# CDR-MOD Room $CO_2$ and Temperature Sensors with Modbus

The CDR-MOD sensors are designed to detect carbon dioxide concentration and temperature in the room spaces and have built-in RS485 Modbus communication interface. The CO2 sensor calibrate automatically its measurement. The CDR sensors have linear 0..10V signals outputs relating to CO2-concentration, temperature, and humidity. The sensors can be used for demand controlled ventilation in buildings.

The CDR-MOD sensors can be installed on a wall surface or on a wall mounting box in dry indoor environment. The CDR sensors come with a number of options such as display, active setpoint, extra digital/resistive inputs, occupancy detection, lux level measurement and 0-10Vdc measurement option.

The CDR-MOD have resistive and digital inputs for integrating local measurements such as window contacts or external temperature sensors.

The CDR-MOD sensors can also operate as CO2, Temperature, Light Level or Humidity controllers offering single enclosure measurement and control solutions. Other features include maximum demand control for ventilation plants.

| **Model Type** | Model | Description |
|---|---|---|
| | **CDR-MOD** | CDR Room $CO_2$ and Temperature Sensor with Modbus Communications, 1 DI, 1RI, 3AO (0..10Vdc), 2DO |
| | **-LCD** | Display Option |
| | **-RH** | 2%rH Relative Humidity Option |
| | **-AL** | Alarm Display Option See Note 4 |
| | **-SP** | Active Setpoint Potentiometer (Knob) Option See Note 3 |
| | **-SPB** | Active Setpoint Push Button Option See Note 5 |
| | **-LL** | Light Level and Occupancy Detection Option See Note 1 |
| | **-PB** | Push Button Interface Option with Timer |
| | **-PB2** | 2 Momentary Push Buttons with Timer |
| | **-PB3** | 3 Momentary Push Buttons with Timer |
| | **-DI2** | Digital Input Option for 2 Digital Inputs |
| | **-RI2** | Resistive Input Option for 2 Resistive Inputs See Note 2 |
| | **-AI** | 2 x Analogue Input Option; Replaces RI1 and RI2 |

| **Accessories** | Model | Description |
|---|---|---|
| | **SW-DCT-USB** | Windows Device Configuration Tool Software with Serial USB Interface, 1.8m USB Lead |

***Note 1: If -LL Option is selected the Resistive Input 1/ AI (0-10Vdc) measurement is no longer available.***

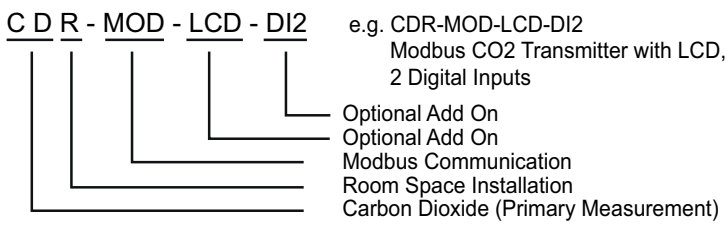
***Note 2: -RI2 / -AI (0-10Vdc) Option is not available if -SP option is selected. If both are required please contact SyxthSense for active setpoint options.***

***Note 3. If -SP Option is selected the -LL options are no longer available (and vice versa).***

***Note 4. If -LCD is fitted, the -AL option is provided with the backlight of the LCD. If -LCD is not fitted the alarm option is provided with the traffic light LEDs.***

***Note 5. Requires -LCD Option.***

**Order Codes**

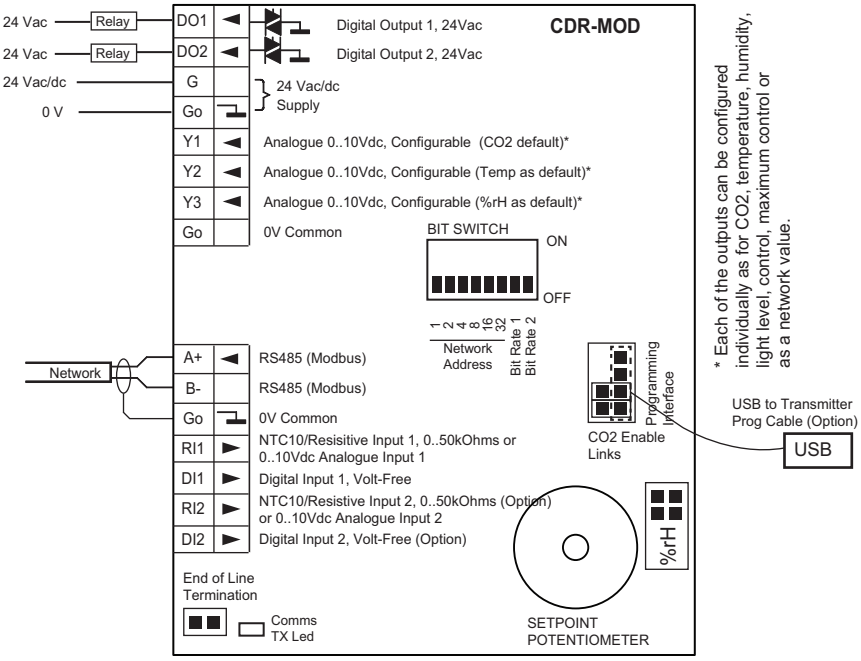



**Technical Data**

| | | |
|---|---|---|
| Power Supply | Power supply | 24Vac/dc -10%/+15%, max 1VA |
| Displays and Interfaces | Option -LCD | LCD Display for Showing $CO_2$, Temperature, Humidity, Light Level (configurable through the tool or Modbus) |
| | Option -AL | Green, Amber, Red Traffic Light LEDs (if -LCD not fitted)<br>White, Amber, Red LCD backlight with -LCD option<br>(alarm limits 750 and 1250ppm, adjustable) |
| | Option -SP | Setpoint Potentiometric Knob (network or control; adjustable min/max limits)<br>***Note: If this option is selected RI2 /AI Option (resistive input 2) are no longer available.*** |
| | Option -SPB | Setpoint with 2 Push Buttons (network or control; adjustable min/max limits) ***Note: Please select/order LCD option to visualise the setpoint. If this option is selected PB/PB2 options are replaced by setpoint buttons. If PB/PB2 are still required these are fitted underneath the SPB buttons (PB3/PB4 Modbus registers)*** |
| | Option -PB | Push Button with Delay Timer; status available through DO1, DO2 or via Network ***Note: If SPB option is also selected, the button is fitted underneath the SPB buttons (PB3 Modbus register)*** |
| | Option -PB2 | 2 x Push Buttons with Delay Timer; status available through DO1, DO2 or via Network ***Note: If SPB option is also selected, the buttons are fitted underneath the SPB buttons (PB3/PB4 Modbus registers)*** |
| | Option -PB3 | 3 x Push Buttons with Delay Timer; status available through DO1, DO2 or via Network ***Note: If SPB option is also selected, the PB3 option is not available*** |
| Signal Outputs | Analogue Outputs | 3 x 0..10Vdc < 5mA; 100k min impedance for 1% accuracy |
| | Digital Outputs | 2 x 24Vac 2A Triac; requires 24Vac Power Supply (DO1 & DO2) |
| | Option -PB (Push Button) | DO1 or DO2 configurable as 24Vac Triac; requires 24Vac Power Supply |
| | Option -LL (Occupancy) | DO1 or DO2 configurable as 24Vac Triac; requires 24Vac Power Supply |
| Signal Inputs | Resistive Input | 1 x NTC10/Resistive Input, 0..50kOhms (network value) |
| | Digital Input | 1 x Digital Input, Volt-Free Contact, Impedance <1KOhm<br>Pulse Counting: Max 25Hz, Min Pulse Length 20mA (Volatile) |
| | Option -RI2 | Additional NTC10/Resistive Input, in total 2 x NTC10/Resistive Inputs, 0..50kOhms (network values; NTC10 default) |
| | Option -DI2 | Additional Digital Input, in total 2 x Digital Inputs, Volt-Free Contacts (network values), Impedance <1KOhm<br>Pulse Counting: Max 25Hz, Min Pulse Length 20mA (Volatile) |
| | Option -AI | 2 x 0..10Vdc Voltage Inputs (Replaces RI1 & RI2) |
| Sensing Characteristics | Carbon Dioxide ($CO_2$) | |

