



## IPAQ C530/R530

Smart 2-wire universal transmitter  
with HART<sup>®</sup> 7 and NFC technology

The documentation is only complete when used in combination with the relevant documentation for the signal converter. The manual/handbook must be read prior to adjustment and/or installation. All information is subject to change without notice.



|       |                                                                   |    |
|-------|-------------------------------------------------------------------|----|
| 1     | Safety instructions                                               | 5  |
| 1.1   | Intended use                                                      | 5  |
| 1.2   | Certifications                                                    | 6  |
| 1.2.1 | EU directive compliance                                           | 6  |
| 1.2.2 | Ex approvals                                                      | 6  |
| 1.3   | Safety instructions from the manufacturer                         | 7  |
| 1.3.1 | Copyright and data protection                                     | 7  |
| 1.3.2 | Disclaimer                                                        | 7  |
| 1.3.3 | Product liability and warranty                                    | 8  |
| 1.3.4 | Information concerning the documentation                          | 8  |
| 1.3.5 | Warnings and symbols used                                         | 9  |
| 1.4   | Safety instructions for the operator                              | 9  |
| 2     | Device description                                                | 10 |
| 2.1   | General description                                               | 10 |
| 2.2   | Nameplate                                                         | 11 |
| 2.3   | Versioning per NAMUR NE53                                         | 12 |
| 2.4   | Scope of delivery                                                 | 12 |
| 3     | Installation                                                      | 13 |
| 3.1   | In-head transmitter                                               | 13 |
| 3.2   | Rail mounting kit for in-head transmitters                        | 14 |
| 3.3   | Rail-mount transmitter                                            | 15 |
| 4     | Electrical connections                                            | 16 |
| 4.1   | Safety instructions                                               | 16 |
| 4.2   | Electrical connections of in-head transmitter                     | 18 |
| 4.3   | Connection diagram of in-head transmitter                         | 19 |
| 4.4   | Connection diagram of in-head transmitter (intrinsically safe)    | 20 |
| 4.5   | Electrical connections of rail-mount transmitter                  | 21 |
| 4.6   | Connection diagram of rail-mount transmitter                      | 22 |
| 4.7   | Connection diagram of rail-mount transmitter (intrinsically safe) | 22 |
| 4.8   | Cable length                                                      | 23 |
| 5     | Operation                                                         | 24 |
| 5.1   | NFC configuration and logging                                     | 24 |
| 5.2   | HART® networks                                                    | 25 |
| 5.3   | Point-to-point connection analog / digital mode                   | 25 |
| 5.4   | Multi-drop connection                                             | 26 |
| 5.5   | Factory settings for configuration                                | 27 |
| 5.6   | Configuration with ConSoft                                        | 28 |
| 5.7   | Configuration with a hand held communicator FC 475                | 32 |
| 5.8   | Device management software                                        | 32 |

|                                                                             |           |
|-----------------------------------------------------------------------------|-----------|
| 5.9 Configuration with PACTware .....                                       | 33        |
| 5.10 Current output and HART® dynamic/device variables .....                | 33        |
| 5.11 Diagnostic information according to NAMUR NE 107 .....                 | 34        |
| 5.12 Factory default settings.....                                          | 38        |
| 5.13 Sensor error monitoring .....                                          | 38        |
| 5.14 System or sensor error correction .....                                | 38        |
| <b>6 Service .....</b>                                                      | <b>39</b> |
| 6.1 Accessory parts .....                                                   | 39        |
| 6.2 Spare parts availability.....                                           | 39        |
| 6.3 Availability of services .....                                          | 39        |
| 6.4 Returning the device to the manufacturer.....                           | 39        |
| 6.4.1 General information.....                                              | 39        |
| 6.4.2 Form (for copying) to accompany a returned device.....                | 41        |
| 6.5 Disposal .....                                                          | 41        |
| 6.5.1 Dispose of the transmitter.....                                       | 41        |
| 6.5.2 Disassembling and recycling.....                                      | 42        |
| 6.5.3 Disassembling and recycling of IPAQ C530/C530X .....                  | 42        |
| 6.5.4 Disassembling and recycling of IPAQ R530/R530X .....                  | 43        |
| 6.5.5 Packaging of IPAQ C530/C530X and R530/R530X .....                     | 45        |
| <b>7 Technical data .....</b>                                               | <b>46</b> |
| 7.1 Measuring principles.....                                               | 46        |
| 7.1.1 Resistance temperature sensor .....                                   | 46        |
| 7.1.2 Thermocouples .....                                                   | 47        |
| 7.2 Technical data.....                                                     | 48        |
| 7.3 Dimensions .....                                                        | 53        |
| 7.4 Temperature data for areas with potentially explosive atmospheres ..... | 54        |
| 7.5 Output load diagram.....                                                | 55        |
| 7.6 Electrical data for outputs and inputs.....                             | 56        |
| 7.7 RTD and T/C accuracy table .....                                        | 57        |
| <b>8 Appendix .....</b>                                                     | <b>59</b> |
| 8.1 Installation and control drawing .....                                  | 59        |
| <b>9 Notes .....</b>                                                        | <b>61</b> |

## 1.1 Intended use

The IPAQ 530 is a universal HART® compatible 2-wire transmitter intended to be used in industrial environments and designed for measurements of:

- 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

C530 / C530X is intended for installation in a DIN B-head or larger according to EN 50446.  
R530 / R530X is intended for installation on a 35 mm DIN-rail according to EN 60715.

The transmitters are configured from a PC by using the ConSoft software and a transmitter configuration kit (USB connection), by a HART® configurator, by a HART® modem and a suitable software, e.g. PactWare, or by a smartphone with built-in NFC support.



**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. 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.*



*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.*



**CAUTION!**

*This device is a Group 1, Class A device as specified within CISPR11. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.*

## 1.2 Certifications

### 1.2.1 EU directive compliance

CE marking



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

- EMC Directive 2014/30/EU, harmonized standards EN 61326-1 and EN 61326-2-3
- Devices for use in hazardous areas: ATEX Directive 2014/34/EU, harmonized standards EN 60079-0 and EN 60079-11
- CE Directive 93/68/EC
- RoHS Directive 2011/65/EU, harmonized standard EN IEC 63000.
- Radio Equipment Directive (RED) 2014/53/EU.

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

### 1.2.2 Ex approvals

#### C530X (intrinsically safe)

|        |                     |                                                                     |
|--------|---------------------|---------------------------------------------------------------------|
| ATEX   | KIWA 17ATEX0053 X   | II 1G Ex ia IIC T6...T4 Ga                                          |
| IECEX  | IECEX KIWA 17.0027X | Ex ia IIC T6...T4 Ga                                                |
| USA    | FM18US0260X         | IS CL I DIV 1 GP A-D, T6...T4<br>Cl I Zn 0 AEx/Ex ia IIC T6...T4 Ga |
| Canada | FM18CA0124X         |                                                                     |

#### R530X (intrinsically safe)

|        |                     |                                                                     |
|--------|---------------------|---------------------------------------------------------------------|
| ATEX   | KIWA 17ATEX0055 X   | II 1G Ex ia IIC T6...T4 Ga                                          |
| IECEX  | IECEX KIWA 17.0029X | Ex ia IIC T6...T4 Ga                                                |
| USA    | FM18US0260X         | IS CL I DIV 1 GP A-D, T4...T6<br>Cl I Zn 0 AEx/Ex ia IIC T4...T6 Ga |
| Canada | FM18CA0124X         |                                                                     |



Refer also to "Specific Conditions of Use" in the Ex 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.*



**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.*



*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.*

## 2.1 General description

The IPAQ 530 signal conditioner is a smart, digital 2-wire universal HART® compatible 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.

Configuration of the transmitter is possible with:

- HART® 7 protocol via 4...20 mA output circuit.
- HART® 7 hand held terminal.
- The graphic user interface DTM.
- The third part PC software with a FSK modem for HART® 7 communication
- PC configuration software ConSoft with PC configuration kit ICON-X
- NFC interface in a portable device such as a smartphone.  
A smartphone app, makes it possible to read, write, save and share settings directly in the field.

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.

### C530 - In-head transmitter

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 DIN-B head or larger according to EN 50446. As an alternative you can also mount the in-head version on a 35 mm rail according to EN 60715 with the help of the rail installation kit (for details refer to *Rail mounting kit for in-head transmitters* on page 14).

### R530 - Rail-mount transmitter

The R530 rail-mount transmitter has the same features as the in-head version.

The rail-mount transmitter is optionally available in an intrinsically safe version for installation in 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.

## 2.2 Nameplate



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

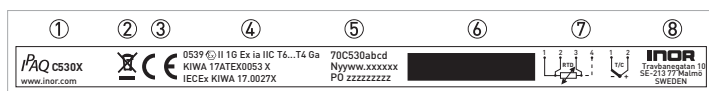


Figure 2-1: Example of nameplate for in-head transmitter

- ① Product name
- ② Electronic/electric device waste marking
- ③ CE marking (EU conformity)
- ④ Ex-relevant electrical data
- ⑤ Part number, serial number (yyww = year and week of manufacturing) and batch number
- ⑥ Printable field, sensor configuration
- ⑦ Connection diagrams
- ⑧ Manufacturer address

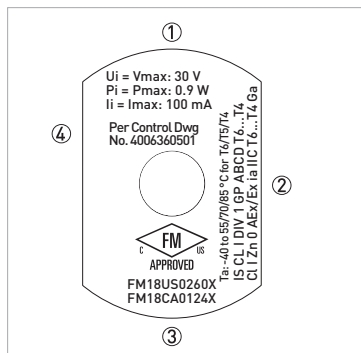


Figure 2-2: Example for bottom nameplate

- ① Electrical data for output
- ② Ex relevant electrical data and ambient temperature
- ③ Ex approvals for North America
- ④ Control drawing number

## Nameplate for rail-mount transmitter

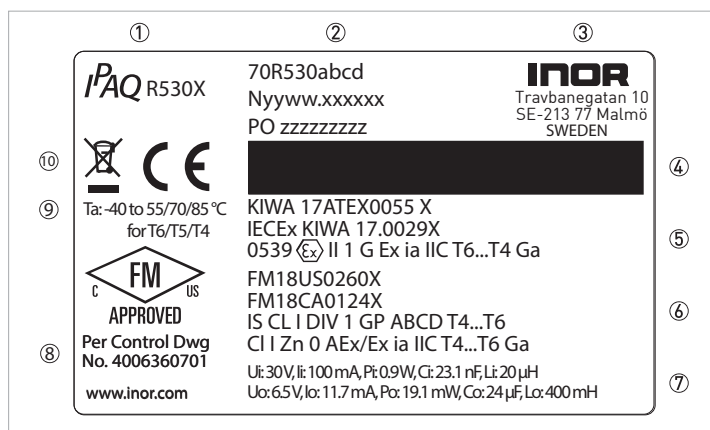


Figure 2-3: Example of nameplate for rail-mount transmitter

- ① Product name
- ② Part number, serial number (yyww = year and week of manufacturing) and batch number
- ③ Manufacturer address
- ④ Printable field, sensor configuration
- ⑤ Ex relevant electrical data and Ex approvals
- ⑥ Additional Ex relevant electrical data and Ex approvals (for example for North America)
- ⑦ Electrical data for output and input
- ⑧ Control drawing number
- ⑨ Ambient temperature
- ⑩ CE marking (EU conformity) and electronic/electric device waste marking

## 2.3 Versioning per NAMUR NE53

| Hardware | Firmware   | Firmware release date (MM/YYYY) | ConSoft | HART® | Documentation        |
|----------|------------|---------------------------------|---------|-------|----------------------|
| 8 ①      | 01.01.07 ① | 04/2018                         | 3.3.7   | 7.6   | MA IPAQ 530 R01, R02 |
| 9 ①      | 01.01.10 ① | 02/2019                         | 3.4.2   | 7.6   | MA IPAQ 530 R01, R03 |

① Label located on bottom side of head mounted transmitter and on the side of rail mounted transmitter.

## 2.4 Scope of delivery



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



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



*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.

### 3.1 In-head transmitter



**DANGER!**

*The must be installed in an enclosure having an Ingress Protection suitable for the actual use but at least IP20.*

The transmitter is intended for installation in DIN B connection head or larger. For detailed information refer to *Dimensions* on page 53.

