

**HANDHELD
CALIBRATOR-MULTIMETER
OC502-t**

Owner's Manual

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CALIBRATOR - MULTIMETER OC 502-t

- ✓ **Current Calibrator 0/4 - 22mA, Source-Sink**
- ✓ **Voltage Calibrator 0-14V**
- ✓ **mV-Outputs 28mV and 560mV**
- ✓ **DIN Thermocouples J, K, N, R, S, T, B, E**
- ✓ **Multimeter $\pm 2V$ to $\pm 200V$ DC and $\pm 100mA$**
- ✓ **Calibrates and Measures simultaneously**
- ✓ **Firm steps and continuous ramps**
- ✓ **Direct value entry via the keyboard**
- ✓ **Rechargeable Battery**
- ✓ **Software calibration**



Model OC 502-t is a Calibrator-Multimeter which generates currents 0/4-22mA in Source or Sink mode and Voltages 0 to 14V. External voltages $\pm 2V$, $\pm 20V$ and $\pm 200VDC$ (firm ranges or Autoranging) and currents up to $\pm 100mA$ can be measured while the calibrator generates the selected output signal. Due to this simultaneous operation a response from e.g. external transmitters under test can be measured with the calibrated signal from OC502-t. Both, the generated calibration signal and the measured external signal are displayed.

For calibration of mV devices such as strain gauges chains, Millivolt outputs 0-28mV or 0-560mV with high resolution are available.

Din Thermocouples J, K, N, R, S, T, B, E can be simulated in positive temperature range. The sensor type will be selected and the required temperature entered with the keyboard. The display shows the temperature, the mV output is at the output terminals. The junction is compensated for the ambient temperature with internal sensor. The compensation can be switched-off.

OC502-t can be software recalibrated via the keyboard whenever required. The instrument is supplied from internal rechargeable battery which permits 9 hour uninterrupted operation.

Back ground light can be switched on.

1 FUNCTIONS

OC502-t can be set for following functions by using the keyboard and the digital display:

- Tara of the analogue outputs, the filter selection, background light.
- Direct value entry via the keyboard. The current can be set between 0 and 22mA, the voltage between 0 and 14V.
- Raising or sinking Ramps 0-14V or 0-22mA, with selectable steps.
- Range selection 0-28mV or 0-560mV with resolution 0.001mV and 0.01mV.
- Simulation of DIN - J, K, N, R, S, T, B, E Thermocouples with or without compensation.
- Signal output of all Signal types in firm steps such as 0-2-4-6-8-10-12-14V.

Calibrator	Current Source	0 ... 22 mA
	Current Sink	0 ... 22 mA
	Voltage Source	0 ... 14 V
	mV Source	0 ... 28.000 mV and 0 ... 560.00 mV
	DIN Thermometers	J, K, N, R, S, T, B, E

The calibrator functions are settable with three sliding switches:
 ON-OFF Power ON and OFF
 SRC-I, SNK-I Current Source 0-22mA, Current Sink 0-22mA
 OUT-V, OUT-I Voltage Output 0-14V, Current Output 0-22mA

ATTENTION!

In the **Current Sink Mode** the switches **SNK-I** and **OUT-I** have to be selected. Do not switch to **OUT-V!**
 The Current and the Voltage Outputs might be destroyed!

Multimeter	Voltage Ranges	Firm ranges	$\pm 2V, \pm 20V, \pm 200VDC$
		Autoranging	0 ... $\pm 200VDC$
	Current Range	Firm range	0 ... $\pm 100mADC$

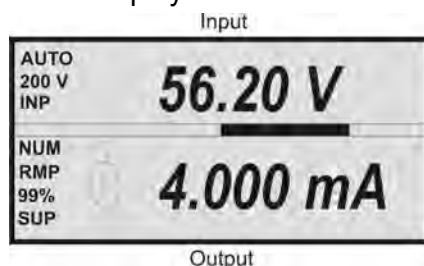
The Multimeter Functions can be set with the keys *100mA, AUTO, 2V, 20V, 200V*.