| | | |
|---|---|---|
| | Range | 0...5000ppm $CO_2$ (Range Adjustable) |
| | Accuracy | ± 50ppm + 3% of the reading @ 25°C (@77°F) |
| | Technology | Auto Calibrating; Patented Non-Dispersive Infrared (NDIR) |
| | Non-Linearity | <1% FS |
| | Warm-Up Time | <20 seconds |
| | Response Time | 2 minutes |
| | Temperature | |
| | Range | 0..50°C (32..122°F) |
| | Accuracy | ±0.3°C |
| | Humidity; Option -RH | |
| | Range | 0..100%rH |
| | Accuracy | ±2% rH (within 0..90% rh) |
| | Light Level and Occupancy; Option -LL | ***NNote: If this option is selected RI1 (resistive input) / AI (0-10Vdc) are no longer available and need to be left disconnected.*** |
| | Range | 0..3,000 Lux |
| | Occupancy | Infrared Detection (Adjustable Delay) |
| Communication | Modbus Communications | |
| | Procotol | Modbus RTU |
| | Interface | RS485; maximum 63 devices |
| | Addressing | 1..63 via a bit switch; 1..247 via tool / network |
| | Communication | 9k6/19k2/38k4/57k6 Baud; Parity None/Even/Odd, 1 or 2 Stop Bits (baud rate adjustable through bit switch or network) |
| Connections | Terminal Connections | Solid and Stranded Cable; 55° Angle for Wiring<br>Maximum Size: 0.05 to 1.5$mm^2$ (EN ISO) / 14 to 30 AWG (UL)<br>Rising Clamp: Size 2.5 x 1.9mm |
| Environmental Conditions | Operating | |
| | Temperature | 0°C...+50°C (32..122°F) |
| | Humidity | 0...95%rh (non-cond.) |
| | Storage | |
| | Temperature | -30°C...+70°C (-22..158°F) |
| | Humidity | 0...95%rh (non-cond.) |
| Standards | CE Conformity | CE Directive 2004/108/EY<br>EN61000-6-3: 2001 (Generic Emission)<br>EN61000-6-1: 2001 (Generic Immunity). |
| | Degree of Protection | IP20 |
| Housing | Housing Material | ABS Plastics, Self Extinguishing |
| | Mounting | Wall or Junction Box Mounting |
| | Dimensions | W86 x H120 x D29mm |
| | Weight | 180g |

**Wiring Terminals**




| | |
|---|---|
| DO1 | Digital Output; 24Vac Triac Switching to 0V; max. 2A |
| DO2 | Digital Output; 24Vac Triac Switching to 0V; max. 2A |
| G | 24Vac/dc Power Supply |
| G0 | 0V Common |
| Y1 | 0..10Vdc Analogue Output (Function Selectable) |
| Y2 | 0..10Vdc Analogue Output (Function Selectable) |
| Y3 | 0..10Vdc Analogue Output (Function Selectable) |
| G0 | 0V Common |
| A+ | RS485 A+ Connection (Modbus) |
| B- | RS485 B- Connection (Modbus) |
| G0 | 0V Common |
| RI1 | NTC10/Resistive Input 0..50kOhms<br>or 0..10Vdc Analogue Input 1 |
| DI1 | Digital Input; Volt-Free, Max 25Hz, Min Pulse Length 20mS |
| RI2 | NTC10/Resistive Input 0..50kOhms<br>or 0..10Vdc Analogue Input 2 |
| DI2 | Digital Input; Volt-Free, Max 25Hz, Min Pulse Length 20mS |

**Wiring Precautions**

Switch off the power before any wiring is carried out. If the sensor has the LCD display fitted, unplug the LCD display and then wire the power supply and analogue outputs, if relevant.

After the wiring has been completed; plug-in the display and power up the sensor.

**Digital Input Pulse Counting**

Digital Inputs can be used for pulse counting up to 25Hz, minimum pulse length 20mS. The pulse count is stored in a dedicated register and can be read over the network. It is possible to write to this register to reset the value.

***NOTE: The pulse count value is not battery backed, and therefore the network master is required to manage the data synchronisation in case of power failure.***

**NTC10/ Resistive Inputs**

The resistive inputs can be configured to operate as NCT10 inputs or Resistive Inputs. As default the inputs are configured as NTC10. The maximum measurement range is -10°C to 100°C (-40°F to 212°F). The configuration is changed via the Configuration Software.

**0-10Vdc Analogue Inputs; AI-Option**

If AI-option has been selected then RI1 & RI2 are converted to 0-10Vdc Inputs to measure 0-10Vdc signals (resistive inputs are no longer available).

**Y1/Y2/Y3 Analogue Output Operation (Modes)**

The analogue outputs Y1/Y2/Y3 can be configured for the following options.

| Output Modes | Description |
|---|---|
| Network | The output is set by the network (Modbus). On the Modbus network the actual value is configured through "Y1, Y2, Y3 Override Values" parameters, respectively. |
| $CO_2$ Measurement (Default for Y1) | The output represents the CO2 measurement.This this is scaled over 0..10V. |
| Temperature Measurement (Default for Y2) | The output represents the temperature measurement. This is scaled over 0..10V. |
| Humidity Measurement (requires -RH option) | The output represents the humidity measurement. This is scaled over 0..10V. |
| Light Measurement (requires -LL option) | The output represents the light level measurement. This is scaled over 0..10V. |
| $CO_2$ Control | The output represents the CO2 control signal. |
| Temperature Control | The output represents the temperature control signal. |
| Humidity Control (requires -RH option) | The output represents the humidity control signal. |
| Light Control (requires -LL option) | The output represents the light level (LUX) control signal. |
| Maximum Control | The output represents the maximum of the $CO_2$ and temperature control signals. Typically used in ventilation plants where the ventilation level is boosted based on high $CO_2$ concentration or when high room temperature is prevailing (cooling). |
| Potentiometer (SP/SPB options) | Allows the setpoint potentiometer or push button setpoint position to be fed to the analogue output as 0..10V signal. |
| Max Hum/Temp | The output represents the maximum of the temperature and humidity control loops. |
| Max Hum/Temp/CO2 | The output represents the maximum of the temperature, humidity and CO2 control loops. |

**DO1/DO2 Digital Output Operation**

The DO1or DO2 can be used to switch plants on/off based on a configured measurement and the setpoint (thermostatic operation). If OC (Occupancy Sensor) option is fitted and then selected, the DO1/DO2 can be used to switch output on when occupancy is detected. If the push button option (-PB) is fitted then DO1/DO2 can be set to switch ON when push button is pressed (delayed switch off).

| Digital Output Mode Options | Description (Typical Operation) |
|---|---|
| Network | The DO1/DO2 is switched ON/OFF over the communication network. |
| CO2 Control Mode (e.g. CO2 High Limit Control) | Direct Mode: The DO1/DO2 is switched ON when the CO2 reading exceeds the CO2 Setpoint (1000 ppm default) + CO2 Digital Output Mode Hysteresis. The DO1/DO2 switches OFF when the CO2 reading drops below the setpoint.The control direction is adjustable; reverse / direct. |
| Temperature Control Mode (e.g. Low Temperature Limit) | Reverse Mode: The DO1/DO2 is switched ON when the temperature drops below the Temperature Setpoint - Temperature Mode Hysteresis. The output is switched OFF when the temperature exceeds the Setpoint. The control direction is adjustable; reverse (heating) / direct (cooling). |
| Humidity Control Mode (e.g. Humidity High Limit) (requires -RH option) | Direct Mode: The DO1/DO2 is switched ON when the humidity reading exceeds the Humidity Setpoint (60% default) + Humidity Digital Output Mode Hysteresis, and switches OFF when the humidity drops below the Setpoint. The control direction is adjustable; reverse (humidification) / direct (de-humidification). |
| Light Level Control (LUX) Mode (e.g. Low Light Level) (requires -LL option) | Reverse Mode: The DO1/DO2 is switched ON when the light level drops below the Light Level Setpoint - Light Level Digital Output Mode Hysteresis, and switches OFF when the level increases above Setpoint. The control direction is adjustable. |

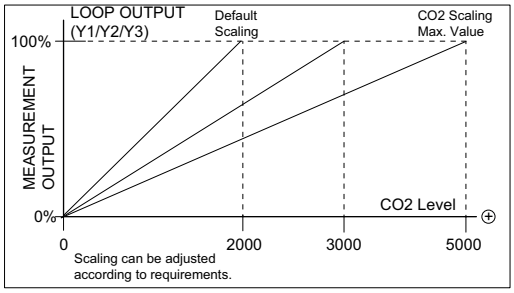
| Digital Output Mode Options | Description (Typical Operation) |
|---|---|
| Occupancy<br>(requires -LL option) | The DO1/DO2 is switched ON when the occupancy sensor detects occupancy; the output remains on adjustable time "Occupancy Delay Time Setting" plus approx 10 seconds after occupancy has been detected. |
| Push Button 1<br>(requires -PB option) | If -PB option is fitted, it is possible to have the DO1 (or DO2) on for the "Push Button Delay Time" specified in the settings after the pressing of button is detected. |
| Push Button 2, 3 and 4 | If -PB2 option is fitted then option for Push Button 2 is also available. If third and fourth push button is required, please contact SyxthSense Sales. |
| Alarm Amber Threshold | The DO1/DO2 output is switched on at the Amber Alarm level. |
| Alarm Red Threshold | The DO1/DO2 output is switched on at the Red Alarm level. |

**CO2 Measurement Output Scaling and Single Point Calibration**

The CDR measures the carbon dioxide content of the room space and the measurement can be sent to any of the analogue outputs (Y1/Y2/Y3). It is also available over the Modbus.

This output is scaled as default 0% = 0ppm and 100% = 2,000ppm). The scaling can be modified through Maximum CO2 Scaling parameter.

