



SCR/SQR series

Air quality sensors



APPLICATION
MANUAL

EN

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1. APPLICATION

SCR and SQR air quality sensors are designed for air quality measurement and maintain. Simultaneous measurement of 3 air parameters is provided through relay, analog or digital interfaces.

PID control, if enabled, will maintain user set air quality, humidity or temperature level in the premises by directly controlling air damper position, fan intensity or air heater level by the relay or analog signal.

2. SENSOR TYPES

There are 2 sensor types depending on air quality sensor. List of the sensor types described in the table below:

| Sensor type | CO ₂ | VOC | %RH | °C |
|-------------|-----------------|-----|-----|----|
| SCR | + | | + | + |
| SQR | | + | + | + |

3. MECHANICAL INSTALLATION

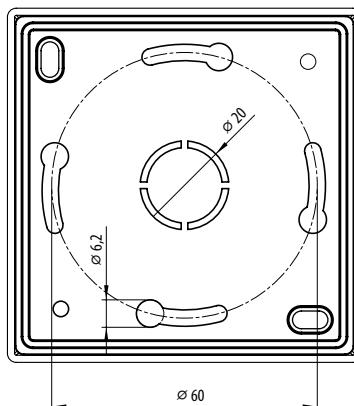
Room conditions, where sensor is installed, must ensure environmental requirements:

- ambient temperature: 0 °C ... 50 °C;
- relative humidity: 0 % ... 90 %, non-condensing;
- protection against vertical dripping water;
- no excessive vibrations.

The sensor can be mounted on a flush mounting box or in any other place screwing two-four holes on the fastening surface.

Cable connection is provided through a hole in the middle of the back side.

Sensor mounting diagram showed below:

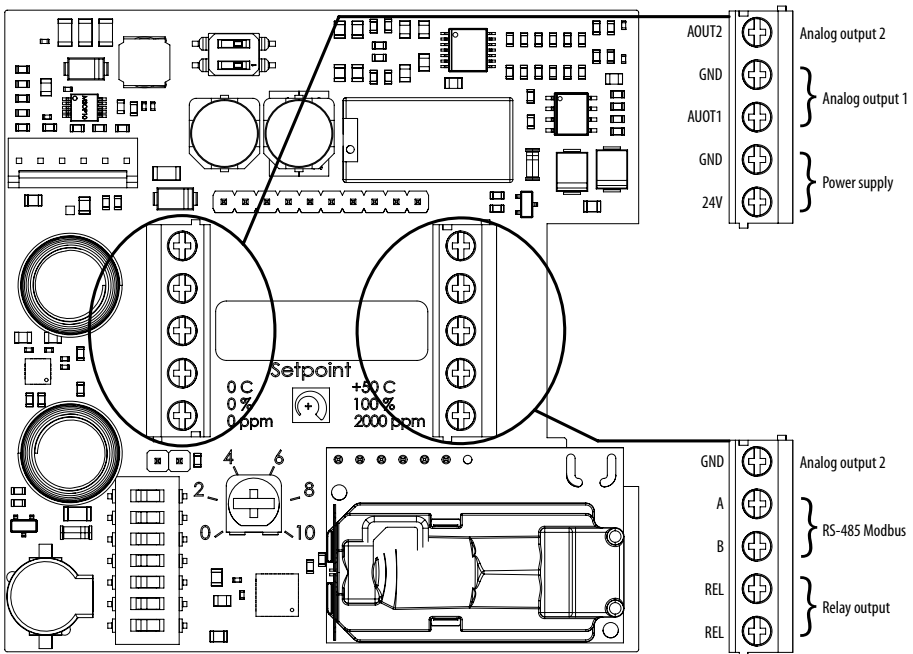




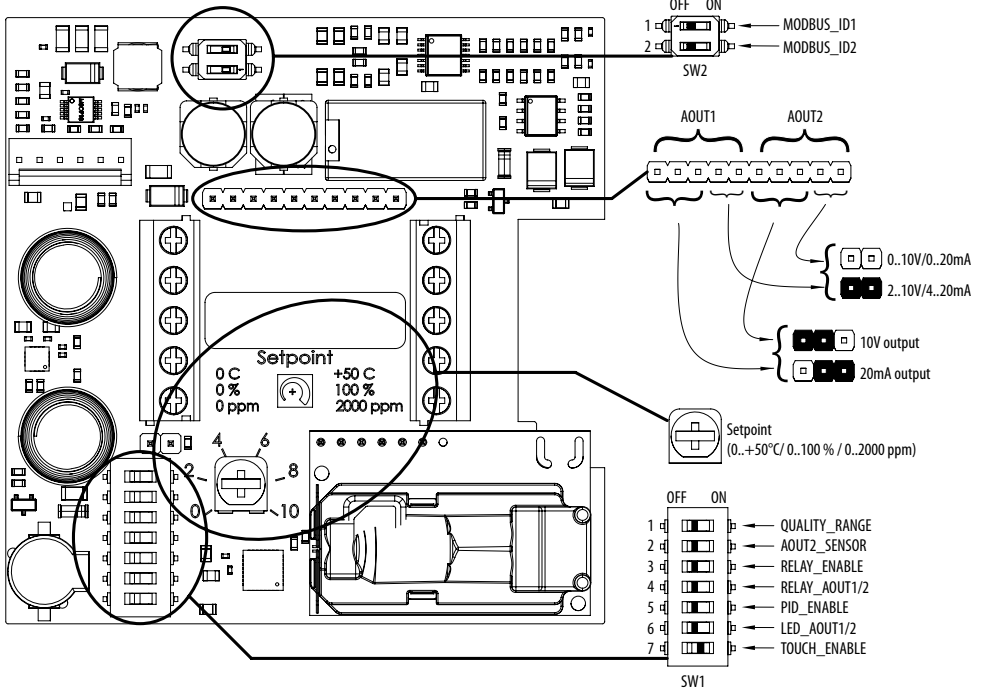
Screws used for sensor mounting on a flush mounting box or surface must be 2,0..3,0mm diameter and be flat head type. Failure to observe this requirement can cause permanent sensor failure that is not covered by warranty.

4. ELECTRICAL INSTALLATION

Wire in accordance with connection diagram and local requirements on electrical installations. Power supply for the sensor is 24Vac or +24Vdc.



5. CONFIGURATION



Switch **SW1_1 (QUA_RANGE)** selects range of the air quality measurement:

| Range | SW1 (QUA_RANGE) |
|--|-----------------|
| SCR type: 0..2000 ppm SQR type: Normal | OFF |
| SCR type: 0..5000 ppm SQR type: Wide (2 times less sensitive) | ON |

Switch **SW1_2 (AO2_SENSOR)** selects sensor to use for the Analog output 2 signal:

| Sensor | SW2 (AO2_SENSOR) |
|------------------------|------------------|
| Relative humidity, %RH | OFF |
| Air temperature, °C | ON |

Switch **SW1_3 (RELAY_ENABLE)** allows internal relay to operate:

| Relay | SW3 (RELAY_ENABLE) |
|----------|--------------------|
| Disabled | OFF |
| Enabled | ON |

Switch **SW1_4 (RELAY_AOUT1/2)** selects Analog output signal to control the relay:

| Analog output | SW4 (RELAY_AOUT1/2) |
|---------------|---------------------|
| AOUT1 | OFF |
| AOUT2 | ON |

Switch **SW1_5 (PID_ENABLE)** selects all output signals type:

| Signals type | SW5 (PID_ENABLE) |
|--------------------|------------------|
| Normal measurement | OFF |
| PID control | ON |

Switch **SW1_6 (LED_AOUT1/2)** selects Analog output signal to be indicated by the LED:

| LED output | SW6 (LED_AOUT1/2) |
|------------|-------------------|
| LED AOUT1 | OFF |
| LED AOUT2 | ON |

Switch **SW1_7 (TOUCH_ENABLE)** selects the type of setpoint setting (by default enabled):

| Touch | SW7 (TOUCH_ENABLE) |
|----------|--------------------|
| Disabled | OFF |
| Enabled | ON |

Switches **SW2_1 (MODBUS_ID1)** and **SW2_2 (MODBUS_ID2)** selects Modbus ID slave address:

| Modbus ID | SW6 (MODBUS_ID1) | SW7 (MODBUS_ID2) |
|-----------|------------------|------------------|
| 80 | OFF | OFF |
| 81 | ON | OFF |
| 82 | OFF | ON |
| 83 | ON | ON |

Changes to configuration switches will apply after sensor power supply restart.

Configuration set by switches can be overridden by using RS-485 Modbus configuration. Sensor will use settings set via Modbus interface if configuration switches will not be changed after that. Changing to configuration switches settings will override corresponding value in Modbus register.

Analog outputs type selection

Configuration jumpers for AOUT1 and AOUT2 are identical and selects analog signal types.

