



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

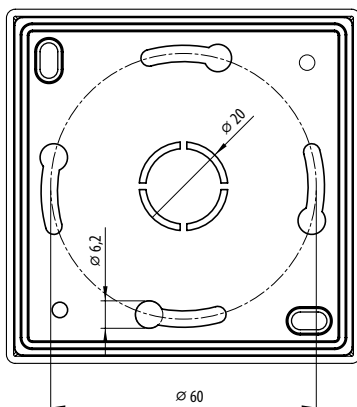
Room conditions, where sensor is installed, must ensure environmental requirements:

- 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:

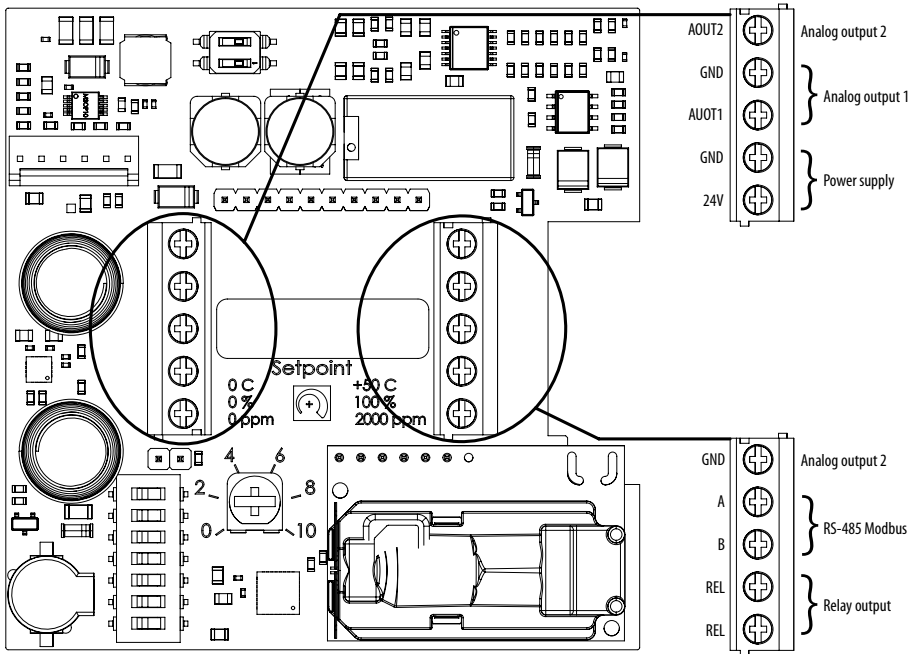




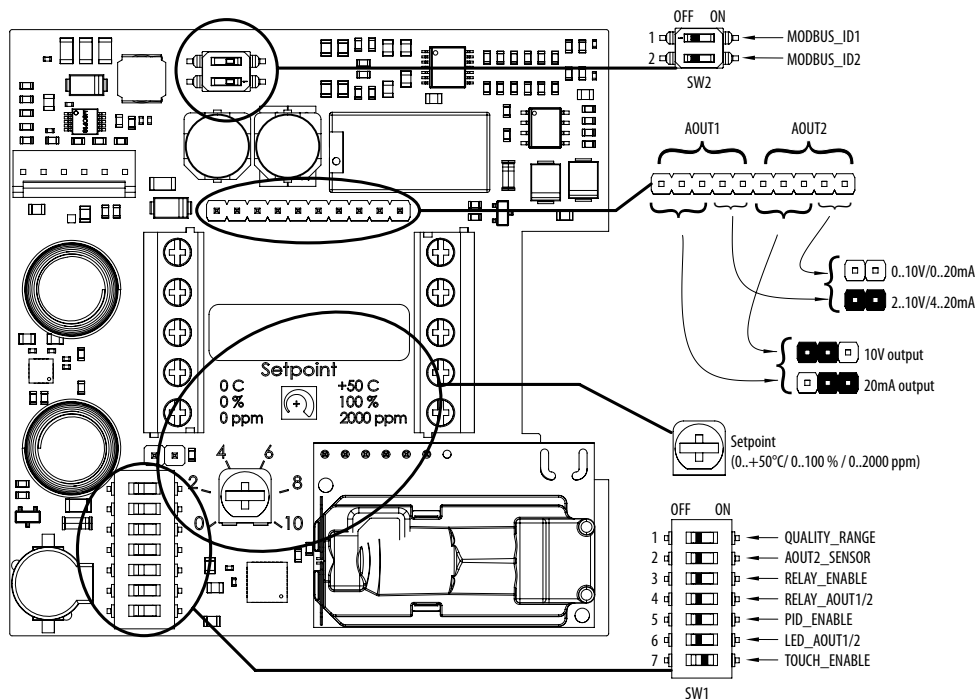
Screws used for sensor mounting on a flush mounting box or surface must be 2,0..3,0mm diameter and be flat head type. Failure to observe this requirement can cause permanent sensor failure that is not covered by warranty.

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

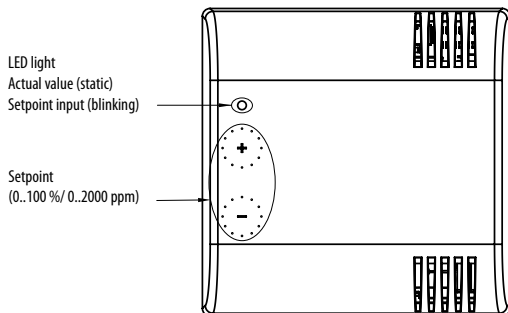
Typical configurations are:

- 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	AOUT2 ¹
Air temperature, °C	



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.

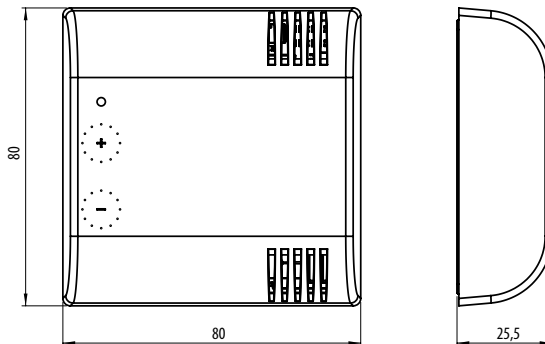
Possible, but not limited to, devices list for direct control:

- 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 ± 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 : ± 6 % typical VOC: ± 15 % %RH: ± 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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