IOA MCR-EX-RTD-I

Temperature measuring transducer

Data sheet
109044_en_02

 2025-09-17

1 Description

The programmable temperature transducer is designed for the intrinsically safe operation of resistance temperature detectors, resistance-type sensors, and potentiometers installed in the Ex area. The measured values are converted into a linear 0/4 mA ... 20 mA signal.

You can operate the non-intrinsically safe output both actively or passively.

You can plug the device into the base elements of the VIP I/O marshalling product portfolio.

You can configure features such as sensor type, connection technology, measuring range, measuring unit, filter, alarm signal, and output range using the clipx ENGINEER DEVICE PARAMETERIZATION software.

Use the IFS-USB-PROG-ADAPTER programming adapter (Item No. 2811271) to connect the device to the PC.

Alternatively, you can use the Bluetooth programming adapter (Item No. 2905872).

Installation in zone 2 in accordance with Ex ec type of protection is permitted.

Features

- Input for standard temperature sensors (RTDs), resistance-type sensors, and potentiometers
- Intrinsically safe inputs [Ex ia] IIC
- Current output 0 mA ... 20 mA or 4 mA ... 20 mA
- High level of accuracy over the entire measuring range
- Configuration via software (clipx ENGINEER DEVICE PARAMETERIZATION)
- Can be pushed onto the base elements in the VIP I/O-marshalling product range
- Safe 3-way electrical isolation
- Installation in Ex zone 2 permitted
- High transmission accuracy
- Status and error indicator in accordance with NE 43
- Housing width of 10 mm

This document is valid for the products listed in the “Ordering data” chapter.
It can be downloaded at: phoenixcontact.com/product/1085764
Make sure you always use the latest documentation.

2 Table of contents

3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
Ex i temperature transducer for VIP I/O marshalling base elements: converts signals from resistance temperature detectors installed in the Ex area and transmits a 0/4 mA ... 20 mA signal to a load (active or passive) in the safe area. Freely configurable.	IOA MCR-EX-RTD-I	1085764	1

Accessories	Type	Item no.	Pcs./Pkt.
8-channel VIP I/O marshalling base element for universal use. All connections as screw connection technology. This module with the D-SUB 25 connector is pin compatible with the Foxboro I/A series DCS.	VIP/S/D25M/BASE 1-8/L/C/EX	2906595	1
16-channel VIP I/O marshalling base element for universal use. Plug-in field and supply terminals available as accessories. With Push-in connection technology. Compatible with the Tricon CX DCS series (D-SUB 50).	VIP/MSTB/D50M/BASE/16CH/CX/EX	2908788	1
16-channel VIP I/O marshalling base element with 37-pos. D-SUB connector for universal use. Plug-in field and supply terminals available as accessories. With Push-in connection technology. For either Ex i or non-Ex.	BASE-MSTB/D37M/16CH/EX	1065476	1
8-channel VIP I/O marshalling base element for universal use. All connections as screw connection technology. With the COMBICON connector, compatible with the Honeywell C300 and RUSIO series. Marking for channels 1–8.	VIP/S/MC/BASE 1-8/L/EX	2906596	1
8-channel VIP I/O marshalling base element for universal use. All connections as screw connection technology. With the COMBICON connector, compatible with the Honeywell C300 and RUSIO series. Marking for channels 9–16.	VIP/S/MC/BASE 9-16/L/EX	2906630	1
8-channel VIP I/O marshalling base element for universal use. All connections as screw connection technology. With the COMBICON connector, compatible with the Honeywell C300 and RUSIO series. Marking for channels 17–24.	VIP/S/MC/BASE 17-24/L/EX	2907024	1
8-channel VIP I/O marshalling base element for universal use. All connections as screw connection technology. With the COMBICON connector, compatible with the Honeywell C300 and RUSIO series. Marking for channels 25–32.	VIP/S/MC/BASE 25-32/L/EX	2907025	1
8-channel VIP I/O marshalling base element for universal use. All connections as screw connection technology. With the COMBICON connector, compatible with the Honeywell C300 and RUSIO series. Marking for channels 1–8 and painting.	VIP/S/MC/BASE 1-8/L/C/EX	2907186	1

Accessories	Type	Item no.	Pcs./Pkt.
8-channel VIP I/O marshalling base element for universal use. All connections as screw connection technology. With the COMBICON connector, compatible with the Honeywell C300 and RUSIO series. Marking for channels 9–16 and painting.	VIP/S/MC/BASE 9-16/L/C/EX	2907187	1
8-channel VIP I/O marshalling base element for universal use. All connections as screw connection technology. With the COMBICON connector, compatible with the Honeywell C300 and RUSIO series. Marking for channels 17–24 and painting.	VIP/S/MC/BASE 17-24/L/C/EX	2907209	1
8-channel VIP I/O marshalling base element for universal use. All connections as screw connection technology. With the COMBICON connector, compatible with the Honeywell C300 and RUSIO series. Marking for channels 25–32 and painting.	VIP/S/MC/BASE 25-32/L/C/EX	2907210	1
Programming adapter with USB interface, for programming with software. The USB driver is included in the software solutions for the products to be programmed, such as measuring transducers or motor managers.	IFS-USB-PROG-ADAPTER	2811271	1
Bluetooth adapter with micro USB and S-PORT interface for wireless communication with the MINI Analog, MINI Analog Pro, MACX Analog, Interface System Gateways, and PLC logic device series.	IFS-BT-PROG-ADAPTER	2905872	1
Marker for terminal blocks, Sheet, white, unmarked, can be labeled with: BLUEMARK E.CARD, BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, PLOTMARK, CMS-P1-PLOTTER, mounting type: latching, for terminal block width: 6.2 mm, Number of individual labels: 80, text field height: 10.5 mm, text field width: 5.6 mm	UC-TM 6	0818085	10
Marker for terminal blocks, Sheet, blue, unmarked, can be labeled with: BLUEMARK E.CARD, BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, PLOTMARK, CMS-P1-PLOTTER, mounting type: latching, for terminal block width: 6.2 mm, Number of individual labels: 80, text field height: 10.5 mm, text field width: 5.6 mm	UC-TM 6 BU	0818344	10
Zack marker strip, Strip, white, unmarked, can be labeled with: PLOTMARK, CMS-P1-PLOTTER, mounting type: latching, for terminal block width: 5.08 mm, Number of individual labels: 10, text field height: 10.5 mm, text field width: 4.98 mm	ZB 5,08:UNBEDRUCKT	0809793	10
Marker pen, for manual labeling of unprinted Zack strips, smear-proof and waterproof, line thickness 0.5 mm	B-STIFT	1051993	10
Zack Marker strip, flat, Strip, white, unmarked, can be labeled with: PLOTMARK, CMS-P1-PLOTTER, mounting type: latching, for terminal block width: 6.2 mm, Number of individual labels: 10, text field height: 6.15 mm, text field width: 5.15 mm	ZBF 6:UNBEDRUCKT	0808710	10

