



# TxRail-USB

## TEMPERATURE TRANSMITTER - OPERATING MANUAL – V1.0x B

### INTRODUCTION

**TxRail-USB** is an USB configurable DIN rail mount temperature transmitter. It allows selection and configuration of input type, measurement range, output type and calibration. Its output can be set to either loop powered 4-20 mA or 0-10 Vdc. Highly accurate and user-friendly, the **TxRail-USB** performs well from simple to sophisticated measurement applications.

The output current is linearized according to the selected input sensor and adjusted to the configured range.

### SPECIFICATIONS

**Sensor input:** User defined. The supported sensors are listed in **Table 1**, along with their maximum ranges.

**Thermocouples:** Types J, K, R, S, T, N, E and B, according to IEC 60584 (ITS-90). Impedance >> 1 M $\Omega$

**Pt100:** Type 3-wire, Excitation 0.8 mA,  $\alpha = 0.00385$ , according IEC 60751 (ITS-90).

For 2-wire sensors, tie terminals 3 and 4 together.

**Pt1000:** Type 3-wire, Excitation 0.8 mA,  $\alpha = 0.00385$ , according IEC 60751 (ITS-90).

For 2-wire sensors, tie terminals 3 and 4 together.

**NTC R<sub>25°C</sub>:** 10 k $\Omega$   $\pm$ 1 %, B<sub>25/85</sub> = 3435

**Voltage:** 0 to 50 mVdc. Impedance >> 1 M $\Omega$

Sensor Type	Maximum Measurement Range	Minimum Measurement Range
Voltage	0 to 50 mV	5 mV
Thermocouple K	-150 to 1370 °C	100 °C
Thermocouple J	-100 to 760 °C	100 °C
Thermocouple R	-50 to 1760 °C	400 °C
Thermocouple S	-50 to 1760 °C	400 °C
Thermocouple T	-160 to 400 °C	100 °C
Thermocouple N	-270 to 1300 °C	100 °C
Thermocouple E	-90 to 720 °C	100 °C
Thermocouple B	500 to 1820 °C	400 °C
Pt100	-200 to 650 °C	40 °C
Pt1000	-200 to 650 °C	40 °C
NTC	-30 to 120°C	40 °C

**Table 1** – Sensors accepted by the transmitter

**Switch-on delay:** < 2.5 s. The accuracy is only guaranteed after 15 min.

**Terms of reference:** ambient: 25 ° C; voltage: 24 Vdc, load: 250  $\Omega$ ; settling time: 10 minutes

**Temperature Effect:** <  $\pm$ 0.16 % / 25 °C

**Response time:** typical 1.6 s.

**Maximum voltage allowed at input terminals no sensor:** 3 V.

**RTD current:** 800  $\mu$ A.

**RTD cable resistance effect:** 0.005 °C /  $\Omega$

**Maximum allowable cable resistance for RTD:** 25  $\Omega$ .

Sensor Type	Typical Accuracy	Maximum Accuracy
Pt100 / Pt1000 (-150 to 400°C)	0.10%	0.12%
Pt100 / Pt1000 (-200 to 650°C)	0.13%	0.19%
mV, K, J, T, E, N, R, S, B	0.1 % (*)	0.15 % (*)
NTC	0.3 °C	0.7 °C

**Table 2** – Calibration error, percentage of the full measurement range.

(\*) **Add cold junction compensation:**  $\leq \pm$  1 °C.

**Power supply influence:** 0.006 % / V typical (percentage of the full measure range).

**Output (4-20 mA):** 4-20 mA or 20-4 mA current, 2-wired; linearized according to the selected sensor.

**Output Resolution (4-20 mA):** 2  $\mu$ A.

**Output (0-10 Vdc):** 0-10 Vdc or 10-0 Vdc voltage, linear with respect to the measured temperature for the selected sensor.

