MACX MCR-SL-(2)I-(2)I-ILP(-SP)



Input isolator

Data sheet
106893_en_05

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1 Description

The single- or dual-channel input loop powered 2-way isolator with increased isolation voltage and plug-in connection technology is used for the electrical isolation and filtering of analog signals.

The device allows operation on active sensor technology with a supply voltage of 6 V ... 30 V DC.

The device is powered via the current loop of the sensor. Therefore, no additional power supply is necessary.

Input signal = output signal: 0(4) mA ... 20 mA

The measurement signal is transferred 1:1.

Features

- 2-conductor passive isolators for electrical isolation and filtering of standard analog signals
- Supplied by an input loop
- 2.9 V voltage drop
- SIL 3 in accordance with IEC/EN 61508
- 2-way electrical isolation
- Plug-in connection terminal blocks, either screw or spring-cage connection technology (Push-in Technology)
- Installation in Ex zone 2 permitted
- Housing width of 12.5 mm

Make sure you always use the latest documentation.
It can be downloaded from the product at phoenixcontact.com/products.

This document is valid for the products listed in the “Ordering data” chapter.

You can use the Signal Conditioner app to call-up comprehensive module information via the integrated QR code reader.

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3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
1-channel input loop-powered 2-way isolator with plug-in connection technology for the electrical isolation of analog signals. Input signal = output signal: 0(4) mA ... 20 mA. Screw connection technology.	MACX MCR-SL-I-I-ILP	2905278	1
1-channel input loop-powered 2-way isolator with plug-in connection technology for the electrical isolation of analog signals. Input signal = output signal: 0(4) mA ... 20 mA. Push-in connection technology.	MACX MCR-SL-I-I-ILP-SP	2905279	1
2-channel input loop-powered 2-way isolator with plug-in connection technology for the electrical isolation of analog signals. Input signal = output signal: 0(4) mA ... 20 mA. Screw connection technology.	MACX MCR-SL-2I-2I-ILP	2905280	1
2-channel input loop-powered 2-way isolator with plug-in connection technology for the electrical isolation of analog signals. Input signal = output signal: 0(4) mA ... 20 mA. Push-in connection technology.	MACX MCR-SL-2I-2I-ILP-SP	2905281	1

Accessories	Type	Item no.	Pcs./Pkt.
The partition plate is used to maintain Ex i isolating distances when Ex i and non-Ex i devices are mounted side by side on a DIN rail.	MCR-DP	1430594	1
Cover for screw shafts of the MSTB connector ranges with a pitch of 5.0 mm and 5.08 mm. These can be aligned and shortened for use with different numbers of positions.	EA-MSTB 2,5/ 5	1831016	50
Plastic label, Sheet, white, unlabeled, can be labeled with: BLUEMARK E.CARD, BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, PLOTMARK, CMS-P1-PLOTTER, mounting type: adhesive, Number of individual labels: 10, text field height: 9 mm, text field width: 11 mm	UC-EMLP (11X9)	0819291	10
Plastic label, Sheet, yellow, unlabeled, can be labeled with: BLUEMARK E.CARD, BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, PLOTMARK, CMS-P1-PLOTTER, mounting type: adhesive, Number of individual labels: 10, text field height: 9 mm, text field width: 11 mm	UC-EMLP (11X9) YE	0822602	10
Plastic label, can be ordered: by sheet, white, labeled according to customer specifications, mounting type: adhesive, text field height: 9 mm, text field width: 11 mm	UC-EMLP (11X9) CUS	0824547	1
Plastic label, can be ordered: by sheet, yellow, labeled according to customer specifications, mounting type: adhesive, text field height: 9 mm, text field width: 11 mm	UC-EMLP (11X9) YE CUS	0824548	1
Plastic label, Sheet, silver, unlabeled, can be labeled with: BLUEMARK E.CARD, BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, PLOTMARK, CMS-P1-PLOTTER, mounting type: adhesive, Number of individual labels: 10, text field height: 9 mm, text field width: 11 mm	UC-EMLP (11X9) SR	0828094	10

