User Manual

Gamma 20

Analog-Digital Multimeter

REV:F/02/11/2014 IC 2-60-006-00-00556

sifam tinsley
PRECISION INSTRUMENTATION

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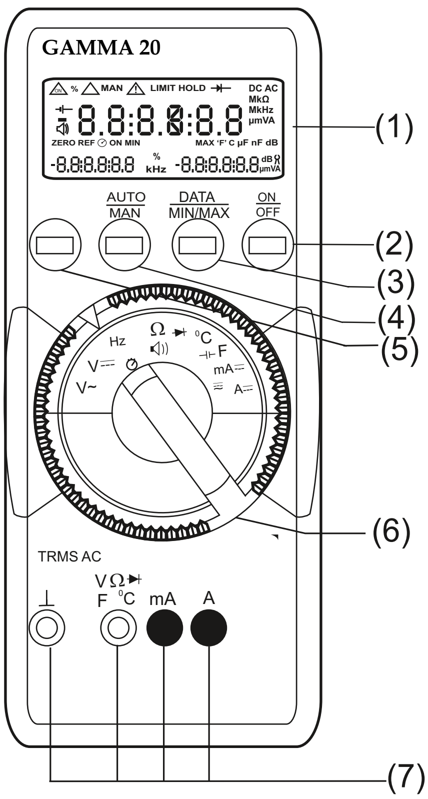
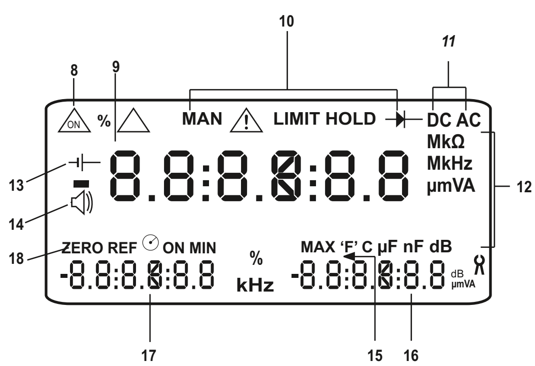




WARRANTY

Dear Customer,

You are now the privileged owner of **Gamma 20** Analog-Digital / Multimeter a product that ranks the first of its kind in the world. **Company** provides 12 months warranty from the original date of Purchase against defective material and workmanship.

In the unlikely event of failure of the instrument / accessories within the warranty period. **Company** will repair meter / accessories free of charge. Please hand over the meter / accessories to the dealer / stockist from whom you have purchased along with this card and relevant Cash Memo / Invoice. This warranty entitles you to bring the meter / accessories at your cost to the nearest stockist / dealer and collect it after repairs.

NO TRANSPORTATION CHARGES WILL BE REIMBURSED.

The warranty is not valid in following cases:

1. Warranty card duly signed and stamped and original Cash Memo / Invoice is not sent along with Meter.
2. Complete warranty card is not presented to authorised person at the time of repairs.
3. Meter / accessories is not used as per the instructions in the instruction manual.
4. Defect caused by misuse, negligence, accidents, tampering and Acts of God.
5. Improper repairing by any person not authorised by the company.
6. Modification, Alteration of any sort is made in electrical circuitry.
7. Seal provided inside/outside is broken.

Warranty of **Gamma 20** accessories does not cover Fuses, Battery & Mains Adapter.

In case of dispute to the validity of the warranty, the decision of Company service center will be final.

If you bought this Meter directly from the company, and if you notice transit damage, then you must obtain the insurance surveyors report and forward it to **Company** .

Thank you.

