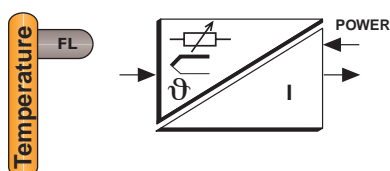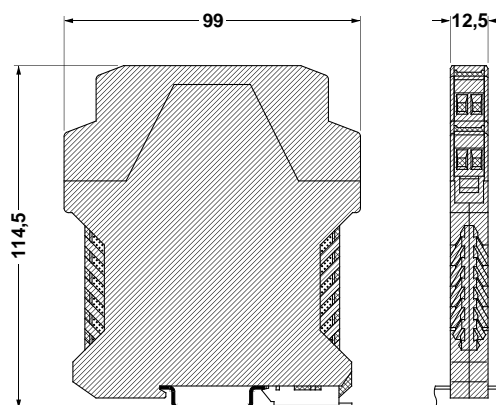# Programmable Loop-Powered Temperature Measuring Transducer MCR-FL-T-LP-I

1. Brief Description

– For resistance thermometers, thermocouples, and resistance and voltage sensors

– Can be mounted on symmetrical EN 50 022 DIN rails

– Can be freely programmed using the MCR-PI-CONF-WIN configuration software (Order No. 28 14 79 9)

Dimensional drawing for MCR-FL-T-LP-I

Universal **PC programmable temperature measuring transducers** convert temperature signals from resistance thermometers and thermocouples as well as sensors with linear mV characteristic curves to analog 4…20 mA signals.

On the output side the temperature measuring transducers are operated in a 4…20 mA current loop, which simultaneously provides the module with the required power for signal conversion.

To change the configuration data, use the MCR-PAC-T programming adapter (Order No. 28 64 59 0) and the Windows-compatible MCR-PI-CONF-WIN configuration software (Order No. 28 14 79 9).

Customized measuring range settings and an extended setup can thus be implemented.

Failure information in the event of sensor breaks or sensor short circuit can be set according to NE 43. This measuring transducer maintains a high level of accuracy throughout the entire ambient operating temperature range.

The devices are supplied with the following default configuration: PT100 sensor, 0…100°C (32…212⁰F) measuring range, 3-wire termination.

1.1. Input Signals

	Designation	Measuring Range Limits	Minimum Measuring Span
Resistance thermometer (RTD)	Pt100 Pt500 Pt1000 according to IEC 751	-200 to +850˚C (-328 to +1562˚F) -200 to +250˚C (-328 to +482˚F) -200 to +250˚C (-328 to +482˚F)	10 K 10 K 10 K
	Ni100 Ni500 Ni1000 according to DIN 43760	-60 to +250˚C (-76 to +482˚F) -60 to +150˚C (-76 to +302˚F) -60 to +150˚C (-76 to +302˚F)	10 K 10 K 10 K
	• Connection type: 2, 3 or 4-wire termination • With 2-wire termination, the cable resistance can be compensated (0...20 Ω). • With 3 and 4-wire termination, sensor cable resistance up to a maximum of 40 Ω per cable • Sensor current ≤ 0.6 mA		
Resistance sensor	Resistance (Ω)	10... 400 Ω 10...2000 Ω	10 Ω 100 Ω

