USER MANUAL

ARD-MM612, 613, 615, 616
Analog/Digital Multimeter

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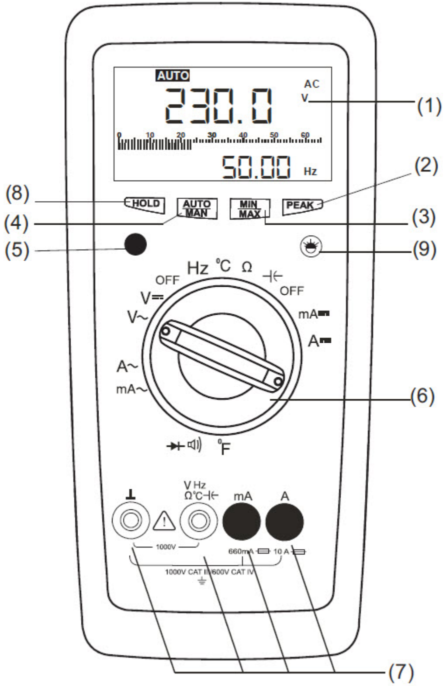
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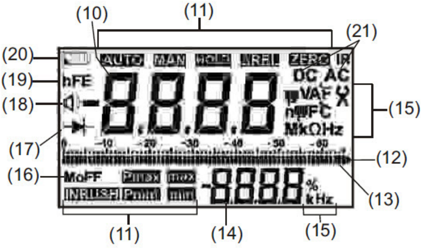
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hFE
8.8.8.8
MkΩHz
MoFF
INRUSH
max
min
-8888
%
kHz

Multimeter Operating Elements

(1) Liquid Crystal Display (LCD)
(2) PMAX/PMIN pushbutton
(3) Pushbutton for MIN/MAX functions
(4) Pushbutton for manual range selection
(5) Multi function pushbutton
(6) Function selector switch
(7) Terminal sockets with Automatic Blocking System
(8) Pushbutton for HOLD function
(9) Pushbutton for backlight function
(10) Main display for digits, decimal point, and polarity
(11) Display for manual range selection, Hold, MIN/MAX, Relative, Peak functions
(12) Overrange indication
(13) Bar graph for analog indication
(14) Sub display for digits, decimal point and polarity
(15) Display for the unit of measured quantity
(16) Display for indication of Auto-Off Function
(17) Display for diode testing
(18) Beeper indication
(19) Display for hFE measurement
(20) Low battery indication
(21) Display for the selected function, i.e. AC or DC

1.0 Safety Features and Precautions

This digital multimeter is manufactured in compliance with established safety regulations, and incorporates a high level of safety. However, the safety of both the user and the instrument cannot be guaranteed in the event of incorrect operation or negligent handling.

To maintain the safe and proper condition of the meter and to ensure safe operation, it is absolutely necessary to carefully and completely read these operating instructions before use.

For user safety and protection, this multimeter is fitted with an Automatic terminal Blocking System (ABS). It is coupled with the function selector switch which blocks the terminal sockets not necessary for measurement.

Observe the following safety precautions:

- The meter must only be operated by persons who under stand 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 and earth is 1000 V.
- 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 test leads are in good condition, e.g. no cracked insulation, no open circuits in the leads or connectors.
- The 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 permissible overload limits of the measuring ranges. Limit values can be found in chapter 16.
- All current ranges, with the exception of the 16A range multimeter, are protected with fuses. The maximum allowable voltage for the measuring current circuit (nominal voltage of the fuse) is 1000 VAC/VDC in "mA" and "A" ranges.
- When taking measurements, keep fingers behind the finger guards on the probes.
- Multimeter has been designed for measurements in the secondary current transformer circuits and how no integrated fuse in the 16A current circuits for reducing hazards in the event of short circuits on the primary side. In circuits with contact hazards, Model 613 may only be used if the current circuit is protected by a fuse or circuit breaker of 20 A.
- Protection provided by the digital multimeter may be impaired if the meter is not used in a manner specified in this manual.

Cat I	Measurements in electrical circuits which are not directly connected to the mains: for example electrical systems in motor vehicles and aircraft, batteries, etc.
Cat II	Measurements in electrical which are electrically connected o the low-voltage mains:with plugs, e.g. at home, in the office or laboratory, etc.
Cat III	Measurements in building installations, stationary power consumers, distributor terminals, devices connected permanently to the distributor.
Cat IV	Measurements at power sources for low-voltage installations, meters, mains terminals, primary over voltage protection devices.

