

## TFL 611: Continuous frost monitor with capillary sensor

For monitoring the temperature of large-surfaced system components, in order to prevent freezing, e.g. for heating coils, water pipes or air ducts with continuous frost-protection control with fully active capillary sensor.

Compact unit for mounting on walls. Transparent cover of impact-proof thermoplastic. With frost-protection control. Micro-switch with single-pole change-over. Setpoint adjuster with scale for the lower switching point. Capillary sensor of copper with grommet, with safety function (in the event of the capillary tube breaking or leakage) by means of a continuous output signal (0...10 V d.c.). LED indicator lights up when there is a risk of frost; variable operating modes Auto and Manual. Versions with capillary tubes of 2 m and 6 m in length.



T10412

Type	Capillary tube	Setting range $X_s$ °C	Switching diff. $X_{sd}$ K	Permissible sensor temp. °C	Weight kg
<b>TFL 611 F200</b> <sup>1)</sup>	2 m	1...10	2	-15...110	0,34
<b>TFL 611 F600</b> <sup>1)</sup>	6 m	1...10	2	-15...110	0,41
Power supply	24 V~, ± 20%		Active capillary length <sup>3)</sup>		min. 250 mm
Power consumption	6 VA		Factory setting		5 °C
Measuring range of sensor	0...15 °C / 0...10 V=		Temp. at head of instrument <sup>4)</sup>		-15...60 °C
Control signal output	0...10 V=, max. ± 1 mA		Degree of protection		IP 42 (EN 60529)
Max. length of cable at 1,5 mm <sup>2</sup>	300 m		Protection class		II (IEC 60730)
Control signal input	0...10 V=, max. ± 0,1 mA		Wiring diagram		<a href="#">A10390</a>
Contact rating maximum <sup>2)</sup>	6(4) A, 250 V~		Dimension drawing		<a href="#">M10422</a>
Contact rating minimum	5 mA, 5 V~		Fitting instructions		MV 505954
Time constant in still air	90 s				
Time constant in moving air	40 s				

### Accessories

**0292146 001\*** Set for duct fitting consisting of: 5 capillary-tube holders, 1 depth adjustable flange

**0303167 000\*** 5 capillary-tube holders

**0374534 001\*** Depth adjustable flange

\*) Dimension drawing or wiring diagram are available under the same number

1) The accessory 0292146 001 for duct fitting must be ordered separately.

2) If under inductive load, take RC circuit into account.

3) The monitor always reacts to the coldest place (minimum length is 250 mm).

4) The head of the instrument is frost protected for ambient temperatures up to max. -15 °C by a heating system.

### Operation

Using a vapour-filled capillary tube and diaphragm system, the frost monitor measures the lowest temperature that occurs anywhere along at least 250 mm of the capillary tube.

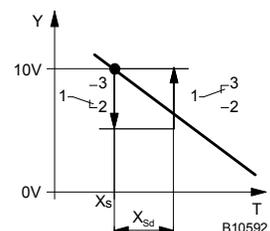
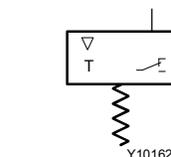
If the monitor is correctly positioned at the air outlet of the heating coil, it measures the lowest temperature even if there are strata of differing air temperatures. In so doing, the steam pressure causes a movement of the diaphragm capsule in the capillary tube. By means of an inductive measuring system, this movement is converted into an electric signal and is amplified electronically; it then creates a 0...10 V d.c. measuring signal.

The TFL 611 fulfils its task with the aid of three independent functions:-

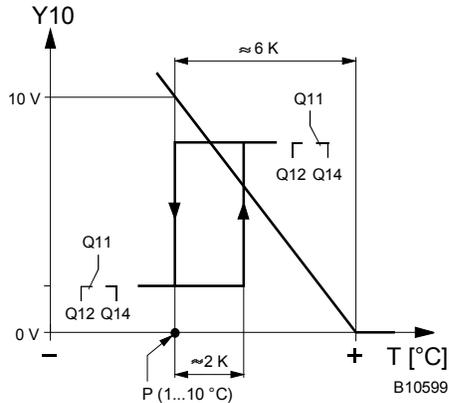
1. It continuously opens the heating valve within a proportional control range.
2. It switches the ventilators off and closes the dampers via its relay contacts.
3. It makes the measured temperature available for further processing.

The measuring signal is processed further for the monitor function and the valve control to the frost signal.

At about 6 Kelvin above the set frost point (P), the frost signal starts to rise.



**Functional diagram**



**Key**

- P (Xs) Frost point, variable
- T Capillary temperature
- Y10 Valve control signal (when Y = 0 V d.c.)

