

L

L

User Manual



RISH Multi 20
Analog-Digital Multimeter

15030898
REV. - D

Rishabh Instruments Pvt. Ltd.

Factory:

A-31, MIDC, Satpur, Nashik-422 007 India

Phone (0253) 2202202, 2202162

Fax : 91 - 0253 - 2351064, 2202302

E-mail : info@rishabh.co.in

Website : www.rishabh.co.in

Mumbai Office :

A-54, MIDC, Marol Ind. Estate,
Andheri (East), Mumbai - 400 093

Phone : (022) 56921425 / 6

Fax : 91 - 22 - 56921427

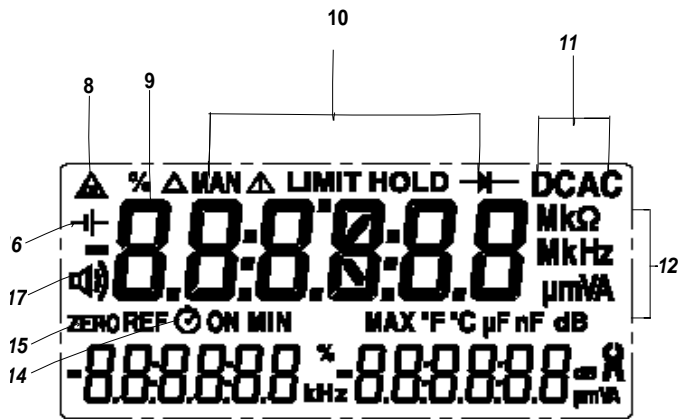
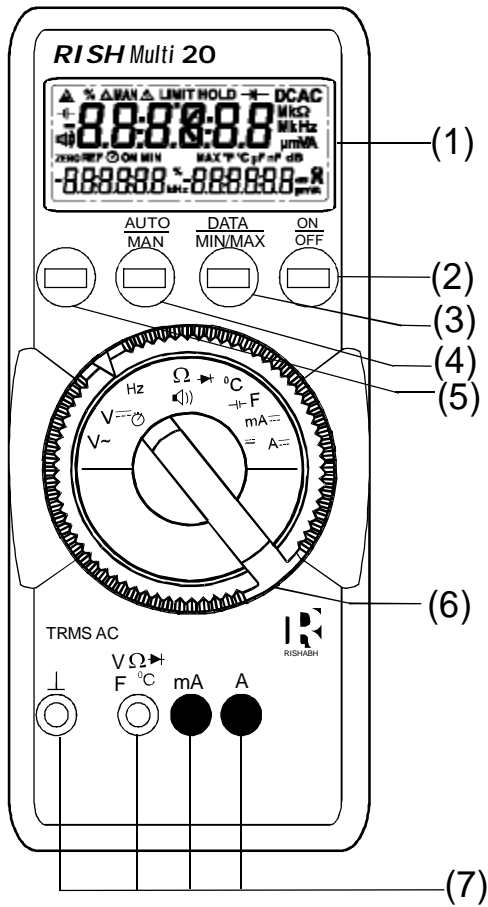


Printed in India, Subject to change without Notice

└

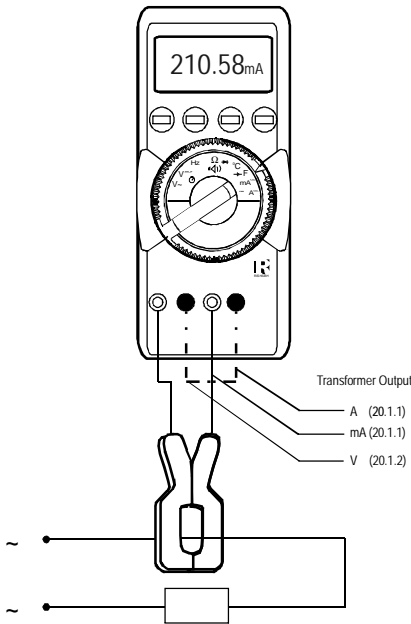
└

L



┌

AC current measurement with (clip-on) current transformers



- (1) Liquid crystal display
- (2) ON / OFF pushbutton
- (3) Pushbutton for data hold and MIN/MAX storage functions
- (4) Pushbutton for manual range selection
- (5) Multi-function pushbutton
- (6) Function selector switch
- (7) Terminal sockets with automatic blocking system
- (8) symbol for "CONTINUOUSLY ON"
- (9) Digital display with indication of decimal point and polarity
- (10) Symbols for displaying selected functions
- (11) Display for selected function
- (12) Display for the unit of measured quantity
- (13) Activated stop watch indicator
- (14) Zero adjust indicator
- (15) Low battery indicator
- (16) Buzzer indication

Contents

1. Safety features and safety precautions.....	4
2. Switching the meter on.....	5
3. Function and range selection.....	6
3.1 Autoranging.....	6
3.2 Manual range selection.....	6
4. Triple Digital Display	7
4.1 Backlit	7
5. "DATA" hold / compare facility.....	8
6. Minimum value and maximum value "MIN/MAX" storage facility with time display.	9
7. Voltage measurement.....	11
7.1 Voltage measurement on electrical systems up to 1000 V with the KS30 measuring adapter.....	11
8. Current measurement	13
AC current measurement with (clip-on) current transformers.....	14
9. Resistance measurement and continuity test.....	15
10. Diode test and continuity test.....	17
11. Capacitance measurement.....	17
12. Frequency measurement.....	18
13. Temperature measurement.....	18
14. Stop watch.....	19
15. Specifications.....	20
16. Maintenance.....	28
16.1 Battery.....	28
16.2 Fuses.....	28
16.3 Case.....	29
17. Repair and replacement parts service	29
18. Appendix.....	29

1. Safety features and safety precautions

You have chosen a meter which offers you a very high degree of safety. The analog/digital multimeter *RISHM* ~~20~~ is manufactured in compliance with the safety standard IEC 61010-1:2001 / DIN 61010-1:2001.

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.

For your safety and for protection of the meter, the *RISHM* ~~20~~ multimeter is fitted with an automatic terminal blocking system. It is coupled with the function selector switch, which blocks the terminal sockets not necessary for measurement.

