Intelligent two wire universal transmitter

The documentation is only complete when used in combination with the relevant documentation for the sensor.
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1.1 Intended use

The transmitter is a two-wire PC configured transmitter designed for temperature measurements and intended to be used in industrial environments.

The manufacturer has constructed these transmitters for the following type of measurements:

- Temperature measurements with resistance thermometers
- Temperature measurements with thermocouples
- Voltage measurements in a range up to 1000 mV
- Resistance measurement up to 10 kΩ
- Measurements with potentiometers

The OPTITEMP TT 33 C / TT 33 C Ex is intended for installation in a B connection head or larger according to EN 50446.

The OPTITEMP TT 33 R / TT 33 R Ex is intended for installation on a 35 mm rail according to EN 60715 / DIN 50022.

The transmitters are configured from a PC by using the ConSoft program and a transmitter configuration kit (USB connection). Calibration of the transmitter, after the PC configuration, is not necessary.

DANGER!
You may only use transmitters labelled with the “Ex” symbol in potentially explosive areas or connect them to a sensor located in those areas. Additionally always note the zone(s) for which the devices have an approval. Otherwise the transmitters might cause an explosion that can result in fatal injuries.

DANGER!
Responsibility for the correct use of the devices with special regard to suitability, intended use and the field of application lies solely with the operator. To avoid any kind of incorrect use, also note the information in the chapter “Device description”.

DANGER!
The transmitters do not contain any serviceable parts inside. Any substitution of components may impair the intrinsic safety of the versions with an Ex approval. Always send defective devices to the manufacturer or the local distributor for repair or exchange. If this is the case, attach a clear description of the malfunction for warranty claims.

INFORMATION!
The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose. To avoid any kind of incorrect use, also note the information in the chapter “Device description”!

CAUTION!
Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.
1.2 Certifications

1.2.1 EC directive compliance

The device fulfils all applicable statutory requirements of the following EC directives:

- EMC Directive 2014/30/EU, harmonized standards EN 61326-1 and EN 61326-2-3
- CE Directive 93/68/EC

The manufacturer certifies successful testing of the product by applying the CE marking.

1.2.2 Ex approvals

**TT 33 C Ex (intrinsically safe)**

<table>
<thead>
<tr>
<th>ATEX</th>
<th>IECEx</th>
<th>II 1G Ex ia IIC T6...T4 Ga</th>
</tr>
</thead>
<tbody>
<tr>
<td>KIWA 16ATEX0039 X</td>
<td>IECEx KIWA 16.0017X</td>
<td>Ex ia IIC T6...T4 Ga</td>
</tr>
</tbody>
</table>

**TT 33 R Ex (intrinsically safe)**

<table>
<thead>
<tr>
<th>ATEX</th>
<th>IECEx</th>
<th>II 1G Ex ia IIC T6...T4 Ga</th>
</tr>
</thead>
<tbody>
<tr>
<td>KIWA 16ATEX0041 X</td>
<td>IECEx KIWA 16.0019X</td>
<td>Ex ia IIC T6...T4 Ga</td>
</tr>
</tbody>
</table>

**INFORMATION!**

See also “Specific Conditions of Use” in the ATEX certificates in the download area of the manufacturer’s website.
1.3 Safety instructions from the manufacturer

1.3.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer’s documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data completely against access by third parties.

We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

1.3.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.
1.3.3 Product liability and warranty
The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation or operation of the devices (systems) will cause the warranty to be void. The respective “Standard Terms and Conditions” which form the basis for the sales contract shall also apply.

1.3.4 Information concerning the documentation
To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of icons as shown below.
1.3.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.

**DANGER!**
This warning refers to the immediate danger when working with electricity.

**DANGER!**
This warning refers to the immediate danger of burns caused by heat or hot surfaces.

**DANGER!**
This warning refers to the immediate danger when using this device in a hazardous atmosphere.

**DANGER!**
These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator’s plant.

**WARNING!**
Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator’s plant.

**CAUTION!**
Disregarding these instructions can result in damage to the device or to parts of the operator’s plant.

**INFORMATION!**
These instructions contain important information for the handling of the device.

**LEGAL NOTICE!**
This note contains information on statutory directives and standards.

**HANDLING**
This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

**RESULT**
This symbol refers to all important consequences of the previous actions.

1.4 Safety instructions for the operator

**WARNING!**
In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel. This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.
2 DEVICE DESCRIPTION

2.1 Scope of delivery

INFORMATION!
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order.

The scope of delivery always consists of the transmitter and its documentation.

2.2 General description

TT 33 C
The TT 33 C is an intelligent, digital 2-wire universal in-head transmitter for temperature measurements and other measurement applications in an industrial environment. For further information about the possible measurements refer to Intended use on page 5.

The in-head transmitter is optionally available in an intrinsically safe version for installation in potentially explosive areas. These devices wear the “Ex” symbol and have an approval for mounting into classified hazardous area, Zone 0, 1 and 2.

All in-head versions are intended for installation in a “B connection head” or larger according to EN 50446 / DIN 43729. As an alternative you can also mount the in-head version on a 35 mm rail according to EN 60715 / DIN 50022 with the help of the rail installation kit (refer to Rail mounting kit for in-head transmitters on page 15).

TT 33 R
The TT 33 R is an intelligent, digital 2-wire universal rail-mount transmitter with the same features as the in-head version.

The rail-mount transmitter is optionally available in an intrinsically safe version for installation into potentially explosive areas. All devices with an Ex approval wear the “Ex” symbol. The rail-mount transmitter is intended for installation on a 35 mm rail according to EN 60715 / DIN 50022.

