

QPA... Series

Indoor Air Quality Room Sensors



Description

The QPA20 Series Room Carbon Dioxide (CO₂) and Air Quality Sensors are especially suited for applications where precise, stable carbon dioxide or air quality sensing is required.

Several models are available — with CO₂ only, or with Volatile Organic Compounds (VOC) (also known as mixed gas), relative humidity and/or temperature sensing. All units deliver a 0 to 10 Vdc signal for all outputs and have a CO₂ measuring range of 0 to 2000 ppm.

Features

- With maintenance-free CO₂ sensing element based on optical infrared absorption measurement, Non Dispersive Infrared (NDIR) and additional integrated reference light source.
- CO₂; temperature and CO₂; humidity; temperature; VOC-only multisensor.
- No recalibrations required.
- 24 Vac or 15 to 35 Vdc operating voltage
- Signal outputs 0 to 10 Vdc or 0 to 5 Vdc.
- Temperature output model with passive output option.

Application

For use in 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 room, such as tobacco smoke, body odor, or material fumes.
- The relative humidity in the room.
- The room temperature.

**Application,
 Continued**

The QPA20... can be used as a:

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

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 rooms with varying occupancy levels where smoking is prohibited, such as museums, theaters, movie theaters, auditoriums, office spaces, and school rooms.

Product Numbers

Table 1.

Product Number	CO ₂ Measuring Range	VOC Sensitivity	Temperature Measuring Range	Humidity Measuring Range	Display of Measured Value
QPA1000	—	Low (R1) Normal (R2) High (R3)	—	—	No
QPA2000	0 to 2000 ppm	—	—	—	No
QPA2002		Low (R1) Normal (R2) High (R3)	—	—	Yes
QPA2002D			—	—	No
QPA2060		—	32°F to 122°F/ -31°F to 95°F (0°C to 50°C/ -35°C to 35°C)	—	Yes
QPA2060D		—		—	No
QPA2062		—		0 to 100%	Yes
QPA2062D		—			No
QPA2080		—	Dependent on connected sensing element*	—	No
QPA2080D		—	Dependent on connected sensing element*	—	Yes

NOTE: QPA2000, QPA2002, QPA2060, and QPA1000 are available as no-logo variants. To order, add an “N” suffix (for example: QPA1000N).

* Elements included: LG-Ni1000, Pt1000, Pt100, NTC 10KΩ

**Equipment
 Combinations**

QPA20 Series Sensors can be used with all types of systems and devices capable of acquiring and handling the 0 to 10 Vdc output signal delivered by the sensor.

Mode of Operation

CO₂ Concentrations

The QPA20 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 sensor acquires and evaluates the CO₂ concentration. The resulting output signal of 0 to 10 Vdc is proportional to the CO₂ content of the ambient air.

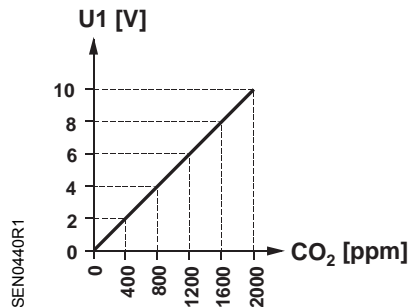


Figure 1. Function Diagram CO₂ (Output U1).

VOC Concentration (QPA1000)

The QPA1000 Air Quality Sensors determine the mixed gas concentration (VOC) using metal-oxide semiconductor sensing elements. The sensor measures precisely at all times and requires no maintenance or recalibration due to its integrated compensation mechanism, saving service costs.

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

VOC Diagram (Output U1)

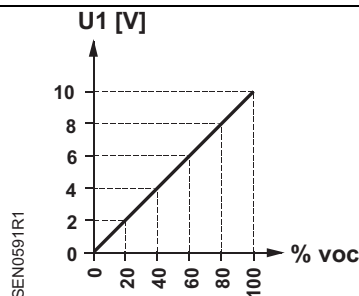


Figure 2. VOC Diagram (Output U1).

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 maximum 10% change to the VOC signal per minute (factory setting). The other two positions 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, (for example, 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 (QPA2002 and QPA2002D 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 U2 as a 0 to 10 Vdc signal to be fed to the ventilation controller.

