



Frost detector

QAF64.2-J
QAF64.6-J

for use on the air side

-
- With active capillary tube sensing element for acquiring the lowest temperature within a range of 0...15 °C
 - With startup function
 - Operating voltage AC 24 V
 - Signal voltage DC 0...10 V

Use

On the air side of ventilation and air conditioning plants:

- Typically: hot water air heating coils where there is a risk of freezing due to cold incoming outside air
- Where fans are to be switched off, heating valves opened and air dampers closed to prevent freeze-ups
- Where risk of frost shall be signaled

Functions

Technical design

With the help of a vapor-filled capillary tube and diaphragm, the QAF64... acquires the lowest temperature which occurs along at least 250 mm length of capillary tubing.

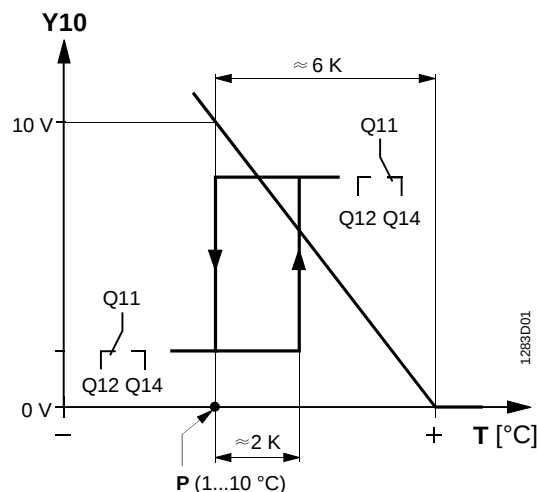
When correctly located at the air outlet of the air heating coil, the frost detector acquires the lowest air temperature even in the case of temperature stratification. The vapor pressure in the capillary tube produces a certain travel of the diaphragm. This movement is converted to an electric signal with the help of an inductive measuring system. It is then electronically amplified so that a DC 0...10 V measuring signal can be produced (terminal B).

The frost detector performs its task by providing 3 independent functions:

1. It opens the heating valve continuously within a proportional control range.
2. It switches off the fans and closes the air dampers via its relay contact.
3. It makes the acquired temperature available for further handling.

The measuring signal is then used as a frost signal by the frost detector and for valve control. The frost signal starts rising at about 6 K above the adjusted frost value.

Function diagram



Legend

P	Frost value (adjustable)
T	Capillary tube temperature
Y10	Valve control signal (at Y = DC 0 V)
Q11/12/13	Relay output (changeover contact)

Startup function

The frost signal is added to the valve control signal fed to signal input Y. This causes the heating valve to travel to its fully open position – resulting from the control signal received via signal output Y10 – before the output relay changes to the "Frost" position (Q11-Q12). This circuitry prevents frequent switching of the plant during the startup phase.

To make certain it is always the lowest temperature along the capillary tube that is acquired, the temperature of the diaphragm inside the housing must always be higher than the temperature at the capillary tube. This is ensured by a heating element inside the housing, which maintains the temperature at the diaphragm above 15 °C as long as the ambient temperature does not fall below -15 °C.

Operating modes

Automatic operation

"Auto"

Manual operation "Manu"

"Test" mode

Three operating modes can be selected:

If, after shutdown due to frost, the capillary tube temperature rises (>2 K), the output relay will automatically return to its normal position.

If, after shutdown due to frost, the capillary tube temperature rises (>2 K), the output relay will return to its normal position only if either the inbuilt reset button is pressed or the power supply is cut off (e.g. via an external reset button).

In test mode, the output relay is forced to the "Frost" position. The valve control signal Y10 will not be affected.

When returning to the switch position "Manu", the frost position is maintained. It must be cancelled by pressing the reset button.

Display and setting elements

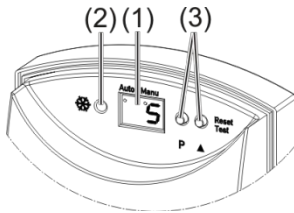
Operating modes

The frost detector offers different operating modes, allowing different setpoint adjustments:

- "Auto" = automatic operation (normal position)
- "Test" = frost simulation via button
- "Manu" = manual function

CAUTION

In manual mode, only trained personnel are allowed to change the setpoint.



(1)	Display	7-segment display, 2 digits, red
(2)	Indication of switch position	1 LED for relay output
(3)	Buttons	To operate and set the frost detector and to make the reset in manual mode

Parameters and configuration

<i>Designation</i>	<i>Display</i>	<i>Factory setting</i>	<i>Value range</i>
Switching point	Sp	5 °C	1...10 °C
Operating mode	St	Automatic	Automatic (at) Manual (hd)

Mechanical design

The frost detector consists of a two-sectional housing (base and cover) and a capillary tube which is active over its full length.

