

QPM Series

Indoor Air Quality Duct Sensors



Description

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

Several models are available with either CO₂ only, or with Volatile Organic Compounds (VOC) (also known as mixed gas), relative humidity and/or temperature sensing. All units deliver a voltage or current signal for all outputs and have a CO₂ measuring range of 0 to 2000 ppm.

Features

- Maintenance-free, Non-Dispersive Infrared (NDIR) CO₂ sensing element is ideal for use in spaces that are occupied 24/7.
- Combination units enable a single sensor to take the place of up to three individual sensors.
- No recalibration required.
- 24 Vac or 15 to 35 Vdc operating voltage
- 0 to 10 Vdc, 0 to 5 Vdc, or 4 to 20 mA signal outputs (field selectable)

Application

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

- CO₂ concentrations as an indication of occupancy in rooms where smoking is prohibited.
- 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.

QPM2102 models measure both CO₂ and volatile organic compounds (VOC) for optimized indoor air quality. A single 0 to 10V, 0 to 5V, or 4 to 20 mA (selectable) output signal is automatically adjusted to reflect the higher of the two values. This enables the combination CO₂ + VOC sensor to be easily substituted for a CO₂ sensor in any demand control ventilation control system.

The QPM21 Series Sensors can be used as:

- Control sensors in the supply or exhaust air duct.
- Transmitters for building automation and control systems and/or display units.

**Application,
 Continued**

Typical use:

- Acquisition of CO₂ and VOC concentrations:
 In party rooms, lounges, fair pavilions and exhibition halls, restaurants, canteens, shopping malls, sports gymnasiums, sales rooms, and conference rooms.
- Acquisition of CO₂ concentrations:
 In ventilation applications of rooms with varying occupancy levels where smoking is prohibited, such as museums, theaters, movie theaters, auditoriums, office spaces and school rooms.

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

Product Numbers

Table 1.

Product Number	CO ₂ Measuring Range	VOC Sensitivity	Temperature Measuring Range	Humidity Measuring Range	Measured Value Display
QPM2100	0 to 2000 ppm	—	—	—	No
QPM2102		Low (R1) Normal (R2) High (R3)	—	—	No
QPM2102D					Yes
QPM2160		—	32°F to 122°F/-31°F to 95°F (0 to 50°C/-35 to 35°C)	—	No
QPM2160D		—			Yes
QPM2162		—	—	0 to 100%	No
QPM2162D		—			Yes

Ordering

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

**Equipment
 Combinations**

The QPM Series Air Quality Sensors are suited for use with all types of systems and devices capable of acquiring and handling the signal delivered by the sensor.

Mode of Operation

CO₂ Concentrations

The QPM Series Air Quality Sensors acquire the CO₂ concentration by infrared absorption measurement (NDIR). Due to an additional integrated reference light source, the measurement is always accurate. This reduces service costs as no service or recalibration is needed.

The resulting output signal is proportional to the CO₂ content of the ambient air.

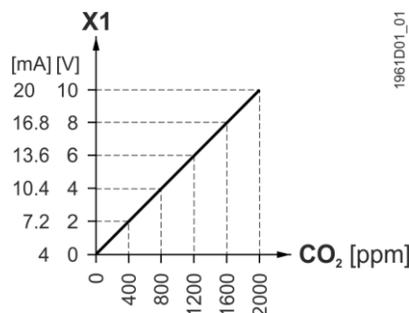


Figure 1. CO₂ Signal Output (X1).

CO₂/VOC Concentration (QPM2102 and QPM2102D Only)

The sensor acquires and evaluates the CO₂/VOC concentration and converts 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 two demand signals are compared and – depending on the result and the selected VOC sensitivity – delivered as the common air quality demand.

The ventilation demand signal is delivered via output X2 as a 0 to 10 Vdc, 0 to 5 Vdc, or 4 to 20 mA signal to be fed to the ventilation controller.