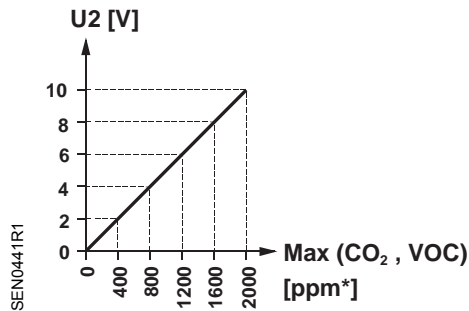


Figure 3. Ventilation Demand Diagram (Output U2).

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.

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 (QPA2062 and QPA2062D 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 0 to 10 Vdc signal, corresponding to a relative humidity range of 0 to 100%.

Temperature (QPA206... Only)

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

The change is converted to an active 0 to 10 Vdc output signal (\cong 32°F to 122°F [0°C to 50°C] or -31°F to 95°F [-35°C to 35°C]).

Sensing Element

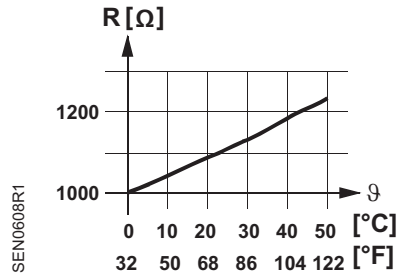


Figure 4. LG-Ni Characteristic Curve.

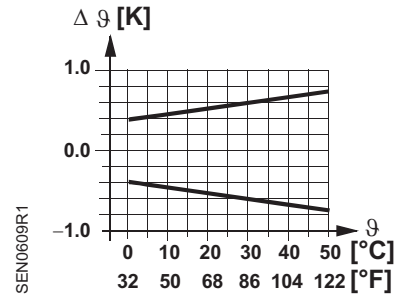


Figure 5. LG-Ni Accuracy.

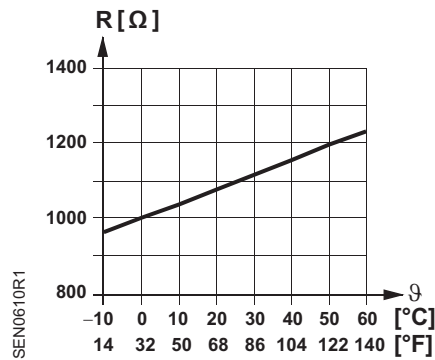


Figure 6. Pt 1000 Characteristic Curve.

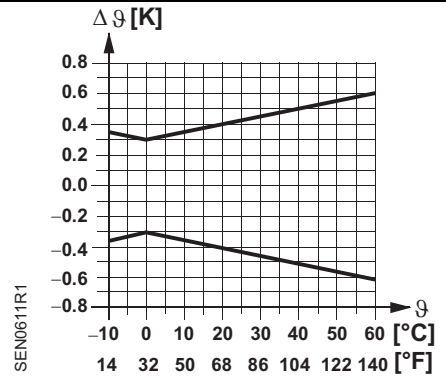


Figure 7. Pt 1000 Accuracy.

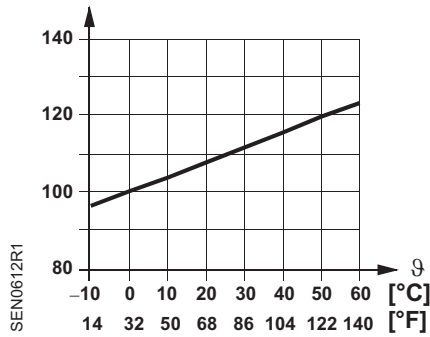


Figure 8. Pt 100 Characteristic Curve.

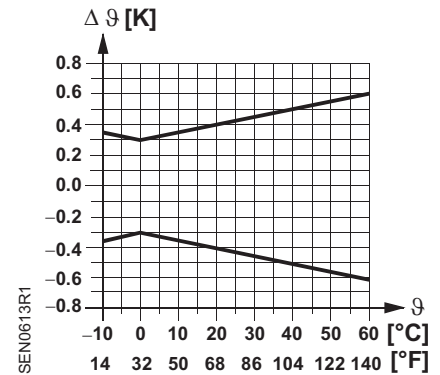


Figure 9. Pt 100 Accuracy.

