

**Temperature switch with adjustability of switch differential  
For process industry  
Model TS-972**



**Smart in sensing**

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Prior to starting any work, read the operating instructions!  
Keep for later use!

**WIKAI Instruments India Pvt. Ltd.**  
128 SIDCO North Phase  
Ambattur Industrial Estate, Chennai 600 098  
Tel. +44 2625 2017 / 2018 / 9840919318  
switch.sales@wika.com  
www.wika.co.in

## 1. General information

- The temperature switch described in the operating instructions has been designed and manufactured using state-of-the-art technology. All components are subject to stringent quality and environmental criteria during production. Our management systems are certified to ISO 9001.
- These operating instructions contain important information on handling the instrument. Working safely requires that all safety instructions and work instructions are observed.
- Observe the relevant local accident prevention regulations and general safety regulations for the instrument's range of use.
- The operating instructions are part of the product and must be kept in the immediate vicinity of the temperature measuring instrument and readily accessible to skilled personnel at any time.
- Skilled personnel must have carefully read and understood the operating instructions prior to beginning any work.
- The manufacturer's liability is void in the case of any damage caused by using the product contrary to its intended use, non-compliance with these operating instructions, assignment of insufficiently qualified skilled personnel or unauthorised modifications to the instrument.
- The general terms and conditions contained in the sales documentation shall apply.
- Subject to technical modifications.
- Further information:
  - Internet address: [www.wika.co.in](http://www.wika.co.in)
  - Relevant data sheet: PV 37.02 . 01/2022

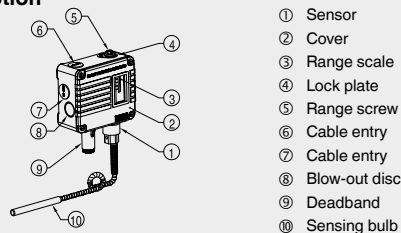
### Abbreviations, definitions

DPDT	Double pole double throw
SPDT	Single pole double throw
NC	Normally closed contact type (NC = normally closed)
NO	Normally open contact type (NO = normally open)
COM	Common contact
GND	Ground connection

## 2. Design and function

### 2.1 Overview

### 2.2 Description



The temperature element of the model TS-972 instruments are fitted with gas filled thermal system and suitable for Air, Gas, Water, Steam, Oil, etc. The primary sensing element is the bulb and the secondary sensing element is a hydraulically formed seamless Phosphor Bronze Bellows fixed external to the switch housing. Change in temperature which is sensed by the bulb results in a change in system temperature and this is communicated through an Armoured capillary to the secondary element (Bellows) which responds to this change and actuates the mechanism.

### 2.3 Terms used

#### Maximum operating temperature

The maximum static temperature with which the instrument can be used without changing the assured performance data.

#### Reset point

The temperature value at which the switch returns to the starting position. Mathematically, the temperature value for the reset point is equal to the temperature value of the switch point minus the switch differential on rising temperature. On falling temperature, the temperature value for the reset point is equal to the temperature value of the switch point plus the switch differential.

#### Switch differential

The switch differential is the difference between the switch point and the reset point. This is also known as the switch hysteresis.

### 2.4 Scope of delivery

- Temperature switch
- Operating instructions

Cross-check scope of delivery with delivery note.

### 3. Safety

#### 3.1 Explanation of symbols



##### **WARNING!**

... indicates a potentially dangerous situation that can result in serious injury or death, if not avoided.



##### **CAUTION!**

... indicates a potentially dangerous situation that can result in light injuries or damage to property or the environment, if not avoided.



##### **DANGER!**

... identifies hazards caused by electrical power. Should the safety instructions not be observed, there is a risk of serious or fatal injury.



##### **WARNING!**

... indicates a potentially dangerous situation that can result in burns, caused by hot surfaces or liquids, if not avoided.



##### **Information**

... points out useful tips, recommendations and information for efficient and trouble-free operation.