Accessories	Type	Item no.	Pcs./Pkt.
Plastic label, can be ordered: by sheet, silver, labeled according to customer specifications, mounting type: adhesive, Number of individual labels: 10, text field height: 9 mm, text field width: 11 mm	UC-EMLP (11X9) SR CUS	0828098	1
Plastic label, Card, white, unlabeled, can be labeled with: BLUEMARK ID COLOR, BLUEMARK ID, THERMOMARK PRIME, THERMOMARK CARD 2.0, THERMOMARK CARD, THERMOMARK PRIME 2.0, mounting type: adhesive, Number of individual labels: 135, text field height: 9 mm, text field width: 11 mm	US-EMLP (11X9)	0828789	10
Plastic label, Card, yellow, unlabeled, can be labeled with: BLUEMARK ID COLOR, BLUEMARK ID, THERMOMARK PRIME, THERMOMARK CARD 2.0, THERMOMARK CARD, THERMOMARK PRIME 2.0, mounting type: adhesive, Number of individual labels: 135, text field height: 9 mm, text field width: 11 mm	US-EMLP (11X9) YE	0828871	10
Plastic label, Card, silver, unlabeled, can be labeled with: BLUEMARK ID COLOR, BLUEMARK ID, THERMOMARK PRIME, THERMOMARK CARD 2.0, THERMOMARK CARD, THERMOMARK PRIME 2.0, mounting type: adhesive, Number of individual labels: 135, text field height: 9 mm, text field width: 11 mm	US-EMLP (11X9) SR	0828872	10
Device marker, Sheet, white, unlabeled, can be labeled with: TOPMARK NEO, TOPMARK LASER, mounting type: adhesive, Number of individual labels: 255, text field height: 9 mm, text field width: 11 mm	LS-EMLP (11X9) WH	0831678	10
Device marker, Sheet, silver, unlabeled, can be labeled with: TOPMARK NEO, TOPMARK LASER, mounting type: adhesive, Number of individual labels: 255, text field height: 9 mm, text field width: 11 mm	LS-EMLP (11X9) SR	0831705	10
Device marker, Sheet, yellow, unlabeled, can be labeled with: TOPMARK NEO, TOPMARK LASER, mounting type: adhesive, Number of individual labels: 255, text field height: 9 mm, text field width: 11 mm	LS-EMLP (11X9) YE	0831732	10
Actuation tool, for ST terminal blocks, insulated, also suitable for use as a bladed screwdriver, size: 0.6 x 3.5 x 100 mm, 2-component grip, with non-slip grip	SZS 0,6X3,5	1205053	10

4 Technical data

Hardware/firmware version	
Hardware/firmware version (2905278)	06 / -
Hardware/firmware version (2905279)	06 / -
Hardware/firmware version (2905280)	06 / -
Hardware/firmware version (2905281)	06 / -

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

Input data Current input	
Configurable/programmable	no
Max. voltage input signal	< 30.5 V
Current input signal	0 mA ... 20 mA 4 mA ... 20 mA
Input voltage limitation	30.5 V
Voltage dissipation	2.9 V (I = 20 mA)
Step response (10-90%)	5 ms (500 Ω load)
Additional error, load-dependent	0.022 % (of measured value / 100 Ω load)

Output data Current output	
Configurable/programmable	no
Output signal maximum voltage	27.5 V
Current output signal	0 mA ... 20 mA 4 mA ... 20 mA
Load/output load current output	≤ 1375 Ω (I = 20 mA)
Residual ripple	< 10 mV_{rms} (500 Ω load)

General data	
Supply voltage range	loop-powered, no external supply necessary
Transmission error, typical	0.08 % (of final value)
Signal transmission behavior	In = Out
Maximum temperature coefficient	≤ 0.002 %/K (of measured value / 100 Ω load)
Degree of protection	IP20 (not assessed by UL)
Flammability rating according to UL 94	V0 (Housing)
Dimensions W/H/D	12.5 mm / 112.5 mm / 113.7 mm (MACX MCR-SL-I-I-ILP) 12.5 mm / 107.9 mm / 113.7 mm (MACX MCR-SL-I-I-ILP-SP)
Depth (Snapped onto DIN rail NS 35/7,5 in accordance with EN 60715)	114.5 mm
Type of housing	PA 6.6-FR

Ambient conditions	
Ambient temperature (operation)	-40 °C ... 85 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 % (non-condensing)
Altitude	≤ 2000 m

