Operating instructions, mounting & installation

# FST

**Frost protection thermostat, mechanical, 1-step**

# FS

**Frost protection thermostat**

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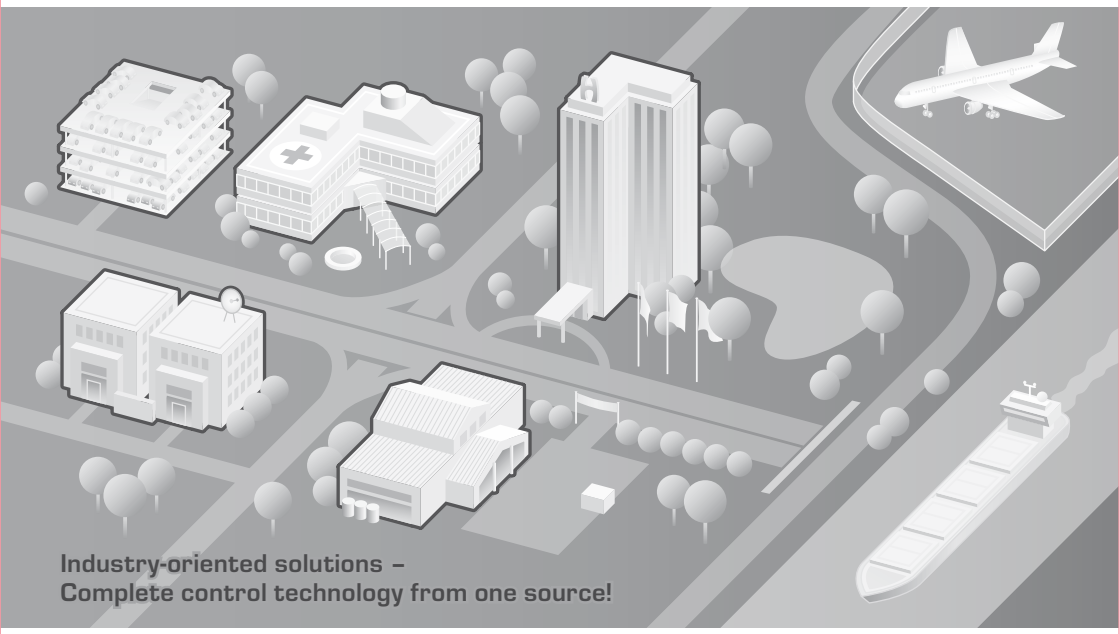

**Industry-oriented solutions –
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# FST

## Frost protection thermostat, mechanical, 1-step, with switching output

**APPLICATION:**
For protecting heat exchangers, water circulating systems, and heating registers against freezing up. All devices are self-secure and have lead-sealable setpoint adjustment. FST-3 and FST-5 can also be used for monitoring liquids. The sensor tube can be installed inside an emersion sleeve.

**TECHNICAL DATA:**

Switching capacity: ..... 10 (4) A; 24...250 V AC

Setting range: ..... -10 °C...+12 °C/14 °F...50 °F, preset to +5 °C falling

Operating difference: ..... 1K

Contact: ..... dustproof micro switch as single-pole potential-free changeover contact

Enclosure temperature: ..... -15 °C...+55 °C

Sensor and capillary: ..... made of copper, active over the entire length

Sensor temperature: ..... -20 °C...+110 °C

Process connection: ..... by mounting clamps MK-05-K (included in the scope of delivery)

Connecting head: ..... plastic, material polyamide, 30% glass-globe-reinforced, with quick-locking screws, colour pure white (similar RAL9010)

Dimensions: ..... 108 x 72.5 x 70 mm

Electrical connection: ..... 0.14 - 1.5 mm² via terminal screws

Cable union: ..... M20, including strain relief

Protection class: ..... I (according to EN 60730)

Protection type: ..... IP 65 (according to IEC 529)

Standards: ..... CE conformity, EMC directive 89/336/EWG, low-voltage directive 73/23/EWG

Place of installation: ..... enclosure to be installed in a place where ambient temperature at the enclosure cannot drop below the controller's set point value

**FUNCTION:**

Heating: ..... Wire contacts 1 - 4.

Contact 1 - 4 closes when temperature drops below the preset setpoint value or in case of frost.

Simultaneously, contact 1 - 2 breaks and can be used as signal contact.

The FST is "self-secure", i.e. in case of a capillary system damage, it switches automatically to heating function. Contact 1 - 4 closes and therefore, can be used as operating contact.

