

MINI MCR-SL-F-UI-NC

Frequency transducers



Data sheet
105442_en_01

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1 Description

Configurable 3-way isolated frequency transducer. The device is suitable for the connection of NAMUR proximity sensors (IEC 60947-5-6 and EN 50227) as well as for sensors with NPN and PNP outputs that generate a frequency signal.

The measured values are converted into a linear current or voltage signal.

The device is configured via DIP switches. The frequency range is configured with extended options via a press/slide button ("teach-in wheel").

The device supports fault monitoring.

Features

- Configurable 3-way frequency transducer
- Configurable via DIP switch
- Approval for Ex-zone 2 (nA)
- Screw or spring-cage connection can be provided



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 phoenixcontact.net/products.



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

2	Table of contents	
1	Description	1
2	Table of contents	2
3	Ordering data	3
4	Technical data	4
5	Safety regulations and installation notes.....	6
	5.1 Installation notes	6
	5.2 Installation in the Ex area (zone 2).....	6
6	Installation	7
	6.1 Connection notes	7
	6.2 Structure	7
	6.3 Block diagram.....	7
	6.4 Connecting the sensors.....	7
	6.5 Power supply.....	8
	6.6 Assembly.....	8
	6.7 Connection of the cables	9
7	Fault monitoring FM.....	10
8	Configuration	11
	8.1 Configuration tables	11
9	Configuration via the “teach-in” press/slide button.....	14
	9.1 Lower teach-in value (1)	14
	9.2 Upper teach-in value (2)	14
	9.3 Reset both values (3).....	14
10	Diagnostic indicator	14

3 Ordering data

Description	Type	Order No.	Pcs. / Pkt.
The configurable frequency transducer is suitable for the connection of NAMUR proximity sensors as well as for sensors with NPN and PNP outputs. Configurable via DIP switch and teach-in wheel. Screw connection, standard configuration.	MINI MCR-SL-F-UI-NC	2902832	1
The configurable frequency transducer is suitable for the connection of NAMUR proximity sensors as well as for sensors with NPN and PNP outputs. Configurable via DIP switch and teach-in wheel. Spring-cage connection, standard configuration.	MINI MCR-SL-F-UI-SP-NC	2902833	1
Accessories	Type	Order No.	Pcs. / Pkt.
The MINI MCR-SL-PTB-FM(-SP) power terminal block is used to supply the supply voltage to the T-connector. The FM power terminal block offers the additional function of monitoring in combination with the fault monitoring module. Screw connection.	MINI MCR-SL-PTB-FM	2902958	1
The MINI MCR-SL-PTB-FM(-SP) power terminal block is used to supply the supply voltage to the T-connector. The FM power terminal block offers the additional function of monitoring in combination with the fault monitoring module. Spring-cage connection.	MINI MCR-SL-PTB-FM-SP	2902959	1
The fault monitoring module is used to evaluate and report group errors from the fault monitoring system and to monitor the supply voltages. The error is reported via an N/O contact. Screw connection, standard configuration.	MINI MCR-SL-FM-RC-NC	2902961	1
The fault monitoring module is used to evaluate and report group errors from the fault monitoring system and to monitor the supply voltages. The error is reported via an N/O contact. Spring-cage connection, standard configuration.	MINI MCR-SL-FM-RC-SP-NC	2902962	1
DIN rail connector for DIN rail mounting. Universal for T-BUS housing. Gold-plated contacts, 5-pos.	ME 6,2 TBUS-2 1,5/5-ST-3,81 GN	2869728	10
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
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
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