Electrical isolation (≤ 2000 m above mean sea level)	
Electrical isolation	2-way isolation
Test voltage Overvoltage category Pollution degree	5 kV AC (50 Hz, 60 s) II 2
Input/output/power supply Standards/regulations Rated insulation voltage Insulation	 IEC/EN 61010-1 600 V_{rms} Safe isolation

Connection data	Screw connection	Push-in connection
Conductor cross section, rigid	0.2 mm² … 2.5 mm²	0.2 mm² … 2.5 mm²
Conductor cross section, flexible	0.2 mm² … 2.5 mm²	0.2 mm² … 2.5 mm²
Conductor cross section flexible (2 conductors with same cross section)		0.25 mm² … 0.34 mm² (TWIN ferrule without plastic sleeve) 0.5 mm² … 1.5 mm² (TWIN ferrule with plastic sleeve)
Conductor cross section AWG	24 … 14	24 … 14 24 … 22 (TWIN ferrule without plastic sleeve) 20 … 16 (TWIN ferrule with plastic sleeve)
Stripping length	7 mm	10 mm
Tightening torque	0.5 Nm … 0.6 Nm	
Diameter Test socket in the connector	2.3 mm	

Conformance with EMC directive
EN 61326-1
Noise emission according to EN 61000-6-4

Conformance/approvals	
CE CE-compliant and EN 61326-1	
ATEX PxCIF15ATEX2905278X	Ⓔx II 3 G Ex nA IIC T4 Gc X
UL, USA/Canada	UL 61010 Listed Class I, Div. 2, Groups A, B, C, D T4 Class I, Zone 2, Group IIC T4
Safety Integrity Level (SIL, IEC 61508) 968/FSP 1200.01/21	3

5 Safety notes

5.1 Installation notes

- The EPL Gc (ATEX category 3) device is suitable for installation in zone 2 potentially explosive areas. It satisfies the requirements of the following standards:
  EN/IEC 60079-0, EN 60079-15
  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 must be stopped if it is damaged, has been subjected to an impermissible load, stored incorrectly, or if it malfunctions.
- The device is not designed for use in potentially dust-explosive atmospheres. If dust is present, installation must take place in a suitable and approved housing (at least IP54) that meets the requirements of EN 60079-31. The specified surface temperature of the housing must be observed.
- 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.

5.2 Installation in the Ex area (zone 2)

- Observe the specified conditions for use in potentially explosive areas! Install the device in a suitable, approved housing that meets the requirements of IEC/EN 60079-15 and has at least IP54 protection. Also observe the requirements of IEC/EN 60079-14.
- Only devices which are designed for operation in Ex zone 2 and are suitable for the conditions at the installation location may be connected to the circuits in the Ex zone.
- In potentially explosive areas, connecting and disconnecting cables and plugs in non-intrinsically safe circuits and the latching of devices onto and unlatching devices from the DIN rail connector is only permitted in a de-energized state or when the atmosphere is not potentially explosive.
- 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.

5.3 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.

5.4 Safety-related applications (SIL)

When using the device in safety-related applications, observe the instructions in “Safety-related applications”, as the requirements differ for safety-related functions.

5.5 UL note

PROCESS CONTROL EQUIPMENT FOR HAZARDOUS LOCATIONS 31ZN

1 Suitable for use in class 1, division 2, groups A, B, C and D hazardous locations, or nonhazardous locations only.

2 WARNING - EXPLOSION HAZARD: Do not disconnect equipment while the circuit is live or unless the area is known to be free of ignitable concentrations.

3 WARNING - EXPLOSION HAZARD: Substitution of any components may impair suitability for Class I, Division 2.

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 a switch/circuit breaker close to the device, which is labeled as the disconnecting device for this device.
- Provide overcurrent protection (I ≤ 16 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 installation, servicing, and maintenance work and during configuration, disconnect the device from all effective power sources, provided you are not dealing with SELV or PELV circuits.
- If the device is not used as described in the documentation, the intended protection can be negatively affected.
- Thanks to its housing, the device has basic insulation to the neighboring devices, for 300 V_{eff}. If several devices are installed next to each other, this has to be taken into account, and additional insulation has to be installed if necessary! If the neighboring device is equipped with basic insulation, no additional insulation is necessary.
- 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.

