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## 1.INTRODUCTION

The Novus Calibrators series **DC80** are portable instruments designed to meet the user needs for measuring and simulating signals such as voltage, current, resistance, thermocouples and RTDs. The available options depend on the particular model. They are:

- DC80T, for Thermocouples and mV
- DC80R, for RTDs and resistance
- DC80L, for linear mV, V and mA (provides internal power supply for powering 2-wire transmitters)

## 2.SAFETY INFORMATION

To avoid possible electric shock or personal injury:

- Use the Calibrator only as specified in this manual, or the protection provided by the Calibrator might be impaired.
- Do not apply more than the rated voltage between the terminals, as marked on the Calibrator, or between any terminal to earth.
- Make sure the battery door is closed and latched before operating the calibrator.
- Remove test leads from the calibrator before opening the battery door.
- Inspect the Calibrator before using it. Do not use the Calibrator if it appears damaged.
- Do not operate the calibrator around explosive gas, vapor, or dust.

To avoid possible damage the calibrator or system, make sure to use the right connector and select the appropriate range before using the instrument for measurement or simulation.

## 3.MODEL DC80T

The MODEL DC80T is capable of measuring and generating mV and thermocouple signals. The specifications shown on the tables below are valid for the period of one year, at ambient temperatures between 18-28 °C.

INPUT/OUTPUT RANGE	RESOLUTION	ACCURACY
-10 mV to 75 mV	0.01 mV	± (0,06 % + 0,02 mV)

### Measurement and Simulation specifications for Thermocouples:

Type	Range	Resolution	Accuracy	Tamb Error (*)
J	-200 to 1200 °C / -328 to 2192 °F	0.1 °C / °F	± (0,05 % do Span) + Erro JF	± 2,0 °C
K	-200 to 1370 °C / -328 to 2498 °F	0.1 °C / °F	± (0,05 % do Span) + Erro JF	± 2,0 °C
T	-200 to 400 °C / -328 to 752 °F	0.1 °C / °F	± (0,05 % do Span) + Erro JF	± 2,0 °C
E	-200 to 950 °C / -328 to 1742 °F	0.1 °C / °F	± (0,05 % do Span) + Erro JF	± 2,0 °C
R	-20 to 1750 °C / -4 to 3182 °F	1 °C / °F	± (0,10 % do Span) + Erro JF	± 2,0 °C
S	-20 to 1750 °C / -4 to 3182 °F	1 °C / °F	± (0,10 % do Span) + Erro JF	± 2,0 °C
B	600 to 1800 °C / 1112 to 3272 °F	1 °C / °F	± (0,10 % do Span) + Erro JF	± 2,0 °C
N	-250 to 1300 °C / -418 to 2372 °F	0.1 °C / °F	± (0,05 % do Span) + Erro JF	± 2,0 °C

- (\*) Tamb Error is the accuracy of internal ambient temperature sensor
- Maximal input voltage: 30 Vpp.

### 3.1. MODEL DC80T GENERAL SPECIFICATIONS

Maximum voltage allowed between any terminal and earth ground or between the two input terminals: ..... 30 V

Storage temperature: ..... -40 °C ~ 60 °C

Operating temperature: ..... 0 °C ~ 50 °C

Operating altitude: ..... 3000 meters maximum

Temperature coefficient: .....  $\pm 0.02\%$  / °C on 0 °C ~ 18 °C and 28 °C ~ 50 °C