The transmitters are configured from a PC by using the ConSoft program and a transmitter configuration kit. When transmitters are configured from a PC no calibration is necessary.

The PC configuration software ConSoft is used for configuration, display and documentation. The current ConSoft version is available for downloading on our website.

You can find configuration instructions in the ConSoft reference manual.

ConSoft is compatible with Windows XP/Vista/7/8/8.1/10.
2.3 Nameplate

INFORMATION!

Look at the device nameplate to ensure that the device is delivered according to your order.

The transmitter can be identified by the information on the nameplates.

Nameplate for in-head transmitter

Figure 2-1: Example for round nameplate

1. Product name
2. CE marking (EC conformity)
3. Ex-relevant electrical data
4. Part number, serial number (yyww = year and week of manufacturing) and batch number
5. Printable field, sensor configuration
6. Connections
7. Manufacturer and address

Figure 2-2: Example for bottom nameplate

1. Electrical data for output
2. Electronic/electric device waste marking
3. Control drawing number
Nameplate for rail-mount transmitter

Figure 2-3: Example for nameplate

1. Product name
2. Part number, serial number (yyww = year and week of manufacturing) and batch number
3. Manufacturer and address
4. Printable field, sensor configuration
5. Technical data
6. Electrical data for output and input
7. Control drawing number
8. CE marking (EC conformity) and electronic/electric device waste marking
Installation

3.1 Notes on installation

INFORMATION!
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order.

3.2 In-head transmitter

The transmitter is intended for installation in DIN B connection heads or larger. The large Ø7 mm / 0.28 inch center hole facilitates the electrical connection of the sensor and the installation. For detailed information refer to Dimensions on page 33.

Figure 3-1: Connection head installation kit

1. M4 screw
2. Spring
3. Lock washer
4. Wires from the measuring inserts
5. MI Cable

INFORMATION!
The connection head installation kit does not belong to the standard scope of delivery of the transmitter, you have to order it separately.
3 INSTALLATION

DANGER!
The transmitter is optionally available in an intrinsically safe version (zone 0, 1 and 2) for installation in potentially explosive atmospheres. The intrinsically safe version must be supplied by an intrinsically safe power supply unit or Zener barrier placed outside of the potentially explosive zone. The Ex transmitter must be installed in a housing with the protection rating IP20 or better according to EN 60529 / IEC 60529.

WARNING!
The transmitter has been developed for an operating temperature of -40...+85°C/-40°F...+185°F. To avoid destruction or damage of the device, always assure that the operating temperature or ambient temperature does not exceed the permissible range. The thermowell also transfer the process temperature to the transmitter housing. If the process temperature is close to or exceeds the maximum temperature of the transmitter, then the temperature in the transmitter housing can rise above the maximum permissible temperature. One way to decrease the head transfer via thermowell is to install the transmitter further away from the heat source. Inversely similar measurements can be done if the temperature gets below specified minimum temperature.
3.3 Rail mounting kit for in-head transmitters

INFORMATION!
The rail mounting kit allows to install the in-head transmitter on a rail according to EN 60715 / DIN 50022.
The kit does not belong to the standard scope of delivery. You have to order it separately.

INFORMATION!

The screws in the kit is not to be used with this transmitter.

Rail mounting kit for in-head transmitters

Figure 3-2: Rail mounting kit for in-head transmitters

1. Rail (not included in the kit)
2. Screws (not needed)
3. Clamp
4. Transmitter

Installation procedure: Step 1

1. Place the transmitter on the rail mounting kit as shown above.
2. Push the transmitter down until it reaches the plate and is attached.
3 INSTALLATION

3.4 Rail-mount transmitter

These transmitters are intended for installation on a 35 mm rail according to EN 60715 / DIN 50022.

**CAUTION!**
The manufacturer has developed the TT 33 R for an operating temperature range of -40...+85°C / -40...+185°F. To avoid destruction or damage of the device, always note the following items:

- Assure that the operating temperature or the ambient temperature does not exceed the permissible range.

The rail-mount transmitter is intended for installation on a 35 mm rail according to EN 60715 / DIN 50022.

---

**Installation procedure: Step 2**

1. Hook one end of the kit into the rail as shown above.
2. Push the other end of the kit down until it snaps onto the rail.
3. Release by pushing the hook, shown in the picture, and at the same time lift the clip out of the rail.

**Figure 3-3: Rail installation**

1. Fix the upper part of the transmitter onto the rail.
2. Press the lower part of the transmitter against the rail.
3. To remove the transmitter, bend the locking device using a small screwdriver. Carefully pull the transmitter in the forward direction.

**CAUTION!**
The manufacturer has developed the TT 33 R for an operating temperature range of -40...+85°C / -40...+185°F. To avoid destruction or damage of the device, always note the following items:

- Assure that the operating temperature or the ambient temperature does not exceed the permissible range.
4.1 Safety instructions

DANGER!
All work on the electrical connections may only be carried out with the power disconnected.

DANGER!
Observe the corresponding regulations, declarations of conformity, the type test certificate of the device and the relevant instructions of this document.

CAUTION!
Before you connect and operate a transmitter, always note the following items to avoid an electric shock:

- For all work on the electrical connections use an electrostatic safe (i.e. grounded) workplace! In this way you minimize the risk of electrostatic discharge (ESD).

