Operating Instructions

GOSSEN METRAWATT
GMC-INSTRUMENTS GROUP

METRAHIT | CAL

Calibrator

3-349-442-03
14/8.24

Table of Contents

1 Safety Instructions

Read and follow these instructions carefully and completely in order to ensure safe and proper use.

The instructions must be made available to all persons who use the instrument.

Keep for future reference.

General

- The device may only be used by qualified electricians in the commercial field.
- Observe and comply with all safety regulations which are applicable for your work environment.
- Wear suitable and appropriate personal protective equipment (PPE) whenever working with the instrument.

Accessories

Use only the specified accessories (included in the scope of delivery or listed as options) with the instrument.

Handling

- Use the instrument in undamaged condition only.
  Inspect the instrument before use. Pay particular attention to damage, interrupted insulation or kinked cables.
- Use the accessories and all cables in undamaged condition only.
  Inspect accessories and all cables before use. Pay particular attention to damage, interrupted insulation or kinked cables.
- If the instrument or its accessories don't function flawlessly, permanently remove the instrument/accessories from operation and secure them against inadvertent use.
- If the instrument or accessories are damaged during use, for example if they're dropped, permanently remove the instrument/accessories from operation and secure them against inadvertent use.
- If there are any signs of interior damage to the instrument or accessories (e.g. loose parts in the housing), permanently remove the instrument/accessories from operation and secure them against inadvertent use.
- The instrument and the accessories may only be used for the tests/measurements described in the documentation for the device.
- The instruments and accessories of Gossen Metrawatt GmbH are designed to ensure optimum compatibility with the Gossen Metrawatt products that are expressly provided for them. Unless otherwise expressly confirmed in writing by Gossen Metrawatt GmbH, they are not intended and suited for use with other products.
- Route cables in an orderly fashion, for example accessory cables. Loose, disorderly cables result in unnecessary danger of tripping and falling.
- The instrument is a calibrator (not a multimeter).
- Do not use the instrument in intrinsically safe electrical circuits.
- Be prepared for the occurrence of unexpected voltages at devices under test (e.g. defective devices). For example, capacitors may be dangerously charged.
- If necessary, use a multimeter to make sure that no dangerous touch voltages are present in the signal circuits to which the instrument is to be connected.
- In order to prevent damage to the instrument, observe the maximum allowable voltage and current values indicated at the jacks.
- Maximum permissible voltage to be applied between the terminals is 27 V. If U_{max} or I_{max} is exceeded, the integrated fuse is tripped.

- With the exception of the resistance simulation and mA SINK operating modes, the connected signal circuits may not feed any voltage or current back to the calibrator. In order to avoid major damage to the instrument when interference voltage is applied (within the permissible limit values), an integrated fuse may possibly be tripped.

Operating Conditions

- Do not use the instrument and its accessories after long periods of storage under unfavorable conditions (e.g. humidity, dust or extreme temperature).
- Do not use the instrument and its accessories after extraordinary stressing due to transport.
- Do not expose the instrument to direct sunlight.
- Only use the instrument and its accessories within the limits of the specified technical data and conditions (ambient conditions, IP protection code, measuring category etc.).
- Do not use the instrument in potentially explosive atmospheres. Danger of explosion!
- Do not use the device in areas subject to the risk of fire. Danger of fire!
- Do not use the instrument in circuits with corona discharge (high-voltage).

Rechargeable Batteries/Batteries

- Use batteries in undamaged condition only. Risk of explosion and fire in the case of damaged batteries!
- Inspect the batteries before use. Pay particular attention to leaky and damaged batteries.
- When using (rechargeable) batteries, the respective test/measuring instrument may only be used with inserted and secured battery compartment lid. Otherwise, dangerous voltages may occur at the battery contacts under certain circumstances.

Fuses

- The instrument may only be used as long as the fuses are in flawless condition. Defective fuses must be replaced. Fuses may only be replaced by our repair service department.
- Never bridge the fuses. Never put the fuses out of operation.

Measurement Cables and Establishing Contact

- Plugging in the measurement cables must not necessitate any undue force.
- Never touch conductive ends (of test probes for example).
- Fully unroll all measurement cables before starting a test/measurement. Never perform a test/measurement with the measurement cable rolled up.

2 Application

Please read this important information!

2.1 Intended Use / Use for Intended Purpose

The METRAHIT CAL calibrator is a calibration and simulation instrument for electrical quantities. As a handheld instrument, it is used for precise, on-site calibration and inspection tasks, as well as for testing and laboratory applications.

To do so, the METRAHIT CAL generates mV, V and mA signals, simulates thermo-voltages for various types of thermocouples for predefined temperatures (°C or °F), as well as resistance values for various Pt and Ni temperature sensors, sends continuous frequency signals (the amplitude of the generated square-wave pulses is adjustable and they can be used to simulate sensor pulses), and it acts as a transmitter simulator (sink).

Calibration signals can be read out either manually or automatically by means of intervals with intermediate steps, or as a ramp in a stepless fashion.

The calibrator has been designed for safe connection to signal circuits.

With the optional interface adapter USB X-TRA and the optional software METRAwin90-2 a connection between PC and calibrator can be established for operating the device and for evaluating data.

Safety of the user, as well as that of the instrument, is only assured when it's used for its intended purpose.

2.2 Use for Other than Intended Purpose

Using the instrument for any purposes other than those described in the condensed operating instructions or these instrument operating instructions is contrary to use for intended purpose. Use for other than intended purpose may lead to unforeseeable damage!

2.3 Liability and Guarantee

Liability and guarantee granted by Gossen Metrawatt GmbH comply with the applicable contractual and mandatory legal regulations.

3 The Instrument

3.1 Scope of Delivery

Please check the scope of delivery for completeness and intactness.

1	Calibrator METRAHIT CAL
2	Batteries
1	KS17-2 safety cable set (1 pair of safety measurement cables (yellow and black) (1.5 m) with 4 mm test probes, 1000 V CAT III / 600 V CAT IV)
1	Condensed operating instructions
1	Rubber holster
1	DAkkS calibration certificate

3.2 Accessories

Some functions necessitate (optional) accessories.

A comprehensive overview of the entire range of accessories and detailed information can be found in the data sheet of the instrument, available on the Internet at www.gossenmetrawatt.com.

Safety cable set KS17-2 (scope of delivery)

Electrical safety:

Maximum rated voltage	**600 V**	**1000 V**	**1000 V**
Measuring category	**CAT IV**	**CAT III**	**CAT II**
Maximum rated current	**1 A**	**1 A**	**16 A**
With safety cap attached	•	•	—
Without safety cap	—	—	•

Ambient Conditions (EN 61010-031):

Temperature	-20 °C … + 50 °C
Relative humidity	50 to 80%
Pollution degree	2

Applications:

Attention!
Observe the maximum values for electrical safety (see above).
In environments according to measuring category III or IV it is only allowed to perform measurements with the safety cap attached to the test probe in accordance with DIN EN 61010-031.

In order to establish contact inside 4 mm sockets, the safety caps have to be removed by prying open the snap fastener of the safety cap with an object (e.g. a second test probe).

Power Pack NA X-TRA (Z218G) (not included)

Use power packs from Gossen Metrawatt GmbH only in combination with your instrument. This assures operator safety by means of an extremely well insulated cable, and safe electrical isolation (nominal secondary ratings: 5 V / 600 mA). Installed batteries are disconnected electronically if the power pack is used, and need not be removed from the instrument.

Application see chap. 4.1 on page 13.

USB X-TRA Bidirectional Interface Adapter (Z216C) (not included)

This adapter makes it possible to connect the calibrator to a USB port at a PC. The adapter allows for data transmission between the calibrator and the PC.

This makes it possible to transfer calibration procedures and complete measuring point-oriented calibration cycles from the PC.

Application see chap. 12 on page 31.

Software METRAwin 90-2 (Z211A) (not included)

METRAwin 90 calibration software is a multilingual program for controlling various calibrators for electrical quantities with the help of a PC, and for documenting calibration results.

Application see product documentation on METRAwin 90-2, available at https://www.gossenmetrawatt.de.

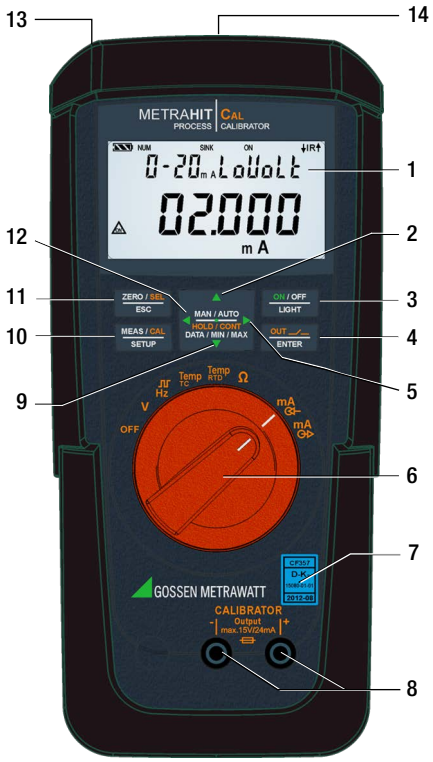
Fuse link (Z109N) (not included)

Replacement part

Application see chap. 15.2 on page 33.

