SIEMENS

Technical Instructions
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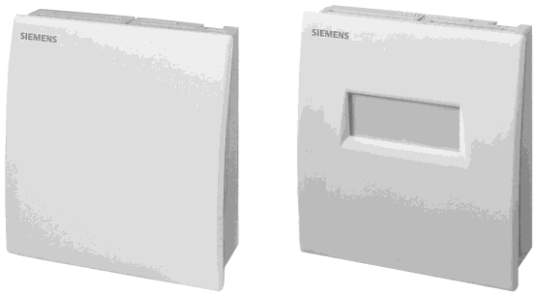
QPA20xx Series

Indoor Air Quality Room Sensors



Description

The QPA20xx Series Room Air Quality Sensors are designed for applications where precise, stable carbon dioxide or air quality sensing is required.

Several models are available — with either CO_2 only, or with Volatile Organic Compounds (VOC) (also known as mixed gas), relative humidity and/or temperature sensing. All units deliver a voltage or current (selectable) signal and have a CO_2 measuring range of 0 to 2000 ppm.

Features

- Maintenance-free, Non-Dispersive Infrared (NDIR) CO_2 sensing element is ideal for use in spaces that are occupied 24/7.
- Combination units enable a single sensor to take the place of up to three individual sensors.
- No recalibration required.
- 24 Vac or 15 to 35 Vdc operating voltage
- 0 to 10 Vdc, 0 to 5 Vdc, or 4 to 20 mA signal outputs (field selectable)

Application

For use in ventilation and air conditioning applications to enhance room comfort and to optimize energy consumption by providing demand-controlled ventilation. The sensor acquires:

- CO_2 concentrations as an indication of occupancy in rooms where smoking is prohibited.
- The relative humidity in the room.
- The room temperature.

QPA2002 models measure both CO_2 and volatile organic compounds (VOC) for optimized indoor air quality. A single 0 to 10V, 0 to 5V, or 4 to 20 mA (selectable) output signal is automatically adjusted to reflect the higher of the two values. This enables the combination CO_2 + VOC sensor to be easily substituted for a CO_2 sensor in any demand control ventilation control system.

Application, Continued

The QPA20xx Series Room Sensors can be used as:

- Control sensors.
- Transmitters for building automation and control systems and/or display units.

Typical use:

- Acquisition of CO_2 and VOC concentrations:
  In party rooms, lounges, fair pavilions and exhibition halls, restaurants, canteens, shopping malls, sports gymnasiums, sales rooms, and conference rooms.
- Acquisition of CO_2 concentrations:
  In rooms with varying occupancy levels where smoking is prohibited, such as museums, theaters, movie theaters, auditoriums, office spaces, and school rooms.

NOTES:

- The QPA20xx Series Sensors are not designed for use as safety devices, such as gas or smoke warning devices.
- Do not install outdoors.

Product Numbers

Table 1.

Product Number	CO_2 Measuring Range	VOC Sensitivity	Temperature Measuring Range	Humidity Measuring Range	Display of Measured Value
QPA2000	0 to 2000 ppm	—	—	—	No
QPA2002		Low (R1) Normal (R2) High (R3)	—	—	
QPA2002D			—	—	Yes
QPA2060		—	32°F to 122°F/ -31°F to 95°F (0°C to 50°C/ -35°C to 35°C)	—	No
QPA2060D		—		—	Yes
QPA2062		—		0 to 100%	No
QPA2062D		—			Yes

NOTE: An ARG70 Mounting Plate (sold separately) is required to install a QPA20xx sensor on a 2" × 4" electrical box.

Equipment Combinations

QPA20xx Series Sensors can be used with all types of systems and devices capable of acquiring and handling the 0 to 10 Vdc output signal delivered by the sensor.

Mode of Operation

CO_2 Concentrations

The QPA20xx Series Air Quality Sensors acquire the CO_2 concentration by infrared absorption measurement (NDIR). Due to an additional integrated reference light source, the measurement is always accurate. This reduces service costs as no service or recalibration is needed. The sensor acquires and evaluates the CO_2 concentration. The resulting output signal is proportional to the CO_2 content of the ambient air.