	Designation	Measuring Range Limits	Minimum Measuring Span
Thermocouple (TC)	B (PtRh30-PtRh6) C (W5Re-W26Re)[1] D (W3Re-W25Re)[1] E (NiCr-CuNi) J (Fe-CuNi) K (NiCr-Ni) L (Fe-CuNi)[2] N (NiCrSi-NiSi) R (PtRh13-Pt) S (PtRh10-Pt) T (Cu-CuNi) U (Cu-CuNi)[2] MoRe5-MoRe41[3] according to IEC 584 Part 1	0 to +1820˚C (+32 to +3308˚F) 0 to +2320˚C (+32 to +4208˚F) 0 to +2495˚C (+32 to +4523˚F) -200 to +915˚C (-328 to +1679˚F) -200 to +1200˚C (-328 to +2192˚F) -270 to +1372˚C (-454 to +2502˚F) -200 to +900˚C (-328 to +1652˚F) -270 to +1300˚C (-454 to +2372˚F) 0 to +1768˚C (+32 to +3214˚F) -50 to +1768˚C (+32 to +3214˚F) -200 to +400˚C (-328 to +752˚F) -200 to +600˚C (-328 to +1112˚F) 0 to +2000˚C (+32 to +3632˚F)	500 K 500 K 500 K 50 K 50 K 50 K 50 K 50 K 500 K 500 K 50 K 50 K 500 K
	• Cold junction: internal (Pt100) or external (0...80°C [32…176ºF]) • Cold junction accuracy: ±1 K		
Voltage sensor (mV)	Millivolt sensor (mV)	-10...100 mV	5 mV

[1] According to ASTM E988
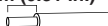[2] According to DIN 43710
[3] No specification

2. Technical Data
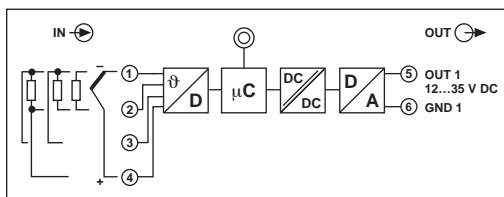
MCR-FL-T-LP-I

Programmable loop-powered temperature measuring transducer

$_c$**$\mathbf{\mathcal{N}}$**$_{us}$

M 3

8 mm (0.31 in.)

	solid [mm^2]	flexible [mm^2]	AWG
Connection data	0.2 - 1.75	0.2 - 1.75	24 - 15

Description		Type	Order No.	Pcs. Pkt.
MCR temperature measuring transducer, for resistance thermometers, thermocouples, and resistance and voltage sensors		**MCR-FL-T-LP-I**	**28 64 56 1**	1

Technical Data	
Input	• PT100, PT500, PT1000 and Ni100, Ni500, Ni1000 resistance thermometers, in 2, 3 or 4-wire technology, minimum measuring span of 10 K
	• Thermocouple sensors (B, C, D, E, J, K, L, N, R, S, T, U); minimum measuring span of 50 K/500 K
	• Linear mV signals from -10 mV to +100 mV; minimum measuring span of 5 mV
	• Resistance sensor of 10 Ω to 400 Ω and 10 Ω to 2000 Ω; minimum measuring span of 10 Ω/100 Ω
Output	
Output signal	4…20 mA/20…4 mA
Maximum output signal	≤ 23 mA
Load	(V_{Supply} - 12 V)/0.023 A, maximum
Output signal in the event of open circuit/short circuit [1])	≤ 3.6 mA/≥ 21.0 mA
Measuring range exceeded/not reached	≤ 20.5 mA/≥ 3.8 mA (linear increase/drop)

General Data

Supply voltage	12…35 V DC
Maximum current consumption	< 3.5 mA
Transmission error[2] Resistance thermometer (RTD)	0.2 K or 0.08% (Pt100, Ni100),
	0.5 K or 0.20% (Pt500, Ni500),
	0.3 K or 0.12% (Pt1000, Ni1000)
Thermocouple (TC)[5]	0.5 K or 0.08% (K, J, T, E, L, U), typical,
	1.0 K or 0.08% (N, C, D), typical,
	2.0 K or 0.08% (S, B, R, MoRe5-MoRe41), typical
Resistance sensor (Ω)	±0.1 Ω or 0.08% (10…400 Ω),
	±1.5 Ω or 0.12% (10…2000 Ω),
Voltage sensor (mV)	±20 μV or 0.08% (-10…100 mV)