2 OUTPUTS and INPUTS

CALIBRATOR:	Voltage and Current Output:	+ OUT -
MULTIMETER:	Voltage Input:	GND, IN-V
	Current Input:	GND, IN-I

3 LCD DISPLAY

The LCD Display is divided into 2 sections. The upper part shows the multimeter functions, the lower part shows the generated calibrator signals. A Bargraph in the middle displays the measured values as an analogue function. The left side of the display shows various statements:



AUTO-FIX	Automatic Range selection or Firm Ranges
200V	Firm Ranges 2V, 20V, 200V, 100mA
INP	The display shows the input signal. With FN the following functions can be set: HLD Display HOLD MAX Maximum Value Hold MIN Minimum Value Hold RST Reset the max. and the min. values to zero
NUM	Direct value selection with the keyboard
RMP	Automatic Ramp
SUP	Charger plugged, Battery is charged
99%	Battery voltage shown in % of full capacity. Charge the battery when less than 0% is displayed. Charge only with the enclosed original charger.

4 KEYBOARD

7 100mA	8 Auto	9 Set	FN
4 2V	5 20V	6 200V	← Menu
1 Num	2 Step	3 Ramp	→ Esc
. Up	0 Clr	+/- Down	Enter

5 SPECIFICATIONS

CALIBRATOR Outputs + OUT -

Current Source	Range	0 ... 22mA, max. Load 750 Ohm
	Accuracy	± (0.05% from Value + 0.1% from Range)
	Option:	0 ... 110mA, see page 16: OC502-V2-100.
Current Sink	Range	0 ... 22mA @ max. 24VDC
	Accuracy	± (0.05% from Value + 0.1% from Range)
Voltage Source	Range	0 ... 14 V, 0 ... 560mV, 0 ... 28mV
	Accuracy	± (0.05% from Value + 0.1% from Range)
	Load:	0 - 25V, maximum 1mA 0 - 560mV, 0 - 28mV: maximum load 1kOhm

Thermocouples	According to ITS 90:
	Type B, E, J, K, N, R, S, T
	Range: -270 °C up to 1820 °C
	Accuracy: ± 0.3 – 2.5 °C
	Load: maximum load 1kOhm
	Could Junction compensation with SMT160 can be menu calibrated.

Working Ranges and specified Accuracies for Thermocouples without internal compensation

R	Range [°C]	-50 - 0	0 - 400	400 - 1760
	Accuracy [°C]	1.6	1.6	1.6
S	Range [°C]	-50 - 0	0 - 500	500 - 1760
	Accuracy [°C]	2.4	1.9	1.5
B	Range [°C]	50 - 800	800 - 100	1000 - 1820
	Accuracy [°C]	2.5	1.5	1.3
J	Range [°C]	-140 - 0	0 - 700	700 - 1200
	Accuracy [°C]	1.1	0.6	0.6
T	Range [°C]	-270 - -100	-100 - 0	0 - 400
	Accuracy [°C]	1.7	0.7	0.3
E	Range [°C]	-120 - 0	0 - 370	370 - 1000
	Accuracy [°C]	1.1	0.3	0.7
K	Range [°C]	-230 - -100	-100 - 0	0 - 1370
	Accuracy [°C]	1.8	0.8	0.9
N	Range [°C]	-270 - -100	-100 - 0	0 - 1300
	Accuracy [°C]	2.1	1.4	1.2

The accuracies shown are maximum values. Typical accuracies are lower.

Resolution	0...22.000mA, 0...14.000V, 0...560.00mV, 0...28.000mV, 0.1°C
Tempco	± 25ppm/K
Ramps	Raising or sinking Ramps with programmable Steps ± 0.1mA, ± 0.05V, ± 2mV, ± 0.1mV, ± 5 °C or ± 0.5mA, ± 0.25V, ± 10mV, ± 0.5mV, ± 20 °C
Temperature	Working: -10 °C ... +35 °C, Store: 0 ... 45 °C
Terminals	4mm gold plated terminals

ATTENTION!

In the **Current Sink Mode** the switches **SNK-I** and **OUT-I** have to be selected. Do not switch to **OUT-V**! The Current and the Voltage Outputs might be destroyed!