**Output Resolution (0-10 Vdc):** 0.0025 V (12 bits)

**Power supply:** 10 to 35 Vdc (output 4-20 mA) and 12 to 35 Vdc (output 0-10 Vdc).

**Maximum load (RL):** RL (máx.) = (Vdc – 10) / 0,02 [ $\Omega$ ]

Where: Vdc= Power supply voltage (10-35 Vdc)

**Operating Temperature:** -40 to 85 °C

**Humidity:** 0 to 90 % RH

**Electromagnetic Compatibility:** EN 61326-1:2006

**No electrical isolation between input and output.**

**Internal protection against polarity inversion.**

**Cold junction compensation for thermocouples.**

**Connection Wire Cross Section:** 0.14 a 1.5 mm<sup>2</sup>

**Screw Tightening:** 0.8 Nm.

**Housing:** ABS UL94-HB.

### CONFIGURATION

A **TxRail-USB** Setup Kit consisting of the Txconfig II software and USB cable can be purchased from the manufacturer or any authorized distributor. The Txconfig II software is continuously updated and new versions can be downloaded at no charge from the manufacturer's website. To install, execute the **TxConfigIISetup.exe** file and follow the instructions.

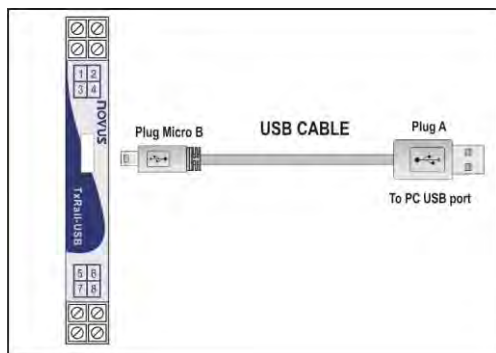


Fig. 1 – USB cable connection

During the setup, the transmitter is powered by the USB, not requiring an external power supply.

The transmitter setup can also be made by connecting it to the loop, using the *loop* power supply. There is no electrical insulation between the transmitter and the communication port (interface), therefore it is not recommended to configure it with the sensor inlet connected to the process. See Fig. 2.

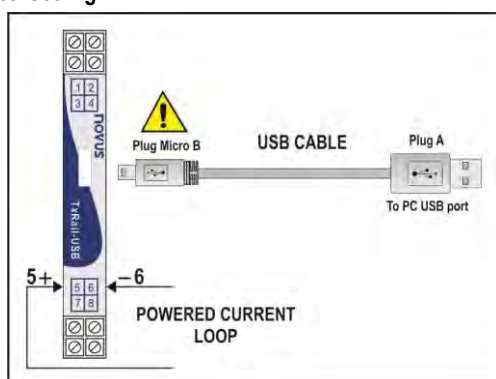
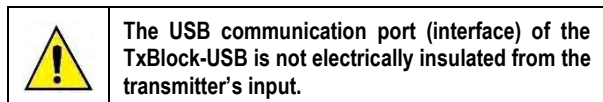


Fig. 2 – USB cable connections – Loop powered

After these connections, the user must run the *TxConfig II* software and, if necessary, consult the *Help* topic to help using the software.



#### SOFTWARE CONFIGURATION:

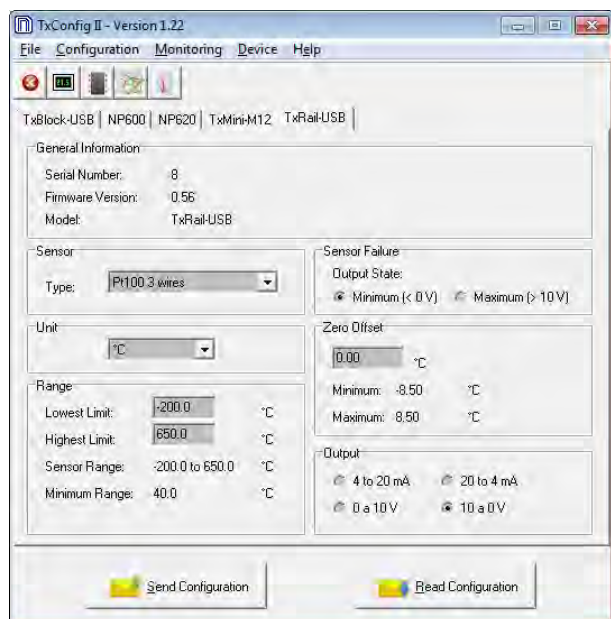


Fig. 3 – TxConfig II software main screen

The fields in the screen mean:

- 1. General Information:** This field shows information that identifying the transmitter. This information should be sent to the manufacturer in an eventual request for technical assistance.
- 2. Sensor:** Select the type of sensor to be used. See **Table 1**.
- 3. Measuring Range:** Sets de measurement range of the transmitter.

