BA 156R/24/ae/08.03
51006707

iTEMP® PCP TMT 121
Temperature DIN rail transmitter









Operating instructions

Endress+Hauser
The Power of Know How

Safety message

Instructions and procedures in the operating instructions may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by safety pictograms and symbols. Please refer to the safety messages before performing an operation preceded by pictograms and symbols, see chapter 1.5.
Though the information provided herein is believed to be accurate, be advised that the information contained herein is NOT a guarantee of satisfactory results. Specifically, this information is neither a warranty nor guarantee, expressed or implied, regarding performance; merchantability, fitness, or other matter with respect to the products; and recommendation for the use of the product / process information in conflict with any patent. Please note that the manufacturer reserves the right to change and / or improve the product design and specifications without notice.

Warning!
Failure to follow these installation guidelines could result in death or serious injury.
– Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

– Do not remove the connection head cover in explosive atmospheres when the circuit is live.
– Configuration of the transmitter is not permitted in a hazardous area, make sure the transmitter setup is done before the transmitter will be installed in hazardous area.
– Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.
– All connection head covers must be fully engaged to meet explosion-proof requirements.

Process leaks could result in death or serious injury.

– Do not remove the thermowell while in operation.
– Install and tighten thermowells and sensors before applying pressure.

Electrical shock could cause death or serious injury.

– Use extreme caution when making contact with the leads and terminals.

Brief overview

Using the following short form instructions you can commission your system easily and swiftly:

Safety notes	Page 4
➪	
Installation	Page 7
➪	
Wiring	Page 10
➪	
Display and operating elements Preparing the communication with PC configuration software	Page 12
➪	
Instrument configuration (including a description of the unit functions) A complete description of all the functions as well as a detailed overview of the functionality can be found in this chapter.	Page 13

Table of contents

1 Safety notes

Safe and secure operation of the DIN rail transmitter can only be guaranteed if the operating instructions and all safety notes are read, understood and followed.

1.1 Designated use

- The unit is a universal, presettable temperature DIN rail transmitter for resistance thermometer (RTD), thermocouple (TC) as well as resistance and voltage sensors. The unit is constructed for mounting on a DIN rail.
- The manufacturer cannot be held responsible for damage caused by misuse of the unit.
- Separate Ex documentation is part of this operating manual, for measurement systems in hazardous areas. The installation conditions and connection values indicated in these instructions must be followed!

1.2 Installation, commissioning and operation

The unit is constructed using the most up-to-date production equipment and complies to the safety requirements of the local guidelines. The temperature transmitter is fully factory tested according to the specifications indicated on the order. However, if it is installed incorrectly or is misused, certain application dangers can occur. Installation and wiring of the unit must only be done by trained, skilled personnel who are authorized to do so by the plant operator. This skilled staff must have read and understood these instructions and must follow them to the letter. The plant operator must make sure that the measurement system has been correctly wired to the connection schematics.

Electrical temperature sensors such as RTD's and thermocouples produce low-level signals proportional to their sensed temperature. The temperature transmitter converts the low-level sensor signal to a standard 4 to 20 mA DC signal that is relatively insensitive to lead length and electrical noise. This current signal is then transmitted to the control room via two wires.

The transmitter needs to be commissioned before installation in a hazardous area. Configuration of the device in explosion area is not allowed. Make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices before connecting in an explosive atmosphere.

The transmitter electronics module is permanently sealed within the housing, resisting moisture and corrosive damage. Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

Warning!
Electrical shock could cause death or serious injury. If the sensor is installed in a high voltage environment and a fault or installation error occurs, high voltage may be present on the transmitter leads and terminals.

1.3 Operational safety

Hazardous areas
When installing the unit in a hazardous area, the national safety requirements must be met. Make sure that all personnel are trained in these areas. Strict compliance with installation instructions and ratings as stated in this documentation is mandatory.

The measuring device complies with the general safety requirements in accordance with IEC61010, the EMC requirements of IEC61326 and NAMUR recommendation NE21 and NE43.

Technical advancement
The manufacturer reserves the right to modify technical data without prior notice. Your distributor can supply you with current information and updates to these Operating Instructions.

1.4 Returns

Please follow the Return Authorization Policy at the end of these instructions. Due to its construction, the transmitter cannot be repaired. When disposing of the transmitter, please take note of the local disposal regulations.

1.5 Safety pictograms and symbols

Safe and reliable operation of this unit can only be guaranteed if the safety notes and warnings in these operating instructions are followed. The safety notes in these instructions are highlighted using the following symbols.

Note!
This icon indicates activities and actions that, if not followed correctly, could have an indirect influence on the unit operation or could lead to an unforeseen unit reaction.

Caution!
This icon indicates activities and actions that, if not followed correctly, could lead to faulty device operation or even damage to the unit.

Warning!
This icon indicates activities and actions that, if not followed correctly, could lead to personal injury, a safety risk or even total damage to the unit.


Explosion protected, type examined operating equipment!
If one of these icons is on the device's nameplate, the device can be used in hazardous areas.

Hazardous area!
This symbol identifies the hazardous area in the diagrams in these Operating Instructions.

– Devices that are used in hazardous areas or cables for such devices must have the corresponding type of protection.

Safe area (non-hazardous areas)!
This symbol identifies the non-hazardous area in the diagrams in these Operating Instructions.

– Devices in non-hazardous areas must also be certified if connection cables run through a hazardous area.

2 Identification

2.1 Unit identification

2.1.1 Legend plate

Compare the legend plates on the DIN rail transmitter with the following figures:

Fig. 1: Example: DIN rail transmitter legend plate

Fig. 2: Identification for hazardous area use (example, only on FM certified units)

CE Mark, declaration of conformity CE

The devices are designed to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with IEC61010 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures" and with the EMC requirements of IEC61326.The measuring system described in these Operating Instructions thus complies with the statutory requirements of the EC Directives. The manufacturer confirms successful testing of the device by affixing to it the CE mark.

