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# MINI MCR-SL-SHUNT-UI

## Configurable 3-way isolating amplifier



Data sheet  
103511\_en\_05

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## 1 Description

The 6.2 mm slim configurable 3-way isolation amplifier **MINI MCR-SL-SHUNT-UI(-SP)(-NC)** converts mV voltages to standard signals. The signals are amplified, filtered, and electrically isolated.

The 3-way isolation amplifier makes it possible, for example, to measure DC currents flowing through a shunt resistor.

The voltage drop of a few mV via the resistor is applied at the isolation amplifier and is converted to a standard signal by the isolation amplifier.

The DIP switches, which can be accessed on the side of the housing, are used to configure the input and output signal ranges.

Power (19.2 V DC to 30 V DC) can be supplied through connection terminal blocks on the modules or in conjunction with the DIN rail connector.

### Features

- Configurable 3-way isolating amplifier
- Input and output signal range configurable via DIP switches
- Approval for Ex-zone 2 (nA)
- Can be supplied with screw or spring-cage connection
- Can be supplied configured or unconfigured



### **WARNING: Correct usage in potentially explosive areas**

The module is a category 3 item of electrical equipment. It is absolutely vital to follow the instructions provided here during installation and observe the information in the "Safety regulations and installation notes".



Make sure you always use the latest documentation.

It can be downloaded from the product at [www.phoenixcontact.net/catalog](http://www.phoenixcontact.net/catalog).



This data sheet is valid for all products listed on the following page:

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### 3 Ordering data

Description	Type	Order No.	Pcs. / Pkt.
MCR 3-way isolating amplifier, with configurable input/output, for electrical isolation and conversion of analog signals in the mV range, single-pos. as well as 2-pos. with screw connection, pre-configured	MINI MCR-SL-SHUNT-UI	2810858	1
MCR 3-way isolating amplifier, with configurable input/output, for electrical isolation and conversion of analog signals in the mV range, single-pos. as well as 2-pos. with spring-cage connection, pre-configured	MINI MCR-SL-SHUNT-UI-SP	2810874	1
MCR 3-way isolating amplifier, with configurable input/output, for electrical isolation and conversion of analog signals in the mV range, single-pos. as well as 2-pos. with screw connection, pre-configured	MINI MCR-SL-SHUNT-UI-NC	2810780	1
MCR 3-way isolating amplifier, with configurable input/output, for electrical isolation and conversion of analog signals in the mV range, single-pos. as well as 2-pos. with spring-cage connection, pre-configured	MINI MCR-SL-SHUNT-UI-SP-NC	2810793	1
Accessories	Type	Order No.	Pcs. / Pkt.
DIN rail connector (TBUS), 5-pos., for bridging the supply voltage, can be snapped onto NS 35/... DIN rails according to EN 60715	ME 6,2 TBUS-2 1,5/5-ST-3,81 GN	2869728	10
MCR power terminal block for supplying several MINI Analog modules via the DIN rail connectors, with screw connection, current consumption up to max. 2 A	MINI MCR-SL-PTB	2864134	1
MCR power terminal block for supplying several MINI-ANALOG modules via the DIN rail connectors, with spring-cage connection, current consumption up to max. 2 A	MINI MCR-SL-PTB-SP	2864147	1
DIN rail power supply unit, primary-switched mode, slim design, output: 24 V DC / 1.5 A	MINI-SYS-PS-100-240AC/24DC/1.5	2866983	1
DIN rail power supply unit, primary-switched mode, slim design, output: 24 V DC / 1.5 A, ATEX approval	MINI-PS-100-240AC/24DC/1.5/EX	2866653	1
Eight MINI analog signal converters with screw connection method can be connected to a control system using a system adapter and system cabling with a minimum of wiring and very low error risk.	MINI MCR-SL-V8-FLK 16-A	2811268	1
Fold up transparent cover for MINI MCR modules with additional labeling option using insert strips and flat Zack marker strip 6.2 mm	MINI MCR DKL	2308111	10
Label for extended marking of MINI MCR modules in connection with the MINI MCR-DKL	MINI MCR-DKL-LABEL	2810272	10
MINI analog multiplexer, generates one analog output from 8 analog input signals, for MINI analog module with screw connection.	MINI MCR-SL-MUX-V8-FLK 16	2811815	1

