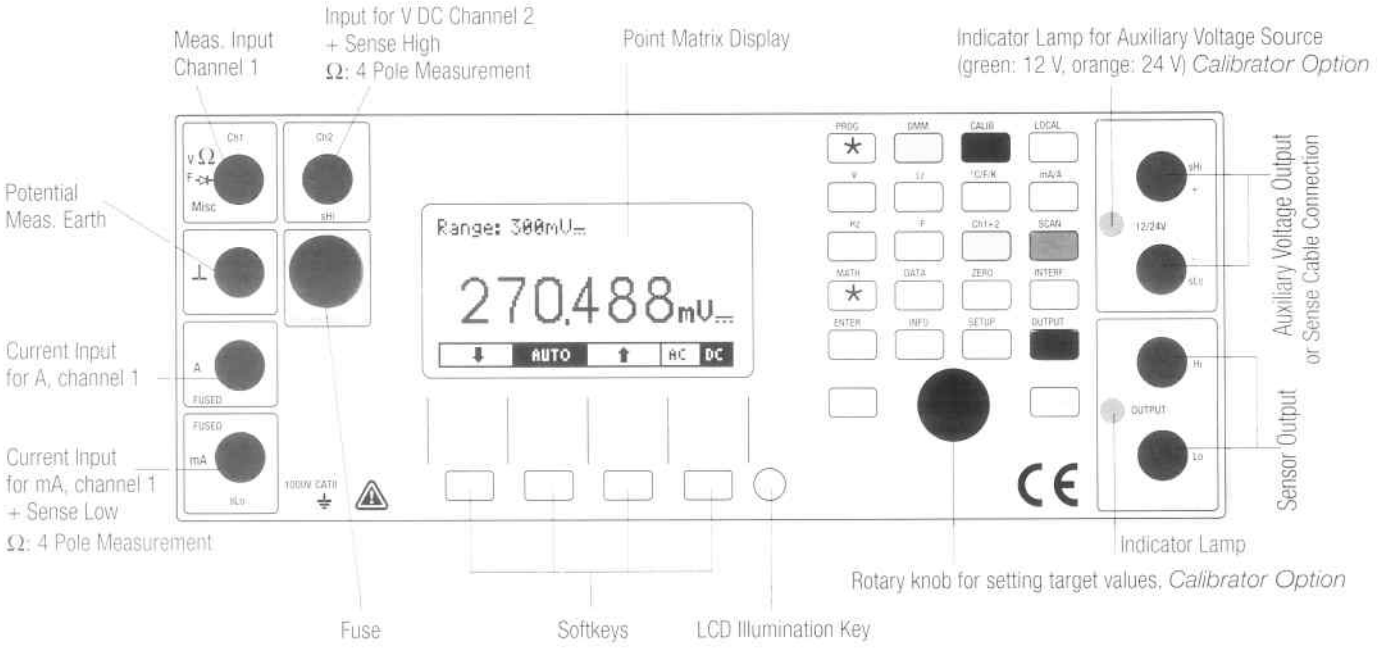
GOSSEN METRAWATT CAMILLE BAUER

METRAtop®51/52/53

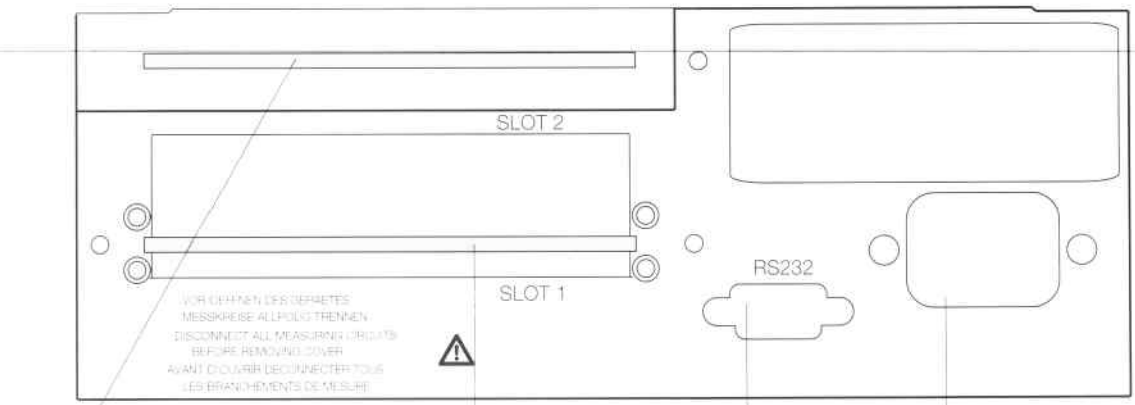
Benchtop Multimeter and Calibrator

3-348-762-15
5/2.00



Keys for METRAtop® 51 ... 53
Keys for METRAtop® 52 + 53
★ Keys without function
Keys/knob for calibrator (METRAtop® 53) *option*
Key for SCANNER (8 channel measuring point switcher), *option*

Front View



SLOT 2 for IEEE488 PC Interface Card
SLOT 1 for 8 Channel Measuring Point Switcher
Serial Interface
Mains Connection

Rear View

Contents Page

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1 Safety Features and Precautions

You have selected an instrument which provides you with a high level of safety.

The METRAtop® systems multimeter is manufactured and tested in accordance with safety regulations IEC 1010–1/DIN EN 61010–1/VDE 0411–1.
When properly used, 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 carefully and thoroughly** before placing your instrument into service, and that you follow all instructions contained therein. Make the operating instructions available to other users as well.

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 30 V or 60 V DC may occur (effective value).
- Avoid working alone when taking measurements which involve contact hazards. Be certain that a second person is present.
- *The maximum allowable voltage* between any measuring terminal and measuring earth *is 1000 V CAT II*. **Voltages of greater than 500 V may only be applied to the V jack (channel 1 in this case) in the voltage measuring ranges.**
- **No interference voltages may be applied to the auxiliary voltage or sensor outputs at the calibrator (12/24 V sHi and sLo, as well as OUTPUT Hi and Lo).**
- Be prepared for the occurrence of unexpected voltages at devices under test (e.g. defective devices). For example, capacitors can be dangerously charged.
- Make certain that the measurement cables are in flawless condition, e.g. no damage to insulation, no interruptions in cables or plugs etc.
- No measurements may be made with this instrument in electrical circuits with corona discharge (high-voltage).
- Special care is required when measurements are made in HF electrical circuits. Dangerous pulsating voltages may be present.
- Measurements under moist ambient conditions are not allowable.
- Be absolutely certain that the *measuring ranges are not overloaded beyond their allowable capacities*. Limit values can be found in chapter 17, *METRAtop 51 ... 53 Characteristic Values – Measuring Functions* , on page 35.
- All current ranges are equipped with fuses. The maximum allowable voltage for the measuring current circuit (= nominal voltage of the fuse) is equal to 500 V~ in the "mA" ranges and 600 V~ in the "A" ranges.
- The instrument may only be used in *power installations* when the electrical circuit is protected with a *20 A fuse* or *circuit breaker*, and the *nominal voltage* of the installation does not exceed *500 V*.
- We recommend the *KS30 measuring adapter* for hazard-free *voltage measurements in power installations of up to 1000 V*, which is available as an accessory. The internal resistance of the KS30 limits measuring current in case of excessive voltage or operator error, and assures reliable quenching of ignited spark paths. For additional information see chapter 5.3, *Voltage Measurements in Power Installations of up to 1000 V with the KS30 Measuring Adapter* , on page 10.

Meaning of symbols on the instrument


Warning concerning a point of danger (Attention: observe documentation)


Earth

CAT II Overvoltage category II device
CAT III Overvoltage category III device


EU mark of conformity


CSA mark of approval


VDE authority mark of approval

Repair, Parts Replacement and Balancing

Voltage conducting parts may be exposed when the instrument is opened. The instrument must be disconnected from the measuring circuit before repair, replacement of parts or balancing. If repair or balancing of an open, live instrument cannot be avoided, these may only be performed by trained personnel who are familiar with the dangers involved.

Errors 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 demonstrates visible damage,
- if the instrument no longer functions.

2 Applications

METRAtop® 51 ... 53 series measuring and calibration devices are high performance, precision instruments for R&D and quality assurance labs. With a display range of 300,000 digits, as well as high accuracy and long-term stability, they meet all of the demands of calibration and research laboratories. When operated with rechargeable batteries, the instrument can be used as a mains-independent **benchtop multimeter** for mobile applications. Rechargeable battery operation is not recommended for the METRAtop® 53. It can be installed to a 19" rack as a **system multimeter** and can be PC controlled via the data interface (RS232 or optional IEEE 488).

2.1 METRAtop® 50 Series Features and Accessories

2.1.1 Basic Instruments

METRAtop® 51:	Multimeter with one measuring channel
METRAtop® 52:	Multimeter with two measuring channels; the second measuring channel is configured exclusively for direct voltages.
METRAtop® 53:	Same functions as METRAtop® 52, plus additional calibration functions

2.1.2 Options

SCANNER (Z251A):	Expands METRAtop® 51 ... 53 with 8 additional measuring channels
Calibrator (Z253A)	For subsequent integration to the METRAtop® 52(only at the factory)
IEEE 488 (Z252A)	Additional interface
Battery Module(Z250A)	For mains-independent operation, not for use with METRAtop® 53.

2.1.3 Accessories

METRAwin® 10/50 Data Acquisition and Analysis Software

If a PC is connected to the RS232 interface, convenient evaluation of measurement data is assured.
With METRAwin® 10/50, measurement data from both channels of the METRAtop® 52 can be simultaneously acquired, stored, displayed and documented, as well as from 8 additional channels with the SCANNER expansion module.
Measurement values are displayed:

- in digital and analog form similar to multimeter display (up to 4 multimeters)
- as a curve (XY and Yt), like a 4 channel recorder
- in tabular form (data logger; up to 10 channels)
- as a Yt line profile, like a 4 channel line recorder.

METRAwin® 90/50 Calibration Software

METRAwin® 90/50 calibration software is available for the METRAtop® 53, which automatically controls all calibration sequences. A graphics generator for calibration procedures, sequence control, analysis functions and a calibration certificate generator are also included. Furthermore, the software is suited for the automation of calibration sequences at test benches for hydraulic pressure and flow. Data export to MICROSOFT® EXCEL and WORD is accomplished with the clipboard function which makes specific reports, data analysis and processing easy.

19" Rack Set

19" rack set for METRAtop® 51 ... 53

2.2 Representation of Keys and Functions in this Text

DATA	Function keys and keys from the numeric keypad are represented with bold face capital letters.
AUTO	The 4 softkeys are represented with capital letters.

The positions "right", "left", "upper" and "lower" are to be understood from the viewpoint of the observer when facing the front of the instrument, unless otherwise specified.

3 Initial Start-Up

3.1 Power Supply

The multimeter can be operated either with mains power or with installed storage batteries.

3.1.1 Storage Battery Module (option)

The storage battery module consists of a pc-board to which a holder for 4 IEC R14 storage batteries and a battery charger are mounted.
The storage battery charge level is continuously monitored by the multimeter and the storage batteries are recharged as required, as long as the multimeter is connected to mains voltage.

The storage battery module can be easily retrofitted.

After installation of the storage batteries, they should be charged for at least 10 hours in mains operation before they are placed into use.

Attention!
Do not insert normal batteries into the storage battery compartment.
Because storage batteries are recharged during mains operation, danger of explosion exists if normal batteries are used.

At the end of their service life, dispose of storage batteries properly, i.e. at collection points designated for this purpose.

3.1.2 Switching the Instrument On

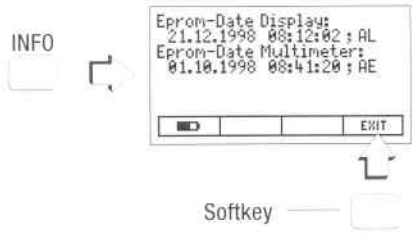
- Press the **ON/OFF** key (**LOCAL**).
  An acoustic signal acknowledges that the instrument has been switched on.
  "Wait..." is displayed briefly. The multimeter automatically switches to the voltage measurement range.

Disconnect the instrument from the measuring circuit before opening, and observe chapter 18, page 38!

3.1.3 Switching the Instrument Off

- Press and hold the **ON/OFF** key until the cursor has travelled through the uppermost display line.

3.2 Firmware Revision Level



Multimeter tasks are shared by two processors, one processor for the display functions and one for multimeter functions. Thus there are two EPROM versions, whose firmware revision levels can be displayed.

- Press the **INFO** key to display revision level.
- Exit this function with the EXIT key.

3.3 Storage Battery Charge Level (only if option is installed)

- Press the **INFO** key.
- In order to display the storage battery charge level, press the key which is assigned to the storage battery symbol.
  Zum Abrufen der aktuellen Akkuspannung bzw. des aktuellen Ladezustands müssen Sie die Taste jeweils erneut drücken.

3.3.1 Charging the storage battery in mains

Pulse charging occurs at predefined intervals in this operating mode in order to maintain a full charge.
"CHARGE ON ⎍" is displayed if rechargeable battery status is queried during charging.
Automatic charging is always enabled, as long as manual charging has not been activated.

Manual Charging (Continuous Charging)

If the batteries need to be charged on demand, for example in order to assure a full charge for a mobile service call, the "CHARGE OFF" softkey must be activated, upon which the display is changed to "CHARGE ON". The rechargeable batteries are then charged for a predefined period of time, unless the maximum charging level has been reached before this period of time has elapsed.
To stop charging press the "CHARGE ON" softkey, upon which "CHARGE OFF" appears at the display.

- Exit the storage battery charging function with the EXIT key.

3.4 Basic Settings in the SETUP Menu

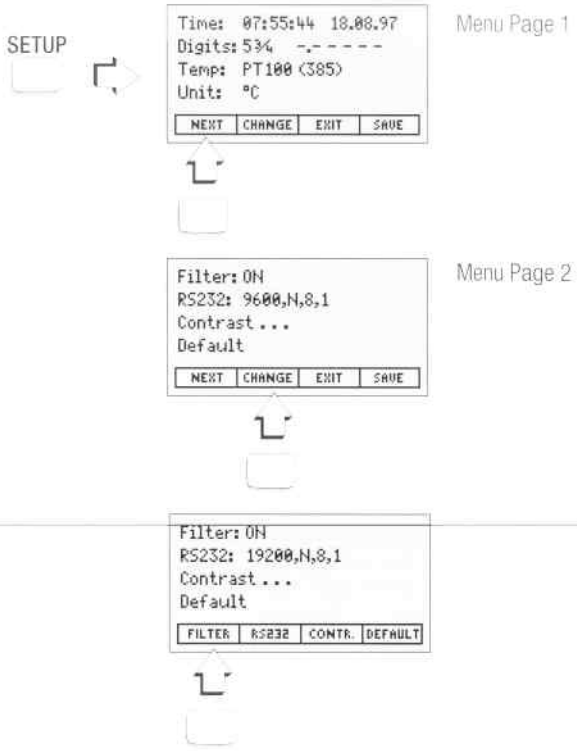
The following default settings should be checked and changed if necessary for initial start-up, or when a temperature sensor has been replaced:

Factory Default Settings

Multimeters are delivered from the factory with the following default settings:

Time:	time and date *these must be individually reset*
Digits:	5 3/4
Temp.:	PT100 (385)
Unit:	°C
Filter:	ON
RS232:	9600,N,8,1
Contrast:	intermediate value

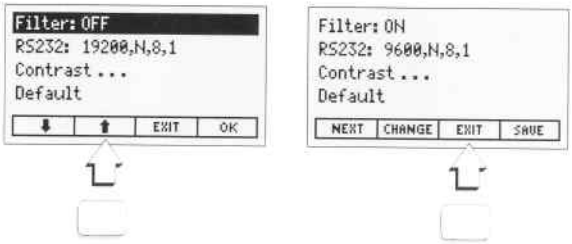
Selecting and Changing Parameters



- Press the **SETUP** function key.
- Setup parameters are included in 2 display pages.
  Turn to the page in which the parameters to be changed are located with the NEXT key.
- Then activate the CHANGE key, and a selection of parameters appears in the menu bar.
- Select the parameter to by changed by pressing the corresponding key.

The significance of, and settings for the respective parameters are described in the following pages.

Changing Parameters without Storage to Memory

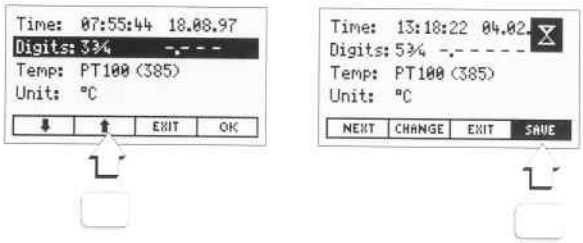


This function provides for temporary storage of a parameter, i.e. only until the multimeter is switched off.

- Confirm the current setting with the OK key. You are now returned to the main menu.
- Exit the setup menu with the EXIT key.

If the new setting is not confirmed with OK before exiting the setup menu, the selected value is not activated.

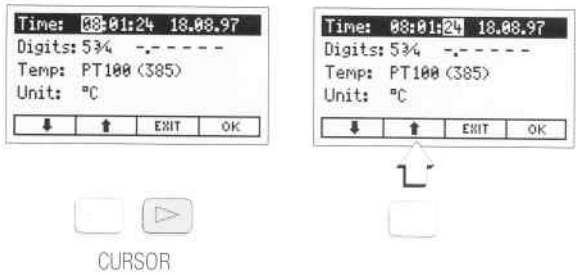
Storing Parameter Changes to Memory



- Activate the SAVE key, in order to permanently store changed values to memory.

An hour-glass appears in the header during the storage sequence. After completion of the storage sequence, the last performed measurement is displayed once again.
All settings made in the setup menu remain in storage if the **SAVE** key has been activated, even after the multimeter has been switched off or disconnected from the power supply.