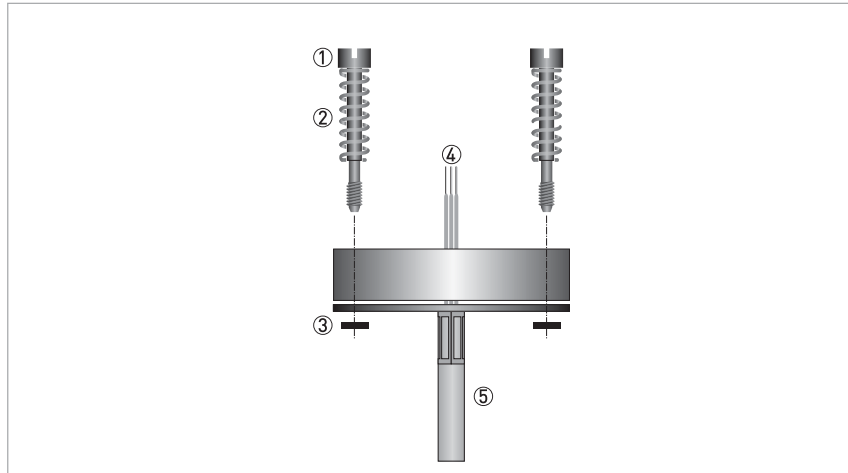


Figure 3-1: Connection head installation kit

- ① M4 screw
- ② Spring
- ③ Lock washer
- ④ Wires from the measuring insert.
- ⑤ MI cable



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



**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.*



**WARNING!**

*The transmitter has been developed for an operating temperature of -40...+85°C / -40...+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 heat 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.*



**CAUTION!**

*For the electrical connection to the in-head transmitter, the maximum torque for screw terminals is 0.5 Nm, for both tightening and untightening the screw.*

### 3.2 Rail mounting kit for in-head transmitters



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

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

#### Rail mounting kit for in-head transmitters

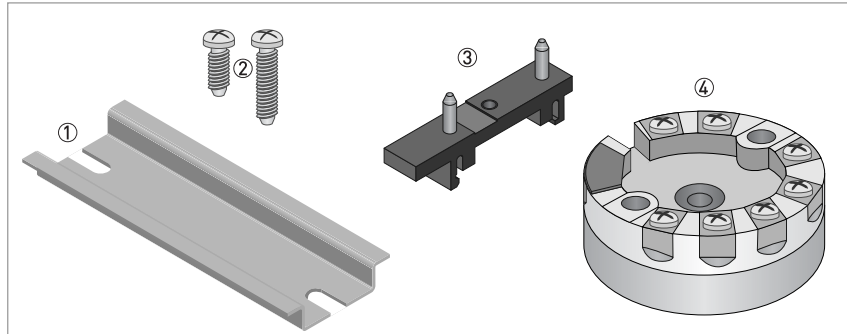
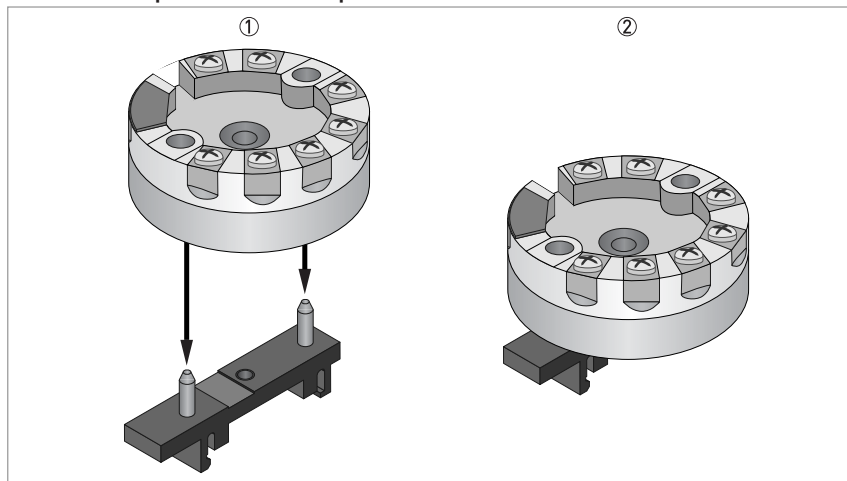


Figure 3-2: Rail mounting kit for in-head transmitters

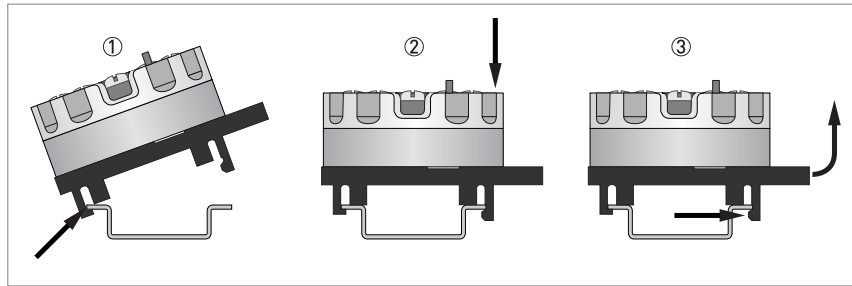
- ① Rail (not included in the kit)
- ② Screws (not needed)
- ③ Clip
- ④ Transmitter

#### Installation procedure: Step 1



- ① Place the transmitter on the clip.
- ② Press down the transmitter until it is attached to the clip.

## Installation procedure: Step 2



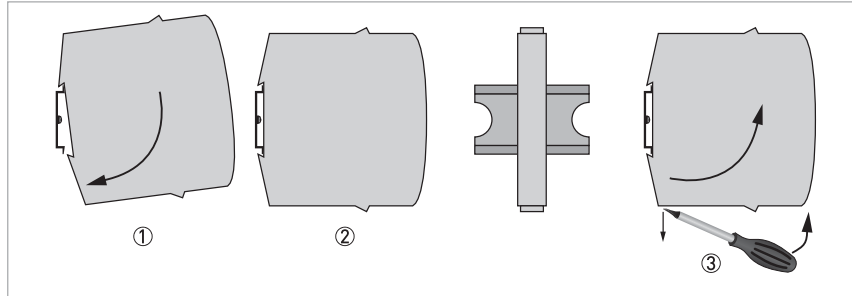
- ① Hook one end of the clip into the rail.
- ② Push the other end down until it snaps onto the rail.
- ③ Release by pushing the hook, and at the same time lift the clip out of the rail.

## 3.3 Rail-mount transmitter

**DANGER!**

*IPAQ R530X must be installed in an enclosure having an ingress protection suitable for the actual use but at least IP20.*

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



- 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!**

*For the electrical connection to the rail-mount transmitter, the maximum torque for screw terminals is 0.25 Nm, for both tightening and untightening the screw.*

**CAUTION!**

*The manufacturer has developed the R530 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. Take note of the voltage data on the nameplate!*

**DANGER!**

*Observe the national regulations for electrical installations!*



*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.*

**DANGER!**

*In potentially explosive areas, the intrinsically safe versions must be used.*

*The C530X / R530X (intrinsically safe) can be installed in potentially hazardous area zone 0, 1 and 2 / DIV 1 and 2.*

*The C530X / R530X (intrinsically safe) can be installed in potentially hazardous zone 0, 1 and 2 / DIV 1 and 2 and the input may be connected to temperature sensors installed in zone 0 / DIV 1.*

*The intrinsically safe versions must be supplied by an intrinsically safe power supply unit or Zener barrier placed outside of the potentially explosive area.*

**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.*
- *The intrinsically safe versions must be supplied by an intrinsically safe power supply unit or a Zener barrier placed outside of the potentially explosive area.*

*In potentially explosive areas only Ex approved HART® modems must be used.*

*In order to ensure reliable HART® communication with this transmitter, the maximum cable length of the output circuit must be observed. For detailed information refer to Cable length on page 23.*

**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.*



*Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate (applies only to the intrinsically safe versions).*

***DANGER!***

*For the transmitters used in hazardous areas following special conditions have to be considered: The communication interface (USB connection) may only be connected to the associated ICON interface if the temperature transmitter is outside of the hazardous area. If certified ICON-X interface is used, a connected sensor may be located in the hazardous area. If non-Ex ICON interface is used, a connected sensor shall not be located in the hazardous area.*

*For the permitted ambient temperature range, refer to Temperature data for areas with potentially explosive atmospheres on page 54*

*The transmitter shall be mounted into a suitable enclosure that provides a degree of protection of at least IP20.*

*The NFC Interface for communication must not be used in hazardous areas.*

## 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

| Pt100...Pt1000, Ni100, Ni120, Cu10<br>2-wire connection | Pt100...Pt1000, Ni100, Ni120, Cu10<br>3-wire connection | Pt100...Pt1000, Ni100, Ni120, Cu10<br>4-wire connection |
|---------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|
|                                                         |                                                         |                                                         |
| Resistance, 2-wire connection                           | Resistance, 3-wire connection                           | Resistance, 4-wire connection                           |
|                                                         |                                                         |                                                         |
| Potentiometer, 3-wire slide wire                        |                                                         |                                                         |
|                                                         |                                                         |                                                         |

### Thermocouple and voltage measurement

| Thermocouple | Voltage | Thermocouple with external CJC (Pt100) |
|--------------|---------|----------------------------------------|
|              |         |                                        |

### 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 Technical data on page 48



To enable HART<sup>®</sup> communication, the output circuit must have an output load of at least 250  $\Omega$ .

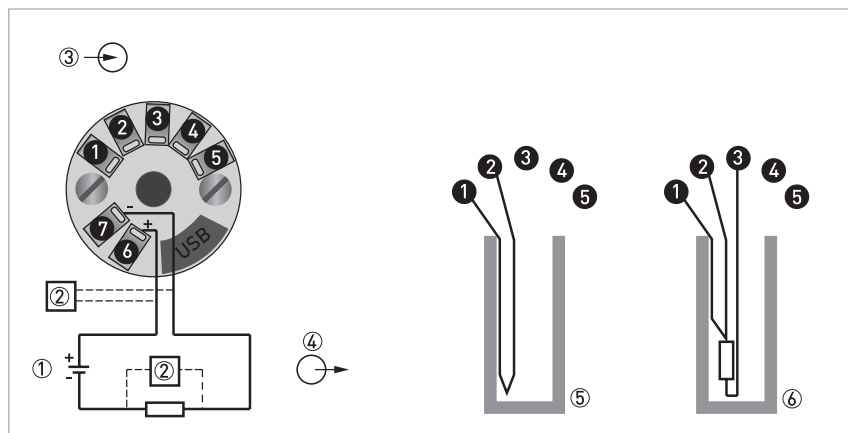


Figure 4-1: Connection diagram

- ① Voltage supply 8.5...36 VDC (terminals 6, 7)
- ② HART<sup>®</sup> modem
- ③ Input
- ④ Output
- ⑤ Thermocouple
- ⑥ Pt100 3-wire connection



The HART<sup>®</sup> modem is connected parallel to the output load or parallel to the output of the transmitter.



In order to ensure reliable HART<sup>®</sup> communication with this transmitter, the maximum cable length of the output circuit must be observed. For detailed information refer to Cable length on page 23.



At an ambient temperature below -30 °C the HART<sup>®</sup> communication might be unstable.