Influence of the ambient temperature (temperature drift)	• Resistance thermometer (RTD): $Td = \pm (15\ ppm/K \bullet$ maximum measuring range $+ 50\ ppm/K \bullet$ set measuring range) $\bullet \Delta\vartheta^3)$
	• Pt100 resistance thermometer: $Td = \pm (15\ ppm/K \bullet$ (measuring range final value $+ 200) + 50\ ppm/K \bullet$ set measuring range) $\bullet \Delta\vartheta^3)$
	• Thermocouple (TC): $Td = \pm (50\ ppm/K \bullet$ maximum measuring range $+ 50\ ppm/K \bullet$ set measuring range) $\bullet \Delta\vartheta^3)$

Influence of the load[4]		≤ ±0.02%/100 Ω
Influence of the supply voltage[4]		≤ ±0.01%/V deviation of 24 V
Response time		< 2 s
On delay		4 s
Test voltage	Input/output	2 kV AC, 50 Hz, 1 minute
Ambient operating temperature range		-40°C...+85°C (-40°F...+185°F)
Storage temperature		-40 °C...+100°C (-40°F...+212°F)
Climatic category		According to EN60 654-1, Class C
Condensation		Permissible
Degree of protection		IP 20
Mounting location		Any
Mounting position		On symmetrical EN 50 022 DIN rails
Resistance to shock and vibration		4 g/2...150 Hz according to IEC 60 068-2-6
Configuration		Using MCR-PI-CONF-WIN configuration software package
Electromagnetic compatibility		$C\!\in$ Conformance with EMC Directive 89/336/EEC
• Noise emission and noise immunity		EN 61 326-1 (IEC 1326) and NAMUR NE 21
Housing material		Polyamide PA, unarmored

[1] Not for thermocouples
[2] % refers to the set measuring span.
[3] $\Delta\vartheta$ = Difference between the ambient temperature and the reference condition
[4] All data refers to the measuring range final value of 20 mA
[5] Influence of the internal cold junction Pt100 DIN IEC 751 Kl.B

3. $C\!\in$ Conformance With EMC Directive 89/336/EEC

The measuring system meets the legal requirements of EU directives. Phoenix Contact indicates that the device has been successfully tested through the use of the $C\!\in$ mark.

EMC (Electromagnetic Compatibility):

Noise immunity and noise emission according to EN 61 326-1 (IEC 1326) and NAMUR NE 21.

4. Connections

2-Wire Connection

For short distances.