#### 3.2 Intended use

The model TS-972 mechanical temperature switch is fitted with an SPDT or DPDT switch contact and is used in industrial control, monitoring and alarm applications. The switch point can be specified by the customer on site. Depending on the version, the instrument can switch electrical loads of up to AC 250 V, 15 A.

The TS-972 temperature switch offers many application possibilities for gaseous and liquid aggressive media that are highly viscous or crystallising.



##### **WARNING!**

Use in the wrong application can lead to considerable personal injury and damage to equipment.

- ▶ Only use the instrument in applications that lie within its technical performance limits (e.g. max. temperature, current rating, ambient temperature, material compatibility, ...) For performance limits see chapter 9 "Specifications".
- ▶ This instrument is not permitted to be used in hazardous areas!

The instrument has been designed and built solely for the intended use described here, and may only be used accordingly.

The manufacturer shall not be liable for claims of any type based on operation contrary to the intended use.

#### 3.3 Improper use



##### **WARNING!**

##### **Injuries through improper use**

Improper use of the instrument can lead to hazardous situations and injuries.

- ▶ Refrain from unauthorised modifications to the instrument.
- ▶ Do not use the instrument within hazardous areas.

Any use beyond or different to the intended use is considered as improper use.

#### 3.4 Personnel qualification



##### **WARNING!**

##### **Risk of injury should qualification be insufficient!**

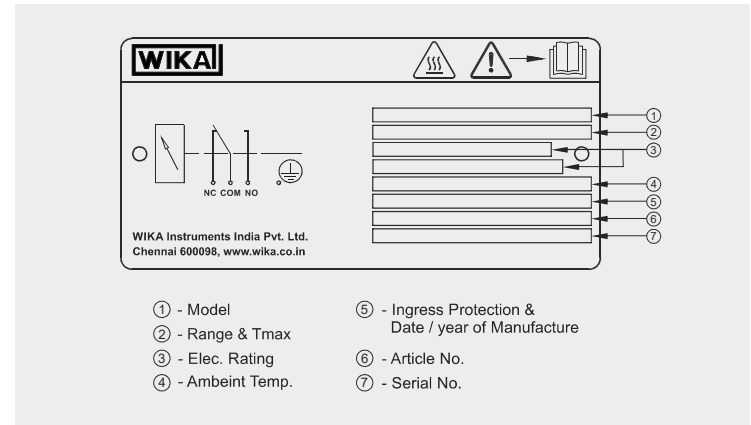
- Improper handling can result in considerable injury and damage to equipment.
- ▶ The activities described in these operating instructions may only be carried out by skilled personnel who have the qualifications described below.

##### **Skilled electrical personnel**

Skilled electrical personnel are understood to be personnel who, based on their technical training, know-how and experience as well as their knowledge of country-specific regulations, current standards and directives, are capable of carrying out work on electrical systems and independently recognising and avoiding potential hazards. The skilled electrical personnel have been specifically trained for the work environment they are working in and know the relevant standards and regulations. The skilled electrical personnel must comply with current legal accident prevention regulations.

#### 3.5 Labelling, safety marks

##### **Product label (example)**



Before mounting and commissioning the instrument, ensure you read the operating instructions!

## 4. Transport, packaging and storage

### 4.1 Transport

Check the instrument for any damage that may have been caused by transport. Obvious damage must be reported immediately.



#### CAUTION!

##### Damage through improper transport

With improper transport, a high level of damage to property can occur.

- ▶ When unloading packed goods upon delivery as well as during internal transport, proceed carefully and observe the symbols on the packaging.
- ▶ With internal transport, observe the instructions in chapter 4.2 "Packaging and storage".

If the instrument is transported from a cold into a warm environment, the formation of condensation may result in instrument malfunction. Before putting it back into operation, wait for the instrument temperature and the room temperature to equalise.

### 4.2 Packaging and storage

Do not remove packaging until just before mounting.

Keep the packaging as it will provide optimum protection during transport (e.g. change in installation site, sending for repair).