Please note 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 wherever voltages of more than 30 V (TRMS) can appear.
- Do not work alone in shock hazardous environment while carrying out measurement.
- The maximum permissible voltage between any of the terminal sockets (7) and ground is 1000 V.
- Take into account that unexpected voltages can occur on devices under test (e.g. defective instruments). Capacitors may be charged to a dangerously high voltage, for instance.
- 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 measuring on HF circuits. Dangerous composite voltages may exist there.
- Measurements under moist environmental conditions are not permitted.
- *Do not exceed the permissible overload limits of the measuring ranges.* See Table "Measuring ranges" under "15. Specifications".
- All current measuring ranges, are fused. The maximum permissible voltage of the measuring circuit (= nominal voltage of the fuse) is 1000 V AC/DC on the "mA" ranges, "A" ranges.
- You must only use the meter in *power systems*, when the current circuit is protected by a *fuse* or a *circuit breaker* of 20 A, and when the nominal *voltage* of the system does not exceed 1000 V.

For safe voltage measurements on power systems, up to 1000V we recommend the *KS30* measuring adapter, which is available as accessory. Its internal resistance limits the measuring current in the case of overvoltage and incorrect operation and safely suppresses sparking from spark gaps. Also refer to Section "7.1 Voltage measurement on electrical systems up to 1000V with the *KS30* measuring adapter".

Fuse replacement

⇒ Open the meter same as for battery replacement.

⇒ Remove the blown fuse, e. g. with the aid of a probe, and replace it with a new one.

Permissible types

-for current measuring ranges up to 300mA

Type FF(UR) 1.6A / 1000V AC/DC; (10kA); 6.3mm x 32mm

-for the 10A current measuring ranges:

Type FF(UR) 16A / 1000V AC/DC; (30kA); 10mm x 38mm

Caution:

Absolutely verify that only the specified fuse is installed!

If a fuse of other cut-out capacity, other nominal current or other switching capacity is used, a dangerous situation exists for you, and there is danger of damaging protective diodes, resistors or other components.

The use of mended fuses or shorting of the fuse holder is not permissible.

16.3 Case

Special maintenance of the case is not required. Take care that the surface between the connection sockets is clean. For cleaning take a moist cloth. Avoid scrubbing.

17. Repair and replacement parts service

When you need service, please contact:

RISHABH INSTRUMENTS PVT. LTD.

F-31, M.I.D.C. Area,

Satpur, Nashik - 422 007.

Maharashtra, India.

Tel : +91-253-2202202, 2202160

Fax : +91-253-2351064, 2202302

E-mail : service@rishabh.co.in

18. Appendix

18.1 AC current measurement with (clip-on) current transformers

18.1.1 Transformer output mA/A

Caution:

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 connectors. Therefore, verify that the current circuit of the meter and the secondary winding of the transformer connected to the meter form an intact circuit. Connect the transformer to the sockets \perp and mA and/or A.

The maximum permissible operating voltage is the nominal voltage of the current transformer. When reading the measured value, take into account the transformer ratio and the additional error in indication.

18.1.2 Transformer output V

Several transformers are fitted with a voltage output (designation mV/A).

The secondary output must therefore be connected to the connection sockets \perp and V.

Ambient conditions

Functional temperature range	-20 °C... + 50 °C
Storage temperature range	-25 °C...+70 °C
Climatic class	2z/-20/50/70/75 % with reference to VDI / VDE 3540
Altitude	up to 2000 m

Mechanical configuration

Protection type	IP 50 for the connection sockets IP 20 according to DIN VDE 0470 Part 1 / EN 60529
Dimensions	84 mm x 195 mm x 35 mm
Weight	350 g approx., including battery

16. Maintenance

Caution:

Disconnect the meter from the measuring circuit before you open it to replace the battery or the fuse!

16.1 Battery

Prior to initial start-up, or after storage of your meter, verify that the battery of your meter does not leak. Repeat this check in regular short intervals. If the battery leaks, completely remove the battery electrolyte carefully with a moist cloth and install a new battery before you operate your meter again.

When the symbol "⊕" (17) appears on the LCD (1), replace the battery as soon as possible. You can continue to measure, but a reduced measuring accuracy must be taken into account.

The meter operates with a 9 V flat cell battery according to IEC 6 F 22 or IEC 6 LR 61 or with a suitable NiCd storage battery.

Replacing the battery

⇒ Place the meter on its face, loosen the two screws on the rear and remove the lower part of the case, lifting it from the bottom. The lower and the upper part of the case are fixed together at the top on the front by means of detent hooks.

⇒ Remove the battery from the battery compartment and carefully disconnect the contacts from the battery.

⇒ Snap the connection contacts to a new 9V battery and insert the battery into the battery compartment.

⇒ Replace the lower part of the case. Start at the top on the front and take care that the detent hooks are properly engaged at this point.

⇒ Tighten the lower part with the two screws.

⇒ Please destroy the batteries in an environmental friendly way.

16.2 Fuses

A blown fuse is signalled on the LCD display the instant a measured quantity having a voltage of more than 4 V is applied to the corresponding connection sockets. Then, the digital display (9) shows „FUSE“.

The 16 A fuse interrupts the 10 A range, the 1.6 A fuse all other current measuring ranges. All other measuring ranges continue to function. When a fuse blows, first eliminate the cause of the overload before using the meter again!

Meaning of the symbols on the device



Warning of a danger point
(Attention, refer to documentation)



Ground connector



Double or reinforced all-insulation

Repair, replacement of parts and calibration

When 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 or calibration. If repair or calibration cannot be avoided unless the meter is open and live, this work must only be performed by a qualified person who understands the danger involved.

Faults and extraordinary stress

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

It is assumed that safe operation is no longer possible,

- when the meter shows obvious signs of damage,
- when the meter no longer functions correctly,
- after prolonged storage under adverse conditions,
- Due to severe stress during transportation.

2. Switching the meter on

Battery

Fit the meter with 9 volt flat cell battery provided along with the meter.

Before you use the meter for the first time or after storage, absolutely refer to Section "16.1" Maintenance Battery".