### 3.1 Order key

#### Standard configuration example

Order No.	Input		Output	Cut-off frequency	Factory calibration certificate FCC
<b>2810858</b>	<b>IN40</b>		<b>OUT01</b>	<b>100</b>	<b>NONE</b>
2810858 ≙ ...-SHUNT-UI	IN40 ≙ 0...50 mV IN24 ≙ 0...60 mV IN41 ≙ 0...75 mV IN42 ≙ 0...80 mV IN25 ≙ 0...100 mV IN43 ≙ 0...120 mV IN44 ≙ 0...150 mV IN26 ≙ 0...200 mV IN45 ≙ 0...240 mV IN27 ≙ 0...300 mV IN28 ≙ 0...500 mV IN46 ≙ 0...600 mV IN47 ≙ 0...750 mV IN48 ≙ 0...800 mV IN29 ≙ 0...1,0 V IN49 ≙ 0...1,2 V IN50 ≙ 0...1,5 V IN30 ≙ 0...2,0 V IN51 ≙ 0...2,4 V IN52 ≙ 0...3,0 V	IN53 ≙ -50...+50 mV IN13 ≙ -60...+60 mV IN54 ≙ -75...+75 mV IN55 ≙ -80...+80 mV IN14 ≙ -100...+100 mV IN56 ≙ -120...+120 mV IN57 ≙ -150...+150 mV IN15 ≙ -200...+200 mV IN58 ≙ -240...+240 mV IN16 ≙ -300...+300 mV IN17 ≙ -500...+500 mV IN59 ≙ -600...+600 mV IN60 ≙ -750...+750 mV IN61 ≙ -800...+800 mV IN18 ≙ -1,0...+1,0 V IN62 ≙ -1,2...+1,2 V IN63 ≙ -1,5...+1,5 V IN19 ≙ -2,0...+2,0 V IN64 ≙ -2,4...+2,4 V IN65 ≙ -3,0...+3,0 V	OUT01 ≙ 0...20 mA OUT02 ≙ 4...20 mA OUT03 ≙ 0...10 V OUT04 ≙ 2...10 V OUT05 ≙ 0...5 V OUT06 ≙ 1...5 V  OUT13 ≙ -5...+5 V OUT14 ≙ -10...+10 V	30 ≙ 30 Hz 100 ≙ 100 Hz	NONE ≙ Without FCC YES ≙ With FCC (fee is charged)  YESPLUS ≙ FCC with 5 measuring points (fee is charged)

**Note:**

A bipolar output (-5...+5 V, -10...+10 V) can only be used with a bipolar input signal.

## 4 Technical data

Input	
Configurable/programmable	Yes, preconfigured
Voltage input signal	-50 mV ... 50 mV -60 mV ... 60 mV -75 mV ... 75 mV -80 mV ... 80 mV -100 mV ... 100 mV -120 mV ... 120 mV -150 mV ... 150 mV -200 mV ... 200 mV -240 mV ... 240 mV -300 mV ... 300 mV -500 mV ... 500 mV -600 mV ... 600 mV -750 mV ... 750 mV -800 mV ... 800 mV -1 V ... 1 V -1.2 V ... 1.2 V -1.5 V ... 1.5 V -2 V ... 2 V -2.4 V ... 2.4 V -3 V ... 3 V 0 mV ... 50 mV (additional areas can be configured, see table) 0 mV ... 60 mV 0 mV ... 75 mV 0 mV ... 80 mV 0 mV ... 100 mV 0 mV ... 120 mV 0 mV ... 150 mV 0 mV ... 200 mV 0 mV ... 240 mV 0 mV ... 300 mV 0 mV ... 500 mV 0 mV ... 600 mV 0 mV ... 750 mV 0 mV ... 800 mV 0 V ... 1 V 0 V ... 1.2 V 0 V ... 1.5 V 0 V ... 2 V 0 V ... 2.4 V 0 V ... 3 V
Max. voltage input signal	Approx. 30 V DC
Input resistance of voltage input	Approx. 10 k $\Omega$
Output	
Voltage output signal	0 V ... 10 V 2 V ... 10 V 0 V ... 5 V 1 V ... 5 V -10 V ... 10 V (The bi-polar output can be used only for bi-polar input signals.) -5 V ... 5 V (The bi-polar output can be used only for bi-polar input signals.)
Max. voltage output signal	12.5 V
Current output signal	0 mA ... 20 mA 4 mA ... 20 mA
Max. current output signal	28 mA
Configurable/programmable	Yes, preconfigured
Load/output load voltage output	$\geq 10$ k $\Omega$
Ripple	< 20 mV <sub>pp</sub> (at 500 $\Omega$ )
Load/output load current output	< 500 $\Omega$ (at 20 mA)