3.4.1 Time and Date



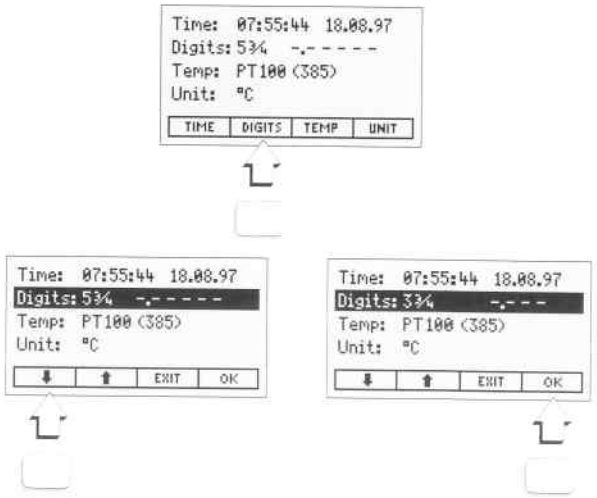
CURSOR

Time and date are used for the reporting of measurement values, if they have been processed by METRAwin® 10/50 software, and if they are read out to a printer.

- Select the TIME function.
- Select the desired setting position with the **CURSOR LEFT** and **CURSOR RIGHT** keys.
- Activate the CURSOR DOWN or CURSOR UP key to make a selection within the setting position.

The selected time is immediately stored to memory after the last entry has been made, even without the save function.

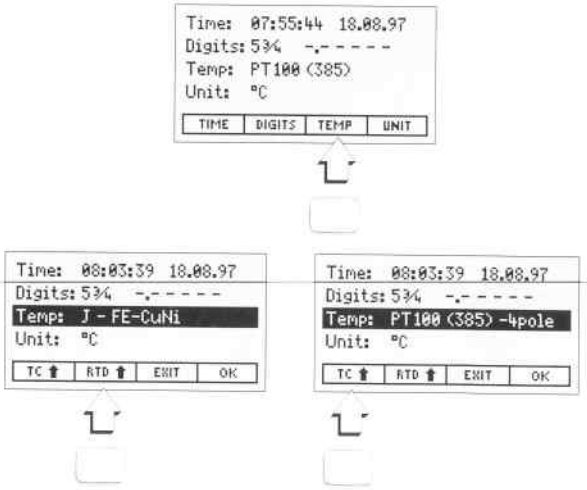
3.4.2 Resolution in Digits



Resolution within a range of 3¾ to 5¾ digits can be entered here.

- Select the DIGITS function.
- Activate the CURSOR DOWN key to select a lower resolution, or the CURSOR UP key for a higher resolution.
  Corresponding digit positions, including decimal point, are displayed to the right of the digital value.

3.4.3 Thermocouples and Temperature Sensors



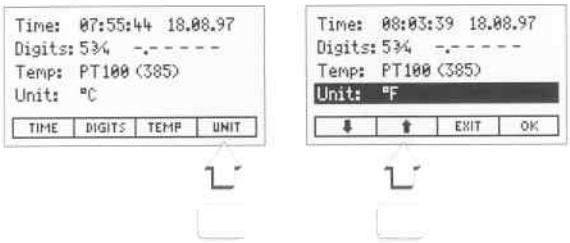
Before a temperature measurement can be made, the Pt resistance sensor or thermocouple in use must be selected. 2 or 4-wire measurement can also be selected for the Pt100.

- First select the TEMP function.
- Select the TC function for thermocouples or RTD for resistance temperature detectors. Through repeated pressing of the same function key, the various resistance detector and thermocouple types can be selected.

Function	Sensor Type	α Value	Alloy	Measuring Range
RTD	Pt100	0.00385*	—	–200 ... +850 °C
		0.00392**	—	–200 ... +850 °C
	Pt1000	0.00385	—	–200 ... +850 °C
	Ni100	—	—	–60 ... +250 °C
TC	Type K	—	NiCr-Ni	–200 ... +1350 °C
	Type J	—	Fe-CuNi	–200 ... +1200 °C

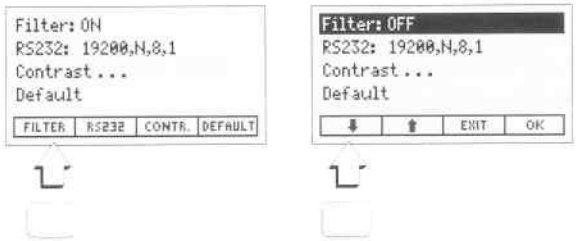
* corresponds to European PT385 curve
** corresponds to US PT392 curve

3.4.4 Temperature Scaling



- Select the UNIT function.
- Activate the CURSOR DOWN or CURSOR UP key to switch back and forth between degrees Celsius and degrees Fahrenheit.

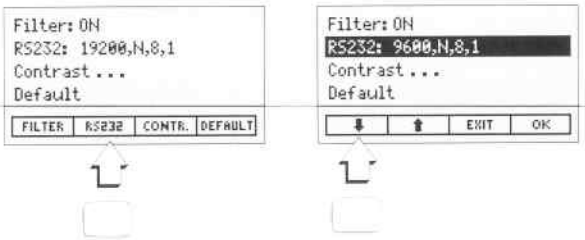
3.4.5 Filter



Interference sources are suppressed with an analog filter (low-pass) when the filter function for current and voltage is activated.

- Select the FILTER function.
- Switch the function on or off with the CURSOR UP key.

3.4.6 Baud Rate for RS232 or Address for IEEE (optional)

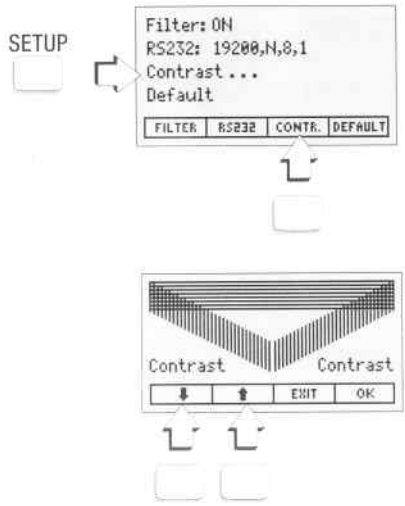


- Select either the RS232 of the IEEE function.
  The interface type, which has been previously selected with the **INTERF** key, now appears at the display (see chapter 15, page 27).

RS232: Select either 9600 or 19200 baud.
IEEE: Select an address within a range of 00 to 31.

- Activate the SCROLL DOWN key to reduce the value or SCROLL UP to increase the value.

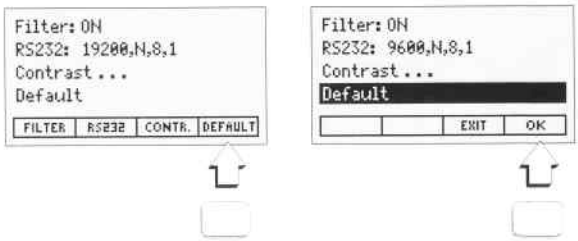
3.4.7 Contrast



Contrast can be set here to a value which is comfortable for your eyes.

- Select the CONTR. function.
- Increase or reduce contrast by pressing the CURSOR UP or CURSOR DOWN key. *Pressing and holding the key results in an uninterrupted increase or decrease in contrast.*

3.4.8 Default Settings



Previously made changes can be reversed here through reactivation of the default settings.

- Select the DEFAULT function.
- After confirmation with OK, the default settings are re-loaded.

4 Selection of Measuring Functions and Ranges

In addition to the function keys for the selection of functions, measurement range selection is made possible with a dot matrix display in combination with software controlled keys, so-called softkeys.

4.1 Automatic/Manual Measuring Range Selection

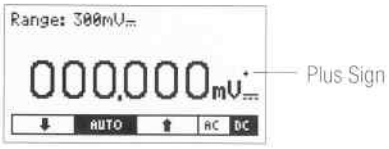
The multimeter is equipped with automatic measuring range selection for the following measurement functions:

- V AC
- V DC
- mA AC
- mA DC
- Ω
- F

Automatic selection is active as soon as the corresponding measurement has been selected. The instrument automatically selects the measuring range which allows for optimum resolution, depending upon the applied measuring quantity.
When switching from V AC to frequency measurement, the previously selected voltage range is retained.
You can deactivate automatic measuring range selection by activating the cursor up and down keys.

4.2 Zero Adjustment

Zero adjustment is possible for the measurement functions V, mA/A, Ω, °C/F/K, Hz and F. The last measurement value is used as a reference value for subsequent measurements.



- Perform the measurement.
- Activate the **ZERO** key.
  The instrument acknowledges zero adjustment with an acoustic signal, and 000.000, for example, is displayed at the LCD at maximum resolution. The value measured at the moment the key is activated serves as the reference value.
  A plus sign to the right of the magnitude identifies subsequently measured values, as values from which this reference value is to be automatically deducted.
- A return to the measurement without offset is accomplished by pressing the ZERO key a second time.
  The plus sign disappears and the current measurement value is again displayed with no reference to the offset.
  The ZERO function is also deactivated, if a different measurement function is selected.

4.3 LCD Display

The digital display shows the measurement value with decimal point and sign. The selected unit of measure and type of current are also displayed. A minus sign appears in front of the digits for the measurement of direct magnitudes, if the positive pole of the measuring quantity is applied to the "⊥" input. ">" appears to the left of the measurement value if the measuring range upper limit of 319,999 is exceeded (in the range F : 31999).

The measuring range which has been pre-selected with the softkeys is displayed at the upper left. The thermocouple type, or the reference temperature, is displayed in the footer for temperature measurements.

The sampling speed for V, A and Ω measurements depends upon the selected resolution.

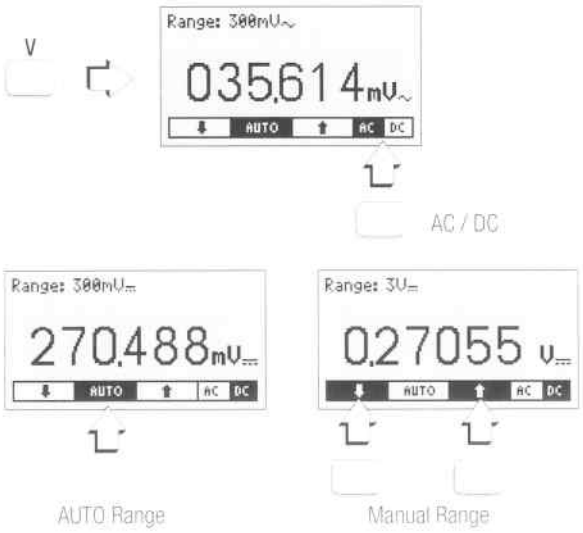
Menu Bar

Depending upon the type of measurement, various menus and functions are displayed in the footer, which can be activated with the softkeys located beneath the display segments.

Background Illumination

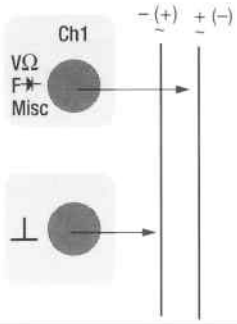
LCD illumination can be activated or deactivated with the key to the right of the softkeys.

5 Voltage Measurement



- Press function key **V**.
- Select either DC or AC with the help of the softkey.

The measuring range is selected automatically.



- Connect the measurement cables as shown.
- If necessary select another measuring range, in order to increase resolution.

Note
In the 1000 V range an intermittent acoustic warning indicates that a measurement value of 1010 V DC or 760 V AC has been exceeded.

Attention!
Make sure that the measurement cables are correctly connected for voltage measurements (not at the mA or A jacks !).
If fuse tripping limit values are exceeded due to operator error, both the device and the user are in danger!

5.1 Pulsating Voltages

Voltage measurement for alternating magnitudes is accomplished at TRMS. For the measurement of pulsating voltages $V_{\simeq}$, first determine the direct voltage component $V_{⎓}$ and the alternating voltage component $V_{\sim}$. Pulsating voltage can be calculated with these two measurement values as follows:

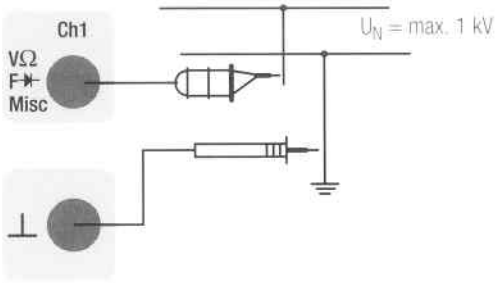
$$V_{\simeq} = \sqrt{V_{⎓}^2 + V_{\sim}^2}$$

5.2 Zero Adjustment for Voltage Measurement

An existing offset can be eliminated for voltage measurements by means of zero adjustment:

- Connect the measurement cables to the multimeter and connect the free ends to one another.
- Activate the **V** key for voltage measurements.
- Activate the **ZERO** key.
  The instrument acknowledges zero adjustment with an acoustic signal. The voltage measured at the moment the key is activated serves as a reference value.
  A plus sign to the right of and above the magnitude mV or V identifies subsequently measured values as values, from which the offset measured with the **ZERO** *key is to be automatically deducted.*
- A return to the measurement without offset is accomplished by pressing the ZERO key a second time.
  The plus sign disappears and the current measurement value is again displayed with no reference to the offset.

5.3 Voltage Measurements in Power Installations of up to 1000 V with the KS30 Measuring Adapter



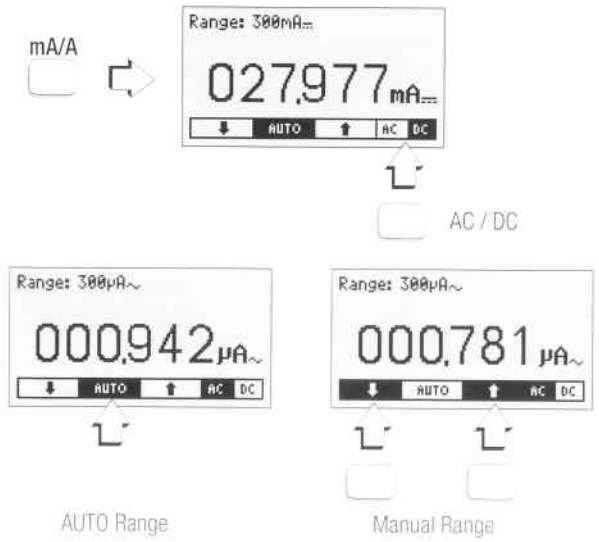
Transient overvoltages of several kilovolts or lightning discharge can occur in low voltage systems due to switching functions. Direct connection of the multimeter to a network of this type for the purpose of voltage measurement can thus be dangerous for the operator and the instrument.

Use the KS30 measuring adapter for voltage measurement in power installations with nominal voltages of up to 1000 V. The KS30 is an adapter for the multimeter, which eliminates dangers caused by overvoltages and operator errors with the following protective functions:

- Input circuit protection for multimeter voltage measuring ranges. The internal resistance of the KS30 limits current when excessive voltage occurs.
- Overload capacity: continuous 1200 V_{eff} transient (rise: 10 µs/fall: 1000 µs) max. 6 kV.
- Reliable quenching of ignited spark paths after the occurrence of excessive voltage, even if a substantial voltage source is applied.
- Current limiting for operator error (e.g. application of measuring voltage to a current input)

Additional measurement error caused by use of the KS30 measuring adapter is equal to about max. 2% depending upon input resistance at the multimeter.

Voltages of over 1000 V can be measured with a high-voltage probe. The required safety precautions must be observed!



- First disconnect supply power from the measuring circuit or the load component and discharge all capacitors if any are present.

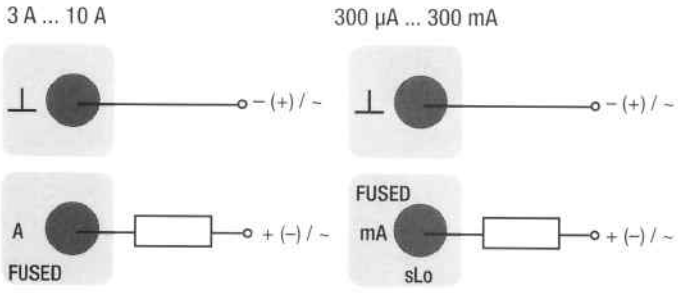
Note
When measuring currents of unknown magnitude, *use the A measuring range first* at the 10 A setting.

- Press function key **mA/A**.
  The instrument switches to the **300 µA ... 300 mA range**.
  The most favorable measuring range is automatically selected.
- Repeated activation of function key **mA/A** activates the **3 A ... 10 A measuring range.**
  Here, the measuring range must be selected manually.

Each repeated activation of function key **mA/A** switches back and forth between the mA and the A measuring ranges. After selection of the measuring function, current type DC is always active.

- Select the DC or the AC range with the help of the softkey.

AC current measurement occurs at TRMS.
Pulsating currents are calculated in the same fashion as described in chapter 5.1, page 10.



- Securely connect the instrument in series to the load component (without transition resistance), as shown. Use jack A or mA, depending upon which measuring range you have selected.

Note
Depending upon the selected measuring range, either jack A, **or** jack mA is connected to the measuring input.

Current Measuring Tips:

- The instrument may only be used in power installations when the electrical circuit is protected with a 20 A fuse or circuit breaker, and the nominal voltage of the installation does not exceed 500 V.
- The measuring circuit must be mechanically stable and protected against unintentional opening. Conductor cross sections and connection points must be substantial enough to avoid excessive overheating.

Note
In the 300 mA and 10 A measuring ranges an intermittent acoustic warning indicates that a measurement value of 310 mA or 10.1 A has been exceeded.

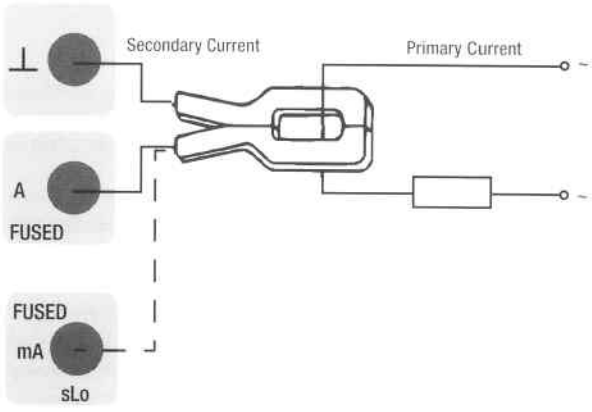
- Current ranges up to 300 mA are protected with a FF1.6 A/ 500 G fuse in combination with power diodes up to a short-circuit current of 25 A. The breaking capacity of the fuse is equal to 20 kA at a nominal voltage of 500 V ~ with resistive load.
- The 3 A and 10 A current measuring ranges are protected with a 16 A / 600 V fuse. The breaking capacity of the fuse is equal to 100 kA at a nominal voltage of 600 V~ with resistive load.
- If one of the fuses blows, this condition is indicated at the LCD as soon as a measuring quantity with a voltage of greater than 1.5 V is applied to the corresponding connector jack. "FUSE" appears in the digital display.
- If a fuse blows, eliminate the cause of the overload before placing the instrument back into operation!
- Fuse replacement is described in chapter 18.3, page 38.