Furthermore the CO2 measurement reading can be adjusted on site using the Single Point Calibration field.




**CO2 Measurement Enable**

CO2 measurement is enabled by inserting CO2 link jumpers (two) on the programming header. As default these are fitted (see programming interface section for further details).

**CO2 Measurement Auto-Calibration**

The CO2 sensor has automatic auto-calibration feature. This feature monitors the background CO2 level over the calibration period (8 days), and calibrates the CO2 level to the lowest point measured during this period. The sensors are supplied as factory calibrated to the typical background levels. After powering up the sensor, the sensor carries out initial calibration within 1 day after which the CO2 level is calibrated every 8 days automatically.The auto calibration logic virtually eliminates the need for manual calibration in applications where the indoor CO2 drops to outside levels during unoccupied periods.

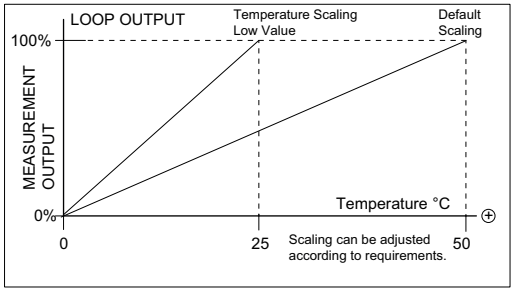
**NOTE:** If the CO2 sensor is fitted in spaces where the background level does not drop close to the typical background level (= fresh air) of 400ppm (e.g. greenhouses) it is essential that the auto-calibration feature is disabled during the commissioning.

**Temperature Measurement Output Scaling and Single Point Calibration**

The CDR measures the room space temperature, and the measurement can be sent to any of the analogue outputs (Y1/Y2/Y3). It is also available over the Modbus.

This output is scaled as default 0% = 0°C and 100% = 50°C). The scaling can be modified through Maximum Temperature Scaling parameter. The output can also be scaled in Fahrenheit units.

Furthermore the temperature measurement reading can be adjusted on site using the Single Point Calibration field.

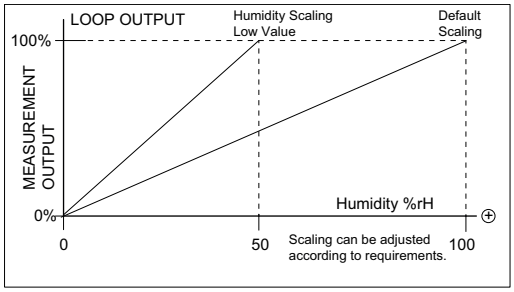



**Humidity Measurement Output Scaling and Single Point Calibration; Only when -RH Option Fitted**

The CDR with -RH option measures the room space humidity. The humidity reading is available over the Modbus network, and the measurement can be sent to any of the analogue outputs (Y1/Y2/Y3).

This output is scaled as default 0% = 0°C and 100% = 100%rH). The scaling can be modified through Maximum Humidity Scaling parameter.

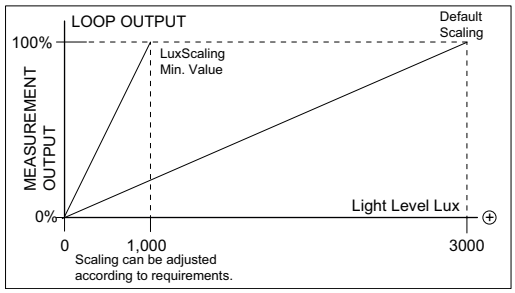
Furthermore the humidity measurement reading can be adjusted on site using the Single Point Calibration field.



**Light Level Measurement Output Scaling; Only when -LL Option Fitted**

The CDR sensors fitted with -LL option measure the light level. The light level (LUX) reading is available over the Modbus network, and the measurement can be sent to any of the analogue outputs (Y1/Y2/Y3).

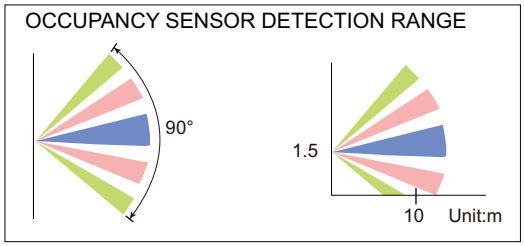
This output is scaled as default 0% = 0 LUX and 100% = 3,000 LUX). The scaling can be modified through Maximum LUX Scaling parameter.




ENERGY SAVING FEATURE: When the LL option is combined with the SPB (Setpoint by buttons) option, it is possible to configure the control setpoint to automatically switch to setback/boost value when the room space is not occupied.

**Occupancy Sensor (-LL Option)**

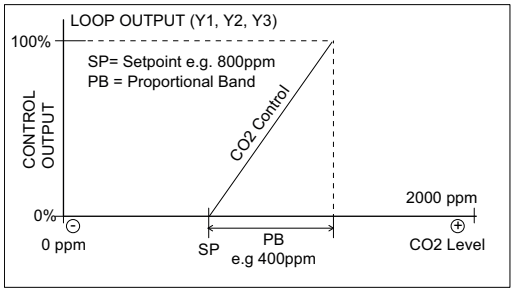
The LL option offers a low power Passive Infrared Motion sensor with 21mm Fresnel lens designed for HVAC ventilation and lighting control applications. The sensor detects human body within its detection range. The LL sensor employs a dual element pyroelectric infrared sensor with advanced electronics circuitry.




**CO2 Control Loop Operation**

**Proportional or PI Control (Reverse/ Direct)**

The CO2 measurement can be used for the CO2 control. The calculated control demand is then send to the output Y1, Y2 or Y3 (depending on the corresponding analogue output mode selection).



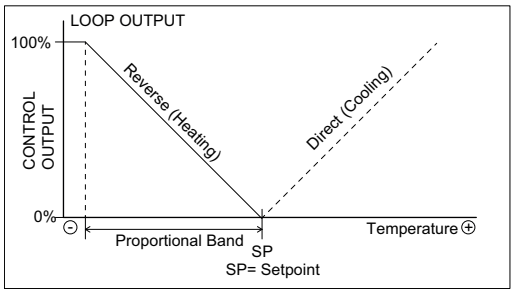

The CO2 control loop output corresponds to the CO2 setpoint and the CO2 proportional band. If configured as Direct Control (typical), then if the CO2 level increases above the setpoint the loop output starts to modulate to 100%. When the CO2 level is the amount of the Proportional Band above the setpoint, the loop output is 100%. The configuration is done via the configuration parameters (or over the Modbus network). The CO2 control loop can also be configured to operate as Proportional + Integral control by changing the Integral Action Time from 0 to a required value.

It is possible apply the Boost function to the control loop to override the output to 100% (see Boost Function for more details).

**Temperature Control Loop Operation**

**Proportional or PI Control (Reverse/ Direct)**

The temperature measurement can also be used for the temperature control. The calculated control demand is then send to the output Y1, Y2 or Y3 (depending on the corresponding analogue output mode selection).



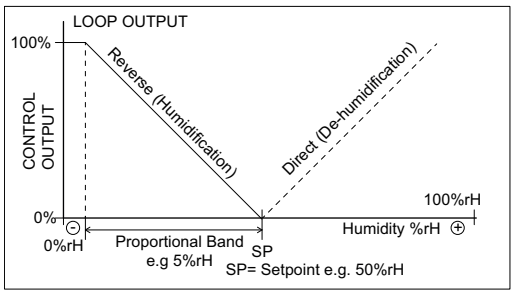

The temperature control loop output corresponds to the temperature setpoint and temperature proportional band. If configured as Reverse Control (heating), then if the temperature level drops below the setpoint the loop output starts to modulate to 100%. When the temperature is the amount of the Proportional Band below the setpoint the loop output is 100%. In the Direct Control mode the output modulates in reverse. The configuration is done via the configuration parameters (or over the Modbus network).

The temperature control loop can also be configured to operate as Proportional + Integral control by changing the Integral Action Time from 0 to a required value.

It is possible apply the Boost function to the control loop to override the output to 100% (see Boost Function for more details).

**Humidity Control Loop Operation Mode Selection; Only CDR-RH or when -RH Option Fitted**

**Proportional or Proportional + Integral Control (Reverse/ Direct)**




The humidity measurement can also be used for the humidity control. The calculated control demand is then send to the output Y1, Y2 or Y3 (depending on the corresponding analogue output mode selection).

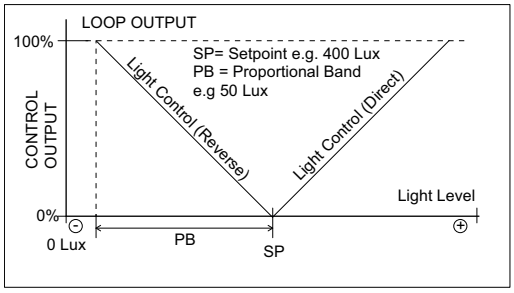
The humidity control loop output corresponds to the humidity setpoint and the humidity proportional band. If configured as Reverse Control (humidification), then if the humidity level drops below the setpoint the loop output starts to modulate to 100%. When the humidity is the amount of the Proportional Band below the setpoint the loop output is 100%. In the Direct Control mode the output modulates in reverse. The configuration is done via the configuration parameters (or over Modbus network).

