | Diplays current Zone 2 humidity measurement reading  | 406  | uint16 | 0..1000 (x10)              | 0..100%rH   | R   |
| Z2 CO2 Sensor   | Displays current measurement Zone 2 CO2 reading  | 407  | uint16 | 0..10,000 (x1)             | 0..10,000ppm  | R   |
| Z2 VOC Sensor   | Display current Zone 2 VOC Index Value   | 408  | uint16 | 0..500 (x1)                | 0..500 index  | R   |
| Z2 Dew Point  | Dew Point Temperature for Zone 2   | 409  | int16  | -400..1200 (x10)           | -40.0..120.0°C                                      | R   |
| <b>TCR80 SERIES CONTROLLER PHYSICAL INPUTS</b>                          |  |  |        |                            |   |     |
| Averaged Temperature  | Average Temperature Calculated by the Average Function   | 460  | int16  | -400..2480 (x10)           | NTC Mode: -40..120°                                 | R   |
| UI1   | Universal Input 1 Measurement<br>Note: Value depends on the temperature / mode selection                               | 461  | int16  | -400..2480 (x10)           | NTC Mode: -40..120°<br>AI Mode: 0..100% =<br>0..10V | R   |
| UI2   | Universal Input 2 Measurement<br>Note: Value depends on the temperature / mode selection                               | 462  | int16  | -400..2480 (x10)           | NTC Mode: -40..120°<br>AI Mode: 0..100% =<br>0..10V | R   |
| UI3   | Universal Input 3 Measurement<br>Note: Value depends on the temperature / mode selection                               | 463  | int16  | -400..2480 (x10)           | NTC Mode: -40..120°<br>AI Mode: 0..100% =<br>0..10V | R   |
| UI4   | Universal Input 4 Measurement<br>Note: Value depends on the temperature / mode selection                               | 464  | int16  | -400..2480 (x10)           | NTC Mode: -40..120°<br>AI Mode: 0..100% =<br>0..10V | R   |
| DI1   | Digital Input 1 Status   | 200  |        | 0..1                       | 0..1  | R   |
| DI2   | Digital Input 2 Status   | 201  |        | 0..1                       | 0..1  | R   |
| DI3   | Digital Input 3 Status   | 202  |        | 0..1                       | 0..1  | R   |
| DI4   | Digital Input 4 Status   | 203  |        | 0..1                       | 0..1  | R   |
| <b>TCR80 SERIES CONTROLLER PHYSICAL OUTPUTS</b>                         |  |  |        |                            |   |     |
| Y1  | Analogue Output 1 Value  | 465  | uint16 | 0..1000 (x10)              | 0..100% = 0..10V                                    | R   |
| Y2  | Analogue Output 2 Value  | 466  | uint16 | 0..1000 (x10)              | 0..100% = 0..10V                                    | R   |
| Y3  | Analogue Output 3 Value  | 467  | uint16 | 0..1000 (x10)              | 0..100% = 0..10V                                    | R   |
| Y4  | Analogue Output 4 Value  | 468  | uint16 | 0..1000 (x10)              | 0..100% = 0..10V                                    | R   |
| Triac 1 Status  | Triac 1 Output Status  | 206  |        | 0..1                       | 0..1  | R   |
| Triac 2 Status  | Triac 2 Output Status  | 207  |        | 0..1                       | 0..1  | R   |
| Triac 3 Status  | Triac 3 Output Status  | 208  |        | 0..1                       | 0..1  | R   |
| Triac 4 Status  | Triac 4 Output Status  | 209  |        | 0..1                       | 0..1  | R   |
| Triac 1 PWM Demand  | Triac Output 1 PWM Demand (xCR11 Series)<br>Note: For On/Off Mode shows 0% when Off and 100% when On.                  | 470  | int16  | 0..1000 (x10)              | 0..100%   | R   |
| Triac 2 PWM Demand  | Triac Output 2 PWM Demand (xCR11 Series)   | 471  | int16  | 0..1000 (x10)              | 0..100%   | R   |
| Triac 3 PWM Demand  | Triac Output 3 PWM Demand (xCR11 Series)   | 472  | int16  | 0..1000 (x10)              | 0..100%   | R   |
| Triac 4 PWM Demand  | Triac Output 4 PWM Demand (xCR11 Series)   | 473  | int16  | 0..1000 (x10)              | 0..100%   | R   |
| ThreePoint 1 Position   | ThreePoint 1 Position  | 474  | int16  | 0..1000 (x10)              | 0..100%   | R   |

|                                    |   |     |       |                     |  |   |
|------------------------------------|---|-----|-------|---------------------|--|---|
| ThreePoint 2 Position              | ThreePoint 2 Position   | 475 | int16 | 0..1000 (x10)       | 0..100%  | R |
| ThreePoint 1 Demand                | ThreePoint 1 Demand   | 436 | int16 | 0..1000 (x10)       | 0..100%  | R |
| ThreePoint 2 Demand                | ThreePoint 2 Demand   | 437 | int16 | 0..1000 (x10)       | 0..100%  | R |
| <b>ZONE 1 SETPOINT AND DEMANDS</b> |   |     |       |                     |  |   |
| Calculated Multi-Stage Setpoint    | Z1 Calculated Setpoint for Multi-Stage Control Loop (set via Nominal Setpoint or through TDR/QDR20) | 420 | int16 | -32000..32000 (x10) | -3200.0..3200.0  | R |
| Heating Demand                     | Z1 Heating Stage Demand (Multi-Loop Heating Stage 1/2/3)  | 421 | int16 | 0..1000 (x10)       | 0..100%  | R |
| Cooling Demand                     | Z1 Cooling Stage Demand (Multi-Loop Cooling Stage 1/2/3)  | 422 | int16 | 0..1000 (x10)       | 0..100%  | R |
| Current Control Mode               | Z1 Current Control Mode Status  | 423 | int16 | 0..2 (x1)           | 0 = Occupied<br>1 = Unoccupied<br>2 = Night  | R |
| Cooling Status                     | Z1 Main Loop Cooling Stage Override Status  | 424 | int16 | 0..3 (x1)           | 0 = Normal Operation<br>1 = Digital Input Disable (Condensation)<br>2 = Dew Point Disable (Condensation)<br>3 = Dehumidify (Cooling Stage 2 Overridden ON) | R |
| CO2 Loop Demand                    | Z1 CO2 Loop Demand  | 425 | int16 | 0..1000 (x10)       | 0..100%  | R |
| Humidity Loop Demand               | Z1 Humidity Control Loop Demand   | 426 | int16 | 0..1000 (x10)       | 0..100%  | R |
| VOC Loop Demand                    | Z1 VOC Control Loop Demand  | 427 | int16 | 0..1000 (x10)       | 0..100%  | R |
| Fan Demand                         | Z1 Fan Loop Demand  | 428 | int16 | 0..1000 (x10)       | 0..100%  | R |
| Fan Mode                           | Z1 Current Fan Mode   | 429 | int16 | 0..4 (x1)           | 0 = Off<br>1 = Manual Speed 1<br>2 = Manual Speed 2<br>3 = Manual Speed 3<br>4 = Auto  | R |
| <b>ZONE 2 SETPOINT AND DEMANDS</b> |   |     |       |                     |  |   |
| Calculated Multi-Stage Setpoint    | Z2 Calculated Setpoint for Multi-Stage Control Loop (set via Nominal Setpoint or through TDR/QDR20) | 430 | int16 | -32000..32000 (x10) | -3200.0..3200.0  | R |
| Heating Demand                     | Z2 Heating Stage Demand (Multi-Loop Heating Stage 1/2/3)  | 431 | int16 | 0..1000 (x10)       | 0..100%  | R |
| Cooling Demand                     | Z2 Cooling Stage Demand (Multi-Loop Cooling Stage 1/2/3)  | 432 | int16 | 0..1000 (x10)       | 0..100%  | R |
| Current Control Mode               | Z2 Current Control Mode Status  | 433 | int16 | 0..2 (x1)           | 0 = Occupied<br>1 = Unoccupied<br>2 = Night  | R |
| Cooling Status                     | Z2 Main Loop Cooling Stage Override Status  | 434 | int16 | 0..3 (x1)           | 0 = Normal Operation<br>1 = Digital Input Disable (Condensation)<br>2 = Dew Point Disable (Condensation)<br>3 = Dehumidify (Cooling Stage 2 Overridden ON) | R |
| CO2 Loop Demand                    | Z2 CO2 Loop Demand  | 435 | int16 | 0..1000 (x10)       | 0..100%  | R |
| Humidity Loop Demand               | Z2 Humidity Control Loop Demand   | 436 | int16 | 0..1000 (x10)       | 0..100%  | R |
| VOC Loop Demand                    | Z2 VOC Control Loop Demand  | 437 | int16 | 0..1000 (x10)       | 0..100%  | R |
| Fan Demand                         | Z2 Fan Loop Demand  | 438 | int16 | 0..1000 (x10)       | 0..100%  | R |
| Fan Mode                           | Z2 Current Fan Mode   | 439 | int16 | 0..4 (x1)           | 0 = Off<br>1 = Manual Speed 1<br>2 = Manual Speed 2<br>3 = Manual Speed 3<br>4 = Auto  | 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) |  |     |
| <b>UNIVERSAL INPUTS</b> |  |                                   |   |                         |  |     |
| UI1 Mode                | <p>Sets the Universal Input 1 Mode</p> <p>Note: Options 8,9,10, 13, 14 and 15 override to selected controller mode on OFF to ON transition.</p> <p>Note: Option 11/16 overrides to Occupied Mode on ON transition and Unoccupied Mode on OFF transition.</p> <p>Note: Option 12/17 overrides to Occupied Mode on ON transition and Off Mode on OFF transition.</p> <p>Note: When setting Universal Input to Digital modes, reset (apply changes) is required after the change to activate the correct state.</p> <p>Note: Properties 500-511 available in BACnet as Config Object properties 1150-1161</p> | <b>500 (BACnet 1150)</b>          | unit16  | 0..17 (x1)              | 0 = Not Used<br>1 = 0..10V (0..100%)<br>2 = NTC10 (Default)<br>3 = Z1 Dew Point (NTC10)<br>4 = Z2 Dew Point (NTC10)<br>5 = Digital - Network<br>6 = Digital - Z1 Disable Cooling / Resistive Condensation Sensor<br>7 = Digital - Z2 Disable Cooling / Resistive Condensation Sensor<br>8 = Digital - Z1 Occupied<br>9 = Digital - Z1 Unoccupied<br>10 = Digital -Z1 Off<br>11 = Digital -Z1 Unocc/Occ<br>12 = Digital -Z1 Off / Occ<br>13 = Digital -Z2 Occupied<br>14 = Digital -Z2 Unoccupied<br>15 = Digital -Z2 Off<br>16 = Digital -Z2 Unocc / Occ<br>17 = Digital -Z2 Off / Occ | R/W |
| UI1 Voltage Min.        | Sets Min. Clamp Voltage for UI1.   | <b>501 (1151)</b>                 | 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.   | <b>502 (1152)</b>                 | unit16  | 0..100 (x10)            | 0..10.0 (Default 10.0)   | R/W |
| UI1 Scale Min.          | Sets the scaling for Min. Measurement when UI1 @ 0V (0%)   | <b>503 (1153)</b>                 | 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%)  | <b>504 (1154)</b>                 | unit16  | 0..30000 (x10)          | 0.0..3000.0 (Default 100.0)  | R/W |
| UI1 Temperature Offset  | UI1 Temperature Single Point Sensor Calibration Offset<br>Note: Only applies when UI Mode = NTC10  | <b>505 (1155)</b>                 | int16   | -100..100 (x10)         | -10.0..+10.0deg (Default 0)  | R/W |
| UI2 Mode                | Sets the Universal Input 2 Mode.   | <b>506 (1156)</b>                 | unit16  | 0..17 (x1)              | See <b>UI1 Mode</b> for Enumerations   | R/W |
| UI2 Voltage Min.        | Sets Min. Clamp Voltage for UI2. Advanced Setting.   | <b>507 (1157)</b>                 | 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.   | <b>508 (1158)</b>                 | unit16  | 0..100 (x10)            | 0..10.0 (Default 10.0)   | R/W |
| UI2 Scale Min.          | Sets the scaling for Min. Measurement when UI2 @ 0V (0%)   | <b>509 (1159)</b>                 | 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%)  | <b>510 (1160)</b>                 | unit16  | 0..30000 (x10)          | 0.0..3000.0 (Default 100.0)  | R/W |
| UI2 Temperature Offset  | UI2 Temperature Single Point Sensor Calibration Offset   | <b>511 (1161)</b>                 | int16   | -100..100 (x10)         | -10.0..+10.0deg (Default 0)  | R/W |
| UI3 Mode                | Sets the Universal Input 3 Mode.   | <b>512</b>                        | unit16  | 0..17 (x1)              | See <b>UI1 Mode</b> for Enumerations   | R/W |
| UI3 Voltage Min.        | Sets Min. Clamp Voltage for UI3.   | <b>513</b>                        | unit16  | 0..100 (x10)            | 0..10.0 (Default 0)  | R/W |
| UI3 Voltage Max.        | Sets Max. Clamp Voltage for UI3. Use only if the connected device upper range is more than 3000.   | <b>514</b>                        | unit16  | 0..100 (x10)            | 0..10.0 (Default 10.0)   | R/W |
| UI3 Scale Min.          | Sets the scaling for Min. Measurement when UI3 @ 0V (0%)   | <b>515</b>                        | unit16  | 0..30000 (x10)          | 0.0..3000.0 (Default 0)  | R/W |
| UI3 Scale Max.          | Sets scaling for the Max. Measurement when UI3 @ 10V (100%)  | <b>516</b>                        | unit16  | 0..30000 (x10)          | 0.0..3000.0 (Default 100.0)  | R/W |
| UI3 Temperature Offset  | UI3 Temperature Single Point Sensor Calibration Offset   | <b>517</b>                        | int16   | -100..100 (x10)         | -10.0..+10.0deg (Default 0)  | R/W |
| UI4 Mode                | Sets the Universal Input 4 Mode.   | <b>518</b>                        | unit16  | 0..17 (x1)              | See <b>UI1 Mode</b> for Enumerations   | R/W |

