MANUAL

Universal Temperature Converter
KFD2-UT2-(Ex)*(-1)
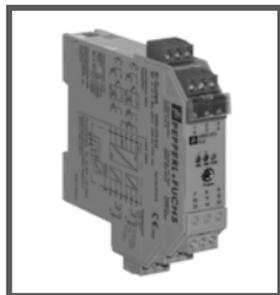
PEPPERL+FUCHS

PROTECTING YOUR PROCESS

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1   Symbols used in this document

STOP
Warning

This symbol indicates a warning about a possible danger.
Failure to observe this warning may result in personal injury or death, or property damage or destruction.

Attention

This symbol warns of a possible fault.
If the instruction given in this warning is not heeded, the device and any systems or plants connected to it could develop a fault or even fail completely.

Note

This symbol brings important information to your attention.

2   Overview

2.1   Application

The devices of the K-system from Pepperl+Fuchs are used to transmit signals between field devices and the process control system or control.

Devices with the "Ex" code in their type identifiers are suitable for connection to field devices in the hazardous area. The field current circuits of these devices are intrinsically safe and are galvanically isolated from the not intrinsically safe circuits. The devices thus represent an electrical isolation between the hazardous area and the safe area within a system.

Devices without an "Ex" code can be used for signal transmission between field devices in the safe area and the process control system or the control.

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The temperature converters KFD2-UT2-(Ex)* of the K-system (referred to as UT2) are used for temperature measurement.

Resistance temperature detectors, thermocouples, potentiometers or voltage sources can be connected to the inputs of the converter.

The KFD2-UT2-(Ex)* converts the input signals into proportional current signals. The KFD2-UT2-(Ex)*-1 converts the input signals into proportional voltage signals. The output signals can, for example, be forwarded to displays or analogue inputs of the process control system.
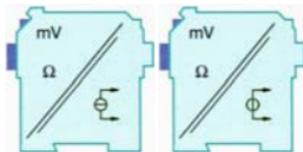
Further information (e. g. certificates, the data sheets for the UT2 devices and the operating instructions for the K-system) can be found on our Internet page www.pepperl-fuchs.com (product search, enter *UT2*).

2.2 Versions

The following versions of the temperature converter are available:

KFD2-UT2-** * **
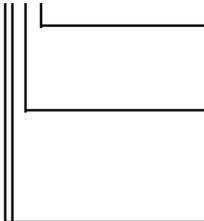
-1 = with voltage output

without identifying number = with current output

1 = 1 input, 1 output
2 = 2 inputs, 2 outputs

Ex = for connection of field devices in areas exposed to danger of explosion

without identifier letters = for connection of field devices in the safe area

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3   Safety instructions

STOP
Warning

The temperature converters KFD2-UT2-(Ex)*(-1) may only be operated by trained personnel in a manner corresponding to this operating manual.

STOP
Warning

Protection of operating personnel and the plant is only guaranteed if the devices are used according to their specifications. Any use other than that described in the manual endangers the safety and functionality of the devices and the connected systems.

STOP
Warning

The devices may only be mounted, connected and adjusted by electrical professionals **outside the explosion hazardous area***.*

STOP
Warning

If malfunctions cannot be eliminated, place the devices out of service and protect them from accidental use. The devices may only be repai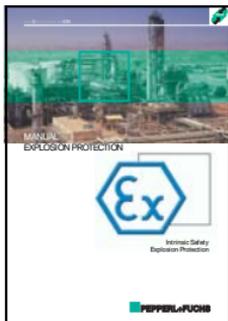red directly by the manufacturer Pepperl+Fuchs. Any opening or change in the units are dangerous and are therefore not to be performed. They void any warranty.

Note

Responsibility for adhering to local safety regulations and directives is held by the operator.

4 Explosion protection

For primary explosion protection, that is, measures to avoid or restrict the production of a dangerous, explosive atmosphere, please consult the directive 1999/92/EC (ATEX 137) or the corresponding national provisions.

For secondary explosion protection, that is, measures to avoid the ignition of a surrounding explosive atmosphere by electrical equipment, Pepperl+Fuchs will gladly provide you with a copy of the "Ex-protection manual" for a nominal fee.

Please pay particular attention to DIN EN 60079-10, DIN EN 60079-14, DIN EN 50014 and DIN EN 50020 or the corresponding national provisions.

Pepperl+Fuchs also provides a seminar on the topic of explosion protection.

5 Mounting and connection

5.1 Mounting

⚠️
Attention

The temperature converters KFD2-UT2-(Ex)(-1) are constructed in protection class IP20 and must therefore be protected from undesirable environmental conditions (water, dust, small foreign objects).*

The devices of the K-systems from Pepperl+Fuchs and thus also the temperature converters KFD2-UT2-(Ex)*(-1) can be mounted on a 35 mm top-hat rail corresponding to DIN EN 50022. The devices must be snapped onto the rail **vertically**, and never slanted or tipped to the side.

Further mounting alternatives, e. g. using the Power Rail, can be found in the operating instructions for the K-system on our Internet page www.pepperl-fuchs.com (product search, enter *UT2*).