UL recognized component to UL 3111-1 c UL us

GL German Lloyd marine approval GL

GL Type Approval for temperature measurements in hazardous locations on GL Classed Vessels, Marine and Offshore Installations.

2.2 Delivery contents

The delivery contents of the temperature DIN rail transmitter are as follows:

- Temperature DIN rail transmitter
- Operating instructions
- Control drawing for use in hazardous areas

Note!
Please take note of the DIN rail transmitter accessories (Configuration Kit) in chapter 8 "Accessories".

2.3 Registered trademarks

- iTEMP® and ReadWin® 2000
  are registered trademarks of Endress+Hauser Wetzer GmbH + Co. KG, Nesselwang, Germany

3 Installation

3.1 Installation conditions

- When installing and operating the unit, please take note of the allowable ambient temperature (see chapter 10 "Technical Data").
- When using the unit in a hazardous area, the limits indicated in the certification must be adhered to (see control drawing).

3.1.1 Dimensions

The DIN rail transmitter dimensions can be found in chapter 10 "Technical data".

3.1.2 Installation point

Installation on DIN rail according to EN 50 022-35, e.g. in control panel.

3.1.3 Installation angle

There are no limits as to the angle of installation.

3.2 Installation

3.2.1 Typical North American installation

For installation, proceed as follows:

- Attach the TMT 121 transmitter to a suitable rail or panel.
- Attach thermowell (1) to pipe or process container wall. Install and tighten the thermowell before applying process pressure.
- Attach necessary extension nipples and adapters (3) to the thermowell (1). Seal the nipple and adapter threads with silicone tape.
- Screw the sensor (2) into the thermowell (1). Install drain seals if required for harsh environments or to satisfy code requirements.
- Screw the connection head (4) to the sensor assembly.
- Attach the sensor lead wires to the connection head terminals.
- Connect sensor wires from the terminals inside the head to the TMT 121 transmitter (5).
- Install and tighten the connection head cover. Enclosure covers must be completely engaged to meet explosion-proof area requirements.

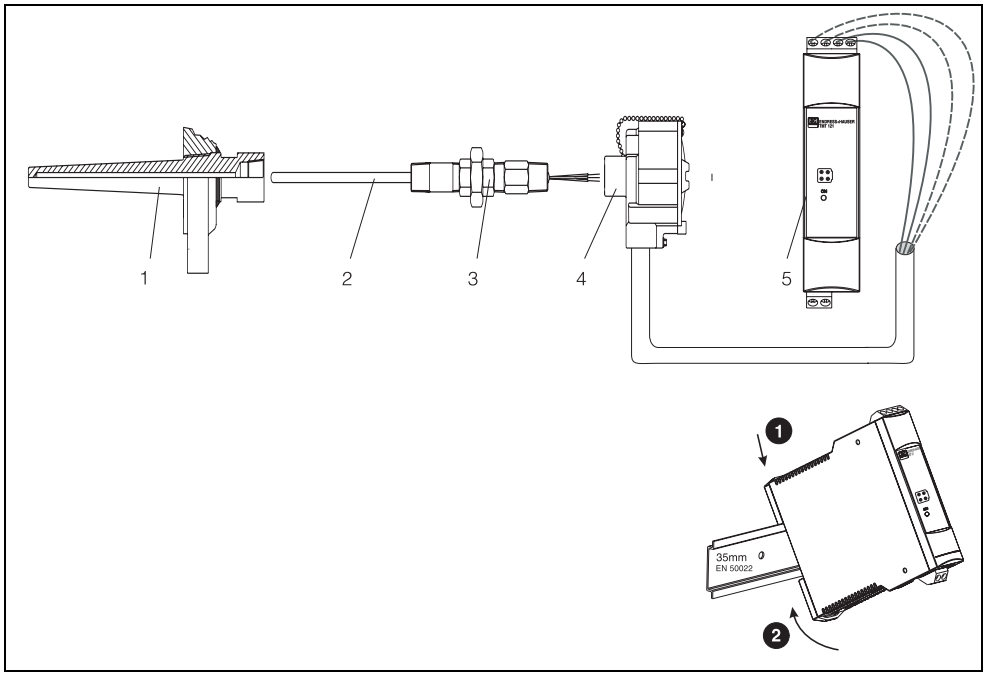


Fig. 3: Installation of DIN rail TMT 121 transmitter.

1 thermowell
2 sensor
3 extension nipples and adapters
4 connection head
5 TMT 121 transmitter

3.2.2 Typical European installation

For installation, proceed as follows:

- Attach the TMT 121 transmitter to a suitable rail or panel.
- Attach thermowell to pipe or process container wall. Install and tighten the thermowell before applying any pressure.
- Attach and connect appropriate lengths of sensor lead wire from the connection head to the sensor terminal block.
- Tighten the connection head cover. Enclosure covers must be completely engaged in order to meet explosion-proof area requirements.
- Run the sensor lead wires from the sensor assembly to the TMT 121 transmitter.
- Attach the sensor wires to the TMT 121 transmitter.

