

MULTIFUNCTIONAL CALIBRATOR

MS7003



TECHNICAL DESCRIPTION AND INSTRUCTION FOR USAGE

MULTIFUNCTIONAL CALIBRATOR

I. DESIGNATION

The multifunctional calibrator MS7003 is designed for measurement and simulation of different types of process parameters and for accurate test and tuning of laboratory and industrial instruments for control and measurement.

MS7003 measures:

1. Signals from low-potential sources in automatically band switching
– 40...100 и 100...1000 mV.
2. Voltage unified signals in ranges 0... 10 V.
3. Power sources and unified signals in ranges to 0...20 mA.
4. Two-wire transmitters power supplied by the line 4...20 mA
5. Temperature from thermocouples – J, K, T, E, R, S, N, B.
6. Temperature from thermal resistors Pt100, Pt1000.
7. Resistive sensors in the range 0...999Ω.

MS7003 simulates:

1. Signals from low-potential sources in ranges – 40...1000 mV.
2. Voltage unified signals in ranges 0...10 V.
3. Power sources and unified signals in ranges to 0...20 mA.
4. Two-wire transmitters power supplied by the line 4...20 mA
5. Potentials of thermocouples – J, K, T, E, R, S, N, B.

II. TECHNICAL CHARACTERISTICS

Input-output characteristics			
Voltage input			
Ranges	Resolution	Zero error	Accuracy
-40.000 ... 99.999 mV DC	1 μV	< 10 μV	0.01 %
100.00 ... 999.99 mV DC	10 μV	< 0.1 mV	0.01 %
-1.000 ... 10.300 V DC	1 mV	< 1 mV	0.01 %
Power input			
Range	Resolution	Zero error	Accuracy
0.000 ... 26.000 mA	1 μA	< 3 μA	0.01 %
Loop 0.000 ... 24.000 mA	1 μA	< 3 μA	0.01 %
Measurement of resistance			
Range	Resolution	Current at measuring	Accuracy
0.00 ... 999.99 Ω	0.01 Ω	1 mA	< 0.02 Ω
0.0 ... 4000.0 Ω	0.1 Ω	0.3 mA	< 0.2 Ω
Measurement of temperature (Thermocouples – J,K,T,E,R,S,N,B ; RTD – Pt 100, Pt1000)			
Sensor	Range	Resolution	Accuracy
TC	–250.0 ... 2310.0 °C	0.1 °C	According to the type
Pt100	– 200.0 ... 850.0 °C	0.1 °C	0.2 °C
Pt1000	– 200.0 ... 850.0 °C	0.1 °C	0.2 °C
Voltage output			
Ranges	Resolution	Zero error	Accuracy
-40.000 ... 99.999 mV DC	1 μV	< 10 μV	0.01 %
100.00 ... 999.99 mV DC	10 μV	< 0.1 mV	0.01 %
-1.000 ... 10.300 V DC	1 mV	< 1 mV	0.01 %
Power output			
Range	Resolution	Zero error	Accuracy
0.000 ... 26.000 mA	1 μA	< 2 μA	0.005 %
Loop 3.000 ... 24.000 mA	1 μA	< 2 μA	0.01 %
Simulation of thermocouples (Thermocouples – J,K,T,E,R,S,N,B)			
Range	Resolution		
–250.0 ... 2310.0 °C	0.1 °C		

Thermocouple	Range	Accuracy
J	-210...1200 °C	0,2°C
K	-200...1372 °C	0,3°C
T	-270... 400 °C	0,2°C
E	-50...1000 °C	0,2°C

Thermocouple	Range	Accuracy
R	-50...1768 °C	0,4°C
S	-50...1768 °C	0,4°C
N	-200...1300 °C	0,3°C
B	50...1820 °C	0,5°C

* The accuracies are determined according to the range!

Other characteristics	
Error from compensating conductors when measuring RTD and R	$\pm 0.005 \text{ } ^\circ\text{C}/\Omega$
Power at the measured resistance	Pt 100 or range 400 Ω - 1 mA Pt 1000 or range 4000 Ω - 0.3 mA
Input resistance when current measuring	<55 Ω
Maximum resistance in the line when current generating	700 Ω at 20 mA
Resistance supplying the two-wire line	13.5 V
Temperature compensation at the cold end of thermocouples	From keypad -99.9...99.9 $^\circ\text{C}$ Internal automatic -25.0...75.0 $^\circ\text{C}$
Display	LCD 2 x 16
Time for measurement	< 800 ms
Power supplying voltage	4 x 1.2 V ; 2700mAh NiMH element
Time for charging of the battery	8 - 14 h
Operating temperature and relative humidity	-10 ... 55 $^\circ\text{C}$; 0 ...65 %
Storage temperature and relative humidity	-30 ... 75 $^\circ\text{C}$; 0... 95 %
Overall dimensions, mm	175 x 105 x 25
Weight (with batteries)	< 500g