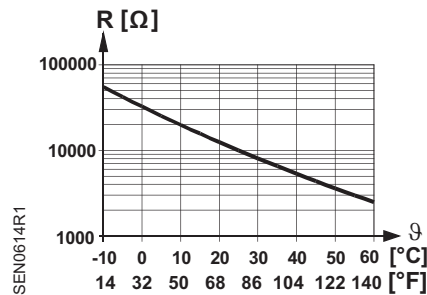


Figure 10. NTC 10K Characteristic Curve.

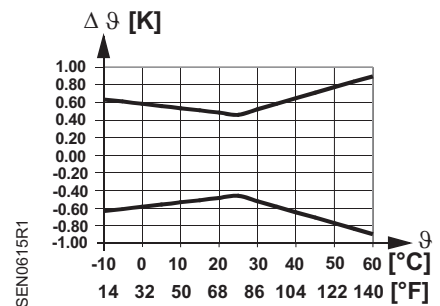


Figure 11. NTC 10K Accuracy.

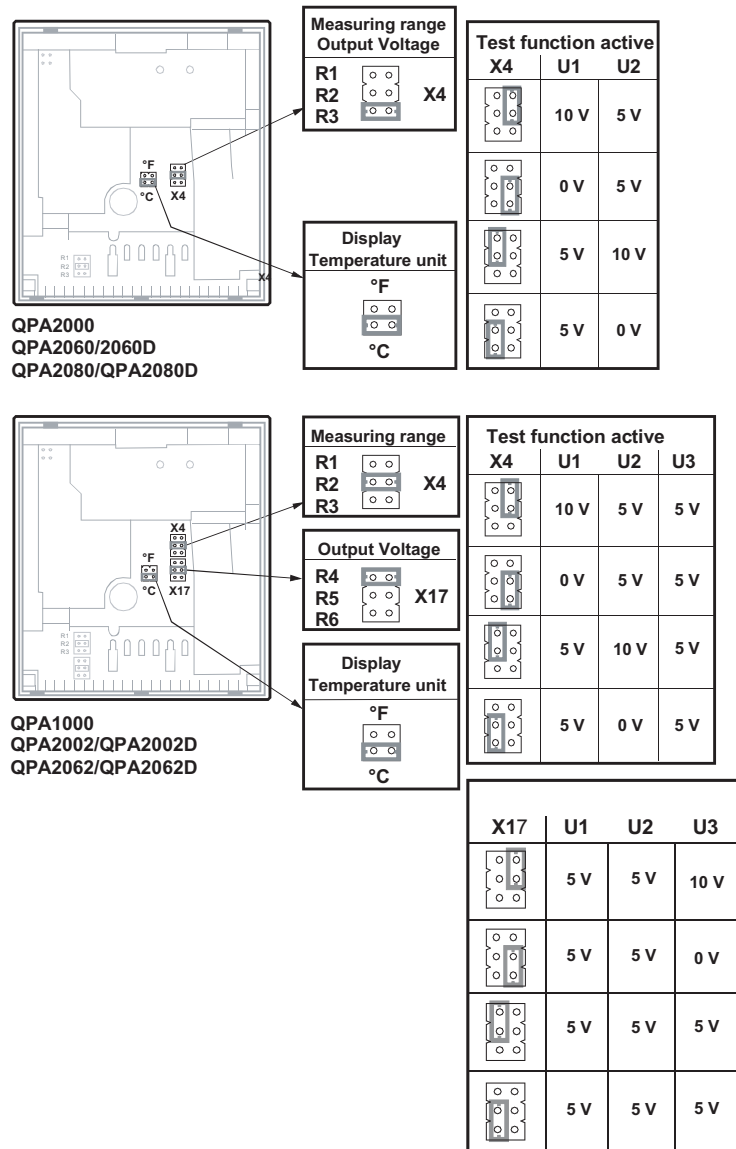
Mechanical Design

The units have been designed for wall mounting. They are suited for use with most types of commercially available recessed conduit boxes. The cables can be introduced from the rear (concealed wiring) or from below or above (surface-run wires) through knockout openings.

The units consist of two major sections: Casing and baseplate. Both snap together but can be detached again.

The measuring circuit, the sensing elements and the setting elements are located on a printed circuit board inside the unit.

The connection terminals are on the mounting base.



SEN042R4

Figure 12. Setting Elements.

NOTE: The setting elements are located inside the cover.

