



TT 31 R HANDBOOK

Intelligent 2-wire universal transmitter, I- and 2-channel







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1	Safety information	4
1.1	Intended use	4
1.2	Product liability and guarantee	4
1.3	Certifications, TT 31 R	5
1.3.1	Certifications, TT 31 R	5
1.3.2	General certifications	5
1.4	Manufacturer's safety instructions	6
1.4.1	Notes about the documentation	6
1.4.2	Symbol conventions	6
2	Device description	8
3	Installation	9
3.1	Installation TT 31 R	9
4	Electrical connections	10
4.1	Safety instructions	10
4.2	Connections, measuring input	11
4.3	Connection diagram TT 31 R	12
4.4	Connection diagram TT 31 R 	13
4.5	Cable length	15
5	Operation	16
5.1	Connection with the KROHNE PC configuration set	16
5.1.1	Connection, TT 31 R	16
5.1.2	Connection, TT 31 R 	17
5.2	General information	19
5.2.1	Temperature difference measurement	21
5.2.2	Sensor break monitoring	21
6	Technical data	22
6.1	Specifications, TT 31 R / TT 31 R 	22
6.1.1	Technical data	22
6.1.2	Output load diagram	23
6.1.3	Dimensions	23
6.1.4	Values for input signals, TT 31 R 	24
7	Service	25
7.1	Ordering information TT 31 R	25

1.1 Intended use

The TT 31 R is an intelligent, two-wire universal transmitter for temperature and other measurement applications. It is only intended for installation on a top-hat rail according to DIN EN 50022.

The TT 30 C is optionally available in an intrinsically safe version. When installed in the safe area, the transmitter may be operated with sensors in areas with potentially explosive atmospheres! These devices are labeled with the Ex symbol .



ATTENTION!

Responsibility for the use of the device with regard to suitability, intended use and area of application lies solely with the user.

The manufacturer shall not be liable for damage resulting from improper use or use for other than the intended purpose.

1.2 Product liability and guarantee

Use for other than the intended purpose or improper installation and operation may lead to loss of the guarantee. The guarantee shall likewise be void if the device is damaged or its function otherwise impaired.


KROHNE Messtechnik GmbH hereby guarantees that the product will be free of material and workmanship defects for a period of five (5) years from the date of delivery ("limited guarantee"). This limited guarantee refers to repairs or exchanges, and is only valid for the first end user of the product.


The "General conditions of sale" forming the basis of the purchase contract are also applicable.

1.3 Certifications, TT 31 R

1.3.1 Certifications, TT 31 R

Approval DEMKO 06 ATEX 141334X

CE 0102  II (1) G [Ex ia] IIC

CE 0102  II (1) D [Ex iaD]

1.3.2 General certifications



IMPORTANT NOTE!

See also the ATEX certificate "Special conditions for safe use".

The measuring device complies with the statutory requirements of the following EC directives:

The manufacturer's declaration can be viewed on the Internet at

<http://www.krohne.com/html/dlc/index.shtml>.

KROHNE Messtechnik GmbH certifies successful testing of the product by applying the CE mark.

1.4 Manufacturer's safety instructions

The measuring device has been built and tested in accordance with the current state of the art, and complies with the relevant safety standards.

However, dangers may arise from improper use or use for other than the intended purpose. For this reason, observe all of the safety instructions in this document carefully.

1.4.1 Notes about the documentation

In addition to the safety rules and industrial safety regulations in this documentation, national and regional safety rules and industrial safety regulations must also be observed.

1.4.2 Symbol conventions

For greater clarity, the following symbols are used in this documentation:



DANGER!, WARNING!, ATTENTION!, CAUTION!

This symbol indicates general dangers.

All warnings must always be observed. Even partial failure on your part to observe them can lead to serious damage to health, damage to the device or to the user's system components.



DANGER!

This symbol is used to identify dangers when working with electric current.

Work on the device's electrical and electronic components may only be performed by qualified personnel with the appropriate training.



DANGER!

This symbol indicates dangers in areas with potentially explosive atmospheres, for example those which may arise during installation and operation of explosion-proof devices.

Special regulations apply for use in areas with potentially explosive atmospheres; these must always be observed in order to ensure safe use in such areas. Installation, set-up,

operation and maintenance of the device may only be performed by qualified persons with training in explosion protection.



Important note!, Note!, Information!

This symbol identifies important notes and information for working with the device.



Legal note!