4 Technical data

Input	
Description of the input	Frequency input
Configurable/programmable	Yes
Available input sources	NPN/PNP transistor outputs NAMUR initiators Floating relay contact (dry contact)
Max. voltage input signal	30 V (incl. DC voltage)
Frequency measuring range	0.002 Hz ... 20 kHz (DIP switch) 0.002 Hz ... 80 kHz (Teach-in wheel)
Output	
Output description	Voltage output / current output
Voltage output signal	0 V ... 5 V 1 V ... 5 V 0 V ... 10 V 10 V ... 0 V
Max. voltage output signal	approx. 12.3 V
Current output signal	0 mA ... 20 mA 4 mA ... 20 mA 20 mA ... 0 mA 20 mA ... 4 mA
Max. current output signal	24.6 mA
Configurable/programmable	Yes
Load/output load voltage output	$\geq 10 \text{ k}\Omega$
Ripple	$< 20 \text{ mV}_{\text{PP}}$
Load/output load current output	500 Ω (at 20 mA)
Supply	
Supply voltage range	9.6 V DC ... 30 V DC (The T connector (ME 6,2 TBUS-2 1,5/5-ST-3,81 GN, Order No. 2869728) can be used to bridge the supply voltage. It can be snapped onto a 35 mm DIN rail according to EN 60715))
Typical current consumption	$< 28 \text{ mA}$ (at $I_{\text{OUT}} = 20 \text{ mA}$, 24 V DC, load 500 Ω)
Power consumption	$< 800 \text{ mW}$ (at $I_{\text{OUT}} = 20 \text{ mA}$, 9.6 V DC, load 500 Ω)
Diagnostic and status indicators	
Status display	LED red
General data	
Transmission error in the set measuring range	0.1 %
Maximum temperature coefficient	0.01 %/K
Step response (0–99%)	$< 35 \text{ ms}$ (At $f > 500 \text{ Hz}$)
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 ² ... 2.5 mm ²	0.2 mm ² ... 2.5 mm ²
Conductor cross section, stranded	0.2 mm ² ... 2.5 mm ²	0.2 mm ² ... 2.5 mm ²
Stripping length	12 mm	8 mm

Ambient conditions	
Ambient temperature (operation)	-20 °C ... 65 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 % (no condensation)

Conformance with EMC Directive 2004/108/EC	
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	
Conformance	CE-compliant
ATEX	⊕ II 3 G Ex nA IIC T4 Gc X
UL, USA / Canada	508 listed
UL, USA / Canada	Class I, Div. 2, Groups A, B, C, D T5 applied for
Shipbuilding	GL applied for

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/products.

6 Installation

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

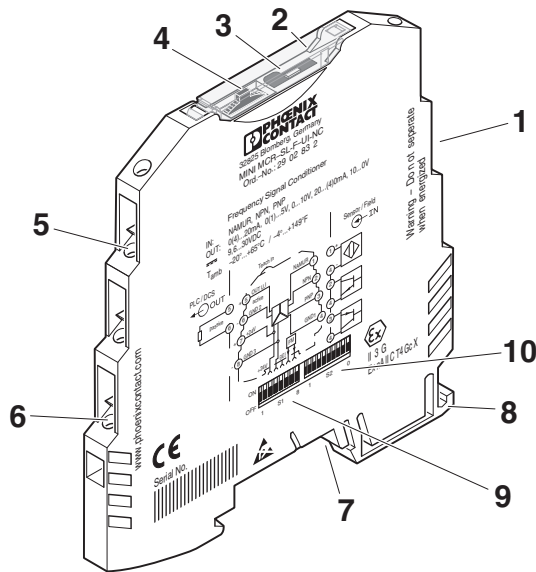


Figure 1 Structure

1. Input: frequency sensors
2. Cover
3. Diagnostics LED
4. Press/Slide button for Teach-In
5. Output: Standard signals
6. Supply voltage
7. Connection for DIN rail connector
8. Universal snap-on foot for EN DIN rails
9. DIP switch S1
10. DIP switch S2

6.3 Block diagram

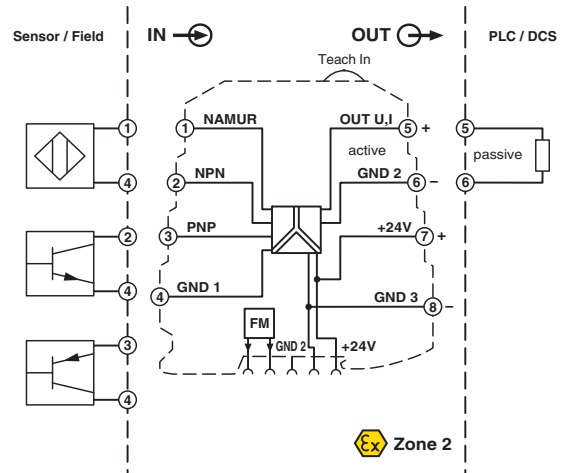
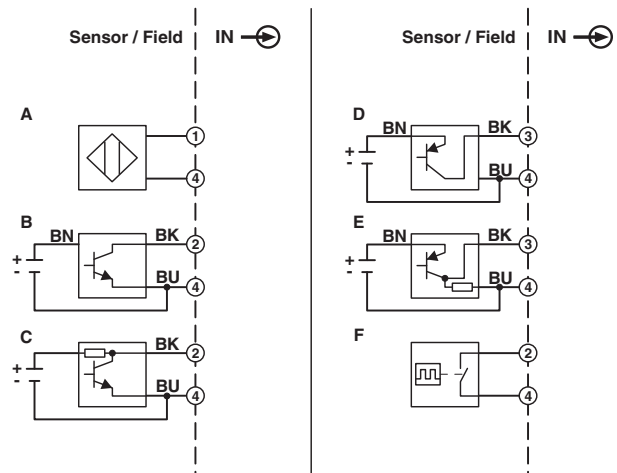


