

QPM2102D

QPM2160D, QPM2162D

QPM1100, QPM2100, QPM2102

QPM2160, QPM2180

Duct Air Quality Sensors

QPM11...
QPM21...

- maintenance-free CO₂ sensing element (depending on the type) based on optical infrared absorption measurement (NDIR¹)
- or with VOC²⁾ sensing element, based on a heated tin dioxide semiconductor
- CO₂ temperature (active or passive) and CO₂ 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:

- CO₂ 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 CO₂ 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 CO₂ 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) Normal (R2) Fast (R3)	---	---	---
QPM2100	0...2000 ppm	---	---	---	no
QPM2102	0...2000 ppm	Slow (R1) Normal (R2) Fast (R3)	---	---	no
QPM2102D	0...2000 ppm	Low (R1) Normal (R2) 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
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
- passive sensor signals for sensor QPM2180

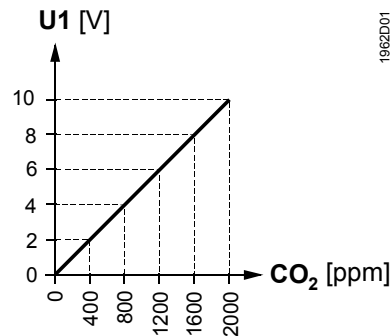
Mode of operation

CO₂ concentrations

The Symaro™ air quality sensors acquire the CO₂ concentration by infrared absorption measurement (NDIR). Owing to an additional integrated reference light source, the measurement is always accurate and no service or recalibration is needed, thus saving service costs.

The resulting output signal of DC 0...10 V or DC 0...5 V is proportional to the CO₂ content of the ambient air.

Function diagram CO₂
(output U1)

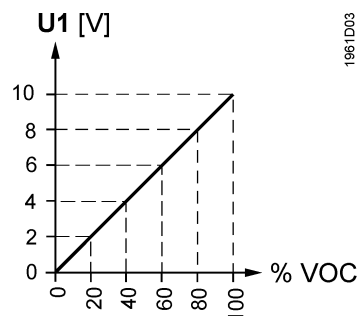


VOC concentration (QPM1100)

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.

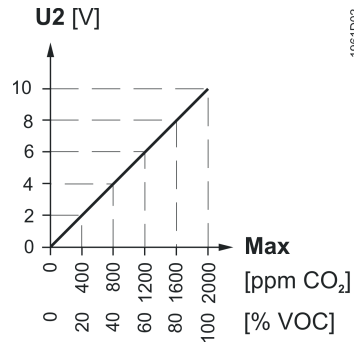
CO₂/VOC concentration (QPM2102 and QPM2102D)

The sensor acquires and evaluates the CO₂ / VOC concentration and transforms it to a ventilation demand signal.

It represents the result of maximum selection of the CO₂ 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:

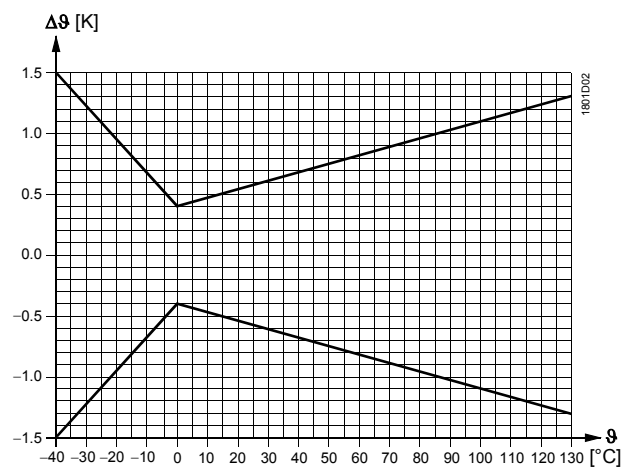
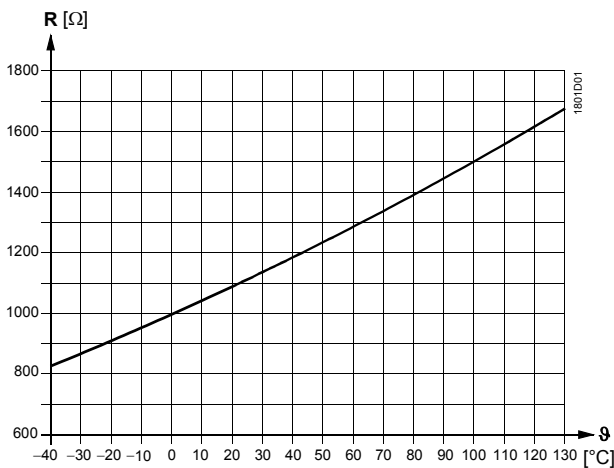
- LG-Ni1000
- Pt1000
- Pt100
- NTC 10kOhm

