

Duct Sensor

QFM41xx Series



Description	Duct sensor for relative humidity and temperature with calibration certificates
Features	<ul style="list-style-type: none">• 24 Vac or 13.5 to 35 Vdc operating voltage• 0 to 10 Vdc or 4 to 20 mA signal output for relative humidity and temperature sensing• Very high measuring accuracy across the entire measuring range• Capacitive humidity measurement• Recalibration service
Application	<p>The QFM41xx Series Duct Sensors are used in ventilation and air conditioning buildings requiring:</p> <ul style="list-style-type: none">• Very high accuracy and reliability for measuring relative humidity and temperature.• Regular recalibration and readjustment of the sensors. <p>Typical installations:</p> <ul style="list-style-type: none">• Storage and production facilities in the paper, textile, pharmaceutical, food, chemical and electronics industries, etc.• Laboratories• Hospitals• Computer centers• Greenhouses <p>These sensors can be used as a:</p> <ul style="list-style-type: none">• Control sensor in the supply or return air.• Limit sensor for maximum limitation of supply air humidity after a steam humidifier.• Limit sensor, for example, for measured value indication or for connection to a building automation and control system.

Product Numbers

Table 1.

Part Number	Temperature	Temperature Signal Output	Humidity	Humidity Signal Output
QFM4160	32°F to 122°F (0°C to 50°C) or -31°F to 95°F (-35°C to 35°C) or -40°F to 158°F (-40°C to 70°C)	0 to 10 Vdc	0 to 100%	0 to 10 Vdc
QFM4171		4 to 20 mA		4 to 20 mA
QFM4101	–	–		

Equipment Combinations

The QFM41xx Series Duct Sensors can be used for all systems or devices capable of acquiring and handling the sensor's 0 to 10 Vdc or 4 to 20 mA output signal.

Function

Relative Humidity

The sensor measures the relative humidity in the air duct via its capacitive sensing element whose electrical capacitance changes according to the relative humidity of the ambient air. An electronic measuring circuit converts the sensor's signal to a continuous 0 to 10 Vdc or 4 to 20 mA signal, which corresponds to 0% to 100% relative humidity.

Temperature

The sensor measures the temperature in the air duct via its sensing element whose electrical resistance changes according to the temperature of the ambient air.

This change in resistance is converted to an active 0 to 10 Vdc or 4 to 20 mA output signal corresponding to a temperature range of 32°F to 122°F (0°C to 50°C), -31°F to 95°F (-35°C to 35°C), or -40°F to 158°F (-40°C to 70°C). The measuring range can be selected.

Mechanical Design

- The duct sensor consists of the housing, printed circuit board, connection terminals, immersion rod with measuring probe, and circular connector.
- The two-sectional housing is comprised of a base and removable cover (screw-on design). The measuring circuit and the setting element are located on the printed circuit board inside the cover, and the connection terminals are on the base.
- The sensing elements are located at the end of the measuring probe and protected by the filter cap.
- The housing has a special clamping system that is used to secure flex conduit to the base. (See *Installation Instructions 129-413*).
- The immersion rod and housing are made of plastic and rigidly connected.
- The sensor is designed for screwed or flanged mounting. It can be fitted as follows:
 - With the mounting flange supplied with the sensor, which is to be fitted to the sensor and then secured in accordance with the required immersion length (recommended method), or
 - Without mounting flange (making use of the maximum immersion length). For that purpose, the housing has four holes for fitting the sensor directly to the air duct.

Setting Element

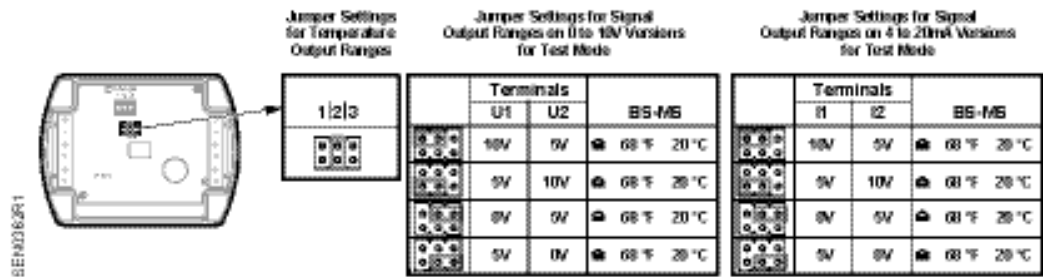


Figure 1. Configuring the Jumpers.