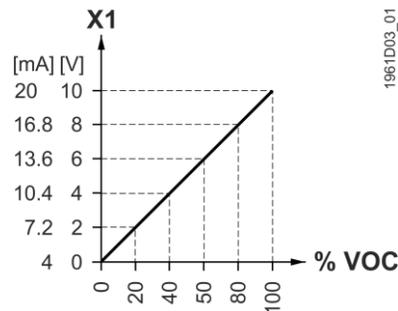


Figure 2. VOC Signal Output (X2).

VOC Sensitivity

Using the jumper on the setting element for the measuring range, the impact of VOC ventilation demand on maximum selection against CO₂ ventilation demand can be changed.

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

Response Time VOC Signal

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

Relative Humidity (QPM2162 and QPM2162D Only)

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

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

Temperature (QPM2160, QPM2160D, QPM2162 and QPM2162D Only)

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

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

Mechanical Design

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

The two-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.

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 placed over the immersion rod and then secured at the required immersion length.

Setting Elements

NOTE: The setting elements are located inside the cover.

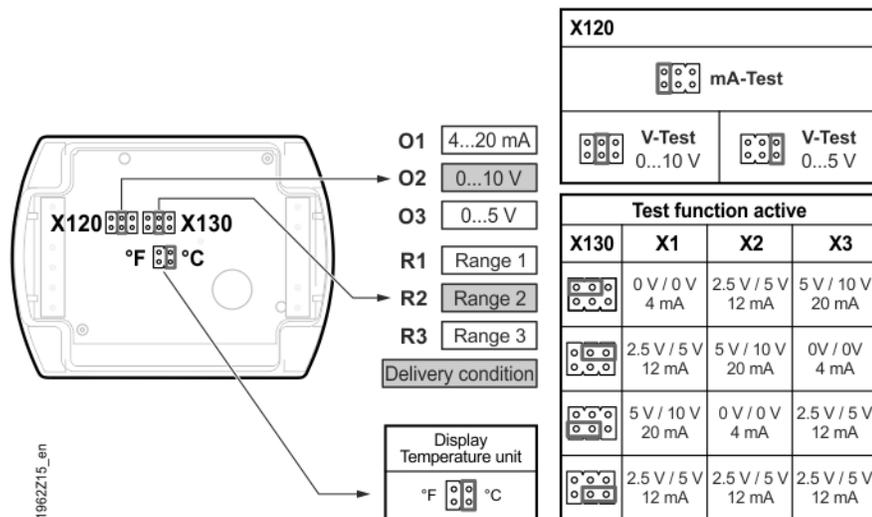


Figure 3. Setting Elements.

Measuring Range
QPM2100

Meaning of the different jumper positions:

- For CO₂ Only:
 Jumper in the middle position (R2) = 0 to 2000 ppm (factory setting).
 R1 and R3 are not used.

QPM2102/QPM2102D

- For CO₂/VOC, jumpers determine VOC Sensitivity:
 - Jumper in the left vertical position (R1) = VOC sensitivity "low".
 - Jumper in the middle position (R2) = VOC sensitivity "normal" (factory setting).
 - Jumper in the right vertical position (R3) = VOC sensitivity "high".

QPM2160/QPM2160D,
QPM2162/QPM2162D

- For the CO₂ and temperature, jumpers determine temperature range:
 - Jumper in the upper position (R1) = -31°F to 95°F (-35 to 35°C).
 - Jumper in the positions (R2 or R3) = 32°F to 122°F (0 to 50°C) (R2, factory setting).

