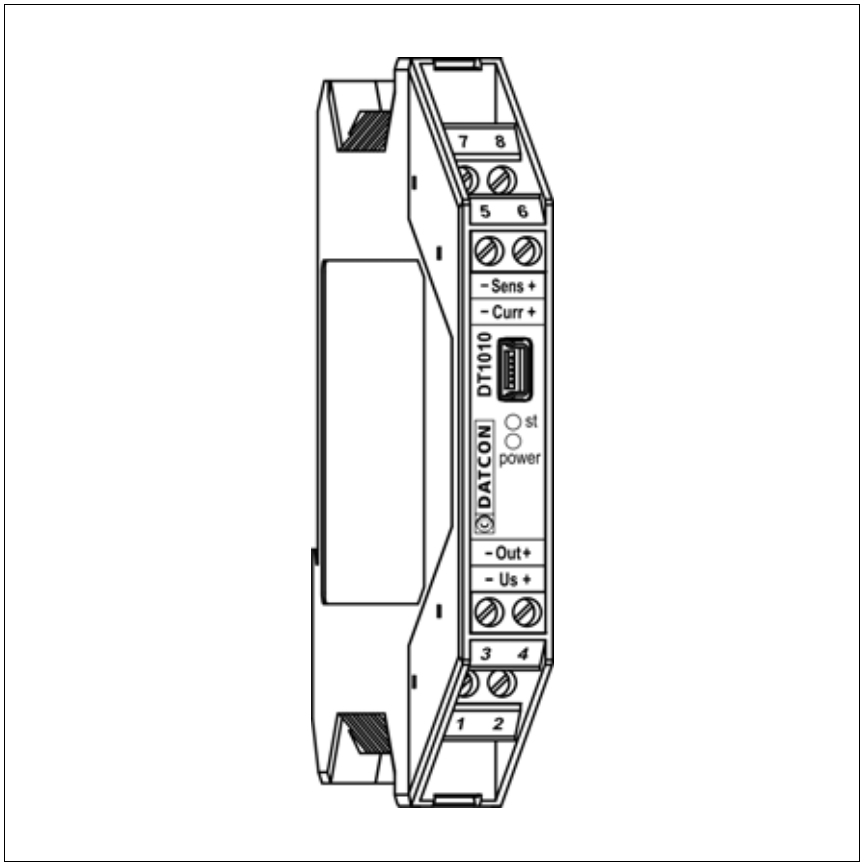
DATCON
INDUSTRIAL MEASUREMENT

DT1010 xx xx

Temperature / Resistance / Potentiometer Transmitter

Operating Instructions



CE

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1. About this document

1.1. Function

This operating instructions manual has all the information you need for quick set-up and safe operation of DT1010 xx xx.
Please read this manual before you start setup.

1.2. Target group

This operating instructions manual is directed to trained personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3. Symbolism used

Information, tip, note
This symbol indicates helpful additional information.

Caution, warning, danger
This symbol informs you of a dangerous situation that could occur. Ignoring this cautionary note can impair the person and/or the instrument.

List
• The dot set in front indicates a list with no implied sequence.

Action
→ This arrow indicates a single action.

Sequence
1 Numbers set in front indicate successive steps in a procedure.

2. For your safety

2.1. Authorized personnel

All operations described in this operating instructions manual must be carried out only by trained and authorized specialist personnel. For safety and warranty reasons, any internal work on the instruments must be carried out only by DATCON personnel.

2.2. Appropriate use

The DT1010 xx xx is a Temperature / Resistance / Potentiometer Transmitter. Detailed information on the application range is available in chapter **3. Product description**.

2.3. Warning about misuse

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, or damage to system components through incorrect mounting or adjustment.

2.4. General safety instructions

The DT1010 xx xx is a high-tech instrument requiring the strict observance of standard regulations and guidelines. The user must take note of the safety instructions in this operating instructions manual, the country-specific installation standards as well as all prevailing safety regulations and accident prevention rules.

2.5. CE conformity

The DT1010 xx xx is in conformity with the provisions of the following standards:
EN 61010-1 (safety)
EN 61326 (EMC)

2.6. Environmental instructions

Protection of the environment is one of our most important duties.
Please take note of the instructions written in the following chapters:

- Chapter **3.6. Storage and transport**
- Chapter **9.2. Disposal**

3. Product description

3.1. Delivery configuration

Delivered items

The scope of delivery encompasses:

- DT1010 xx xx
- documentation:
  this operating instructions
  certification
  warranty

3.2. Type designation

DT1010 □□

			OUTPUT		
			IA	**IP**	**U**
			0 / 4-20 mA active configurable	0 / 4-20 mA passive configurable	0 / 2-10 V configurable
INPUT	**Pt100**	Pt100 0-400 ohm	●	●	●
	Pt1000	Pt500, Pt1000 0-4000 ohm	●	●	●
	Ni100	Ni100 0-400 ohm	●	●	●
	Ni1000	Ni1000 0-4000 ohm	●	●	●

3.3. Principle of operation

Area of application

The DT1010 xx xx Temperature / Resistance / Potentiometer Transmitter provide signal transmission and conversion between sensor or resistance / potentiometer and signal processing unit.
The transmitter feature complete 3-way isolation: the input to output and both to the power supply circuits are isolated.
The output signal may be:
0-20 mA, 4-20 mA, 0-10 V, 2-10 V.
The sensor / resistance / potentiometer can be connected to the input either with 2 / 3 or 4 wire.
The module features complete configuration of sensor input variables and process signal outputs.
Some of the configuration options are: sensor type, resistance range, signal output scaling, 2 / 3 or 4 wire measuring mode, signal filtering, calibrated sensor curve fitting, etc. The configuration software is capable of storing all the parameters for future re-configurations.
The configuration parameters are downloaded from the PC to the DT1010 xx xx via USB port.

Principle of operation

The measuring current flows through the sensor / resistance / potentiometer connected to the input. The voltage drop on the measuring sensor is compared with the voltage drop on the internal reference resistor. The voltage difference is led to a 21 bit A/D converter. The digital output signal of the A/D converter is processed by a microcontroller.
The microcontroller produces a pulse width modulated output signal which is proportional to the processed, scaled measuring value. The output pulse is galvanic isolated by an opto coupler. After filtering the pulse is converted into analogue current or voltage signal.
Connecting the instrument to the PC through the USB interface the instrument's communication circuitry come into active state and it is ready for communication with the configuration software.

Power supply

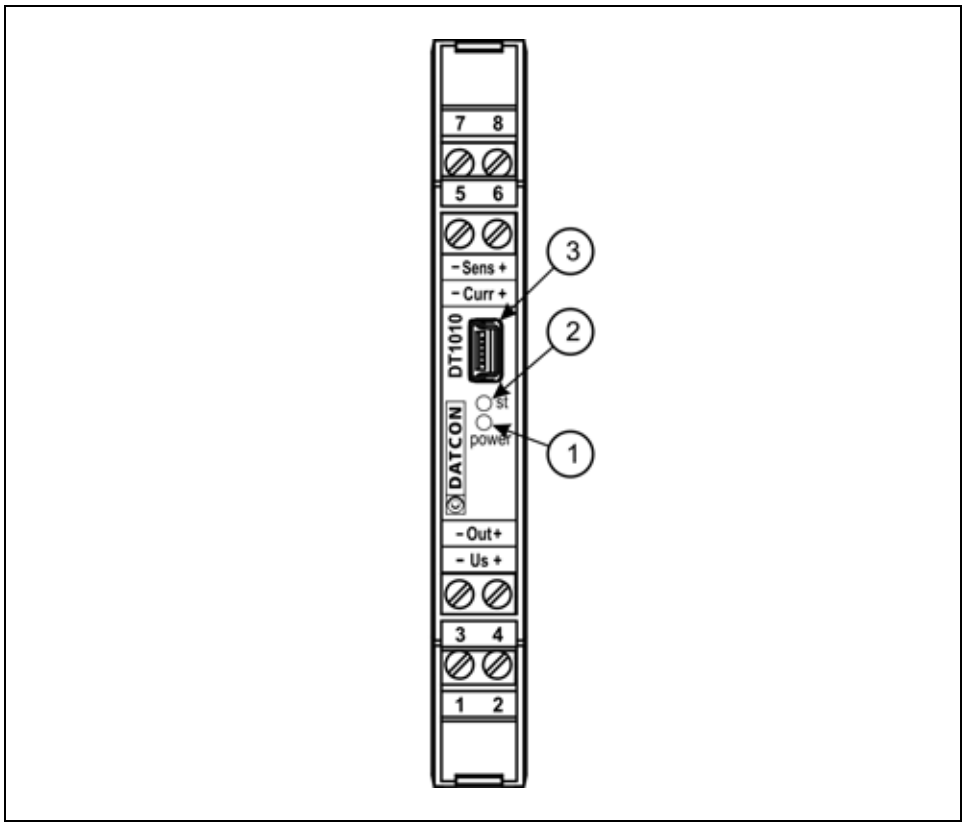
The instrument works from a 19-35 VDC supply voltage.
The power consumption is 1.6 W.