Accessories	Type	Item no.	Pcs./Pkt.
Zack Marker strip, flat, Strip, can be ordered: Strip, white, labeled according to customer specifications, mounting type: snap into flat marker groove, for terminal block width: 6.2 mm, Number of individual labels: 10, text field height: 6.15 mm, text field width: 5.15 mm	ZBF 6 CUS	0825027	1
Marker for terminal blocks, Sheet, white, unmarked, can be labeled with: BLUEMARK E.CARD, BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, PLOTMARK, CMS-P1-PLOTTER, mounting type: latching, for terminal block width: 6.2 mm, Number of individual labels: 80, text field height: 5.1 mm, text field width: 5.6 mm	UC-TMF 6	0818140	10
Marker for terminal blocks, can be ordered: by sheet, white, labeled according to customer specifications, mounting type: snap into flat marker groove, for terminal block width: 6.2 mm, Number of individual labels: 80, text field height: 5.1 mm, text field width: 5.6 mm	UC-TMF 6 CUS	0824646	1
Marker for terminal blocks, Sheet, white, unmarked, can be labeled with: BLUEMARK E.CARD, BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, THERMOMARK PRIME 2.0, THERMOMARK PRIME, THERMOMARK CARD 2.0, THERMOMARK CARD, TOPMARK NEO, TOPMARK LASER, mounting type: latching, for terminal block width: 6.2 mm, Number of individual labels: 60, text field height: 4.7 mm, text field width: 5.4 mm	UCT-TMF 6	0828746	10
Marker for terminal blocks, can be ordered: by sheet, white, labeled according to customer specifications, mounting type: snap into flat marker groove, for terminal block width: 6.2 mm, Number of individual labels: 60, text field height: 4.7 mm, text field width: 5.4 mm	UCT-TMF 6 CUS	0829665	1
Zack Marker strip, flat, Strip, white, labeled, printed horizontally: consecutive numbers 1 ... 10, 11 ... 20, etc. up to 91 ... 100, mounting type: latching, for terminal block width: 6.2 mm, Number of individual labels: 10, text field height: 6.15 mm, text field width: 5.15 mm	ZBF 6,LGS:FORTL.ZAHLEN	0808749	10
Zack Marker strip, flat, Strip, white, labeled, Printed vertically: consecutive numbers 1 ... 10, 11 ... 20, etc. up to 91 ... 100, mounting type: latching, for terminal block width: 6.2 mm, Number of individual labels: 10, text field height: 6.15 mm, text field width: 5.15 mm	ZBF 6,QR:FORTL.ZAHLEN	0808765	10
Zack Marker strip, flat, Strip, white, labeled, printed horizontally: consecutive even numbers 2 ... 20, 22 ... 40, etc. up to 82 ... 100, mounting type: latching, for terminal block width: 6.2 mm, Number of individual labels: 10, text field height: 6.15 mm, text field width: 5.15 mm	ZBF 6,LGS:GERADE ZAHLEN	0810834	10
Zack Marker strip, flat, Strip, white, labeled, printed horizontally: Odd numbers 1 - 19, 21 - 39, etc. up to 81 - 99, mounting type: latching, for terminal block width: 6.2 mm, Number of individual labels: 10, text field height: 6.15 mm, text field width: 5.15 mm	ZBF 6,LGS:UNGERADE ZAHLEN	0810876	10

4 Technical data

Hardware/firmware version	
Hardware/firmware version (1085764)	00 / 1.100
The technical data and safety characteristics are valid as of the specified HW/FW version.	

Input data Resistance thermometer	
Description of the input	intrinsically safe
Sensor types (RTD) that can be used	Pt, Ni, Cu, Si sensors: 2, 3, 4-conductor
Resistance thermometers	Pt 50 , Pt 100 , Pt 200 , Pt 500 , Pt 100S , Pt 500S , Ni 100 , Ni 500 , Cu 50 , Cu 53 , KTY81-110 , KTY84-130
Potentiometer	0 Ω ... 50 kΩ
Max. permissible overall conductor resistance	25 Ω (Per cable)
Linear resistance measuring range	0 Ω ... 50 kΩ
Temperature measuring range	-200 °C ... 850 °C (Range depending on the sensor type)
Temperature measuring range	≥ 20 K (R0: 100 Ω ... 10000 Ω) ≥ 100 K (R0: 10 Ω ... 100 Ω)

Output data Current output	
Configurable/programmable	Yes
Current output signal	0 mA ... 20 mA 4 mA ... 20 mA (active) 4 mA ... 20 mA (Passive, external source voltage 19.2 V ... 26.4 V)
Output signal maximum current	21 mA
Load/output load current output	≤ 600 Ω
Output ripple	< 20 mV_{PP}
Output ripple (current)	< 15 μA_{PP} < 10 μA_{rms}
Behavior in the event of a sensor error	As per NE 43 or can be freely defined