This symbol identifies references to legal and normative regulations.

The KROHNE TT 31 R is an intelligent, two-wire universal transmitter with one or two channels for

- Temperature measurements with resistance thermometers
- Temperature measurements with thermocouples
- Temperature difference measurements with resistance thermometers
- Measurements with potentiometers
- Voltage measurements in a range up to 500 mV

in an industrial environment.

The transmitter is optionally available for areas with potentially explosive atmospheres.

An IBM compatible PC and the "TempSoft" software are required for configuration of the transmitter.

No further calibration work is required after configuration.

The two wire universal transmitter TT 31 R is designed for installation on a top-hat rail according to DIN EN 50022.

The transmitter is configured using a standard IBM compatible PC and the "TempSoft" software.

The current version of the software is available for download on our website <http://www.krohne.com/html/dlc/index.shtml>.

You can find configuration instructions in the "TempSoft" reference manual.

3.1 Installation TT 31 R

The TT 31 R transmitter is intended for installation on a top-hat rail according to DIN EN 50022.

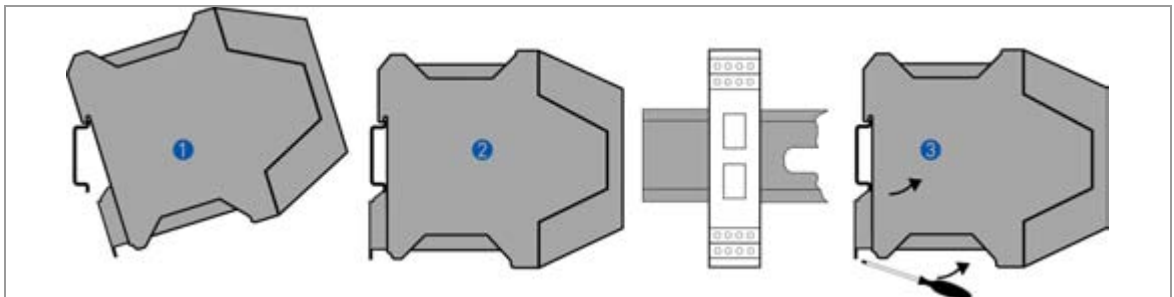


Figure 1: Rail installation

- 1 Hook the upper groove of the transmitter onto the rail.
- 2 Press the transmitter downwards until the snap fastener engages on the rail.
- 3 To remove, press the snap fastener downwards using a screwdriver. Carefully pull the transmitter forwards.

4.1 Safety instructions

**ATTENTION!**

Only trained and qualified personnel may carry out any work on the device. Always observe the regional industrial safety and other safety regulations.

**ATTENTION!**

Observe the national regulations for electrical installations!

Only perform work on the electrical connections in the de-energized state. For all work on the device, such as electrical connection or calibration work, use an electrostatically safe (grounded) work station in order to minimize the risk of electrostatic discharge (ESD).

Observe the voltage specifications on the rating plate!

**DANGER!**

When connecting devices with an Ex certificate, observe the corresponding chapters and the instructions in this manual.

Observe the corresponding regulations and the declaration of conformity and type test certificate for the device.

**ATTENTION!**

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.

**ATTENTION!**

The "Input/output/PC isolation" as described in the data sheet means galvanic isolation, comparable to a Zener barrier. Thus the TT 31 R^{Ex} can be supplied using a non Ex-tested power supply unit.