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Dimensions of the
KFD2-UT2-(Ex)*(-1) in mm
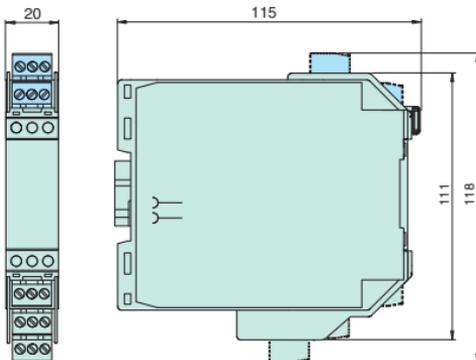
5.2 Connection

The KF series' slip-off terminals significantly simplify connection and construction of switching cabinets. They allow quick and error-free exchange of the unit when service is needed.

The terminals can be screwed on, are self-opening, and have generous connection room for a wire diameter of up to 2.5 mm² and coded plugs, so that leads cannot be confused.

Intrinsically safe field circuits are connected to the **blue** terminals 1 to 6 of the KFD2-UT2-Ex*(-1). These may be conducted using DIN EN 60079-14-compliant leads into the hazardous area.

Non-intrinsically safe field circuits are connected to the **green** terminals 7 to 15 of the KFD2-UT2-*(-1).

Two sensors can be connected to the KFD2-UT2-(Ex)2(-1). Only one sensor can be connected to the KFD2-UT2-(Ex)1(-1).

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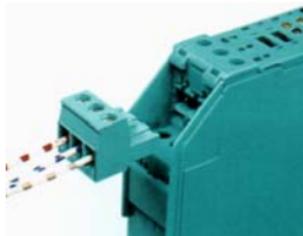
You can connect the following sensors:

- Resistance temperature sensors
  - Pt10, Pt50, Pt100, Pt500, Pt1000 according to EN 60751: 1995 or GOST 6651-94
  - Ni 100 according to DIN 43760
  - Cu10, Cu50, Cu100 according to GOST P50353-92

  in 2-wire, 3-wire or 4-wire technique

  If you connect a sensor in 4-wire technique to the KFD2-UT2-(Ex)2(-1), only a resistance temperature detector in 2-wire technique is possible as the second sensor.

- Thermocouples
  - Type B, E, J, K, N, R, S, T according to IEC 584-1: 1995
  - Type L according to DIN 43710
  - Type TXA, TXK, TXKH according to GOST P8.585-2001

  For a cold junction compensation, you require the K-CJC terminal block as an accessory instead of the normal terminal block 1 to 3 or 4 to 6; for information on entering the external reference temperature see section 7.2.1.

- Potentiometers (800 Ω - 20 kΩ) in 3-wire technique

- Sources for voltage signals between -100 mV and +100 mV

Channel 1 KFD2-UT2-(Ex)1(-1) and KFD2-UT2-(Ex)2(-1)	Channel 2 KFD2-UT2-(Ex)2(-1) only
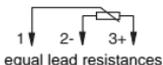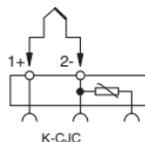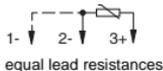
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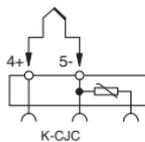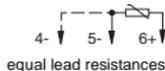
The remaining green terminals have the following functions:
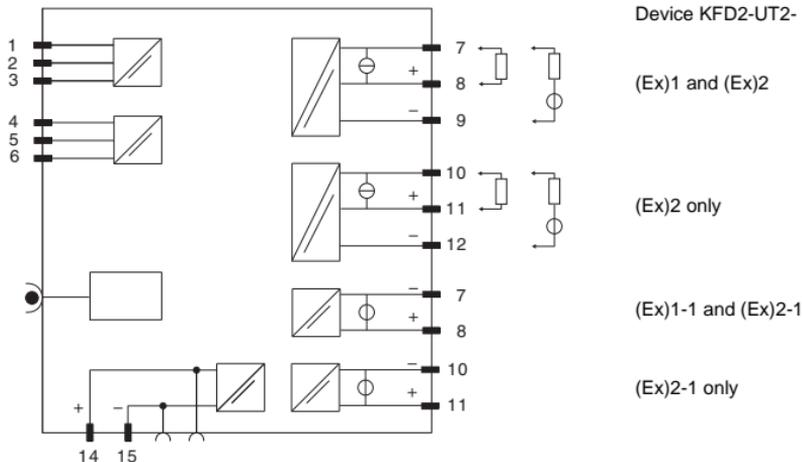
Terminals	KFD2-UT2-(Ex)1	KFD2-UT2-(Ex)2	KFD2-UT2-(Ex)1-1	KFD2-UT2-(Ex)2-1
7/8	Current output, source		Voltage output	
7/9	Current output, sink		–	
10/11	–	Current output, source	–	Voltage output
10/12	–	Current output, sink	–	
13	–			
14/15	Power supply 24 V DC			

If a current output is operated as a sink, the voltage across the terminals must be between 5 V and 30 V. An additional resistance is only required if the voltage is above 16.5 V. The resistance must be between $(U - 16.5\ V)/0.0215\ A$ and $(U - 5\ V)/0.0215\ A$ (see diagram).