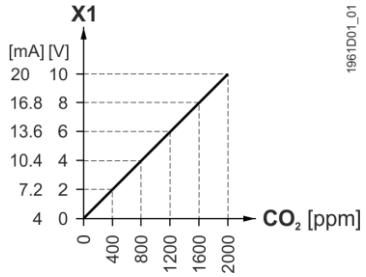


Figure 1. CO_2 Signal Output (X1).

CO_2/VOC Concentration (QPA2002 and QPA2002D Only)

The sensor acquires and evaluates the CO_2/VOC concentration and converts it to a ventilation demand signal.

It represents the result of maximum selection of the CO_2 measuring signal and the filtered VOC measuring signal. With maximum selection, the two demand signals are compared and, depending on the result and the selected VOC sensitivity, delivered as the common air quality demand.

The ventilation demand signal is delivered via output X2 as a signal to be fed to the ventilation controller.

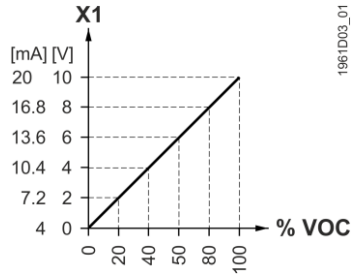


Figure 2. VOC Signal Output (X2).

VOC Sensitivity

Using jumper X130 on the setting element for the measuring range, the impact of VOC ventilation demand on maximum selection against CO_2 ventilation demand can be changed.

The position in the middle (R2) produces normal sensitivity of the VOC signal (factory setting). The other two positions are used for increasing (R3) or decreasing (R1) VOC sensitivity. See Figure 3.

Response Time VOC Signal

Before the processor handles a change of the measured VOC value for maximum selection, there is a delay in response time of three minutes for every Volt the signal value changes.

Relative Humidity (QPA2062 and QPA2062D Only)

The sensor acquires the relative humidity in the room with a capacitive humidity sensing element whose capacitance changes as a function of the relative humidity.

An electronic measuring circuit converts the signal from the sensing element to a continuous signal, corresponding to a relative humidity range of 0 to 100%.

Temperature (QPA206… Only)

The sensor acquires the room temperature with a sensing element whose electrical resistance changes as a function of the temperature.

The change is converted to an output signal with a selectable measuring range (≙ 32°F to 122°F [0°C to 50°C] or -31°F to 95°F [−35°C to 35°C]).

Mechanical Design

These are wall-mounted units, and they are designed for use with most types of commercially available, recessed conduit boxes. The cables can be introduced from the rear (concealed wiring) or from below or above (surface-run wires) through knockout openings.

The units consist of two major sections: Casing and baseplate. Both snap together but can be detached again.

The measuring circuit, the sensing elements and the setting elements are located on a printed circuit board inside the unit.

The connection terminals are on the mounting base.

NOTE:
For installation on a 2” × 4” electrical box, an ARG70 base plate must be ordered, separately.

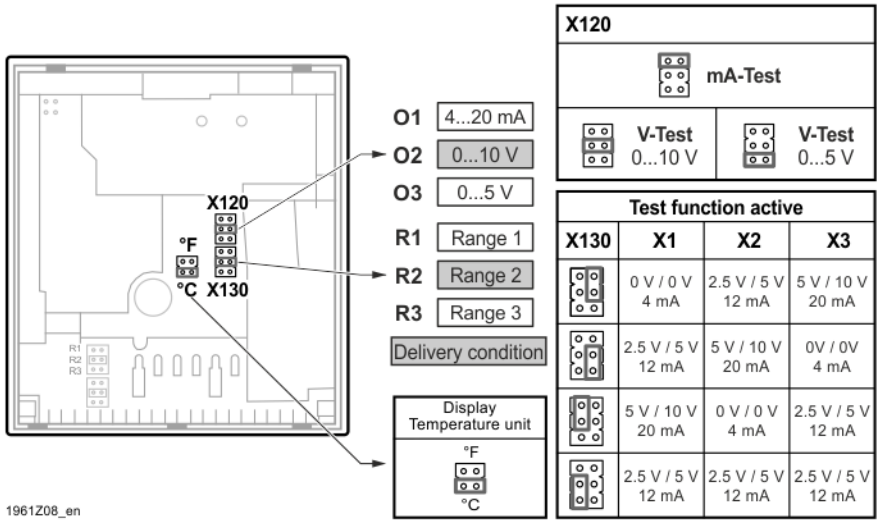


Figure 3. Setting Elements.