|                        |  |     |        |                 |   |     |
|------------------------|--|-----|--------|-----------------|---|-----|
| UI4 Voltage Min.       | Sets Min. Clamp Voltage for UI4. Advanced Setting.   | 519 | unit16 | 0..100 (x10)    | 0..10.0 (Default 0)                     | R/W |
| UI4 Voltage Max.       | Sets Max. Clamp Voltage for UI4. Use only if the connected device upper range is more than 3000.   | 520 | unit16 | 0..100 (x10)    | 0..10.0 (Default 10.0)                  | R/W |
| UI4 Scale Min.         | Sets the scaling for Min. Measurement when UI4 @ 0V (0%)   | 521 | unit16 | 0..30000 (x10)  | 0.0..3000.0 (Default 0)                 | R/W |
| UI4 Scale Max.         | Sets scaling for the Max. Measurement when UI4 @ 10V (100%)  | 522 | unit16 | 0..30000 (x10)  | 0.0..3000.0 (Default 100.0)             | R/W |
| UI4 Temperature Offset | UI4 Temperature Single Point Sensor Calibration Offset   | 523 | int16  | -100..100 (x10) | -10.0..+10.0deg (Default 0)             | 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. | 524 | unit16 | 0..1 (x1)       | 0 = Celcius (Default)<br>1 = Fahrenheit | R/W |

**ANALOGUE OUTPUTS**

|                                   |  |     |        |               |   |     |
|-----------------------------------|--|-----|--------|---------------|---|-----|
| Y1 Mode                           | Y1 Output Configuration<br>Default: Heating Stage 1<br><br>Note: For Modus to override the output from the network set the mode to network.<br><br>Note: For BACnet the output can be overridden using corresponding AV objects. | 530 | unit16 | 0..29 (x1)    | 0 = Network Value<br>1 = Z1 Heating Stage 1<br>2 = Z1 Heating Stage 2<br>3 = Z1 Heating Stage 3<br>4 = Z1 Cooling Stage 1<br>5 = Z1 Cooling Stage 2<br>6 = Z1 Cooling Stage 3<br>7 = Z1 CO2 Demand<br>8 = Z1 VOC Demand<br>9 = Z1 Humidity Demand<br>10 = Z1 Max Function 1<br>11 = Z1 Max Function 2<br>12 = Z1 Fan Demand<br>13 = Z1 6-Way Valve<br>14 = Z1 Reverse 6-Way Valve<br>15 = Z2 Heating Stage 1<br>16 = Z2 Heating Stage 2<br>17 = Z2 Heating Stage 3<br>18 = Z2 Cooling Stage 1<br>19 = Z2 Cooling Stage 2<br>20 = Z2 Cooling Stage 3<br>21 = Z2 CO2 Demand<br>22 = Z2 VOC Demand<br>23 = Z2 Humidity Demand<br>24 = Z2 Max Function 1<br>25 = Z2 Max Function 2<br>26 = Z2 Fan Demand<br>27 = Z2 6-Way Valve<br>28 = Z2 Reverse 6-Way Valve<br>29 = Economiser | R/W |
| Y1 Override                       | Analogue Output Y1 Override Value  | 531 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0)   | R/W |
| Y1 Minimum                        | Y1 Output Minimum Level  | 532 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0%)  | R/W |
| Y1 Maximum                        | Y1 Output Maximum Level  | 533 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 100%)  | R/W |
| Y2 Mode                           | Y2 Output Configuration<br>Default: Cooling Stage 1  | 534 | unit16 | 0..29 (x1)    | See <b>Y1 Mode</b> for Enumerations   | R/W |
| Y2 Override                       | Analogue Output Y2 Override Value  | 535 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0)   | R/W |
| Y2 Minimum                        | Y2 Output Minimum Level  | 536 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0%)  | R/W |
| Y2 Maximum                        | Y2 Output Maximum Level  | 537 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 100%)  | R/W |
| Y3 Mode                           | Y3 Output Configuration<br>Default: Fan Speed Control  | 538 | unit16 | 0..29 (x1)    | See <b>Y1 Mode</b> for Enumerations   | R/W |
| Y3 Override                       | Analogue Output Y3 Override Value  | 539 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0)   | R/W |
| Y3 Minimum                        | Y3 Output Minimum Level  | 540 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0%)  | R/W |
| Y3 Maximum                        | Y3 Output Maximum Level  | 541 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 100%)  | R/W |
| Y4 Mode                           | Y4 Output Configuration<br>Default: CO2 Control  | 542 | unit16 | 0..29 (x1)    | See <b>Y1 Mode</b> for Enumerations   | R/W |
| Y4 Override                       | Analogue Output Y4 Override Value  | 543 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0)   | R/W |
| Y4 Minimum                        | Y4 Output Minimum Level  | 544 | unit16 | 0..1000 (x10) | 0.0..100.0% (Default 0%)  | R/W |
| Y4 Maximum                        | Y4 Output Maximum Level  | 545 | 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.   | 546 | 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. | 547 | uint16 | 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.  | 548 | uint16 | 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. | 549 | uint16 | 0..100 (x10) | 0..100% (Default 100%) | R/W |

**DIGITAL INPUT SETTINGS**

|                           |  |     |        |                |                                     |     |
|---------------------------|--|-----|--------|----------------|-------------------------------------|-----|
| Digital Input 1 Off Delay | Delay Off Timer for the Universal Input 1 in Digital Input Mode  | 555 | uint16 | 0..28,800 (x1) | 0..28,800 seconds (default 0 secs)  | R/W |
| Digital Input 1 Polarity  | UI1 Digital Input Polarity Setting - allows the polarity of the input operation to be reversed when used in digital modes. | 556 | uint16 | 0..1 (x1)      | 0 = Normal (Default)<br>1 = Reverse | R/W |
| Digital Input 2 Off Delay | Delay Off Timer for the Universal Input 2 in Digital Input Mode  | 557 | uint16 | 0..28,800 (x1) | 0..28,800 seconds (default 0 secs)  | R/W |
| Digital Input 2 Polarity  | UI2 Digital Input Polarity Setting - allows the polarity of the input operation to be reversed when used in digital modes. | 558 | uint16 | 0..1 (x1)      | 0 = Normal (Default)<br>1 = Reverse | R/W |
| Digital Input 3 Off Delay | Delay Off Timer for the Universal Input 3 in Digital Input Mode  | 559 | uint16 | 0..28,800 (x1) | 0..28,800 seconds (default 0 secs)  | R/W |
| Digital Input 3 Polarity  | UI3 Digital Input Polarity Setting - allows the polarity of the input operation to be reversed when used in digital modes. | 560 | uint16 | 0..1 (x1)      | 0 = Normal (Default)<br>1 = Reverse | R/W |
| Digital Input 4 Off Delay | Delay Off Timer for the Universal Input 4 in Digital Input Mode  | 561 | uint16 | 0..28,800 (x1) | 0..28,800 seconds (default 0 secs)  | R/W |
| Digital Input 4 Polarity  | UI4 Digital Input Polarity Setting - allows the polarity of the input operation to be reversed when used in digital modes. | 562 | uint16 | 0..1 (x1)      | 0 = Normal (Default)<br>1 = Reverse | R/W |