DANGER!
Never connect or operate a non-Ex version of a transmitter in potentially explosive areas, otherwise it might cause an explosion that can result in fatal injuries! Before you connect and operate a transmitter version with an Ex approval, always note the following items to avoid an explosion which may result in fatal injuries:

- Connect the Ex version only to Ex approved sensors or sensors that meet the requirements for "simple apparatus" in EN 60079-11
- Observe the corresponding regulations, the declaration of conformity, the Ex type test certificate of the device and the relevant instructions of this document.

WARNING!
Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order.

INFORMATION!
The transmitter is protected against polarity reversal. No damage will occur to the device if the polarity of the supply voltage is switched. The output will then indicate 0 mA.
4.2 Electrical connections of in-head transmitter

The input and output signals and the power supply must be connected in accordance with the following illustrations. The transmitter is easy to install with the connection head installation kit. To avoid measuring errors, all cables must be connected properly and the screws tightened correctly.

**RTD and potentiometer measurement**

<table>
<thead>
<tr>
<th>Pt100...Pt1000, Ni100, Ni120, Cu10 2-wire connection</th>
<th>Pt100...Pt1000, Ni100, Ni120, Cu10 3-wire connection</th>
<th>Pt100...Pt1000, Ni100, Ni120, Cu10 4-wire connection</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="2-wire connection" /></td>
<td><img src="image" alt="3-wire connection" /></td>
<td><img src="image" alt="4-wire connection" /></td>
</tr>
<tr>
<td><img src="image" alt="Resistance, 2-wire connection" /></td>
<td><img src="image" alt="Resistance, 3-wire connection" /></td>
<td><img src="image" alt="Resistance, 4-wire connection" /></td>
</tr>
<tr>
<td><img src="image" alt="Resistance, 2-wire connection" /></td>
<td><img src="image" alt="Resistance, 3-wire connection" /></td>
<td><img src="image" alt="Resistance, 4-wire connection" /></td>
</tr>
<tr>
<td><img src="image" alt="Potentiometer, 3-wire slide wire" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Thermocouple and voltage measurement**

<table>
<thead>
<tr>
<th>Thermocouple</th>
<th>Voltage</th>
<th>Thermocouple with external CJC (Pt100)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Thermocouple" /></td>
<td><img src="image" alt="Voltage" /></td>
<td><img src="image" alt="Thermocouple with external CJC" /></td>
</tr>
</tbody>
</table>


4.3 Connection diagram of in-head transmitter

**CAUTION!**
Always establish the electrical connections according to the following diagrams. Otherwise it can come to destruction or damage of the transmitter. Note that the maximum output load always depends on the power supply. If the maximum output load is exceeded, then the measured value will become incorrect. For further information refer to the output load diagram in the chapter "Technical data" on page 35.

![Connection diagram of in-head transmitter](image)

4.4 Connection diagram of in-head transmitter (intrinsically safe)

![Connection diagram of intrinsically safe in-head transmitter](image)
4.5 Electrical connections of rail-mount transmitter

The input and output signals and the power supply must be connected in accordance with the following illustrations. To avoid measuring errors, all cables must be connected properly and the screws tightened correctly.

### RTD and potentiometer measurement

- **2-wire connection**
  - Pt100...Pt1000, Ni100, Ni120, Cu10

- **3-wire connection**
  - Pt100...Pt1000, Ni100, Ni120, Cu10

- **4-wire connection**
  - Pt100...Pt1000, Ni100, Ni120, Cu10

### Resistance, 2-wire connection

- **2-wire connection**
  - Pt100...Pt1000, Ni100, Ni120, Cu10

- **3-wire connection**
  - Pt100...Pt1000, Ni100, Ni120, Cu10

- **4-wire connection**
  - Pt100...Pt1000, Ni100, Ni120, Cu10

### Potentiometer, 3-wire slide wire

- **3-wire slide wire**

### Thermocouple and voltage measurement

- **Thermocouple**
  - (Pt100)

- **Voltage**
  - (Pt100)

- **Thermocouple with external CJC (Pt100)**

---

4. ELECTRICAL CONNECTIONS

OPITEMP TT 33 C/R
4.6 Connection diagram of rail-mount transmitter

![Connection diagram of rail-mount transmitter](image)

Figure 4-3: Connection diagram

1. Input
2. \( R_{\text{Load}} \)
3. Voltage supply 8...36 VDC

4.7 Connection diagram of rail-mount transmitter (intrinsically safe)

![Connection diagram of rail-mount transmitter (intrinsically safe)](image)

Figure 4-4: Connection diagram

1. Input (intrinsically safe)
2. Classified hazardous area (potentially explosive area e.g. zone 0, 1 or 2)
3. Safe area
4. \( R_{\text{Load}} \) (intrinsically safe)
5. Voltage supply 8...30 VDC (intrinsically safe - terminals 21, 22)
5.1 Configuration of transmitter

The transmitters are configured from a PC by using the ConSoft program and a transmitter configuration kit. For more information refer to Accessory parts on page 24.

The ConSoft is a PC based graphical user interface for configuration of the transmitters. The PC configuration software ConSoft is used for configuration, display and documentation.

Configuration can be performed with or without connected power supply.

To make a configuration of the transmitter you need to do following:

1. Install the PC configuration software ConSoft in your PC.
2. Install the driver for the USB interface (included in the transmitter configuration kit). See documentation for transmitter configuration kit. USB interface will indicate correct installation and connection of the transmitter – PC.
3. Connect the transmitter to your PC via USB interface.
4. Start the software ConSoft.
5. Click on the icon “Read from the transmitter”. The software will identify and connect to the transmitter. A configuration window for the connected transmitter will open.
6. In the configuration window is it possible to edit the parameters that needs to be changed.
7. The selected configuration is downloaded to the transmitter by clicking the icon “Transfer to transmitter”
8. The transmitter begins using the new parameters directly after downloading.