General data	
Nominal supply voltage	24 V DC
Supply voltage range	19.2 V DC ... 30 V DC
Max. current consumption	< 40 mA (24 V DC)
Power dissipation	≤ 0.7 W (Active output) ≤ 1 W (Passive output)
Power consumption	≤ 1 W (Active output) ≤ 0.73 W (Passive output)
Transmission error, typical	0.1 % (e.g. for Pt 100, 300 K span, 4 ... 20 mA)
Maximum temperature coefficient	0.01 %/K
Step response (0–99%) with filter factor = 1	≤ 1.7 s
Mounting position	any
Degree of protection	IP20 (not assessed by UL)
Flammability rating according to UL 94	V0 (Housing)
Status display	LED supply voltage, PWR (green) Red LED, flashing 2.8 Hz (cable error, sensor error on input or output, ERR) Red LED, flashing 1.2 Hz (simulation mode, ERR) LED, red, lights up: module error (exception: connected programming adapter and no supply voltage)
Dimensions W/H/D	10.3 mm / 80.1 mm / 136 mm (IOA MCR-EX-RTD-I)
Type of housing	PA 6.6-FR

Ambient conditions	
Ambient temperature (operation)	-40 °C ... 70 °C (Derating)
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 % (non-condensing)
Operating mode	Indoor use

Electrical isolation (≤ 2000 m above mean sea level)	
Electrical isolation	3-way isolation
Overvoltage category Pollution degree	II (≤ 5000 m) 2 (≤ 5000 m)
Input/output/power supply Standards/regulations Rated insulation voltage Test voltage Insulation	 IEC/EN 61010-1 200 V_{rms} 2.3 kV AC (50 Hz, 60 s) Double/reinforced insulation
Input/output, power supply Standards/regulations Rated insulation voltage	 IEC/EN 60079-11 150 V_{rms} 212 V_P
Input/output/power supply Standards/regulations Rated insulation voltage	 IEC/EN 60079-7 251 V_{rms} 355 V_P

Altitude range IEC/EN 61010-1	
Height range	> 2000 m ... 3000 m
Ambient temperature (operation)	-40 °C ... 60 °C
Rated insulation voltage	150 V_{rms} (Input/output/power supply)
Insulation	Double/reinforced insulation
Height range	> 3000 m ... 4000 m
Ambient temperature (operation)	-40 °C ... 55 °C
Rated insulation voltage	150 V_{rms} (Input/output/power supply)
Insulation	Double/reinforced insulation
Height range	> 4000 m ... 5000 m
Ambient temperature (operation)	-40 °C ... 49 °C
Rated insulation voltage	150 V_{rms} (Input/output/power supply)
Insulation	Double/reinforced insulation
Altitude range IEC/EN 60079-7	
Height range	> 2000 m ... 3000 m
Ambient temperature (operation)	-40 °C ... 60 °C
Rated insulation voltage	162 V_{rms} (Input/output/power supply) 230 V_P (Input/output/power supply)
Height range	> 3000 m ... 4000 m
Ambient temperature (operation)	-40 °C ... 55 °C
Rated insulation voltage	60 V_{rms} (Input/output/power supply) 84 V_P (Input/output/power supply)
Height range	> 4000 m ... 5000 m
Ambient temperature (operation)	-40 °C ... 49 °C
Rated insulation voltage	60 V_{rms} (Input/output/power supply) 84 V_P (Input/output/power supply)

Safety data in accordance with ATEX and IECEx (≤ 2000 m above mean sea level)	
Max. output voltage U_o	6 V
Max. output current I_o	16.6 mA (RTD in 4-conductor technology)
Max. output current I_o	13 mA (RTD in 3-conductor technology)
Max. output current I_o	7.1 mA (RTD in 2-conductor technology)
Max. output current I_o	16.6 mA (2x RTD in 2-conductor technology)
Max. output current I_o	13 mA (Potentiometer)
Max. output power P_o	25 mW (RTD in 4-conductor technology)
Max. output power P_o	20 mW (RTD in 3-conductor technology)
Max. output power P_o	11 mW (RTD in 2-conductor technology)
Max. output power P_o	25 mW (2x RTD in 2-conductor technology)
Max. output power P_o	20 mW (Potentiometer)
Max. external inductivity L_o / Max. external capacitance C_o simple circuit	IIA : 850 mH / 1000 µF
Max. external inductivity L_o / Max. external capacitance C_o simple circuit	IIB/IIIC : 460 mH / 1000 µF
Max. external inductivity L_o / Max. external capacitance C_o simple circuit	IIC : 100 mH / 40 µF
Max. external inductivity L_o / Max. external capacitance C_o mixed circuit	IIB/IIA/IIIC : 100 mH / 950 nF ; 50 mH / 950 nF ; 5 mH / 950 nF ; 1 mH / 950 nF
Max. external inductivity L_o / Max. external capacitance C_o mixed circuit	IIC : 100 mH / 555 nF ; 50 mH / 555 nF ; 5 mH / 555 nF ; 1 mH / 555 nF ; 10 µH / 555 nF
Max. internal capacitance C_i	44 nF
Safety-related maximum voltage U_m	121 V AC
Safety-related maximum voltage U_m	110 V DC
Safety-related maximum voltage U_m	30 V DC (Zone 2: CHn+, CHn-)

Altitude range IEC/EN 60079-11	
Height range Ambient temperature (operation) Safety-related maximum voltage U_m Rated insulation voltage	> 2000 m ... 3000 m -40 °C ... 60 °C 121 V AC/DC 150 V_{rms} (Input/output, power supply) 212 V_P (Input/output, power supply)
Height range Ambient temperature (operation) Safety-related maximum voltage U_m Rated insulation voltage	> 3000 m ... 4000 m -40 °C ... 55 °C 60 V AC/DC 60 V_{rms} (Input/output, power supply) 84 V_P (Input/output, power supply)
Height range Ambient temperature (operation) Safety-related maximum voltage U_m Rated insulation voltage	> 4000 m ... 5000 m -40 °C ... 49 °C 33 V AC/DC 60 V_{rms} (Input/output, power supply) 84 V_P (Input/output, power supply)

Connection data	
Connection method	Plug-in connection
Programming connection	Micro USB type B Programming adapter

Conformance with EMC directive	
Noise immunity according to , EN 61000-6-2 , When being exposed to interference, there may be minimal deviations.	
Noise emission according to EN 61000-6-4	

