

# METRAHIT | CAL

## Calibrator

3-349-442-03  
11/12.15



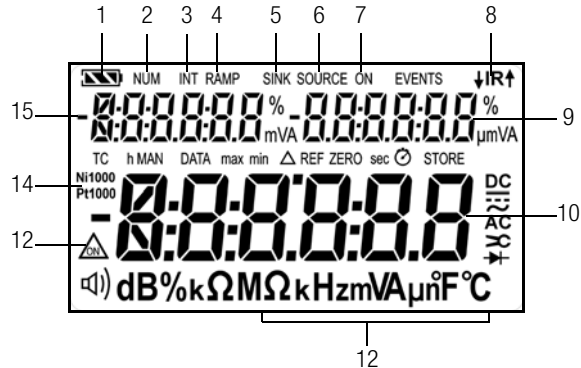
## Operating Overview – Connections, Keys, Rotary Switch, Symbols



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

- 1 Display (LCD) (see page 3 for significance of symbols)
- 2 **HOLD / CONT** Pause/resume ramp/interval  
△ Increase parameter values  
*Mode menu:* Selection of individual menu entries against direction of flow
- 3 **ON / OFF | LIGHT** key for switching device and display illumination on and off
- 4 **OUT | ENTER**  
OUT: Switch calibrator output on and off  
*Mode menu:* Acknowledge entry (ENTER)
- 5 ▷ Move cursor to the right  
*SELECT RANGE operating mode:* ramp function selection
- 6 **Rotary switch** for calibration functions and complete shutdown
- 7 DAKKS calibration mark
- 8 Connector jacks for calibrator output
- 9 **HOLD / CONT** Pause/resume ramp/interval  
▽ Reduce parameter values  
*Mode menu:* Selection of individual menu entries in direction of flow
- 10 **MEAS / CAL | SETUP**  
Key for switching back and forth between calibration and menu function
- 11 **ZERO / SEL | ESC**  
*Mode menu:* Exit current menu level and return to a higher level, exit parameters configuration without saving data. Pause ramp/interval.
- 12 ◁ Move cursor to the left,  
*SELECT RANGE operating mode:* 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



- 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 is active
- 6 SOURCE: Current source is active
- 7 ON: The calibrator output is active
- 8 IR: Infrared interface display
- 9 Auxiliary display with decimal point and polarity display
- 10 Main display with decimal point and polarity display
- 11 Calibration unit of measure
- 12  $\Delta$ : Simulator in continuous mode operation
- 13 Ni/Pt1000: Selected temperature sensor
- 14 Auxiliary display with decimal point and polarity display

### Battery Level Indicator



Battery full



Battery OK



Battery weak



Battery (almost) dead,  $U < 1.8 \text{ V}$

### Interface Indicator (with selector switch setting $\neq$ OFF)



Data transmission  $\downarrow$  to /  $\uparrow$  from calibrator is active



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

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## 1 Safety Features and Precautions

You have selected an instrument which provides you with a high level of safety. This instrument fulfills the requirements of applicable European and national EC directives. This is confirmed by means of the CE mark. A corresponding declaration of conformity can be requested from GMC-I Messtechnik GmbH.

The device has been manufactured and tested in accordance with safety regulations IEC 61010-1:2010/DIN EN 61010-1:2010/VDE 0411-1:2011. When used for its intended purpose, safety of the operator, as well as that of the instrument, is assured. Their safety is however not guaranteed, if the instrument is used improperly or handled carelessly.

**In order to maintain flawless technical safety conditions, and to assure safe use, it is imperative that you read the operating instructions thoroughly and carefully before placing your instrument into service, and that you follow all instructions contained therein.**

**Observe the following safety precautions:**

- The instrument may only be operated by persons who are capable of recognizing contact hazards and taking the appropriate safety precautions. Contact hazards exist anywhere, where voltages of greater than 33 V RMS may occur.



### Attention!

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

**Maximum voltage to be applied between the connector jacks (8) is 27 V. If  $U_{\max}$  or  $I_{\max}$  is exceeded, the integrated 250 V fuse is blown.**

- Be prepared for the occurrence of unexpected voltages at devices under test (e.g. defective devices). For example, capacitors may be dangerously charged.
- Device functions may not be started in electrical circuits with corona discharge (high-voltage).

- Make certain that the measurement cables are in flawless condition, e.g. no damage to insulation, no interruptions in cables or plugs etc.
- For this reason, it is imperative that a *calibrator* is **never confused** with a *multimeter*.
- If necessary, use a multimeter to make sure that no dangerous contact 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. With the exception of the resistance simulation and mA SINK operating modes, the connected signal circuits should *not feed any voltage or current* back to the calibrator. In order to avoid damage to the instrument when interference voltages are applied (within allowable limit values), **the mA SINK and mA SOURCE circuits are equipped with an fuse**, which makes this circuit highly resistive in the event that excessive current should occur in case of a fault for the duration of overloading.



### Attention!

If the calibrator is connected with reversed polarity, a high current may occur which trips the integrated fuse.



### Note!

**Please observe the following prior to connecting the DUT:**

Switch on the instrument and adjust the correct calibrator function before connecting the DUT. Otherwise, a high current may flow through the DUT for a short while after power-on, thus interfering with the fuse test.



### Warning!

The instrument may not be operated in explosive atmospheres, or connected to intrinsically safe electrical circuits.

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## Meanings of Symbols on the Instrument



Warning concerning a source of danger (attention: observe documentation!)



Ground



Continuous, doubled or reinforced insulation

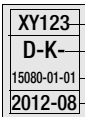


Indicates EC conformity



The device may not be disposed of with the trash. Further information regarding the WEEE mark can be accessed on the Internet at [www.gossenmetrawatt.com](http://www.gossenmetrawatt.com) by entering the search term WEEE.

### DAkkS calibration mark (blue seal):



Serial number

German Accreditation Body GmbH – Calibration lab

Registration number

Date of calibration (year – month)

## Opening of Equipment / Repair

The equipment may be opened only by authorized service personnel to ensure the safe and correct operation of the equipment and to keep the warranty valid.

Even original spare parts may be installed only by authorized service personnel.

In case the equipment was opened by unauthorized personnel, no warranty regarding personal safety, measurement accuracy, conformity with applicable safety measures or any consequential damage is granted by the manufacturer.

### Repair, Parts Replacement and Balancing

When the instrument is opened, voltage conducting parts may be exposed. The instrument must be disconnected from the electrical circuit before the performance of repairs, the replacement of parts or balancing. If balancing, maintenance or repair of a live open instrument is required, work may only be carried out by trained personnel who are familiar with the dangers involved.