MULTIMETER Inputs **GND, IN-V, IN-I**

Voltage:	Ranges	± 2V (1.83 MΩ), ± 20V (363 kΩ), ± 200V (333 kΩ)
IN-V:	Autoranging	± 200V DC
	Accuracy	± 0.1% from range ± 1 Digit
Current:	Range	± 100mA DC (10 Ω)
IN-I:	Accuracy	± 0.1% from range ± 1 Digit
Tara:	Tara can be activated with the keyboard.	
Filter:	Averaging filter with filtering constants 0 to 9.	
Tempco:	± 25ppm/K	
Terminals	4mm gold plated terminals	

The specifications are valid after a warm-up time of 10 min. and an ambient temperature of 23 °C±2 °C.

The calibrator output and the multimeter inputs have common GND.

MICROCONTROLLER

The Multimeter or the Calibrator functions can be selected with sliding switches. The settings and the parameters are stored in internal memory. The instrument can be software calibrated via the keyboard.

Keyboard:	The keys have to be pressed at least for 0.5 sec in order to permit the controller to accept the command.
Rate:	1 sample per 1 sec.
Memory:	EEPROM.

SUPPLY

Battery:	Two 3.7V-2000mAh rechargeable Li-ion Batteries permit an uninterrupted operation of 9 hours with 20mA set at the calibrator output.
Charger:	Mains voltage 100-240V, 48-60Hz / 12V-600mA DC. The battery requires 4.0 hours to be fully charged. The green LED stops flashing.

6 CALIBRATOR - FUNCTION SELECTION

The calibrator functions are selectable with three sliding switches. The keyboard permits setting of Ramps, Steps or direct Value entry.

The Multimeter is active all the time and can be simultaneously used with the calibrator. The function is described in § 7.

The display is divided into two parts. The upper part shows the multimeter values, the lower part is assigned to the calibrator outputs 0-20mA or 0-10V. The middle part is a Bargraph showing the values as analogue information.

6.1 Setting of the output current 0 - 22mA in Steps or Ramps

Sliding switch to be set to SRC-I and OUT-I.

The key *Clr* set the output current to 4mA.

The key *Up* increases the output current in 0.20 mA steps.

The key *Down* decreases the output current in 0.20 mA steps.

The key *Ramp* activates the automatic ramp. To stop the ramp, press the key again.

The key *Step* generates the current steps of 4, 8, 12, 16, 20, 22mA

6.2 Direct setting of the output current between 0 and 22mA

Sliding switch to be set to SRC-I and OUT-I.

The key *Num* activates the numeric selection.

Enter the required value with the keyboard and press *Enter*.

To erase the last entry, use the keys ← and → .

6.3 Setting of the voltage output 0 - 14 V in Steps or Ramps

Sliding switch to be set to OUT-V.

The key *Clr* sets the output voltage to 0 V.

The key *Up* increases the output voltage in 0.10 V steps.

The key *Down* decreases the output voltage in 0.10 V steps.

The key *Ramp* activates the automatic voltage ramp.

The key *Step* generates voltage increments 0, 2, 4, 6, 8, 10, 12, 14V.

6.4 Setting of mV Outputs 0–560mV and 0–28mV in Steps or Ramps

Same like 0–14V voltage output. Menu selection: Select 2 or Select 3.

6.5 Thermocouple output in Steps or Ramps

Put the Sliding Switch into Position OUT-V.

Press MENU until the display shows VOLTAGE OUTPUT U.

Select 4 with MENU.

THERMOCOUPLE OUTPUT. Select the required Type.

Select **Cold Junct. Comp.** Select 1 (ON) for internal on-board compensation. Press MENU.

Select **Unit Selection.** Select 1 for degree Centigrade (°C). Press ESC.

Key *Clr* sets the output signal to 0.0 °C.

Key *Up* increases the Output mV in 10 °C steps.

Key *Down* decays the Output mV in 10 °C steps.

Key *Ramp* activates the automatic Ramp generation.