III.FRONT PANEL



– ON / OFF the instrument



– ON / OFF Illumination








– Switches operating mode Simulation (OUT) and operating mode Measurement (IN)

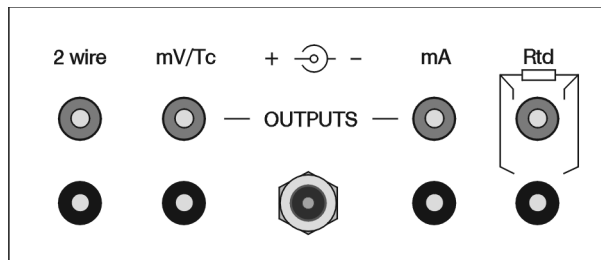


– Enter operating mode MENU

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-  – Do not confirm the set-pointed value and return the previous automatically
-  – Tuning of the change of the parameter (d)
-  – Select a parameter from operating mode MENU, change the output parameter by step d
-  – Confirm the set-pointed value
-  – Digital keypad

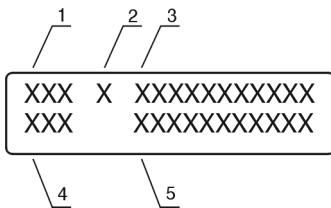
IV. BACK PANEL



V. INSTRUCTIONS FOR USAGE

V.1. DISPLAY

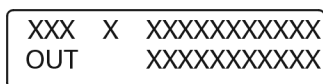
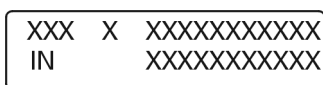
MS7003 uses 2x16 letter-digit LCD display with the following format:




- 1) Simulated or measured parameter
- 2) Type of the thermocouple in operating mode TC
- 3) Type of the thermal resistor, the current output or type and value of the temperature correction
- 4) Indicates the operating mode – measurement (IN) or simulation of a parameter (OUT)
- 5) Value of the parameter or the step

More information about the symbols, shown on the display, and their significance can be read below at the description of the functions.


V.2. SELECTION OF THE VALUE ON THE DISPLAY



The change of the value on display can be done by pressing the button .

! At measurement of resistance the menu output is inhibited. In all other cases at passing from OUT to IN the outputs save their set-pointed value, and they are not zeroed.

V.3. SELECTION OF OPERATING MODE

The entry and the movement in the menu for selection of operating mode can be done by the button . The type of the menu for selection of operating mode is changed according to this if we are in IN or OUT.

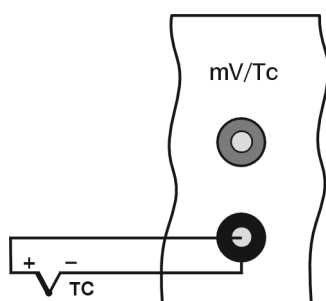
At IN: TC, mV, V, mA, Ω , K Ω , RTD

At OUT: TC, mV, V, mA, mA Loop














V.4. THERMOCOUPLES

V.4.1. Measurement of temperature by thermocouple

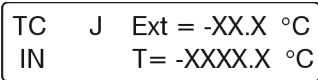
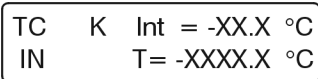
Scheme of connection



Control of the keypad

	Select input (IN)
  	Select operating mode thermocouples (TC)
  	Select the type of thermocouple (J, K, E, T, S, R, B, and N)
  	Select the type of the temperature compensation (Int – must be entered by the keypad; Ext – automatic from the built-in sensor)
	Exit from the menu
 	Change of the value of the temperature compensation (only in operating mode Int)

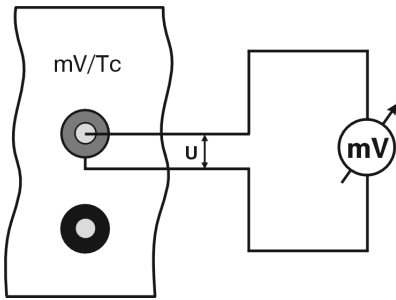
Appearance of the display

	Measurement of thermocouple type J with automatic temperature compensation from built-in sensor
	Measurement of thermocouple type K with temperature compensation entered by the keypad















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V.4.2. Simulation of thermocouple