Example: U = 24 V

$(24\ V - 16.5\ V)/0.0215\ A = 350\ \Omega$

$(24\ V - 5\ V)/0.0215\ A = 880\ \Omega$

R [Ω]

Resistance area

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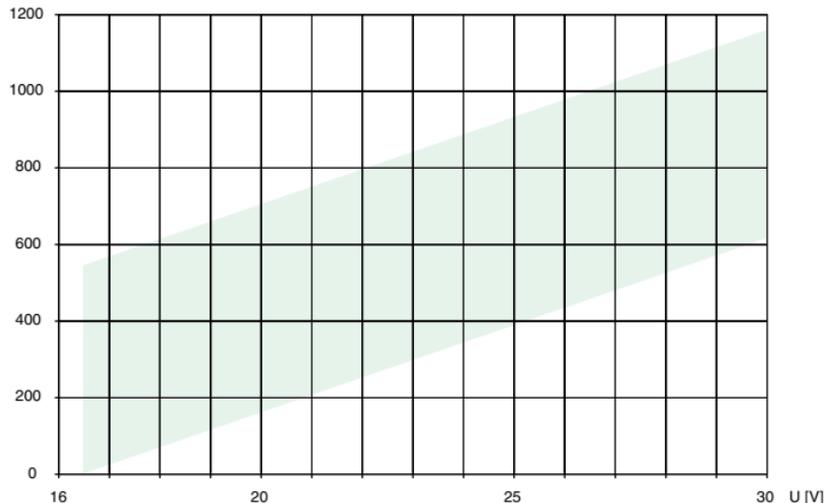
If a current output is operated as a source, the load resistance must be between 0 Ω and 550 Ω (535 Ω if the output format is 4 mA to 20 mA unlimited).

Further information on connecting the UT2 (e. g. on the terminal assignment and on the power supply and collective error message via Power Rail) can be found in the data sheet and in the operating instructions for the K-system on our Internet page www.pepperl-fuchs.com (product search, enter *UT2*).

5.3 Controls and indicators of the UT2

On the front panel of the UT2 you will find:

- LED ERR 1 (red) to indicate
  - a lead fault at input 1 (terminals 1 to 3; flashes red)
  - the simulation mode (flashes red)
  - a device fault (steady red)
- only with KFD2-UT2-(Ex)2(-1) additionally:
  LED ERR 2 (red) to indicate
  - a lead fault at input 2 (terminals 4 to 6, flashes red)
  - the simulation mode (flashes red)
  - a device fault (steady red)
- LED PWR (green) to indicate the supply voltage
- Interface for connecting a computer for parameterization and diagnostics of the device with the **PACT**_ware_**TM** operating software, using the K-ADP-USB adapter

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6   Operating software

The devices are parameterised using the **PACT**_ware_**™** operating software.

The **PACT**_ware_**™** operating software and the necessary device and communication DTMs can be downloaded from our internet page www.pepperl-fuchs.com (product search, enter PACTware).

The manual "Installation and Configuration DTM Collection Conventional Interface Introduction" guides you through the installation steps necessary to install the software. The manual can be found on our Internet page www.pepperl-fuchs.com (product search, enter PACTware).

In the following sections, you will find the device-specific information for the temperature converters KFD2-UT2-(Ex)*(-1).

6.1   Connection between device and computer

Connect the device and the computer using the K-ADP-USB adapter. This adapter can be ordered as an accessory.

Connecting the device to the computer via the USB interface

1. Mount the device as described in the system description.
2. Connect the device to the power supply as described in the system description.
3. Connect the device to the PC via the adapter with USB interface K-ADP-USB.
   – Connection on the device: front programming socket
   – Connection on the PC: USB interface

   > The hardware wizard is displayed. Read the note.
4. Follow the installation instructions and confirm the installation steps.

   > The installation completion window is displayed.
5. Confirm the end of the installation with **Finish**.

   > The interface driver is installed.

◯ ⫦ Note	*The hardware wizard is displayed only on initial installation or for an update.*

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6.2 Communication driver

In a **PACT**_ware_**™** project, communication with a UT2 is only possible via a communication driver. If your project does not yet contain such a driver, please add it to the project from the device catalogue (see manual).

The parameters of the communication DTM is the used PC interface and the number of retries.

The parameter is set as follows:

- Double-click the communication driver with the mouse
- Select the *Communication Port*
- *Communication Retries*: number of retries the COM DTM attempts to establish communication to the connected device.

To add a UT2 to a project, select a communication driver of the project. Then add the UT2 from the device catalogue.

Further information on the individual steps can be found in the manual.

The description in the following chapter assumes that a UT2 has been selected in the project.

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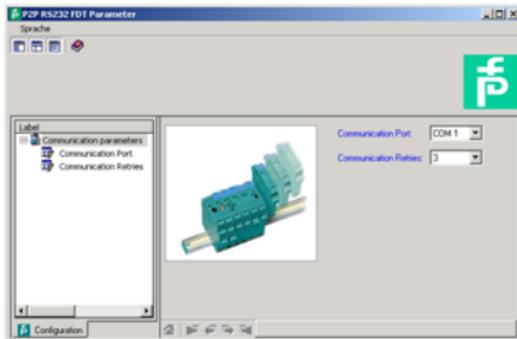
6.3 Measured value

If you have started the communication between **PACT**_ware_**TM** and UT2 (e. g. via *Device data →*
Establish connection), you can open the Measured value window via *Device data → Measured value*.
It shows the following information on the outputs of the UT2 (for the KFD2-UT2-(Ex)1(-1), only output I
is significant):

- Measured values at the inputs as numerical values and bar graph, displayed in the selected units.
- Values of the analogue outputs as numerical value and bar graph, displayed in the selected unit.