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

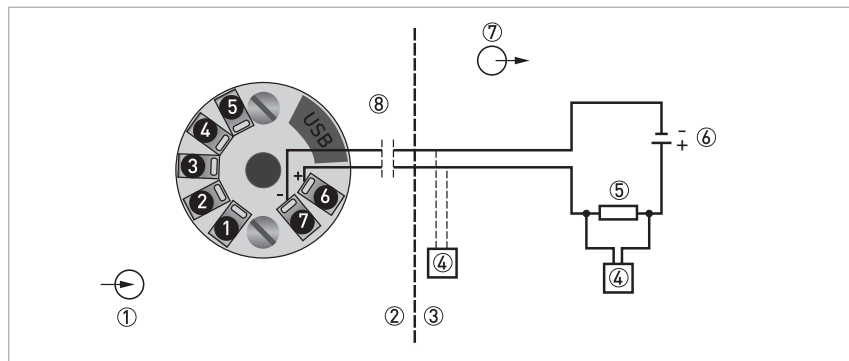


Figure 4-2: Connection diagram

- ① Input (intrinsically safe)
- ② Classified hazardous area (potentially explosive area e.g. zone 0, 1 or 2 / DIV 1, 2)
- ③ Safe area
- ④ HART<sup>®</sup> modem, Ex (Intrinsically safe)
- ⑤  $R_{Load}$  (intrinsically safe) ,  $R \geq 250 \Omega$
- ⑥ Zener barrier / Voltage supply 8.5...30 VDC and output 4...20 mA (intrinsically safe – terminals 6, 7)
- ⑦ Output
- ⑧ Refer to chapter "Cable length"



*The HART<sup>®</sup> modem is connected in parallel to the output load or to the output of the transmitter.*

**DANGER!**

*The transmitter may be operated in areas with potentially explosive atmospheres if the voltage supply is ensured by means of an associated apparatus.*

*In potentially explosive areas only Ex approved HART<sup>®</sup> modems may be used. The safety instructions for operation in potentially explosive areas must be observed.*

*In order to ensure reliable HART<sup>®</sup> communication with this transmitter, the maximum cable length of the output circuit must be observed. For detailed information refer to Cable length on page 23.*

## 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

| Pt100...Pt1000, Ni100, Ni120, Cu10<br>2-wire connection | Pt100...Pt1000, Ni100, Ni120, Cu10<br>3-wire connection | Pt100...Pt1000, Ni100, Ni120, Cu10<br>4-wire connection |
|---------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|
|                                                         |                                                         |                                                         |
| Resistance, 2-wire connection                           | Resistance, 3-wire connection                           | Resistance, 4-wire connection                           |
|                                                         |                                                         |                                                         |
| Potentiometer, 3-wire slide wire                        |                                                         |                                                         |
|                                                         |                                                         |                                                         |

### Thermocouple and voltage measurement

| Thermocouple | Voltage | Thermocouple with external CJC<br>(Pt100) |
|--------------|---------|-------------------------------------------|
|              |         |                                           |

## 4.6 Connection diagram of rail-mount transmitter

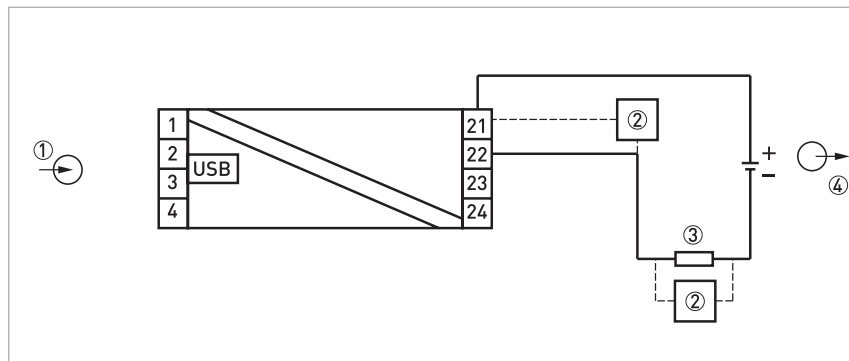


Figure 4-3: Connection diagram

- ① Input
- ② HART® modem
- ③  $R_{Load}$ ,  $R \geq 250 \Omega$
- ④ Voltage supply 8.5...36 VDC and output 4...20 mA



The HART® modem is connected parallel to the output load or parallel to the output of the transmitter.

The load must be at least 250  $\Omega$  for HART® to work.

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

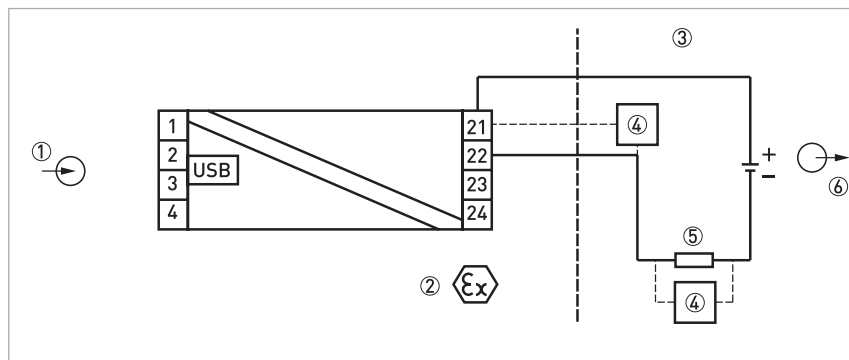


Figure 4-4: Connection diagram

- ① Input (intrinsically safe)
- ② Classified hazardous area (potentially explosive area e.g. zone 0, 1 or 2 / DIV 1, 2)
- ③ Safe area
- ④ HART® modem / Ex (intrinsically safe)
- ⑤  $R_{Load}$  (intrinsically safe)
- ⑥ Zener barrier / Voltage supply 8.5...30 VDC and output 4...20 mA (intrinsically safe - terminals 21, 22)

**DANGER!**

The transmitter may be operated in areas with potentially explosive atmospheres if the voltage supply is ensured by means of an associated apparatus.

## 4.8 Cable length

In order to ensure reliable HART® communication, the maximum cable length of the output circuit must be observed.

To calculate the maximum cable length for the output circuit, determine the total resistance of the output loop (load resistance + approximate cable resistance). Find out the capacitance of the cable being used. In the following tables you can find the maximum cable length based on the typical values for 1 mm<sup>2</sup> cables. CN is the abbreviation for "Capacitance Number" which is multiple of 5000 pF present in the device.

| Field device            | Cable insulation |      |              |      |                   |      |
|-------------------------|------------------|------|--------------|------|-------------------|------|
|                         | PVC              |      | Polyethylene |      | Polyethylene foam |      |
|                         | [m]              | [ft] | [m]          | [ft] | [m]               | [ft] |
| 1 (CN = 1)              | 600              | 1969 | 1100         | 3609 | 2000              | 6562 |
| 10 Multidrop (CN = 1)   | 500              | 1640 | 900          | 2953 | 1600              | 5249 |
| 10 Multidrop (CN = 4.4) | 85               | 279  | 150          | 492  | 250               | 820  |

Table 4-1: Maximum length for typical 1 mm<sup>2</sup> cables

| Insulation        | Capacitance [pF/m] |
|-------------------|--------------------|
| PVC               | 300...400          |
| Polyethylene      | 150...200          |
| Polyethylene foam | 75...100           |

| Conductors              |               |     | Resistance [Ω/km]<br>(both conductors in series) |
|-------------------------|---------------|-----|--------------------------------------------------|
| Area [mm <sup>2</sup> ] | Diameter [mm] | AWG |                                                  |
| 2.0                     | 1.6           | 14  | 17                                               |
| 1.3                     | 1.3           | 16  | 28                                               |
| 1.0                     | 1.15          | 17  | 36                                               |
| 0.8                     | 1.0           | 18  | 45                                               |
| 0.5                     | 0.8           | 20  | 70                                               |
| 0.3                     | 0.6           | 22  | 110                                              |
| 0.2                     | 0.5           | 24  | 160                                              |

Table 4-2: Cable parameters

For multiple connections (Multidrop mode), the following formula shall be used:

$$L = [(65 \times 10^6) / (R \times C)] \times (C_n \times 5000 + 10000) / C$$

with

L: cable length [m or ft]

R: load resistance (incl. the resistance of any Zener barrier) + cable resistance [Ω]

C: cable capacitance [pF/m or pF/ft]

C<sub>n</sub>: number of transmitters in the loop

## 5.1 NFC configuration and logging

The IPAQ 530 contains an NFC interface for communication with a smartphone app. The configuration procedure uses the NFC function in combination with a smartphone with built-in NFC support to perform all settings of the transmitter. The transmitter does not need any power or other external connection, just to be close to the smartphone. The app makes it possible to read, write, save and share settings directly in the field.

The logging function give the possibility to log events directly in the field without any other equipment beside the smartphone. The logged data can be stored or shared by the mobile network. It makes it also very simple to read and display the actual measuring value in the transmitter.

The app does also give direct access to the transmitter documentation and calibration data through an internet connection.

## 5.2 HART<sup>®</sup> networks

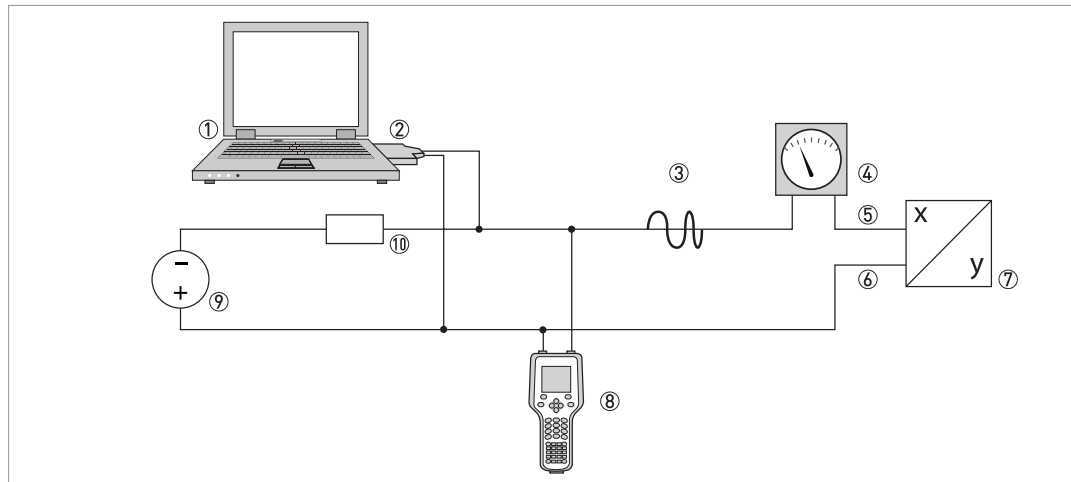


*In order to ensure reliable HART<sup>®</sup> communication with this transmitter, the loop resistance must be at least 250  $\Omega$ ! If the USB interface (configuration modem) is connected to the transmitter then the HART<sup>®</sup> communication is disconnected.*

## 5.3 Point-to-point connection analog / digital mode

Point-to-point connection between the transmitter and the HART<sup>®</sup> master.

The current output of the device may be active or passive.



- ① Primary Master
- ② HART<sup>®</sup> modem
- ③ HART<sup>®</sup> signal
- ④ Analog indicator
- ⑤ Terminal 7
- ⑥ Terminal 6
- ⑦ Device with address = 0 and passive or active current output
- ⑧ Secondary Master
- ⑨ Power supply for devices (slaves) with passive current output
- ⑩ Load  $\geq 250 \Omega$  (0hm)

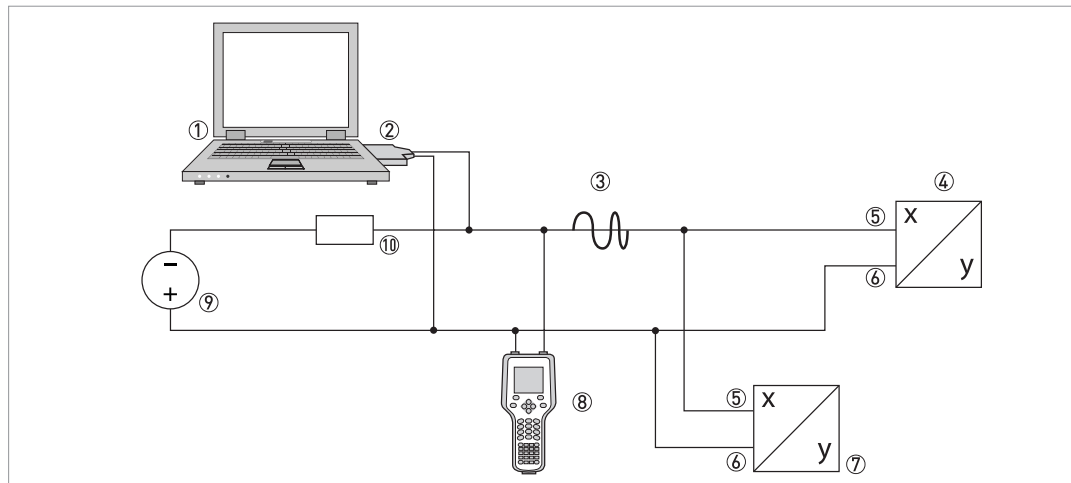


*At an ambient temperature below -30°C / -22°F the HART<sup>®</sup> communication might be unstable.*

## 5.4 Multi-drop connection

As a multipoint connection (Multidrop) with up to 63 devices in parallel (this transmitter or other HART® devices).

The current outputs of the devices must be passive!



