SIEMENS

1962

QPM2102D

QPM2160D, QPM2162D

QPM1100, QPM2100, QPM2102

QPM2160, QPM1160, QPM1162, QPM2163, QPM2180

# QPM11..
# Duct Air Quality Sensors QPM21..

- **Maintenance-free $CO_2$ sensing element (depending on the type) based on optical infrared absorption measurement (NDIR[1])**
- **Or with VOC[2] sensing element, based on a heated tin dioxide semiconductor**
- **$CO_2$ temperature (active or passive) and $CO_2$ 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 or 4...20 mA 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:

- $CO_2$ 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 QPM11… 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 $CO_2$ 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 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* | *$CO_2$ measuring range* | *VOC time constant* | *Temperature measuring range* | *Humidity measuring range* | *Measured value display* |
|---|---|---|---|---|---|
| **QPM1100** | --- | Slow (R1)<br>Normal (R2)<br>Fast (R3) | --- | --- | --- |
| **QPM1160** | --- | Slow (R1)<br>Normal (R2)<br>Fast (R3) | 0...50 °C / –35...+35 °C | --- | no |
| **QPM1162** | --- | Slow (R1)<br>Normal (R2)<br>Fast (R3) | 0...50 °C / –35...+35 °C | 0...100 % | no |
| **QPM2100** | 0…2000 ppm | --- | --- | --- | no |
| **QPM2102** | 0…2000 ppm | Slow (R1)<br>Normal (R2)<br>Fast (R3) | --- | --- | no |
| **QPM2102D** | 0…2000 ppm | Low (R1)<br>Normal (R2)<br>High (R3) | --- | --- | yes |
| **QPM2160** | 0…2000 ppm | --- | 0...50 °C / –35...+35 °C | --- | no |
| **QPM2160D** | 0…2000 ppm | --- | 0...50 °C / –35...+35 °C | --- | yes |
| **QPM2162** | 0…2000 ppm | --- | 0...50 °C / –35...+35 °C | 0...100 % | no |
| **QPM2162D** | 0…2000 ppm | --- | 0...50 °C / –35...+35 °C | 0...100 % | Yes |
| **QPM2163** | 0…2000 ppm | Slow (R1)<br>Normal (R2)<br>Fast (R3) | 0...50 °C / –35...+35 °C | 0...100 % | no |
| **QPM2180** | 0…2000 ppm | --- | Depending on connected 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 4...20 mA
- passive sensor signals for sensor QPM2180

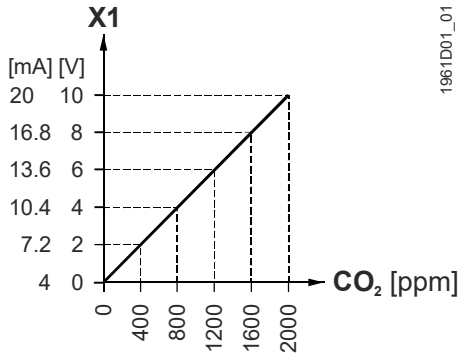
## Mode of operation

**$CO_2$ concentrations**

The Symaro™ air quality sensors acquire the $CO_2$ concentration by infrared absorption measurement (NDIR).

The resulting output signal of DC 0...10 V or DC 0...5 V or 4...20 mA is proportional to the $CO_2$ content of the ambient air.

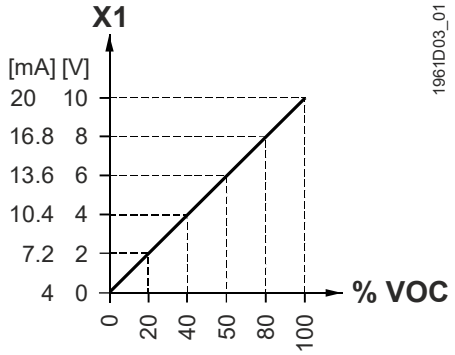
*Function diagram $CO_2$ (output X1)*




**VOC concentration (QPM1100, QPM1160, QPM1162)**

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 or 4...20 mA output signal proportionate to the VOC content of the ambient air.

