

QPM2102D

QPM2160D, QPM2162D

QPM1100, QPM2100, QPM2102

QPM2160, QPM2180

## Duct Air Quality Sensors

**QPM11..**  
**QPM21..**

- Maintenance-free CO<sub>2</sub> sensing element (depending on the type) based on optical infrared absorption measurement (NDIR<sup>1</sup>)
- Or with VOC<sup>2</sup> sensing element, based on a heated tin dioxide semiconductor
- CO<sub>2</sub> temperature (active or passive) and CO<sub>2</sub> humidity-temperature multisensor
- No recalibrations required
- Operating voltage AC 24 V or DC 15...35 V
- Signal outputs DC 0...10 V or DC 0...5 V adjustable
- Selectable passive temperature sensing element

1) NDIR = Non dispersive infrared

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

### Use

In air ducts of ventilation and air conditioning plant to enhance room comfort and to optimize energy consumption by providing demand-controlled ventilation. The sensor acquires:

- CO<sub>2</sub> concentrations
- VOC concentrations as an indication of odors in the duct air, such as tobacco smoke, body odor, or material fumes
- The relative humidity of the duct air
- The duct air temperature

Sensors QPM1100 and QPM21... can be used as a:

- Control sensor in the supply or extract air duct
- Transmitter for building automation and control systems and / or display units (QPM21...D only).

Typical use:

- Acquisition of CO<sub>2</sub> 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<sub>2</sub> concentrations:  
In ventilation plant of rooms with varying occupancy levels where smoking is prohibited, such as museums, theatres, movie theatres, auditoriums, office spaces and school rooms

*Important!*

- The QPM21... sensors are not suited for use as safety devices, such as gas or smoke warning devices!
- The sensors must not be used outdoors!

### Type summary

| Type reference  | CO <sub>2</sub><br>measuring range | VOC<br>time constant                  | Temperature<br>measuring range            | Humidity<br>measuring range | Measured value<br>display |
|-----------------|------------------------------------|---------------------------------------|---|-----------------------------|---------------------------|
| <b>QPM1100</b>  | ---                                | Slow (R1)<br>Normal (R2)<br>Fast (R3) | ---                                       | ---                         | ---                       |
| <b>QPM2100</b>  | 0...2000 ppm                       | ---                                   | ---                                       | ---                         | no                        |
| <b>QPM2102</b>  | 0...2000 ppm                       | Slow (R1)<br>Normal (R2)<br>Fast (R3) | ---                                       | ---                         | no                        |
| <b>QPM2102D</b> | 0...2000 ppm                       | Low (R1)<br>Normal (R2)<br>High (R3)  | ---                                       | ---                         | yes                       |
| <b>QPM2160</b>  | 0...2000 ppm                       | ---                                   | 0...50 °C / -35...+35 °C                  | ---                         | no                        |
| <b>QPM2160D</b> | 0...2000 ppm                       | ---                                   | 0...50 °C / -35...+35 °C                  | ---                         | yes                       |
| <b>QPM2162</b>  | 0...2000 ppm                       | ---                                   | 0...50 °C / -35...+35 °C                  | 0...100 %                   | no                        |
| <b>QPM2162D</b> | 0...2000 ppm                       | ---                                   | 0...50 °C / -35...+35 °C                  | 0...100 %                   | Yes                       |
| <b>QPM2180</b>  | 0...2000 ppm                       | ---                                   | Depending on connected<br>sensing element | ---                         | no                        |

### Ordering

When ordering, please give name and type reference, e.g.:

Duct air quality sensor **QPM2102**

The sensor is supplied complete with mounting flange and cable entry gland M16.

### Equipment combinations

All systems and devices capable of processing the following sensor signals:

- DC 0...10 V or DC 0...5 V or
- passive sensor signals for sensor QPM2180

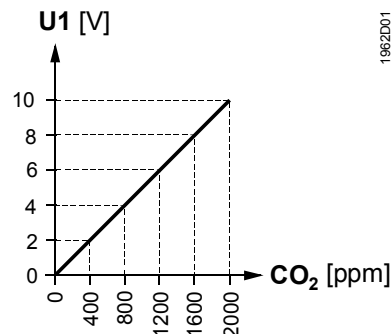
## Mode of operation

### CO<sub>2</sub> concentrations

The Symaro™ air quality sensors acquire the CO<sub>2</sub> concentration by infrared absorption measurement (NDIR).

The resulting output signal of DC 0...10 V or DC 0...5 V is proportional to the CO<sub>2</sub> content of the ambient air.