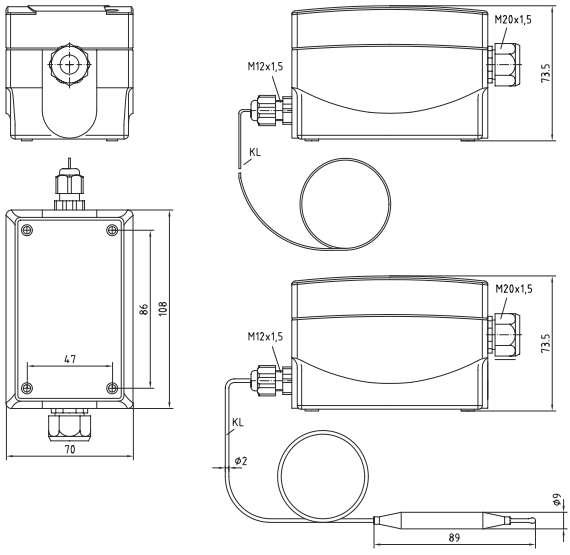
**FST-1/5**

**FST-3**

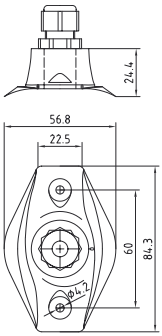
**Frost protection thermostat FST, 1-step, including mounting clamps:**

| Typ/WG2 | Temperature-range | Steps | Features Control characteristics | Length-of capillary |
|---|---|---|---|---|
| **FST-1D** | -10 °C...+12 °C | 1-step | TR, automatic | 6,0 m |
| **FST-3D** | -10 °C...+12 °C | 1-step | TR, automatic | 1,8 m |
| **FST-5D** | -10 °C...+12 °C | 1-step | TR, automatic | 3,0 m |
| Optional: | **HR** = Manual reset | | | |
| Accessories: | **KRD-04** | Capillary tube gland bracket | | |
| | **MK-05-K** | Mounting clamps (6 pieces), plastic | | |
| | **TH-ms-01** | Immersion sleeves, brass, for FST-3 | | |
| | **TH-VA-02** | Immersion sleeves, stainless steel, for FST-3 | | |
| | Immersion sleeve | Immersion sleeves see last chapter | | |
| Note: | FST-x **D** | TR = temperature controller (means: automatically switching) | | |

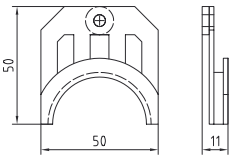
Dimensional drawing **FST**



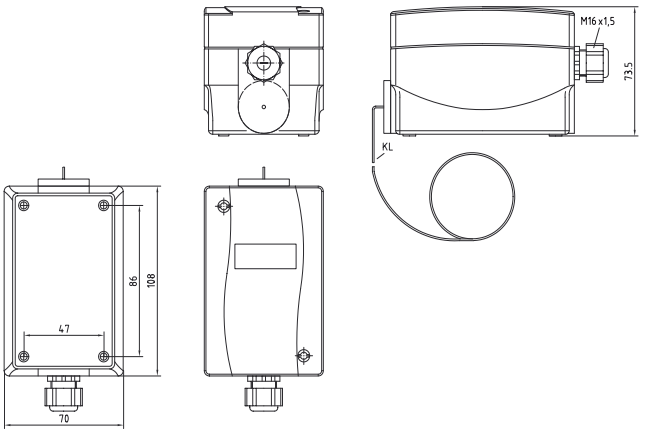

Dimensional drawing **KRD-04**




Dimensional drawing **MK-05-K**




Dimensional drawing **FS**




**KRD-04**

**MK-05-K**

# FS

## Frost protection thermostat with active and switching output

REGELTECHNIK

**APPLICATION:**

Frost protection thermostat for monitoring air conditioning systems, heat exchangers, heating registers, and similar equipment. Falling below the limit value at the coldest measuring point of the capillary tube is detected.