Relative humidity: ..... 95 % up to 30 °C

..... 75 % up to 40 °C

..... 45 % up to 50 °C

Shock: ..... Random 2 g, 5 Hz to 500 Hz

Safety: ..... 1 meter drop test

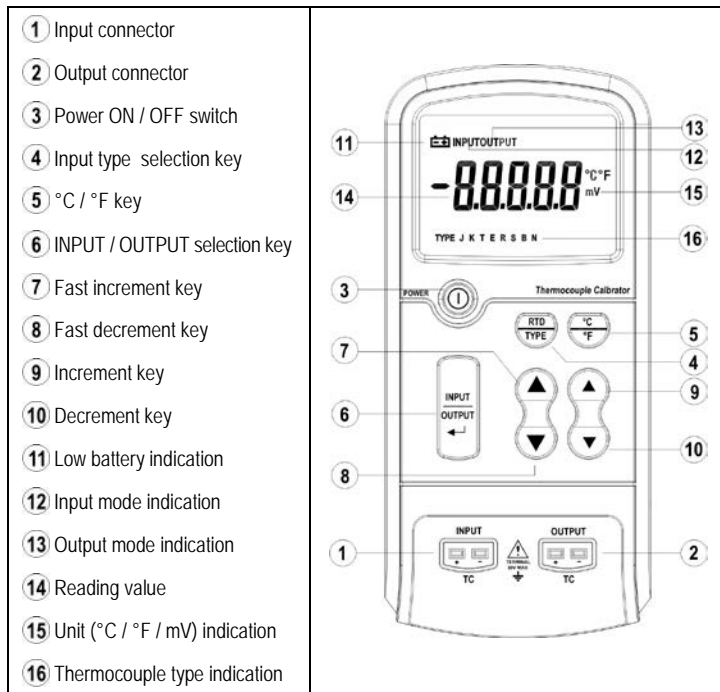
Power requirements: ..... 6 x AAA 1.5 V Battery

Size: ..... 205 mm x 98 mm x 46 mm

Weight: ..... 472 g (with batteries)

### 3.2. MODEL DC80T FRONT PANEL

The keypad and display functions are shown below:



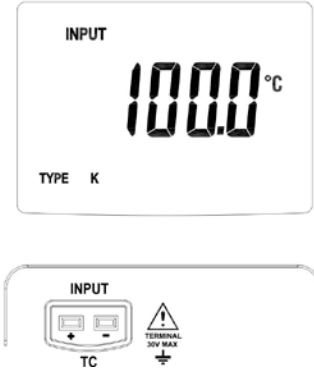
### 3.3. MODEL DC80T OPERATING INSTRUCTIONS

In thermocouple temperature simulation the calibrator generates the voltage as an actual thermocouple, considering both the simulated temperature (hot joint) and connection temperature (cold joint). To ensure stated accuracy the user must use a connection cable between calibrator and calibrated device with the same thermoelectric properties of the selected thermocouple (extension or compensation cable).

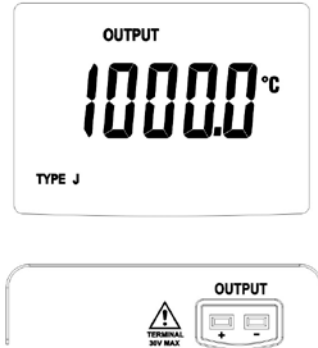
A K type extension cable (yellow connector) is supplied with the calibrator and should only be used for K type calibration for maximum accuracy.

Make sure that the appropriate cable with the correct polarity is being used to avoid large calibration errors.

#### Thermocouple or mV measurement

<ol style="list-style-type: none"><li>1. Press the power switch <b>3</b> to turn on the calibrator.</li><li>2. Press the INPUT / OUTPUT key <b>6</b> to select INPUT mode.</li><li>3. Press the TC TYPE selection key <b>4</b> to configure the instrument to the desired input type</li><li>4. Connect the T/C or mV signal to the input connector <b>1</b>.</li><li>5. The measured value is presented in <b>14</b>.</li></ol>	
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#### Thermocouple or mV Simulation

<ol style="list-style-type: none"><li>1. Press the power switch <b>3</b> to turn on the calibrator.</li><li>2. Press the INPUT / OUTPUT key <b>6</b> to select OUTPUT mode.</li><li>3. Press the TC TYPE selection key <b>4</b> to configure the desired output signal type.</li><li>4. Press the increment / decrement keys <b>7 8 9 10</b> to adjust the value to be simulated.</li><li>5. The simulated signal is delivered at the output connector <b>2</b>.</li><li>6. To change output values, press the increment / decrement keys until the desired value is presented in the display. Changing to other input types is accomplished by the TC TYPE selection key <b>4</b>.</li></ol>	
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## 4.MODEL DC80R

The MODEL DC80R RTD Process Calibrator measures and simulates resistance values of 7 distinct types of RTDs, either in °C or °F. Simultaneous measurement and signal simulation is not provided.

