

IOA MCR-EX-TC-I

Temperature measuring transducer

Data sheet
109046_en_02

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1 Description

The programmable temperature measuring transducer is designed for intrinsically safe operation of thermocouple sensors in accordance with IEC 60584/EN 60584-1, DIN 43710 and mV sources 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.

One plug for the cold junction compensation is included with the device (IOA MCR-CJC-PT100, Item No.: 1085776).

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 thermocouples and mV sources, intrinsically safe [Ex ia] IIC
- 4 mA ... 20 mA or 20 mA ... 4 mA output signal range
- 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/1085766

Make sure you always use the latest documentation.

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3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
Ex i temperature transducer for VIP I/O marshalling base elements: converts signals from thermocouples 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-TC-I	1085766	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
Plug for cold junction compensation for thermocouples, in combination with MACX MCR(-EX)-TC... temperature transducers	IOA MCR-CJC-PT100	1085776	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

Accessories	Type	Item no.	Pcs./Pkt.
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
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

Accessories	Type	Item no.	Pcs./Pkt.
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 (1085766) 00 / 1.100

The technical data and safety characteristics are valid as of the specified HW/FW version.

Input data Thermocouples

Description of the input	intrinsically safe
Sensor types that can be used (TC)	B, E, J, K, N, R, S, T, L, U, C, D, A, A-1, A-2, A-3, M, Lr
Temperature measuring range	-230 °C ... 2500 °C (Range depending on the sensor type)
Voltage	-1000 mV ... 1000 mV
Temperature measuring range	Min. 50 K with thermocouple, 10% of the nominal span of the respective range with mV sources

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	$\leq 600 \Omega$
Output ripple	$< 20 \text{ mV}_{\text{PP}}$
Output ripple (current)	$< 15 \mu\text{A}_{\text{PP}}$ $< 10 \mu\text{A}_{\text{rms}}$
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 type J, 400 K span, 4 mA ... 20 mA)
Maximum temperature coefficient	0.01 %/K
Typical cold point errors	± 2 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-TC-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	II (≤ 5000 m)
Pollution degree	2 (≤ 5000 m)
Input/output/power supply	
Standards/regulations	IEC/EN 61010-1
Rated insulation voltage	200 V _{rms}
Test voltage	2.3 kV AC (50 Hz, 60 s)
Insulation	Double/reinforced insulation
Input/output, power supply	
Standards/regulations	IEC/EN 60079-11
Rated insulation voltage	150 V _{rms} 212 V _p
Input/output/power supply	
Standards/regulations	IEC/EN 60079-7
Rated insulation voltage	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	4.3 mA (mV)
Max. output current I_o	7.1 mA (TC with internal cold junction compensation)
Max. output current I_o	16.8 mA (TC with external cold junction compensation)
Max. output current I_o	7.1 mA (TC without cold junction)
Max. output power P_o	6.5 mW (mV)
Max. output power P_o	11 mW (TC with internal cold junction compensation)
Max. output power P_o	25.2 mW (TC with external cold junction compensation)
Max. output power P_o	11 mW (TC without cold junction)
Max. external inductivity L_o / Max. external capacitance C_o simple circuit	IIA : 850 mH / 1000 μ F
Max. external inductivity L_o / Max. external capacitance C_o simple circuit	IIB/IIIC : 460 mH / 1000 μ F
Max. external inductivity L_o / Max. external capacitance C_o simple circuit	IIC : 100 mH / 40 μ F
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 μ H / 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	> 2000 m ... 3000 m
Ambient temperature (operation)	-40 °C ... 60 °C
Safety-related maximum voltage U_m	121 V AC/DC
Rated insulation voltage	150 V_{rms} (Input/output, power supply) 212 V_p (Input/output, power supply)
Height range	> 3000 m ... 4000 m
Ambient temperature (operation)	-40 °C ... 55 °C
Safety-related maximum voltage U_m	60 V AC/DC
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
Safety-related maximum voltage U_m	33 V AC/DC
Rated insulation voltage	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

Ⓢ I (M1) [Ex ia Ma] I
Ⓢ II (1) G [Ex ia Ga] IIC
Ⓢ II (1) D [Ex ia Da] IIIC
Ⓢ 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 ($I \leq 3 \text{ A}$) 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 $300 \text{ V}_{\text{eff}}$. 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 ($>30 \text{ V AC}$ / $>60 \text{ V DC}$) 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