3.4. Adjustment

After connecting the DT1010 xx xx is ready to work with the factory default parameters are written in Chapter 6.1.. For working with the default parameters there is no need any adjustment. The detailed description of the setup can be found in Chapter 7..

3.5. Indicators, USB connector

The following figure shows the indicators and the USB connector on the instruments front:



1. The „power” green indicator has two function:
- continuous light indicates that the instrument is in measuring mode
- a short flash indicates that a successful communication has granted with the configuration software.
2. „st” red indicator has two function:
- continuous light indicates that the instrument is in configuration mode
- blinking light indicates different error states
3. USB-B mini, 5 pole connector for connecting to the PC at configuration.

3.6. Storage and transport

This instrument should be stored and transport in places whose climatic conditions are in accordance with chapter **10.1. Technical specifications**, as described under the title: Environmental conditions.

The packaging of DT1010 xx xx consist of environment-friendly, recyclable cardboard is used to protect the instrument against the impacts of normal stresses occurring during transportation. The corrugated cardboard box is made from environment-friendly, recyclable paper. The inner protective material is nylon, which should be disposed of via specialized recycling companies.

4. Mounting

4.1. General instructions

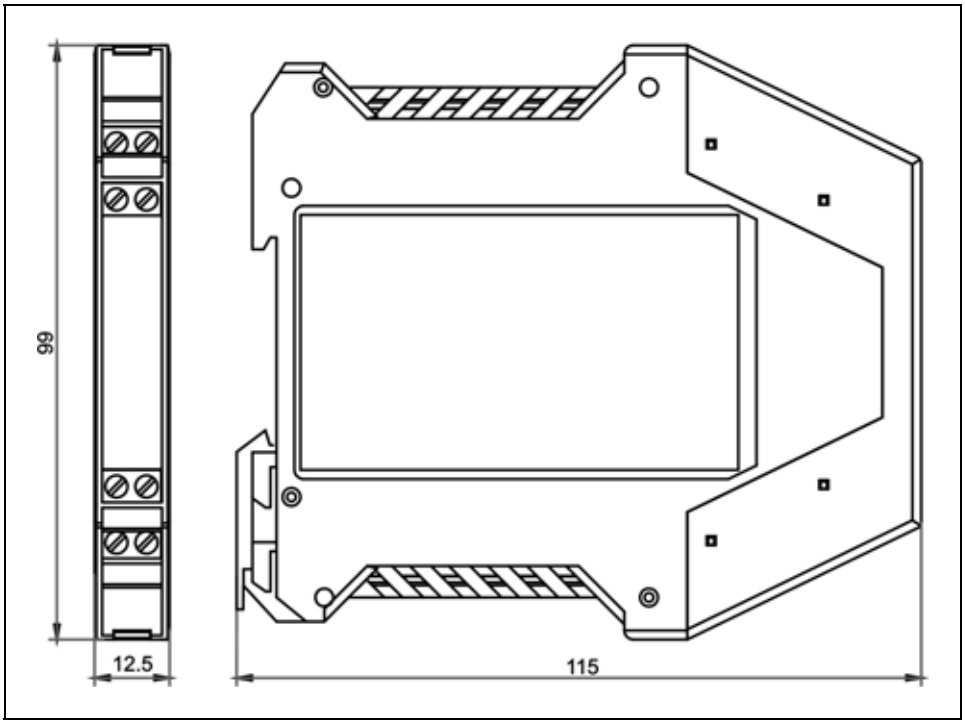
The instrument should be installed in a cabinet with sufficient IP protection, where the operating conditions are in accordance with chapter **10.1. Technical specification**, as described under the title: Operating conditions.

Mounting position

The instruments are designed in a housing for mounting on TS-35 rail.
The instruments should be mounted in vertical position (horizontal rail position).

Horizontal mounting may cause overheating and damage of the instrument.

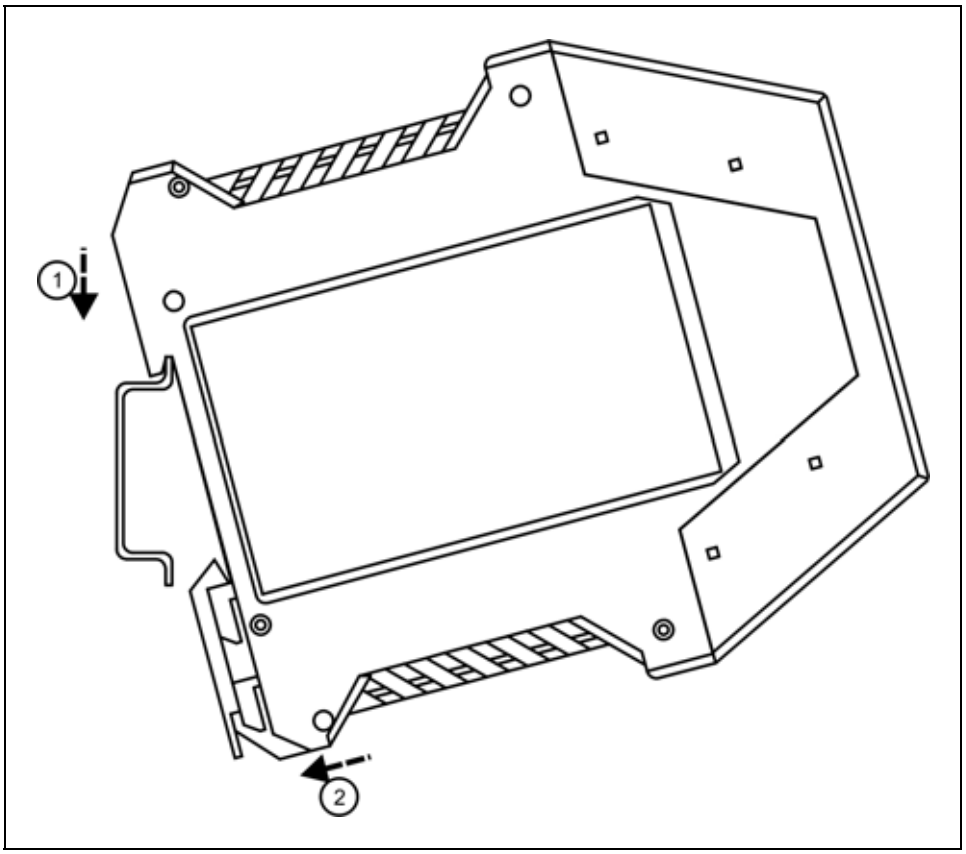
4.2. Main dimensions of the instrument



4.3. Mounting

The following figure shows the mounting procedures (fixing on the rail):

Mounting on the rail



The mounting doesn't need any tool.
1. Tilt the instrument according to the figure; put the instrument's mounting hole onto the upper edge of the rail (figure step 1.).
2. Push the instrument's bottom onto the bottom edge of the rail (figure step 2.), you will hear the fixing assembly closing.
3. Check the hold of the fixing by moving the instrument firmly.