#### Permissible conditions at the place of storage:

- Storage temperature: -10 ... +60°C (14 ... +140°F)
- Humidity: 35 ... 85 % relative humidity (no condensation)

#### Avoid exposure to the following factors:

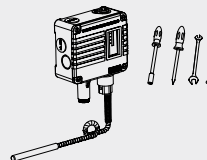
- Direct sunlight or proximity to hot objects
- Mechanical vibration, mechanical shock (putting it down hard)
- Soot, vapour, dust and corrosive gases
- Hazardous environments, flammable atmospheres

Store the instrument in its original packaging in a location that fulfils the conditions listed above.

## 5. Commissioning, operation

Before installation, commissioning and operation, ensure that the appropriate instrument has been selected in terms of design and specific measuring conditions.

Tools: Star screw driver, socket wrench 6.5 mm, open-ended spanner suitably, allen key 6 mm.



### 5.1 Requirements at the measuring point

- The process temperature must never exceed the specified maximum operating temperature.
- The ambient and medium temperatures must never be outside the permissible operating conditions (see chapter 9 "Specifications"). The temperature at the instrument case must not exceed the value of 60°C. The limit values at the instrument must be fulfilled by taking appropriate measures, e.g. by mounting with a distance from large hot surfaces or vessels; if required, by extending the connection with a pipeline or by providing it with thermal insulation.
- Protected from weather influences.
- Any vibrations or shocks which occur must not exceed accelerations of 1 g (9.81 m/s<sup>2</sup>) within a frequency range of 10 ... 150 Hz.
- The measuring line and the process connection must be designed such that no mechanical loads can occur on the instrument in the entire permissible ambient and medium temperature ranges.
- Sealing faces are clean and undamaged.
- Maintain clearance for blow-out device of > 20 mm.
- Sufficient space for a safe electrical installation.

→ For performance limits see chapter 9 "Specifications"

### 5.2 Mechanical mounting

- After unpacking the instrument, a visual inspection for damage must be carried out.
- Mounting is only permitted in the detemporised state. Reliably detemporise the instrument using the available valves and protective devices.
- Use seals suitable for the process connection provided.
- When screwing the instruments in, the force required for sealing must not be applied through the case, but only through the spanner flats provided for this purpose on the process connection, and using a suitable tool. The tightening torque is dependent on the selected process connection.
- After screwing in, make sure that no damage or cracks have occurred at the process connection.

### 5.3 Electrical mounting and integration into the installation

The connection cable must provide basic insulation for external circuits of protection class I. The instrument must be able to be switched off completely by means of a switch or a control unit. Depending on the load, additional protective measures, e.g. for motor protection, may be required



#### **DANGER!**

##### **Danger to life caused by electric current**

Upon contact with live parts, there is a direct danger to life.

- The instrument may only be installed and mounted by skilled personnel.
- Switch off the load circuit before starting work and secure against being switched on unauthorised

#### **Cable preparation**

Provide strain relief for the installed cables (e.g. integrated in cable gland). The cable gland(s) used must be suitable for achieving an IP66 ingress protection. Size the connecting cables for the largest current strength in the circuits and ensure sufficient UV resistance and mechanical stability.

Recommendation: 4-wire cable with conductor cross-section of 0.5 ... 2.5 mm<sup>2</sup> (AWG 20 ... 14). Fit wire ends with end splices. Conductor cross-section for end splices with plastic sleeve ≤ 1.0 mm<sup>2</sup> and for end splices without plastic sleeve ≤ 1.5 mm<sup>2</sup>.

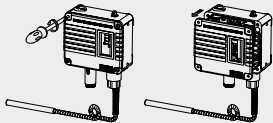
Carry out the terminal assignment according to the switching function tightening torque: 0.7 ... 0.5 N/m approx.