NOTE: The setting elements are located inside the cover.

Measuring Range

Meaning of the different jumper positions:

QPA2000

- For CO_2 only:
  Jumper in the middle position (R2) = 0 to 2000 ppm (factory setting).
  R1 and R3 are not used.

QPA2002 and QPA2002D

- For CO_2/VOC, jumpers determine VOC sensitivity:
  - Jumper in the upper position (R1) = VOC sensitivity "low".
  - Jumper in the middle position (R2) = VOC sensitivity "normal" (factory setting).
  - Jumper in the lower position (R3) = VOC sensitivity "high".

QPA206xx

- For CO_2 and temperature, jumpers determine temperature range:
  - Jumper in the upper position (R1) = -31°F to 95°F (–35 to 35°C).
  - Jumper in the positions (R2 or R3) = 32°F to 122°F (0 to 50°C) (R2, factory setting).

Output Signal Selection

- O1 = 4 to 20 mA
- O2 = 0 to 10V
- O3 = 0 to 5V

Active Test Function

Jumper for the measuring range in the vertical position:
The signal output delivers the values according to the *Test function active* table (see Figure 3).

Temperature Display Changeover

Meaning of the different jumper positions:

Temperature display:

- Jumper in the horizontal, lower position = °C (factory setting).
- Jumper plug in the horizontal, upper position = °F.

Troubleshooting

QPA2000

- In the event of CO_2 failure, 10 Vdc, 5 Vdc, or 20 mA will be present at signal output X1 (after 60 seconds).

QPA2002/QPA2002D

- In the event of CO_2 or VOC failure, 10 Vdc, 5 Vdc, or 20 mA will be present at signal output X2 (after 60 seconds).

QPA2060/QPA2060D

- If the temperature sensor becomes faulty, 0 Vdc or 0 mA will be present at signal output X2.

QPA2062/QPA2062D

- If the temperature sensor becomes faulty, 0 Vdc or 0 mA will be present at signal output X3, and the humidity signal at signal output X2 will increase to 10 Vdc, 5 Vdc, or 20 mA (after 60 seconds).
- If the humidity sensor becomes faulty, 10 Vdc, 5 Vdc, or 20 mA will be present at signal output X2 (after 60 seconds), and the temperature signal will remain active.

Measured Value Display

With sensors type QPA2002D, QPA2060D and QPA2062D, the measured values can be read on an LCD. The following measured values are displayed:

- CO_2 : In ppm.
- CO_2 + VOC: As a bar chart (4 bars ≙ X2 = 2V, 1V, or 7.2 mA
  20 bars ≙ X2 = 10V). More bars = higher VOC
- Temperature: In °C or °F.
- Humidity: In percent.

Disposal

The device is considered electrical and electronic equipment for disposal in terms of the applicable European Directive and may not be disposed of as domestic garbage.

- Dispose of the device through channels provided for this purpose.
- Comply with all local and currently applicable l aws and regulations.

Engineering Notes

- The sensor must be powered by a transformer for safety extra low-voltage (SELV) with separate windings, suited for 100% duty. It must be sized and fused in compliance with local safety regulations.
- When sizing the transformer, the power consumption of the sensor must be taken into consideration. For information about wiring, see the Technical Instructions of the devices with which the sensor is used.
- Observe maximum permissible cable lengths.

Cable Routing and Selection	• When laying the cables, it should be considered that electrical interference increases the longer the cables run parallel and the smaller the distance between them. • On applications with EMC problems, shielded cables should be used. • For the secondary power lines and signal lines, use cables with twisted pairs.
Mounting Notes	• Inner wall of the room to be ventilated, not in niches, behind curtains, above or near heat sources, and not exposed to direct light from spot lights. • Do not expose the sensor to direct sunlight. • Airflow of greater than 30 fpm may affect the temperature and humidity sensing accuracy. Avoid installing in areas prone to drafts. • The end of the conduit at the sensor must be sealed to prevent inaccurate measurements due to drafts through the conduit. • Installation Instructions are included with the unit.
Commissioning Notes	Check the sensor's functions can be checked 30 minutes after applying power. • Checking the CO_2 function: In well-ventilated rooms, the sensor shows the CO_2 concentration of the outside air. Typically, this is 360 ppm (depending on the sensor's measuring accuracy). Also, a basic functional check can be made by exhaling on the sensor. Note that the sensor's rate of response has been purposely delayed (time constant t_{90} = 5 minutes). • Checking the VOC function: Touch the sensor with a cotton ball dowsed in alcohol. • Ventilation should start when the preset switching level of the connected controller is reached. • After applying power to sensors with display, "**Init"** will appear for about six seconds.