Switching the meter on

⇒ Press the "ON/OFF" pushbutton (2).

Switch-on is acknowledged by a sound signal. As long as you keep the push-button pressed, all segments of the liquid crystal display (LCD) will appear. The LCD is shown on page 2.

After the pushbutton is released, the meter is ready for operation.

Note:

Electric discharges and high frequency interference may cause incorrect information to be displayed and block the measuring process. Reset the meter by switching it OFF and ON again. Otherwise, check the battery connections.


Disconnect the meter from the measuring circuit before you open it and see section "16: Maintenance"!

Automatic turn-off

Your meter turns off automatically, when the measured value remains constant (variations of the measured value $\leq \pm 20$ digits) for about 10 minutes and when neither a pushbutton nor the function selector switch is operated during that time.

How to prevent automatic turn-off

Switch your meter to "CONTINUOUSLY ON" mode.

⇒ To do this, press the yellow multi-function pushbutton (5) and the "ON/OFF" pushbutton (2) together. The function "CONTINUOUSLY ON" is shown on the LCD (1) by the  symbol (8).

Turning the meter off

➔ Press the "ON/OFF" pushbutton (2).

3. Function and range selection

The function selector switch (6) is coupled with the automatic terminal blocking system which only allows access to two correct sockets for each function. Prior to switching to the "mA" or "A" functions or from the "mA" or "A" functions, remove the test lead from the corresponding socket. When the test leads are plugged-in, the terminal blocking system prevents accidental switching to non-permissible functions.

3.1 Autoranging

The multimeter features autoranging for all measuring ranges except for temperature measurement and diode test. Autoranging is automatically selected after switching the meter ON. According to the measured quantity applied, the meter automatically selects the measuring range which gives the best resolution. When switching to frequency measurement the previously selected voltage measuring range is maintained.

The meter switches automatically to:

- the next higher range at $\pm (309999 \text{ digits} + 1 \text{ digit})$

- the next lower range at $\pm (28000 \text{ digits} - 1 \text{ digit})$

For capacitance measurement the change of switchover occurs

at 2999 digits + 1 digit
and 280 digits - 1 digit

3.2 Manual range selection

You can switch off autoranging and select and fix the ranges manually according to the table on the following page.

Manual mode is switched OFF when you press pushbutton AUTO/MAN (4) for approximately 1s, when the function selector switch (6) is operated, or when you turn the meter OFF and ON again.

↓ AUTO/ MAN (4)	Function	Acknowledge- ment	
		Display	Sound signal
Short	Manual mode on : Used range is fixed	MAN (10)	1x
Short	Switching sequence at: V: 300mV→3.0V→30V→300 V→ 1000 V→ 300mV→... dB : = the switching sequence at V~ mA: 300uA→3mA→30mA→300mA 300uA... A: 10A Ω: 30MΩ→300Ω→3.0kΩ→300kΩ→3.0 MΩ 30MΩ→... F: 3.0nF→30nF→300nF→3.0μF→ 30μF→ 300 μF→ 3000 μF→ 30000 μF→3.0 nF...	MAN (10)	1x
Long	Return to autoranging	-	2x



Response time (after manual range selection)

Measured quantity/ measuring range	Response time	Step function of the measured quantity
V $\overline{\sim}$, V \sim , A $\overline{\sim}$, A \sim	1.5 s	from 0 to 80 % of upper range limit
300Ω...3.0MΩ	2s	from ∞ to 50 % of upper range limit
30 MΩ	5s	
→+	1.5s	
3.0nF...300 μF	max. 3s	from 0 to 50 % of upper range limit
3000 μF	max. 7s	
30 000 μF	max. 14s	
300Hz,3KHz	max.2s	
30 KHz,300 KHz	max.0.7s	
°C	max. 3s	

Power supply

Battery	9V flat cell battery; manganese-dioxide cell according to IEC 6 F 22, alkaline-manganese cell according to IEC 6 LR 61 or suitable NiCd storage battery
Lifespan	Without Backlit, using alkaline-manganese cell: approx. 60 hours on V $\overline{\sim}$ approx. 40 hours on V \sim , A \sim , A $\overline{\sim}$
Battery test	automatic display of the "⊕" symbol, when the battery voltage drops below approx. 6 V.

EMC

Emission	Electromagnetic compatibility EN 61326 : 2002 Class B	
Immunity	EN 61326 : 2002	
	IEC 61000-4-2	8kV atmosphere discharge 4kV contact discharge
	IEC 61000-4-3	3V/m

Fuses

Fuse for the FF1.6 A /1000 V:	6.3 mm x 32 mm; rating 10 kA with 1000 V AC/DC and ohmic load; in conjunction with power diodes protects all current measuring ranges up to 300 mA.
Fuse for the ranges up to 300 mA	16A/ 1000 V AC/DC; 10 mm x 38 mm; rating 30 kA with 1000 V AC/DC and ohmic load; protects the 10 A ranges up to 1000 VAC/DC ; see "18. Maintenance" for manufacturers and types of fuses.
Fuse for the ranges up to 10 A	



Influence quantity	Range of influence	Measured quantity/ measuring range1)	Variation
Battery voltage	± ⁵⁾ ... < 7,9 V > 8,1 V ... 10,0 V	V $\overline{\text{=}}$	±15 Digits
		V \sim	±30 Digits
		A $\overline{\text{=}}$	±20 Digits
		A \sim	±40 Digits
		Ω	±40 Digits
		3.0nF ... 30mF	±50 Digits
		Hz	±10 Digits
	°C	±40 Digits	
Relative humidity	75% 3 Days meter off		±1 Digit
MIN / MAX	-	V AC/DC	±2 Digits
	-	A AC/DC	±2 Digits
DATA	-		±1 Digit
	-		±1 Digit

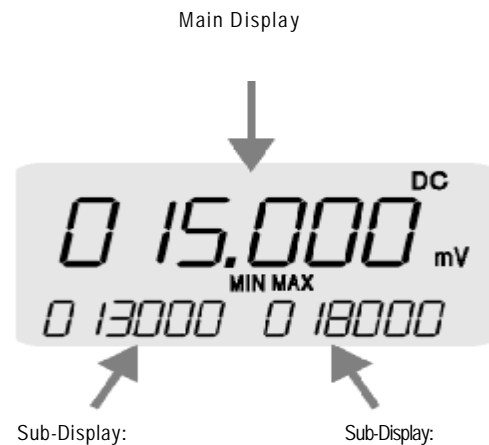
- 1) With zero adjustment
- 2) With temperature: Error data apply per 10 K change in temperature.
With frequency : Error data apply to a display of 10 % of the measuring range.
- 3) With unknown waveform (crest factor CF > 2), measure with manual Range selection.
- 4) With the exception of sinusoidal waveform
- 5) After the "±" symbol is displayed.