The specifications are valid for the period of one year, at temperatures between 18~28 °C.

### Resistance measurement and simulation specifications:

Range	Measurement accuracy (4 W ± Ω)	Simulate Accuracy (± Ω)	Excitation current (mA)
0.00 Ω ~ 400.00 Ω	0.15	0.20	0.1 ~ 3.0
400.0 Ω ~ 1500.0 Ω	0.5	0.5	0.05 ~ 0.8
1500.0 Ω ~ 3200.0 Ω	1	1	0.05 ~ 0.4

The excitation current applies only to the simulation mode. The excitation current is provided by the target instrument (OHM meter of RTD meter) connected to the calibrator.

### RTD measurement and simulation specifications:

Mode	Range	Accuracy (°C)			Excitation current (mA)
		Input 4 W	Input 2 W / 3 W	Output	
Pt10 385	-200 ~ 800 °C / -328 ~ 1472 °F	1.5	2.0	1.5	0.1 ~ 3.0
Pt50 385	-200 ~ 800 °C / -328 ~ 1472 °F	0.7	1.0	0.7	0.1 ~ 3.0
Pt100 385	-200 ~ 800 °C / -328 ~ 1472 °F	0.33	0.5	0.55	0.1 ~ 3.0
Pt200 385	-200 ~ 250 °C / -328 ~ 482 °F	0.2	0.3	0.7	0.1 ~ 3.0
	250 ~ 630 °C / 482 ~ 1166 °F	0.8	1.6	1.0	
Pt500 385	-200 ~ 500 °C / -328 ~ 932 °F	0.3	0.6	0.7	0.05 ~ 0.8
	500 ~ 630 °C / 932 ~ 1166 °F	0.4	0.9	0.7	
Pt1000 385	-200 ~ 100 °C / -328 ~ 212 °F	0.2	0.4	0.3	0.05 ~ 0.8
	100 ~ 630 °C / 212 ~ 1166 °F	0.2	0.5	0.3	
Pt100 392	-200 ~ 630 °C / -328 ~ 1166 °F	0.3	0.5	0.3	0.1 ~ 3.0

The excitation current applies only to the simulate mode. The excitation current is provided by the target instrument (OHM meter of RTD meter) connected to the calibrator.

## 4.1. MODEL DC80R GENERAL SPECIFICATIONS

Maximum voltage allowed between any terminal and earth ground or between the two input terminals: ..... 30 V

Resolution: ..... RTD 0.1 °C / °F; Resistance 0.01 / 0.1 Ω

Storage temperature: ..... -40 °C ~ 60 °C

Operating temperature: ..... -10 °C ~ 55 °C

Operating altitude: ..... 3000 meters maximum

Temperature coefficient: ..... ±0.01 % / °C (0 °C ~ 18 °C and 28 °C ~ 50 °C)