3.3 Instrument Overview

Operating Overview – Connections, Keys, Rotary Switch, Symbols



Not a measurement input!
Do not apply interference voltage, except for current sink.

1 Display (LCD) (see page 18 for significance of symbols)

2 **HOLD / CONT** Pause/resume ramp/interval
△ Increase parameter values
Operating mode menu: Selection of individual menu entries against the direction of flow

3 **ON / OFF | LIGHT** Key for switching device and display illumination on and off

4 **OUT | ENTER**
OUT: Switching calibrator output On and Off
Operating mode menu: Confirm the entry (ENTER)

5 ▷ Move cursor to the right
Operating mode SELECT RANGE: Ramp function selection

6 **Rotary switch** for calibration functions and complete shutdown

7 DAkkS calibration seal

8 Connector jacks for calibrator output

9 **HOLD / CONT** Pause/resume ramp/interval
▽ Reduce parameter values
Operating mode menu: Selection of individual menu items in the direction of flow

10 **MEAS/CAL | SETUP**
Key for switching back and forth between calibration and menu function

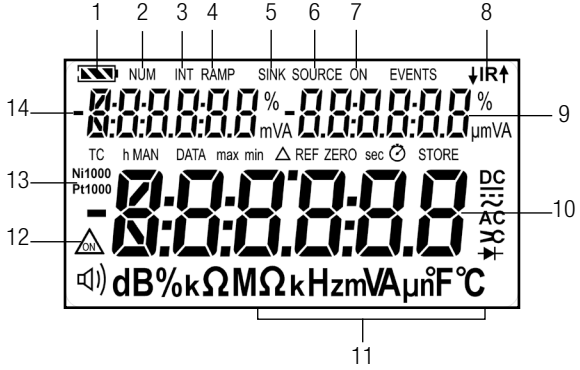
11 **ZERO/SEL | ESC**
Operating mode menu: Exit menu level and return to a higher level, exit parameters configuration without saving data
Pause ramp/interval

12 ◁ Move cursor to the left,
Operating mode SELECT RANGE: Interval function selection

13 Power pack connector jack (accessory: NA X-TRA)

14 Infrared interface (accessory interface adapter: USB X-TRA)

Symbols Used in the Digital Display



Battery Level Indicator

Battery full

Battery OK

Battery weak

Battery (almost) dead, U < 1.8 V

Interface indicator (with selector switch setting ≠ OFF)

IR Data transmission ↓ to / from calibrator active

IR IR interface in standby mode
(ready to receive starting commands)

1 Battery level indicator
2 NUM: Numeric entry of the output signal
3 INT: Interval sequence active
4 RAMP: Ramp function active
5 SINK: Current sink active
6 SOURCE: Current source is active
7 ON: Calibrator output is active
8 IR: infrared interface indicator
9 Auxiliary display with decimal point and polarity display
10 Main display with decimal point and polarity display
11 Calibration unit of measure
12 ON: Simulator in continuous mode operation
13 Ni/Pt1000: Selected temperature sensor
14 Auxiliary display with decimal point and polarity display

3.4 Symbols on the Instrument and the Included Accessories

Warning concerning a point of danger
(attention, observe documentation!)

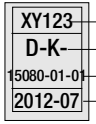
Ground

Continuous, doubled or reinforced
insulation

European conformity marking

The device may not be disposed of with household trash. Further information regarding the WEEE mark can be accessed on the Internet at www.gossenmetrawatt.com by entering the search term “WEEE”.

DAkkS Calibration seal (blue seal):



- XY123 — Consecutive number
- D-K- — Deutsche Akkreditierungsstelle GmbH – calibration lab
- 15080-01-01 — Registration number
- 2012-07 — Date of calibration (year – month)

3.5 Applicable Regulations and Standards

IEC 61010-1/ DIN EN 61010-1/ VDE 0411-1	Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements
EN 60529 VDE 0470, part 1	Degrees of protection provided by enclosures (IP code)
DIN EN 61326-1 VDE 0843-20-1	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements

3.6 Characteristic Values

Calibration Function	Simulation Range	Resolution 30,000 Digits (4¾ places)		Intrinsic Uncertainty	Overload
Direct voltage source			Minimum load resistance	±(% S + mV)	I_{max}
V	0 V … ±300 mV	0.01 mV	1 kΩ	0.05 + 0.02	18 mA
	0 V … 3 V	0.1 mV		0.05 + 0.2	
	0 V … 10 V	1 mV		0.05 + 2	
	0 V … 15 V	1 mV		0.05 + 2	
Frequency generator duty cycle (pulse-no-pulse ratio): 50 %, amplitude: 10 mV… 15 V			Minimum load resistance	±(% S + Hz)	I_{max}
Hz	1 Hz … 1 kHz	0,1 … 1 Hz	1 kΩ	0.05 + 0.2	18 mA
Current Source			mac. load	±(% S + µA)	
mA	4 mA … 20 mA	1 µA	16 V	0.05 + 2	
	0 mA … 20 mA				
	0 mA … 24 mA				
Current Sink				±(% v.S + µA)	U_{max}
mA	4 mA … 20 mA	1 µA	V_{in} = 4 V … 27 V	0.05 + 2	27 V
	0 mA … 20 mA				
	0 mA … 24 mA				
Resistance simulation			Sensor Current [mA]	±(%.S + Ω)	I_{max}
Ω	5 Ω … 2000 Ω	0.1 Ω	0.05 … 0.1 … 4 … 5	0.05 + 0.2	5 mA

Note!

Observe maximum allowable voltage for connection from external sources to the calibrator output if current sink is selected: U_{ext} 0 … 27 V.
The calibrator is protected against brief application of a large interference voltage with a replaceable fuse in the event of operator error, i.e. in the event of overloading > I_{max}/U_{max} the fuse may blow.

Simulator for Temperature Sensors (resolution: 0.1 K)

	Sensor Type	Simulation Range in °C	Simulation Range in °F	Intrinsic Uncertainty	Overload
°C / °F	**Resistance Thermometer per IEC 751**				I_{max}
	Pt100	–200 … +850	–328 … +1562	±(0.1 % of resistance + 0.2 Ω)	5 mA
	Pt1000	–200 … +300	–328 … +572		
	Resistance Thermometer per DIN 43760				I_{max}
	Ni100	–60 … +180	–76 … +356	±(0.1 % of resistance + 0.2 Ω)	5 mA
	Ni1000	–60 … +180	–76 … +356		
	RTD sensor current 0.05 mA… 0.1 mA… 4mA … 5 mA				
	Thermocouples per DIN and IEC 584-1				I_{max}
	K (NiCr/Ni)	–250 … +1372	–418 … +2501	±(0.1 % of voltage + 40 µV) *	18 mA
	J (Fe/CuNi)	–210 … +1200	–346 … +2192		
	T (Cu/CuNi)	–270 … +400	–454 … +752		
	B (Pt30Rh/Pt6Rh)	+500 … +1820	+932 … +3308		
	E (NiCr/CuNi)	-270 … +1000	-454 … +1832		
	R (Pt13Rh/Pt)	-50 … +1768	–58 … +3214		
	N (NiCrSi-NiSi)	-270 … +1300	–454 … +2372		
	S (Pt10Rh/Pt)	-50 … +1768	–58 … +3214		
	J (Fe/CuNi)	–200 … +900	–328 … +1652		
	U (Cu/CuNi)	–200 … +600	-328 … +1112		

* Without internal reference junction;
Relative to fixed external reference temperature and thermovoltage of the thermocouple,
Temperature error see table page 11
Internal reference junction: 2 K intrinsic error
External reference junction: Entry –30 … 60 °C

Key: S = setting value

Internal Clock

Time format	DD.MM.YYYY hh:mm:ss
Resolution	0.1 s
Accuracy	±1 min./month
Temperature influence	50 ppm/K

Reference Conditions

Ambient temperature	+23° C ±2 K
Relative humidity	40 … 75%
Battery voltage	3.0 V ±10%

Thermocouple Simulation Error in [°C]

Thermocouple error is specified in the technical data as thermovoltage error ΔU. ΔT error is dependent upon characteristic thermocouple slope.

In consideration of characteristic thermocouple non-linearity, which also applies to its slope (1st dT/dU derivation), the mathematically calculated ΔT error is shown in the following table for all thermocouple types in the 100 °C sub-range. The values shown in the table represent maximum possible error for the respective sub-range.

For internal reference temperature the intrinsic error of the reference junction must be taken into account.

For external reference temperature ≠ 0 °C, the sub-ranges of the table to the left adjusted by the amount of the respective reference temperature are applicable.

Example:
External reference temperature = 50 °C:
The errors of the sub-range 100 °C … 200 °C apply in this case for setting values from 50 °C to 150 °C.

Formula for temperature conversion from Celsius to Fahrenheit:
T [°F] = 32 + T [°C] x 1.8.

