



Symaro™

Duct sensors

QFM31..

for relative humidity (high accuracy) and temperature

- Operating voltage AC 24 V / DC 13.5...35 V
- Signal output DC 0...5 V / DC 0...10 V / 4...20 mA for relative humidity and temperature
- Very high measuring accuracy across the entire measuring range
- Function test
- Capacitive humidity measurement
- Range of use $-40...+70\text{ °C}$ / $0...100\text{ \% r. h.}$
with LCD display $-25...+70\text{ °C}$ / $0...100\text{ \% r.h.}$

Use

The QFM31.. is for use in ventilation and air conditioning plants where high accuracy and short response times for measuring relative humidity are required. The measuring range covers the entire humidity range of $0...100\text{ \%}$.

Examples

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

The QFM31.. is used as a

- control sensors in the supply or extract air
- limit sensor for maximum limitation of supply air humidity after a steam humidifier
- limit sensor, e.g. for measured value indication or for connection to a building automation and control system
- sensor for enthalpy and absolute humidity, together with the SEZ220 (see Data Sheet N5146)

Type summary

Type reference	Temperature measuring range	Temperature signal output	Humidity measuring range	Humidity signal output	Operating voltage	Measured value display	Measuring tip
QFM3100	None	None	0...100 %	active, DC 0...5 V, DC 0...10 V, 4...20 mA	AC 24 V or DC 13,5...35 V	No	AQF3150
QFM3101	None	None	0...100 %	active, 4...20 mA	DC 13,5...35 V	No	AQF3150
QFM3160	0...50 °C / -40...+70 °C / -35...+35 °C	active, DC 0...5 V, DC 0...10 V, 4...20 mA	0...100 %	active, DC 0...5 V, DC 0...10 V, 4...20 mA	AC 24 V or DC 13,5...35 V	No	AQF3150
QFM3160D	0...50 °C / -40...+70 °C / -35...+35 °C	active, DC 0...5 V, DC 0...10 V, 4...20 mA	0...100 %	active, DC 0...5 V, DC 0...10 V, 4...20 mA	AC 24 V or DC 13,5...35 V	Yes	AQF3150
QFM3171	0...50 °C / -40...+70 °C / -35...+35 °C	active, 4...20 mA	0...100 %	active, 4...20 mA	DC 13,5...35 V	No	AQF3150
QFM3171D	0...50 °C / -40...+70 °C / -35...+35 °C	active, 4...20 mA	0...100 %	active, 4...20 mA	DC 13,5...35 V	Yes	AQF3150
QFM3173 *	0...50 °C / -40...+70 °C / -35...+35 °C	active, 4...20 mA	0...100 %	active, 4...20 mA	DC 13,5...35 V	No	AQF3151
QFM3173D *	0...50 °C / -40...+70 °C / -35...+35 °C	active, 4...20 mA	0...100 %	active, 4...20 mA	DC 13,5...35 V	Yes	AQF3151

* For measuring accuracy, see [Technical data](#).

Ordering and delivery

When ordering, please give name and type reference, e.g.:

Duct sensor **QFM3160**

Place a separate order for the service set AQF3153 listed under accessories.

Equipment combinations

All systems and devices capable of acquiring and handling the sensor's DC 0...5 V, DC 0...10 V or 4...20 mA output signal.

When using the sensors for minimum or maximum selection, for averaging, or to calculate enthalpy, enthalpy difference, absolute humidity, and dew point, we recommend to use the SEZ220 signal converter (see Data Sheet N5146).

Technical design

Relative humidity

The sensor acquires the relative humidity in the air duct via its capacitive humidity sensing element whose capacitance varies as a function of the relative humidity of the ambient air.

An electronic circuit converts the sensor's signal to a continuous DC 0...5 V, DC 0...10 V or 4...20 mA signal, corresponding to a relative humidity of 0...100 %.

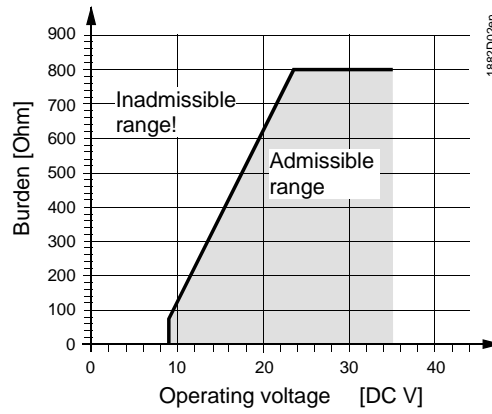
Temperature

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

This variation is converted to an active DC 0...5 V, DC 0...10 V or 4...20 mA output signal, depending on the type of sensor. The output signal corresponds to a selectable temperature range of 0...50 °C, -35...+35 °C, or -40...+70 °C.