Table 1: Safety Category Ratings per IEC61010

	AC - Alternating Current		See explanation in manual
	DC - Direct Current		Double insulation Protection Class II
	Either AC or DC		Fuse
	Ground		

Table 2: International Symbols

2.0 Initial Start-Up

Battery

Remove the rubber holster and install the provided AA batteries into the meter.

Please see chapter 17.1 for detailed instructions on battery installation.

Switching the Meter ON

Turn the function selector switch (6) from the "OFF" position to the desired measuring function.

All of the segments of LCD are activated briefly and "ON" is acknowledged by a sound signal.

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 turn back on. If this procedure is unsuccessful, briefly disconnect the battery from the contact terminals.

ATTENTION: Before opening, disconnect meter from the measuring circuit and follow the instructions in chapter 16.

Automatic Meter-Off (MoFF)

The meter switches itself OFF automatically after 15 minutes if no keys or the selector switch has been activated during this time. When this happens, the state of the meter is saved. The MoFF sign (16) on the LCD panel indicates whether or not MoFF is enabled.

Switching the Meter back ON

Power the meter on by pressing any of the push functions (except HOLD (8) and Multifunction (5)) or using the rotary selector switch. If the meter is powered on by the using the rotary selector switch, the saved state is cleared. If the meter is powered on by using the push functions, the saved data will be displayed.

Switching the Meter OFF

Turn the selector switch to the "OFF" position.

3.0 Function and Range Selection

The function selector switch (6) is coupled with the Automatic terminal Blocking System (ABS) which allows access only 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 systems prevents accidental switching to non-permissible functions.

3.1 Switching the Measuring Ranges

The 660 mVAC and 660 mVDC measuring ranges are not automatically selected when the meter is switched ON. The above ranges can only be selected manually with AUTO/MAN key.

3.2 Auto/Manual Ranging

The multimeter features auto ranging for all measuring ranges with the exception of the °C, °F, continuity, Diode ,% , AAC , ADC.

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.
You can switch OFF auto-ranging and select the ranges manually according to the table 2. Manual mode is switched OFF when AUTO/MAN is pressed for approximately 1s, when the function selector switch (6) is operated, or when the meter is turned OFF and ON again.

AUTO/ MAN Key	Function	Acknowledgment
		Display
Brief	Manual Operation ON: User range is fixed Switching sequence at:	MAN (11)
Brief	VAC / VDC: 6.6V → 66V → 660V → 1000V → 660mV → 6.6V... mAAC / mADC: 66mA → 660mA → 66mA → 66mA... Ω: 660Ω → 6.6KΩ → 66kΩ → 660KΩ → 6.6MΩ → 66MΩ → 660Ω... F: 6.6nF →66nF → 660nF → 6.6mF → 66mF → 660mF → 6.6mF → 40mF → 6.6 mF... Hz: 66Hz → 660Hz → 6.6KHz →66KHz → 660KHz → 6.6MHz → 10MHz → 66Hz...	MAN (11)
Long	Return to autoranging	AUTO (11)

Note: For °C, Continuity, Diode, AAC, ADC, %, all functions have fixed range.

Table 2

4.0 Liquid Crystal Display (LCD)

4.1 Digital Display

The main digital display shows the measurement value, decimal point, and sign. The selected measuring unit (15) and function (21) 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 terminal. "OL" appears if the measuring range upper limit 6600 (on the range →⊢:99 is exceeded.

The digital display is updated 2.8 times per second. The sub digital display (14) shows the measured value. The main purpose of the double display is to display simultaneous measurements as shown in Table 3.

Main Display	Sub Display
Voltage	Frequency
Voltage	Min/Max
Frequency	Duty Cycle
Current	Frequency

Table 3

4.2 Analog Indication

The analog indication with bar graph is updated 28 times per second. Analog indication is of particular use when observing variations of measured values. The analog bar graph (13) has its own polarity indication in measuring DC quantities, when the positive pole of the measured quantity is applied to the "⊥" input terminal. The analog bar graph has 65 scale divisions so that variations of the measured values around "zero"can be observed exactly. The over range is indicated by the right triangle (12) when measured value is > 6600 counts (for →⊢ measurement > 1999).