Relative humidity: ..... 95 % up to 30 °C

..... 75 % up to 40 °C

..... 45 % up to 50 °C

..... 35 % up to 55 °C

Shock: ..... Random 2 g, 5 Hz to 500 Hz

Safety: ..... 1 meter drop test

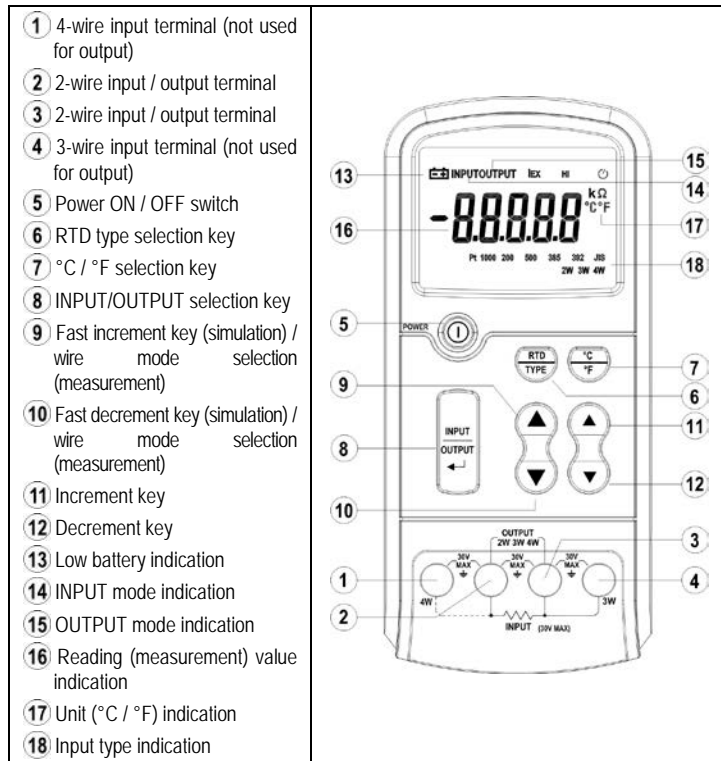
Power requirements: ..... 6 x AAA 1.5 V Battery

Size: ..... 205 mm x 98 mm x 46 mm

Weight: ..... 472 g (including batteries)

## 4.2. MODEL DC80R FRONT PANEL

The keypad and display functions are shown below:

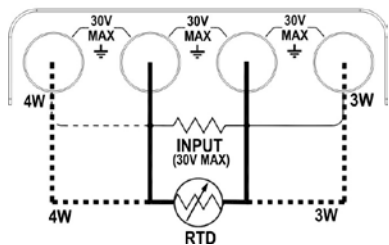


Accessories included: 2 pairs of test leads and alligator clips

### 4.3. MODEL DC80R OPERATING INSTRUCTIONS

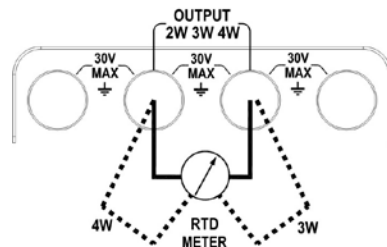
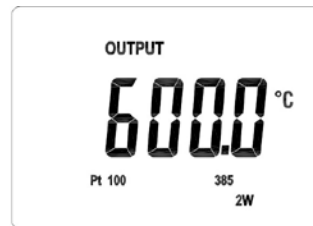
#### RTD measurement

1. Press the power switch **5** to turn ON the calibrator.
2. Press the INPUT / OUTPUT key **8** to select INPUT mode.
3. Press RTD mode key **6** for selecting the RTD type.
4. Connect the RTD or Resistance to the input connector.
5. For 3 W / 4 W mode measurements, press the wire mode select key **9** and **10** to select the desired mode. Then wire the signal to the corresponding input terminal.
6. Get the reading value **16**.



#### RTD Simulation

1. Press the power switch **5** to turn ON the calibrator.
2. Press the INPUT / OUTPUT key **8** to select OUTPUT mode.
3. Press RTD mode key **6** to select the desired RTD type.
4. Press the Increment / decrement keys **9** **10** **11** **12** to set the desired output value.
5. Connect the RTD or Resistance meter to the input terminals, as indicated in the drawing at the right.
6. For simulating signal in 3W / 4W modes, add the extra wires as shown in the drawing.
7. To change the output value, press the increment / decrement keys **9** **10** **11** **12** until the desired value is presented on the display. Changing to another RTD type is accomplished by the RTD TYPE selection key **6**.



## 5.MODEL DC80L

The DC80L is the calibrator model for measuring and simulating **V, mV and mA** signals. The DC80L is capable of measuring and generating 0 to 24 mA DC current signals and voltages up to 15 V DC. Simultaneous measurement and signal simulation is not provided.

Current measurements options are:

- With use of external power supply provided by the system. In this case, the calibrator is placed in series to measure the loop current (signal of a 2-wire transmitter, for example).
- The calibrator provides the power to the loop. This option makes use of the DC80L built-in power supply. This configuration applies to measurements of standalone 4-20 mA transmitters (sink type transmitters).

Current simulation possibilities are:

- The calibrator sources the current to the target instrument.
- The calibrator simulates (behaves as) a 2-wire transmitter.