4.2 Connections, measuring input

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

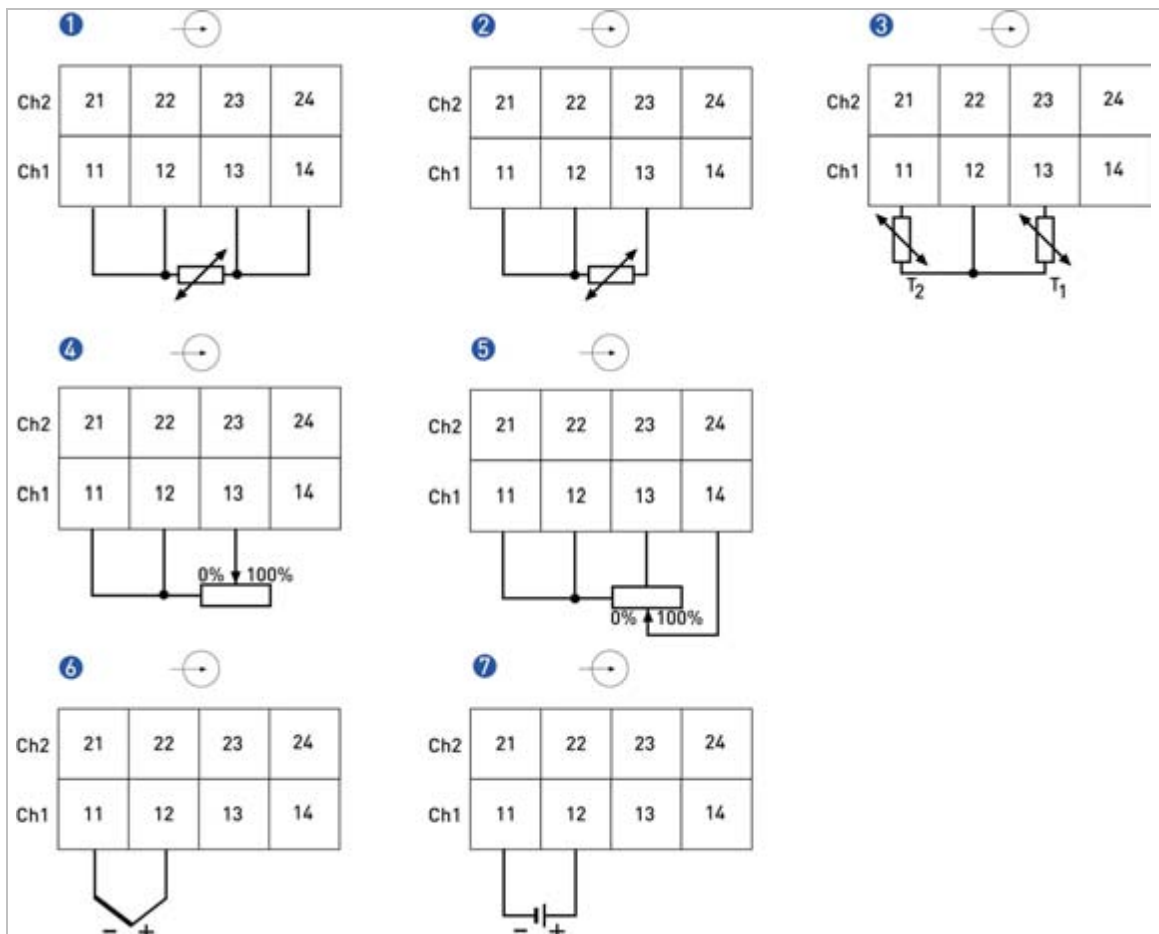


Figure 2: Installation diagram TT 31 R

- 1 Pt100, Pt1000, Ni100, Ni1000, 4 wire connection
- 2 Pt100, Pt1000, Ni100, Ni1000, 3 wire connection
- 3 Pt100, temperature difference $T_1 > T_2$
- 4 Potentiometer, 3 wire connection
- 5 Potentiometer, 4 wire connection
- 6 Thermocouple
- 7 Voltage

4.3 Connection diagram TT 31 R

**ATTENTION!**

Neither install the transmitter in an area with a potentially explosive atmosphere, nor connect it to a sensor in an area with a potentially explosive atmosphere!