#### **Grounding**

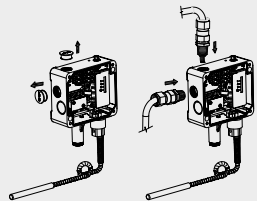
Include the ground connection in the inside of the instrument into the grounding concept of the installation. Maximum conductor cross-section 4 mm<sup>2</sup>

#### **Clamping the cable**

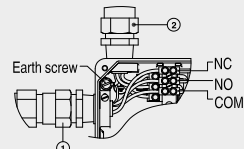
Remove cover screw for electrical connection



Remove dummy cap and fix cable gland

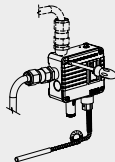


#### **Electrical connection**



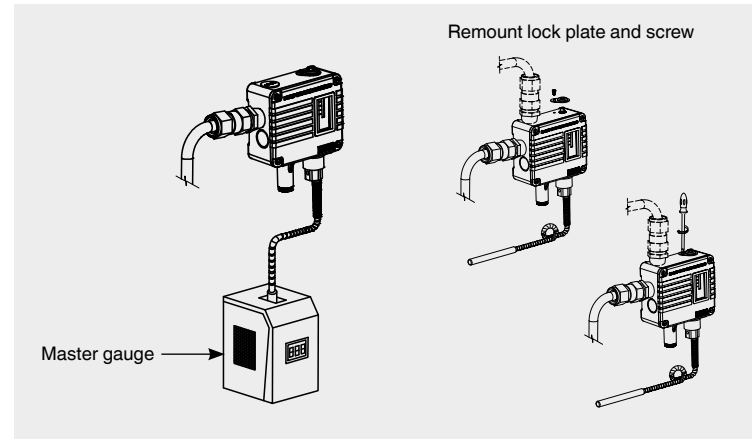
1 & 2 For dual switch  
1 - single / dual switch - side connection  
2 - dual switch - top connection

Close cover and fix again with screw



### 5.4 Switch point setting

For an exact setting of the switch point, a test assembly with temperature generation and temperature reference is needed. This test assembly can, for example, be realised with a suitable temperature bath with 0.25 °C accuracy master gauge as shown in picture

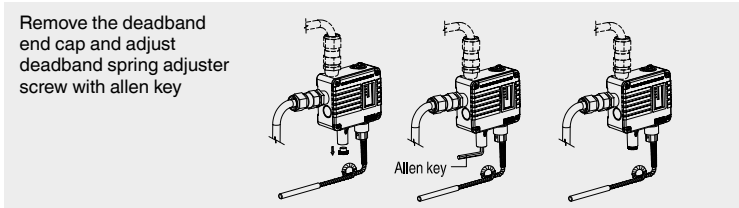


1. Connect the model TS-972 temperature switch, temperature reference and temperature generation to a common temperature system.
2. Ensure that the switch point setting does not switch any loads on or off by mistake. For visualisation of the switching function, an equivalent circuit, e.g. with a light bulb, is recommended.
3. Setting of the switch points
  - Temperature switches are normally set at factory for "Falling Temperature" unless specified otherwise.
  - Switching point should preferably lie in mid 50% of the adjustable range span.
  - Markings provided on the range scale are for approximate setting only. Use a master Temperature Gauge to set switching points precisely.
  - Remove locking device to unlock range adjuster.
  - By turning the Range Adjuster in Anti-clockwise/ Clockwise the set point can be raised / lowered respectively. The switching point can be set, for fall or rise in Temperature.
4. After setting, refix the locking device back in position to prevent unauthorised adjustment of the setpoint.

For instruments with adjustable switch differential directly in the connection, follow the instructions in the next chapter

5.5 Setting of the switch differential

The handling instructions described here cannot be carried out on instrument versions with fixed switch differential.  
Before setting the switch differential, the handling steps in chapter 5.4 “Switch point setting” must be carried out.



- 5. Release/build up the temperature slowly and check the reset point. By rotate range setting screw anticlock wise to increase the reset point @ desired value on falling temperature. To increase the dead band by rotate the allen key anti clock wise, switch point alone increase on rising temperature.  
After correcting the switch differential, the switch point must be re-checked.
- 6. If the switch point and the reset point coincide with the required temperature values, the switch point and switch differential setting is complete, after setting lock end cap.
- 7. Close the cover again and fix it with the 4 supplied screws,
- 8. see chapter 2.1 “Overview”.

