



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.

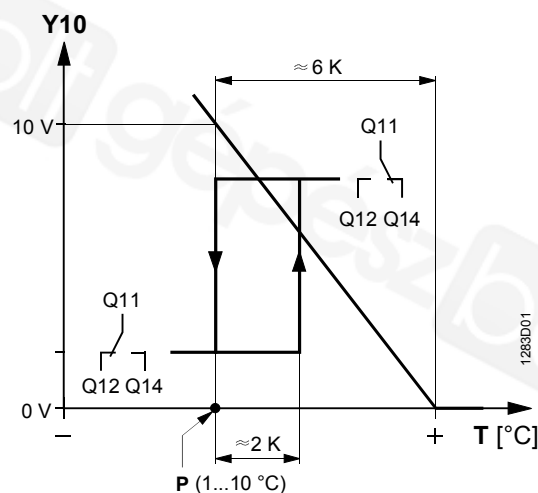
When correctly located at the air outlet of the air heating coil, the frost detector acquires the lowest air temperature even in the case of temperature stratification. The vapor pressure in the capillary tube produces a certain travel of the diaphragm. This movement is converted to an electric signal 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

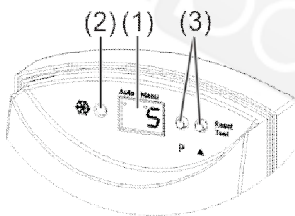
Operating modes

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

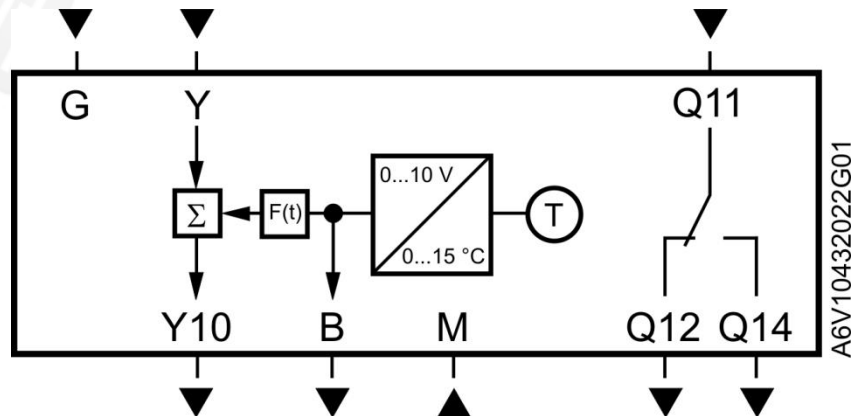
| | | |
|---|---|--|
| Power supply | Operating voltage | AC 24 V \pm 20% (SELV) |
| | Frequency | 50/60 Hz |
| | Power consumption | Max. 6.6 VA |
| | External supply line protection | Circuit breaker max. 13 A Characteristic B, C, D according to EN 60898 or Power source with current limitation of max. 13 A |
| 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...11.5 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 |
| | External supply line protection | see section power supply |
| 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. | |
| Degree of protection | Housing | IP42 according to EN 60529 |
| | Protection class | I |
| 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. | |
| | Fatigue strength | DIN EN 60 721-3-3: Class 3M2 |

| | | |
|--------------------------|-----------------------------|---|
| Materials and colors | Base | PA (RAL 7001, silver-grey) |
| | Cover | PC (transparent) |
| | Cap | ABS, (RAL 7035, light-grey) |
| | Capillary tube | Copper |
| | Packaging | Corrugated cardboard |
| Directives and standards | Product standard | EN 60730-1 |
| | Environmental compatibility | The product environmental declaration 8000079858 ^{*)} contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal). |
| | 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>