INFORMATION!

Full functionality of the transmitter is achieved with ConSoft program version 3.2.0 or later and the firmware in the USB Interface must have a version number 1.2.07 or later. Consoft is compatible with Windows XP/Vista/7/8/8.1/10. The current software version of ConSoft and the USB interface are available for downloading on our website.

CAUTION!

Only use the manufacturer’s configuration kit for PC configuration. Another configuration kit could destroy or damage the transmitter.

DANGER!

The communication port (USB connection) may only be connected to the associated USB Interface if the temperature transmitter is outside the hazardous area. If the certified TT-CON Ex interface is used then it is allowed to have the sensor installed in a hazardous area while transmitter and interface are within a safe area. If the standard USB interface is used then it is not allowed to have the sensor in a hazardous area when the interface is used.
5.2 Factory setting of transmitter

The transmitters are delivered with a factory configuration Pt100 (α = 0.00385), 3-wire connection 0...+100 °C / +32...+212 °F, Sensor error monitoring Upscale, Filtering level 0.9 s or configured according to customer’s requirements.

Due to the long-term drift of max. ±0.02% of span per year, a re-calibration of the transmitter is normally not needed. Should you for any reason require the re-calibration, the transmitter must be returned to the factory.

5.3 Sensor error monitoring

In case of a sensor break or short circuit the transmitter indicates this by either drop the output <3.6 mA or lift it to >21.0 mA. The sensor error indication is individually configurable and is set via the configuration software.

5.4 Sensor error correction

By setting the measured min. and max. value for the sensor in given temperature range, the transmitter can compensate for known sensor errors. This is set via the configuration software.

---

Figure 5-1: Connection during configuration of in-head transmitter

a = USB Interface; b = PC software ConSoft

1. Input
2. \( R_{\text{Load}} \)
3. Output voltage supply (terminals 6 and 7, configuration can be performed with or without connected power supply to the transmitter.)
4. Communication with USB interface and a PC software ConSoft
Service

6 SERVICE

6.1 Accessory parts

<table>
<thead>
<tr>
<th>Accessory part</th>
<th>Order code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal rail mounting kit for in-head version</td>
<td>70ADA00027</td>
</tr>
<tr>
<td>Configuration kit including modem, software Consoft and cables for USB connection</td>
<td>4001107901</td>
</tr>
<tr>
<td>Connection Head installation kit</td>
<td>70ADA00017</td>
</tr>
<tr>
<td>Ex Configuration kit including Ex-approved modem, software Consoft and cables for USB connection</td>
<td>4001107902</td>
</tr>
</tbody>
</table>

6.2 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

6.3 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.

INFORMATION!
For more precise information, please contact your local sales office.
6.4 Returning the device to the manufacturer

6.4.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

**WARNING!**

Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- Due to statutory regulations on environmental protection and safeguarding the health and safety of the personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.
- This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.

**WARNING!**

If the device has been operated with toxic, caustic, radioactive, flammable or water-endangering products, you are kindly requested:

- to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,
- to enclose a certificate with the device confirming that it is safe to handle and stating the product used.
6.4.2 Form (for copying) to accompany a returned device

CAUTION!
To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

<table>
<thead>
<tr>
<th>Company:</th>
<th>Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department:</td>
<td>Name:</td>
</tr>
<tr>
<td>Tel. no.:</td>
<td>Fax no. and/or Email address:</td>
</tr>
<tr>
<td>Manufacturer’s order no. or serial no.:</td>
<td></td>
</tr>
</tbody>
</table>

The device has been operated with the following medium:

<table>
<thead>
<tr>
<th>This medium is:</th>
<th>radioactive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>water-hazardous</td>
</tr>
<tr>
<td></td>
<td>toxic</td>
</tr>
<tr>
<td></td>
<td>caustic</td>
</tr>
<tr>
<td></td>
<td>flammable</td>
</tr>
</tbody>
</table>

We checked that all cavities in the device are free from such substances.
We have flushed out and neutralized all cavities in the device.

We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.

Date: 
Signature: 
Stamp:

6.5 Disposal

LEGAL NOTICE!
Disposal must be carried out in accordance with legislation applicable in your country.

Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:

According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life must not be disposed of with other waste. The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.
7.1 Measuring principles

The kind of the measuring principle depends on the measuring insert that you combine with the transmitter. In matters of the thermometer type the manufacturer offers two different measuring inserts, either with a resistance thermometer or with a thermocouple. This transmitter only supports resistance thermometer.

7.1.1 Resistance temperature sensor

The measuring insert with a temperature-sensitive sensor made from a platinum RTD, whose value at 0°C / +32°F is 100 Ω. That is where the name “Pt100” comes from.

It is generally valid that the electric resistance of metals increases according to a mathematical function as the temperature rises. This effect is taken advantage of by resistance temperature sensors to measure temperature. The “Pt100” temperature sensors features a measuring resistance with defined characteristics, standardised in IEC 60751. The same is true for the tolerances. The average temperature coefficient of a Pt100 is 3.85 x 10^-3 K^-1 in the range from 0...+100°C / +32...+212°F.