(To be filled by authorized dealer)

Model No. :____________________

Serial No. :____________________

Date of Purchase :____________________

Cash Memo / Invoice No. :____________________

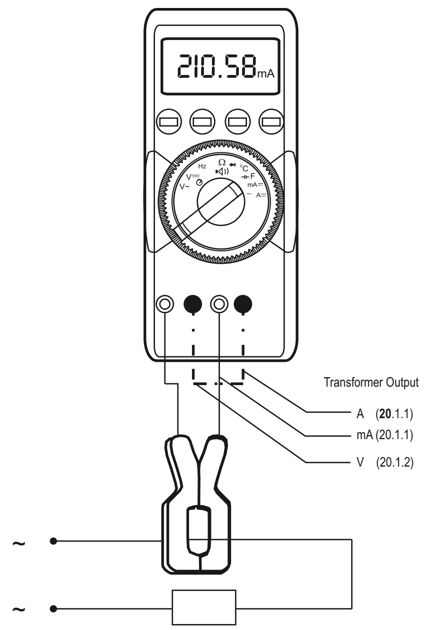
Dealer's Signature :____________________

Dealer's Stamp :____________________

Scope of Supply

1) Instrument	2) Cable Set
3) Spare Fuse	4) Safety Cover
5) 1.5 V Battery 6 Nos. - Rechargeable - Yes No	
6) User Manual	7) Warranty Card
8) Crocodile Clips	9) Optional-mains Adapter Yes No
10) Belt	

AC current measurement with (clip-on) current transformers



The Information contained in these installation instructions is for use only by installers trained to make electrical power installations and is intended to describe the correct method of installation for this product.

It is the user's responsibility to determine the suitability of the installation method in the user's field conditions.

(1) Liquid crystal display.
(2) ON/OFF pushbutton.
(3) Pushbutton for data hold and MIN/MAX storage functions.
(4) Push button 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) Display for digits, decimal point and polarity.
(10) Symbols for displaying selected functions.
(11) Display for the selected function.
(12) Display for the unit of measured quantity.
(13) Low battery indication.
(14) Buzzer indication.
(15) Display ^{0}C/ for temperature measurement range.
(16) Sub display 1 : for digits, decimal point and polarity.
(17) Sub display 2 : for digits, decimal point and polarity.
(18) Zero adjustment indicator.

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1. Safety features and safety precautions

You have chosen a meter which offers you a very high degree of safety.

This meter Gamma 20 is manufactured and tested in compliance with the safety standard IEC 61010-1:2001 / DIN EN61010 -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 meter 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, this meter 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 be operated only by persons who understand the danger of shock hazards and know how to apply safety precautions. Shock hazards exist wherever voltages of more than 30V (TRMS) can appear.
- Do not work alone in shock hazardous environment while carrying out measurement.
- The maximum permissible voltage between terminal Socket (7) and ground is 1000 V.
- Take into account that unexpected voltages can occur on device under test (e.g. defective instrument). 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) is1000 V AC/DC in "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 1000V.

For safe voltage measurements on power systems, up to 1000V we recommend the KS 30 measuring adapter, which is available as accessory. Its internal resistance limits the measuring current in the case of over voltage and incorrect operation and safely suppress sparking from spark gaps. Also refer to Section "7.1Voltage measurement on electrical systems up to 1000V with the KS 30 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 300 mA:
  FF (UR) 1.6A /1000 V AC/DC; (10 KA); 6.3 mm x 32 mm
- for the 10A current measuring ranges:
  Type FF(UR) 16A/1000V AC/DC; (30kA); 10mmx38mm

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 scrabbing.

17. Repair and replacement parts Service

When you need service, please contact :

Sifam Tinsley Instrumentation	**Sifam Tinsley Instrumentation Ltd.**
3105, Creekside Village Drive,	Central Buildings, Woodland Close,
Suite No 801,Kennesaw,	Old Woods Trading Estate,
Georgia 30144	Torquey, Devan, England, TQ27BB
Contact Number: +1.404.736.4903	Website: www.sifamtinsley.com/uk
Web: www.sifamtinsley.com	Contact Number: +44(O) 1803 615139
	E-mail: info@tinsley.co.uk

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 ⊥ 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 ⊥ and V.