3 position AOUT1 and AOUT2 jumpers selects voltage or current signal types:

| Signal types | Jumper position |
|----------------------------------|-----------------|
| Voltage: 0..10 V or 2..10 V | "V" |
| Current: 0..20 mA or 4..20 mA | "mA" |

2 position AOUT1 and AOUT2 jumpers selects offset for the signals:

| Offset | Jumper |
|-------------------------------------|---------|
| No offset: 0..10 V or 0..20 mA | Opened |
| With offset: 2..10 V or 4..20 mA | Shorted |

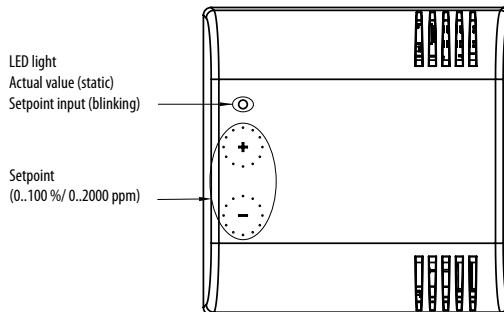
Typical configurations are:

- For 0..10V signals – "V" with no offset
- For 4..20mA signals – "mA" with offset enabled

Setpoint setting

Touch-sensitive buttons on the housing of the device and potentiometer on the board selects setting point for the PID control to maintain. At the same time this setting defines relay on/off switching point.

Touch-sensitive buttons & LED light



LED light actual output values (static LED light):

| Color | %RH / VOC | °C | CO ₂ | CO ₂ wide |
|--------|-----------|----------|-----------------|----------------------|
| Blue | 0..20 % | 0..10°C | 0..400 ppm | 0..1000 ppm |
| Green | 20..40 % | 10..20°C | 400..800 ppm | 1000..2000 ppm |
| Yellow | 40..60 % | 20..30°C | 800..1200 ppm | 2000..3000 ppm |
| Orange | 60..80 % | 30..40°C | 1200..1600 ppm | 3000..4000 ppm |
| Red | 80..100 % | 40..50°C | 1600..2000 ppm | 4000..5000 ppm |

LED light setpoint input values (blinking LED light):

| Color | %RH / VOC | °C | CO ₂ normal | CO ₂ wide |
|---------------|-----------|------|------------------------|----------------------|
| Blue | 10 % | 5°C | 200 ppm | 500 ppm |
| Blue/Green | 20 % | 10°C | 400 ppm | 1000 ppm |
| Green | 30 % | 15°C | 600 ppm | 1500 ppm |
| Green/Yellow | 40 % | 20°C | 800 ppm | 2000 ppm |
| Yellow | 50 % | 25°C | 1000 ppm | 2500 ppm |
| Yellow/Orange | 60 % | 30°C | 1200 ppm | 3000 ppm |
| Orange | 70 % | 35°C | 1400 ppm | 3500 ppm |
| Orange/Red | 80 % | 40°C | 1600 ppm | 4000 ppm |
| Red | 90 % | 45°C | 1800 ppm | 4500 ppm |

Setpoint setting via touch-sensitive buttons is activated by holding down both “+” and “-” buttons at the same time for at least 3 seconds. The LED starts flashing according to the light combinations in the table at the corresponding setpoint. The setpoint is changed by pressing “+” to increase and “-” to decrease, respectively. To save the selection, hold down both the “+” and “-” buttons at the same time for at least 3 seconds. If not saved, the setpoint will return to its previous value.

6. OPERATION

Simultaneously, sensor is providing 3 types of reading which can be monitored using different types of interfaces:

- Analog outputs – 0..10V or 4..20mA
- Relay output
- RS-485 Modbus
- LED indicator

VOC value reading is available 5 minutes after device power on. During start-up, low fixed value will present – 10 % for Normal and 5 % for Wide air quality range.

6.1. Analog outputs

Analog output sensor type:

| Sensor | Analog output |
|---|--------------------|
| SCR type: CO ₂ SQR type: VOC | AOUT1 |
| Relative humidity, %RH Air temperature, °C | AOUT2 ¹ |



Sensors for the analog outputs can be defined differently using Modbus configuration. For example, AOUT1 can be set for relative humidity and AOUT2 for the air temperature.

Output levels are in range from lowest to highest values (which depends on configuration), where actual sensor range described in the table below:

| Sensor | Lowest value | Highest value |
|------------------------|--------------|---------------|
| CO ₂ Normal | 0 ppm | 2000 ppm |
| CO ₂ Wide | 0 ppm | 5000 ppm |
| VOC Normal | 0 % | 100 % |
| VOC Wide | 0 % | 100 % |
| %RH | 0 %RH | 100 %RH |
| °C | 0 °C | +50.0 °C |

6.2. Relay output

Relay control is tied to one of the analog outputs, which control relay to switch on and off. Analog output level to trigger relay switch is selected using setpoint potentiometer on the board.