Burden diagram

Output signal, terminal I1 / I2



Mechanical design

The duct sensor consists of a housing, a printed circuit board, connection terminals, a mounting flange and an immersion rod having a measuring tip.

The two-part housing comprises a base and a screwed removable cover.

A rubber seal is installed between the base and the cover in order to satisfy the requirements of IP 65 degree of protection.

The measuring circuit and the setting element are accommodated on the printed circuit board inside the cover, the connection terminals on the base.

The measuring tip is screwed on the immersion rod of the housing.

The sensing elements are located at the end of the measuring tip and protected by the filter cap.

Cable entry is made via the cable entry gland M16 (IP 54) supplied with the sensor, which can be screwed into the housing.

Immersion rod and housing are made of plastic and rigidly connected.

The sensor is fitted with the mounting flange supplied with the sensor. The flange is to be placed over the immersion rod and then secured in accordance with the required immersion length.

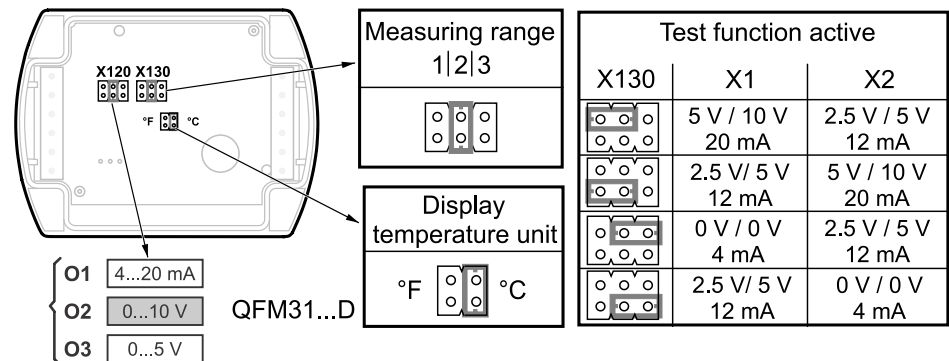
Measured value display

The types QFM3160D, QFM3171D and QFM3173D provide the measured values on its LCD display. The following measured values are displayed alternately in intervals of 5 s:

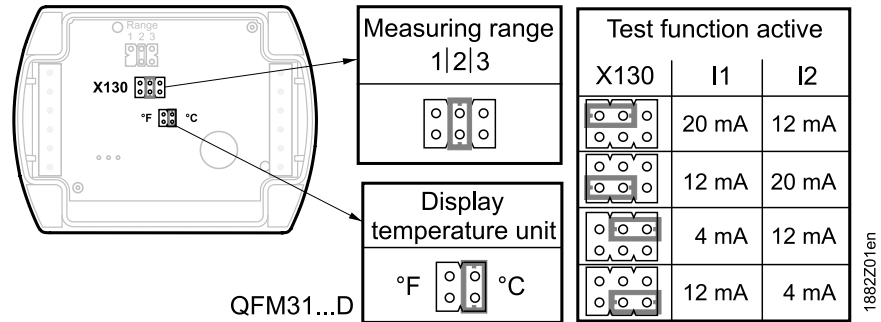
Temperature: in °C or °F

Humidity: in % r. h.

Setting element QFM3100, QFM3160, QFM3160D



QFM3101, QFM3171,
QFM3171D, QFM3173,
QFM3173D



The setting elements are located inside the cover. A setting element consists of 6 pins and a jumper. It is used for selecting the required temperature measuring range and for activating the test function. Types with LCD display have a second setting element with 4 pins and a jumper.