<p>Measuring Range</p> <p>QPA2000</p> <p>QPA1000, QPA2002 and QPA2002D</p> <p>QPA206...</p>	<p>Meaning of the different jumper positions:</p> <ul style="list-style-type: none"> • For CO₂ only: Jumper in the middle position (R2) = 0 to 2000 ppm (factory setting). R1 and R3 are not used. • For CO₂/VOC, jumpers determine VOC sensitivity: <ul style="list-style-type: none"> – Jumper in the upper position (R1) = VOC sensitivity "low". – Jumper in the middle position (R2) = VOC sensitivity "normal" (factory setting). – Jumper in the lower position (R3) = VOC sensitivity "high". • For CO₂ and temperature, jumpers determine temperature range: <ul style="list-style-type: none"> – 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).
<p>Active Test Function</p>	<p>Jumper for the measuring range in the vertical position: The signal output delivers the values according to table "Test function active".</p>
<p>Temperature Display Changeover</p>	<p>Meaning of the different jumper positions:</p> <p>Temperature display:</p> <ul style="list-style-type: none"> – Jumper in the horizontal, lower position = °C (factory setting). – Jumper plug in the horizontal, upper position = °F.
<p>Troubleshooting</p> <p>QPA1000</p> <p>QPA2000, QPA2000N</p> <p>QPA2002, QPA2002D, and QPA2002N</p> <p>QPA2060, QPA2060D, and QPA2060N</p> <p>QPA2062 and QPA2062D</p>	<ul style="list-style-type: none"> • In the event of VOC failure, 10 Vdc or 5 Vdc will be present at signal output U1 (after 60 seconds). • In the event of CO₂ failure, 10 Vdc or 5 Vdc will be present at signal output U1 (after 60 seconds). • In the event of CO₂ or VOC failure, 10V or 5 Vdc will be present at signal output U2 (after 60 seconds). • If the temperature sensor becomes faulty, 0V will be present at signal output U2. • If the temperature sensor becomes faulty, 0V will be present at signal output U3, and the humidity signal at signal output U2 will increase to 10V (after 60 seconds). • If the humidity sensor becomes faulty, 10V will be present at signal output U2 (after 60 seconds), and the temperature signal will remain active.
<p>Measured Value Display</p>	<p>With sensors type QPA2002D, QPA2060D and QPA2062D, the measured values can be read off from 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 $\hat{=}$ U2 = 2V, 20 bars $\hat{=}$ U2 = 10V). More bars = higher VOC • Temperature: In °C or °F. • Humidity: In percent.
<p>Disposal</p>	<p>The major plastic components bear the material references in compliance with ISO/DIS 11 469 for environment-friendly disposal.</p>

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- Engineering Notes**
- The sensor must be powered by a transformer for safety extra low-voltage (SELV) with separate windings, suited for 100% duty. It must be sized and fused in compliance with local safety regulations.
 - When sizing the transformer, the power consumption of the sensor must be taken into consideration. For information about wiring, see the Technical Instructions of the devices with which the sensor is used.
 - Observe maximum permissible cable lengths.
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- Cable Routing and Selection**
- 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.
 - On applications with EMC problems, shielded cables should be used.
 - For the secondary power lines and signal lines, use cables with twisted pairs.
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- Mounting Notes**
- Inner wall of the room to be ventilated, not in niches, behind curtains, above or near heat sources, and not exposed to direct light from spot lights.
 - Do not expose the sensor to direct sunlight.
 - Airflow of greater than 30 fpm may affect the temperature and humidity sensing accuracy. Avoid installing in areas prone to drafts.
 - The end of the conduit at the sensor must be sealed to prevent inaccurate measurements due to drafts through the conduit.
 - Installation Instructions are included with the unit.
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- Commissioning Notes**
- Check the sensor's functions can be checked 30 minutes after applying power.
- Checking the CO₂ function:
 In well-ventilated rooms, 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 about six seconds.
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Specifications	Operating voltage (SELV)	24 Vac \pm 20%
	Frequency	50/60 Hz at 24 Vac
	Power consumption	\leq 2 VA
Power supply		
Cable length for measuring signal	Permissible cable length	See the <i>Technical Instructions</i> of the device handling the signal
Functional data, CO₂	Measuring range (MW = measured value)	0 to 2000 parts per million (ppm)
	Measuring accuracy @ 73°F (23°C) and 1013 hPa	$\leq \pm$ (50 ppm + 2% measured value)
	Temperature dependency in 41°F to 113°F (5°C to 45°C) range	\pm 2 ppm/°C typically
	Long-time drift	$\leq \pm$ 20 ppm per year
	Time constant t_{90}	<5 minutes
	Output signal, linear (terminal U1)	0 to 10 Vdc \cong 0 to 2000 ppm, maximum + 1 mA
	Recalibration	Not required for 8 years