Figure 2 Block diagram

6.4 Connecting the sensors



Connection scheme	Description
A	NAMUR
B	NPN without pullup
C	NPN with pullup
D	PNP without pulldown
E	PNP with pulldown
F	Dry contact

BK: black, BN: brown, BU: blue

6.5 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 MINI Analog Module

Where the total current consumption of the aligned MINI Analog modules does not exceed 400 mA, the power can be supplied directly at the connection terminal blocks of one MINI Analog module.

A 400 mA fuse should be connected upstream.

Supply via a Power Terminal Block

The MINI MCR-SL-PTB-FM power terminal block (Order No. 2902958) or the MINI MCR-SL-PTB-FM-SP power terminal block (Order No. 2902959), which are the same shape, are used to feed the supply voltage to the DIN rail connector.

We recommend connecting a 2.5 A slow-blow fuse (e.g., SIBA 179 120.2,5 20x5).

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 therefore 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)

6.6 Assembly

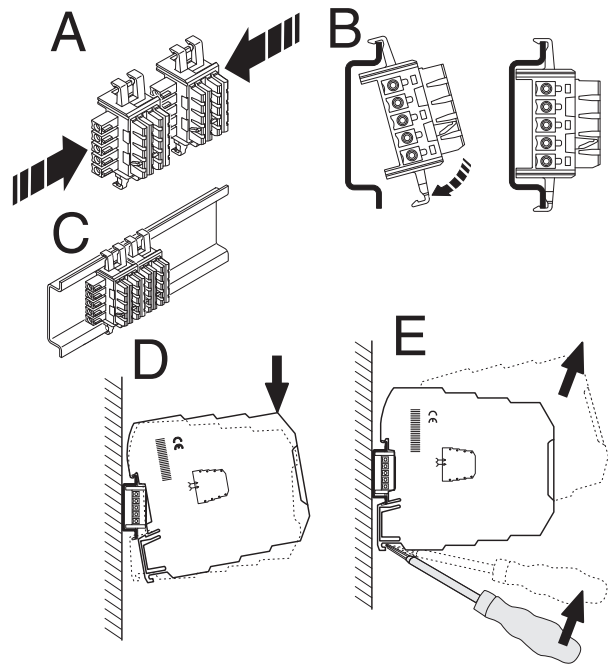


Figure 3 Mounting and removing

- 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.

6.7 Connection of the cables

The module is available in two connection versions:

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

Screw connection:

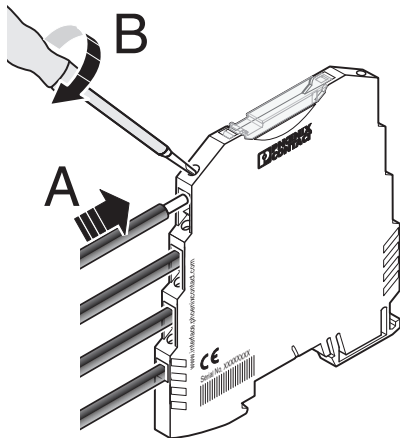


Figure 4 Screw connection

- 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:

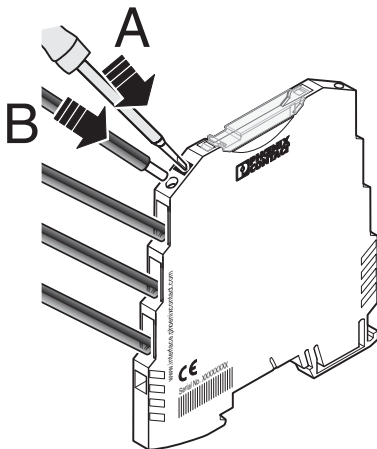


Figure 5 Spring-cage connection

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

7 Fault monitoring FM

Detected errors on the signal input or in the device are reported via the DIN rail connector to the MINI MCR-SL-FM-RC-NC (Order No. 2902961) or MINI MCR-SL-FM-RC-SP-NC (Order No. 2902962), which are the same shape. The module reports the error centrally via an N/C contact.