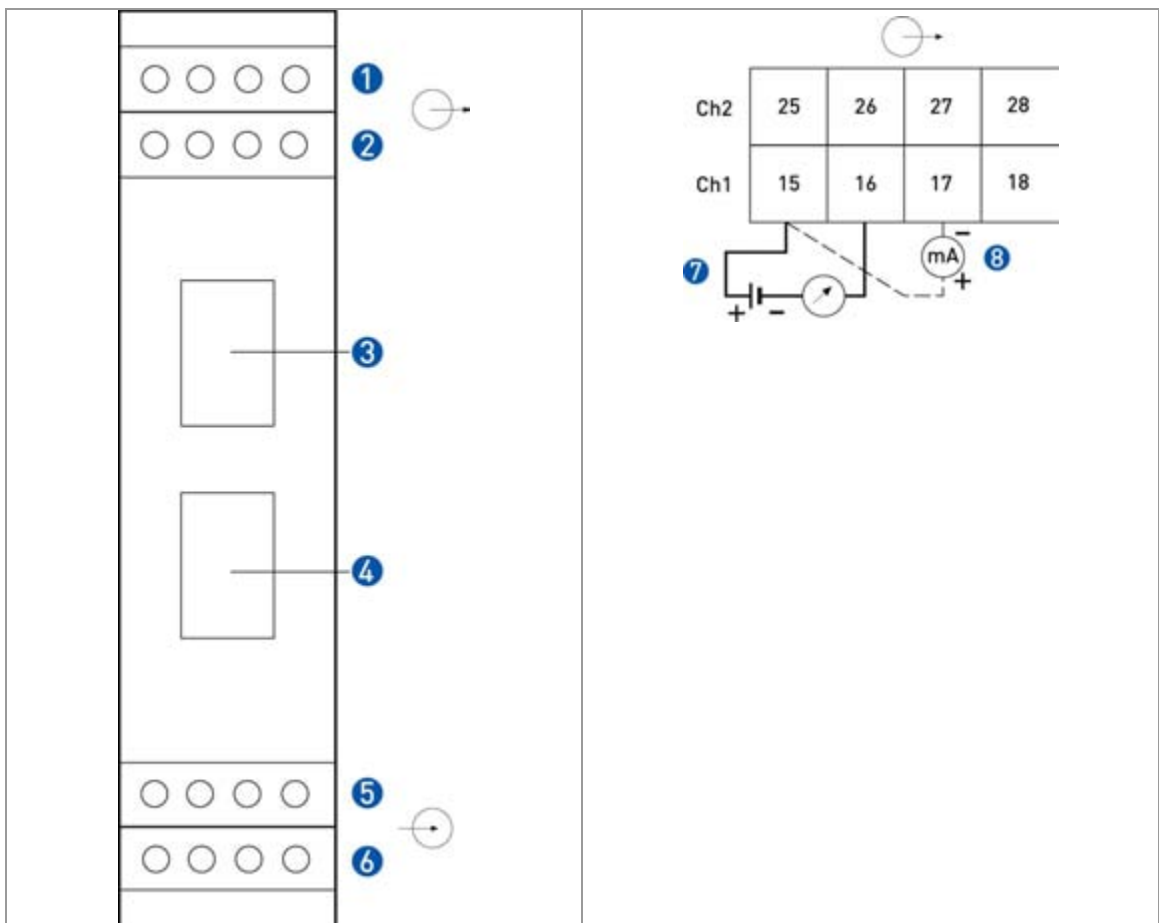


Figure 3: TT 31 R connection diagram

- | | | | |
|---|--------------------------|---|------------------|
| 1 | Output, channel 2 | 5 | Input, channel 1 |
| 2 | Output, channel 1 | 6 | Input, channel 2 |
| 3 | PC connection, channel 2 | 7 | Output signal |
| 4 | PC connection, channel 1 | 8 | Test circuit |

The maximum output load is dependent on the power supply (see Chapter 6.1.2).

4.4 Connection diagram TT 31 R **ATTENTION!**

The transmitter must be installed in a safe area. The measuring input may be connected to sensors in an area with a potentially explosive atmosphere.