Influence quantity	Range of influence	Measuring ranges	Attenuation
Common mode interference voltage	Noise quantity max. 1000 V \sim 50 Hz, 60 Hz sinusoidal	V $\overline{\text{=}}$	>120 dB
		300 mV...	> 80 dB
		300 V \sim	> 70 dB
		1000V \sim	> 60 dB
Normal mode interference voltage	Noise quantity V \sim , value of the measuring range at a time, max. 1000 V \sim , 50 Hz, 60 Hz sinusoidal	V $\overline{\text{=}}$	> 50dB
		V \sim	> 110 dB

4. Triple Digital Display

The three digital displays, one main display and two sub-displays, show the measurement value with correct deci-mal point and sign. The selected unit of measure and the current type are also displayed. A minus sign appears in front of the number for the measurement of zero-frequency direct quantities, if the positive pole of the measured quantity is applied to perpendicular input.

OL" (overload) is displayed, if the actual value falls below the measuring range lower limit for the following measured quantities: VDC, IDC, VAC, IAC, mAAC, mADC, capacitance, Ω , Hz: 309999
Refreshing of the digital display occurs at different intervals for the various measured quantities ..



Although the main display is activated immediately after the multimeter is switched on, the two sub-displays must be activated with the MIN/MAX key. This prevents the continuous display of an undefined condition which was present at the start of measurement, e.g. open-circuit, as a maximum value.

4.1 Backlit

The instrument is provided with user selectable Backlit for measurements in poor light conditions or dark area.

Switching the Backlit ON and OFF:

By pressing "AUTO/MAN" and "DATA/MIN/MAX" keys simultaneously the Backlit can be switched ON.

And by pressing the same keys simultaneously Backlit can be switched OFF.

5. "DATA" (hold & compare) facility.

Measurement values can be automatically "frozen" with the DATA (Hold) function. This can be especially useful when your full attention is required for testing the measuring point with the test probes.

After the measurement value has been acquired, and the appropriate "condition" has been fulfilled according to the following table, the measurement value is displayed in the left hand sub-display and two acoustic signal sounds. At the same time "MAN" appears and indicates that the measuring range is now set. The test probes can now be removed from the measuring point and the measurement value can be read from the sub-display. If the measurement value lies below the limit value shown in the table, the instrument is reactivated for the storage of a new value; the "DATA" display blinks.



Comparison of measurement values (DATA Compare)
 If the newly stored measurement value deviates less than 0.33% of the measuring range from the first measurement value, the acoustic signal (DATA Compare) sounds twice. If it deviates more than 0.33% from the measuring range, only a brief signal sounds.

Function DATA	DATA MIN/MAX (3)	Condition		Meter reaction Display		
		Measuring ranges	Limit of measured values (digits)	Meas. value digital	DATA	Sound signal
Activate	short				Flashes	1X
Store		V, dB ⁽²⁾ , A, Hz Ω, F	>280000 <0L >28000	dis- played	dis- played	1x 2x ⁽⁴⁾
Reactivate		V, dB ⁽²⁾ , A, Hz Ω, F	>280000 <0L >28000	stored mea- sured value	Flashes	
Reset	long			cleared	cleared	2x

Influence quantities and variations

Influence quantity	Range of influence	Measured quantity/ measuring ranges ¹⁾	variation ²⁾ ±(... % of rdg. + ... digits)
Temperature	-10 °C ... +21 °C and +25°C ... +40 °C	V $\overline{\sim}$	0.05+3
		V $\overline{\sim}$, V $\overline{\sim}$	0.2+3
		300µA...300 mA $\overline{\sim}$	0.2+3
		300µA... 300 mA $\overline{\sim}$	0.3+3
		10 A $\overline{\sim}$ 10 A $\overline{\sim}$	0.5+3
		300 Ω	0.1+5
		3.0k...3.0MΩ	0.1+3
		30 MΩ	0.6+3
		3.0nF... 30.0µF	0.5+3
		30.0µF...30.0mF	2.0+3
		Hz	0.1+3
		-200 ... +200 °C	0.5 Kelvin + 2 Digit
+200 ... +850 °C	0.5+2		
Frequency of the measured quantity	25 Hz... < 45 Hz	300 mV $\overline{\sim}$	1.0+20
	> 65 Hz...200 Hz		1.0+20
	25 Hz... < 45 Hz	3... 300 V $\overline{\sim}$	1.0+20
	> 65 Hz... 400 Hz		0.5+20
	> 400 Hz... 1kHz		0.5+20
	>1 kHz... 20kHz		0.5+20
	25 Hz... < 30 Hz	1000 V $\overline{\sim}$	1.0+20
	30 Hz... < 45 Hz		0.5+20
	> 65 Hz... 1 kHz		2.0+20
	15 Hz... < 45 Hz	A $\overline{\sim}$	1.0+20
>65 Hz... < 1 kHz	1.0+20		
Waveform of the measured quantity ²⁾	Crest-factor CF > 3 ... 5	V $\overline{\sim}$ ⁽⁴⁾ , A $\overline{\sim}$ ⁽⁴⁾	±1% of rdg
			±3% of rdg
The permissible crest factor CF of the AC quantity to be measured function of the displayed value:			
Voltage measurement		Current measurement	

Reference conditions

Ambient temperature:	+23 °C ±2 K
Relative humidity:	45 % ... 55 % RH
Frequency of the measured quantity:	45 Hz ... 65 Hz
Waveform of the measured quantity:	sinusoidal
Battery voltage:	8V±0,1V

- 1) Reactivate by falling below the specified limits of the measured value
 - 2) Referring to AC values.
 - 3) When storing a value for the first time twice sound
- For following "Holds" only twice if actual hold value differs from first stored value by less than 100 digits.
- The analog indication is not influenced by DATA hold. You can still read the actual measured value. Note that with a "held" digital display, the location of the decimal point is also held.
- As long as the DATA hold function is active, manual range selection is not possible.
- The DATA hold function is switched off, when the "DATA" push button (3) is pressed for approximately 1s, when the function selector switch (6) is operated, or when meter is turned OFF and ON again.