The different jumper positions have the following meaning:

- *For the active temperature measuring range:*
 Jumper in the left position (R1) = $-35...+35\text{ }^{\circ}\text{C}$,
 Jumper in the middle position (R2) = $0...50\text{ }^{\circ}\text{C}$ (factory setting)
 Jumper in the right position (R3) = $-40...+70\text{ }^{\circ}\text{C}$
- *For the active test function:*
 Jumper in the horizontal position: The values available at the signal output are those given in the table "Test function active"
- For the measured value display (QFM31..D)
 - Jumper vertical in the right position = $^{\circ}\text{C}$ (factory setting)
 - Jumper vertical in the left position = $^{\circ}\text{F}$

Malfunction

2-wire

QFM3101, QFM3171,
QFM3171D, QFM3173,
QFM3173D

- Should the temperature sensor become faulty a current of 4 mA will be applied at signal output I2 after 60 seconds, and the humidity signal at signal output I1 will reach 20 mA.
- Should the humidity sensor become faulty a current of 20 mA will be applied at signal output I1 after 60 seconds, and the temperature signal will remain active.

3-wire

QFM3100, QFM3160,
QFM3160D

- Should the temperature sensor become faulty a voltage of 0 V (0 mA) will be applied at signal output X2 after 60 seconds, and the humidity signal at signal output X1 will reach DC 10 V or 5 V or 20 mA.
- Should the humidity sensor become faulty a voltage of DC 10 V or 5 V or 20 mA will be applied at signal output X1 after 60 seconds, and the temperature signal will remain active.

Service set AQF3153

The service set comprises three measuring tips without sensor element. Each tip signals a predefined temperature and humidity value to the basic unit:

- 85 % r. h., $40\text{ }^{\circ}\text{C}$
- 50 % r. h., $23\text{ }^{\circ}\text{C}$
- 20 % r. h., $5\text{ }^{\circ}\text{C}$

The fixed values are available at the signal outputs. The accuracy of the values is the same as for the test function. The measuring tips can be exchanged in operation.

Accessories

<i>Name</i>	<i>Type reference</i>
Filter cap (for replacement)	AQF3101, AQF3102, AQF3103
Measuring tip (exchangeable for replacement)	AQF3150: QFM3100, QFM3101, QFM3160 (D), QFM3171 (D) AQF3151: QFM3173 (D)
Service set (for function test)	AQF3153
3 m cable for remote measurement	AQY2010

Engineering notes

A transformer for safety extra low-voltage (SELV) with separate windings for 100 % duty is required to power the sensor. When sizing and protecting the transformer, the local safety regulations must be complied with.

When sizing the transformer, the power consumption of the duct sensor must be taken into consideration.

For correct wiring of the sensor, refer to the Data Sheets of the devices with which the sensor is used.

The permissible line lengths must be considered.

Cable routing and cable selection

It must be considered for routing of cables 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 **QFM3171(D) / QFM3173(D)**

Terminals G1(+) and I1(–) for the humidity output must always be connected to power, even if only terminals G2(+) and I2(–) of the temperature output are used!

Mounting notes

Location

Mount the sensor in the center of the duct wall. If used together with steam humidifiers, the minimum distance after the humidifier must be 3 m to max 10 m.

Fit the sensor in the extract air duct if the application involves dew point shifting.

Fit only the flange to the duct wall. The sensor is then inserted through the flange and engaged.

Caution!

- The seal between base and cover must not be removed, or else degree of protection IP 65 will be no longer ensured.
- The sensing elements inside the measuring tip are sensitive to impact. Avoid any such impact on mounting.

Mounting instructions

Mounting Instructions are printed on the inner side of the package.

Commissioning notes

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

Wiring and the output signals can be checked by making use of the test function (refer to "Mechanical design").



We recommend not to use voltmeters or ohmmeters directly at the sensing element. In the case of the simulated passive output signals, measurements with commercially available meters cannot be made (measuring current too small).

Disposal



This symbol or any other national label indicate that the product, its packaging, and, where applicable, any batteries may not be disposed of as domestic waste. Delete all personal data and dispose of the item(s) at separate collection and recycling facilities in accordance with local and national legislation.

For additional details, refer to www.siemens.com/bt/disposal.

FCC

FCC Statement

The equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation

FCC Caution: Changes or modifications not expressly approved by Siemens Switzerland Ltd. could void user authority to operate the equipment. United States representative