Ambient conditions

Functional temperature range	$-20^0C...+50^0C$
Storage temperature range	$-25^0C...+70\,^0C$
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 meter, verify that the batteries of 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 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 9V flat cell battery according to IEC 6 F 22 or IEC6 Lr61 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 wedges.
- Remove the battery from the compartment and carefully disconnect the contacts from the battery.
- Snap the connection contacts to a new 9V battery and insert the battery in to 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 environment 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 all other current measuring ranges. All other measuring ranges continue to function. When a fuse blows, first eliminate the cause of the overload using the meter again !

Meaning of the symbols on the device

⚠	Warning of a danger point (Attention, refer to the usermanual)
⏚	Earth (ground) terminal.
▣	Double or reinforced insulation
CAT II / III / IV	Instrument for over voltage category II / III or IV
CE	EU conformity mark.

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 or replacement of parts. If repair cannot be avoided unless the meter is opened and live, this work must only be performed by a qualified person who understands the danger involved.

Fausts 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 accidental use.
It is assumed that safe operation may not be 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 a 9V flat cell battery provided along with the meter.
Before you use the meter for the first time or after storage, 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 pushbutton 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

The meter turns off automatically, when the measured value remains constant (variations of the measured value $\leq \pm$ 2digits) 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 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 ON (8).

Turning the multimeter 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 allows access only to two correct sockets for each function. Prior to switching to the "mA" 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 systems prevents accidental switching to non permissible functions.

3.1 Autoranging

The multimeters feature autoranging for all measuring ranges except for temperature measurement and diode test. Autoranging is automatically selected after switching the Multimeter ON. According to the measured quantity applied, the multimeter 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 ± (309999 digits + 1digit)
the next lower range	at ± (28000 digits - 1 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 auto-ranging and select the ranges manually according to the table on the following page.

Manual mode is switched OFF when pushbutton AUTO/MAN is pressed (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
	Switching sequence at: V : 3.0V→30V→300 V→ 1000 V→300mV→ 3.0V→ ... Hz: 300 Hz→ 3 KHz→ 30 KHz→ 300 KHz → 300Hz ... mA : 300uA→3mA→30mA→300mA 300µA... A : 10A Ω: 30MΩ→300Ω→3.0kΩ→300kΩ→3.0 MΩ 30MΩ→ ··· F : 3.0 nF→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⎓, V~, A⎓, A~	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	
^{0}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⎓ approx. 40 hours on V~, A~, A⎓
Battery test	automatic display of the " ⊣⊢ " symbol, when the battery voltage drops below approx. 6 V.
EMC	Electromagnetic compatibility
Emission	EN 61326 : 2002 Class B
Immunity	EN 61326 : 2002 IEC 61000-4-2 8 kV atmosphere discharge 4 kV contact discharge IEC 61000-4-3 : 3 V/m

Fuses

Fuse for the FF 1.6 A/1000 v: 6.3mmX32mm

ranges up to 300 mA	rating 10 kA with 1000VAC/DC and ohmic load; in conjunction with power diodes, protects all current measuring ranges upto 300mA.
Fuse for the ranges upto 10A	rating 30 kA with 1000V AC/DC and ohmic load; protects the 10 A ranges up to 1000 V AC/DC; see "16. Maintenance" for manufacturers and types of fuses.

Influence quantity	Range of influence	Measured quantity/ measuring range1)	Variation
Battery voltage	⊣⊢[5] ...< 7,9 V > 8,1 V ... 10,0 V	V ⎓	±15 Digits
		V~	±30 Digits
		A ⎓	±20 Digits
		A~	±40 Digits
		Ω	±40 Digits
		3.0 nF ...30 mF	±50 Digits
		Hz	±10 Digits
		°C	±40 Digits
Relative humidity	75% 3 Days meter off		±1 Digit
MIN / MAX	-	V AC/DC	± 2Digits
	-	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~	V⎓	>120 dB
	Noise quantity max. 1000 V~ 50 Hz, 60 Hz sinusodial	300 mV... 30.0 V~	> 80 dB
		300 V~	> 70 dB
		1000V~	> 60 dB
Normal mode interference voltage	Noise quantity V~, value of the measuring range at a time, max. 1000 V~, 50 Hz, 60 Hz sinusodial	V⎓	> 50dB
	Noise quantity max. 1000 V-	V~	> 110 dB