Sensing element

LG-Ni 1000

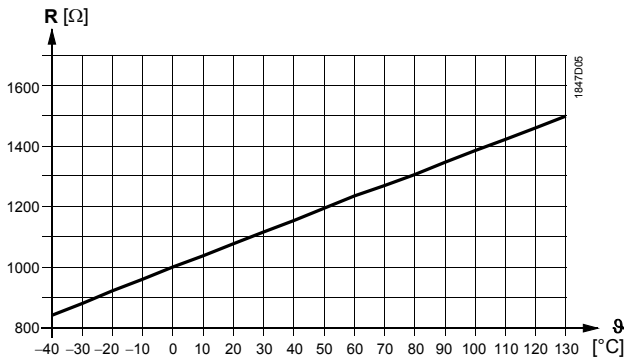
Characteristic curve:

Accuracy:

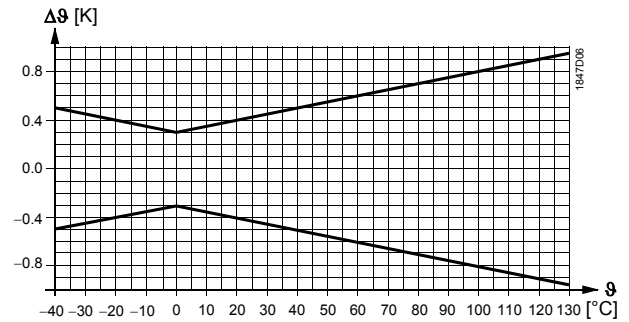


Pt 1000 (KI. B)

Characteristic curve:

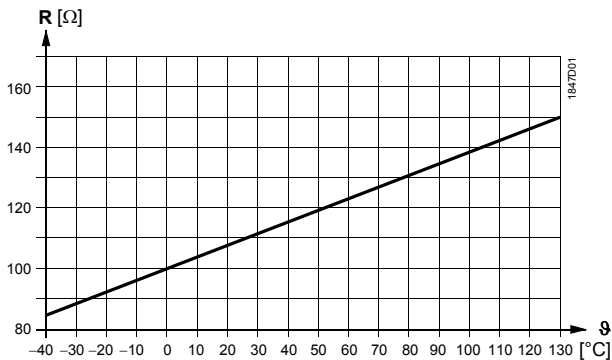


Accuracy:

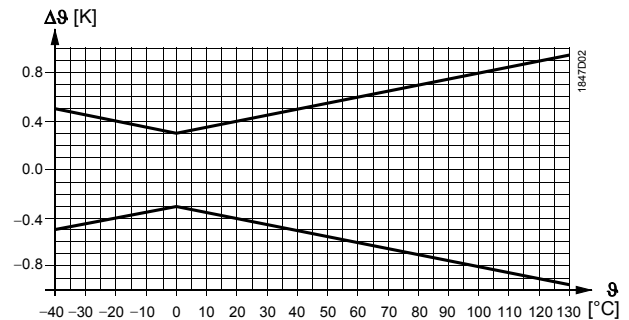


Pt 100 (KI. B)

Characteristic curve:

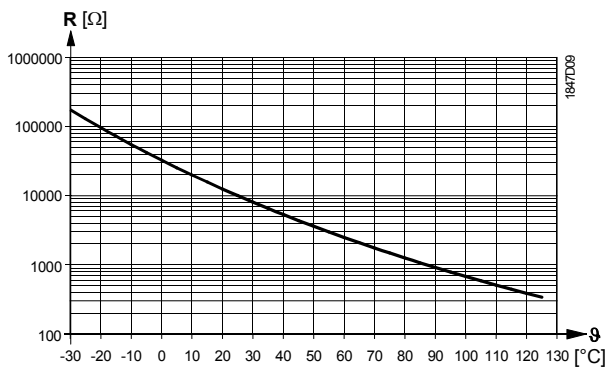


Accuracy:

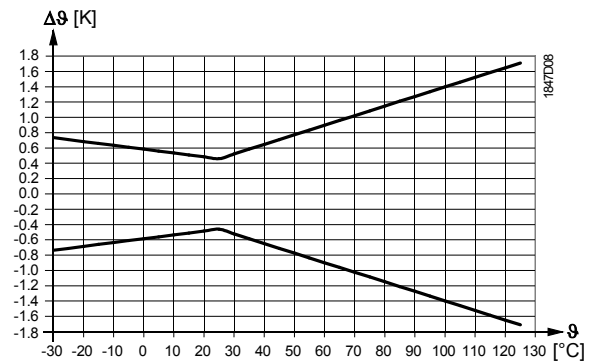


NTC 10k

Characteristic curve:



Accuracy:

**Key**

R	Resistance in Ohm
θ	Temperature in Celsius
$\Delta\theta$	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

196ZT13en

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

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

Display
Temperature unit
°F °C

The setting elements are located inside the cover

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

with QPM1100,
QPM2102 and
QPM2102D

with QPM2160/2160D
and QPM2162/2162D

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

...for the active test
function

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

The different vertical plug positions have the following meaning:

- *For the CO₂ 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)
- *As per listing above R3 or R4 (depending on the device):*
 - Plugged in jumper = DC 0...10 V
 - Removed jumper = DC 0...5 V

Shorting plug for the measuring range in the horizontal positions:

The signal output delivers the values according to table "Test function active".

- *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 CO₂ 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 CO₂ 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:

- CO₂: In ppm
- CO₂ + 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 $-5...+45\text{ }^{\circ}\text{C}$

Mounting instructions

Mounting Instructions are enclosed in the package.

Commissioning notes

Checking the CO₂ function

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

- In well ventilated rooms, the sensor shows the CO₂ 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) or 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 or Circuit breaker max. 13 A Characteristic B, C, D according to or Power source with current limitation of max. 10 A
	Power consumption	
	QPM1100	< 0.8 VA
	QPM2100, QPM2160, QPM2160D, QPM2162, QPM2162D QPM 2180, QPM2102, QPM2102D	<1.7 VA, typ. <0.5 VA <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 ₂ "	Measuring range	0...2000 ppm
	Measuring accuracy at 23 °C and 1013 hPa	$\leq \pm(50\text{ ppm} + 2\% \text{ of measured value})$
	Temperature dependency in the range of $-5...45\text{ }^{\circ}\text{C}$	$\pm 2\text{ ppm} / ^{\circ}\text{C}$ (typically)
	Long-time drift	$\leq \pm 5\%$ 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, max. $\pm 1\text{ mA}$
	Recalibration-free	8 years
	Measuring range	0...100% VOC
Functional data "VOC"	Time constant t_{63} VOC (CO ₂ 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%, max. $\pm 1\text{ mA}$