Display

Liquid crystal display section (65 mm x 30 mm) with analog indication and digital display and with display of the unit of measured quantity, function and various special functions.

Digital:

Display / Height of numer.	7-segment numerals / 12 mm
Number of digits	5 3/4 digits = 31 0000 counts
Overrange Indication	"OL" is displayed
Polarity Indication	"-" sign is displayed, when the positive pole is at "1"
Sampling rate	10 readings / sec

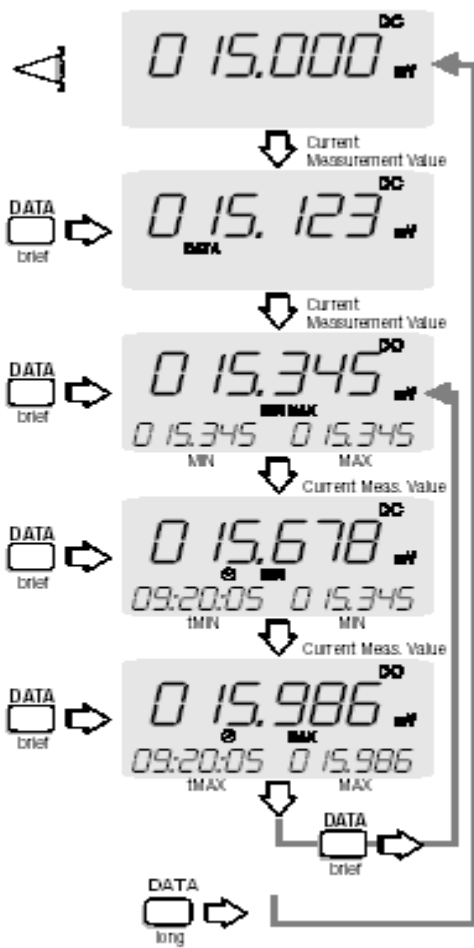
6 Minimum and Maximum Value Storage "MIN-MAX" with Time display.

Minimum and maximum values can be read out at the sub displays for long-term observation of measured quantities.

1. If the DATA|CLEAR key is activated twice, current MIN and MAX values are displayed at the sub-displays.
 2. Press the DATA|CLEAR key again to display the MIN value and the time of occurrence.
 3. If the DATA|CLEAR key is once again activated, the MAX value and the corresponding time of occurrence are displayed.
- MIN and MAX values are deleted by pressing and holding the DATA|CLEAR key (approx. 1 s), by activating the rotary switch or by switching the instrument off and back on again.

Function MAN/MAX	↓ DATA MIN/MAX (3)	Measured values MIN and MAX / Elapsed times	Meter reaction Display		
			Measured value digital	MIN/ MAX	Sound signal
1. Activate and store	2 x short	stored	Current measurement value	Min & Max	1x
2. Store and display	short ↓	stored		t & Min	1x
	short ↓		t & Max	1x	
3. Return to 1.	short	stored	same as 1.	same as 1.	1x
Reset	long	cleared	cleared	cleared	2x


Note!
No new MIN-MAX values are determined for that measurement values can stabilize.



Intrinsic error of digital display at reference conditions (...% of rdg+...% of rng)	Overload capacity ⁷⁾	
	Overload value	Overload duration
2.5+0.2 ⁷⁾	1000 V DC AC rms sine	10 Sec
1.2+0.2		
1.2+0.2		
1.2+0.2		
3.2+1.0		
3.2+1.0		
3.2+1.0		
(...% of rdg+ Digits)	≤ kHz 1000V ≤ 30kHz 300V ≤ 100kHz 30V	Continuous
0.1+3 ⁷⁾		
0.1+3 ⁷⁾		
0.05+3 ⁷⁾		
0.05+3 ⁷⁾	1000V	Continuous
± 20 Digits		
1Kelvin +3 ⁸⁾	1000 V DC AC rms sine	10 Sec
1% + 3 ⁸⁾		
1Kelvin +3 ⁸⁾		
1% + 3 ⁸⁾		

7) Vac > 1V_{eff/rms}

8) Without sensor.

Measurement function	Measuring range	Resolution	Discharge resistance	U_{0max}	
F	3.0 nF	1 pF	10 M Ω	3 V	
	30 nF	10 pF	10 M Ω	3 V	
	300 nF	100 pF	1 M Ω	3 V	
	3.0 μ F	1 nF	100 k Ω	3 V	
	30 μ F	10 nF	11 k Ω	3 V	
	300 μ F	100 nF	2 k Ω	3 V	
	3000 μ F	1 μ F	2 k Ω	3 V	
	30000 μ F	10 μ F	2 k Ω	3 V	
			$f_{min}^{(6)}$		
Hz	300.00 Hz	0.01 Hz	10 Hz		
	3.0000 kHz	0.1 Hz	100 Hz		
	30.000 kHz	1 Hz	100 Hz		
	300.00 kHz	10 Hz			
	100 min ²⁾	10 ms			
$^{\circ}$ C	Pt 100	-200.0... +100.0 $^{\circ}$ C	0.1 $^{\circ}$ C	-	-
		+100.0... +850.0 $^{\circ}$ C	0.1 $^{\circ}$ C	-	-
	Pt 1000	-100.0... + 100.0 $^{\circ}$ C	0.1 $^{\circ}$ C	-	-
		+ 100.0... + 850.0 $^{\circ}$ C	0.1 $^{\circ}$ C	-	-

2) At 0 $^{\circ}$ C ... + 40 $^{\circ}$ C

3) With zero adjuster; without zero adjuster

6) Lowest measurable frequency with a sinusoidal measuring signal which is symmetrical to zero

7. Voltage measurement

⇒ Connect the test leads as shown. The "⊥" socket should be connected to the lowest potential ground available.