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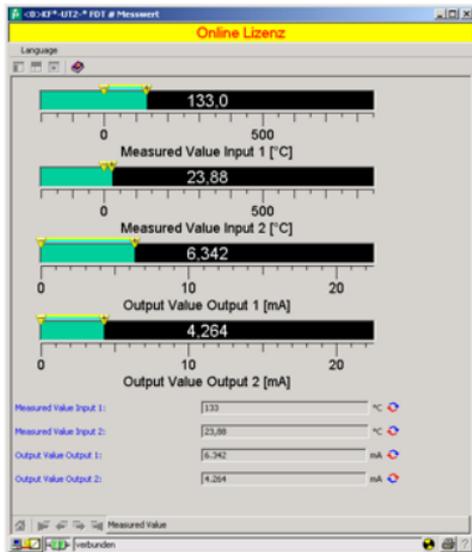
6.4 Simulation

If you have started the communication between **PACT**_ware_**™** and UT2 (e. g. via *Device data →*
Establish connection), you can open the Simulation window via *Device data → Simulation*.

STOP

Warning

The simulation interrupts the normal function of the device!
Before starting the simulation, make sure that no dangerous condition in the plant will
result.

The simulation mode is started with the check box *Simulation ☑ Active*.

You can now specify output currents or output voltages for testing purposes. Press Enter to take over
the set numerical value.

Use the check box *Simulation ☐ Active* to end the simulation.

If the power supply is interrupted, the device ends the simulation.

Note

You can close the simulation window with the Close button or by clicking on the
*Windows-standard ⊠ button at the top right. The device will **remain** in simulation mode,*
however, until you select Simulation Off again.
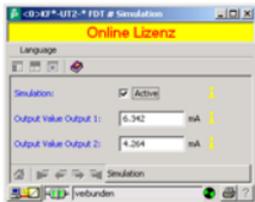
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6.5 Diagnosis

If you have started the communication between **PACT**$_{ware}$**™** and UT2 (e. g. via *Device data → Establish connection*), you can open the Diagnosis window via *Device data → Diagnosis*. It shows the following information:

Explanations:

- *Memory error*: error in the memory of the UT2; if this error was caused by an incorrect data transfer, you can eliminate it via *Device data → Additional functions → Service* (see section 6.6); otherwise, please contact Pepperl+Fuchs

- *Internal device error*: please contact Pepperl+Fuchs

- *Redundancy error*: only if *Redundancy active* has been selected (see section 7.2.2) in the case of a lead fault at **both** inputs (see below)

- *Simulation mode*: see section 6.4

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- *Undervoltage lockout*: the supply voltage is too low for the outputs to work properly, the outputs return 0 mA or 0 V, no matter which fault current/which fault voltage has been selected
- *Redundancy too large*: only if *Redundancy active* has been selected (see section 7.2.2), if the set maximum deviation is exceeded
- *Sensor breakage*: see section 7.2.1
- *Sensor short circuit*: only RTD type of sensor; see section 7.2.1
- *Overrange*, *Underrange*: measured variable outside the maximum measuring range of the selected sensor (see section 7.3 and section 7.4 or 7.5)
- *CJC Error*: if the cold junction compensation has been selected (see section 7.2.1) and a breakage or short circuit occurs within the K-CJC terminal
- *Input 1*: terminals 1 to 3 (also uses terminal 4 for 4-wire resistance measurement);
  Input 2: terminals 4 to 6, for KFD2-UT2-(Ex)2(-1) only

6.6 Service

In menu Service the factory settings of the UT2 can be reloaded.

Reload the factory settings via pressing the button *Factory Reset*.

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7 Editing device data

STOP
Warning

Any change to device data will change the operation of the device!
Before transferring new data into the device, make sure that no danger to the installation will result.

If you call the parameters for a UT2 in **PACT**_ware_**™** (e. g. *Device data* → *Parameters*, see "**PACT**_ware_**™** process automation configuration tool" manual), a window with menus for parameterization appears, these manues will be described as follows.

7.1 Menu Information and Description
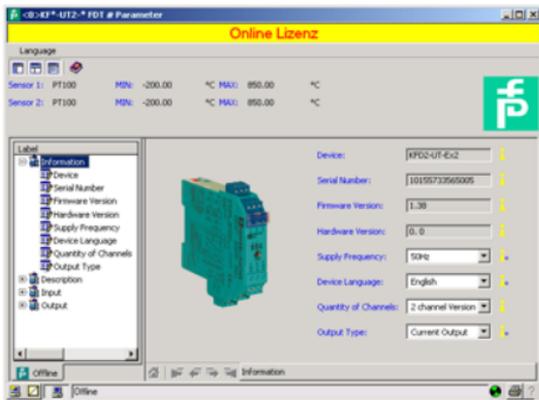
The information in the upper part of the menu *Information* is read from the UT2. This information cannot be changed.

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Please specify the frequency of your supply network (50 Hz or 60 Hz) under *Net frequency*. This way you achieve the best possible suppression of influences of this net frequency on the UT2.

With Quantity of channels it can be preselected if a one channel or two channel device shall be parameterised. Depending on the selection the second channel is displayed or not displayed.