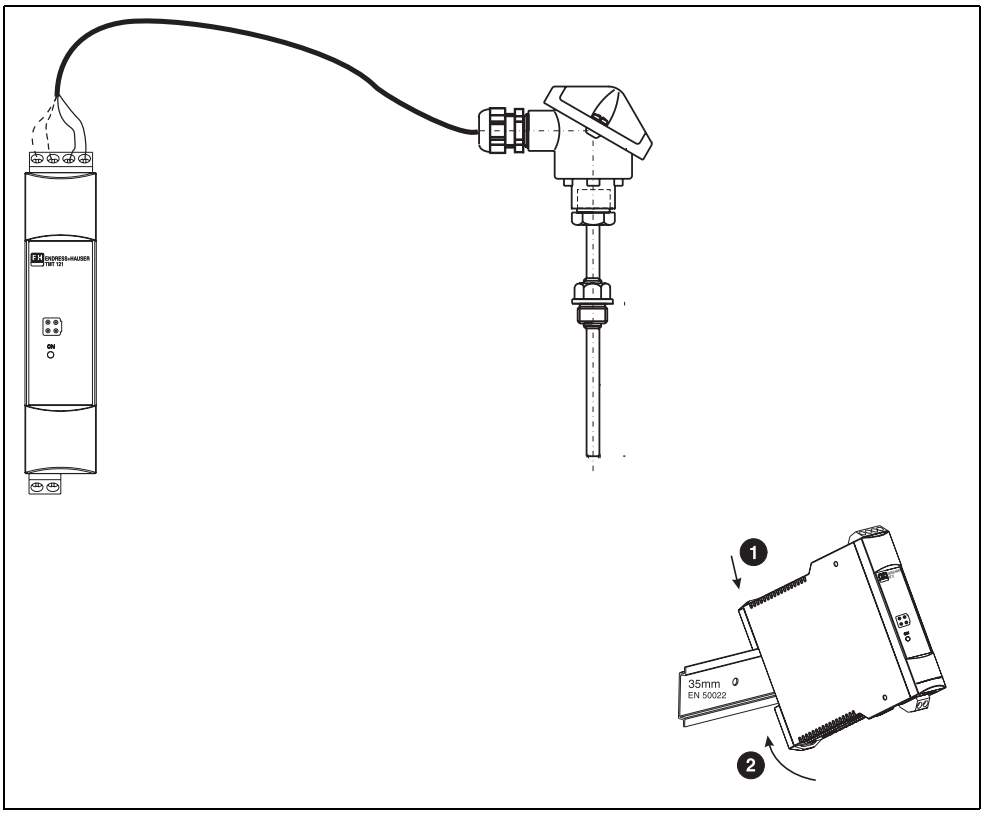


Fig. 4: Installing the TMT 121 DIN rail transmitter

4 Wiring

4.1 Overview

Terminal layout

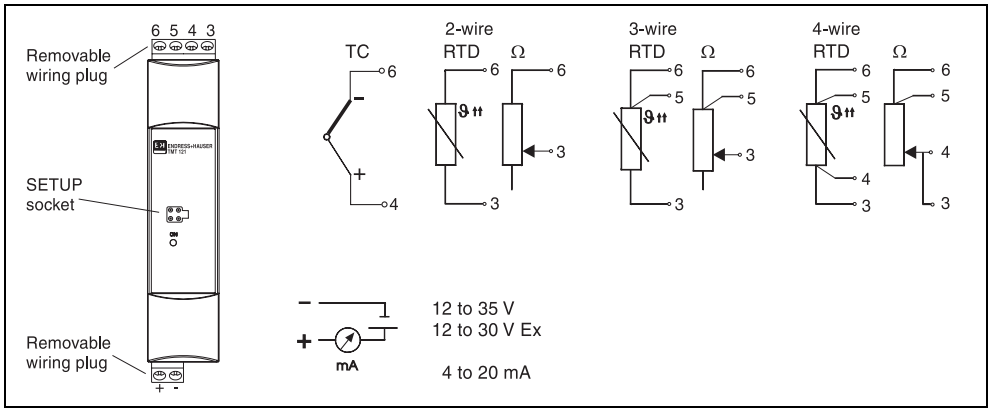


Fig. 5: DIN rail transmitter wiring

4.2 Measurement unit connection

Caution!

- Switch off power supply before opening the housing cover. Do not install or connect the unit to power supply. If this is not followed parts of the electronic circuit will be damaged.
- If the device has not been grounded as a result of the housing being installed, we recommend grounding it via one of the ground screws.

- **Sensors:**
  Connect the sensor cables to the respective DIN rail transmitter terminals (Terminals 3 to 6) by following the wiring diagram .
- **Output signal and power supply:**
  Connect the cable wires from the power supply to terminal 1 and 2 according to the wiring diagram. For convenient installation, the connection is designed as a removable plug, so the connection can be made on the terminals, then plug in the connection socket to the transmitter housing.

Note!
The screws on the terminals must be screwed in tightly.

- **PC configuration (SETUP socket):**
  Connect the SETUP connection cable (see Fig. 5).

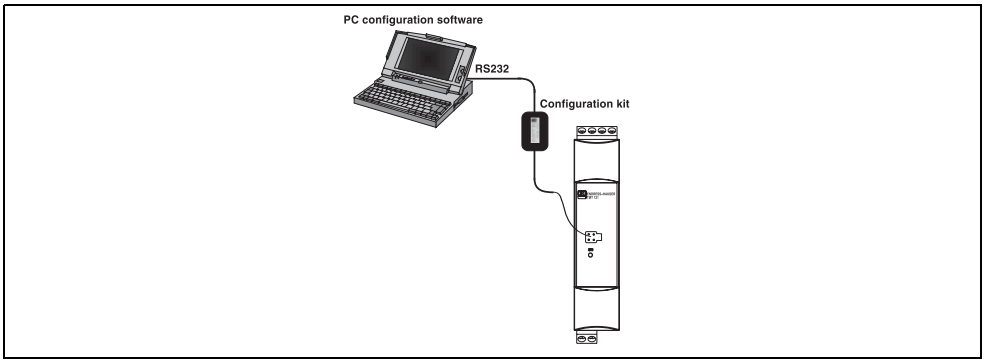


Fig. 6: Connection to PC for configuration

During configuration the DIN rail transmitter can be connected to a power source, either a 9 V battery or a power supply unit (see chapter 5.1 'Communication')

Note!
The screws on the terminals must be screwed in tightly. DIN rail transmitter configuration during measurement operation is possible. There is no need to disconnect cables!

4.3 Ground the Transmitter

The transmitter will operate with the current signal loop either floating or grounded. However, the extra noise in floating systems affects many types of readout devices. If the signal appears noisy or erratic, grounding the current signal loop at a single point may solve the problem. The best place to ground the loop is at the negative terminal of the power supply. Do not ground the current signal loop at more than one point. The transmitter is galvanically isolated to 3.75 kV AC (from the sensor input to the output), so the input circuit may also be grounded at any single point. When using a grounded thermocouple, the grounded junction serves as this point.

