

PC-Programmable Universal Temperature Transmitter

Data Sheet 1183A

May 2000

Features

- Accepts all industry standard RTDs and thermocouples (mV signals, resistance and potentiometers)
- Programmed using Windows based software
- Voltage and current outputs (0-5 V, 0-10 V, ± 5 V, ± 10 V, 4-20 mA, 0-20 mA) and their inverse
- Programmable digital alarm output (PNP transistor @ 24 V dc, 100 mA)
- Compact 17.5 mm housing with plug-in screw terminals
- UL/CUL recognition and Class 1, Div. 2 (groups A, B, C and D) installation

General Description

The MCR-T/UI-E is an isolated universal temperature transmitter that features complete configuration of sensor input variables and process signal outputs. The module can be fully configured by PHOENIX CONTACT or self-programmed using Windows based software. Some of the configuration options are:

- Sensor type
- Signal output range
- Temperature range
- Sensor break (output)
- Over range/under range (output)
- Digital output behavior
- Scale C° or F°

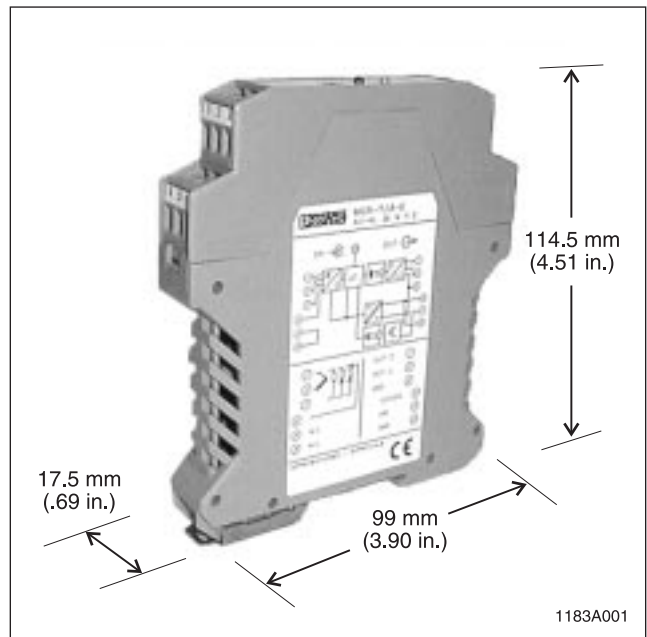


Figure 1. PC-Programmable Universal Temperature Transmitter Dimensions

The module's configuration software is capable of storing all the parameters of the configured input/output data for future re-configurations. The analog input signal from the temperature sensor is digitized at 24 bit resolution and then transferred to the microprocessor (μ C). The μ C then forms a temperature linear digital output value from the input signal. This digital signal is then electrically isolated and transferred to the D/A converter, which provides the corresponding proportional analog output. The overall full-scale accuracy of the module is 0.1% with a temperature drift of 0.005%/K.

The module's ambient temperature range is -20°C to +65°C (-4°F to +149°F). The module also features a unique design that maximizes heat dissipation of the module's interior electrical circuits. Side ventilation slots prevent overheating and drift, a problem area for most compact electronic signal conditioners. The module can be mounted on standard 35 mm DIN-rail and also features keyed plug-in terminals for easy and safe wiring.

Isolation

The MCR-T... modules feature a combination of optical and transformer isolation. The optical isolation provides common mode voltage (CMV) isolation up to 1 kV between the sensor input and the process signal output. The module's power supply is isolated from the sensor input by a DC/DC transformer isolation circuit. Isolation assures that there will be no measurement errors introduced by currents that are developed due to ground loop problems.

Surge and Short Circuit Protection

The modules are designed for use in industrial environments. Stringent IEC testing has shown that the modules have passed the IEC 801.2 (Electrostatic discharge) and IEC 801.4 (Electrical fast Transient/Burst) tests. Suppressor diodes have been integrated to protect both input and output circuits from both wiring errors and shorting.