4.2 Display with Backlight (Optional)

This instrument is provided with a selectable backlight for taking measurements in poor lighting conditions.

Switching the Backlight On

Press the ☀ (9) to activate backlight for 60 seconds.

Switching the Backlight Off

Press the ☀ (9) again before 60 seconds has elapsed. The light will turn off automatically after 60 seconds.

5.0 Beeper

The following steps are acknowledged by a sound signal:

- Activation or deactivation of the following functions: AUTO/MAN, MIN/MAX, or HOLD, and Backlight.
- When measuring AC Voltage > 1000 V, AC/DC mA > 660.0 mA, the beeper will continue sounding as the overload warning.
- Approximately 1 minute before the meter is automatically powered off, the beeper will sound 5 times. Before the meter is powered off, the beeper will sound one long time to warn the user.

6.0 Hold and Delay Hold Features

6.1 Hold Function

Press HOLD (8) button to stop updating the LCD panel. After enabling the HOLD function, the meter switches from manual to automatic ranging mode, but measuring range remains the same.

6.2 Delay Hold Function

To activate Delay HOLD function, press HOLD (8) button for 2 seconds. The meter will wait for 6 seconds, then enters HOLD mode. In the 6 second period, the "HOLD" symbol on the LCD will blink and after 6 seconds the meter will hold the measured value present. To exit from delay HOLD function either change range or press AUTO/MAN (4), or HOLD (8) button again.

7.0 MIN/MAX Function

With the MIN/MAX function, you can hold the minimum and maximum measured value which was applied to the input of the multimeter after activating MIN/MAX function. The most important application is the determination of the minimum and the maximum value for long-term monitoring of measured parameters.

The actual measured value can still be noted/read during this feature. Apply the measured quantity to the meter and select the measuring range prior to activating the MIN/MAX function. With the function activated, you can select the measuring ranges only manually, if you switch to another range, the stored MIN/MAX values are cleared. After pressing MIN/MAX (3) for the first time, the sub display shows maximum value. Sub display shows minimum value when it is pressed again. Main display always shows current value in MIN/MAX mode.

To exit from this mode press and held MIN/MAX (3) button for longer than one second, operate the function selector switch, or turn the meter OFF and ON again. Pressing HOLD (8) in MIN/MAX mode makes the meter stop updating the maximum or the minimum value.

NOTE: MIN/MAX function is available in all the ranges of measurement except in Hz.

8.0 Peak Measurement

Multimeter 616 provides peak hold function to capture the maximum or minimum peak value. To enter peak mode, press PEAK (2) pushbutton for less than 1 second. A self-calibration process will execute automatically before normal peak-hold operation. In peak mode, main display shows current value of signal, and sub-display shows PMAX or PMIN value which is selected by PEAK (2) key. After pressing PEAK (2) pushbutton for the first time, sub-display shows PMAX value. Sub display shows PMIN value, when PEAK (2) pushbutton is pressed again. To exit PEAK-hold function, press PEAK key more than 1 second, operate the function selector switch, or turn the meter OFF and ON again.

9.0 Voltage Measurement

According to the voltage to be measured, set the function selector switch (6) to VAC or VDC. Connect the test leads as shown in figure 1. Insert black probe into the "⊥" terminal and red probe into the “V” terminal. In VAC mode main display always shows voltage and sub display shows frequency.

NOTE: The measuring range 660 mV can only be selected with the AUTO/MAN key.

ATTENTION: Ensure current measuring range (“mA” or “A”) is not selected while voltage measurement. When the cut-out rating of the fuses is exceeded because of incorrect operation, a dangerous situation exists.

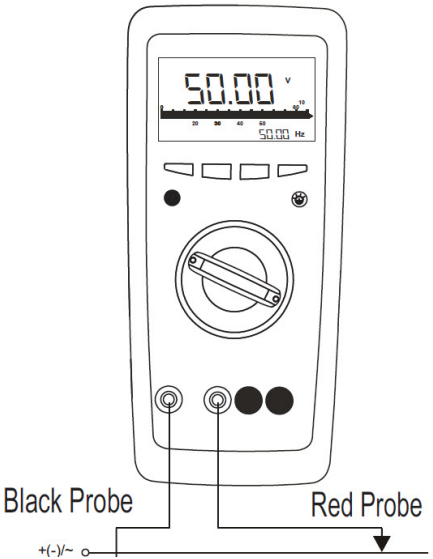

Fig. 1 Voltage Measurement

10.0 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 for currents >660 mA and mA for currents <=660 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 (5) pushbutton.

