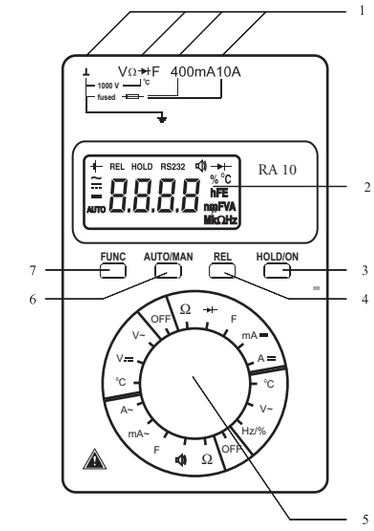
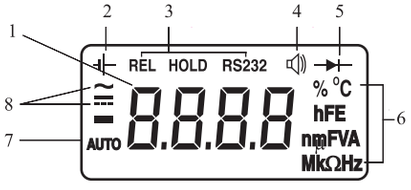
RA10

Digital Multimeters


1
VΩ→|F 400mA10A
1000 V
fused
REL HOLD RS232
RA 10
AUTO
% °C
hFE
nmFVA
MkΩHz
2
FUNC
AUTO/MAN
REL
HOLD/ON
7
6
3
4
OFF
Ω
F
mA
A
°C
V~
Hz/%
V~
V
°C
A~
mA~
F
Ω
OFF
5


2
3
4
5
1
REL HOLD RS232
8
7
AUTO
% °C
hFE
nmFVA
MkΩHz
6

RA **10 Operating Elements**

1 Terminal Sockets
2 LCD Display
3 Data HOLD/ ON Pushbutton
4 Pushbutton for Relative value
5 Function Selector Switch for ON/OFF and Measurement Function Selection
6 Pushbutton for Automatic or Manual range selection
7 Multifunction Pushbutton (yellow key)

Display

1 Digital Display with Indication of Decimal Point and Polarity
2 Low Battery Display
3 REL, HOLD, Display
4 Continuity Test Display : Buzzer Indication
5 Diode Measurement Display
6 Display for Unit of Measured Quantity
7 Display for Automatic Measuring Range Selection
8 Display of Selected Current / voltage Type

Contents **Page**

1 Safety Features and Precautions

You have selected an instrument which provides you with a high level of safety.
The RA 10 digital multimeter is manufactured in complaince with safety regulations. In case of incorrect use or careless handling, the safety of both user and multimeter is not assured.

To maintain the safe and proper condition of the meters and to ensure their safe operation, it is absolutely necessary to carefully and completely read these operating instructions before using any meter. These instructions must be followed in all respects.

Observe the following safety precautions :

* The meter must only be operated by persons who understand the danger of shock hazards and know how to apply safety precautions. Shock hazards exist anywhere, where voltages of more than 30 V (TRMS) may occur.
* Do not work alone in shock hazardous environment while carrying out measurement
* The maximum allowable voltage between any terminal sockets (1) and earth is equal to 1000 V. Voltages of greater than 500 V may only be applied to sockets " ", and "V" with the selector switch in the voltage measurement position (selector switch in "V" position).
* Take in to account that unexpected voltages can occur at devices under test (e.g. defective devices). For example, ⊥ capacitors can be dangerously charged.

* Verify that the test leads are in good condition, e.g. no cracked insulation, no open circuits in the leads or connectors.
* This meter must not be used for measurements on circuits with corona discharge (high-voltage).
* Be particularly careful when measurements are made in HF electrical circuits. Dangerous composite voltages may be present.
* Measurements under moist ambient conditions are not permitted.
* Do not exceed the permissible overload limits of the measuring ranges. Limit values can be found in the table "Measuring Ranges" in chapter 15 "Specifications".

* All current ranges are equipped with fuses. The maximum allowable voltage for the measuring current circuit (=nominal voltage of the fuse) is equal to 600 V~.
* **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 1000V.**

Meaning of symbols on the instrument

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

Earth

Repair, Parts Replacement and Calibration
After opening the meter, live parts may be exposed. Therefore, the meter must be disconnected from the measuring circuit prior to opening its case for repair, replacement of parts of calibration. If repair or calibration cannot be avoided unless the meter is open and live, this work must be performed by a qualified person who understands the danger involved.

Faults and extraordinary Stress
When it must be assumed that the safe operation is no longer possible, take the meter out of service and secure it against accidential use.