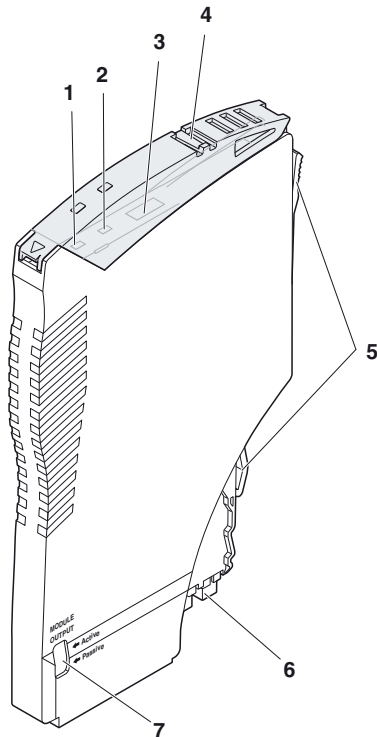
NOTE: Electrostatic discharge

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.

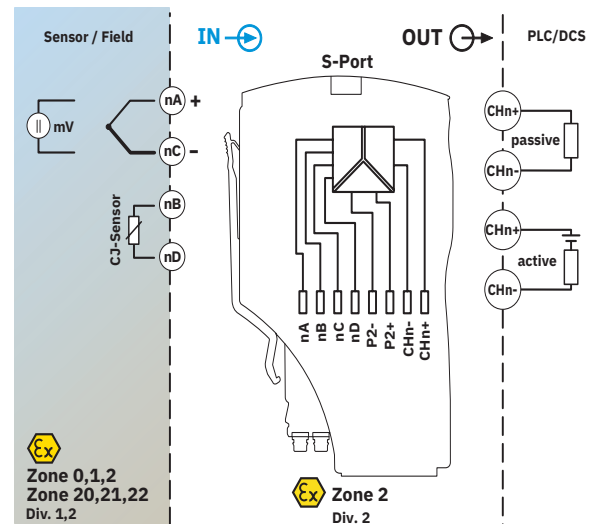
6.3 Structure

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

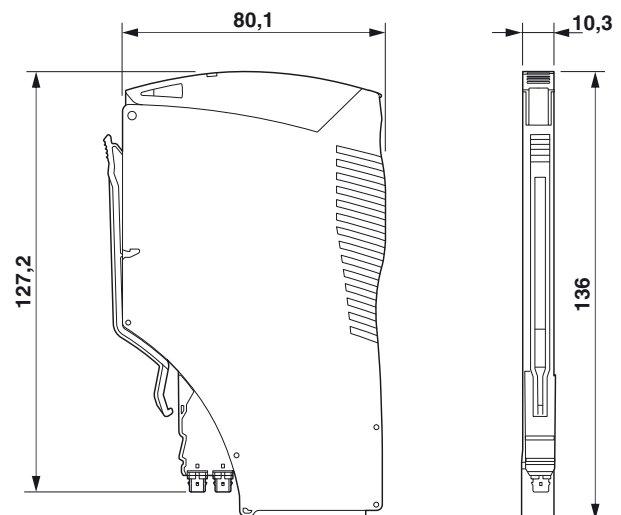


6.5 Output

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

Figure 2 Dimensions



6.7 Power supply

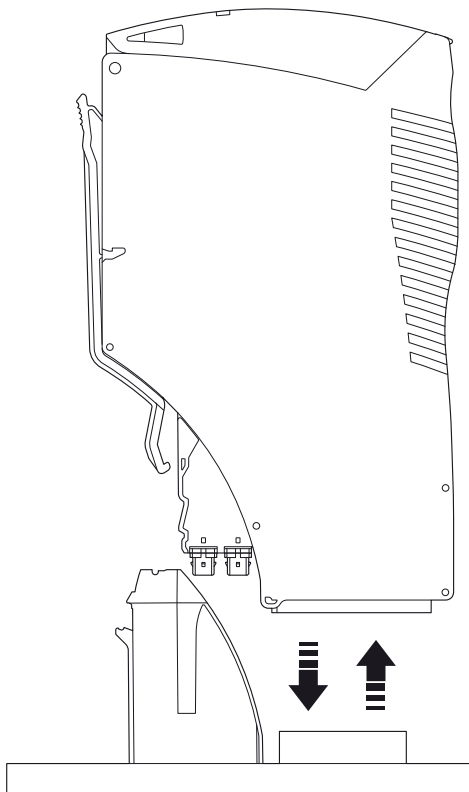
The device is supplied with power via the base element. Observe the information on the packing slip of the selected base element, as well as the information in the VIP I/O-marshalling user manual.