Each time the pushbutton is pressed, alternate switching takes place between DC and AC. The change-over is acknowledged by a sound signal.

The symbols DC and AC (21) are displayed as per selected function on the LCD.

When selecting a range with the function selector switch (6), the DC function is always set by default.

Connect the multimeter in series with the load, as shown. Ensure that the connections are tight (with least 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 1000 VAC/DC.
- 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.
- The current measuring ranges up to 660 mA are protected to a short circuit current of 25 A by a fuse 1.6 A/1000 VAC/VDC in conjunction, with power diodes. The cut-out capacity of the fuse is 10kA at a rated voltage of1000 VAC/VDC and ohmic load.
- The 10 A current measuring range is protected with a 16 A/1000 V AC/DC fuse. The cut-out capacity of the fuse is 30 kA at a normal voltage of 1000 VAC/VDC and ohmic load.
- Fuse replacement is described in chapter 17.2.

ATTENTION: The measuring ranges 16 A of multimeter 613 are not protected by a fuse.

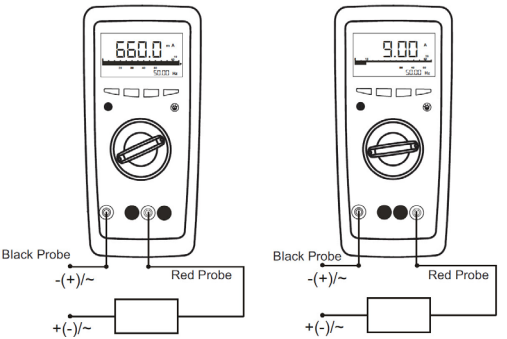

Fig. 2 Current Measurement

10.1 AC Measurement with (Clip-On) Current Transformers

10.1.1 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 connectors. 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 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.

Transformer Output Multimeter 612

The multimeter 612 shows the switching position "∝" and the corresponding sockets. Connect to this socket a (clip-on) current transformer with a transmission ratio of 1000:1 then the measured values are displayed directly in the “A’’ range.

10.1.2 Transformer Output V

Many transformers have voltage output (referred to as mV/A) The secondary output must therefore be connected to the connection sockets "⊥" and “ V ”.

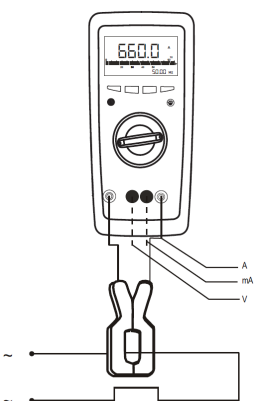

Fig. 3 Current Measurement w/ Clip-on Transformers

11.0 Resistance Measurement

- 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 in figure 4.

Zero Adjustment on the 660Ω Measurement Range

When measuring small resistance values on the 660Ω range, you can eliminate the resistance of the leads and contact resistance by REL function.

- Connect the test leads to the multimeter and join the free ends.
- Press and hold PEAK(2) and press the AUTO/MAN(4) pushbutton. The meter enter into the “REL” mode , “REL” symbol will displayed on to the LCD.
- Also “00.00” (+1digit) will displayed on main display & the resistance measured at the instance the pushbuttons were pressed is displayed on sub display & used as reference value.
- It is automatically deducted from the values measured there after.

There are two ways to clear the REL function:

- Press and hold PEAK and then pressing AUTO/MAN.
  - This is acknowledged by sound signals.
- Switch the multimeter off.

12.0 Diode Testing & Continuity Testing

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

12.1 Continuity Testing

- Set the function selector switch (6) to **Ω** then press the yellow multi-function pushbutton (5). The multimeter acknowledges turn-ON with a sound signal.
- At the same time, "🔊" appears on the LCD and “OL” will be displayed on main display.
- The sound signal is generated whenever the reading is less than 30 Ω.