Key *Step* generates Output mV in Steps 0, 200, 400, 600, 800, 1000, 1200, 1400 °C

RAMPS

The key *Ramp* activates the Ramp Generator. The display increments or decrement in steps selected in the Menu and shows the symbol *RMP*. With the key *Ramp* the Ramp can be stopped. When pressed again, the Ramp will continue from the value when it had been stopped. By keeping pressed the key *Ramp* for several seconds, the Ramp will start from beginning.

6.6 Direct setting of the output voltage value between 0 and 14 V, 0-560mV, 0-28mV and T/C

Sliding switch set to OUT-V.

The key *Num* activates the numeric selection.

Enter the required value with the keyboard and press *Enter*.

To erase the entry, use the keys ← and → .

6.7 Selection of the display function

The key **MENU** selects following operation modes – see page 14:

TARA SELECT	Tara of the Multimeter input signal to Zero
FILTER DEGREE	Selection of averaging filter from 0 to 9.
RAMP SELECT	Activates Ramps: 1 Raising Ramp with 0.5mA, 0.25V, 10mV, 0.5mV and 20 °C steps 2 Raising Ramp with 0.1mA, 0.05V, 2mV, 0.1mV and 5 °C steps 3 Sinking Ramp with -0.1mA, -0.05V, -2mV, -0.1mV and -5 °C steps 4 Sinking Ramp with -0.5mA, -0.25V, -10mV, -0.5mV and -20 °C steps
GRAPHICS	Graphics of last 128 measuring points in the Multimeter function of the voltage range up to 200V DC or currents up to 100mA DC.
BACKLIGHT	Back ground light: OFF or ON. With ON selection the display remains illuminated for 20 seconds after pressing any key of the keypad.
VOLTAGE OUTPUT U	Output Signal selection 1 Output 0...14V 2 Output 0...560mV 3 Output 0...28mV 4 Thermocouples Simulation
THERMOCOUPLE OUTPUT	(Select 4 is activated) 1 Type B 2 Type E 3 Type J 4 Type K 5 Type N 6 Type R 7 Type S 8 Type T
Cold Junct. Comp.	Cold Junction Compensation can be activated or switched-off.
Unit Selection	°C or °F
EEprom Archive	Erase or Store the settings in internal EEPROM.

The key **Esc** terminates the programming mode and the display switches into the Measuring mode.

7 MULTIMETER - FUNCTION SELECTION

The multimeter is active all the time and can be simultaneously used with the calibrator.

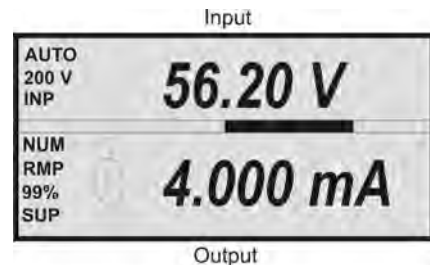
The calibrator output and the multimeter inputs have common GND.

The upper part of the display shows the values and parameters of the Multimeter:

AUTO Autoranging $\pm 2 \dots \pm 200\text{VDC}$, settable with the key **Auto**.
FIX Firm voltage ranges $\pm 2\text{V}$, $\pm 20\text{V}$, $\pm 200\text{V DC}$, settable with **Auto**.
 Firm current range $\pm 100\text{mA DC}$, settable with **100mA**.

With the key **FN** following mode of operation can be set:

INP The display shows the input signal
HLD HOLD the display
MAX The display shows the maximum value
MIN The display shows the minimum value
RST The maximum and the minimum stored
 values are erased



8 SOFTWARE CALIBRATION

The voltage and the current ranges of the multimeter and the output signals of the calibrator can be precisely calibrated by using the keyboard. The calibration menu can be opened with the key **Set**.

```
1 Out 4 .. 20 mA 0 .. 10 V
2 Input i 0..100mA
3 Input u 0..2V
4 Input u 0..20V
5 Input u 0..200V
6 Hardware
```

A full calibration of all 5 ranges or selected ranges only can be approached. A five digit multimeter 10VDC and 20mADC will be used as well as a Voltage/Current calibrator 100mA, 2V, 20V and 200VDC.

1: Calibrator Outputs
2-5: Multimeter Inputs
6: Hardware Configuration

To close the calibration menu press the key **Esc**.