5 Operation

5.1 Communication

The DIN rail transmitter must be set up using a PC and configuration set. The following points must be taken into account if trouble-free setup is to be achieved:

- Configuration software installation
  More details and download see:
  www.readwin2000.com
- Connect the DIN rail transmitter to the PC using the connection cable from the configuration set (TMT121A-VM).

5.1.1 Configuration software installation (Readwin® 2000)

System conditions	– IBM PC or compatible computer (min. Pentium 166 MHz) – Windows 95/98/ME/NT4.0/2000/XP – 64 MB RAM – Mouse – CD-ROM drive – Screen resolution 800 x 600 Pixel – free serial interface
Recommended minimum configuration	– Pentium 400 MHz – 128 MB main RAM – 120 MB free hard drive memory – Screen resolution 1024 x 768 Pixel
Installation start	Start Windows®: 1. Place installations-CD in the respective drive 2. Generally, the 'Autorun'-file starts. If not, start "Setup.exe "and follow the installation instructions 3. If required the help/operating manual can be printed out once the software has been successfully installed.

5.1.2 Connecting the DIN rail transmitter to the PC using the configuration kit connection cable

1. Connect the SETUP connector of the interface connecting cable to the SETUP plug on front of the DIN rail transmitter (see 'Fig. 6' in Chapter 4.2).
2. Connect the RS232C connector to a free serial interface socket on the PC. In order to achieve optimum connection, tighten the RS232C connector screws to the PC.
3. If the PC does not have a RS232 serial interface, use a USB (UNIVERSAL SERIAL BUS) converter. Full compliance with the USB specifications Version 1.0.11.1 and USB CDC Version 1.1 are required to support the RS232 serial interface.

6 Commissioning

6.1 Installation and function check

Installation check
Monitor all connections making sure they are tight. In order to guarantee fault-free operation, the terminal screws must be screwed tightly onto the connection cables.

Function check
Measuring the analog 4 to 20 mA output signal or following failure signals:

Measurement range undercut	linear fall to 3.8 mA
Measurement range excess	linear rise to 20.5 mA
Sensor break; sensor short circuit[1]	≤ 3.6 mA or ≥ 21.0 mA

1) not for thermocouples

6.2 Switch on the device

Once the power supply has been connected, the DIN rail transmitter is operational.

6.3 Configuration

6.3.1 Setting up using the PC configuration software

The operating and readout software is a universally applicable service and configuration software. The operating software offers the user the following possibilities:

- Setup device functions
- Measured value visualization
- Device parameter data storage
- Measuring point documentation

The DIN rail transmitter left the factory with a default parameter configuration. If no customer specific configuration was specified on the order then the default parameter configuration is constructed as follows:

Sensor	Pt100 (RTD)
Connection mode	3-wire
Measuring range and units	0 to 100 °C

Note!
If a change has been made to the measurement point, the DIN rail transmitter can be re-configured. In order to re-configure the parameters, follow these instructions:
- Install the configuration software and make connection to the PC (see Chap. 5, 'Operation').
- For detailed operating instructions for the PC configuration software please read the online documentation (**BA137R/09/ae**) contained in the PC operation and readout software (see folder '**Doc**').

This software can be downloaded free of charge from the Internet at the following address:
www.readwin2000.com

⚠ Warning!
Explosions could result in death or serious injury. Configuration of the transmitter is not permitted in a hazardous area!

6.3.2 Description of device functions

All parameters that can be read out and set up for the configuration of the temperature transmitter are listed and described in the following table. Also the menu structure in the PC configuration software is shown in the following table.

Configurable parameters (Default settings in bold)				
Standard settings				
Sensor type	**Sensor type**	**Range start value**	**Range end value**	**min. range**
	Pt100	-328 °F (-200 °C)	1562 °F (850 °C)	18 °F (10 °C)
	Pt500	-328 °F (-200 °C)	482 °F (250 °C)	18 °F (10 °C)
	Pt1000	-328 °F (-200 °C)	482 °F (250 °C)	18 °F (10 °C)
	Ni100	-76 °F (-60 °C)	356 °F (180 °C)	18 °F (10 °C)
	Ni500	-76 °F (-60 °C)	302 °F (150 °C)	18 °F (10 °C)
	Ni1000	-76 °F (-60 °C)	302 °F (150 °C)	18 °F (10 °C)
	TC Typ B	32 °F (0 °C)	3308 °F (1820 °C)	900 °F (500 °C)
	TC Typ C	32 °F (0 °C)	4208 °F (2320 °C)	900 °F (500 °C)
	TC Typ D	32 °F (0 °C)	4523 °F (2495 °C)	900 °F (500 °C)
	TC Typ E	-328 °F (-200 °C)	1679 °F (915 °C)	90 °F (50 °C)
	TC Typ J	-328 °F (-200 °C)	2192 °F (1200 °C)	90 °F (50 °C)
	TC Typ K	-328 °F (-200 °C)	2501 °F (1372 °C)	90 °F (50 °C)
	TC Typ L	-328 °F (-200 °C)	1652 °F (900 °C)	90 °F (50 °C)
	TC Typ N	-454 °F (-270 °C)	2372 °F (1300 °C)	90 °F (50 °C)
	TC Typ R	32 °F (0 °C)	3214 °F (1768 °C)	900 °F (500 °C)
	TC Typ S	32 °F (0 °C)	3214 °F (1768 °C)	90 °F (50 °C)
	TC Typ T	-328 °F (-200 °C)	752 °F (400 °C)	90 °F (50 °C)
	TC Typ U	-328 °F (-200 °C)	1112 °F (600 °C)	90 °F (50 °C)
	10 to 400 Ω	10 Ω	400 Ω	10 Ω
	10 to 2000 Ω	10 Ω	2000 Ω	100 Ω
	-10 to 100 mV	-10 mV	100 mV	5 mV
	Polynom RTD	20 °F (°C)	2000 °F (°C)	18 °F (10 °C)
Connection mode	Input of RTD connection mode. Input: • 2-wire • **3-wire** • 4-wire ✎ Note! Function is only active on selection of resistance thermometers (RTD).			
Unit	Input for unit Input: **° C**, °F, K, mV or Ω			
Measurement range start value	Input of 4 mA value. Input: Limitation values see **'Sensor type'** **0 °C**			
Measurement range end value	Input of 20 mA value. Input: Limitation values see **'Sensor type'** **100 °C**			
Coefficient X0 to X4	On sensor type polynom RTD, see description **'Customer specific linearization'**			