Temperature Error for Thermocouple Simulation

Thermocouple type	T Error in K for Thermocouple Types (Ref. Temp. 0 ° C)									
Sub-Range: °C	J	L	T	U	K	E	S	R	B	N
– 200 ... -100	1.2	1.0	1.6	1.4	1.6	1.1				2.3
– 100 ... 0	0.6	0.8	0.9	0.9	0.8	0.6	*) 5.2	*) 5.5		1.1
0 ... 100	0.5	0.6	0.6	0.6	0.7	0.5	3.8	3.9		0.9
100 ... 200	0.6	0.7	0.6	0.6	0.7	0.5	3.2	3.2		0.8
200 ... 300	0.6	0.7	0.6	0.6	0.7	0.5	2.6	2.5		0.8
300 ... 400	0.7	0.8	0.6	0.6	0.8	0.5	2.5	2.3		0.8
400 ... 500	0.7	0.8		0.6	0.8	0.6	2.4	2.2		0.9
500 ... 600	0.7	0.9		0.6	0.9	0.6	2.4	2.2	4.2	0.9
600 ... 700	0.8	0.9			0.9	0.7	2.3	2.1	3.6	0.9
700 ... 800	0.8	0.9			1.0	0.8	2.3	2.1	3.3	1.0
800 ... 900	0.9	0.9			1.1	0.8	2.3	2.1	2.9	1.0
900 ... 1000	0.9				1.2	0.9	2.3	2.0	2.8	1.1
1000 ... 1100	1.0				1.2		2.3	2.0	2.6	1.2
1100 ... 1200	1.1				1.3		2.3	2.0	2.5	1.3
1200 ... 1300					1.4		2.3	2.1	2.4	1.4
1300 ... 1400					1.5		2.4	2.1	2.3	
1400 ... 1500							2.4	2.2	2.3	
1500 ... 1600							2.5	2.2	2.3	
1600 ... 1700							2.6	2.3	2.3	
1700 ... 1800							2.8	2.5	2.4	

Display

LCD panel (65 x 36 mm) with digital display including display of simulator unit and various special functions.

Background Illumination

Background illumination is switched off approximately 1 minute after it has been activated.

Display / char. height	7-segment characters Main display: 1 × 6 digits, 12 mm Auxiliary displays: 2 × 6 digits, 7 mm
max. resolution	30,000
Polarity display	"–" (minus sign) is displayed
Display refresh	2 times per second, every 500 ms

Power Supply

Battery: 2 × 1.5 V mignon cell (size AA)
alkaline manganese per IEC LR6
(1.2 V NiMH rechargeable batteries are also possible)

Operating time: with alkaline manganese (2600 mAh)

Calibration function	Current consumption	Operating time
mV, thermocouple	55 mA	45 h
15 V	240 mA	10 h
Ω, RTD	85 mA	30 h
Sink, 20 mA	310 mA	8 h
Source, 20 mA	310 mA	8 h

If voltage drops below 1.8 V, the instrument is switched off automatically.

Battery indicator: Battery capacity display via battery symbol "".
Querying of momentary battery voltage via menu function

Power saving circuit

The device is switched off automatically if none of the controls are activated for a period of approximately 10 minutes. The simulator is switched off after a period of only 5 minutes (sockets are current and voltage-free). Automatic shutdown can be deactivated.

Power pack socket	If the NA X-TRA power pack has been plugged into the instrument, the installed batteries are disconnected automatically. Rechargeable batteries can only be recharged externally.

Fuses

Refer to chap. 15.2 regarding location of the fuse link

FF 160 mA / 400 V, 5 mm × 20 mm
Breaking capacity min. 10 kA
Article number: Z109N

Electrical Safety

Protection class	II
Operating voltage	Max. 50 V
Measuring category	I (250 V)
Pollution degree	2
Test voltage	500 V~ per DIN EN 61010-1/VDE 0411-1

Electromagnetic Compatibility (EMC)

Interference emission	EN 61326-1, class B
Interference immunity	EN 61326-1 EN 61326-2-1

Data Interface

Type	Optical via infrared light through the housing
Data transmission	Serial, bidirectional (not IrDa compatible)
Protocol	Device specific
Baud rate	38,400 baud
Functions	Set/query calibration functions and parameters The USB X-TRA plug-in interface adapter (see accessories) is used for adaptation to the PC's USB port.

Ambient Conditions

Accuracy range	0 °C … + 40 °C
Operating temperature	–10 °C … +50 °C
Storage temperature	–25 °C … +70 °C (without batteries)
Relative humidity	40 % … 75 %, no condensation allowed
Elevation	To 2000 m

Mechanical Design

Housing	Impact resistant plastic (ABS)
Dimensions	200 × 87 × 45 mm (without rubber holster)
Weight	approx. 0.35 kg with batteries
Protection	IP 54 per DIN EN 60529 / IEC 60529 (protection against ingress of solid foreign objects: protected against dust in harmful quantities, protection against water ingress: protection against ingress of splashing water from all sides; pressure equalization via the housing)

4 Operation

4.1 Power Supply

You have installed the batteries or rechargeable batteries upon initial setup (see condensed operating instructions).

Attention!
As a result of internal battery voltage monitoring, the instrument may respond as follows if the battery charge level is low:
– Cannot be switched on
– Shuts back down immediately
– Shuts back down if a load is connected to the output
In this case, change the batteries or work with the power pack, if possible (see below).

Attention!
If rechargeable batteries are used, they must be recharged externally.

Querying Charge Level

The current battery charge level can be queried in the " *InFo*" menu:

If the "▭" symbol appears at the display, the batteries should be replaced as soon as possible. You can continue working with the instrument, but reduced accuracy may result.

Replacing Batteries / Rechargeable Batteries

The preset operating parameters are retained during battery replacement; however, time and date must be set again.

Attention!
Switch the instrument off and disconnect all cables from the instrument!

Attention!
Only use (recharchable) batteries that comply with the technical data (chap. 3.6 on page 9)!

- ⇨ Set the instrument face down onto the working surface.
- ⇨ Turn the slotted screw on the lid with the battery symbols counterclockwise.
- ⇨ Lift off the lid and remove the batteries from the battery compartment.
- ⇨ Insert two new (rechargeable) batteries into the battery compartment, making sure that the plus and minus poles match up with the provided polarity symbols.
- ⇨ When replacing the battery compartment lid, insert the side with the guide hooks first.
  Tighten the screw by turning it clockwise.
- ⇨ Dispose of used batteries in an environmentally friendly manner, see chap. 19 on page 35.

Operation with the Power Pack (accessory, not included)

Installed batteries are disconnected electronically if the NA X-TRA (Z218G) power pack is used, and need not be removed from the instrument.

- ⇨ Connect the NA X-TRA with the connector jack for power packs. See chap. 3.3 on page 7.
- ⇨ Connect the NA X-TRA to a mains power outlet.

Attention!
Make sure that the device is connected with a cable in order to provide for permanent power supply during operation.

4.2 Switching the Instrument On/Off

Switching the Instrument On Manually

➪ Move the rotary switch from **OFF** to any calibration function.

or

➪ Press the **ON / OFF | LIGHT** key if the rotary switch is not in the OFF position.
Power-up is acknowledged with a brief acoustic signal. As long as the key is held depressed, all of the segments at the LCD are illuminated (see page 8).
After the key is released, the device is ready to execute calibration.

Switching the Instrument On with a PC

After transmission of a data frame from the PC, the simulator is switched on. See also chap. 12.1.

Note!
Electrical discharge and high frequency interference may cause incorrect displays to appear, and may disable the simulator. Switch the instrument off and back on again in order to reset. If the problem persists, briefly dislodge the battery from the connector contacts.

Switching the Instrument Off Manually

➪ Press and hold the **ON / OFF | LIGHT** key until 0FF appears at the display. Shutdown is acknowledged with two, brief acoustic signals.

➪ Complete shutdown of all functions including the IR interface is accomplished by turning the rotary switch to **OFF**.

Automatic Shutdown of the Calibrator

The device is switched off automatically after the selected time AP oFF (see chap. 5.2) has elapsed. Shutdown is acknowledged with a brief acoustic signal.
Automatic shutdown is disabled in the continuous operation mode (AP oFF = on).

Disabling Automatic Shutdown

The instrument can be set to continuous operation.

➪ Select AP oFF = on in the Setup menu (see chap. 5.2). Continuous operation is indicated at the display with the ⏦ symbol.

5 Setting Device and Calibration Parameters

The instrument's "SEt" mode (menu mode) makes it possible to set operating and measuring parameters, query information and activate the interface.

- The menu mode is accessed by pressing the **MEAS/CAL | SETUP** key, assuming that the instrument is switched on and set to the "Calibrate" operating mode.
  "inFo" appears at the display.
- The main menu "SEt" can be accessed, after which the display can be returned to the "inFo" menu, by repeatedly pressing the ◁ ▷ △ ▽ key (any direction).
- After selecting the desired main menu , sub-menus are accessed by pressing the **OUT | ENTER** key.
- The desired parameter is selected by repeatedly pressing the △ ▽ key.
- In order to check or change a parameter, acknowledge it with the **OUT | ENTER** key.
- The ◁ ▷ keys can be used to position the cursor at the entry position.
  The desired value is selected with the help of the △ ▽ keys.
- Changes can only be applied with the **OUT | ENTER** key.
- You can return to the sub-menu without making any changes by pressing the **ZERO/SEL | ESC** key, and to the main menu by pressing the **ZERO/SEL | ESC** key once again etc.
- You can switch to the calibrating mode from any menu level by pressing the **MEAS/CAL | SETUP** key.