Via Output Type the type of the analogue output (current, voltage) can be preselected. This depends on the device which shall be parameterised.
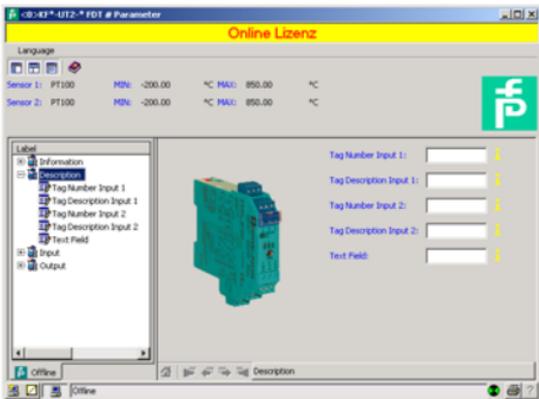
The information in menu *Description* can be edited as desired.

For the KFD2-UT2-(Ex)1(-1), only the *Description Input 1* and the *Text field* are significant.

7.2 Menu Input

The *Input* tab has the three subordinate tabs *I/input*, *II/input* and *Extras*. The *II/input* and *Extras* tabs are only significant for the KFD2-UT2-(Ex)2(-1).

7.2.1 Menu Input 1 and Input 2

On the menu *Input 1*, you set the parameters for the input at the terminals 1 to 3. On the menu *Input 2*, you set the parameters for the input at the terminals 4 to 6 (see section 5.2).

The menus *Input 1* and *Input 2* are structured in the same way and are therefore described together here.

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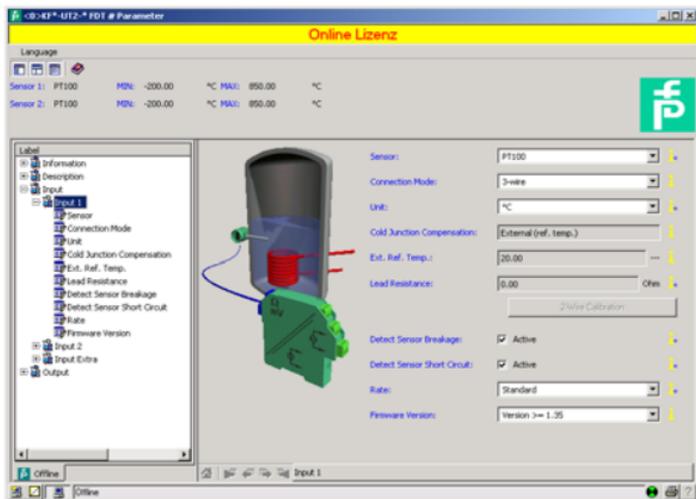
The following parameters can be set:

- *Sensor* (see section 5.2)*:*
    - Resistance temperature detector: *Pt10GOST* etc.
    - Thermocouple: *TXK* etc.
    - *Potentiometer*
    - *Voltage*
- *Connection mode* (for resistance temperature detectors only, see section 5.2):
    - *2-wire*
    - *3-wire*
    - *4-wire*
- *Unit*:
    - for resistance temperature detectors and thermocouples: °*F*, *K* or °*C*
    - for potentiometers: fixed *ratio*
    - for voltage (sources): fixed *mV*

    The unit selected here will be used for **all** respective settings and displays in **PACT**_ware_**™**.
- *Cold junction compensation* (for thermocouples only):
    - external (Reference temperature)
    - internal (K-CJC)

    If you have selected *Ext. ref. temp.*, you can enter the external reference temperature (range of values: *-100 °C* to *320 °C*)

    For an *internal Cold junction compensation*, you require the K-CJC terminal block as an accessory instead of the normal terminal 1 to 3 or 4 to 6 (see section 5.2).
- *Lead Resistance*: When connecting an RTD with 2 wire connection the lead resistance of the cabling can be entered numerically if known.
- *2-Wire Calibration*: When connecting an RTD with 2-wire connection the lead resistance of the cabling can be calibrated if the resistance is unknown. For calibration the sensor must be jumpered.
- *Sensor-breakage monitoring* (for all types of sensors)

- *Sensor-short-circuit monitoring* (for resistance temperature detectors only)

  You activate or deactivate monitoring by clicking the respective checkbox
  (☑ = selected, ☐ = deselected).

- *Measuring rate* (for resistance temperature detectors only)
  - *slow*
  - *standard*

  With the *standard* measuring rate, the accuracy values specified in the data sheet are adhered to.
  With the *slow* measuring rate, the rejection of 50 Hz and 60 Hz is improved.

- *Firmware version*: Here the Firmware Version of the device can be preselected. Depending on Firmware Version some options and functions can differ. If the Firmware Version is unknown, this can be entered automatically through an upload.

7.2.2 Menu Input Extras

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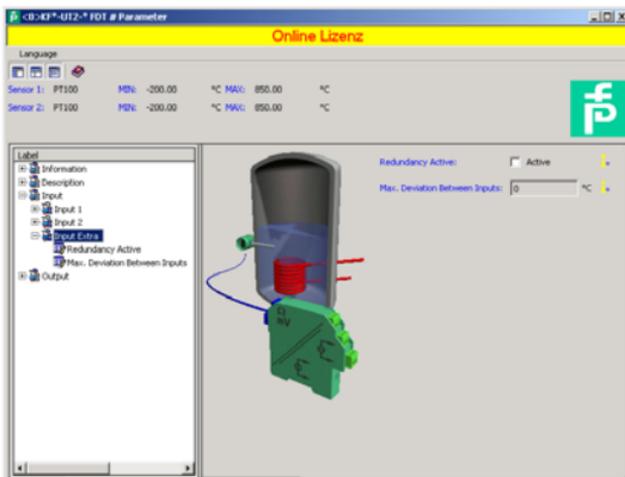
The subordinate *Extras* tab is only significant for the KFD2-UT2-(Ex)2(-1). If you click the checkbox to select *Redundancy active* on the tab (☑) and enter a value under *Maximum deviation*, the UT2 will show the following behaviour:

- If the *Maximum deviation* between the measured values at input 1 (terminals 1 to 3) and input 2 (terminals 4 to 6) is exceeded,
  – the Diagnosis window (see section 6.5) shows the error message *Deviation error in redundancy*.
  – an error is indicated via the collective fault signal if the Power Rail is used. See the operating instructions for the K-system on our Internet page www.pepperl-fuchs.com (product search, enter *UT2*.).
  – both outputs process the measured value at input 1 (terminals 1 to 3, see section 5.2)
  – the outputs do not output any fault current/fault voltage

- If a lead fault (see section 7.2.1) is detected at **one** of the two inputs,
  – the Diagnosis window (see section 6.5) shows the respective error message.
  – an error is indicated via the collective fault message (If the Power Rail is used. See above.).
  – both outputs process the value of the input that does not show a fault
  – the outputs do not output any fault current/fault voltage

- If a lead fault (see section 7.2.1) is detected at **both** inputs,
  – the Diagnosis window (see section 6.5) shows the error message *Redundancy error* in addition to the respective error messages.
  – an error is indicated via the collective fault message (If the Power Rail is used. See above.).
  – the outputs show the selected behaviour in case of a fault (see section 7.3 and section 7.4.5 or section 7.5.5)

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7.3 Menu Output

The menu *Output* has the two subordinate menus *Analogue Output 1* and *Analogue Output 2*.

On the menu *Analogue Output 1*, you set the parameters for the output at the terminals 7 to 9. On the menu *Analogue Output 2*, you set the parameters for the output at the terminals 10 to 12 (see section 5.2). The menu *Analogue Output 2* is only significant for the KFD2-UT2-(Ex)2(-1) and is not displayed when one channel version is selected (see section 7.1).

The menus *Analogue Output 1* and *Analogue Output 2* are structured in the same way and are therefore described together here.

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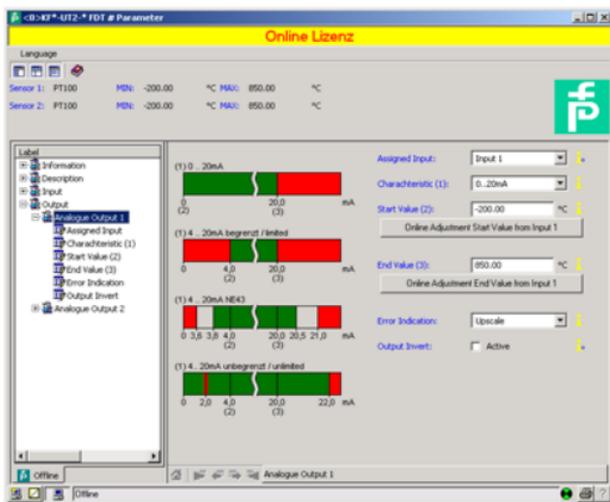
The following parameters can be set:

- *Assigned input*:
  - *Input 1*: input at the terminals 1 to 3; see section 5.2
  - *Input 2*: input at the terminals 4 to 6, for KFD2-UT2-(Ex)2(-1) only
- *Characteristic*, if *Current output* has been selected in the last line (*Current output* only for KFD2-UT2-(Ex)1 devices and KFD2-UT2-(Ex)2 devices):
  - *4 mA ... 20 mA unlimited*
  - *4 mA ... 20 mA (NE 43)*
  - *4 mA ... 20 mA limited*
  - *0 mA ... 20 mA*

  For information on the behaviour of the current output at the different settings, see section 7.4.
- *Characteristic*, if *Voltage output* has been selected in the last line (*Voltage output* only for KFD2-UT2-(Ex)1-1 devices and KFD2-UT2-(Ex)2-1 devices):
  - *1 V ... 5 V unlimited*
  - *1 V ... 5 V (NE 43)*
  - *1 V ... 5 V limited*
  - *0 V ... 5 V*

 For information on the behaviour of the voltage output at the different settings, see section 7.5.
- *Start value* of the measurement range

  The minimum possible value is displayed according to the selected sensor. You can also use the *Adopt from measured value* button for the start value.
- *End value* of the measurement range

  The maximum possible value is displayed according to the selected sensor. You can also use the *Adopt from measured value* button for the end value.
- *Error Indication*: (see section 7.4.5 or section 7.5.5)
  - *Upscale*
  - *Downscale*
  - *Hold*
  - *Up-/downscale (only suitable for use with RTDs)*
- *Characteristic inverted*: see section 7.4 or section 7.5; you activate or deactivate the inverted characteristic by clicking the respective checkbox (☑ = selected, ☐ = deselected).

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7.4 Behaviour of the current output of the KFD2-UT2-(Ex)*

The linear behaviour outside the measurement range described in the following only results if temperature values ranging between the minimum value and the maximum value of the selected sensor correspond to the current values. If this is not the case, the output current jumps to the minimum or maximum specified value. The Diagnosis window (see section 6.5) shows the message *Above limit* or *Below limit*.