Configurable parameters (Default settings in bold)	
Expanded settings	
Cold junction	Selection of the internal (Pt100) or an external comparison measurement point. Input: • **internal** • external ✎ Note! Function is only active on selection of a thermocouple (TC), see **'Sensor type'**
External temperature	Input of the external comparison measurement point value. Input: -40.00 to 185.00 °F / -40.00 to 85.00 °C (°C, °F, K) **0.00 °C** ✎ Note! Function is only active when "external" has been selected in the device function **'Cold junction'**.
Cable resistance	Input of cable resistance compensation on a 2-wire RTD connection. Input: **0.00** to 20.00 Ω ✎ Note! Function is only active when a 2-wire RTD connection has been selected, see **'Sensor type'**.
Fault condition	Input of the output signal on sensor rupture or short circuit. Input: • **max (≥ 21.0 mA)** • min (≤ 3.6 mA)
Output	Input of the standard (4 to 20 mA) or inverse (20 to 4 mA) current output signal. Input: • **4 to 20 mA** • 20 to 4 mA
Filter	Selection of the digital filter 1. order (filter time constant). Input: **0** to 8 s
Offset	Input of the zero point correction (offset). Input: -10.00 to 10.00 °C (-18.00 to 18.00 °F) **0.00 °C**
Measuring point ident	Measuring point description Input: 8 characters
Service functions	
Output simulation	Activate simulation mode. Input: • **OFF** • ON Input of the simulation value (current). Input: 3.8 to 20.5 mA

Customer-specific linearization

Customer-specific linearization and sensor matching are activated after the **POLYNOM RTD** sensor type is selected. Please find detailed information about linearization in the PC configuration software.

7 Maintenance

The temperature DIN rail transmitter has no moving parts and requires minimal scheduled maintenance.

Sensor Checkout
To determine whether the sensor is at fault, replace it with another sensor or connect a test sensor locally at the transmitter to test remote sensor wiring. Select any standard, off-the-shelf sensor for use with a temperature DIN rail transmitter, or consult the factory for a replacement special sensor or transmitter combination.

8 Accessories

Configuration set for PC SETUP (SETUP program and PC serial interface cable (TTL/RS 232C):
→ Order No.: TMT121A-VM.

ReadWin® 2000

PC SETUP program can be downloaded free of charge from the internet from the following address:
www.readwin2000.com

Please contact your supplier when ordering!

9 Trouble-shooting

9.1 Trouble-shooting instructions

If faults occur after commissioning or during measurement, always start any fault finding sequence using the following checklists. The user is guided to the possible fault cause and its removal by question and answer.

9.2 Application errors without messages

9.2.1 General application errors

Error	Cause	Action/cure
No communication	2-wire connection incorrect	Re-connect correctly (see connection diagram)
	No power supply on the 2-wire connection	Check the current loop
	Power supply too low (< 8 V)	Check power supply
	Defective interface cable	Check interface cable
	Defective interface	Check PC interface
	Defective device	Replace device

9.2.2 Application errors for RTD connection

Pt100/Pt500/Pt1000/Ni100

Error	Cause	Action/cure
Fault current (≤ 3.6 mA or ≥ 21 mA)	Defective sensor	Check sensor
	Incorrect connection of RTD	Connect cables correctly to terminal schematic
	Incorrect connection of the 2-wire cable	Connect cables correctly to terminal schematic (polarity)
	No power supply on the 2-wire connection	Check current loop; the supply should be > 12 V
	Incorrect transmitter programming (number of wires)	Change device function 'Connection mode' (see chap. 'Commissioning')
	Programming	Thermocouple setup (see chap. 'Commissioning'). Change to RTD
	Defective device	Replace device

Error	Cause	Action/cure
Measured value incorrect/ inaccurate	Faulty sensor installation	Install sensor correctly
	Heat conducted by sensor	Take note of sensor installation point
	Transmitter setup faulty (number of wires)	Change device function 'Connection mode'
	Transmitter setup faulty (scale)	Change scale
	Incorrect RTD setup	Change device function 'Sensor type'
	Sensor connection (2-wire)	Check sensor connection
	Sensor cable resistance (2-wire) not compensated	Compensate cable resistance
	Offset incorrectly set	Check offset

9.2.3 Application errors for TC connection

Error	Cause	Action/cure
Fault current (≤ 3.6 mA or ≥ 21 mA)	Incorrect connection of sensor	Connect cables correctly to terminal schematic (polarity)
	Defective sensor	Check sensor
	Setup	Incorrect sensor type setup under device function 'Sensor type'; setup correct thermocouple
	Incorrect 2-wire connection (current loop)	Connect the cables correctly (see connection diagram)
	No power supply on the 2-wire connection	Check current loop; the supply should be > 12 V
	Defective device	Replace device

Error	Cause	Action/cure
Measured value incorrect/ inaccurate	Faulty sensor installation	Install sensor correctly
	Heat conducted by sensor	Take note of sensor installation point
	Transmitter setup faulty (scale)	Change scale
	Incorrect TC setup	Change device function 'Sensor type'
	Incorrect cold junction setup	See chap. 'Commissioning'
	Incorrect offset setup	Check offset
	Fault due to the thermo wire welded to the well (interference voltages incurred)	Please use a sensor in which the thermo wire is not welded

9.3 Returns

Please follow the Return Authorization Policy at the end of these instructions.