5.6 Commissioning

- Check that the following torques for screw connections are maintained:
  - Clamping screws and screw for locking plate: Approx. 0.6 Nm
  - Case screws: Approx. 1.25 ... 1.5 Nm
- The instruments are designed for vertical mounting. The sensing bulb should be fully immersed in the process media.
  - The connected electrical load should not exceed declared Voltage & Current rating.
  - The process temperature should never exceed the claimed maximum working temperature. The sensing element will get permanently damaged if temperature exceeds EVEN ONCE.
  - Thermowell is a must for non compatible media.
- The instrument must not be subjected to any external loading (e.g. use as a climbing aid, support for objects)

Caution:

- ▶ Do not handle the instrument by it's capillary system.
- ▶ Do not bend sharp at the bulb or at instrument end
- ▶ The Instrument should be mounted suitably so as to avoid excessive heat transfer from the process lines or adjacent plant.
- ▶ In humid environment where the ambient temperature is sub zero, precautions should be taken to prevent ice formation within the instruments from the jamming the mechanism.
- ▶ Avoid temperature shocks

For pressurized application, where line pressure is more than 1 bar, or, when temperature is higher than boiling point, thermowell is recommended to be used.

6. Faults



**CAUTION!**  
**Physical injuries and damage to property and the environment**  
If faults cannot be eliminated by means of the listed measures, the instrument must be taken out of operation immediately.  
Ensure that there is no temperature in the instrument and that the load circuit is switched off. Protect against being put into operation accidentally.  
Contact the manufacturer.  
If a return is needed, please follow the instructions given in chapter 8.2 “Return”.



**WARNING!**  
**Physical injuries and damage to property and the environment caused by media**  
Upon contact with hazardous media, harmful media (e.g. corrosive, toxic, carcinogenic), and also with refrigeration plants and compressors, there is a danger of physical injuries and damage to property and the environment.  
Should a failure occur, aggressive media with extremely high temperature  
For these media, in addition to all standard regulations, the appropriate existing codes or regulations must also be followed.



For contact details see chapter 1 “General information”.

Faults	Causes	Measures
<b>Contact is not switching in accordance with the specification at the set switch point/reset point</b>	Electrical connection is interrupted.	Carry out a continuity test on the electrical connection lines.
	Wiring error, e.g. short circuit.	Check the pin assignment and correct it if necessary.
	Electrical load unsuitable for the switch contact model.	Maintain the permissible electrical loads for the switch contact model.
	Contact contaminated.	Replace instrument
	Switch differential greater than the switch point.	Carry out switch point setting with matching test assembly, see chapter 5.4.
<b>Short circuit</b>	Vibrations	Decouple the instrument mechanically.
	Moisture in the instrument.	Only use in ambient conditions for which the ingress protection is suitable.

Faults	Causes	Measures
<b>Contact chatter (repeated, short-duration opening and closing).</b>	Vibrations	Decouple the instrument mechanically.
<b>Switching status remains unchanged despite reaching the switch point/reset point.</b>	Error with switch point setting.	Carry out switch point setting with matching test assembly, see chapter 5.4.
	Contacts defective (e.g. fused contact zone).	Replace instrument Before recommissioning the new instrument, provide a protective circuit for the contact.
	Insufficient temperature	Check the process line temperature with temperature gauge.

For the exchange of the instrument chapters 8 “Dismounting, return and disposal” and 5.6 “Commissioning, operation” must be observed.

## 7. Maintenance and cleaning

### 7.1 Maintenance

The instruments are maintenance-free.

The switch point setting must be checked after 6 months. Carry out switch point setting with matching test assembly, see chapter 5.2.

Repairs must only be carried out by the manufacturer.