Diagrams

Internal diagram



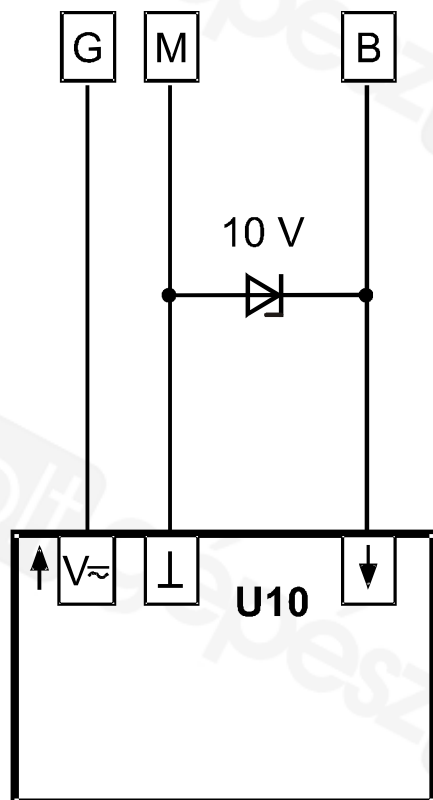
| | | |
|-----|--|---------------------------------|
| G | System voltage (SELV) AC 24 V | |
| M | System neutral, measuring neutral | |
| B | Measuring signal output DC 0...11.5 V $\hat{=}$ 0...15 °C | |
| Y | Signal input for valve control signal from the controller, DC 0...10 V | |
| Y10 | Signal output for valve control, DC 0...10 V | |
| Q11 | | } Relay contact AC/DC 5...250 V |
| Q12 | Closed when there is a risk of frost | |
| Q14 | | |

Note

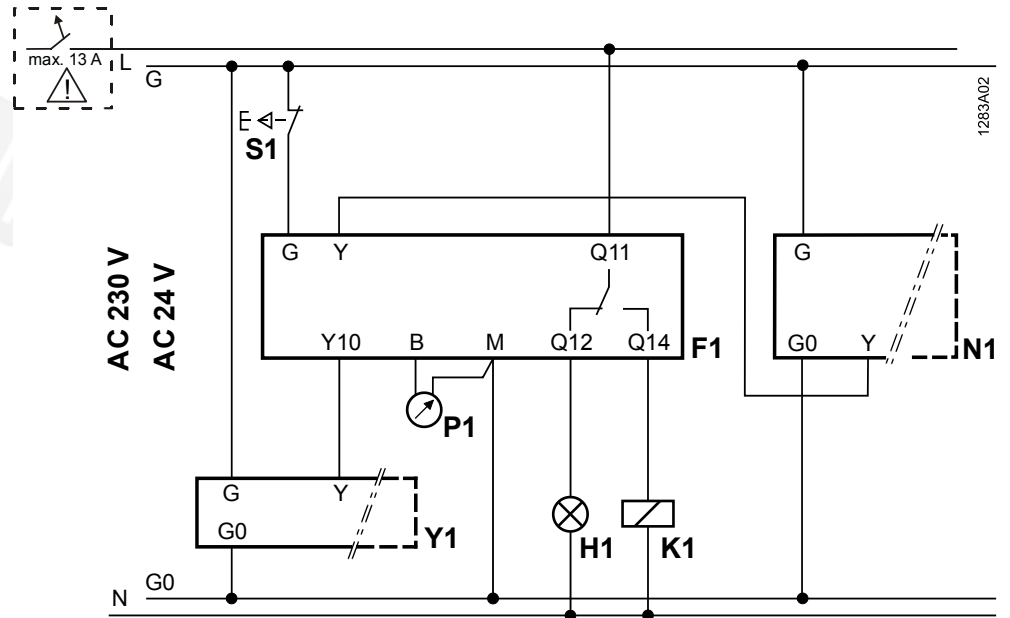
If terminal "B" of the QAF... is connected to a controller, signal >10 V might drop out (e.g. 11 V) which, with certain types of controllers, can lead to a fault status message.

Remedy

Fit a Zener diode to terminal "B" of the QAF.. or to the controller's input to ensure that the DC 0...10 V signal will not exceed 10 V.