The humidity control loop can also be configured to operate as Proportional + Integral control by changing the Integral Action Time from 0 to a required value.

It is possible apply the Boost function to the control loop to override the output to 100% (see Boost Function for more details).

**Light Level (LUX) Control Loop Operation; Only when -LL Option Fitted**

**Proportional Control (Reverse/ Direct)**




The LUX measurement can also be used for light control. The calculated control demand is sent to the output Y1, Y2 or Y3 (depending on the corresponding analogue output mode selection).

The light control loop output corresponds to the light level setpoint and the light control proportional band. If configured as Reverse Control, then if the light level drops below the setpoint the loop output starts to modulate to 100%. When the light level is the amount of the Proportional Band below the setpoint the loop output is 100%.In the Direct Control mode the output modulates in reverse. The configuration is done via the configuration parameters (or over the Modbus network).

The LUX control loop can also be configured to operate as Proportional + Integral control by changing the Integral Action Time from 0 to a required value.

It is possible apply the Boost function to the control loop to override the output to 100% (see Boost Function for more details).

Unoccupied Setpoint

If the sensor has been configured for control, then it is possible to set the control setpoint to a different setting during the unoccupied periods (controlled by the occupancy sensor). Great feature for energy savings.

**Maximum Control Loop**

Each of the analogue outputs can also be configured as "Maximum Control". In this case the corresponding output (Y1, Y2, Y2) takes the maximum of the CO2 Loop and Temperature Loop outputs. This is typically used in demand based ventilation.

Furthermore the each analogue output can be configured as "Max Hum/Temp" or "Max Hum/Temp/CO2", in which case the maximum of these control loops is taken.

**Boost Function**

It is possible to boost/override any of the control outputs to 100%. This can be achieved via a push button on the device (PB-option) or via a digital input. If the Push Button is used then the control output is boosted to 100% for the amount of Push Button Delay Time. When the boost is active the Blue Push Button backlight is lit.The boost can be cancelled by pressing the push button again.

When the digital input option is selected, the output is boosted to 100% when the input is closed. When the digital input is opened the output remains 100% for the time set in the parameter Digital Input Off Delay. If PB2 option is fitted then it is possible to select either Button 1 or Button 2 to boost the output.

**Push Buttons**

It is possible to fit up to four push buttons (or up to two if -SPB push button setpoint option is fitted). The push buttons can be used to activate the boost as described in Boost Function section, or used as a network user interface. The push button LED is as default controlled by the internal application i.e. the LED is ON when the push button timer is active. The push button timer can be cancelled by pressing the push button again when active.

If the Push Button LED Mode is set to BMS, then the LED can be controlled by the BMS. In typical application, when the user presses the push button, the internal timer starts, and the BMS reads the push button status. When the push button status has been confirmed by the BMS, the BMS switches

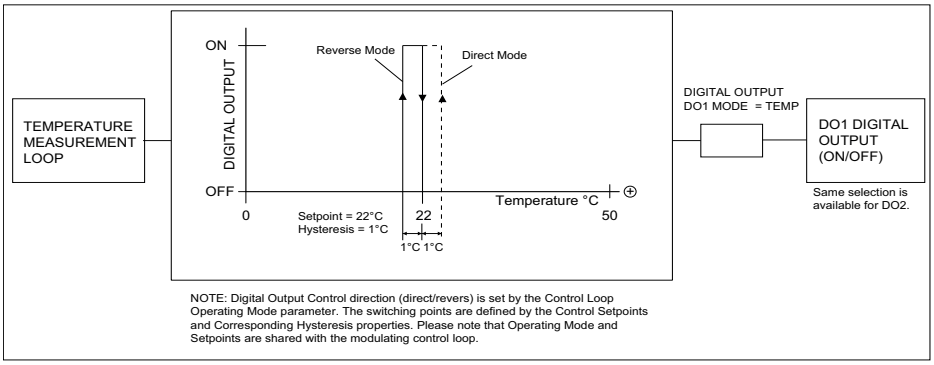
the corresponding PB LED ON and therefore sending acknowledgement to the user. It is not possible to reset the push button timer in network mode by pressing the button again.

Note: It is possible to print the push button caps with custom legends. Please contact SyxthSense Sales for further details.

**Digital Output DO1/DO2 Control Modes**

When the digital output DO1 or DO2 is configured to work in any of the control modes; CO2 Control, Temperature Control; Humidity Control or LUX control; the corresponding digital output is switched ON/OFF based on the corresponding Setpoint property and the corresponding hysteresis. The direction of the operation is also adjustable through Control Loop Operating Mode Parameter.

The diagram below illustrates the operation for Temperature Control Mode. The same concept is applicable for any of the DO1/DO2 control modes (CO2, Temperature, Humidity, LUX).




NOTE: Digital Output Control direction (direct/revers) is set by the Control Loop Operating Mode parameter. The switching points are defined by the Control Setpoints and Corresponding Hysteresis properties. Please note that Operating Mode and Setpoints are shared with the modulating control loop.

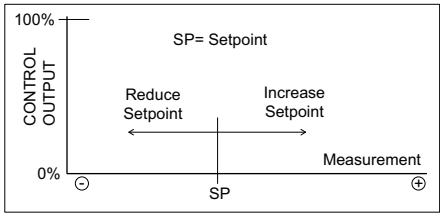
**Alarm LED / LCD Operation (CDR-AL Models / Option)**

If the -AL option is fitted the transmitter is configured to monitor the $CO_2$, temperature, humidity or light levels for alarms. As standard the -AL option comes with traffic light LEDs. When -LCD option is also fitted the alarm condition is displayed using the backlight colours of the LCD instead of LEDs. (LCD replaces the LEDs).

In both cases if the measurement exceeds the amber alarm limit then the amber LED / Backlight is switched ON. If the measurement exceeds the red alarm limit, the red LED / Backlight is switched ON. At normal condition green LED or white backlight is displayed. The alarm mode has an adjustable hysteresis to prevent the LEDs / Backlight flickering and all alarm limits are adjustable. The alarm condition is also available over the Modbus. The configuration is done via the configuration parameters (or over the Modbus).

Note: The DO1/DO2 outputs can also be configured to activate on Amber or Amber/Red alarm e.g to drive external devices in case of the alarm limit has been exceeded.

**Setpoint Potentiometer Knob (-SP option) or Setpoint with Push Buttons (-SPB option)**




With setpoint options it is possible to adjust the current control setpoint. The setpoint potentiometer knob option provides rotary knob for the setpoint whereas the SPB option provides two push buttons for setpoint. The adjustment shifts the CO2, temperature, humidity or LUX setpoint up or down depending on the configuration parameter settings up to the minimum and maximum allowable setpoints. The setpoint can also be made only to be available as a network parameter (no influence to control). In this case the value displayed is between the minimum and the maximum settings (e.g -5.0 to +5.0).

It is also possible to send the setpoint potentiometer position (-SP option) or Setpoint Push Button Setting (-SPB option) to an analogue output as 0..10V signal.

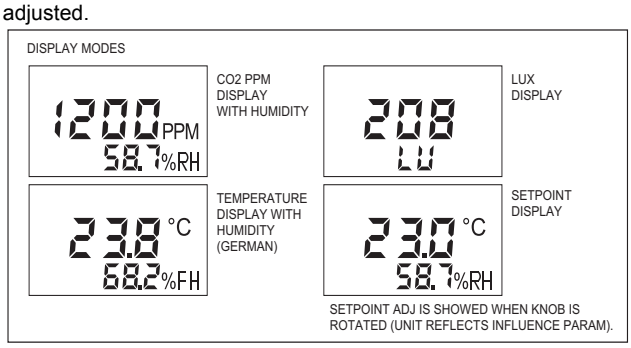
When SPB option is used, by writing the setpoint over the network resets the user adjustments to 0 if the "Reset SPA on SP Change" property is enabled (default). If "Reset SPA on SP Change" is disabled, then writing the setpoint over the network will not reset the user adjustment. In this case "Reset SPA" network variable can be used to reset the user adjustment to zero. Enabling "Save SPA" option will store the user adjustment to the non-volatile memory.

***Note: SPB option requires also -LCD option to be selected/fitted.***

**Display (Requires Option -LCD)**

The LCD display shows the temperature, humidity, CO2 and LUX readings. CO2, temperature and LUX readings are primary readings displayed on the "top line". These readings can be rotated. The humidity reading is shown on the "bottom line" if -RH option has been fitted. The display has white

backlight which is as default switched off. The backlight can be switched on and its intensity can be adjusted.