**Supply**

Nominal supply voltage	24 V DC
Supply voltage range	19.2 V DC ... 30 V DC (to bridge the supply voltage, the DIN rail connector (ME 6,2 TBUS-2 1,5/5-ST-3,81 GN, Order No. 2869728) can be used. It can be snapped onto a 35 mm DIN rail according to EN 60715)
Power consumption	< 450 mW (Current output)

**General data**

Limit frequency (3 dB)	(100 Hz / 30 Hz switchable)
Maximum transmission error	≤ 0.2 % < 0.4 % (Without adjustment)
Temperature coefficient, typical	< 0.002 %/K
Maximum temperature coefficient	< 0.01 %/K
Step response (10-90%)	3.5 ms (At 100 Hz)
Electrical isolation	Basic insulation according to EN 61010
Surge voltage category	II
Mounting position	Any
Degree of protection	IP20
Pollution degree	2
Rated insulation voltage	50 V AC/DC
Test voltage, input/output/supply	1.5 kV (50 Hz, 1 min.)
Dimensions W / H / D	6.2 mm / 93.1 mm / 102.5 mm
Type of housing	PBT green

**Connection data**
**Screw connection**
**Spring-cage conn.**

Conductor cross section, solid	0.2 mm <sup>2</sup> ... 2.5 mm <sup>2</sup>	0.2 mm <sup>2</sup> ... 2.5 mm <sup>2</sup>
Conductor cross section, stranded	0.2 mm <sup>2</sup> ... 2.5 mm <sup>2</sup>	0.2 mm <sup>2</sup> ... 2.5 mm <sup>2</sup>
Stripping length	12 mm	8 mm

**Ambient conditions**

Ambient temperature (operation)	-20 °C ... 65 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C

**Conformance with EMC Directive 2004/108/EC**

Noise immunity according to EN 61000-6-2
Noise emission according to EN 61000-6-4

**Conformance / approvals**

Conformance	CE-compliant
ATEX	⊕ II 3 G Ex nA IIC T4 Gc X
UL, USA / Canada	UL 508 Recognized
Shipbuilding	GL EMC 2 D

## 5 Safety regulations and installation notes

### 5.1 Installation notes

- The category 3 device is suitable for installation in the zone 2 potentially explosive area. It fulfills the requirements of EN 60079-0:2009 and EN 60079-15:2010.
- Installation, operation, and maintenance may only be carried out by qualified electricians. Follow the installation instructions described. When installing and operating the device, the applicable regulations and safety directives (including national safety directives), as well as general technical regulations, must be observed. The technical data is provided in this package slip and on the certificates (conformity assessment, additional approvals where applicable).
- It is not permissible to open or modify the device. Do not repair the device yourself but 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 60529/EN 60529) of the device is intended for use in a clean and dry environment. Do not subject the device to any load that exceeds the described limits.
- The device is not designed for use in atmospheres with a danger of dust explosions.