*Diagram VOC (Output X1)*




*Time constant "VOC signal"*

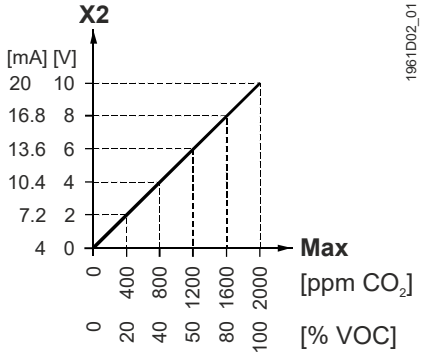
Select the time constant for VOC measurement by limiting the maximum slew rate for the VOC signal. The jumper X130 (measuring range) fine tunes the time constant for VOC ventilation demand.
The center position (R2) produces a normal slew rate of max. 10% change to the VOC signal per minute (factory setting). 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 X130 corresponds to <13 min (R1), <3.5 min (R2), or <1 min (R3) for a sudden change to 50% VOC.

**$CO_2$/VOC concentration (QPM2102, QPM2102D and QPM2163)**

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 delivered as the common air quality demand.
The ventilation demand signal is delivered via output X2 as a DC 0…10 V or 0...5 V or 4...20 mA signal to be fed to the ventilation controller.

*Ventilation demand diagram (output X2)*




**Relative humidity (QPM2162, QPM2162D QPM1162 and QPM2163)**

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 or 4...20 mA 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 or 4...20 mA output signal (≙ 0...50 °C or −35...+35 °C).

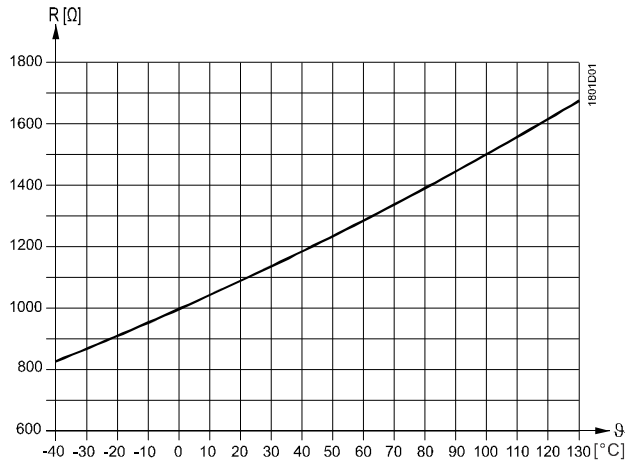
**Temperature passive (QPM2180)**

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

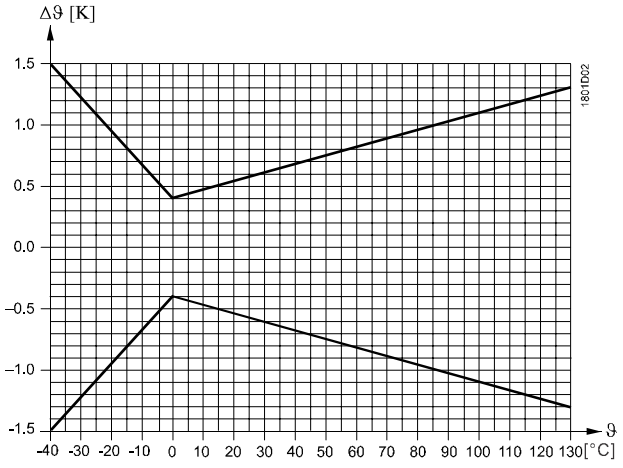
**Sensing element**

LG-Ni 1000

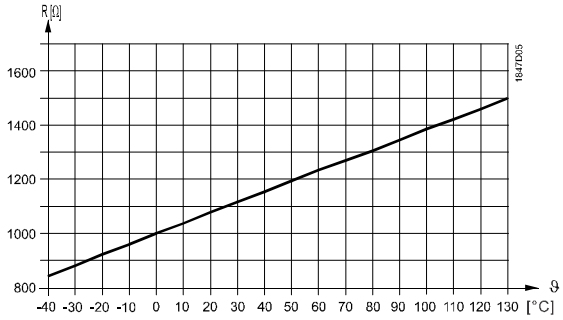
Characteristic curve:

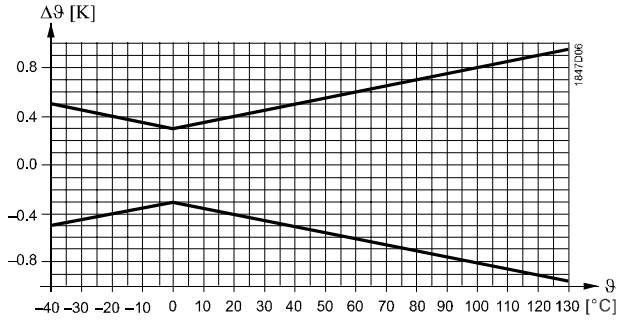



Accuracy:

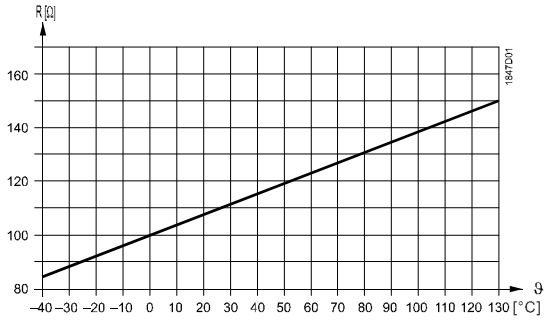


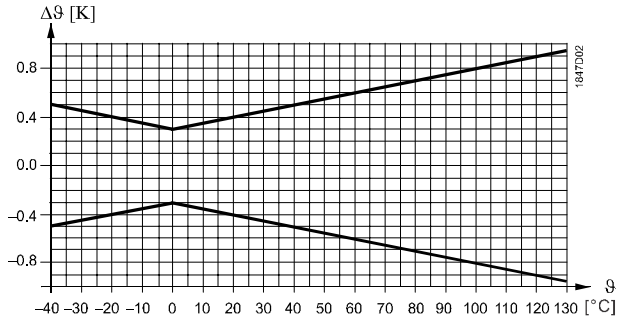
Pt 1000 (Kl. B) Characteristic curve: Accuracy:



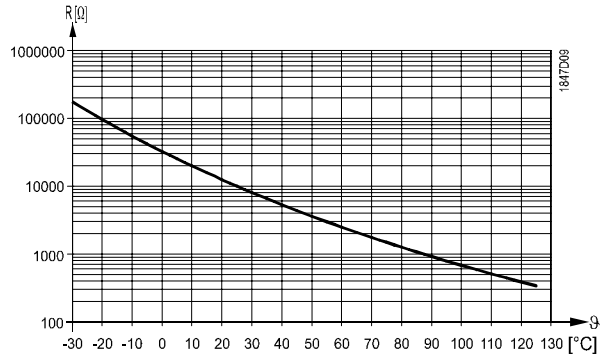



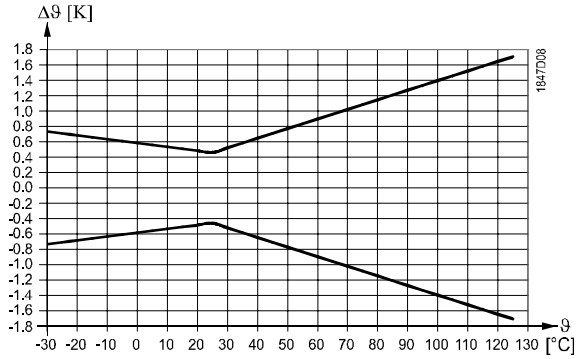

Pt 100 (Kl. B) Characteristic curve: Accuracy:




NTC 10k Characteristic curve: Accuracy:




*Key*

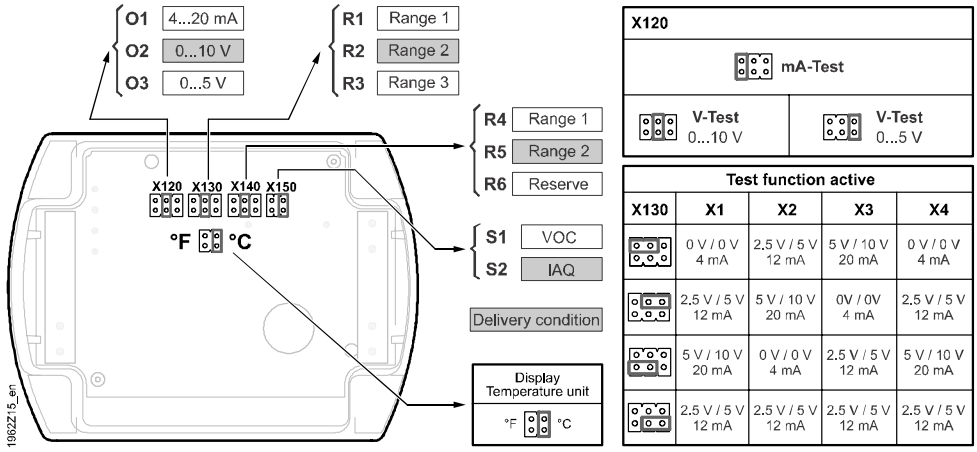
| | |
|---|---|
| R | Resistance in Ohm |
| ϑ | Temperature in Celsius |
| Δϑ | Temperature differential in Kelvin |