Function diagram CO<sub>2</sub>  
(output U1)

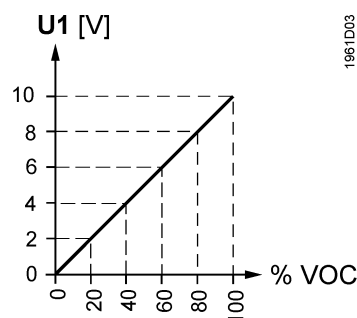


### VOC concentration (QPM1100)

Symaro™ air quality sensors determine the mixed gas concentration (VOC) using metal-oxide semiconductor sensing elements. The sensors measure precisely at all times and with no maintenance and recalibration required thanks to an integrated compensation mechanism, saving service costs.

The sensor provides a DC 0...10 V or DC 0...5 V output signal proportionate to the VOC content of the ambient air.

Diagram VOC  
(Output U1)



Time constant  
"VOC signal"

Select the time constant for VOC measurement by limiting the maximum slew rate for the VOC signal. The jumper X4 (measuring range) fine tunes the time constant for VOC ventilation demand.

The center position (R2) produces a normal slew rate of max. 10% change to the VOC signal per minute (factory setting). The other 2 position reduce (R1, 2.5% VOC/min) or increase (R3, 40% VOC/min) the maximum slew rate. A smaller slew rate (R1) filters out short-term VOC concentration peaks, e.g. caused by a highly perfumed person passing by. The sensor reacts immediately and quickly to changes in VOC concentration at the higher slew rate (R3).

Time constant  $t_{63}$  selected by jumper X4 corresponds to <13 min (R1), <3.5 min (R2), or <1 min (R3) for a sudden change to 50% VOC.

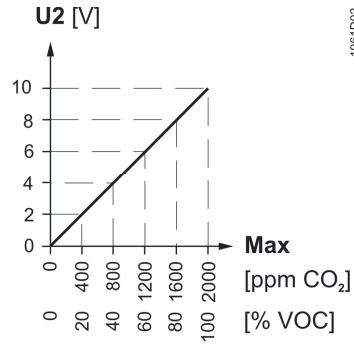
### CO<sub>2</sub>/VOC concentration (QPM2102 and QPM2102D)

The sensor acquires and evaluates the CO<sub>2</sub> / VOC concentration and transforms it to a ventilation demand signal.

It represents the result of maximum selection of the CO<sub>2</sub> measuring signal and the filtered VOC measuring signal. With maximum selection, the 2 demand signals are compared and delivered as the common air quality demand.

The ventilation demand signal is delivered via output U2 as a DC 0...10 V or 0...5 V signal to be fed to the ventilation controller.

Ventilation demand diagram (output U2)



Relative humidity (QPM2162 and QPM2162D)

The sensor acquires the relative humidity in the air duct 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 or DC 0...5 V signal, corresponding to a relative humidity range of 0...100 %.

Temperature active (QPM216...)

The sensor acquires the temperature in the air duct 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 or DC 0...5 V output signal ( $\cong$  0...50 °C or -35...+35 °C).

Temperature passive (QPM2180)

The sensor measures the room temperature using a sensing element where electrical resistance changes with the temperature of the ambient air. The sensing element is on the device's rear side and connected at the appropriate connection terminals.

The following sensing elements are included with the device:

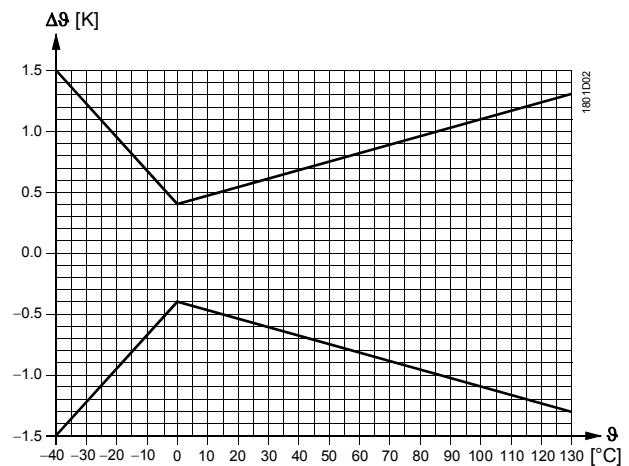
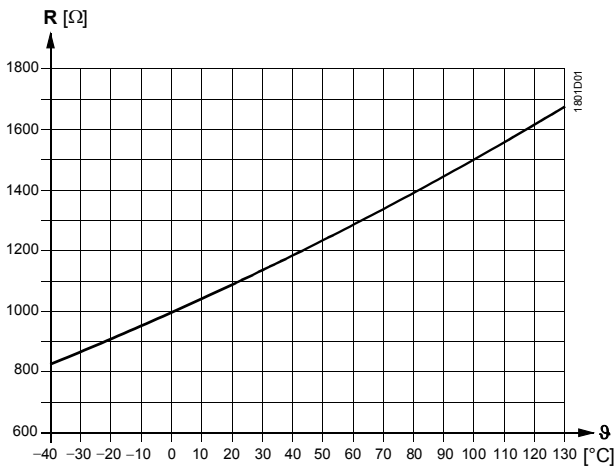
- LG-Ni1000
- Pt1000
- Pt100
- NTC 10kOhm