- ① Primary master
- ② HART® modem
- ③ HART® signal
- ④ Other HART® devices or this transmitter (refer also to ⑦)
- ⑤ Terminal 7
- ⑥ Terminal 6
- ⑦ Device with address > 0 and passive current output, connection of max. devices (slaves)
- ⑧ Secondary Master
- ⑨ Power supply for devices (slaves) with passive current output
- ⑩ Load  $\geq 250 \Omega$  (0hm)

## 5.5 Factory settings for configuration



### **DANGER!**

*Only an Ex approved HART® modem located in safe area may be connected to a transmitter placed in potentially explosive area.*

The transmitters are delivered with either a factory settings or configured according to customers' specifications.

| Menu             | Parameter                                | Factory settings              |
|------------------|------------------------------------------|-------------------------------|
| Device Root menu |                                          |                               |
| -> Sensor        | Type of sensor                           | RTD Pt100 $\alpha = 0.003850$ |
|                  | Number of wires                          | 3                             |
|                  | PV Lower range value                     | 0                             |
|                  | PV Upper range value                     | 100                           |
|                  | Digital units                            | °C                            |
|                  | Damping value                            | 1.4s                          |
|                  | Sensor break (Downscale/Upscale)         | Upscale                       |
|                  | Sensor short circuit (Downscale/Upscale) | Upscale                       |

## 5.6 Configuration with ConSoft

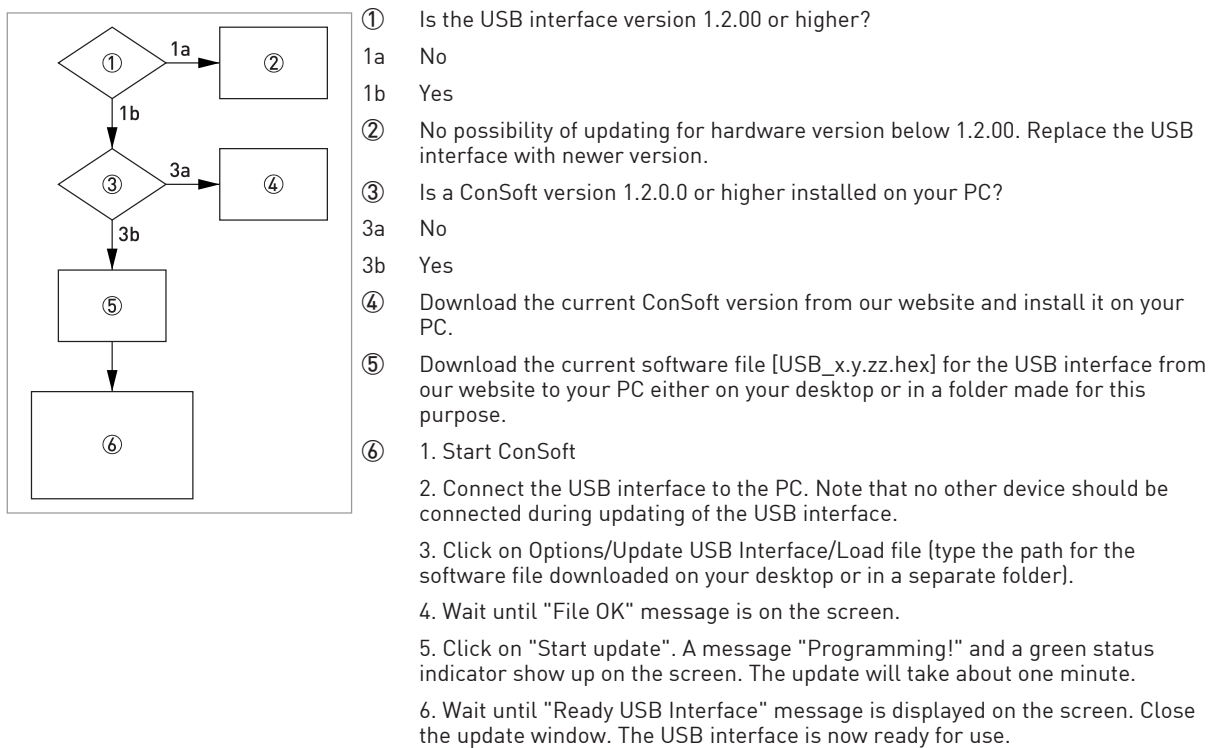
The ConSoft is a PC based graphical user interface for configuration of the transmitters. The PC configuration software ConSoft is used for configuration, display and documentation. The current software versions of ConSoft and the USB interface are available for downloading on our website.



### CAUTION!

*When the USB interface (configuration modem) is connected to the transmitter then the HART<sup>®</sup> communication is disconnected, even if ConSoft is not running.*

To upgrade your USB interface software to the latest version, use the following flow chart.



*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 transmitter's communication port (USB connection) may only be connected to the certified ICON-X Interface. When the ICON-X is connected, the temperature transmitter shall be outside of the hazardous area; a connected sensor may be located in the hazardous area.*

*For the applicable ambient temperature range, see the control drawings for C530X/R530X at the end of this book, and for ICON-X - 4006801801*

Proper connection of the transmitters with a PC requires the USB interface which is included in the ICON-X configuration kit. For connection of the transmitters refer to the following connection diagrams during configuration.



**DANGER!**

*Make sure the area is safe before connecting the USB interface ICON-X to the transmitter.*

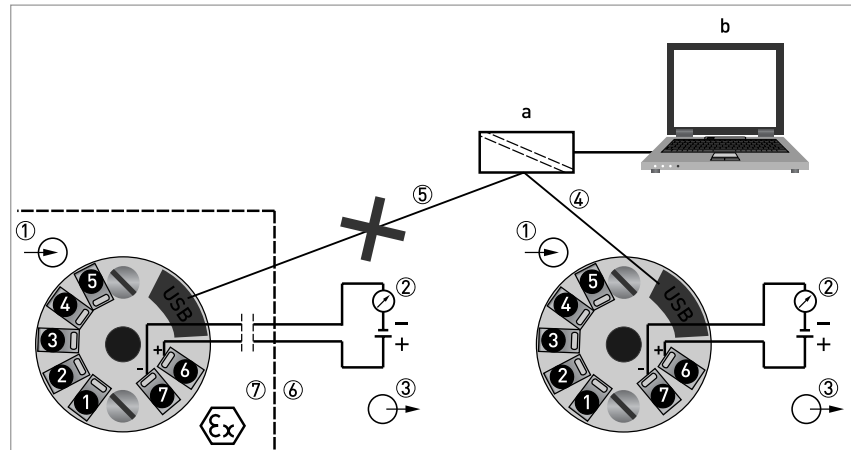


Figure 5-1: Connection during configuration of in-head transmitter

a = PC configuration kit; b = PC software ConSoft

- ① Input (intrinsically safe)
- ②  $R_{Load}$  (intrinsically safe)
- ③ Output voltage supply (intrinsically safe terminals 6 and 7)
- ④ Communication with USB interface and a PC software ConSoft
- ⑤ Connection to USB interface and a PC software ConSoft is not permitted if Ex version of IPAQ C530 (IPAQ C530X) is placed in the classified hazardous area (potentially explosive area)
- ⑥ Safe area
- ⑦ Classified hazardous area (potentially explosive area e.g. zone 0, 1 and 2 / DIV 1 and 2)

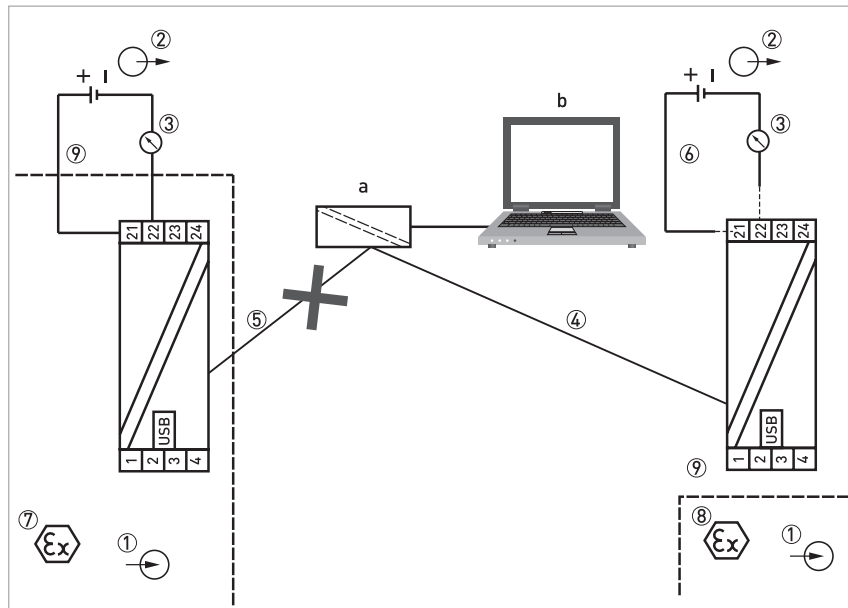


Figure 5-2: Connection during configuration of rail-mount transmitter

a = PC configuration kit; b = PC software ConSoft

- ① Input (intrinsically safe)
- ② Voltage supply (intrinsically safe terminals 21, 22)
- ③  $R_{Load}$  (intrinsically safe)
- ④ Communication with USB interface and a PC software ConSoft
- ⑤ Connection to USB interface and a PC software ConSoft is not permitted if Ex version of IPAQ R530 (IPAQ R530X) is placed in the classified hazardous area (potentially explosive area)
- ⑥ Connection to the voltage supply during configuration with USB interface and PC software ConSoft is not needed
- ⑦ Classified hazardous area (potentially explosive area e.g. zone 0 / DIV 1)
- ⑧ Classified hazardous area (potentially explosive area e.g. zone 0, 1 and 2 / DIV 1 and 2)
- ⑨ Safe area

## 5.7 Configuration with a hand held communicator FC 475

The Field communicator FC 475 is a hand held communicator from Emerson Process Management for configuring HART® and Foundation Fieldbus devices. To be able to configure the transmitter with the FC 475 you need a Device Description (DD) file.

The transmitter DD has to be installed on the FC 475, otherwise the user will work with the transmitter as generic device losing opportunity to control all features of the transmitter. For installing DD on the FC 475 the "Easy Upgrade Programming Utility" is needed and the FC 475 must have a system card with "Easy Upgrade" option (see details in the "475 Field Communicator User's Manual").

The transmitter DD for FC 475 can also be downloaded from our website. For information about installing, follow the instructions in the attached "readme.txt" file.

For proper connection of transmitter with the hand held communicator refer to *Connection diagram of in-head transmitter* on page 19 and refer to *Connection diagram of rail-mount transmitter* on page 22.

To configure the transmitter for areas with potentially explosive atmospheres refer to *Connection diagram of in-head transmitter (intrinsically safe)* on page 20 and refer to *Connection diagram of rail-mount transmitter (intrinsically safe)* on page 22.

## 5.8 Device management software

The transmitter can be configured via the PC software as AMS (Asset Management System) and Simatic PDM.

### Asset Management Solutions Device Manager (AMS)

The AMS is a PC application from Emerson Process Management for configuring and managing HART® and Foundation Fieldbus devices. For adaptation to different devices AMS uses Device Descriptions (DD).

The transmitter DD has to be installed on the AMS system and a so called "Installation Kit HART AMS" is needed (available as download on the internet). For installing the DD with the installation kit refer to the "AMS Intelligent Device Manager Books Online" section "Basic AMS Functionality / Device Configurations / Installing Device Types / Procedures / Install device types from media". Please read also the "readme.txt", which is also contained in the installation kit.

The transmitter DD for AMS can also be downloaded from our website. For information about installing, follow the instructions in the attached "readme.txt" file.

AMS supports the "EDDL Process Variables Root Menu", the "Diagnostic Root Menu" and the "Device Root Menu" for online access to the device.

### Process Device Manager (PDM)

The Simatic PDM is a PC application from Siemens for configuring HART® and PROFIBUS devices. For adaptation to different devices Simatic PDM uses Device Descriptions (DD).

The transmitter DD has to be installed on the PDM System and a so called "Device Install HART PDM" is needed (available as download on the internet).

For installing the DD on PDM refer to the "PDM Manual" section 13: "Integrating Devices". Please read also the "readme.txt", which is also contained in the "Device Install".

The transmitter DD for PDM can also be downloaded from our website. For information about installing, follow the instructions in the attached "readme.txt" file.

PDM supports the "EDDL Process Variables Root Menu", the "Diagnostic Root Menu" and the "Device Root Menu" for online access to the device. Furthermore it supports the "Offline Root Menu" for offline configuration.

## 5.9 Configuration with PACTware

PACTware is a DTM/FDT enabled PC software, which can be downloaded from [pactware.com](http://pactware.com).

To be able to configure the transmitters via PACTware, download the transmitter DTM (Device Type Manager) file from our website. For information about installing, follow the instructions in the attached "readme.txt" file.