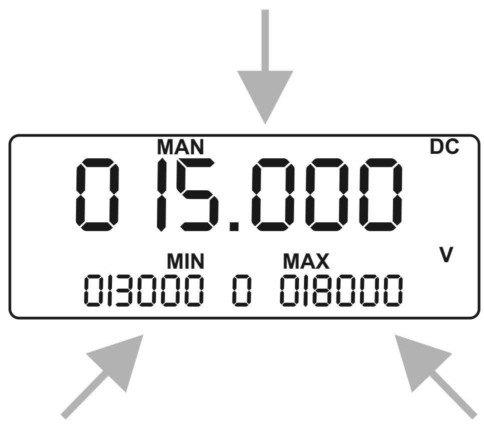
4. Triple Digital Display

The three digital displays, one main display and two sub-displays, show the measurement value with correct decimal 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 above the measuring range upper limit for the following measured quantities: VDC, IDC, VAC,IAC,mAAC,mADC,F 'Ω',Hz:.

Refreshing of the digital display occurs at different intervals for the various measured quantities ..

Main Display



Sub-Display: MIN

Sub-Display: MAX

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 contineous 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:

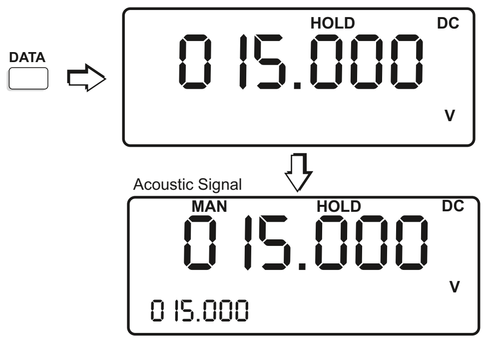
By pressing "AUTO/MAN" and "DATA/MIN/MAX" keys simultaneously the Backlit can be switched ON.

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

5.DATA “HOLD” facility.

Measurement values can be automatically “frozen” with the data 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 “HOLD” display blinks.

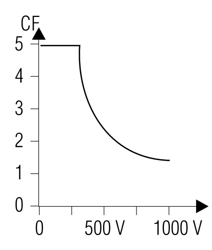


Function DATA	⇩ DATA MIN/MAX (3)	Condition: Measuring ranges	Condition: Limit of measured values (digits)	Meter reaction Display: Meas. value digital	Meter reaction Display: DATA	Meter reaction: Sound signal
Activate	short				Flashes	1X
Store		V, A,Hz Ω, F	>280000 <0L >28000	dis-played	dis-played	1x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

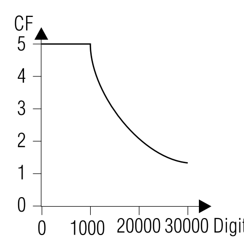
Influence quantities and variations

Influence quantity	Range of influence	Measured quantity/ measuring ranges1)	variation2) ±(... % of rdg. +... digits)
Tempera-ture	-10 °C ... +21 °C and +25°C ... +40 °C	V⎓	0.05+3
		V~,V	0.2+3
		300 μA...300 mA ⎓	0.2+3
		300 μA... 300 mA≂	0.3+3
		10 A≂ 10 A⎓	0.5+3
		300 Ω	0.1+5
		3.0 k..3.0MΩ	0.1+3
		30 MΩ	0.6+3
		3.0 nF... 30.0 μF	0.5+3
		30.0 μF..30.0 mF	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~	1.0+20
	> 65Hz...200 Hz		1.0+20
	25 Hz... < 45 Hz	3... 300 V~	1.0+20
	> 65 Hz... 400 Hz		2.5+20
	> 400 Hz...1kHz		
	>1 kHz... 20kHz		
	25 Hz... < 30 Hz	1000 V~	1.0+20
	30 Hz... < 45 Hz		0.5+20
	> 65 Hz... 1 kHz		2.0+20
	15 Hz... < 45 Hz	A~	1.0+20
	>65 Hz... < 1 kHz		1.0+20
Waveform of the measured quantity[3]	Crest-factor CF 1 ... 3	V~[4], A~[4]	±1% of rdg
	Crest-factor CF > 3 ... 5		±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 ± 2K
Relative humidity	: 45% ... 55 % RH
Frequency of measured quantity	45Hz ...65 Hz
Waveform of the measured quantity	sinusoidal
Battery voltage	8V ± 0.1V