Notes:

On the 1000 V range, an intermittent sound signal warns you, when the measured value exceeds the upper range limit.

Caution:

Ensure that a current measuring range ("mA" or "A") is not selected, when you connect your multimeter for voltage measurements! When the cut-out rating of the fuses is exceeded because of incorrect operation, a dangerous situation exists!

Zero adjustment on the 300 mV $\overline{\text{r}}$ measuring range

You can adjust the zero on the 300 mV $\overline{\text{r}}$ measuring range:

⇒ Connect the test leads to the meter and join the free ends.

After having selected the measuring range, briefly press the yellow multi-function pushbutton (5).

The meter acknowledges zero setting by a sound signal, the LCD shows "000.00" (± 1 digit) and the symbol "ZERO" (18) is displayed. The voltage displayed the instant the pushbutton is pressed is used as reference value (max. ± 2000 digits). It is automatically deducted from the values measured there after.

You can clear the zero adjustment

- by pressing the yellow multi-function pushbutton (5) for a long time, clearance is acknowledged by the buzzer sounding twice.
- by switching the instrument off.

7.1 Voltage measurement on electrical systems up to 1000 V with the KS30 measuring adapter

On low-voltage systems, transient overvoltages of several kilovolts can occur due to switching functions or lightning discharges. Direct connection of your multimeter to such systems for voltage measurement can, therefore, be dangerous.

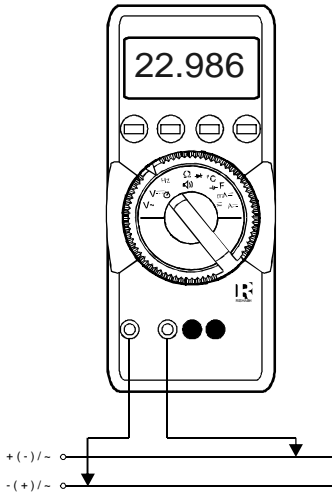
For voltage measurements on power systems with nominal voltages up to 1000 V, use the KS30 measuring adapter. It is an adapter for multimeters which eliminates dangers caused by overvoltages and incorrect operation of the multimeter. It provides the following protective functions:

- Protection of the input circuit to the voltage measuring range of multimeters. The internal resistance of the KS30 limits the current in the case of overvoltage.
- Overload capacity: continuously 1000 V_{rms}
transient (rise 10 μ s/fall 1000 μ s) 6 kV max
- Safe suppression of sparking from spark gaps after overvoltage.
- Current limitation in the case of incorrect operation (e.g. applying a voltage to a current input)

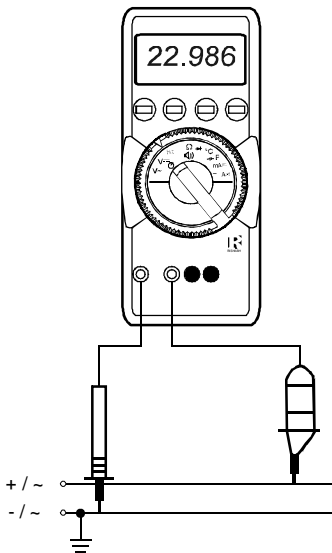
Using the measuring adapter KS30 the additional measured fault is approx.

-2%. Voltages above 1000 V can be measured with a high voltage probe, provided the necessary safety precautions are taken!

Voltage measurement



Voltage measurement on electrical system up to 1000 V with the KS30 measuring adapter



Intrinsic error of digital display at reference conditions		Overload Capacity ²⁾	
$\overline{\text{---}}$ (...% of rdg+...% of rng +...Digits)	$\sim^{1)}$ (% of rdg+...Digits)	Overload value	Overload duration
0.02+0.015+30 ³⁾	0.5+30	1000 V DC AC rms sine	continuously
0.02+0.008+20	0.2+30		
0.02+0.008+20	0.2+30		
0.02+0.008+20	0.2+30		
0.02+0.008+20	0.2+30		
$\overline{\text{---}}$	$\sim^{1)}$		
0.05+0.02+20	0.5+30	0.36 A	continuously
0.02+0.01+20	0.5+30		
0.02+0.01+20	0.5+30		
0.1+0.01+20	0.5+30		
0.2+0.05+30	0.5+30	10A ⁵⁾	5 min
0.05+0.015+20 ³⁾		1000 V DC AC rms sine	10 sec.
0.05+0.015+20			
0.05+0.015+20			
0.05+0.025+20			
0.1+0.025+20			
0.1+0.25+20			
1.2+0+10			
0.2+0.0+10			

3) With zero adjuster; without zero adjuster

4) Display : 5 ¼ places for DC , 4 ¼ places for AC

5) 12A 5min, 16A 30 s

15) Specifications

Measurement function	Measuring range	Resolution at measuring Range upper limit		Input impedance	
V		300000 ¹⁾	30000 ¹⁾	∞	∞ ¹⁾
	300 mV	10μV	10μV	>20MΩ	5 MΩ//<50 pF
	3.0 V	100μV	100μV	11 MΩ	5 MΩ//<50 pF
	30 V	1mV	1mV	10 MΩ	5 MΩ//<50 pF
	300 V	10mV	10mV	10 MΩ	5 MΩ//<50 pF
	1000 V	100mV	100mV	10 MΩ	5 MΩ//<50 pF
Voltage drop. approx. for upper range limit B ∞					
mA	300 μA	10 nA	10 nA	300mV	300 mV
	3 mA	100 nA	100 nA	300 mV	300mV
	30 mA	1 μA	1 μA	300mV	300 mV
	300 mA	10 μA	10 μA	300mV	300 mV
A	10 A	1 mA	1 mA	400mV	400mV
Ω	Open Circuit Voltage				
	300 Ω	10mΩ			0.6V
	3.0 kΩ	100mΩ			0.6V
	30 kΩ	1 Ω			0.6V
	300 kΩ	10 Ω			0.6V
	3.0 MΩ	100 Ω			0.6V
	30 MΩ	1000Ω			0.6V
α ₁)	300 Ω	0.1 Ω			Max. 1.3V
▶	3.0 V	100μV			Max. 2.5V

1) TRMS measurement

Values < 100 Digit (<500 Digit for measuring range 300 mV) will be suppressed

2) At 0 °C ... + 40 °C

8. Current measurement

⇨ First disconnect the power supply to the circuit being measured and/or to the load, and discharge all capacitors within that circuit.