It is assumed that Safe operation is no longer possible,
* when the meter shows oblivious sign of damage,
* when the meter no longer functions correctly,
* after a prolonged storage under adverse conditions,
* due to severe stress due to transportation.

2 Initial Start-Up

Battery
Fit the meter with battery (batteries) provided along with the meter
please see chapter 16.1, page 27, before initial start-up of your instrument, or after a lengthy period of storage.

Switching the Meter ON
Turn the Function selector switch from the OFF position to the desired measuring function.
All of the segments of LCD are activated briefly.
A drawing of the LCD can be found on page 2.

☞ **Note !**
Electrical discharge and high frequency interference can cause incorrect displays, and may block the measuring sequence. To reset, switch the meter off, and then back on. If this procedure is unsuccessful, briefly disconnect the battery from the contact terminals.

⚠ **Attention !**
Before opening, disconnect the meter from the measuring circuit and observe chapter 16, page 27!

Automatic turn-OFF
Your meter switches itself OFF automatically after 15 minutes, if no keys or the selector switch have been activated during this time.

Switching the Meter back ON
Activate the HOLD/ON key.

Switching the Meter OFF
Turn the selector switch to the OFF position.

3 Selecting Measuring Functions and Ranges

3.1 Measuring Function Selection

The desired measuring function is selected with the Function selector switch (blue or yellow printing). In order to select the function printed in yellow half circle, the yellow multifunction key must also be pressed. If the multifunction key is pressed again, the function printed in blue half circle is reactivated.

3.2 Automatic Measuring Range Selection

These multimeters features autoranging for all measuring ranges except for the ranges 400 mV ~ and 10 A. Automatic selection is functional as soon as the meter is switched ON. According to the measured quantity applied, the meter automatically selects the measuring range which gives the best resolution.

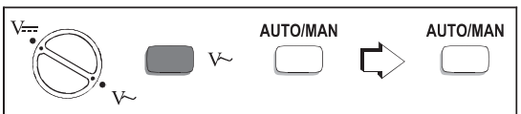
3.3 Manual Measuring Range Selection

You can switch OFF autoranging, select and fix the ranges manually according to the table given on page no. 10.

First select the desired measuring function with the function selector switch and, if appropriate, the multifunction key.

Briefly activate the AUTO/MAN key.

Manual mode is switched OFF if you press and hold the AUTO/MAN key until you hear a second acoustic signal, and the display switches to AUTO.
When switching back to automatic operation in the 400 mV~ range occurs, the 4 V ~ range is activated.



Example: manual meas. range selection for volts AC

⇓ AUTO/ MAN	Function	Acknowledge-ment	
		Display	Acoust. Signal
Brief	Manual Operation ON: Measuring Range is defined Switching Sequence at:		1 x
Brief	V ⎓ : 400 mV →4 V → 40 V → 400 V → 1000 V → 400 mV → 4 V → ... V ∼/: 4 V → 40 V → 400 V → 1000 V → 400 mV → ... mA ⎓ : 40 mA → 400 mA → 40 mA ... mA ∼/: 40 mA → 400 mA → 40 mA ... Ω : 40 MΩ → 400 Ω → 4 kΩ → 40 kΩ → 400kΩ → 4 MΩ → 40 MΩ...		1 x
Long	Return to Automatic Range Selection	AUTO	2x

Note : For Temperature (℃), Frequency (Hz), Duty cycle (%) and Capacitance (F) measuring range is always Auto. No manual range selection is possible.

4 Liquid Crystal Display

4.1 Digital Display

The digital display shows the measurement value, decimal point and sign. The selected measuring unit and function are displayed. When measuring DC quantities minus sign appears in front of the digits, if the positive pole of the measurement magnitude is applied to the " " input. "OL" appears if the measuring range upper limit is exceeded.

The digital display is updated thrice per second for V, A, W, Capacitance, Frequency & Duty cycle measurements.

5 Buzzer

The following steps are acknowledged by an sound signal :

* New measurement function selection
* Activation or deactivation of the following functions : AUTO/MAN, REL or HOLD
* **When measuring AC Voltage > 750 V, DC Voltage > 1000 V, AC/DC mA > 400.0 mA, AC/DC A > 10 A, the buzzer will keep sounding as the overload warning.**
* **Approximate 1 minute before the meter is auto power off, the buzzer will raise constantly 5 sounds to warning. Before the meter is power off, the buzzer will raise one long sound to warn the user.**

6 Measurement Value Storage "HOLD"

By pressing the HOLD/ON key, the currently displayed measurement value can be "held", and "HOLD" is simultaneously displayed on the LCD.

