

Duct Sensors

QFM21xx Series



Description	Duct sensors for relative humidity and temperature
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 sensing • 0 to 10 Vdc or 4 to 20 mA, or Siemens Ni 1K ohm signal output for temperature sensing • $\pm 3\%$ measuring accuracy for relative humidity, within the comfort range
Application	<p>The QFM21xx Series Duct Sensors are used in air ducts of ventilation and air conditioning applications for measuring relative humidity and temperature.</p> <p>The sensors are used as:</p> <ul style="list-style-type: none"> • Control sensors in supply or return air ducts • Reference sensors, for example, for shifting the dew point • Limit sensors, for example, in connection with steam humidifiers • Limit sensors, 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
QFM2100	–	–	0 to 100%	0 to 10 Vdc
QFM2110	–31°F to 140°F (–35°C to 60°C)	1000 Ω Pt (0.00385)		
QFM2120		Siemens 1000 Ω Ni		
QFM2160U	–40°F to 158°F (–40°C to 70°C) or –31°F to 95°F (–35°C to 35°C)	0 to 10 Vdc		4 to 20 mA
QFM2171		4 to 20 mA		
QFM2101	–	–		

Equipment Combinations

The QFM21xx Series duct sensors can be used for all systems or devices capable of acquiring and handling the sensor's 0 to 10 Vdc, 4 to 20 mA or passive resistance output signals.

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.

The 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 0 to 9.5V or 4 to 19.2 mA (\cong 0 to 95% rh), the signal is linear to the measuring accuracy given in the *Specifications* section, 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.

Depending on the type of sensor, this change in resistance is converted either to an active 0 to 10 Vdc or 4 to 20 mA output signal corresponding to a temperature range of -40°F to 158°F (-40°C to 70°C); -31°F to 95°F (-35°C to 35°C); or is provided as a passive output signal ($\cong -31^{\circ}\text{F}$ to 140°F [-35°C to 60°C]).

Sensing Elements, Synthetic Resistance Output

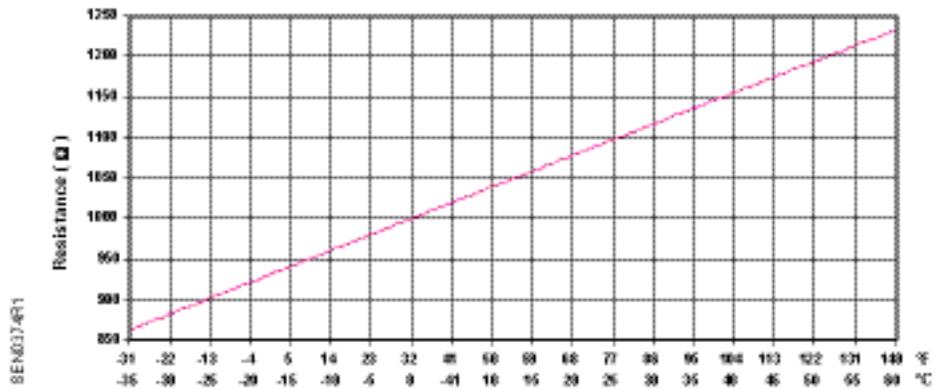
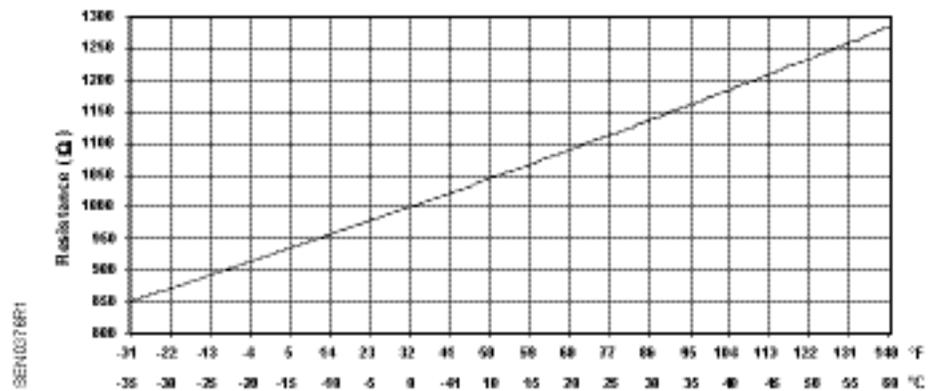


Figure 1. 1000 ohm Platinum.

**Sensing Elements,
Synthetic Resistance
Output, Continued****Figure 2. Siemens 1000 ohm Nickel.****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 (snap-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

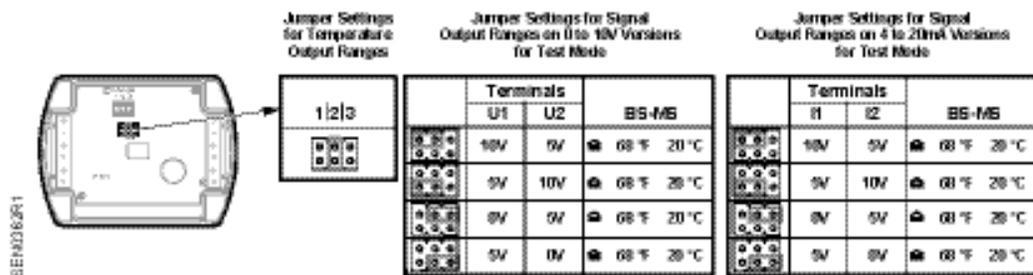


Figure 3. Configuring the Jumpers.

