
QPA20…


QPA20…D

# Room Air Quality Sensors QPA20…

- **With maintenance-free photoacoustic $CO_2$ sensing element and – depending on the type of sensor – VOC[1] sensing element, based on a heated tin dioxide semiconductor**
- **$CO_2$ temperature and $CO_2$ humidity-temperature multisensor**
- **No recalibrations required**
- **Operating voltage AC 24 V or DC 13.5…35 V**
- **Signal outputs DC 0...10 V**

1) VOC = volatile organic compounds (also called mixed gas)

## Use

In ventilation and air conditioning plant 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
- VOC concentrations as an indication of odors in the room, such as tobacco smoke, body odor, or material fumes
- The relative humidity in the room
- The room temperature

The QPA20… can be used as a:

- Control sensor
- Transmitter for building automation and control systems and / or display units

Typical use:

- Acquisition of $CO_2$ and VOC concentrations:
  In party rooms, lounges, fair pavillions 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, theatres, movie theatres, auditoriums, office spaces, and school rooms

*Important!*

The QPA20… sensors are not suited for use as safety devices, such as gas or smoke warning devices!

## Type summary

| *Type reference* | *$CO_2$ measuring range* | VOC sensitivity | *Temperature measuring range* | *Humidity measuring range* | *Display of measured value* |
|---|---|---|---|---|---|
| **QPA2000** | 0…2000 ppm | --- | --- | --- | No |
| **QPA2002** | 0…2000 ppm | Low (R1)<br>Normal (R2)<br>High (R3) | --- | --- | No |
| **QPA2002D** | 0…2000 ppm | Low (R1)<br>Normal (R2)<br>High (R3) | --- | --- | Yes |
| **QPA2060** | 0…2000 ppm | --- | 0...50 °C / –35...+35 °C | --- | No |
| **QPA2060D** | 0…2000 ppm | --- | 0...50 °C / –35...+35 °C | --- | Yes |
| **QPA2062** [1)] | 0…2000 ppm | --- | 0...50 °C / –35...+35 °C | 0...100 % | No |
| **QPA2062D** [1)] | 0…2000 ppm | --- | 0...50 °C / –35...+35 °C | 0...100 % | Yes |

1) Available from March 2006

## Ordering

When ordering, please give name and type reference, e.g.:
Room air quality sensor **QPA2002**

## Equipment combinations

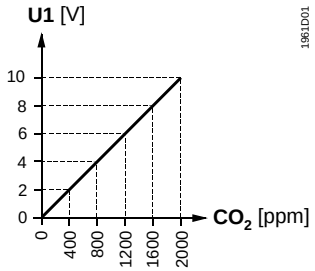
The QPA20… are suited for use with all types of systems and devices capable of acquiring and handling the DC 0...10 V output signal delivered by the sensor.

## Mode of operation

**$CO_2$ concentrations**

The sensor acquires and evaluates the $CO_2$ concentration. The resulting output signal of DC 0...10 V is proportional to the $CO_2$ content of the ambient air.

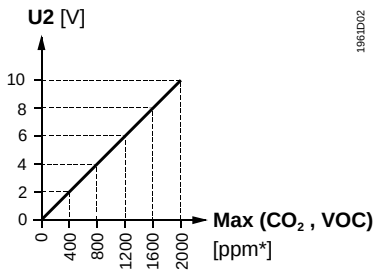
*Function diagram $CO_2$ (output U1)*




**$CO_2$/VOC concentration**
– only with **QPA2002** and **QPA2002D**

The sensor acquires and evaluates the $CO_2$ / VOC concentration and transforms 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 2 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 U2 as a DC 0…10 V signal to be fed to the ventilation controller.

*Ventilation demand diagram (output U2)*



*VOC sensitivity*

Using the shorting plug 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 2 other positions are used for increasing (R3) or decreasing (R1) VOC sensitivity.

*Response time "VOC signal"*

Before the processor handles a change of the measured VOC value for maximum selection, a response time of 3 minutes for every Volt the signal value changes is observed.