**DIGITAL OUTPUT SETTINGS**

|                       |  |     |        |                |  |     |
|-----------------------|--|-----|--------|----------------|--|-----|
| ThreePoint1 Mode      | Threepoint 1 Mode (=Source)  | 566 | uint16 | 0..25 (x1)     | 0 = None (Default)<br>1 = Network Value  | R/W |
| ThreePoint2 Mode      | Threepoint 2 Mode (=Source)  | 567 | uint16 | 0..25 (x1)     | 2 = Z1 Heating Stage 1<br>3 = Z1 Heating Stage 2<br>4 = Z1 Heating Stage 3<br>5 = Z1 Cooling Stage 1<br>6 = Z1 Cooling Stage 2<br>7 = Z1 Cooling Stage 3<br>8 = Z1 CO2 Demand<br>9 = Z1 VOC Demand<br>10 = Z1 Humidity Demand<br>11 = Z1 Max Function 1<br>12 = Z1 Max Function 2<br>13 = Z1 Fan Demand<br>14 = Z2 Heating Stage 1<br>15 = Z2 Heating Stage 2<br>16 = Z2 Heating Stage 3<br>17 = Z2 Cooling Stage 1<br>18 = Z2 Cooling Stage 2<br>19 = Z2 Cooling Stage 3<br>20 = Z2 CO2 Demand<br>21 = Z2 VOC Demand<br>22 = Z2 Humidity Demand<br>23 = Z2 Max Function 1<br>24 = Z2 Max Function 2<br>25 = Z2 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<br>Default: Heating Stage 1  | 570 | uint16 | 0..31 (x1)  | 0 = Network Value<br>1 = Z1 Heating Stage 1  | R/W |
| TR2 Output Mode                       | Triac Output 2 Configuration<br>Default: Cooling Stage 1  | 571 | uint16 | 0..31 (x1)  | 2 = Z1 Heating Stage 2<br>3 = Z1 Heating Stage 3<br>4 = Z1 Cooling Stage 1<br>5 = Z1 Cooling Stage 2<br>6 = Z1 Cooling Stage 3   | R/W |
| TR3 Output Mode                       | Triac Output 3 Configuration<br>Default: Heating Stage 2  | 572 | uint16 | 0..31 (x1)  | 7 = Z1 CO2 Demand<br>8 = Z1 VOC Demand<br>9 = Z1 Humidity/DeHum Demand   | R/W |
| TR4 Output Mode                       | Triac Output 4 Configuration<br>Default: Cooling Stage 2<br><br>Note: Outputs are controlled using either PWM or On/Off Modes (set by TRx Mode parameters).<br><br>Note: With options 12-14 and 27-39, set Fan Mode = Stepped and corresponding Triac Output Type = On-Off. | 573 | uint16 | 0..33 (x1)  | 10 = Z1 Max Function 1<br>11 = Z1 Max Function 2<br>12 = Z1 Fan Demand<br>13 = Z1 Fan Speed 1<br>14 = Z1 Fan Speed 2<br>15 = Z1 Fan Speed 3<br>16 = Z2 Heating Stage 1<br>17 = Z2 Heating Stage 2<br>18 = Z2 Heating Stage 3<br>19 = Z2 Cooling Stage 1<br>20 = Z2 Cooling Stage 2<br>21 = Z2 Cooling Stage 3<br>22 = Z2 CO2 Demand<br>23 = Z2 VOC Demand<br>24 = Z2 Humidity/DeHum Demand<br>25 = Z2 Max Function 1<br>26 = Z2 Max Function 2<br>27 = Z2 Fan Demand<br>28 = Z2 Fan Speed 1<br>29 = Z2 Fan Speed 2<br>30 = Z2 Fan Speed 3<br>31 = None<br>32 = Cooling Active<br>33 = Heating Active | R/W |
| PWM Period                            | PWM Control Logic Period. The controller calculates the new sequence at these intervals.  | 574 | uint16 | 0..180 (x1) | 0..180s (Default 20s)  | R/W |
| DO ON Value                           | The value at the Triac (or Relay) Output Switches ON  | 575 | uint16 | 0..100 (x1) | 0..100% (Default 50%)  |     |
| DO 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  | 577 | uint16 | 0..1 (x1)   | 0 = Normal (Default)<br>1 = Reverse  | R/W |
| TR2 Direction                         | Triac Output 2 Direction  | 578 | uint16 | 0..1 (x1)   | 0 = Normal (Default)<br>1 = Reverse  | R/W |
| TR3 Direction                         | Triac Output 3 Direction  | 579 | uint16 | 0..1 (x1)   | 0 = Normal (Default)<br>1 = Reverse  | R/W |
| TR4 Direction                         | Triac Output 4 Direction  | 580 | uint16 | 0..1 (x1)   | 0 = Normal (Default)<br>1 = Reverse  | R/W |
| Triac 1 / ThreePoint 1 Level Override | Triac 1 Output (PWM) Network Override or 3-Point Actuator Override Level<br>Note: Set output to Network   | 583 | uint16 | 0..100 (x1) | PWM:<br>0% = OFF (default)<br>100% = ON  | R/W |
| Triac 2 Level Override                | Triac 2 Output (PWM) Network Override<br>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 or 3-Point Actuator Override Level<br>Note: Set output to Network   | 585 | uint16 | 0..100 (x1) | 3-Point:<br>0..100%  | R/W |
| Triac 4 Level Override                | Triac 4 Output (PWM) Network Override<br>Note: Set output to Network  | 586 | uint16 | 0..100 (x1) |  | R/W |
| TR1 Type                              | Triac 1 (DO1) Output Type - On/Off or PWM   | 587 | uint16 | 0..1 (x1)   | 0 = On/Off<br>1 = PWM (Default)  | R/W |
| TR2 Type                              | Triac 2 (DO2) Output Type - On/Off or PWM   | 588 | uint16 | 0..1 (x1)   |  | R/W |
| TR3 Type                              | Triac 3 (DO3) Output Type - On/Off or PWM   | 589 | uint16 | 0..1 (x1)   |  | R/W |
| TR4 Type                              | Triac 4 (DO4) Output Type - On/Off or PWM   | 590 | uint16 | 0..1 (x1)   |  | R/W |



| NETWORK VALUES AND OUPUT EXERCISE |  |                                   |   |                         |  |     |
|-----------------------------------|--|-----------------------------------|---|-------------------------|--|-----|
| Parameter                         | Description  | Modbus Register / BACnet Property | MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16 |                         | Value Range / Enumerations                 | R/W |
|                                   |  |                                   | Type  | Data Range (multiplier) |  |     |
| Network Value 1                   | Network Value 1. Used for control loop external measurements and TDR/QDR20 display functions.<br>NOTE: This value is also automatically sent to Modbus Slave 1 Reg 538 if slave activated. TDR/QDR can display the value depending on configuration. | 600                               | 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)<br>NOTE: This value is also automatically sent to Modbus Slave 1 Reg 539 if slave activated  | 601                               | uint16  | 0..65535 (x1)           | 0..65535 (Default 0)                       | R/W |
| Network Value 3                   | Network Value 1. Used for control loop external measurements and display functions.<br>NOTE: This value is also automatically sent to Modbus Slave 2 Reg 538 if slave activated  | 602                               | int16   | -9990..9990 (x10)       | -999.0..999.0 (Default 0)                  | R/W |
| Network Value 4                   | Network Value 2 (for displaying network integer value e.g. energy measurements)<br>NOTE: This value is also automatically sent to Modbus Slave 2 Reg 539 if slave activated  | 604                               | uint16  | 0..65535 (x1)           | 0..65535 (Default 0)                       | R/W |
| Valve Exercise Period             | Sets the period of inactivity to activate the corresponding output.  | 610                               | uint16  | 0..15 (x1)              | 0..15 days (Default 14 days)               | R/W |
| Y1 Exercise Time                  | Analogue Output 1 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y1 Exercise Time   | 611                               | uint16  | 0..15 (x1)              | 0..15 Minutes (Default: 0)<br>0 = Disabled | R/W |
| Y2 Exercise Time                  | Analogue Output 2 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y2 Exercise Time   | 612                               | uint16  | 0..15 (x1)              | 0..15 Minutes (Default: 0)<br>0 = Disabled | R/W |
| Y2 Exercise Time                  | Analogue Output 3 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y3 Exercise Time   | 613                               | uint16  | 0..15 (x1)              | 0..15 Minutes (Default: 0)<br>0 = Disabled | R/W |
| Y2 Exercise Time                  | Analogue Output 4 Exercise Time. After configured period of inactivity, the output is driven to 50% for the Y4 Exercise Time   | 614                               | uint16  | 0..15 (x1)              | 0..15 Minutes (Default: 0)<br>0 = Disabled | R/W |
| TR1 Exercise Time                 | Triac Output 1 (DO1) Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR1 Exercise Time  | 615                               | uint16  | 0..15 (x1)              | 0..15 Minutes (Default: 0)<br>0 = Disabled | R/W |
| TR2 Exercise Time                 | Triac Output 2 (DO2) Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR2 Exercise Time  | 616                               | uint16  | 0..15 (x1)              | 0..15 Minutes (Default: 0)<br>0 = Disabled | R/W |
| TR3 Exercise Time                 | Triac Output 3 (DO3) Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR3 Exercise Time  | 617                               | uint16  | 0..15 (x1)              | 0..15 Minutes (Default: 0)<br>0 = Disabled | R/W |
| TR4 Exercise Time                 | Triac Output 4 (DO4) Exercise Time. After configured period of inactivity, the output is driven to opposite state for the TR4 Exercise Time  | 618                               | uint16  | 0..15 (x1)              | 0..15 Minutes (Default: 0)<br>0 = Disabled | R/W |