Conformance/approvals	
CE CE-compliant and EN 61326	
ATEX IBExU 19 ATEX 1006 X	Ⓔx I (M1) [Ex ia Ma] I Ⓔx II (1) G [Ex ia Ga] IIC Ⓔx II (1) D [Ex ia Da] IIIC Ⓔx II 3 (1) G Ex ec ic [ia Ga] IIC T4 Gc
IECEx IECEx IBE 19.0001 X	[Ex ia Ma] I [Ex ia Ga] IIC [Ex ia Da] IIIC Ex ec ic [ia Ga] IIC T4 Gc
UL, USA/Canada E330267 E199827	UL 61010-1 UL 61010-2-201 UL 61010-2-030 CAN/CSA No. 61010-1-12 CAN/CSA C22.2 No. 61010-2-201 CSA C22.2 No. 61010-2-030 [Ex ia Ga] IIC X [Ex ia Da] IIIC X Ex ec [ia Ga] IIC T4 Gc X Ex ec [ia IIIC Da] IIC T4 Gc X [AEx ia Ga] IIC [AEx ia Da] IIIC AEx ec [ia Ga] IIC T4 Gc AEx ec [ia IIIC Da] IIC T4 Gc
Corrosive gas test	ISA S71.04.2013 G3 Harsh Group A

5 Safety regulations and installation notes

5.1 Installation notes

- The device is an item of associated equipment with an EPL [Ga], [Da] (ATEX category 1) with “intrinsic safety” type of protection and can be installed in zone 2 potentially explosive areas as an EPL Gc (ATEX category 3) device. Intrinsically safe circuits can be led up to zone 0 / zone 20. It satisfies the requirements of the following standards.

  IEC/EN 60079-0, IEC/EN 60079-7, IEC/EN 60079-11

  For detailed information, please refer to the declarations of conformity.
- Installation, operation, and maintenance may only be carried out by qualified electricians. Follow the installation instructions as described.
- When installing and operating the device, observe the applicable regulations and safety directives (including national safety directives), as well as the generally recognized technical regulations.
- Observe the safety information, conditions, and limits of use specified in the product documentation. Comply with them.
- The device must not be opened or modified. Do not repair the device yourself, replace it with an equivalent device. Repairs may only be carried out by the manufacturer. The manufacturer is not liable for damage resulting from violation.
- The IP20 degree of protection (IEC/EN 60529) specifies that the device is intended for use in a clean and dry environment. Do not subject the device to mechanical and/or thermal stress that exceeds the specified limits.
- The device complies with the EMC regulations for industrial areas (EMC class A). When using the device in residential areas, it may cause radio interference.
- Only Phoenix Contact devices may be connected to the programming interface that have been specified for this – see respective data sheet.
- Do not use the programming interface for configuration in a potentially explosive area.
- Only use copper conductors providing the permitted temperature range (60 °C / 75 °C) as connecting cables.
- The device must be stopped if it is damaged, has been subjected to an impermissible load, stored incorrectly, or if it malfunctions.
- Only use base elements that are approved for this item.
- Install the device in an environment with pollution degree 2 or better.

5.2 Intrinsic safety

- The device is approved for intrinsically safe (Ex i) circuits up to zone 0 (gas) and zone 20 (dust) in the Ex area. The safety technology values for intrinsically safe equipment and the connecting lines must be observed for the hook-up process (IEC/EC 60079-14) and the values specified in this installation note and/or the EU examination certificate must be observed.
- When carrying out measurements on the intrinsically safe side, observe the relevant regulations regarding the connection of intrinsically safe equipment. Use only these approved measuring devices in intrinsically safe circuits.
- If the device was used in circuits which are not intrinsically safe, it is forbidden to use it again in intrinsically safe circuits. Label the device clearly as being not intrinsically safe.

5.3 Installation in the Ex area (zone 2, class I, division 2)

- The equipment must be installed in a suitably certified, tool-secured housing that provides a minimum protection class of IP54 in accordance with IEC 60079-0. The overall equipment (with its housing) shall only be used in an area of pollution degree 2 or higher, as defined in IEC 60664-1. Alternatively, the additional housing must have an internal pollution degree of 2 or higher, as defined in IEC 60664-1.
- Plugging and unplugging operations are only permitted in potentially explosive areas when the power is disconnected.
- The device must be stopped and immediately removed from the Ex area if it is damaged, was subject to an impermissible load, stored incorrectly or if it malfunctions.

5.4 Installation in areas with a danger of dust explosions (zone 22)

- The device is not suitable for installation in zone 22.
- If, however, you wish to use the device in zone 22, you must install it in housing that complies with IEC/EN 60079-31. When doing so, observe the maximum surface temperatures. Observe the requirements of IEC/EN 60079-14.
- Connection to the intrinsically safe circuit in areas with a danger of dust explosions (zone 20, 21 or 22) is only permitted if the equipment connected to this circuit is approved for this zone (e.g., category 1D, 2D or 3D).

5.5 UL notes

The safety specifications, which are based on UL approval, can be found in the “Control Drawing”.
The “Control Drawing” is part of the package slip.

6 Installation

6.1 Connection notes

WARNING: Electrical danger due to improper installation

Observe the connection notes for safe installation in accordance with EN/UL 61010-1:

- Disconnecting devices and branch circuit protection with suitable AC or DC rating shall be provided in the building installation.
- The device is intended for installation in a control cabinet or in a comparable enclosure. The device may only be operated when it has been installed. The control cabinet must meet the requirements of UL/IEC 61010-1 in terms of protection against spread of fire and protection against electric shock or burn.
- Provide for a switch/circuit-breaker in the vicinity of a device that is marked as disconnect device for this device.
- Provide overcurrent protection (I ≤3 A) within the installation.
- To protect the device against mechanical or electrical damage, install it in suitable housing with an appropriate degree of protection according to IEC/EN 60529.
- During maintenance work, disconnect the device from all effective power sources.
- If the device is not used as described in the documentation, the intended protection can be negatively affected.
- The housing of the device provides a basic insulation against the neighboring devices for 300 V_{eff}. If several devices are installed next to each other, this must be taken into account. If the neighboring device is equipped with basic insulation, no additional insulation is required.
- The voltages applied to the input, output, and power supply are extra-low voltages (ELV). Depending on the application, hazardous contact voltage (>30 V AC/ >60 V DC) to ground may occur. Safe electrical isolation from the other connections exists for this case.
- While the devices are in operation, contact-dangerous voltages may be present on the control elements. For this reason parameterization, conductor connection, and opening of the module lid are allowed only when devices are in a de-energized state unless the connected circuits are exclusively SELV or PELV circuits.