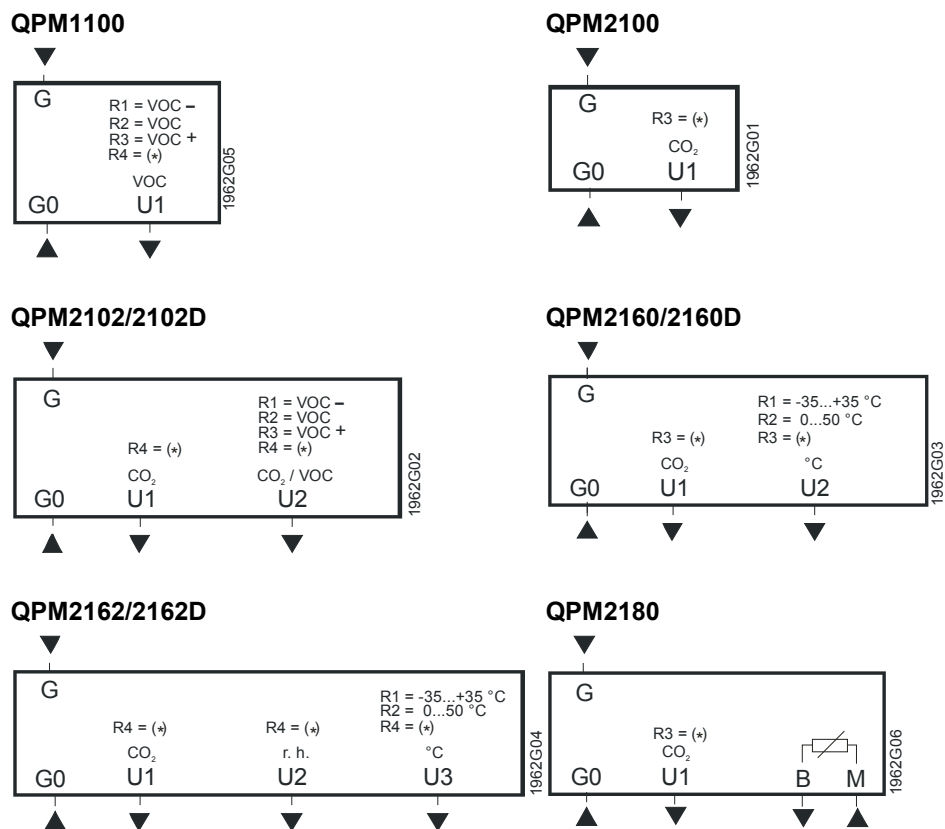
Functional data "Maximum selection of CO ₂ and VOC" with QPM2102 and QPM2102D Functional data "r.h." with QPM2162D	Output signal, linear (terminal U2)	DC 0...10 V or DC 0...5 V $\hat{=}$ max. of 0...2000 ppm, CO ₂ or 0...100% VOC, max. \pm 1 mA
	Range of use	0...95 % r.h. (noncondensing)
	Measuring range	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 $\hat{=}$ 0...100 % r.h., max. \pm 1 mA
	Range of use	-5...+45 °C
	Measuring range	0...50 °C (R2) 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 $\hat{=}$ 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 QPM2102D, QPM2160D, QPM2162D	IP65 according to EN 60529 in the built-in state
	QPM1100, QPM2100, QPM2102, QPM2160, QPM2162, QPM2180	IP54 according to EN 60529 in the built-in state
	Protection class	III according to EN 60730-1
Electrical connections	Screw terminals for	1 \times 2.5 mm ² or 2 \times 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 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
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. 0.247 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)

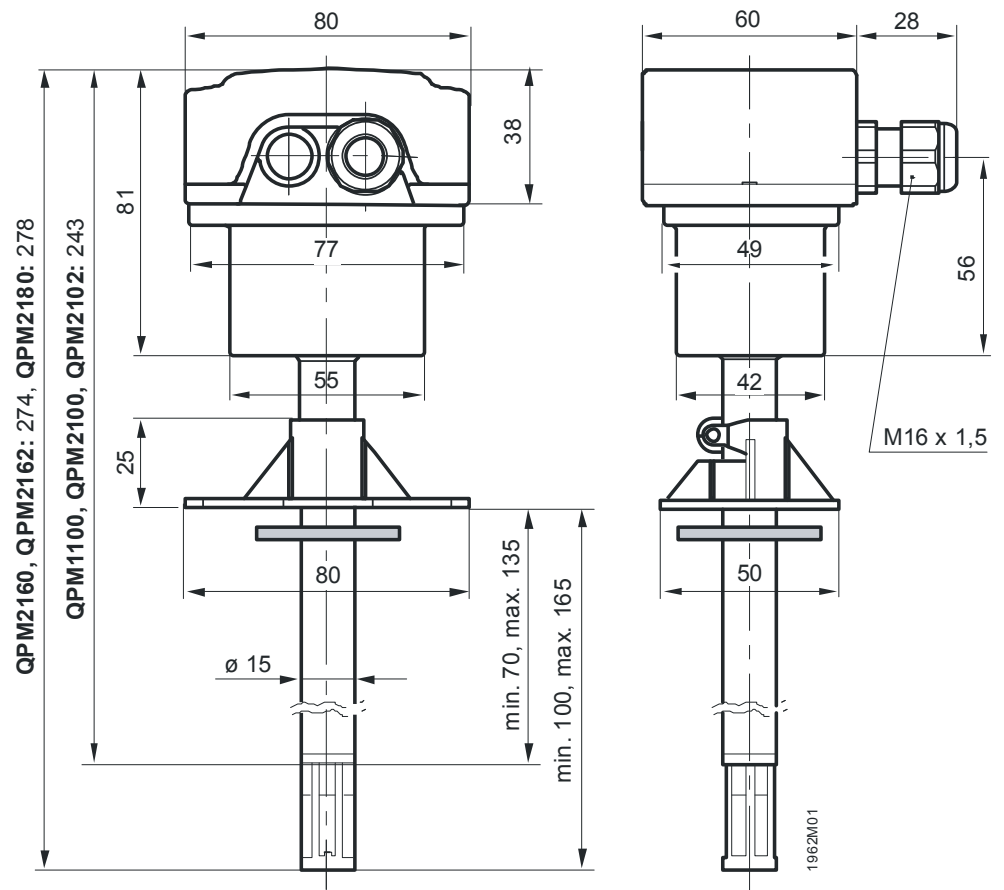
*) The documents can be downloaded from <http://siemens.com/bt/download>.

