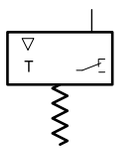
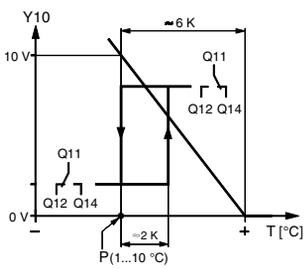
TFL 611: Continuous frost monitor with capillary sensor

TFL611F*01





How energy efficiency is improved

Demand-controlled, large-area monitoring of system components with active capillary sensor

Features

- Detects the lowest temperature that occurs for a length of at least 250 mm at any position along the capillary tube
- Used on air side in ventilation and air conditioning units where protective measures must be taken against freezing
- Active capillary sensor for measuring the lowest temperatures in the range 0...15 °C
- Vapour-filled capillary tube and diaphragm system with inductive system of measurement
- Setting range 1...10 °C
- Start-up function
- LED and 7-segment display
- Self-monitoring of sensor line

Technical data

Power supply		
	Power supply[1)]	24 V~, 10/-20%
	Power consumption	< 6.6 VA
	Frequency	50...60 Hz
Parameters		
	Measuring range	0...15 °C
	Setting range	1...10 °C
	Adjustment point	5 °C
	Accuracy for adjustment point	± 1 K
	Switching difference	Approx. 2 K
	Temperature for capillary tube	< 110 °C
	Time constant in still air	Approx. 90 s
	Time constant in moving air	< 40 s
	Response length for capillary tube	Min 250 mm
Inputs/Outputs		
	Admissible cable length	300 m with 1.5 mm²
Analogue input	Valve control for terminal Y	0...10 V
	Current	< 0.1 mA
Analogue outputs	Sensor temperature for terminal B	0...10 V ≙ 0...15 °C
	Valve control for terminal Y10	0...10 V
	Current	±1 mA
Potential-free relay outputs (Q terminals)	Min. switching capacity	12 V~/=, 100 mA
	Max. switching capacity	250 V~, 6(2) A; 24 V=, 6 A
Ambient conditions		
Operation	Humidity (non-condensing)	< 85% rh
	Temperature	-15...55 °C
Storage and transport	Humidity (non-condensing)	< 95% rh
	Temperature	-25...65 °C
Construction		
	Terminals with spring technology	Max. 2 × 1.5 mm² Or 1 × 2.5 mm² Min. 0.25 mm²
	Cable inlet	Cable gland M16 for cable diameter 5...10 mm
	Protection class[2)]	I
	Housing	PA, silver grey (RAL 7001)

1) *SELV/PELV: Safety Extra Low Voltage/Protected Extra Low Voltage*
2) *No earth conductor necessary*

Housing cover	PC, transparent
Cap	ABS, light grey (RAL 7035)
Capillary tube	Copper

Standards and directives

Vibration resistance	EN 60721-3-3 (class 3M2)
Type of protection	IP 42 (EN 60730)
Operation as per IEC 721-3-3	Class 3K5
Storage and transport as per IEC 721-3-2	Class 2K3
RoHS Directive 2011/65/EU	EN 50581
EMC directive 2004/108/EC	EN 61000-6-1, EN 61000-6-2, EN 61000-6-3
Low-voltage directive 2006/95/EC	EN 60730-1, EN60730-2-9

Overview of types

Type	Description	Weight
TFL611F201	Continuous frost monitor; 0...15 °C; capillary tube length= 2m	0.34 kg
TFL611F601	Continuous frost monitor; 0...15 °C; capillary tube length= 6m	0.41 kg

Accessories

Type	Description
0292146001	Set for duct fitting consisting of: 5 capillary-tube holders, 1 depth-adjustable flange
0303167000	Five holders for fitting the capillary tube
0374534001	Depth-adjustable flange

Intended use

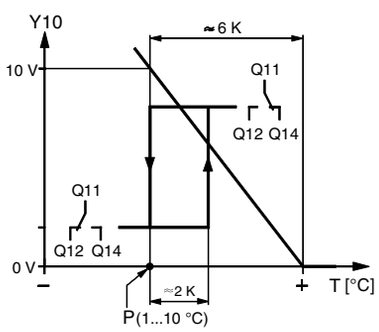
This product is only suitable for the purpose intended by the manufacturer, as described in the “Description of operation” section.
All related product regulations must also be adhered to. Changing or converting the product is not admissible.

Description of operation

The frost monitor uses a vapour-filled capillary tube and a diaphragm system to capture the lowest temperature that occurs at any point along a section of the capillary tube at least 250 mm long.
When the monitor is positioned correctly at the air outlet of the heating coil, it captures the lowest temperature that occurs even if there are different air temperature layers. In the process, the vapour pressure in the capillary tube causes a movement of the diaphragm box. The inductive system of measurement converts this movement into an electrical signal, amplifies it electronically and generates a 0...10 V measuring signal (terminal B).
The TFL 611... performs its task using three independent functions:
1. It opens the heating valve continuously within a proportional control range
2. It switches the fans off by means of its relay contacts and closes the dampers
3. It makes the measured temperature available for further processing

The measuring signal is processed into the frost signal for the monitoring function and the valve control. At around 6 Kelvin above the set frost point (P) the frost signal starts increasing.