5. Connecting

5.1. Preparing the connection

Always observe the following safety instructions:

- The connection must be carried out by trained and authorized personnel only!
- Connect only in the complete absence of supply voltage
- Use only a screwdriver with appropriate head

Select and prepare connection cable

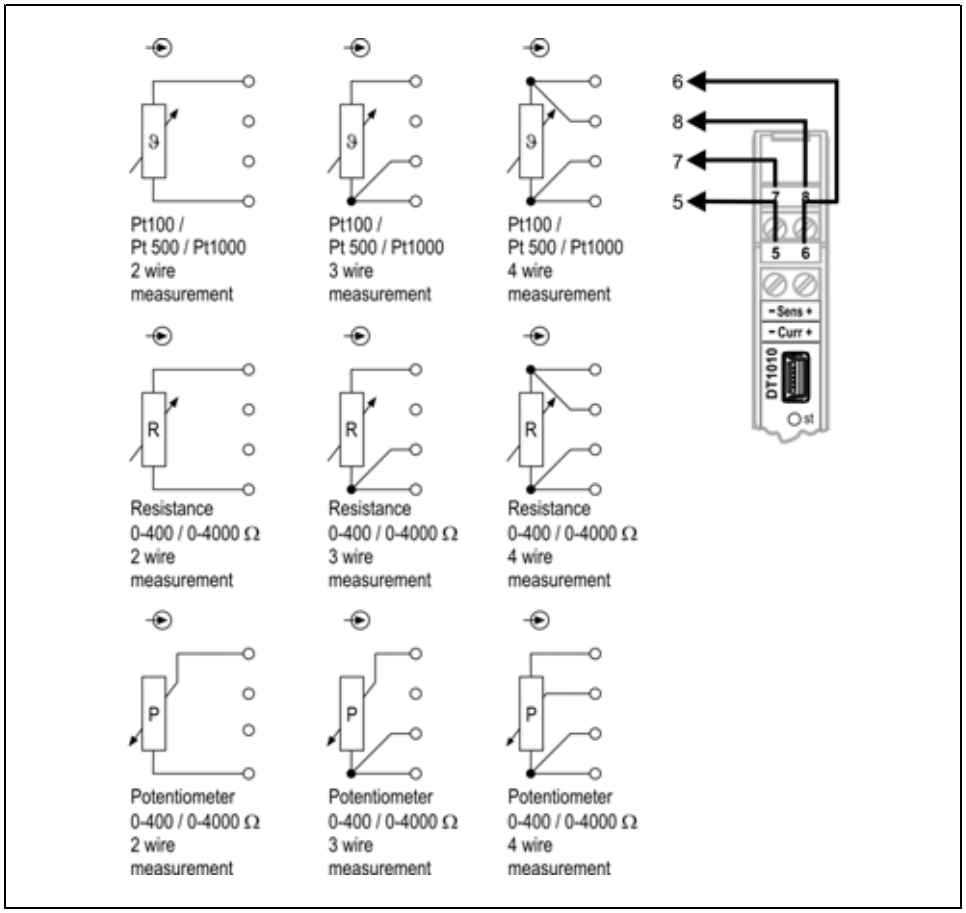
Take note the suitability of the connecting cable (wire cross-section, insulation, etc.).
The wire cross-section should be 0.25-1.5 mm².
You may use either solid conductor or flexible conductor.
In case of using flexible conductor use crimped wire end.

For the input connection we recommended to use screened cable. It's an important rule that the power cables and signal cables should lead on a separate way.

5.2. Connecting sensor / resistor / potentiometer to the input

The following figure shows the wiring plan, connecting the sensor / resistor / potentiometer to the input:

Wiring plan, connecting the sensor / resistor / potentiometer to the input
(see also “Application example”)



1. Loosen terminal screws.
2. Insert the wire ends into the open terminals according to the wiring plan.
3. Screw the terminal in.
4. Check the hold of the wires in terminals by pulling on them firmly.

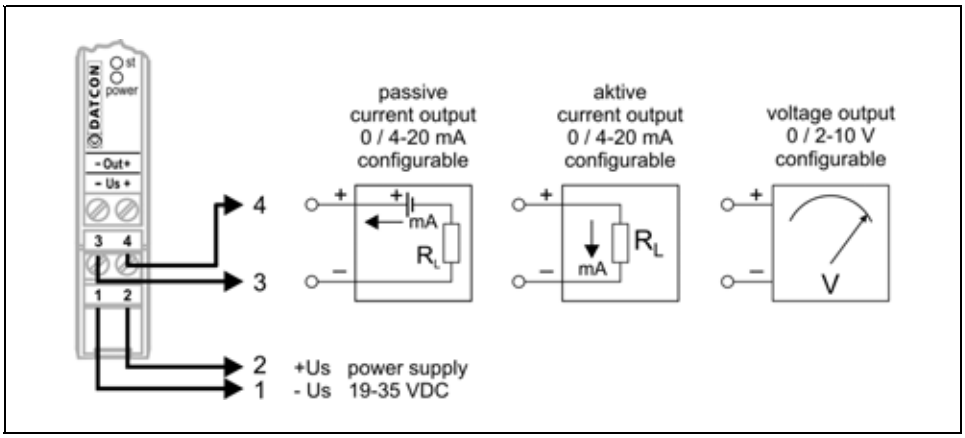
Checking the Connections

Check if the cables are connected properly (have you connected all the cables, have you connected to the right place, do not the cable-ends touch each other).

5.3. Connecting the signal processing unit and the power supply

The following figure shows the wiring plan, connecting the signal processing unit and the power supply:

Wiring plan, connecting the signal processing unit and the power supply
(see also “Application example”)



Be careful the polarity of the cables

1. Loosen terminal screws.
2. Insert the wire ends into the open terminals according to the wiring plan.
3. Screw the terminal in.
4. Check the hold of the wires in terminals by pulling on them firmly.

Checking the connections

Check if the cables are connected properly (have you connected all the cables, have you connected to the right place, do not the cable-ends touch each other).
The connection is finished.

5.4. Put the instrument under supply voltage

Put the instrument under supply voltage

After you have completed the connections, put the instrument under supply voltage. If the connection is correct the green indicator gives light and you can measure an output signal according to the measured value on the input.

6. The first start-up, indicators

6.1. The first start-up

After connecting the DT1010 xx xx is ready to work with the factory default parameters.
When you are going to use other parameters you should set-up the instrument according to Chapter 7.
Factory default settings:

- Sensor connecting 4 wire.
- Measuring mode: temperature measurement.
- Current output: 4-20 mA.
- Current output error value: 3.2 mA.
- Averaging: 16 measurement.
- Output refresh time: 0.5 sec.
- Sensor characteristics fitting mode: off.
- Output scaling: -200.0 °C ÷ 4 mA-t; +800.0 °C ÷ 20 mA.
- Password:”1000”.
- Wire resistance in 2 wire connecting: 0 Ohm.
- Potentiometer measurement mode and scaling:

0% ÷ 0.00, 100% ÷ 100.00. (for potentiometer measurement first you should calibrate the potentiometer according: Chapter 7.)

6.2. Indicators

(1) **power** (green): mode an communication indicator
(2) **st.** (red): mode and error indicator

The two indicator gives information in conjunction as follows:

- **Measurement mode:**

power: light, st.: dark.

- **Error state:**

power: light, st.: blinking.
The number of blinkings gives the error information while the output current is forced into 3.2 mA or 20.8 mA (depends on setting).
1 blink: fatal error. (repairing: in factory service only).
2 blinks: input break (repairing: check the sensor and wiring).
3 blinks: potentiometer mode is selected but the potentiometer is not calibrated (see Chapter 7.)
4 blinks: measuring value out of range.
5 blinks: analog output scaling error (the instrument is unable to convert the measured value into the 3.9-20.1 mA range, while the output current is forced to 3.2 mA or 20.8 mA, depends on setting). (see Chapter 7.)

- **Configuration mode:**

After connecting the instrument to the PC USB port, starting the configuration program and opening the proper virtual serial port, the instrument is ready to communicate with the program (for selecting the proper virtual port begin with the last and than try the others).
st.: light, power: short flash in a case when a successful communication has granted.

7. Setting-up

7.1. First steps

Necessary tools

For setting-up you need:

- mini USB B (5 pin)-USB A cable
- USB driver install program
- DT1010_DT1310 v2013-09-18 - 2015-03-25.exe configuration software
- PC

Install the virtual COM port diver

You have to install once the virtual COM driver before use the configuration program first. This driver provides the USB port interface as a simple serial port for the configuration program. The driver is located in folder ‘DT1010\USB Driver’. Install this driver.