During operation, a constant current I (≤ 1 mA) flows through the Pt100 RTD, which brings about a voltage drop U. The resistance R is calculated using Ohm’s Law (R=U/I). As the voltage drop U at 0°C / +32°F is 100 mV, the resulting resistance of the Pt100 temperature assembly is 100 Ω (100 mV / 1 mA = 100 Ω).

![Figure 7-1: Pt100 resistance temperature sensor in 4-wire connection at 0°C / +32°F, schematic.](image)
7.1.2 Thermocouples

The thermocouple features two electric conductors made from different metals, connected at one end. Each free end is connected to a compensation cable which is then connected to a millivolt meter. This circuitry forms a "thermal circuit". The point at which the two electric conductors connect is called the measuring point and the point at which the compensation cables connect to the conductors of the millivolt meter is called the cold junction.

If the measuring point of this thermal circuit is heated up, a small electrical voltage (thermal voltage) can be measured. If, however, the measuring point and the cold junction are at the same temperature, no thermoelectric voltage is generated. The degree of thermoelectric voltage, also known as electromotive force (EMF), depends on the thermocouple material and the extent of the temperature difference between the measuring point and the cold junction. It can be measured using the millivolt meter with no auxiliary power.

Simply put, the thermocouple behaves like a battery, the voltage of which also increases as the temperature rises.

**INFORMATION!**
The characteristic curves and tolerances of commercially available thermocouples are standardised in IEC 60584.

![Thermocouple measuring circuit, schematic.](image)

- ① Measuring point \( t_1 \) (hot junction)
- ② Thermocouple
- ③ Transition junction \( t_2 \)
- ④ Compensation cable / extension cable
- ⑤ Reference junction \( t_3 \) (cold junction)
- ⑥ Copper conductor
- ⑦ Voltage meter \( U_{th} \)
7.2 Technical data

INFORMATION!

• The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.

• Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).

Measuring system

<table>
<thead>
<tr>
<th>Application range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature measurements of solids, liquids and gases in industrial environment.</td>
</tr>
</tbody>
</table>

Design

<table>
<thead>
<tr>
<th>Versions</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT 33 C</td>
</tr>
<tr>
<td>In-head transmitters which are intended for installation in a &quot;B connection head&quot; or larger according to EN 50446. This transmitter is optionally available in an intrinsically safe version (Zone 0, 1 and 2) for installation in potentially explosive atmospheres.</td>
</tr>
<tr>
<td>TT 33 R</td>
</tr>
<tr>
<td>Rail-mount transmitters which are intended for installation on a rail according to DIN 50022 / EN 60715, 35 mm / 1.38&quot;. The transmitter is optionally available in an intrinsically safe version (Zone 0, 1 and 2) for installation in potentially explosive atmospheres.</td>
</tr>
</tbody>
</table>

Features

<table>
<thead>
<tr>
<th>Sensor matching</th>
</tr>
</thead>
<tbody>
<tr>
<td>A matching to a calibrated temperature sensor can easily be performed by entering the sensor deviation in the low and high ends of the measuring ranges.</td>
</tr>
<tr>
<td>Customized linearization</td>
</tr>
<tr>
<td>For resistance and mV inputs, either a 50-point Customized Linearization table or via Callendar-Van Dusen constants can provide a correct process value.</td>
</tr>
<tr>
<td>PC programmable</td>
</tr>
<tr>
<td>Measuring ranges are set from PC. Full accuracy is provided without any need for calibration. Configuration without external power.</td>
</tr>
<tr>
<td>Runtime counter</td>
</tr>
<tr>
<td>Hour counter for elapsed operational time</td>
</tr>
<tr>
<td>Simulated output</td>
</tr>
<tr>
<td>Fixed current output during a maximum time of 15 min</td>
</tr>
</tbody>
</table>

Measuring accuracy

<table>
<thead>
<tr>
<th>Accuracy &amp; Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic accuracy is max. of ±0.08°C or ±0.08% of span.</td>
</tr>
<tr>
<td>Ambient temperature influence</td>
</tr>
<tr>
<td>RTD and Thermocouple: for detailed information refer to RTD and T/C accuracy table on page 37. Resistance: ±0.01 % x 4000 Ω (2000 Ω at 2-wire) = ±0.02 % of span per °C Voltage: ±0.01 % of span per °C</td>
</tr>
<tr>
<td>Supply voltage influence</td>
</tr>
<tr>
<td>±0.005 % of span per V</td>
</tr>
<tr>
<td>Long-term drift</td>
</tr>
<tr>
<td>Max of ±0.02 °C or ±0.02 % of span per year</td>
</tr>
</tbody>
</table>
### Operating conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperature</strong></td>
<td></td>
</tr>
<tr>
<td><strong>In-head transmitter</strong></td>
<td><strong>Operating and storage temperature:</strong> Standard version: -40...+85°C / -40...+185°F IS version: for detailed information refer to Temperature data for areas with potentially explosive atmospheres on page 34</td>
</tr>
<tr>
<td><strong>Rail-mount transmitter</strong></td>
<td><strong>Operating and storage temperature:</strong> Standard version: -40...+85°C / -40...+185°F IS version: for detailed information refer to Temperature data for areas with potentially explosive atmospheres on page 34</td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td>0...98% RH (non-condensing)</td>
</tr>
<tr>
<td><strong>Protection category</strong></td>
<td></td>
</tr>
<tr>
<td><strong>In-head transmitter</strong></td>
<td>Housing: IP65 Terminals: IP00</td>
</tr>
<tr>
<td><strong>Rail-mount transmitter</strong></td>
<td>Housing: IP20 Terminals: IP20</td>
</tr>
</tbody>
</table>