8.1 CALIBRATION of CALIBRATOR OUTPUTS

8.1.1 Current Output 4-20mA

Outputs + **OUT** - with connected mA-Meter.

Sliding switch **OUT-I**.

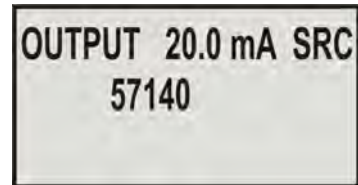
Press **1**. The display shows:



With the keys **Up** or **Down** appears the calibration constant 0. To change it, enter 11 with **Up** or **Down**. The whole constant can be set with the keyboard. The 4.000 mA output current is set. Fine corrections can be made with **Up** or **Down**. Press **Enter** to save the point. The display confirms with *EEPROM*.

Press **Menu** to next calibration range. The Display shows:

With the keys **Up** or **Down** set the output current to 20.000 mA.
Press **Enter** to store.

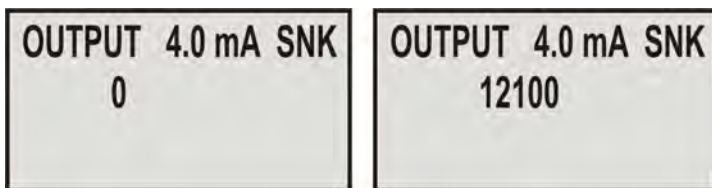


With **Esc** returns the display to calibration menu.

8.1.2 Current Sink 0/4-20mA

Sliding Switches **OUT-I** and **SNK-I**

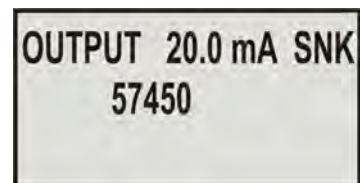
Output Terminal + **OUT** connect with the Plus Terminal of external voltage source (max. 24V). Output Terminal - **OUT** connect with the Minus Terminal of external voltage source with an mA-Meter connected in serial. Press the key **1**. The display shows:



With the keys **Up** or **Down** appears the calibration constant 0. To change it, enter 11 with **Up** or **Down**. The whole constant can be set with the keyboard. The 4.000 mA output current is set. Fine corrections can be made with **Up** or **Down**. Press **Enter** to save the point. The display confirms with *EEPROM*.

Press **Menu** to next calibration range. The Display shows:

With the keys **Up** or **Down** set the output current to 20.000 mA.
Press **Enter** to store.



With **Esc** returns the display to calibration menu.

8.1.3 Voltage Ranges 0-14V, 0-560mV, 0-28mV

Output Terminals + **OUT** – with external V-Meter connected.

Sliding Switch in Position **OUT-V**.

Set the output voltage 2V with **Up** or **Down** and store with **Enter**.

Select 10V Range with **Menu**, set the calibration Constant with **Up** or **Down** and store with **Enter**.

Continue with **Menu** for calibration of Ranges 560mV and 28mV.

With the key **Esc** changes the display into the calibration Menu.

OUTPUT 0.0 V
750

OUTPUT 10.0 V
45910

OUTPUT 0.0 mV
700

OUTPUT 500.0 mV
57380

OUTPUT 0.00 mV
740

OUTPUT 25.00 mV
57780

8.2 CALIBRATION of MULTIMETER INPUTS

8.2.1 Current Input 0-100mA

Connect external Current Calibrator to Input Terminals **GND** and **IN-I**.

Press **2**. The display shows:

Short the inputs. Press **Enter** to store the zero input.

Press **Menu**. The display changes to:

Apply 100mA from external calibrator.

Press **Enter** to store the 100mA full range input.

INP (0 - 0.1A) 0.0A
1.23167

INP (0 - 0.1A) 0.1A
2.22845

8.2.2 Voltage Input 2VDC

Connect 2VDC from external Voltage Calibrator to Input Terminals **GND** and **IN-V**.

Press **3**. The display shows:

Short the inputs. Press **Enter** to store the zero input.

Press **Menu**. The display changes to:

Apply 2VDC from external calibrator.