Software

Easy to use DT1010_DT1310 v2013-09-18 - 2015-03-25.exe configuration software (free of charge). Simple copy it into an optional folder, click on the “Start” button and you can configure the instrument.

Setting-up

1. Connect the instrument with the USB cable to the PC USB port and put it under supply voltage.
2. Start the configuration program.
3. Select the appropriate serial port.
4. Click on the „Open Serial Port” button.
5. st. (red) indicator gives light, signing that the instrument is configuration mode.
6. power (green) indicator signs with a short flash the successful communication between the program and the instrument.
7. Use the configuration software as is written on the following pages.
8. At the end of the settings click on the “Download settings” button, the new settings are written into the instrument.
9. Click on the „Close Serial Port” button for finishing the configuration procedure and disconnect the USB cable.

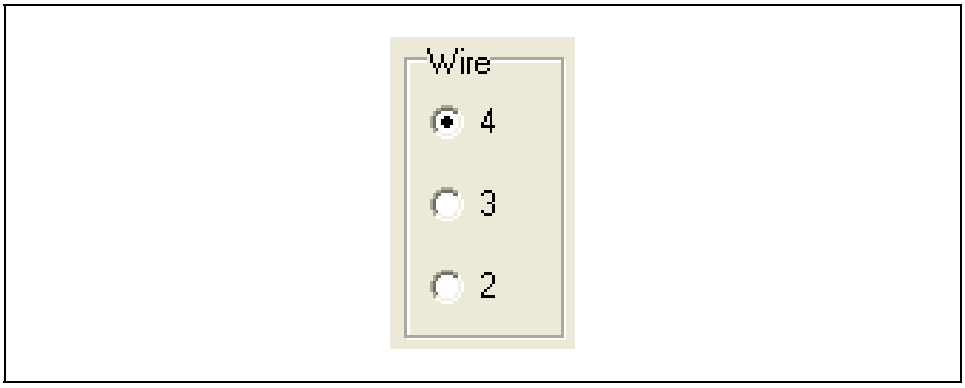
7.2. Connecting wire setting

Function

The sensor / resistance / potentiometer can be connected to the input either with 4 / 3 / 2 wire.
The 4 wire connection gives the best result: the instrument is able to compensate the connecting cable resistances.
The 3 wire mode is a compromise it may give a good result when all the 3 wire have same resistance.
The two wire mode is the cheapest mode, use only when there is no other possibility.
[Factory default: 4 wire.]

Sequence of operations

1. Select the appropriate connecting wire mode by clicking the button.
The figure shows the factory default setting.



Warning! Select always appropriate wiring mode.
Inappropriate selection may cause measuring error.

7.3. Input mode setting

Function

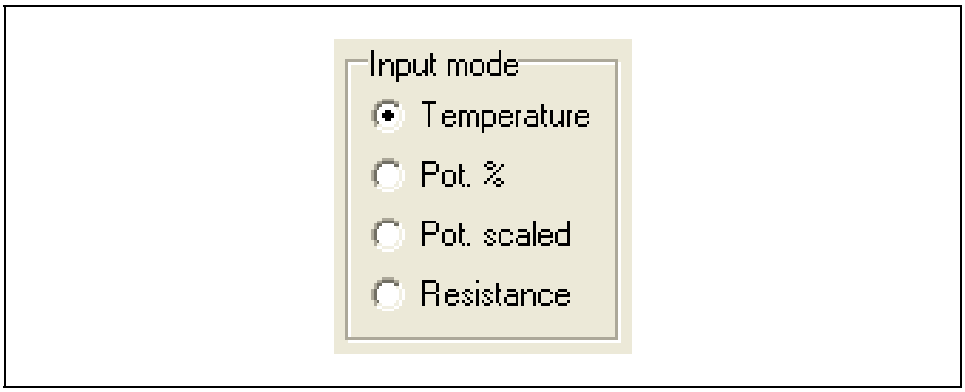
The instrument has four measuring modes:

- temperature
- potentiometer %
- potentiometer scaled
- resistance

[Factory default: temperature measurement.]

Sequence of operations

1. Select the appropriate input mode by clicking the button. The figure shows the factory default setting.



- Temperature transmitter, measured in °C, with 0.1°C resolution [Factory default].
- Potentiometer transmitter, measured in percent between 0-100%, with 1% resolution.
- Potentiometer transmitter with scaled output, with selectable number of decimals (between 1-4).
- Resistance transmitter, measured in ohm with two decimal resolution.

Note: before selecting potentiometer mode it should calibrate the potentiometer. The calibrating means it should be define the start and the end points of the potentiometers wiper.

7.4. Analogue output setting

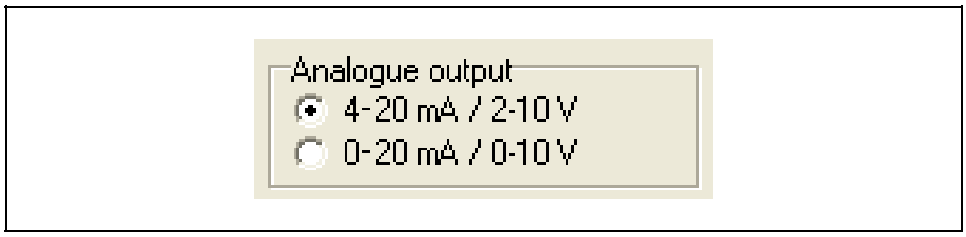
Function

The output signal can be current: 0 / 4-20 mA, or voltage 0 / 2-10 V. (should be specified at order)

[Factory default: 4-20 mA]

Sequence of operations

1. Select the appropriate output signal by clicking the button.
The figure shows the factory default setting.



Note:
It is recommended to use 4-20 mA.
It's advantages:

- wire break can be detected by the signal processing unit.
- it can drive a loop-indicator (e.g. DT4200)

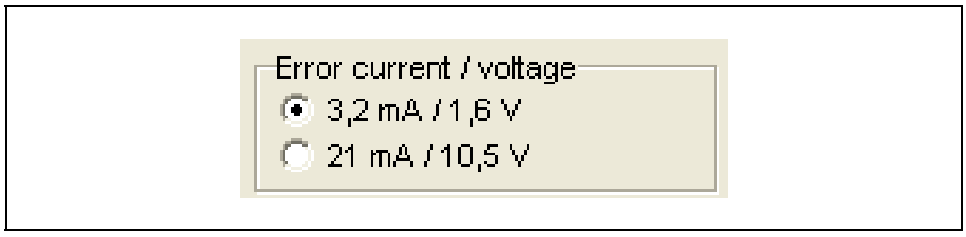
7.5. Error current / voltage setting

Function

In a case of an error state the output current / voltage is forced into error state. The value of the error current / voltage can be set:
Current: 3.2 mA or 21 mA
Voltage: 1.6 V or 10.5 V
[Factory default: 3.2 mA]

Sequence of operations

1. Select the appropriate output signal by clicking the button.
The figure shows the factory default setting.



Note:
In a case of 0-20 mA output current the error current is 21 mA, independent from setting.

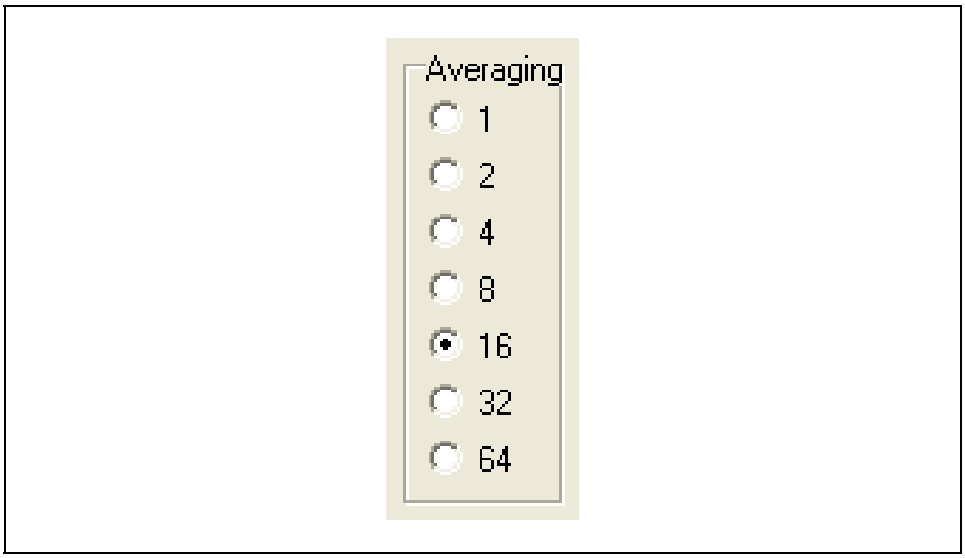
7.6. Setting averaging

Function

The instrument performs cca. 12 measurements in each seconds. (In 3 wire mode only 5 measurements). The measurement result is generated as the average of several measurements.
Here you can define the number of measurements that should be used for calculating the averaged numerical value. By increasing this number the signal stability increases, but the signal settling time becomes lower.
[Default factory setting: 16]

Sequence of operations

1. Select the appropriate output signal by clicking the button.
The figure shows the factory default setting.



Note: Selecting the „1” value the last measured result will be transmitted. Measured results - measured before the last measurement - have no effect on the output signal.