Inputs

The MCR-T... module accepts the following sensor types and input signals:

- 2, 3, or 4-wire Resistance Temperature Detectors (RTDs)
 - Refer to block diagram for wiring instructions
- Thermocouple sensors
 - Thermocouple inputs must be connected to terminal 1 and 2, taking into account the polarity of the sensor (terminal 1 "+" input and terminal 2 "-" input)
- Thermocouple sensors of the same type connected in series for differential temperature measurements
 - Differential temperature can be measured by connecting two thermocouples of the same type in series (refer to block diagram for wiring instructions). Switching "off" the cold junction compensation using the software can carry out the measurement.
- mV signals from -20 mV to +2400 mV
 - Inputs must be connected to terminal 1 and 2, taking into account the polarity of the sensor (terminal 1 "+" input and terminal 2 "-" input)
- Linear resistance inputs between 0 Ω to 8000 Ω
 - 2 wire resistors can be measured (refer to block diagrams for wiring)
- 3-wire potentiometer up to 8 k Ω
 - Refer to block diagram for wiring

Outputs

The MCR-T... module provides an analog and a digital switch output.

Analog output:

Industry standard analog outputs, such as: 0-10 V, 0-5 V, ± 10 V, ± 5 V, 0-20 mA and 4-20 mA can be configured using the software. Inverse signals of these outputs (e.g. 20-4 mA) can also be selected via the software for directional temperature measurement in cooling applications.

Digital output:

A PNP (sourcing) transistor @ 24 V dc, 100 mA is provided at the output. Switching behavior, lower/upper limit, and time delay (2 sec) can be programmed using the software. This feature can be useful for temperature control applications, by taking the signal directly into a digital input card on the PLC or to a 24 V dc relay for switching higher currents and voltages.

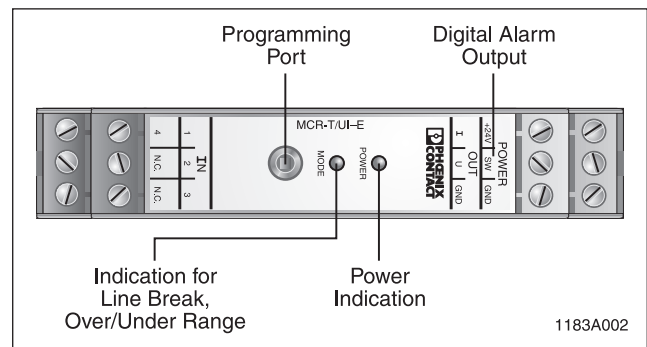


Figure 2. PC-Programmable Universal Temperature Transmitter Top View Diagram

Error Recognition

Error detection is provided for wire breaks and over / under range measurements. The red "MODE" LED lights up continuously until the problem is detected and fixed. As for remote indication, analog output values can be programmed for different error conditions.

Table 1. Error Recognition Table

Error Condition	Voltage Output	Current Output
Line break	Select a value for each error condition between -12 V to +12 V	Select a value for each error condition between 0 to 24 mA
Over range		
Under range		

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Module Configuration

The MCR-T... modules are pre-calibrated to the following setting,

Input: PT 100 3-wire RTD
 Temperature range: -200°C to +850°C
 Output: 4-20 mA
 Alarm output: disabled

Any changes to these settings will require re-configuration of the module using the software. For modules that need to be configured by the factory, please fill out the **Ordering Form**, which is available upon request or by Fax-on-Demand (Document # 7206). A configuration kit is also available for self-programming (refer part description/numbers).