**Lower Range Limit:** Equivalent temperature for a current of 4 mA.

**Upper Range Limit:** Equivalent temperature for a current of 20 mA.

#### Sensor Range

The values chosen cannot exceed the **range of sensor** shown in this field. See **Table 1** of this manual.

#### Minimum Range

Do not set a lower band (span) that the **Minimum Range** indicated below in this same field. See **Table 1** of this manual.

- 4. Sensor Failure:** It establishes the output behavior, when the transmitter indicates a failure:

**Minimum:** output current goes to < 3.8 mA (down-scale), typically used for refrigeration.

**Maximum:** output current goes to > 20.5 mA (up-scale), typically used for heating.

- 5. Zero Correction:** It corrects small deviations presented in the transmitter output, for example, when the sensor is replaced.
- 6. Send Configuration:** It applies the new setup. Once sent, the setup will be immediately adopted by the transmitter.
- 7. Read Configuration:** Reads the current setup in the transmitter connected. The screen now presents the current setup that may be changed by the user.

#### FACTORY SETTING:

- Sensor: Pt100 3-wire, range 0 to 100 °C
- Sensor failure: upscale (maximum).
- 0 °C zero correction.
- Unit: °C;
- Output: 4-20 mA.

Upon purchase order, the user can define a specific setup.

#### MECHANICAL INSTALLATION

The TxRail-USB transmitter is suitable to be installed in heads. Vibrations, moisture and extreme temperatures, electro-magnetic interference, high voltage and other interferences can permanently damage the unit, and could cause error in the measured value.

#### DIMENSIONS:

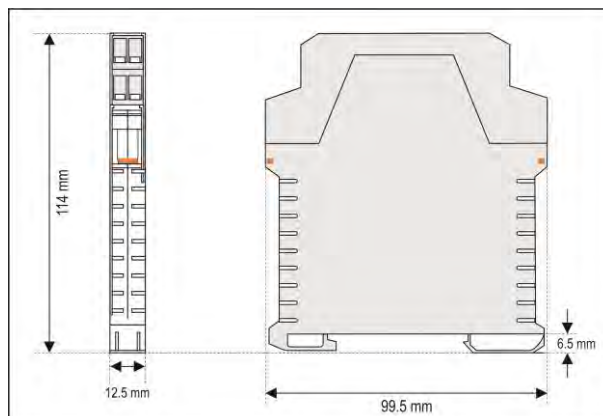


Fig. 4 – Transmitter dimensions

## OPENING THE TRANSMITTER:

In order to open the transmitter, you must press the orange lockers located on both sides of the enclosure and pull the frontal cover very carefully, just like shown in Fig. 05.

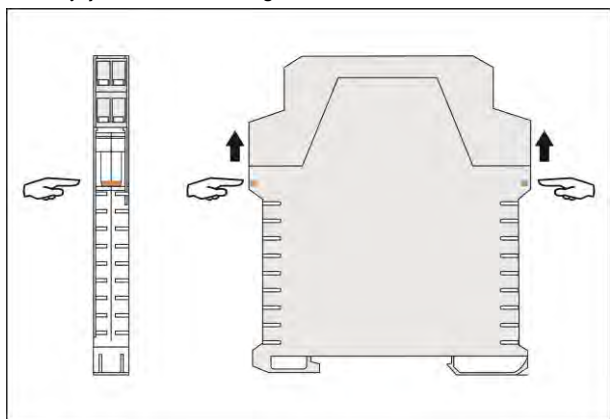


Fig. 5 – Opening the transmitter

## ELECTRICAL INSTALLATION

- Polyamide enclosure.
- Section of the cable used: 0.14 to 1.5 mm<sup>2</sup>
- Recommended torque in the terminal: 0.8 Nm.

## RECOMMENDATIONS FOR INSTALLATION

- Conductors of small electrical signals must be distant from activation and high-tension/current conductors, preferably passing through grounded conduits.
- A specific electrical power supply network should be provided for instruments use only.
- In controlling and monitoring applications, possible consequences of any system failure must be considered in advance.
- RC filters (47R an 100nF, serial) in inductor charges (contactors, solenoids, etc.) are recommended.

## ELECTRICAL CONNECTIONS

The figures below show the electrical connections required. The terminals 1, 2, 3 and 4 are dedicated to the sensor connection. **LOAD** represents the 4-20 mA current measuring device (indicator, controller, recorder, etc.).