Settling time after stabilizing the input signal (4 wire mode):

Averaging number:	Settling time (sec):
1	0.1
2	0.2
4	0.4
8	0.7
16	1.4
32	2.7
64	5.4

Settling time after stabilizing the input signal (3 wire mode):

Averaging number:	Settling time (sec):
1	0.25
2	0.5
4	1.0
8	1.8
16	3.5
32	6.8
64	13.6

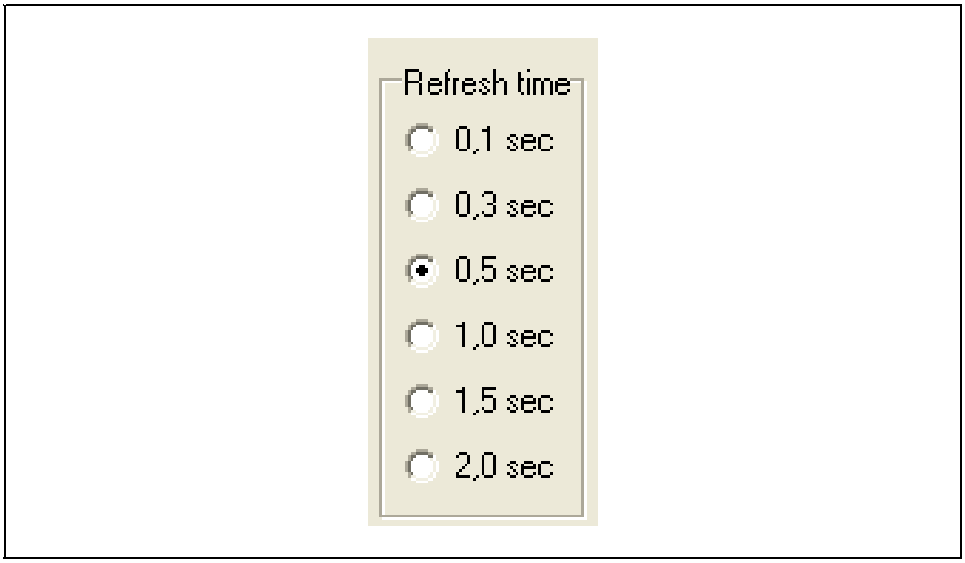
7.7. Output refresh time setting

Function

The output current / voltage refresh time can be set independently from the measuring time. There are 6 different refresh times (sec): 0.1; 0.3; 0.5; 1.0; 1.5; 2.0

Sequence of operations

1. Select the appropriate output signal by clicking the button.
The figure shows the factory default setting.



7.8. Analogue output scaling

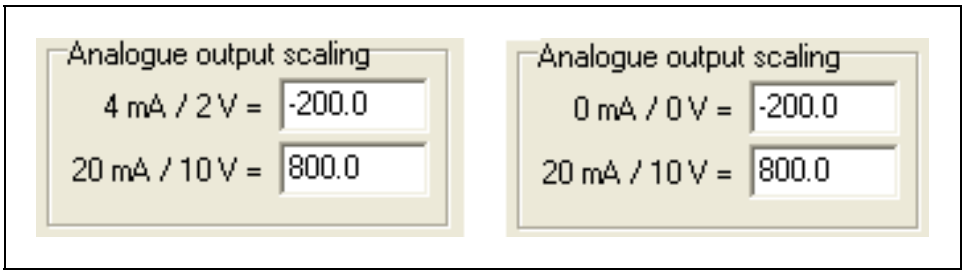
Function

There are two output versions of the instrument:
DT1010 xx Ix xx: 0 / 4-20 mA current output or
DT1010 xx U xx: 0 / 2-10 V voltage output
It can be assign any temperature or resistance range or potentiometer scale to the output.
[Factory default: 4 mA = -200.0 °C and 20 mA = +800.0 °C.]

Sequence of operations

1. Type-in the value of the start point of the range or scale (0 / 4 mA or 0 / 2 V).
2. Type in the value of the end point of the range or scale (20 mA or 10 V).

The figure shows the factory default settings.



Note:
It can be used either dot (.) or comma (,) for decimal.
When you type in more decimals the software corrects it for one decimal after clicking on the “download settings” button.

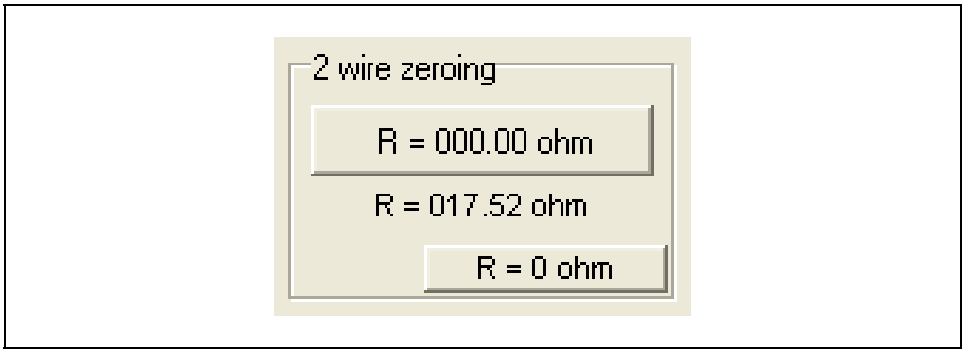
7.9. Two wire zeroing

Function

When the sensor / resistance / potentiometer is connected to the input with two wire, the wire resistance will cause a measurement error. With this function can be compensated this error. (The compensation will work only properly at the same ambient temperature.)
[Factory default: wire resistance = 0 Ohm.]

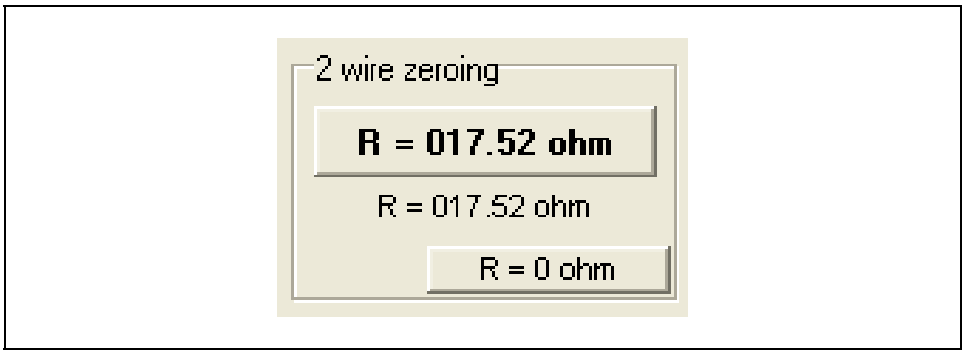
Sequence of operations

This setting will work only when the two wire mode is selected.



1. Short the connecting wire at the sensor side, so the instrument will measure the resistance of the connecting wire. You will see this in the “2 wire zeroing” window (17.52 ohm).