The configuring jumpers are located on the PCA, under the cover. They consist of six pins and a jumper. They are used to select the required measuring range and to activate the test function. The different jumper positions have the following meanings:

- **For the active temperature measuring range with the jumper in the:**
 Left position (1) = -31°F to 95°F (-35°C to 35°C)
 Mid position (2) = 32°F to 122°F (0°C to 50°C) (factory setting)
 Right position (3) = -40°F to 158°F (-40°C to 70°C)
- **For just the active sensor:**
 Jumper in the horizontal position: See Figure 1 (Test Function Active) for values available at the signal output.

Fault

- If the temperature sensor becomes faulty, there will be a voltage of 0V at signal output U2 and humidity signal at signal output U1 increases to 10V.
- If the humidity sensor becomes faulty, there will be a voltage of 10V at signal output U1 after 60 seconds, and the temperature signal will remain active.

Calibration Certificates

The sensor and its exchangeable measuring tip (AQF4150) are numbered, registered, and calibrated prior to delivery. The associated calibration certificates are supplied with the sensor.

Accessories

(For replacement)

- AQF3101 Filter cap (for replacement)
- AQF4150 Measuring tip (exchangeable)

Engineering Notes

- To power the sensor, a Class II transformer with separate windings for 100% duty is required. When sizing and protecting the transformer, observe local electrical code regulations.
- When sizing the transformer, the power consumption of the duct sensor must be taken into consideration.
- For correct wiring of the sensor, see the Data Sheets of the devices with which the sensor is used.
- Permissible line lengths must be observed.



Cable Routing and Cable Selection

When laying the cables, note 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

- The sensor must be mounted in locations where it can be easily accessed for service.
- The sensor should be mounted in the middle of the duct wall. If used in connection with steam humidifiers, the distance to the humidifier must be a minimum of 9.84 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).
- If the application involves dew point shifting, the sensor must be mounted in the return air duct. Only the flange should be fitted to the duct wall. The sensor is then inserted through the flange and engaged.
- Mounting Instructions are printed on the package.

Warning/Caution Notations

WARNING:		Personal injury or loss of life may occur if you do not perform a procedure as specified.
CAUTION:		Equipment damage may occur if you do not follow a procedure as specified.



CAUTION:

- The sensing elements in the immersion rod are susceptible to impact and shock. Avoid any such impact when mounting.
- Do not remove the seal between the housing and cover.

Commissioning Notes

Check wiring before switching on power. The temperature measuring range must be selected on the sensor, if required.

Recalibration Service

Siemens Building Technologies, Inc. HVAC Products provides a recalibration service for used sensors. The recalibration should be performed at 12-month intervals under "normal" conditions, that is, within the comfort range for humidity and temperature, and at air contamination levels that are not above average.

The recalibration service includes the following:

- Delivery and invoicing of the new AQF4150 measuring tip complete with calibration certificate.
- Delivery of a calibration certificate for the (old) measuring tip returned to Siemens Building Technologies HVAC Products, enabling the customer to assess the time of usage of the measuring tip

Specifications

Operating voltage 24 Vac \pm 20% or 13.5 to 35 Vdc

Frequency 50/60 Hz

Power supply

Power consumption \leq 1 VA

Wire lengths for measuring signal, terminal U1, U2

Permissible wire lengths:

Copper 23 AWG	164 ft (50 m)
Copper 18 AWG	492 ft (150 m)
Copper 16AWG	984 ft (300 m)

Functional data for humidity sensor	Measuring accuracy at 73°F (23°C) 0 to 100% rh Temperature dependency Time constant at 32°F to 122°F (0°C to 50°C) and 10 to 80% rh	$\pm 2\%$ $\leq 0.05\% \text{ rh}/^\circ\text{C}$ Approximately 20 s, in moving air
Humidity signal	Output signal Linear, (Terminal U1) Linear, (Terminal I1)	0 to 10 Vdc \cong 0 to 100% rh Max $\pm 1 \text{ mA}$ 4 to 20 mA \cong 0 to 100% rh
Functional data for sensors with active temperature output (0 to 10 Vdc or 4 to 20 MA) See Table 1	Measuring range R1 R2 (Factory setting) R3 Sensing element Measuring accuracy for ranges between: 59°F to 95°F (15°C to 35°C) -40°F to 59°F and 95°F to 158°F (-40°C to 15°C and 35°C to 70°C) Time constant	-31°F to 95°F (-35°C to 35°C) 32°F to 122°F (0°C to 50°C) -40°F to 158°F (-40°C to 70°C) NTC 10K Ω $\pm 1.4^\circ\text{F}$ ($\pm 0.8^\circ\text{C}$) $\pm 1.8^\circ\text{F}$ ($\pm 1.0^\circ\text{C}$) Approximately 20 s in moving air
Temperature signal	Output signal, linear (terminal U2 or I2)	Over selected measuring range
Electrical connections	Connection terminals for Cable entry gland (enclosed)	14 AWG (1) or 16 AWG (2) M 16 x 1.5
Environmental conditions	Operation Temperature (housing with electronic) Humidity Transport Temperature Humidity Protection class rating	-40°F to 158°F (-40°C to 70°C) 0 to 100% rh (with condensation) -13°F to 158°F (-25°C to 70°C) <95% rh IP 65 (NEMA 4)
Materials and colors	Base Cover Immersion rod Filter cap Mounting flange Cable entry gland Circular connector Connector with screwed plug Contact carrier and body knurled nut and contact Coupling piece Contact carrier Casing and product Sensor (complete assembly) Packaging	Polycarbonate, RAL 7001 (silver-gray) Polycarbonate, RAL 7035 (light-gray) Polycarbonate, RAL 7001 (silver-gray) Polycarbonate, RAL 7001 (silver-gray) PA 66 (black) PA, RAL 7035 (light-grey) Lumberg RSC 4/9 PA, black CuZn, nickel-plated Lumberg RKFM 4/9,5 M TPU CuZn, nickel-plated Silicone-free Corrugated cardboard
Agency certification	☑ Conforms to UL Listing cUL Listing ☑ Conforms to Australian EMC Framework Radio Interference Emission Standard	EMC Directive 89/336/EEC UL873 XAPX Canadian Standard C22.2 No. 24-93 Radio Communication Act 1992 AS/NZS 3548
Weight	Including packaging	Approx 0.54 lb (2.44 kg)