WARNING: Explosion hazard

If the device has been used in non-intrinsically safe circuits, it must not be used again in intrinsically safe circuits.

The device must be clearly marked as non-intrinsically safe.

6.2 Electrostatic discharge

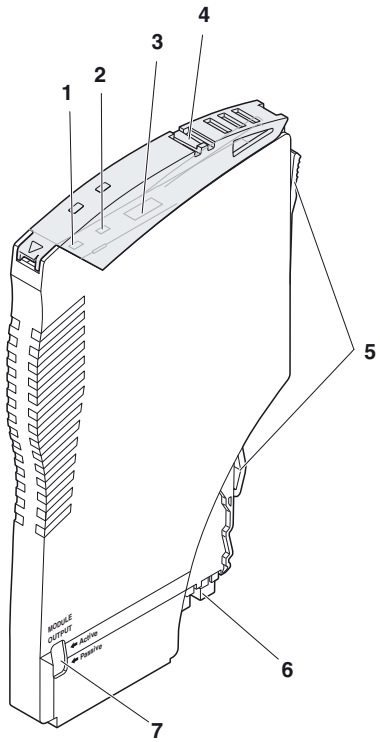
NOTE: Electrostatic discharge

The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and EN 61340-5-2.

Take protective measures against electrostatic discharge before operating or installing the device.

6.3 Structure

Figure 1 Structure



1 Green “PWR” LED, power supply

2 Error indicator "ERR" red LED

Flashing quickly (2.8 Hz): sensor error or line fault at the input and output

Flashing slowly (1.4 Hz): simulation mode

Lights up: Module error (exception: connected programming adapter and no supply voltage)

3 Programming socket for connection of the programming adapter

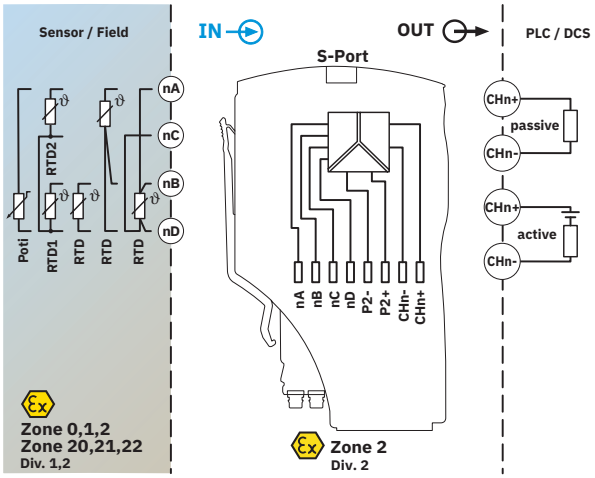
4 Module cover with integrated groove for custom marking

5 Release hook

6 Coding plug

7 Switch for switching the output from passive to active

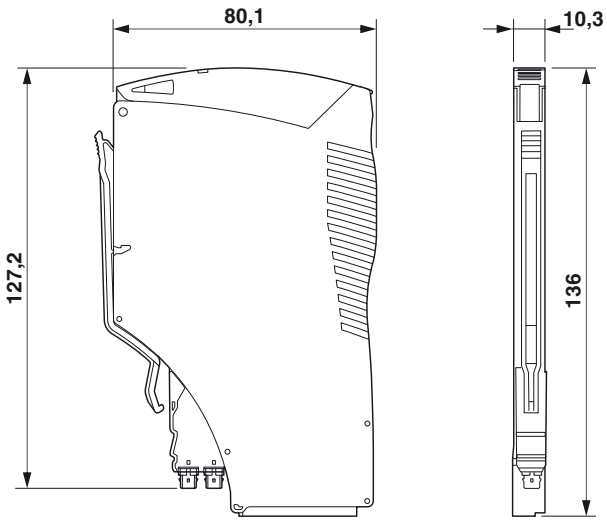
6.4 Basic circuit diagram with connection terminal blocks



6.5 Output

Operating mode	Connection of input card to terminal
Source – passive input card	CHn+ (I+) and CHn- (I-)
Drain – active input card	CHn+ (I-) and CHn- (I+)

6.6 Dimensions



6.7 Power supply

The device is supplied with power via the base element.

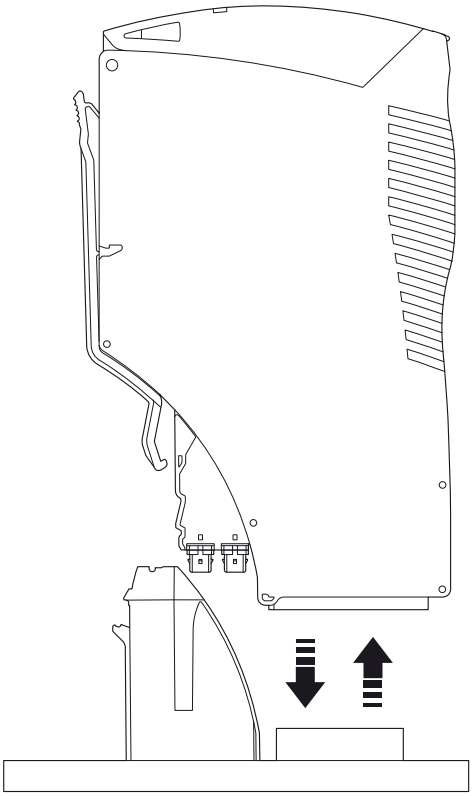
Observe the information on the packing slip of the selected base element, as well as the information in the VIP I/O-marshalling user manual.

108825 UM DE VIP I/O-Marshalling

6.8 Mounting

You can plug the device into the base elements of the VIP I/O marshalling product portfolio.