Connection terminals



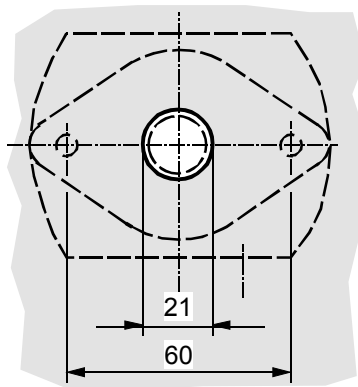
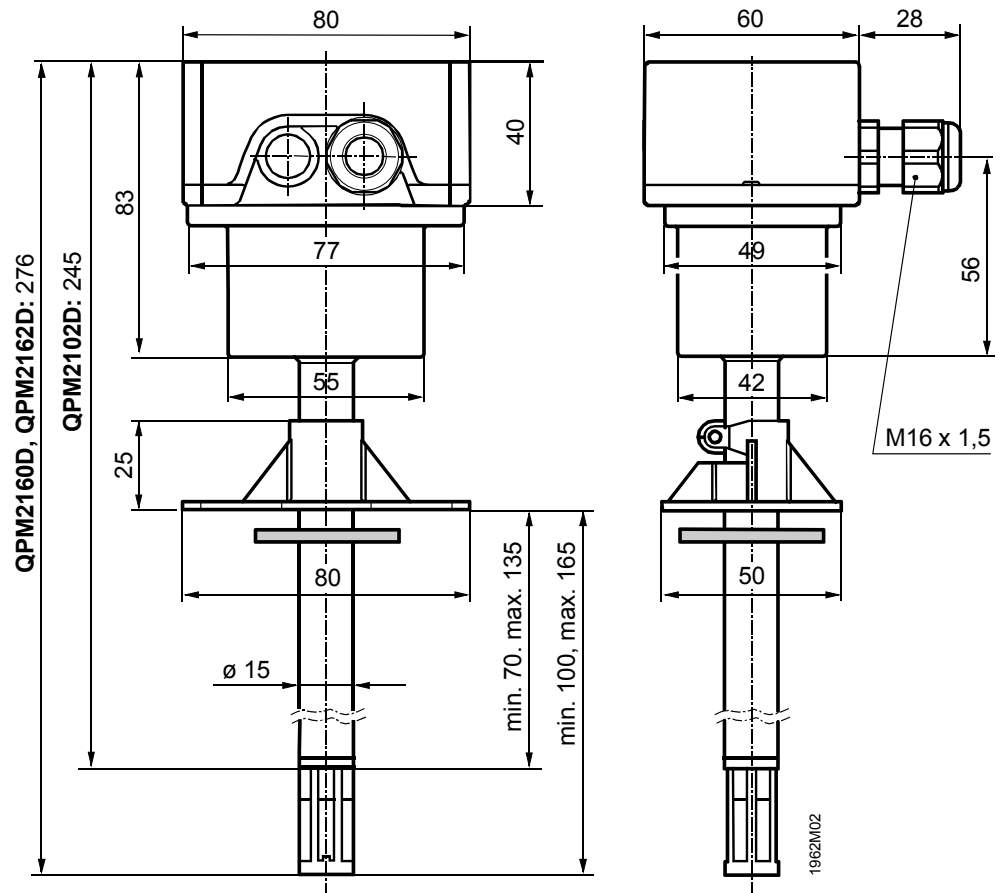
- G System voltage AC 24 V (SELV) or DC 15...35 V
- G0 System ground and measuring neutral
- U1 Signal output DC 0...10 V or DC 0...5 V
- U2 Signal output DC 0...10 V or DC 0...5 V
- U3 Signal output DC 0...10 V or DC 0...5 V
- R...(*) Signal output with R... = DC 0...10 V
- Signal output without R...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

Dimensions



Drilling plan

Dimensions in mm



Drilling plan

Dimensions in mm

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