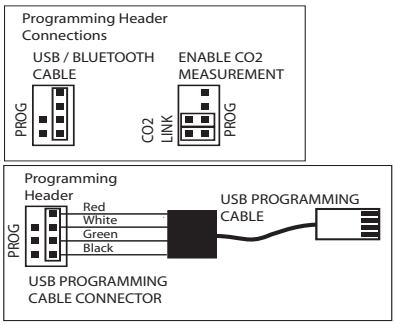



***Note: The backlight is permanently on if activated. At 50% intensity the backlight lifetime is approx 10,000 hours. After this time the LCD module needs replacing if the backlight is required. The display continues to operate without the backlight.***

**Configuration Parameters and Programming**

The parameter options can be configured using the SCT Sensor Configuration Tool software; or via the Modbus network.

If the SCT Configuration software is used, this is connected via the PC USB cable (or via Bluetooth module) to the programming header of the transmitter. In order to connect please remove temporarily the CO2 link jumpers (two), and store them securely to re-fit them after the programming is complete. Then plug-in the USB cable to the programming header as shown on the image below.

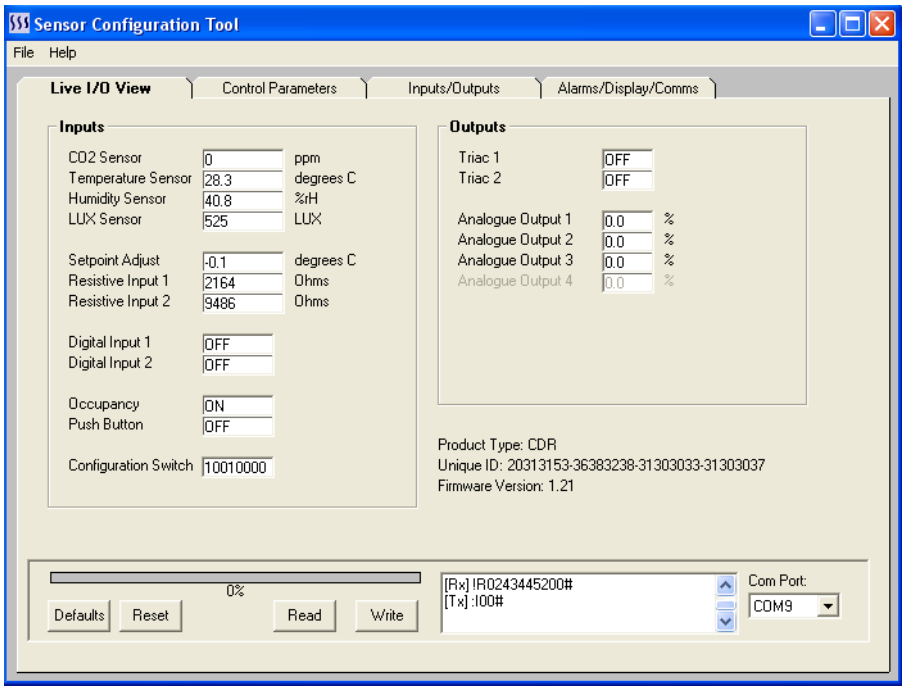



The correct process for connecting the sensor via the USB is as follows:-

- Disconnect USB Connector from PC
- Disconnect the Sensor from Power
- Plug-In the 4-Way Connector to the Sensor
- Connect the USB to the PC
- Power Up the Sensor

***NOTE: Always disconnect USB from PC before plugging the cable into the sensor.***

***NOTE: The CO2 readings are not available unless the CO2 link jumpers are fitted.***




| Common Parameters | |
|---|---|
| **Parameter Name** | **Description** |
| Defaults | Reloads the default configuration from the sensor non-volatile memory. **Note: All modified settings are lost.** |
| Reset | Performs soft reset of the sensor. Apply after major changes. |
| Read | Reads the sensor data. |
| Write | Writes the new settings to the sensor (automatically stored in the non-volatile memory) |
| COM Port | Select the COM port for the USB Cable or Bluetooth. USB cable driver must be installed in order the Serial to TTL connection to operate. |

| Live IO-View | | |
|---|---|---|
| **Parameter Name** | **Description** | **Range** |
| **INPUTS** | | |
| CO2 Sensor | CO2 Sensor Reading | 0..5,000ppm |
| Temperature Sensor | Temperature Sensor Reading | 0..50°C (32..122°F) |
| Humidity Sensor | Humidity Sensor Reading | 0..100% rH |
| LUX Sensor | LUX Sensor Reading | 0..3,000 LUX |
| Setpoint Adjust | Setpoint Adjuster Reading | -500..+500 |
| Resistive Input 1 | Resistive Input 1 Reading | 0..50kOhms |
| Resistive Input 2 | Resistive Input 2 Reading | 0..50kOhms |
| Analogue Input 1 | Analogue Voltage Input (with AI-Option Only) | 0..100% |
| Analogue Input 2 | Analogue Voltage Input (with (AI-Option Only) | 0..100% |
| Digital Input 1 | Digital Input 1 Status | Off - On |
| Digital Input 2 | Digital Input 2 Status | Off - On |
| Occupancy | Occupancy Status | Off - On |
| Push Button | Push Button Status | Off - On |
| Configuration Switch | Bit Switch Status for Each Switch | 00000000 - 11111111 |
| **OUTPUTS** | | |
| Triac 1 | Digital Output 1 | Off - On |
| Triac 2 | Digital Output 2 | Off - On |
| Analogue Output 1 | Analogue Output 1 | 0..100% |
| Analogue Output 2 | Analogue Output 2 | 0..100% |

| Live IO-View | | |
|---|---|---|
| **Parameter Name** | **Description** | **Range** |
| Analogue Output 3 | Analogue Output 3 | 0..100% |

| Control Parameters | | |
|---|---|---|
| **Parameter Name** | **Description** | **Range** |
| **TEMPERATURE** | | |
| Temperature Loop Operating Mode | Direction of the temperature control loop. | 0 = Reverse Control (Heating)<br>1 = Direct Control (Cooling) |
| Temperature Control Setpoint | Temperature Setpoint | 0.0...150.0°C/°F (Default 20°C) |
| Temperature Proportional Band | Temperature Proportional Band | 1.0...150.0°C/°F (Default 50°C) |
| Temperature Control Integral Action | Integral Action time of the temperature control loop. Set to 0 to disable. | 0..10,000 seconds (Default 0) |
| Temperature Digital Output Mode Hysteresis | Hysteresis for the digital output temperature control function. | 0.1...150.0°C/°F (Default 2°C) |
| Temperature Loop Boost Input | Boosts the Control Output to 100% | Select Push Button 1/2 or Digital Input 1/2. |
| **HUMIDITY** | | |
| Humidity Loop Operating Mode | Direction of the humidity control loop. | 0 = Reverse Control (Humidification)<br>1 = Direct Control (De-humidification) |
| Humidity Control Setpoint | Humidity Setpoint | 0.0...100.0 %rH (Default 50%) |
| Humidity Proportional Band | Humidity Proportional Band | 0.1...100.0 %rH (Default 20.0%) |
| Humidity Control Integral Action | Integral Action time of the humidity control loop. Set to 0 to disable. | 0..10,000 seconds (Default 0) |
| Humidity Digital Output Mode Hysteresis | Hysteresis for the digital output humidity control function. | 1.0...100.0 %rH (Default 5.0%) |
| Humidity Loop Boost Input | Boosts the Control Output to 100% | Select Push Button 1/2 or Digital Input 1/2. |
| **CO2** | | |
| CO2 Loop Operating Mode | Direction of the CO2 control loop. | 0 = Reverse Control<br>1 = Direct Control |
| CO2 Control Setpoint | CO2 Setpoint | 0..3250ppm (Default 1,000 ppm) |
| CO2 Proportional Band | CO2 Proportional Band | 10..5000 ppm (Default = 300 ppm) |
| CO2 Control Integral Action | Integral Action time of the CO2 control loop. Set to 0 to disable. | 0..10,000 seconds (Default 0) |
| CO2 Digital Output Mode Hysteresis | Hysteresis for the digital output CO2 control function. | 10..5000ppm (Default 100 ppm) |
| CO2 Loop Boost Input | Boosts the Control Output to 100% | Select Push Button 1/2 or Digital Input 1/2. |
| **LUX** | | |
| Lux Loop Operating Mode | Direction of the LUX control loop. | 0 = Reverse Control<br>1 = Direct Control |
| Lux Control Setpoint | LUX Setpoint | 0..3,000 Lux (Default 400 Lux) |
| LUX Proportional Band | LUX Proportional Band | 1..3,000 Lux (Default 400 Lux) |
| LUX Control Integral Action | Integral Action time of the LUX control loop. Set to 0 to disable. | 0..10,000 seconds (Default 0) |
| LUX Digital Output Mode Hysteresis | Hysteresis for the digital output LUX control function. | 1..3,000 Lux (Default 100 Lux) |
| LUX Loop Boost Input | Boosts the Control Output to 100% | Select Push Button 1/2 or Digital Input 1/2. |
| **SETPOINT ADJUST** | | |
| Setpoint Adjuster Minimum Value | Sets the minimum value for the setpoint (setpoint turned fully anti clockwise) | -500..0 (Default -3.0) |
| Setpoint Adjuster Maximum Value | Sets the maximum value for the setpoint (setpoint turned fully clockwise) | 0..500 (Default 3.0) |
| Setpoint Value Influence to Control Setpoint | Setpoint Value Influence to Control Setpoint | 0 = No Influence (network value)<br>1 = CO2 Control<br>2 = Temperature<br>3 = Humidity<br>4 = Lux |