9.4 Disposal

Due to its construction, the DIN rail transmitter cannot be repaired. When disposing of the DIN rail transmitter please take note of the local disposal regulations.

9.5 Software history

1.00.00 / 10.2001	Original software Compatible with: • Readwin® 2000 1.2.2 and higher	
1.01.00 / 04.2003	Original software Compatible with: • Readwin® 2000 1.12.0 and higher New: By measuring °F, values are stored with higher precision.	

10 Technical Data

10.1 Function and system design

Measuring principle	Electronic monitoring and conversion of input signals in industrial temperature measurement.
Measuring system	The temperature DIN rail transmitter is a two wire transmitter with an analog output. It has measurement input for resistance thermometers (RTD) in 2-, 3- or 4-wire connection, thermocouples and voltage transmitters. Setting up of the unit is done using the configuration set for PC.

10.2 Input

Measured variable	Temperature (temperature linear transmission behavior), resistance and voltage
Measuring range	The transmitter monitors different measuring ranges depending on the sensor connection and input signals.

Type of input

Input	Designation	Measuring range limits	Min. span
Resistance thermometer (RTD) to IEC 751 (α = 0.00385) to DIN 43760 (α = 0.006180)	Pt100 Pt500 Pt1000 Ni100 Ni500 Ni1000	-328 to 1562 °F (-200 to 850 °C) -328 to 482 °F (-200 to 250 °C) -328 to 482 °F (-200 to 250 °C) -76 to 356 °F (-60 to 180 °C) -76 to 302 °F (-60 to 150 °C) -76 to 302 °F (-60 to 150 °C)	18 °F (10 °C) 18 °F (10 °C) 18 °F (10 °C) 18 °F (10 °C) 18 °F (10 °C) 18 °F (10 °C)
	• Connection type: 2-, 3- or 4-wire connection • Software compensation of cable resistance possible in the 2-wire system (0 to 20 Ω) • Sensor cable resistance max. 11 Ω per cable in the 3- and 4-wire system • Sensor current: ≤ 0.6 mA		
Resistance transmitter	Resistance Ω	10 to 400 Ω 10 to 2000 Ω	10 Ω 100 Ω

Input	Designation	Measuring range limits	Min. span
Thermocouples (TC) to NIST Monograph 175, IEC 584	Type B (PtRh30-PtRh6)[1] Type E (NiCr-CuNi) Type J (Fe-CuNi) Type K (NiCr-Ni) Type N (NiCrSi-NiSi) Type R (PtRh13-Pt) Type S (PtRh10-Pt) Type T (Cu-CuNi)	32 to 3308 °F (0 to +1820 °C) -328 to 1679 °F (-200 to +915 °C) -328 to 2192 °F (-200 to +1200 °C) -328 to 2501 °F (-200 to +1372 °C) -454 to 2372 °F (-270 to +1300 °C) 32 to 3214 °F (0 to +1768 °C) 32 to 3214 °F (0 to +1768 °C) -328 to 752 °F (-200 to +400 °C)	900 °F (500 °C) 90 °F (50 °C) 90 °F (50 °C) 90 °F (50 °C) 90 °F (50 °C) 900 °F (500 °C) 900 °F (500 °C) 90 °F (50 °C)
to ASTM E988	Type C (W5Re-W26Re) Type D (W3Re-W25Re)	32 to 4208 °F (0 to +2320 °C) 32 to 4523 °F (0 to +2495 °C)	900 °F (500 °C) 900 °F (500 °C)
to DIN 43710	Type L (Fe-CuNi) Type U (Cu-CuNi)	-328 to 1652 °F (-200 to +900 °C) -328 to 1112 °F (-200 to +600 °C)	90 °F (50 °C) 90 °F (50 °C)
	• Internal cold junction (Pt100) or external, 32 to 176 °F (0 to 80 °C) • Accuracy of cold junction: ± 1.8 °F (1 °C) • Sensor current: 30 nA		
Voltage transmitter (mV)	Millivolt transmitter (mV)	-10 to 100 mV	5 mV

1) High measuring error increase for temperature lower than 572 °F (300 °C)

10.3 Output

Output signal

Analog 4 to 20 mA, 20 to 4 mA

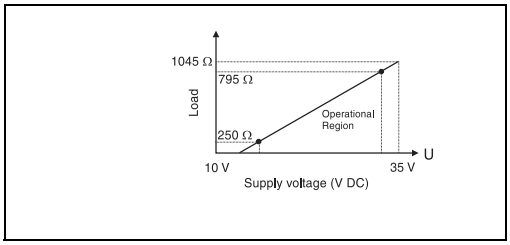
Breakdown information

Breakdown information to NAMUR NE 43
Breakdown information is created when the measuring information is invalid or not present anymore and gives a complete listing of all errors occuring in the measuring system.

		Signal (mA)
Under ranging	Standard	3.8
Over ranging	Standard	20.5
Sensor break; sensor short circuit low	To NAMUR NE 43	≤ 3.6
Sensor break; sensor short circuit high	To NAMUR NE 43	≥ 21.0

Source impedance

max. ($V_{Power\ supply}$ - 12V) / 0.022 A (current output)
e.g. (24 V - 12V)/0.022 A = 545.5Ω



Transmission behavior

Temperature linear, resistance linear, voltage linear

Filter	1st order digital filter: 0 to 8 s
Galvanic isolation	U = 2 kV AC (input/output)
Min. current consumption	≤ 3.5 mA
Current limit	≤ 23 mA
Switch on delay	4 s (during power up I_a = 3.8 mA)
Response time	1 s

10.4 Power supply

Electrical connection	See 'Terminal layout' in Chapter 'Wiring'.
Supply voltage	U_b = 12 to 35 V, polarity protected (for hazardous location see control drawing)
Residual ripple	Allowable ripple U_{ss} ≤ 3 V at U_b ≥ 15 V, $f_{max.}$ = 1 kHz