Functional data, maximum selection of CO₂ and VOC with QPA2002 and QPA2002D	Measuring range	0 to 2000 ppm
	VOC sensitivity	See Table 1
	Output signal, linear (terminal U2)	0 to 10 Vdc \cong 0 to 2000 ppm, maximum \pm 1 mA
	Response time, VOC signal t_{voc}	3 minutes/V
Functional data, rh with QPA2062 and QPA2062D	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 95% rh	\pm 5% rh
	30 to 70% rh	\pm 3 rh (typically)
	Temperature dependency	\leq 0.1% rh/°C
	Time constant	Approximately 20 seconds
Output signal, linear (terminal U2)	0 to 10 Vdc \cong 0 to 100% rh, maximum \pm 1 mA	
Functional data, temperature with QPA206...	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)	\pm 1.4°F (\pm 0.8°C)
	outside the above range, between: -31°F to 122°F (-35°C to 50°C)	\pm 1.8°F (\pm 1°C)
	Time constant t_{63}	8.5 minutes
Output signal, linear (terminal U2 or U3)	0 to 10 Vdc \cong 32°F to 122°F (0°C to 50°C)/-31°F to 95°F (-35°C to 35°C), maximum \pm 1 mA	
Measured value display, protective data	QPA2002D, QWPA2060D, QPA2062D	LCD
	Degree of protection, housing	IP 30 to IEC 529
	Safety class	III to EN 60 730
Electrical connections	Screw terminals for	1 \times 12 AWG or 2 \times 16 AWG
Environmental conditions	Transport: Temperature: Humidity:	-13°F to 158°F (-25°C to 70°C) < 95% rh
Materials and colors	Cover	ASA + PC, NCS S 0502-G (white)
	Housing	ASA + PC, NC 2801-Y43R (gray)
	Mounting plate	PC, NCS 2801-Y43R (gray)
	Sensor (complete)	Silicone-free
	Packaging	Corrugated cardboard
Standards	Product safety	
	Automatic controls for household and similar use	EN 60 730-1
	Electromagnetic compatibility	
	Immunity (QPA2062, QPA2062D)	EN 61 000-6-1
	Immunity (QPA2000, QPA2002, QPA2002D, QPA2060, QPA2060D)	EN 61 000-6-2
	Emissions	EN 61 000-6-3
	CE conformity	EMC directive 89/336/EEC
UL conformity	UL 916	

Standards, Continued

 conformity to Australian EM framework
 Radio Interference Emission Standard

Radio Communication Act 1992
 AS/NZS 3548

Weight (including packaging)

Without display
 With display

Approximately 3.53 oz (0.10 kg)
 Approximately 4.23 oz (0.12 kg)

Room sensors with active outputs have power dissipation influencing temperature measurement. The degree of influence depends on the operating voltage and is compensated at 24 Vac operating voltage in Siemens QPA20 Series room sensors. All other operating voltages may result in over- or under-compensation.

Furthermore, the measuring accuracy is influenced by the following:

- Prevailing airflow
- Wall surface (rough, smooth)
- Type of wall (wood, plaster, concrete, brick)
- Location of wall (inside, outdoors).

In an installed sensor, the application-specific measuring accuracy becomes constant after about a 1-hour operating time. It can be adjusted by a higher system (for example, a controller) as needed.

Wiring Terminals

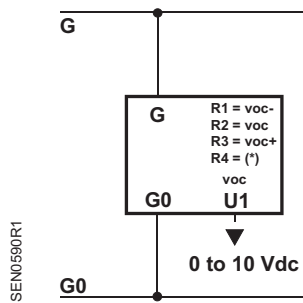


Figure 13. QPA1000.

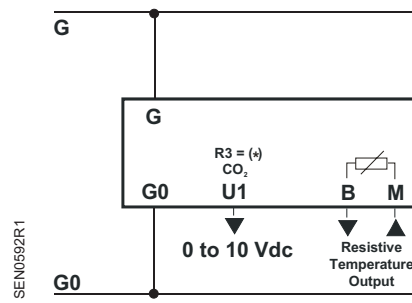


Figure 14. QPA2080, QPA2080D.