⇨ With the function selector switch (6), select A $\overline{=}$ for currents > 300 mA, and mA $\overline{=}$ for currents < 300 mA. When measuring currents of unknown magnitude, *select the highest measuring range first.*

⇨ Select the function corresponding to the measured quantity by briefly pressing the yellow multi-function pushbutton (5). Each time the pushbutton is pressed, alternate switching takes place between DC and (DC + AC) and the change-over is acknowledged by a sound signal. The symbols DC and AC (11) show the selected function on the LCD.

When selecting a range with the function selector switch (6), the DC function is always set initially. When pressing the yellow multi-function pushbutton (5) for a long time, the meter always switches back to DC and acknowledges this by the buzzer sounding twice.

⇨ Connect the meter in series with the load, as shown. Make the connections tight (without contact resistance).

Notes on current measurement:

- The meter must be used only in power systems, when the current circuit is protected by a fuse or a *circuit breaker* of 20 A, and when the *nominal*

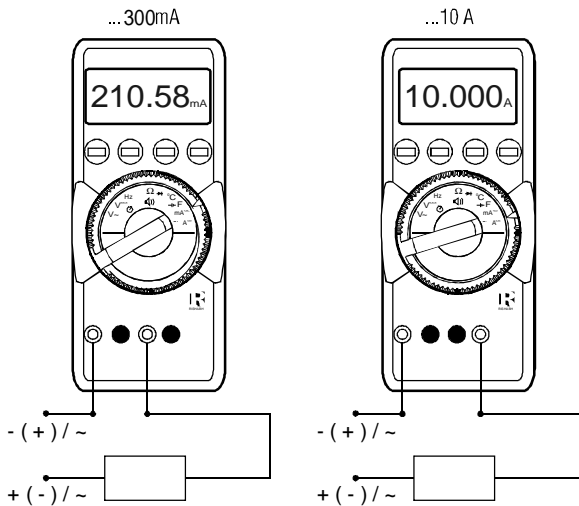
Voltage of the system does not exceed 1000 V.

- Make the measuring circuit connections mechanically strong and secure so that they do not accidentally open. The conductor cross sections and connection points should be designed to avoid excessive heating.
- On the 300mA and 10A ranges, an intermittent sound signal warns you, when the measured value exceeds the upper range limit.
- The current measuring ranges up to 300mA are protected to a short circuit current of 25 A by a fuse FF1.6/1000V in conjunction with power diodes. The cutout capacity of the fuse is 10 kA at a rated voltage of 1000 V and ohmic load.
- The current measuring ranges up to 10A are protected by a 16A/1000 V fuse. The cut-out capacity of the fuse is 30 kA at a nom. voltage of 1000 V and ohmic load.
- A blown fuse is signaled on the LCD the instant a measured quantity having a voltage of more than 4V is applied to the corresponding connection sockets. Then, the digital display (9) shows the word "FUSE".
- After a fuse has blown, eliminate the cause of the overload before using the meter again!
- Replacement of the fuses is described in section "16. Maintenance".

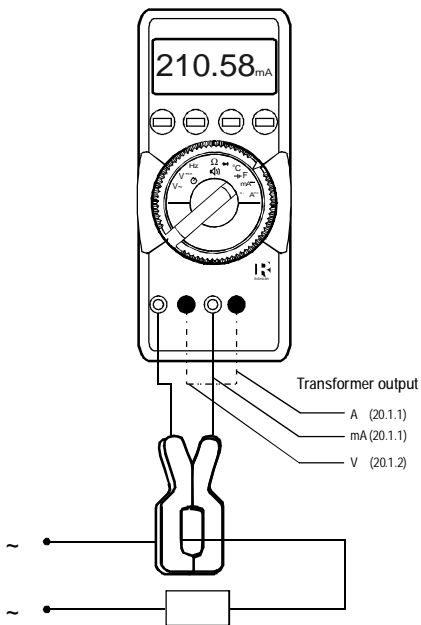
AC current measurement with (clip-on) current transformers

See appendix section 18.1

Current measurement



AC current measurement with (clip-on) current transformer



14 - Stop watch

This function allows you to measure elapsed times up to one hour.

- ⇨ Run the function selector switch (6) to "V $\overline{\text{---}}$ "
- ⇨ Use the pushbutton "AUTO/MAN" (4) to select a measuring range between 3V and 1000V.
- ⇨ The function stop watch cannot be activated in the range 300 mV $\overline{\text{---}}$.
- ⇨ Briefly press the yellow multifunction push button(5)
"00:00:00" and the stop watch symbol (17) are displayed on the LCD.
- ⇨ The stop watch is started and stopped by pressing the "AUTO/MAN" pushbutton (4). The display is 'n' minutes ,seconds and tenth of seconds..
- ⇨ The Time can be cleared by pressing the 'DATA-MIN/MAX' push button (3).
- ⇨ Briefly press the multi function push button (6) in order to return to voltage measurement.

12. Frequency measurement.

Frequency measurement is only possible with a four ranges
i.e. 300 Hz, 3 KHz, 30 KHz, 300 KHz.

- ⇒ Set the function selector switch (6) to Hz.
- ⇒ See section "15. Specification" for the lowest measurement frequencies and minimum measurable voltage levels.

13. Temperature measurement

With Pt 100 and Pt 1000 temperature sensors you can measure temperatures on the range from -200 (-100) °C ... + 850 °C

- ⇒ Set the function switch (6) to "°C".
 - ⇒ Connect the sensor to the two sockets for which access is allowed.
- The meter automatically detects the connected sensor (Pt 100 or Pt 1000) and shows the measured temperature in °C on the digital display.