Scheme of connection











Control of the keypad

-  Select output (OUT)
-    Select operating mode thermocouples (TC)
-    Select the type of the thermocouple (J, K, E, T, S, R, B, and N)
-    Select the type of the temperature compensation (Int – entered by the keypad; Ext – automatic from the built-in sensor)
-    Select the value of the temperature compensation (**only in operating mode Int**)
-  Exit from the menu

-  ...  Select the temperature
-  Confirm the new entered value
-  Return the previous value, if the new one has not been confirmed

If the simulated temperature will be changed with one step, it must be set-pointed that way:

-  Enter operating mode set-point of a step
-  ...  Set-point the value of the step
-  Confirm the new entered value
-  Return the previous value, if the new one has not been confirmed
-  Exit from operating mode set-point of step
-   Change the set-pointed temperature with one step

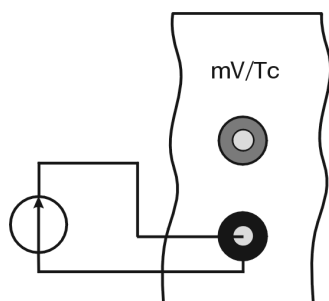
Appearance of the display

TC	J	Ext = -XX.X °C	Simulation of thermocouple type J with automatic temperature compensation from built-in sensor
OUT		T = -XXXX.X °C	

TC	J	Int = -XX.X °C	Simulation of thermocouple type J with temperature compensation entered by the keypad
OUT		T = -XXXX.X °C	

V.5. VOLTAGE**V.5.1. Measurement of voltage**

MS7003 has three ranges for measurement of voltage: 100 mV, 1000 mV and 10 V. The ranges 100 mV and 1000 mV are switched automatically and are in operating mode millivolts (mV), and 10 V in operating mode volts (V).

Scheme of connection**Control by the keypad**

	Select input (IN)
	Select operating mode (mV) or (V)
	Exit from the menu

Appearance of the display

mV	IN	U= XXX.XX mV	Measurement of voltage (100...1000) mV

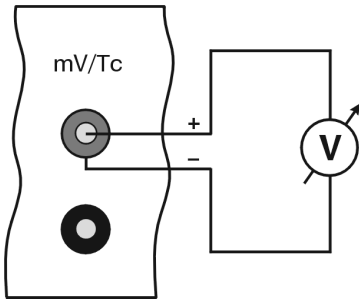
V	IN	U= - XX.XXX V	Measurement of voltage (-10...10) V

5. 5. 2. Generation of voltage










MS7003 has three ranges for generation of voltage: 100 mV, 1000 mV and 10 V. The ranges 100 mV and 1000 mV are switched automatically and are in operating mode millivolts (mV), and 10 V in operating mode volts (V).

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Scheme of connection





Control by the keypad

-  Select output (OUT)
-    Select operating mode (mV) or (V)
-  Exit from the menu
-  ...  Set-point voltage
-  Confirm the new entered value
-  Return the previous value, if the new one has not been confirmed

If the generated voltage will be changed with one step, it must be set-pointed that way:

-  Enter operating mode set-point of a step
-  ...  Set-point the value of the step
-  Confirm the new entered value
-  Return the previous value, if the new one has not been confirmed
-  Exit from operating mode set-point of step

-   Change the set-pointed voltage with one step

Appearance of the display

- | | | | | |
|----|-----|----|--------|----|
| mV | OUT | U= | XXX.XX | mV |
|----|-----|----|--------|----|

 Generation of voltage (100...1000) mV
- | | | | | |
|---|-----|----|----------|---|
| V | OUT | U= | - XX.XXX | V |
|---|-----|----|----------|---|

 Generation of voltage (-1...10) V

V.6. CURRENT

V.6.1. Measurement of current

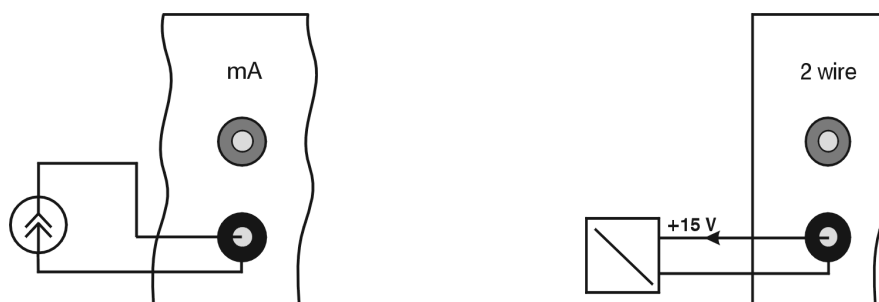
MS7003 supports two schemes for measurement of current – measurement in current circuit and measurement of current of two-wire transmitter, power supplied by the instrument.

The input for measurement in current circuit is protected by melting fuse 200 mA, installed in the instrument.