The Hold display is switched OFF if :

* the Hold key is reactivated
* the function selector switch is operated
* the yellow multi function key is activated for a change of function, e.g. AC ----> DC.
* REK key is activated.
* **AUTO/MAN key is activated**

7 REL - Relative value measurement

REL key is the key to measure relative value & it acts in activation. All functions can be used for Relative value Measurement except Hz / duty, diode & continuity function.

8 Voltage Measurement

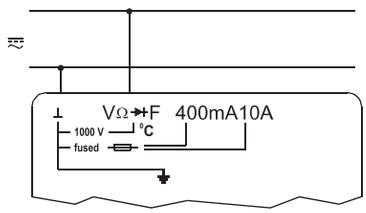
By pressing the HOLD/ON key, the currentl

➪ Connect the measurement cable as shown. Terminal "⊥" should be grounded, and the second measuring cable with a higher potential connected to Terminal "V".

☞ **Note!**
The measuring range 400 mV ~ can only be selected manually with the "AUTO/MAN" key!

⚠ **Attention!**
Make certain that the current ranges ("mA" or "A") are deactivated and that the measurement cables are connected to the correct terminals, "V and ⊥ ", before connecting your multimeter for the measurement of voltage! If the fuse tripping limit values are exceeded due to operator error, both the operator and the instrument are in danger! Observe the voltare limit values as printed on the meter !

Select the respective voltage type which corresponds to the measuring value by briefly pressing the yellow multifunction key. Each activation of the key causes alternate switching between AC and DC, as well as acknowledgment by means of an sound signal. The symbols ⎓ DC and ~ AC indicate the selected voltage type in the LCD display.
After selection of this function with the selector switch, the voltage type DC is always activated.



9 Current Measurement

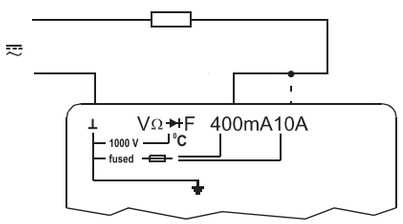
Attention!
First switch off the power supply to the measuring circuit and/or to the load, and discharge any capacitors which might be present.

a) Select function A with the function selector switch for currents > 400 mA, or function mA for currents < 400mA. When measuring currents of an unknown magnitude, select the highest measuring range first.
b) Select the function corresponding to the measured quantity by briefly pressing the yellow multi-function key. Each time the key is pressed, alternate switching takes place between AC and DC, and change over is acknowledge by sound signal. The symbols ⎓ DC and ~ AC indicate the selected current type in the LCD display.
After selection of this function with the selector switch, the Current type DC is always activated.
c) Connect the measuring instrument in series to the load as shown (without contact resistance).

Notes on Current Measurement :

* The meter must be used only in power systems, when the current circuit is protected with a 20 A fuse or circuit breaker, and the nominal voltage of the system does not exceed 600 V.
* Make the measuring circuit connections mechanically strong and secure, so that they do not accidently open. The conductor cross sections and connection points should be designed to avoid excessive heating.
* Current ranges up to 400 mA are protected with a FF1.6 A/ 600 V fuse.

* In the 400 mA measuring range an intermittent sound signal warns you, if the measurement values has exceeded the measuring range upper limit value.
* The 10 A current measuring range is protected with a 16 A/ 600 V fuse.
* If a fuse blows, eliminate the cause of the overload before placing the meter back into operation!
* Fuse replacement is described in chapter 16.2, page 28.



9.1 AC Measurement with (Clip-On) Current Transformers

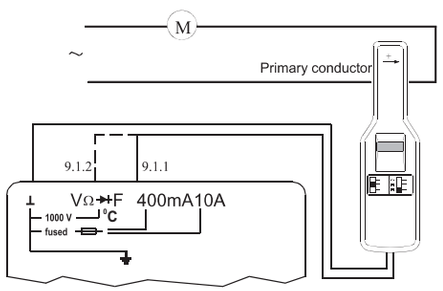
9.1.1 Transformer Output mA/A

Attention!
If current transformers are operated with an open circuit on the secondary side, e.g. due to defective or disconnected leads, a blown fuse in the meter or a wrong connection, dangerously high voltages can occur at the connections. For this reason, verify that the current circuit of the multimeter and secondary winding of transformer connected to the multimeter form an intact circuit. Connect the transformer to the sockets⊥ and mA or A

Some currents transformers include safety devices, which prevent dangerous voltage increases at open electrical circuits. The maximum allowable operating voltage at the primary conductor is equal to the nominal voltage of the current transformer. When reading the measurement value, consider the transformation ration of the transformer, as well as additional display error.