Wiring Terminals

R1 = -31°F to 95°F (-35°C to 35°C)
 R2 = 32°F to 122°F (0°C to 50°C)
 R3 = -40°F to 158°F (-40°C to 70°C)

G, G0 Operating voltage 24 Vac (Class II) or 13.5 to 35 Vdc
 U1 Signal output 0 to 10 Vdc for relative humidity 0 to 100%
 U2 Signal output 0 to 10 Vdc for selected temperature range

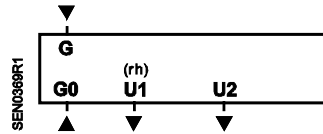


Figure 2. QFM4160.

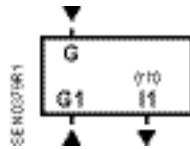


Figure 3. QFM4101.

G1, G2 Operating 13.5 to 35 Vdc
 I1 Signal output 4 to 20 mA for relative humidity 0 to 100%
 I2 Signal output 4 to 20 mA for selected temperature range

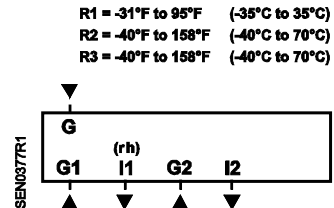


Figure 4. QFM4171.

Dimensions

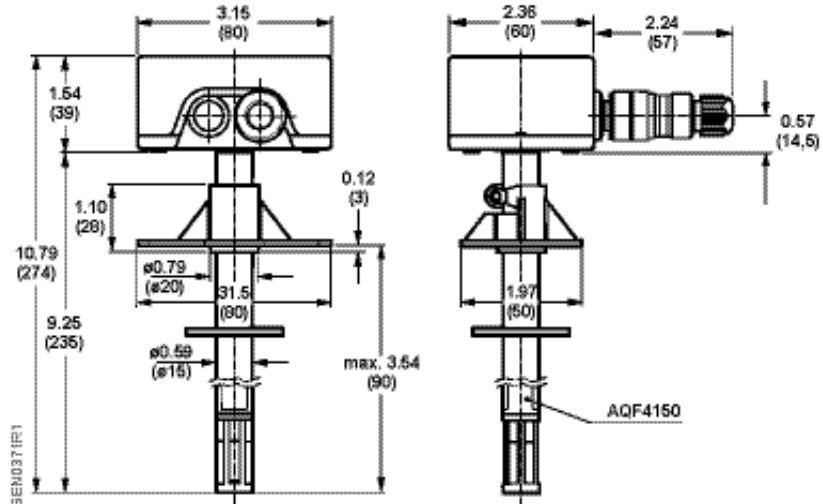


Figure 5. QFM4160 Duct Sensor and Mounting Flange Dimensions in Inches (Millimeters).

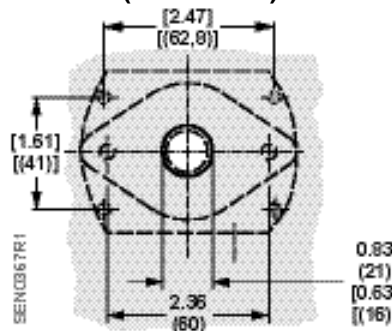


Figure 6. Drilling Template with [without] Mounting Flange in Inches (Millimeters).

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