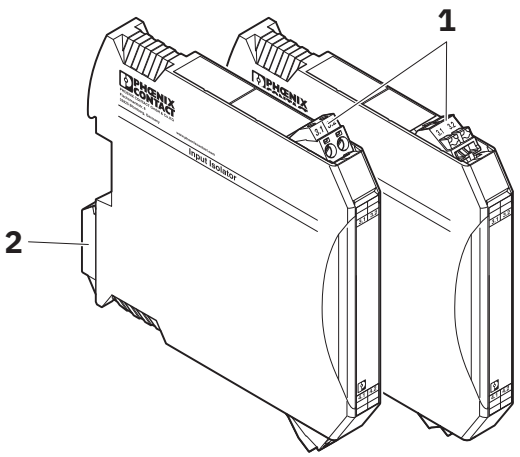
6.2 Electrostatic discharge

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.

6.3 Structure

Figure 1 Structure



1 COMBICON plug-in screw or push-in connection terminal

2 Snap-on foot for DIN rail mounting

6.4 Basic circuit diagram with connection terminal blocks

Figure 2 Single-channel

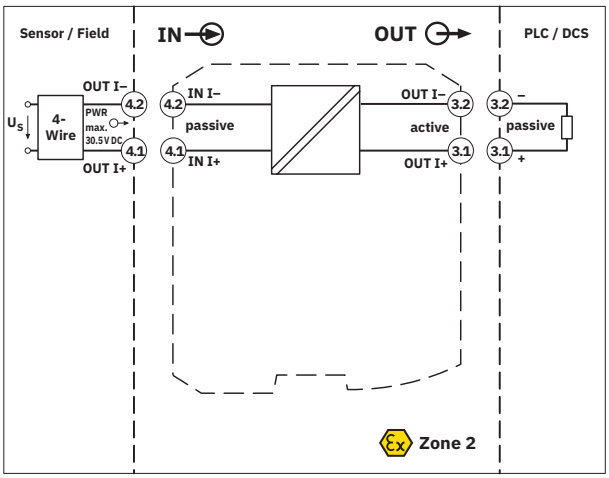
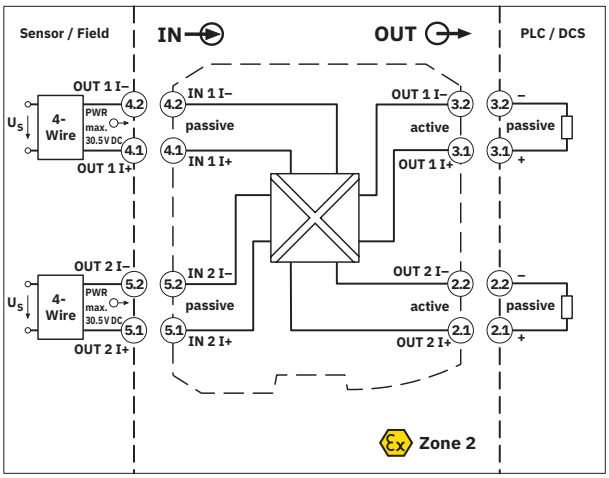


Figure 3 Two-channel



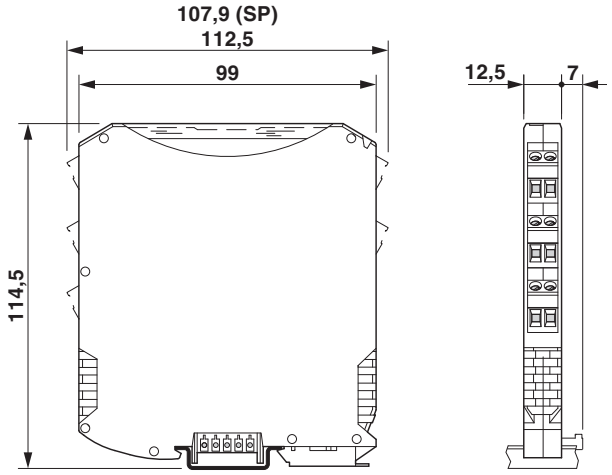
6.5 Power supply

An ME 6,2 TBUS-2 DIN rail connector (Item No. 2869728) is used to supply active devices. A DIN rail connector is not required to operate this passive device.

This device can be snapped onto a DIN rail connector - an electrically conductive connection is not established. This means that you do not need to disconnect an existing DIN rail connector element connection.