Sensing element

LG-Ni 1000

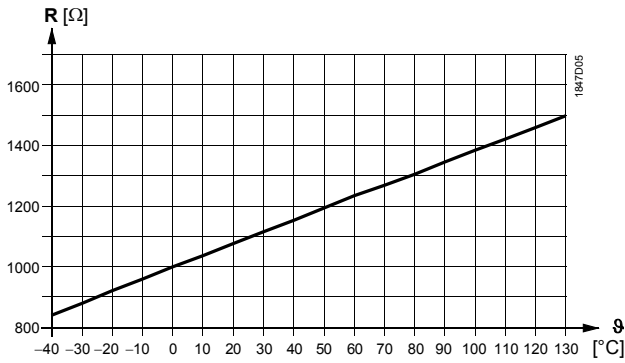
Characteristic curve:

Accuracy:

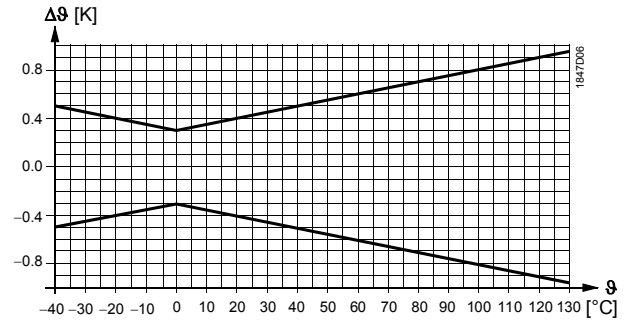


Pt 1000 (KI. B)

Characteristic curve:

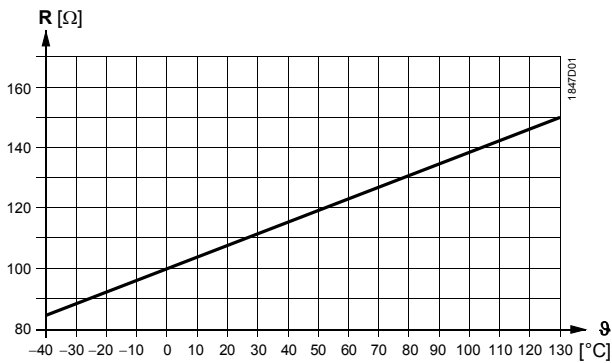


Accuracy:

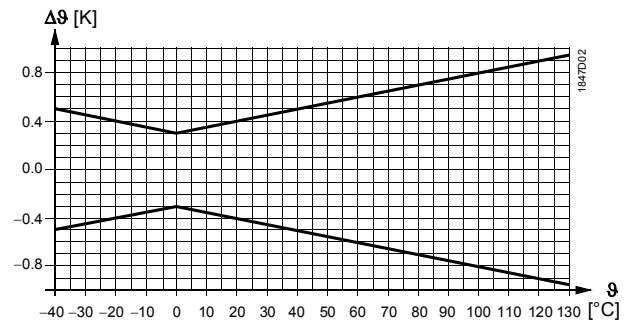


Pt 100 (KI. B)

Characteristic curve:

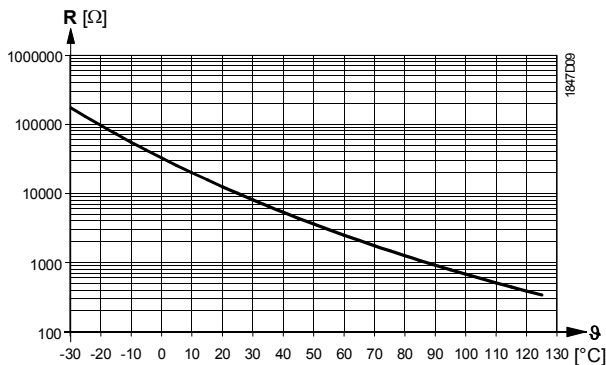


Accuracy:

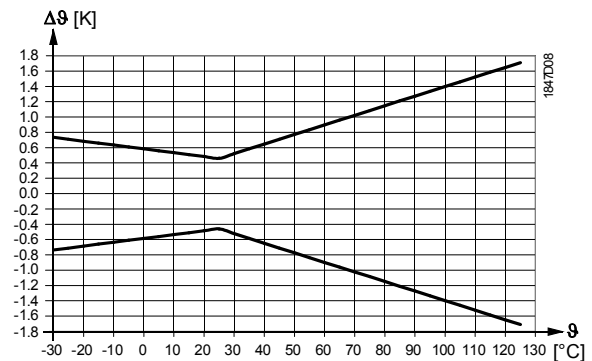


NTC 10k

Characteristic curve:



Accuracy:

**Key**

|                   |                                    |
|-------------------|------------------------------------|
| R                 | Resistance in Ohm                  |
| $\vartheta$       | Temperature in Celsius             |
| $\Delta\vartheta$ | Temperature differential in Kelvin |

**Mechanical design**

The duct air quality sensor consists of housing, printed circuit board, connection terminals, mounting flange and immersion rod with measuring probe.

The 2-sectional housing is comprised of base and removable cover (without display: snap-on design; with display: screwed fastening). The measuring circuit and the setting elements are located on the printed circuit board inside the cover, the connection terminals on the base.

The humidity and temperature sensing elements are located at the end of the measuring probe and are protected by a filter cap.

Cable entry is made via the cable entry gland M16 (IP 54) supplied with the sensor, which screws into the housing.

Immersion rod and housing are made of plastic and are rigidly connected.

The sensor is fitted with the mounting flange supplied with the sensor. The flange is to be placed over the immersion rod and then secured in accordance with the required immersion length.

### Setting elements ...

QPM2100/2160/2160D  
QPM2180

Measuring range  
Output voltage  
R1| R2| R3

X4

| Test function active |      |      |
|----------------------|------|------|
| X4                   | U1   | U2   |
|                      | 10 V | 5 V  |
|                      | 0 V  | 5 V  |
|                      | 5 V  | 10 V |
|                      | 5 V  | 0 V  |

196Z13en

QPM1100  
QPM2102 / QPM2102D  
QPM2162 / QPM2162D

Measuring range  
R1| R2| R3

X4

Output voltage  
R4| R5| R6

X17

| * Test function active |      |      |     |     |     |     |      |
|------------------------|------|------|-----|-----|-----|-----|------|
| X4                     | U1   | U2   | U3  | X17 | U1  | U2  | U3   |
|                        | 10 V | 5 V  | 5 V |     | 5 V | 5 V | 10 V |
|                        | 0 V  | 5 V  | 5 V |     | 5 V | 5 V | 0 V  |
|                        | 5 V  | 10 V | 5 V |     | 5 V | 5 V | 5 V  |
|                        | 5 V  | 0 V  | 5 V |     | 5 V | 5 V | 5 V  |

°F °C

°F °C

°F °C

\* Set either X4 or X17 into test function, but not both at the same time.

The setting elements are located inside the cover

...for the measuring range  
with **QPM2100**

The different vertical plug positions have the following meaning:

with QPM1100,  
QPM2102 and  
QPM2102D

- For the CO<sub>2</sub> measuring range:
  - Shorting plug in the mid position (R2) = 0...2000 ppm (factory setting)
- For VOC weighting:
  - Shorting plug in the left position (R1) = VOC sensitivity "slow"
  - Shorting plug in the mid position (R2) = VOC sensitivity "normal" (factory setting)
  - Shorting plug in the right position (R3) = VOC sensitivity "fast"
- For the temperature measuring range:
  - Shorting plug in the left position (R1) = -35...+35 °C
  - Shorting plug in the mid position (R2) = 0...50 °C (factory setting)

... for output voltage for  
all **QPM...**

- As per listing above R3 or R4 (depending on the device):
  - Plugged in jumper = DC 0...10 V
  - Removed jumper = DC 0...5 V

...for the active test  
function

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

... for selection of the  
temperature unit on the  
display

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

## Behavior in the event of fault

### QPM1100

- In the event of VOC failure, DC 10 V or 5 V will be present at signal output U1 (after 60 seconds)

### QPM2...

- In the event of CO<sub>2</sub> or VOC failure, DC 10 V or 5 V will be present at signal output U1 (after 60 seconds)

### QPM2102/2102D

- In the event of CO<sub>2</sub> or VOC failure, DC 10 V or 5 V will be present at signal output U2 (after 60 seconds)

### QPM2160/2160D

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

### QPM2162/2162D

- 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 DC 10 V or 5 V (after 60 seconds)
- Should the humidity sensor become faulty, DC 10 V or 5 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 **QPM2102D**, **QPM2160D** and **QPM2162D**, the measured values can be read on an LCD. The following measured values are displayed:

- CO<sub>2</sub>: In ppm
- CO<sub>2</sub> + VOC: As a bar chart: 4 bars  $\hat{=}$  U2 = 2 V or 1 V  
20 bars  $\hat{=}$  U2 = 10 V or 5 V
- Temperature: In °C or °F
- Humidity: In % r.H.