### Installation conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mounting</strong></td>
<td>In-head transmitter: DIN B-head or larger, DIN-rail (with adapter) Rail-mount transmitter: rail acc. to DIN 50022 / EN 60715, 35 mm / 1.38&quot; For detailed information refer to Installation on page 13</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>In-head transmitter: 35 g / 0.07 lb Rail-mount transmitter: 70 g / 0.15 lb</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>For detailed information refer to Dimensions on page 33.</td>
</tr>
</tbody>
</table>

### Materials

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Housing</strong></td>
<td>PC/ABS + PA</td>
</tr>
<tr>
<td><strong>Flammability acc. to UL</strong></td>
<td>In-head transmitter: V0 Rail-mount transmitter: V0/HB</td>
</tr>
</tbody>
</table>

### Electrical connections

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply</strong></td>
<td>Standard version: 8...36 VDC IS version: 8...30 VDC</td>
</tr>
<tr>
<td><strong>Isolation</strong></td>
<td>Galvanically isolated (in-out), 1500 VAC, 1 minute</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>Single/stranded wires: max. 1.5 mm² / AWG 16</td>
</tr>
<tr>
<td><strong>Reverse Polarity Protection</strong></td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Inputs / Outputs

#### Input - RTD

<table>
<thead>
<tr>
<th>Type</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100 (IEC 60751, α = 0.00385)</td>
<td>-200...+850°C / -328...+1562°F</td>
</tr>
<tr>
<td>Pt100 (UJS C1404-1981, α = 0.003916)</td>
<td></td>
</tr>
<tr>
<td>PtX (10 ≤ X ≤ 1000) (IEC 60751, α = 0.00385)</td>
<td>The upper range depends on the X value, max. input temperature corresponding to 4000 Ω</td>
</tr>
<tr>
<td>Ni100 (DIN 43760)</td>
<td>-40...+250°C / -76...+482°F</td>
</tr>
<tr>
<td>Ni120 (Edison No. 7)</td>
<td></td>
</tr>
<tr>
<td>Ni1000 (DIN 43760)</td>
<td>-50...+180°C / -58...+356°F</td>
</tr>
</tbody>
</table>
### TECHNICAL DATA

**OPTITEMP TT 33 C/R**

| Cu10 (Edison Copper Windings No. 15) | -50...+200°C / -58...+392°F |
| Sensor current | ≤300 μA |
| Maximum sensor wire resistance | 3- and 4-wire connection: 20 Ω/wire; 2-wire connection: Compensation for 0 to 40 Ω loop resistance |
| Adjustment | Minimum span 10°C / 18°F |
| Sensor error compensation | ±10% of span for span <50°C/90°F, otherwise ±10°C/18°F |

#### Input - resistance / potentiometer

| Range [resistance] | 0...10000 Ω |
| Range [potentiometer] | 100...10000 Ω |
| Zero adjustment | Within range |
| Max offset adjustment | 50% of selected max value |
| Minimum span | 10 Ω |
| Sensor current | ≤300 μA |
| Customized linearization | Up to 50 points |
| Maximum sensor wire resistance | 20 Ω / wire |

#### Input - thermocouples

| T/C type B - Pt30Rh-Pt6Rh (IEC 60584) | 400...+1800°C / +752...+3272°F |
| T/C type C - W5Re-W26Re (ASTM E 988) | 0...+2315°C / 32...+4199°F |
| T/C type D - W3Re-W55Re (ASTM E 988) | 0...+2315°C / 32...+4199°F |
| T/C type E - NiCr-CuNi (IEC 60584) | -200...+1000°C / -328...+1832°F |
| T/C type J - Fe-CuNi (IEC 65084) | -200...+1000°C / -328...+1832°F |
| T/C type K - NiCr-NiAl (IEC 60584) | -200...+1350°C / -328...+2442°F |
| T/C type N - NiCrSi-NiSi (IEC 60584) | -250...+1300°C / -418...+2372°F |
| T/C type R - Pt13Rh-Pt (IEC 65084) | -50...+1750°C / -58...+3182°F |
| T/C type S - Pt10Rh-Pt (IEC 65084) | -50...+1750°C / -58...+3182°F |
| T/C type T - Cu-CuNi (IEC 65084) | -200...+400°C / -328...+752°F |
| Input impedance | >10 MΩ |
| Maximum wire loop resistance | 500 Ω (including T/C sensor) |
| Cold Junction Compensation [CJC] | Internal, external (Pt100) or fixed |

#### Input - voltage

| Range | -10...+1000 mV |
| Zero adjustment | Within range |
| Minimum span | 2 mV |
| Customized linearization | Up to 50 points |
| Input impedance | >10 MΩ |
| Maximum wire loop resistance | 500 Ω |

#### Output

| Output signal | 4...20 mA, 20...4 mA; temperature, resistance or voltage linear, customized linearization possible. |
| Permissible load | [Supply voltage -8]/0.022 |
| NAMUR compliance | Output limits and failure currents acc. to NAMUR NE 43 |
| Adjustable filtering level | 0.15 to 75 s, [default 0.9 s] (3-wire RTD) |
## Monitoring

Sensor break and short circuit monitoring, selectable, upscale ≥21.0 mA or downside ≤3.6 mA action, individually configurable.