### Defects and Extraordinary Strains

If it may be assumed that the instrument can no longer be operated safely, it must be removed from service and secured against unintentional use.

Safe operation can no longer be relied upon:

- If the instrument or the test probes are damaged
- If the instrument no longer functions
- After long periods of storage under unfavorable conditions

## 2 Initial Start-Up

### Battery operation

Be certain to refer to section 12.2 regarding correct battery installation.



#### 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.

If this is the case, replace the batteries in accordance with section 12.2, or continue work with the power pack if possible.

### Operation with the Power Pack (accessory, not included)

Installed batteries are disconnected electronically if the NA X-TRA power pack is used, and need not be removed from the instrument (see also section 12.2). If rechargeable batteries are used, they must be recharged externally.

### 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 liquid crystal display (LCD) are illuminated. The LCD is shown in the diagram on page 3.  
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 section 10.1.



#### 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.

### Setting Time and Date

See section 9.2 on page 22.

### Switching the Instrument Off Manually


- ⇒ Press and hold the **ON / OFF | LIGHT** key until OFF 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 with the AP oFF function (see section 9.2), has elapsed. Shutdown is acknowledged with a brief acoustic signal. Automatic shutdown is disabled in the continuous operating mode (AP oFF = on).

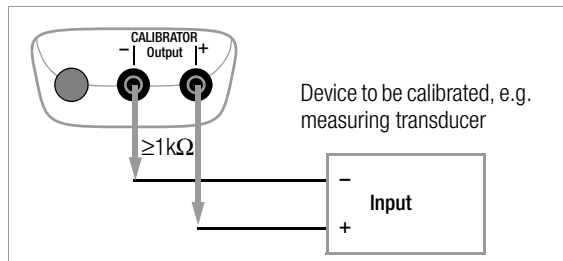
### Disabling Automatic Shutdown

The instrument can be set to continuous operation.

- ⇒ Select AP oFF = on in the Setup menu (see section 9.2). Continuous operation is indicated at the display with the  symbol.

### 3 Voltage Source [V]

Voltages can be simulated within the following ranges: 0 ... ±60 mV, 0 ... ±300 mV, 0 ... 3 V, 0 ... 10 V and 0 ... 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**.
- 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 digit to be changed with the <|> keys, and change the respectively selected 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

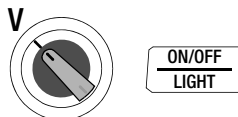
- Press the **ZERO/SEL | ESC** key in order to switch to the [SELEct rAnGE] menu.
- Select the desired voltage range with the ∇△ keys. Acknowledge your selection with OUT | ENTER. The display is switched to the voltage value entry window, but the selected voltage range still appears in the auxiliary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

#### Selecting the Voltage Range for the Interval or Ramp Function

- Press the **ZERO/SEL | ESC** key in order to switch to the [SELEct rAnGE] menu. Select the desired voltage range with the ∇△ keys.
- Switch to the interval or ramp function menu with the <|> keys (see section 8). Start the respective function by pressing OUT | ENTER.

#### Abbreviated Instructions

##### Select calibration function.



##### Select voltage range and acknowledge for fixed value function.



##### Change the fixed value.

000.00 V <|> ∇△

(Negative values within a range of ±60 mV or ±300 mV can be selected by scrolling with the ∇ key to below the zero point.)



## 4 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 k $\Omega$ .

- Connect the device to be calibrated with the measurement cable in the same way as specified for the voltage simulator.
- Select the HZ calibration function  $\square\square\square$  with the rotary switch.
- 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 [SELEct rAnGE] by pressing the ZERO/SEL | ESC key twice. Select the desired voltage range with the  $\nabla/\Delta$  keys. Acknowledge your selection with OUT | ENTER. The display is switched to the voltage amplitude entry window.
- **Set voltage amplitude (0 ... 15 V):**  
Select the digit to be changed with the  $\triangleleft/\triangleright$  keys, and change the respectively selected digit with the  $\nabla/\Delta$  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 ... 1000 Hz):**  
**ON indicates: Voltage is applied directly to the output using the selected frequency!**  
Select the digit to be changed with the  $\triangleleft/\triangleright$  keys, and change the respectively selected digit with the  $\nabla/\Delta$  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  $I_{\max} = 18 \text{ mA}$ , “OLE OL” and 3 acoustic signals (out of limit – limit value exceeded) where  $I > 27 \text{ mA}$ ; the simulator is switched off.



### Attention!

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

The calibrator is protected against brief application of a large interference voltage with a replaceable fuse in the event of operator error (see section 12.3).

## Abbreviated Instructions

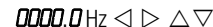
Set the voltage range (starting from frequency display).



Set voltage amplitude (starting from frequency display).

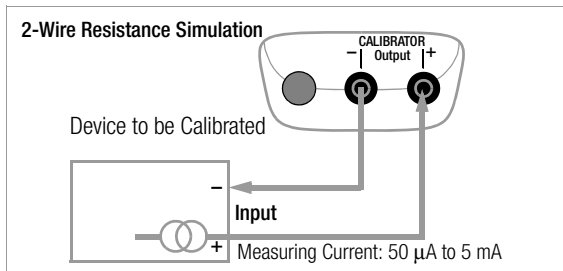


Set frequency.



## 5 Resistance Simulation [ $\Omega$ ]

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



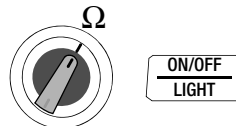
- ⇨ Connect the device to be calibrated with the measurement cable as shown.
- ⇨ Select the  $\Omega$  calibration function with the **rotary switch**.
- ⇨ Switch the calibrator on by pressing the ON / OFF | LIGHT key.
- ⇨ Set the resistance simulation value:  
**ON indicates: The output is active!**  
Select the digit to be changed with the  $\triangleleft \triangleright$  keys, and change the respectively selected digit with the  $\nabla \triangle$  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

- ⇨ Press the **ZERO/SEL | ESC** key in order to switch to the [SELEct RANGE] menu.
- ⇨ Switch to the interval or ramp function menu with the  $\triangleleft \triangleright$  keys. Start the respective function with OUT | ENTER.

### Abbreviated Instructions

Select the calibration function.



Change the fixed value.

0000.0  $\Omega$   $\triangleleft \triangleright \triangle \nabla$



#### Note!

The following error messages are possible:

"Hi Curr" (high current – current value to high) where  $I > 4.5$  mA and

"Lo Curr" (low current – current too low or reversed polarity) where  $I < 40$   $\mu$ A (corresponds to unconnected sockets)



#### Attention!

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

The calibrator is protected against brief application of a large interference voltage with a replaceable fuse in the event of operator error (see section 12.3).