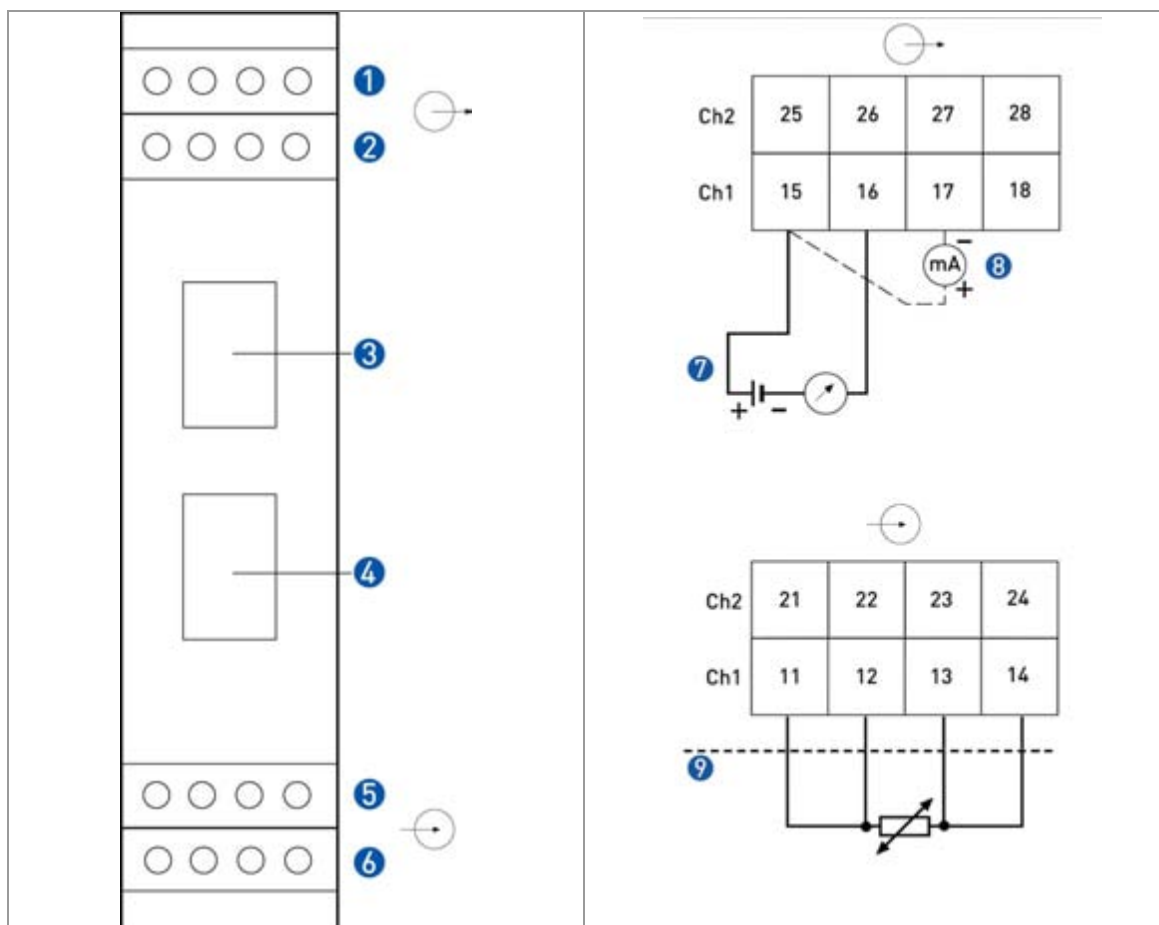


Figure 4: TT 31 R connection diagram 

- | | | | |
|---|--------------------------|---|--|
| 1 | Output, channel 2 | 5 | Input, channel 1 |
| 2 | Output, channel 1 | 6 | Input, channel 2 |
| 3 | PC connection, channel 2 | 7 | Output signal |
| 4 | PC connection, channel 1 | 8 | Test circuit |
| | | 9 | Area with potentially explosive atmosphere |

The maximum output load is dependent on the power supply (see Chapter 6.1.2).

4.5 Cable length



ATTENTION!

In the Ex version, please note that the maximum cable length is determined by all of the cable parameters.

The total capacitance and inductance of the cable must be within the limits for the transmitter described in the Ex certificate.

To calculate the maximum cable length for the output circuit, determine the total resistance of the output loop (load resistance plus the approximate cable resistance). Find out the cable capacitance of the cable being used.

In the case of additional capacitance and inductance of the sensor, these values must be subtracted from C_0 / from L_0 .

To calculate the maximum cable length, the Ex data must be used.

Input (terminals 11 ... 14, 21 ... 24, intrinsically safe sensor terminals)

$$I_0 = 13 \text{ mA}$$

$$L_0 = 100 \text{ mH}$$

$$C_0 = 550 \text{ nF}$$

Calculation (L_{\max} : is indicated in meters)

$$L_{\max} = C_0/C \quad \text{Value } C_0 \text{ from the Ex data, } C = \text{cable capacitance / m}$$

$$L_{\max} = L_0/L \quad \text{Value } L_0 \text{ from the Ex data, } L = \text{cable inductance / m}$$



Important note!

Use the smaller of the two calculated values as the maximum cable length.

5.1 Connection with the KROHNE PC configuration set



ATTENTION!

No PC may be connected to a transmitter in areas with potentially explosive atmospheres.

If you wish to configure the transmitter with the PC, this must be done outside of the area with a potentially explosive atmosphere.

5.1.1 Connection, TT 31 R

The transmitter can be configured either with or without voltage supply.

1. Without voltage supply

If the transmitter is connected to the PC with cable type D (offline cable), then it is supplied with voltage via the PC cable.