10.5 Performance characteristics

Reference operating conditions: Calibration temperature: 73.4 °F ± 9 °F (+23 °C ± 5 °C)

Maximum measured error

	Type	Measurement accuracy[1]
Resistance thermometer RTD	Pt100, Ni100 Pt500, Ni500 Pt1000, Ni1000	0.36 °F (0.2 °C) or 0.08% 0.9 °F (0.5 °C) or 0.20% 0.54 °F (0.3 °C) or 0.12%
Thermocouple TC	K, J, T, E, L, U N, C, D S, B, R	typ. 0.9 °F (0.5 °C) or 0.08% typ. 1.8 °F (1.0 °C) or 0.08% typ. 3.6 °F (2.0 °C) or 0.08%

	Measurement range	Measurement accuracy[1]
Resistance transmitter (Ω)	10 to 400 Ω 10 to 2000 Ω	± 0.1 Ω or 0.08% ± 1.5 Ω or 0.12%
Voltage transmitters (mV)	-10 to 100 mV	± 20 µV or 0.08%

1) % is related to the adjusted measurement range. The value to be applied is the greater.

Influence of supply voltage
- ≤ ±0.01%/V deviation from 24 V
  Values refer to the full scale value.

Influence of ambient temperature (Temperature drift)	• Resistance thermometer (RTD): T_d= ±(8.3 ppm/°F * max. meas. range + 27.8 ppm/°F * preset meas. range) * $\Delta\,\vartheta$ • Resistance thermometer Pt100: T_d= ±(8.3 ppm/°F * (range end value + 200) + 27.8 ppm/°F * preset meas. range) * $\Delta\,\vartheta$ • Thermocouple (TC): T_d= ±(27.8 ppm/°F * max. meas. range + 27.8 ppm/°F * preset meas. range) * $\Delta\,\vartheta$ $\Delta\,\vartheta$ = Deviation of the ambient temperature according to the reference condition (73.4 °F ± 9 °F).
Influence of load	• ± 0.02%/100 Ω Values refer to the full scale value
Long-term stability	• ≤ 0.18 °F/year (0.1 °C/year) or ≤ 0.05%/year Values under reference operating conditions. % refer to the set span. The highest value is valid.
Influence of cold junction	Pt100 IEC 751 Cl. B (internal cold junction for thermocouples TC)

10.6 Installation conditions

Installation conditions	• Installation angle: no limit • Installation on DIN rail, e.g. in control panel

10.7 Environmental conditions

Ambient temperature limits	-40 to 185 °F (-40 to +85 °C) for Ex-area, see Ex-certification or control drawing
Storage temperature	-40 to 212 °F (-40 to +100 °C)
Climate class	as per IEC 60654-1, class C
Condensation	allowed
Degree of protection	NEMA 1 (IP 20)
Shock and vibration resistance	4g / 2 to 150 Hz as per IEC 60 068-2-6

Electromagnetic compatibility (EMC)

CE Electromagnetic Compatibility Compliance
The device meets all requirements listed under IEC 61326 Amendment 1, 1998 and NAMUR NE 21

This recommendation is a uniform and practical way of determining whether the devices used in laboratory and process control are immune to interference with an objective to increase its functional safety.

Discharge of static electricity	IEC 61000-4-2	6 kV cont., 8 kV air	
Electromagnetic fields	IEC 61000-4-3	80 to 1000 Hz	10 V/m
Burst (signal)	IEC 61000-4-4	1 kV; 2 kV (B)[1]	
Transient voltage	IEC 61000-4-5	1 kV unsym. / 0.5 kV sym.	
HF coupling	IEC 61000-4-6	0.15 to 80 MHz	10 V

1) self recovery

10.8 Mechanical construction

Design, dimensions

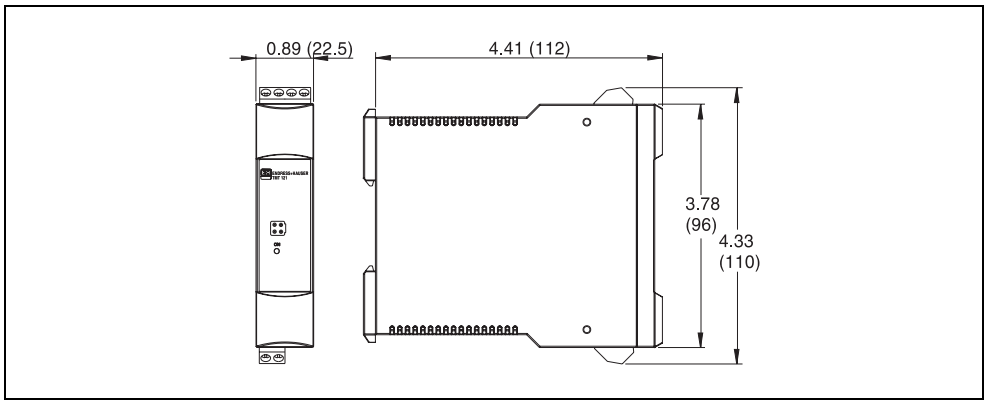


Fig. 7: Dimensions of the DIN rail transmitter in inches (mm)

Weight

approx. 3.2 oz (90 g)

Material

- Housing:
  Plastic PC / ABS, UL 94V0

Terminals

Cable up to max. 16 AWG (secure screws)

10.9 Human interface

Display elements

No display elements are present directly on the temperature transmitter.
The measured value display can be called up using the PC configuration software ReadWin® 2000.

Operating elements

No operating elements are present directly on the transmitter to prevent from manipulation. The device parameters of the DIN rail transmitter are configured using the PC operating software ReadWin® 2000.

⚠ Warning!
Explosions could result in death or serious injury. Configuration of the transmitter is not permitted in a hazardous area!

Remote operation

Configuration set
Configuration kit TMT 121A-VM (Interface TTL -/- RS232), configurable using PC program (Readwin® 2000). Starting from version R2.00.00 of TMT 121A-FM, the temperature transmitter is configurable without voltage supply.