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.

## 6 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**.
- ⇨ 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 digit to be changed with the <|> keys, and change the respectively selected 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 the 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 SErSo] 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.







 , rfo  bAtt 2.9 V ▽ ... ▽ tENP , rTErrAL 23.7 °C

### Parameter Entries for Thermocouple Temperature Simulation








#### Select unit of measure °C or °F – SET menu.

 , rfo ▽ SEt  b rE ▽ ... ▽ tENP , rTErrAL  
 unit SEt °F ▽ °C  

#### Select internal reference temperature – SET menu.

 , rfo ▽ SEt  b rE ▽ ... ▽ tENP E3tErrAL  
 unit SEt  tENP SEt E3tErrAL ▽ , rTErrAL  
 tENP , rTErrAL 23.7 °C 

#### Select and set external reference temperature – SET menu.

 , rfo ▽ SEt  b rE ▽ ... ▽ tENP , rTErrAL  
 unit SEt  tENP SEt , rTErrAL ▽ E3tErrAL  
 E3tErrAL SEt 21.0 °C <|> ▽ △   
tENP E3tErrAL 22.4 °C 

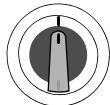
## 6.1 Temperature Simulation for Resistance Temperature Detectors – RTD setting for temperature

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

### Abbreviated Instructions

Select the calibration function.

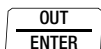
RTD



Select a sensor value and acknowledge for the fixed value function.



SELEct SEnSor Pt 100 ▾ ... ▾ n 1000



Set the 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.

## 6.2 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 the calibration function.

TC



Select a sensor type and acknowledge for the fixed value function.



SELEct SEnSor b ▾ ... ▾ u



Set the temperature simulator value.

120.0 °C ◀ ▶ △ ▽

Select internal or external reference temperature, set external reference temperature (see page 11).

## 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 measurement 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.

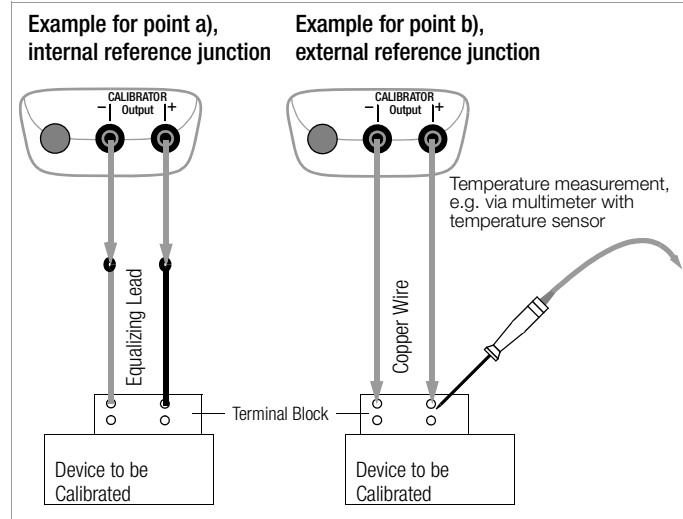
Otherwise, the external reference temperature is entered in all cases where temperature measurement at the device to be calibrated is accomplished by means of a thermostatic reference junction (end of the thermocouple equalizing lead).



### Attention!

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

The calibrator is protected against brief application of a large interference voltage with a replaceable fuse in the event of operator error (see section 12.3).



## 7 Current Source and Current Sink [mA]

- ⇨ Connect the device to be calibrated with the measurement cables (see example in section 7.1).
- ⇨ Select the mA current sink (⊖) or mA current source (⊕) calibration function with the **rotary switch**.
- ⇨ Switch the calibrator on by pressing the ON / OFF | LIGHT key.

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 digit to be changed with the <|> keys, and change the respectively selected digit with the ∇|Δ 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

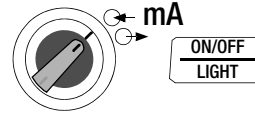
- ⇨ Press the **ZERO/SEL | ESC** key in order to switch to the [SELEct rAnGE] menu.
- ⇨ Select the desired current range with the ∇|Δ keys (0 ... 20 mA, 4 ... 20 mA or 0 ... 24 mA).  
Acknowledge your selection with OUT | ENTER.  
The display is switched to the current value entry window, but the selected current range still appears in the auxiliary display.

### Selecting the Current Range for the Interval or Ramp Function

- ⇨ Press **ZERO/SEL | ESC** key in order to switch to the [SELEct rAnGE] menu. Select the desired current range with the ∇|Δ keys.
- ⇨ Switch to the interval or ramp function menu with the <|> keys. Start the respective function with OUT | ENTER.

## Abbreviated Instructions

Select the calibration function.



Select a current range and acknowledge for the fixed value function.



Change the fixed value.

15.00 mA <|> Δ∇

## 7.1 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. **LOVLT** appears at the display if voltage is too low.



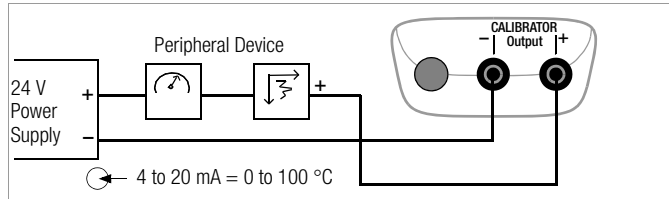
### Attention!

If the calibrator is used as a current sink and switched off at closed electrical circuit or else switches off automatically due to low battery status, a high current may occur which – depending on the capacity of the external voltage source – trips the integrated fuse.

**Do not switch off the calibrator before opening the electrical circuit.**

Please make sure that the current sink function is only performed with sufficient battery capacity or in combination with a power pack.

## Example of a 2-Wire Transmitter Measuring Circuit



## 7.2 Current Source

Internal supply power is used to simulate a current source.



### Note!

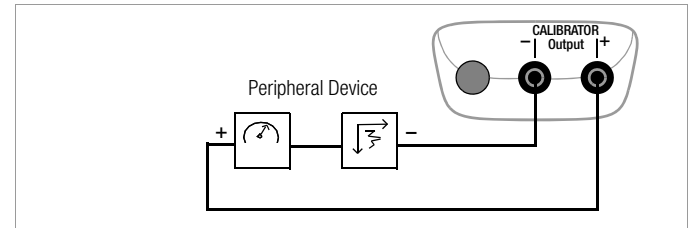
The current source's internal control loop is monitored: If voltage drop at the external load (burden) is greater than 16 V, or if the electrical circuit is interrupted, "Hi burd" appears at the display.



### Attention!

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

The calibrator is protected against brief application of a large interference voltage with a replaceable fuse in the event of operator error (see section 12.3).