Do not supply this input with voltage!

The power supply circuit of an outer two-wire transmitter is with current limitation approximately 40 mA. Avoid lasting shorting of this circuit.

Schemes of connection



Control by the keypad

-  Select input (IN)
-    Select operating mode (mA) or (mA Loop)
-  Exit from the menu

Appearance of the display

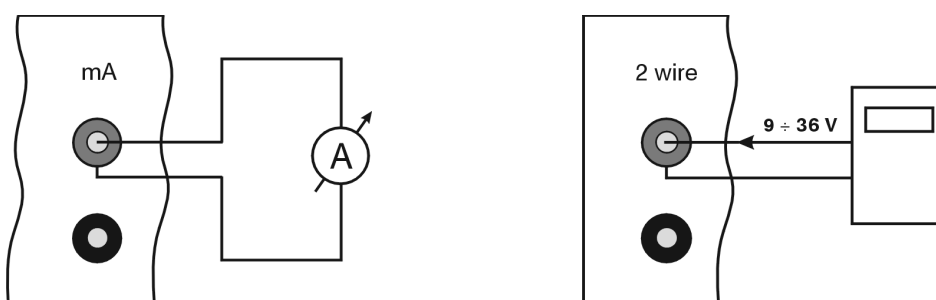
mA		Measurement of current
IN	I = XX.XXX mA	

mA	Loop	Measurement Loop Powered
IN	I = XX.XXX mA	

V.6.2. Generation of current






MS7003 supports two operating mode of current generation mA and mA Loop Powered

Schemes of connection

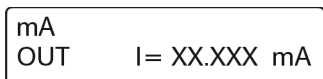
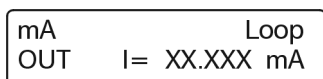


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Control by the keypad

-  Select output (OUT)
-    Select operating mode mA or mA Loop
-  Exit from the menu

Appearance of the display

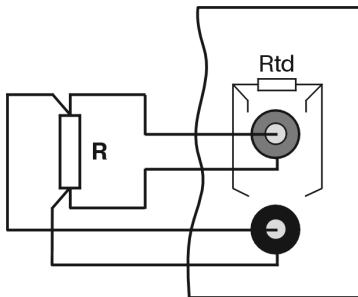
-  Current generation
-  Current generation at Loop Powered

5.6 RESISTANCE






! At measurement of resistance the menu output is inhibited, because internal current generation for measurement of resistance is used. To enter it again you have to exit operating conditions measurement of resistance!

V.6.3. Measurement of resistance

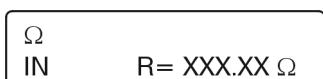
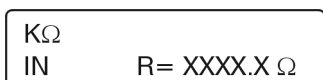
Scheme of connection



Control by the keypad

-  Select input (IN)
-    Select operating mode measurement of resistance (Ω) or ($K\Omega$)
-  Exit from the menu

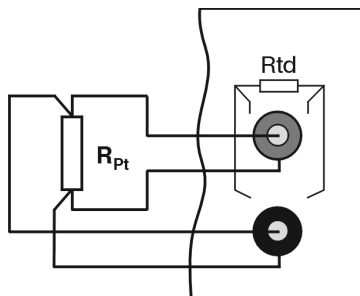
Appearance of the display

-  Measurement of resistances (Ω)
- 
-

 Measurement of resistances ($K\Omega$)

V.6.4. Measurement of temperature by resistive thermal sensitive element

MS7003 supports resistive thermal sensitive element Pt100

Scheme of connection***Control by the keypad***

Select input (IN)



Select operating mode resistive thermal sensitive element (RTD)



Exit from the menu

Appearance of the display

RTD	DIN	Pt100
IN	T= - XXX.X °C	

Measurement of Pt100

RTD	DIN	Pt1000
IN	T= - XXX.X °C	

Measurement of Pt1000

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VI.CHARGE

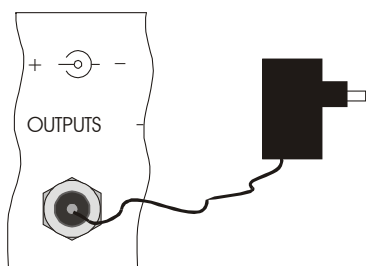
The status of the battery is controlled in two levels.

Forewarning level – at every 20 s on the display appears “Low Battery” and the illumination of the display stops emitting light.

When you reach the second level on the display appears “Low Battery Good Bye” and MS7003 switches off automatically.

The charging of the storage batteries can be done by the internal charging device, and the charge is stopped automatically by the device. The process of charging lasts at least 8 hours.

Scheme of connection



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