## 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 …**




Test function active

| X130 | X1 | X2 | X3 | X4 |
|---|---|---|---|---|
| | 0 V / 0 V 4 mA | 2.5 V / 5 V 12 mA | 5 V / 10 V 20 mA | 0 V / 0 V 4 mA |
| | 2.5 V / 5 V 12 mA | 5 V / 10 V 20 mA | 0V / 0V 4 mA | 2.5 V / 5 V 12 mA |
| | 5 V / 10 V 20 mA | 0 V / 0 V 4 mA | 2.5 V / 5 V 12 mA | 5 V / 10 V 20 mA |
| | 2.5 V / 5 V 12 mA | 2.5 V / 5 V 12 mA | 2.5 V / 5 V 12 mA | 2.5 V / 5 V 12 mA |

The setting elements are located inside the cover

…for the measuring range

The different vertical plug positions have the following meaning:

with **QPM2100**

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

with QPM1100, QPM1160, QPM1162, QPM2163 QPM2102 and QPM2102D

- *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 "

with QPM2160/2160D and QPM2162/2162D/

- *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)

with QPM1160/QPM1162/ QPM2163

- *For the temperature measuring range:*
  - Shorting plug in the left position (R4) = –35...+35 °C
  - Shorting plug in the mid position (R5) = 0...50 °C (factory setting)
  - Shorting plug in the right position (R6) Reserve

with QPM2163

- *For the IAQ / VOC output*
  - Shorting plug in the left position (S1) = VOC only
  - Shorting plug in the right position (S2) = IAQ = CO2+VOC (factory setting)

… for output for all **QPM…**

O1 = 4...20 mA
O2 = DC 0…10 V
O3 = 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 vertical, right position = °C (factory setting)
  - Jumper in the vertical, left position = °F

**Behavior in the event of fault**

**QPM1100/1160/1162**
- In the event of VOC failure, DC 10 V or 5 V or 20 mA will be present at signal output X1 (after 60 seconds)

**QPM2…**
- In the event of $CO_2$ failure, DC 10 V or 5 V or 20 mA will be present at signal output X1 (after 60 seconds)

**QPM2102/2102D/2163**
- In the event of VOC failure, DC 10 V or 5 V or 20 mA will be present at signal output X2 (after 60 seconds)

**QPM1160/2160 /2160D**
- Should the temperature sensor become faulty, 0 V or 0 mA will be present at signal output X2

**QPM1162/2162/2162D**
- Should the temperature sensor become faulty, 0 V or 0 mA will be present at signal output X3, and the humidity signal at signal output X2 will increase to DC 10 V or 5 V or 20 mA (after 60 seconds)
- Should the humidity sensor become faulty, DC 10 V or 5 V or 20 mA will be present at signal output X2 (after 60 seconds), and the temperature signal will remain active

**QPM2163**
- Should the humidity sensor become faulty, DC 10 V or 5 V or 20 mA will be present at signal output X3 (after 60 seconds), and the temperature signal will remain active
- Should the temperature sensor become faulty, 0 V or 0 mA will be present at signal output X4, and the humidity signal at signal output X4 will increase to DC 10 V or 5 V or 20 mA (after 60 seconds)

**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:
- $CO_2$ : In ppm
- $CO_2$ + VOC: As a bar chart: 4 bars ≙ X2 = 2 V or 1 V or 7,2 mA
  20 bars ≙ X2 = 10 V or 5 V or 20 mA
- 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 °C

Mounting instructions

Mounting Instructions are enclosed in the package.