In one group, a fault monitoring module is only required once. Individual evaluation of the up to 80 Phoenix Contact isolation amplifiers can be omitted.

The fault monitoring module can also be used to monitor the supply voltage.

- For the behavior of the fault monitoring contact for the different DIP switch configurations, please refer to the table.

Error response		Fault monitoring: N/C contact			
		Measuring range overrange	Measuring range underrange	Cable break	Short-circuit
A		activated	deactivated	activated	deactivated
B		activated	activated	activated	activated
C		deactivated	deactivated	activated	activated
D		deactivated	deactivated	deactivated	deactivated
NE43	Upscale	activated	activated	activated	activated
	Downscale				
	0 mA				
	Upscale/downscale				
Module error		Activated (error is always reported)			
Invalid DIP switch configuration		Activated (error is always reported)			

8 Configuration

The modules have the standard configuration:

- NAMUR sensor
- Mean-value generation "OFF"
- Frequency range 0.002 Hz ... 20 kHz
- Output 4...20 mA
- Error evaluation according to NE43 (downscale)
- Fault monitoring contact reacts to all errors

At delivery, all DIP switches are in the "OFF" position.

Configure the DIP switches according to the planned application using the configuration tables.

DIP switch S1 is used for specifying the sensor type, mean-value generation, output signal range, measuring range start value, and measuring range final value.

DIP switch S2 is used for specifying the measuring range final value, error evaluation, and standard configuration.

8.1 Configuration tables

		• ≙ ON DIP S1							
		1	2	3	4	5	6	7	8
Input	NAMUR (Error detection cable break/short circuit ON)								
	NPN/PNP (Error detection cable break/short circuit OFF)	•							
Mean-value generation	OFF								
	ON	•							
Analog output signal	0...20 mA								
	20...0 mA			•					
	4...20 mA				•				
	20...4 mA			•	•				
	0...10 V						•		
	10...0 V				•		•		
	0...5 V				•	•			
	1...5 V			•	•	•			
Start frequency (Recognition time)	0.002 Hz (> 8 min)								
	0.1 Hz (~ 10 s)						•		
	1 Hz (~ 1 s)							•	
	10 Hz (~ 0.1 s)						•	•	