### 7.2 Cleaning



#### CAUTION!

##### Physical injuries and damage to property and the environment

Improper cleaning may lead to physical injuries and damage to property and the environment. Residual media in the dismounted instrument can result in a risk to persons, the environment and equipment.

- Carry out the cleaning process as described below.

1. Before cleaning, correctly disconnect the instrument from the temperature supply and switch the load circuit off.
2. Use the requisite protective equipment.
3. Clean the instrument with a moist cloth.  
Electrical connections must not come into contact with moisture!



#### CAUTION!

##### Damage to the instrument

Improper cleaning may lead to damage to the instrument!

- Do not use any aggressive cleaning agents.
- Do not use any hard or pointed objects for cleaning.

4. Wash or clean the dismounted instrument, in order to protect persons and the environment from exposure to residual media.

## 8. Dismounting, return and disposal



#### WARNING!

##### Physical injuries and damage to property and the environment through residual media

Residual media in the dismounted instrument can result in a risk to persons, the environment and equipment.

- Observe the information in the material safety data sheet for the corresponding medium.
- Wash or clean the dismounted instrument, in order to protect persons and the environment from exposure to residual media.

### 8.1 Dismounting



#### WARNING!

##### Risk of burns

During dismounting there is a risk of dangerously hot media escaping.

- Let the instrument cool down sufficiently before dismounting it!



#### DANGER!

##### Danger to life caused by electric current

Upon contact with live parts, there is a direct danger to life.

- The dismounting of the instrument may only be carried out by skilled personnel.
- Remove the instrument once the system has been isolated from power sources.



#### WARNING!

##### Physical injury

When dismounting, there is a danger from aggressive media and high temperatures.

- Observe the information in the material safety data sheet for the corresponding medium.
- Dismount the instrument when there is no temperature.

8.2 Return

Strictly observe the following when shipping the instrument:  
All instruments delivered to WIKA must be free from any kind of hazardous substances (acids, bases, solutions, etc.) and must therefore be cleaned before being returned.



**WARNING!**  
**Physical injuries and damage to property and the environment through residual media**  
Residual media in the dismantled instrument can result in a risk to persons, the environment and equipment.  
► With hazardous substances, include the material safety data sheet for the corresponding medium.  
► Clean the instrument, see chapter 7.2 “Cleaning”.

When returning the instrument, use the original packaging or a suitable transport packaging.

8.3 Disposal

Incorrect disposal can put the environment at risk.  
Dispose of instrument components and packaging materials in an environmentally compatible way and in accordance with the country-specific waste disposal regulations.

9. Specifications

Operating conditions

Permissible temperature ranges  
Ambient: -10 ... +60 °C (14 ... 140 °F)  
Storage: -10 ... +60 °C (14 ... 140 °F)

Ingress protection

IP66 per IS/IEC 60529

Setpoint repeatability

±1% of FSR

Scale accuracy

±5% of FSR

Switching function

- 1 × SPDT (single pole double throw)
- 2 × SPDT (single pole double throw) for DPDT action synchronising error within 2% of FSR

Setting range

Code	Range <sup>(1), (3)</sup>	Maximum working pressure <sup>(4)</sup>	Switching differential for contact versions <sup>(2)</sup>	
			1 × SPDT	2 × SPDT
C009	25 ... 90°C	300°C	6 ... 20°C	8 ... 20°C
C010	70 ... 150°C	300°C	8 ... 30°C	10.5 ... 30°C
C024	5 ... 60°C	110°C	8 ... 15°C	12 ... 15°C

- <sup>(1)</sup> In the absence of customer specification, the switch point will be preset on falling temperature to the mid point of the range [i.e. 50% of span + minimum range value]
- <sup>(2)</sup> The values indicate the maximum achievable limits of switch differential.
- <sup>(3)</sup> Set and reset point of the switch should not exceed the upper and lower range limits.
- <sup>(4)</sup> Maximum working temperature that the sensor element can withstand without suffering any permanent damage. The instrument might have to be calibrated afterwards