6.1 AC Measurement with (Clip-On) Current Transformers

If current transformers are used at the secondary side in an open condition, e.g. due to defective or non-connected power cables, a blown device fuse or incorrect connection, dangerously high voltages can occur at the connections. For this reason, check to see if the measuring instrument's current path and the transformer's secondary winding, which is connected to the instrument, complete a closed current circuit.

The maximum allowable operating voltage is equal to the nominal voltage of the current transformer. When reading the measurement value, consider the transformation ratio of the transformer, as well as additional display error.

AC Measurement with Clip-On Current Transformer

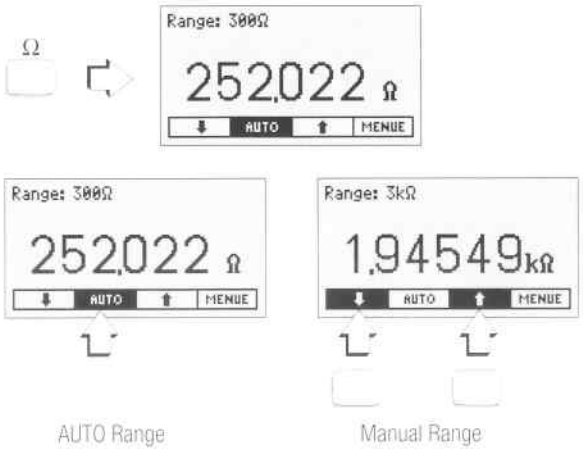


Current Transformers with Voltage Output

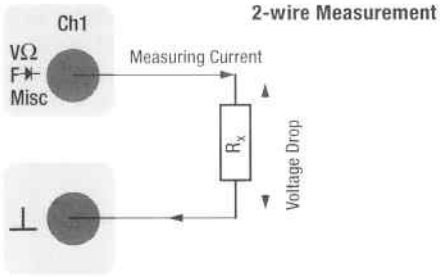
Some transformers have a voltage output (designated mV/A). Consequently, the secondary connection must be connected to ⊥ and V.

7 Resistance Measurement

7.1 2-Wire Measurement



- Press function key Ω.



- Be absolutely certain that the device under test is voltage-free. Extraneous voltages distort measurement results!
- Connect the device under test as shown.

7.2 Zero Adjustment for Resistance Measurement

Cable and transition resistance can be eliminated with zero balancing for the measurement of small resistances:

- Connect the measurement cables to the multimeter and connect the free ends to one another.
- Activate the Ω key for resistance measurement.
  The smallest resistance measuring range is automatically selected.
- Activate the **ZERO** key.
  The instrument acknowledges zero adjustment with an acoustic signal, and 000.000 Ω is displayed at the LCD at maximum resolution. The resistance measured at the moment the key is activated serves as the reference value.
  A plus sign to the right of the Ω magnitude identifies subsequently measured values as values, from which this reference value is to be automatically deducted.
- A return to the measurement without the reference value is accomplished by pressing the ZERO key a second time.
  The plus sign disappears and the current measurement value is again displayed with no reference to the reference value.

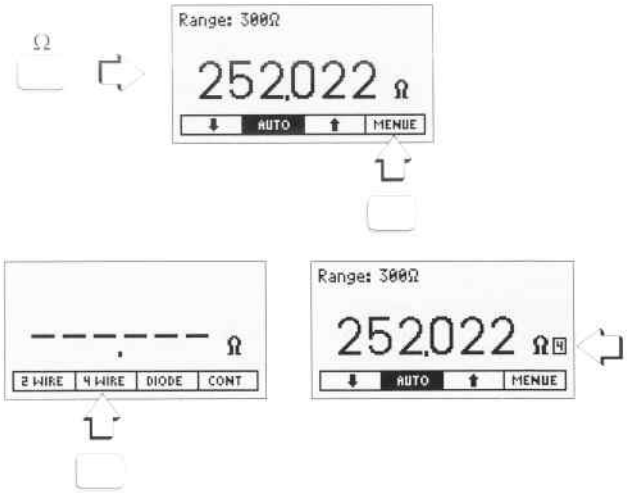
Note

Long measurement cables have an effect on measurement results in the MΩ measuring range.
Remedy: Ground measurement cables and DUT as necessary.
Avoid ambient influences such as capacitive interference caused by strong currents.

7.3 4-Wire Measurements (possible to 3 kΩ) (power cable resistance compensation)

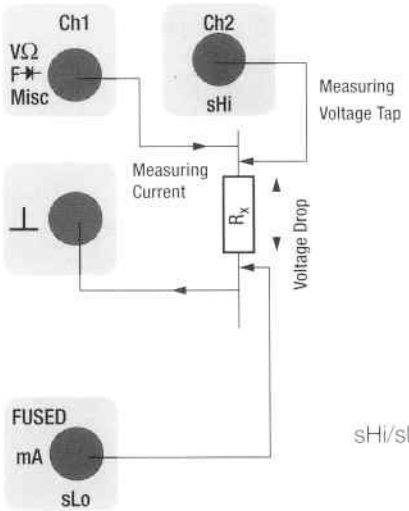
The two potential connections, between which voltage is measured, play a decisive role in the results of measurement. Every resistance encountered between these two points contributes to the overall measured resistance. These include transition resistance, as well as lead resistance. Thus if a very low resistance is to be measured, e.g. contact resistance at a contactor relay of only a few milliohms, the potential connections for voltage measurement from the measuring instrument must be made to the device under test via the shortest possible path. For this reason, the measuring instrument is equipped with separate terminals for power supply and voltage measurement. This type of 4-pole contacting is referred to as connection in accordance with Thomson/Kelvin.

KC2 and KC3 Kelvin clips, which are available as accessories, allow for easy, correct connection.



- Press function key Ω.
- Activate the menu key.
- Select the 4 WIRE function.

4-Wire Measurement

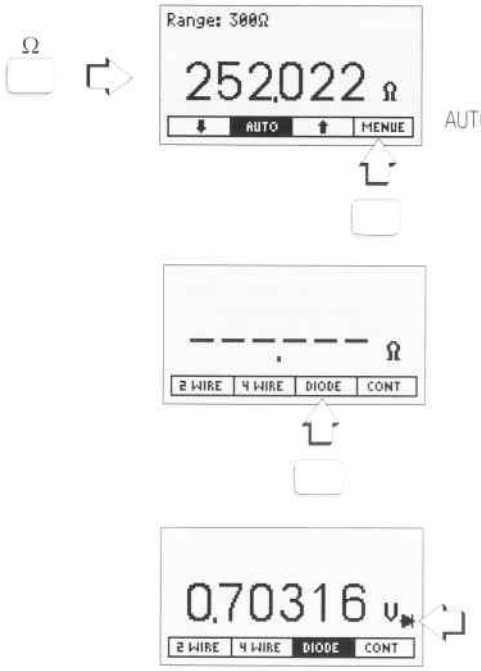


sHi/sLo = Sensor Lead Terminals

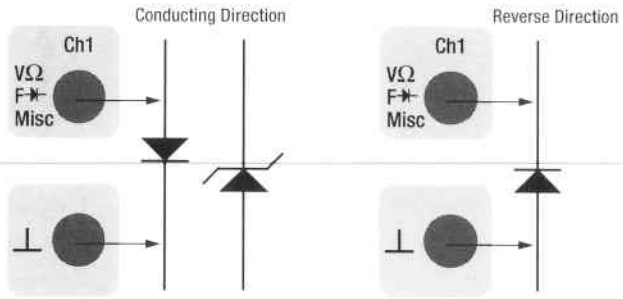
- Be absolutely certain that the device under test is voltage-free. Extraneous voltages distort measurement results!
- Connect the device under test as shown.

8 Diode and Continuity Testing

8.1 Diode Testing



- Press function key Ω.
- Activate the menu key.
- Select the DIODE function.



Note
Be absolutely certain that the device under test is voltage-free. Extraneous voltages distort measurement results!

- Connect the device under test as shown.

Conducting Direction and Short-Circuit

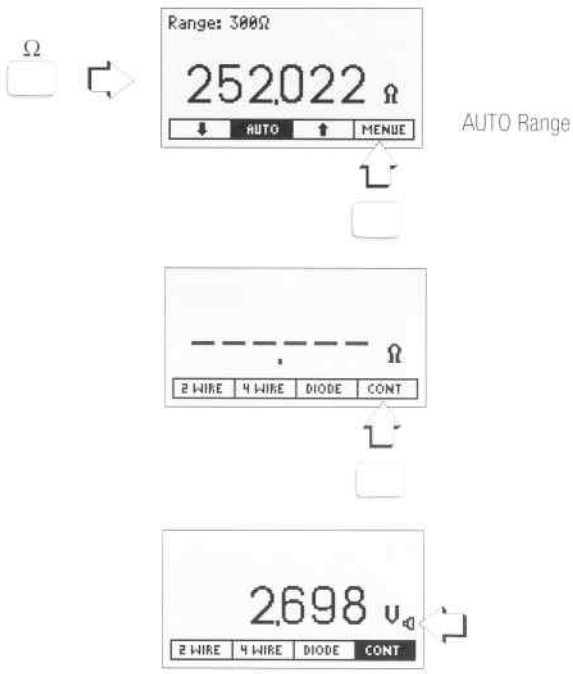
The measuring instrument displays forward voltage in volts. As long as the voltage drop does not exceed the maximum display value of 3.0000 V, you can test several elements connected in series, or reference diodes with small reference voltages.

Reverse Direction or Interruption

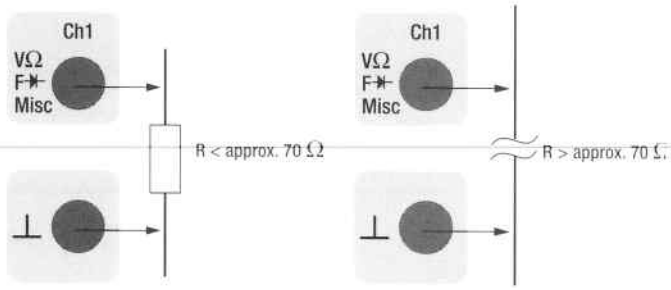
The measuring instrument displays open-circuit voltage.

Note
Resistors and semiconductor paths in parallel to the diode distort measurement results!

8.2 Continuity Testing with Acoustic Signal



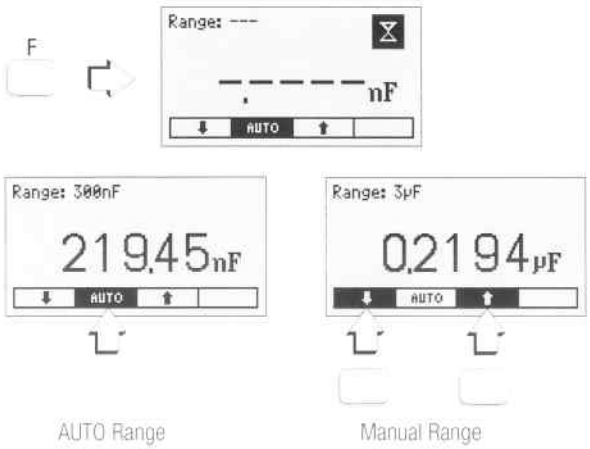
- Press function key Ω.
- Activate the menu key.
- Select the CONT function.



- Connect the device under test as shown.

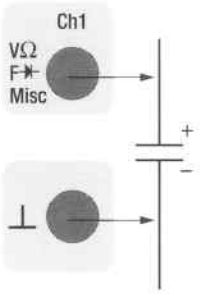
Continuity is indicated by an acoustic signal (exact value via voltage measurement with applied current: 0 ... approx. 200 mV).

9 Capacitance Measurement



AUTO Range Manual Range

- Be absolutely certain that the device under test is voltage-free. Extraneous voltages distort measurement results!
- Press function key **F**.



- Connect the (discharged!) device under test to jacks "⊥" and "F" with measurement cables.
- If required, select a different measuring range in order to increase resolution.

Note
Polarized capacitors must be connected to the "⊥" jack at the "–" pole.
Resistors and semiconductor paths in parallel to the capacitor distort measurement results!

An hour-glass is displayed, which indicates that the respective measurement sequence has not yet been completed. The sequence can require up to a maximum of 10 s depending upon capacitance.

Note
If the capacitance value is changed during the measurement sequence, the resulting measurement value may be incorrect. In such a case, wait until an additional measurement value is displayed.

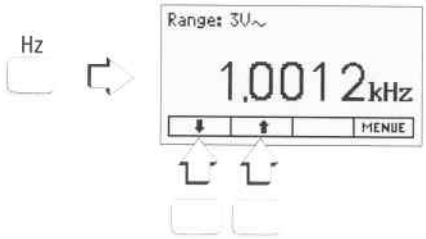
9.1 Zero Adjustment for Capacitance Measurement

For the measurement of small capacitive values, the inherent capacitance of the measuring instrument and the cables can be eliminated with zero balancing:

- Connect the measurement cables to the measuring instrument without a DUT.
- Activate the **F** key for capacitance measurement.
  The smallest capacitance range is selected automatically.
- Activate the **ZERO** key.
  The instrument acknowledges zero adjustment with an acoustic signal. The capacitance measured at the moment the key is activated serves as a reference value.
  A plus sign to the right of and above the magnitude nF identifies subsequently measured values as values, from which this reference value is to be automatically deducted.
- A return to the measurement without the reference value is accomplished by pressing the ZERO key a second time.
  The plus sign disappears and the current measurement value is again displayed with no reference to the reference value.

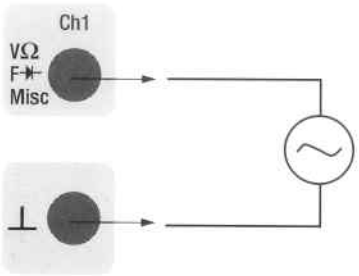
10 Frequency Measurement

10.1 Frequency



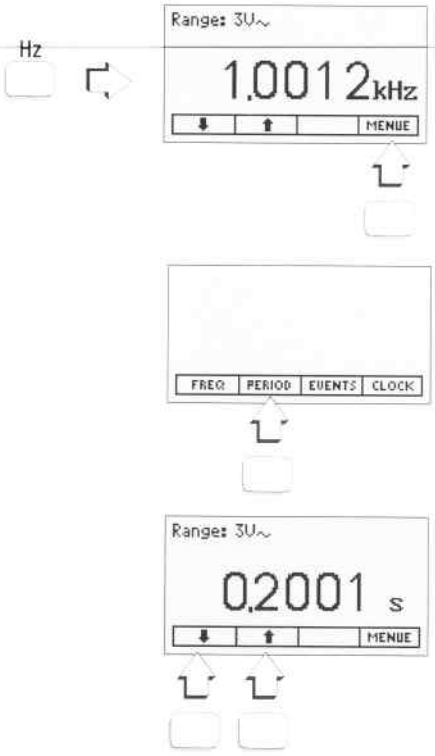
- Press function key **Hz**.
- Select a suitable measuring range for the voltage amplitude in volts.

The measuring range is retained upon switching to the frequency measurement range.



- Connect the measurement cables as shown. Connector jack "⊥" should be grounded.

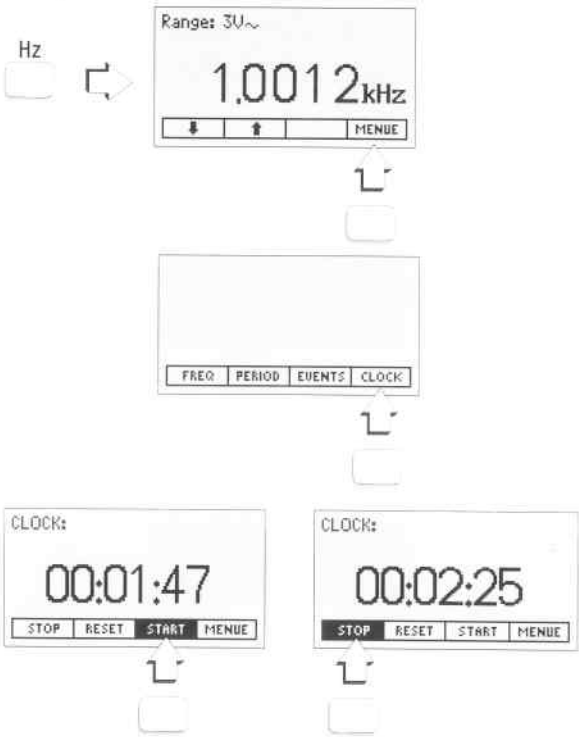
10.2 Cycle Duration



Cycle duration for the signal can be displayed here in seconds.

- Press function key **Hz**.
- Activate the MENU function.
- Select the PERIOD function.
- Select the same measuring range as described for frequency measurement.