## Commissioning notes

Checking the $CO_2$ function

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

- 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 $t_{63}$ = 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.

## Disposal

This symbol or any other national label indicate that the product, its packaging, and, where applicable, any batteries may not be disposed of as domestic waste. Delete all personal data and dispose of the item(s) at separate collection and recycling facilities in accordance with local and national legislation.
For additional details, refer to www.siemens.com/bt/disposal.

## Technical data

Power supply

| | | |
|---|---|---|
| Operating voltage | AC 24 V ±20 % or DC15…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 | At "U" output signal | "I" output signal |
| QPM1100 | Max. <1.6 VA | Max. <3.5 VA |
| QPM2100, QPM2180, QPM2160, QPM2160D | Max. <0.9 VA | Max. <3.2 VA |
| QPM2102, QPM2102D | Max. <1.8 VA | Max. <3.9 VA |
| QPM2162, QPM2162D | Max. <0.9 VA | Max. <3.4 VA |
| QPM1160 | Max. <2.1 VA | Max. <2.9 VA |
| QPM1162 | Max. <2.1 VA | Max. <3.5 VA |
| QPM2163 | Max. <3.2 VA | Max. <5.0 VA |

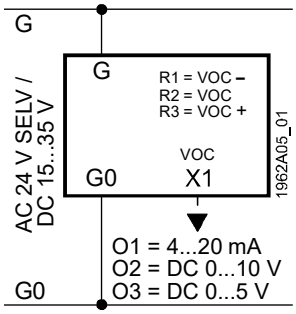
| | | |
|---|---|---|
| Cable lengths for measuring signal | Perm. cable lengths | Refer to Data Sheet of the device handling the signal |
| Functional data "$CO_2$" | Measuring range | 0...2000 ppm |
| | Measuring accuracy at 23 °C and 1013 hPa | ≤±(50 ppm + 2 % of measured value) |
| | Temperature dependency in the range of -5…45 °C | ±2 ppm / °C (typically) |
| | Long-time drift | ≤±5% of measuring range / 5 years (typically) |
| | Time constant $t_{63}$ | <5 min |
| | Output signal, linear (terminal X1) | DC 0...10 V ≙ 0...2000 ppm, max. ±1 mA<br>4...20 mA ≙ 0...2000 ppm, max. 500 Ohm |
| | Recalibration-free | 8 years |
| Functional data "VOC" | Measuring range | 0…100% VOC |
| | Time constant $t_{63}$ VOC ($CO_2$ see above) | <13 min (R1), <3.5 min (R2), <1 min (R3) |
| | Output signal, linear (terminal X1) | DC 0...10 V or DC 0...5 V ≙ 0...100%, max. ±1 mA<br>4...20 mA ≙ 0...100 %, max. 500 Ohm |
| Functional data "Maximum selection of $CO_2$ and VOC" with QPM2102, QPM2102D and QPM2163 | Output signal, linear (terminal X2) | DC 0...10 V or DC 0...5 V ≙ max. of 0...2000 ppm, $CO_2$ or 0…100% VOC, max. ±1 mA<br>4...20 mA ≙ max. von 0...2000 ppm $CO_2$ or 0...100 % VOC, max. 500 Ohm |
| | Range of use | 0...95 % r.h. (noncondensing) |
| Functional data "r.h." with QPM2162D, QPM1162 and QPM2163 | Measuring range | 0…100 % r.h. |
| | Measuring accuracy at 23 °C and DC 24 V<br>0…95 % r.h.<br>30…70 % r.h. | <br>±5 % r.h.<br>±3 % r.h. (typically) |
| | Time constant $t_{63}$ | Approx. 20 s |
| | Output signal, linear (terminal X2) | DC 0...10 V or DC 0...5 V ≙ 0...100 % r.h., max. ±1 mA<br>4...20 mA ≙ 0...100 % r.h., max. 500 Ohm |
| Functional data "Temperature" with QPM2160/ QPM2160D, QPM2162/ QPM2162D, QPM1160/QPM1162/ QPM2163 | Range of use | −5...+45 °C |
| | Measuring range | 0...50 °C (R2)<br>or −35...+35 °C (R1) |
| | Measuring accuracy at DC 24 V in the range of<br>23 °C<br>15...35 °C<br>−35...+50 °C | <br>±0.3 K (typically)<br>±0.6 K<br>±1 K |
| | Time constant | <3.5 min. in with 2 m/s moved air |
| | Output signal, linear (terminal X2, X3 or X4) | DC 0...10 V or DC 0...5 V ≙ 0...50 °C / −35...+35 °C max. ±1 mA<br>4...20 mA ≙ 0... 50 °C, / −35...+35 °C, max. 500 Ohm |
| Functional data "Temperature" with QPM218.. | 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, QPM1160, QPM1162, QPM2100, QPM2102, QPM2160, QPM2162, QPM2163, 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 × 2.5 $mm^2$ or 2 × 1.5 $mm^2$ |