Specifications

Power supply	Operating voltage (SELV)	24 Vac ±20%, or 15 to 35 Vdc
	Frequency	50/60 Hz at 24 Vac
	Power consumption	≤2 VA
Cable length for measuring signal	Permissible cable length	See the *Technical Instructions* of the device handling the signal
Functional data, CO_2	Measuring range (MW = measured value)	0 to 2000 parts per million (ppm)
	Measuring accuracy @ 73°F (23°C) and 1013 hPa	≤ ± (50 ppm + 2% measured value) *
	Temperature dependency in 41°F to 113°F	± 2 ppm/°C typically (5°C to 45°C) range
	Long-time drift	≤ ± 5% measuring range/5 years
	Time constant t_{90}	<5 minutes
	Output signal, linear (terminal X1)	0 to 2000 ppm
	Recalibration	Not required for 8 years
	*Allow up to 96 hours for unit to reach published accuracy.	
Functional data, maximum selection of CO_2 and VOC with QPA2002 and QPA2002D	Measuring range	0 to 2000 ppm
	VOC sensitivity	See Table 1
	Output signal, linear (terminal X2)	0 to 2000 ppm
	Response time, VOC signal t_{voc}	3 minutes/V

Functional data, rh with QPA2062 and QPA2062D	Range of use	0 to 95% rh (non-condensing)
	Measuring range	0 to 100% rh
	Measuring accuracy @ 73°F (23°C) and 24 Vac 0 to 95% rh 30 to 70% rh	 ± 5% rh ± 3 rh (typically)
	Temperature dependency	≤ 0.1% rh/°C
	Time constant	Approximately 20 seconds
	Output signal, linear (terminal X2)	0 to 100% rh
Functional data, temperature with QPA206xx	Measuring range	32°F to 122°F (0°C to 50°C) (R2, R3) -31°F to 95°F (-35°C to 35°C) (R1)
	Measuring element	NTC 10K Ω
	Measuring accuracy at 24 Vac: 59°F to 95°F (15°C to 35°C) outside the above range, between: -31°F to 122°F (-35°C to 50°C)	 ± 1.4°F (± 0.8°C) ± 1.8°F (±1°C)
	Time constant t_{63}	8.5 minutes
	Output signal, linear (terminal X2 or X3)	32°F to 122°F (0°C to 50°C)/ -31°F to 95°F (-35°C to 35°C)
Measured value display, protective data	QPA2002D, QWPA2060D, QPA2062D	LCD
	Degree of protection, housing	IP 30 to IEC 529
	Safety class	III to EN 60 730
Electrical connections	Screw terminals for	1 × 12 AWG or 2 × 16 AWG
Environmental conditions	Transport: Temperature: Humidity:	 -13°F to 158°F (-25°C to 70°C) < 95% rh
Materials and colors	Cover Housing Mounting plate Sensor (complete)	ASA + PC, NCS S 0502-G (white) ASA + PC, NC 2801-Y43R (gray) PC, NCS 2801-Y43R (gray) Silicone-free
	Packaging	Corrugated cardboard
Standards	Product safety Automatic controls for household and similar use	 EN 60 730-1
	Electromagnetic compatibility Immunity (QPA2062, QPA2062D) Immunity (QPA2000, QPA2002, QPA2002D, QPA2060, QPA2060D) Emissions	 EN 61 000-6-1 EN 61 000-6-2 EN 61 000-6-3
	CE conformity	EMC directive 89/336/EEC
	UL conformity	UL 916
	conformity to Australian EM framework Radio Interference Emission Standard	Radio Communication Act 1992 AS/NZS 3548
Weight (including packaging)		Approximately 4.25 oz (0.12 kg)

Additional Notes

Room sensors with active outputs have power dissipation influencing temperature measurement. The degree of influence depends on the operating voltage and is compensated at 24 Vac operating voltage in Siemens QPA20 Series room sensors. All other operating voltages may result in over- or under-compensation.