5.1 Querying Parameters – InFo Menu

bAtt – Query Battery Voltage

MEAS/CAL SETUP , inFo OUT ENTER bAtt 3.1V.

tiME / dAtE – query date and time

MEAS/CAL SETUP , inFo OUT ENTER bAtt ▽ ... ▽ 02.01.2008 13:46:56

TT.MM. YYYY hh:mm:ss

D = day, M = month, Y = year, h = hour, m = minute, s = second

Note!
Date and time must be reentered after replacing the batteries.

cALdAt – query calibration date

MEAS/CAL SETUP , inFo OUT ENTER bAtt ▽ ... ▽ cALdAt 02.01.08 uEr 0.04

ItEMP – query internal reference temperature and temperature unit of measure

The temperature of the internal reference junction is measured with a temperature sensor in close proximity to the input sockets.

MEAS/CAL SETUP , inFo OUT ENTER bAtt ▽ ... ▽ ItEMP , ntErn 24.2 °C

5.2 Entering Parameters – SETUP Menu

tiME – Set Time

Entering the correct time makes it possible to calibrate in real-time.

MEAS/CAL SETUP, nFo ▷ SEt OUT ENTER tiME

OUT ENTER tiME SEt 10:24:24 (hh:mm:ss) ◁ ▷ △ ▽ OUT ENTER

Date and time must be reentered after replacing the batteries.

dAtE – Enter Date

Entering the current date makes it possible to calibrate in real-time.

MEAS/CAL SETUP, nFo ▷ SEt OUT ENTER tiME ▽ dAtE

OUT ENTER dAtE SEt 02.01 (TT: day.MM: month) ◁ ▷ △ ▽ OUT ENTER

YEAr SEt 2008 (YYYY: year) ◁ ▷ △ ▽ OUT ENTER

Note!
Date and time must be reentered after replacing the batteries.

Addr – Set Device Address

See chap. 12.2 regarding settings.

irStb – Status of the Infrared Receiver in the Stand-By Mode

See chap. 12.2 regarding settings.

APoFF – Specified Time for Automatic Shutdown and Continuous ON

The instrument is switched off automatically if the calibration value remains unchanged for a long period of time and if none of the keys or the rotary switch have been activated before the specified time "APoFF" (entered in minutes) has elapsed.
If a value between 10 and 15 minutes is set, this value is retained even after switching power supply off.

Operating mode "Continuous On"

If the **on** setting is selected, the calibrator is set to continuous operation and ⚠ appears at the left-hand side of the main display.
Alternatively, you can select operating mode "Continuous On" via keys (prerequisite: switch position other than OFF and instrument OFF):
To this end, press and hold the two keys **OUT | ENTER** and **ON / OFF | LIGHT** until the display test appears.
The calibrator can only be switched off manually now. After switching on again, the default value of 10 min is set.

MEAS/CAL SETUP, nFo ▷ ... ▷ SEt OUT ENTER tiME ▽ ... ▽ APoFF

APoFF SEt 10 ... 59 min on △ ▽ OUT ENTER

(10 min = default setting)

tEMP – °C/°F setting, select internal/external reference temperature

See chap. 9 regarding selection.

5.3 Reset device

Previously entered changes can be undone, and default settings can be restored. This may be advisable under the following circumstances:

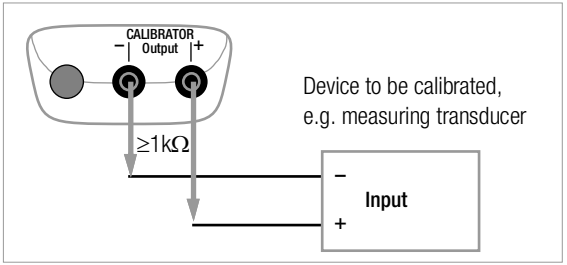
- After the occurrence of software or hardware errors
- If you are under the impression that the multimeter does not work correctly

Attention!
Disconnect all cables from the instrument.

⇨ Simultaneously press and hold the ZERO/SEL ESC and ON/OFF LIGHT keys and reinsert the batteries at the same time.

6 Voltage Source [V]

Voltages can be simulated within the following ranges: 0 mV … ±300 mV, 0 V … 3 V, 0 V … 10 V und 0 V … 15 V.
Resistance of the connected circuit should not be any less than 1 kΩ.



- Connect the device to be calibrated with the measurement cable as shown.
- Select the V calibration function with the **rotary switch**.
- If the instrument had switched itself off via **APoFF** or had been switched off via the **ON / OFF | LIGHT** key before:
  Switch the calibrator on by pressing the **ON / OFF | LIGHT** key.

The last selected voltage range is displayed.

- Set the voltage value:
  ON indicates:
  Voltage is applied directly to the output!
  Select the position of the digit you wish to change with the ◁ ▷ keys, and change the respective digit with the ▽△ keys.
- The output can be deactivated with the **OUT | ENTER** key [*out.oFF*], or activated once again.

Selecting a Voltage Range for the Fixed Value Function

- Switch to the menu by pressing the **ZERO/SEL | ESC** key [*SELEct rAnGE*].
- Select the desired voltage range with the ▽△ keys. Acknowledge your selection with **OUT | ENTER**.
  The display is switched to the voltage value entry window, but the selected voltage range still appears in the auxiliary display.

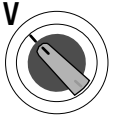
Selecting the Voltage Range for the Interval or Ramp Function

- Switch to the menu by pressing the **ZERO/SEL | ESC** key [*SELEct rAnGE*]. Select the desired voltage range with the ▽△ keys.
- Switch to the interval or ramp function menu with the ◁ ▷ keys (see chap. 11). Start the respective function with **OUT | ENTER**.

Abbreviated Instructions

Select calibration function.

V



ON/OFF
LIGHT

Select voltage range and acknowledge for fixed value function.

ZERO/SEL
ESC

SELEct rAnGE *15* V ▽ … ▽ *300* mV

OUT
ENTER

Change the fixed value.

000.00 V ◁ ▷ △▽

(Negative values within a range of ±300 mV can be selected by scrolling with the S key to below the zero point.)

7 Frequency Generator (positive square-wave pulses) [Hz]

Voltage and frequency can be set independent of each other for frequency generators.
The output signal is a square wave. Resistance of the connected circuit should not be any less than 1 kΩ.

- ➪ Connect the device to be calibrated with the measurement cable in the same way as specified for the voltage simulator.
- ➪ Select the calibration function with the rotary switch. ⎍⎍⎍/HZ.
- ➪ If the instrument had switched itself off via **APoFF** or had been switched off via the **ON / OFF | LIGHT** key before: Switch the calibrator on by pressing the **ON / OFF | LIGHT** key.
- ➪ **Set the voltage range (300 mV, 3 V, 10 V or 15 V):** Switch to the voltage range menu by pressing the **ZERO/SEL | ESC** key twice [SELEct rAnGE]. Select the desired voltage range with the ▽△ keys. Acknowledge your selection with **OUT | ENTER**. The display is switched to the voltage amplitude entry window.
- ➪ **Set voltage amplitude (0 V… 15 V):** Select the position of the digit you wish to change with the ◁ ▷ keys, and change the respective digit with the ▽△ keys. Acknowledge your selection with **OUT | ENTER**. The display is switched to the frequency entry window, but the selected voltage amplitude still appears in the auxiliary display.
- ➪ **Set frequency (1 Hz … 1000 Hz):** **ON indicates: Voltage is applied directly to the output using the selected frequency!** Select the position of the digit you wish to change with the ◁ ▷ keys, and change the respective digit with the ▽△ keys.
- ➪ The output can be deactivated with the **OUT | ENTER** key [out.oFF], or activated once again.

Note!
The following error messages are possible:
"Hi Curr" (high current – current at overload limit), where $I_{Max.}$ = 18 mA, „OUt OL" and 3 acoustic signals (Out Of Limit – limit value exceeded), where I > 27 mA, the simulator is switched off.

Attention!
No external voltage may be applied to the calibrator jacks in this operating mode.
The calibrator is protected against brief application of large external voltage with a replaceable fuse in the event of operator error (see chap. 15.2).

Abbreviated Instructions

Set the voltage range (starting from frequency display)

ZERO/SEL ESC ZERO/SEL ESC SELEct rAnGE 15 V ▽ … ▽ 300 mV OUT ENTER

Set voltage amplitude (starting from frequency display)

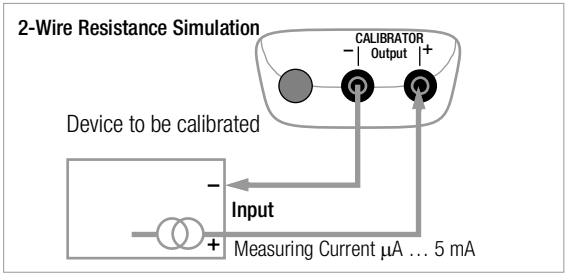
ZERO/SEL ESC 000.00 V ◁ ▷ △▽ OUT ENTER

Set frequency

0000.0 Hz ◁ ▷ △▽

8 Resistance Simulation [Ω]

The resistance simulator is capable of simulating resistors using 2-wire connection for the following range: 5 Ω … 2000 Ω.



