



OPERATIONS AND MAINTENANCE MANUALS O&MM-02

INSTRUCTION MANUAL

WIRE-WOUND SENSORS



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1. INTRODUCTION

This instruction manual applies to the following types of temperature sensors: **01, 05, 06**. The sensors are manufactured in accordance with the EN 60584-1 standard.

2. TECHNICAL SPECIFICATIONS AND DESCRIPTION

Temperature detectors measure the temperature at the location of the resistor or measuring junction.

The measuring sensor is a thermocouple composed of two thermoelectrodes made of different metals, connected by a measuring junction.

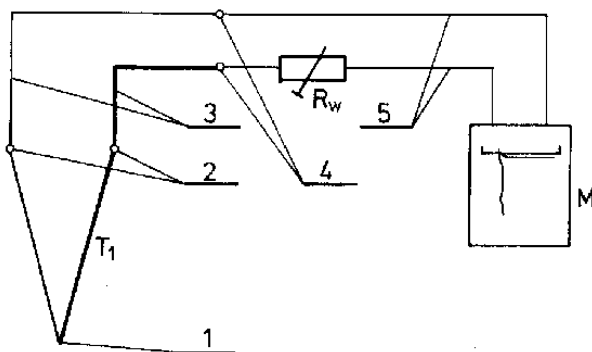


Fig. 1 Diagram of the measuring system with a thermoelectric sensor: T_1 – thermoelectric sensor; R_w – line equalization resistor; M – cooperating/indicating/recording and regulating device; 1 – measuring junction; 2 – free ends; 3 – compensation wires; 4 – reference junction; 5 – connecting wires.

If the measuring junction is located in the medium, the temperature of which is to be measured, and the free ends are at a temperature different than the temperature of the medium, then a thermoelectric power proportional to the temperature difference will occur between the free ends of the thermocouple.

When a constant temperature of the free ends is ensured, the thermoelectric power that occurs will depend on the changes in the temperature of the measuring junction. Since temperature fluctuations often occur around the free ends of the thermocouple, it is necessary to extend the free ends (using compensation wires) to a place with a constant temperature.

A sheathed wire-wound thermocouple consists of a thermocouple inserted into an outer sheath. The thermocouple sheath depends on the sensor type (see product catalogue).

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The thermocouple is composed of two thermoelectrodes welded together at their ends, forming a measuring junction.

One thermoelectrode is made of a platinum-rhodium alloy (PtRh 30), while the other of a platinum-rhodium alloy (PtRh6) for the PtRh30 – PtRh6 type. For the PtRh10(13) – Pt type, one thermoelectrode is made of a platinum-rhodium alloy (PtRh10[13]), while the other of platinum (Pt).

Thermoelectrodes are insulated using a ceramic insulator (2). Thermoelectrodes are connected to a terminal block (6), to which compensation wires are connected on the other side. The terminal block is placed in the connection head (7), in which the external ceramic cover is mounted and protected against mechanical damage by a steel pipe (5), on which the handles should be mounted.

In another type of sensor, one thermoelectrode is made of a nickel-chromium alloy (NiCr), while the other of a nickel-aluminium alloy (NiAl) for the NiCr-NiAl type. For the Fe-CuNi type, one thermoelectrode is made of iron (Fe), while the other of a copper-nickel alloy (CuNi).

The electrical insulation of the thermoelectrodes is provided by ceramic insulating covers of the measuring junction. Thermoelectrodes are connected to a terminal block, to which compensation wires are connected on the other side. The terminal block is placed in the connection head, in which the external metal cover is also mounted. The role of the cover is to protect the thermocouple against mechanical damage, contamination of the thermoelectrodes and corrosion.

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3. OPERATING CONDITIONS

Do not exceed the measuring range of the sensors during operation.

Temperature range:

The temperature range is a complex characteristic, influenced by both the sensor type and the insulated cable sheath material.

The measuring range of a thermocouple is the range of temperatures that can be measured with a given thermocouple due to the measuring range of the meter and the scope of application of the sensor cooperating with the meter.

The long-term use scope is the temperature range, at which a given thermocouple, under specific physicochemical conditions, can be used for measurement without concern of changing its thermoelectric characteristics.

The short-term use scope is the temperature range, at which a given thermocouple, under specific physicochemical conditions, can be used for measurement without concern of changing the thermoelectric characteristics of the thermocouple in a limited time.