| 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   | 620                               | uint16  | 0..6 (x1)               | 0 = Disabled (Default)<br>1 = UI1<br>2 = UI2<br>3 = UI3<br>4 = UI4<br>5 = Z1 Temperature<br>6 = Z2 Temperature | R/W |
| Measurement 2    | Measurement 2 for Average Calculation   | 621                               | uint16  | 0..6 (x1)               |  | R/W |
| Measurement 3    | Measurement 3 for Average Calculation   | 622                               | uint16  | 0..6 (x1)               |  | R/W |
| Measurement 4    | Measurement 4 for Average Calculation<br>NOTE: Options 1-4 use Register 460-463 values allowing averaging to be done both NTC10 and voltage | 623                               | uint16  | 0..6 (x1)               |  | R/W |

| ZONE 1 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) |   |     |
| <b>ZONE 1 CONTROL MODES AND OVERRIDES</b> |   |                                   |   |                         |   |     |
| Z1 Override Control Mode                  | Z1 Override Current Control Mode (last transition applies e.g. if overridden from BACnet/Modbus network the user can change through the TDR/QDR20 Display - network poll)   | 681                               | uint16  | 0..3 (x1)               | 0 = Occupied<br>1 = Unoccupied<br>2 = Night<br>3 = No Override (Default)  | R/W |
| <b>ZONE 1 MULTI-STAGE CONTROL LOOP</b>    |   |                                   |   |                         |   |     |
| Loop Source                               | Sets the Control Source for the Z1 Multi-Stage Control Loop.<br><br>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.<br><br>Note: Average value is the calculation from Average Function. | 700                               | uint16  | 0..10 (x1)              | 0 = Network Value (Reg 600)<br>1 = Zone Temperature (Default)<br>2 = UI1 - NTC10<br>3 = UI2 - NTC10<br>4 = UI3 - NTC10<br>5 = UI4 - NTC10<br>6 = UI1 - 0..10Vdc<br>7 = UI2 - 0..10Vdc<br>8 = UI3 - 0..10Vdc<br>9 = UI4 - 0..10Vdc<br>10 = Average Value | R/W |
| Nominal Setpoint                          | Z1 Control Loop Nominal Setpoint<br>Note: The control loop setpoint can be shifted by the high/low limit (cascade) control function.  | 701                               | uint16  | 0..2120 (x10)           | 0.0..212.0, Default 21.0  | R/W |
| Proportional Band                         | Z1 Control Loop Proportional Band (for each Stage)  | 705                               | uint16  | 1..500 (x1)             | 1..500 (Default 5)  | R/W |
| Integral Action Time                      | Z1 Control Loop Integral Action Time (Set to 0 to disable)  | 706                               | uint16  | 0..3600 (x1)            | 0..3600s (Default 600s)<br>0 = Disabled   | R/W |
| No of Heating Stages                      | Sets the number of heating stages for Z1.   | 707                               | uint16  | 0..3 (x1)               | 0 = None<br>1 = 1-Stage (default)   | R/W |
| No of Cooling Stages                      | Sets the number of cooling stages for Z1.   | 708                               | uint16  | 0..3 (x1)               | 2 = 2-Stages<br>3 = 3-Stages  | R/W |
| Occ Heating Deadzone                      | Occupied Mode Heating Deadzone for Z1   | 709                               | uint16  | 0..300 (x10)            | 0.0..30.0 (Default 0.5)   | R/W |
| Occ Cooling Deadzone                      | Occupied Mode Cooling Deadzone for Z1   | 710                               | uint16  | 0..300 (x10)            | 0.0..30.0 (Default 0.5)   | R/W |
| Unocc Heating Deadzone                    | Unoccupied Mode Heating Deadzone for Z1   | 711                               | uint16  | 0..300 (x10)            | 0.0..30.0 (Default 3.0)   | R/W |
| Unocc Cooling Deadzone                    | Unoccupied Mode Cooling Deadzone for Z1   | 712                               | uint16  | 0..300 (x10)            | 0.0..30.0 (Default 3.0)   | R/W |
| Frost Setpoint                            | Off Mode Frost Setpoint for Z1  | 713                               | uint16  | 0..600 (x10)            | 0.0..60.0 (Default 10.0)  | R/W |
| <b>ZONE 1 CHANGE-OVER FUNCTION</b>        |   |                                   |   |                         |   |     |
| Change-Over Source                        | Sets the Source for the Change-Over Function for Z1.<br><br>Note: As default the Network Command is Off i.e. no change-over function is active.   | 722                               | uint16  | 0..8 (x1)               | 0 = Network Command (Reg 726, Default)<br>1 = UI1 - NTC10<br>2 = UI2 - NTC10<br>3 = UI3 - NTC10<br>4 = UI4 - NTC10<br>5 = Digital Input 1 (UI1)<br>6 = Digital Input 2 (UI2)<br>7 = Digital Input 3 (UI3)<br>8 = Digital Input 4 (UI4)                  | R/W |
| Change-Over Low Level                     | Z1 Temperature below which the change-over is active (cooling stage active). Note: Relevant only for NTC Input 1/2/3/4 options.   | 724                               | uint16  | 0..1000 (x10)           | 0..100.0°<br>Default 18°  | R/W |
| Change-Over High Level                    | Z1 Temperature above which the change-over is off (heating stage active, no override on control). Note: Relevant only for NTC Input 1/2/3/4 options.  | 725                               | uint16  | 0..1000 (x10)           | 0..100.0°<br>Default 22°  | R/W |
| Change-Over Override                      | Heating / Cooling Mode Command from Network.<br>Note: Requires change-over source to be set as Network.   | 726                               | uint16  | 0..1 (x1)               | 0 = Heating (Default)<br>1 = Cooling  | R/W |
|   |   |                                   |   |                         |   |     |
|   |   |                                   |   |                         |   |     |

| <b>ZONE 1 LOW/HIGH LIMIT RESET FUNCTION</b> |   |            |        |               |   |     |
|---|---|------------|--------|---------------|---|-----|
| Reset Control Source                        | Sets the Temperature Source for the Reset Control Function for Z1.<br>Note: Default: 5 - Disabled                                   | <b>727</b> | uint16 | 0..5 (x1)     | 0 = Network Value (Reg 600)<br>1 = UI1 - NTC10<br>2 = UI2 - NTC10<br>3 = UI3 - NTC10<br>4 = UI4 - NTC10<br>5 = Disable (Defaultt) | R/W |
| High Limit Setpoint                         | Z1 High Limit Setpoint. Above this limit the setpoint is reduced proportionally according to the ratio and temperature difference.  | <b>729</b> | uint16 | 0..1000 (x10) | 0.0..100.0°<br>Default 35°  | R/W |
| Low Limit Setpoint                          | Z1 Low Limit Setpoint. Below this limit the setpoint is increased proportionally according to the ratio and temperature difference. | <b>730</b> | uint16 | 0..1000 (x10) | 0.0..100.0°<br>Default 15°  | R/W |
| Reset Ratio                                 | Z1 Reset ratio used to calculated the setpoint reset.   | <b>731</b> | uint16 | 0..100 (x10)  | 0.0..10.0 (Default 1.0)   | R/W |

| <b>ZONE 1 MAX FUNCTION</b> |   |            |        |            |  |     |
|----------------------------|---|------------|--------|------------|--|-----|
| Max1 Source 1              | Sets the Souce for Input 1 of Z1 Maximum Function 1<br>Default: Heating Stage 1 | <b>732</b> | uint16 | 0..12 (x1) | 0 = Network Value (Reg 600)  | R/W |
| Max1 Source 2              | Sets the Souce for Input 2 of Z1 Maximum Function 1<br>Default: Cooling Stage 1 | <b>733</b> | uint16 | 0..12 (x1) | 1 = Z1 Heating Stage 1<br>2 = Z1 Heating Stage 2<br>3 = Z1 Heating Stage 3   | R/W |
| Max2 Source 1              | Sets the Souce for Input 1 of Z1 Maximum Function 2<br>Default: Cooling Stage 1 | <b>734</b> | uint16 | 0..12 (x1) | 4 = Z1 Cooling Stage 1<br>5 = Z1 Cooling Stage 2<br>6 = Z1 Cooling Stage 3   | R/W |
| Max2 Source 2              | Sets the Souce for Input 2 of Z1 Maximum Function 2<br>Default: CO2 Demand      | <b>735</b> | uint16 | 0..12 (x1) | 7 = Z1 CO2 Demand<br>8 = Z1 VOC Demand<br>9 = Z1 Humidity/DeHum Demand<br>10 = Z1 Max Function 1<br>11 = Z1 Max Function 2<br>12 = Z1 Fan Demand | R/W |

| <b>ZONE 1 FAN CONTROL</b> |   |            |        |             |   |     |
|---------------------------|---|------------|--------|-------------|---|-----|
| Fan Control Source        | Sets the Temperature Source for the Z1 Fan Control Function.  | <b>740</b> | uint16 | 0..11 (x1)  | 0 = Network Value (Reg 600)<br>1 = Z1 Heating Stage 1<br>2 = Z1 Heating Stage 2<br>3 = Z1 Heating Stage 3<br>4 = Z1 Cooling Stage 1<br>5 = Z1 Cooling Stage 2<br>6 = Z1 Cooling Stage 3<br>7 = Z1 CO2 Demand<br>8 = Z1 VOC Demand<br>9 = Z1 Humidity/DeHum Demand<br>10 = Z1 Max Function 1 (Default)<br>11 = Z1 Max Function 2 | R/W |
| Min Fan Speed             | Sets the Z1 Minimum Fan Speed for EC Fans   | <b>741</b> | uint16 | 0..100 (x1) | 0..100% (Default 15%)   | R/W |
| Fan Speed 1               | Sets the Z1 Fan Speed 1 for EC Fans (when source 33%)   | <b>742</b> | uint16 | 0..100 (x1) | 0..100% (Default 33%)   | R/W |
| Fan Speed 2               | Sets the Z1 Fan Speed 2 for EC Fans (when source 66%)   | <b>743</b> | uint16 | 0..100 (x1) | 0..100% (Default 66%)   | R/W |
| Fan Speed 3               | Sets the Z1 Fan Speed 3 for EC Fans (when source 99%)   | <b>744</b> | uint16 | 0..100 (x1) | 0..100% (Default 100%)  | R/W |
| Fan Mode                  | Sets the Z1 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. | <b>745</b> | uint16 | 0..1 (x1)   | 0 = Continuous Mode (Default)<br>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% fo Z1  | <b>746</b> | uint16 | 0..1 (x1)   | 0 = Off (Default)<br>1 = Minimum Speed  | R/W |
| Fan Off Delay             | Switch OFF delay when the source demand drops to 0 (and Fan Off Mode is set to Off) for Z1.   | <b>747</b> | uint16 | 0..600 (x1) | 0..600 seconds (Default 0)  | R/W |
| Fan Start-Up Delay        | Z1 Fan Start-Up when the source demand increases above 0%. During the delay the fan runs at Fan Speed 1 setting.  | <b>748</b> | uint16 | 0..600 (x1) | 0..600 seconds (Default 10)   | R/W |
| Fan Level Override        | Z1 Current Fan Level that can be set from the network. The override value is also automatically sent to the corresponding Room Display Interface.   | <b>749</b> | uint16 | 0..5        | 0 = Manual Off<br>1 = Level 1<br>2 = Level 2<br>3 = Level 3<br>4 = Automatic<br>5 = No Override   | R/W |
| Fan Levels                | Z1 Fan Levels   | <b>750</b> | uint16 | 0..2        | 0 = 0-1-A<br>1 = 0-1-2-A<br>2 = 0-1-2-3-A   | R/W |