If you select *Characteristic inverted*, the conversion of start value and end value will be inverted.
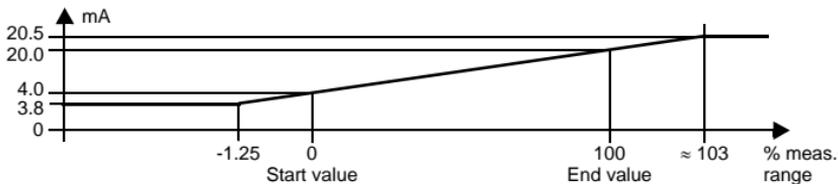
7.4.1 Setting 4 mA ... 20 mA unlimited
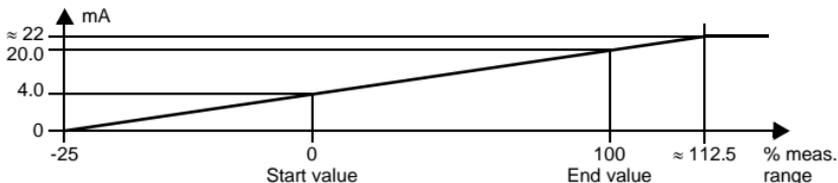
At this setting, the start value of the measurement range is converted to 4 mA and the end value to 20 mA. Intermediate values are converted proportionately.

If the value falls below the start value, the output current decreases linearly to a minimum of 0 mA (-25 % of the measurement range). Further decreases cannot be evaluated (output 0 mA). If the value exceeds the end value, the output current increases linearly to a maximum of 22 mA (approx. 112.5 % of the measurement range). Further increases cannot be evaluated (output approx. 22 mA).
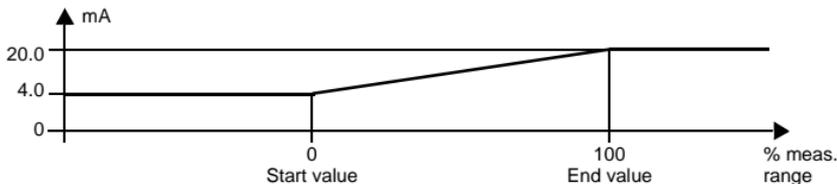
7.4.2 Setting 4 mA ... 20 mA (NE 43)

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At this setting, the start value of the measurement range is converted to 4 mA and the end value to 20 mA. Intermediate values are converted proportionately.

If the value falls below the start value, the output current decreases linearly to a minimum of 3.8 mA (-1.25 % of the measurement range). Further decreases cannot be evaluated (output 3.8 mA). If the value exceeds the end value, the output current increases linearly to a maximum of 20.5 mA (approx. 103 % of the measurement range). Further increases cannot be evaluated (output 20.5 mA).
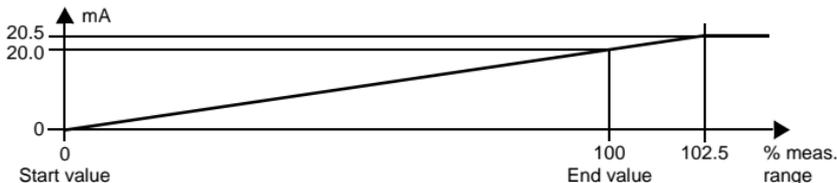
7.4.3 Setting 4 mA ... 20 mA limited

At this setting, the start value of the measurement range is converted to 4 mA and the end value to 20 mA. Intermediate values are converted proportionately.

Values below the start value cannot be evaluated (output 4 mA). Values above the end value cannot be evaluated either (output 20 mA).

7.4.4 Setting 0 mA ... 20 mA

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At this setting, the start value of the measurement range is converted to 0 mA and the end value to 20 mA. Intermediate values are converted proportionally.

Values less than the start value cannot be evaluated (output 0 mA). If the value exceeds the end value, the output current increases linearly to a maximum of 20.5 mA (102.5 % of the measuring range). Further increases cannot be evaluated (output 20.5 mA).

7.4.5 Fault current

The following table shows the values of the current output during a fault, depending on the settings. For information on the behaviour of the current output if *Redundancy active* has been selected, refer to section 7.2.2.

Setting	Characteristic 4 mA ... 20 mA unlimited	Characteristics 4 mA ... 20 mA (NE 43) 4 mA ... 20 mA limited	Characteristic 0 mA ... 20 mA
Upscale	approx. 22 mA (cannot be distinguished from value exceeding end value)	approx. 21.5 mA	approx. 21.5 mA
Downscale	0 mA (cannot be distinguished from value below start value)	2.0 mA	0 mA (cannot be distinguished from measurement of the start value)
Hold	last measured value before the fault		
Upscale/ downscale **only makes sense for RTD**	approx. 22 mA in the case of lead short circuit (cannot be distinguished from value exceeding end value)	approx. 21.5 mA in the case of lead short circuit	approx. 21.5 mA in the case of lead short circuit
	0 mA in the case of lead breakage (cannot be distinguished from value below start value)	2.0 mA in the case of lead breakage	0 mA in the case of lead breakage (cannot be distinguished from measurement of the start value)

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7.5 Behaviour of the voltage output of the KFD2-UT2-(Ex)*-1

The linear behaviour outside the measurement range described in the following only results if temperature values ranging between the minimum value and the maximum value of the selected sensor correspond to the voltage values. If this is not the case, the output voltage jumps to the minimum or maximum specified value. The Diagnosis window (see section 6.5) shows the message *Above limit* or *Below limit*.