### PT100 2-WIRE / NTC

**Note:** When the Pt100 2-wire the terminals 1 and 3 must be interconnected, according to the figure below.

The Pt100 wire length **should be less than 30 cm** to maintain the measurement error within specifications (electrical resistance).

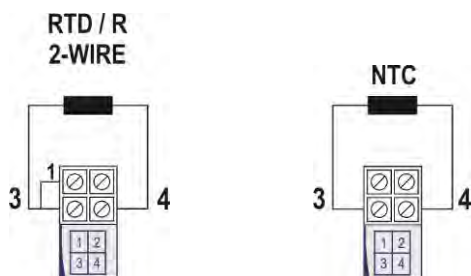


Fig. 6 – Transmitter electrical connections (Pt100 2-wire / NTC)

### PT100 3-WIRE

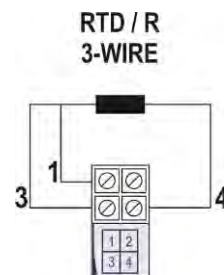


Fig. 7 – Transmitter electrical connections (Pt100 3-wire)

### PT100 4-WIRE

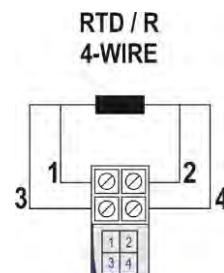


Fig. 8 – Transmitter electrical connections (Pt100 4-wire)

**Pt100 3 and 4-wire:** For appropriate cable resistance compensation they should be equal for all legs. Maximum wire resistance is 25 Ω per wire leg. Usage of a 3 or 4 wire with conductors of equal length and gauge is recommended.

## THERMOCOUPLES

### THERMOCOUPLE SENSOR

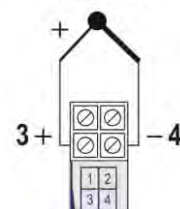


Fig. 9 – Transmitter electrical connections (Thermocouple)

## VOLTAGE (0-50 mV)

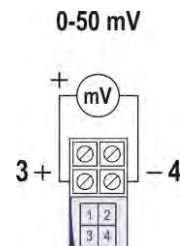


Fig. 10 – Transmitter electrical connections (0-50 mV)

## OUTPUTS (0-10 V and 4-20 mA)

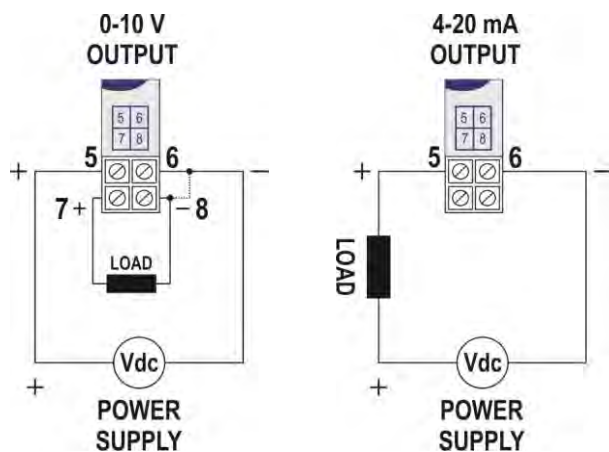


Fig. 11 – Transmitter electrical connections (0-10 V and 4-20 mA)

## OPERATION

The sensor offset can be changed through the *TxConfig II* software. The USB cable may be connected to the transmitter without causing any measurement errors. See item *Zero Correction* in the chapter **CONFIGURATION** of this manual.

The user must choose the most suitable sensor and range to the process. The chosen range must not exceed the maximum range of measurement defined for the sensor and should not be smaller than the minimum range for the same sensor.

It is important to note that the transmitter accuracy is based on the maximum range of the sensor used, even when a narrower range is programmed. Example:

- The Pt100 sensor has a max. range of -200 to +650 °C and accuracy of 0.12 %, thus we will have an error up to 1.7 °C (0.2 % of 850 °C).
- This error may be present even when a narrower range is configured for the sensor. (For example: 0 to 100 °C.)

**Note:** When measurements are made at the transmitter, see if the Pt100 excitation current required by the calibrator is compatible with the Pt100 excitation current used in the transmitter: 0.8 mA.