The cover is secured to the base with a fixing screw and can be removed.

The housing accommodates the electronics, the diaphragm with the heating element, the setting elements, the connection terminals and the type field.

Connection terminals, setting elements and type field can be accessed after removing the cover.

The cables are introduced to the housing from below. There is one hole for the enclosed cable gland M16, and 2 knockout holes for additional cable glands M16. The QFA64.. can be fitted directly to the wall – with or without a test loop – or with the help of a mounting flange (if the air duct is insulated).

Type summary

<i>Product number</i>	<i>Stock number</i>	<i>Description</i>
QAF64.2-J	S55700-P155	Frost detector with 2-m capillary
QAF64.6-J	S55700-P156	Frost detector with 6-m capillary

Ordering

When ordering, please give product number, stock number and description.
The mounting accessories not included in the scope of delivery must be ordered as separate items.

Accessories

Included in the scope of delivery

- 1 x M16 cable gland for cable entry
- 2 x screw to DIN 7981-St 4.2 x 22 for direct mounting
- 1 x rubber grommet for capillary entries into air ducts (4 109 2106 0)

Not included in the scope of delivery

<i>Product number</i>	<i>Stock number</i>	<i>Designation</i>	<i>Parts</i>
AQM63.0	BPZ:AQM63.0	Mounting flange	1 x depth-adjustable mounting flange for the housing
AQM63.2 ¹⁾	BPZ:AQM63.2	Capillary supports	3 x capillary tube clamp 3 x spacer

1) QAF64.6-J requires 2 AQM63.2

Notes

Engineering

The frost detector operates on AC 24 V. The transformer used must be suited for safety extra low voltage (SELV), 100% duty, and must have separate windings. Fuses, switches, wiring and earthing must be in compliance with local safety regulations. The permissible cable lengths must be observed.

If the capillary tube is mechanically damaged or if there is a leak in the diaphragm system, the frost detector signals a low temperature and assumes the "Frost" position. That is the case also if there is a power failure or if one of the major electronic components fails.

In the case of large cross-sectional areas of the air duct, an air heating coil can be monitored by several QAF64..:

- QAF64.. valve control signal outputs/inputs in series, and
- QAF64.. relay contacts in series



CAUTION

If the relay contacts Q11/Q12/Q14 do not operate on safety extra-low voltage (SELV), the following applies:

- Only authorized personnel may open the frost detector to make settings or the relay circuit must be de-energized
- For manual operation, an external button must be installed for the reset function (see "Connection diagram")

Mounting

Mounting location

On the hot side of the air heating coil.

Mounting of housing

Direct mounting

Fit the housing (by using the 2 fixing holes) to the wall of the air heating coil. Introduce the capillary tube in the air duct and protect it by using the rubber grommet supplied with the unit (refer to "Accessories").

When fitting the frost detector inside the air duct: secure the housing to the inner wall of the air heating coil and lead the capillary tube through one of the lateral grooves.

Direct mounting, with test loop for functional test

Fit the housing (by using the 2 fixing holes) to the wall of the air heating coil and lead the capillary tube through one of the lateral grooves.

Bend the capillary tube to form a test loop, introduce it to the air duct and protect it by using the enclosed rubber grommet (refer to "Accessories").

This mounting method is not recommended when the ambient temperature at the external test loop may fall below the temperature at the measuring location in the air duct (the measuring signal of the sensing element always represents the lowest temperature, no matter where it occurs along the capillary tube!).

With mounting flange (refer to "Accessories")

This mounting method is suited for air ducts having an insulation of up to 70 mm.

Fit the mounting flange to the wall of the air heating coil and introduce the capillary tube through the flange in the air duct.

Fitting the capillary tube

Coil the capillary tube evenly across the entire cross-sectional area of the air heating coil and attach it to the coil with the help of the clamps, maintaining a spacing of 40 mm (refer to "Accessories").



CAUTION

The capillary tube must not be sharply bent. The bending radius should be as great as possible.

Installation

The low voltage terminals are protected against wiring errors with own voltages up to AC 24 V.



CAUTION

The terminals are not protected against wiring errors with AC 230 V mains voltage.

Commissioning

The frost detector must be commissioned and set as specified in the instructions supplied with it. No settings are required on it (factory setting = 5 K).

Manual function test

A test loop allows the function of the frost detector to be checked with the help of a mixture of ice and water or ice spray. This way, frost can be simulated, also allowing the plant to be checked under frost conditions (switch-off functions).

Function test via function button on the unit

The menu includes a "Frost test" function, meaning that frost can be simulated, also allowing the plant to be checked under frost conditions (switch-off functions).

Disposal



The frost detectors are considered electronics devices for disposal in terms of European Directive 2012/19/EU and may not be disposed of as domestic waste.