| Control Parameters | | |
|---|---|---|
| **Parameter Name** | **Description** | **Range** |
| Unoccupied SPA | Changes the control setpoint to the set value when the space is unoccupied (requires -LL option) | 0..500 (Default 0.0) |
| Save SPA | Saves User Setpoint (Setpoint Adjustment) changes to non-volatile after changes have been completed. | 0 = Disabled (Default)<br>1 = Enabled |
| Reset SPA on SP Change | Resets the User Setpoint Adjustment (SPA), when the setpoint is written over the network. | 0 = Disabled<br>1 = Enabled (Default) |

| Inputs / Outputs | | |
|---|---|---|
| **Parameter Name** | **Description** | **Range** |
| **SENSOR INPUTS** | | |
| CO2 Offset | One Point CO2 Calibration Field | -200..+200ppm<br>(Default 0ppm) |
| CO2 AO Scale | Analogue Output Maximum CO2 Scaling | 1000..5000 ppm<br>(Default = 2,000 ppm) |
| Temperature Offset | One Point Temperature Calibration Field | -3.0..+3.0°C/°K<br>(Default 0°C) |
| Temperature AO Scale | Analogue Output Maximum Temperature Scaling | 0.1...150.0°C/°F<br>(Default 50°C) |
| Humidity Offset | One Point Humidity Calibration Field | -5.0..+5.0 %rH<br>(Default 0 %rH) |
| Humidity AO Scale | Analogue Output Humidity Maximum Scaling | 0.1...100.0 %rH<br>(Default 100.0%) |
| LUX AO Scale | Analogue Output Maximum Lux Scaling | 1000..3,000 Lux<br>(Default 3,000 Lux) |
| Occupancy Off Delay | Delay Time Setting for Occupancy | 1..7200 Seconds (Default 600s) |
| Push Button Off Delay | Delay Time Setting for Push Button | 1..28,800 Seconds (Default 600s) |
| Push Button Mode | Push Button LED Mode (Fw2.21) | 0 = Local (default)<br>1 = BMS |
| DI1 Off Delay | Delay Time Setting for Digital Input 1 | 0..28,800 Seconds (Default 0s) |
| DI2 Off Delay | Delay Time Setting for Digital Input 2 | 0..28,800 Seconds (Default 0s) |
| **OUTPUTS** | | |
| AO1 (Y1) | Analogue Output Y1 Mode<br>Default: 1 = CO2 Sensor | 0 = Network Value<br>1 = CO2 Measurement<br>2 = Temperature Measurement<br>3 = Humidity Measurement<br>4 = Light Measurement (LUX)<br>5 = CO2 Control<br>6 = Temperature Control<br>7 = Humidity Control<br>8 = Light Control (LUX)<br>9 = Maximum Control<br>10 = Potentiometer (SP/SPB)<br>11 = Max Hum/Temp Control<br>12 = Max Hum/Temp/CO2 Control |
| AO2 (Y2) | Analogue Output Y2 Mode<br>Default 2 = Temperature Sensor | |
| AO3 (Y3) | Analogue Output Y3 Mode<br>Default: 3 = Humidity Sensor | |
| DO1 | Digital Output 1 Mode<br>Default: 6 = Push Button 1 | 0 = Network Value<br>1 = CO2 Relay<br>2 = Temperature Relay<br>3 = Humidity Relay<br>4 = Light Relay (LUX)<br>5 = Occupancy Relay<br>6 = Push Button 1<br>7 = Push Button 2<br>8 = Push Button 3<br>9 = Push Button 4<br>10 = Alarm Amber Threshold<br>11 = Alarm Red Threshold |
| DO2 | Digital Output 2 Mode<br>Default: 5 = Occupancy | |

| Alarm/Display/Comms | | |
|---|---|---|
| **Parameter Name** | **Description** | **Range** |
| **ALARMS** | | |
| Alarm Source | Alarm LED Mode | 0 = CO2 (default)<br>1 = Temperature<br>2 = Humidity<br>3 = LUX<br>4 = None |
| Alarm Amber Threshold | Amber Alarm LED Switching Point | 0..5000 (Default 750) |
| Alarm Red Threshold | Red Alarm LED Switching Point | 0..5000 (Default 1250) |
| Alarm Hysteresis | Alarm LED Hysteresis | 0..5000 (Default 50) |
| **DISPLAY** | | |
| Temperature Units | Temperature Unit Selection | 0 = Celsius (Default)<br>1 = Fahrenheit |
| Language | Language Selection (for display rH vs FH) | 0 = English (Default)<br>1 = German |
| Display Mode | Display Mode | 0 = Rotate Installed<br>1 = CO2 Only<br>2 = Temperature Only<br>3 = LUX Only<br>4 = Setpoint Only |
| LCD brightness | Brightness of the LCD | Off - 10% to 100% |
| **COMMS** | | |
| Modbus Baud Rate<br>NOTE: Does not show Modbus Baud Rate set via bit switches. | Modbus Baud Rate (can only be set if BR1 and BR2 are in OFF position) | 0 = 9600 (Default)<br>1 = 19200<br>2 = 38400<br>3 = 57600 |
| Modbus Parity | Modbus Parity | 0 = None (Default)<br>1 = Odd<br>2 = Even |
| Stop Bits | Stop Bits | 0 = 1 Stop Bit (Default)<br>1 = 2 Stop Bits |
| Address<br>NOTE: Does not show Modbus address set via bit switches. | Modbus Address (can only be set if all address bit switches are in OFF position) | 0..247<br>(Default 0) |

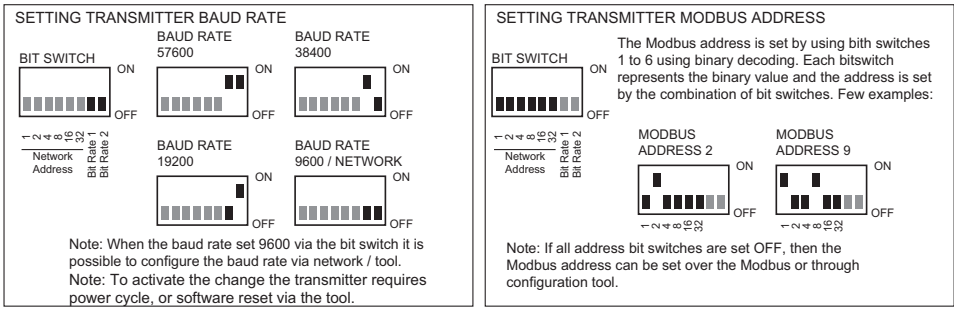
**Parameter Storage**

The configuration parameters are stored in the non-volatile memory. The SCT (Sensor Configuration Tool) software will automatically store the register values on the non-volatile permanent memory after the changes are carried out. If the changes are carried out over the network (Modbus or BACnet), then "NonVol Update" flag is required to be forced on to save the changes. The parameter returns automatically to the off state once the values have been stored.

**Setting Up Modbus Address and Baud Rate**

The CDR Modbus address and the baud rate is normally set through the bit switch. It is also possible to set the address and baud rate over the configuration tool or over the Modbus communication network.

***NOTE: The new settings are activated automatically after approx 5 seconds if the bit switch positions have not been moved. In this case the controller reset is applied to activate the new settings.***




**Modbus Registers - CDR-MOD**

The CDR-MOD transmitter supports the following Modbus registers and function codes. The default communication speed is 9600 bps, 8 data bits, Parity None and 1 Stop Bit. The default Modbus Slave address is 0. The device Parity can be changed between Odd, None and Even. The baud rate is selectable between 9600, 19200, 38400 and 57600 bps. The baud rate speeds can be selected using the built-in bit switch, or over the network if BR1 and BR2 are set to OFF. The sensor addresses 1 to

63 can be set using the local bit switch, and over the Modbus the adjustable address range is 1 to 247.