## Accessories

| Name                         | Type reference |
|------------------------------|----------------|
| Filter cap (for replacement) | AQF3101        |

## Engineering notes

To power the sensor, a transformer for safety extra low-voltage (SELV) with separate windings for 100 % duty is required. When sizing and protecting the transformer, local safety regulations must be complied with.

When sizing the transformer, the power consumption of the duct sensor must be taken into consideration.

For correct wiring, refer to the Data Sheets of the devices with which the sensor is used.

The permissible cable lengths must be observed.

### Cable routing and cable selection

When laying the cables, it must be observed that the longer the cables run side by side and the smaller the distance between them, the greater the electrical interference.

Shielded cables must be used in environments with EMC problems.

Twisted pair cables are required for the secondary supply lines and the signal lines.

## Mounting notes

### Mounting location and orientation

To ensure degree of protection IP54 resp. IP65, the sensor must be fitted with the cable entry pointing downward!

The sensor should be mounted in locations where it can be easily accessed for service.

### Note!

- If used in connection with steam humidifiers, the distance to the humidifier must be a minimum of 3 m. If permitted by the installation, the distance should be as great as possible, but no more than 10 m
- The sensing elements in the immersion rod are susceptible to impact and shock. Any impact or shock should therefore be avoided

- The sensor must not be mounted in ventilation plant on top of a building (impact of solar radiation)! To ensure correct operation, the sensor's ambient temperature must lie in the range of  $-5...+45\text{ °C}$

Mounting instructions

Mounting Instructions are enclosed in the package.

## Commissioning notes

Checking the CO<sub>2</sub> function

The sensor's functions can be checked 30 minutes after applying power:

- In well ventilated rooms, the sensor shows the CO<sub>2</sub> 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  $t_{63} = 5\text{ min}$ )

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.

## Disposal



The devices are considered electronics devices for disposal in term of European Directive 2012/19/EU and may not be disposed of as domestic waste.

- Dispose of the device via the channels provided for this purpose.
- Comply with all local and currently applicable laws and regulations.

## Technical data

|                                    |   |  |   |
|------------------------------------|---|--|---|
| Power supply                       | Operating voltage   | AC 24 V $\pm 20\%$ or DC 15...35 V (SELV)<br>or<br>AC/DC 24 V class 2 (US)   |   |
|                                    | Frequency   | 50/60 Hz at AC 24 V  |   |
|                                    | External supply line protection (EU)  | Fuse slow max. 10 A<br>or<br>Circuit breaker max. 13 A<br>Characteristic B, C, D according to<br>or<br>Power source with current limitation of max. 10 A |   |
|                                    | Power consumption   |  |   |
|                                    | QPM1100   | < 0.8 VA   |   |
|                                    | QPM2100, QPM2160, QPM2160D, QPM2162,<br>QPM2162D QPM 2180,<br>QPM2102, QPM2102D | <1.7 VA, typ. <0.5 VA<br><2.3 VA, typ. <1.0 VA   |   |
| Cable lengths for measuring signal | Perm. cable lengths   | refer to Data Sheet of the device handling the signal  |   |
| Functional data "CO <sub>2</sub> " | Measuring range   | 0...2000 ppm   |   |
|                                    | Measuring accuracy<br>at 23 °C and 1013 hPa                                     | $\pm 2$ (50 ppm + 2 % of measured value)   |   |
|                                    | Temperature dependency<br>in the range of $-5...45\text{ °C}$                   | $\pm 2\text{ ppm / °C}$ (typically)  |   |
|                                    | Long-time drift   | $\leq 5\%$ of measuring range / 5 years (typically)  |   |
|                                    | Time constant $t_{63}$  | <5 min   |   |
|                                    | Output signal, linear (terminal U1)   | DC 0...10 V $\hat{=}$ 0...2000 ppm,<br>max. $\pm 1\text{ mA}$  |   |
|                                    | Recalibration-free  | 8 years  |   |
|                                    | Functional data "VOC"   | Measuring range  | 0...100% VOC  |
|                                    |   | Time constant $t_{63}$ VOC (CO <sub>2</sub> see above)   | <13 min (R1), <3.5 min (R2), <1 min (R3)                                |
|                                    |   | Output signal, linear (terminal U1)  | DC 0...10 V or DC 0...5 V $\hat{=}$ 0...100%,<br>max. $\pm 1\text{ mA}$ |