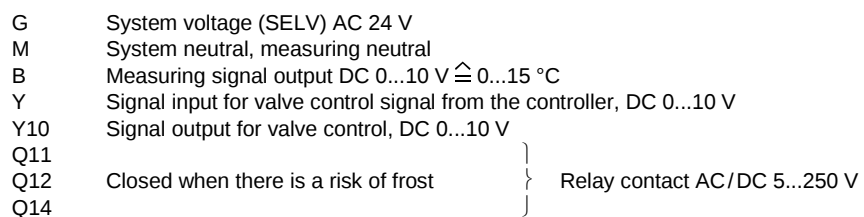
- Dispose of the Device via the channels provided for this purpose.
- Comply with all local and currently applicable laws and regulations.

Technical data

Power supply	Operating voltage (SELV)	AC 24 V +10/-20%
	Frequency	48...63 Hz
	Power consumption	Max. 6.6 VA
Analog input	Valve control (terminal Y)	DC 0...10 V
	Current	Max. 0.1 mA
	Perm. cable length with 1.5 mm ²	300 m
Analog outputs	Sensing element temperature (terminal B)	DC 0...10 V $\hat{=}$ 0...15 °C
	Valve control (terminal Y10)	DC 0...10 V
	Current	Max. 1 mA
	Perm. cable length with 1.5 mm ²	300 m
Relay output (terminals Q11, -12 , -14)	Output	Potentialfree
	Min. switching capacity	AC/DC 12 V, 100 mA
	Max. switching capacity	AC 230 V, 6(2) A; DC 24 V, 6 A
Functional data	Measuring range	0...15 °C
	Setting range for frost	1...10 °C
	Calibration point	+5 °C
	Accuracy at calibration point	+/- 1 K
	Switching differential	Approx. 2 K
	Time constant	
	In still air	Approx. 90 s
	In moving air	<40 s
	Capillary tube	
	Min. active length material	250 mm
	Perm. temperature	110 °C max.
Protective data	Degree of protection of housing	IP 42 to EN 60 529
Electrical connections	Spring-cage terminals	2 x 1.5 mm ² or 1 x 2.5 mm ²
	Cable entry	M16 cable gland for cable dia. 5...10 mm
Environmental conditions	Operation	IEC 721-3-3
	Climatic conditions	Class 3K5
	Temperature	-15...55 °C
	Humidity	<85% r.h.
	Storage/transport	IEC 721-3-2
	Climatic conditions	Class 2K3
	Temperature	-25...65 °C
	Humidity	<95% r.h.
Materials and colors	Fatigue strength	DIN EN 60 721-3-3: Class 3M2
	Base	PA (RAL 7001, silver-grey)
	Cover	PC (transparent)
	Cap	ABS, (RAL 7035, light-grey)
	Capillary tube	Copper
	Packaging	Corrugated cardboard
Norms and standards	Product standard	EN 61326-x
	EU Conformity (CE)	8000036003 ^{*)}
Weight	QAF64.2-J	Approx. 0.34 kg
	QAF64.6-J	Approx. 0.41 kg