Press **Enter** to store the 2V full range input.

INP (0 - 2 V) 0 V
1.23282

INP (0 - 2 V) 2 V
2.41458

8.2.3 Voltage Input 20VDC

Inputs **GND** and **IN-V** supplied from external voltage calibrator 20VDC.

Press **4**. The display shows:

Short the inputs. Press **Enter** to store the zero input.

Press **Menu**. The display changes to:

Apply 20VDC from external calibrator.

Press **Enter** to store the 20V full range input.

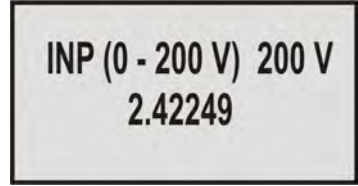
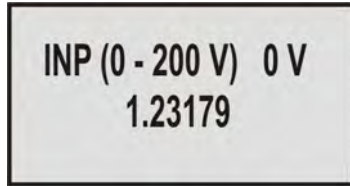
INP (0 - 20 V) 0 V
1.23189

INP (0 - 20 V) 20 V
2.32273

8.2.4 Voltage input 200VDC

Inputs *GND* and *IN-V* supplied from external voltage calibrator 200VDC.

Press **5**. The display shows:
Short the inputs. Press **Enter** to store the zero input.



Press **Menu**. The display changes to:
Apply 200VDC from external calibrator.
Press **Enter** to store the 200V full range input.

Press **Esc** to exit the calibration mode. The instrument is calibrated.

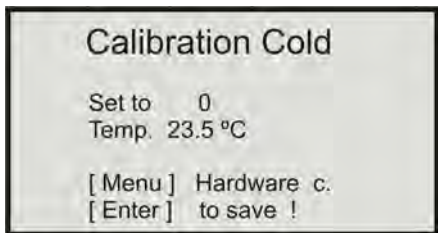
NOTE
Do not approach the calibration when the battery sign **0%** at the display is illuminated. The instrument has to be charged first.

9 LOGO

After the power has been switched on, the display shows a manufacturer Logo. Upon request this Logo can be customized. Contact the manufacturer for more information.

10 HARDWARE

This menu step contains the settings of the output configuration 12 bit or 16 bit signal resolution, 20mA or 100mA output current and the possible correction of the cold junction compensation. The Option 100mA has to be ordered from the manufacturer.



Corrections can be set with UP or DOWN, confirmed with ENTER. With ESC returns the display to the measuring mode.

The factory setting is 16 bit. When 12 bit resolution is selected, the display and the output signal resolution is limited to two decimal points.

ATTENTION
When the calibration has not been done correctly due to invalid calibration values, **Calibration Error** appears at the display. The display changes automatically to the calibration Overview. The wrongly calibrated point is marked with **err**.

11 TARE

The Tare is active in the Multimeter function and can be used for DC-V and DC-I measurements to set the display to zero. Attention has to be paid when the Tare is set. The entire measuring range has to be considered in order not to overrange the meter.

The Tare is activated with the key Menu. The display shows:



Key 1 deactivates Tare.

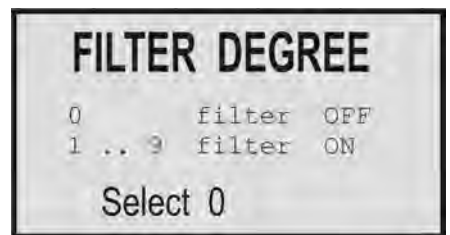
Key 2 activates the Tare and the Tare value is shown at the lowest display section. The Tare Selection will be closed with the key **Esc**.

12 FILTER

An averaging Filter is active in the multimeter function. The filter value (number of measurements) can be set from 0 to 9. By selecting 0 the filter is deactivated. The filter function is activated after the key **Menu** is pressed twice. The display shows:

Key 0 switches the filter off.