Output Signal Selection	<ul style="list-style-type: none"> • O1 = 4 to 20 mA • O2 = 0 to 10V • O3 = 0 to 5V
Active Test Function	<p>Jumper for the measuring range in the horizontal position: The signal output delivers the values according to the <i>Test function active</i> table (see Figure 3).</p>
Temperature Display Changeover	<p>Meaning of the different jumper positions:</p> <ul style="list-style-type: none"> – Jumper in the right vertical position = °C (factory setting). – Jumper plug in the left vertical position = °F.
Troubleshooting QPM2100/QPM2100D QPM2102/QPM2102D QPM2160/QPM2160D QPM2162/QPM2162D	<ul style="list-style-type: none"> • In the event of CO₂ or VOC failure, 10 Vdc, 5 Vdc, or 20 mA will be present at signal output X2 (after 60 seconds). <p>f the temperature sensor becomes faulty, 0V or 0 mA will be present at signal output X2.</p> <ul style="list-style-type: none"> • If the temperature sensor becomes faulty, 0V or 0 mA will be present at signal output X3, and the humidity signal at signal output X2 will increase to 10 Vdc, 5 Vdc, or 20 mA (after 60 seconds). • If the humidity sensor becomes faulty, 10 Vdc or 5 Vdc will be present at signal output X2 (after 60 seconds), and the temperature signal will remain active.
Display of Measured Values	<p>With sensors QPM2102D, QPM2160D and QPM2162D, the measured values can be read on an LCD. The following measured values are displayed:</p> <ul style="list-style-type: none"> • CO₂: In ppm • CO₂ + VOC: As a bar chart 4 bars $\hat{=}$ X2 = 2V, 1V or 7.2 mA, 20 bars $\hat{=}$ X2 = 10V, 5V or 20 mA • Temperature: In degrees C or F • Humidity: In % rh
Disposal 	<p>The device is considered electrical and electronic equipment for disposal in terms of the applicable European Directive and may not be disposed of as domestic garbage.</p> <ul style="list-style-type: none"> • Dispose of the device through channels provided for this purpose. • Comply with all local and currently applicable laws and regulations.
Engineering Notes	<ul style="list-style-type: none"> • The sensor must be powered by a transformer for Safety Extra Low-Voltage (SELV) with separate windings, suited for 100% duty. It must be sized and fused in compliance with local safety regulations. • When sizing the transformer, the power consumption of the sensor must be taken into consideration. For information about wiring, see the Technical Instructions of the devices with which the sensor is used. • Observe maximum permissible cable lengths.
Cable Routing and Selection	<ul style="list-style-type: none"> • When laying the cables, it should be considered that electrical interference increases the longer the cables run parallel and the smaller the distance between them. • Use shielded cables on applications with EMC problems. • For the secondary power lines and signal lines, use cables with twisted pairs.

Mounting Notes
Mounting Location and Orientation

- To ensure degree of protection, mount the sensor with the cable entry pointing downward.
- Mount the sensor in a location where it can be easily accessed for service.
- If used in connection with steam humidifiers, the distance to the humidifier must be a minimum of 9.8 feet (3 m). If permitted by the installation, the distance should be as great as possible, but no more than 32.8 feet (10 m).
- Handle carefully; the sensing elements in the immersion rod are susceptible to impact and shock.
- The sensor must not be mounted in a ventilation application on top of a building (impact of solar radiation). To ensure correct operation, the sensor's ambient temperature must be between 23°F to 113°F (-5°C to 45°C).

Commissioning Notes

Check the sensor's functions 30 minutes after applying power.

- **Checking the CO₂ function:**
 In well-ventilated spaces, the sensor shows the CO₂ concentration of the outside air. Typically, this is 360 ppm (depending on the sensor's measuring accuracy). Also, a basic functional check can be made by exhaling on the sensor. Note that the sensor's rate of response has been purposely delayed (time constant t_{90} = 5 minutes).
- **Checking the VOC function:**
 Touch the sensor with a cotton ball dowsed in alcohol.
- Ventilation should start when the preset switching level of the connected controller is reached.
- After applying power to sensors with display, **Init** will appear for approximately six seconds.