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 3 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 Temperature measurement with thermocouple sensors

For temperature measurements via thermocouple sensors, you must connect the terminal points nA (“+” input) and nC (“-” input), taking the polarity of the sensor into consideration.

For a compensated measurement, connect the plug for the cold junction compensation (IOA MCR-CJC-PT100, Item No.: 1085776) to the nB and nD terminal points on the base element.

6.11.2 Measurement of mV voltages

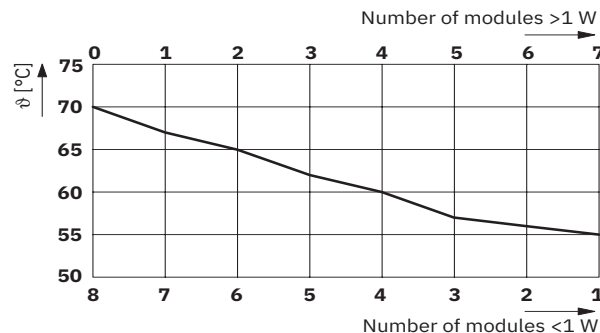
Terminal points nA (“+” input) and nC (“-” input) can be used for measuring voltages in the range of -1000 mV ... +1000 mV.

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 4 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



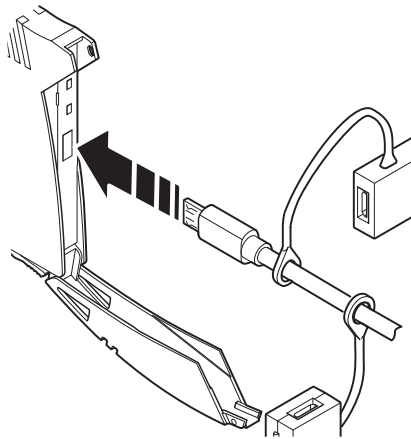
WARNING - Explosion Hazard

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 5 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	
	Measuring mode
	Sensor type
	Cold junction compensation
	Temperature range
	Input signal average value filter
	Correction for cold junction
Output	
	Output range
	Signal inversion
	Fault signaling
Service	
	Reset
	Simulation mode

8 Function description

8.1 Notes on using thermocouples

Thermocouples consist of two conductors made from different metals with different thermoelectric properties which are connected together on one side and are exposed to a temperature gradient and, therefore, convert heat flow to electrical voltage. Electrical voltage is measured at both thermocouple connections.

Thermocouples are often referred to with the abbreviation TC.

8.1.1 Cold junction compensation

In a thermocouple, however, voltage will not only be generated at the contact point of the connected conductors, but also at both connection points of the measuring transducer, as each of these points together with the connected thermocouple cable will form another thermocouple.

In order to be able to calculate the absolute measurement point temperature value from this voltage difference, and thus also the temperature difference, the temperature of the connection points must be the same and known.

To this end, the connection points are artificially maintained at a known temperature: for laboratory measurements, for example, at 0°C using ice water, in industrial applications with thermostatically controlled heating and cooling.

When considering the connection point temperature, this is referred to as cold junction compensation.

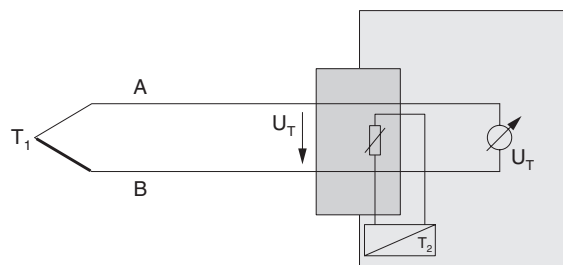
Cold junction compensation can also be implemented with a separate temperature measurement at the connection points.



Thermocouples are suitable for high temperatures or large temperature ranges.

Resistance thermometers are more suitable for temperatures up to a maximum of 800°C.

Figure 6 Thermocouple and interface module at the sensor including cold junction compensation



T_1 Temperature at the measurement point

T_2 Temperature at the connection point

U_T Voltage generated between the measurement point and the connection point. Indicates the absolute temperature T_1 at the measurement point by considering the connection point temperature T_2 .

8.2 Current output

The current output can be freely configured within the limits of 0 mA ... 20 mA.

The minimum span is 4 mA.

Contacts CHn (+) and CHn (-)

8.3 Measuring mV voltages

Terminal points nA ("+" input) and nC ("- input) can be used for measuring voltages in the range of -1000 mV ... +1000 mV.