MEASURING SYMBOL	COMPONENT	CONTINUOUS OPERATION TEMPERATURE RANGE [°C]	SHORT-TERM OPERATION TEMPERATURE RANGE [°C]
J		+20 – 700	-180 – 750
T		-185 – 300	-250 – 400
K		0 – 1100	-180 – 1350
N		0 – 1100	-270 – 1300
E		0 – 800	-40 – 900
S		0 – 1550	-50 – 1750
R		0 – 1600	-50 – 1700

The influence of some chemical substances on the medium, for which the temperature is measured, with the sheath materials is known to the manufacturer of the device. In case of any doubts, it is recommended to contact the device manufacturer.

The operating conditions of a thermocouple depend largely on the sensor's operating environment. The lifetime of sensors operating in a neutral environment is the greatest. The operation of the sensor in a different environment, e.g., an oxidizing or reducing atmosphere, significantly shortens the sensor's lifetime.

Many factors determine the longevity of a sensor. The operating environment of a thermocouple may cause the following unfavourable phenomena:

- change in the chemical composition of thermoelectrodes caused by diffusion through the thermocouple junction,

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- change in the chemical composition of one or both thermoelectrodes caused by partial evaporation of one of the alloying components at higher temperatures,
- change in the chemical composition of one or both thermoelectrodes caused by the absorption of pollutants from the environment.

Of course, there are many more factors that can negatively affect sensors. It is possible, that the pollutants in the atmosphere, in which the sensor operates, are so aggressive, that the sensor's operating period may be as short as 6 months.

4. TRANSPORT AND STORAGE

During transport and storage, sensors should be protected from the influence of external weather conditions, such as precipitation. Sensors should be stored indoors. Long sensors must be transported after appropriate bracing. Sensors with ceramic components must be appropriately protected during transport. Sensors must be protected from accidental movement during transport. Sensors must be stored at a temperature of 5–50°C, with relative humidity not exceeding 80%.

5. USE (OPERATION, MAINTENANCE AND INSPECTIONS)

Sensors are maintenance-free devices.

Maintenance and inspections should be performed by qualified personnel. The inspection should include the condition of the outer sheath and the cable. Periodic calibration is recommended, in order to ensure that the sensor is measuring temperature correctly.

6. FAILURES, FAULTS

After a failure occurs, it is recommended to contact the device manufacturer.

7. SPARE PARTS

For some sensor versions, it is possible to purchase, for example, a replaceable insert or connectors as spare parts.

In case of a need to purchase any spare parts, it is recommended to contact the device manufacturer.

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8. SAFETY

In order to ensure safe operation of the device, please follow the information contained in this manual.

Do not twist the cable during sensor installation.

Do not pull the cable.

Do not allow the cable to bend excessively.

Do not bend the measuring tip of the resistance detector.

Do not damage external ceramic covers or special sheaths.

Do not use for purposes other than intended.

Do not use outside the temperature ranges specified in this manual.

For minimum and maximum application temperatures, it is recommended to contact the device manufacturer.

9. INSTALLATION

The sensors should be installed by qualified personnel.

Sensors should be installed in a way, so that the measuring component (junction/resistor) is as close as possible to the measured surface.

Sensors equipped with a mounting stub should be installed by screwing the mounting stub in clockwise.

During installation of the sensor, ensure that it is immersed at such a depth, that the measuring junction is located in the measured medium.

Provided that technical reasons allow that, it is recommended to use longer sensors in order to obtain a favourable ratio of the length of the sheath part, located at ambient temperature, to the total length of the sensor. For this reason, it is beneficial to install the sensor in pipeline elbows.

The protruding parts of the sensor sheaths should be thermally insulated.

If the sensor sheaths and head are exposed to thermal radiation, use sensor protective screens.

The sensor must be installed in accessible places to ensure easy inspection or replacement during operation.

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10. ELECTRICAL CONNECTION

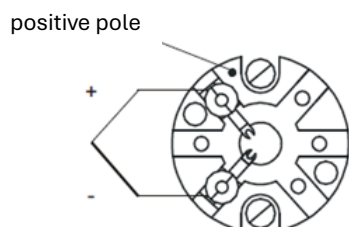
The sensors should be connected by qualified personnel.

THERMOCOUPLES

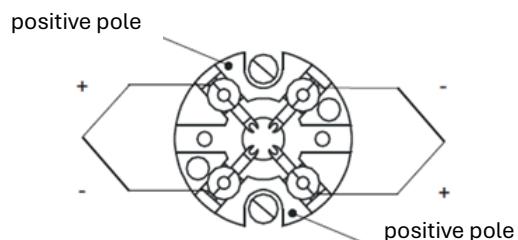
Thermocouples should be connected according to their polarity: „+”; „-”. Sensors should be connected using the appropriate type of cable, depending on the sensor type, e.g., K, J, N.

An example of a connection method is shown in the diagram of the connection of the sensor to the terminal block (**02-...WK1**):

Single thermocouple



Double thermocouple



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