|   |  |   |
|---|--|---|
| Functional data<br>"Maximum selection of CO <sub>2</sub> and VOC" with QPM2102 and QPM2102D<br>Functional data "r.h." with QPM2162D | Output signal, linear (terminal U2)                          | DC 0...10 V or DC 0...5 V $\hat{=}$ max.<br>of 0...2000 ppm, CO <sub>2</sub> or 0...100% VOC, max. $\pm$ 1 mA |
|   | 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.  | $\pm$ 5 % r.h.  |
|   | 30...70 % r.h.   | $\pm$ 3 % r.h. (typically)  |
|   | Time constant $t_{63}$                                       | approx. 20 s  |
|   | Output signal, linear (terminal U2)                          | DC 0...10 V or DC 0...5 V $\hat{=}$<br>0...100 % r.h., max. $\pm$ 1 mA  |
|   | Range of use   | -5...+45 °C   |
|   | Measuring range  | 0...50 °C (R2)<br>or -35...+35 °C (R1)  |
|   | Measuring accuracy at AC 24 V in the range of                |   |
|   | 23 °C  | $\pm$ 0.3 K (typically)   |
|   | 15...35 °C   | $\pm$ 0.6 K   |
|   | -35...+50 °C   | $\pm$ 1 K   |
|   | Time constant  | <3.5 min. in with 2 m/s moved air   |
|   | Output signal, linear (terminal U2 or U3)                    | DC 0...10 V oder DC 0...5 V $\hat{=}$<br>0...50 °C / -35...+35 °C max. $\pm$ 1 mA                             |
|   | Sensing range  | see "Mode of operation"   |
|   | Measuring accuracy   | see "Mode of operation"   |
|   | Time constant $t_{63}$                                       | <3.5 min. at 2 m/s of circulated air  |
|   | Output signal (terminal B, M)                                | passive   |
| Air velocity  | Max. air velocity $V_{max}$ .                                | 10 m/sec.   |
| Degree of protection  | Protection degree of housing<br>QPM2102D, QPM2160D, QPM2162D | IP65 according to EN 60529<br>in the built-in state   |
|   | QPM1100, QPM2100, QPM2102, QPM2160,<br>QPM2162, QPM2180      | IP54 according to EN 60529<br>in the built-in state   |
|   | Protection class   | III according to EN 60730-1   |
| Electrical connections  | Screw terminals for  | 1 $\times$ 2.5 mm <sup>2</sup> or 2 $\times$ 1.5 mm <sup>2</sup>  |
| Environmental conditions  | Operation to   | IEC 60721-3-3   |
|   | Climatic conditions  | class 3K3   |
|   | Temperature (housing incl. electronics)                      | 0...50 °C   |
|   | Humidity   | 0...95 % r.h. (noncondensing)   |
|   | Mechanical conditions  | class 3M2   |
|   | Transport to   | IEC 60721-3-2   |
|   | Climatic conditions  | class 2K3   |
|   | Temperature  | -25...+70 °C  |
|   | Humidity   | <95 % r.h.  |
|   | Mechanical conditions  | class 2M2   |
| Materials and colors  | Base   | polycarbonate, RAL 7001 (silver-grey)   |
|   | Cover  | polycarbonate, RAL 7035 (light-grey)  |
|   | Immersion rod  | polycarbonate, RAL 7001 (silver-grey)   |
|   | Filter cap   | polycarbonate, RAL 7001 (silver-grey)   |
|   | Mounting flange  | PA66 – GF35 (black)   |
|   | Cable entry gland  | PA, RAL 7035 (light-grey)   |
|   | Sensor (complete assembly)                                   | silicone-free   |
|   | Packaging  | corrugated cardboard  |

Directives and Standards

Product standard

EN 60730-1

Automatic electrical controls for household and similar use

Electromagnetic compatibility (Applications)

For use in residential, commerce, light-industrial and industrial environments

EU Conformity (CE)

CE1T1962xx<sup>1)</sup>

RCM Conformity

CE1T1961en\_C1<sup>1)</sup>

UL

UL 873, <http://ul.com/database>

Environmental compatibility

The product environmental declaration CE1E1962<sup>1)</sup> contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal).

Weight

Incl. packaging

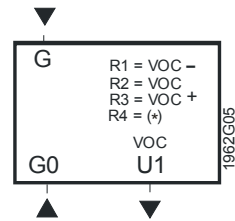
|                           |                  |
|---------------------------|------------------|
| QPM1100, QPM2100, QPM2102 | approx. 0.247 kg |
| QPM2160, QPM2162, QPM2180 | approx. 0.252 kg |
| QPM2102D                  | approx. 0.267 kg |
| QPM2160D, QPM2162D        | approx. 0.272 kg |

ppm = parts per million (number of parts per one million parts)

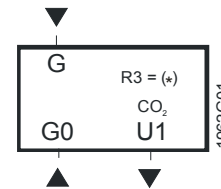
<sup>\*</sup>) The documents can be downloaded from <http://siemens.com/bt/download>.