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/12mm

Number of digits	$5^{3/4}$digit ∧ 31000 counts
Over range	"OL" is displayed.
Polarity indication	"-"sign is displayed, when the positive pole is at " ⊥ "
Sampling rate	10 reading/s

1) Reactivate by falling below the specified limits of the measured value.

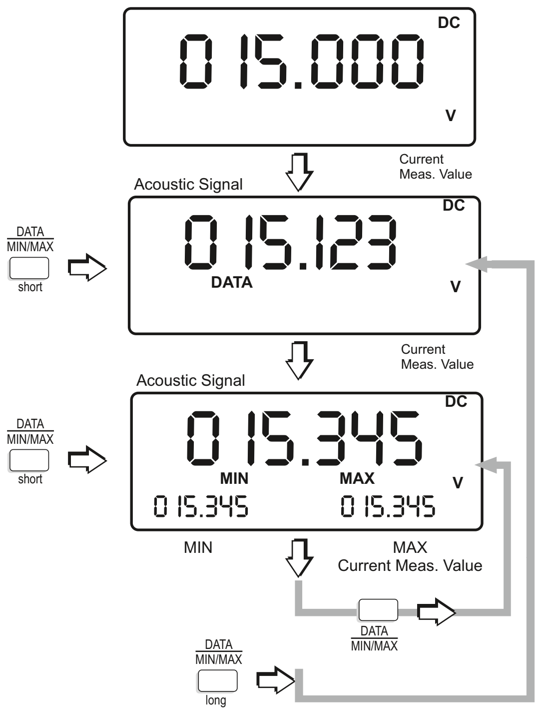
2) When storing a value for the first time twice sound signal is generated.

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 1 s, when the function selector switch (6) is operated, or when meter is turned OFF and ON again.

6. Minimum and Maximum Value Storage facility.

Minimum and maximum values can be read out at the sub displays for long-term observation of measured quantities.
1.If the DATA/MIN/MAX key is activated twice, current MIN and MAX values are displayed at the sub-displays.
2.Press the DATA/MIN/MAX key again to display the MIN value and the time of occurrence.
3. If the DATA/MIN/MAX 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/MIN/MAX 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 display store	2 x short	stored	Current measurement value	Min & Max	1x
Reset	long	cleared	cleared	cleared	1x



Intrinsic error of digital display at reference conditions	Overload capacity[2)]	
(...% of rdg+...% of rng)	Overload value	Overload duration
2.5+0.2 [3)]	1000 V DC AC rms sine	10 Sec
1.2+0.2		
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	**Contin-uous**
0.1+3 [7)]	≤ 30kHz 300V	
0.1+3 [7)]	≤ 100kHz 30V	
0.05+3 [7)]		
0.05+3 [7)]		
± 20 Digits	**1000V**	**Contin-uous**
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.

Measure-ment function	Measuring range	Resolution	Discharge resistance	$U_{0\,max}$
F	3.0 nF	1 pF	10 MO	3 V
	30 nF	10 pF	10 MO	3 V
	300nF	100 pF	1 MO	3 V
	3.0 µF	1nF	100 MO	3 V
	30 µF	10 nF	11 kO	3 V
	300µF	100 nF	2 kO	3 V
	3000 µF	1 µF	2 kO	3 V
	30000 µF	10µF	2 kO	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**		
°C	Pt 100: -200.0... +100.0 °C	0.1 °C	-	-
	Pt 100: +100.0... +850.0 °C	0.1 °C	-	-
	Pt 1000: -100.0.. + 100.0 °C	0.1 °C	-	-
	Pt 1000: + 100.0.. + 850.0 °C	0.1 °C	-	-

2) At 0°c...+40°c.