9.1.2 Transformer Output mV/A.

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



10 Diode Testing & Continuity Measurement

10.1 Diode Testing

Attention!
Verify that the device under test is electrically dead. External voltages would falsity the mesurement results!

* Set the function selector switch to "⊣⊢ ".
* Connect the device under test as shown.

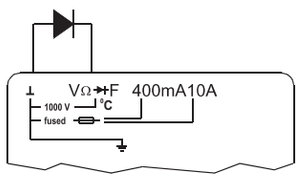
Conducting Direction and Short-Circuit
The measuring instrument displays the forward voltage in volts. As long as the voltage drop does not exceed the maximum display value of 1,000 V, you can test several elements connected in series.

Reverse Direction or Interruption
The measuring instrument displays a voltage of 'OL'

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

Conducting Direction

Reverse Direction



10.2 Continuity Testing

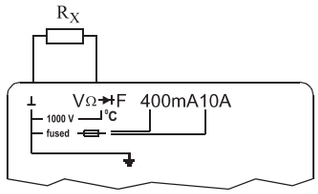
⚠ **Attention!**
Verify that the device under test is electrically dead. External voltages would falsify the measurement results!

* Set the selector switch to "⊣⊢"

Press the yellow multifunction key to switch to the continuity measuring range. Display of the 🔊 symbol is activated.

The instrument generates a continuous sound signal at a measured resistance of 0... approx. < 75 Ω.

* Connect the Device Under Test as shown.

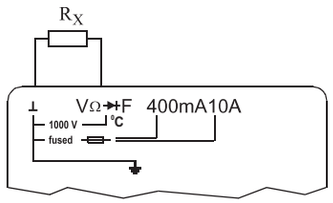


11 Resistance Measurement

Attention!

Verify that the device under test is electrically dead. External voltages would falsify the measurement results!

* Set the selector switch to " ⊣⊢ ".
* Connect the Device Under Test as shown.



Zero Adjustment (Relative mode)

In the measurement of resistance the inherent error of the meter and the resistance of leads can be eliminated by zero adjustment.

- Short the leads connected to meter
- Press REL key

The instrument acknowledges zero adjustment with a sound signal & value close to 00 & REL are displayed on LCD.

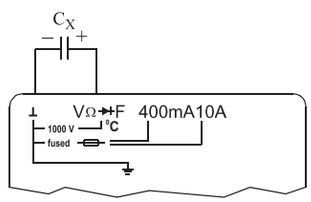
The resistance measured at the moment the REL key is pressed serves as a reference value. This value is then automatically subtracted from all measured value.

Deleting Zero Adjustment
Short the leads connected to meter and then press REL key.
or Activate the function selector switch.
or Switch the Multimeter off.

12 Capacitance Measurement

Attention!
Be absolutely certain that the device under test is electrically dead. External voltages would falsify the measurement results!

Set the function selector switch to "F"
Connect the (discharged!) device under test socket "⊥" and "F" with measurement leads. Polarized capacitors must be connected to the "⊥" socket at the " -- " pole.



Note!
Resistors and semiconductor paths in parallel to the capacitor falsify the measurement results!
To measure small value capacitors please use short measurement cables!
If ⊣⊢ is displayed the measured values are not valid.

Zero Adjustment (relative mode)
For the measurement of small capacitance values in the 5 nF and 50 nF ranges, the inherent error of the meter and the capacitance of the leads can be eliminated by zero adjustment.
- Connect the leads to the meter without without Device under test
- Briefly Press the REL key.
  The instrument acknowledges zero adjustment with an sound signal, and a value close to "00.00" and REL are displayed at the LCD. The capacitance measured at the moment the key is activated serves as a reference value. This value is then automatically subtracted from all measured values.

Deleting Zero adjustment
Press REL key
clearance is acknowledged by buzzer sound.
or Activate the function selector switch
or Switch the multimeter off.