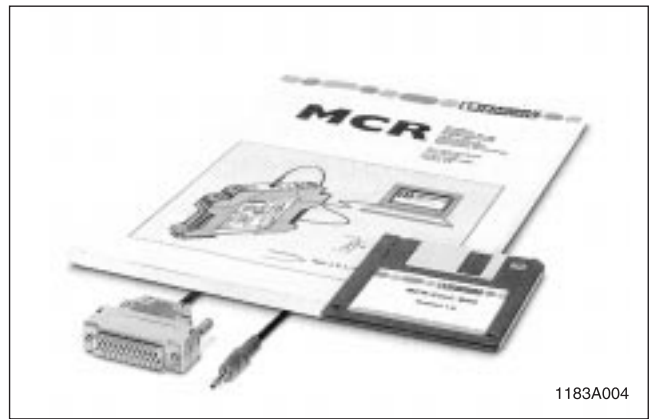


Figure 3. MCR-CONF-WIN Configuration Software

Block Diagram

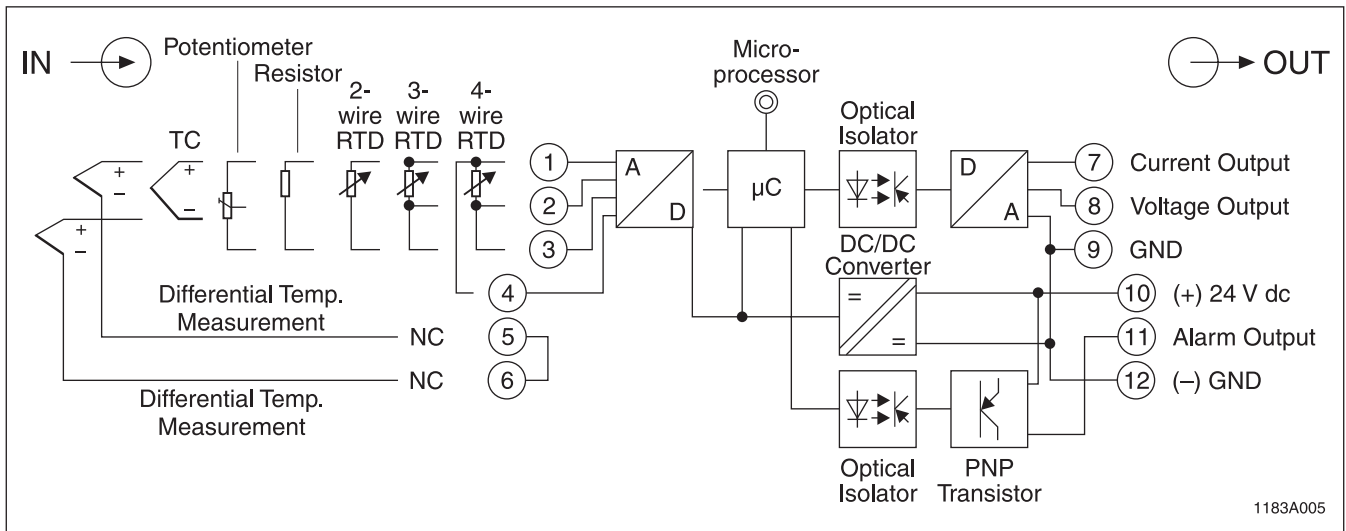


Figure 4. PC-Programmable Universal Temperature Transmitter Block Diagram

Application/Wiring Diagram

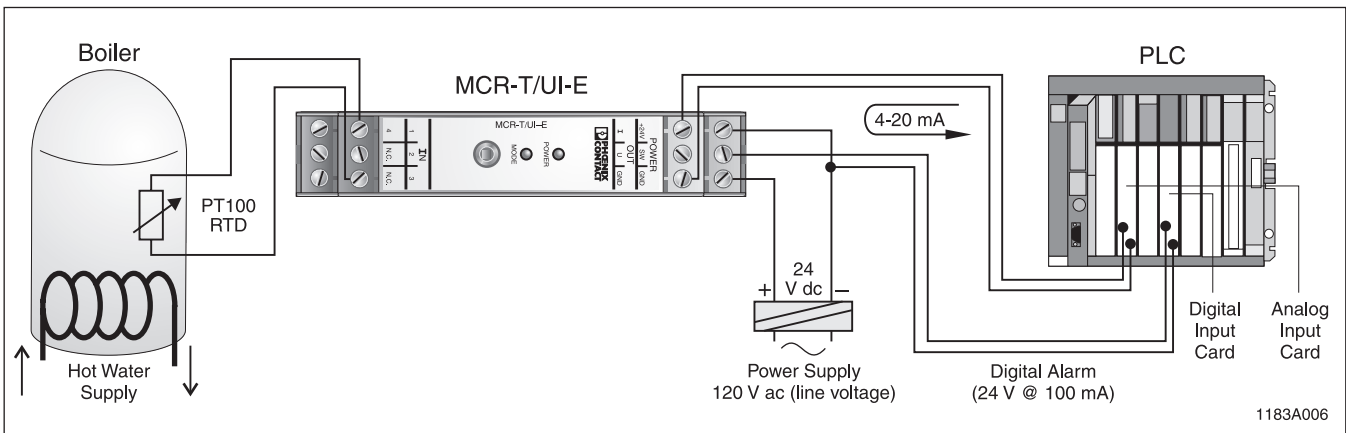


Figure 5. PC-Programmable Universal Temperature Transmitter Application/Wiring Diagram