<https://new.siemens.com/us/en/products/buildingtechnologies/home.html>

Technical data

Power supply	Operating voltage	AC 24 V \pm 20 % or DC 13.5...35 V (SELV) or AC/DC 24 V class 2 (US)	
	Frequency	50/60 Hz at AC 24 V	
	Power consumption	At "U" output signal	"I" output signal
	QFM3100	Max. <1.7 VA	Max. <2.0 VA
	QFM3160, QFM3160D	Max. <1.7 VA	Max. <2.5 VA
	Power consumption	QFM3101, QFM3171, QFM3171D, QFM3173, QFM3173D \leq 1 VA	
	External supply line protection	Fuse slow max. 10 A or Circuit breaker max. 13 A Characteristic B, C, D according to or Power source with current limitation of max. 10 A	
Cable lengths for the measuring signal	Max. perm. cable lengths	See data sheet of the device handling the signal	
Functional data	Measuring range	0...100 % r.h.	
"Humidity sensor"	Measuring accuracy at 23 °C and AC/DC 24 V in 0...100 % r.h.	\pm 2 % r. h.	
	Temperature dependency	\leq 0.05 % r.h./°C	

	Time constant	< 20 s
	Supply air velocity	20 m/s
	Output signal, linear (terminal X1)	DC 0...5 V, DC 0...10 V $\hat{=}$ 0...100 % r.h. max. 1 mA 4...20 mA $\hat{=}$ 0...100 % r.h. max. 1 mA, max. 500 Ohm
	Output signal, linear (terminal I1) Burden	4...20 mA $\hat{=}$ 0...100 % r.h. See "Function"
Functional data "Temperature sensor"	Measuring range	0...50 °C (R2 = factory setting), -35...+35 °C (R1), -40...+70 °C (R3)
	Sensing element	Pt 1000
	QFM3100, QFM3101, QFM3160 (D), QFM3171 (D)	
	Measuring accuracy at AC/DC 24 V in	
	23 °C	±0.3 K
	15...35 °C	±0.6 K
	-35...+70 °C	±0.8 K
	QFM3173 (D)	
	Measuring accuracy at AC/DC 24 V in	
	20...26 °C	±0.2 K
	15...35 °C	±0.3 K
	-35...+70 °C	±0.8 K
	Time constant	< 3.5 min. in with 2 m/s moved air
	Output signal, linear (terminal X2)	DC 0...5 V, DC 0...10 V $\hat{=}$ 0...50 °C / -35...+35 °C / -40...+70 °C, max. 1 mA 4...20 mA $\hat{=}$ 0...50 °C / -35...+35 °C / -40...+70 °C max. 1 mA, max. 500 Ohm
	Output signal, linear (terminal I2) Burden	4...20 mA $\hat{=}$ 0...50 / -35...+35 / -40...+70 °C See "Function"
Degree of protection	Protection class	III according to EN 60730-1
	Protection degree of housing	IP65 according to EN 60529 in the built-in state
Electrical connections	Screw terminals	1 × 2.5 mm ² or 2 × 1.5 mm ²
	Cable entry gland (enclosed)	M 16 x 1.5
Environmental conditions	Operation to	
	Climatic conditions	Class 4K2 to IEC 60 721-3-4
	Temperature (housing with electronics)	-40...+70 °C
	LCD display readable	-25...+70 °C
	Humidity	0...100 % r. h. (with condensation)
	Mechanical conditions	Class 3M2 to IEC 60 721-3-3
	Transport to	IEC 60 721-3-2
	Climatic condition	Class 2K3
	Temperature	-40...+70 °C
	Humidity	<95 % r. h.
	Mechanical conditions	Class 2M2
Materials and color	Base	Polycarbonate, RAL 7001 (silver-grey)
	Cover	Polycarbonate, RAL 7035 (light-grey)
	Immersion rod	Polycarbonate, RAL 7001 (silver-grey)
	Filter cap	
	AQF3101	Body: polycarbonate, RAL 7001 (silver-grey) Filter: PTFE membrane (white)
	AQF3102	PTFE sintered catalytic filter for H ₂ O ₂ environment
	AQF3103	sintered stainless steel to DIN 17440
	Mounting flange	PA66 – GF35 (black)
	Cable entry gland	PA, RAL 7035 (light-grey)
	Sensor (complete assembly)	Silicone-free
	Packaging	Corrugated cardboard
Directives and Standards	Product standard	EN 60730-1 Automatic electrical controls for household and similar use
	Electromagnetic compatibility (Applications)	For use in residential, commerce, light-industrial and industrial environments
	EU Conformity (CE)	CE1T1882xx ¹⁾
	RCM Conformity	CE1T1864en_C1 ¹⁾
	UL	UL 873, http://ul.com/database
	UKCA	A5W00188729A ¹⁾

Environmental compatibility

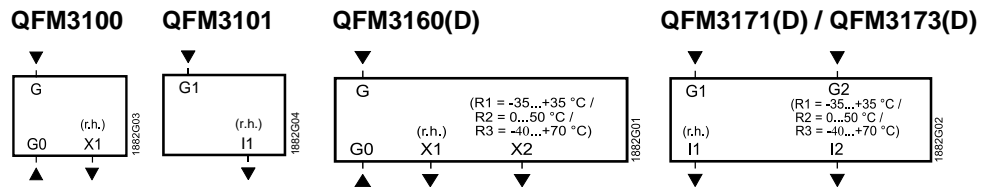
The product environmental declaration CE1E1882¹) contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal).