Measuring range final value																				• ≙ ON							
DIP S1		DIP S2					DIP S1		DIP S2					DIP S1		DIP S2											
	8	1	2	3	4	5	6		8	1	2	3	4	5	6		8	1	2	3	4	5	6	7	8	9	0
20000 Hz								5400 Hz	•	•	•	•	•	•		580 Hz	•	•	•	•	•	•	•				
19 500 Hz	•							5200 Hz		•	•	•	•	•		560 Hz	•	•	•	•	•	•	•				
19000 Hz		•						5000 Hz	•		•	•	•	•		540 Hz				•	•	•	•				
18500 Hz	•	•						4800 Hz		•	•	•	•	•		520 Hz	•			•	•	•	•				
18000 Hz			•					4600 Hz	•	•	•	•	•	•		500 Hz		•		•	•	•	•				
17500 Hz	•		•					4400 Hz					•	•		480 Hz	•	•		•	•	•	•				
17000 Hz	•	•	•					4200 Hz	•				•	•		460 Hz				•	•	•	•				
16500 Hz	•	•	•					4000 Hz		•			•	•		440 Hz	•			•	•	•	•				
16000 Hz				•				3800 Hz	•	•			•	•		420 Hz		•		•	•	•	•				
15500 Hz	•			•				3600 Hz			•		•	•		400 Hz	•	•		•	•	•	•				
15000 Hz		•		•				3400 Hz	•		•		•	•		380 Hz						•	•				
14500 Hz	•	•		•				3200 Hz		•	•		•	•		360 Hz	•					•	•				
14000 Hz			•	•				3000 Hz	•	•	•		•	•		340 Hz		•				•	•				
13500 Hz	•	•	•					2800 Hz				•	•	•		320 Hz	•					•	•				
13000 Hz		•	•	•				2600 Hz	•			•	•	•		300 Hz			•			•	•				
12500 Hz	•	•	•	•				2400 Hz		•		•	•	•		280 Hz	•			•		•	•				
12000 Hz					•			2200 Hz	•	•		•	•	•		260 Hz		•	•			•	•				
11500 Hz	•				•			2000 Hz			•	•	•	•		240 Hz	•	•		•		•	•				
11000 Hz		•			•			1800 Hz	•	•	•	•	•	•		220 Hz				•		•	•				
10500 Hz	•	•			•			1600 Hz		•	•	•	•	•		200 Hz	•			•		•	•				
10000 Hz			•		•			1400 Hz	•	•	•	•	•	•		180 Hz		•		•		•	•				
9800 Hz	•	•	•		•			1200 Hz						•		160 Hz	•	•		•		•	•				
9600 Hz		•	•		•			1000 Hz	•					•		140 Hz			•	•		•	•				
9400 Hz	•	•	•		•			980 Hz		•				•		120 Hz	•		•	•		•	•				
9200 Hz				•	•			960 Hz	•	•				•		100 Hz	•		•	•		•	•				
9000 Hz	•			•	•			940 Hz			•			•		95 Hz	•	•		•	•	•	•				
8800 Hz		•		•	•			920 Hz	•		•			•		90 Hz				•	•	•	•				
8600 Hz	•	•		•	•			900 Hz		•	•			•		85 Hz	•			•	•	•	•				
8400 Hz			•	•	•			880 Hz	•	•	•			•		80 Hz		•		•	•	•	•				
8200 Hz	•	•	•	•	•			860 Hz				•		•		75 Hz	•	•		•	•	•	•				
8000 Hz		•	•	•	•			840 Hz	•		•			•		70 Hz	•			•	•	•	•				
7800 Hz	•	•	•	•	•			820 Hz		•		•		•		65 Hz	•		•		•	•	•				
7600 Hz						•		800 Hz	•	•		•		•		60 Hz		•	•		•	•	•				
7400 Hz	•					•		780 Hz			•	•		•		55 Hz	•	•		•	•	•	•				
7200 Hz		•				•		760 Hz	•		•	•		•		50 Hz				•	•	•	•				
7000 Hz	•	•				•		740 Hz		•	•	•		•		45 Hz	•			•	•	•	•				
6800 Hz			•			•		720 Hz	•		•	•		•		40 Hz	•			•	•	•	•				
6600 Hz	•		•			•		700 Hz					•	•		35 Hz	•	•		•	•	•	•				
6400 Hz		•	•			•		680 Hz	•				•	•		30 Hz				•	•	•	•				
6200 Hz	•	•	•			•		660 Hz		•			•	•		25 Hz	•			•	•	•	•				
6000 Hz				•		•		640 Hz	•	•			•	•		20 Hz		•		•	•	•	•				
5800 Hz	•			•		•		620 Hz			•	•		•		Teach	•	•		•	•	•	•				
5600 Hz		•		•		•		600 Hz	•		•	•		•													

Fault evaluation		Analog OUT								• = ON				
		0...20 mA	20...0 mA	4...20 mA	20...4 mA	0...10 V	10...0 V	0...5 V	1...5 V	DIP S2				
										7	8	9	0	
A	Cable break	21 mA	21 mA	21 mA	21 mA	10.5 V	10.5 V	5.25 V	5.25 V					
	Measuring range overrange	20.5 mA	20.5 mA	20.5 mA	20.5 mA	10.25 V	10.25 V	5.125 V	5.125 V					
	Measuring range underrange	0 mA	0 mA	4 mA	4 mA	0 V	0 V	0 V	1 V					
	Short circuit	0 mA	0 mA	4 mA	4 mA	0 V	0 V	0 V	1 V					
B	Cable break	21 mA	21 mA	21 mA	21 mA	10.5 V	10.5 V	5.25 V	5.25 V					
	Measuring range overrange	20.5 mA	20.5 mA	20.5 mA	20.5 mA	10.25 V	10.25 V	5.125 V	5.125 V	•				
	Measuring range underrange	0 mA	0 mA	3.5 mA	3.5 mA	0 V	0 V	0 V	0.875 V					
	Short circuit	0 mA	0 mA	3 mA	3 mA	0 V	0 V	0 V	0.75 V					
C	Cable break	21 mA	21 mA	21 mA	21 mA	10.5 V	10.5 V	5.25 V	5.25 V					
	Measuring range overrange	20 mA	20 mA	20 mA	20 mA	10 V	10 V	5 V	5 V			•		
	Measuring range underrange	0 mA	0 mA	4 mA	4 mA	0 V	0 V	0 V	1 V					
	Short circuit	21 mA	21 mA	21 mA	21 mA	10.5 V	10.5 V	5.25 V	5.25 V					
D	Cable break	0 mA	0 mA	4 mA	4 mA	0 V	0 V	0 V	1 V					
	Measuring range overrange	20 mA	20 mA	20 mA	20 mA	10 V	10 V	5 V	5 V	•				
	Measuring range underrange	0 mA	0 mA	4 mA	4 mA	0 V	0 V	0 V	1 V					
	Short circuit	0 mA	0 mA	4 mA	4 mA	0 V	0 V	0 V	1 V					
NE43	(Only OUT = 4...20 mA or 20...4 mA)													
	Upscale	Cable break, measuring range overrange, measuring range underrange, short circuit								= 21.5 mA				•
	Downscale	Cable break, measuring range overrange, measuring range underrange, short circuit								= 3.5 mA	•			•
	0 mA	Cable break, measuring range overrange, measuring range underrange, short circuit								= 0 mA		•		•
	Up/downscale	Cable break, short circuit								= 3.5 mA				
	Measuring range overrange, measuring range underrange								= 21.5 mA	•	•		•	
Configuration	Standard configuration via DIP switch												•	