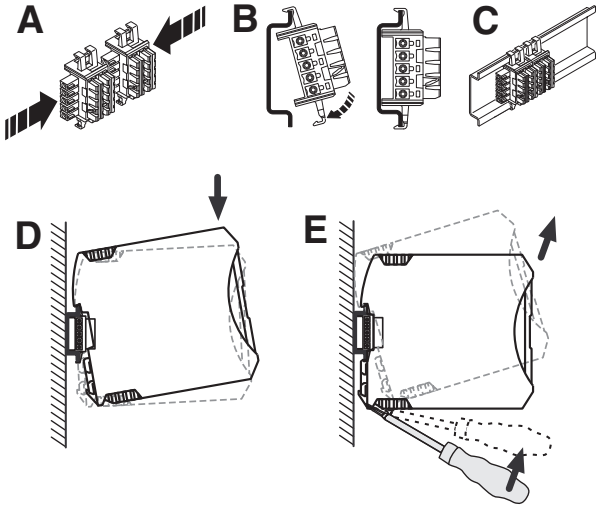
6.6 Dimensions

Figure 4 Dimensions



6.7 Mounting

Figure 5 Mounting and removing



The device can be snapped onto all 35 mm DIN rails in accordance with EN 60715.

6.8 Partition plate

If you want to mount Ex i and non-Ex i devices next to each other on a DIN rail, you will require the MCR-DP partition plate (item no. 1430594). The partition plate ensures that Ex i isolating distances are maintained.

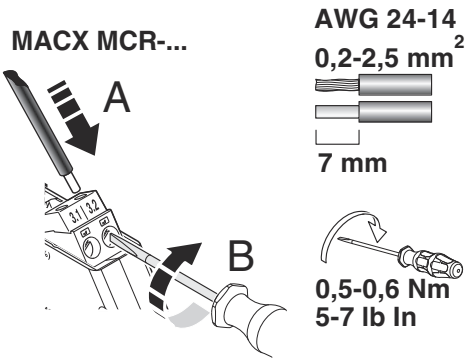
The partition plate is tailored to the MINI Analog, MINI Analog Pro, and MACX Analog device series and the QUINT4 system power supply (item no. 2904614).

The partition plate is compatible with the ME … TBUS DIN rail connectors (e.g., item no. 1090049, 2695439).

6.9 Connecting the cables

Screw connection:

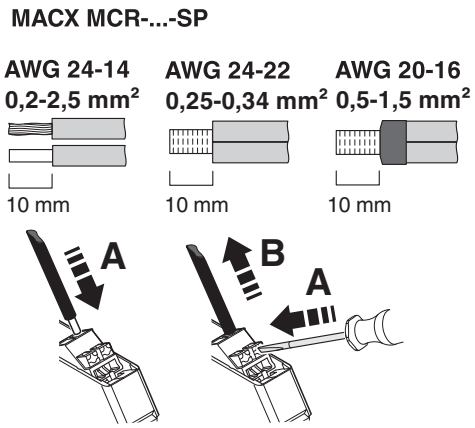
Figure 6 Screw connection



- Strip the wire by approximately 7 mm and crimp the ferrules.
- Insert the wire into the corresponding connection terminal block.
- Use a screwdriver to tighten the screw in the opening above the connection terminal block.
  Tightening torque: 0.6 Nm

Push-in connection (PSPT):

Figure 7 Push-in connection



If you want to use conductors with ferrule:

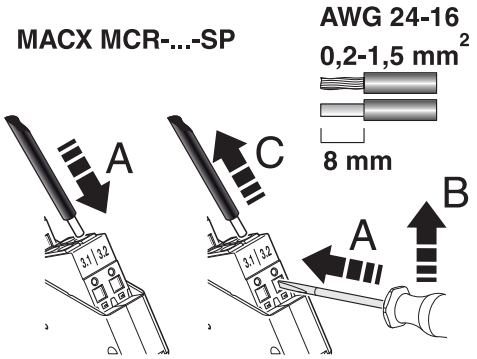
- Strip the wire by approximately 10 mm and crimp ferrules to the end of the wire.
- Insert the wire into the corresponding connection terminal block.
- Push in the pushbutton with a screwdriver to release.

If you want to use conductors without ferrule:

- Strip 10 mm off the wire.
- Push the pushbutton in with a screwdriver.
- Insert the wire into the corresponding connection terminal block.
- Push in the pushbutton with a screwdriver to release.