Specifications

Operating voltage (SELV) 24 Vac \pm 20% or 15 to 35 Vdc
 Frequency 50/60 Hz at 24 Vac

Power supply

Power consumption \leq 2 VA

Functional data, CO₂

Measuring range (MV = measured value) 0 to 2000 parts per million (ppm) *
 Measuring accuracy @ 73°F (23°C) and 1013 hPa $\leq \pm$ (50 ppm + 2% MV)
 Temperature dependency in 23°F to 113°F (-5°C to 45°C) range \pm 2 ppm/°C typically
 Long-time drift $\leq \pm$ 5% measuring range/5 years
 Time constant t_{90} <5 minutes
 Output signal, linear (terminal X1) 0 to 2000 ppm
 Recalibration Not required for 8 years

* Allow up to 96 hours for unit to reach published accuracy.

Functional data, maximum selection of CO₂ and VOC with QPM2102/QPM2102D

Measuring range VOC 0 to 2000 ppm
 VOC sensitivity See Table 1
 Output signal, linear (terminal X2) 0 to 2000 ppm
 Response time, VOC signal t_{voc} 3 minutes/V

Functional data, rh with QPM2162/QPM2162D	Range of use	0 to 95% rh (non-condensing)	
	Measuring range	0 to 100% rh	
	Measuring accuracy @ 73°F (23°C) and 24 Vac 0 to 30/70 to 95% rh 30 to 70% rh	± 5% rh ± 3 rh (typically)	
	Temperature dependency	≤ 0.1% rh/°C	
	Time constant	Approximately 20 seconds	
	Output signal, linear (terminal X2)	0 to 100% rh	
Functional data, temperature with QPM2160/QPM2160D, QPM2162/QPM2162D	Environmental temperature range for electronics	23°F to 113°F (-5°C to 45°C)	
	Measuring range	32°F to 122°F (0°C to 50°C) (R2, R3) -31°F to 95°F (-35°C to 35°C) (R1)	
	Measuring element	NTC 10K Ω	
	Measuring accuracy at 24 Vac 59°F to 95°F (15°C to 35°C) outside the above range, between: -31°F to 59°F/95°F 122°F (-35°C to 15°C/35°C to 50°C)	± 1.4°F (± 0.8°C) ± 1.8°F (± 1°C)	
	Time constant	<3.5 min in 2 m/s moving air	
	Output signal, linear (terminal X2 or X3)	32°F to 122°F (0°C to 50°C)/ -31°F to 95°F (-35°C to 35°C)	
Air velocity	Maximum air velocity V_{max}	10 m/second	
Electrical connections	Screw terminals for	1 x 12 AWG or 2 x 16 AWG	
Environmental conditions	Transport:		
	Temperature:	-13°F to 158°F (-25°C to 70°C)	
	Humidity:	< 95% rh	
Materials and colors	Base	Polycarbonate, RAL 7001 (silver-gray)	
	Cover	Polycarbonate, RAL 7001 (light-gray)	
	Immersion rod	Polycarbonate, RAL 7001 (silver-gray)	
	Filter cap	Polycarbonate, RAL 7001 (silver-gray)	
	Mounting flange	PA66 – GF35 (black)	
	Cable entry gland	PA, RAL 7035 (light-gray)	
	Sensor (complete assembly) Packaging	Silicone-free Corrugated cardboard	
Standards	Electromagnetic compatibility		
	Immunity (QPM2162)	EN 61 000-6-1	
	Immunity (QPM2100, QPM2102, QPM2160)	EN 61 000-6-2	
	Emissions	EN 61 000-6-3	
	 conformity	EMC directive 89/336/EEC	
	 conformity to Australian EM framework Radio Interference Emission Standard	Radio Communication Act 1992 AS/NZS 3548	
	UL Listed	UL 873	
	cUL Listed	Canadian Standard C22.2 No. 24-93	
	Weight	(including packaging)	Approximately 9.5 oz. (0.27 kg)

Wiring Connections

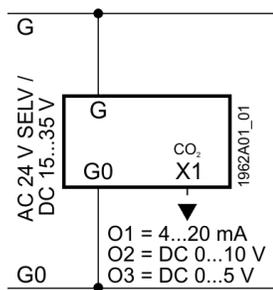


Figure 4. QPM2100, QPM2100D.