Please note that Modbus register space is specified from the Modbus master perspective as in the Modbus Application Protocol specification. The Modbus registers for Function Codes 02, 03, 06 and 16 have presentation for both Modbus "address blocks" and for actual Modbus register offsets. For example, the Temperature is read from Modbus register 1 using Function Code 04. Some Modbus masters will require Function Code 04, register 1 to be entered, whereas the others will require register 30001 and Function Code 04. The Modbus addressing starts from the zero Base address. (Some Modbus masters start addressing from 1, in this case add one to the listed register values).

| Register | Parameter Description | Data Type | Raw Data | Range |
|---|---|---|---|---|
| | **FUNCTION CODE 01 - READ COILS**<br>**FUNCTION CODE 05 - WRITE SINGLE COIL**<br>**FUNCTION CODE 15 - WRITE MULTIPLE COILS** | | | |
| **0** | Digital Output 1 Override (Network Write) | | 0..1 | Off - On |
| **1** | Digital Output 2 Override (Network Write) | | 0..1 | Off - On |
| **7** | Reset SPA - Setpoint Adjustment (Network Write) | | 0..1 | Off - On |
| **8** | PB1 LED Override | | 0..1 | Off - On |
| **9** | PB2 LED Override | | 0..1 | Off - On |
| **10** | PB3 LED Override | | 0..1 | Off - On |
| **11** | PB4 LED Override | | 0..1 | Off - On |
| | **FUNCTION CODE 02 - READ DISCRETE INPUTS (Add 10,000 for Modicon Addressing)** | | | |
| **0** | Digital Input 1 Status | | 0..1 | Off - On |
| **1** | Digital Input 2 Status | | 0..1 | Off - On |
| **2** | Digital Output 1 Status | | 0..1 | Off - On |
| **3** | Digital Output 2 Status | | 0..1 | Off - On |
| **4** | Occupancy Status (Switch Off Delayed "Delay Time Setting" amount in seconds) | | 0..1 | Off - On |
| **5** | Push Button 1 Status (Switch Off Delayed "Delay Time Setting" amount in seconds) | | 0..1 | Off - On |
| **6** | Push Button 2 Status (Switch Off Delayed "Delay Time Setting" amount in seconds) | | 0..1 | Off - On |
| **7** | Push Button 3 Status (PB option fitted when SPB option is also fitted)) | | 0..1 | Off - On |
| **8** | Push Button 4 Status (PB2 option second button when SPB option is also fitted)) | | 0..1 | Off - On |
| | **FUNCTION CODE 04 - READ INPUT REGISTERS (Add 30,000 for Modicon Addressing)** | | | |
| **0** | CO2 Measurement | Unsigned 16 | 0..2000 | 0..2000 ppm |
| **1** | Temperature Measurement | Signed 16 | 0...500<br>320..1220 | 0.0...50.0°C<br>(32.0..122.0°F) |
| **2** | Relative Humidity Measurement | Unsigned 16 | 0..1000 | 0..100.0 %rH |
| **3** | Light Level Measurement | Unsigned 16 | 0..10000 | 0..3000 Lux |
| **4** | Resistive Input 1 (NTC10 default) | Unsigned 16 | 0...50000 | 0..50000 Ohms |
| **5** | Resistive Input 2 (NTC10 default) | Unsigned 16 | 0...50000 | 0..50000 Ohms |
| **6** | Current Calculated Setpoint (°C / ppm / %rH / LUX) or Current Setpoint Adjustment (none option) | Signed 16 | -32,767..+32,767 | -3,276..+-3,276..<br>Act Setpoint or<br>Low..High Value |
| **7** | Analogue Output Y1 | Unsigned 16 | 0..1000 | 0..100.0 % |
| **8** | Analogue Output Y2 | Unsigned 16 | 0..1000 | 0..100.0 % |
| **9** | Analogue Output Y3 | Unsigned 16 | 0..1000 | 0..100.0 % |
| **11** | Alarm Status | Unsigned 16 | 1..3 | 1 = Green (Normal) State<br>2 = Amber Alarm State<br>3 = Red Alarm State |
| **12** | NTC10 Input 1 (RI1 in NTC mode; default) | Signed 16 | -400...3020 | -40.0..302.0 °F<br>-40.0..150.0 °C |
| **13** | NTC10 Input 2 (RI2 in NTC mode; default) | Signed 16 | -400...3020 | -40.0..302.0 °F<br>-40.0..150.0 °C |
| **14** | 0..10Vdc Input 1 (RI1 with AI-Option) | Unsigned 16 | 0..1000 | 0..100.0 % |

| Register | Parameter Description | Data Type | Raw Data | Range |
|---|---|---|---|---|
| **15** | 0..10Vdc Input 2 (RI2 with AI-Option) | Unsigned 16 | 0..1000 | 0..100.0 % |
| **100** | Firmware Version | Unsigned 16 | n/a | n/a |
| | | | | |
| | **FUNCTION CODE 03 - READ HOLDING REGISTERS (For Modicon Addressing Add 40,000)**<br>**FUNCTION CODE 06 - WRITE SINGLE HOLDING REGISTER**<br>**FUNCTION CODE 16 - WRITE MULTIPLE HOLDING REGISTERS** | | | |
| **0** | Analogue Output Y1 Override Value | Unsigned 16 | 0..1000 | 0..10.0 V<br>Default 0 |
| **1** | Analogue Output Y2 Override Value | Unsigned 16 | 0..1000 | 0..10.0 V<br>Default 0 |
| **2** | Analogue Output Y3 Override Value | Unsigned 16 | 0..1000 | 0..10.0 V<br>Default 0 |
| **4** | Analogue Output Y1 Mode<br>Default: 1 = CO2 Sensor | Unsigned 16 | 0..12 | 0 = Network Value<br>1 = CO2 Measurement<br>2 = Temperature Measurement<br>3 = Humidity Measurement<br>4 = Light Measurement<br>5 = CO2 Control<br>6 = Temperature Control<br>7 = Humidity Control<br>8 = Light Control<br>9 = Maximum Control<br>10 = Potentiometer<br>11 = Max Hum/Temp Control<br>12 = Max Hum/Temp/CO2 Control |
| **5** | Analogue Output Y2 Mode<br>Default: 2 = Temperature Sensor | Unsigned 16 | 0..12 | |
| **6** | Analogue Output Y3 Mode<br>Default: 3 = Humidity Sensor | Unsigned 16 | 0..12 | |
| **8** | Digital Output 1 Mode<br>Default: 6 = Push Button 1 | Unsigned 16 | 0..11 | 0 = Network Value<br>1 = CO2 Relay<br>2 = Temperature Relay<br>3 = Humidity Relay<br>4 = Light Relay<br>5 = Occupancy Relay<br>6 = Push Button 1<br>7 = Push Button 2<br>8 = Push Button 3<br>9 = Push Button 4<br>10 = Alarm Amber Threshold<br>11 = Alarm Red Threshold |
| **9** | Digital Output 2 Mode<br>Default: 5 = Occupancy | Unsigned 16 | 0..11 | |
| **10** | CO2 Control Setpoint | Unsigned 16 | 0..3250 | 0..3250ppm<br>(Default 1,000 ppm) |
| **11** | CO2 Proportional Band | Unsigned 16 | 10..5000 | 10..5000 ppm<br>(Default = 300 ppm) |
| **12** | CO2 Control Integral Action | Unsigned 16 | 0..10,000 | 0..10,000 seconds |
| **13** | CO2 Loop Operating Mode | Unsigned 16 | 0..1 | 0 = Reverse Control<br>1 = Direct Control |
| **14** | CO2 Digital Output Mode Hysteresis | Unsigned 16 | 10..5000 | 10..5000ppm<br>(Default 100 ppm) |
| **15** | Temperature Control Setpoint | Unsigned 16 | 0...1500 | 0.0...150.0°C/°F<br>(Default 20°C) |
| **16** | Temperature Proportional Band | Unsigned 16 | 1...1500 | 0.1...150.0°C/°F<br>(Default 50°C) |
| **17** | Temperature Control Integral Action | Unsigned 16 | 0..10,000 | 0..10,000 seconds |
| **18** | Temperature Loop Operating Mode | Unsigned 16 | 0..1 | 0 = Reverse Control (Heating)<br>1 = Direct Control (Cooling) |
| **19** | Temperature Digital Output Mode Hysteresis | Unsigned 16 | 1...1500 | 0.1...150.0°C/°F<br>(Default 2°C) |
| **20** | Humidity Control Setpoint | Unsigned 16 | 0...1000 | 0.0...100.0 %rH<br>(Default 50%) |
| **21** | Humidity Proportional Band | Unsigned 16 | 1...1000 | 0.1...100.0 %rH<br>(Default 20.0%) |
| **22** | Humidity Control Integral Action | Unsigned 16 | 0..10,000 | 0..10,000 seconds |
| **23** | Humidity Loop Operating Mode | Unsigned 16 | 0..1 | 0 = Reverse Control<br>(Humidification)<br>1 = Direct Control<br>(De-humidification) |