The following tables show the DC80L specifications functions and ranges, based on a one year calibration period, at ambient temperatures ranging from +18 °C to +28 °C. "Counts" means **units** of the least significant digit.

### Voltage measurement and simulation:

Function	Range	Resolution	Accuracy ± (% of reading + Counts)
DC V / mV INPUT Auto range	0 ~ 110 mV	0.01 mV	± (0.05 % + 5 counts)
	0 ~ 15 V	0.001 V	± (0.10 % + 5 counts)
DC V / mV OUTPUT	0 ~ 100 mV	0.01 mV	± (0.05 % + 5 counts)
	0 ~ 15 V	0.001 V	± (0.10 % + 5 counts)
Input impedance: 2 M Ω (nominal) < 100 pF			
Over voltage protection: 30 V			
Voltage driver capability: 1 mA			

### DC mA measurement and simulation

Range	Resolution	Accuracy @ 25 °C ± (% of reading + Counts)
0 ~ 24 mA (Input and Output)	0.001 mA	± 0.03 % + 5
Overload protection: 125 mA, 250 V fast acting fuse		
Percent display: 0 % = 4 mA, 100 % = 20 mA		
Source mode: compliance 1000 Ω at 20 mA for battery voltage ≥ 6.8 V ( 700 Ω at 20 mA for battery voltage 5.8 to 6.8 V )		
Simulate mode: External loop voltage requirement: 24 V nominal, 30 Vmax, 12 Vmin		



## Loop Power

Internal power supply	24 V $\pm$ 10 % / 25 mA max.
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### 5.1. MODEL DC80L GENERAL SPECIFICATIONS

Maximum voltage allowed between any terminal and earth ground or between the two input terminals: ..... 30 V

Storage temperature: ..... -40 °C ~ 60 °C

Operating temperature: ..... -10 °C ~ 55 °C

Operating altitude: ..... 3000 meters maximum

Temperature coefficient: .....  $\pm$  0.005 % / °C  
(for the temperature range -10 °C to 18 °C and 28 °C to 55 °C)

Relative humidity: ..... 95 % up to 30 °C

..... 75 % up to 40 °C

..... 45 % up to 50 °C

..... 35 % up to 55 °C

Shock: ..... Random 2 g, 5 Hz to 500 Hz

Safety: ..... 1 meter drop test

Power requirement: ..... 6 x AAA

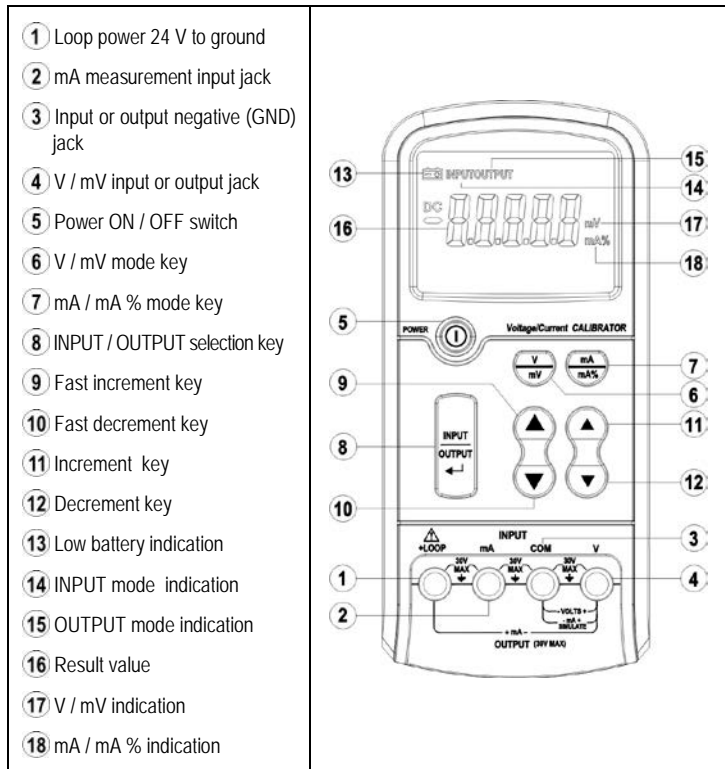
Size: ..... 204 mm (L) x 99 mm (W) x 46 mm (H)

Weight: ..... 460 g (including batteries)

External power supply ..... 9 Vdc / 500 mA

### 5.2. MODEL DC80L FRONT PANEL

The keypad and display functions are shown below:



### 5.3. PROTECTION

The MODEL DC80L calibrator uses two protection fuses, rated 125 mA / 250 V, internally connected in series with the current terminals (2) and (4).