Figure 2 Mounting and removing



6.8.1 IOA... plug installation

1. Align the IOA.../EX plug with the desired slot on the base.
2. Push the plug into the slot on the base. Ensure that the orange latch snaps down over the catch on the base, securing the plug in place.

The IOA... plug is coded to match the base. The coding is transferred to the VIP/.../BASE.../EX base when first installed.

6.8.2 IOA... plug removal

DANGER

Do not remove the plug while the power is connected if the area is potentially explosive.

1. Grasp the IOA.../EX module, with one finger on the orange latch, and squeeze the latch to release it.
2. Pull the module straight out from the base. An indentation will be felt as the internal connections are separated.

If a different style of IOA... must be installed in a base after initial installation, the coding interface can be removed with a tool and a new IOA... installed with a different coding interface.

6.9 LED status indicators

LED	Color/ status	Description
PWR	Green	Supply voltage
	On	Ready to operate
		Configuration without device supply via IFS-USB-PROG-ADAPTER programming adapter
ERR	Red	Error
	On	Module error (exception: connected programming adapter and no supply voltage)
	Flashing (1.4 Hz)	Simulation mode
	Flashing (2.8 Hz)	Sensor error or line fault at the input and output

6.10 Startup

- Before startup, check that the device is operating and wired correctly, in particular with regard to the wiring and marking of the intrinsically safe circuits.

6.11 Sensor types

6.11.1 Resistance temperature detectors (RTDs) and resistors between 0 Ω ... 50 kΩ

Depending on the connection technology, the following terminal points must be connected for temperature measurement with resistance temperature detectors and other resistors:

RL ≤25 Ω per lead

2-conductor connection technology

Terminal blocks nB, nD

You can compensate for the line resistance using the clipx ENGINEER DEVICE PARAMETERIZATION PC program.

3-conductor connection technology

Terminal blocks nA, nD, nB (slider)

You can compensate for the line resistance using the clipx ENGINEER DEVICE PARAMETERIZATION PC program.

4-conductor connection technology

Terminal blocks nA, nB, nC, nD

2 x 2-conductor connection technology

Terminal blocks nB, nD: RTD 1

Terminal blocks nA, nC: RTD 2

Terminal blocks, wire bridge: nC and nD

6.11.2 Potentiometer

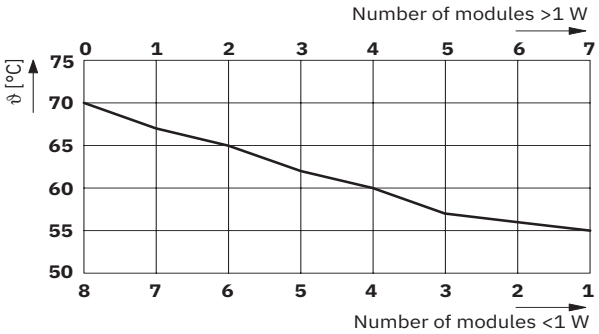
Terminal blocks nA, nD, nB (slider)

6.12 Derating

If you install up to eight or 16 function modules with a power dissipation of <1 W on one base element, the ambient temperature specified in the technical data applies.

If you combine the function modules with function modules that have a power dissipation of > 1 W, you must reduce the maximum permissible ambient temperature.

Figure 3 Derating curve



Install the function modules with a power dissipation of < 1 W next to each other in one block.

If you operate the temperature measuring transducer with a passively operated module output, a minimum load of 100 Ω (e.g., sum of the input resistance on the I/O system and the resistance of the system cable) must be connected to the module output.

7 Configuration

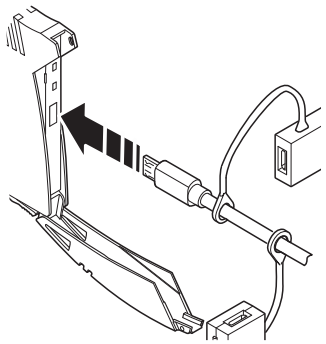
WARNING - Explosion Hazard

Do not use the programming interface for configuration in a potentially explosive area.

Changes to the configuration and parameterization data can be made during operation without a connected Ex measuring circuit as well as in a disconnected state.

The configuration software can be downloaded free of charge as a standalone CLIPX ENGINEER DEVICE PARAMETERIZATION version at: https://www.phoenixcontact.com/product/1371665. The online manual and the online help for the intuitive software explain the configuration, parameterization, and service options (e.g., online monitoring) and their use.

Figure 4 Programming connection



- Connect the device and PC using the IFS-USB-PROG-ADAPTER programming adapter (Item No.: 2811271).

Alternatively, you can use the Bluetooth programming adapter (Item No. 2905872).

7.1 System requirements

For a complete list of system requirements, please refer to the CLIPX ENGINEER DEVICE PARAMETERIZATION website at https://www.phoenixcontact.com/product/1371665.

Use the IFS-USB-PROG-ADAPTER (Item No.: 2811271) for connecting the device to the PC. The drivers for the USB programming adapter are installed automatically.

Alternatively, you can use the Bluetooth programming adapter (Item No. 2905872).

7.2 Configuration via clipx ENGINEER DEVICE PARAMETERIZATION software

You can apply the following settings.

Measuring input	
	Sensor type
	Connection technology
	Temperature range
	Input signal average value filter
Output	
	Output range
	Signal inversion
	Fault signaling
Service	
	Reset
	Simulation mode

8 Function description

8.1 Notes on using resistance temperature detectors

For resistance temperature detectors, a temperature-dependent resistor is used as a sensor which is supplied with a constant current.

The current must be kept as low as possible, in the order of 1 mA, thus preventing the undesired heating of the resistor.

The voltage difference, the so-called voltage drop, is measured at the resistor.

The measured voltage is proportional to the resistance.

Therefore, the signal only needs to be adapted to the evaluating device and used as the measure of the temperature.

Resistance temperature detectors are often referred to as RTDs.

Depending on the application purpose and the measuring accuracy required, resistance temperature detectors can be connected to the evaluating devices in different ways.