Configurable parameters
Sensor type and connection type, engineering units (°C/°F), measurement range, internal/external cold junction, compensation of wire resistance with 2-wire connection, failure mode, output signal (4 to 20/20 to 4 mA), digital filter (damping), offset, measurement point identification (8 characters), output simulation

10.10 Certificates and approvals

CE-Mark

The measurement system fulfils the requirements demanded by the EU regulations. Endress+Hauser acknowledges successful unit testing by adding the CE mark.

Hazardous area approvals

- FM IS, Class I, Div. 1+2, Group A, B, C, D / FM NI, Class I, Div. 2, Group A, B, C, D
- CSA IS, Class I, Div. 1+2, Group A, B, C, D
- ATEX II1G EEx ia IIC T4/T5/T6
- ATEX II3G EEx nA IIC T4/T5/T6
- ATEX II3D in compliance with EN 50281-1

UL

Recognized component to UL 3111-1

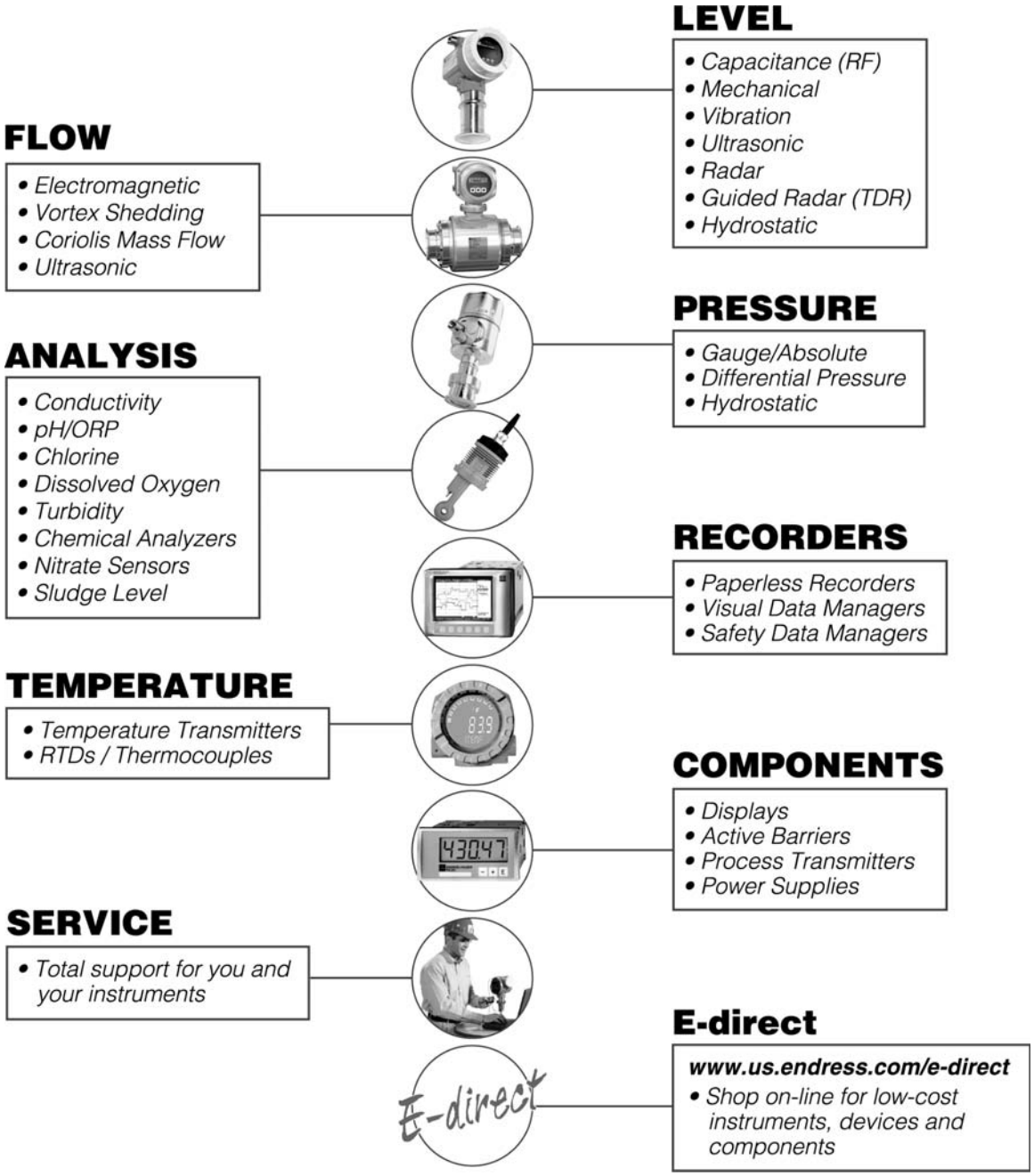
GL

Ship building approval (Germanischer Lloyd)

Other standards and guidelines

- IEC 60529:
  Degrees of protection by housing (IP-Code)
- IEC 61010:
  Safety requirements for electrical measurement, control and laboratory instrumentation
- IEC 61326:
  Electromagnetic compatibility (EMC requirements)
- NAMUR
  Standardization association for measurement and control in chemical and pharmaceutical industries. (www.namur.de)
- NEMA
  Standardization association for the electrical industry

Index



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Visit us on our web site, www.us.endress.com

Endress+Hauser, Inc.
2350 Endress Place
Greenwood, IN 46143
Phone: (317) 535-7138
888-ENDRESS
FAX: (317) 535-8498

Endress+Hauser
Canada Ltd.
1440 Graham's Lane
Unit 1, Burlington
ON, L7S 1W3
Phone: (905) 681-9292
800-668-3199
FAX: (905) 681-9444

Endress+Hauser
Paseo del Pedregal No. 610
Col, Jardines del Pedregal
01900, Mexico D. F.
Mexico
Phone: (525) 568-2405
FAX: (525) 568-7459

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