Push-in connection (TVFKC):

Figure 8 Push-in connection



If you want to use conductors with ferrule:

- Strip the wire by approximately 8 mm and crimp ferrules to the end of the wires.
- Insert the wire into the corresponding connection terminal block.
- Push in the pushbutton with a screwdriver to release.

If you want to use conductors without ferrule:

- Strip 8 mm off the wires.
- Push the pushbutton in with a screwdriver.
- Insert the wire into the corresponding connection terminal block.
- Push in the pushbutton with a screwdriver to release.

6.10 Startup

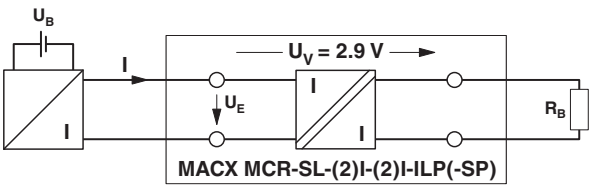
- Before startup, check that the device is operating and wired correctly.

7 Method of operation

The passive isolator draws the power required for isolation from the input signal.

When using passive isolators, make sure that the current sourcing voltage of the measuring transducer U_B is sufficient to drive the maximum current of 20 mA via the passive isolator with a voltage drop U_V = 2.9 V and load R_B. This means:

$U_B \geq U_E = 2.9\ V + 20\ mA \times R_B$



8 Safety-related applications

The following notes apply for the devices:

Designation	Item No.
MACX MCR-I-I-ILP	2905278
MACX MCR-I-I-ILP-SP	2905279
MACX MCR-2I-2I-ILP	2905280
MACX MCR-2I-2I-ILP-SP	2905281

The devices listed above are certified in compliance with DIN EN 61508-1:2010 and DIN EN 61508-2:2010. Test certificate: 968/FSP 1200.01/21

The devices are TÜV-certified.

8.1 Safety function

The defined safety function for the devices applies for the input signal range of 4 ... 20 mA.

The device transfers a measuring signal of 4 ... 20 mA - electrically isolated - into an output signal of 4 ... 20 mA with a tolerance of 2%. The input signals are transferred in a linear 1:1 ratio.

The fault signal is defined for the ranges between <3.6 mA and >21 mA.

The analog output signal has to be evaluated using a down-stream logic unit.

In the case of a two-channel, redundant application (1oo2), you must compare the values and establish a safe state when exceeding a certain tolerance.

8.2 Operating mode

Operating mode in accordance with EN 61508: "low requirement rate" or "high requirement rate" (six requirements per minute maximum)

8.3 Relevant standards

The device can be used in safety-related applications up to SIL 3 (systematic capability SC3). The standards relevant to the intended purpose, such as EN 61508, EN 61511, and EN IEC 62061 must be applied.

8.4 Safety integrity requirements

8.4.1 Error rates

- Type A device (according to IEC/EN 61508-2)
- Safety integrity level (SIL) 3
- Operating mode 4 ... 20 mA
- $MTTF_D$ 221 a
- MTTR 72 h
- Ambient temperature 40°C

8.4.2 Load ≤700 Ω

Failure rate in FIT

λ_{Total}	λ_S	λ_D	λ_{SD}	λ_{DU}	λ_{DD}	SFF	DC_D
103,2	101.7	1.5	0	1.5	0	98.6%	0 %

The MTBF is 1106 years.

PFH/PFD values

T [PROOF]	1 year	2 years	3 years
PFD_{1oo1}	$6{,}6 * 10^{-6}$	$1{,}3 * 10^{-5}$	$2 * 10^{-5}$
PFH_{1oo1}	$1{,}5 * 10^{-9}$	$1{,}5 * 10^{-9}$	$1{,}5 * 10^{-9}$
PFD_{1oo2}	$6{,}6 * 10^{-7}$	$1{,}3 * 10^{-6}$	$2 * 10^{-6}$
PFH_{1oo2}	$1{,}5 * 10^{-10}$	$1{,}5 * 10^{-10}$	$1{,}5 * 10^{-10}$

8.4.3 Load >700 Ω

Failure rate in FIT

λ_{Total}	λ_S	λ_D	λ_{SD}	λ_{DU}	λ_{DD}	SFF	DC_D
103,2	94.2	9	0	9	0	91.3%	0 %

The MTBF is 1106 years.