8.1.1 2-conductor connection

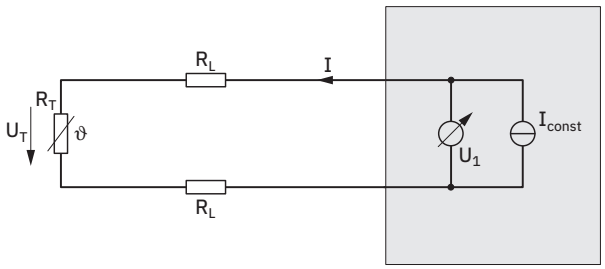
For less accurate measurements, the resistance temperature detector can be connected using the 2-conductor connection method.

Since the connecting cable resistances will falsify the measurement result, the connecting cables should be as short as possible and each cable should not be longer than 10 m.

The cable resistances can be determined for increased accuracy and, with many measuring transducers, be subtracted from the measured resistance. For a 1 mm^2 copper conductor, the resistance is approx. 0.17 Ω per 10 m.

For a resistance temperature detector of type Pt 100, 0.385 Ω equals an approx. 1 K change in temperature.

Figure 5 Resistance temperature detector with 2-conductor connection



$U_T = U_1 - (2\ I_{const}\ R_L)$

$R_T = U_T / I_{const}$

U_1	Total voltage drop determined with voltage measuring device
U_T	Voltage drop at shunt
R_T	Shunt resistance
R_L	Cable resistance between voltage measuring device and shunt
I_{const}	Constant current source (with electronically controlled current output)

When connecting the shunt using the 2-conductor connection method, a change in the cable resistances as a result of a changed ambient temperature will not be considered and thus falsify the measurement result.

For longer cable lengths and more accurate measurements, the resistance temperature detector should be connected using the 3 or 4-conductor connection method.

8.1.2 3-conductor connection

The 3-conductor connection method is suitable for cables between the sensor and measuring transducer of more than 10 m.

For a 3-conductor connection, an additional third cable is used to connect the shunt to the evaluation unit.

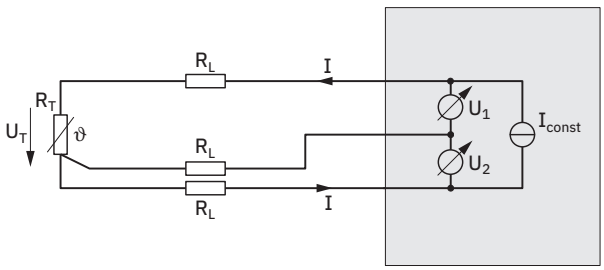
Measuring current will not pass through this cable.

This makes it possible to measure and consider the resistance and its temperature-dependent change on one of the cables through which current is flowing.

The prerequisite is that the resistances of the two cables through which current is flowing must be the same.

This is generally the case when using a 3-conductor cable. Accordingly, the 3-conductor connection method is most frequently used.

Figure 6 Resistance temperature detector with 3-conductor connection



$U_1 = I_{const} R_T + I_{const} R_L$

$U_2 = I_{const} R_L$

$U_T = U_1 - U_2$

$R_T = U_T / I_{const}$

U_1	Voltage drop at R_T and R_L determined with voltage measuring device 1
U_2	Voltage drop at R_L determined with voltage measuring device 2
U_T	Voltage drop at shunt
R_T	Shunt resistance
R_L	Cable resistance between voltage measuring device and shunt (must be the same for the two cables through which current is flowing)
I_{const}	Constant current source (with electronically controlled current output)

8.1.3 4-conductor connection

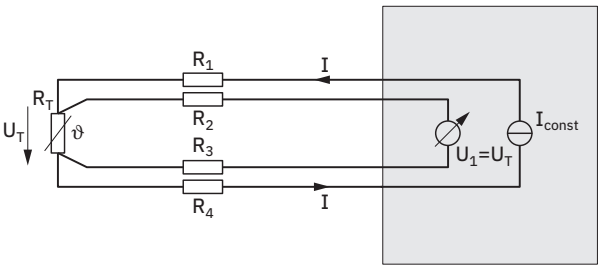
The 4-conductor connection method is suitable for cables between the sensor and measuring transducer of more than 10 m.

Using the 4-conductor connection method, two measuring cables are connected to the shunt, without any measuring current flowing through them.

Cable resistance values and differences do not play a role here.

When using resistance temperature detectors, the 4-conductor connection method enables the most precise measurements.

Figure 7 Resistance temperature detector with 4-conductor connection



$R_T = U_T / I_{const}$

U_1	Voltage drop at R_T determined with voltage measuring device
U_T	Voltage drop at shunt
R_T	Shunt resistance
$R_{1...4}$	Cable resistances between voltage measuring device and shunt (may be different for all cables: R1 ≠ R2 ≠ R3 ≠ R4)
I_{const}	Constant current source (with electronically controlled current output)

To ensure good CMV suppression (common mode voltage) of the measuring transducer, it is useful if R_2 and R_3 are identical.

8.2 Current output

The current output can be freely configured within the limits of 0 mA ...21 mA.

The minimum span is 4 mA.

Contacts CHn (+) and CHn (-)

8.3 Monitoring function

The device is equipped with monitoring functions for the input and output range.

- Wire break
- Shield short circuit
- Measuring value overrange
- Measuring value underrange
- Invalid input high
- Invalid input low

Input monitoring function

The input monitoring function for line break and short circuit refers to the sensor connected to the input.

When an error is detected, the output signal is set to the configured error value.

With RTD sensors and resistance-type sensors, short-circuit failures are detected resistance values <1 Ω.

With RTD sensors, resistance-type sensors, and potentiometers, a line break is detected when the current flow through the sensor is faulty.

The measuring value overrange/underrange errors indicate that a value went outside the set measuring range.

The invalid input errors high and low indicate that an input went outside the definition range of the sensor.

The errors are signaled by the analog output of the module and by a red LED.

Once the fault has been eliminated, the device resumes performing its normal functions.

Output monitoring function

The current output can be monitored for line breaks.

This is activated via the configuration.

As soon as the fault has been eliminated, the device continues to perform its normal function.