To avoid personal injury or damage to the calibrator, use only 125 mA / 250 V fast fuses.

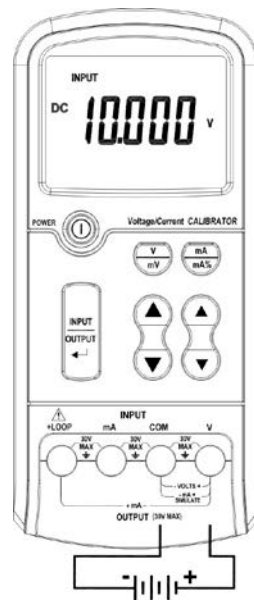
Notes on fuses:

- Fuse 1 is probably blown out when the display flashes the message OL while in Voltage output mode with the leads removed from the calibrator.
- Fuse 2 is probably blown out if the calibrator reads 0.000 in mA input mode, even under the presence of a current input signal

### 5.4. MODEL DC80L OPERATING INSTRUCTIONS

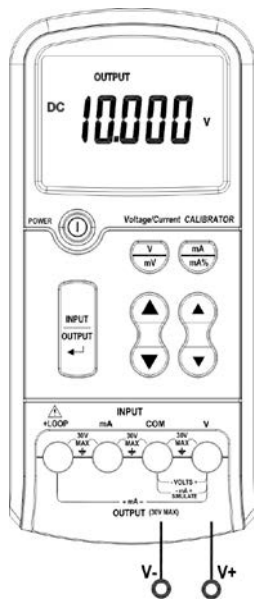
DC mV and V measurements

1. Press the power switch **5** to turn on the Calibrator.
2. Press the INPUT / OUTPUT mode key **8** to select INPUT mode.
3. Press the V/mV mode key **6** to select mV input **17**.
4. Plug the red test lead to "V" jack **4** and the black one to the "COM" jack **3**.
5. Connect the test leads according to the signal polarity: red to the positive polarity; black to the negative polarity (GND).
6. Measurement value is shown on the display **16**.



## DC mV and V generation

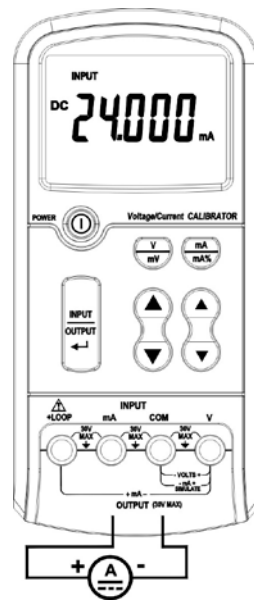
1. Press the power switch (5) to turn on the Calibrator.
2. Press the INPUT / OUTPUT mode key (8) to select OUTPUT mode (15).
3. Press the V / mV mode key (6) to select the desired output scale. The mode indication (V or mV) is shown in (17).
4. Use the increment / decrement keys (9, 10, 11, 12) to adjust the output to the desired value.
5. Plug the red test lead in the "V" jack (4) and the black one to the COM jack (3).
6. Connect the positive test lead (red) and the negative test lead (black) to the target equipment.
7. For changing the output value, use the increment / decrement keys (9, 10, 11, 12) and the V / mV mode key (6) until the desired value is displayed.