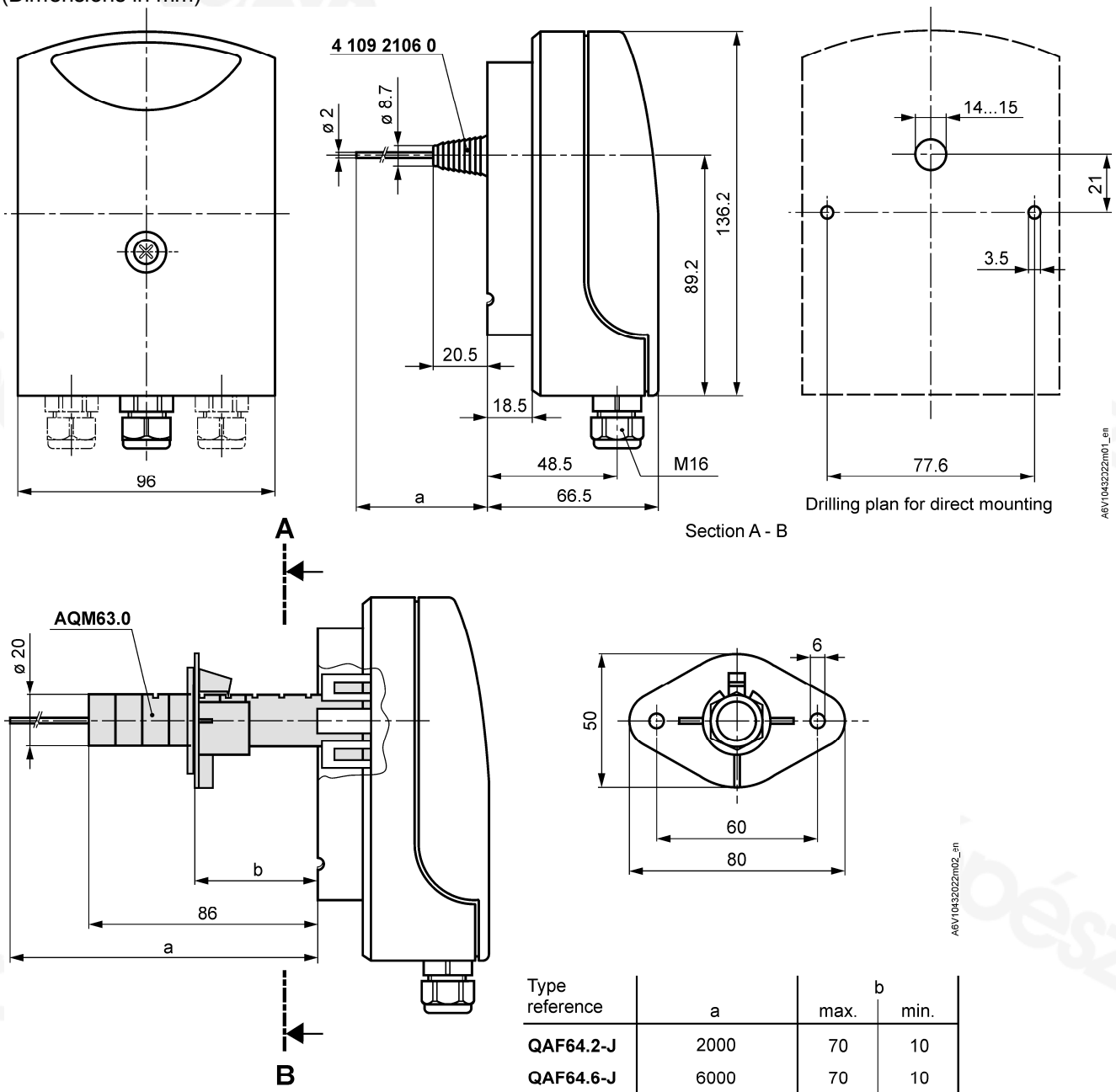
Connection diagram



- F1 Frost detector QAF64...
- N1 Controller delivering a DC 0...10 V control signal
- H1 E.g. external frost alarm device
- K1 E.g. fan contactor
- P1 E.g. temperature indication
- S1 If required: reset button for external cancellation of frost condition
- Y1 Actuating device

Dimensions

(Dimensions in mm)



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

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