## 5.10 Current output and HART<sup>®</sup> dynamic/device variables

The transmitters handle up to 3 measurement-related HART<sup>®</sup> device variables. These variables depend on the device's sensor configuration and the primary variable is represented by the output signal of 4...20 mA. See the following table for more information.

| HART <sup>®</sup> device variable name |
|----------------------------------------|
| Process Temperature                    |
| Device Temperature                     |
| Uncorrected Process Temperature        |

## 5.11 Diagnostic information according to NAMUR NE 107

Diagnostic information about the connected sensor is available in the configuration software ConSoft or via NFC when using a portable device.

The HART® diagnostic messages are generated in accordance with NAMUR NE 107 for:

- Sensor break (failure / sensor wire break)
- Sensor short-circuit (failure / sensor wire short-circuit)
- Transmitter error (failure/transmitter error, non-correctable in the transmitter)

For complete information about all diagnostic information available from the transmitters, refer to the following tables.

### Explanations according to NE 107

- C: check function
- S: not within specification
- M: maintenance required
- F: failure

The "Field Device Status" byte indicates both fault conditions and abnormal operational modes.



*Whilst HART Protocol revision 6.0 and higher requires the Field Device Status to be always meaningful, in earlier protocol revisions the Field Device Status had to be set to 0 if a communication error is reported.*

| Messages in AMS, PDM and FC 475 device diagnostic |                    |                                    | Actions                                                                                                                                                                                                                               |
|---------------------------------------------------|--------------------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standard                                          | NE 107 Signal [12] | Error message                      | Error correction                                                                                                                                                                                                                      |
| Transmitter                                       | C                  | Field device malfunction           | Make a self test to find out more. Check even device specific diagnostic. If the error remains replace the device.                                                                                                                    |
| Transmitter                                       | I                  | Configuration changed              | Information for other softwares.                                                                                                                                                                                                      |
| Transmitter                                       | I                  | Cold start                         | Transmitter is in cold start mode.                                                                                                                                                                                                    |
| Transmitter                                       | I                  | Loop current fixed                 | Transmitter in Multi-Drop mode or loop test.                                                                                                                                                                                          |
| Transmitter                                       | C                  | Loop current saturated             | Check the limits for connected sensor. Ambient temperature is higher then stated limits for sensor, which is allocated to the primary variable analogue output. Replace the sensor allocated to the primary variable analogue output. |
| Transmitter                                       | C                  | More status variable               | Check device specific errors for more information.                                                                                                                                                                                    |
| Transmitter                                       | C                  | Non-primary variable out of limits | Check the limits for connected sensor. Replace the sensor allocated to the non-primary variable.                                                                                                                                      |
| Transmitter                                       | C                  | Primary variable out of limits     | Check the limits for connected sensor. Replace the sensor allocated to the primary variable.                                                                                                                                          |

| Messages in AMS, PDM and FC 475 device diagnostic                                                                                                                                                                                                         |                    |                        | Actions                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standard                                                                                                                                                                                                                                                  | NE 107 Signal [12] | Error message          | Error correction                                                                                                                                                                                                         |
| <b>Extended device status</b> -Extended status information about the device status are supported with command 0, 9 and 48. One byte in the response of the three enumerated commands, give more detailed information, which are listed in the table below |                    |                        |                                                                                                                                                                                                                          |
| Transmitter                                                                                                                                                                                                                                               | M                  | Maintenance required   | Check device specific diagnostic for more information about sensors and transmitter.                                                                                                                                     |
| Transmitter                                                                                                                                                                                                                                               | M                  | Device variable alert  | Check device specific diagnostic for more information about sensors and transmitter.                                                                                                                                     |
| Transmitter                                                                                                                                                                                                                                               | F                  | Critical power failure | NA                                                                                                                                                                                                                       |
| Transmitter                                                                                                                                                                                                                                               | N                  | Failure                | One or more Device Variables are invalid due to a malfunction in the field device or its peripherals. Make a self test to find out more. Check even device specific diagnostic. If the error remains replace the device. |
| Transmitter                                                                                                                                                                                                                                               | N                  | Out of specification   | Indication of deviations from the permissible ambient or process conditions have been detected that may compromise measurement or control accuracy.                                                                      |
| Transmitter                                                                                                                                                                                                                                               | N                  | Function check         | One or more Device Variables are temporarily invalid (e.g. frozen) due to ongoing work on the device                                                                                                                     |

| Messages in AMS, PDM and FC 475 device diagnostic                                                                                            |         |                               | Actions                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Device specific                                                                                                                              | Failure | Error message                 | Error correction                                                                                                                             |
| <b>Device Specific Status (Byte 0-5)</b> Command 48 returns in byte 0 to 13 additional device status information, which are described below. |         |                               |                                                                                                                                              |
| Transmitter                                                                                                                                  | M       | Underrange                    | Measurement is under specified range. Check the specified lower range and sensor and sensor connection. If error remains replace the sensor. |
| Transmitter                                                                                                                                  | M       | Overrange                     | Measurement is over specified range. Check the specified high range and sensor and sensor connection. If error remains replace the sensor.   |
| Transmitter                                                                                                                                  | F       | Ad_short                      | See Sensor short circuit (same error cause).                                                                                                 |
| Transmitter                                                                                                                                  | F       | Ad_open                       | See Sensor break (same error cause).                                                                                                         |
| Transmitter                                                                                                                                  | F       | Sensor break                  | Sensor wire broken. Check the sensor and sensor connection. If error remains replace the sensor.                                             |
| Transmitter                                                                                                                                  | F       | Sensor short circuit          | Sensor wire shorted. Check the sensor and sensor. If error remains replace the sensor.                                                       |
| Transmitter                                                                                                                                  | F       | Sensor invalid                | Invalid sensor selected. Check the sensor selection. If error remains replace device.                                                        |
| Transmitter                                                                                                                                  | F       | Linearization table invalid   | Linearization table invalid. Check Linearization table settings. If error remains replace device.                                            |
| Transmitter                                                                                                                                  | F       | Loop voltage too low          | N/A                                                                                                                                          |
| Transmitter                                                                                                                                  | F       | Dac out of range              | Digital-to-Analog-Converter out of max range. Power cycle the device. If error remains replace device.                                       |
| Transmitter                                                                                                                                  | F       | Dac feedback error (+/- 10%)  | N/A                                                                                                                                          |
| Transmitter                                                                                                                                  | F       | Loop resistance out of range  | Loop Resistance out of range ( $R_{Load} [\Omega] = (U-8.5)/0.022$ ). Check loop connection and voltage. If error remains replace device.    |
| Transmitter                                                                                                                                  | F       | Dac acknowledge error         | No acknowledge from Digital-to-Analog-Converter. Power cycle the device. If error remains replace device.                                    |
| Transmitter                                                                                                                                  | F       | System non-recoverable errors | Internal system non-recoverable error. Power cycle the device. If error remains replace device.                                              |
| Transmitter                                                                                                                                  | M       | Process                       | Maintenance required: Process                                                                                                                |
| Transmitter                                                                                                                                  | M       | Configuration                 | Maintenance required: Configuration                                                                                                          |
| Transmitter                                                                                                                                  | M       | Electronics                   | Maintenance required: Electronics                                                                                                            |
| Transmitter                                                                                                                                  | M       | Sensor                        | Maintenance required: Sensor                                                                                                                 |
| Transmitter                                                                                                                                  | S       | Process                       | Out of Specification: Process                                                                                                                |
| Transmitter                                                                                                                                  | S       | Configuration                 | Out of Specification: Configuration                                                                                                          |
| Transmitter                                                                                                                                  | S       | Electronics                   | Out of Specification: Electronics                                                                                                            |
| Transmitter                                                                                                                                  | S       | Sensor                        | Out of Specification: Sensor                                                                                                                 |
| Transmitter                                                                                                                                  | C       | Process                       | Check: Process                                                                                                                               |
| Transmitter                                                                                                                                  | C       | Configuration                 | Check: Configuration                                                                                                                         |
| Transmitter                                                                                                                                  | C       | Electronics                   | Check: Electronics                                                                                                                           |
| Transmitter                                                                                                                                  | C       | Sensor                        | Check: Sensor                                                                                                                                |
| Transmitter                                                                                                                                  | F       | Process                       | Failure: Process                                                                                                                             |
| Transmitter                                                                                                                                  | F       | Configuration                 | Failure: Configuration                                                                                                                       |
| Transmitter                                                                                                                                  | F       | Electronics                   | Failure: Electronics                                                                                                                         |
| Transmitter                                                                                                                                  | F       | Sensor                        | Failure: Sensor                                                                                                                              |

| Messages in AMS, PDM and FC 475 device diagnostic |         |                                | Actions                                                                      |
|---------------------------------------------------|---------|--------------------------------|------------------------------------------------------------------------------|
| Device specific                                   | Failure | Error message                  | Error correction                                                             |
| Transmitter                                       | M       | Linearization table Underrange | N/A                                                                          |
| Transmitter                                       | M       | Linearization table Overrange  | N/A                                                                          |
| Transmitter                                       | S       | High Alarm                     | Check the sensor and sensor connection. If error remains replace the sensor. |
| Transmitter                                       | S       | Low Alarm                      | Check the sensor and sensor connection. If error remains replace the sensor. |

## 5.12 Factory default settings

The transmitters are delivered with a factory configuration Pt100 ( $\alpha = 0.00385$ ), 3-wire connection 0...+100°C / +32...+212°F, sensor error monitoring "Upscale", filtering level 1.4 s or configured according to customer's requirements.

Due to the long-term drift of max.  $\pm 0.02\%$  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.

## 5.13 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.

## 5.14 System or sensor error correction

### System error correction

To perform a system error correction a dry block cell or a temperature bath together with a calibrated reference thermometer is needed. The system is the sensor + transmitter. Expose the sensor to one (one-point correction) or two (two-point correction) accurately measured temperatures (true temperatures), while the transmitter is connected to the configuration software. The true temperature(s) are entered into the software, and the transmitter automatically corrects for the system errors.

### Sensor error correction

If the temperature sensor is calibrated, or the sensor error compared to the standard curve is known, then the sensor error (deviation from the standard curve) can be entered into the transmitter via the configuration software and the transmitter corrects for the sensor errors.

## 6.1 Accessory parts

| Accessory part                                                                                                       | Order code |
|----------------------------------------------------------------------------------------------------------------------|------------|
| Universal rail mounting kit for in-head version                                                                      | 70ADA00015 |
| Connection Head installation kit                                                                                     | 70ADA00017 |
| Ex configuration kit including Ex approved modem (not a HART® modem), software ConSoft and cables for USB connection | 70CFGUSX01 |
| HART® PC modem USB                                                                                                   | 70MEM00003 |
| ICON-BT Bluetooth configuration kit                                                                                  | 70CFGBT001 |

## 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.



*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.*

|                                                                                                                                                  |                                                                           |                |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------------|--|
| Company:                                                                                                                                         |                                                                           | Address:       |  |
| Department:                                                                                                                                      |                                                                           | Name:          |  |
| Telephone number:                                                                                                                                |                                                                           | Email address: |  |
| Manufacturer order number or serial number:                                                                                                      |                                                                           |                |  |
| The device has been operated with the following medium:                                                                                          |                                                                           |                |  |
| This medium is:                                                                                                                                  | radioactive                                                               |                |  |
|                                                                                                                                                  | water-hazardous                                                           |                |  |
|                                                                                                                                                  | toxic                                                                     |                |  |
|                                                                                                                                                  | caustic                                                                   |                |  |
|                                                                                                                                                  | flammable                                                                 |                |  |
|                                                                                                                                                  | 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 caused by any residual media contained in this 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.

#### 6.5.1 Dispose of the transmitter

Dispose of the transmitter, sensor and packaging materials in an environmentally compatible way and in accordance with the country-specific waste disposal regulations.

### 6.5.2 Disassembling and recycling

This section describes (in short) the instructions of handling and disassembling the device when it's reached EOL (end of life) or is disposed after usage. The information given is sufficient to gather the most important parts of the device (by the end-user) which can be used for recycling.



*The products do not contain dangerous gases or materials. If there is contamination from the process, refer to Returning the device to the manufacturer on page 39.*

### 6.5.3 Disassembling and recycling of IPAQ C530/C530X

|                |                                               |             |
|----------------|-----------------------------------------------|-------------|
| Type           | IPAQ                                          |             |
| Model          | C530 / C530X                                  |             |
| Usage          | Signal conditioner for resistance and voltage |             |
|                | Weight [g]                                    | Weight [lb] |
| Total          | 35.7                                          | 0.0787      |
| Metal parts    | 11.1                                          | 0.0245      |
| Ceramic fibers | 0.3                                           | 0.0007      |
| Plastic parts  | 24.3                                          | 0.0536      |

To achieve reliability and quality performance of the product IPAQ C530/C530X is encapsulated in casting polymer plastic resulting in that dismantling of the IPAQ C530/C530X is not possible. The content of the IPAQ C530/C530X can be found in the following table.