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

Internal diagram

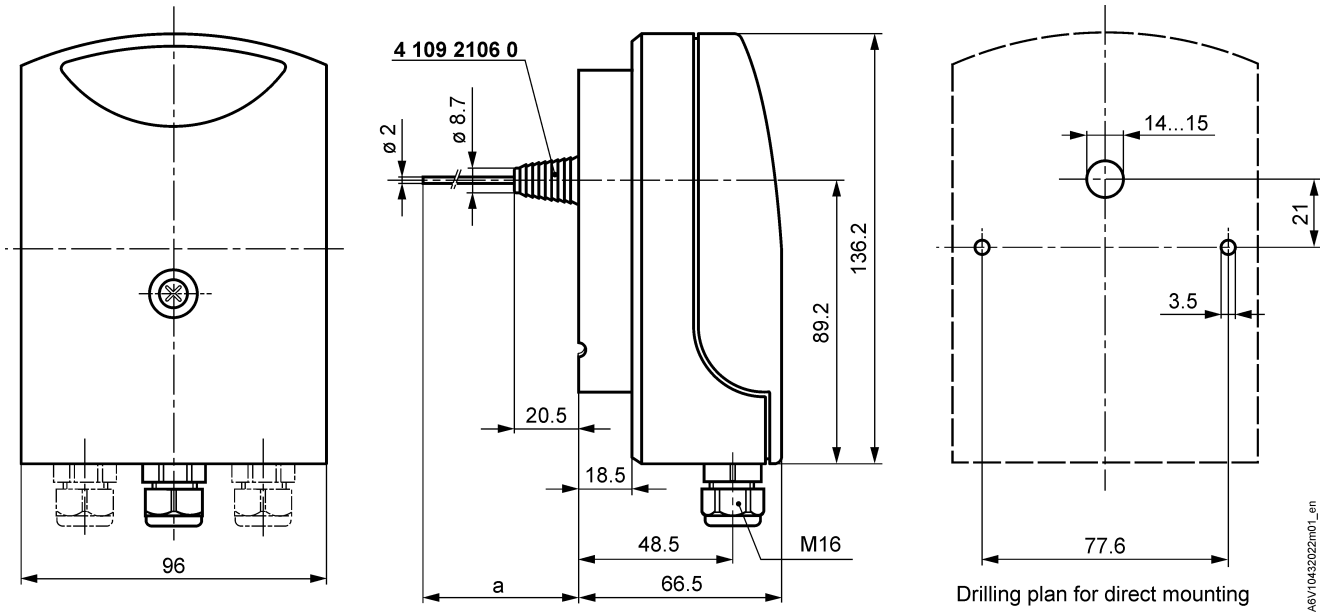


The diagram illustrates a three-phase motor control system with the following components and connections:

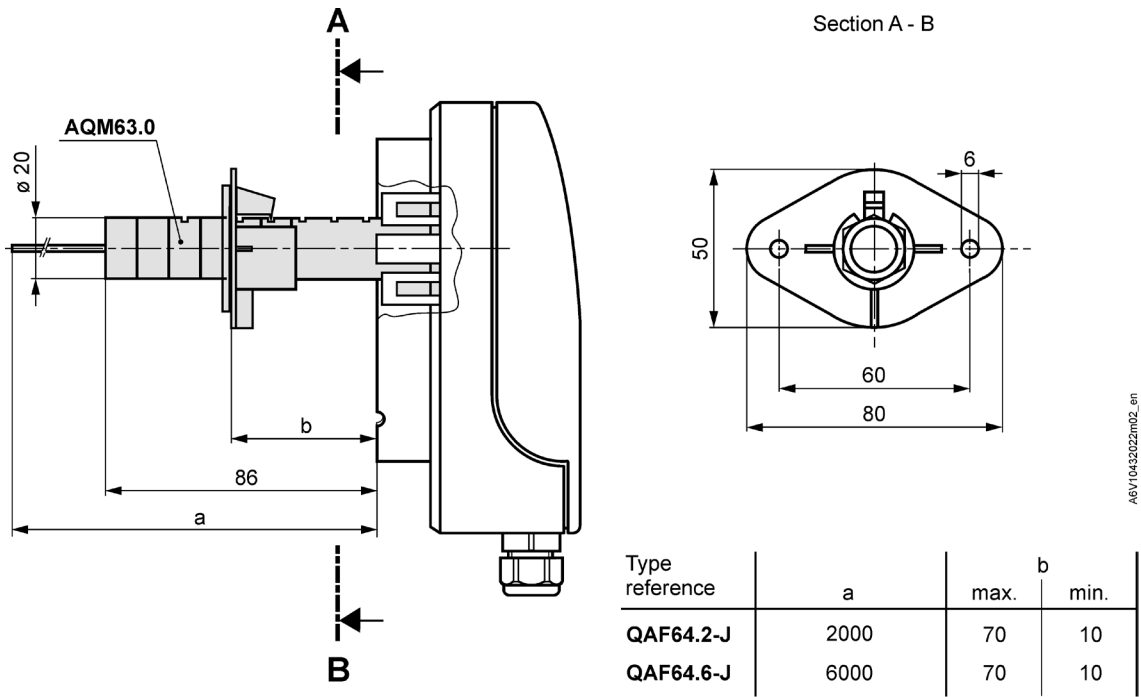
- Power Supply:** Three-phase AC 230 V and AC 24 V. The main supply lines are labeled L (Line), G (Ground), and N (Neutral). A ground symbol is shown at the bottom left.
- Main Switch (S1):** A switch labeled S1 is connected to the L line.
- Motor (M):** A three-phase motor with terminals G, Y, and B. It is connected to the L, G, and N lines.
- Interlocking Relay (K1):** A relay with terminals G, Y, and B. It is connected to the L, G, and N lines.
- Thermal Relay (F1):** A relay with terminals G, Y, and B. It is connected to the L, G, and N lines.
- Control Circuit:** A control circuit is connected between the L and N lines, passing through a fuse (F4) and a switch (S1). The control circuit includes a stop button (P1), a start button (H1), and a thermal relay (F1).
- Interlocking:** The interlocking relay (K1) is connected to the L and N lines, ensuring that the motor (M) and the thermal relay (F1) cannot be operated simultaneously.

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Dimensions



(Dimensions in mm)



QAF64... with depth-adjustable mounting flange AQM63.0

(Dimensions in mm)

Type reference	a	max.	b min.
QAF64.2-J	2000	70	10
QAF64.6-J	6000	70	10