**TECHNICAL DATA:**

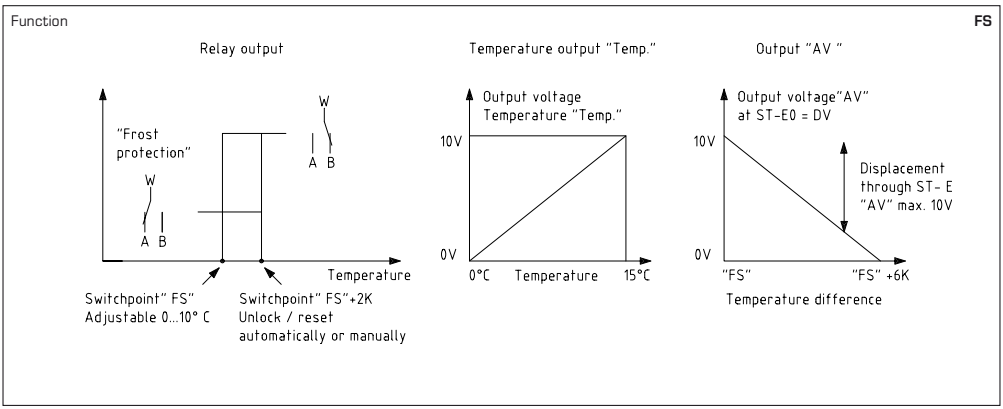
| | |
|---|---|
| Power supply: | 24 V AC/DC |
| Measuring range: | 0...+15 °C<br>(other ranges optional) |
| Output: | 1 x 0-10 V (equivalent to 0...+15 °C)<br>1 x 0-10 V summation output<br>(frost signal and control voltage)<br>1 x potential-free changeover contact, closing when falling below the limit value, setting range 0...+15 °C |
| Ambient temperature: | -15...+50 °C |
| (Enclosure) | |
| Current consumption: | max. 10 mA at 24 V DC |
| Accuracy: | ± 1 K (at 10 °C) |
| Hysteresis of switching step: | 2K |
| Sensor and capillary: | copper, active over the entire sensor length, min. 25 cm |
| Temperature: | -20...+110 °C |
| (sensor and capillary) | (capillary tube at a distance >20 cm from enclosure) |
| Connecting head: | plastic, material polyamide, 30% glass-globe-reinforced, with quick-locking screws, colour pure white (similar RAL 9010) |
| Dimensions: | 108 x 72.5 x 70 mm |
| Electrical connection: | 0.14 - 1.5 mm² via terminal screws |
| Cable union: | M 16, including strain relief |
| Switch-on/start-up time: | < 1 min |
| Response time: | $t_{90}$ < 5 s |
| Humidity: | < 95% r.H., non-precipitating air |
| Protection class: | III (according to EN 60 730) |
| Protection type: | IP 65 (according to IEC 529) |
| Standards: | CE conformity, electromagnetic compatibility according to EN 61 326 + A1 + A2, EMC directive 89/336/EWG, low-voltage directive 73/23/EWG |

**FS**

**FS with Display**

**Rod sensor FS, including mounting clamps:**

| Typ/WG1 | Output | | Sensor length |
|---|---|---|---|
| **FS 1-U** | 1 x 0-10 V | 1 x normally-open contact | 3,0 m |
| **FS 2-U** | 1 x 0-10 V | 1 x normally-open contact | 6,0 m |
| **FS xx-U-Display** | | | |
| Accessories: | **MK-05-K**<br>**KRD-04** | Mounting clamps (6 pieces), plastic<br>Capillary tube gland bracket | |




**FUNCTION FS-U:**

Inside the capillary of the frost protection control device, a pressure signal is generated through the filling used, which is proportional to the lowest temperature over the entire capillary length (minimum however over 200 mm). A pressure sensor converts this pressure signal into an electric signal, amplified by electronics. The thereby generated standard signal 0...10 V equivalent to 0...15 °C is output. This voltage is available at the terminal marked „Temp." In addition, a switchpoint for the potential-free changeover contact can be preset at a 270-degree adjusting screw over a range from 0 °C (left stop) to 10 °C (right stop). When temperature falls below switchpoint „FS", the relay output switches to position „frost protection" (contact „W" connected with contact „A"). If temperature rises by more than 2 K above the preset switchpoint „FS", the system changes back to normal operating mode when „automatic mode" is selected. The relay drops back to initial position (contact „W" connected with contact „B").
When operating mode „manual operation" is selected, the relay output does not automatically switch over also when the preset switchpoint „FS" + 2 K is exceeded, but needs to be reset manually by pressing the „Reset" button or by disconnecting the device from operating voltage.

Additionally, a second voltage output "AV" is available, indicated by 0...10 V. At a voltage of 0 V at control input „ST-E", output voltage "AV" is always then 0 V, when measured temperature is at least 6 K above the preset switchpoint „FS". When measured temperature falls below preset switchpoint „FS"+ 6 K, voltage output „AV" rises linear from 0 V to 10 V. The increase here amounts to 1.67 V per Kelvin approach to the preset switchpoint „FS". Thus, output voltage 10 V will be measured at „FS" = measured temperature. When control input „ST-E" is increased, output voltage „AV" is also increased by that amount. So output „AV" represents a summation output for the input variables „ST-E" and "frost signal". Here, the variable „frost signal" describes the output behaviour of „AV" at „ST-E" = 0 V. Maximum output voltage is limited to 10 V.