### Connection terminals

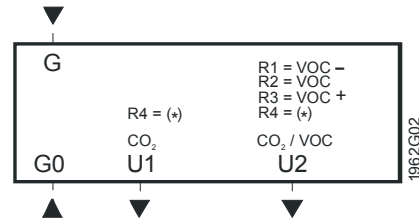
#### QPM1100



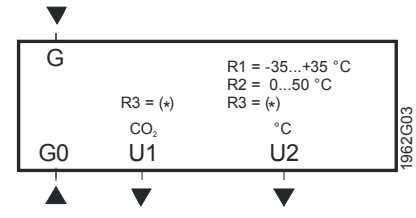
#### QPM2100



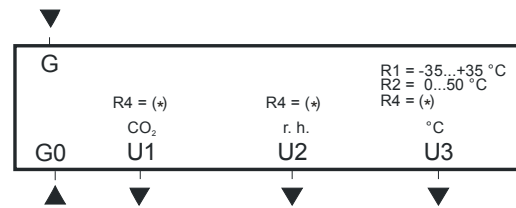
#### QPM2102/2102D



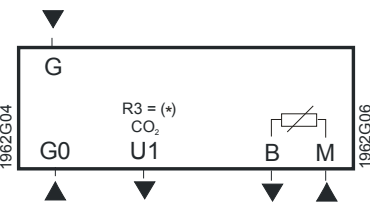
#### QPM2160/2160D



#### QPM2162/2162D

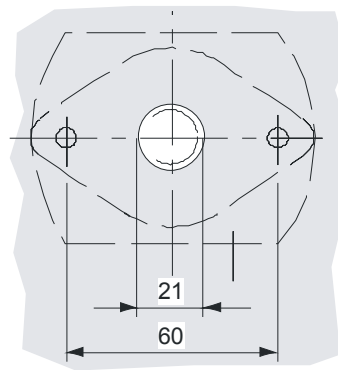
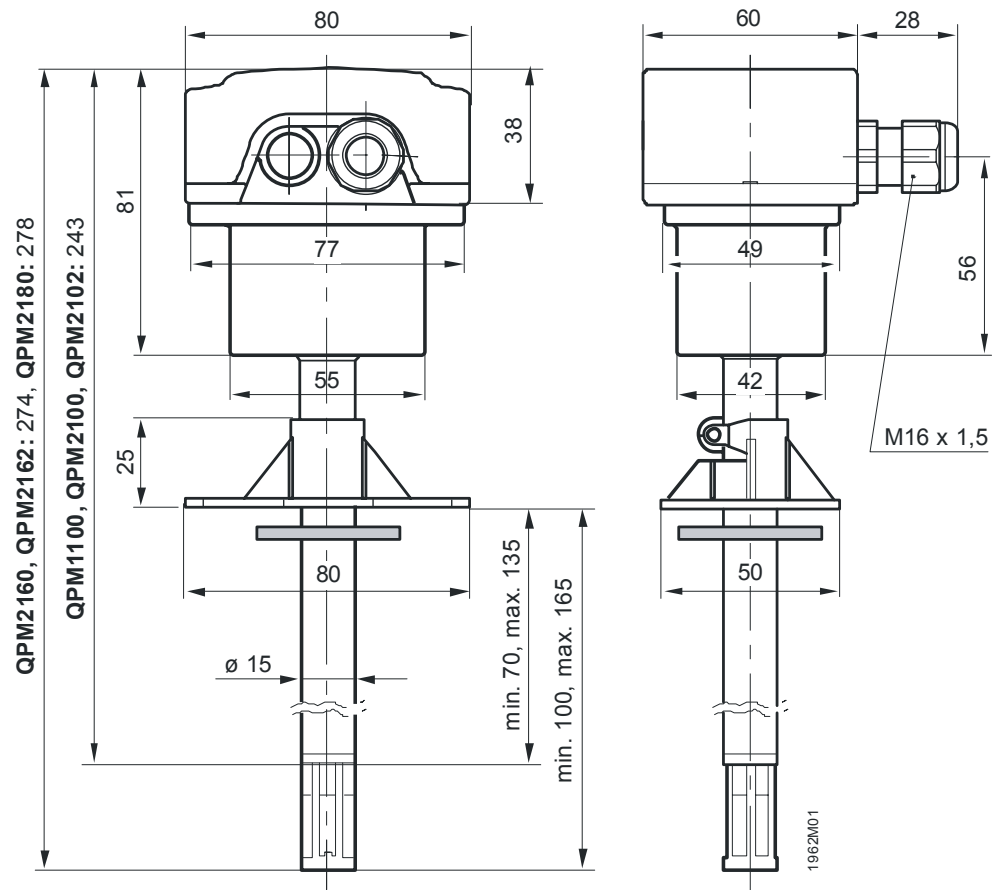