## DC mA measurement

### a) Using external power supply

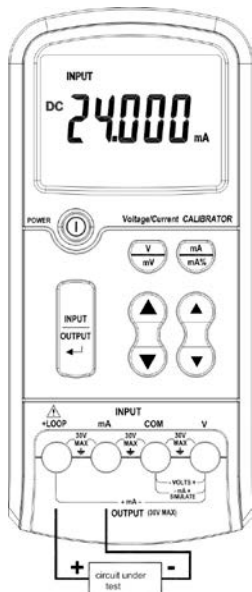
1. Press the power switch to turn on the Calibrator.
2. Press the INPUT / OUTPUT selection key (8) to select input mode. The INPUT sign is shown on the display (14).
3. Press the mA / mA % mode key (7), to select mA or mA % (18).
4. Plug the red test lead in the mA jack (2) and the black one to the COM jack (3).
5. Connect the test lead according to the signal polarity (red to the positive, black to the negative).
6. The measurement is shown on the display (16).



## b) Measurements using calibrator's internal power supply for powering the loop

The calibrator provides an internal 24 V power supply for measuring the signal of 2-wire transmitters (sink transmitters). The 24 Vdc is applied between terminals +LOOP e COM. The sink transmitter is to be connected between terminals +LOOP (Power supply output) and mA (terminal for the loop current monitoring).

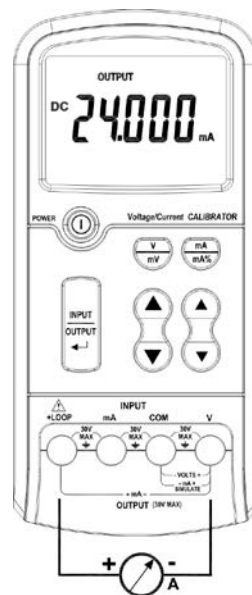
1. Press the power switch **5** to turn on the Calibrator.
2. Choose OUTPUT mode **14** by pressing the INPUT / OUTPUT key **8**.
3. Press the mA / mA % mode key **7** to choose the desired unit. The signs **mA** or **mA %** **18** will be presented on the display.
4. Plug the red test lead into the LOOP jack **1** and the black one to the mA jack **2**.
5. Connect the test leads such that the current enters the red lead and returns to the power supply through the black lead.
6. The measurement is shown on the display **16**.



## DC mA generation

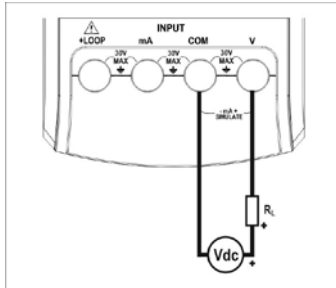
### a) Sourcing mA

1. Press the power switch **5** to turn the Calibrator ON.
2. Press the input / output mode key **8** to select OUTPUT mode **15**.
3. Press the mA / mA % mode key **7** to select mA or mA % **18**.
4. Press the increment / decrement keys **9 10 11 12** to set the desired output value.
5. Plug the red test lead into the LOOP jack **1** and the black one to the V jack **4**.
6. Connect the test leads such that the current enters the red lead and returns to the power supply through the black lead.
7. To change the output value, press the increment / decrement keys **9 10 11 12** and / or the mA mA % mode key **7**.



## b) Simulating a 2-wire Transmitter (sink transmitter)

1. Press the power switch **5** to turn on the Calibrator.
2. Press the INPUT / OUTPUT mode key **8** to select OUTPUT mode **15**.
3. Press the mA / mA % mode key **4** to select mA or mA % **18**.
4. Press the increment / decrement keys **9** **10** **11** **12** to set the desired output value.
5. Plug the red test lead into the V jack **4** and the black one to the COM jack **4**.
6. Connect the test leads such that the current enters the red lead and returns to the power supply through the black lead.
7. To change the output value, press the increment / decrement keys **9** **10** **11** **12** and / or the mA / mA % mode key **4**.



Accessories: a pair of Test Leads

## 6.MAINTENANCE


### Cleaning

Periodically wipe the case with a damp cloth and detergent; do not use abrasives or solvents.

### Calibration

Calibrate your calibrator once a year to ensure its performance according to the specifications.

### Replacing the Battery

Change the battery when the display signs .

Turn off the power, unscrew the battery cover, and replace the batteries.

## 7.WARRANTY

Warranty conditions are available on our web site [www.novusautomation.com/warranty](http://www.novusautomation.com/warranty).