Weight

Incl. packaging	
Without LCD display	0.208 kg
With LCD display	0.225 kg
AQF3150 / AQF3151	0.050 kg
AQF3153	0.066 kg

*) The documents can be downloaded from <http://siemens.com/bt/download>.

Connection terminals

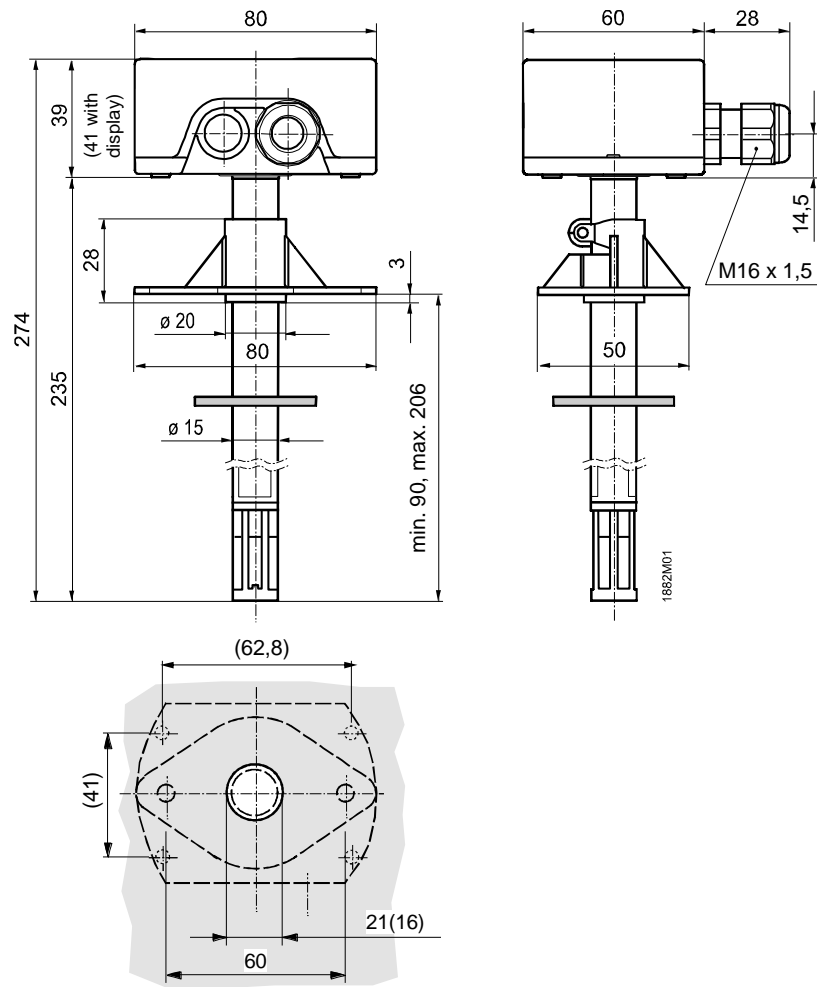


- G, G0 Operating voltage AC 24 V (SELV) or DC 13.5...35 V
- G1, G2 Operating voltage DC 13.5...35 V
- X1 Signal output DC 0...5 V, DC 0...10 V, 4...20 mA for relative humidity 0...100 %
- X2 Signal output DC 0...5 V, DC 0...10 V, 4...20 mA for temperature range 0...50 °C (R2 = factory setting), -35...+35 °C (R1) or -40...+70 °C (R3)
- I1 Signal output 4...20 mA for relative humidity 0...100 %
- I2 Signal output 4...20 mA for temperature range 0...50 °C (R2 = factory setting), -35...+35 °C (R1) or -40...+70 °C (R3)

Note on connection terminals of the QFM3171(D) / QFM3173(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!

Dimensions



Dimensions in mm

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