## 8 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 section 8.1)  
Automatic (periodic) or manually controlled sequences
- or
- **Ramp sequences** (see section 8.2)  
Endless loops (periodic) or one-time only sequences

The above mentioned sequences can be conveniently generated at a PC with the help of METRAWin90-2 software as an accessory.

### 8.1 Interval Sequences – INT Function

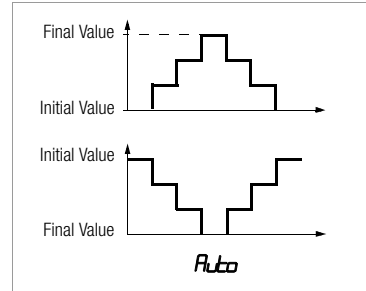
Output ranges are divided into rising or falling interval steps with this function, and the number of interval steps, as well as their duration, can be specified. This function is above all suitable for calibrating analog displays and recorders during one-man operation.

Input parameters for interval sequences:

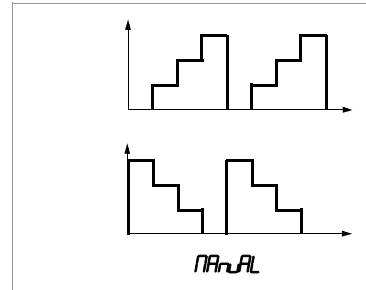
- All simulation functions except for Hz can be adjusted as output quantities.
- A lower (Start) and an upper (End) range limit can be selected for each output quantity from within the overall range.
- The number of steps can be set within a range of 1 ... 99.9. The number of steps can be entered as 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 ( $Int ModE = \overline{MANUAL}$ ) with the  $\Delta$  and  $\nabla$  keys, or automatically ( $Int ModE = \overline{AUTO}$ ) with selectable time per step.

### Examples of Automatic Interval Sequences



### Examples of Manual Interval Sequences





## Setting the Interval Parameters

<b>ZERO/SEL</b> <b>ESC</b>	SELECT RANGE	300 mV ... 15 V ▾ ▹	<b>MEAS/CAL</b> <b>SETUP</b>
Initial value:	Int Start	02.000 V ▹ ▸ ▴ ▾	<b>OUT</b> <b>ENTER</b>
Final value:	Int End	10.000 V ▹ ▸ ▴ ▾	<b>OUT</b> <b>ENTER</b>
Steps:	Int STEPS	03.0 ▹ ▸ ▴ ▾	<b>OUT</b> <b>ENTER</b>
Dwell time:	Int t1	00.05 min.s ▹ ▸ ▴ ▾	<b>OUT</b> <b>ENTER</b>
Repetition:	Int ModE	Auto ▾ <b>MANUAL</b>	<b>OUT</b> <b>ENTER</b>

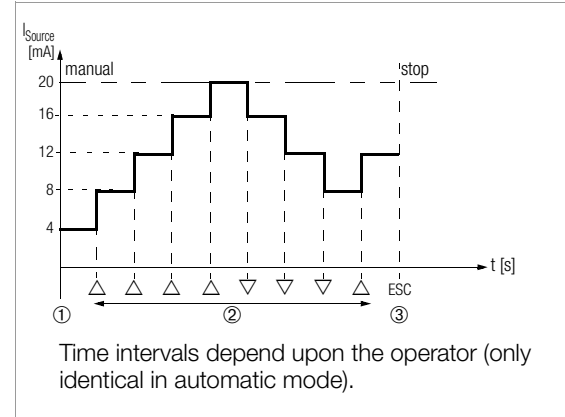
(Auto = automatic sequence, MAnuAL = manual sequence)

## 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** 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

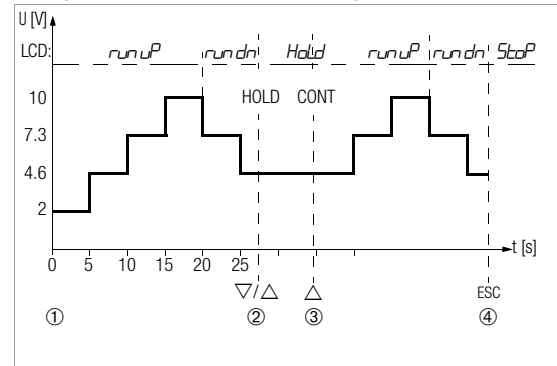
- 1 When **Int rEAdY** is displayed:  
Start the sequence by pressing **OUT** key.
- 2 The sequence is continued in the corresponding direction by pressing the **△** or the **▽** key.
- 3 Stop the interval sequence by pressing **ZERO/SEL** key.

## Automatic Interval Sequence

Automatic execution of a programmed sequence range is above all advisable if feeding to a 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) ( $I_{rt}$ ,  $\Pi_{odE} = A_{uto}$ ), 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 of 0 ... 15 V),  
 $StArt = 2\text{ V}$ ,  $End = 10\text{ V}$ , number of interval  $StEPS = 3$ ,  $tI = 5\text{ s}$ ,  
 $\Pi_{odE} = A_{uto}$

## Key

- 1 When **IrE rEAdY** is displayed:  
Start the sequence by pressing 

OUT
ENTER

.
- 2 The sequence is stopped by pressing the  $\Delta$  or the  $\nabla$  key.  
Interval time elapsed thus far is saved as  $t_x$ .
- 3 The sequence is resumed by pressing the  $\Delta$  key; remaining sequence duration  $t_y = tI - t_x$ .
- 4 Stop the interval sequence by pressing 

ZERO/SEL
ESC

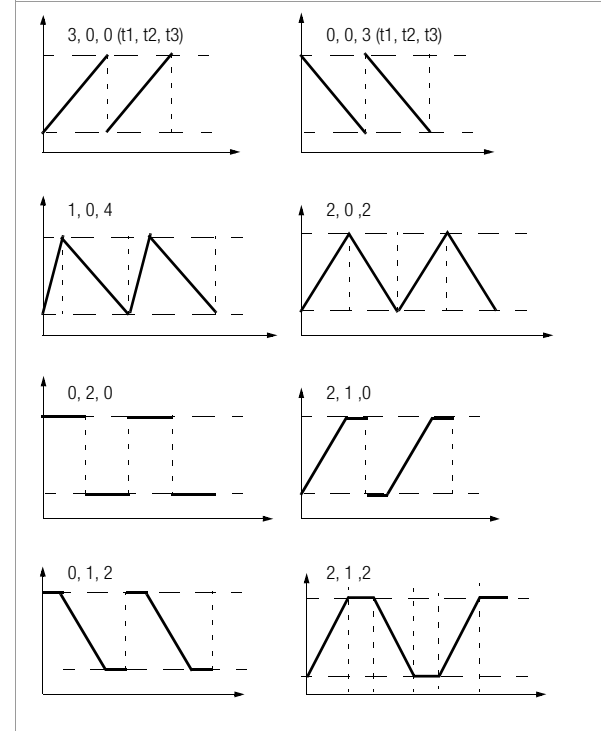
.