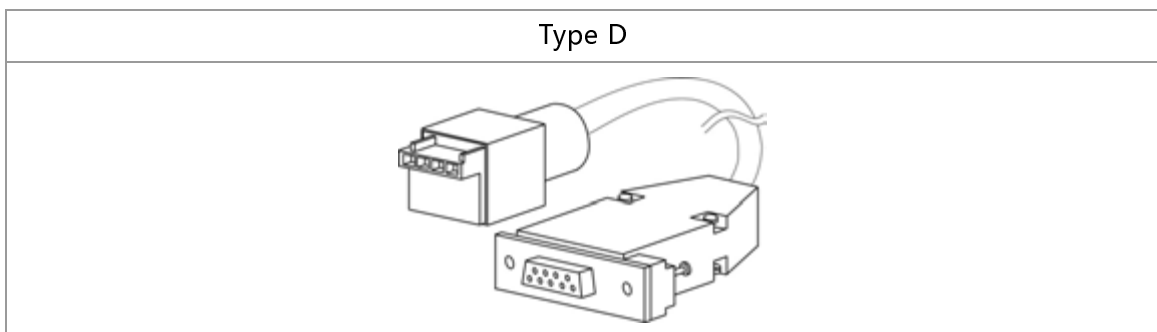


Figure 5: PC connection cable (offline cable)

	Order number	Comment
Type D	VI70IPRP0101	No voltage supply of the transmitter necessary

2. With voltage supply

The transmitter is connected to the PC with ATEX cable type A and adapter type C. In this case the transmitter must be connected to an external voltage supply.

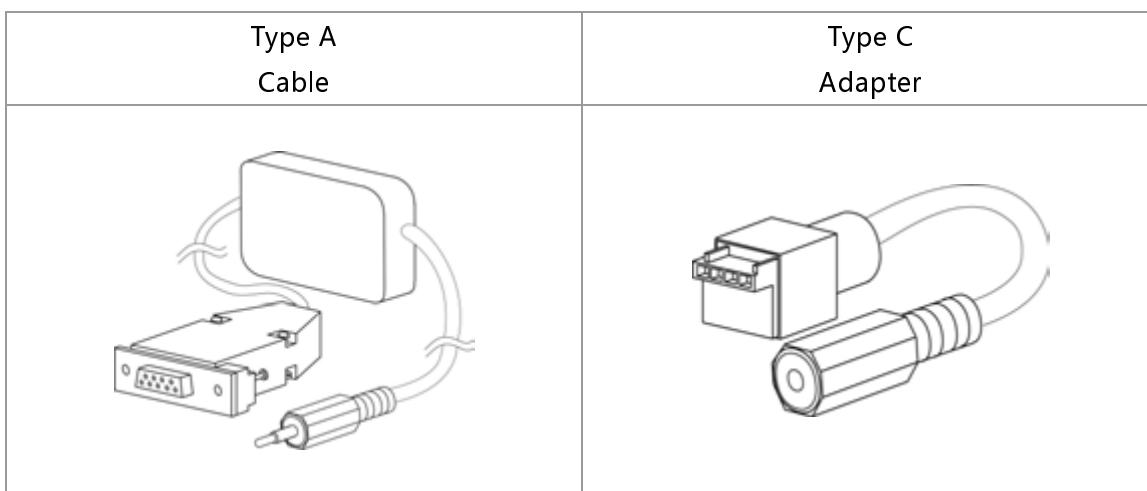



Figure 6: PC connection cable ATEX

	Order number	Comment
Type A (cable)	VI70IPRX0002	ATEX certified
Type C (adapter)	VI70IPRP0001	--

5.1.2 Connection, TT 31 R 

If the transmitter is configured with the PC, a configuration cable and an adapter from the configuration set (order number see Chapter 7.1) must be used as the connection between the PC and the transmitter.

An ATEX certified cable must be used for transmitters bearing the  symbol.