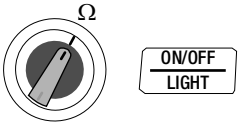
- Connect the device to be calibrated with the measurement cable as shown.
- Select the W calibration function with the rotary switch.
- If the instrument had switched itself off via **APoFF** or had been switched off via the **ON / OFF | LIGHT** key before:
  Switch the calibrator on by pressing the **ON / OFF | LIGHT** key.
- Set the resistance simulation value:
  ON indicates: The output is active!
  Select the position of the digit you wish to change with the ◁ ▷ keys, and change the respective digit with the ▽△ keys.
- The output can be deactivated with the **OUT | ENTER** key [*out.oFF*], or activated once again.

Switching Between the Fixed Value, Interval and Ramp Functions

- Switch to the menu by pressing the **ZERO/SEL | ESC** key [*SELECt rAnGE*].
- Switch to the interval or ramp function menu with the ◁ ▷ keys. Start the respective function with **OUT | ENTER**.

Abbreviated Instructions

Select calibration function.



Change the fixed value.

0000.0 Ω ◁ ▷ △▽

Note!
The following error messages are possible:
"*Hi Curr*" (high current – current value to high),
where I > 4.5 mA and
"*LoCurr*" (low current – current too low or reversed polarity),
where I < 40 µA (corresponds to unconnected sockets).

Attention!
No external voltage may be applied to the calibrator jacks in this operating mode.
The calibrator is protected against brief application of large external voltage with a replaceable fuse in the event of operator error (see chap. 15.2).

Response time of the calibrator output to the specified resistance value after measuring current is applied is max. 30 ms. Devices under test with non-continuous measuring current (e.g. scanned measuring inputs) result in erroneous measured values, if measurement is started before response time has elapsed. The calibrator cannot be used for devices of this type.

9 Temperature Simulation [°C / °F]

The temperature simulator is capable of simulating resistance temperature detectors (RTD) or thermocouples (TC) with specification of the external reference junction temperature.

- ➪ Connect the device to be calibrated with the measurement cables.
- ➪ Select the **Temp RTD** or **Temp TC** calibration function with the **rotary switch**.
- ➪ If the instrument had switched itself off via **APoFF** or had been switched off via the **ON / OFF | LIGHT** key before:
  Switch the calibrator on by pressing the **ON / OFF | LIGHT** key.

The last selected temperature sensor is displayed.

- ➪ Set the temperature value:
  Simulated resistance or simulated voltage is applied directly to the output!
  Select the position of the digit you wish to change with the ◁ ▷ keys, and change the respective digit with the ▽△ keys. As an alternative, press and hold the ▽△ keys with the cursor at any entry position until the higher value digits are scrolled through as well.
- ➪ The output can be deactivated with the **OUT | ENTER** key [*out.oFF*], or activated once again.

Selecting Resistance Temperature Detector (RTD) or Thermocouple (TC) for Fixed Value, Interval or Ramp Function

- ➪ Switch to the fixed value, interval or ramp function menu by pressing the **ZERO/SEL | ESC** key.
- ➪ Select the [*SELECt SEnSor*] menu with the ◁ ▷ keys.
- ➪ Select the desired sensor with the ▽△ keys. Acknowledge your selection with **OUT | ENTER**. The display is switched to the window for temperature value entry, but the selected sensor still appears in the auxiliary display.

Query internal reference temperature – Info menu

MEAS/CAL SETUP *inFo* OUT ENTER *bAtt* **2.9** V ▽ …▽ *tEMP inTErn* **23.1** °C

Parameter Entries for Thermocouple Temperature Simulation

Select unit of measure °C or °F – SEt menu.

MEAS/CAL SETUP *inFo* ▽ *SEt* OUT ENTER *bi nE* ▽ …▽ *tEMP inTErn*

OUT ENTER *uni t SEt* **°F** ▽ **°C** OUT ENTER MEAS/CAL SETUP

Select internal reference temperature – SEt menu.

MEAS/CAL SETUP *inFo* ▽ *SEt* OUT ENTER *bi nE* ▽ …▽ *tEMP EXtErn*

OUT ENTER *uni t SEt* OUT ENTER *tEMP SEt* **EXtErn** ▽ *inTErn*

OUT ENTER *tEMP inTErn* **23.1** °C MEAS/CAL SETUP

Select and set external reference temperature – SEt menu.

MEAS/CAL SETUP *inFo* ▽ *SEt* OUT ENTER *bi nE* ▽ …▽ *tEMP inTErn*

OUT ENTER *uni t SEt* OUT ENTER *tEMP SEt inTErn* ▽ *EXtErn*

OUT ENTER *EXtErn SEt* **21.0** °C ◁ ▷ ▽△ OUT ENTER

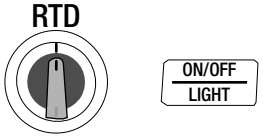
tEMP EXtErn **22.4** °C MEAS/CAL SETUP

9.1 Temperature Simulation for Resistance Temperature Detectors – Temp RTD Setting

Resistance temperature detectors (types Pt100, Pt1000, Ni100 and Ni1000) are simulated by means of resistance values.

Abbreviated Instructions

Select calibration function.



Select sensor value and acknowledge for fixed value function.

ZERO/SEL ESC SELECt SEnSor Pt 100 ▽ …▽ n 1000 OUT ENTER

Set temperature simulator value.

120.0 °C ◁ ▷ △▽

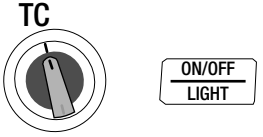
Response time of the calibrator output to the specified resistance value after measuring current is applied is max. 30 ms.
Devices under test with non-continuous measuring current (e.g. scanned measuring inputs) result in erroneous measured values, if measurement is started before response time has elapsed. The calibrator cannot be used for devices of this type.

9.2 Temperature Simulation for Thermocouples – TC Temperature Setting

Thermocouples (types B, E, J, K, L, N, R, S, T and U) are simulated with voltage. Internal or external temperature compensation is possible.

Abbreviated Instructions

Select calibration function.



Select sensor value and acknowledge for fixed value function.

ZERO/SEL ESC SELECt SEnSor b ▽ …▽ u OUT ENTER

Set temperature simulator value.

120.0 °C ◁ ▷ △▽

Select internal or external reference temperature, set external reference temperature (see page 21)

Function Description and Applications

10 different types of thermocouples can be selected, and can be simulated within the temperature ranges specified by IEC/DIN. Selection can be made between an internally measured reference junction temperature, or numeric entry of an external reference junction temperature within a range of –30 to +60° C.

Important Notes Regarding Reference Temperature

Internal reference temperature is continuously measured with an integrated temperature sensor.

The reference temperature is generally measured at the thermocouple connector jack for devices to be calibrated with a thermocouple measuring input.

The two measurements may yield different results, and differences are registered as errors during thermocouple simulation. The following methods help to reduce this error:

a) The device to be calibrated is connected to the jacks at the calibrator with equalizing leads for the thermocouple to be simulated.

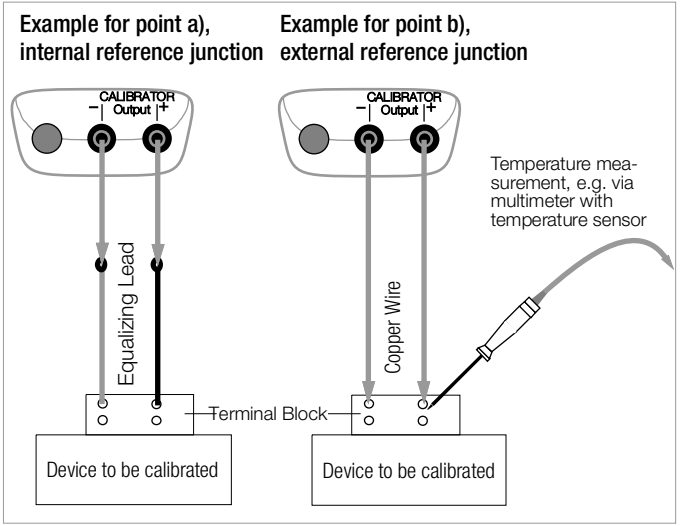
b) The temperature of the thermocouple connector jack at the device to be calibrated is measured with a precision temperature measuring instrument, and the resulting value is entered to the calibrator as a reference temperature. The calibrator and the device to be calibrated are connected with copper wire.

Otherwise, the external reference temperature is entered in all cases where temperature measurement at the device to be calibrated is accomplished by means of a thermostatic reference junction (end of the thermocouple equalizing lead).

Attention!

No external voltage may be applied to the calibrator jacks in this operating mode.

The calibrator is protected against brief application of large external voltage with a replaceable fuse in the event of operator error (see chap. 15.2).



10 Current Source and Current Sink [mA]

- Select the mA current sink (⊖) or mA current source (⊕) calibration function with the **rotary switch**.
- If the instrument had switched itself off via **APoFF** or had been switched off via the **ON / OFF | LIGHT** key before:
  Switch the calibrator on by pressing the **ON / OFF | LIGHT** key.
- Connect the device to be calibrated with the measurement cables (see example in chap. 10.1).

The last selected current range is displayed.