**Start-up function**

The frost signal is added to the valve control signal that is fed to signal input Y. This causes the heating valve to be opened via signal output Y10 before the output relay is switched to the 'Frost' position (Q11-Q12). This circuit prevents the system from switching on and off several times when starting up. In order to ensure that the temperature measured at the capillary tube is always the lowest one, the temperature of the diaphragm capsule inside the housing must always be higher than the temperature of the capillary tube. This is achieved using the controlled heater that is installed in the housing as standard, which maintains a diaphragm capsule temperature of above 15 °C even at an ambient temperature of -15°C.

**Operating modes**

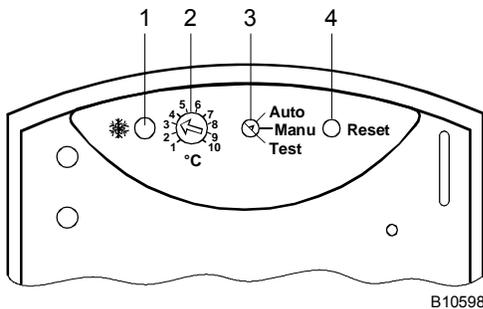
There are three operating modes which can be selected using a rotary switch:-

- Automatic mode (Auto) After a frost shut-off, the output relay automatically returns to its normal position when the capillary tube temperature increases (> 2 K).
- Manual mode (Manu) After a frost shut-off, the output relay does not switch back (when the capillary tube temperature is increasing, i.e. > 2 K) until either the internal reset button has been pressed or the power supply has been switched off (using an external reset button if necessary).
- Test mode (Test) In test mode, the output relay is forced into the 'Frost' position. The valve control signal Y10 is not affected. When the equipment switches back to the 'Manu' switch position, the frost position is retained and can be cancelled using the reset button.

**Features**

The frost monitor consists of a two-piece plastic housing, a lower part and a lid, and a capillary that is active over its entire length. The lid is attached to the lower part of the housing with a screw. The housing contains: the electronic circuit, the diaphragm capsule with heater, the adjustment elements, the type plate and the connecting terminals. The connecting terminals, the adjustment elements and the name plate are accessible after removing the lid. The cables can be routed at the bottom of the housing. The wires can be fed through at the bottom of the housing. For this purposes, the housing has a break-out aperture without a thread for a M16 screw connection and two break-out inputs for additional M16 screw connections. The frost monitor is designed for direct wall mounting with or without a test loop, and also for wall mounting with a mounting flange (for air-duct insulation).

**Setting elements**



**Key**

- 1 LED indicator (red) denoting risk of frost
- 2 Potentiometer for setting the frost point
- 3 Mode switch with three operating modes: Auto, Manu and Test
- 4 Reset button for resetting the frost status in normal mode

**Engineering and fitting notes**

The monitor requires a power supply of 24 V AC. A transformer for safety extra-low voltage (SELV) with separate windings and for 100% duty cycle should be used.

Fuses, switches, wiring and earthing should be implemented in accordance with local regulations. The maximum permissible cable lengths should be observed.

If the capillary becomes mechanically damaged or there is a leak somewhere in the diaphragm system, the frost monitor simulates a low temperature and moves to the 'Frost' position. The same applies in the event of a power failure or when important electronic components malfunction.

**Where to fit**

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

**Fitting the housing**Direct fitting

Fit the housing (with its integrated fixing holes) onto the wall of the heating coil. Protect the capillary tube in the air-duct hole with the rubber plugs provided.

If fitting inside the duct, fit the housing to the inside wall of the heating coil, feeding the capillary tube through a housing hole at the side.

Direct fitting, with test loop for operational test

Fit the housing (with its integrated fixing holes) to the wall of the heating coil, feeding the capillary tube through a housing hole at the side. Form a test loop with the capillary tube and then feed the capillary tube into the air duct. Protect the capillary tube in the air-duct hole with the rubber plugs provided.

This method of fitting is unsuitable if the ambient temperature at the test loop (which is outside) can fall below that at the place of measurement in the air duct (the measuring signal of the sensor always equates to the lowest temperature, wherever it occurs on the capillary tube).

With accessory 0292146 001

Suitable for air ducts with insulation of up to 70 mm.

Fit the flange onto the wall of the heating coil and feed the capillary tube through the flange into the air duct.

**Fitting the capillary tube**

Wind the capillary tube in coils, keeping the same distance, around the whole heating coil and fix to the fins with spacer clamps at a distance of about 50 mm to the fins (accessory 0303167).

Note

The capillary tube should not be bent sharply. Any bends should have as large a radius as possible.

