

# Operating Manual

**MKTS-GL**

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## ● 1 General

### 1.1 For Information

- These operation instructions contain important information on handling the resistance thermometer. Working safely requires that all safety instructions and work instructions are observed.
- Skilled personnel must have carefully read and understood the operating instructions prior to beginning any work.
- The operating instructions are part of the product and must be kept in the immediate vicinity of the resistance thermometer and readily accessible to skilled personnel at any time.
- Observe the relevant local accident prevention regulations and general safety regulations for the resistance thermometer's range of use.
- If the serial number gets illegible (e. g. by mechanical damage), the retraceability of the instrument is not possible any more.
- The temperature sensors, described in this operating manual, are carefully designed and manufactured using state-of-the-art technology. Every component undergoes strict quality inspection in all stages of manufacture.
- 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, unauthorised modifications to the resistance thermometer or assignment of insufficiently qualified skilled personnel.

### 1.2 Signs, abbreviations



#### **Warning!**

A non-observance can cause injuries to persons and/or the demolition of the device. There can be a dangerous to life.



#### **Attention!**

A non-observance can cause a faulty operation of the device or lead to property damage.



#### **Information!**

A non-observance can have influence on the operation of the device or cause unintentional reactions of the device.



#### **Danger!**

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



#### **Warnung!**

Possibly a dangerous situation can occur, which results in burns because of hot surfaces or liquids, if not avoided.

## ● 2 Transport, Packaging, Storage

### 2.1 Transport

Check the instrument for any damage that may have been caused during transportation. If, report them immediately.

### 2.2 Packaging

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 back).

### 2.3 Storage

For longer term storage avoid the following influences:

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

If possible store the device in its original package or an equivalent one

### 3 For your safety



Warning

Before installation, commissioning and operation ensure that the appropriate resistance thermometer has been selected in terms of measuring range, design, specific measuring conditions and appropriate wetted parts materials (corrosion).



More important safety instructions can be found in the individual chapters.

#### 3.1 Intended use of the product

The resistance thermometer MKTS-GL is used for the measurement of temperatures from -50...200 °C in liquid and gaseous media. It can be used for pressures up to 25 bar.

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

The technical specifications contained in these operating instructions must be observed. Improper handling or operation of the instrument outside of its technical specifications requires the instrument to be taken out of service immediately and an inspection by the manufacturer.

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

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

#### 3.2 Personnel qualification



Warning

##### **Risk of injury if qualification is 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.
- Keep unqualified personnel away from hazardous areas.

For installation and starting of the temperature sensor the personnel has to be familiar with the relevant regulations and directives of the country and must have the qualification required. They must have knowledge on measurement and control technology, have to be acquainted with electric circuits, are capable of carrying out the work described and can independently recognise potential hazards. Depending on the operation conditions of the application they have to have the corresponding knowledge, e.g. of aggressive media.

#### 3.3 Special hazards



Warning

For hazardous media such as oxygen, acetylene, flammable or toxic gases or liquids, refrigeration plants, compressors, etc., in addition to all standard regulations, the appropriate existing codes or regulations must also be followed.

**If you do not observe the appropriate regulation, serious injuries and/or damage can occur!**



Warning

A protection from electrostatic discharge (ESD) is required.

The proper use of grounded work surfaces and personal wrist straps is required when working with exposed circuitry (PCB, printed circuit boards), in order to prevent static discharge from damaging sensitive electronic components.



Danger

There is a danger of death caused by electric current.

Upon contact with live parts, there is a direct danger of death.

Electrical instruments may only be installed and connected by skilled electrical personnel.

Operation using a defective power supply unit (e.g. short circuit from the mains voltage to the voltage output) can result in life-threatening voltages at the instrument.



Warning

Residual media in dismantled instruments can result in a risk to personnel, the environment and equipment. Take sufficient precautionary measures.

Do not use this instrument in safety or Emergency Stop devices. Incorrect use of the instrument can result in injury.

Should a failure occur, aggressive media with extremely high temperature and under high pressure or vacuum may be present at the instrument.

## ● 4 Starting, operation

### 4.1 Function

The MKTS-GL is fitted directly into the process via thread of the process connection. A change in resistance of the sensor element is transformed by using a measuring amplifier (internally/externally) into an electrical signal. The signal changes proportional to the temperature.