|                                   |  |            |        |               |   |     |
|-----------------------------------|--|------------|--------|---------------|---|-----|
| Max Auto Fan Speed                | Maximum Fan Speed in Automatic Control Mode  | <b>752</b> | uint16 | 0..100 (x1)   | 0..100% (Default 100%)  | R/W |
| <b>ZONE 1 AIR QUALITY CONTROL</b> |  |            |        |               |   |     |
| CO2 Control Source                | Sets the Source for the CO2 Control for Zone 1<br><br>Zone CO2 Measurement is from Room Display Interface 1 (Modbus Slave 1, Reg 402)<br>Note: If set to UI1/UI2/UI3/UI4, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters. | <b>760</b> | uint16 | 0..5 (x1)     | 0 = Network Value (Reg 601)<br>1 = Zone CO2 Measurement (Default)<br>2 = UI1 - 0..10V<br>3 = UI2 - 0..10V<br>4 = UI3 - 0..10V<br>5 = UI4 - 0..10V | R/W |
| CO2 Setpoint                      | Z1 CO2 Control Setpoint  | <b>761</b> | uint16 | 0..10000 (x1) | 0..10,000 (Default 750)   | R/W |
| CO2 Proportional Band             | Z1 CO2 Control Proportional Band   | <b>762</b> | uint16 | 1..10000 (x1) | 1..10,000 (Default 500)   | R/W |
| CO2 Integral Action Time          | Z1 CO2 Control Integral Action Time (Set to 0 to disable)  | <b>763</b> | uint16 | 0..3600 (x1)  | 0..3600s (Default 0s)   | R/W |
| VOC Control Source                | Sets the Source for the VOC Control for Zone 1<br><br>Zone VOC Measurement is from Room Display Interface 1 (Modbus Slave 1, Reg 402)  | <b>770</b> | uint16 | 0..1 (x1)     | 0 = Network Value (Reg 601)<br>1 = Zone VOC Measurement (Default)   | R/W |
| VOC Setpoint                      | Z1 VOC Control Setpoint  | <b>771</b> | uint16 | 0..500 (x1)   | 0..500 (Default 100)  | R/W |
| VOC Proportional Band             | Z1 VOC Control Proportional Band   | <b>772</b> | uint16 | 1..500 (x1)   | 1..500 (Default 100)  | R/W |
| VOC Integral Action               | Z1 VOC Control Integral Action Time (Set to 0 to disable)  | <b>773</b> | uint16 | 0..3600 (x1)  | 0..3600s (Default 0s)   | R/W |

|                                |  |            |        |              |  |     |
|--------------------------------|--|------------|--------|--------------|--|-----|
| <b>ZONE 1 HUMIDITY CONTROL</b> |  |            |        |              |  |     |
| Humidity Source                | Sets the Source for the Z1 Humidity Control.<br><br>Zone Humidity Measurement is from Room Display Interface 1 (Modbus Slave 1, Reg 401)<br><br>Note: If set to UI1/UI2/UI3/UI4, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters | <b>780</b> | uint16 | 0..5 (x1)    | 0 = Network Value (Reg 600)<br>1 = Zone Humidity Measurement (Default)<br>2 = UI1 - 0..10V<br>3 = UI2 - 0..10V<br>4 = UI3 - 0..10V<br>5 = UI4 - 0..10V | R/W |
| Humidity Setpoint              | Z1 Humidity Control Loop Setpoint  | <b>781</b> | uint16 | 0..100 (x1)  | 0..100% (Default 50%)  | R/W |
| Humidity Proportional Band     | Z1 Humidity Control Proportional Band  | <b>782</b> | uint16 | 1..100 (x1)  | 1..100% (Default 20)   | R/W |
| Humidity Integral Action       | Z1 Humidity Control Integral Action Time (Set to 0 to disable)   | <b>783</b> | uint16 | 0..3600 (x1) | 0..3600s (Default 0s)  | R/W |
| Humidity Mode                  | Z1 Humidity Loop Control Mode<br>Default: Humidify (Reverse)   | <b>784</b> | uint16 | 0..1 (x1)    | 0 = Humidify (Reverse)<br>1 = De-Humidify (Direct)   | R/W |
| Humidity Interlock             | Z1 Enables Cooling Stage 2 Interlock on High Humidity  | <b>785</b> | uint16 | 0..1 (x1)    | 0 = Disabled (Default)<br>1 = Enabled  | R/W |
| Dew Point Range                | Z1 Dew Point calculation range where the Dew Point based cooling max. position calculates linearly from 100% to 0%   | <b>786</b> | uint16 | 0..10 (x1)   | 0..10 Degrees (Default 4)  | R/W |
| Dew Point Mode                 | Z1 Dew Point Mode Selection  | <b>787</b> | uint16 | 0..1 (x1)    | 0 = On-Off<br>1 = Proportional (Default)   | R/W |
| Dew Point Offset               | Z1 Dew Point Offset (from the calculated Dew Point) where the Dew Point based calculated max. position is 0%   | <b>788</b> | uint16 | 0..50 (x10)  | 0..5.0 Degrees (Default 1.0)   | R/W |

|  |  |            |        |                 |  |     |
|--|--|------------|--------|-----------------|--|-----|
| <b>ZONE 1 ECONOMISER AND DISCHARGE LOW TEMP CONTROL, COMPRESSOR AND HEATING3 LOCKOUT FUNCTIONS</b> |  |            |        |                 |  |     |
| Economiser Source  | Sets the Economiser Control Source (typically Cooling Stage 1)                                     | <b>790</b> | uint16 | 0..2 (x1)       | 0 = Z1_Cooling1 (Default)<br>1 = Z1_Cooling2<br>2 = Z1_Cooling3                        | R/W |
| Economiser Limit Temp Source   | Temperature that the Economiser function is monitoring (typically outside air temperature sensor). | <b>791</b> | uint16 | 0..4 (x1)       | 0 = None (Default)<br>1 = UI1-NTC10<br>2 = UI2-NTC10<br>3 = UI3-NTC10<br>4 = UI4-NTC10 | R/W |
| Economiser Limit Temp  | Temperature Limit for the Economiser Output to Modulate  | <b>792</b> | uint16 | 0..2120.0 (x10) | 0..212.0 (Default 60.0)  | R/W |

|                           |   |            |        |                 |  |     |
|---------------------------|---|------------|--------|-----------------|--|-----|
| Economiser Min. Output    | Minimum Output Level for the Economiser (min. damper position)            | <b>793</b> | uint16 | 0..1000.0 (x10) | 0..1000 (Default 15)   | R/W |
| Discharge Temp Source     | Discharge Temperature to be monitored                                     | <b>794</b> | uint16 | 0..4 (x1)       | 0 = None (Default)<br>1 = UI1-NTC10<br>2 = UI2-NTC10<br>3 = UI3-NTC10<br>4 = UI4-NTC10 | R/W |
| Discharge Min Temp        | Min. Temperature Limit for Discharge Temperature                          | <b>795</b> | uint16 | 0..2120.0 (x10) | 0..212.0 (Default 60.0)  | R/W |
| Discharge Limit Band      | Discharge Limit Band (to modulate the economiser output to min. position) | <b>796</b> | uint16 | 0..500.0 (x10)  | 0..50.0 (Default 2.0)  | R/W |
| Compressor Lockout Enable | Compressor Lockout (Heating Stage 1 and 2) Enable                         | <b>775</b> | uint16 | 0..1 (x1)       | 0 = Disabled (Default)<br>1 = Enabled  | R/W |
| Compressor OAT Low Limit  | Temperature Limit to Switch Heating Stages 1 and 2 to 0%                  | <b>776</b> | uint16 | 0..2120.0 (x10) | 0..212.0 (Default 25)  | R/W |
| Htg3 Lockout Enable       | Heating Stage 3 Lockout Enable  | <b>777</b> | uint16 | 0..1 (x1)       | 0 = Disabled (Default)<br>1 = Enabled  | R/W |
| Htg3 Lockout Temp         | Temperature Limit to Switch Heating Stage 3 to 0%                         | <b>778</b> | uint16 | 0..2120.0 (x10) | 0..212.0 (Default 60.0)  | R/W |