**Fitting notes**

The connection terminals are protected against being wired up incorrectly with regard to own voltages of up to 24 V a.c. There is no protection against incorrect connection of 230 V a.c. mains.

**Putting into service**

The frost monitor should be put into service and set up in accordance with the instructions supplied.

The frost monitor can be tested for correct operation with a test loop using an ice/water mixture.

The relay output can be checked using the operating-mode switch (in the 'Test' position).

**Additional technical data**

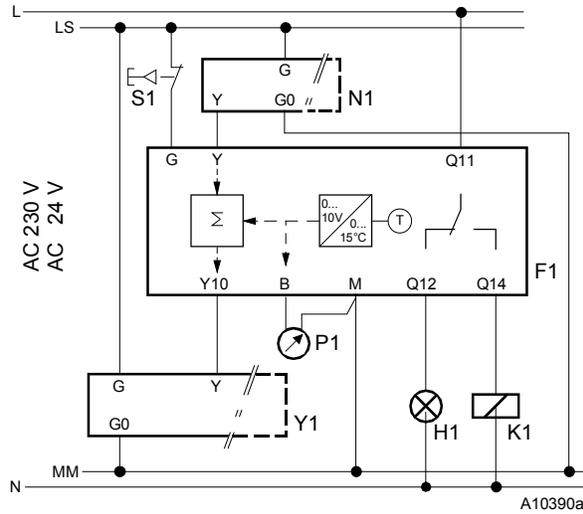
Conforms to:-

Low-voltage directive 2006/95/EC EN 60730-1

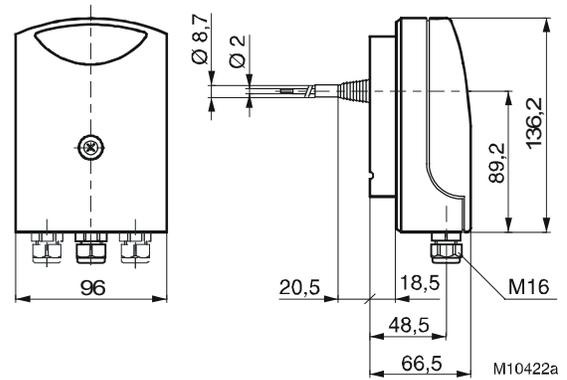
EMC directive 2004/108/EC

EN 61000-6-1/ EN 61000-6-2  
EN 61000-6-3/ EN 61000-6-4

**Wiring diagram**



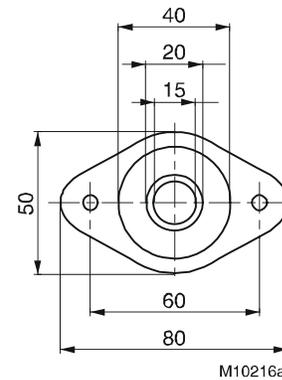
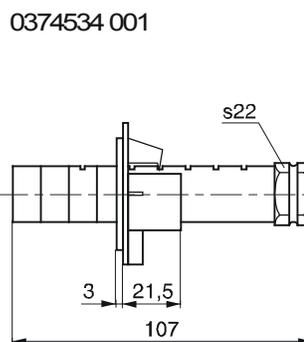
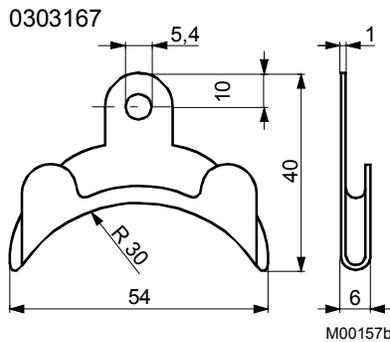
**Dimension drawing**



**Key**

F1	TFL 611 frost monitor	G	System power (SELV) 24 V a.c.
N1	Controller with 0...10 V d.c. control signal	M	System zero, measuring zero
H1	e.g. external frost transmitter	B	Measuring signal output 0...10 V d.c. $\hat{=}$ 0...15 °C
K1	e.g. ventilator protection	Y	Signal input for 0...10 V d.c. controller valve control signal
P1	e.g. temperature indicator with signal input 0...10 V d.c. and display range of 0...15 °C	Y10	Signal output for 0...10 V d.c. valve control
S1	If required: button for external release of frost position	Q11	
Y1	Control element with 0...10 V d.c. control signal input	Q12	Closed when risk of frost
		Q14	Relay contacts 5...250 V a.c./d.c.

**Accessories**



0292146 001:  
5 pcs. 0303167 000 + 1 pcs. 0374534 001