### 5.2 Installation in the Ex area (zone 2)

- Observe the specified conditions for use in potentially explosive areas.
- The device must be installed in a housing (control or distributor box) which meets the requirements of EN 60079-15 and provides at least IP54 (EN 60529) degree of protection.
- During installation and when connecting the supply and signal circuits, observe the requirements of EN 60079-14. Devices may only be connected to circuits in zone 2 if they are suitable for operation in Ex zone 2 and for the prevailing conditions at the place of use.
- In potentially explosive areas, terminals may only be snapped onto or off the DIN rail connector and wires may only be connected or disconnected when the power is switched off.
- The device must be stopped and immediately removed from the Ex area if it is damaged, has been subjected to an impermissible load, has been stored incorrectly, or if it malfunctions.
- You can download the latest documents for these devices from [www.phoenixcontact.net/catalog](http://www.phoenixcontact.net/catalog).



## 6 Installation



The isolation amplifier is suitable for the measurement of millivolt signals.  
Please observe the rated insulation voltage of the device and its possible areas of application.

### 6.1 Connection notes



**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.

### 6.2 Structure

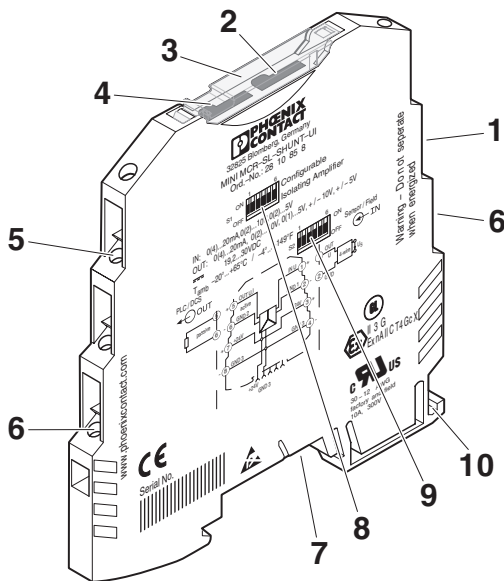


Figure 1 Structure

1. Input: Standard signals
2. Cover
3. Potentiometer for adjustment
4. Groove for ZBF 6 zack marker strip
5. Output: Standard signals
6. Supply voltage
7. Connection option for DIN rail connector
8. DIP switch S1
9. DIP switch S2
10. Universal snap-on foot for EN DIN rails

### 6.3 Block diagram

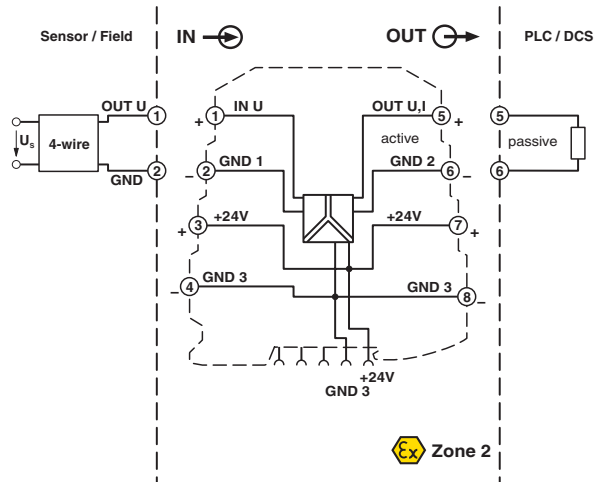


Figure 2 Block diagram

### 6.4 Power supply



**NOTE:** Never connect the supply voltage directly to the DIN rail connector. It is not permitted to draw power from the DIN rail connector or from individual modules.

#### Supply via the module

Where the total current consumption of the aligned modules does not exceed 400 mA, the power can be supplied directly at the connection terminal blocks of the module.  
A 400 mA fuse should be connected upstream.

#### Supply via a power terminal block

The MINI MCR-SL-PTB power terminal block (Order No. 2864134) or the MINI MCR-SL-PTB-SP power terminal block (Order No. 2864147), which are the same shape, are used to feed the supply voltage to the DIN rail connector.  
A 2 A fuse should be connected upstream.