| <b>ZONE 2 CONTROL SETTINGS</b>            |   |                                   |   |                         |   |     |
|---|---|-----------------------------------|---|-------------------------|---|-----|
| Parameter                                 | Description   | Modbus Register / BACnet Property | MODBUS HOLDING REGISTER - FUNCTION CODES 03, 06, 16 |                         | Value Range / Enumerations  | R/W |
|   |   |                                   | Type  | Data Range (multiplier) |   |     |
| <b>ZONE 2 CONTROL MODES AND OVERRIDES</b> |   |                                   |   |                         |   |     |
| Override Control Mode                     | Z2 Override Current Control Mode (last transition applies e.g. if overridden from BACnet/Modbus network the user can change through the TDR/QDR20 Display)  | <b>1681</b>                       | uint16  | 0..3 (x1)               | 0 = Occupied<br>1 = Unoccupied<br>2 = Night<br>3 = No Override (Default)  | R/W |
| <b>ZONE 2 MULTI-STAGE CONTROL LOOP</b>    |   |                                   |   |                         |   |     |
| Main Loop Source                          | Sets the Control Source for the Z2 Multi-Stage Control Loop.<br><br>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.<br><br>Note: Average value is the calculation from Average Function. | <b>1700</b>                       | uint16  | 0..10 (x1)              | 0 = Network Value (Reg 602)<br>1 = Zone Temperature (Default)<br>2 = UI1 - NTC10<br>3 = UI2 - NTC10<br>4 = UI3 - NTC10<br>5 = UI4 - NTC10<br>6 = UI1 - 0..10Vdc<br>7 = UI2 - 0..10Vdc<br>8 = UI3 - 0..10Vdc<br>9 = UI4 - 0..10Vdc<br>10 = Average Value | R/W |
| Main Loop Nominal Setpoint                | Z2 Control Loop Nominal Setpoint<br>Note: The control loop setpoint can be shifted by the high/low limit (cascade) control function.  | <b>1701</b>                       | uint16  | 0..2120 (x10)           | 0.0..212.0, Default 21.0  | R/W |
| Proportional Band                         | Z2 Control Loop Proportional Band (for each Stage)  | <b>1705</b>                       | uint16  | 1..500 (x1)             | 1..500 (Default 5)  | R/W |
| Integral Action                           | Z2 Control Loop Integral Action Time (Set to 0 to disable)  | <b>1706</b>                       | uint16  | 0..3600 (x1)            | 0..3600s (Default 600s)<br>0 = Disabled   | R/W |
| No of Heating Stages                      | Sets the number of heating stages for Z2.   | <b>1707</b>                       | uint16  | 0..3 (x1)               | 0 = None<br>1 = 1-Stage (default)   | R/W |
| No of Cooling Stages                      | Sets the number of cooling stages for Z2.   | <b>1708</b>                       | uint16  | 0..3 (x1)               | 2 = 2-Stages<br>3 = 3-Stages  | R/W |
| Occ Heating Deadzone                      | Occupied Mode Heating Deadzone for Z2   | <b>1709</b>                       | uint16  | 0..300 (x10)            | 0.0..30.0 (Default 0.5)   | R/W |
| Occ Cooling Deadzone                      | Occupied Mode Cooling Deadzone for Z2.  | <b>1710</b>                       | uint16  | 0..300 (x10)            | 0.0..30.0 (Default 0.5)   | R/W |
| Unocc Heating Deadzone                    | Unoccupied Mode Heating Deadzone for Z2   | <b>1711</b>                       | uint16  | 0..300 (x10)            | 0.0..30.0 (Default 3.0)   | R/W |
| Unocc Cooling Deadzone                    | Unoccupied Mode Cooling Deadzone for Z2   | <b>1712</b>                       | uint16  | 0..300 (x10)            | 0.0..30.0 (Default 3.0)   | R/W |
| Frost Setpoint                            | Off Mode Frost Setpoint for Z2  | <b>1713</b>                       | uint16  | 0..600 (x10)            | 0.0..60.0 (Default 10.0)  | R/W |

| <b>ZONE 2 CHANGE-OVER FUNCTION</b> |  |      |        |               |   |     |
|------------------------------------|--|------|--------|---------------|---|-----|
| Change-Over Source                 | Sets the Source for the Change-Over Function for Z2.<br>Note: As default the Network Command is Off i.e. no change-over function is active.          | 1722 | uint16 | 0..8 (x1)     | 0 = Network Command (Reg 1726, Default)<br>1 = UI1 - NTC10<br>2 = UI2 - NTC10<br>3 = UI3 - NTC10<br>4 = UI4 - NTC10<br>5 = Digital Input 1 (UI1)<br>6 = Digital Input 2 (UI2)<br>7 = Digital Input 3 (UI3)<br>8 = Digital Input 4 (UI4) | R/W |
| Change-Over Low Level              | Z2 Temperature below which the change-over is active (cooling stage active). Note: Relevant only for NTC Input 1/2/3/4 options.                      | 1724 | uint16 | 0..1000 (x10) | 0..100.0°<br>Default 18°  | R/W |
| Change-Over High Level             | Z2 Temperature above which the change-over is off (heating stage active, no override on control). Note: Relevant only for NTC Input 1/2/3/4 options. | 1725 | uint16 | 0..1000 (x10) | 0..100.0°<br>Default 22°  | R/W |
| Change-Over Override               | Heating / Cooling Mode Command from Network.<br>Note: Requires change-over source to be set as Network.  | 1726 | uint16 | 0..1 (x1)     | 0 = Heating (Default)<br>1 = Cooling  | R/W |

| <b>ZONE 2 LOW/HIGH LIMIT RESET FUNCTION</b> |   |      |        |               |  |     |
|---|---|------|--------|---------------|--|-----|
| Reset Control Source                        | Sets the Temperature Source for the Reset Control Function for Z2.<br>Note: Default: 0 - Network.                                   | 1727 | uint16 | 0..2 (x1)     | 0 = Network Value (Reg 602)<br>1 = UI1 - NTC10<br>2 = UI2 - NTC10<br>3 = UI3 - NTC10<br>4 = UI4 - NTC10<br>5 = Disable (Default) | R/W |
| High Limit Setpoint                         | Z2 High Limit Setpoint. Above this limit the setpoint is reduced proportionally according to the ratio and temperature difference.  | 1729 | uint16 | 0..1000 (x10) | 0.0..100.0°<br>Default 35°   | R/W |
| Low Limit Setpoint                          | Z2 Low Limit Setpoint. Below this limit the setpoint is increased proportionally according to the ratio and temperature difference. | 1730 | uint16 | 0..1000 (x10) | 0.0..100.0°<br>Default 15°   | R/W |
| Reset Ratio                                 | Z2 Reset ratio used to calculated the setpoint reset.   | 1731 | uint16 | 0..100 (x10)  | 0.0..10.0 (Default 1.0)  | R/W |

| <b>ZONE 2 MAX FUNCTION</b> |   |      |        |            |  |     |
|----------------------------|---|------|--------|------------|--|-----|
| Max1 Source 1              | Sets the Souce for Input 1 of Z2 Maximum Function 1<br>Default: Heating Stage 1 | 1732 | uint16 | 0..12 (x1) | 0 = Network Value (Reg 602)  | R/W |
| Max1 Source 2              | Sets the Souce for Input 2 of Z2 Maximum Function 1<br>Default: Cooling Stage 1 | 1733 | uint16 | 0..12 (x1) | 1 = Z2 Heating Stage 1<br>2 = Z2 Heating Stage 2<br>3 = Z2 Heating Stage 3   | R/W |
| Max2 Source 1              | Sets the Souce for Input 1 of Z2 Maximum Function 2<br>Default: Cooling Stage 1 | 1734 | uint16 | 0..12 (x1) | 4 = Z2 Cooling Stage 1<br>5 = Z2 Cooling Stage 2   | R/W |
| Max2 Source 2              | Sets the Souce for Input 2 of Z2 Maximum Function 2<br>Default: CO2 Demand      | 1735 | uint16 | 0..12 (x1) | 6 = Z2 Cooling Stage 3<br>7 = Z2 CO2 Demand<br>8 = Z2 VOC Demand<br>9 = Z2 Humidity/DeHum Demand<br>10 = Z2 Max Function 1<br>11 = Z2 Max Function 2<br>12 = Z2 Fan Demand | R/W |

| <b>ZONE 2 FAN CONTROL</b> |  |      |        |             |   |     |
|---------------------------|--|------|--------|-------------|---|-----|
| Fan Control Source        | Sets the Temperature Source for the Z2 Fan Control Function. | 1740 | uint16 | 0..11 (x1)  | 0 = Network Value (Reg 602)<br>1 = Z2 Heating Stage 1<br>2 = Z2 Heating Stage 2<br>3 = Z2 Heating Stage 3<br>4 = Z2 Cooling Stage 1<br>5 = Z2 Cooling Stage 2<br>6 = Z2 Cooling Stage 3<br>7 = Z2 CO2 Demand<br>8 = Z2 VOC Demand<br>9 = Z2 Humidity/DeHum Demand<br>10 = Z2 Max Function 1 (Default)<br>11 = Z2 Max Function 2 | R/W |
| Min Fan Speed             | Sets the Z2 Minimum Fan Speed for EC Fans                    | 1741 | uint16 | 0..100 (x1) | 0..100% (Default 15%)   | R/W |
| Fan Speed 1               | Sets the Z2 Fan Speed 1 for EC Fans (when source 33%)        | 1742 | uint16 | 0..100 (x1) | 0..100% (Default 33%)   | R/W |



|                    |   |       |        |             |   |     |
|--------------------|---|-------|--------|-------------|---|-----|
| Fan Speed 2        | Sets the Z2 Fan Speed 2 for EC Fans (when source 66%)   | 1743  | uint16 | 0..100 (x1) | 0..100% (Default 66%)   | R/W |
| Fan Speed 3        | Sets the Z2 Fan Speed 3 for EC Fans (when source 99%)   | 1744  | uint16 | 0..100 (x1) | 0..100% (Default 100%)  | R/W |
| Fan Mode           | Sets the Z2 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. | 1745  | uint16 | 0..1 (x1)   | 0 = Continuous Mode (Default)<br>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% for Z2   | 1746  | uint16 | 0..1 (x1)   | 0 = Off (Default)<br>1 = Minimum Speed  | R/W |
| Fan Off Delay      | Switch OFF delay when the source demand drops to 0 (and Fan Off Mode is set to Off) for Z2.   | 1747  | uint16 | 0..600 (x1) | 0..600 seconds (Default 0)  | R/W |
| Fan Start-Up Delay | Z2 Fan Start-Up when the source demand increases above 0%. During the delay the fan runs at Fan Speed 1 setting.  | 1748  | uint16 | 0..600 (x1) | 0..600 seconds (Default 10)   | R/W |
| Fan Level Override | Z2 Current Fan Level that can be set from the network. The value is also automatically sent to the corresponding Room Display Interface Reg 606.  | 1749  | uint16 | 0..5        | 0 = Manual Off<br>1 = Level 1<br>2 = Level 2<br>3 = Level 3<br>4 = Automatic<br>5 = No Override | R/W |
| Fan Levels         | Z2 Fan Levels   | 17450 | uint16 | 0..2        | 0 = 0-1-A<br>1 = 0-1-2-A<br>2 = 0-1-2-3-A   | R/W |
| Max Auto Fan Speed | Maximum Fan Speed in Automatic Control Mode   | 1752  | uint16 | 0..100 (x1) | 0..100% (Default 100%)  | R/W |