## 8.2 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 setup 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 or RTD).
- A lower (Start) and an upper (End) range limit can be selected for each output quantity from within the overall range.
- Rise time  $t_1$  and decay time  $t_3$  are adjustable from 0 seconds to 60 minutes.
- Dwell time  $t_2$  at the upper and lower range limits is adjustable from 0 seconds to 60 minutes
- There are 2 ramp sequences:
  - One-time only (*ONCE*):  $t_1, t_2, t_3$
  - Repetition (*REPEAT*):  $t_1, t_2, t_3, t_2, t_1, t_2, t_3, \dots$

## Examples of Ramp Sequences



## Setting Ramp Parameters

ZERO/SEL / ESC    *SELECT rANCE*    300 mV ... 15 V ▾ ▷ *rANP*    MEAS/CAL / SETUP

Initial value: *rANP Start* 02.000 V    ◀ ▶ ▴ ▾    OUT / ENTER

Final value: *rANP End* 10.000 V    ◀ ▶ ▴ ▾    OUT / ENTER

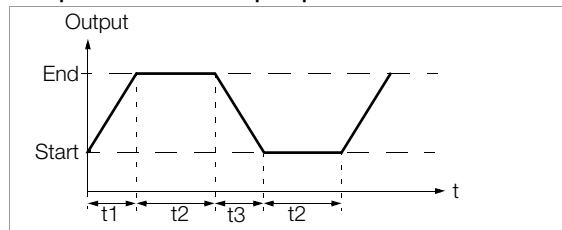
Rise time: *rANP t1* 00.05 min.s    ◀ ▶ ▴ ▾    OUT / ENTER

Dwell time: *rANP t2* 00.08 min.s    ◀ ▶ ▴ ▾    OUT / ENTER

Decay time: *rANP t3* 00.05 min.s    ◀ ▶ ▴ ▾    OUT / ENTER

Repetition: *rANP Mode* *rEPEAT*    ▾ *or* *CE*    OUT / ENTER  
 (rEPEAT = endless loop, onCE = one-time only)

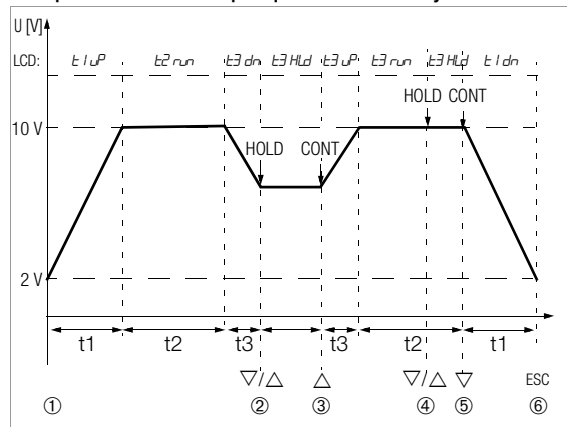
## Example of a Periodic Ramp Sequence



## Manually Controlled Ramp Sequence

After entering all parameters, start by pressing OUT / ENTER. Rising or decaying ramps can be triggered with the  $\Delta$  or  $\nabla$  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 of 0 ... 15 V), *Start* = 2 V, *End* = 10 V, *t1* = 5 s, *t2* = 8 s, *t3* = 5 s, *rEPEAT* for periodic ramps

## Key

- When *rANP rREADY* is displayed: Start the sequence by pressing OUT / ENTER.
- Stop the decaying ramp within decay time *t3* with the  $\Delta$  or  $\nabla$  key.
- Start a rising ramp within remaining decay time *t3* with the  $\Delta$  key.
- Stop the ramp sequence by pressing the  $\Delta$  or  $\nabla$  key.
- Start a decaying ramp with the  $\nabla$  key, remaining dwell time *t2* is cleared.
- Stop the ramp sequence by pressing ZERO/SEL / ESC.

## 9 Device and Calibration Parameters

The instrument's "**SEL**" 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 "Measure" (measuring mode operation). "**rfo**" appears at the display.
- The main "**SEL**" menu can be accessed, after which the display can be returned to the "**rfo**" menu, by repeatedly pressing the  $\triangleleft \triangleright \triangle \nabla$  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  $\triangle \nabla$  key.
- In order to check or change a parameter, acknowledge it with the **OUT | ENTER** key.
- The  $\triangleleft \triangleright$  keys can be used to position the cursor at the entry position. The desired value is selected with the help of the  $\triangle \nabla$  keys.
- Changes can only be accepted 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.

### Example: Setting Time

**MEAS/CAL | SETUP** **rfo** **SET** **OUT | ENTER** **t, nE**

**OUT | ENTER** **t, nE SET 14:11:11** (hh:mm:ss)  $\triangleleft \triangleright \triangle \nabla$  **OUT | ENTER**

#### Setting hours and minutes:

- $\triangleleft \triangleright$  Advance to desired entry position.
  - $\triangle \nabla$  Change the setting, the entry position blinks.  
Press and hold the key to change the setting rapidly.
- OUT | ENTER** The new time setting is activated after acknowledgement.

### Querying Operating Parameters – SETUP Menu > Info

**MEAS/CAL | SETUP** **rfo** **OUT | ENTER** **bAtt**  $\nabla$  ...  $\nabla$  **tENP, nErnAL** **24.2** °C

Parameters: see section 9.1.

### Setting Operating Parameters – SETUP Menu > Set

**MEAS/CAL | SETUP** **rfo**  $\nabla$  **SET** **OUT | ENTER** **t, nE**  $\nabla$  **dAtE**  $\nabla$  **Addr**  $\nabla$  **rStb**  $\nabla$

**RPoFF**  $\nabla$  **un t SET** °F  $\nabla$  °C **OUT | ENTER** **tENP, nErnAL / EStErnAL**

**OUT | ENTER**

**tENP SET, nErn**  $\nabla$  **EStErnAL** **MEAS/CAL | SETUP** **EStErnAL SET** **24.2** °C  $\triangleleft \triangleright \triangle \nabla$

Parameters: see section 9.2.

## 9.1 Querying Parameters – InFo Menu

### bAtt – query battery voltage

 , rfo  bAtt 3.1V.