12.2 Diode Testing

- Set the function selector switch (6) to **Ω** then press the yellow multi-function pushbutton (5) twice. The multimeter acknowledges turn-ON with a sound signal.
- At the same time, "→|←" appears on the LCD and “OL” will displayed on main display.
- The multimeter displays the forward voltage in Volts.
- As long as the voltage drop does not exceed the maximum display value of 1.999 V, you can also test several series-connected elements or reference diodes with small reference voltage.
- Reverse direction or open circuit: The meter indicates overrange “OL”.
- With the diode function selected, the meter emits a continuous sound signal whenever the reading is less than 30mV.

NOTE: Resistors and semiconductor junction in parallel with the diode falsify the measured results.

Changing over between Resistance, Continuity, and Diode Testing

Repeated brief pressing of the yellow multi-function key (5) changes the measuring functions in the following order: Resistance → Continuity → Diode → Resistance...

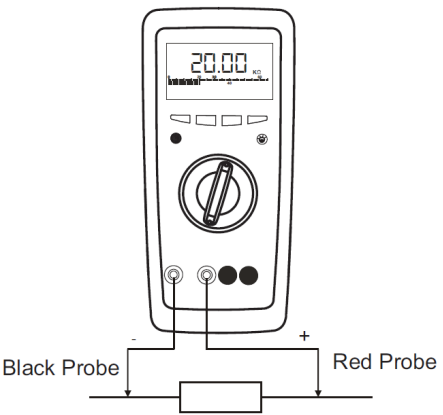

Fig. 4 Resistance Measurement

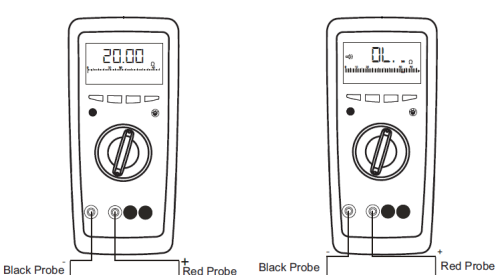

Fig. 5 Continuity Test

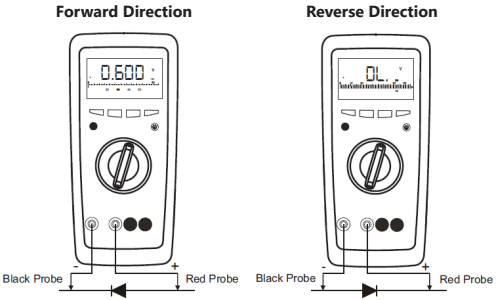

Fig. 6 Diode Test

13.0 Capacitance Measurement (615/616)

- 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 to the "⊥" and "⊣⊢" sockets via test lead.
- Connect polarized capacitors with the – pole to the "⊥" socket.
- Resistors and semiconductor junctions in parallel with the capacitor falsify the measured results.

Zero Adjustment (6.600 nF Measuring Range)

When measuring small capacitance values on the 6.600 nF range, the internal resistance of the multimeter and the capacitance of the leads can be eliminated by “REL” function.

- Connect the test leads to the meter without device under test.

- Press and hold PEAK (2) and press the AUTO/MAN(4) pushbutton. The meter will enter into the REL mode. “REL” symbol will be displayed on the LCD. Also, “00.00” (+1 digit) will be displayed on main display and the capacitance measured at the instant the button is pressed is displayed on the sub display and used as reference value. It is automatically deducted from the values measured there after.

The REL function can be cleared by pressing and holding PEAK and the pressing AUTO/MAN (this is acknowledged by sound signals), or by switching the multimeter off.

14.0 Frequency and Duty Cycle Measurement (615/616)

14.1 Frequency Measurement

- Set the function selector switch (6) to the “Hz”
- The multimeter switches to frequency measurement. The frequency is displayed on the main Display and duty cycle is displayed on to the Sub display. See chapter 16 for the lowest measurable frequencies and the maximum permissible voltages.
- Connections are made the same way as for voltage measurement in figure 1.

14.2 Duty Cycle Measurement

- With duty cycle measurement, it can determine the ratio of pulse duration to cycle time of recurring square-wave signals.
- Set the function selector switch (6) to the “Hz”.
- The multimeter switches to frequency measurement. The frequency is displayed on the main Display and duty cycle is displayed on to the Sub display.
- The duty cycle-that is the percentage pulse duration of a signal is displayed on the LCD in %.

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

- The applied frequency must remain constant during the duty cycle measurement

15.0 Temperature Measurement

The multimeter allows you to measure temperature with K-type thermocouple in the range from 0°C to 1300°C.