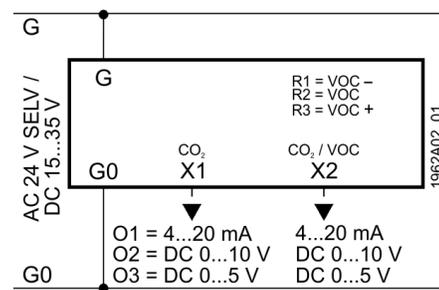


Figure 5. QPM2102, QPM2102D.

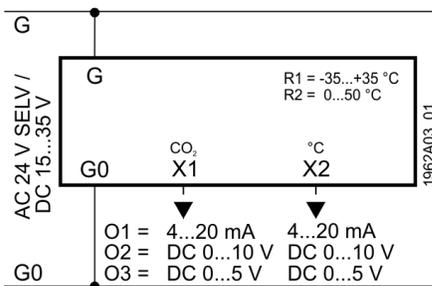


Figure 6. QPM2160, QPM2160D.

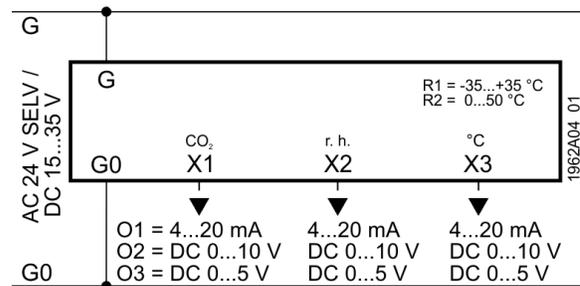


Figure 7. QPM2162, QPM2162D.

- G, G0 System potential 24 Vac (SELV)
- G0 System neutral and measuring neutral
- X1 Signal output 0 to 10 Vdc or 0 to 5 Vdc
- X2 Signal output 0 to 10 Vdc or 0 to 5 Vdc
- X3 Signal output 0 to 10 Vdc or 0 to 5 Vdc

Dimensions

In Inches (Millimeters)