| Register | Parameter Description | Data Type | Raw Data | Range |
|---|---|---|---|---|
| **24** | Humidity Digital Output Mode Hysteresis | Unsigned 16 | 10...1000 | 1.0...100.0 %rH<br>(Default 5.0%) |
| **25** | Lux Control Setpoint | Unsigned 16 | 0..3000 | 0..3,000 Lux<br>(Default 400 Lux) |
| **26** | LUX Proportional Band | Unsigned 16 | 1..3000 | 1..3,000 Lux<br>(Default 400 Lux) |
| **27** | LUX Control Integral Action | Unsigned 16 | 0..10,000 | 0..10,000 seconds |
| **28** | Lux Loop Operating Mode | Unsigned 16 | 0..1 | 0 = Reverse Control<br>1 = Direct Control |
| **29** | LUX Digital Output Mode Hysteresis | Unsigned 16 | 1..3000 | 1..3,000 Lux<br>(Default 100 Lux) |
| **30** | Amber Alarm Switching Point | Unsigned 16 | 0..5000 | 0..5000 (Default 750) |
| **31** | Red Alarm Switching Point | Unsigned 16 | 0..5000 | 0..5000 (Default 1250) |
| **32** | Alarm Hysteresis | Unsigned 16 | 0..5000 | 0..5000 (Default 50) |
| **33** | Alarm Mode | Unsigned 16 | 0..3 | 0 = CO2 (default)<br>1 = Temperature<br>2 = Humidity<br>3 = LUX<br>4 = None |
| **34** | Delay Time Setting for Occupancy | Unsigned 16 | 1..7200 | 1..7200 Seconds |
| **35** | Delay Time Setting for Push Button | Unsigned 16 | 1..28800 | 1..28,800 Seconds |
| **36** | Setpoint Adjuster / Potentiometer Low Position | Signed 16 | -5000..0 | -500..0.0 (-3.0) Default |
| **37** | Setpoint Adjuster / Potentiometer High Position | Unsigned 16 | 0..5000 | 0..+500.0 (3.0) Default |
| **38** | Setpoint Value Influence to Control Setpoint | Unsigned 16 | 0..4 | 0 = No Influence<br>1 = CO2 Control<br>2 = Temperature<br>3 = Humidity<br>4 = Lux |
| **39** | Temperature Unit Selection | Unsigned 16 | 0..1 | 0 = Celsius<br>1 = Fahrenheit |
| **40** | Language Selection (for display rH vs FH) | Unsigned 16 | 0..1 | 0 = English (default)<br>1 = German |
| **41** | Display Mode | Unsigned 16 | 0..3<br>See Note 4 | 0 = Rotate Installed<br>1 = CO2 Only<br>2 = Temperature Only<br>3 = LUX Only<br>4 = Setpoint Only |
| **42** | Analogue Output Maximum CO2 Scaling | Unsigned 16 | 1000..5000 | 1000..5000 ppm<br>(Default = 2,000 ppm) |
| **43** | Analogue Output Maximum Temperature Scaling | Unsigned 16 | 1...1500 | 0.1...150.0°C/°F<br>(Default 50°C) |
| **44** | Analogue Output Humidity Maximum Scaling | Unsigned 16 | 1...1000 | 0.1...100.0 %rH<br>(Default 100.0%) |
| **45** | Analogue Output Maximum Lux Scaling | Unsigned 16 | 1000..3000 | 1000..3,000 Lux<br>(Default 3,000 Lux) |
| **46** | One Point CO2 Calibration Field | Signed 16 | -200..+200 | -200..+200ppm<br>(Default 0ppm) |
| **47** | One Point Temperature Calibration Field | Signed 16 | -30..+30 | -3.0..+3.0°C/°K<br>(Default 0°C) |
| **48** | One Point Humidity Calibration Field | Signed 16 | -50..+50 | -5.0..+5.0 %rH<br>(Default 0 %rH) |
| | | | | |
| **50** | Modbus Address | Unsigned 16 | 0..247<br>See Note 1 | 0..247<br>(Default 1) |

| Register | Parameter Description | Data Type | Raw Data | Range |
|---|---|---|---|---|
| **51** | Modbus Baud Rate | Unsigned 16 | 0...3<br>See Note 2 | 0 = 9600 (Default)<br>1 = 19200<br>2 = 38400<br>3 = 57600 |
| **52** | Modbus Parity | Unsigned 16 | 0...2 | 0 = None (Default)<br>1 = Odd<br>2 = Even |
| **53** | Stop Bits | Unsigned 16 | 0...1 | 0 = 1 Stop Bit (Default)<br>1 = 2 Stop Bits |
| **67** | Hold On Delay Setting for Digital Input 1 | Unsigned 16 | 1..28800 | 1..28,800 Seconds |
| **68** | Hold On Delay Setting for Digital Input 2 | Unsigned 16 | 1..28800 | 1..28,800 Seconds |
| **69** | Push Button LED Mode | Unsigned 16 | 0...1 | 0 = Local (Default)<br>1 = BMS |
| **70** | RI1 Single Point Calibration | Signed 16 | -10,000..10,000 | -1,000..1,000 °C, °F or Ohms |
| **71** | RI2 Single Point Calibration | Signed 16 | -10,000..10,000 | -1,000..1,000 °C, °F or Ohms |
| **72** | DI1 Pulse Count Most Significant 16 Bits | Unsigned 16 | 0..65280 | 0..65280 |
| **73** | DI1 Pulse Count Least Significant 16 Bits | Unsigned 16 | 0..65535 | 0..655350 |
| **74** | DI2 Pulse Count Most Significant 16 Bits | Unsigned 16 | 0..65280 | 0..65280 |
| **75** | DI2 Pulse Count Least Significant 16 Bits | Unsigned 16 | 0..65535 | 0..655350 |
| **80** | LCD Backlight Level | Unsigned 16 | 0..10 | 0..10 |
| **81** | Reset SPA on Setpoint Change | Unsigned 16 | 0..1 | 0 = Disabled, 1 = Enabled (Default) |
| **82** | Save SPA (user adjustment on exit) | Unsigned 16 | 0..1 | 0 = Disabled (Default), 1 = Enabled |
| | | | | |
| **100** | Force Reset | Unsigned 16 | 0..1 | 0 = Normal<br>1 = Force Reset |
| **101** | Non Volatile Memory Update | Unsigned 16 | 0..1<br>Note 3 | 0 = Normal<br>1 = Update |
| **103** | Force Factory Defaults | Unsigned 16 | 0..1 | 0 = Normal<br>1 = Force Defaults |
| **104** | Force 0..10V Output Calibration Routine | Unsigned 16 | 0..1 | 0 = Normal<br>1 = Force Calibration |
| **105** | Force CO2 Sensor Calibration Routine | Unsigned 16 | 0..1 | 0 = Normal<br>1 = Force Calibration |
| **106** | Disable CO2 Sensor Auto-Calibration Routine | Unsigned 16 | 0..1 | 0 = Automatic Calibration (default)<br>1 = Disable Calibration |
| | | | | |
| **Note: Registers 300-315 are avalable from Firmware Version 2.25 Onwards and are Read Only** | | | | |
| **300** | CO2 Measurement | Unsigned 16 | 0..2000 | 0..2000 ppm |
| **301** | Temperature Measurement | Signed 16 | 0...500<br>320..1220 | 0.0...50.0°C<br>(32.0..122.0°F) |
| **302** | Relative Humidity Measurement | Unsigned 16 | 0..1000 | 0..100.0 %rH |
| **303** | Light Level Measurement | Unsigned 16 | 0..10000 | 0..3000 Lux |
| **304** | Resistive Input 1 (NTC10 default) | Unsigned 16 | 0...50000 | 0..50000 Ohms |
| **305** | Resistive Input 2 (NTC10 default) | Unsigned 16 | 0...50000 | 0..50000 Ohms |
| **306** | Current Calculated Setpoint (°C / ppm / %rH / LUX) or Current Setpoint Adjustment (none option) Requires SP Option. | Signed 16 | -32,767..+32,767 | -3,276..+-3,276..<br>Act Setpoint or<br>Low..High Value |
| **307** | Analogue Output Y1 | Unsigned 16 | 0..1000 | 0..100.0 % |
| **308** | Analogue Output Y2 | Unsigned 16 | 0..1000 | 0..100.0 % |
| **309** | Analogue Output Y3 | Unsigned 16 | 0..1000 | 0..100.0 % |
| **311** | Alarm Status | Unsigned 16 | 1..3 | 1 = Green (Normal) State<br>2 = Amber Alarm State<br>3 = Red Alarm State |
| **312** | NTC10 Input 1 (RI1 in NTC mode; default) | Signed 16 | -400...3020 | -40.0..302.0 °F<br>-40.0..150.0 °C |

| Register | Parameter Description | Data Type | Raw Data | Range |
|---|---|---|---|---|
| **313** | NTC10 Input 2 (RI2 in NTC mode; default) | Signed 16 | -400...3020 | -40.0..302.0 °F<br>-40.0..150.0 °C |
| **314** | 0..10Vdc Input 1 (RI1 with AI-Option) | Unsigned 16 | 0..1000 | 0..100.0 % |
| **315** | 0..10Vdc Input 2 (RI2 with AI-Option) | Unsigned 16 | 0..1000 | 0..100.0 % |

Note 1. Modbus address can be configured via network/tool only if the bit switches 1-6 are switched off. Please note if changed over the Modbus, the Non Volatile Memory Updated parameter MUST BE exercised before power cycle or reset.

Note 2. Modbus Baud Rate can be configured over the Modbus if bit switches 7 & 8 are in off state (9600). Please note if changed over the Modbus, the Non Volatile Memory Updated parameter MUST BE exercised before power cycle or reset.

Note 3. When the settings are changed over the communication bus, the changes for the configuration parameters are not stored in the non-volatile memory automatically. In order to store the changes "Non Volatile Memory Update" is required to be set true. If Sensor Configuration Tool is used, the tool will automatically force non-volatile data update.

Note 4. If humidity option is selected, then humidity is shown below the primary display value.

**Dimensions**