### tiME / dAtE – query date and time

 , rfo  bAtt ▾ ... ▾ 02.01.2008 13:46:56

DD.MM.YYYY hh:mm:ss

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

Date and time must be reentered after replacing the batteries.

### cALdAt – query calibration date

 , rfo  bAtt ▾ ... ▾ cALdAt 02.01.08 16:00

### 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.



 , rfo  bAtt ▾ ... ▾ itEMP, intErNAL 24.2° C

## 9.2 Entering Parameters – SETUP Menu

### tiME – set time

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



 , rfo ▷ SET  b NE

 b NE SET 10:24:24 (hh:mm:ss) ◀ ▷ Δ ▽ 


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.

 , rfo ▷ SET  b NE ▾ dAtE

 dAtE SET 02.01 (DD: day . MM: month) ◀ rws 

YEAR SET 2008 (YYYY: year) ◀ ▷ Δ ▽ 

Date and time must be reentered after replacing the batteries.

---

## Addr – set device address

See section 10.2 regarding settings.

---

## irStb – status of the infrared receiver in the stand-by mode

See section 10.2 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 59 minutes is set, this value is retained even after switching the instrument off.



### Operating mode "Continuously ON"

If you select setting **on**, the calibrator is set to continuous operation.  is shown on the bottom left of the display. Alternatively, you can set operating mode "Continuously ON" with the instrument keys (prerequisite: switch position other than OFF and instrument OFF):

Press and hold the two keys **OUT | ENTER** and **ON / OFF | LIGHT** until the display test is activated.

The calibrator can now be switched off manually only. After switching it on again, a default value of 10 minutes is preset.

 **Info** ▷ ... ▷ **SET**  **b. PE** ▽ ... ▽ **APoFF**

**APoFF SET 10 ... 59 min on**  

(10 minutes = default setting)

---

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

See section 6 regarding selection.



### 9.3 Default Settings

Previously entered changes can be undone, and the default settings can be reactivated. 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

⇒ **Disconnect the device from the circuit.**

⇒ Remove the batteries temporarily (see also section 12.2).

⇒ Simultaneously press and hold the  and 

keys, and connect the batteries at the same time.

## 10 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 an interface adapter (accessory) 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)

### 10.1 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 “*r5tb*” parameter has been set to “**on**” (see section 10.2), 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 power pack for lengthy on-times for this reason. This prevents automatic shutdown due to battery voltage monitoring.

#### Operation in the REMOTE Mode

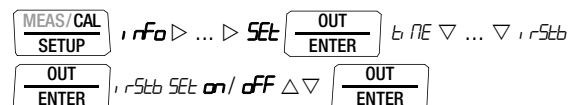
In the REMOTE mode, the device responds just like it does in the local mode. The device is reset to local mode operation after switching it off and back on again with the **ON / OFF | LIGHT** key.

## 10.2 Configuring Interface Parameters

### *r5tb* – 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:

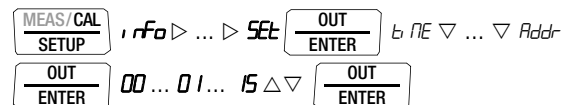
- on**: IR appears at the display and the infrared interface is active, i.e. signals such as making commands can be received, and power is consumed even though the calibrator is switched off.
- off**: IR does not appear at the display and the infrared interface is switched off; signals cannot be received.



(*r5tb* = **off** = default setting)

### *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.



(Addr = 15 = default setting)



## 11 Technical Data

Calibration Function	Simulation Range	Resolution, 30,000 Digits (4¼ places)		Intrinsic Uncertainty	Overload
<b>Direct Voltage Source</b>			Minimum Load Resistance	$\pm(\% S + \text{mV})$	$I_{\text{max}}$
<b>V</b>	0 ... ±300 mV	0.01 mV	1 kΩ	0.05 + 0.02	18 mA
	0 ... 3 V	0.1 mV		0.05 + 0.2	
	0 ... 10 V	1 mV		0.05 + 2	
	0 ... 15 V	1 mV		0.05 + 2	
<b>Frequency Generator</b> Duty cycle (pulse-no-pulse ratio): 50%, amplitude: 10 mV ... 15 V			Minimum Load Resistance	$\pm(\% S + \text{Hz})$	$I_{\text{max}}$
<b>Hz</b>	1 Hz ... 1 kHz	0.1 ... 1 Hz	1 kΩ	0.05 + 0.2	18 mA
<b>Current Source</b>			Max. load	$\pm(\% S + \mu\text{A})$	
<b>mA</b>	4 ... 20 mA	1 μA	16 V	0.05 + 2	
	0 ... 20 mA				
	0 ... 24 mA				
<b>Current Sink</b>				$\pm(\% S + \mu\text{A})$	$U_{\text{max}}$
<b>mA</b>	4 ... 20 mA	1 μA	$V_{\text{in}} = 4 \dots 27 \text{ V}$	0.05 + 2	27 V
	0 ... 20 mA				
	0 ... 24 mA				
<b>Resistance Simulation</b>			Sensor current [mA]	$\pm(\% S + \Omega)$	$I_{\text{max}}$
<b>Ω</b>	5 ... 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:  $U_{\text{ext}}$  0 to 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 case of overloading ( $> I_{\text{max}}/U_{\text{max}}$ ) 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	<b>Resistance Thermometer per IEC 751</b>			$\pm(\% S + K)$	$I_{\text{max}}$	
	Pt100	-200 ... +850	-328...+1562	0.1 + 0.5	5 mA	
	Pt1000	-200 ... +300	-328...+572	0.1 + 0.2		
	<b>Resistance Thermometer per DIN 43760</b>			$\pm(\% S + K)$	$I_{\text{max}}$	
	Ni100	-60 ... +180	-76 ...+356	0.1 + 0.5	5 mA	
	Ni1000	-60 ... +180	-76 ...+356	0.1 + 0.2		
	RTD sensor current: 0.05 ... 0.1 ... 4 ... 5 mA				*	
	<b>Thermocouples per DIN and IEC 584-1</b>				$\Delta U$ in mV *	$I_{\text{max}}$
	K (NiCr/Ni)	-250...+1372	-418...+2501	$\pm(0.05\% \text{ of }  S_{\text{Setting}}  + 0.02 \text{ mV})$	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				
L (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,  
Regarding additional error see also the table on page 26.  
Internal reference junction: 2 K intrinsic error  
External reference junction: entry of -30 to 60 °C

### Key

S = setting value

## Internal clock

Time format	DD.MM.YYYY hh:mm:ss
Resolution	0.1 s
Accuracy	±1 minute per 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 [°C]

Thermocouple error is specified in the technical data as thermovoltage error:  $\Delta U$ .  $\Delta T$  error is dependent upon characteristic thermocouple slope.