**Selected examples:**

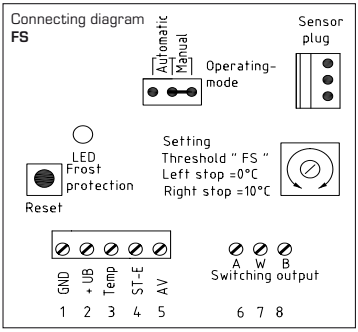
| Preset threshold „FS" | Minimum temp. measured | Output „Temp." | Control voltage „ST-E" | Output voltage „AV" |
|---|---|---|---|---|
| 5°C | 12°C | 8 V | 0 V | 0 V |
| 5°C | 12°C | 8 V | 5 V | 5 V |
| 5°C | 8°C | 5,33 V | 0 V | 5 V |
| 5°C | 8°C | 5,33 V | 5 V | 10 V |
| 5°C | 8°C | 5,33 V | 0 V | 10 V * |

* : Calculative, an output voltage of 13 V is generated, which is limited by electronics to 10 V..

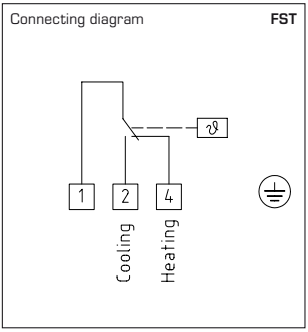
**SAFETY SWITCHING:**

In case of power failure of operating voltage and/or in case of capillary breakage,
the relay output witches to position „frost protection" (contact „A" with contact „W" = currentless condition).
When device inside temperature drops below 10 °C, the heating output is activated (heating element to be ordered separately).

# Connecting diagram and scheme




GND Operating voltage GND
+UB Operating Voltage 24VAC/DC
Temp Output temperature 0-10V=0...15°C
ST-E Control input 0-10V
AV Summation output 0-10V (optional)
B Contact B changover
W Contact W changover
A Contact A changover

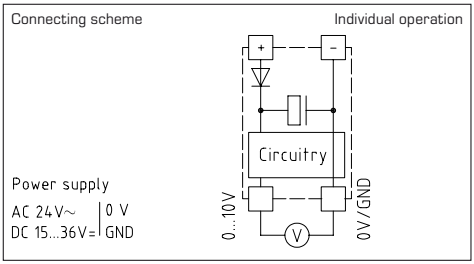



**SUPPLY VOLTAGE FS:**

For operating voltage reverse polarity protection, a one-way rectifier or reverse polarity protection diode is integrated in this device variant. This internal one-way rectifier also allows operating 0 – 10V devices on AC supply voltage.

The output signal is to be tapped by a measuring instrument. Output voltage is measured her against zero potential (0V) of the input voltage!

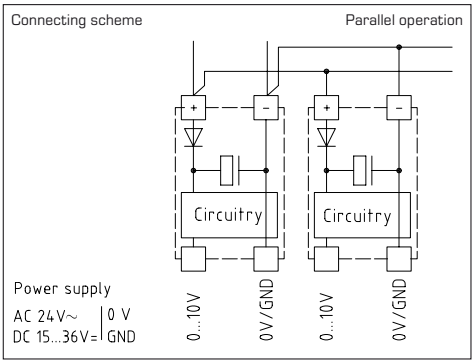
When this device is operated on **DC supply voltage**, the operating voltage input UB+ is to be used for 15...36V DC supply and UB – or GND for ground wire!




When several devices are supplied by one 24V **AC voltage supply**, it is to be ensured that all "positive" operating voltage input terminals (+) of the field devices are connected with each other and all "negative" operating voltage input terminals (–) (= reference potential) are connected together (in-phase connection of field devices). All outputs of field devices must be referenced to the same potential!

In case of reversed polarity at one field device, a supply voltage short-circuit would be caused by that device. The consequential short-circuit current flowing through this field device may cause damage to it.

**Therefore, pay attention to correct wiring!**



# Mounting and Installation

**Notes regarding FS:**

- Please ensure that the minimum temperature at the capillary does not develop at the device's enclosure or at the sensors (installed inside the enclosure).
- The limit value must actually be exceeded over more than 20 cm of the length of the capillary. This necessary minimum length of 20 cm may subdivide into several sections.
- The capillary must not be bent or buckled several times. This could cause leakage and the system's failure to function.
- The voltage output is short-circuit proof.
- Applying overvoltage will destroy the device.
- If this device is operated beyond the specified range, all warranty claims are forfeited.