### 4.2 Before mounting



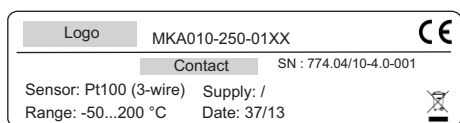
Check if a completely assembled temperature sensor is supplied.

Inspect the temperature sensor for possible damage during transportation. Should there be any obvious damage, inform the transport company and supplier without delay.

Keep the packaging, as it offers optimal protection during transportation.

Ensure that the process connection thread and the connection contacts will not be damaged.

### 4.3 Product label (example)



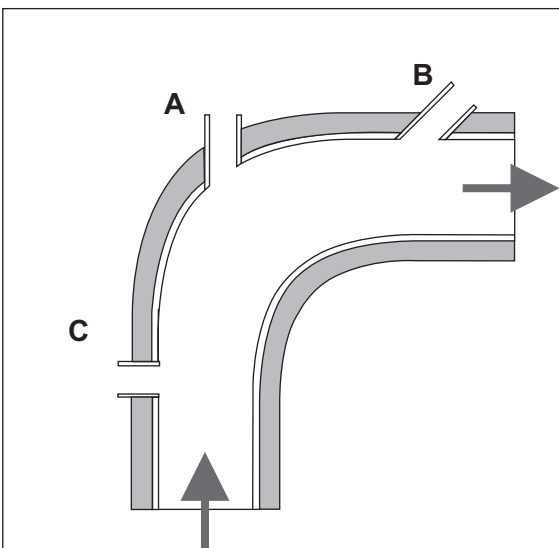
MK... : Product code

SN : Serial number

Date : Date of QC

### 4.4 Mechanical connection

Tools: wrench (flats 27), screw driver



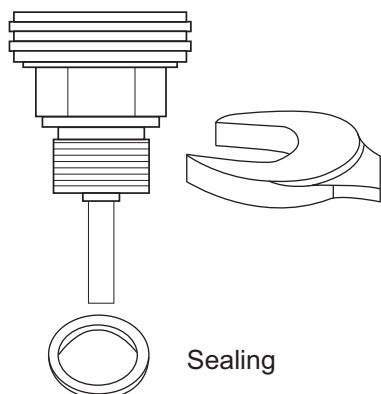
The resistance thermometers are designed for screw fitting directly into the process. The insertion length, along with the flow velocity and viscosity of the process media, may reduce the maximum loading on the protecting tube.

Installation on pipes

A: on elbows

B: in small pipes, inclined

C: perpendicular to flow direction



You have to provide for a sealing element which corresponds to the application.

Exceptions may be instruments with self-sealing threads (e. g. NPT thread).

When mounting the instrument, ensure that the sealing faces of the instrument and the measuring point are clean and undamaged.

Screw in or unscrew the instrument only via the flats using a suitable tool and the prescribed torque. The appropriate torque depends on the dimension of the process connection and on the sealing element used (form/material). Do not use the case as working surface for screwing in or unscrewing the instrument.

When screwing the transmitter in, ensure that the threads are not jammed.

If necessary observe information about tapped holes and welding sockets.

## ● 4 Starting, operation (continued)

### 4.5 Electrical connection



Connect the instrument to earth via the process connection.

The ingress protection specified only apply while the pressure transmitter is connected with the female connectors that provide the corresponding ingress protection.

Ensure that the cable diameter you select fits to the cable gland of the connector. Ensure that the cable gland of the mounted connector is positioned correctly and that the sealings are available and undamaged. Tighten the threaded connection and check the correct position of the sealings to ensure ingress protection.

Make sure that the ends of cables with flying leads do not allow any ingress of moisture.

Route the cable without applying a force or turning moment to the device.

### 4.6 Pin assignment

Sensor \ Connection	2-wire	3-wire	4-wire	2x 2-wire	4-pole transmitter
M12x1*	3 2	4 3 2	4 3 2 1	4 3 2 1	2 4 1 3
valve plug	3 2	3 2	3 2 1	3 2 1	3 1 2
MIL-plug	2 3	1 2 3	1 2 3 4	4 3 2 1	3 5 1 2
cable	bn gn rd wh	ye bn gn rd rd wh	ye bn gn wh rd rd wh wh	gn bn ye wh rd wh bk ye	bn gn ge ws