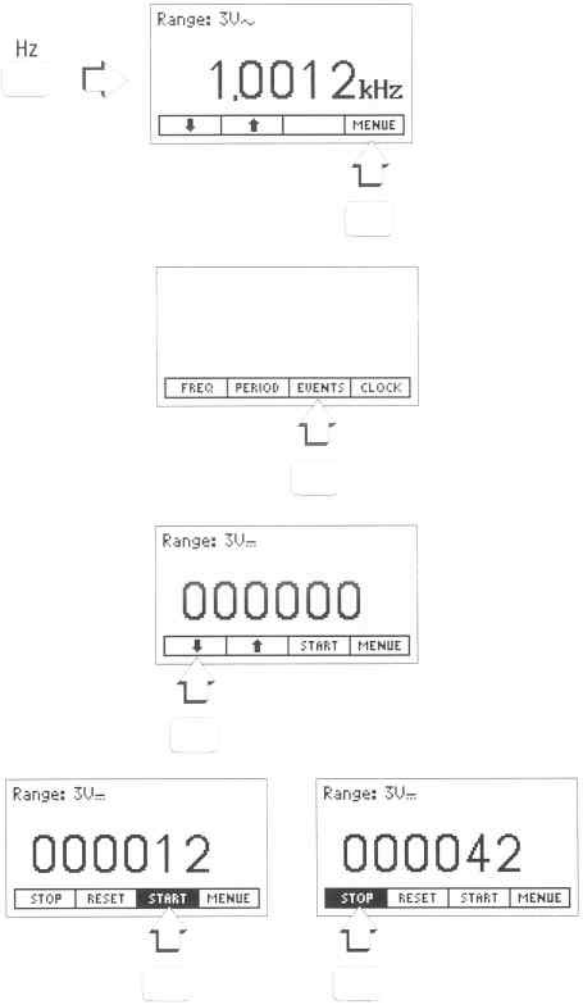
10.3 Stopwatch



Durations of up to one hour can be measured with this function.

- Press function key **Hz**.
- Activate the MENU function.
- Select the CLOCK function.
- Start the clock with the START key, stop the clock with the STOP key.
- The displayed time can be deleted with the RESET function.

10.4 Event Counting



Up to approximately 500,000 events can be counted with this function. The tripping threshold is equal to ±1/30 of the measuring range value, and the signal should be applied for at least 5 ms. Each time the value falls below this threshold, the measuring instrument is again ready for the registration of an event.

- Press function key **Hz**.
- Activate the MENU function.
- Select the EVENTS function.
- Select the desired voltage measurement range.
- Apply the signal as you would for a voltage measurement.
- Start the function with the START key, and stop the function with the STOP key.
- Displayed events can be deleted by activating the RESET function.

If more than 524,287 (corresponds to: 7FFFF *Hex*) events have been counted, overflow is indicated.

11 Temperature Measurement

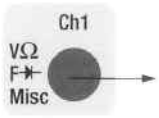
Temperature measurements can be performed with thermocouples (TC) or with resistance temperature detectors (RTD).

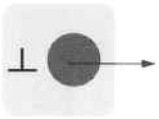
Note
The type of temperature sensor (TC or RTD), as well as the element type, must be entered in SETUP prior to measurement. The type remains in storage until a different sensor type is selected.

11.1 Temperature Measurement with Thermocouples (TC)

- Enter the type of thermocouple you have selected for measurement in SETUP, see chapter 3.4.3.

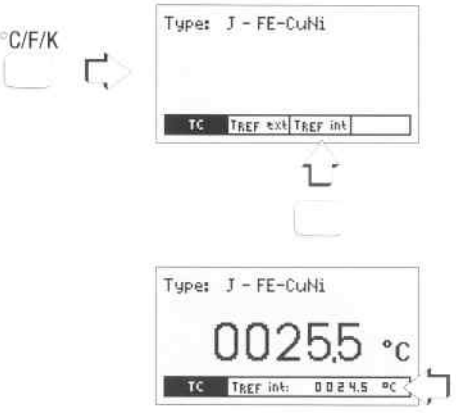
- Press function key °C/F/K.





- Connect the sensor to the two jacks.

11.1.1 Temperature Measurement with Internal Reference Junction

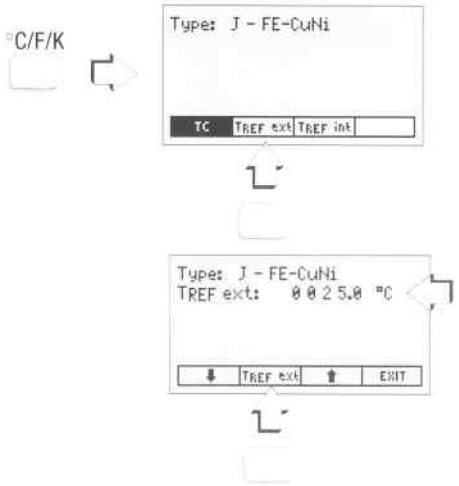


- Activate T_{REF} int.
  The internal reference temperature at the terminals in the multimeter is displayed in the footer. All subsequent measurements are made in reference to this temperature. A compensating lead must be used if sensor leads are to be lengthened!

Note
The internal reference temperature (internal reference junction temperature) is measured with a temperature sensor in proximity to the Ch1 input jack. Due to internal heating, this temperature is somewhat above room temperature. The extent of this deviation has no influence on measurement accuracy.

- Return to the menu with TC.

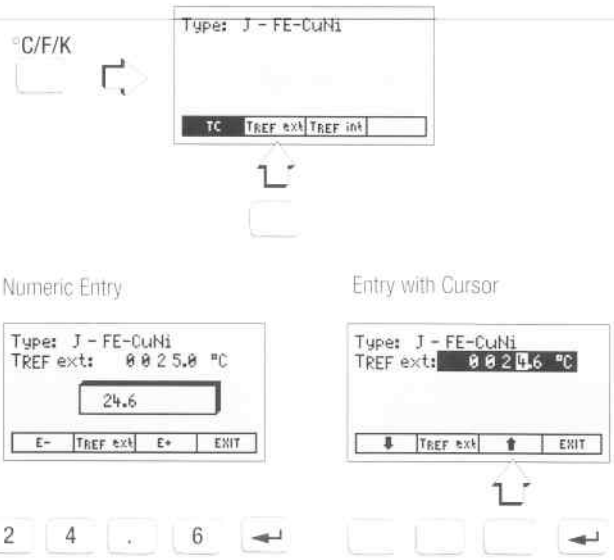
11.1.2 Temperature Measurement with External Reference Junction



Temperature measurement with external reference junction may lead to substantially more accurate results, especially if measurement is made in reference to ice water (0 °C) or a terminal block with precise temperature control (e.g. 50 °C). In such cases the compensating leads can be replaced with copper leads!

- Activate T_{REF} ext.
  The last entered external reference temperature from the thermocouple is displayed in the header. All subsequent measurements are made in reference to this temperature.
- T_{REF} ext must be activated once again in order to initiate measurement.
- Return to the menu with TC.

11.1.3 Defining the External Reference Temperature



The external reference temperature value can be can be changed numerically, or with the help of the CURSOR UP and CURSOR DOWN keys.

Input Range: –50 ... +100 °C

- Numeric Entry:
  Enter the numbers with the numeric keypad including the desired decimal point. An entry field appears automatically after the first numeric key has been activated. The sign can be entered either before or after entry of the value with the ± key. Positive or negative cardinal power is entered either with the E+ or the E- key. Confirm complete entry of the numeric value by pressing **ENTER**.

or

- Entry with Cursor:
  Go to the field with the number to be changed with the help of either the **LEFT** or **RIGHT** cursor key. Change the value of the number with the softkeys for CURSOR UP or CURSOR DOWN. Confirm the changed numeric values by pressing **ENTER**.

- Exit the entry menu by activating T_{REF} ext.
  If the EXIT key is activated, the changed value is not stored to memory.

11.2 Temperature Measurement with Resistance Temperature Detectors

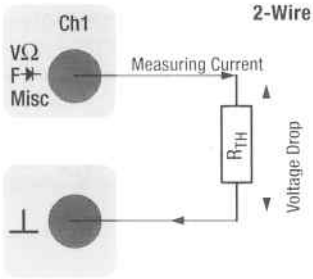
- Enter the type of resistance temperature detector in use (RTD function), the sensor type, the α value and either 2 or 4-wire in SETUP (chapter 3.4.3, page 7).

Note

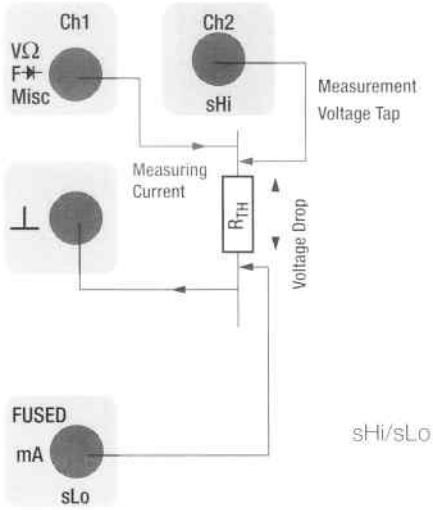
For 2-wire measurement, the factory default value for lead resistance, or a value prescribed by the user, is taken into consideration. The factory default value is equal to 0.1 Ω, which corresponds to temperature sensors which are available as accessories.

- Change lead resistance if this deviates from 0.1 Ω. Confirm with R_{LEAD}.
- See chapter 11.1.3 for numeric entry or entry with the cursor.
- Exit the entry menu by activating R_{LEAD} or EXIT.
  If EXIT is activated the changed value is not stored to memory.

2-Wire Measurement

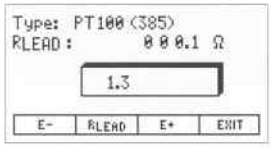


4-Wire Measurement



Entry with Cursor

Numeric Entry



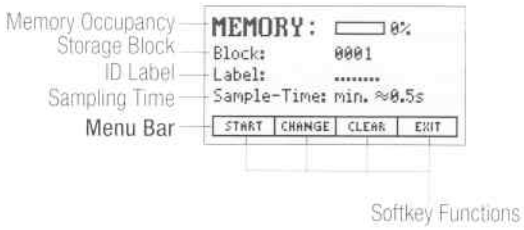
Lead resistance is compensated for with 4-wire measurement. No entry is necessary.

12 Memory Mode (available as of firmware version AL)

Measurement values can be stored in the multimeter in the memory mode. If adequately charged rechargeable batteries (optional) are available, on-site storage to memory is possible without the use of mains power.
The measurement values must be uploaded to a PC in order to allow for data analysis and processing. METRAwin 10/50 software provides for convenient analysis at the PC.

Maximum recording time is dependent upon the selected operating mode (multimeter, voltmeter, calibrator or scanner), and the selected sampling time. The fastest storage rate is attained when the IDLE function is active.

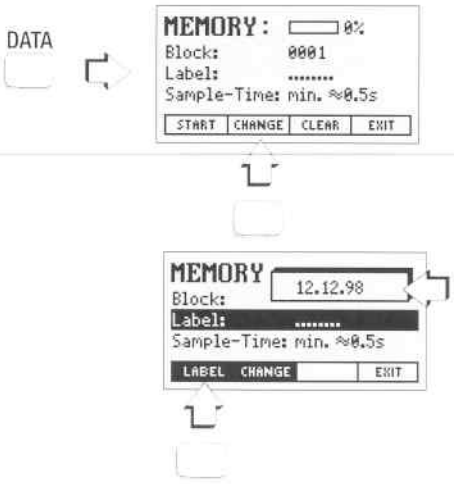
Max. number of storable measurement values: approx. 24.000



Preparation for the Storage of Measurement Values

- First, manually select the desired measuring function and the measuring range if necessary.
- Connect the device under test.
- Select one or more desired operating modes: multimeter, voltmeter, calibrator and/or scanner.

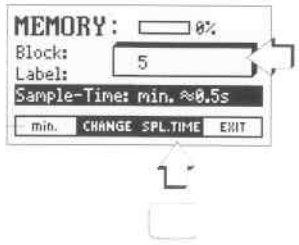
Storing Data to Memory



- Press the **DATA** function key.

The measuring parameters are displayed and the memory mode menu appears. Current memory occupancy is displayed as a percentage.
The block number is advanced automatically for each storage event starting with 00 and up to 9999. The block number for the subsequent storage event is always displayed.

- Enter a unique identification sequence for the next logical record to be stored to memory:
  First activate the CHANGE key, and then the LABEL key.
  A sequence of up to 8 characters (including full stops and hyphens) is possible. The value must be directly entered as a number.
  Spaces can be entered with the right hand scroll key. Any remaining locations to the right of the entered sequence are automatically entered as spaces.
  If the instrument is remote controlled via PC, ASCII characters can also be used for the ID label, although special characters and vowel mutations (ä, ö, ü) may not be entered.
- Acknowledge the "LABEL" entry with the **ENTER** key. If the EXIT key is activated, the selected "LABEL" entry is not activated.



Default Settings for
Minimum Sampling Time
min. = 0.5 s (with 5¾ digit resolution)
min. = 0.05 s (with 4¾ digit resolution)
min. = 0.005 s (with 3¾ digit resolution)

- If you want to change the displayed sampling time (sampling time = storage interval), first activate the CHANGE key, and the SPL.TIME key. Sampling time can be adjusted to any one of the following values: 1, 2, 3, ... 60 s or min. If you want to use the smallest possible sampling time, activate min. in the softkey array.

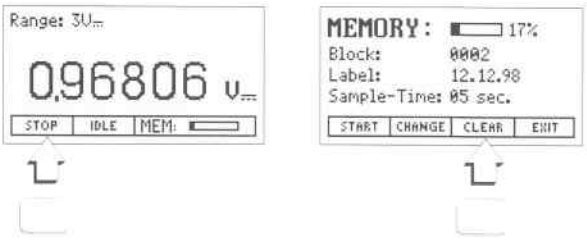
- After the START key has been activated, all subsequent measurements are stored to memory. The two points which represent the colon after MEM in the softkey array blink in time. This indicates that the memory mode is active.
- **The fastest storage rate is attained by activating the IDLE key which freezes the display.**

Exiting the Memory Mode

- Exit the memory mode by activating the STOP key or by switching the multimeter off.

Note

If the multimeter is switched off with the **LOCAL** during memory mode operation, the memory mode is first exited after which the multimeter is switched off.
If the multimeter is disconnected from mains power during memory mode operation, or if mains power fails, all previously stored measurement values, including those stored during the most recent storage sequence, remain in memory for approximately 1 hour, even if no backup power is available from rechargeable batteries.



Deleting Stored Data

The colon after MEM in the softkey array disappears as soon as no capacity for further measurement values remains in the memory. The "mem full" message is also transmitted at the same time if the instrument is being operated in the remote mode. Upload and save any data required for the future to a PC before clearing the memory.

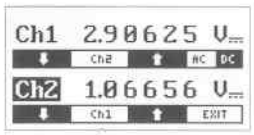
- After activating the CLEAR key, you will be asked to acknowledge. If you acknowledge with yes, all stored data are deleted from memory. The block number is reset to 0001.

13 Voltmeter in METRAtop 52 (channel 2)

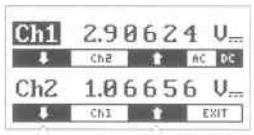
With the additional measuring channel you can perform direct voltage measurements at channel 2 (Ch2) in additional to the current or voltage measurements available at channel 1 (Ch1). "Low" potential for both channels is grounded at the common connector jack "⊥".
This makes the comparison of two direct voltages possible, e.g. for input and output signals or target and actual values.

Switch to 2 channel operation

Ch1+2



Change channels



e.g. select new range

- Connect the measurement cables for channel 2 to the Ch2 and "⊥" jacks. Connector jack "⊥" should be grounded.
- Press function key **Ch1+2**.

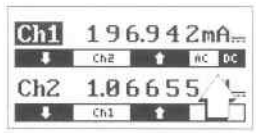
*Both measurement channels are displayed, one above the other. At first, the measuring range selection function is active for channel 2. The respectively active channel **Chx** is identified by means of inverse display.*

- If necessary, select another measuring range in order to change resolution.
- You can activate channel 1 for measuring range selection or AC-DC selection by previously selecting Ch1 in the menu bar.
- Channel 2 can be activated in turn by pressing Ch2 in the menu bar.

The instrument is returned to single channel display when the **Ch1+2** key is activated, or by pressing EXIT, but only if channel 2 has been selected.

e.g. change function in channel 1

mA/A



Change between AC and DC in Ch1

Note
The automatic range selection function is disabled during 2 channel operation, i.e. desired measuring ranges must be selected manually.

Exit 2 channel operation (assuming CH2 is active)

Ch1+2

14 METRAtop® 53 Calibrator Functions

As opposed to the METRAtop® 52, the METRAtop® 53 is expanded with an additional 12 or 24 V auxiliary voltage supply, as well as the following calibrator functions:

- Precision voltage sensor
- Precision current sensor and current sink (2-wire transmitter simulator)
- Temperature simulator
- Resistance sensor (max. 2 kΩ)

The METRAtop® 53 with voltmeter, multimeter and calibration instrument replaces three complete precision instruments with one compact device. It provides for the trouble-free, automatic calibration of measuring transducers for process engineering and physical magnitudes. Read-out of precision signals is accomplished either manually, or via PC with the control program. A rotary knob allows for continuous adjustment of target values.

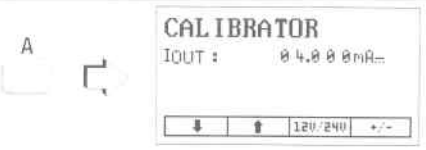
14.1 Switching the Calibrator On

As long as the multimeter is switched on, the calibrator operating mode can be entered by activating the **CALIB** key.

14.2 Calibrator Functions

- Select a calibrator function by pressing the corresponding measurement function key **V**, **A**, **Ω** or **°C**.

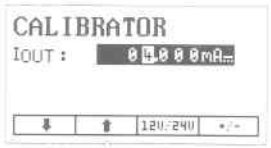
The target value can be entered or changed in three different ways:



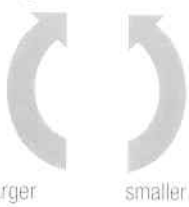
Numeric Entry of the Target Value

or

Entry of the Target Value via Softkey



or **Entry of the Target Value with the Rotary Knob**



- **Numeric Entry of the Target Value**
  Enter the numeric value with the desired decimal point directly at the numeric keypad. An entry window is opened automatically after the first numeric key has been activated. The "–" sign can be entered first, or later with the ± softkey. The ± key at the numeric keypad has no function in the "numeric entry" mode. Positive or negative powers of ten can be entered with the help of the E+ or E- keys. After the complete numeric value has been entered, acknowledge with **ENTER**. Values for the resistance sensor must be entered in Ω, not in kΩ. Entries for the current sensor may only be made in mA.

- **Entry of the Target Value via Softkey**
  Set the cursor at the number to be changed with the **LEFT** and **RIGHT** cursor keys. The entire numeric field is highlighted and the current entry position is displayed normally.
  Change the value of the selected number with the CURSOR UP or CURSOR DOWN softkey.
  The "–" sign can be entered first, or later with the ± softkey.
  The ± key at the numeric keypad switches the signal magnitude to the output jack. After the complete numeric value has been entered, acknowledge with **ENTER**.