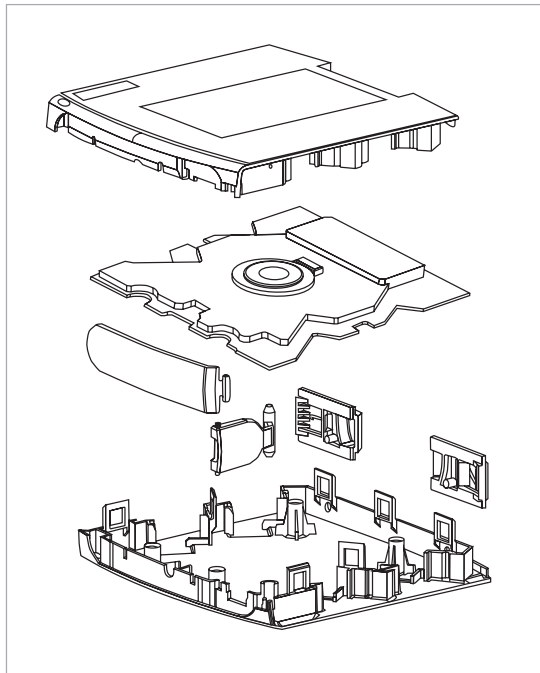
|  | Material                                  | CAS        | Weight [g] | Weight [%] |
|--|-------------------------------------------|------------|------------|------------|
|  | Thermoplastic PC+ABS, PA                  | NA         | 19.3       | 54.1       |
|  | Stainless steel                           | NA         | 5.2        | 14.6       |
|  | Brass                                     | NA         | 3.5        | 9.8        |
|  | Zinc                                      | 7440-66-6  | 0.3        | 0.8        |
|  | Silicone                                  | 7440-21-3  | 1.0        | 2.8        |
|  | Epoxy                                     | NA         | 3.6        | 10.1       |
|  | Lead free solder                          | NA         | 0.4        | 1.1        |
|  | Nitrile                                   | NA         | 0.2        | 0.6        |
|  | Copper                                    | 7440-50-8  | 1.1        | 3.1        |
|  | Polyester                                 | NA         | 0.2        | 0.6        |
|  | Nickel                                    | 7723-14-0  | 0.5        | 1.4        |
|  | Alumina (Al <sub>2</sub> O <sub>3</sub> ) | 1344-28-1  | 0.2        | 0.6        |
|  | Gold (Au)                                 | 7444-57-6  | 0.1        | 0.3        |
|  | Barium titanat (BaTiO <sub>3</sub> )      | 12047-27-7 | 0.1        | 0.3        |

|      | Material                              | CAS       | Weight [g] | Weight [%] |
|------|---------------------------------------|-----------|------------|------------|
| RoHS | Polybrominated diphenyl Ethers (PBDE) | NA        | 0          | 0          |
|      | Cadmium (Cd)                          | 7440-43-9 | 0          | 0          |
|      | Mercury (Hg)                          | 7439-97-6 | 0          | 0          |
|      | Lead (Pb)                             | 7440-31-7 | 0          | 0          |
|      | Chrome VI (Cr VI)                     | 7440-47-3 | 0          | 0          |
|      | Polybrominated biphenyls (PBB)        | NA        | 0          | 0          |
|      | Bis [2-ethylhexyl] phthalate (DEHP)   | 117-81-7  | 0          | 0          |
|      | Butyl benzyl phthalate (BBP)          | 85-68-7   | 0          | 0          |
|      | Dibutyl phthalate (DBP)               | 84-74-2   | 0          | 0          |
|      | Diisobutyl phthalate (DIBP)           | 84-69-5   | 0          | 0          |

#### 6.5.4 Disassembling and recycling of IPAQ R530/R530X

|                |                                               |             |
|----------------|-----------------------------------------------|-------------|
| Type           | IPAQ                                          |             |
| Model          | R530 / R530X                                  |             |
| Usage          | Signal conditioner for resistance and voltage |             |
|                | Weight [g]                                    | Weight [lb] |
| Total          | 69.7                                          | 0.1537      |
| Metal parts    | 9.5                                           | 0.0209      |
| Ceramic fibres | 0.3                                           | 0.0007      |
| Plastic parts  | 54.2                                          | 0.1195      |

To achieve reliability and quality performance of the product IPAQ R530/R530X is encapsulated in casting polymer plastic resulting in that dismantling of the IPAQ R530/R530X is not possible except the housing, which is sorted as plastic. The content of the IPAQ R530/R530X can be found in the following table.



|      | Material                                  | CAS        | Weight [g] | Weight [%] |
|------|-------------------------------------------|------------|------------|------------|
|      | Thermoplastic PC+ABS, PA                  | NA         | 49.2       | 70.6       |
|      | Stainless steel                           | NA         | 4.3        | 6.2        |
|      | Brass                                     | NA         | 3.2        | 4.6        |
|      | Zinc                                      | 7440-66-6  | 0.3        | 0.4        |
|      | Silicone                                  | 7440-21-3  | 1.0        | 1.4        |
|      | Epoxy                                     | NA         | 8.1        | 11.6       |
|      | Lead free solder                          | NA         | 0.6        | 0.9        |
|      | Copper                                    | 7440-50-8  | 2.2        | 3.2        |
|      | Polyester                                 | NA         | 0.2        | 0.3        |
|      | Nickel                                    | 7723-14-0  | 0.3        | 0.4        |
|      | Alumina (Al <sub>2</sub> O <sub>3</sub> ) | 1344-28-1  | 0.1        | 0.1        |
|      | Gold (Au)                                 | 7444-57-6  | 0.1        | 0.1        |
|      | Barium titanat (BaTiO <sub>3</sub> )      | 12047-27-7 | 0.1        | 0.1        |
|      |                                           |            |            |            |
| RoHS | Polybrominated diphenyl Ethers (PBDE)     | NA         | 0          | 0          |
|      | Cadmium (Cd)                              | 7440-43-9  | 0          | 0          |
|      | Mercury (Hg)                              | 7439-97-6  | 0          | 0          |
|      | Lead (Pb)                                 | 7440-31-7  | 0          | 0          |
|      | Chrome VI (Cr VI)                         | 7440-47-3  | 0          | 0          |
|      | Polybrominated biphenyls (PBB)            | NA         | 0          | 0          |
|      | Bis (2-ethylhexil) phthalate (DEHP)       | 117-81-7   | 0          | 0          |
|      | Butyl benzyl phthalate (BBP)              | 85-68-7    | 0          | 0          |
|      | Dibutyl phthalate (DBP)                   | 84-74-2    | 0          | 0          |
|      | Diisobutyl phthalate (DIBP)               | 84-69-5    | 0          | 0          |

#### 6.5.5 Packaging of IPAQ C530/C530X and R530/R530X

The products are delivered to the customers in corrugated cardboard boxes, which protect products against moisture and provides sustainable packaging solutions.

## 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 supports both types.

### 7.1.1 Resistance temperature sensor

The measuring insert with a temperature-sensitive sensor made from a platinum(Pt) RTD, whose value at 0°C / +32°F is 100  $\Omega$ . 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  $3.85 \times 10^{-3} \text{ K}^{-1}$  in the range from 0...+100°C / +32...+212°F.

During operation, a constant current  $I$  ( $\leq 1 \text{ mA}$ ) 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  $\Omega$  (100 mV / 1 mA = 100  $\Omega$ ).

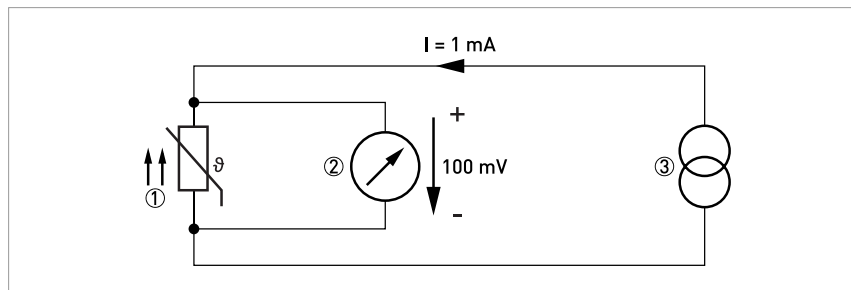


Figure 7-1: Pt100 resistance temperature sensor at 0°C / +32°F, schematic

- ① Pt100 RTD
- ② Voltage meter
- ③ Current source

### 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.



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

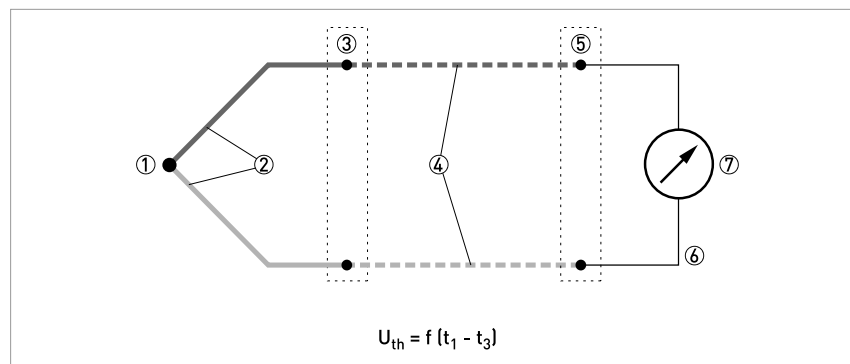


Figure 7-2: Thermocouple measuring circuit, schematic

- 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



- 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.

### Measuring system

|                   |                                                                                  |
|-------------------|----------------------------------------------------------------------------------|
| Application range | Temperature measurements of solids, liquids and gases in industrial environment. |
|-------------------|----------------------------------------------------------------------------------|

### Design

| Versions                 |                                                                                                                                                                                                                                                                      |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C530                     | In-head transmitters which are intended for installation in a DIN B-head or larger according to DIN EN 50446.<br>This transmitter is optionally available in an intrinsically safe version (zone 0, 1 and 2) for installation in potentially explosive atmospheres.  |
| R530                     | Rail-mount transmitters which are intended for installation on a DIN-rail according to EN 60715, 35 mm / 1.38".<br>The transmitter is optionally available in an intrinsically safe version (zone 0, 1 and 2) for installation in potentially explosive atmospheres. |
| Features                 |                                                                                                                                                                                                                                                                      |
| HART® compliance         | The transmitters are fully compliant with the HART® 7 protocol. HART® 7 offers the possibility to receive diagnostic information such as sensor errors or sensor conditions, transmitter error, etc.                                                                 |
| NFC                      | NFC enables wireless communication and configuration between transmitter and a portable device such a smartphone.                                                                                                                                                    |
| Sensor matching          | 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.                                                                                                             |
| Customized linearization | For resistance and mV inputs, either a 50-point customized linearization table or via Callendar-Van Dusen (applies only to RTD, $\alpha = 0.00385$ ) constants can provide a correct process value.                                                                  |
| PC programmable          | Measuring ranges are set from PC.                                                                                                                                                                                                                                    |
|                          | Full accuracy is provided without any need for calibration.                                                                                                                                                                                                          |
|                          | Configuration without external power.                                                                                                                                                                                                                                |
| Runtime counter          | Hour counter for elapsed operational time.                                                                                                                                                                                                                           |
| Simulated output         | Fixed current output during a maximum time of 15 minutes.                                                                                                                                                                                                            |

### Measuring accuracy

|                               |                                                                                                                |
|-------------------------------|----------------------------------------------------------------------------------------------------------------|
| Accuracy & stability          | Typical accuracy is max. of $\pm 0.08^\circ\text{C}$ or $\pm 0.08\%$ of span. (Pt100, 3- or 4-wire connection) |
| Ambient temperature influence | RTD and thermocouple: for detailed information refer to <i>RTD and T/C accuracy table</i> on page 57.          |
|                               | Resistance: $\pm 0.01\% < 4000\ \Omega$ (2000 $\Omega$ at 2-wire) $< \pm 0.02\%$ of span per $^\circ\text{C}$  |
|                               | Voltage: $\pm 0.01\%$ of span per $^\circ\text{C}$                                                             |
| Supply voltage influence      | $< \pm 0.005\%$ of span per V                                                                                  |
| Long-term drift               | Max. of $\pm 0.02^\circ\text{C}$ or $\pm 0.02\%$ of span per year                                              |