\* The MKTS-GL with transmitter has lowered pins for programming. For normal use of the sensor a standard female plug is necessary, for the programming a special female plug which is included in the cable set (see accessories in the data sheet/price list of MKTS-GL)

View: plug pins of male connector

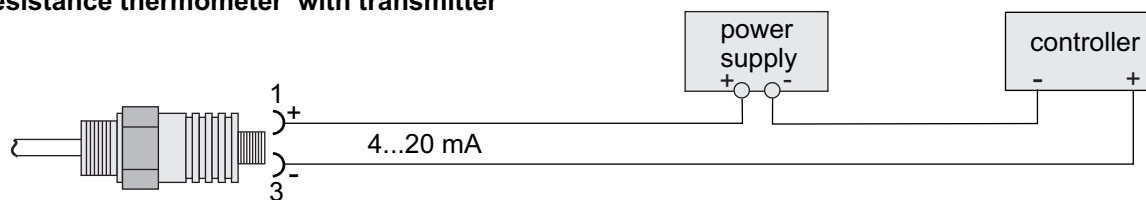
M12, 4-pole	M12, 8-pole	Valve, 4-pole	MIL, 6-pole	Cable, 4-, 6-, 8-pole
				LIYCY 4, 6 or 8x0,25 mm <sup>2</sup> grey

### Specification pin-and-socket connector

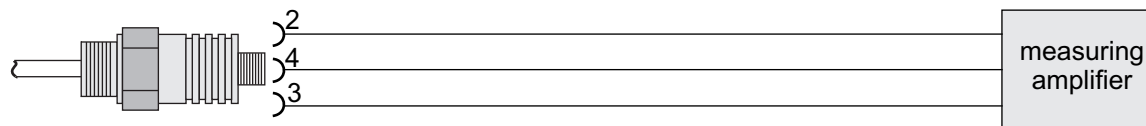
Kind of connector	existing on the sensor	necessary counterpart
Pin-and-socket connector M12x1 4-pole, A-coding	built-in plug M12x1, 4-pole Escha EWAS4 / Lumberg RSE	tip jack M12x1, 4-pole Escha WA..., WW... / Lumberg RK...
Valve pin-and-socket connector model A (Binder series M-A)	built-in plug 4-pole (3+PE) DIN EN 175301-803	tip jack 4-pole (3+PE) DIN EN 175301-803
MIL pin-and-socket connector	built-in plug D38999, 6-pole	tip jack D38999, 6-pole

#### 4.7 Example of connection

##### Resistance thermometer with transmitter



##### Resistance thermometer 3-wire



#### 4.8 Functional test



The output signal must be proportional to the temperature. If not, this might point to a damage of the sensor element. In that case refer to chapter "Troubleshooting" (page 9).