- **Entry of the Target Value with the Rotary Knob**
  Automatic numeric changes are possible with the rotary knob between the **LEFT** and **RIGHT** cursor keys. Press the rotary knob first, so that it pops up.
  Set the cursor at the number to be changed with the **LEFT** and **RIGHT** cursor keys next to the rotary knob. The entire numeric field is highlighted and the current entry position is displayed normally.
  For *automatic* increasing or decreasing of the selected decimal place, as well as the decimal place to its left, briefly turn the knob beyond its spring return position to the left or to the right. The selected number is automatically increased or decreased in steps. If zero is passed, the next numeric character to the left is also increased or decreased. Entry with the rotary knob can be used as a step function or a ramp function for linearity testing.
  For rapid changes, the rotary knob must be turned left or right and held beyond its spring return position.
  Brief turning of the rotary knob in the opposite direction, although not to its end position, freezes the calibration value.

Note
If a value is entered which is beyond the allowable range, the maximum allowable value is automatically selected.

- Connect the OUTPUT Hi and Lo output jacks from the reference source to the measurement inputs of the device to be calibrated.

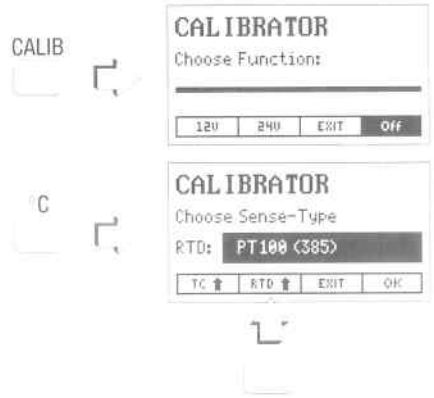
Attention!
No interference voltages may be applied to the auxiliary voltage or sensor outputs at the calibrator (12/24 V sHi and sLo, as well as OUTPUT Hi and Lo).

- See chapter 14.9 for applications examples.
- When the **OUTPUT** key is activated, the selected signal is switched to the output jack, and the LED lights up green.

Note
If a power source has been selected, although no load component has been connected, the error is recognized by the calibrator and the LED lights up red.

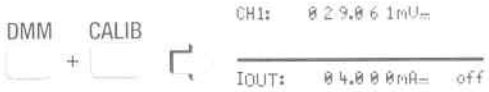
14.3 Switching Between Sensor Functions

In order to switch from one sensor function to another, the **CALIB** key must be activated. The "choose Function:" display appears and one of the functions, **V**, **A**, Ω or °**C**, must be selected.



If the temperature sensor is selected, one of the sensor types, resistance thermometer or thermocouple, must be selected before the target temperature is entered.

14.4 Monitor Function: Two-Fold Display

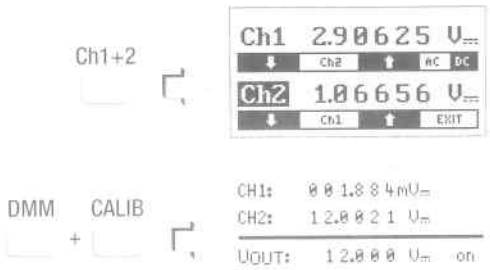


The following can be displayed simultaneously in the calibrator operating mode:

- Ch1: Measurement signal in V, Ω, F, °C or A
- X_{OUT}: Target value from calibration source

- Activate the calibrator operating mode: **CALIB** key.
- Select the calibration source: **V**, **A**, Ω or °**C** key.
- Set the source to the target value.
- Connect the OUTPUT Hi and Lo output jacks to the corresponding input jacks at the device under test.
- Connect the outputs from the device under test to the A or mA input jacks for Ch1.
- Switch the calibration source to the output jacks by activating the **OUTPUT** key.
- Switch to two-fold display:
  Activate the **DMM** and **CALIB** keys simultaneously.

14.5 Monitor Function: Three-Fold Display



The following can be displayed simultaneously by switching to the voltmeter operating mode:

- Ch1: Measurement signal in V or A
  or sensor signal for V (thermocouple) or A
- Ch2: Measurement signal in V
  or sensor signal for V or thermocouple
- X_{OUT}: Calibration source target value

- Switch to the multimeter operating mode: **DMM** key.
- Depending upon input signal select one of the following for channel 1: **V** or **A** key.
- Switch to voltmeter operating mode: **Ch1+2** key.
- Select suitable measuring ranges for both channels.
- Activate the calibrator operating mode: **CALIB** key.
- Select the calibration source: **V**, **A** or °**C** key (thermocouple).
- Set the source to the target value.
- Connect the OUTPUT Hi and Lo output jacks to the corresponding input jacks at the device under test and, if required, to the inputs for Ch1 or Ch2.
- Connect the outputs from the device under test to the input jacks for Ch1 or Ch2.
- Switch the source to the output jacks by activating the **OUTPUT** key.
- Switch to three-fold display:
  Activate the **DMM** and **CALIB** keys simultaneously.

Note

Please note that inherent deviation for channel 2 is twice that of channel 1, and that only direct voltage measurements of up to 300 V are possible.

14.6 Temperature Sensor

The temperature sensor can simulate thermocouples (TC) or resistance temperature detectors (RTD).

- Activate the calibration operating mode: **CALIB** key.
- Select the temperature sensor function: **°C** key.

Note

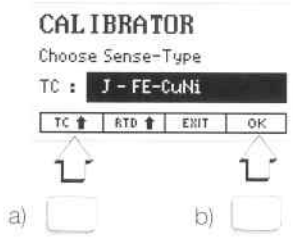
The type of temperature detector (TC or RTD), as well as the type of detector element must be entered prior to simulation. This entry remains in memory, until a different detector type is entered.

14.6.1 Temperature Simulation with Thermocouples (TC)

- Enter the thermocouple type for which simulation is to take place. Repeatedly activate the TC softkey, until the desired thermocouple appears in the display.

Note

If all of the temperature detectors in a given list have been called up one after the other, the list starts again with the first value, which is acknowledged with a brief acoustic signal.



- Acknowledge with OK.

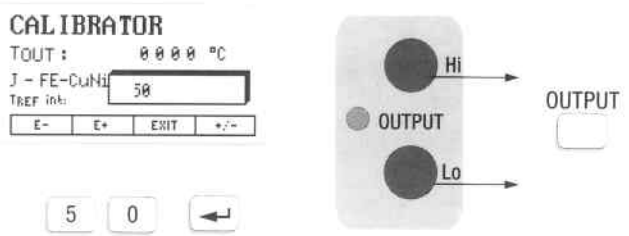
The selection for internal or external reference temperature is displayed in the menu bar.

Temperature Simulation with Internal Reference Junction

- Activate T_{REF} int.
  The internal reference temperature at the connector terminals in the multimeter is displayed in the footer. All subsequent simulations are made in reference to this temperature.

Note

The internal reference temperature (internal reference junction temperature) is measured with a temperature detector in close proximity to the OUTPUT jacks. This temperature is somewhat above room temperature due to internal warming. The extent of this deviation has no effect on sensor accuracy.



- Enter the starting temperature value either directly with the numeric keypad, or with the help of the CURSOR UP/DOWN keys.
- Connect the OUTPUT Hi and Lo output jacks to the corresponding input jacks at the device under test.
- Switch the source to the output jacks by activating the **OUTPUT** key.
- CALIB returns the device to the menu.

Temperature Simulation with External Reference Junction

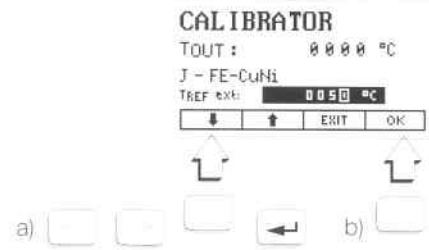
Temperature measurement with external reference junctions may result in substantially more accurate measurements. Especially if these are represented by ice water (0 °C), or a terminal block with a precisely controlled temperature (e.g. 50 °C). In such cases the compensating leads can be replaced with copper leads!

- Activate T_{REF} ext.
- Acknowledge with OK.

Note

Before an external reference temperature is entered, the internal reference temperature is displayed in the footer as T_{REF} ext.

Setting the External Reference Temperature



Enter the external reference temperature value either directly with the numeric keypad, or with the help of the CURSOR UP/DOWN keys.

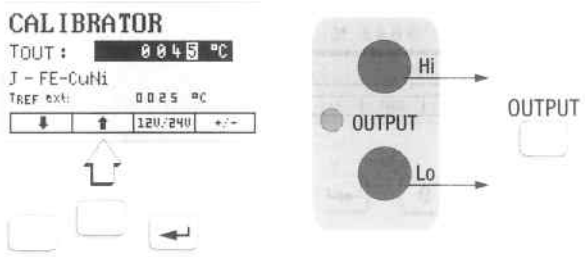
Entry range: –50 ... +100 °C

Note

If a value has been entered which is not within the allowable entry range, the minimum or maximum allowable value is automatically selected, which is acknowledged with a brief acoustic signal.

- Acknowledge with OK.

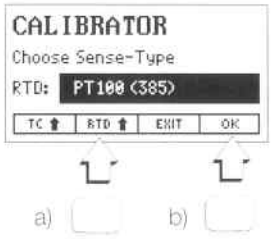
All subsequent simulations are made in reference to the external reference temperature.



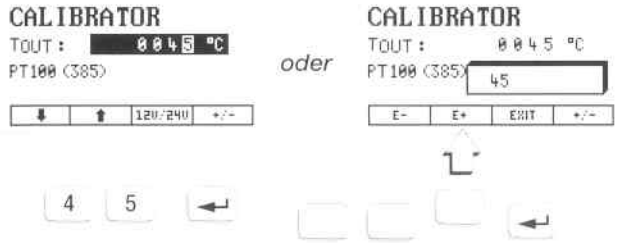
- Enter the starting temperature value either directly with the numeric keypad, or with the help of the CURSOR UP/DOWN keys.
- Connect the OUTPUT Hi and Lo output jacks to the corresponding input jacks at the device under test.
- Switch the source to the output jacks by activating the **OUTPUT** key.
- CALIB returns the device to the menu.

14.6.2 Temperature Simulation with Resistance Temperature Detectors

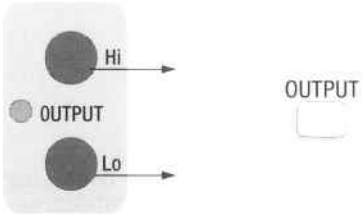
- Enter the resistance temperature detector type for which simulation is to take place. Repeatedly activate the RTD softkey, until the desired resistance temperature detector appears in the display.



- Acknowledge with OK.

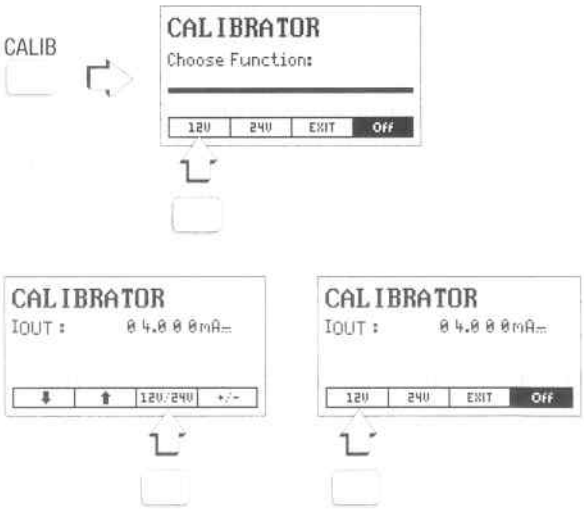


- Enter the starting temperature value either directly with the numeric keypad, or with the help of the CURSOR UP/DOWN keys.



- Connect the OUTPUT Hi and Lo output jacks to the corresponding input jacks at the device under test.
- Switch the source to the output jacks by activating the **OUTPUT** key.
- CALIB returns the device to the menu.

14.7 Activating the Auxiliary Voltage Supply



The METRAtop® 53 includes a stabilized auxiliary voltage supply for 2-wire transmitters and electrical measuring transducers. This eliminates the need for an additional direct voltage power supply.

Nominal Voltage	12 V ±10%	24 V ±10%
Load Current	max. 40 mA	max. 20 mA

The menu for adjustments to, and interruption of auxiliary voltage is entered by switching the calibrator on (**CALIB** key), or with the 12V/24V softkey if the calibrator is already active.

The required voltage must be selected with the 12V or the 24V softkey. Immediately after selection has been made, auxiliary voltage is switched to the 12/24 V sHi and sLo jacks. Current output voltage is indicated by the multicolored LED:
12 V: LED lights up green
24 V: LED lights up orange.

If OFF is activated, auxiliary voltage is switched off and the LED goes out. The auxiliary voltage supply menu is exited by selecting a calibrator function, or with EXIT.

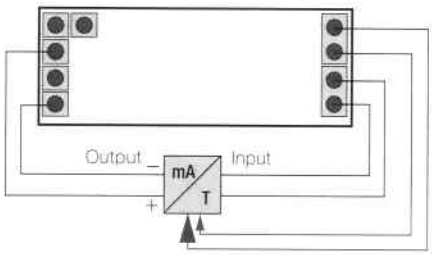
Note
If no auxiliary voltage has been selected, or if auxiliary voltage is deactivated, terminals SHi and SLo are used for the sense cables at the calibrator output (4 pole).

14.8 Exiting the Calibrator Operating Mode

The device returns to multimeter functions when the **DMM** key is activated. If the **OUTPUT** key is not pressed again, the output signal remains switched to the output jacks. The calibrator function, or the sensor signal itself, remains active until the multimeter is switched off.

14.9 Applications Examples

14.9.1 Calibrating a Temperature Transmitter



Connection Diagram

The input of the temperature transmitter is connected to the calibrator with correct poling.

14.9.2 Calibrating a Pressure Transmitter

Set-Up

The pressure calibrator reference adapter consists of an aluminum block, to which the pressure adjusting element, I/p, and the reference pressure transducer, p/U, are mounted. 4 mm hose connectors are included at the front of the aluminum block for pressure supply and connection to the device to be calibrated (p/I or p/U transducer).

Functional Principle

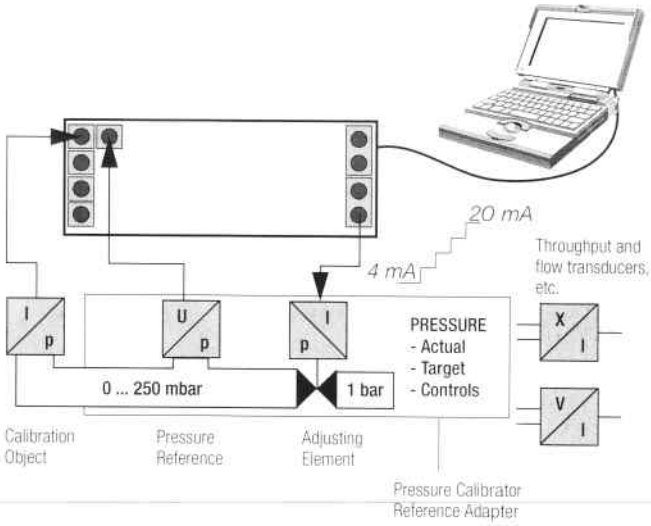
The pressure adjusting element, I/p, is driven together with the calibrator by means of current signals which are increased in steps. In this way, the two pressure transducers are sequentially subjected to proportional pressures. The calibrated reference pressure transducer ("Pressure Reference") measures the reference pressure in the manifold of the aluminum block with known accuracy, which is also simultaneously applied to the input of the transducer to be calibrated "p/I" (calibration object). The transducer output is finally fed to the multimeter "mA" or "V" input, and is measured as an "actual signal".

Control of output pressure with signals of 4 or 4.1 mA to 20 mA is carried out in a stepped fashion with a PC and METRAwin®90/50 software. The current or voltage signals measured at the reference pressure transducer and the device to be calibrated, which are proportional to pressure, are transmitted to the PC as target and actual values respectively, and are evaluated by the software.

Possible linearity deviations at the reference pressure transducer, as well as at the lower and upper range limit values of the device under test can be taken into consideration and corrected by entering linearization tables in the calibration software.

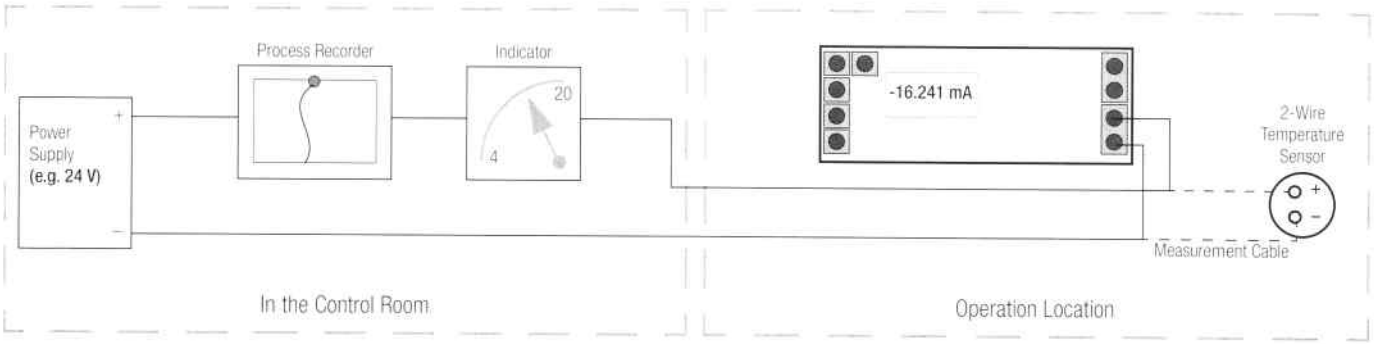
Process

The calibration process makes use of comparative calibration: Reference pressure is set with an adjusting element of intermediate accuracy, and accurate measurement of the preset pressure takes place at the same time. The principle of calibration with reference standard and adjusting element can be used with all measuring transducers (with analog signal output) for physical magnitudes such as rate of flow or volume, if the appropriate adjusting element and calibrated transducer are used. It can also be used for the calibration of power measurement transducers and other transducer types.