#### QPM2180



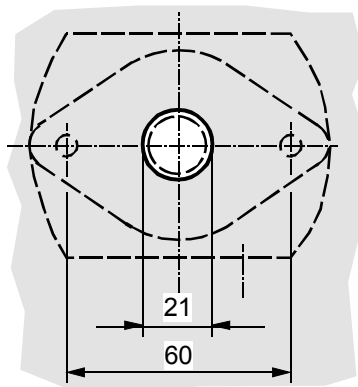
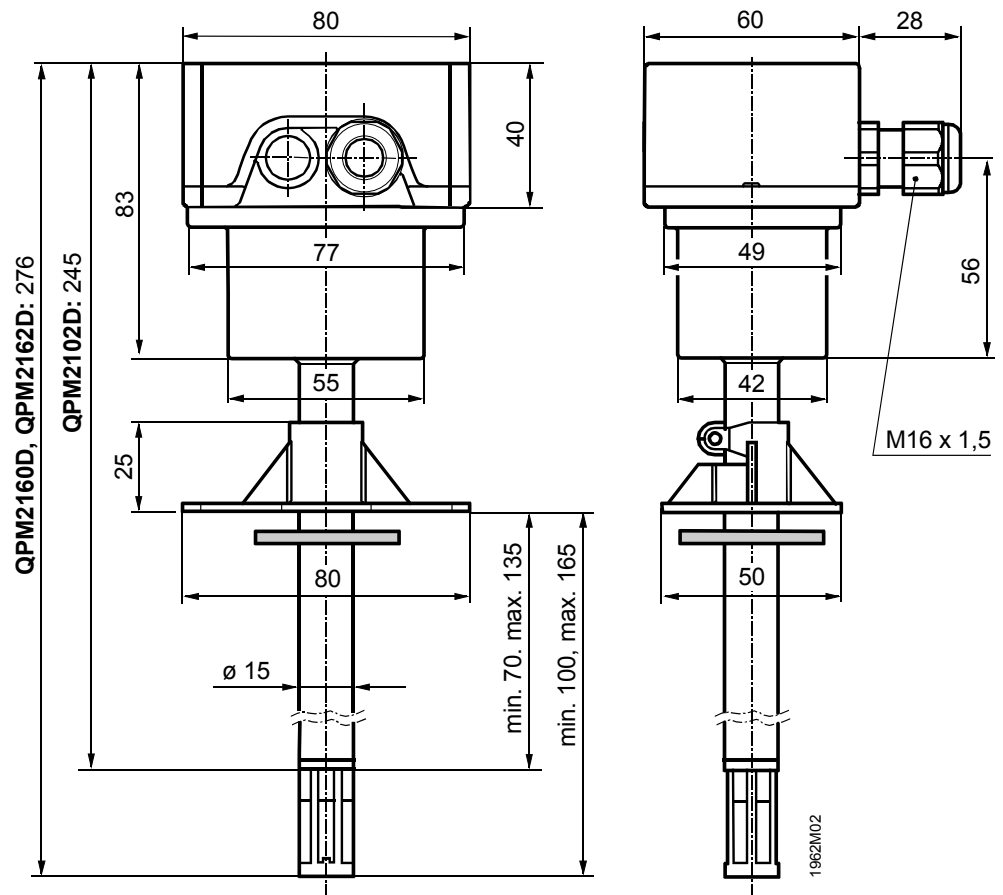
- G System voltage AC 24 V (SELV) or DC 15...35 V
- G0 System ground and measuring neutral
- U1 Signal output DC 0...10 V or DC 0...5 V
- U2 Signal output DC 0...10 V or DC 0...5 V
- U3 Signal output DC 0...10 V or DC 0...5 V
- R...(\*) Signal output with R... = DC 0...10 V
- Signal output without R... = DC 0...5 V
- B, M Passive temperature output (interchangeable)

# Dimensions



Drilling plan

Dimensions in mm



Drilling plan

Dimensions in mm

Issued by  
 Siemens Switzerland Ltd  
 Building Technologies Division  
 International Headquarters  
 Gubelstrasse 22  
 6301 Zug  
 Switzerland  
 Tel. +41 58-724 24 24  
[www.siemens.com/buildingtechnologies](http://www.siemens.com/buildingtechnologies)

© Siemens Switzerland Ltd, 2005  
 Technical specifications and availability subject to change without notice.