13 Frequency & Duty Cycle Measurement

13.1 Frequency Measurement

a) **Set the function selector switch to V~/Hz/% and press Yellow multi-function key, as shown on page 21.**
The frequency measurement mode is activated. "Hz" symbol is displayed on the LCD. The digital display is expanded to 9999 digits. Only the auto mode is possible, no manual range is possible.

b) Connections are made the same way as for voltage measurement.

c) The lowest measurable frequencies and the maximum allowable voltages can be found in the chapter 15. "Specifications".

13.2 Duty Cycle Measurement

a) With duty cycle measurement, we can determine the ratio of pulse duration to cycle time of recurring square wave signals. The duty cycle that is the percentage pulse duration of signal is displayed on LCD i.e.

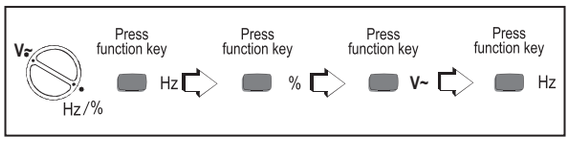
Note : The applied frequency must remain constant during the duty cycle measurement.

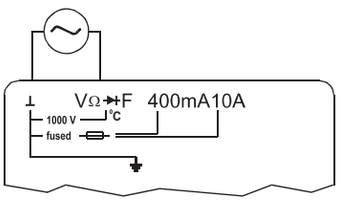
$$\text{Duty cycle (\%)} = \frac{\text{pulse duration}}{\text{cycle duration}} \text{ X } 100$$

b) Set the function selector switch to V~/Hz/% and press yellow multi-function key twice as shown on page 21.
The duty cycle (%) mode is activated. "%" symbol is displayed on LCD.

b) Connections are made the same way as for Voltage measurement

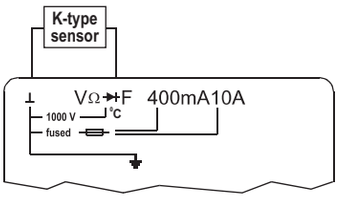
c) Measuring range for duty cycle and maximum allowable voltage can be found in chapter "Specification".





14 Temperature Measurement

RA - 10 allows you to measure temperature with K-type thermocouple (NiCr-Ni) in the range 0°C to +1300°C.
Set the function selector switch to "°C".
Connect the sensor as shown below.



15 Specifications

Meas. Function	Measuring Function	Resolution	Input Impedance V(AC) / V(DC)
V ⎓	400.0mV	100µV	>20MΩ
	4.000V	1mV	11MΩ
	40.00V	10mV	10MΩ
	400.0V	100mV	10MΩ
	1000V	1V	10MΩ
V ∼	400.0mV	100µV	11MΩ
	4.000V	1mV	11MΩ
	40.00V	10mV	10MΩ
	400.0V	100mV	10MΩ
	1000V	1V	10MΩ
			Approx. Voltage drop at max. meas. current
A ⎓	40.00mA	10µA	450mV
	400.0mA	100µA	4.2V
	10.00A [1]	10mA	750mV
A ∼	40.00mA	10µA	450mV
	400.0mA	100µA	4.2V
	10.00A [1]	10mA	750mV
			Open-circuit voltage
Ω	400.0Ω	100mΩ	approx 0.45V
	4.000kΩ	1Ω	
	40.00kΩ	10Ω	
	400.0kΩ	100Ω	
	4.000MΩ	1kΩ	
	40.00MΩ	10kΩ	
⧏))	400.0Ω	100mΩ	
→|←	1.000V	1mV	approx 1V
F	5.000nF	1pF	
	50.00nF	10pF	
	500.0nF	100pF	
	5.000µF	1nF	
	50.00µF	10nF	
	200.0µF	100nF	
			f_{min}
Hz [2]	10.000Hz	0.001Hz	10Hz
	100.00Hz	0.01Hz	10Hz
	1.0000kHz	0.1Hz	10Hz
	10.000kHz	1Hz	10Hz
	100.00kHz	10Hz	10Hz
	500.0kHz	100Hz	10Hz
%	2.0...98.0%	0.1%	---
			Sensor
℃	0...+1300 ℃	1°C	K-type NiCr-Ni

1) max. 10 A / 30 min. 12 A / 5 min. 16 A / 30 Sec
2) Indication for frequency measurement expanded to 9999 D