## Configuration

**ConSoft**
The PC configuration software, ConSoft, is a versatile and user-friendly tool for transmitter configuration.

ConSoft is compatible with Windows XP/Vista/7/8/8.1/10

ConSoft is part of the complete configuration kit, which also contains a USB interface and necessary cables. Full functionality of the transmitter is achieved with ConSoft program version 3.2.0 or later and the firmware in the USB interface must have a version number 1.2.07 or later.

## Approvals and certifications

**CE**
The device fulfills the statutory requirements of the EC directives. The manufacturer certifies that these requirements have been met by applying the CE marking.

**EX approvals**
- **Standard version**: Without
- **Intrinsically safe (IS) version**: ATEX: II 1 G Ex ia IIC T6...T4 Ga
  - IECEx: Ex ia IIC T6...T4 Ga

## Other standards and approvals

**Electromagnetic compatibility**
- Directive: 2014/30/EU
- Harmonized standards: EN 61326-1 and EN 61326-2-3
- NAMUR NE 21
- EN 61326-1 and -2-3: Criteria A
- NE 21: ≤0,5% of span

**Vibration resistance**
- Acc. to IEC 60068-2-6, test Fc, 10...2000 Hz, 10 g
7.3 Dimensions

**In-head transmitter**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>[mm]</th>
<th>[inch]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>33.0</td>
<td>1.30</td>
</tr>
<tr>
<td>b</td>
<td>7.0</td>
<td>0.28</td>
</tr>
<tr>
<td>c</td>
<td>44.5</td>
<td>1.75</td>
</tr>
<tr>
<td>d</td>
<td>19.7</td>
<td>0.78</td>
</tr>
</tbody>
</table>

**Rail-mount transmitter**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>[mm]</th>
<th>[inch]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>17.5</td>
<td>0.69</td>
</tr>
<tr>
<td>b</td>
<td>81.3</td>
<td>3.20</td>
</tr>
<tr>
<td>c</td>
<td>90.0</td>
<td>3.54</td>
</tr>
<tr>
<td>d</td>
<td>35</td>
<td>1.38</td>
</tr>
</tbody>
</table>
7.4 Temperature data for areas with potentially explosive atmospheres

**In-head transmitter**
Intrinsically safe transmitter

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Ambient temperature $T_a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>-40°C $\leq T_a \leq$ 60°C / -40°F $\leq T_a \leq$ 140°F</td>
</tr>
<tr>
<td>T5</td>
<td>-40°C $\leq T_a \leq$ 75°C / -40°F $\leq T_a \leq$ 167°F</td>
</tr>
<tr>
<td>T4</td>
<td>-40°C $\leq T_a \leq$ 85°C / -40°F $\leq T_a \leq$ 185°F</td>
</tr>
</tbody>
</table>

**Rail-mount transmitter**
Intrinsically safe transmitter

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Ambient temperature $T_a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>-40°C $\leq T_a \leq$ 60°C / -40°F $\leq T_a \leq$ 140°F</td>
</tr>
<tr>
<td>T5</td>
<td>-40°C $\leq T_a \leq$ 75°C / -40°F $\leq T_a \leq$ 167°F</td>
</tr>
<tr>
<td>T4</td>
<td>-40°C $\leq T_a \leq$ 85°C / -40°F $\leq T_a \leq$ 185°F</td>
</tr>
</tbody>
</table>
7.5 Output load diagram

Formula for the maximum permissible output load:
permissible \( R_{\text{load}} \) [\( \Omega \)] = \( (U-8)/0.022 \)

**Standard transmitter**

![Output load diagram for standard transmitter](image1)

Figure 7-3: Output load diagram
X: Power supply U [VDC]
Y: Total output load R [Ω]

Formula for the maximum permissible output load:
permissible \( R_{\text{load}} \) [\( \Omega \)] = \( (U-8)/0.022 \)

**Intrinsically safe transmitter**

![Output load diagram for intrinsically safe transmitter](image2)

Figure 7-4: Output load diagram
X: Power supply U [VDC]
Y: Total output load R [Ω]
### 7.6 Electrical data for outputs and inputs

#### In-head transmitter

**Intrinsically safe transmitter TT 33 C Ex**

<table>
<thead>
<tr>
<th>Output terminals 6, 7</th>
<th>Input terminals 1, 2, 3, 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( U_i = U_{max} )  ≤ 30 VDC</td>
<td>( U_0 = U_{OC} )  ≤ 30 VDC</td>
</tr>
<tr>
<td>( I_i = I_{max} )  ≤ 100 mA</td>
<td>( I_0 = I_{OC} )  ≤ 54 mA</td>
</tr>
<tr>
<td>( P_i = P_{max} )  ≤ 900 mW</td>
<td>( P_0 )  ≤ 405 mW</td>
</tr>
<tr>
<td>( L_i )  20 μH</td>
<td>( L_0 )  11 mH</td>
</tr>
<tr>
<td>( C_i )  23.1 nF</td>
<td>( C_0 )  38.1 nF</td>
</tr>
</tbody>
</table>

**Intrinsically safe transmitter TT 33 R Ex**

<table>
<thead>
<tr>
<th>Output terminals 21, 22</th>
<th>Input terminals 1, 2, 3, 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( U_i = U_{max} )  ≤ 30 VDC</td>
<td>( U_0 = U_{OC} )  ≤ 30 VDC</td>
</tr>
<tr>
<td>( I_i = I_{max} )  ≤ 100 mA</td>
<td>( I_0 = I_{OC} )  ≤ 54 mA</td>
</tr>
<tr>
<td>( P_i = P_{max} )  ≤ 900 mW</td>
<td>( P_0 )  ≤ 405 mW</td>
</tr>
<tr>
<td>( L_i )  20 μH</td>
<td>( L_0 )  11 mH</td>
</tr>
<tr>
<td>( C_i )  23.1 nF</td>
<td>( C_0 )  38.1 nF</td>
</tr>
</tbody>
</table>
7.7 RTD and T/C accuracy table