Part Description/Numbers

Configured (per customer requirements, completed
Ordering Form required)
Configured (Non-isolated)
Non-configured
Non-configured (Non-isolated)
Configuration software and cable

Part Description	Part Number
MCR-T/UI-E	2814113
MCR-T/UI	2814090
MCR-T/UI-E-NC	2814126
MCR-T/UI-NC	2814100
MCR-T/UI Configuration Kit	5600479

Product Specifications

Table 2. Input/Output Specifications

Input Specifications	
Thermocouple Sensors	
Thermocouple Type	Temperature Range (°C)
U	-200°C to +600°C
T	-200°C to +400°C
L	-200°C to +900°C
J	-210°C to +1200°C
E	-226°C to +1000°C
K	-200°C to +1372°C
N	-200°C to +1300°C
S	-50°C to +1768°C
R	-50°C to +1768°C
B	+500°C to +1820°C
C	-18°C to +2316°C
W	-18°C to +2316°C
HK	-200°C to +800°C
RTDs (temperature range acc. to DIN IEC 751 or DIN 43 760 and SAMA RC 21-4-1966; for 2, 3 or 4-wire RTDs)	
RTD Type	Temperature Range (°C)
Platinum (DIN/SAMA)	
(10, 100, 120, 500, 1000)	-200°C to +850°C
Nickel (DIN/SAMA)	
(10, 100, 120, 500, 1000)	-60°C to +180°C
Nickel 1000	-50°C to +160°C
Copper 10	-70°C to +500°C
Copper 50	-50°C to +200°C
Copper 53	-50°C to +180°C
KTY 81-110	-55°C to +150°C
Resistor	0...8000 Ω (2 conductor)
Potentiometer (3 conductor)	≤ 8 kΩ (0...100% turn)
Voltage	-20 mV...+2400 mV
Input protection	transient surge voltage protection 30 V dc
Output Specifications	
RTD Type	Temperature Range (°C)
Output signal	4...20 mA, 0...20 mA, 0-5 V, 0-10 V, ±5 V, ±10 V
Load	Current output: ≤500 Ω Voltage output: ≥10 kΩ
Maximum output signal	Current output: 24 mA Voltage output: ±12 V
Ripple	≤20 mV pp
Line break response	-12 V...+12 V or 0 mA... 24 mA (configurable)
Over range/under range response	-12 V...+12 V or 0 mA... 24 mA (configurable)
Output protection	transient protection
Alarm output	PNP transistor output max. load @ 100 mA, switches 24 V dc

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General Specifications

Table 3. General Specifications

General Specifications	
Supply voltage	18-30 V dc
Current consumption	≤60 mA
Accuracy	≤0.1% of full scale (+6 mV or 12 μA at output)
Temperature coefficient	≤0.01%/k, typ. 0.005%/k
Isolation voltage (input/output)	1 kV, 50 Hz, 1 minute
Ambient temperature range	-20°C to +65°C (-4°F to +149°F)
Approvals	CE, UL/CUL recognition, Class 1, Div 2 (groups A, B, C and D)
Dimensions	
Width	99 mm (3.90 in.)
Height	114.5 mm (4.51 in.)
Depth	17.5 mm (.69 in.)

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Headquarters, U.S.

Phoenix Contact Inc.
P.O. Box 4100
Harrisburg, PA 17111-0100
Technical Support and Information: (800) 322-3225
Fax: (717) 948-3475
Fax-On-Demand: (800) 944-9901
Email: info@phoenixcon.com
Web Site: <http://www.phoenixcontact.com>

Headquarters, Canada

Phoenix Contact Ltd.
235 Watline Avenue
Mississauga, Ontario L4Z 1P3
Phone: (905) 890-2820
Fax: (905) 890-0180