By default, and not inverted control configuration, depending on the sensor, relay contacts are closing when:

- CO₂ or VOC – higher reading than setpoint (requesting more fresh air)
- %RH – higher reading than setpoint (requesting more fresh air)
- °C – lower reading than setpoint (requesting more heating)

Hysteresis is provided to not let the relay rapid switching on and off near the setting point.

Modbus interface allows to configure the relay for inverted signal control type.

¹ Depends on the switch SW2 (AOUT2_SENSOR)



Relay will not be controlled if it is disabled by configuration. Activate relay control by configuration switch SW3 (RELAY_ENABLE) or Modbus interface.

6.3. Modbus interface

Modbus protocol data is accessed by reading or writing to Holding registers. Read holding registers (0x03), Write single register (0x06) and Write multiple registers (0x10) functions are supported.

RS-485 interface communication options

| Baudrate | Data bits | Parity check | Stop bits |
|----------------------------------|----------------|-------------------------------|------------------|
| 1200..115200, 19200 ¹ | 8 ¹ | Even ¹ , Odd, None | 2,1 ¹ |

Control and operating data registers

| Register | Access | Values | Default | Function | Description |
|----------|--------|----------------------|---------|---|---|
| 1 | R/W | 0,9 | 9 | Control type | 0 – Modbus 9 – Analog |
| 2 | R/W | 0..10'000 | 0 | AOUT1 Modbus setpoint | Setting point in 0.01 % steps of the configured range |
| 3 | R/W | 0..10'000 | 0 | AOUT2 Modbus setpoint | Setting point in 0.01 % steps of the configured range |
| 4 | R/W | 0..2 | 0 | Relay control | 0 – Auto 1 – Open 2 – Short |
| 10 | R | | | Firmware version | Sensor's firmware version |
| 11 | R | -32768; 0..5'000 | | CO ₂ level | Level in 1ppm steps (-32768 sensor fault) |
| 12 | R | -32768; 0..10'000 | | VOC level | Level in 0.01 % steps (-32768 sensor fault) |
| 13 | R | -32768; 0..10'000 | | Relative humidity | Level in 0.01 %RH steps (-32768 sensor fault) |
| 14 | R | -32768; 0..500 | | Air temperature | Air temperature in 0.1°C steps (-32768 sensor fault) |
| 15 | R | 0..10'000 | | AOUT1 actual value | Value in 0.01 % steps of the configured range |
| 16 | R | 0..10'000 | | AOUT2 actual value | Value in 0.01 % steps of the configured range |
| 17 | R | 0..10'000 | | Potentiometer setpoint | Setting point in 0.01 % steps of the configured range |
| 18 | R | 0..1 | | Relay status | 0 – Open 1 – Short |
| 19 | R | 1'000..9'000 | | Setpoint saved with touch-sensitive buttons | Setting point in 0.01 % steps of the configured range |

¹ Default values

Configuration registers

| Register | Access | Values | Default | Function | Description |
|----------|--------|-------------------|--------------------------------------|-------------------------|---|
| 300 | R/W | 1..247 | 80 | Modbus ID | Configuration switch change will overwrite setting |
| 301 | R/W | 1..8 | 5 | Modbus baud rate | 1 – 1200 baud 2 – 2400 baud 3 – 4800 baud 4 – 9600 baud 5 – 19200 baud 6 – 38400 baud 7 – 57600 baud 8 – 115200 baud Changes will apply after power supply restart |
| 302 | R/W | 1..6 | 2 | Modbus data format | 1 – 8N1 (8 data bits, Parity: none, 1 stop bit) 2 – 8E1 3 – 8O1 4 – 8N2 5 – 8E2 6 – 8O2 Changes will apply after power supply restart |
| 303 | R/W | 0..1 | 0 | Air quality range | 0 – Normal (0..2000ppm, 0..100 % VOC) 1 – Wide (0..5000ppm, 0..200 % VOC) |
| 304 | R/W | 0..3 | By type | AOUT1 sensor | 0 – CO ₂ (if available by type) 1 – VOC (if available by type) 2 – Relative humidity 3 – Air temperature |
| 305 | R/W | 0..3 | 2 | AOUT2 sensor | 0 – CO ₂ (if available by type) 1 – VOC (if available by type) 2 – Relative humidity 3 – Air temperature |
| 306 | R/W | 0..1 | 0 | Relay control | 0 – Disabled 1 – Enabled |
| 307 | R/W | 0..1 | 0 | Relay control output | 0 – AOUT1 controls the relay 1 – AOUT2 controls the relay |
| 308 | R/W | 0..1 | 0 | Relay control type | 0 – Normal 1 – Inverted |
| 309 | R/W | 0..1 | 0 | PID control | 0 – Disabled 1 – Enabled |
| 310 | R/W | 0..15 (binary) | bit0=0 bit1=0 bit2=0 bit3=1 | PID sensors signal type | Each bit is the setting for the sensor: bit 0 – CO ₂ bit 1 – VOC bit 2 – Relative humidity bit 3 – Air temperature Where bit values meaning: "0" – Normal (increasing output on worse/ wet/hot) "1" – Inverted |
| 311 | R/W | 0..65535 | 1'000 | PID AOUT1 Kp | PID control Kp factor |
| 312 | R/W | 0..65535 | 300 | PID AOUT1 Ki | PID control Ki factor |
| 313 | R/W | 0..65535 | 1'000 | PID AOUT2 Kp | PID control Kp factor |
| 314 | R/W | 0..65535 | 300 | PID AOUT2 Ki | PID control Ki factor |