- Set the current simulation value:
  SINK ON indicates that the current sink is active!
  SOURCE ON indicates that the current source is active!
  Select the position of the digit you wish to change with the ◁ ▷ keys, and change the respective digit with the ▽△ keys.
- The current sink / current source can be deactivated by pressing the **OUT | ENTER** key [SINK/SOURCE *out.oFF*], or activated once again.

Selecting a Current Range for the Fixed Value Function

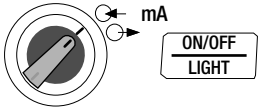
- Switch to the menu by pressing the **ZERO/SEL | ESC** key [*SELECt rAnGE*].
- Select the desired current range with the ▽△ keys (0 … 20 mA, 4 … 20 mA or 0 … 24 mA).
  Acknowledge your selection with **OUT | ENTER**.
  The display is switched to the current value entry window, but the selected current range still appears in the auxiliary display.

Selecting the Current Range for the Interval or Ramp Function

- Switch to the menu by pressing the **ZERO/SEL | ESC** key [*SELECt rAnGE*]. Select the desired current range with the ▽△ keys.
- Switch to the interval or ramp function menu with the ◁ ▷ keys. Start the respective function with **OUT | ENTER**.

Abbreviated Instructions

Select calibration function.



Select current range and acknowledge for fixed value function.

ZERO/SEL ESC *SELECt rAnGE 0 … 20 ▽ 0 … 24 ▽ 4 … 20* OUT ENTER

Change the fixed value.

15.00 mA ◁ ▷ △▽

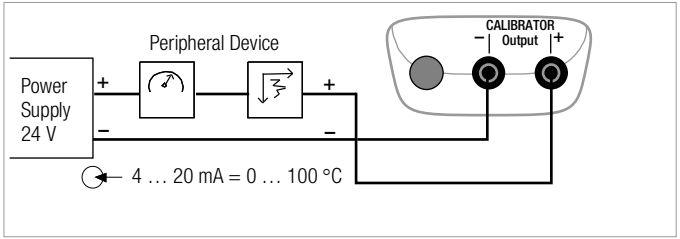
10.1 Current Sink – Simulation of a 2-Wire Transmitter ⊖

A current sink (0 … 24 mA) or current loop load can be simulated with this function. The calibrator regulates the current, which flows via the calibrator jacks from an external power supply, independent of direct voltage applied to the jacks (4 … 27 V). The calibrator varies internal resistance such that the selected current value is maintained.

Note!
The last selected simulation range is saved to memory.
Voltage at the calibrator jacks may not exceed 27 V in the current sink operating mode, because thermal overload would otherwise occur and the fuse would blow. *LoUoLt* appears at the display if voltage is too low.

Attention!
If the calibrator is operated as a current sink and is switched off in a closed electrical circuit or if it switches itself off due to weak batteries, – depending upon the capacity of the external voltage source – high current may occur which trips the integrated fuse link.
Do not switch the calibrator off before the electrical circuit is opened.
Make sure that battery capacity is sufficient or else use a power pack when performing the current sink function.

Example of a 2-Wire Transmitter Measuring Circuit

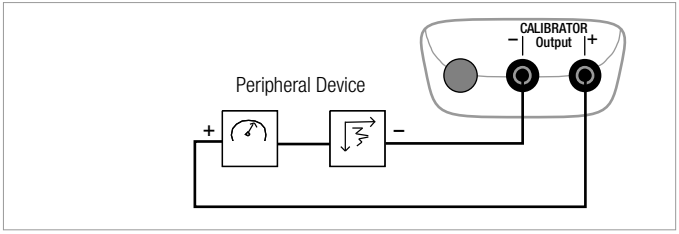


10.2 Current Source

Internal supply power is used to simulate a current source.

Note!
The current source's internal control loop is monitored: If voltage drop at the external load (burden) is greater than 20 V, or if the electrical circuit is interrupted, "Hi burd" appears at the display.

Attention!
No external voltage may be applied to the calibrator jacks in this operating mode.
The calibrator is protected against brief application of large external voltage with a replaceable fuse in the event of operator error (see chap. 15.2).



11 Interval Functions, Ramp Functions and Procedures

Two types of setpoint sequences can be generated in order to simulate sensor conditions at the inputs of transducers, transmitters and buffer amplifiers:

- **Interval sequences** (see chap. 11.1)
  Automatic (periodic) or manually controlled sequences

or

- **Ramp sequences** (see chap. 11.2)
  Endless loops (periodic) or one-time only sequences

The above mentioned sequences can be conveniently generated at a PC with the help of METRAwin 90-2 software as an accessory.

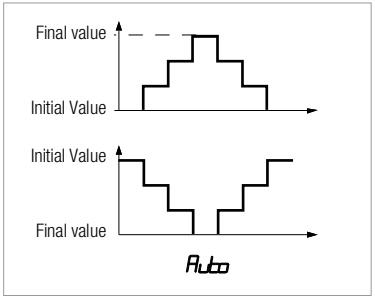
11.1 Interval Sequences – INT Function

Output ranges are divided into rising or falling interval steps with this function, and the number of interval steps, as well as their duration, can be specified. This function is above all suitable for calibrating analog displays and recorders during one-man operation.

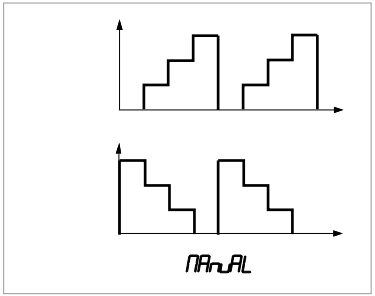
Input parameters for interval sequences:

- All simulation functions except for Hz can be adjusted as output quantities.
- A lower (*StArt*) and an upper (*End*) range limit can be selected for each output quantity from within the overall range.
- The number of steps can be set within a range of 1 … 99.9. The number of steps can be entered as a whole number as well, which is especially practical for analog indicators and recorders with non-standardized scale divisions.
- The interval duration per step (t1) can be selected from within a range of 1 second to 60 minutes.
- Step jumps can be executed manually (*Int ModE* = *MAnuAL*) with the △ and ▽ keys, or automatically (*Int ModE* = *Auto*) with selectable time per step.

Examples of Automatic Interval Sequences



Examples of Manual Interval Sequences



Setting the Interval Parameters

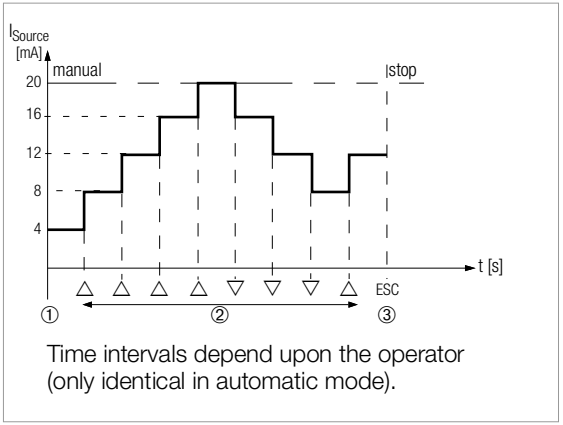
ZERO/SEL ESC	SELECt rAnGE	300 mV … 15 V	▽ ▷ Int	MEAS/CAL SETUP
Initial Value:	Int StArt	02.000 V	◁ ▷ △▽	OUT ENTER
Final value	Int End	10.000 V	◁ ▷ △▽	OUT ENTER
Procedure:	Int StEPS	03.0	◁ ▷ △▽	OUT ENTER
Dwell time:	Int t I	00.05 min.s	◁ ▷ △▽	OUT ENTER
Repetition:	Int ModE	Auto	▽ MAnuAL	OUT ENTER

(Auto = automatic sequence, MAnuAL = manual sequence)

Manually Controlled Interval Sequence

After entering all parameters for the “manual interval sequence” output function (Int ModE = MAnuAL) and starting the function with the OUT ENTER key, the individual steps are triggered with the △ and ▽ keys.
The relationship between the output signal and each of the key operations is depicted with the help of the following example.

Example of a Manually Controlled Interval Sequence



Time intervals depend upon the operator (only identical in automatic mode).

Key

1 When Int rEAdy appears at the display:
Start the sequence by pressing

OUT ENTER

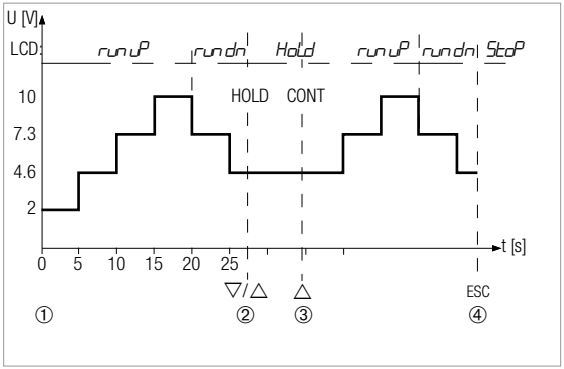
2 The sequence is continued in the corresponding direction by pressing the △ or the ▽ key.
3 Stop the interval sequence by pressing the ZERO/SEL ESC key.