8.4 Monitoring function

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

- Wire break
- Cold junction error
- Measuring value overrange
- Measuring value underrange
- Invalid input high
- Invalid input low

Input monitoring function

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

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

With TC sensors, a line break is detected when the current flow through the sensor is faulty.

The cold junction error occurs when a wire break or a short circuit is detected for the cold junction sensor or the measured value is outside the definition range (-60°C ... +150°C).

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 and maximum load.

This is activated via the configuration.

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

8.5 Measuring accuracy and minimum spans

8.5.1 Input for thermocouples

Minimum measuring span with TC: 50 K

Measuring accuracy of the input with TC signals:

TC type E, J, K, N, T, U, M, L (Gost)

Without cold junction error: 0.30 K

TC type B, R, S, C, D, A1, A2, A3, L

Without cold junction error: 0.50 K

8.5.2 Cold junction error

For cold junction compensation with cold junction plug IOA MCR-CJC-PT100 (Item No. 1085776)

Cold junction error: max. ± 2 K after transient period

The maximum cold junction transient period after an ambient temperature change >10 K is 10 minutes.

For external compensation

Depending on the quality of the cold junction and sensor used

8.5.3 Input for voltage signals

Minimum measuring span: 10% of the nominal span of the relevant range

Measuring accuracy:

-1000 mV ... +1000 mV	: 0.01 %	(of the measuring range)
-500 mV ... +500 mV	: 0.01 %	(of the measuring range)
-250 mV ... +250 mV	: 0.01 %	(of the measuring range)
-150 mV ... 150 mV	: 0.01 %	(of the measuring range)
-60 mV ... +60 mV	: 0.01 %	(of the measuring range)
-30 mV ... +30 mV	: 0.01 %	(of the measuring range)
-15 mV ... +15 mV	: 0.01 %	(of the measuring range)

8.6 Temperature measurement with thermocouple sensors

For temperature measurements via thermocouple sensors, you must connect the terminal points nA (“+” input) and nC (“-” input), taking the polarity of the sensor into consideration.

Sensor type			According to	Measuring range	Smallest measuring range span
B	≐	Pt 30 Rh-Pt 6 Rh	IEC/EN 60548	+500 °C ... +1820 °C	50 K
E	≐	NiCr-CuNi	IEC/EN 60548	-230 °C ... +1000 °C	50 K
J	≐	Fe-CuNi	IEC/EN 60548	-210 °C ... +1200 °C	50 K
K	≐	NiCr-Ni	IEC/EN 60548	-250 °C ... +1300 °C	50 K
N	≐	NiCrSi-NiSi	IEC/EN 60548	-200 °C ... +1300 °C	50 K
R	≐	Pt 13 Rh-Pt	IEC/EN 60548	-50 °C ... +1768 °C	50 K
S	≐	Pt 10 Rh-Pt	IEC/EN 60548	-50 °C ... +1768 °C	50 K
T	≐	Cu-CuNi	IEC/EN 60548	-200 °C ... +400 °C	50 K
L	≐	Fe-CuNi	DIN 43760	-200 °C ... +900 °C	50 K
U	≐	Cu-CuNi	DIN 43760	-200 °C ... +600 °C	50 K
CA	≐	C	ASTM JE988 (2002)	0 °C... +2315 °C	50 K
DA	≐	D	ASTM JE988 (2002)	0 °C... +2315 °C	50 K
A1G	≐	A-1	GOST 8.585-2001	0 °C ... +2500 °C	50 K
A2G	≐	A-2	GOST 8.585-2001	0 °C ... +1800 °C	50 K
A3G	≐	A-3	GOST 8.585-2001	0 °C ... +1800 °C	50 K
MG	≐	M	GOST 8.585-2001	-200 °C ... +100 °C	50 K
LG	≐	L	GOST 8.585-2001	-200 °C ... +800 °C	50 K

Cold junction compensation when using the IOA MCR-TC-I

The device does not have an internal sensor for cold junction compensation because the sensor would have to be connected as close as possible to the terminal points of the thermocouple or thermowire.

As a rule, these are in the field connection terminal block of the base element.

For a compensated measurement, connect the plug for the cold junction compensation (IOA MCR-CJC-PT100, Item No.: 1085776) to the nB and nD terminal points on the base element.

When measuring mV voltages, cold junction compensation is automatically switched off.

You can set cold junction compensation to a fixed value via software.

The device supports Pt 100 ... Pt 1000 with 2-conductor connection technology for external cold junction compensation.

Cable comparison of the external cold junction sensor is possible in 1 mΩ increments.

You can correct the cold junction temperature via software.

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.