If you select *Characteristic inverted*, the conversion of start value and end value will be inverted.
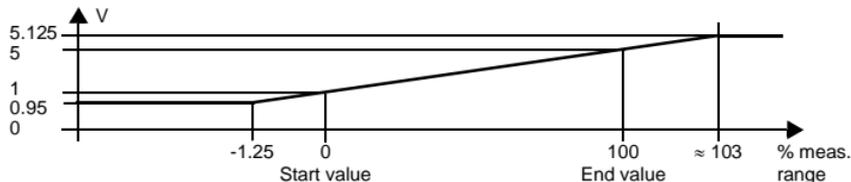
7.5.1 Setting 1 V ... 5 V unlimited
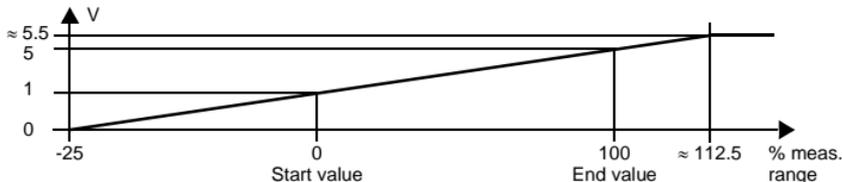
At this setting, the start value of the measurement range is converted to 1 V and the end value to 5 V. Intermediate values are converted proportionately.

If the value falls below the start value, the output voltage decreases linearly to a minimum of 0 V (-25 % of the measurement range). Further decreases cannot be evaluated (output 0 V). If the value exceeds the end value, the output voltage increases linearly to a maximum of 5.5 V (approx. 112.5 % of the measurement range). Further increases cannot be evaluated (output approx. 5.5 V).
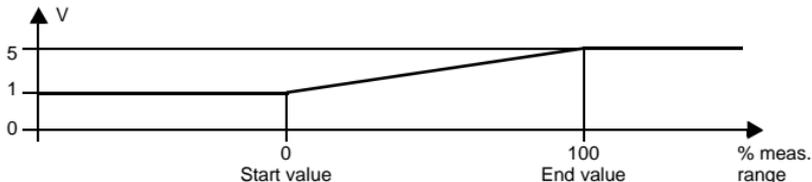
7.5.2 Setting 1 V ... 5 V (NE 43)

At this setting, the start value of the measurement range is converted to 1 V and the end value to 5 V. Intermediate values are converted proportionately.

If the value falls below the start value, the output voltage decreases linearly to a minimum of 0.95 V (-1.25 % of the measurement range). Further decreases cannot be evaluated (output 0.95 V). If the value exceeds the end value, the output voltage increases linearly to a maximum of 5.125 V (approx. 103 % of the measurement range). Further increases cannot be evaluated (output 5.125 V).
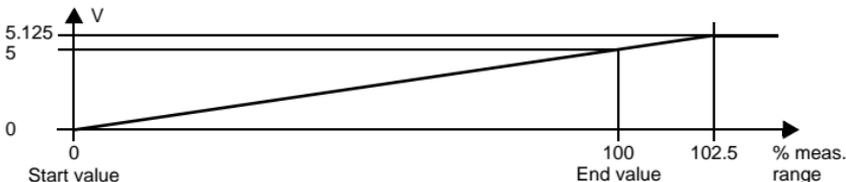
7.5.3 Setting 1 V ... 5 V limited

At this setting, the start value of the measurement range is converted to 1 V and the end value to 5 V. Intermediate values are converted proportionately.

Values below the start value cannot be evaluated (output 1 V). Values above the end value cannot be evaluated either (output 5 V).

7.5.4 Setting 0 V ... 5 V

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At this setting, the start value of the measurement range is converted to 0 V and the end value to 5 V. Intermediate values are converted proportionately.

Values below the start value cannot be evaluated (output 0 V). If the value exceeds the end value, the output voltage increases linearly to a maximum of 5.125 V (approx. 102.5 % of the measurement range). Further increases cannot be evaluated (output 5.125 V).

7.5.5 Fault voltage

The following table shows the values of the voltage output during a fault, depending on the settings. For information on the behaviour of the voltage output if *Redundancy active* has been selected, refer to section 7.2.2.

Setting	Characteristic 1 V ... 5 V unlimited	Characteristics 1 V ... 5 V (NE 43) 1 V ... 5 V limited	Characteristic 0 V ... 5 V
Upscale	approx. 5.5 V (cannot be distinguished from value exceeding end value)	approx. 5.375 V	approx. 5.375 V
Downscale	0 V (cannot be distinguished from value below start value)	0.5 V	0 V (cannot be distinguished from measurement of the start value)
Hold	last measured value before the fault		
Upscale/ downscale **only makes sense for RTD**	approx. 5.5 V in the case of lead short circuit (cannot be distinguished from value exceeding end value)	approx. 5.375 V in the case of lead short circuit	approx. 5.375 V in the case of lead short circuit
	0 V in the case of lead breakage (cannot be distinguished from value below start value)	0.5 V in the case of lead breakage	0 V in the case of lead breakage (cannot be distinguished from measurement of the start value)

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PROCESS AUTOMATION – PROTECTING YOUR PROCESS

Worldwide Headquarters
Pepperl+Fuchs GmbH
68307 Mannheim · Germany
Tel. +49 621 776-0
E-Mail: info@de.pepperl-fuchs.com

For the Pepperl+Fuchs representative
closest to you check www.pepperl-fuchs.com/contact

www.pepperl-fuchs.com

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DOCT-0735E
05/2015