### Operating conditions

|                            |                                                                                           |
|----------------------------|-------------------------------------------------------------------------------------------|
| <b>Temperature</b>         |                                                                                           |
| In-head transmitter        | <b>Operating and storage temperature:</b><br>Standard version: -40...+85°C / -40...+185°F |
|                            | IS version: For permitted ambient temperature range, see page 55                          |
| Rail-mount transmitter     | <b>Operating and storage temperature:</b><br>Standard version: -40...+85°C / -40...+185°F |
|                            | IS version: For permitted ambient temperature range, see page 55                          |
| Humidity                   | 0...95% RH (non-condensing)                                                               |
| <b>Protection category</b> |                                                                                           |
| In-head transmitter        | Housing: IP65                                                                             |
|                            | Terminals: IP00                                                                           |
| Rail-mount transmitter     | Housing: IP20                                                                             |
|                            | Terminals: IP20                                                                           |

### Installation conditions

|            |                                                                       |
|------------|-----------------------------------------------------------------------|
| Mounting   | In-head transmitter: DIN B-head or larger, DIN-rail (with adapter)    |
|            | Rail-mount transmitter: DIN-rail according to EN 60715, 35 mm / 1.38" |
|            | For detailed information refer to <i>Installation</i> on page 13.     |
| Weight     | In-head transmitter: 35 g / 0.08 lb                                   |
|            | Rail-mount transmitter: 70 g / 0.15 lb                                |
| Dimensions | For detailed information refer to <i>Dimensions</i> on page 53.       |

### Materials

|                              |                               |
|------------------------------|-------------------------------|
| Housing                      | PC/ABS + PA                   |
| Flammability according to UL | In-head transmitter: V0       |
|                              | Rail-mount transmitter: V0/HB |

### Electrical connections

|                             |                                                                    |
|-----------------------------|--------------------------------------------------------------------|
| Power supply                | Standard version: 8.5...36 VDC                                     |
|                             | IS version: 8.5...30 VDC                                           |
| Isolation                   | Galvanically isolated (in-out), 1500 VAC, 1 minute                 |
| Connection                  | Single/stranded wires: max. 1.5 mm <sup>2</sup> / AWG 16           |
| Terminal                    | Single/stranded wires: max 1.5 mm <sup>2</sup> , max 0.5 Nm torque |
| Reverse Polarity Protection | Yes                                                                |

### Inputs / Outputs

|                                                         |                                                                                         |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------|
| <b>Input - RTD</b>                                      |                                                                                         |
| Pt100 (IEC 60751, $\alpha = 0.00385$ )                  | -200...+850°C / -328...+1562°F                                                          |
| Pt100 (JIS C1604-1981, $\alpha = 0.003916$ )            |                                                                                         |
| PtX (10 ≤ X ≤ 1000)<br>(IEC 60751, $\alpha = 0.00385$ ) | The upper range depends on the X value, max. input temperature corresponding to 4000 Ω. |
| Ni100 (DIN 43760)                                       | -60...+250°C / -76...+482°F                                                             |
| Ni120 (Edison No. 7)                                    |                                                                                         |
| Ni1000 (DIN 43760)                                      | -50...+180°C / -58...+356°F                                                             |

|                                           |                                                                                                                 |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Cu10 (Edison Copper Windings No. 15)      | -50...+200°C / -58...+392°F                                                                                     |
| Sensor current                            | ≤300 µA                                                                                                         |
| Maximum sensor wire resistance            | 3-wire and 4-wire connection: 50 Ω/wire<br>2-wire connection: Compensation for 0 to 100 Ω loop resistance       |
| Adjustment                                | Minimum span 10°C / 18°F<br>Sensor error compensation ±10% of span for span <50°C / 90°F, otherwise ±5°C / ±9°F |
| <b>Input - resistance / potentiometer</b> |                                                                                                                 |
| 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            | In-head transmitter: 50 Ω/wire<br>Rail-mount transmitter: 50 Ω/wire                                             |
| <b>Input - thermocouples</b>              |                                                                                                                 |
| 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-W25Re (ASTM E 988)      | 0...+2315°C / 32...+4199°F                                                                                      |
| T/C type E - NiCr-CuNi (IEC 60584)        | -270...+1000°C / -454...+1832°F                                                                                 |
| T/C type J - Fe-CuNi (IEC 60584)          | -210...+1200°C / -346...+2192°F                                                                                 |
| T/C type K - NiCr-NiAl (IEC 60584)        | -270...+1300°C / -454...+2372°F                                                                                 |
| T/C type N - NiCrSi-NiSi (IEC 60584)      | -270...+1300°C / -454...+2372°F                                                                                 |
| T/C type R - Pt13Rh-Pt (IEC 60584)        | -50...+1750°C / -58...+3182°F                                                                                   |
| T/C type S - Pt10Rh-Pt (IEC 60584)        | -50...+1750°C / -58...+3182°F                                                                                   |
| T/C type T - Cu-CuNi (IEC 60584)          | -270...+400°C / -454...+752°F                                                                                   |
| Input impedance                           | >10 MΩ                                                                                                          |
| Maximum wire loop resistance              | In-head transmitter (including T/C sensor): 5 kΩ<br>Field transmitter (including T/C sensor): 10 kΩ             |
| Cold Junction Compensation (CJC)          | Internal, external (Pt100) or fixed                                                                             |
| <b>Input - voltage</b>                    |                                                                                                                 |
| 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              | In-head transmitter: 5 kΩ<br>Field transmitter / Switch room transmitter: 10 kΩ                                 |
| <b>Output</b>                             |                                                                                                                 |
| Output signal                             | 4...20 mA, 20...4 mA; temperature, resistance or voltage linear, customized linearization possible.             |

|                            |                                                                                                                                                                                                                                                                                             |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>HART®</b>               |                                                                                                                                                                                                                                                                                             |
| HART® protocol             | HART® 7                                                                                                                                                                                                                                                                                     |
| HART® physical layer       | FSK 1200                                                                                                                                                                                                                                                                                    |
| Permissible load           | (Supply voltage-8,5)/0.022                                                                                                                                                                                                                                                                  |
| NAMUR compliance           | Output limits and failure currents according to NAMUR NE 43                                                                                                                                                                                                                                 |
| Adjustable filtering level | 0.17...90 s, (default 1.4 s) [3-wire RTD]                                                                                                                                                                                                                                                   |
| Monitoring                 | Sensor break and short circuit monitoring, selectable, upscale $\geq 21.0$ mA or downscale $\leq 3.6$ mA action, individually configurable.                                                                                                                                                 |
| <b>Configuration</b>       |                                                                                                                                                                                                                                                                                             |
| 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 3.4.0 or later and the firmware in the USB Interface must have a version number 1.2.07 or later.                                                                                                             |
| INOR connect               | The app INOR Connect for portable devices (smartphones) is a versatile and user-friendly tool for wireless configuration through Bluetooth® or NFC technology.<br><br>Communication via Bluetooth® requires the Bluetooth® interface - ICON-BT, which can be ordered from the manufacturer. |
| Alternatives               | Hand held communicator, e.g. FC 475 (Emerson)                                                                                                                                                                                                                                               |
|                            | Management systems, e.g. AMS (Emerson) and PDM (Siemens)                                                                                                                                                                                                                                    |
|                            | EDD enabled systems                                                                                                                                                                                                                                                                         |
|                            | DTM/FDT enabled systems                                                                                                                                                                                                                                                                     |

### Approvals and certifications

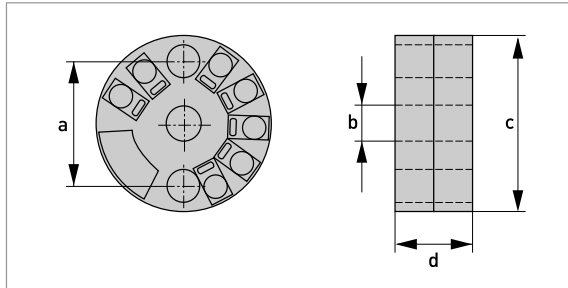
|                                      |                                                                                                                                                                  |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CE                                   | The device fulfils the statutory requirements of the EU directives. The manufacturer certifies that these requirements have been met by applying the CE marking. |
| <b>Ex approvals</b>                  |                                                                                                                                                                  |
| Standard version                     | Without                                                                                                                                                          |
| Intrinsically safe (IS) version      | Refer to <b>Ex approvals</b> in the separate table below.                                                                                                        |
| <b>Other standards and approvals</b> |                                                                                                                                                                  |
| Radio Equipment Directive            | Directive: 2014/53/EU                                                                                                                                            |
|                                      | Harmonized standard: EN 300330                                                                                                                                   |
|                                      | Harmonized standards: EN IEC 61326-1, EN IEC 61326-2-3<br>EN IEC 61000-6-2, EN IEC 61000-6-4                                                                     |
|                                      | Harmonized standard: EN 61010-1                                                                                                                                  |
| RoHS                                 | Directive: 2011/65/EU Harmonized standard: EN IEC 63000                                                                                                          |
| Vibration resistance                 | According to IEC 60068-2-6, test Fc, 10...2000 Hz,<br>10 g for in-head mounted / 5 g for rail mounted transmitter                                                |
| Electromagnetic compatibility        | NAMUR NE 21                                                                                                                                                      |

## Ex approvals

| C530X (intrinsically safe) |                     |                                                                     |
|----------------------------|---------------------|---------------------------------------------------------------------|
| ATEX                       | KIWA 17ATEX0053 X   | II 1 G Ex ia IIC T6...T4 Ga                                         |
| IECEX                      | IECEX KIWA 17.0027X | Ex ia IIC T6...T4 Ga                                                |
| USA                        | FM18US0260X         | IS CL I DIV 1 GP A-D, T6...T4<br>CL I Zn 0 AEx/Ex ia IIC T6...T4 Ga |
| Canada                     | FM18CA0124X         |                                                                     |
| R530X (intrinsically safe) |                     |                                                                     |
| ATEX                       | KIWA 17ATEX0055 X   | II 1 G Ex ia IIC T6...T4 Ga                                         |
| IECEX                      | IECEX KIWA 17.0029X | Ex ia IIC T6...T4 Ga                                                |
| USA                        | FM18US0260X         | IS CL I DIV 1 GP A-D, T6...T4<br>CL I Zn 0 AEx/Ex ia IIC T6...T4 Ga |
| Canada                     | FM18CA0124X         |                                                                     |

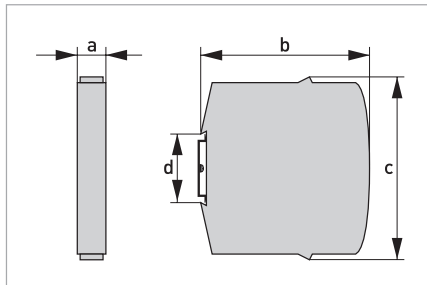
## 7.3 Dimensions

### In-head transmitter



|   | Dimensions |        |
|---|------------|--------|
|   | [mm]       | [inch] |
| a | 33.0       | 1.30   |
| b | 7.0        | 0.28   |
| c | 44.5       | 1.75   |
| d | 19,5       | 0.77   |

### Rail-mount transmitter



|   | Dimensions |        |
|---|------------|--------|
|   | [mm]       | [inch] |
| a | 17.5       | 0.69   |
| b | 81.3       | 3.20   |
| c | 90.0       | 3.54   |
| d | 35         | 1.38   |

## 7.4 Temperature data for areas with potentially explosive atmospheres

Intrinsically safe in head and rail mount transmitter

| Pi     | Temperature class | Allowed ambient temperature                                                                                        |
|--------|-------------------|--------------------------------------------------------------------------------------------------------------------|
| 900 mW | T6                | $-40^{\circ}\text{C} \leq T_a \leq +55^{\circ}\text{C}$ / $-40^{\circ}\text{F} \leq T_a \leq +131^{\circ}\text{F}$ |
|        | T5                | $-40^{\circ}\text{C} \leq T_a \leq +70^{\circ}\text{C}$ / $-40^{\circ}\text{F} \leq T_a \leq +158^{\circ}\text{F}$ |
|        | T4                | $-40^{\circ}\text{C} \leq T_a \leq +85^{\circ}\text{C}$ / $-40^{\circ}\text{F} \leq T_a \leq +185^{\circ}\text{F}$ |
| 700 mW | T6                | $-40^{\circ}\text{C} \leq T_a \leq +60^{\circ}\text{C}$ / $-40^{\circ}\text{F} \leq T_a \leq +140^{\circ}\text{F}$ |
|        | T5                | $-40^{\circ}\text{C} \leq T_a \leq +75^{\circ}\text{C}$ / $-40^{\circ}\text{F} \leq T_a \leq +167^{\circ}\text{F}$ |
|        | T4                | $-40^{\circ}\text{C} \leq T_a \leq +85^{\circ}\text{C}$ / $-40^{\circ}\text{F} \leq T_a \leq +185^{\circ}\text{F}$ |