**Notes regarding FST:**

A preset setpoint value can be lead-sealed at the adjusting screw. **It is absolutely necessary to ensure that ambient temperature at the device does not drop below the preset setpoint temperature. This device must be operated in a non-precipitating pollutant-free ambience.**

The 3 m and 6 m long capillaries are active for a minimum contact length of 300 mm over their entire lengths. Devices with 1.8 m long capillaries have a capillary sensor and only that one is temperature-sensitive. This device may be mounted in any position. The cover should be removed during mounting and electrical connection. Screws delivered together with the device are used for fastening. To avoid damaging the capillary, recoil capillary in the opposite direction as delivered. Avoid pulling the coil in axial direction.

- Lay capillary meander-like (see diagram) and fasten it by mounting clamps MK-05.
  Lay capillary so that vibrations cannot affect the system.
- The minimum bending radius is ca. 35 mm. Buckling the capillary results in damaging the system and is to be avoided.
- When capillary system is damaged, the device switches to "frost protection", i.e. contacts (1 - 4) are closed.
- Operability of frost protection thermostats must be checked before each winter and/or in regular maintenance intervals and should be additionally monitored in a safety chain by the temperature sensors in the control loop.
- When sensitive equipment is monitored, redundant measuring systems must be installed in several independent safety loops.

**Electrical connections – FST:**

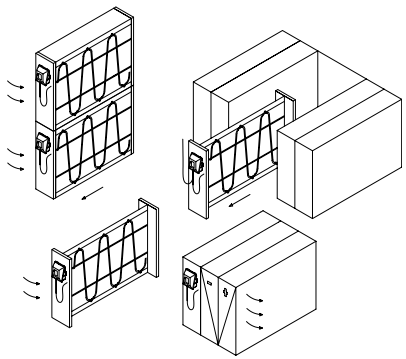
HEATING:

To ensure the frost function, wire contacts (1 - 4).
This contact closes when temperature drops below the preset value.

COOLING:

Wire contact (1 - 3). This contact breaks when temperature drops below the preset value.
The free contact closes simultaneously (signal contact).

Mounting diagram **FS/FST**



**Accessories:**

| | |
|---|---|
| **TH-ms-01** | brass immersion sleeve 120 mm |
| **TH-VA-02** | stainless steel immersion sleeve 120 mm |
| **KRD-04** | capillary tube penetration bracket for air ducts |
| **MK-05 1** | set of 6 mounting clamps |

# General notes

Our "General Terms and Conditions for Business" together with the "General Conditions for the Supply of Products and Services of the Electrical and Electronics Industry" (ZVEI conditions) including supplementary clause "Extended Retention of Title" apply as the exclusive terms and conditions".

Furthermore, the following points must be observed:

- These instructions shall be read before installation and putting in operation and all directions contained herein shall be followed!
- These devices must only be connected to safety extra-low voltage and under dead-voltage condition. To avoid damages and errors at the device (e.g. by voltage induction), shielded cables shall be used, laying parallel with current-carrying lines is to be avoided, and the EMC directives must be adhered to.
- This device shall only be used for its intended purpose. Respective safety regulations issued by the VDE, the states, their control authorities, the TÜV and the local energy supply company must be observed. The buyer has to ensure adherence to the building and safety regulations and has to avoid all dangers of any kind.
- We do not assume any warranties or liabilities for faults or damages arising or resulting from improper use of this device.
- Consequential damages caused by a fault in this device are excluded from warranty or liability.
- These devices must be installed by authorized qualified personnel only.
- The technical data and connecting conditions shown in the mounting and operating instructions delivered together with the device are exclusively valid. Deviations from the catalogue representation are not explicitly mentioned and are possible in terms of technical progress and continuous improvement of our products.
- In case of any modifications made by the user, all warranty claims are forfeited.
- This device must not be installed close to heat sources (e.g. radiators) or be exposed to their heat flow. Direct sun irradiation or heat irradiation by similar sources (powerful lamps, halogen spotlights) must absolutely be avoided.
- Operating this device close to other devices that do not comply with EMC directives may influence functionality.
- This device must not be used for monitoring applications, which solely serve the purpose of protecting persons against hazards or injury, or as an EMERGENCY STOP switch for systems or machinery, or for any other similar safety-relevant purposes.
- Dimensions of enclosures or enclosure accessories may show slight tolerances on the specifications provided in these instructions.
- Modifications of these records are not permitted.
- In case of a complaint, only complete devices returned in original packing will be accepted.

**These instructions must be read before installation and putting in operation and all notes provided therein are to be regarded!**



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