Furthermore, the measuring accuracy is influenced by the following:

- Prevailing airflow
- Wall surface (rough, smooth)
- Type of wall (wood, plaster, concrete, brick)
- Location of wall (inside, outdoors).

In an installed sensor, the application-specific measuring accuracy becomes constant after about a 1-hour operating time. It can be adjusted by a higher system (for example, a controller) as needed.

Wiring Terminals

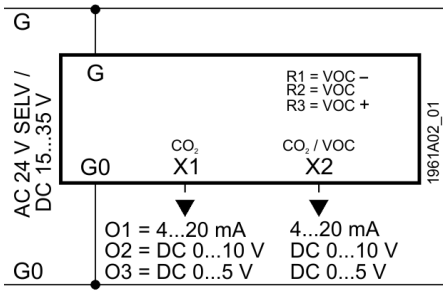


Figure 4. QPA2002, QPA2002D.

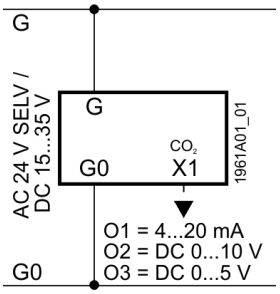


Figure 5. QPA2000.

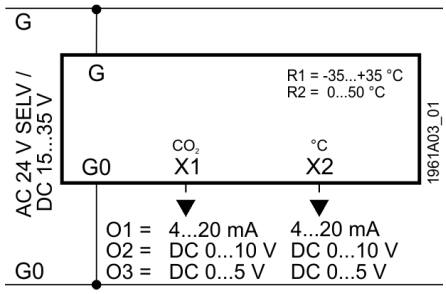


Figure 6. QPA2060, QPA2060D.

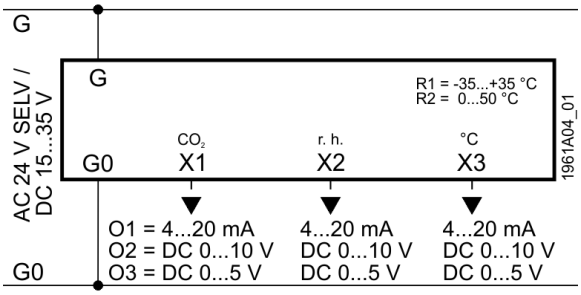


Figure 7. QPA2062, QPA2062D.

Dimensions

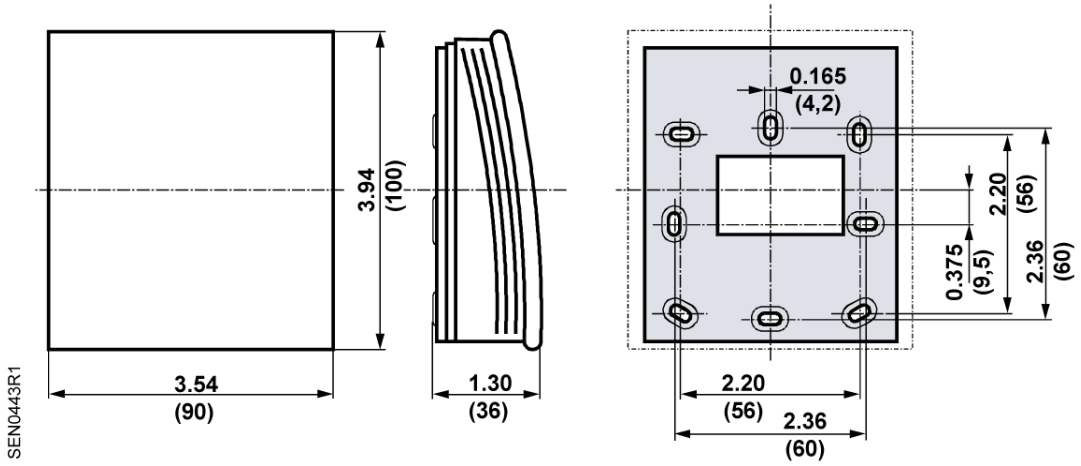


Figure 8. Dimensions in Inches (Millimeters).