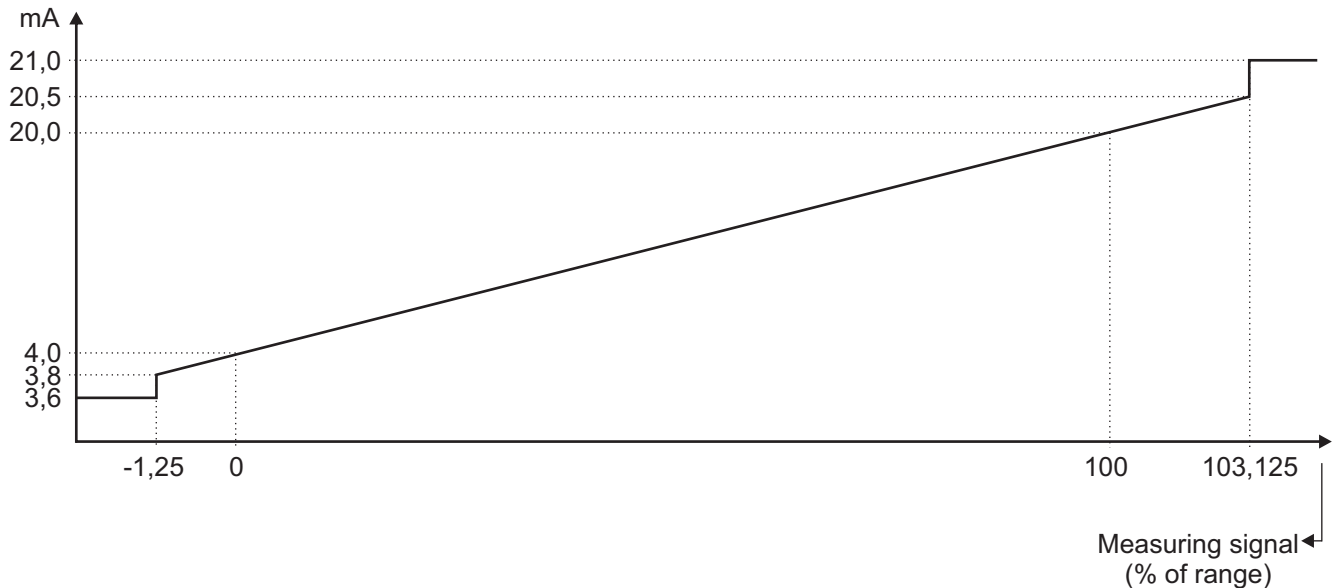
Warning

- Open process connections only after the system is without pressure.
- Observe the ambient and working conditions outlined in chapter "Technical data" (page 11)
- When touching the temperature sensor, keep in mind that the surfaces of the instrument components might get hot during operation.

### 9.9 Error detection / Error current

The device detects wire break and short circuit (sensor element <> measuring amplifier) as well as pressures outside of the measuring range and indicates this with an error current in the current loop circuit.

The current output is proportional to the temperature from 4...20 mA. If the measured temperature would result in a current below 4 mA the current output drops linear to 3,8 mA and if the measured temperature would result in a current above 20 mA the current output increases linear to 20,5 mA. If case of wire break / short circuit of the sensor the current output on error can be set to optionally 3,6 mA or 21 mA.



Output current and measured signal

## ● 5 Transmitter (Configuration)

MKTS-GL with transmitter can be configured comfortably by using a software tool.

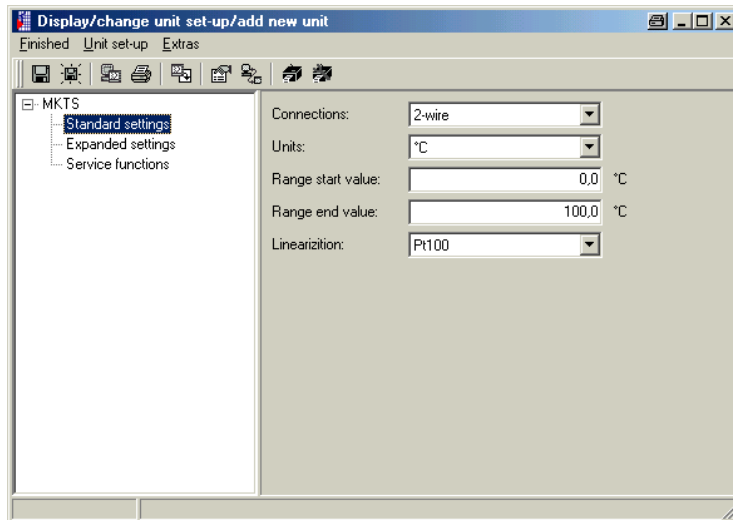
### Presetable parameters:

- Connection (2-, 3-, 4-wire)
- Simulation (on/off)
- Damping (0... 60s)
- Compensation resistance
- Units (°C/°F)
- Fault condition reaction
- Offset (-9,9...+9,9 K)
- Measurement ranges
- Output (analog standard/inverse)
- Identification/TAG

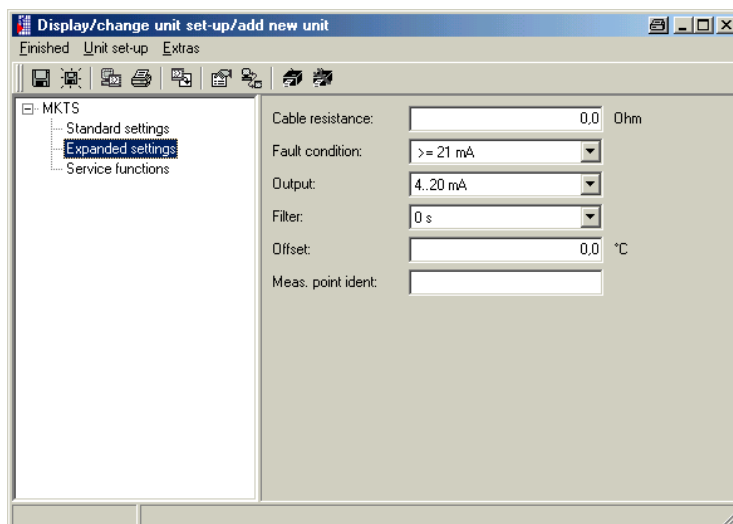
After installation and start of the software use the pull-down-menu „?“ to call the help for the configuration of the transmitter. This user manual has detailed step by step instructions.