9 Configuration via the “teach-in” press/slide button.

The "teach-in" configuration can be used to extend the frequency range via 20 kHz up to 80 kHz.

In order not to exceed the 0.1% uncertainty of measurement of the module, the range values must be set up with a minimum range variable.

Default = range start value	Minimum range final value
0.002 Hz ... 1 Hz	Start value + 1%
> 1 Hz ... 60 Hz	Start value + 10%
> 60 Hz ... 200 Hz	Start value + 20%
> 200 Hz ... 1100 Hz	Start value + 30%
> 1100 Hz	Start value + 40%

Example calculation:

The range which is to be set via the teach-in wheel starts at 10 Hz.

- Calculate the minimum range final value to be set:
Start value (10 Hz) + 10% = 10 Hz + 1 Hz = **11 Hz**

Default = range final value	Maximum range start value
0.002 Hz ... 1 Hz	Final value - 1%
> 1 Hz ... 60 Hz	Final value - 10%
> 60 Hz ... 600 Hz	Final value - 20%
> 600 Hz	Final value - 30%

Example calculation:

The range which is to be set via the teach-in wheel ends at 10 Hz.

- Calculate the maximum range start value to be set:
Final value (10 Hz) - 10% = 10 Hz - 1 Hz = **9 Hz**
- Set the ranges with the press/slide button.

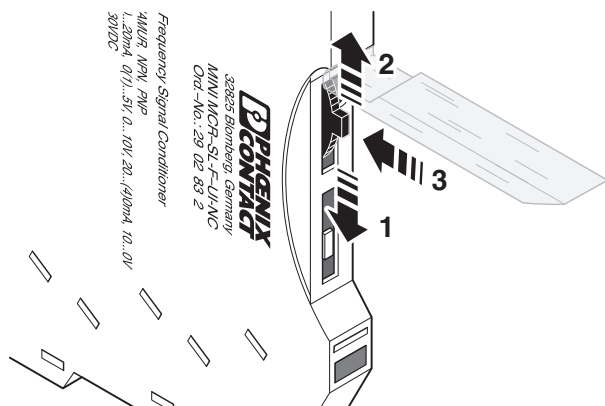


Figure 6 Configuration

9.1 Lower teach-in value (1)

- Set the frequency value of the application to the lowest teach-in value and press the button downwards for approximately 1 second (towards terminal 1).

If the value is saved successfully, the LED flashes once.

- Press down the button for longer than 3 seconds (towards terminal 1) to reset the lower teach-in value to the lowest start value.

If the value has been reset successfully, the LED flashes twice.

9.2 Upper teach-in value (2)

- Set the frequency range of the application to the highest teach-in value and press the button upwards for approximately 1 second (towards terminal 5).

If the value is saved successfully, the LED flashes once.

- Press the button up for longer than 3 seconds (towards terminal 5) to reset the upper teach-in value to 20 kHz.

If the value has been reset successfully, the LED flashes twice.

9.3 Reset both values (3)

- Press the button for longer than 3 seconds to reset both teach-in values. The complete measuring range (0.002 Hz ... 20 kHz) is used.

If the values have been deleted successfully, the diode flashes twice.

10 Diagnostic indicator

The LEDs indicate the following error states:

- LED flashes at 2.8 Hz: cable error, sensor error, measured value overrange, measured value underrange, or invalid DIP switch configuration
- LED is permanently on: internal device error