Functional Schematic

14.9.3 Calibration of a Measuring Chain which Functions as a Current Sink (Transmitter Simulation)



Schematic Diagram

To Calibrate a Measuring Chain from the Control Room:

1. Disconnect the measuring cables from the sensor and connect them to the calibrator, making certain that poling is correct.
2. Enter the "mA" function at the calibrator and then the calibration value preceded by the minus sign (–) , e.g. –16,241.
3. Activate the calibrator output with the "output" key. The selected current flows when the LED lights up green.
4. Calibrate the calibration object based upon the prescribed (correct) current value.

In order to calibrate an indicator or a recorder which has been disconnected from its power supply, simply use the calibrator as a current sensor by leaving the sign unchanged (positive).

14.10 Calibrator Signal Data

Voltage Sensor

Calibration Function	Sensor Range	Resolution	V_{DC}- Inherent Deviation
V *	300.00 mV	10 µV	±(0.02% of rdg. + 5 d)
	3.0000 V	100 µV	
	30.000 V	1 mV	

* Ri > 20 kΩ

Current Sensor and Current Sink

Calibration Function	Sensor/Sink Range	Resolution	Inherent Deviation
mA	0 ... ±3.0000 mA	100 nA	±(0.02% of rdg. + 5 d)
	0 ... ±30.000 mA	1 µA	

Max. load: 750 Ω at 30 mA

The METRAtop® 53 calibration instrument functions as a "current sensor" or a "current sink" depending upon connection configuration and sign (+ or –).

Note
Observe the maximum voltage which may be applied to the calibrator output from an external source: U_{ext} 0 ... 30 V.

External Voltage Source	For connection to METRAtop® 53	
	correct poling	reversed poling
U_{ext} +	Hi	Lo
U_{ext} –	Lo	Hi
	Current Sensor Mode	
	with + setpoint	with – setpoint
	Current Sink Mode	
	with – setpoint	with + setpoint

Current Sensor Mode: The output voltage at the calibrator adjusts itself automatically such that the pre-selected current value is maintained. Operation takes place within the 1st and 3rd quadrants (+U, +I or –U, –I).

Current Sink Mode: This operating mode simulates the output of a 2-wire transmitter. It is enabled as long as the test circuit can provide more current than the calibration instrument is currently set for. The selected output current, I_S, flows from a voltage source, U_{ext}, through the series connected load (max. 750 Ω) and into the current sink. The calibration instrument adjusts itself to the voltage value of the device under test and can thus only take up the selected current value. Operation takes place within the 2nd and 4th quadrants (+U, –I or –U, +I). The limit values for maximum load and maximum external voltage still apply.
Applications: active device under test, simulation of a load connected to a power supply, simulation of the output circuit of a 2-wire transmitter.

Resistance Simulator

Calibration Function	Range	Resolution	Inherent Deviation
Ω	30.0 .... 2000.0 Ω	0.1 Ω	±(0.05 % of rdg. + 5 d)
Measurement Current 0.05 ... 0.1 ... 3.0 ... 5 mA			

Max short-circuit current: 5 mA

Note
The LED blinks green-orange if detector current falls below approx. 125 µA.

Temperature Simulator

Calibr. Function °C / °F	Sensor Type	Sensor Range in °C	Sensor Range in °F	Resolution	Inherent Deviation *
	Resistance Thermometers per IEC 751				
	Pt100	-180 ...+850	-292 ...+1562	1 K	±(0.05 %rdg.+2d)
	Pt1000	-180 ...+250	-292 ...+482		
	Ni100	-60 ...+180	-76 ...+356		±(0.05 %rdg.+1d)
	Ni1000	-60 ...+180	-76 ...+356		
	Sensor Current	0.05 ... 0.1 ... 3.0 ...5 mA			
	Thermocouples per DIN or IEC 584-1				
	J (Fe/CuNi)	-200...+1200	-328...+2192	1 K	±(0.05%rdg.+35µV)
	L (Fe/CuNi)	-200...+900	-328...+1652		
	T (Cu/CuNi)	-250...+400	-418...+ 752		
	U (Cu/CuNi)	-200...+600	-328...+1112		
	K (NiCr/Ni)	-250...+1350	-418...+2462		
	E NiCr/CuNi)	-250...+1000	-418...+1832		
	S (Pt10Rh/Pt)	-50...+1750	-58...+3182		
	R (Pt13Rh/Pt)	-50...+1750	-58...+3182		
	B (Pt30Rh/Pt6Rh)	+50...+1800	+122...+3272	2 K	
	N (CU/Cu10)	-240...+1300	-400...+2372	1 K	
	Additional error for internal reference junction				160 µV

* without internal reference junction

Temperature Effect

30 ppm/K from measurement value, additional offset of 1 digit per K.

Auxiliary Voltage

The METRAtop® 53 is equipped with a stabilized auxiliary voltage source for the supply of power to 2-wire transmitters and electrical measuring transducers. The use of an additional direct current power supply is thus unnecessary.

Nominal Voltage	12 V ±10 %	24 V ±20 %
Load Current	≤ 40 mA	≤ 20 mA

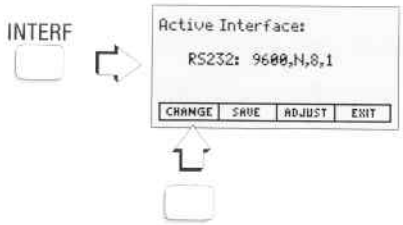
15 Data Interface

The multimeter is equipped with an RS 232C serial interface. The interface can be used for the following functions:

- Transmission of measurement values to a PC for convenient evaluation with METRAwin®10/50 program software.
- Remote control and parameter setting for all functions and measuring ranges.
- Software update
- Balancing of all multimeter functions.
  (ADJUST function: for authorized service personnel only)

Connection with a PC via RS232

- Connect the multimeter to the mains without switching it on.
- Connect the interface labelled RS232 to the serial port at your PC (e.g. COM2) with a suitable interface cable (Z3241).
- Switch the multimeter on.



- Press the **INTERF** function key.
  The active interface is displayed.
- If IEEE appears at the display, select the RS232 interface with the CHANGE key.
- The displayed interface can be permanently selected by activating the SAVE key.
- The appropriate baud rate can be selected and saved in the **SETUP** menu (see chapter 3.4.6, page 8).

Software Update (SCANNER and IEEE options)

A software update is required if a scanner and an IEEE interface are subsequently installed. The new functions are activated during the update process.

- Connect the multimeter to a PC a described above.
- Insert the update floppy disc into the PC's A: drive (or B:), and display its contents. Double click the INSTALL.BAT file from the explorer or file manager, or enter Start-Execute A:INSTALL. This program creates a temporary directory on your hard disc, which is automatically deleted after completion of the software update.
- Follow the instructions displayed by the program.

METRAwin®10/50 Software (optional)

METRAwin®10/50 allows for the simultaneous acquisition, storage, display and documentation of measurement data from two channels for the METRAtop®52, or for 8 additional channels with the SCANNER expansion module.
Measurement values are displayed:

- in digital and analog form similar to multimeter display (up to 4 multimeters)
- as a curve (XY and Yt), like a 4 channel recorder
- in tabular form (data logger: up to ten channels)
- as a Yt line profile, like a 4 channel line recorder.

Measurement data can be stored in ASCII format, or to temporary memory for further processing in spreadsheet programs like Microsoft EXCEL. Additional functions include:

- Triggering
- Linearization tables
- Mathematical linking

In order to use METRAwin®10/50, the following prerequisites must be fulfilled:

Hardware: You need

- PC IBM AT or compatible type as of 80486 CPU and at least 4 MB main memory
- VGA monitor
- hard disc with at least 4 MB free memory
- 3,5" floppy disc drive (1.44 MB)
- MICROSOFT compatible mouse
- if print-outs are required
  a printer which is supported by WINDOWS.

Software: You need

- PC/MS DOS, version 6.0 or higher
- MS WINDOWS 3.1 or higher

or

- MS WINDOWS 95, 98 or NT

16 Command Register

16.1 General

These interface commands are valid for the RS232 interface, and, with only a few exceptions, can also be used for the IEEE interface. As soon as a command is transmitted to the multimeter via the interface, it is switched to remote operation.

If a command is recognized as valid, the multimeter transmits a YES to the PC after the command has been executed. A NO is transmitted to the PC if the command cannot be recognized, or if its syntax is incorrect (with RS232 only).
Only the text components which appear in the following paragraphs in capital letters are evaluated for internal analysis of the commands. The text components which appear in lower case letters can be omitted.
Example: SYSTem:LOCal can be abbreviated as SYST:LOC or syst:loc.
Parameters shown in brackets [Opt1, ... Optx] are optional and can be partially or entirely omitted. Options must nevertheless be entered in the prescribed sequence.

RESolution Nr

Some commands allow for the entry of the desired measuring resolution. The following definitions apply:

RES 6 ‣ 300000, RES 5 ‣ 30000, RES 4 ‣ 3000, RES 3 ‣ 300 digits. Refer to the operating instructions in order to determine which resolutions are possible in which measuring ranges.

RANGE

Refer to the operating instructions regarding adjustable measuring ranges for measured quantities. RANGE is entered as follows:

Measuring Ranges		RANGE in Command Format for the Multimeter	Response from Multimeter
	nano	30E–9 / 300E–9	30 / 300n
	micro	3E–6 / 30E–6 / 300E–6	3 / 30 / 300my
	milli	3E–3 / 30E–3 / 300E–3	3 / 30 / 300m
3,19999/31,9999/319,999		3 / 30 / 300	3 / 30 / 300
	kilo	3E+3 / 30E+3 / 300E+3	3 / 30 / 300k
	Mega	3E+6 / 30E+6 / 300E+6	3 / 30 / 300M

Entries for Range and Value Place Markers

Entries for **Range** and **Value** can be made in exponential or in decimal format. If the entered value exceeds the measuring range, the multimeter generates a beeping acoustic signal and selects the highest possible measuring range.
Leading zeros to the left of the decimal point are evaluated in the exponential format and determine output resolution. The number of places to the left of the decimal point determines the measuring range. If the decimal format is used, the value is limited to 6 characters and additional characters are deleted.

Example:

		Display format and output resolution
SOUR:CURR:VAL	–1.2345E-3	‣ –1.2345 mA
SOUR:CURR:VAL	–0.0012345	‣ –1.2300 mA limited to 6 characters, addit. characters are deleted.
SOUR:VOL:VAL	–00.3	‣ –300.00 mV
	–00.3E+0	‣ –00.300 V
	–300E-3	‣ –300.00 mV
	–3E+6	‣ –30.000 V, device generates beeping acoustic signal: meas.range has been exceeded.

16.2 Multimeter Channel 1 Commands

Voltage: Range, Resolution and Filter Settings

SENSe:VOLTage: AC / DC [, RANGe Auto / **Range** , RESolution Nr, FILTer on / off]

Default: RANGE = Auto, RES = 6, Filter on
Range See ranges in chapter Characteristic Values
Example: SENS:VOLT:AC
Example: SENS:VOLT:AC,RANG AUTO,FILT off
Example: SENS:VOLT:DC,RANG 30,RES 4,FILT off

Current: Range, Resolution and Filter Settings

SENSe:CURRent: AC / DC [, RANGe Auto / Auto_Amp / **Range** , RESolution Nr, FILTer on / off]

Default: RANGE = Auto, RES = 6, Filter on
Auto Autorange with ref. to mA sockets and ranges
Auto_Amp Autorange with ref. to ampere sockets and ranges
Example: SENS:CURR:AC
Example: SENS:CURR:AC,RANG AUTO
Example: SENS:CURR:AC,RANG AUTO_AMP,RES 4,FILT ON
Example: SENS:CURR:DC,RANG 3,RES 4

Resistance (2-wire): Range and Resolution Settings

SENSe:RESIstance [, RANGe Auto / **Range** , RESolution Nr]

Default: RANGE = Auto, RES = 6
Example: SENS:RESI
Example: SENS:RESI,RANG 300
Example: SENS:RESI,RANG 3E+6,RES 5

Resistance (4-wire): Range and Resolution Settings

SENSe:FRESIstance [, RANGe **Range** , RESolution Nr]

Default: RANGE = Auto, RES = 6
Example: SENS:FRESI,RANG 300
Example: SENS:FRESI,RANG 3000

Capacitance: Range Setting

SENSe:CAPacitance [, RANGe Auto / **Range**] Default: RANGE = Auto

Example: SENS:CAP,RANG 30E-9
Example: SENS:CAP,RANG 30E-6
Example: SENS:CAP,RANG 30E-3

Frequency Measurement: Voltage Range Setting

SENSe:FREQency [, RANGe **Range**] Default: Range = 3 V~, Frequency = always Autorange

Range 3 ... 750 V~
Example: SENS:FREQ,RANG 3
Example: SENS:FREQ,RANG 750

Period: Voltage Range Setting

SENSe:PERiod [, RANGe **Range**] Default: Range = 3 V~, Frequency = Autorange

one range only up to a period of 3.2 sec.
Example: SENS:PER,RANG 30

Temperature: Thermocouple, Type and Reference Temperature Settings

SENSe:TEMPerature:TC [, TYPE J / K , INT / , EXT **Temp**]

INT:	reference temperature, Tref internal
EXT:	manually selected reference temperature
Temp:	reference temperature in °C/K as per SETUP
Default:	Type = J, Tref = INT
Example:	SENS:TEMP:TC,TYPE J,INT
Example:	SENS:TEMP:TC,TYPE K,EXT 22.8

Temperature: Resistance Thermometer (2-wire), Type and Reference Temperature Settings

SENSe:TEMPerature: RTD [, TYPE PT100 / PT100-392 / PT1000 / Ni100 , **Rlead**]

Default:	PT100, Rlead = 0.1 Ω reference resistance
Example:	SENS:TEMP:RTD,TYPE PT100
Example:	SENS:TEMP:RTD,TYPE PT1000
Example:	SENS:TEMP:RTD,TYPE PT100-392,R 0.1

Temperature: Resistance Thermometer (4-wire) and Type Settings

SENSe:TEMPerature: FRTD [, TYPE PT100 / PT100-392]

Default:	PT100, Rlead = 0.1 Ω reference resistance
Example:	SENS:TEMP:FRTD,TYPE PT100-392,R 0.1

Diode Measurement: Resolution Setting

SENSe:DIODe [, RESolution Nr] Default: Res = 5, 6 possible, 3 V DC fixed

Example: SENS:DIOD,RES 5

Continuity Testing: Setting

SENSe:CONTinuity Example: SENS:CONT

Set Zero Point: Relative Measurement

SENSe:ZERO on / off Example: SENS:ZERO ON

Sets zero point to last measurement value.

16.3 Multimeter Channel 2 Commands (voltmeter)

Channel 2 can only be activated if channel 1 has been set to current or voltage measurement.

Voltage Ch2: Range Setting

SENSe:CH2:ON [, RANGe **Range**] Example: SENS:CH2:ON,RANG 30

Range 300 mV, 3, 30, 300 V

Deactivate Channel 2

SENSe:CH2:OFF Example: SENS:CH2:OFF

Set Zero Point: Relative Measurement

SENSe:CH2:ZERO on / off Example: SENS:CH2:ZERO ON

Sets zero point to last measurement value.

16.4 Calibrator Commands

Voltage: Set Value

SOURce:VOLTage:VALue **Value** Example: SOUR:VOLT:VAL 12

Value See ranges in chapter Characteristic Values from –30.000 to +30.000 V

Current: Set Value

SOURce:CURRent:VALue **Value** Example: SOUR:CURR:VAL 12E-3

Value See ranges in chapter Characteristic Values from –30.000 to +30.000 mA

Resistance: Set Value

SOURce:RESIstance:VALue **Value** Example: SOUR:RESI:VAL 1000

Value See ranges in METRAtop operating instructions from 0.0300 kΩ to 2.0000 kΩ

Temperature: Thermocouple, Type, Reference Temperature and Output Temperature Settings

SOURce:TEMPerature:TC: TYPE J .. K : INT / EXT **Temp** :VALue **Value**

TYPE	B, E, J, K, L, N, R, S, T, U
INT	reference temperature, Tref internal
EXT	manually selected reference temperature
Temp	reference temperature in °C/K as per SETUP
Value	temperature value in °C/K as per SETUP
Example:	SOUR:TEMP:TC:TYPE J:INT:VAL 10
Example:	SOUR:TEMP:TC:TYPE K:EXT 22.8:VAL 10

Temperature: Resistance Thermometer, 2-Wire, Type and Output Temperature Settings

SOURce:TEMPerature:RTD: TYPE PT100 ... NI1000 :VALue **Value**

TYPE	PT100, PT1000, NI100, NI1000
Value	temperature value in °C/K as per SETUP
Example:	SOUR:TEMP:RTD:TYPE PT100:VAL 10

Calibrator Output: Activate / Deactivate

SOURce:OUT on / off Example: SOUR:OUT ON

Calibrator Auxiliary Power Supply: Activate 12 V or 24 V

SOURce: UH 12V / UH 24V Example: SOUR:UH 12V

Only 1 auxiliary power supply can be activated.

Calibrator Auxiliary Power Supply: Deactivate 12 V or 24 V

SOURce:UH OFF Example: SOUR:UH OFF

Deactivates the selected auxiliary power supply.

16.5 Scanner Commands

Scanner commands are only accepted if no calibrator values appear at the display. Observe also display commands (chapter 6).
Ch8 has a special function for temperature measurement with thermocouples: it displays the reference temperature. All commands with the syntax "SCAN:CHx: ..." initialize the scanner and start measurement as of the first activated scanner channel.

Voltage: Range Setting

SCANner: CH1 ... CH8 :VOLTage: RANGe **Range** [,RESolution Nr]

Range	see chapter 17, page 35 from 300 mV to 110 V
RES	6, 5 only if all active channels (on) are set for voltage measurement
Example:	SCAN:CH1:VOLT:RANG 300,RES 5

Resistance (2-wire): Range Setting

SCANner: CH1 ... CH8 :RESIstance: RANGe **Range**

Range	see chapter 17, page 35 from 300 Ω to 30 MΩ
Example:	SCAN:CH1:RESI:RANG 300

Resistance (4-wire): Range Setting

SCANner: CH1 ... CH4 FRESIstance: RANGe **Range**

Range:	see chapter 17, page 35 300 Ω or 3 kΩ
Example:	SCAN:CH2:FRESI:RANG 300

Temperature: Thermocouple, Type and Reference Temperature Settings

All channels must be set to the same type and reference source when thermocouples are used. Ch8 is always used for the measurement and display of the reference temperature in this case.