**Relative humidity**
– only with **QPA2062** and **QPA2062D** –

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 DC 0...10 V signal, corresponding to a relative humidity range of 0...100 %.

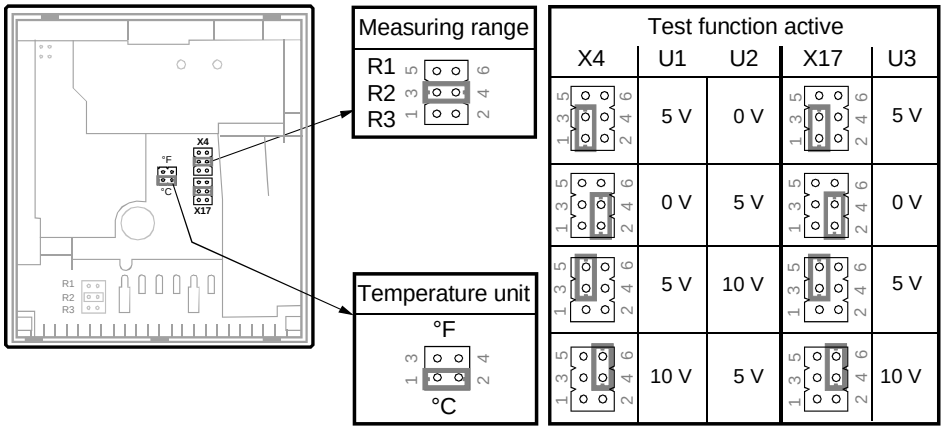
**Temperature**
– only with **QPA206…** –

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 active DC 0...10 V output signal (≙ 0...50 °C or −35...+35 °C).

## Mechanical design

The units have been designed for wall mounting. They are suited 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 2 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 mounting base carries the connection terminals.

**Setting elements…**




The setting elements can be accessed after removing the mounting base.

… for the measuring range

Meaning of the different shorting plug positions:

with **QPA2000**

- *For the $CO_2$ measuring range:*
  Shorting plug in the mid position (R2) = 0…2000 ppm (factory setting)

with **QPA2002** and **QPA2002D**

- *For $CO_2$ / VOC weighting:*
  - Shorting plug in the upper position (R1) = VOC sensitivity "low"
  - Shorting plug in the mid position (R2) = VOC sensitivity "normal" (factory setting)
  - Shorting plug in the lower position (R3) = VOC sensitivity "high"

with **QPA206…**

- *For the temperature measuring range:*
  - Shorting plug in the upper position (R1) = –35...+35 °C
  - Shorting plug in the mid position (R2) = 0...50 °C (factory setting)
  - Shorting plug in the lower position (R3) = 0...50 °C

… for the active test function

Shorting plug for the measuring range in the vertical position:
The signal output delivers the values according to table "Test function active".

… for changeover of the temperature display

Meaning of the different shorting plug positions:

- *For the unit of temperature:*
  - Shorting plug in the horizontal, lower position = °C (factory setting)
  - Shorting plug in the horizont, upper position = °F

**Behavior in the event of fault**

All types

- In the event of $CO_2$ failure, 10 V will be present at signal output U1 (after 60 seconds)

**QPA2002**

- In the event of $CO_2$ or VOC failure, 10 V will be present at signal output U2 (after 60 seconds)

**QPA2060** and **QPA2060D**

- Should the temperature sensor become faulty, 0 V will be present at signal output U2

**QPA2062** and **QPA2062D**

- Should the temperature sensor become faulty, 0 V will be present at signal output U3, and the humidity signal at signal output U2 will increase to 10 V (after 60 seconds)
- Should the humidity sensor become faulty, 10 V will be present at signal output U2 (after 60 seconds), and the temperature signal will remain active

**Display of measured values**

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

- $CO_2$ : In ppm
- $CO_2$ + VOC: As a bar chart (4 bars ≙ U2 = 2 V, 20 bars ≙ U2 = 10 V)
- Temperature: In °C or °F
- Humidity: In %

**Disposal**

The major plastic components bear the material references in compliance with ISO / DIS 11 469 to facilitate environment-friendly disposal.