PFH/PFD values

T [PROOF]	1 year	2 years	3 years
PFD_{1oo1}	$4 * 10^{-5}$	$7.9 * 10^{-5}$	$1.2 * 10^{-4}$
PFH_{1oo1}	$9 * 10^{-9}$	$9 * 10^{-9}$	$9 * 10^{-9}$
PFD_{1oo2}	$4 * 10^{-7}$	$7.9 * 10^{-6}$	$1.2 * 10^{-6}$
PFH_{1oo2}	$9 * 10^{-10}$	$9 * 10^{-10}$	$9 * 10^{-10}$

8.5 Conditions

– The failure rates of the components used remain constant throughout the period of use.
– The propagation of errors by the device in the system is not taken into consideration.
– The repair time (replacement) should be eight hours.
– The failure rates of the external power supply are not taken into consideration.
– The average temperature at which the device is to be used is +40°C.
– The specified error rates are based on an ambient temperature of +40°C.

8.6 Installation and startup

NOTE:
Installation, operation, and maintenance may only be carried out by professionals.

During installation, observe the instructions in the package slip:

Designation	MNR No.
PACKB.MACX MCR-SL-(2)I-(2)I-ILP(-SP)	9071251

The package slip is supplied with the device. It can also be downloaded at: www.phoenixcontact.com/products.

Lockable housing with IP54 protection is recommended for the installation of the devices.

- Connect the device according to the installation notes.
- In SIL applications, the 20 mA signal lines may not have an electrical connection to the grid.
- The devices are not impact-free; in other words, an overburdening of the output will disrupt the input circuit.
- Make sure that the connected sensor and measuring transducer correspond to the intended configuration.
- Check that the device operates correctly with the measuring transducer and sensor connected.
- A calibrated sensor simulator and a calibrated digital multimeter may be required in order to check the device with the measuring transducer connected.
- Start up the safety circuit and check that it operates correctly.

8.7 Notes on operation

The output signal of the passive isolator in normal, uninterrupted mode is within the range of 3.6 ... 21 mA. If a malfunction or error occurs during operation, the connected safety-related controller establishes that a measured value is outside of normal operation and initiates appropriate measures. Because the passive isolator does not have a diagnostic function, it cannot be determined whether the error was caused by the passive isolator or by the devices connected upstream of the passive isolator. You therefore have to check the entire safety loop from the sensor to the output of the passive isolator.

After being switched off and on again, the required voltages are established in the device. Signal transmission is then performed without further action.

8.8 Recurring checks

The function of the entire safety loop must be checked regularly according to IEC/EN 61508 and IEC/EN 61511.

The intervals for checking are specified by the intervals of each individual device within the safety loop.

It is the operator's responsibility to select the type of checks and the checking intervals in the specified time period.

Checking must be carried out in such a way that the correct function of the safety equipment in conjunction with all components can be verified.

Possible procedure for recurring checks for discovering dangerous and undetected device failures

A calibrated simulator (0/4 mA ... 20 mA current) or a sensor simulator and one or ideally two calibrated digital multimeters are required in order to check the devices.

1. Take appropriate steps to prevent incorrect use.
2. Disconnect the safety circuit from further processing.
3. Connect the current simulator to the input of the repeater power supply/signal conditioner, or the sensor simulator to the input of the measuring transducer.
4. Connect the digital multimeters to the input and output of the repeater power supply/signal conditioner.
5. At the input of the device or at the input of the measuring transducer, set the setpoints for the start and end of the measuring range and a mean value (for example, 50%) with the sensor simulator. A check is necessary to ensure that the measurement deviation lies within the specified tolerances.
6. Measure the current in the repeater power supply/signal conditioner. The output must be set to the same value.
7. Setting ≤ 3.6 mA or > 21 mA verifies that the subsequent processing can detect signals that are out of range and evaluate them accordingly. If the output value deviates from the input value by more than 3 times the specified class accuracy rating, the device should be checked. In the event of an error, the device should be replaced with an equivalent device.
8. Restore the safety circuit to full functionality.
9. Resume normal operation.

8.9 Repair

The devices have a long service life, are protected against malfunctions, and are maintenance-free.

However, if a device should fail, send it back to Phoenix Contact immediately. The type of malfunction and possible cause must also be stated.

Please use the original packaging or other suitable safe packaging when sending devices back for repairs or recalibration.