Meas. Function	Measuring Function	Digital display inherent deviation at reference conditions ± (...% of rdg + ...digits)	Overload capacity[1]	
			Overload value	Overload duration
V ⎓	400.0mV	0.75+2		
	4.000V	0.5+2	1050V(DC)	Continuous
	40.00V			
	400.0V			
	1000V			
V ∼	400.0mV	1.5+5	1050V(AC) rms	Continuous
	4.000V	1+5		
	40.00V			
	400.0V			
	1000V	1+10		
A ⎓	40.00mA	0.8+2	480mA	Continuous
	400.0mA			
	10.00A[4]	1.5+5	[4]	[4]
A ∼	40.00mA	1+5	480mA	Continuous
	400.0mA			
	10.00A[4]	2+5	[4]	[4]
Ω	400.0Ω	0.8+5	500V DC/AC rms	10 min
	4.000kΩ	0.8+2		
	40.00kΩ			
	400.0kΩ			
	4.000MΩ	1+5		
	40.00MΩ	2+5		
	400.0Ω	Acoustic signal for 0...<75Ω (approx)		
	1.000V	2+10		
F	5.000nF	3+40[3]	500V DC/AC rms	10 min
	50.00nF	2+10[3]		
	500.0nF	0.5+3[3]		
	5.000µF	1+2[3]		
	50.00µF	1.5+2[3]		
	200.0µF	5+10[3]		
Hz[5]	10.000Hz	0.2+2	≤1kHz : 1000V ≤10kHz : 400V ≤500kHz : 40V except 400mV	Continuous
	100.00Hz			
	1.0000kHz			
	10.000kHz			
	100.00kHz			
	500.0kHz			
%	2.0...98.0%	10Hz...1kHz : ±5D 1kHz...10kHz : ±5D/kHz		
℃	0...+1300 ℃	2+3	500V DC/AC rms	10 min

1) At 0 ℃... + 40 ℃
2) With zero adjustmet "REL".
3) Time required for measurement approximately 60 seconds.
4) max. 10 A/30 min 12 A/5 min 16 A/30 s
5) Indication of the frequency measurement expanded to up to 9999 digits

Reference Conditions

Ambient Temperature	+ 23 0C ± 2 K
Relative Humidity	45% ... 55%
Measuring Magnitude Frequency	Sine, 50 Hz
Measuring Magnitude Waveform	Sine
Battery Voltage	3 V ± 0.1 V

Ambient Conditions

Working Temperature Range	- 10 0C ... + 50 0C
Storage Temperature Range	- 25 0C ... + 70 0C
Climate Classification batteries)	2z/-10/50/70/75% (without
	in compliance with VDI/VDE 3540
Relative Humidity	45 ... 75%
Elevation	to 2000 m

Display

LCD display field (50 mm x 30 mm) with digital display and display of unit measure, current type and various special functions.

Digital

Display/Char. Height	7 segment digits / 10 mm
Number of Places	3 3/4 place 3999 steps
Overflow Display	"OL"
Polarity Display	"--" sign is displayed when plus pole is at " "
Measuring Rate	3 measurements/s

Influence Quantity and Effects

Influence Variable	Influence Range	Meas. Magnitude/ Measuring Range	Influence Effect
Temperature	0 °C ... +21 °C and +25 °C ... +50 °C	V ⎓	0.1 x intrinsic error/K
		V ∼	
		mA /A ⎓	
		mA / A ∼	
		Ω	
		F	
		Hz	
		Duty(%)	
		°C	

Influence Variable	Influence Range (max. resolution)	Frequency	Inherent Error at Ref. ±(... % of rdg. +... D)
Frequency V_{AC}	4, 40, 400 V	20 Hz ... < 50 Hz >750Hz... 1kHz	2 + 3
	400 mV,1000 V	20 Hz ... < 50 Hz > 50 Hz ... 500 Hz	2 + 3

Influence Variable	Influence Range	Meas. Magnitude/ Measuring Range	Influence Effect
Relative Humidity	55 ... 75%	V ≃ mA / A ≃ Ω F Hz (%) °C	1x Inherent Error

Influence Variable	Interference Magnitude	Measuring Range	Attenuation
Common mode Interference Voltage	1000 V DC/AC 50 Hz sine	all V DC	> 100 dB
	1000 V DC	all V AC	> 100 dB
	1000 V AC 50 Hz sine	400 mV / 4 V AC	> 80 dB
		40 V AC	> 63 dB
		400 V AC	> 43 dB
		1000 V AC	> 23 dB
Series-Mode Interference Voltage	max.1000 V AC 50/60 Hz sine	V DC	> 43 dB
	max.1000 V DC	V AC	> 55 dB