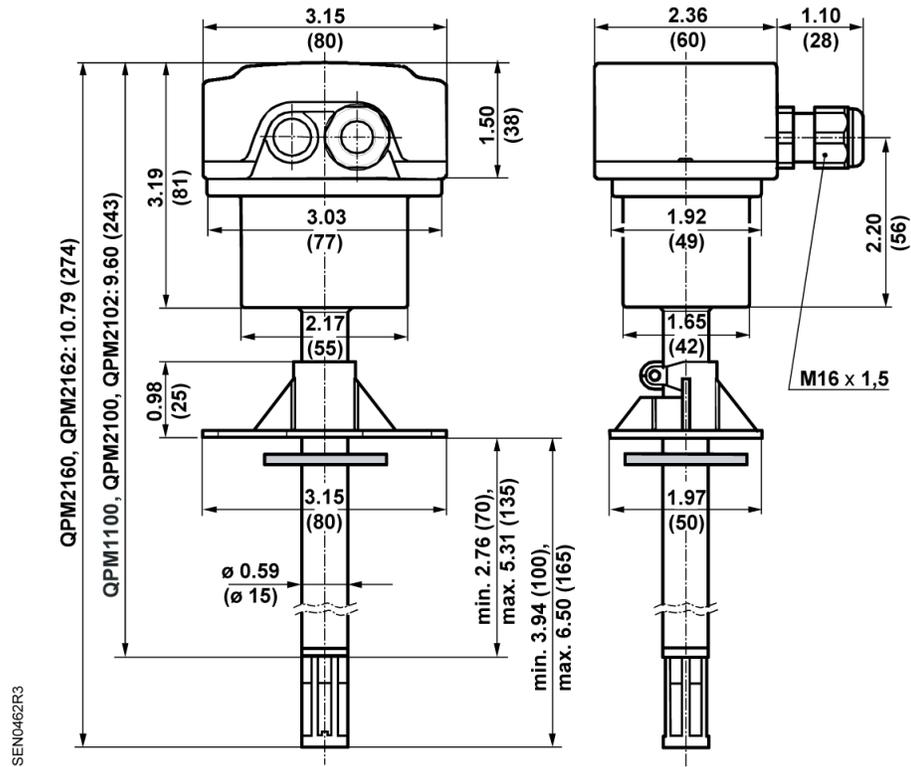


Figure 8. QPM Series Duct Air Quality Sensors
 Dimensions in Inches (Millimeters)

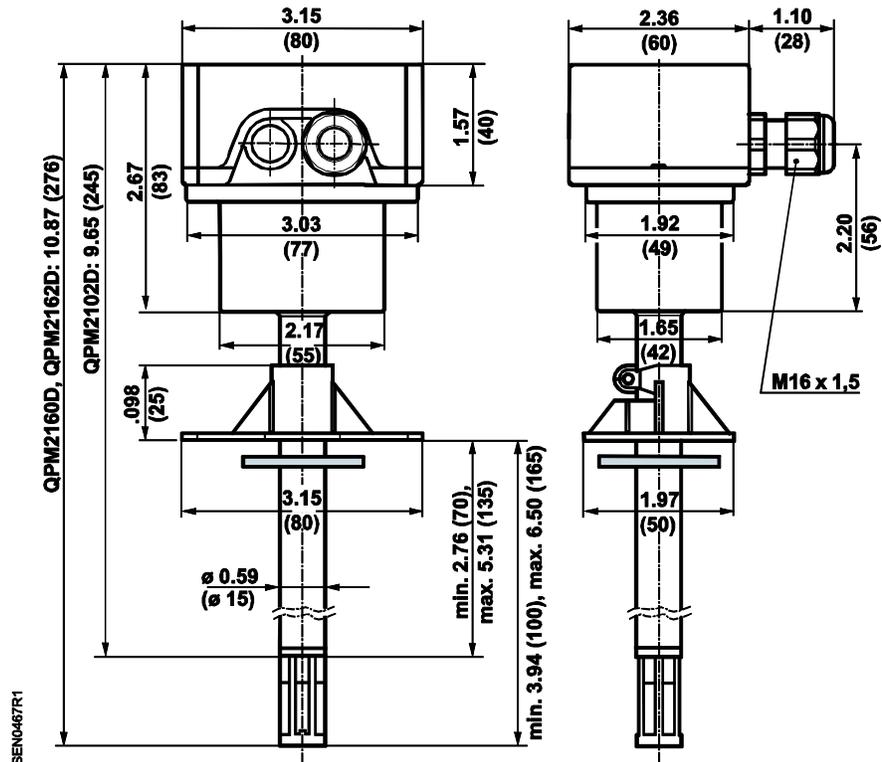


Figure 9. QPM Series Duct Air Quality Sensors with Display.

**Dimensions,
Continued**

**In Inches
(Millimeters)**

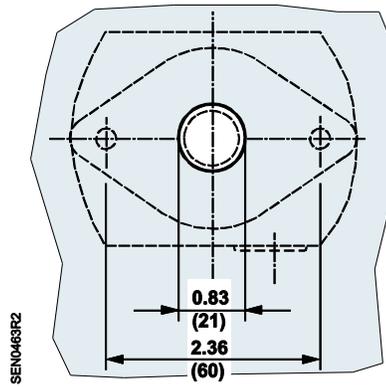


Figure 10. Drilling Pattern.

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