8.4 Measuring accuracy and minimum spans

Sensor material	Standards	Measuring range
Platinum	IEC 60751:2008 (α = 0,00385)	-200 °C ... +850 °C
	Identical: GOST 6651:2009	
Platinum	GOST 6651-2009 (α = 0.00391)	-200 °C ... +850 °C
Platinum	JIS C 1604:1997 (α = 0.00385)	-200 °C ... +850 °C
Nickel	DIN 43760	-60 °C ... +250 °C
Copper	GOST 6651-2009 (α = 0.0428)	-180 °C ... +200 °C
Copper	GOST 6651:1994 (α = 0.00426)	-50 °C ... +180 °C
Silicon	KTY81-110 (Philips/NXP)	-55 °C ... +150 °C
Silicon	KTY84-130 (Philips/NXP)	-40 °C ... +300 °C

8.4.1 Input for Pt RTDs and Ni RTDs

Minimum measuring span

$10\ \Omega \le R_0 < 100\ \Omega$: 100 K
$100\ \Omega \le R_0 \le 10\ k\Omega$: 20 K

R_0 is the resistance value of the sensor at 0°C.

Measuring accuracy

$10\ \Omega \le R_0 < 100\ \Omega$	:	0.2 K x 100 Ω / R0	=	0.1% x (100 Ω / R0) x (200 K / measuring span)
$100\ \Omega \le R_0 \le 1\ k\Omega$	:	0.2 K	=	0.1% x (200 K / measuring span)
$1\ k\Omega < R_0 \le 10\ k\Omega$	:	0.4 K	=	0.1% x (400 K / measuring span)

8.4.2 Input for Cu RTDs and Ni RTDs

Minimum measuring span

$10\ \Omega \le R_0 < 100\ \Omega$: 100 K
$100\ \Omega \le R_0 \le 10\ k\Omega$: 20 K

Measuring accuracy

$10\ \Omega \le R_0 < 100\ \Omega$	:	0.5 K x 100 Ω / R0	=	0.1% x (100 Ω / R_0) x (500 K / measuring span)
$100\ \Omega \le R_0 \le 1\ k\Omega$	:	0.5 K	=	0.1% x (500 K / measuring span)
$1\ k\Omega < R_0 \le 10\ k\Omega$	:	1.0 K	=	0.1% x (1000 K / measuring span)

8.4.3 Input for KTY 81-110, KTY 84-130 (Philips)

Minimum measuring span

20 K

Measuring accuracy

0.1% x (200 K/measuring span)

8.4.4 Resistance-type sensors and resistors

50% of the measuring range ≤ (nominal value of resistance-type sensor + lead resistance) ≤ measuring range

Minimum measuring span

10% of the selected measuring range

Measuring accuracy

0 Ω ... 75 Ω	:	0.10% x (75 Ω/measuring span)
0 Ω ... 150 Ω	:	0.05% x (150 Ω/measuring span)
0 Ω ... 300 Ω	:	0.02% x (300 Ω/measuring span)
0 Ω ... 600 Ω	:	0.01% x (600 Ω/measuring span)
0 Ω ... 1200 Ω	:	0.01% x (1200 Ω/measuring span)
0 Ω ... 2400 Ω	:	0.01% x (2400 Ω/measuring span)
0 Ω ... 4800 Ω	:	0.01% x (4800 Ω/measuring span)
0 Ω ... 6250 Ω	:	0.1% x (6250 Ω/measuring span)
0 Ω ... 12500 Ω	:	0.1% x (12500 Ω/measuring span)
0 Ω ... 25000 Ω	:	0.1% x (25000 Ω/measuring span)
0 Ω ... 50000 Ω	:	0.1% x (50000 Ω/measuring span)

Example

Resistance-type sensor with nominal value	:	1000 Ω
Measuring range to be selected	:	0 Ω ... 1200 Ω
Minimum measuring span	:	10% of the selected measuring range = 120 Ω
Measuring accuracy	:	0.01% of the selected measuring range = 120 mΩ

8.4.5 Potentiometer

50% of the measuring range ≤ (nominal value of potentiometer + lead resistance) ≤ measuring range

The line resistance must be ≤10 Ω per cable and the same in all three cables.

Minimum measuring span

10% of the selected measuring range

Measuring accuracy

0 Ω ... 75 Ω	:	0.10 %
0 Ω ... 150 Ω	:	0.05 %
0 Ω ... 300 Ω	:	0.02 %
0 Ω ... 600 Ω	:	0.02 %
0 Ω ... 1200 Ω	:	0.02 %
0 Ω ... 2400 Ω	:	0.02 %
0 Ω ... 4800 Ω	:	0.02 %
0 Ω ... 6250 Ω	:	0.10 %
0 Ω ... 12500 Ω	:	0.10 %
0 Ω ... 25000 Ω	:	0.10 %
0 Ω ... 50000 Ω	:	0.10 %

Example

Potentiometer with nominal value	:	1000 Ω
Measuring range to be selected	:	0 Ω ... 1200 Ω
Minimum measuring span	:	10% of the selected measuring range = 120 Ω
Measuring accuracy	:	0.02% of the selected measuring range = 240 mΩ

9 Comparison of the safety data

WARNING - Explosion Hazard

Compare the safety data before connecting a device located in the Ex i area to this device.

Provide proof of intrinsic safety according to standard IEC/EN 60079-14 and other national standards and installation specifications, if applicable.

Safety data

Field devices	U_i, I_i, P_i, L_i, C_i
Temperature transducer	U_o, I_o, P_o, L_o, C_o

The values for U_o, I_o, P_o, L_o, C_o are to be found under "Safety data in accordance with ATEX and IECEx" in the "Technical data" section.

Requirements for intrinsic safety (simple circuits)

$U_i \geq U_o$
$I_i \geq I_o$
$P_i \geq P_o$
$L_i + L_c \leq L_o$
$C_i + C_c \leq C_o$

L_c and C_c depend on the cables used.

Condition $L_i \leq 1\%$ of L_o or $C_i \leq 1\%$ of C_o

10 Digital nameplate

The digital nameplate provides the option of obtaining product-specific data related to a specific serial number.

If you scan the QR code (digital nameplate) on the device, you can, for example, retrieve documents on the production status as well as clearly identify the hardware and firmware status of the device at hand.