Aux. Voltage influence:
(without ⊣⊢ display) - all ranges except cap.: ± 8 D
cap.range: ± 20 D

Power Supply

Battery	**RA10** 2 x 1.5 V mignon cell zinc-carbon cell per IEC R6 alkaline manganese cell per IEC LR 6
Battery	RA **10** with zinc-carbon cell : approx. 300 hr. with alkaline manganese cell : approx. 600 hr.
Battery Test	Automatic display of the symbol " ⊣⊢ " when battery voltage falls below : approx. 2.4 V

Fuse

Fuse for ranges up to 400 mA	FF 1.6 A / 600 V; 6.3 mm x 32 mm; protects all current measuring ranges up to 400 mA
Fuse for 10 A Range	FF 16 A / 600 V; 6.3 mm x 32 mm; protects all current measuring ranges up to 10 A.

Electrical Safety

Test Voltage	3.7 kV~

Mechanical Design

Protection	For meter : IP 50 For Terminals : IP 20
Dimensions	W x H x D 92 mm x 154 mm x 25 mm
Weight	approx. 0.2 kg with battery

16 Maintenance

Attention :
Disconnect the instrument from the measuring circuit before opening the instrument to replace the battery or the fuse !

16.1 Battery

Before initial start-up, or after storage of your instrument, make sure that no leakage has occurred at the instrument battery. Repeat this inspection at regular intervals.
If battery leakage has occurred, electrolyte from the battery must be carefully and completely removed and a new battery must be installed, before the instrument can be placed back into operation.
If the " ⊣⊢ " symbol appears in the LCD display, you should change the battery as soon as possible. You can continue to take measurements, but reduced measuring accuracy may result.

Replacing the Battery(ies)

The housing base must be removed from the instrument in order to replace the battery(ies).

Press the tab located beneath connector jacks with a test probe, a banana plug or a similar object in the direction indicated by the arrow as shown on the housing base, and remove the base.

RA 10

Remove the battery from the battery compartment.
Insert two new 1.5 V mignon cells in accordance with the polarity symbols in the battery compartment.
Place both battery cables between the cells before closing the housing in order to prevent pinching of the cables.

Replace the housing base and press until it snaps audibly into place.
Dispose of the dead battery in an environmentally sound fashion.

16.2 Fuses

The 16 A fuse interrupts the 10 A current measuring range, and the 1.6 A fuse the mA current measuring ranges. All other measuring ranges continue to function.
If a fuse blows, eliminate the cause of the overload before placing the instrument back into operation!

Replacement of Fuses

Open the instrument as described under battery replacement.
Remove the defective fuse with the help of, for example, a test probe, and replace it with a new fuse.
Make certain that the new fuse makes good contact.
The following fuses may be used :

* for current measuring ranges up to 4mm mA :
  type FF 1.6 A / 600 V~ ; 6.3 mm x 32 mm
* for the 10 A measuring range :
  type FF 16 A / 600 V~ ; 6.3 mm x 32 mm

Attention!
Be absolutely certain that only the specified fuses as above are used. The use of fuse with different specifications may place the operator, the system & measuring instrument in danger. The use of repaired fuses or short-circuting of the fuse holder is prohibited.

Fuse Testing

Set the selector switch to " ⊣◀ ".
press yellow function key to select " 🔊 "
Plug the measurement cable into the "V,Ω, ⊣◀ , F" socket.
Contact the mA socket with the other end of the measurement cable. A continuous audible signal and the display of approx. 10.2 Ω, indicate that the fuse for the mA current range is OK.
Contact the A socket with the other end of the measurement cable. A continuous audible signal and the display of approx. 0.0Ω, indicate that the fuse for the A current range is OK.

If a value other than those indicated above, of if overflow ("OL") is displayed, the corresponding fuse must be replaced.

16.3 Housing

No special maintenance is required for the housing. Excessive contamination has an adverse effect on isolation and reduces input resistance. The surface must be kept clean for this reason. Use a slightly dampened cloth for cleaning. Avoid the use of cleansers, abrasives or solvents.

17 Repair and Replacement parts service

When you need service, please contact :