Automatic Interval Sequence

Automatic execution of a programmed sequence range is above all advisable if feed to the signal circuit and scanning of the peripheral device under test are physically separated.

After entering all parameters for the “automatic interval sequence” output function (see above) (*Int*, *ModE* = *Auto*), the sequence can be started and stopped whenever desired, as well as resumed.

Example of an Automatic Interval Sequence



Interval parameters: Output Quantity: U (range 0 V … 15 V), *StArt* = 2 V, *End* = 10 V, number of interval steps *StEPS* = 3, *t 1* = 5 s, *ModE* = *Auto*

Key

1 When *Int rEAdY* appears at the display:

Start the sequence by pressing [OUT / ENTER]

2 The sequence is stopped by pressing the △ or the ▽ key. Interval time elapsed thus far is saved as t_x.

3 The sequence is resumed by pressing the △ key, and remaining sequence duration $t_y = t1 - t_x$.

4 Stop the interval sequence by pressing the [ZERO/SEL / ESC] key.

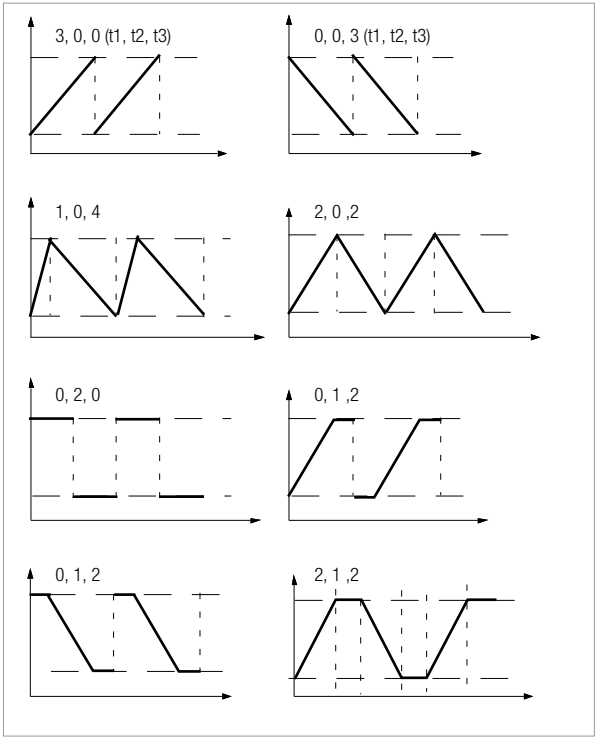
11.2 Read-Out a Periodic Ramp – RAMP Function

Ramp-type signals can be used to test the dynamic performance of devices to be calibrated, or entire measuring circuits. An example would be performance of a control loop with a setpoint specified via the analog setpoint input at the controller. The instrument can be used to replace costly hardware and software for the set-up of long-term test bays with cyclical time sequences.

Parameters for the ramps depicted below:

- The following functions can be adjusted as output quantities: voltage U, current sink I Sink, current source I Source, resistance R or temperature temp (TC oder RTD).
- A lower (*StArt*) and an upper (*End*) range limit can be selected for each output quantity from within the overall range.
- Rise time t1 and decay time t3 are adjustable from 0 seconds … 60 minutes.
- Dwell time t2 at the upper and lower range limits is adjustable from 0 seconds … 60 minutes.
- There are 2 ramp sequences:
  – One-time only (*onCE*): t1, t2, t3
  – Repetition (*rEPEAt*): t1, t2, t3, t2, t1, t2, t3, …

Examples of Ramp Sequences

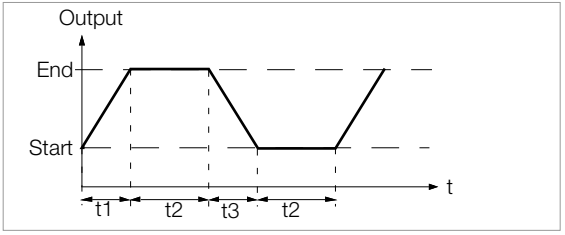


Setting Ramp Parameters

ZERO/SEL ESC	SELECt rAnGE	300 mV … 15 V ▽ ▷ rAMP	MEAS/CAL SETUP
Initial Value:	rAMP StArt	02.000 V	◁ ▷ △ ▽ OUT ENTER
Final value	rAMP End	10.000 V	◁ ▷ △ ▽ OUT ENTER
Rise time:	rAMP t1	00.05 min.s	◁ ▷ △ ▽ OUT ENTER
Dwell time:	rAMP t2	00.08 min.s	◁ ▷ △ ▽ OUT ENTER
Decay Time:	rAMP t3	00.05 min.s	◁ ▷ △ ▽ OUT ENTER
Repetition:	rAMP ModE	rEPEAt	▽ onCE OUT ENTER

(rEPEAT = endless loop, onCE = one-time only)

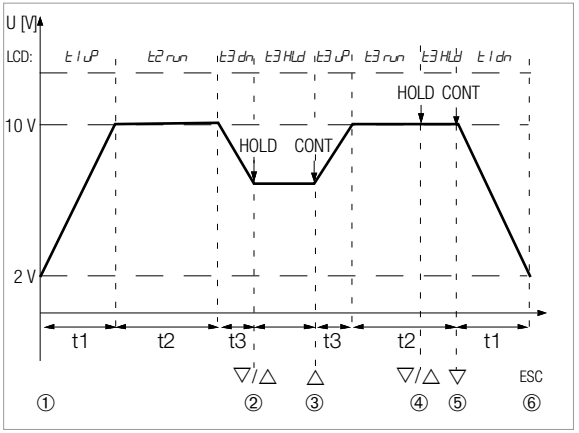
Example of a Periodic Ramp Sequence



Manually Controlled Ramp Sequence

After entering all parameters, start by pressing OUT ENTER
Rising or decaying ramps can be triggered with the r **or** ▽ key.
The relationship between the output signal and each of the key operations is depicted with the help of the following example.

Example of a Periodic Ramp Sequence Controlled by Manual Intervention



Ramp parameters: Output Quantity: U (range 0 … 15 V), StArt = 2 V, End = 10 V, t1 = 5 s, t2 = 8 s, t3 = 5 s, rEPEAt for periodic ramps

Key

1 When rAMP rEAdy appears at the display:

Start the sequence by pressing OUT ENTER

2 Stop the decaying ramp within decay time t3 with the r or s key.
3 Start a rising ramp within remaining decay time t3 with the △ key.
4 Stop the ramp sequence by pressing the △ or the ▽ key.
5 Start a decaying ramp with the ▽ key, remaining dwell time t2 is cleared.
6 Stop the ramp sequence by pressing ZERO/SEL ESC.

12 Interface Operation (with selector switch setting ≠ OFF)

The calibrator is equipped with an infrared interface for communication with the PC. Commands are optically transferred through the instrument housing by means of infrared light to the USB X-tra (Z216C) interface adapter (optional accessory, see chap. 3.2 on page 5), which is attached to the calibrator. The adapter's USB interface allows for connection to the PC with an interface cable. Commands and parameters can be transmitted from the PC to the calibrator. The following functions can be executed:

- Configuration and read-out of calibration parameters
- Calibration function and measuring range selection
- Start calibration
- Programming of user-specific procedures (interval and ramp functions)

12.1 Activating the Interface

The interface is automatically activated for receiving operation (calibrator receives data from the PC) as soon as the interface is addressed by the PC, assuming that the "*IrStb*" parameter has been set to "**on**" (see chap. 12.2), or the instrument is already switched on (the first command wakes up the calibrator, but does not yet execute any further commands).

Switching the Interface On via the PC

After transmission of a data frame from the PC, the simulator is switched on. Use the NA X-TRA (Z218G) power pack for lengthy on-times for this reason (optional accessory, see chap. 3.2 on page 5). This prevents automatic shutdown due to battery voltage monitoring.

Operation in the REMOTE Mode

In the REMOTE mode, the device responds just like it does in the local mode. The device is reset to local mode operation after switching it off and back on again with the **ON / OFF | LIGHT** key.

12.2 Configuring Interface Parameters

IrStb – Status of the Infrared Receiver in the Stand-by Mode

There are two possible switching statuses for the infrared interface when the calibrator is switched off:

on: IR appears at the display and the infrared interface is active, i.e. signals such as making commands can be received, and power is consumed even though the calibrator is switched off.

oFF: IR does not appear at the display and the infrared interface is switched off, signals cannot be received.

MEAS/CAL SETUP, *nFo* ▷ … ▷ *SEt* OUT ENTER, *bNE* ▽ … ▽ *IrStb*

OUT ENTER, *IrStb SEt* **on** / **oFF** △▽ OUT ENTER

(*IrStb* = **oFF** = default value)

Addr – Address

If several calibrators are connected to the PC via an interface adapter, a separate address can be assigned to each instrument. Address number 1 should be selected for the first instrument, 2 should be assigned to the second and so forth.