SCANner: CH1 ... CH7 :TEMPerature:TC:TYPE J / K [, INT / , EXT / , MAN **Temp**]

INT	reference temperature, Tref internal (default)
EXT	external reference temperature to Ch8
MAN	assign reference temperature manually with:
Temp	reference temperature in °C/K as per SETUP
Example:	SCAN:Ch1:TEMP:TC,TYPE J,INT
Example:	SCAN:Ch1:TEMP:TC,TYPE K,EXT (with ext. PT100 sensor to CH8)
Example:	SCAN:CH1:TEMP:TC,TYPE K,MAN 22.8

Temperature: Resistance Thermometer, 2-Wire and Type Settings

SCANner: CH1 ... CH8 :TEMPerature:RTD:TYPE PT100 / PT100-392 / PT1000 / NI1000

Default	Rlead = 0.1 Ω permanently set
Example:	SCAN:CH1:TEMP:RTD:TYPE PT100
Example:	SCAN:CH2:TEMP:RTD:TYPE PT1000
Example:	SCAN:CH8:TEMP:RTD:TYPE PT100-392

Temperature: Resistance Thermometer, 2-Wire and Type Settings

SCANner: CH1 ... CH4 :TEMPerature:FRTD:TYPE PT100 / PT100-392

The 4-wire commands are only valid for channels 1 through 4, because channels 5 through 8 are required for sensor cables.
Example: SCAN:CH1:TEMP:FRTD:TYPE PT100-392

Activate / Deactivate Scanner Channel

SCANner: CH1 ... CH8 : on / off

Example: SCAN:CH1:ON

Set Scanning Time

SCANner:TIME **mm:ss**

Example: SCAN:TIME 00:50

Save Scanner Settings to Memory

SCANner:SAVE

Example: SCAN:SAVE

Delete Scanner Settings

SCANner: CH1 ... CH8 / ALL : clear

Example:
SCAN:CH1:CLEAR
Example:
SCAN:ALL:CLEAR

Start / Stop Scanner Measurements

SCANner: Start / Stop

Example: SCAN:START

STOP holds the scanner at its current position.
START continues measurement as of the stop position.

16.6 Memory Commands

Each storage block consists of a header, which is followed by measurement values made up of 4 bytes each.

The <MEM FULL> message is transmitted to the PC when memory capacity becomes full, or if the memory mode is activated when memory is already full.

Activating the Memory Mode

Prerequisites:
- A measuring function must be active.
- Memory may not be 100% full.

MEMory:START — Example: MEM:START

Activating the Memory Mode
Here: in the "IDLE MODE" (with frozen display)

MEMory:START IDLE — Example: MEM:START IDLE

See IDLE **on/off** command.

Exiting the Memory Mode

MEMory:STOP — Example: MEM:STOP

Displaying Memory Status

MEMory:STATE — Example: MEM:STATE

Memory status contains the following information:
Memory occupancy as a percentage, block number, storage event ID label with 8 characters, sampling time.

Example for MEM:STATE
The following telegram is transmitted by the multimeter:

0%
0001
Label x
02 sec.
MEM:ON - IDLE:OFF

Read Out Memory Content

MEMory:READ — Example: MEM:READ

See chapter 16.7 regarding memory content.

Label a Storage Event

MEMory:LABEL *txt* — Example: MEM:LABEL

A sequence of up to 8 numbers and/or letters can be used to label a storage event. Any places left blank are automatically entered as a space.

Entering the Sampling Rate

MEMory:TIME $\frac{xy}{min}$ — Example: MEM:TIME 01

During operation at the highest sampling rate (smallest possible sampling rate: MIN-Mode) 00H is written 4 times per second.
Sampling time can be adjusted within the following range:
01 ... 60 s
Default: min. = 0.5 s (with 5¾ digit resolution)
min. = 0.05 s (with 4¾ digit resolution)
min. = 0.005 s (with 3¾ digit resolution)

Clearing Memory

MEMory:CLEAR — Example: MEM:CLEAR

This command deletes all data stored to memory.
Upload and save any data required for the future to a PC before clearing the memory.

Activate/Deactivate Refresh Display Function, "Idle Mode"

MEMory:IDLE **on/off** — Example: MEM:IDLE ON

The fastest storage rate is attained by freezing the display with the command IDLE = on, which disables refresh display function.
IDLE = on: measurement value display is frozen.
IDLE = off: measurement value display is continuously refreshed.

Default: IDLE = off

16.7 Memory Content Telegram

The memory content telegram consists of a header and measurement value bytes, which are transmitted one after the other.

Header Content

00¦FF¦55¦AA¦L1¦L2¦L3¦L4¦L5¦L6¦L7¦L8¦N1¦N2¦N3¦N4¦
TT.¦MM.¦JJ¦HH:¦MM:¦SS¦R1¦R2¦C1¦C2¦S1¦S2¦S3¦S4¦S5¦S6¦S7¦S8

00¦FF¦55¦AA: Start bytes

L1 ... L8: Label (via keyboard: 0,1,2,3,4,5,6,7,8,9,.,-, ,)
(via PC interface: 20H .... 7FH)

N1 ... N4: Consecutive number (0001 ... 9999)

DD.¦MM.¦YY: Date (03.10.98)

HH:¦MM:¦SS Time (11:12:13)

R1¦R2: Sampling rate (00...60) (00 === min. sampling time)

C1: CH1 functions (bit.0 indicates if activated (1=on))

00H	UDC
10H	UAC
20H	IDC
30H	IAC
40H	R-2w
50H	R-4w
60H	C
70H	f
80H	Temp.
90H	Diode
A0H	Continuity
B0H	Period
C0H	Count

C2: CH2 function (bit.0 indicates if activated (1=on))
D0H UDC-CH2

S1 ... S8: SCAN1...SCAN8 functions
(bit.0 indicates if activated (1=on))

00H	UDC
10H	TEMP-TC
20H	TEMP-RTD-2pol
30H	TEMP-RTD-4pol
40H	R-2w
50H	R-4w

E0Hfor TEMP-TC reference temperature
(only possible with S8)
F0Hfor 4-wire connection

The header is always followed by 4 measurement value bytes.

Content of Measurement Value Bytes

¦ok¦ov¦a1¦a2¦m4¦m3¦m2¦m1¦ ¦k4¦k3¦k2¦k1¦vz¦18¦17¦16¦
¦15¦14¦13¦12¦11¦10¦09¦08¦ ¦07¦06¦05¦04¦03¦02¦01¦00¦

ok: '1' ▸ measurement value is invalid(---.---)

ov: '1' ▸ measurement value overflow(> 3.20000)

a1|a2: *Resolution:*
'00' 5½ place
'01' 4½ place
'10' 3½ place
'11' 2½ place

m4|m3|m2|m1: *Measuring Range:*

'0001'	3µ	(3n for capacitance)
'0010'	30µ	(30n for capacitance)
'0011'	300µ	(300n for capacitance)
'0100'	3m	(3µ for capacitance)
'0101'	30m	(30µ for capacitance)
'0110'	300m	(300µ for capacitance)
'0111'	3	(3m for capacitance)
'1000'	30	(30m for capacitance)
'1001'	300	(300m for capacitance)
'1010'	3k	
'1011'	30k	
'1100'	300k	
'1101'	3M	
'1110'	30M	
'1111'	300M	

k4|k3|k2|k1: *Channel:*
'0010' CH1
'0011' CH2
'0100' SCAN1
'0101' SCAN2
'0110' SCAN3
'0111' SCAN4
'1000' SCAN5
'1001' SCAN6
'1010' SCAN7
'1011' SCAN8

vz: *Measurement Value Sign (+ or -):*
'1' ▸ measurement value sign is minus.

18 | ... | 00: *Measurement Value Quantity:*
Measurement value in hexadecimal form where 18=MSB and 00=LSB

Example

00 FF 55 AA 4C 61 62 65 6C 20 43 43 30 30 30 33
32 33 2E 31 30 2E 39 38 31 31 3A 32 31 3A 34 36
31 35 11 D1 51 01 31 11 F0 00 F0 E1 07 20 01 EC
08 30 92 EA 49 44 E2 00 07 50 01 3C 9A 60 00 40
1A 70 00 CB 1A B0 00 FA

Break down

00 FF 55 AA		4 start bytes
4C 61 62 65 6C 20 43 43		Label: "Label CC"
30 30 30 33		No.: "0003"
32 33 2E 31 30 2E 39 38		Date: "23.10.98"
31 31 3A 32 31 3A 34 36		Time: "11:21:46"
31 35		Sampling rate: 15 sec
11	CH1 = UAC on	
D1	CH2 = UDC on	
51	SCAN1 = R-4w on	
01	SCAN2 = UDC on	
31	SCAN3 = TEMP-RTD 4-pole on	
11	SCAN4 = TEMP-TC on	
F0	SCAN5 = 4-wire, SCAN1 application	
00	SCAN6 = UDC off	
F0	SCAN7 = 4-wire, SCAN3 application	
E1	SCAN8 = TEMP-TC reference temperature on	
07 20 01 EC	5¾ / 3 / CH1 / + / 000492 --->	0.00492 V (AC)
08 30 92 EA	5¾ / 30 / CH2 / + / 037610 --->	03.7610 V (DC)
49 44 E2 00	5¾ /OL-300/ S1 / + / 320000 --->	>320.000 Ω (4w)
07 50 01 3C	5¾ / 3 / S2 / + / 000316 --->	0.00316 V (DC)
9A 60 00 40	4¾ /def.3k / S3 / + / 000064 --->	----.- °C (RTD-4w)
1A 70 00 CB	4¾ / 3k / S4 / + / 000203 --->	0020.3 °C (TC)
1A B0 00 FA	4¾ / 3k / S8 / + / 000250 --->	0025.0 °C (Tref)

16.8 General Commands

Configuring the Multimeter for Hand-Held Operation

SYSTem:LOCal — Example: SYST:LOC

Stops data transmission to the PC and resets the display mode from IDLE back to standard, see command IDLE.
This command is only valid for the RS232 interface.
Use the GTL command (go to local) for the IEEE interface.

Rapid Measurement without Display

DISPlay: IDLE — Example: DISP:IDLE

Recommended for rapid data transmission (high speed measurement with low resolution).
This operating mode can only be exited with the SYST:LOC command (or GTL for the IEEE interface), see command LOCal.
Active measurement value transmission to the PC is interrupted.

Change Display Mode

DISPlay: DMM **on/off** | CAL **on/off** | SCAN **on** — Example: DISP:DMM ON

Source commands switch the display to the dual mode if DMM and CAL values are read out simultaneously.

Query System Time

SYSTem:TIME? — Example: SYST:TIME?

Set System Time

SYSTem:TIME hh:mm:ss — Example: SYST:TIME 08:05:00

Query System Date

SYSTem:DATE? — Example: SYST:DATE?

Set System Date

SYSTem:DATE DD:MM:YY — Example: SYST:DATE 10:07:98

Query Battery Voltage

Only possible if rechargeable battery option has been installed.

SYSTem:BAT — Example: SYST:BAT

Query Basic Configuration

IDN? — Example: IDN?

Response from multimeter (1st line shows general layout followed by example):

IDN= status, serial no., device type, features, date time, DISPLAY version, date time, DMM version, date time, SCAN version, date time-balance-DISPLAY, date time-balance-DMM, date time-balance-SCAN, number of manual balancing operations, system info

IDN= 3,HK 781417 0007,M2520,A1 B0 C1 D1,
11.09.1998 12:35:00,AH,07.09.98 14:15:00,AB,02.10.09 08:45:20,AC,
10.11.1998 10:11:00,12.11.1998 12:20:00,14.11.1998 14:40:00,
000000000000000,1001100
System info shows installed options in a predetermined sequence, e.g.:
1111100 means Ch2, no rechargeable battery, no calibrator, scanner, IEEE, 0, 0 installed.

16.9 Measurement Value Commands

Start Measurement Value Transmission to the PC

Usually only available with RS232 interface because this command does not comply
with the IEEE standard due to cyclical transmission.

READ: START [, ALL | DMM | CH1 | CH2 | SCAN | SCAN1 | ... | SCAN8]

Example:READ:START,CH1 — result: only CH1
Example:READ:START,DMM — CH1+CH2
Example:READ:START,SCAN — all scanner channels
Example:READ:START,SCAN1 — only SCAN1

16.9.1 Stop Measurement Value Transmission to the PC

Usually only with RS232.

READ: STOP — Example: READ:STOP

Request Measurement Value Snapshot

READ: CH1 | CH2 | SCAN1 | ... | SCAN8 — Example: READ:CH1

Configuration: Query Calibrator, Measuring Channels, Battery Level and Setup

CONFIG?: CH1 | CH2 | SOURCE | SCAN | BAT | SETUP — Example: CONFIG?:SOURCE

Provides following responses (1st line shows general layout followed by example):

SOURCE = **Function Range ; [Output** on/off, **Aux. Voltage** Value on/off, **TC or RTD** type]
Source = Resist. 2w +0.3000E+3;Output on;UH =12V off

CH1 = **Function : Range ; [Zero Point** on/off, **TC** or **RTD** type, R-lead,Temp. U/M,Tref int/ext Value]
CH1 = Volt AC:300m;zero off
CH1 = Temp:3k;Zero off;Type PT100 (385);Rlead +000.1E+0;Unit °C

CH2 = **Function : Range ; Zero**
CH2 = Volt DC:300m;Zero off

The **SCAN** command is not answered with SCAN = ..., but rather 9 values are displayed simultaneously:
SCANTIME 00:10;SCANTIME-Min. 07s;5 ¾ digits
SCAN-CH1 on ;Resist. 2w :300
SCAN-CH2 off ;Resist. 4w ;300
SCAN-CH3 on ;Temp-RTD 4w /PT100(385)-4
SCAN-CH4 on ;Temp-TC /K - NiCr-Ni;manual Tref: +0.0234E+3
SCAN-CH5 not init
SCAN-CH6 4-wire used
SCAN-CH7 4-wire used
SCAN-CH8 for Temp-Ref used

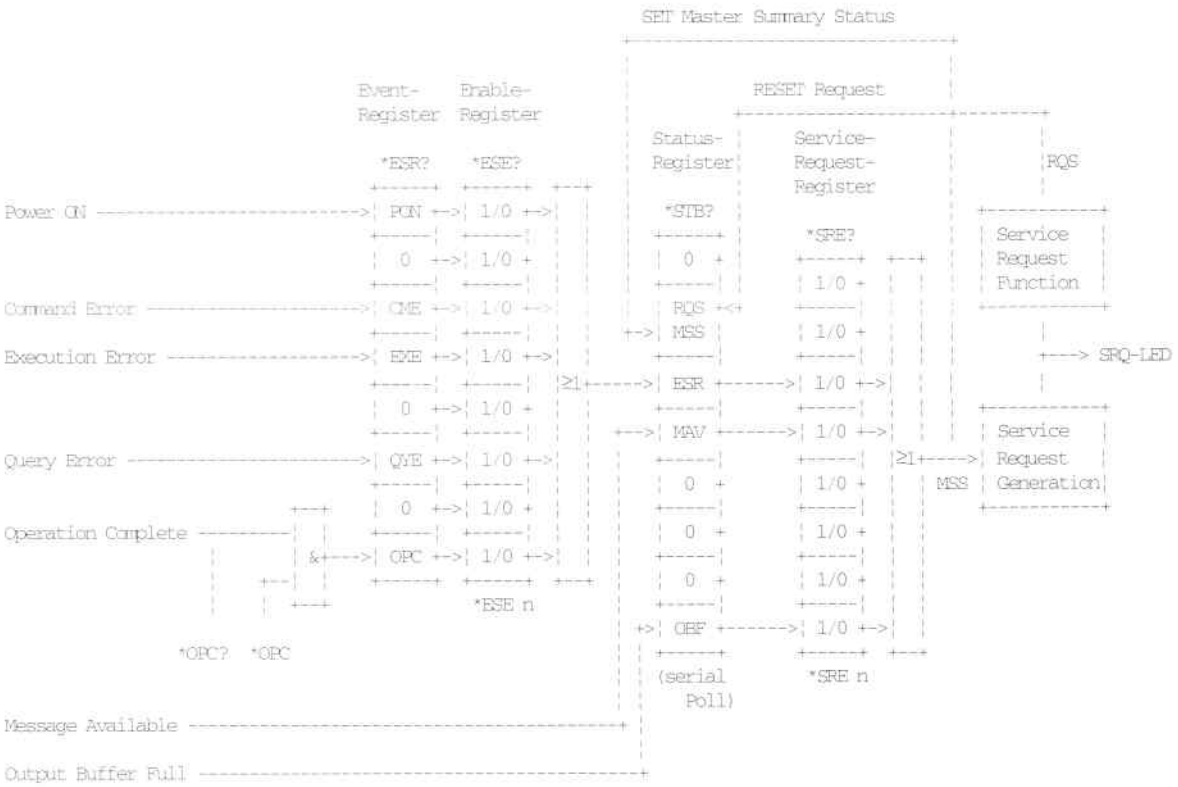
Battery = 5.23V;Charge OFF — if rechargeable battery option has been installed

Setup = 5 ¾ Digits;Filter ON

16.10 General IEEE488 Commands

The multimeter recognizes these standard IEEE488 commands and responds as defined within the standard.