The software tool comes with selectable English or German version.

Example for the configuration of the transmitter



Screen shot 1 of instrument configuration



Screen shot 2 of instrument configuration



## ● 6 Troubleshooting



- Open pressure connections only after the system is without pressure.
- Residual media in dismantled instruments can result in a risk to personnel, the environment and equipment
- Remove the temperature sensor from service and mark it to prevent it from being used again accidentally, if it becomes damaged or unsafe for operation.

Failure	Possible cause	Procedure
No output signal	Cable break Mechanical load too high or overtemperature	Check connectors and cable Replace the sensor with a suitable design
No/false output signal	Incorrectly wired	Follow pin assignment (see instrument label / operating instructions)
Erroneous measured values	Sensor drift caused by overtemperature Sensor drift caused by chemical attack	Replace the sensor with a suitable design Replace the sensor with a suitable design
Erroneous measured values (too low)	Entry of moisture into cable or plug	Replace the sensor with a suitable design
Erroneous measured values and response time too long	Wrong mounting geometry, e.g. mounting depth too or heat dissipation too high Deposits on the sensor	The temperature-sensitive area of the sensor must be inside the medium surfaces must be isolated Remove deposits
Measurement signal „comes and goes“	Cable break in connecting cable or loose contact caused by mechanical overload	Replace the sensor with a suitable design, e.g. thicker conductor cross section
Corrosion	Composition of medium not as expected or modified or wrong material of protecting tube	Analyse medium and then select a more suitable material
Signal interference	Stray currents caused by electric fields or earth loops Earth circuits	Use of screened connecting cables, increase the distance to motors and power lines Elimination of potentials, use of supply isolators or galvanically isolated measuring amplifiers

Note: In case of unjustified reclamation an additional charge is possible.

## ● 7 Maintenance, Dismounting, Return, Cleaning, Disposal (continued)

### 7.1 Maintenance

The screw-in resistance temperature sensors MKTS-GL require no maintenance and contain no components which could be repaired or replaced.

### 7.2 Dismounting



Residual media in dismantled instruments can result in a risk of personnel, the environment and equipment. Take sufficient precautionary measures.



There is a risk of burns. Let the instrument cool down sufficiently before dismantling. During dismantling there is a risk of dangerously hot pressure media escaping.  
Only disconnect the resistance thermometer once the system has been depressurised.

### 7.3 Return



Before the return of an instrument see chapter 7.4.

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

To avoid a damage, use for example antistatic plastic film, shock-absorbent material, a marking as highly sensitive measuring instrument.

### 7.4 Cleaning



- Before cleaning the instrument disconnect the electrical connection.
- Clean the instrument with a moist cloth.
- Electrical connections must not come into contact with moisture.
- Wash or clean the dismantled instrument before returning it in order to protect personnel and the environment from exposure to residual media.
- Residual media in dismantled instruments can result in a risk to persons, the environment and equipment. Take sufficient precautionary measures.

### 7.5 Disposal



Dispose instrument components and packaging materials in accordance with the respective waste treatment and disposal regulations of the region or country to which the sensor is supplied

## ● 8 Technical data

### Input

Resistance thermometer: 1 x Pt 100(0) (2-, 3- or 4-wire), 2 x Pt 100(0) (2-wire)

### Output

Transmitter: 4...20 mA, 2-wire (load: max. (U<sub>b</sub> - 10 V) / 0,023 A)

### Accuracy

Resistance thermometer: Class A, DIN EN 60751 (sensor: HERAEUS M222)  
 Transmitter: 0,1K / 0,8% of adjusted range  
 Sensor current: <0,6 mA / Response time electronics: 1 s  
 Response time in water: Protecting tube 6x0,5 mm: z0,5=~12,0 s / z0,9=~30,9 s  
 Protecting tube 6x1,0 mm: z0,5=~7,6 s / z0,9=~22,1 s