2. Click on the upper button, you will see the measured resistance on this button. The setting is ready.



7.10. Sensor correction values

Function

The real sensor characteristics may differ from the theoretical R-°C curve. The difference will cause a measurement error on temperature measurement. When you are capable to calibrate the sensor on minimum 3 points you will know the resistance difference of the theoretical and real characteristics. Using this resistance values, the instrument will correct the measurement error on this points exactly by adding the correction values and - using interpolation method - on all other points of the whole characteristics. For the best curve fitting it is recommended to choose the correction points at about 20%; 50%; 80% of the measurement range.

Note: The accuracy of this correction method depends on the accuracy of the calibrating device.

Sequence of operations

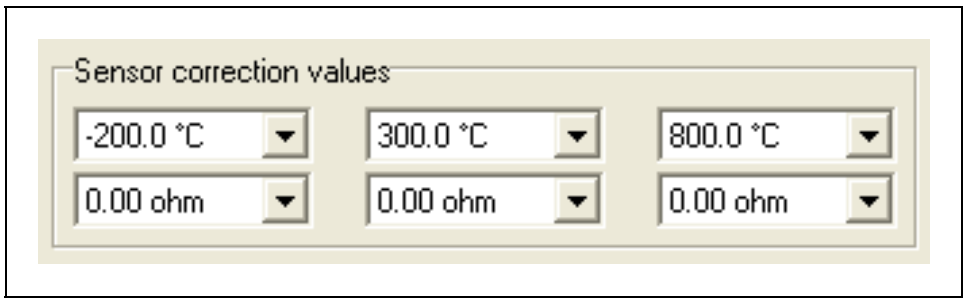
Example:
The measurement range is 50 °C - 150 °C.
Calibrate the sensor on the following temperatures:
70 °C; 100 °C; 130 °C.

1. Make a table according this:

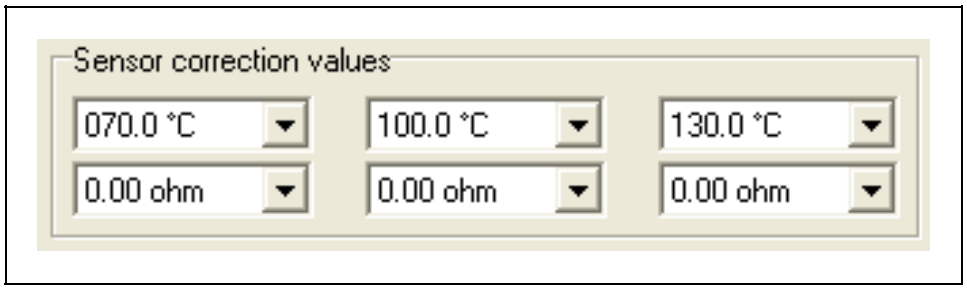
Temperature (°C)	R **n**ominal (ohm)	R **m**easured (ohm)	**Rn - Rm (ohm)**
70	127.08	126.76	**0.32**
100	138.51	138.49	**0.02**
130	149.83	149.91	**-0.08**

Use the **bold** resistance values for correction according the following figures:

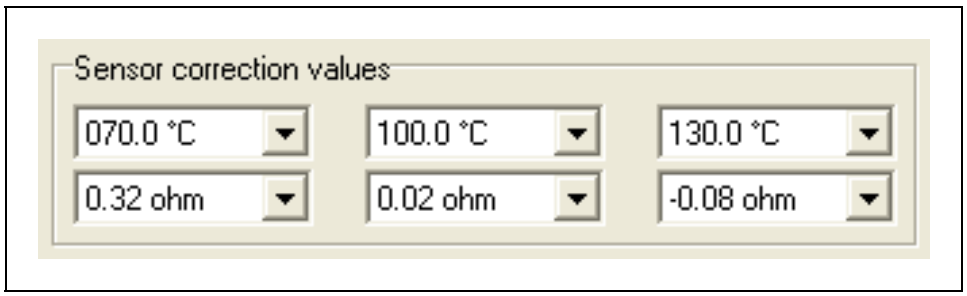
Sequence of operations The figure shows the factory default settings.



2. Type-in the 3 temperature value:



3. Type-in the bold resistance difference values:



The setting is ready.

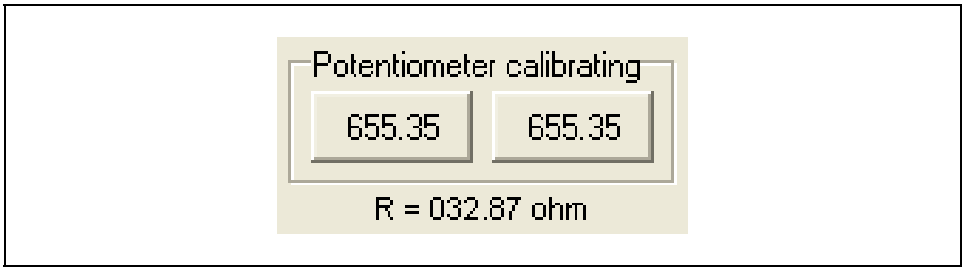
7.11. Potentiometer calibrating

Function

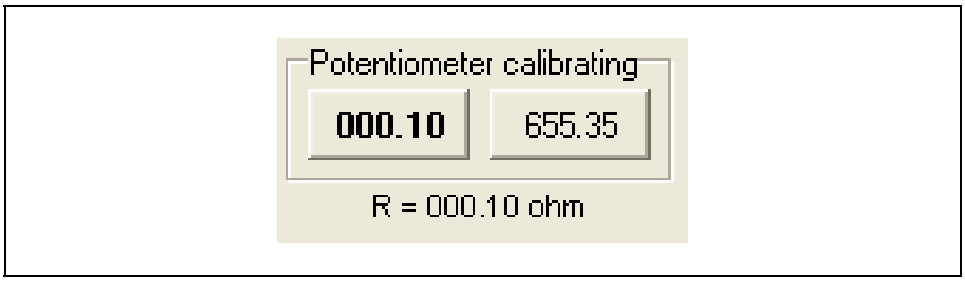
Before selecting potentiometer measuring mode it should be calibrated the potentiometer. At calibrating must define the start and the end position of potentiometer's wiper. So you can fit the measuring range of the instrument to the potentiometer scale. If the potentiometer is not calibrated the "st." indicator signs the error with 3 blinking.

Sequence of operations

1. The figure shows the state before calibrating. In the "R" window you can see the resistance value of the potentiometer given in two decimal form.

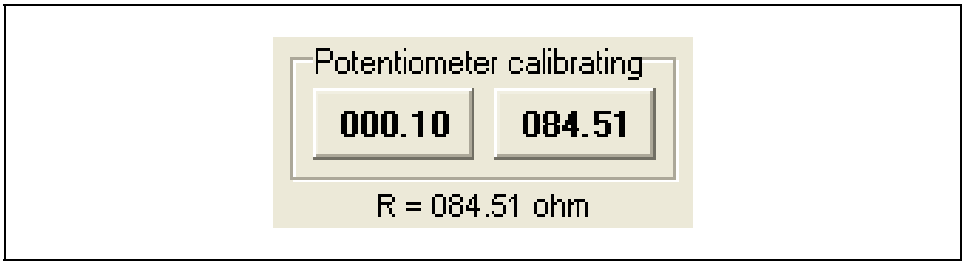


2. Set the potentiometer wiper to the start position, than click on the left button.



You will see on the left button the resistance value of the potentiometer in the start position.

3. Set the potentiometer wiper to the end position, than click on the right button.



You will see on the right button the resistance value of the potentiometer in the end position.

Note:
Any wiper position can be assign to the 0% and 100% so you can realize reverse operation too.