3) With zero adjustment.

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

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

On low-Voltage systems, transient over voltages of several kilovolts can occur due to switching functions or lightning discharges. Direct connection of your meter to such systems for voltage measurement can be dangerous. For voltage measurements in power systems with nominal voltages upto 1000V, use the KS30 measuring adapter. It is an adapter for meter which eliminates dangers caused by overvoltages and incorrect operation of the meter. It provides the following protective functions..

- Protection of the input circuit of 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 µs/fall 1000 µs) 6 kV max.
- Safe suppression of sparking from spark plug after overvoltage.
- Current limitation in the case of incorrect operation (e.g. applying a voltage to a current input)

Using the measuring adapter KS 30 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!

7.2 Simultaneous Frequency and AC Voltage measurement:

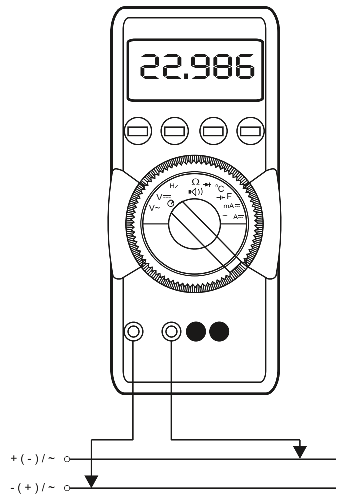
➪ Set the function selector switch to " V~ "

➪ Briefly press the yellow multi-function pushbutton(s).

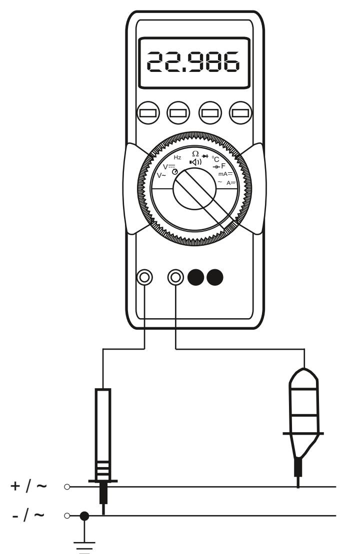
Now meter measures frequency on main display and Voltage on sub display. Frequencies up to 40 KHz can be measured with this mode, but voltage is measured accurately up to 20 KHz (See " Influence quantities and variations" on page 25)

➪ To Exit this mode press yellow multi-function push button for long time. This is acknowledged by the buzzer sounding twice.

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]	
⎓ (...% of rdg+...% of rng +...Digits)	~ [1] (% of rdg+...Digits)	Overload value	Overload duration
0.02+0.15+30 [6]	0.5+30	1000 V DC AC rms sine	continu-ously
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		
⎓	≂ [1]		
0.05+0.02+20	0.5+30	0.36 A	continu-ously
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
(...% of rdg+...% of rng +...Digits)			
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 adjustment.

4) Display: 5¾ places for DC, 4¾ places for AC.
5) 12A 5min, 16A 30s.
6) Values less than 350 digits will be suppressed.

15) Specifications

Measurement function	Measuring range	Resolution at measuring Range upper limit		Input impedance	
V		300000[4]	30000[4]	⎓	⎓~[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.	
				⎓	⎓~[1]
mA	300 µA	10 nA	10 nA	300 mV	300 mV
	3 mA	100 nA	100 nA	300 mV	300mV
	30 mA	1 µA	1 µA	300 mV	300 mV
	300 mA	10 µA	10 µA	300 mV	300 mV
A	10 A	1 mA	1 mA	400mV	400mV
Ω			Open Circuit Voltage		
	300 Ω	10m Ω	0.6V		
	3.0 kΩ	100m Ω	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		
🔊	300 Ω	0.1 Ω	Max. 1.3V		
➔⊢	3.0 V	100uV	Max. 2.5V		

1) TRMS measurement.
Values <150 Digit (350 Digit for measuring range 300 mV will be suppressed.
2) At 0°c...+40°c.