## 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, refer to the Data Sheets of the devices with which the sensor is used.
The maximum permissible cable lengths must be observed.

Cable routing and cable selection

When laying the cables, it should be considered that electrical interference is the greater 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

Mounting location

Inner wall of the room to be ventilated, not in niches, not behind curtains, not above or near heat sources, and not exposed to direct light from spot lights.
The sensor must not be exposed to direct solar radiation.
The end of the conduit at the sensor must be sealed to prevent false measurements due to drafts through the conduit.

Mounting Instructions

Mounting Instructions are enclosed in the package.

## Commissioning notes

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 (the sensor's measuring accuracy must be considered). Also, a basic functional check can be made by exhaling on the sensor. In that case, it must be taken into account that the sensor's rate of response has been purposely delayed (time constant $t_{90}$ = 5 min)
- Checking the VOC function:
  Touch the sensor with a cotton ball dowsed in alcohol (e.g. gas from a cigarette lighter, without lighting a flame)

Ventilation should start when the preset switching level of the connected controller is reached.

After applying power to the types of sensor with display, Init will appear for about 6 seconds.

## Technical data

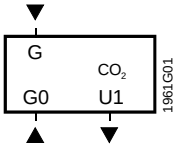
| | | |
|---|---|---|
| Power supply | Operating voltage (SELV) | AC 24 V ±20 % or DC13.5…35 V |
| | Frequency | 50/60 Hz at AC 24 V |
| | Power consumption | ≤2 VA |
| Cable lengths for measuring signal | Perm. cable lengths | refer to Data Sheet of the device handling the signal |
| Functional data "$CO_2$" | Measuring range (MW = measured value) | 0...2000 ppm [1)] |
| | Measuring accuracy at 20 °C, 40 % r.h. and 970 hPa | ≤±(20 ppm [1)] + 1.5 % MW) |
| | Temperature dependency in the range of 15…35 °C | ≤±4 % MW |
| | Repeatability | ≤±20 ppm [1)] |
| | Long-time drift | ≤±20 ppm [1)] p.a. |
| | Time constant $t_{90}$ | <5 min |
| | Output signal, linear (terminal U1) | DC 0...10 V ≙ 0...2000 ppm [1)], max. ±1 mA |
| | Recalibration-free | 8 years |
| Functional data "Maximum selection of $CO_2$ and VOC" with QPA2002 and QPA2002D | Measuring range | 0...2000 ppm [1)] |
| | VOC sensitivity | refer to "Type summary" |
| | Output signal, linear (terminal U2) | DC 0...10 V ≙ 0...2000 ppm [1)], max. ±1 mA |
| | Response time "VOC signal" $t_{VOC}$ | 3 min/V |
| Functional data "r.h." with QPA2062 and QPA2062D | Range of use | 0...95 % r.h. (noncondensing) |
| | Measuring range | 0…100 % r.h. |
| | Measuring accuracy at 23 °C and AC 24 V | |
| | 0…95 % r.h. | ±5 % r.h. |
| | 30…70 % r.h. | ±3 % r.h. (typically) |
| | Temperature dependency | ≤0.1 % r.h./°C |
| | Time constant | 2 min |
| | Output signal, linear (terminal U2) | DC 0...10 V ≙ 0...100 % r.h., max. ±1 mA |
| Functional data "Temperature" with QPA206… | Measuring range | 0...50 °C (R2, R3) or −35...+35 °C (R1) |
| | Measuring element | NTC 10 kΩ |
| | Measuring accuracy in the range of | |
| | 15...35 °C | ±0.8 K |
| | −35...+50 °C | ±1 K |
| | Time constant | 7 min |
| | Output signal, linear (terminal U2 or U3) | DC 0...10 V ≙ 0...50 °C / −35...+35 °C max. ±1 mA |
| Display of measured value | With QPA2002D, QPA2060D, QPA2062D | LCD |
| Protective data | Degree of protection of housing | IP 30 to IEC 529 |
| | Safety class | III to EN 60 730 |
| Electrical connections | Screw terminals for | 1 × 2.5 mm² or 2 × 1.5 mm² |
| Environmental conditions | Operation to | IEC 721-3-3 |
| | Climatic conditions | class 3K3 |
| | Temperature (housing incl. electronics) | 0...50 °C |
| | Humidity | 0…95 % r.h. (noncondensing) |
| | Mechanical conditions | class 3M2 |