## 7.5 Output load diagram

Formula for the maximum permissible output load:  
 permissible  $R_{Load} [\Omega] = (U - 8.5) / 0.022$



*Shaded areas shows the working area of the HART® communication.*

### Standard transmitter

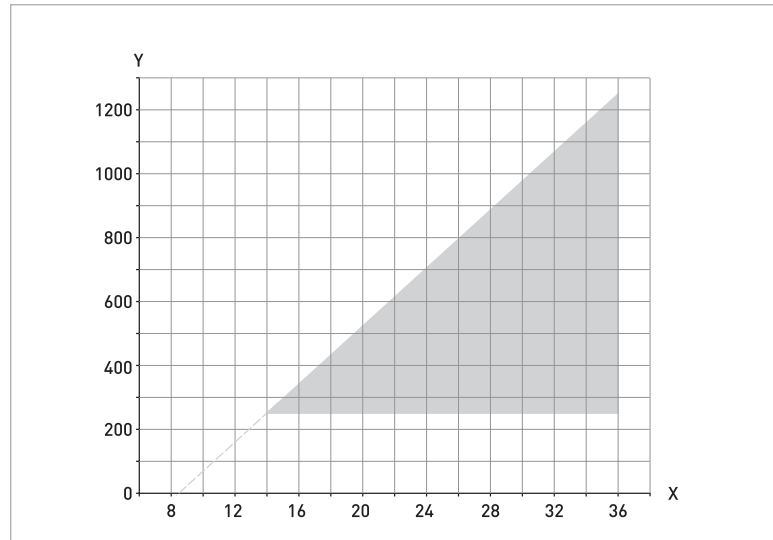


Figure 7-3: Output load diagram

X: Power supply U [VDC]  
 Y: Total output load R [Ω]

### Intrinsically safe transmitter

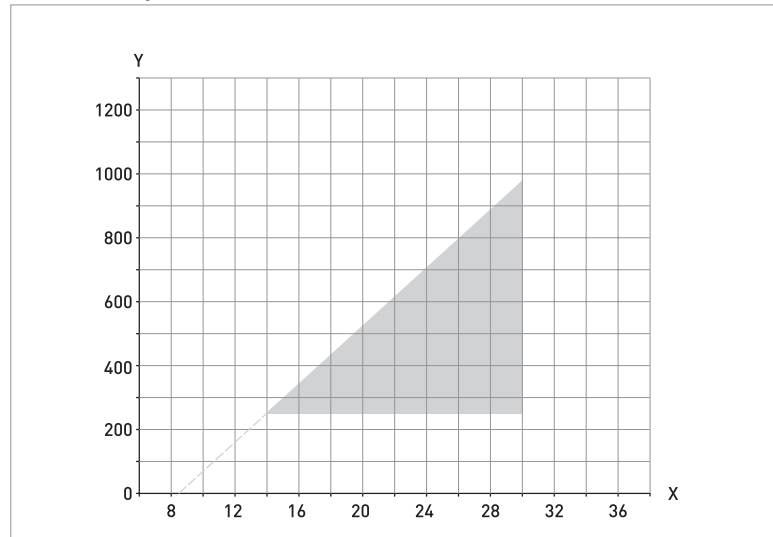


Figure 7-4: Output load diagram

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 C530X

| Output terminals 6, 7 |                       | Input terminals 1, 2, 3, 4 |                        |
|-----------------------|-----------------------|----------------------------|------------------------|
| $U_i = V_{\max}$      | $\leq 30 \text{ VDC}$ | $U_o = U_{0C}$             | $\leq 6.5 \text{ VDC}$ |
| $I_i = I_{\max}$      | $\leq 100 \text{ mA}$ | $I_o = I_{SC}$             | $\leq 11.7 \text{ mA}$ |
| $P_i = P_{\max}$      | $\leq 900 \text{ mW}$ | $P_o$                      | $\leq 19.1 \text{ mW}$ |
| $L_i$                 | $20 \mu\text{H}$      | $L_o$                      | $400 \text{ mH}$       |
| $C_i$                 | $23.1 \text{ nF}$     | $C_o$                      | $24 \mu\text{F}$       |

### Rail-mount transmitter

#### Intrinsically safe transmitter R530X

| Output terminals 21, 22 |                       | Input terminals 1, 2, 3, 4 |                        |
|-------------------------|-----------------------|----------------------------|------------------------|
| $U_i = V_{\max}$        | $\leq 30 \text{ VDC}$ | $U_o = U_{0C}$             | $\leq 6.5 \text{ VDC}$ |
| $I_i = I_{\max}$        | $\leq 100 \text{ mA}$ | $I_o = I_{SC}$             | $\leq 11.7 \text{ mA}$ |
| $P_i = P_{\max}$        | $\leq 900 \text{ mW}$ | $P_o$                      | $\leq 19.1 \text{ mW}$ |
| $L_i$                   | $20 \mu\text{H}$      | $L_o$                      | $400 \text{ mH}$       |
| $C_i$                   | $23.1 \text{ nF}$     | $C_o$                      | $24 \mu\text{F}$       |

## 7.7 RTD and T/C accuracy table

Typical accuracy  $\pm 0.08\%$  of span, max. of  $\pm 0.1$  K or  $\pm 0.1\%$  of span. (Pt100, 3- or 4-wire connection)

Conformance level 95% ( $2\sigma$ )

CJC = Cold Junction Compensation

### Accuracies in °C

| Input type | Temp. range              | Min. span | Accuracy (maximum of)                              | Temp. influence<br>(Dev. from ref. temp. 20°C) |
|------------|--------------------------|-----------|----------------------------------------------------|------------------------------------------------|
|            | [°C]                     |           | [°C]                                               |                                                |
| RTD Pt100  | -200...+850              | 10        | $\pm 0.08^\circ\text{C}$ or $\pm 0.08\%$ of span ① | $\pm 0.01\%$ of span per °C                    |
| RTD PtX ②  | Corresp. to max.<br>4 kΩ | 10        | $\pm 0.1^\circ\text{C}$ or $\pm 0.1\%$ of span ①   | $\pm 0.01\%$ of span per °C ③                  |
| RTD Ni100  | -60...+250               | 10        | $\pm 0.1^\circ\text{C}$ or $\pm 0.1\%$ of span ①   | $\pm 0.01\%$ of span per °C                    |
| RTD Ni120  | -60...+250               | 10        | $\pm 0.1^\circ\text{C}$ or $\pm 0.1\%$ of span ①   | $\pm 0.01\%$ of span per °C                    |
| RTD Ni1000 | -50...+180               | 10        | $\pm 0.1^\circ\text{C}$ or $\pm 0.1\%$ of span ①   | $\pm 0.01\%$ of span per °C ③                  |
| RTD Cu10   | -50...+200               | 83        | $\pm 1.5^\circ\text{C}$ or $\pm 0.2\%$ of span ①   | $\pm 0.02\%$ of span per °C                    |
| T/C type B | +400...+1800             | 700       | $\pm 1.0^\circ\text{C}$ or $\pm 0.2\%$ of span ④   | $\pm 0.01\%$ of span per °C                    |
| T/C type C | 0...+2315                | 200       | $\pm 1.0^\circ\text{C}$ or $\pm 0.2\%$ of span ④   | $\pm 0.01\%$ of span per °C                    |
| T/C type D | 0...+2315                | 200       | $\pm 1.0^\circ\text{C}$ or $\pm 0.2\%$ of span ④   | $\pm 0.01\%$ of span per °C                    |
| T/C type E | -270...+1000             | 50        | $\pm 0.5^\circ\text{C}$ or $\pm 0.1\%$ of span ④   | $\pm 0.01\%$ of span per °C                    |
| T/C type J | -210...+1200             | 50        | $\pm 0.5^\circ\text{C}$ or $\pm 0.1\%$ of span ④   | $\pm 0.01\%$ of span per °C                    |
| T/C type K | -270...+1300             | 50        | $\pm 0.5^\circ\text{C}$ or $\pm 0.1\%$ of span ④   | $\pm 0.01\%$ of span per °C                    |
| T/C type N | -100...+1300             | 100       | $\pm 0.5^\circ\text{C}$ or $\pm 0.1\%$ of span ④   | $\pm 0.01\%$ of span per °C                    |
| T/C type N | -270...-100              | 100       | $\pm 1.0^\circ\text{C}$ ④                          | $\pm 0.1\%$ of span per °C                     |
| T/C type R | -50...+1750              | 300       | $\pm 1.0^\circ\text{C}$ or $\pm 0.1\%$ of span ④   | $\pm 0.01\%$ of span per °C                    |
| T/C type S | -50...+1750              | 300       | $\pm 1.0^\circ\text{C}$ or $\pm 0.1\%$ of span ④   | $\pm 0.01\%$ of span per °C                    |
| T/C type T | -270...+400              | 50        | $\pm 0.25^\circ\text{C}$ or $\pm 0.2\%$ of span ④  | $\pm 0.01\%$ of span per °C                    |

① Valid for 3- and 4-wire connection. For factory settings Pt100, 3-wire connection, 0...100°C applies  $\pm 0.05^\circ\text{C}$ .

② ( $10 \leq X \leq 1000$ )

③ For 2-wire connection and span  $> 2000 \Omega$  applies  $\pm 0.02\%$  of span per °C

④ CJC error not included.  $\leq 0.5^\circ\text{C}$  within ambient temperature range

## Accuracies in °F

| Input type | Temp. range              | Min. span | Accuracy (maximum of)       | Temp. influence<br>(Dev. from ref. temp. 68°F) |
|------------|--------------------------|-----------|-----------------------------|------------------------------------------------|
|            | [°F]                     | [°F]      | [°F]                        |                                                |
| RTD Pt100  | -328...+1562             | 18        | ±0.14°F or ±0.08% of span ① | ±0.006% of span per °F                         |
| RTD PtX ②  | Corresp. to max.<br>4 kΩ | 18        | ±0.18°F or ±0.1% of span ①  | ±0.006% of span per °F ③                       |
| RTD Ni100  | -76...+482               | 18        | ±0.18°F or ±0.1% of span ①  | ±0.006% of span per °F                         |
| RTD Ni120  | -76...+482               | 18        | ±0.18°F or ±0.1% of span ①  | ±0.006% of span per °F                         |
| RTD Ni1000 | -58...+356               | 18        | ±0.18°F or ±0.1% of span ①  | ±0.006% of span per °F ③                       |
| RTD Cu10   | -58...+392               | 149       | ±2.7°F or ±0.2% of span ①   | ±0.006% of span per °F                         |
| T/C type B | +752...+3272             | 1260      | ±1.8°F or ±0.1% of span ④   | ±0.006% of span per °F                         |
| T/C type C | +32...+4199              | 360       | ±1.8°F or ±0.1% of span ④   | ±0.006% of span per °F                         |
| T/C type D | +32...+4199              | 360       | ±1.8°F or ±0.1% of span ④   | ±0.006% of span per °F                         |
| T/C type E | -454...+1832             | 90        | ±0.9°F or ±0.1% of span ④   | ±0.006% of span per °F                         |
| T/C type J | -346...+2192             | 90        | ±0.9°F or ±0.1% of span ④   | ±0.006% of span per °F                         |
| T/C type K | -454...+2372             | 90        | ±0.9°F or ±0.1% of span ④   | ±0.006% of span per °F                         |
| T/C type N | -148...+2372             | 180       | ±0.9°F or ±0.1% of span ④   | ±0.006% of span per °F                         |
| T/C type N | -454...-148              | 180       | ±1.8°F ④                    | ±0.18% of span per °F                          |
| T/C type R | -58...+3182              | 540       | ±1.8°F or ±0.1% of span ④   | ±0.006% of span per °F                         |
| T/C type S | -58...+3182              | 540       | ±1.8°F or ±0.1% of span ④   | ±0.006% of span per °F                         |
| T/C type T | -454...+752              | 90        | ±0.9°F or ±0.1% of span ④   | ±0.006% of span per °F                         |

① Valid for 3-wire, 4-wire connection. For factory settings Pt100, 3-wire, 32-212 °F applies ±0.09 °F.

② (10 ≤ X ≤ 1000)

③ For 2-wire connection and span >2000 Ω applies ±0.02% of span per 1.8° F

④ CJC error not included. ≤ 0.9°F within ambient temperature range

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| Part No.   | Quantity | ATX, IECX and CFMx |
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