MEAS/CAL SETUP, *nFo* ▷ … ▷ *SEt* OUT ENTER, *bNE* ▽ … ▽ *Addr*

OUT ENTER, *00* … *01* … *15* △▽ OUT ENTER

(Addr = *15* = default setting)

13 Displays – Error Messages

Message	Function	Meaning
FuSE	Fuse	Blown fuse
	Power Supply	Battery voltage has fallen below 1.8 V
Hi Curr	Voltage/pulse Simulate	High current = current too high (I > 18 mA)
	Resistance/RTD Simulate	High current = current too high (I > 4.5 mA)
LoCurr	Resistance simulation	Low current = current too low (I < 40 µA) (indicates that connector jacks are open) or reversed polarity e. g. with Pt and Ni sensors
OutOL	Voltage simulator Frequency generator	Output overload = limit value violated (I > 30 mA), 3 acoustic signals are generated at the same time and the simulator jacks are deactivated. After eliminating the cause of overload, the output can once again be switched on by pressing the **ON / OFF** I **LIGHT** key.
LoVolt	Current Sink	U < 3 V (to little loop voltage)
Hi burd	Current Source	High burden: the resistance applied by mean of the connected circuit is too high. Voltage built up at the calibrator is equal to or greater than 20 V.

Blinking Calibration Unit of Measure

All calibration functions are balanced/adjusted at the factory in compliance with technical specifications. If a calibration unit of measure blinks, this indicates that balancing constants which have been established and saved to the calibrator are no longer available for the respective function. If this is the case, results may deviate from the specification. We recommend sending the instrument to our Service (see chap. 17 on page 35).

14 Storage and Transport

Attention!
Improper Storage
Damage to the product and measuring error due to environmental influences
Store the instrument in a protected location and only within the limits of permissible ambient conditions, see chap. 3.6 on page 9.

Attention!
Removing the Battery During Periods of Non-Use
The integrated quartz movement draws power from the batteries even when the instrument is switched off. It is advisable to remove the batteries during long periods of non-use for this reason (e.g. vacation). This prevents excessive depletion of the batteries, which may result in damage under unfavorable conditions.
Make sure that no battery leakage has occurred before initial start-up, as well as after long periods of storage. Continue to inspect the batteries for leakage at short, regular intervals.

Attention!
Improper Transport
Damage to the product and measuring error
– Transport the instrument only within the limits of the permissible ambient conditions (see chap. 3.6 on page 9).
- For protection, we recommend the accessories available for the instrument (transport case, pouches, etc.); details can be found in the data sheet of the instrument.

15 Maintenance

15.1 Housing

Attention!
Life endangering due to electric shock!
The product is operated with electric current. Therefore there is a general risk of electric shock. This can be fatal or cause serious injuries.
– The instrument and all connected conductors must be voltage-free before beginning, as well as during cleaning.
– Switch the instrument off and disconnect all conductors.
– Never immerse the instrument in water or other liquids.
– Never touch the instrument with wet hands.

Attention!
Unsuitable Cleaning Agents
Unsuitable cleaning agents such as aggressive or abrasive cleansers result in damage to the instrument/accessories.
– Use a cloth for cleaning, which has been slightly dampened with water.
– Avoid the use of cleansers, abrasives or solvents.

No special maintenance is required for the housing. Keep outside surfaces clean.

15.2 Fuses

Testing the Fuse

The fuse is tested automatically when the device is switched on.
If the fuse is blown or has not been inserted, “FuSE” blinks at the digital display.

Blown fuse

The same message appears if the output sockets are short circuited when the device is switched on.

Replacing the Fuse

Attention!
If a fuse should blow, eliminate the cause of overload before placing the instrument back into service!

Attention!
Life endangering due to electric shock!
Switch the instrument off and disconnect all cables from the instrument!

Attention!
Only use (rechargeable) batteries that comply with the technical data (chap. 3.6 on page 9)!

- Set the instrument face down onto the working surface.
- Turn the slotted screw on the cover with the fuse symbol counterclockwise.
- Lift off the cover and pry the fuse out using the flat side of the fuse cover.
- Insert a new fuse. Make sure that the fuse is centered, i.e. between the tabs at the sides.
- When replacing the fuse cover, insert the side with the guide hooks first.
  Tighten the screw by turning it clockwise.
- Dispose of the blown fuse properly (see chap. 19 on page 35).

15.3 Recalibration

Use of your instrument and resultant stressing affect the instrument and lead to deviation from warranted accuracy values.

In the case of strict measuring accuracy requirements, as well as in the event of severe stressing (e.g. severe climatic or mechanical stress), we recommend a relatively short calibration interval of once per year. If this is not the case, a calibration interval of 2 to 3 years is usually adequate.

Please contact GMC-I Service GmbH for calibration services, see chap. 17 on page 35.

Note!

Date on Calibration Certificate / Calibration Interval Begins Upon Receipt

Your instrument is furnished with a calibration certificate on which a date appears. This date may be further in the past if your instrument has been stored for some time prior to sale. The instruments are stored in accordance with the specified conditions. Drift is thus negligible for a duration of 1 year and longer storage periods are highly unusual.

Consequently, the instrument's characteristic values lie within the specifications and the first calibration interval can be determined as of the date of receipt.

16 Repair

If your instrument requires repair, please contact our service department, see chap. 17 on page 35.

Note!

Loss of warranty and guarantee claims

Unauthorized modification of the instrument is prohibited. This also includes opening the instrument.

If it can be ascertained that the tester has been opened by unauthorized personnel, no guarantee claims can be honored by the manufacturer with regard to personal safety, measuring accuracy, compliance with applicable safety measures or any consequential damages.

- The device may only be repaired or opened by authorized, qualified personnel who are familiar with the associated dangers.
- Original replacement parts may only be installed by authorized, qualified personnel.
- The instrument may not be placed back into operation until troubleshooting and repair have been performed, and calibration and dielectric strength have been tested and approved at our factory or by an authorized service center.

17 Contact, Support and Service

Gossen Metrawatt GmbH can be contacted directly and conveniently – we have a single number for everything! Whether you require support or training, or have an individual inquiry, we can answer all of your questions here:

+49 911 8602-0

Monday to Thursday:	08:00 am - 4:00 pm
Friday:	08:00 am - 2:00 PM

Or contact us by e-mail at: info@gossenmetrawatt.com

Do you prefer support by e-mail?

Measuring and Test Technology:
support@gossenmetrawatt.com

Industrial Measuring Technology:
support.industrie@gossenmetrawatt.com

Please contact GMC-I Service GmbH for repairs, replacement parts and calibration [1] :

+49 911 817718-0

service@gossenmetrawatt.com

https://www.gmci-service.com/en/

Beuthener Str. 41
90471 Nürnberg
Germany

[1] DAkkS calibration laboratory per DIN EN ISO/IEC 17025 accredited by the Deutsche Akkreditierungsstelle GmbH under reference number D-K-15080-01-01

18 CE Declaration

The instrument fulfills all requirements of applicable EU directives and national regulations. We confirm this with the CE mark.
The CE declaration can be found on our website:
https://www.gmc-instruments.de/en/services/download-center/

19 Disposal and Environmental Protection

Proper disposal makes an important contribution to the protection of our environment and the conservation of natural resources.

Attention!
Environmental Damage
Improper disposal results in environmental damage.
Follow the instructions concerning return and disposal included in this section.

The following comments refer specifically to the legal situation in the Federal Republic of Germany. Owners or end users who are subject to other regulations must comply with the respective local requirements and implement them correctly on site. Further information can be obtained, for example, from the responsible authorities or the local distributor.

Waste Electrical Equipment, Electrical or Electronic Accessories and Waste Batteries (including rechargeable batteries)

Electrical equipment and batteries (including rechargeable batteries) contain valuable raw materials that can be recycled, as well as hazardous substances which can cause serious harm to human health and the environment, and they must be recycled and disposed of correctly.

The symbol at the left depicting a crossed-out garbage can on wheels refers to the legal obligation of the owner or end user (German electrical and electronic equipment act ElektroG and German battery act BattG) not to dispose of used electrical equipment and batteries with unsorted municipal waste (“household trash”). Waste batteries must be removed from the old device (where possible) without destroying them and the old device and the waste batteries must be disposed of separately. The battery type and its chemical composition are indicated on the battery’s labelling. If the abbreviations “Pb” for lead, “Cd” for cadmium or “Hg” for mercury are included, the battery exceeds the limit value for the respective metal.

Please observe the owner’s or end user’s responsibility with regard to deleting personal data, as well as any other sensitive data, from old devices before disposal.

Old devices, electrical or electronic accessories and waste batteries (including rechargeable batteries) used in Germany can be returned free of charge to Gossen Metrawatt GmbH or the service provider responsible for their disposal in compliance with applicable regulations, in particular laws concerning packaging and hazardous goods. Waste batteries must be returned in the discharged state or with appropriate precautions against short circuiting. Further information regarding returns can be found on our website.

Packaging Materials

We recommend retaining the respective packaging materials in case you might require servicing or calibration in the future.

Attention!
Danger of Asphyxiation Resulting from Foils and Other Packaging Materials
Children and other vulnerable persons may suffocate if they wrap themselves in packaging materials, or their components or foils, or if they pull them over their heads or swallow them.
Keep packaging materials, as well as their components and foils, out of the reach of babies, children and other vulnerable persons.

In accordance with German packaging law (VerpackG), the user is obligated to correctly dispose of packaging and its components separately, and not together with unsorted municipal waste (“household trash”).

Packaging which is not subject to so-called system participation is returned to the appointed service provider. Further information regarding returns can be found on our website.

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