Type A Cable	Type C Adapter

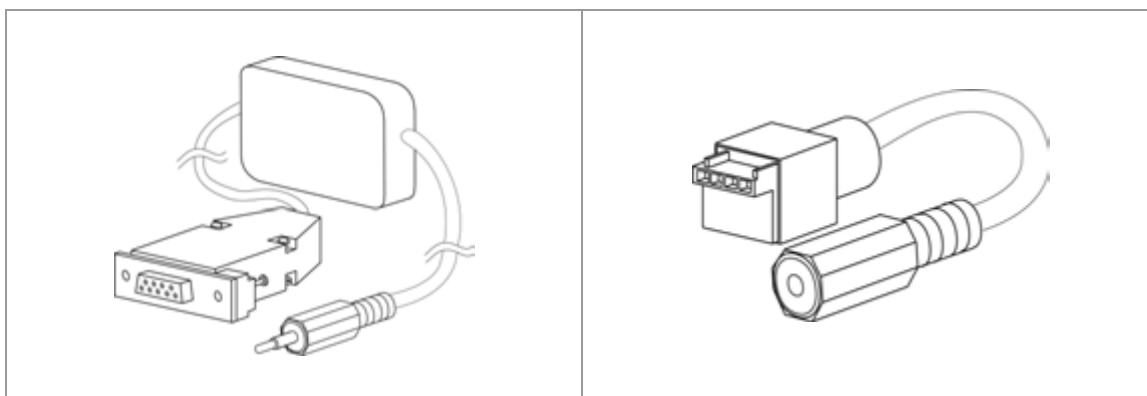


Figure 7: PC connection cable

	Order number	Comment
Type A (cable)	VI70IPRX0002	ATEX certified
Type C (adapter)	VI70IPRP0001	--

5.2 General information



CAUTION!

For configuration, the two channel TT 31 R / TT 31 R^{Ex} has on the front side a separate PC connection for each channel. Connect the cable of the PC configuration set with the connection of the channel that you wish to configure (see Figure 3).



NOTE!

With the TT 31 R, genuine on-line communication is possible, i.e. access to all functions during operation. Online communication is only permissible in a safe area.

Ex works setting

The transmitter is shipped with the following settings:

Model	Input	Output	Sensor break
TT 31 R	Pt100, 3-wire, 0...100°C	4...20 mA	On
TT 31 R ^{Ex}	Pt100, 3-wire, 0...100°C	4...20 mA	On

Configuration is carried out when the PC is "online", i.e. the transmitter can remain in operation during configuration. During configuration, the output is "frozen", i.e. the transmitter continues to work with the last value. As soon as configuration has been completed, the transmitter uses the new parameters.

For configuration, the transmitter must be connected to a supply voltage. If the transmitter is configured with offline PC cable type D, it is supplied with power via this cable (see Chapter 5.1.1). The "TempSoft" software is required to configure the transmitter. The current version is available for downloading on the KROHNE website

<http://www.krohne.com/html/dlc/index.shtml>.

Install the "TempSoft" software on your PC, if it is not already installed. During the installation process, follow the instructions given by the software.

When the transmitter has been configured using the PC, it is ready for operation (no calibration required).

You can find additional configuration information in the "TempSoft" reference manual.

5.2.1 Temperature difference measurement

The sensor break function must be deactivated for temperature difference measurements. In the "Temp Soft" software, the sensor break function must be set to "Sensor break = without".

5.2.2 Sensor break monitoring

The transmitter uses a pulse signal to determine a sensor break/short circuit. This signal may interfere with electronic temperature calibrators. To switch off the pulse signal, deactivate the "Sensor break" function (Sensor break = without) in the "TempSoft" software.

**Action**

To protect the PC connections, they must be closed off using the supplied protection caps after configuration has been completed.

6.1 Specifications, TT 31 R / TT 31 R^{Ex}

6.1.1 Technical data

	Designation	Value
Input	Pt100	-200...+1000°C
	Pt1000	-200...+200°C
	PtX	The upper range is dependent on the X value.
	Ni100	-60...+250°C
	Ni1000	-10...+150°C
	Potentiometer	0...2000 Ω
	Thermocouples	Types: AE, B, E, J, K, L, N, R, S, T, U
	Voltage	-10...+500 mV
	Sensor break function	User-defined output
Output		4...20 mA, 20...4 mA, temperature linear
Ambient temperature	TT 31 R	-20...+70°C
	TT 31 R ^{Ex}	-20...+60°C
Galvanic isolation		1500 VAC, 1 min
Power supply	TT 31 R	8...36 VDC
	TT 31 R ^{Ex}	8...36 VDC Not intrinsically safe
Typical accuracy		+/- 0.1% of the measuring span
Installation		Rail according to EN 50020, 35 mm