| | | |
|---|---|---|
| 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<br>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 *) |
| | RCM Conformity | CE1T1961en_C1 *) |
| | UL | UL 873, http://ul.com/database |
| | UKCA | A5W00188730A *) |
| Environmental compatibility | The product environmental declaration CE1E1962*) contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal). | |
| Weight | Incl. packaging | |
| | QPM1100, QPM2100, QPM2102 | Approx. 0.25 kg |
| | QPM2160, QPM2162, QPM2180 | Approx. 0.25 kg |
| | QPM2102D | Approx. 0.27 kg |
| | QPM2160D, QPM2162D | Approx. 0.27 kg |
| | QPM1160, QPM1162 | Approx. 0.237 kg |
| | QPM2163 | Approx. 0.263 kg |

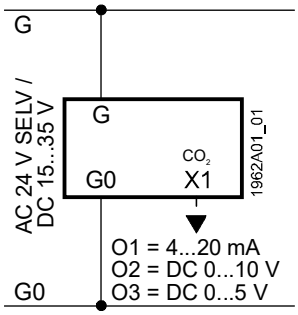
ppm = parts per million (number of parts per one million parts)

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

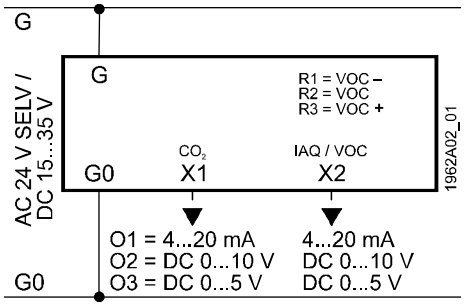
### QPM1100



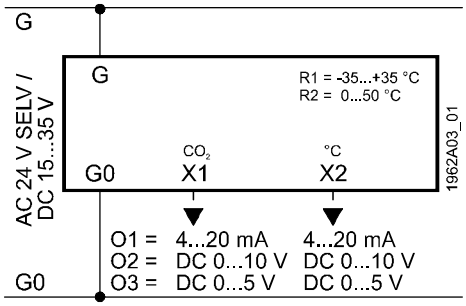

### QPM2100



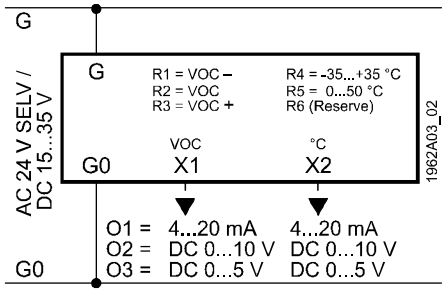

### QPM2102/2102D



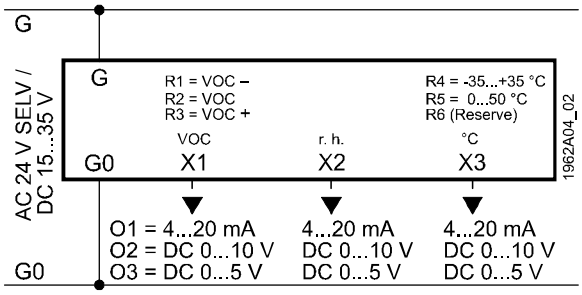

### QPM2160/2160D



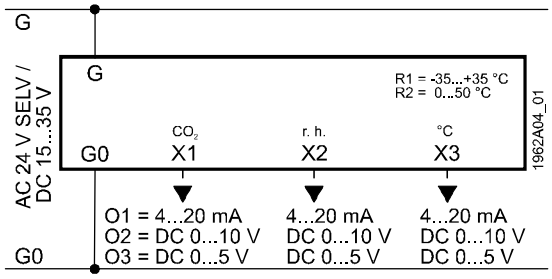

### QPM1160



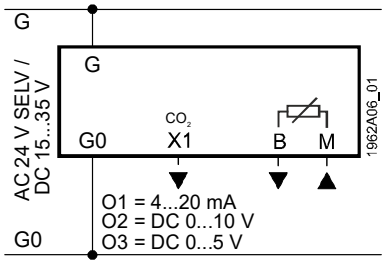

### QPM1162



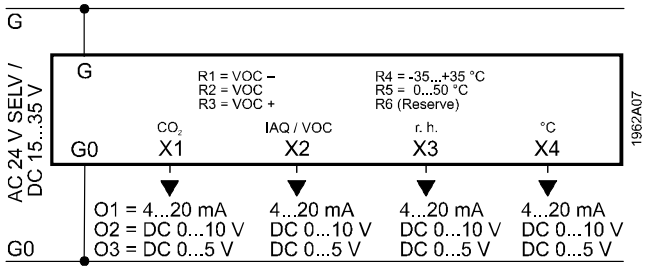

### QPM2162/2162D




### QPM2180

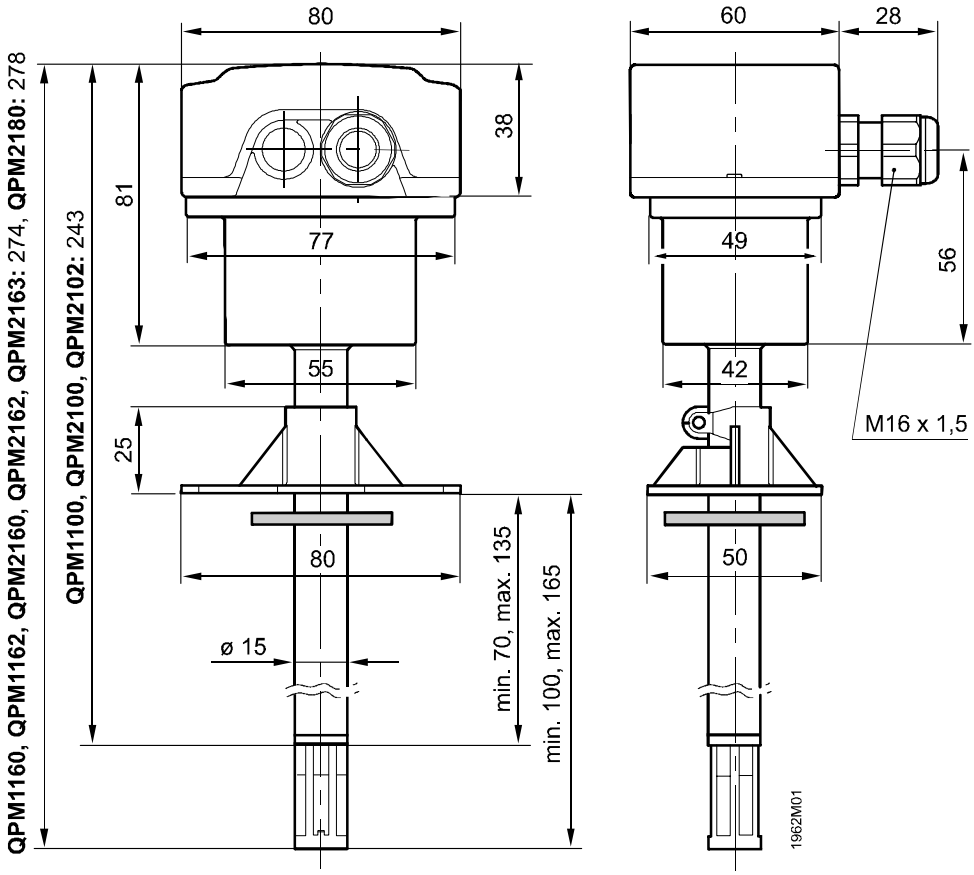