9. Current Measurement

- First disconnect the power supply to the circuit being measured and/ or to the load, and discharge all capacitors within that circuit.
- Select the DC current measuring ranges as described in section4.1
- With the function selector mA ⎓ for currents <300 mA. When measuring current 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).

The change-over is acknowledged by a sound signal. The symbols DC and AC (11) are displayed as per selected function on the LCD. When selecting a range with the function selector switch (6), the DC+AC function is always set by default. When pressing the yellow multi- function pushbutton (5) for a long time, the multimeter always switches back to DC + AC and acknowledges this by two sound signals.

- Connect the multimeter in series with the load, as shown. Ensure that the connections are tight (without contact resistance).

Notes on Current measurement :

- The multimeter must be used only in the power systems, where 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 exceed1000V.
- 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 300 mA and 10 mA ranges, an Intermittent sound signal warns you, when the Measured value exceeds the upper range limit.
- The current measuring ranges upto 300 mA are protected to a short circuit current of 25 A by a fuse 1.6 A/1000V AC/DC in conjunction, with power diodes. The cut-out capacity of the fuse is 10kA at a rated voltage of1000V AC/DC and ohmic load.
- The current measuring ranges up to 10A are protected by a16A/1000V fuse. The cut-out capacity of the fuse is 30kA at a nom. voltage of 1000V and ohmic load.
- A blown fuse is signalled on the LCD 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 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".

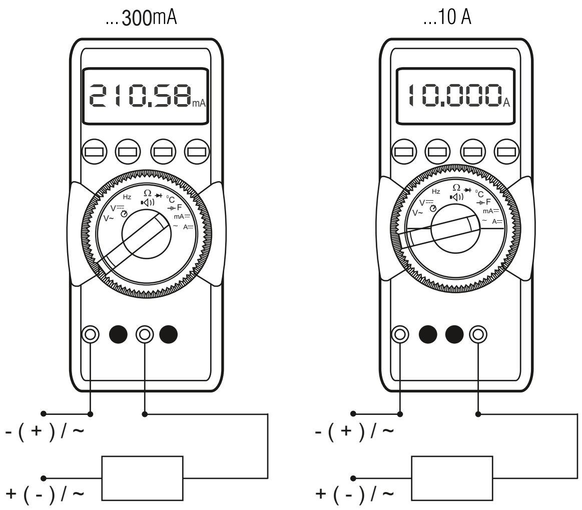
8.1 Simultaneous Frequency and AC current measurement:

- When in AC current measurement (mA or A), briefly press yellow multifunction push button(s).

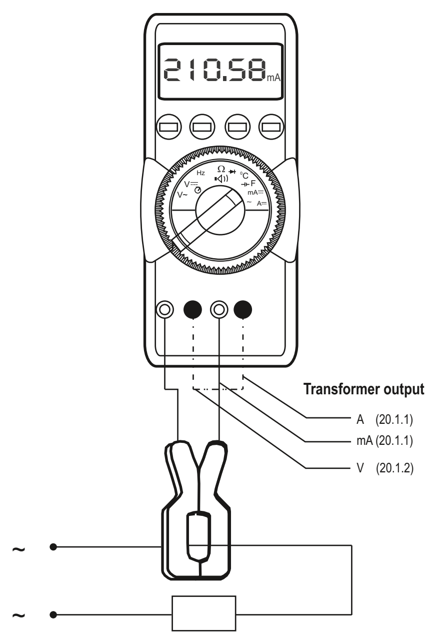
Now meter measures frequency on main display and AC current on sub display. Frequencies up to 40 KHz can be measured, but current is measured accurately up to 1 KHz.

