SIEMENS

Duct Sensor

QFM31xx Series

Description	Duct sensor for relative high accuracy humidity and temperature
Features	• 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
	• Optional display
Application	The QFM31xx Series Duct Sensors are used in ventilation and air conditioning buildings where high accuracy and short response times for measuring relative humidity are required. The measuring range covers the entire humidity range of 0 to 100%.

Typical installations:

- Storage and production facilities in the paper, textile, pharmaceutical, food, chemical and electronics industries, etc.
- Laboratories
- Hospitals
- Computer and EDP centers
- Indoor swimming pools
- Greenhouses

These sensors can be used as a:

- 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
QFM3100	–	–		
QFM3110	-31°F to 140°F (-35°C to 60°C)	1000Ω Pt (0.00385)		0 to 10 Vdc
QFM3160		0 to 10 Vdc		
QFM3160D	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 100%	
QFM3171		4 to 20 mA		
QFM3171D				4 to 20 mA
QFM3101	–	–		

Equipment Combinations

The QFM31xx Series Duct Sensor 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 humidity 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. In the range of 0 to 9.5V or 4 to 19.2 mA (≙ 0 to 95% rh), the signal is linear to the measuring accuracy given in *Specifications*, resulting in an effective measuring range of 0 to 95% rh.

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 jumper selectable 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).

Mechanical Design

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

- 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. The sensor 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.

Measured Value Display   Models QFM3160D and QFM3171D provide the measured values on its LCD display. The following measured values are displayed alternately in intervals of 5 seconds:
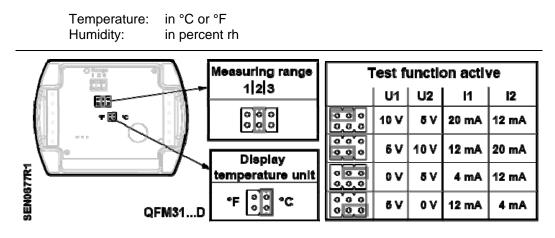
Temperature: in °C or °F
Humidity: in percent rh

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 (0 to 10V or 4 to 20 mA) 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.

- **For the measured value display (QFM31…D):**
  -- Jumper vertical in the right position   = °C (factory setting)
  -- Jumper vertical in the left position   = °F

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 will increase 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.

Accessories	AQF3101	Filter cap
(For replacement)	AQF3150	Sensing tip
	74 662 01040	US rigid 1/2-inch Conduit Adapter

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 wire 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.

Note to QFM2171D

Terminals G1 (+) and I1 (-) for the humidity output must always be connected to power, even if only terminals Gs (+) and I2 (-) of the temperature output are used.

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.

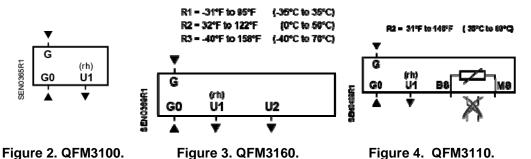- Mounting Instructions are printed on the package.

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 perform a procedure as specified.

⚠ **CAUTION:**

- The sensing elements in the immersion rod are susceptible to impact and shock. Avoid any such impact when mounting.

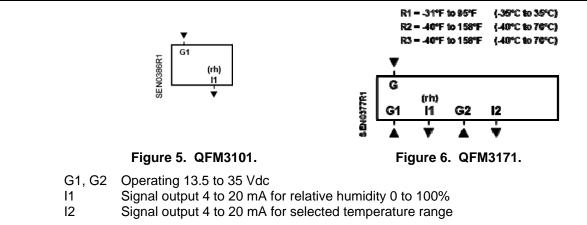- Do not remove the seal between the housing and cover.

Commissioning Notes	Check wiring before switching on power. The temperature measuring range must be selected on the sensor, if required.	
Specifications **Power supply**	Operating voltage	24 Vac $\pm$ 20% or 13.5 to 35 Vdc
	Frequency	50/60 Hz
	Power consumption	$\leq$ 1 VA

Wire lengths for measuring signal, terminal U1, U2	Permissible wire lengths:
	    Copper 24 AWG
	    Copper 18 AWG
	    Copper 16 AWG
		
		164 ft (50 m)
		492 ft (150 m)
		984 ft (300 m)

Functional data for humidity sensor	Measuring accuracy at 73°F (23°C) 0 to 100% rh	 $\pm$ 2%
	Temperature dependency	$\leq$ 0.05% rh/°C
	Time constant at 32°F to 122°F (0°C to 50°C) and 10 to 80% rh	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 mA
		4 t 20 mA $\cong$ 0 to 100% rh Max

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
		
		-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)

	Sensing element	NTC 10K Ω

	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° to 15°C and 35°C to 70°C)
		
		$\pm$ 1.4°F ($\pm$ 0.8°C)
		$\pm$ 1.8°F ($\pm$1.0°C)

	Time constant	Approximately 20 s in moving air
	Output signal, linear (terminal U2 or I2)	Over selected measuring range
Electrical connections	Connection terminals for wires	14 AWG (1) or 16 AWG (2)

Environmental conditions	Operation
	    Temperature (housing with electronic)
	        LCD display readable
	    Humidity
	Transport
	    Humidity
		
		-40°F to 158°F (-40°C to 70°C)
		-13°F to 158°F (-25°C to 70°C)
		0 to 100% rh (with condensation)
		-13°F to 158°F (-25°C to 70°C)
		<95% rh

	Protection class rating	IP 65 (NEMA 4)
Materials and colors	Base Cover Immersion rod Filter cap Mounting flange Cable entry gland 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) Silicone-free Corrugated cardboard

Agency certification	CE Conforms to	EMC Directive 2004/108/EC
	UL Listing	UL873
	cUL Listing	Canadian Standard C22.2 No. 24-93
	☯ Conforms to Australian EMC Framework Radio Interference Emission Standard	Radio Communication Act 1992 AS/NZS 3548
Weight (including packaging)	Without LCD display	7.34 ounces (0.208 kg)
	With LCD display	23.49 ounces (0.666 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)

R2 = 31°F to 140°F   (35°C to 60°C)

Figure 2. QFM3100.	**Figure 3. QFM3160.**	**Figure 4. QFM3110.**

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
BS,MS   Signal output for temperature range -31°F to 140°F (-35°C to 60°C), passive

NOTE: Do not interchange the wires.

NOTE: For QFM3171(D): Terminals G1(+) and I1(-) for the humidity output must always be connected to power, even if only the temperature output G2(+) and I2(-) is used.

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

Figure 5. QFM3101.	**Figure 6. QFM3171.**

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
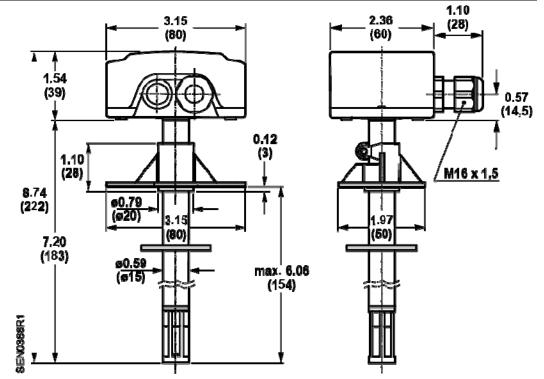
Dimensions

Figure 7. QFM3160 Duct Sensor and Mounting Flange Dimensions in Inches (Millimeters).

Figure 8. Drilling Template with [without] Mounting Flange in Inches (Millimeters).

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