Notes:

This measurement automatically considers the lead resistance of the RISHABH temperature sensors which are available as accessory.

Temperature measurement

considering sensor lead resistances up to 50Ω

Lead resistances of sensors having a value differing from that of RISHABH sensors can be considered up to a value of 50Ω as follows:

- ⇒ Briefly press the yellow multi-function pushbutton (5).
The temperature measurement range is now selected which considers a changed lead resistance of the sensor. This is indicated on the LCD by the "ZERO" symbol.
- ⇒ Briefly press the yellow multi-function pushbutton (5) again.
The LCD now displays the resistance value which the meter automatically considers. So that you can recognize that this is the resistance correction value on the temperature measuring range, the "°C" character is simultaneously shown.
- ⇒ You can set the line resistance correction value as follows:
Press the DATA-MIN/MAX pushbutton (3) to increment the value, or the AUTO/MAN pushbutton (4) to decrement the value. Each time the pushbutton is briefly pressed, the value changes by one digit. You pass through fast, when you press the pushbutton longer.
- ⇒ Briefly press the yellow multi-function pushbutton (5) again.
The LCD displays the measured temperature in consideration of the changed lead resistance. The symbol "ZERO" (18) in the LCD shows you this.
- ⇒ Each following time the yellow multi-function pushbutton (5) is briefly pressed, the display changes between measured temperature with changed lead resistance and correction value of the lead resistance.
You can exit the function "temperature measurement with changed lead resistance"

9. Resistance measurement and continuity test

- ⇒ Verify that the device under test is electrically dead. External voltages would falsify the measured result!
- ⇒ Set the function selector switch (6) to "Ω".
- ⇒ Connect the device under test as shown.

Zero adjustment on the measuring range 300Ω

When measuring small resistance values on the 300Ω range, you can eliminate the resistance of the leads and transient resistances by zero adjustment:

- ⇒ Connect the test leads to the meter and join the free ends.
- ⇒ Briefly press the yellow multi-function pushbutton (5).

The meter acknowledges zero adjustment by a sound signal, the LCD shows "000.00" resp. "0.0000" (+1 digit) and the symbol "ZERO" (18) is displayed. The resistance measured the instant the pushbutton is pressed is used as reference value (max. 2000 digits). It is automatically deducted from the values measured thereafter.


You can clear the zero adjustment

- by pressing the yellow multifunction pushbutton (5) for a long time, clearance is acknowledged by the buzzer sounding twice,
- by switching the instrument off


Continuity test with buzzer

With "buzzer" function activated, the meter issues a continuous sound signal below 100.00 Ω range only.

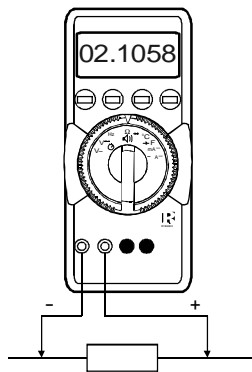
⇒ To switch buzzer ON:

Select range 30kΩ, 300kΩ, 3.0MΩ, or 30MΩ, through manual mode and briefly press the yellow multi function key (5). The symbol  (17) appears on the display screen.

⇒ To switch buzzer OFF:

Select range 30kΩ, 300kΩ, 3.0MΩ, or 30MΩ, through manual mode and briefly press the yellow multi function key (5) The symbol  (17) disappears from the display screen.

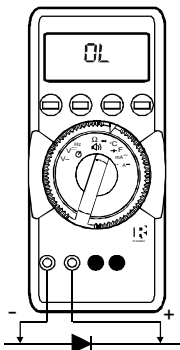
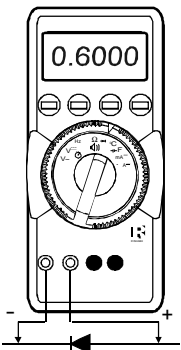
Resistance measurement



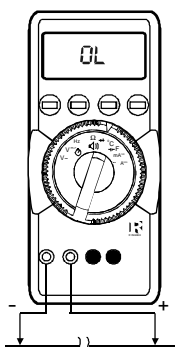
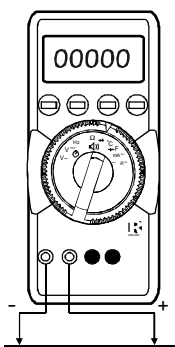
Diode test

Forward direction

Reverse direction



Continuity test/



10. Diode test and continuity test

- ⇒ Verify that the device under test is electrically dead. External voltages would falsify the measured result!
- ⇒ Set the function selector switch (6) to "→".
- ⇒ Connect the device under test as shown.

Forward direction and/or short circuit:

The meter displays the forward voltage in Volts. As long as the voltage drop does not exceed the maximum display value of 2.0999 V, you can also test several series-connected elements or reference diodes with small reference voltage.

Reverse direction or interruption:

The meter indicates overrange "OL".

Note:

Resistors and semiconductor junctions in parallel with the diode falsify the measured result!

11. Capacitance measurement

- ⇒ Verify that the device under test is electrically dead. External voltages would falsify the measured result!
- ⇒ Set the function selector switch (6) to "F".
- ⇒ Connect the (discharged!) device under test to the "L" and "F" sockets via test leads.

Notes:

Connect polarized capacitors with the "-" pole to the "L" socket.

Resistors and semiconductor junctions in parallel with the capacitor falsify the measured result!

Zero adjustment on the measuring ranges 3nF to 30nF

When measuring small capacitance values on the 3 nF and 30 nF range, you can eliminate the internal resistance of the meter and the capacitance of the leads by zero adjustment:

- ⇒ Connect the test leads to the meter without the device under test.
- ⇒ Briefly press the yellow multi-function pushbutton (5).

The meter acknowledges zero adjustment by a sound signal, by displaying "0.000" resp. "00,00" (+1 digit) and the symbol "ZERO" (18) on the the LCD. The capacitance measured the instant the pushbutton is pressed is used as reference value (max. 500 digits). It is automatically deducted from the values measured thereafter.

You can clear the zero adjustment

- by pressing the yellow multi-function pushbutton (5) for a long time, clearance is acknowledged by the buzzer sounding twice,
- by switching the instrument off