| <b>ZONE 2 AIR QUALITY CONTROL</b> |  |      |        |               |   |     |
|-----------------------------------|--|------|--------|---------------|---|-----|
| CO2 Control Source                | Sets the Source for the CO2 Control for Zone 2<br><br>Zone CO2 Measurement is from Room Display Interface 1 (Modbus Slave 2, Reg 402)<br>Note: If set to UI1/UI2/UI3/UI4, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters. | 1760 | uint16 | 0..5 (x1)     | 0 = Network Value (Reg 603)<br>1 = Zone CO2 Measurement (Default)<br>2 = UI1 - 0..10V<br>3 = UI2 - 0..10V<br>4 = UI3 - 0..10V<br>5 = UI4 - 0..10V | R/W |
| CO2 Setpoint                      | Z2 CO2 Control Setpoint  | 1761 | uint16 | 0..10000 (x1) | 0..10,000 (Default 750)   | R/W |
| CO2 Proportional Band             | Z2 CO2 Control Proportional Band   | 1762 | uint16 | 1..10000 (x1) | 1..10,000 (Default 500)   | R/W |
| CO2 Integral Action               | Z2 CO2 Control Integral Action Time (Set to 0 to disable)  | 1763 | uint16 | 0..3600 (x1)  | 0..3600s (Default 0s)   | R/W |
| VOC Control Source                | Sets the Source for the VOC Control for Zone 1<br><br>Zone VOC Measurement is from Room Display Interface 1 (Modbus Slave 2, Reg 402)  | 1770 | uint16 | 0..1 (x1)     | 0 = Network Value (Reg 603)<br>1 = Zone VOC Measurement (Default)   | R/W |
| VOC Setpoint                      | Z2 VOC Control Setpoint  | 1771 | uint16 | 0..500 (x1)   | 0..500 (Default 100)  | R/W |
| VOC Proportional Band             | Z2 VOC Control Proportional Band   | 1772 | uint16 | 1..500 (x1)   | 1..500 (Default 100)  | R/W |
| VOC Integral Action               | Z2 VOC Control Integral Action Time (Set to 0 to disable)  | 1773 | uint16 | 0..3600 (x1)  | 0..3600s (Default 0s)   | R/W |

| <b>ZONE 2 HUMIDITY CONTROL</b> |  |      |        |              |  |     |
|--------------------------------|--|------|--------|--------------|--|-----|
| Humidity Source                | Sets the Source for the Z2 Humidity Control.<br><br>Zone Humidity Measurement is from Room Display Interface 1 (Modbus Slave 2, Reg 401)<br><br>Note: If set to UI1/UI2/UI3/UI4, then 0..10V is scaled to measurement according to UI Input Min/Max scaling parameters | 1780 | uint16 | 0..5 (x1)    | 0 = Network Value (Reg 602)<br>1 = Zone Humidity Measurement (Default)<br>2 = UI1 - 0..10V<br>3 = UI2 - 0..10V<br>4 = UI3 - 0..10V<br>5 = UI4 - 0..10V | R/W |
| Humidity Setpoint              | Z2 Humidity Control Loop Setpoint  | 1781 | uint16 | 0..100 (x1)  | 0..100% (Default 50%)  | R/W |
| Humidity PB                    | Z2 Humidity Control Proportional Band  | 1782 | uint16 | 1..100 (x1)  | 1..100% (Default 20)   | R/W |
| Humidity IA                    | Z2 Humidity Control Integral Action Time (Set to 0 to disable)   | 1783 | uint16 | 0..3600 (x1) | 0..3600s (Default 0s)  | R/W |
| Humidity Mode                  | Z2 Humidity Loop Control Mode<br>Default: Humidify (Reverse)   | 1784 | uint16 | 0..1 (x1)    | 0 = Humidify (Reverse)<br>1 = De-Humidify (Direct)   | R/W |
| Humidity Interlock             | Z2 Enables Cooling Stage 2 Interlock on High Humidity  | 1785 | uint16 | 0..1 (x1)    | 0 = Disabled (Default)<br>1 = Enabled  | R/W |

|                  |  |             |        |             |  |     |
|------------------|--|-------------|--------|-------------|--|-----|
| Dew Point Range  | Z2 Dew Point calculation range where the Dew Point based cooling max. position calculates linearly from 100% to 0% | <b>1786</b> | uint16 | 0..10 (x1)  | 0..10 Degrees (Default 4)                | R/W |
| Dew Point Mode   | Z2 Dew Point Mode Selection  | <b>1787</b> | uint16 | 0..1 (x1)   | 0 = On-Off<br>1 = Proportional (Default) | R/W |
| Dew Point Offset | Z2 Dew Point Offset (from the calculated Dew Point) where the Dew Point based calculated max. position is 0%       | <b>1788</b> | uint16 | 0..50 (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 |                            | Value Range / Enumerations   | R/W |
|                                   |   |                                   | Type  | Data Range (multiplier)    |  |     |
| Address                           | Modbus Address<br>BACnet MAC Address  | <b>800</b>                        | uint16  | 1..247 (x1)<br>1..127 (x1) | Modbus: 1..247<br>BACnet: 1..127   |     |
| Baud Rate                         | Baud Rate   | <b>801</b>                        | uint16  | 0..5                       | 0 = 9600<br>1 = 19200<br>2 = 38400<br>3 = 57600<br>4 = 76800<br>5 = 115200 |     |
| Modbus Parity                     | Modbus Parity   | <b>802</b>                        | uint16  | 0..2                       | 0 = None<br>1 = Odd<br>2 = Even  |     |
| Modbus Stopbits                   | Modbus Stopbits   | <b>803</b>                        | uint16  | 0..1                       | 0 = 1 Stop Bit<br>1 = 2 Stop Bits  |     |
| Soft Reset                        | Soft Reset  | <b>810</b>                        | uint16  | 0..1                       | 0 = Normal<br>1 = Reset  |     |
| Persist                           | Persist (Store Parameters in Non-Volatile Memory)   | <b>811</b>                        | uint16  | 0..1                       | 0 = Normal<br>1 = Persist  |     |
| Factory Defaults                  | Reload Defaults (NOTE: Resets all settings to factory defaults)   | <b>812</b>                        | uint16  | 0..1                       | 0 = Normal<br>1 = Factory Defaults   |     |
| Service Pin                       | Service Pin (BACnet Only)   | <b>813</b>                        | uint16  | 0..1                       | 0 = Normal<br>1 = Service Pin  |     |
| Zone 1 Sensor                     | Enables Zone 1 TDR20/QDR20 Sensor (Modbus Address 1)  | <b>814</b>                        | uint16  | 0..1                       | 0 = Disabled<br>1 = Enabled (Default)                                      |     |
| Zone 2 Sensor                     | Enables Zone 2 TDR20/QDR20 Sensor (Modbus Address 2)  | <b>815</b>                        | uint16  | 0..1                       | 0 = Disabled (Default)<br>1 = Enabled                                      |     |
| Zones Lock Override               | Overrides the Zone Sensor Lock (both Zone 1 and Zone 1 - TDR20/QDR20)                                   | <b>608</b>                        | uint16  | 0..2                       | 0 = No Override<br>1 = Unlock Screen<br>2 = Lock Screen                    |     |
| Firmware Version                  | Firmware Version  | <b>820</b>                        | uint16  | N/A                        | N/A  |     |
| Serial Number                     | Serial Number   | <b>821</b>                        | uint16  | N/A                        | N/A  |     |
| Date Code                         | Date Code   | <b>822</b>                        | uint16  | N/A                        | N/A  |     |
| Product ID                        | Product ID  | <b>823</b>                        | uint16  | N/A                        | N/A  |     |
| Device ID                         | BACnet Device ID. Set to 0 to use Automatically generated ID. Follow change with "Persist" and "Reset". | <b>825</b>                        | uint32  | 0..4,194,303 (x1)          | 0..4,194,303   |     |

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 |   |                                   |  |                                 |   |     |
|---------------------------------------|---|-----------------------------------|--|---------------------------------|---|-----|
| Parameter                             | Description   | Modbus Register / BACnet Property | MODBUS INPUT REGISTERS - FUNCTION CODE 04<br>MODBUS HOLDING REGISTER - FUNCTION CODES 03, 16 |                                 |   |     |
|                                       |   |                                   | 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) | <b>450</b>                        | uint16   | 0..25700 (x1)<br>0x0000..0x6464 | Byte 1: Y1 (0x00..0x64),<br>Byte 2: Y2 (0x00..0x64)   | R   |
| Y3/Y4                                 | Combined 16-Bit Register for Outputs Y3 and Y4  | <b>451</b>                        | uint16   | 0..25700 (x1)<br>0x0000..0x6464 | Byte 1: Y3 (0x00..0x64),<br>Byte 2: Y4 (0x00..0x64)   | R   |
| Htg/Clg                               | Combined 16-Bit Register for Heating and Cooling Demands  | <b>452</b>                        | uint16   | 0..25700 (x1)<br>0x0000..0x6464 | Byte 1: Htg (0x00..0x64),<br>Byte 2: Clg (0x00..0x64) | R   |



|               |  |     |        |                                 |   |   |
|---------------|--|-----|--------|---------------------------------|---|---|
| Triac1/Triac2 | Combined 16-Bit Register for Triac 1 and Triac 2 Demands | 453 | unit16 | 0..25700 (x1)<br>0x0000..0x6464 | Byte 1: Triac 1 (0x00..0x64)<br>Byte 2: Triac 2 (0x00..0x64)                      | R |
| Triac1/Triac2 | Combined 16-Bit Register for Triac 3 and Triac 4 Demands | 454 | unit16 | 0..25700 (x1)<br>0x0000..0x6464 | Byte 1: Triac 1 (0x00..0x64)<br>Byte 2: Triac 2 (0x00..0x64)                      | R |
| Device Status | Combined 16-Bit Register for Binary Status of the Device | 455 | unit16 | 0..25700 (x1)                   | Bit0 - DI1, Bit1 = DI2, Bit3 = PIR, Bit4 = Relay, Bit5= Boost, Bit6 = Screen Lock | R |