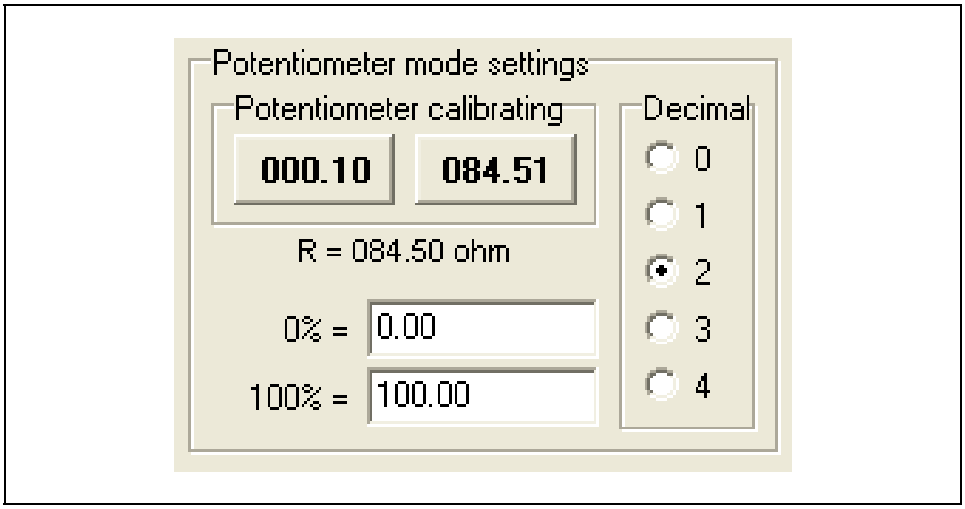
7.12. Potentiometer scaling

Function

When you are going to use the potentiometer with better resolution than 1% you can assign resistance values with 1, 2, 3, 4 decimal resolution to the start and end position of the potentiometer.

Sequence of operations

The figure shows the factory default settings.



1. Select the number of decimals.
2. Type-in the start resistance value (0%, upper window), than the end resistance value (100%, lower window).

Note:
It can be used either dot (.) or comma (,) for decimal.
When you type in more decimals the software corrects it for one decimal after clicking on the “download settings” button.

7.13. New password setting

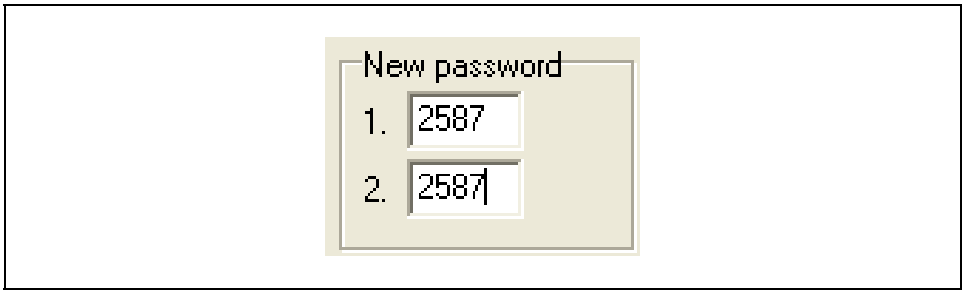
Function

Here you can exchange the factory password for a new one.
The range is: 0-9999.
[Factory default: 1000]

Sequence of operations

1. Type-in the new password into the upper field. (0-9999)
2. Type-in one more time the new password into the lower field.

The figure shows an example, when the selected password is: „2587”.



When the two password is not the same the software announces it and you have to type in twice the new password.

Note:
If you change your mind and don’t want to exchange the password simple clear the password typed-in the two fields.

Warning!
Do not forget the password!
If you forget the password it can be reset the factory default in the factory only!

7.14. Resetting default settings

Function

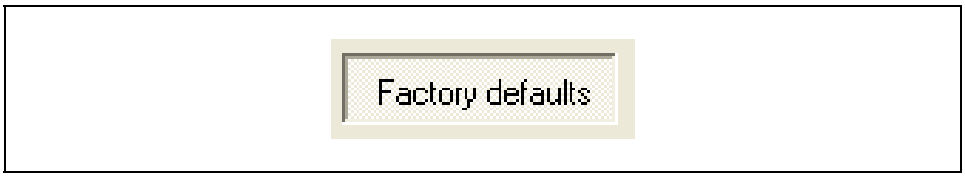
In this case all the settings are deleted, and the default settings are restored.
Using this function makes sense in that case, when the settings of the instrument have changed so much, that it is easier to start the setting-up process from the default factory setting.

Sequence of operations

1. Click on the „Factory default” button.

After clicking the button you will see the factory default settings.

2. Figure shows the button after clicking.



7.15. Analogue output limiting

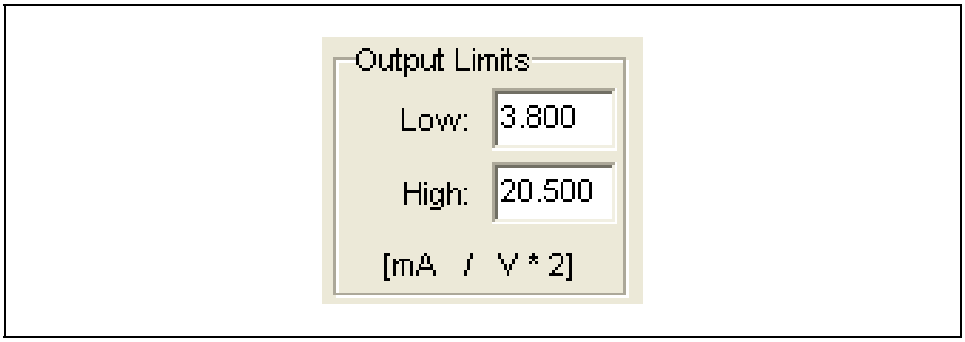
Function

The analogue output works correspond with NAMUR standard. For example the 4–20 mA type output has 3,8 mA – 20,5 mA current range.

You can limit this range. For example: let the low output limit is 12 mA and the high output limit is 17 mA. In this case if calculated current is lower than 12 mA or higher than 17 mA, the output current will indicate the error state. (See: 7.16.: Analogue output error state disabling.)

Sequence of operations

1. Type-in the low and the high output limits. (In voltage mode the typed value is desired voltage value x2)
The figure shows the factory default settings:



7.16. Analogue output error state disabling

Function

The checked check box of the instrument disables the output error sate. In this case the analogue output can not generate error current, the output current remains between the low and the high values.
(See: 7.15.: Analogue output limiting.)

Sequence of operations

1. Check the check box for disabling the output error signal.

8. Fault rectification

8.1. Fault finding

The fault finding must be carried out by trained and authorized personnel only!

- The green indicators is dark ⟶ check the power supply. If the supply voltage is OK: the instrument is defective.
- There is no output signal ⟶ check the device connected to the input.

When the result of fault finding is that the DT1010 xx xx is defective call the manufacturer service department.

8.2. Repairing

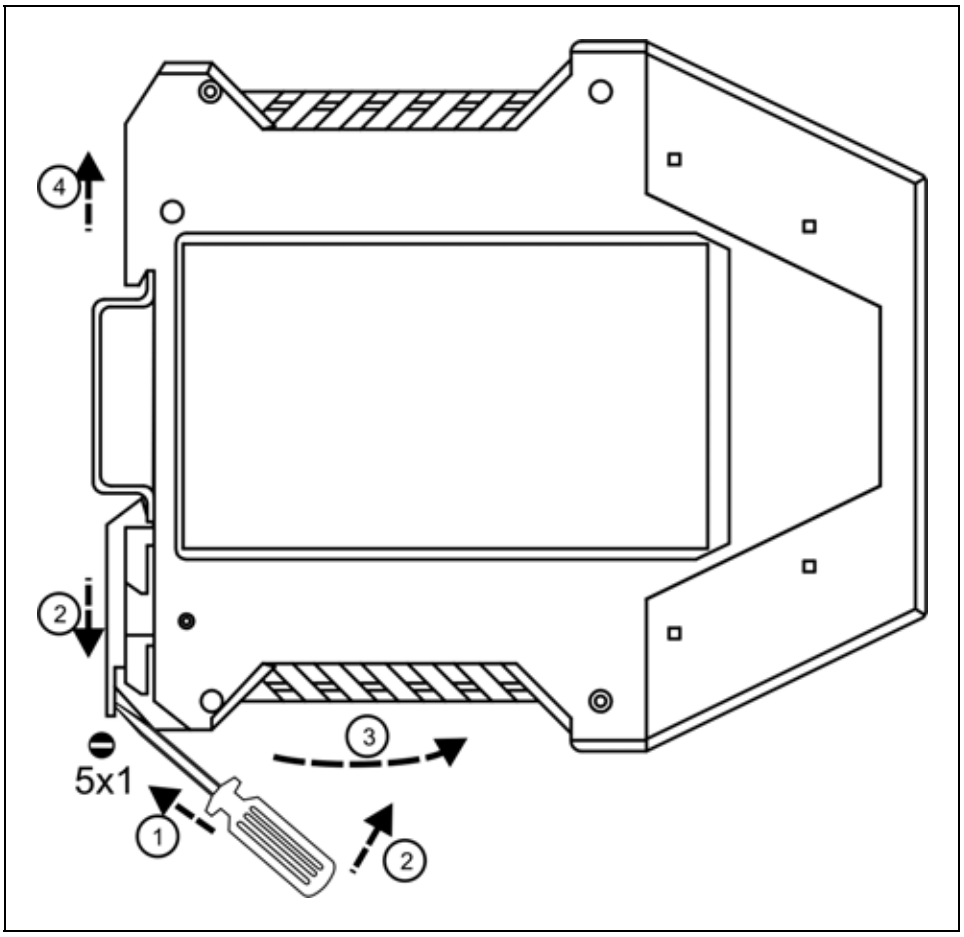
There is no user repairable part inside the instrument.
In accordance with Point **2.1.: For safety and warranty reasons, any internal work on the instrument must be carried out by DATCON personnel.**