*CLS	Clear status command
*ESE n	Event status enable
*ESE?	Event status enable query
*ESR?	Event status register query
*IDN?	Identification query
*OPC	Operation complete
*OPC?	Operation complete query
*RST	Reset
*SRE n	Service request enable
*SRE?	Service request enable query
*STB?	Read status byte query
*TRG	Trigger command (no outcome, acknowledgement only)
*TST?	Self-test query
*WAI	Wait-to-continue command



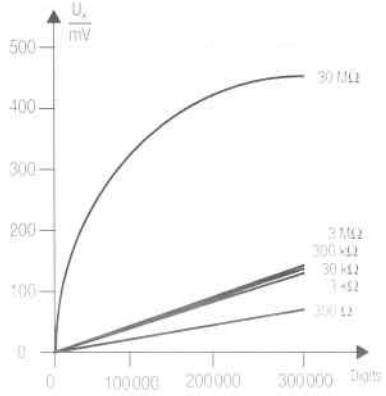
17 METRAtop®51 ... 53 Characteristic Values – Measuring Functions

Meas. Function	Measuring Range	Resolution at Measuring Range Upper Limit 300 000	30 000	3 000	Input Impedance —	TRMS ~	Inherent Deviation at Maximum Resolution ±(...% rdg.+... d) at reference conditions —	TRMS ~ [2]	Overload Capacity [1] Overload Value	Duration	Meas. Function
	300 mV [3]	1 µV	10 µV	100 µV	> 20 MW	1 MΩ // < 50 pF	0.025 + 35 [3]	0.5 + 50			
	3 V [3]	10 µV	100 µV	1 mV	11 MΩ	1 MΩ // < 50 pF	0.01 + 10 [3]	0.2 + 50	DC1000V AC 750 V eff Sinus	continuous	
V [7]	30 V [3]	100 µV	1 mV	10 mV	10 MΩ	1 MΩ // < 50 pF	0.01 + 10 [3]	0.2 + 50			V
	300 V [3]	1 mV	10 mV	100 mV	10 MΩ	1 MΩ // < 50 pF	0.01 + 10 [3]	0.2 + 50			
	DC1000V/AC750V	10 mV	100 mV	1 V	10 MΩ	1 MΩ // < 50 pF	0.01 + 10	0.2 + 50			
					Voltage Drop, approx.						
					—	TRMS ~	—	TRMS ~ [2]			
	300 µA	1 nA	10 nA	100 nA	160 mV	160 mV	0.05 + 20	0.5 + 50			
	3 mA	10 nA	100 nA	1 µA	160 mV	160 mV	0.05 + 10	0.5 + 50			
A [7]	20 mA 30 mA	100 nA	1 µA	10 µA	200 mV	200 mV	(0.02% rdg.+0.01% R + 5) (0.05% rdg.+0.01% R + 5)	0.5 + 50	0.36 A	continuous	A
	300 mA	1 µA	10 µA	100 µA	350 mV	350 mV	0.1 + 10	0.5 + 50			
	3 A	10 µA	100 µA	1 mA	150 mV	150 mV	0.2 + 20	0.75 + 50	12 A [4]	5 min	
	10 A	100 µA	1 mA	10 mA	400 mV	400 mV	0.2 + 20	0.75 + 50			
					Open-Circuit Voltage	Short-Circ. Curr.					
	300 Ω	1 mΩ	10 mΩ		0.6 V	max. 300µA	0.02 + 20 [5]				
	3 kΩ	10 mΩ	100 mΩ		0.6 V	max. 55 µA	0.02 + 20 [5]				
Ω [7]	30 kΩ	100 mΩ	1 Ω		0.6 V	max. 6 µA	0.02 + 20		500 V DC AC eff Sinus	10 min	Ω
	300 kΩ	1 Ω	10 Ω		0.6 V	max. 0.6 µA	0.02 + 20				
	3 MΩ	10 Ω	100 Ω		0.6 V	max. 60 nA	(0.1% rdg. +0.02% R + 5 d)				
	30 MΩ	—	1 kΩ		0.6 V	max. 60 nA	(1% rdg. +0.2% R + 5 d)				
→|	3 V–	10 µV	1 mV		max. 3.00 V	—	0.2 + 10				→|
					Discharge Resistor	$U_{0\,max}$					
	30 nF		1 pF		10 MΩ	3 V	1.0 + 50 [5]				
	300 nF		10 pF		1 MΩ	3 V	1.0 + 10				
	3 µF		100 pF		100 kΩ	3 V	1.0 + 10		500 V DC AC eff Sinus	10 min	F
F	30 µF		1 nF		10 kΩ	3 V	1.0 + 10				
	300 µF		10 nF		1 kΩ	3 V	1.0 + 10				
	3 mF		100 nF		1 kΩ	3 V	5.0 + 10				
	30 mF		1 µF		1 kΩ	3 V	5.0 + 10				
					f_{min} [6]						
	3.0000 kHz		0.1 Hz		1 Hz				DC1000V AC750V		
Hz	30.000 kHz		1 Hz		1 Hz		0.001 + 3 [7]		300 V	continuous	Hz
	100.00 kHz		10 Hz		10 Hz				300 V		
	300.00 kHz		10 Hz		10 Hz				30 V		
s	3.0000 s		100 µs					±5 D	DC1000V AC750V		s
°C	Pt 100	−200.0 ... +100.0°C	0.1 K				0.5 K + 3 [8]		500 V DC AC eff Sinus	10 min	°C
		+100.0 ... +850.0°C	0.1 K				0.5% + 3 [8]				
	Pt 1000	−200.0 ... +100.0°C	0.1 K				0.5 K + 3 [8]				
		+100.0 ... +850.0°C	0.1 K				0.5% + 3 [8]				
	K NiCr-Ni	−200.0 ... +1350.0°C	0.1 K				0.7% [8,9]				
	J Fe-CuNi	−200.0 ... +1200.0°C	0.1 K				0.8% [8,9]				
	Ni100	−60 ... +100°C	0.1 K				0.5 K + 3 [8]				
		+100 ... +250°C	0.1 K				0.5% + 3 [8]				

1) At 0 ° ... + 40 °C
2) 0.1 ... 1x measuring range, 16 ... 50 Hz ... 100 kHz sine. See p. 36 for influences.
3) Measuring range for channels 1 and 2, whereby inherent deviation for channel 2 is twice that of channel 1 (channel 2: DC range to 300 V)
4) 16 A 30 s
5) with "Zero" key activated (lead compensation)
6) Smallest measurable frequency for sinusoidal meas. signal symmetric to zero point
7) Range 3 V ≃ : U_E = 0.3 $V_{eff/rms}$ ... 3 $V_{eff/rms}$
30 V ≃ : U_E = 3 $V_{eff/rms}$ ... 30 $V_{eff/rms}$
300 V ≃ : U_E = 30 $V_{eff/rms}$ ... 300 $V_{eff/rms}$
750 V ≃ : U_E = 300 $V_{eff/rms}$ ... 750 $V_{eff/rms}$
8) Plus sensor deviation
9) Without integrated reference junction; inherent deviation: +10 digits for T < 0 °C or +5 digits for T > 0 °C
10) Sampling rate dependent upon resolution: 0.5 s / 50 ms / 5 ms (without filter); filter ON: 3 Hz @ –3 dB
11) 4-wire: resolution 300.000, measuring range 300 Ω / 3 kΩ, inherent deviation ±(0.02% + 50 digits)

Key: rdg. = measurement value, R = measuring range, d = digit(s)

Measuring Voltage for Resistance Measurement



Voltage U_x at resistance to be measured R_x is dependent upon measuring range and display.

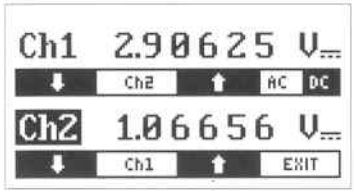
Display

LCD Matrix (128 x 64 pixels) with adjustable contrast and LED background illumination. Displays unit of measure, current type and various special functions.

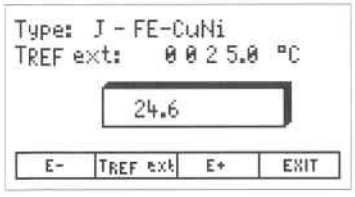
Number of Digits	3¾ ... 5¾ place
Overflow Display	">" is displayed
Polarity Display	"–" sign is displayed if pus pole at "⊥"
Sampling Rate	2/s. for Ω and °C: 1/s for F: dependent upon measurement value

Display Examples

Voltage Measuring Range



2 Channel Measurement with METRAtop® 52



Convenient Parameter Entry

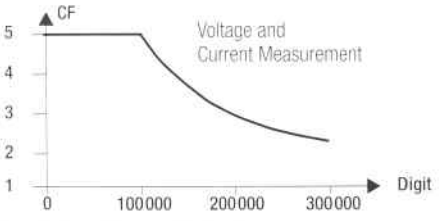
Influence Variables and Effects

Influence Variable	Influence Range	Measuring Quantity / Measuring Range [1]	Influence Effect ppm/K
Temperature	0 °C ... +21 °C and +25 °C ... +40 °C	V⎓	30
		V~	50
		300 µA / 3 mA / 30 mA ⎓	100
		300 mA / 3 A / 10 A ⎓	200
		300 µA / 3 mA / 30 mA ~	100
		300 mA / 3 A / 10 A ~	200
		300 Ω ... 3 MΩ	100
		30 MΩ	1000
		30 nF ... 300 µF	500
		Hz	50
		°C	100

Influence Variable	Influence Range max. resolution	Frequency	Inherent Deviation at Reference Value [2] ±(... % rdg. +... d)
Frequency V_{AC}	300.000 mV	> 15 Hz ... 30 Hz	2 + 100
		> 30 Hz ... 45 Hz	1 + 100
		> 45 Hz ... 1 kHz	0.5 + 50
		> 1 kHz ... 20 kHz	2 + 100
	3.00000 V 30.0000 V [4]	> 15 Hz ... 30 Hz	1.5 + 50
		> 30 Hz ... 45 Hz	0.5 + 50
		> 45 Hz ... 1 kHz	0.2 + 50
		> 1 kHz ... 20 kHz	0.5 + 50
		> 20 kHz ... 100 kHz	2 + 50
		> 100 kHz ... 300 kHz	10 + 50
	300.000 V [4] 750.00 V [4]	> 15 Hz ... 45 Hz	1.5 + 50
		> 45 Hz ... 1 kHz	0.2 + 50
		> 1 kHz ... 5 kHz	0.5 + 50
		> 5 kHz ... 100 kHz	5 + 50
Frequency I_{AC}	300.000 µA 3.00000 mA 30.0000 mA 300.000 mA	> 15 Hz ... 30 Hz	1.5 + 50
		> 30 Hz ... 45 Hz	0.75 + 50
		> 45 Hz ... 1 kHz	0.5 + 50
		> 1 kHz ... 5 kHz	0.75 + 50
		> 5 kHz ... 10 kHz	3 + 50
	3.00000 A 10.0000 A	> 15 Hz ... 30 Hz	1.5 + 50
		> 30 Hz ... 45 Hz	1 + 50
		> 45 Hz ... 1 kHz	0.75 + 50
		> 1 kHz ... 5 kHz	1 + 50
		> 5 kHz ... 10 kHz	5 + 50

Influence Variable	Influence Range		Measuring Quantity / Measuring Range [1]	Influence Effect [3]
Measuring Quantity Magnitude Waveform [3]	Crest factor CF	1 ... 3	V~, A~	± 1 % v. M.
		>3 ... 5		± 3 % v. M.

The allowable crest factor CF for the alternating magnitude to be measured is dependent upon the displayed value:



1) With zero balancing
2) Error messages are valid as of a display of 10 % of the measuring range
3) Except for sinusoidal waveform
4) **Limitation**: frequency x voltage max. 3 000 000 V x Hz

Influence from Mains Voltage	±5 digits
Influence of Channel 1 on Channel 2	typically 20 digits per mA DC for current measurement at channel 1

Influence Variable	Influence Range	Meas. Quantity / Meas. Range [1]	Influence Effect
Relative Humidity	75% 3 days Instrument off	V, A, Ω F, Hz °C	1 x inherent deviation

Influence Variable	Influence Range	Measuring Range	Attenuation dB
Common-Mode Interference Voltage *	Interference magnitude max. 1000 V ~	V ⎓	> 70
	Interference magnitude max. 1000 V ~ 50 Hz, 60 Hz sine	300 mV ... 30 V ~	> 60
		300 V ~	> 60
		1000 V ~	> 60
Series-Mode Interference Voltage *	Interference magnitude V ~ , resp. meas. range nominal value, max. 1000 V ~ , 50 Hz, 60 Hz sine	V ⎓	> 60
	Interference magnitude max. 1000 V —	V ~	> 60

* with activated filter only

Response Time

(after manual range selection)

Meas. Quantity / Measuring Range	Resp. Time	Measurement Quantity Jump Function 0 ... 80%	10 ... 100%	∞ ... 5%	∞ ... 50%
V ⎓ , A ⎓	2 s	•			
V ~, A ~	4 s	•			
CH2 300 mV	10 s	•			
CH2 3 V, 30 V, 300 V	4 s	•			
R 2-wire	2 s				•
R 4-wire	6 s				•
Continuity	< 10 ms			•	
⇻	2 s				•
30 nF, 300 nF, 300 µF	4 s	•			
3 µF	6 s	•			
30 µF	10 s	•			
3 mF	8 s	•			
30 mF	15 s	•			
3 kHz	1,5 s		•		
30 kHz, 300 kHz	3 s		•		
°C 2-wire	2 s	• TC			• RTD
°C 4-wire	6 s				• RTD

Digitalization Rate

Display resolution for current and voltage can be adjusted in accordance with the following table depending upon the sampling rate:

Display / Digits	300.000	30.000	3.000
Sampling Rate / Hz	2	20	200

Reference Conditions

Reference Temp.	23 °C ±2 K
Relative Humidity	45 ... 55 %
Meas. Quantity Frequency	45 ... 65 Hz
Meas. Quantity Waveform	Sine
Operating and Mains Voltage	230 V ±1%, 50 Hz
Warm-Up Time	30 min.

Power Supply

Mains	230 V ±10% Power consumption 18 VA_{max} 115 V ±10% *(optional)*
Storage Batteries	4 NiCd storage batteries (mini-cells)
Service Life	max. 8 hr. (4 hr. with LCD illumination)
Storage Batt. Test	⊣ symbol for low bat (battery voltage less than 4.8 V)

Fusing

Fuse Ranges

up to 300 mA

FF (UR) 1,6 A / 1000 V AC/DC; 6,3 mm x 32 mm; breaking capacity 10 kA at 1000 V AC/DC with resistive load; protects all current ranges up to 300 mA in combination with power diodes; accessible from outside

up to 10 A

FF (UR) 16 A / 1000 V AC/DC; 10 mm x 38 mm; breaking capacity 30 kA at 1000 V AC/DC with resistive load; protects 3 A and 10 A ranges

Electrical Safety

Protection Class	I per IEC 61010-1/DIN EN 61010-1/ VDE 0411-1	
Overvoltage Category	II	III
Operating Voltage	1000 V	600 V
Contamination Level	2	2
Test Voltage	5.55 kV~ per IEC 61010/VDE 0411-1	

Electromagnetic Compatibility EMC

Interference Emission	EN 50081-1:1992 / EN 55022:1987 Class B
Interference Immunity	EN 50082-1:1992 / IEC 801-2:1991 8 kV atmos. discharge / IEC 801-3:1984 3 V/m / IEC 801-4:1988 0,5 kV

Connections

Front Panel

Left:

4 x 4 mm safety jacks for DMM:
V, earth, A, mA (=Sense LO),
1x 4 mm safety jack: Sense HI or measuring channel 2

1x 1.6 A/500 V fuse holder

Right: (only METRAtop® 53 or METRAtop® 52 with calibrator)

4 x 4 mm safety jacks: Hi Lo (Sense) or
auxiliary voltage 12 V/24 V / Hi Lo (output)

Rear Panel

Mains Connection	Euro-plug
Interface	RS232, 9 pole port
Slot 1 for	8 channel measuring point switcher (scanner)
Slot 2 for	IEEE488 adapter, PC format

Data Interface

Type	RS232C, serial, per DIN 19241
Format	8 data bits, no parity, 1 stop bit
Baud Rate	9600 baud, 19,200 baud

Ambient Conditions

Operating Temperature Range	0 ... +50 °C
Storage Temperature Range	−25 ... +70 °C (without batteries)
Relative Humidity	max. 75%, w/o dewing
Climate Classification	2z/0/50/70/75 % in compliance with VDI/VDE 3540
Elevation	to 2000 m

Mechanical Design

Protection	Housing: IP 40, Housing rear panel and connections: IP 20
Dimensions	W x H x D: 221.5 mm x 88 mm x 332 mm
Weight	METRAtop® 51: approx. 2 kg METRAtop® 52: approx. 2 kg METRAtop® 53: approx. 2.5 kg

18 Maintenance

18.1 Storage Battery Operation (Option)

Attention!
Before replacing storage batteries, completely disconnect the instrument from all test lines and external power circuits.

The instrument requires 4 NiCd storage batteries, size IEC KR14.

18.2 Housing

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

18.3 Fuses

The instrument is equipped with fuses, which protect the measuring current circuit from overload caused by currents applied to the **A** and **mA** terminals.

The fuse for the A range is located within the instrument and is accessible after the housing has been opened.

Attention!
Before replacing the fuse, completely disconnect the instrument from all test lines and external power circuits.

- Loosen and remove the screw at the back side of the housing base with a phillips-head screwdriver (M3). Pull the housing back and away.
- Replace the fuse. See technical data in chapter 17 for fuse specifications.
- Replace the housing and fasten it with the previously removed screw.

Attention!
Be absolutely certain that only the specified fuses are used!
The use of a fuse with different triggering characteristics, a different nominal current or a different breaking capacity places the operator, as well as damping diodes, resistors and other components in danger.
The use of repaired fuses or short-circuiting of the fuse holder is prohibited.

19 Repair and Replacement Parts Service DKD Calibration Lab and Rental Instrument Service

When you need service, please contact:

GOSSEN-METRAWATT GMBH
Service Center
Thomas-Mann-Strasse 16 - 20
D-90471 Nuremberg
Telephone +49 911 86 02 - 410 / 256
Telefax +49 911 86 02 - 2 53
e-mail fr1.info@gmc-instruments.com

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

METRAtop® 51 ... 53 Guarantee

1 year materials and workmanship.

20 Product Support

If required please contact:

GOSSEN-METRAWATT GMBH
Product Support Hotline
Telephone +49 911 86 02 - 112
Telefax +49 911 86 02 - 709

DKD Calibration Certificate Reprints

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

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