| Register | Access | Values | Default | Function | Description |
|----------|--------|--------|---------|---------------------------------|--|
| 315 | R/W | 0..1 | 0 | LED indication by output | 0 – AOUT1 1 – AOUT2 |
| 316 | R/W | 0..10 | 2 | LED brightness | Level in 10% steps |
| 317 | R/W | 0..1 | 0 | Touch-sensitive buttons control | 0 – Disabled 1 – Enabled Changes will apply after power supply restart |
| 390 | R/W | | | Reset to default settings | Write 0x64DF value to reset |

6.4. PID control

PID functionality will change sensor outputs from real-time readings to direct control signals for the external devices to achieve Variable Air Volume (VAV) operation or heating control in the premises. Depending on control requirements, modulating analog signal or on/off relay control can be used with PID control.

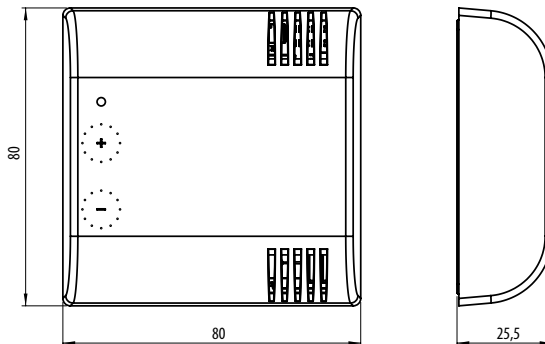
Possible, but not limited to, devices list for direct control:

- Air damper actuator – requesting more fresh air on higher CO₂, VOC or %RH reading
 - Air fan – requesting more fresh air on higher CO₂, VOC or %RH reading
 - Heater – requesting more heating level on lower °C reading
- Common for all sensor reading values (CO₂, VOC, %RH, °C) potentiometer with scale marks is provided on the board for setting point selection. Same point is used for analog and relay control signals.

Modbus interface allows to change default Kp and Ki factors, and invert control signals. Inverting temperature control signal, for example, can be used for cooling level control.

7. TECHNICAL DATA

Dimensions



Case and environment data

| | |
|--------------------------------|---------------------------|
| Material | ABS plastic |
| Protection class | IP30 |
| Dimensions | 80x80x25.5 mm |
| Weight | 65 g |
| Ambient operating temp. | 0..+50 °C |
| Storage temperature | -30..+70 °C |
| Ambient humidity | 0..90 %RH, non-condensing |

Electrical data

| | |
|--------------------------|----------------------------|
| Supply voltage | 24 Vac / 24 Vdc $\pm 20\%$ |
| Power consumption | <0.4 W (<20 mA) |

Outputs

| | |
|-----------------------|---|
| Connectors | 2.5 mm ² terminal blocks |
| Analog outputs | 2, 0..10V / 2..10V / 0..20mA / 4..20mA with up to 20mA output current |
| Relay outputs | 1, 230Vac 1A |
| Accuracy | CO ₂ : $\pm 6\%$ typical VOC: $\pm 15\%$ %RH: $\pm 3\%$ RH °C: ± 1.0 °C |
| Response time | 60 sec. |



SCR and SQR sensors conforms to the requirements of the EMC directive through standard EN 61326-1.



Recycling of equipment and packaging should be taken into consideration and disposed in accordance with local and national regulations.



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