In consideration of characteristic thermocouple non-linearity, which also applies to slope (1<sup>st</sup> dT/dU derivation) mathematically calculated  $\Delta T$  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.

If an **internal** reference temperature is used, the intrinsic error of the reference junction must be taken into account .

If an **external** reference temperature of other than 0 °C is used, the sub-ranges of the table on the right apply, adjusted by the amount of the relevant reference temperature.

## Example

External reference temperature = 50 °C: the errors of the sub-range 100 ... 200 °C apply for setting values from 50 ... 150 °C.

Temperature conversion from centigrades to Fahrenheit:  
 $T [^{\circ}\text{F}] = 32 + T [^{\circ}\text{C}] \times 1.8.$

## Additional 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	*)	*)		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 mm x 36 mm) with digital display including simulation unit of measure 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 x 6 digits, 12 mm Auxiliary displays: 2 x 6 digits, 7 mm
Max. Resolution	30000
Polarity Display	“-” (minus sign) is displayed
Refresh Rate	2 times per second, every 500 ms

## Power Supply

Battery	2 AA size batteries Alkaline manganese per IEC LR6 (2 ea. 1.2 V NiMH rechargeable battery also possible)
Service life	With alkaline manganese (2600 mAh)

Calibration Function	power consumption	Service life
mV, thermocouple	55 mA	45 h
15 V	240 mA	10 h
$\Omega$ , 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 with battery symbol in 4 segments: “  ” Querying of momentary battery voltage via menu function.
-------------------	---

## Power Saving Circuit

The device is shut down automatically if none of its controls are activated during the specified “AP OFF” time. 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 is plugged in, the installed batteries are disconnected automatically. Rechargeable batteries can only be recharged externally.
-------------------	---

## Fuses

Refer to section 12.3 regarding location of the fuse link.  
FF160mA/400V, 5 mm x 20 mm  
min. 10 kA breaking capacity  
(Article number: Z109N)

## Electrical Safety

Protection class	II per EN 61010-1:2010/VDE 0411-1:2011
Operating voltage	Max. 50 V
Measuring category	I (250 V)
Pollution degree	2
Test voltage	500 V~ per EN 61010-1:2010/VDE 0411-1:2011

## Electromagnetic Compatibility (EMC)

Interference emission	EN 61326-1:2006, class B
Interference immunity	EN 61326-1:2006 EN 61326-2-1:2006

## 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 temp. range	-10 °C ... +50 °C
Storage temp. range	-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 x 87 x 45 mm (without protective rubber cover)
Weight	Approx. 0.35 kg with batteries
Protection	IP 54 (pressure equalization via the housing)

Table Excerpt Regarding Significance of IP Codes

IP XY (1 <sup>st</sup> char. X)	Protection against penetration by solid particles	IP XY (2 <sup>nd</sup> char. Y)	Protection against penetration by water
5	Dust protected	4	Splashing water

## 12 Maintenance



### Attention!

Disconnect the instrument from the device to be calibrated before opening to replace batteries or fuses!

### 12.1 Displays – Error Messages

Message	Meaning
<i>FUSE</i>	Blown fuse
	Battery voltage has fallen below 1.8 V

### 12.2 Batteries



#### Note!

#### Removing the Batteries 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 battery, which may result in damage under unfavorable conditions.



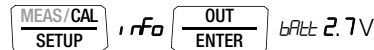
#### Note!

#### Battery Replacement

The selected operating parameters remain in memory, although date and time must be reentered.

### Charge Level

The current battery charge level can be queried in the “*Info*” menu:



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.

If battery leakage has occurred, carefully and completely clean the electrolyte from the instrument with a damp cloth, and replace the battery before using the instrument.

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.

The instrument requires two 1.5 V batteries in accordance with IEC R 6 or IEC LR 6, or two equivalent rechargeable NiCd batteries.

## Replacing the Batteries



### Attention!

Disconnect the instrument from the device to be calibrated before opening the battery compartment lid when replacing the batteries.

- ⇨ 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 1.5 V mignon 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.
- ⇨ Please dispose of depleted batteries in accordance with environmental protection regulations!

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



## Replacing the Fuse

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



### Attention!

Disconnect the instrument from the device to be calibrated before opening the fuse cover in order to replace the fuse!

- ⇨ 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. located 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 with the trash.



### Attention!

Use specified fuses only!  
If fuses with other blowing characteristics, other current ratings or other breaking capacities are used, the operator is placed in danger, and protective diodes, resistors and other components may be damaged.  
The use of repaired fuses or short-circuiting the fuse holder is prohibited.



### Note!

#### Testing the Fuse with the Instrument Switched On

After inserting the fuse with the instrument switched on, it must be switched off briefly and then switched back on again. If contact is poor or the fuse is blown, FUSE blinks at the display.

### 12.4 Housing Maintenance

No special maintenance is required for the housing. Keep outside surfaces clean. Use a slightly dampened cloth for cleaning. Avoid the use of cleansers, abrasives or solvents.

### 12.5 Return and Environmentally Sound Disposal

This calibrator is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German electrical and electronic device law). This device is subject to the RoHS directive. Further-more, we make reference to the fact that the current status in this regard can be accessed on the Internet at [www.gossenmetrawatt.com](http://www.gossenmetrawatt.com) by entering the search term WEEE.

We identify our electrical and electronic devices in accordance with WEEE 2012/19/EU and ElektroG using the symbol shown at the right per DIN EN 50419.



These devices may not be disposed of with the trash. Please contact our service department regarding the return of old devices (see section 15).

If you use **batteries** or **rechargeable batteries** in your instrument or accessories which no longer function properly, they must be duly disposed of in compliance with the applicable national regulations. Batteries or rechargeable batteries may contain harmful substances or heavy metal such as lead (Pb), cadmium (Cd) or mercury (Hg).

They symbol shown to the right indicates that batteries or rechargeable batteries may not be disposed of with the trash, but must be delivered to collection points specially provided for this purpose.



Pb Cd Hg

## 13 Calibrator Messages

The following messages appear at the main or the auxiliary displays as required. See page 3 for messages displayed at visible segments.


Message	Function	Meaning
<i>Hi Curr</i>	Simulation of voltage/pulse	High current = current too high ( $I > 18 \text{ mA}$ )
	Simulation of resistance/RTD	High current = current too high ( $I > 4.5 \text{ mA}$ )
<i>LoCurr</i>	Resistance simulator	Low current = current too low ( $I < 40 \mu\text{A}$ ) (indicates that connector jacks are open) or reversed polarity, e.g. with Pt and Ni sensors
<i>OutOL</i>	Voltage simulator, frequency generator	Output overload = limit value violated ( $I > 30 \text{ mA}$ ), 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   LIGHT key.
<i>LoVdL</i>	Current sink	$U < 3 \text{ V}$ (to little loop voltage)
<i>Hi burd</i>	Current source	High burden: Resistance applied by means of the connected circuit is too high. Voltage built up at the calibrator is equal to or greater than 16 V.