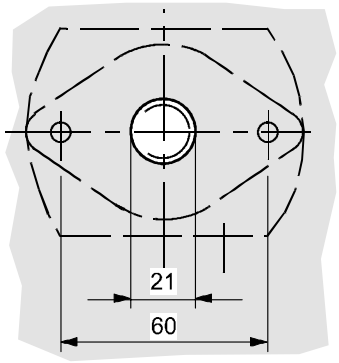

### QPM2163




| | |
|---|---|
| G | Sytem voltage AC 24 V (SELV) or DC 15...35 V |
| G0 | System ground and measuring neutral |
| X1 | Signal output DC 0...10 V or DC 0...5 V, 4…20 mA |
| X2 | Signal output DC 0...10 V or DC 0...5 V, 4…20 mA |
| X3 | Signal output DC 0...10 V or DC 0...5 V, 4…20 mA |
| X4 | Signal output DC 0...10 V or DC 0...5 V, 4…20 mA |
| B, M | Passive temperature output (interchangeable) |

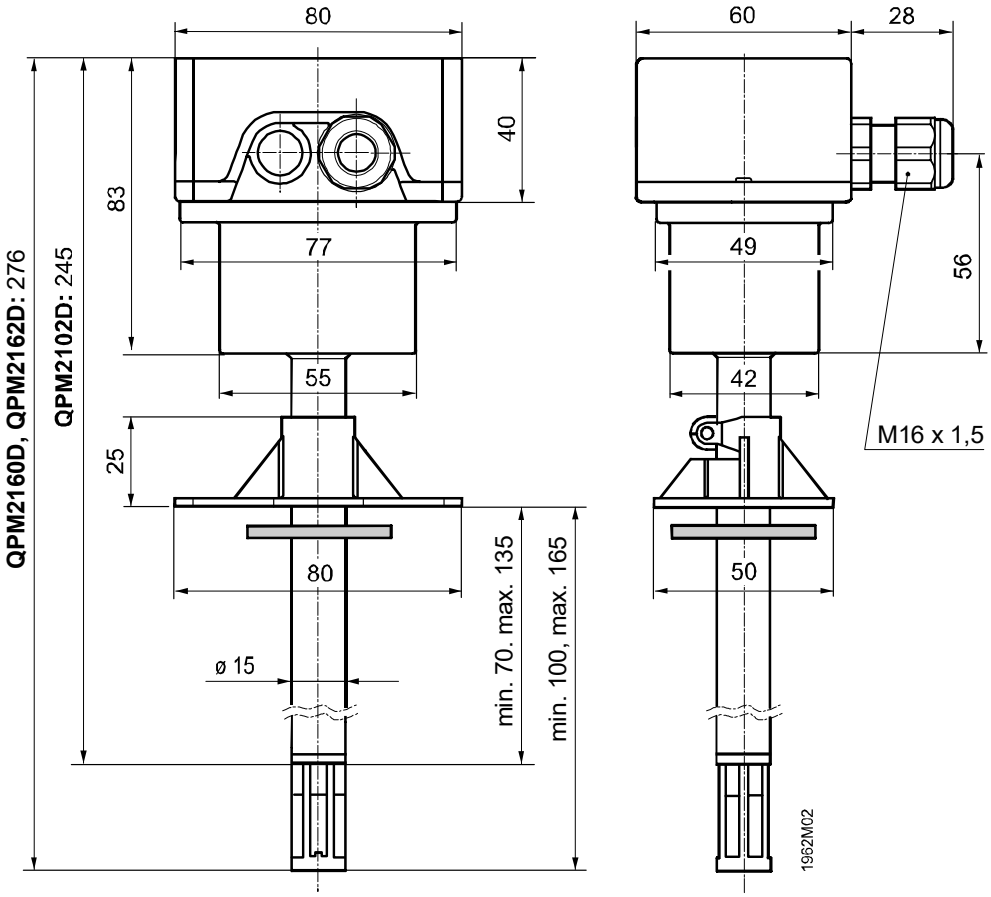
## Dimensions

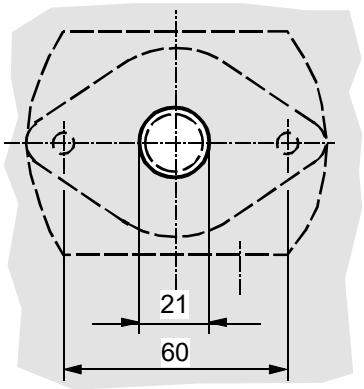



Drilling plan

Dimensions in mm




Drilling plan

Dimensions in mm

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