### Usability and measuring range

Pt 100(0): Usability -50...+200°C  
 Transmitter: Measuring range programmable (standard: 0...100°C)  
 Minimum span: 10 K

### Power supply

Transmitter: 10...35 V, supply out of current loop

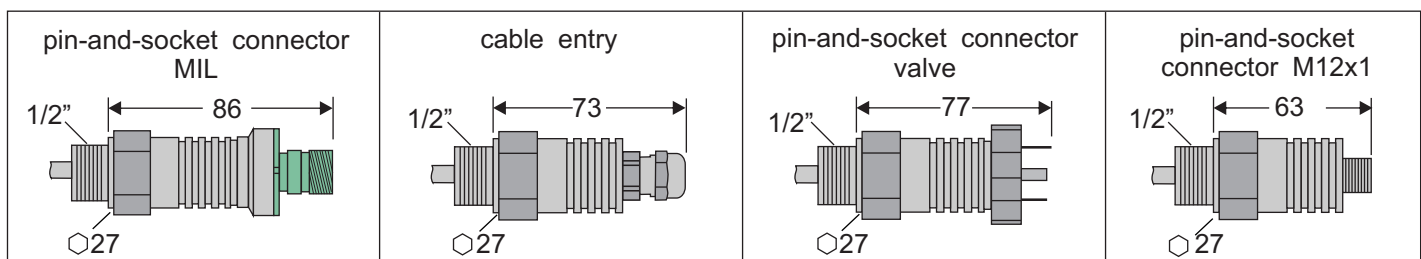
### Ambient temperature conditions

Operating: -50...+100°C, with transmitter: -40...+85°C  
 Storing: -50...+100°C, with transmitter: -40...+100°C

### Mechanics

Case: Ø 26 x 63...86 mm + fitting length (dependent on electrical connection)  
 Material: Protection tube, body of case: stainless steel 1.4571  
 Weight: 200...240 g, fitting length 50 mm  
 Process connection: 1/4" / 3/8" / 1/2" / 3/4" / 1" / 1/4NPT / 3/8NPT / 1/2NPT  
 Electrical connection: MIL plug D 38999, 6-pole / Valve plug DIN EN 175301-803, 4-pole, type A  
 Plug M12x1, 4-pole / Cable entry M12x1,5 with 2 m cable  
 Protection: Degree IP 67

## ● 9 Dimensions (in mm)



# TYPE APPROVAL CERTIFICATE

This is to certify that the undernoted product(s) has/have been tested in accordance with the relevant requirements of the DNV GL Type Approval System.

Certificate No. **47 922 - 03 HH**

Company **Müller Industrie-Elektronik GmbH**

**Justus-von-Liebig-Str. 24  
31535 Neustadt am Rübenberge, GERMANY**

Product Description **Programmable compact thermometer (transmitter)**

Type **MK ...**

Environmental Category **D, EMC1**

Technical Data /  
Range of Application **Measuring sensor (standard): 1x Pt100, accuracy class A (DIN EN 60751)  
Measuring range: -50...+200°C  
Accuracy: 0.1 K or 0.08% (linear temperature transmission behaviour)  
Power supply: rated 24V DC (10...35V DC)  
Output signal: 4...20mA, 2-wire, analogue  
Housing material: stainless steel  
Max. length of thermo well: 300mm  
Process connection: G 1/2"  
Electrical connection: M12 plug-in connector (standard)  
Degree of protection: IP 67  
Response time (approximately values; water; Ø 6x0.5mm):  
z0.5 = 12.0s, z0.9 = 30.9s  
Configurable via Windows PC-Software: PXU01  
Firmware version: 1.xx.xx  
Software requirement class: 3**

Test Standard **Guidelines for the Performance of Type Approvals, Chapter 2 - Edition 2003**

Documents **Test Reports: paconsult no. 278-03 (24-11-2003), no. 13-5258 Rev. 1(02-09-2013)  
Documentation: GL-File-No. 70.70.4778503, GL-Project-No. 13-070214  
Data Sheets: MKTS-GL (Rev. 41463), M 222 10/2003  
Construction Drawings**

Remarks **None**

Valid-until **2019-08-12**

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File No. **I.D.01**

**Hamburg, 2014-08-13**

**DNV GL**

www.dnvgl.com

Type Approval Symbol



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