9. Dismounting

9.1. Dismounting procedure

Dismounting from the rail

The following figure shows the dismounting procedures:



The dismounting procedure needs a screwdriver for slotted screws.
1. Before dismounting disconnect all wires.
2. Put the screwdriver end into the fixing assembly's hole (figure step 1.).
3. Lift the screwdriver handle until it possible to open the fixing assembly (figure step 2.).
4. Keeping the screwdriver in this position lift the instrument bottom from the bottom edge of the rail (figure step 3.).
Lift the whole instrument (you may put out the screwdriver) (figure step 4), the instrument will be free.

9.2. Disposal

According with the concerning EU directive, the manufacturer undertakes the disposal of the instrument that are manufactured by it and intended to be destroyed. Please deliver it in contamination-free condition to the site of the Manufacturer or to a specialized recycling company.

10. Appendix

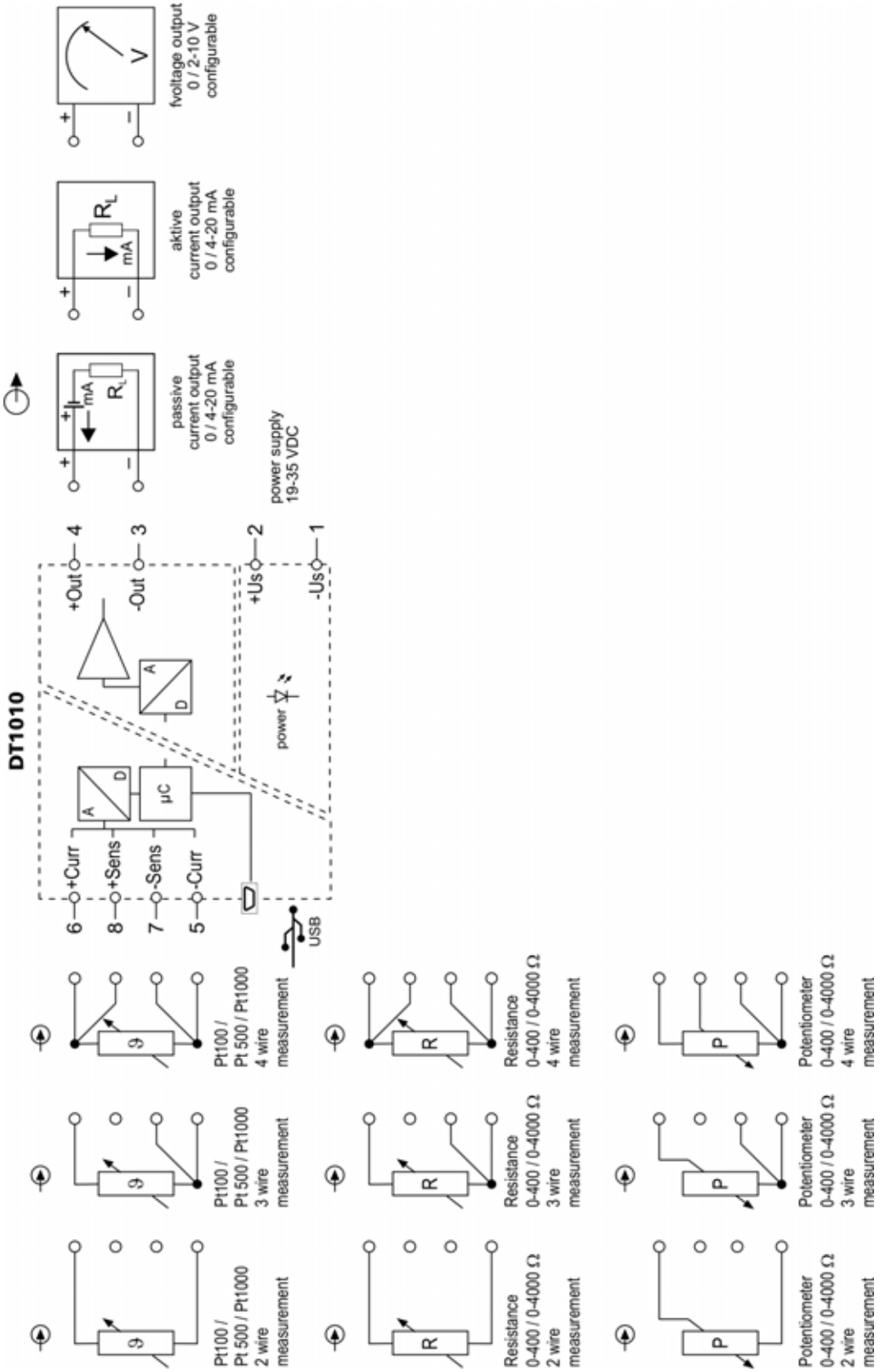
10.1. Technical specification

Input parameters	
Input signal:	Pt100 / Pt500 / Pt1000 / Cu50 / Ni100 / Ni1000 sensor or resistance / potentiometer
Connection:	4 / 3 / 2 wire
Measuring current:	880 µA (Pt1000: 250 µA)
Sensor dissipation	80 µW (sensor temp.: 0 ºC) 270 µW (sensor temp.: 800 ºC)
Resistance of wire:	100 ohm (max.)
Measurement range:	-200 - +800 ºC 0-400 Ω, 0-4000 Ω
Number of correction points:	3
Output parameters	
Output signal:	DC current / DC voltage
Output ranges:	4-20 mA / 0-20 mA 2-10 V / 0-10-V
Overload:	21 mA or 10.5 V
Scaling:	Linear, with optional start- and end values
Burden resistance (current output):	<500 ohm
Load resistance (voltage output):	>500 ohm
Output resistance:	>5 Mohm (current output) 500 ohm (voltage output)
Error @ 25 ºC ±2 ºC:	0.1 ºC + 0.05%
Temperature coefficient:	Typ.: 25 ppm / ºC; max.: 50 ppm / ºC
Supply-voltage effect:	practically zero
Configuration	
Configuration:	Via USB port with DT1010.exe software
Connector:	Mini USB B (5 pin)

Galvanic isolation	
Test voltage:	2500 VDC (between input-output, input-power supply terminals) 500 VDC (between output-power supply terminals)
Power supply	
Power supply:	19-35 VDC
Power consumption:	1.6 W
Ambient conditions:	
Operating temperature range:	0-60 °C -20 - +60 °C on customer request
Storage temperature range:	-20 - +70 °C
Relative humidity:	90% (max., non condensing)
Place of installation:	cabinet
Mounting position:	vertical (horizontal rail position)
Electromagnetic compatibility (EMC):	
Accordance with the standard EN 61326-1	
Immunity:	-A- criterion
Noise emission:	-A- class
General data:	
Housing:	TS-35 rail mounting housing material: polyamide PA6.6
Connection:	screw-terminal
Connecting cable:	1.5 mm^2 (max.)
Dimensions:	12.5 x 99 x 115 mm (width x height x depth)
Mass:	0.15 kg
Ingress Protection (EN 60529):	IP 20

The Manufacturer maintains the right to change technical data.

10.2. Application example



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