Functional diagram



Key

P	Frost point (adjustable)
T	Capillary temperature
Y10	Valve control signal (at Y = 0 V)
Q11/12/14	Relay output (changeover) 230 V~

Start-up function

The frost signal is added to the valve control signal connected to signal input Y. The effect of this is that before the output relay is switched to the “Frost” position (Q11/Q12), the heating valve is opened fully via signal output Y10. This switching prevents the system from turning on and off multiple times when it starts up. To ensure that the lowest temperature is always detected at the capillary tube, the temperature of the diaphragm box in the interior of the housing must always be above the capillary temperature. This is performed by the controlled heating that is installed in the housing as standard, which keeps the diaphragm box temperature at over 15 °C at an ambient temperature of as low as –15 °C.

Operating modes

There are three operating modes that can be selected:

Automatic mode “Auto”

After a frost switch-off, when the capillary temperature increases (> 2 K), the output relay automatically switches back into the normal position.

Manual mode “Manu”

After a frost switch-off, when the capillary temperature increases (> 2 K), the output relay only switches back when either the internal reset button is pressed or there is a supply voltage interruption (possibly with an external reset button).

Test mode “Test”

In the test mode, the output relay is forced to switch to the “Frost” position. Valve control signal Y10 is not affected.

When the unit switches back to the “Manu” switch position, the frost position is maintained; it must be deleted with the reset button.

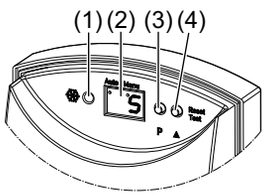
Indicating and operating elements

Operating modes

The device has different operating modes that permit different settings and adjustments of the setpoint:

- “Auto” automatic mode (normal setting)
- “Test” frost simulation using button
- “Manual” function

Note
In the “Manual” operating mode, the setpoint may only be adjusted by trained qualified personnel.



Key

1	Switching point indicator	1 LED for relay output
2	Display	7 segment display, two-digit, red
3, 4	Buttons	For operating and programming the device and for performing the reset in the manual operating mode

Design

The frost monitor consists of a two-part plastic housing, lower section and cover, and a capillary active along the whole length. The cover is fastened to the lower section of the housing by means of a screw and can be removed. The housing contains: the electronic circuitry, the diaphragm box with heating, the setting elements, the type plate and the connection terminals. The connection terminals, setting elements and type plate are accessible after the cover is removed. The cables can be inserted at the bottom of the housing. There is an opening without thread provided for this, for the M16 screw fitting supplied, and two pre-scored inlets for additional M16 screw fittings. The frost monitor is designed both for direct wall mounting, with or without test loops, and for wall mounting with a flange (for air duct insulation).

Engineering and fitting notes

The monitor must be supplied with a voltage of 24 V~. A transformer for protective extra-low voltage with separate winding and for 100% operating time must be used. Fuses, switches and wiring must be provided according to the local regulations. The admissible cable lengths must be adhered to. If the capillary is damaged mechanically, or if there is a leak somewhere else in the diaphragm system,

the frost monitor falsely detects a low temperature and goes into the “Frost” position. The same applies to a power failure or the failure of important electronic switching components.
In the case of larger air duct diameters, the monitoring of a heating coil can be performed with multiple TFL 611 via:

- Series connection of the TFL 611 valve control signal outputs/inputs
- Series connection of the TFL 611 relay contacts

Note
If the relay contacts (Q11/Q12/Q14) are being operated with low voltage (U > 50 V), the following conditions apply:

- For adjustment work, the device may only be opened by authorised electricians, or the relay circuit must be disconnected from the electrical supply.
- With the manual operating mode, an external button must be fitted for the reset function. (see connection diagram)

Place of installation

On the warm side of the heating coil (air/water heat exchanger).

Fitting the housing

Direct fitting
Mount the housing (with integrated fixing holes) on the wall of the heating coil. Protect the capillary tube in the ventilation duct opening with the rubber plug supplied.
Direct fitting with test loop for function test
Mount the housing (with integrated fixing holes) on the wall of the heating coil while leading the capillary tube out through an opening in the housing on the side. Form a test loop with the capillary tube and then lead the capillary tube into the air duct. Protect the capillary tube in the ventilation duct opening with the rubber plug supplied. This fitting method is unsuitable if the ambient temperature at the external test loop can be lower than at the measuring point in the air duct. (The measuring signal of the sensor always corresponds to the lowest temperature, wherever this occurs on the capillary tube!)
With flange (see accessories)
Suitable for air ducts with insulations up to 70 mm. Mount the flange on the wall of the heating coil and lead the capillary tube through the flange into the air duct.

Capillary tube installation

Pull the capillary tube in windings at a uniform distance over the entire heating coil and fasten it with spacer clamps to the slats at a distance of around 50 mm from the slats. Fitting accessories (see accessories).

Damage to property
►The capillary tube must not be kinked. When it is bent, the radius of the bend should be as large as possible.