Phoenix Contact GmbH & Co. KG
Abteilung Service und Reparatur
Flachsmarktstr. 8
32825 Blomberg
GERMANY

8.10 Standards

The devices are developed and tested according to the following standards:

IEC/EN 61508-1	Functional Safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements
IEC/EN 61508-2	Functional Safety of electrical/electronic/programmable electronic safety-related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems
IEC/EN 61326-1	Electrical equipment for measurement, control and laboratory use - EMC requirements
IEC/EN 61326-3-2	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 3-2: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (Functional Safety) - Industrial applications with specified electromagnetic environment
IEC/EN 61511	Functional safety - Safety instrumented systems for the process industry sector

8.11 Abbreviations

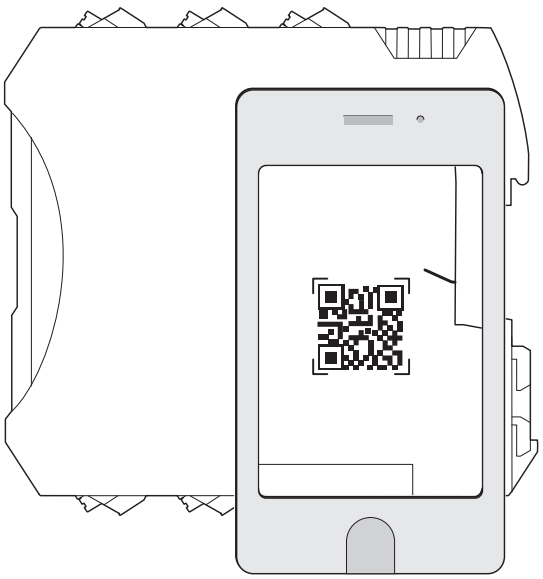
Abbreviation		Meaning
DC_D	Diagnostic coverage of dangerous failures	Diagnostic coverage of dangerous failures: $DC_D = \lambda_{DD}/(\lambda_{DU} + \lambda_{DD})$
DC_S	Diagnostic coverage of safe failures	Diagnostic coverage of safe failures: $DC_S = \lambda_{SD}/(\lambda_{SU} + \lambda_{SD})$
FIT	Failure in time	1 FIT = 1 failure/10^9 h
HFT	Hardware fault tolerance	Hardware fault tolerance: ability of a function unit to continue with the execution of a demanded function despite existing faults or deviations
λ_D	Rate of dangerous failures	Proportion of dangerous failures per hour
λ_{DD}	Rate of dangerous detected failures	Proportion of detected dangerous failures per hour
λ_{DU}	Rate of dangerous undetected failures	Proportion of undetected dangerous failures per hour
λ_S	Rate of safe failures	Proportion of safe failures per hour
λ_{SD}	Rate of safe detectable failures	Proportion of detectable safe failures per hour
λ_{SU}	Rate of safe undetectable failures	Proportion of undetectable safe failures per hour
MTBF	Mean time between failures	Mean time between consecutive failures
PFD_{avg}	Average probability of failure on demand	Average probability of dangerous failure on demand of a safety function
PFH_D	Probability of a dangerous failure per hour	Probability of failure per hour for the safety function
PL	Performance level	The performance level indicates the capability of safety-related parts of a control system to carry out a safety function in foreseeable conditions (PL: a, b, c, d, e)
SFF	Safe failure fraction	Proportion of safe failures: proportion of failures without the potential to set the safety-related system to a dangerous or impermissible function state
SIL	Safety integrity level	International standard IEC 61508 defines four discrete safety integrity levels (SIL 1 to 4). Each level corresponds to a probability range for the failure of a safety function. The higher the safety integrity level of safety-related systems, the lower the probability that the demanded safety functions will not be performed.

9 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.

Figure 9 Scan QR code



10 Revision history

Document revision	Hardware revision	Firmware revision	Date	Description
05	06 (2905278)	-	2025-04-15	Absorption of increased test voltage
	06 (2905279)			
	06 (2905280)			
	06 (2905281)			
04	05 (2905278)	-	2024-11-04	Figure 2 adjusted due to new printing
	05 (2905279)			Figure 3 adjusted due to new printing
	05 (2905280)			Description of new Push-in connection technology (PSPT) added
	05 (2905281)			Description of digital nameplate added
				UKCA approval removed