Please note: The cable resistances directly affect the measuring result and falsify it, provided that they are not compensated by the software.
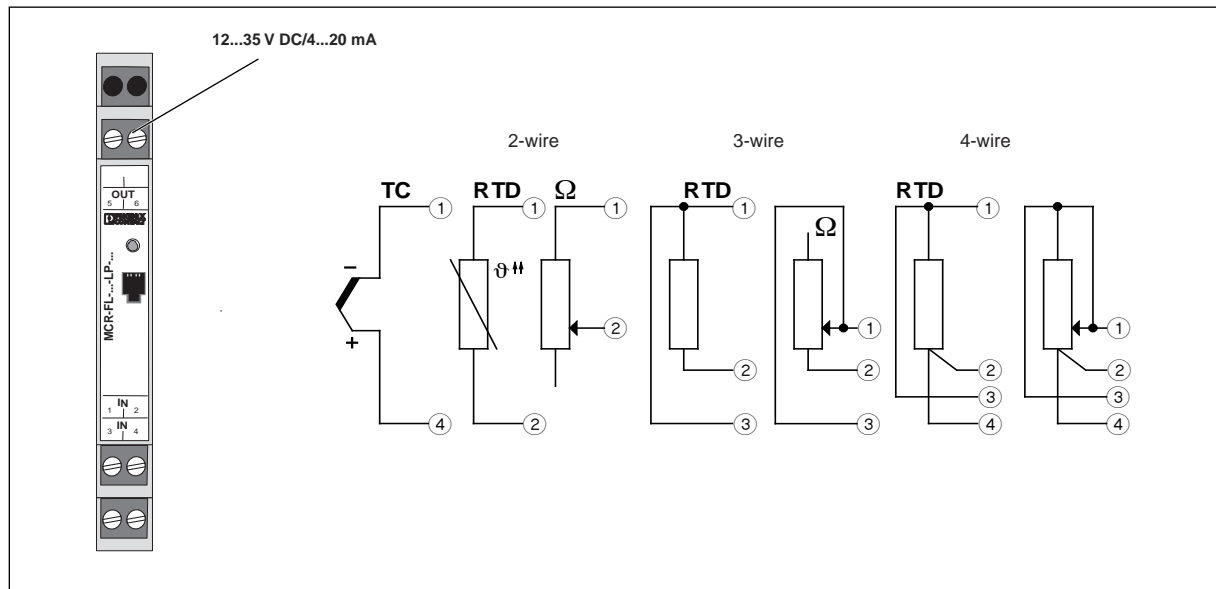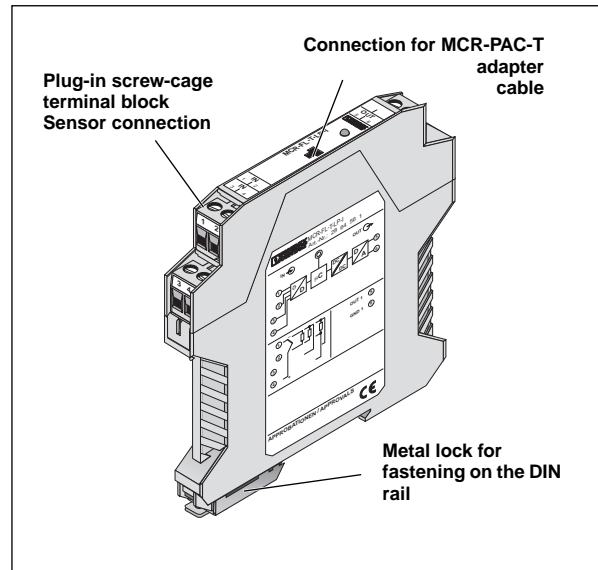
3-Wire Connection

For long distances between the resistance thermometer and the MCR module and equal cable resistances (R_{L1}= R_{L2}= R_{L3}).

Please note: The cable resistance per wire must not exceed 40 Ω.

4-Wire Connection

For long distances between the resistance thermometer and the MCR module and varied cable resistances ($R_{L1} \neq R_{L2} \neq R_{L3} \neq R_{L4}$).

Please note: The cable resistance per wire must not exceed 40 Ω. The permissible residual ripple is $U_{pp} \leq 5$ V at $U_b \geq 15$ V, and $f_{max.}$ of 1 kHz.

Connection for MCR-PAC-T adapter cable

Plug-in screw-cage terminal block Sensor connection

Metal lock for fastening on the DIN rail

12...35 V DC/4...20 mA

2-wire   3-wire   4-wire

TC   RTD   Ω   RTD   RTD

5. Configuration

The devices are supplied with the following default configuration: PT100 sensor, 0…100°C (32…212ºF) measuring range, 3-wire termination.

To change the configuration data, use the MCR-PAC-T programming adapter (Order No. 28 64 59 0) and the Windows-compatible MCR-PI-CONF-WIN configuration software (Order No. 28 14 79 9). Customized measuring range settings and an extended setup can be implemented. In addition, the online help explains the configuration options and their implementation.

Configurable Parameters:

– Sensor type and connection type
– Unit of measurement (°C/°F)
– Measuring ranges
– Internal/external cold junction
– Compensation of the cable resistance for
  2-wire termination
– Errors
– Output signal (4...20mA/20...4mA)
– Attenuation
– Offset
– Designation for measuring points
  (8 characters)
– Output simulation

6. Connection Examples

Temperature measurement in pipes