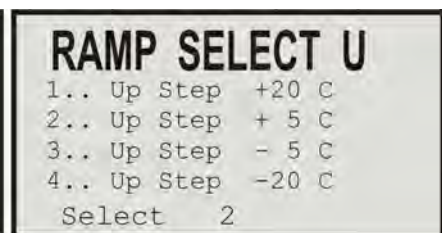
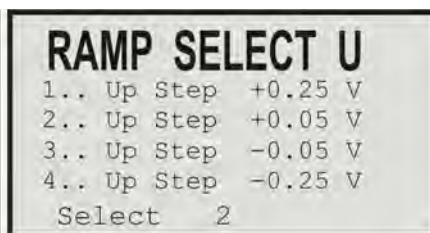
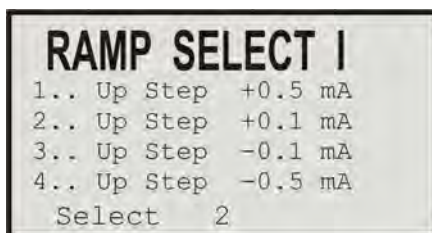
Keys 1-9 select the filter value. The filter selection is closed with **Esc**.



13 RAMPS

The Ramp function can be opened with **Menu**. The display shows RAMP SELECT:

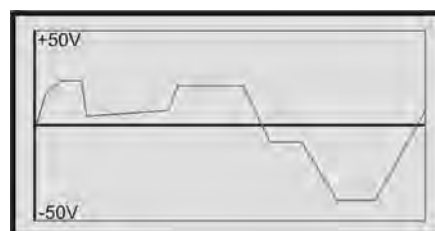
- 1 Increasing ramp with steps of 0.5mA, 0.25V, 10mV, 0.5mV and 20 °C
- 2 Increasing ramp with steps of 0.1mA, 0.05V, 2mV, 0.1mV and 5 °C
- 3 Decaying ramp with steps of -0.1mA, -0.05V, -2mV, -0.1V and -5 °C
- 4 Decaying ramp with steps of -0.5mA, -0.25V, -10mV, -0.5mV and -20 °C



Current or Voltage Ramp are automatically generated with the selection of switches OUT-I or OUT-V.

14 GRAPHICS

During the measurement of DC Voltage or DC Current the last 128 measured points are automatically memorized and can be shown at the display. The Graphic Mode will be opened with **Menu** and confirmed with **Enter**.



15 HANDHELD CALIBRATOR – MULTIMETER OC502-V2-100

- ✓ **Current Calibrator 0/4 - 110mA, Source**
- ✓ **Voltage Calibrator 0-11V**
- ✓ **Multimeter $\pm 2V$ to $\pm 200V$ DC and $\pm 100mA$**
- ✓ **Calibrates and Measures simultaneously**
- ✓ **Firm steps and continuous ramps**
- ✓ **Direct value entry via the keyboard**
- ✓ **Rechargeable Battery**
- ✓ **Software calibration**



Model OC 502-V2-100 is a Calibrator-Multimeter for generation of 0/4 - 110mA in Source and Sink mode and Voltages between 0 to 11V. External voltages $\pm 2V$, $\pm 20V$ and $\pm 200VDC$ (firm ranges or Autoranging) and currents up to $\pm 100mA$ can be measured while the calibrator generates the selected output signal. Due to this simultaneous operation a response from e.g. an external transmitter under test can be measured which is signal supplied from OC502-V2-100. Both, the generated calibration signal and the measured external signal are shown at the LCD digital display

OC502-V2-100 can be software calibrated via the keyboard whenever required.

The instrument is supplied from internal battery and permits an uninterrupted operation of 3-4 hours with the output current between 0 and 20mA. For higher output currents up to 100mA the calibrator has to be connected to the charger. When the display shows BAT of the battery capacity, the calibrator has to be connected to the charger.

SPECIFICATIONS

CALIBRATOR OC502-V2-100		Outputs + OUT -
Current Source	Range Accuracy	0 ... 110mA $\pm 0.1\%$ from range
Voltage Source	Range Accuracy	0 ... 11 V $\pm 0.1\%$ from range
Tempco:		$\pm 25ppm/K$
Temperature:	Working: Storing:	+20 °C ... +25 °C 0 ... 45 °C

The remaining parameters, menu steps and settings are identical with the standard model OC502-t without generation of mV-Signals and simulation of thermocouples.