#### Supply via a system power supply unit

The system power supply unit with 1.5 A output current connects the DIN rail connector to the supply voltage and can thus be used to supply several modules from the mains.

- MINI-SYS-PS-100-240AC/24DC/1.5 (Order No. 2866983)
- Potentially explosive areas:  
MINI-PS-100-240AC/24DC/1.5/EX (Order No. 2866653)

6.5 Assembly

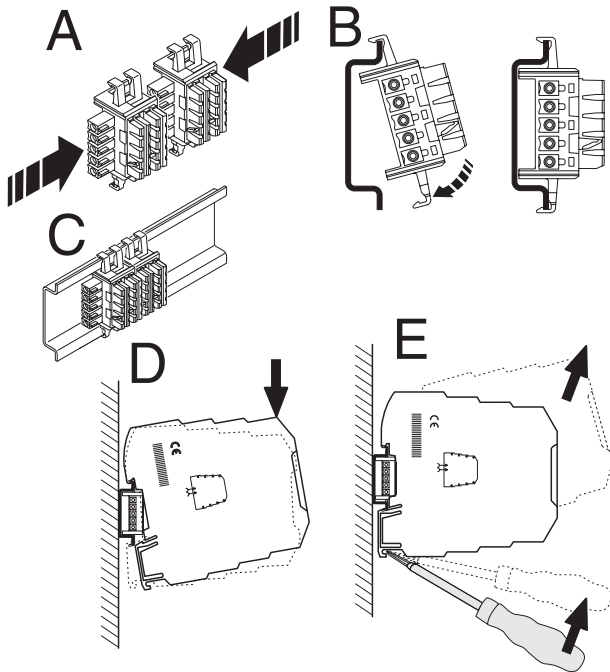


Figure 3 Mounting and removing

- Mount the module on a 35 mm DIN rail according to EN 60715.
- When using the DIN rail connector, first place it into the DIN rail (see A – C). It is used to bridge the power supply. It is also absolutely vital that you snap the module and the DIN rail connector into position in the correct direction: the snap-on foot should be at the bottom and the connector on the left.

6.6 Connecting the wires

The MINI MCR-SL-SHUNT-UI(-SP)(-NC) is available in two connection versions:

- Screw terminal blocks (for MINI MCR-SL-SHUNT-UI(-NC))
- Spring-cage terminal blocks (for MINI MCR-SL-SHUNT-UI-SP(-NC))

Screw connection:

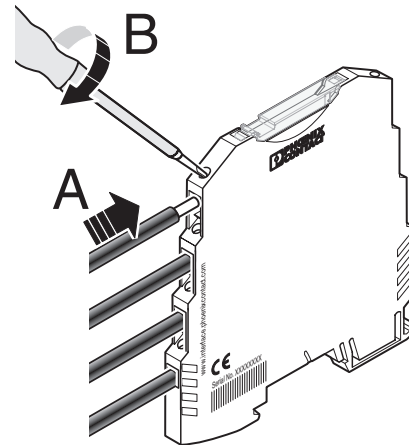


Figure 4 Screw connection

- Insert the wire into the corresponding connection terminal block.
- Use a screwdriver to tighten the screw in the opening above the connection terminal block.

Spring-cage connection:

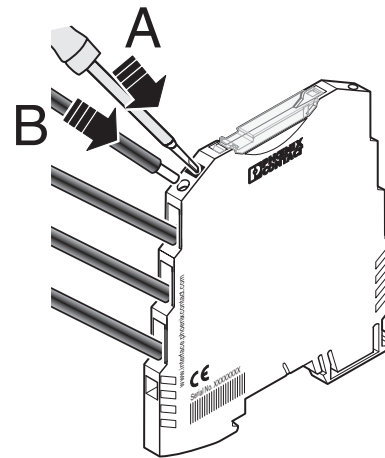


Figure 5 Spring-cage connection

- Insert a screwdriver into the opening above the connection terminal block.
- Insert the wire into the corresponding connection terminal block.

## 7 Configuration

If the modules are not configured (all DIP switches set to position 0), the module does not have a defined function until the DIP switches have been set.