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 passive (resistive output) temperature measuring range with the jumper in the:**
 Mid position (2) = -31°F to 140°F (-35°C to 60°C) (factory setting)
- **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) = -40°F to 158°F (-40°C to 70°C) (factory setting)
 Right position (3) = -40°F to 158°F (-40°C to 70°C)

NOTE: Switching depends on which part number is ordered.

- **For just the active sensor:**
 Jumper in the horizontal position: See Figure 3 for values available at the signal output.

NOTE: U1 and U2 are the voltage output signals; I1 and I2 are the current output signals.

Fault

- If the temperature sensor becomes faulty, there will be a voltage of 0V at signal output U2 or signal output BS-MS $\hat{=}$ -31°F (-35°C), and the 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.

Accessory

(For replacement)

AQF3101 Filter cap

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 possibility of 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.
- 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.

Commissioning Notes

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

Specifications

Operating voltage	24 Vac \pm 10% 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 24 AWG	164 ft (50 m)
Copper 18 AWG	492 ft (150 m)
Copper 16 AWG	984 ft (300 m)

Functional data for humidity sensor

Measuring accuracy at 73°F (23°C) 0 to 30% rh and 70 to 95% rh 30 to 70% rh	\pm 5% \pm 3%, typically
Temperature dependency	\leq 0.06 rh/°F (\leq 0.1% 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
Permissible air velocity	66 ft (20 m)/s

Humidity signal

Output signal, linear (terminal U1)	0 to 10 Vdc \cong 0 to 100% rh Max \pm 1 mA
Output signal, linear (terminal I1)	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)	Measuring ranges for active outputs:	
	R1	-31°F to 95°F (-35°C to 35°C)
See Table 1	R2 (Factory setting)	-40°F to 158°F (-40°C to 70°C)
	R3	-40°F to 158°F (-40°C to 70°C)
	Sensing element	NTC 10K Ω
	Measuring accuracy for ranges:	
	59°F to 95°F (15°C to 35°C)	± 1.4°F (± 0.8°C)
	-40°F to 59°F and 95°F to 158°F -40° to 15°C and 35°C to 70°C)	± 1.8°F (±1.0 °C)
	Time constant	Approximately 20 s in moving air
	Output signal, linear (terminal U2 or I2)	Over selected measuring range
Functional data for sensors with passive temperature output (1KΩ Ni)	Measuring range	
	-31°F to 140°F (-35°C to 60°C)	
See Table 1	Sensing element resistance simulated, corresponding to:	
	1000 Ω Pt (0.00385α), or Siemens 1000 ohm Ni	
	Measuring accuracy for ranges between:	
	59°F to 95°F (15°C to 35°C)	± 1.4°F (± 0.8°C)
	-31°F to 59°F and 95°F to 140°F (-35° to 15°C and 35°C to 60°C)	± 1.8°F (±1.0°C)
	Time constant	Approximately 20 s in moving air
	Output resistance @ terminal BS/MS	See Figures 1, and 2
Electrical connections	Connection terminals for wires	
	14 AWG (1) or 16 AWG (2)	
Environmental conditions	Operation	
	Temperature (housing with electronic)	-40°F to 158°F (-40°C to 70°C)
	Humidity	0 to 95% rh (non-condensing)
	Transport	
Temperature	-13°F to 158°F (-25°C to 70°C)	
Humidity	<95% rh	
	Protection class rating	IP 54
Materials and colors	Base	Polycarbonate, RAL 7001 (silver-gray)
	Cover	Polycarbonate, RAL 7035 (light-gray)
	Immersion rod	Polycarbonate, RAL 7001 (silver-gray)
	Filter cap	Polycarbonate, RAL 7001 (silver-gray)
	Mounting flange	PA 66 (black)
	Cable entry gland	PA, RAL 7035 (light-grey)
	Sensor (complete assembly)	Silicone-free
	Packaging	Corrugated cardboard
Agency certification	CE Conforms to	
	EMC Directive 89/336/EEC	
	UL Listing	UL873 XAPX
	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)	Approx 0.40 lb (0.18 kg)	

Wiring Terminals

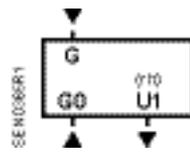


Figure 4. QFM2100.

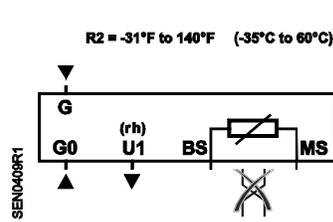


Figure 5. QFM2110,
 QFM2120, QFM2140.

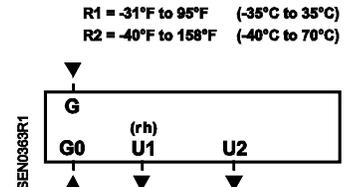


Figure 6. QFM2160U.

- 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 from -31°F to 95°F (-35°C to 60°C), passive

NOTE: Do not interchange wires.

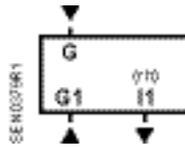


Figure 7. QFM2101.

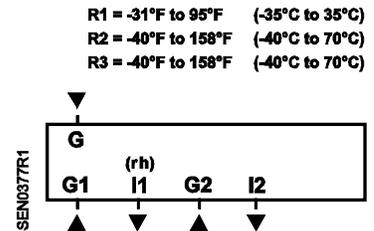


Figure 8. QFM2171.

- 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