### Blinking Calibration Unit of Measure

All calibration functions are balanced/adjusted in accordance with the respective technical specifications at the factory. 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 Repair and Replacement Parts department for rebalancing (see section 15).

## 14 Accessories

### 14.1 General

The extensive accessories available for our measuring instruments and calibrators are checked for compliance with currently valid safety regulations at regular intervals, and are expanded as required for new applications. Currently up-to-date accessories which are suitable for your measuring instrument are listed at the following web address along with photo, order number, description and, depending upon the scope of the respective accessory, data sheet and operating instructions: [www.gossenmetrawatt.de](http://www.gossenmetrawatt.de) (→ [Products](#) → Measuring Technology – Portable → Calibrators → METRAHIT CAL →  Accessories).

### 14.2 Power Pack NA X-TRA (not included)

Use only power packs from GMC-I Messtechnik 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.

### 14.3 Technical Data for Measurement Cables (scope of delivery: KS17 safety cable set)

#### 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 applied	•	•	—
without safety cap applied	—	—	•

#### Ambient Conditions (EN 61010-031)

Temperature	–20 °C ... + 50 °C
Relative humidity	50 to 80%
Contamination level	2

#### Application KS17



**Attention!**  
Please observe the maximum values of the electrical safety of the device.

In conformity with standard DIN EN 61010-031, measurements in an environment according to measuring category III may only be performed with the safety cap applied to the test probe of the measurement cable.

For establishing contact in 4 mm jacks you have to remove the safety cap by levering out the snap lock of the safety cap with another sharp object (e.g. the second test probe).



#### **14.4 USB X-TRA Bidirectional Interface Adapter**

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.

#### **14.5 METRAwin 90 Software**

**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.

Please refer to the METRAwin 90 installation instructions for a description of the METRAwin 90-2, METRAwin 90-F and METRAwin 90-FJ product variants and their detailed system requirements.

\* runs under an IBM compatible Windows operating system

## 15 Repair and Replacement Parts Service Calibration Center \* and Rental Instrument Service

If required please contact:

GMC-I Service GmbH  
**Service Center**  
Thomas-Mann-Str. 20  
90471 Nuremberg, Germany  
Phone: +49 911 817718-0  
Fax: +49 911 817718-253  
E-mail [service@gossenmetrawatt.com](mailto:service@gossenmetrawatt.com)  
[www.gmci-service.com](http://www.gmci-service.com)

This address is only valid in Germany.  
Please contact our representatives or subsidiaries for  
service in other countries.

### \* DAKkS Calibration Laboratory for Measured Electrical Quantities D-K-15080-01-01 accredited per DIN EN ISO/IEC 17025:2005

Accredited quantities: direct voltage, direct current value, direct current resistance, alternating voltage, alternating current value, AC active power, AC apparent power, DC power, capacitance, frequency and temperature

### Competent Partner

GMC-I Messtechnik GmbH is certified in accordance with  
DIN EN ISO 9001:2008.

Our DAKkS calibration laboratory is accredited by the Deutsche  
Akkreditierungsstelle GmbH (National accreditation body for the  
Republic of Germany) in accordance with DIN EN ISO/  
IEC 17025:2005 under registration number D-K-15080-01-01.

We offer a complete range of expertise in the field of metrology:  
from **test reports** and **factory calibration certificates**, right on up to  
**DAKkS calibration certificates**.

Our spectrum of offerings is rounded out with free **test equipment  
management**.

Our service department includes an **on-site DAKkS calibration bench**.  
If errors are discovered during calibration, our specialized person-  
nel are capable of completing repairs using original replacement  
parts.

As a full service calibration lab, we can calibrate instruments from  
other manufacturers as well.

### Services

- Pick-up and delivery
- Express service (immediate, 24 hour and weekend service)
- Initial start-up and queries
- Device and software updates to current standards
- Replacement parts and repairs
- Help desk
- DAKkS calibration lab per DIN EN ISO/IEC 17025:2005
- Service contracts and test equipment management
- Rental instrument service
- Disposal of old instruments

### DAKkS Calibration Certificate Reprints

If you order a DAKkS calibration certificate reprint for your  
instrument, please provide us with the reference numbers  
indicated in the upper and lower most fields of the calibration seal.  
We do not need the instrument's serial number.

## 16 Guarantee

All METRA HIT digital multimeters and calibration instruments are guaranteed for a period of 3 years after shipment. The manufacturer's guarantee covers materials and workmanship. Damages resulting from use for any other than the intended purpose or operating errors, as well as any and all consequential damages, are excluded.

The calibration certificate confirms that the product conformed to the specified technical data at the time of calibration. We guarantee the observance of the specified technical data within the admissible tolerance limits for a period of 12 months from delivery.

## 17 Product Support

If required please contact:

GMC-I Messtechnik GmbH

**Product Support Hotline**

Phone: +49 911 8602-0

Fax +49 911 8602-709

E-Mail: [support@gossenmetrawatt.com](mailto:support@gossenmetrawatt.com)

## 18 Recalibration

The respective measuring task and the stress to which your calibrator is subjected affect the ageing of the components and may result in deviations from the guaranteed accuracy.

If high measuring accuracy is required and the instrument is frequently used in field applications, combined with transport stress and great temperature fluctuations, we recommend a relatively short calibration interval of 1 year. If your calibrator is mainly used in the laboratory and indoors without being exposed to any major climatic or mechanical stress, a calibration interval of 2-3 years is usually sufficient.

During recalibration\* in an accredited calibration laboratory (DIN EN ISO/IEC 17025) the deviations of your instrument in relation to traceable standards are measured and documented. The deviations determined in the process are used for correction of the readings during subsequent application.

We are pleased to perform DAkkS or factory calibrations for you in our calibration laboratory. Please visit our website at [www.gossenmetrawatt.com](http://www.gossenmetrawatt.com) (→ Company → DAkkS Calibration Center or → FAQs → Calibration questions and answers).

By having your calibrator calibrated regularly, you fulfill the requirements of a quality management system per DIN EN ISO 9001.

\* Verification of specifications or adjustment services are not part of the calibration. For products from our factory, however, any necessary adjustment is frequently performed and the observance of the relevant specification is confirmed.

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Prepared in Germany • Subject to change without notice • PDF version available from the Internet



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