If the modules are preconfigured, please specify the order number and the complete order key.

If the order key is incomplete, the standard configuration will be supplied.

DIP switch S1 specifies the output signal depending on the input signal.

DIP switch S2 specifies the input signal.

### Standard Configuration

"NC" versions (...-NC) have the following standard configuration:

- Input: 0 mV...50 mV
- Output: 0 mA...20 mA
- Limit frequency: 100 Hz

(All DIP switches are set to the "off" position, transmission error < 0.2 %.)

### 7.1 Configuration tables

#### Input signal

IN		DIP S2				
bipolar	unipolar	1	2	3	4	5
-50 mV ... 50 mV	0 mV ... 50 mV	off	off	off	off	off
-60 mV ... 60 mV	0 mV ... 60 mV	off	off	ON	off	off
-75 mV ... 75 mV	0 mV ... 75 mV	off	ON	off	ON	off
-80 mV ... 80 mV	0 mV ... 80 mV	off	ON	ON	off	off
-100 mV ... 100 mV	0 mV ... 100 mV	off	ON	ON	ON	off
-120 mV ... 120 mV	0 mV ... 120 mV	ON	off	off	ON	off
-150 mV ... 150 mV	0 mV ... 150 mV	ON	ON	off	off	off
-200 mV ... 200 mV	0 mV ... 200 mV	ON	off	ON	ON	off
-240 mV ... 240 mV	0 mV ... 240 mV	ON	ON	off	ON	off
-300 mV ... 300 mV	0 mV ... 300 mV	ON	ON	ON	off	off
-500 mV ... 500 mV	0 mV ... 500 mV	off	off	off	off	ON
-600 mV ... 600 mV	0 mV ... 600 mV	off	off	ON	off	ON
-750 mV ... 750 mV	0 mV ... 750 mV	off	ON	off	ON	ON
-800 mV ... 800 mV	0 mV ... 800 mV	off	ON	ON	off	ON
-1,0 V ... 1,0 V	0 V ... 1,0 V	off	ON	ON	ON	ON
-1,2 V ... 1,2 V	0 V ... 1,2 V	ON	off	off	ON	ON
-1,5 V ... 1,5 V	0 V ... 1,5 V	ON	off	off	off	ON
-2,0 V ... 2,0 V	0 V ... 2,0 V	ON	off	ON	ON	ON
-2,4 V ... 2,4 V	0 V ... 2,4 V	ON	ON	off	ON	ON
-3,0 V ... 3,0 V	0 V ... 3,0 V	ON	ON	ON	off	ON

**Output signals**



The bipolar output can be used only for bipolar input signals.

The output signal must be configured according to the input signal (unipolar IN or bipolar IN).

OUT		DIP S1					
		1	2	3	4	5	6
Bipolar IN	-10 ... +10 V	ON	off	ON	off	off	off
	-5 ... +5 V	ON	ON	off	off	off	off
	0 ... +10 V	ON	off	ON	off	ON	off
	0 ... +5 V	ON	ON	off	off	ON	off
	2 ... +10 V	ON	off	ON	off	off	ON
	1 ... +5 V	ON	ON	off	off	off	ON
	0 mA ... 20 mA	off	off	off	off	ON	off
	4 mA ... 20 mA	off	off	off	off	off	ON
Unipolar IN	0 ... 10 V	ON	off	ON	off	off	off
	0 ... 5 V	ON	ON	off	off	off	off
	2 ... 10 V	ON	off	ON	ON	off	off
	1 ... 5 V	ON	ON	off	ON	off	off
	0 mA ... 20 mA	off	off	off	off	off	off
	4 mA ... 20 mA	off	off	off	ON	off	off