Notes on installation

The connection terminals are protected against incorrect wiring for voltages up to 24 V~. There is no protection against the incorrect connection of 230 V~ mains power supply.

Information on commissioning

The enclosed instructions must be followed when commissioning and adjusting the frost monitor. No adjustments to the frost sensor are required (factory setting is 5K).
Manual function test:
The operation of the frost sensor can be tested using a test loop and an ice-water mixture or ice spray. Frost can be simulated in this way and the installation can be tested for frost at the same time (switch-off functions).
Function test using function button on device:
A “frost test” function is implemented in the menu, i.e. “frost” can be simulated with this function and the installation can be tested for frost at the same time (switch-off functions).

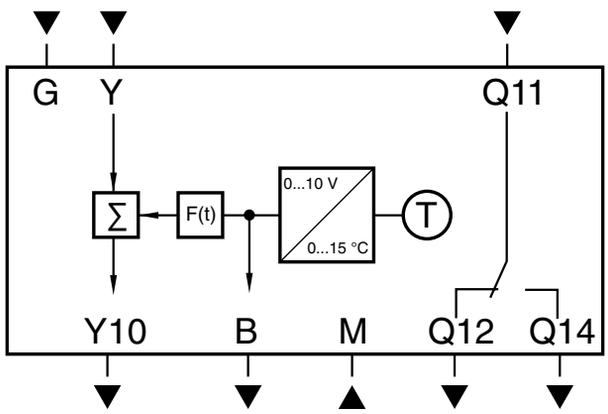
Parameters and configuration

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

Disposal

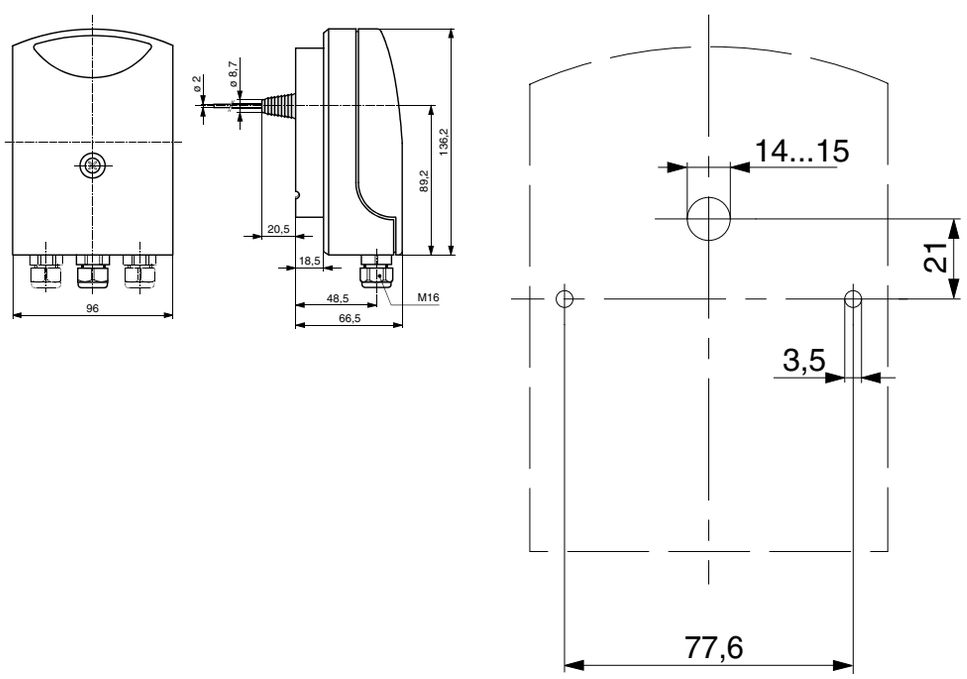
When disposing of the product, observe the currently applicable local laws.
More information on materials can be found in the Declaration on materials and the environment for this product.

Connection diagram



Key	
G	System voltage ~ 24 V
M	System null, measuring null
B	Measuring signal output = 0...10 V ≙ 0...15 °C
Y	Signal input for controller valve control signal = 0…10 V
Y10	Signal output for valve control = 0…10 V
Q11, Q12, Q14	Relay contacts ~ 12...250 V Min 100 mA, max 6(2) A Relay contacts = 12...24 V Min 100 mA, max 6A

Dimension drawing



Accessories

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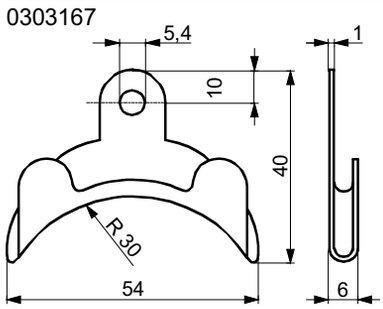

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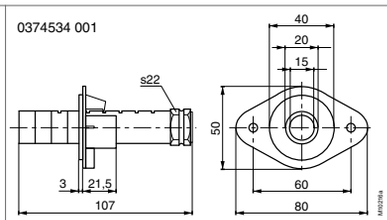

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