- To exit this mode press yellow multi-function push-button(s") for long time. This is acknowledged by the buzzer sounding twice.

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 ⎓ ”
- The function stop watch cannot be activated in the range 300 mV⎓
- 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,30KHz,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 Pt100 and Pt1000 temperature sensors you can measure temperatures on the range from -200 (- 100) °C...+850°C

- Set the function selector switch (6) to "°C"
- Connect the sensor to the two sockets for which access is allowed.

The meter automatically detects the connected sensor (Pt100 to Pt1000) and shows the measured temperature in°C on the digital display.

Briefly press the AUTO/MAN key to switch to "°F" and back to "°C".

Temperature measurement considering sensor lead resistances up to 50 Ω

Lead resistence of sensors can be considered up to a value of 50 Ω as follows:
The temperature measurement range is now selected.

- The LCD now displays. the zero resistance value. 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.
- 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 results!
- 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 300 Ω range, you can eliminate the resistance of the leads and contact resistance 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 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 10.00 Ω range only.

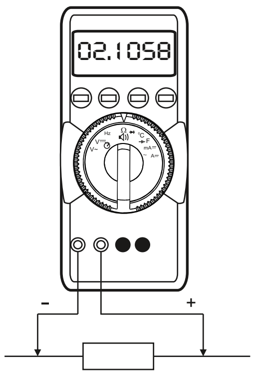
- <u>To switch buzzer **ON**</u>:

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

- <u>To switch buzzer **OFF**</u>:

Briefly press the yellow multi function key (5). The symbol (17) disappears from the display screen.

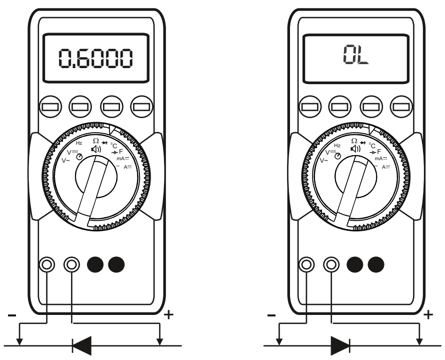
Resistance measurement



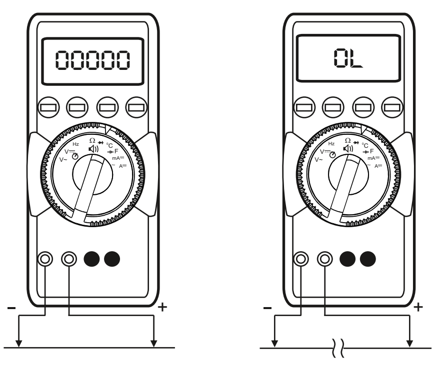
Diode test

Forward direction

Reverse direction



Continuity test/



10. Diode test

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

<u>Forward direction and/or short circuit:</u>

The multimeter displays the forward voltage in Volts. As long as the voltage drop does not exceed the maximum display value of 2.999V, you can also test several series-connected elements or reference diodes with small reference voltage.

<u>Reverse direction or interruption:</u>

The meter indicates overrange "OL"

Note:

Resistors and semiconductor junction in parallel with the diode falsify the measured results!

11. Capacitance measurement

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

Note:

Connect polarised capacitors with the " __ " pole to the " ⊥ " socket. Resistors and semiconductor junctions in parallel with the capacitor falsify the measured results!

Zero adjustment on the 30 nF measuring ranges 3nF to 30nF

When measuring small capacitance values on the 3 nF and 30 nF range, you can eliminate the internal capacitance of the leads can be eliminated by zero adjustment.

- Connect the test leads to the meter without 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" (+1digit) and the symbol "ZERO" (18) on the LCD. The capacitance measured at the instant the pushbutton is pressed is used as reference value (max.500digits). It is automatically deduced from the values measured thereafter.

  The zero adjustment can be cleared
- By pressing the yellow multi-function pushbutton (5) for a long time, clearance is acknowledged by the two sound signal.
- By switching the meter off.