Table 1: Technical Data TT 31 R / TT 31 R^{Ex}

6.1.2 Output load diagram

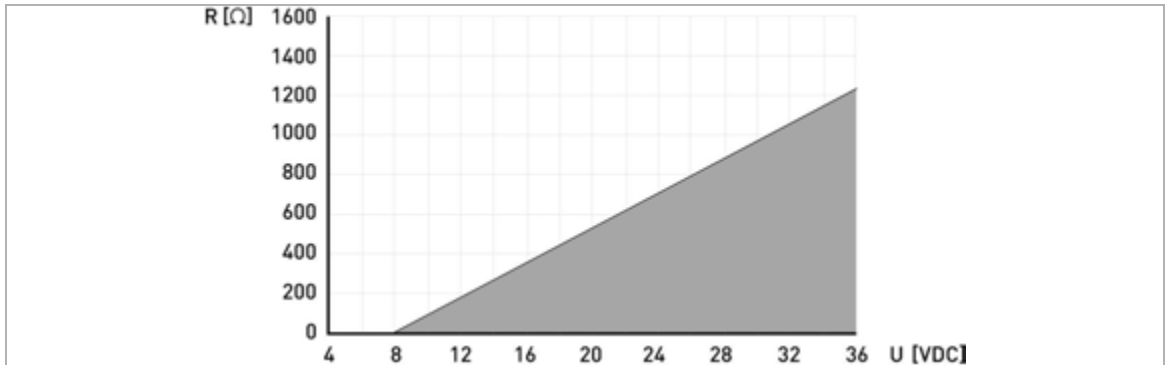


Figure 8: Output load diagram TT 31 R, TT 31 R

R Total output load [Ω]

U Power supply [VDC]

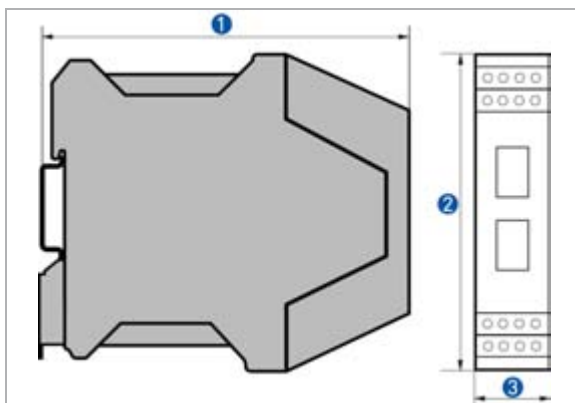


NOTE

The output load is calculated according to the following formulae:

TT 31 R / TT 31 R $R_{LOAD} = (U - 8.0) / 0.022$

6.1.3 Dimensions





	Dimension [mm]	Dimension [inch]
1	115	4.53
2	100	3.93
3	22.5	0.88

Figure 9: Dimensions, TT 31 R/TT 31 R





6.1.4 Values for input signals, TT 31 R 

Inputs 11-14, 21-24 (Intrinsically safe sensor connection)	
U _o :	≤ 15 VDC
I _o :	≤ 13 mA
P _o :	≤
L _o :	~ 100 mH
C _o :	~ 550 nF

Table 2: Inputs, TT 31 R **ATTENTION!**

The "Input/output/PC isolation" is galvanic isolation, comparable to a Zener barrier. The TT 31 R  can be supplied with an input voltage of <250 V using a non Ex-tested power supply unit.

7.1 Ordering information TT 31 R

Product	Order No.
TT 31 R, 1-Ch.	VII2421L0010000
TT 31 R, 2-Ch.	VII2422L0010000
TT 31 R  (ATEX), 1-Ch. (terminal connection)	VII2421LX010000
TT 31 R  (ATEX), 2-Ch. (terminal connection)	VII2422LX010000
TT 31 R  (ATEX), 1-Ch. (plug connection)	VII2421LX020000
TT 31 R  (ATEX), 2-Ch. (plug connection)	VII2422LX020000
Software and cables	
PC "TempSoft" configuration set with cable	VI70CFG00092
ATEX cable for PC connection (included in configuration set VI70CFG00092)	VI70IPRX0002
Adapter cable for TT 31 / TT 40 (included in configuration set VI70CFG00092)	VI70IPRX0001
Offline cable for PC connection (included in configuration set VI70CFG00092)	VI70IPRX0101
Configuration ex works	VI70CAL00001

For your notes:

For your notes

KROHNE Product Overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Mass flowmeters
- Ultrasonic flowmeters
- Vortex flowmeters
- Flow controllers
- Level measuring instruments
- Pressure gauges
- Temperature measuring instruments
- Water solutions & analysis
- Oil and gas turnkey solutions

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