Conformance level 95% (2σ)

CJC = Cold Junction Compensation

### Accuracies in °C

<table>
<thead>
<tr>
<th>Input type</th>
<th>Temp. range [°C]</th>
<th>Min. span [°C]</th>
<th>Accuracy (Maximum of)</th>
<th>Temp. influence (Dev. from ref. temp. 20°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTD Pt100</td>
<td>-200...+850</td>
<td>10</td>
<td>±0.08°C or ±0.08% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>RTD PtX 1</td>
<td>Corresp. to max. 4 kΩ</td>
<td>10</td>
<td>±0.1°C or ±0.1% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>RTD Ni100</td>
<td>-60...+250</td>
<td>10</td>
<td>±0.1°C or ±0.1% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>RTD Ni120</td>
<td>-60...+250</td>
<td>10</td>
<td>±0.1°C or ±0.1% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>RTD Cu10</td>
<td>-50...+200</td>
<td>83</td>
<td>±1.5°C or ±0.2% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>T/C type B</td>
<td>+400...+1800</td>
<td>700</td>
<td>±1.0°C or ±0.1% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>T/C type C</td>
<td>0...+2315</td>
<td>200</td>
<td>±1.0°C or ±0.1% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>T/C type D</td>
<td>0...+2315</td>
<td>200</td>
<td>±1.0°C or ±0.1% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>T/C type E</td>
<td>-200...+1000</td>
<td>50</td>
<td>±0.5°C or ±0.1% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>T/C type J</td>
<td>-200...+1000</td>
<td>50</td>
<td>±0.5°C or ±0.1% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>T/C type K</td>
<td>-200...+1350</td>
<td>50</td>
<td>±0.5°C or ±0.1% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>T/C type N</td>
<td>-100...+1300</td>
<td>100</td>
<td>±0.5°C or ±0.1% of span</td>
<td>±0.1% of span per °C</td>
</tr>
<tr>
<td>T/C type N</td>
<td>-250...-100</td>
<td>100</td>
<td>±1.0°C</td>
<td>±0.1% of span per °C</td>
</tr>
<tr>
<td>T/C type R</td>
<td>-50...+1750</td>
<td>300</td>
<td>±1.0°C or ±0.1% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>T/C type S</td>
<td>-50...+1750</td>
<td>300</td>
<td>±1.0°C or ±0.1% of span</td>
<td>±0.01% of span per °C</td>
</tr>
<tr>
<td>T/C type T</td>
<td>-200...+400</td>
<td>50</td>
<td>±0.5°C or ±0.1% of span</td>
<td>±0.01% of span per °C</td>
</tr>
</tbody>
</table>

1. 10 ≤ X ≤ 1000
2. CJC error is not included
### Accuracies in °F

<table>
<thead>
<tr>
<th>Input type</th>
<th>Temp. range</th>
<th>Min. span</th>
<th>Accuracy (Maximum of)</th>
<th>Temp. influence [Dev. from ref. temp. 68°F]</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTD Pt100</td>
<td>-328...+1562</td>
<td>18</td>
<td>±0.14°F or ±0.08% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>RTD PtX (1)</td>
<td>Corresponds to max. 4 kΩ</td>
<td>18</td>
<td>±0.18°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>RTD Ni100</td>
<td>-76...+482</td>
<td>18</td>
<td>±0.08°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>RTD Ni120</td>
<td>-76...+482</td>
<td>18</td>
<td>±0.08°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>RTD Ni1000</td>
<td>-58...+356</td>
<td>18</td>
<td>±0.08°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>RTD Cu0</td>
<td>-58...+392</td>
<td>149</td>
<td>±2.7°F or ±0.2% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>T/C type B</td>
<td>+752...+2722</td>
<td>1260</td>
<td>±1.8°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>T/C type C</td>
<td>+32...+4199</td>
<td>360</td>
<td>±1.8°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>T/C type D</td>
<td>+32...+4199</td>
<td>360</td>
<td>±1.8°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>T/C type E</td>
<td>-328...+1832</td>
<td>90</td>
<td>±0.9°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>T/C type J</td>
<td>-328...+1832</td>
<td>90</td>
<td>±0.9°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>T/C type K</td>
<td>-328...+2462</td>
<td>90</td>
<td>±0.9°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>T/C type N</td>
<td>-148...+2372</td>
<td>180</td>
<td>±0.9°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>T/C type N</td>
<td>-418...-148</td>
<td>180</td>
<td>±1.0°F (2)</td>
<td>±0.18% of span per °F</td>
</tr>
<tr>
<td>T/C type R</td>
<td>-58...+3182</td>
<td>540</td>
<td>±1.0°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>T/C type S</td>
<td>-58...+3182</td>
<td>540</td>
<td>±1.0°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
<tr>
<td>T/C type T</td>
<td>-328...+752</td>
<td>90</td>
<td>±0.9°F or ±0.1% of span</td>
<td>±0.004% of span per °F</td>
</tr>
</tbody>
</table>

1. 10 ≤ X ≤ 1000
2. CJC error is not included
8.1 Installation and control drawing
KROHNE – Process instrumentation and measurement solutions

- Flow
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- Temperature
- Pressure
- Process Analysis
- Services

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