## 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  |  |  |   |
|--|--|--|---|
| <b>Date:</b>   | Mar 1, 2024  |  |   |
| <b>Vendor Name:</b>  | Senticon Ltd   |  |   |
| <b>Vendor ID:</b>  | 1374   |  |   |
| <b>Product Name:</b>   | xCR Smart Room Controller  |  |   |
| <b>Product Models:</b>   | TCRxx, QCRxx   |  |   |
| <b>Applications Software Version:</b>  | 1.0  |  |   |
| <b>Firmware Revision:</b>  | 1.0.0  |  |   |
| <b>BACnet Prorocol Revision</b>  | 1.19   |  |   |
| <b>Product Description:</b>  | Smart Room Controller  |  |   |
| <b>BACnet Standard Device Profile:</b>   | BACnet Application Specific Controller (B-ASC)   |  |   |
| <b>BACnet Interoperability Blocks Supported:</b>   | Data Sharing - ReadProperty-B (DS-RP-B)<br>Data Sharing - ReadPropertyMultiple-B (DS-RPM-B)<br>Data Sharing - WriteProperty-B (DS-WP-B)<br>Data Sharing - COV-B (DS-COVU-B)<br>Device Management - DynamicDeviceBinding-B (DM-DDB-B)<br>Device Management - DynamicObjectBinding-B (DM-DOB-B)<br>Device Management - DeviceCommunicationControl-B (DM-DCC-B) |  |   |
| <b>Segmentation Capability:</b>  | No   |  |   |
| <b>Data Link Layer Options:</b>  | MS/TP Master; Supported Baud 9600/19200/38400/57600/76800/115200   |  |   |
| <b>Device Address Binding:</b>   | No static device binding supported   |  |   |
| <b>Networking Options:</b>   | None   |  |   |
| <b>Character Sets Supported:</b>   | ISO 10646 (UTF-8)  |  |   |
| <b>Gateway Options:</b>  | None   |  |   |
| <b>Network Security Options:</b>   | Non-Secure Device  |  |   |
| <b>Standard Object Types Supported:</b>  | <b>Object Type:</b>  | <b>Optional Properties</b>                           | <b>Writeable Properties</b>   |
|  | Analog Value:  | Description, COV Increment, Relinquish Default       | Present Value<br>COV Increment  |
|  | Binary Value:  | Description, Inactive_Text, Active_Text              | Present Value   |
|  | Device Object:   | Description<br>Active COV Subsriptions<br>Max Master | Object Identifier<br>Object Name<br>APDU Timeout (0...60000)<br>Number Of APDU Retries (0...10)<br>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"> <li>- HVAC application overwrites the present value that has been written with the Write Property Service.</li> <li>- In this case, no error message will be sent.</li> </ul> <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"> <li>- No error message, if the limits have been exceeded</li> <li>- Too high values are set to the range maximum</li> <li>- Too small values are set to the range minimum</li> </ul> |  |  |   |

| 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. | TCR82_XXX               | R/W |
|                            | Object_Type                    |               | 8                       | R   |
|                            | System_Status                  |               | Status_Operational      | R   |
|                            | Vendor_Name                    |               | Senticon Ltd            | R   |
|                            | Vendor_Identifier              |               | 1374                    | R   |
|                            | Model_Name                     |               | TCR81 / TCR82           | 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)                       | UI1                  | -40.0..120.0°C /<br>-40..248°F<br>0..100.0% | -                  | DEGREES_CELCIUS or<br>DEGREES_FAHRENHEIT or<br>NO_UNITS | 0.0..100<br>Default 1.0* | R   |
| AV(1)                       | UI2                  | -40.0..120.0°C /<br>-40..248°F<br>0..100.0% | -                  | DEGREES_CELCIUS or<br>DEGREES_FAHRENHEIT or<br>NO_UNITS | 0.0..100<br>Default 1.0* | R   |
| AV(2)                       | UI3                  | -40.0..120.0°C /<br>-40..248°F<br>0..100.0% | -                  | DEGREES_CELCIUS or<br>DEGREES_FAHRENHEIT or<br>NO_UNITS | 0.0..100<br>Default 1.0* | R   |
| AV(3)                       | UI3                  | -40.0..120.0°C /<br>-40..248°F<br>0..100.0% | -                  | DEGREES_CELCIUS or<br>DEGREES_FAHRENHEIT or<br>NO_UNITS | 0.0..100<br>Default 1.0* | R   |
| AV(4)                       | Z1 Temperature       | -40.0..120.0°C /<br>-40.0..248.0°F          | -                  | DEGREES_CELCIUS or<br>DEGREES_FAHRENHEIT                | 0.0..100 (Default 0.5*)  | R   |
| AV(5)                       | Z1 Humidity          | 0..100.0                                    | -                  | RELATIVE_HUMIDITY                                       | 0.0..100 (Default 5*)    | R   |
| AV(6)                       | Z1 CO2               | 0..10,000                                   | -                  | PARTS_PER_MILLION                                       | 0.0..100 (Default 50*)   | R   |
| AV(7)                       | Z1 VOC               | 0..1,000                                    | -                  | NO_UNITS  | 0.0..100 (Default 10*)   | R   |
| AV(8)                       | Z2 Temperature       | -40.0..120.0°C /<br>-40.0..248.0°F          | -                  | DEGREES_CELCIUS or<br>DEGREES_FAHRENHEIT                | 0.0..100 (Default 0.5*)  | R   |
| AV(9)                       | Z2 Humidity          | 0..100.0                                    | -                  | RELATIVE_HUMIDITY                                       | 0.0..100 (Default 5*)    | R   |
| AV(10)                      | Z2 CO2               | 0..10,000                                   | -                  | PARTS_PER_MILLION                                       | 0.0..100 (Default 50*)   | R   |
| AV(11)                      | Z2 VOC               | 0..1,000                                    | -                  | NO_UNITS  | 0.0..100 (Default 10*)   | R   |
| AV(12)                      | Z1_Setpoint_Temp     | 0.0..212.0                                  | Nonvol_Setpoint    | NO_UNITS  | n/a                      | R/W |
| AV(13)                      | Z1_Setpoint_Humidity | 0..100.0                                    | Nonvol_Setpoint    | RELATIVE_HUMIDITY                                       | n/a                      | R/W |

|        |   |               |                 |                   |     |     |
|--------|---|---------------|-----------------|-------------------|-----|-----|
| AV(14) | Z1_Fan_Speed                              | 0..4.0        | Nonvol_FanSpeed | NO_UNITS          | 1   | R/W |
| AV(15) | Z1_Occupancy_Mode<br>(Occupied/Unocc/Off) | 0..2.0        | Nonvol_OpMode   | NO_UNITS          | 1   | R/W |
| AV(16) | Z2_Setpoint_Temp                          | 0.0..212.0    | Nonvol_Setpoint | NO_UNITS          | n/a | R/W |
| AV(17) | Z2_Setpoint_Humidity                      | 0..100.0      | Nonvol_Setpoint | RELATIVE_HUMIDITY | n/a | R/W |
| AV(18) | Z2_Fan_Speed                              | 0..4.0        | Nonvol_FanSpeed | NO_UNITS          | 1   | R/W |
| AV(19) | Z2_Occupancy_Mode<br>(Occupied/Unocc/Off) | 0..2.0        | Nonvol_OpMode   | NO_UNITS          | 1   | R/W |
| AV(20) | Network_Decimal_1                         | -999.0..999.0 | Nonvol_Setpoint | NO_UNITS          | n/a | R/W |
| AV(21) | Network_Integer_1                         | 0..65535.0    | Nonvol_Setpoint | NO_UNITS          | n/a | R/W |
| AV(22) | Network_Decimal_2                         | -999.0..999.0 | Nonvol_Setpoint | NO_UNITS          | n/a | R/W |
| AV(23) | Network_Integer_2                         | 0..65535.0    | Nonvol_Setpoint | NO_UNITS          | n/a | R/W |
| AV(24) | Y1  | 0.0..100.0%   | -               | PERCENT           | 5   | R/W |
| AV(25) | Y2  | 0.0..100.0%   | -               | PERCENT           | 5   | R/W |
| AV(26) | Y3  | 0.0..100.0%   | -               | PERCENT           | 5   | R/W |
| AV(27) | Y4  | 0.0..100.0%   | -               | PERCENT           | 5   | R/W |
| AV(28) | Triac1_PWM                                | 0..100        | -               | PERCENT           | 5   | R/W |
| AV(29) | Triac2_PWM                                | 0..100        | -               | PERCENT           | 5   | R/W |
| AV(30) | Triac3_PWM                                | 0..100        | -               | PERCENT           | 5   | R/W |
| AV(31) | Triac4_PWM                                | 0..100        | -               | PERCENT           | 5   | 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: AV14/AV15/AV16/AV17 override the controller and TDR/QDR20 interface. To allow changes from the TDR20/QDR20, set the Priority Inputs to 'null' after the override.**

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

**NOTE: On COV Increments marked with asterisk (\*), the COV Increment changes are stored in non volatile memory after applying 'Persist'.**

| 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)<br>1: Active (On)          | Binary_Inactive    | R   |
| BV(1)                     | DI_2            | Digital Input 2 Status                                      | 0: InActive (Off)<br>1: Active (On)          | Binary_Inactive    | R   |
| BV(2)                     | DI_3            | Digital Input 1 Status                                      | 0: InActive (Off)<br>1: Active (On)          | Binary_Inactive    | R   |
| BV(3)                     | DI_4            | Digital Input 2 Status                                      | 0: InActive (Off)<br>1: Active (On)          | Binary_Inactive    | R   |
| BV(4)                     | Z1_Cooling_Mode | Cooling Mode Override for Heating Stage 1 (Heating/Cooling) | 0: InActive (Heating)<br>1: Active (Cooling) | Binary_Inactive    | R/W |
| BV(5)                     | Z2_Cooling_Mode | Cooling Mode Override for Heating Stage 1 (Heating/Cooling) | 0: InActive (Heating)<br>1: Active (Cooling) | Binary_Inactive    | R/W |

**PROPRIETARY OBJECT**  
**OBJECT NAME / TYPE: "CONFIGx" / 128**

The devices have six instances of proprietary Device Configuration objects split as with the configuration tools; Cfg\_Inputs, Cfg\_Outputs, 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 *Device Setup and Modbus/BACnet Communication* section tables.

In addition to the generic parameters, the BACnet AV and BV objects have proprietary property to enable COV (Unsubscribed COV) function. For the AV 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<br>x = AV Object Number (AV0..AV11, AV14..AV15, A18..AV19) | 100x            | uint16 | 0..1(x1)                | 0 = COV Disabled<br>1 = COV Enabled | R/W |
| BVx COV                    | BV Object COV Enable Flag<br>x = BV Object Number (BV0..BV3)                         | 110x            | uint16 | 0..1(x1)                | 0 = COV Disabled<br>1 = COV Enabled | R/W |

## Dimensions

### DIMENSIONS