| | | |
|---|---|---|
| | Transport to | IEC 721-3-2 |
| | Climatic conditions | class 2K3 |
| | Temperature | −25...+70 °C |
| | Humidity | <95 % r.h. |
| | Mechanical conditions | class 2M2 |
| Materials and colors | Cover | ASA + PC, NCS S 0502-G (white) |
| | Housing | ASA + PC, NCS 2801-Y43R (grey) |
| | Mounting plate | PC, NCS 2801-Y43R (grey) |
| | Sensor (complete) | silicone-free |
| | Packaging | corrugated cardboard |
| Standards | Product safety | |
| | Automatic electrical controls for household and similar use | EN 60 730-1 |
| | Electromagnetic compatibility | |
| | Immunity | EN 61 000-6-2 |
| | Emissions | EN 61 000-6-3 |
| | CE conformity to | EMC directive 89/336/EEC |
| | conformity to | |
| | Australian EMC Framework | Radio Communication Act 1992 |
| | Radio Interference Emission Standard | AS/NZS 3548 |
| Weight | Incl. packaging | |
| | Without display | approx. 0.10 kg |
| | With display | approx. 0.12 kg |

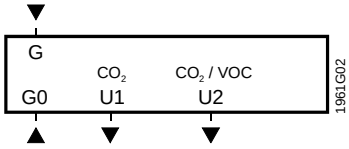
1) ppm = parts per million

## Connection terminals

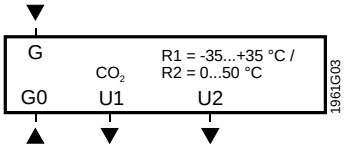
**QPA2000**



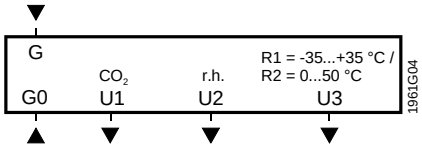

**QPA2002, QPA2002D**




**QPA2060, QPA2060D**

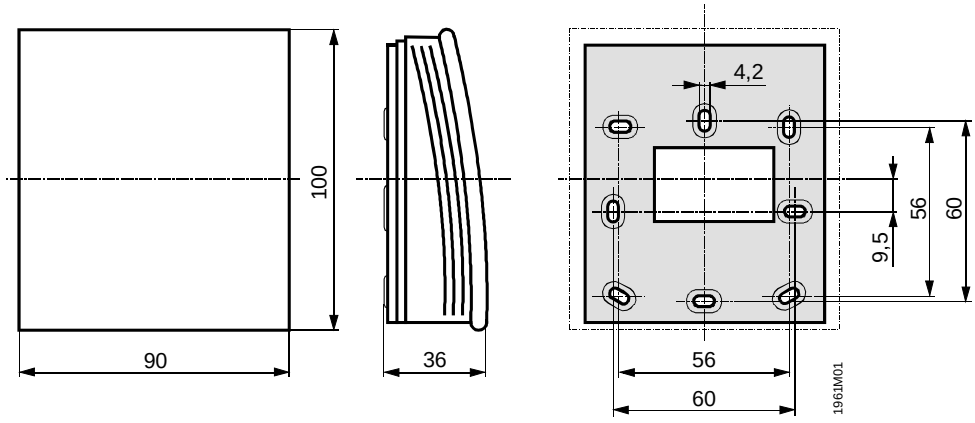



**QPA2062, QPA2062D**




| | |
|---|---|
| G, G0 | System potential AC 24 V (SELV) or DC 13.5...35 V |
| G0 | System neutral and measuring neutral |
| U1 | Signal output DC 0...10 V |
| U2 | Signal output DC 0...10 V |
| U3 | Signal output DC 0...10 V |

## Dimensions (in mm)




Drilling plan