**Limit frequency**

Cut-off frequency (3 dB)	DIP S2
30 Hz	ON
100 Hz	off

Possible measuring ranges

	-10 V ... 10 V	0 V ... 10	2 V ... 10	0 mA ... 20 mA	4 mA ... 20	-5 V ... 5 V	0 V ... 5 V	1 V ... 5 V
0 mV ... 50 mV		X	X	X	X		X	X
0 mV ... 60 mV		X	X	X	X		X	X
0 mV ... 75 mV		X	X	X	X		X	X
0 mV ... 80 mV		X	X	X	X		X	X
0 mV ... 100 mV		X	X	X	X		X	X
0 mV ... 120 mV		X	X	X	X		X	X
0 mV ... 150 mV		X	X	X	X		X	X
0 mV ... 200 mV		X	X	X	X		X	X
0 mV ... 240 mV		X	X	X	X		X	X
0 mV ... 300 mV		X	X	X	X		X	X
0 mV ... 500 mV		X	X	X	X		X	X
0 mV ... 600 mV		X	X	X	X		X	X
0 mV ... 750 mV		X	X	X	X		X	X
0 mV ... 800 mV		X	X	X	X		X	X
0 V ... 1,0 V		X	X	X	X		X	X
0 V ... 1,2 V		X	X	X	X		X	X
0 V ... 1,5 V		X	X	X	X		X	X
0 V ... 2,0 V		X	X	X	X		X	X
0 V ... 2,4 V		X	X	X	X		X	X
0 V ... 3,0 V		X	X	X	X		X	X
-50 mV ... 50 mV	X	X	X	X	X	X	X	X
-60 mV ... 60 mV	X	X	X	X	X	X	X	X
-75 mV ... 75 mV	X	X	X	X	X	X	X	X
-80 mV ... 80 mV	X	X	X	X	X	X	X	X
-100 mV ... 100 mV	X	X	X	X	X	X	X	X
120 mV ... 120 mV	X	X	X	X	X	X	X	X
-150 mV ... 150 mV	X	X	X	X	X	X	X	X
-200 mV ... 200 mV	X	X	X	X	X	X	X	X
-240 mV ... 240 mV	X	X	X	X	X	X	X	X
-300 mV ... 300 mV	X	X	X	X	X	X	X	X
-500 mV ... 500 mV	X	X	X	X	X	X	X	X
-600 mV ... 600 mV	X	X	X	X	X	X	X	X
-750 mV ... 750 mV	X	X	X	X	X	X	X	X
-800 mV ... 800 mV	X	X	X	X	X	X	X	X
-1,0 V ... 1,0 V	X	X	X	X	X	X	X	X
-1,2 V ... 1,2 V	X	X	X	X	X	X	X	X
-1,5 V ... 1,5 V	X	X	X	X	X	X	X	X
-2,0 V ... 2,0 V	X	X	X	X	X	X	X	X
-2,4 V ... 2,4 V	X	X	X	X	X	X	X	X
-3,0 V ... 3,0 V	X	X	X	X	X	X	X	X

7.2 Adjustment

A potentiometer is located underneath the cover; this is used for fine adjustment of the analog signals once the configuration of the DIP switches has been modified.

The potentiometer can be used to adjust the amplification by  $\pm 1.25\%$ .



Please note that measuring equipment with appropriate measuring accuracy is required for precise adjustment.

The module is adjusted via its output final value:

- Connect a calibration source to the input of the isolation amplifier and specify the final value of the set input signal.
- Use a potentiometer to set the exact final value of the set output signal.

8 Connection/application example

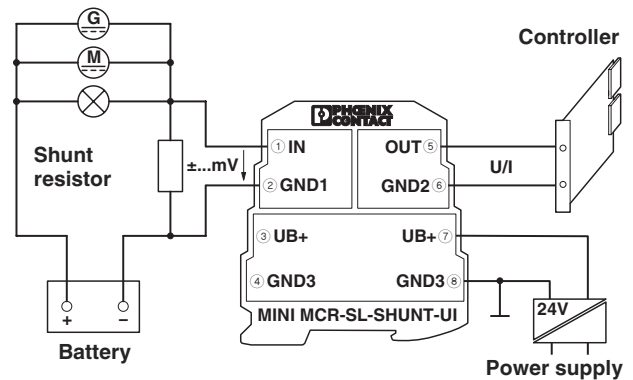


Figure 6 Connection example