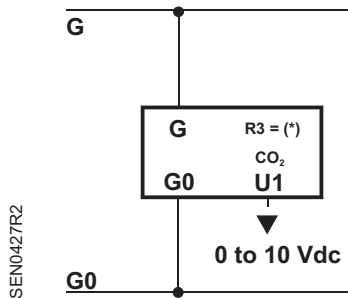


Figure 15. QPA2000, QPA2000N.

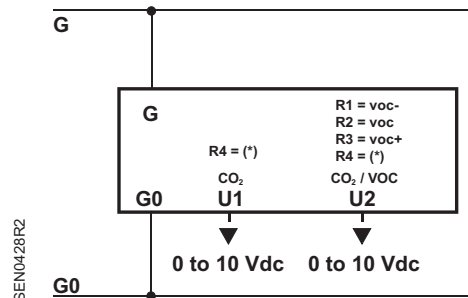


Figure 16. QPA2002, QPA2002D, QPA2002N.

Wiring Terminals, Continued

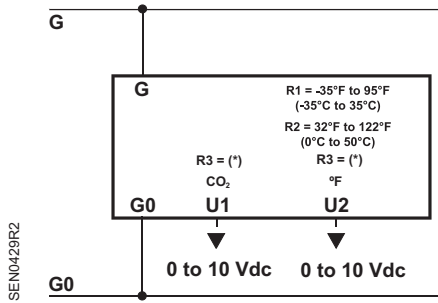


Figure 17. QPA2060, QPA2060D, QPA2060N.

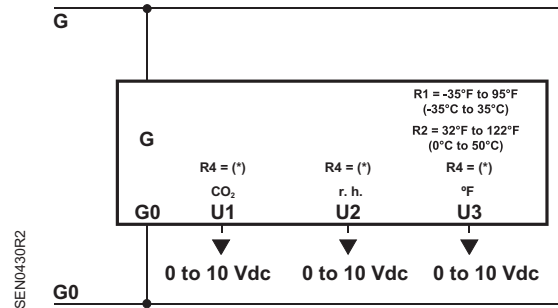


Figure 18. QPA2062, QPA2062D.

G, G0 System potential 24 Vac (SELV)
 G0 System neutral and measuring neutral
 U1 Signal output 0 to 10 Vdc or 0 to 5 Vdc
 U2 Signal output 0 to 10 Vdc or 0 to 5 Vdc

U3 Signal output 0 to 10 Vdc or 0 to 5 Vdc
 R..(*) Signal output with R...= 0 to 10 Vdc; without R... = 0 to 5 Vdc
 B, M Passive temperature output (interchangeable)

Dimensions

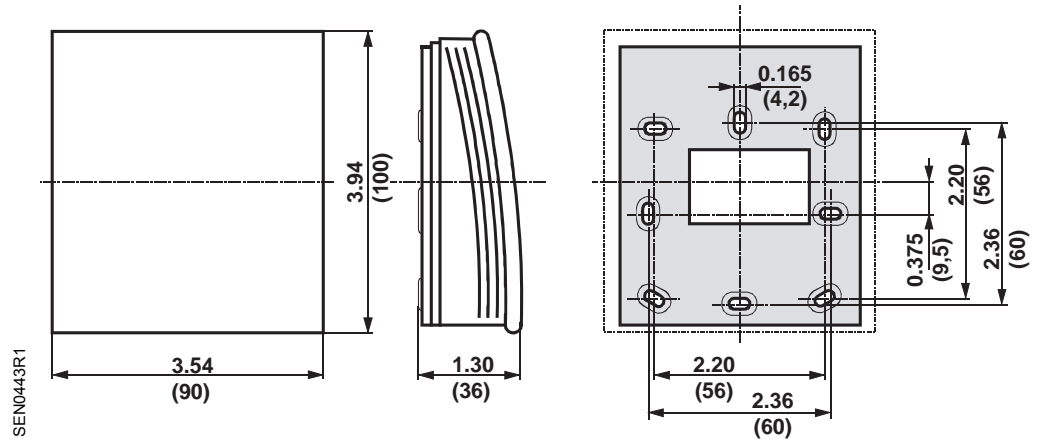


Figure 19. Dimensions in Inches (Millimeters).

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