- Set the function selector switch (6) to “°C ”
- Connect the multimeter probe to the two unblocked terminals and thermocouple output.
- The multimeter measures temperature in °C.
- To measure temperature in °F press the yellow multi-function key (5) .

Changing between °C and °F

Repeated brief pressing of the yellow multi-function switch (5) changes the measuring functions in the following order: °C → °F → °C, etc. Analog scale is disabled during Temperature measurement mode.

NOTES

16.0 Specifications

Measuring Function	Measuring Range	612	613	615	616 TRMS	Resolution
V⎓	660.0 mV	●	●	●	●	100 µV
	6.600 V	●	●	●	●	1 mV
	66.00 V	●	●	●	●	10 mV
	660.0 V	●	●	●	●	100 mV
	1000 V	●	●	●	●	1 V
V~	660.0m V	●	●	●	●	100 V
	6.600 V	●	●	●	●	1 mV
	66.00 V	●	●	●	●	10 mV
	660.0 V	●	●	●	●	100 mV
	1000 V	●	●	●	●	1 V
A⎓						
	66.00 mA	●	●	●	●	10A
	660.0 mA	●	●	●	●	100A
	10.00 A		16A	●	●	10mA
A~	66.00 mA	●	●	●	●	10A
	660.0 mA	●	●	●	●	100A
	10.00 A		16A	●	●	10mA
⎓(AC) [5]	66.00 A	●				10mA
	660.0 A	●				100mA
Ω						
	660.0 Ω	●	●	●	●	111 mΩ
	6.600 KΩ	●	●	●	●	1 Ω

Measuring Function	Input Impedence	Digital Display Deviation ±(% of RDG+digits)	Overload Capacity [1]	
			Overload Values	Overload Duration
V⎓	>10 GΩ //<40pF	0.7+5	1000 V DC AC eff/rms Sine wave	Cont.
	11 GΩ //<40pF	0.4+5		
	10 GΩ //<40pF	0.4+5		
	10 GΩ //<40pF	0.4+5		
	10 GΩ //<40pF	0.4+5		
V~	>10 GΩ //<40pF	1.2+5		
	11 GΩ //<40pF	1.0+3		
	10 GΩ //<40pF			
	10 GΩ //<40pF			
	10 GΩ //<40pF			
A⎓	Voltage Drop			
	66.00 mV	0.8+5	0.7A	Cont.
	660.0 mV	0.8+5		
	350 mV	1.5+5	6)	6)
A~	66.00 mV	0.8+5	0.7A	0.7A
	660.0 mV	0.8+5		
	350 mV	1.5+5	6)	6)
⏦(AC)	66.00 mV	0.8+5	0.7A	Cont.
	660.0 mV	0.8+5		
Ω	No Load Voltage			
	-3.3 V	0.8+5		
	-1.08 V	0.8+5		

Measuring Function	Measuring Range	612	613	615	616 TRMS	Resolution
Ω	66.00 KΩ	•	•	•	•	10
	660.0 KΩ	•	•	•	•	100
	6.600 MΩ	•	•	•	•	1K
	66.00 MΩ	•	•	•	•	10K
Beeper	660.0 Ω	•	•	•	•	100 m
Diode	2.000 V	•	•	•	•	1 mV
F	6.600 nF			•	•	1 pF
	66.00 nF			•	•	10 pF
	660.0 nF			•	•	100 pF
	6.600 mF			•	•	1 hF
	66.00 mF					10 nF
	660.0 mF			•	•	100 nF
	6.600 mF			•	•	1 mF
	40.00 mF			•	•	10 mF
Hz	66.00 Hz			•	•	0.01 Hz
	660.0 Hz			•	•	0.1 Hz
	6.600 KHz			•	•	1 Hz
	66.00 KHz			•	•	10 Hz
	660.0 KHz			•	•	100 Hz
	6.600 MHz					1 KHz
	10.00 MHz			•	•	10 KHz
%	1.0 to 98.90%			•	•	.01%
°C / °F	0 to 1300 °C	•	•	•	•	1 °C

1) At 0°C to 40°C
2) At input >3.5 Vrms
3) For <10 Khz at 5 Vp-p

Measuring Function	Input Impedence	Digital Display Deviation ±(% of RDG+digits)	Overload Capacity[1]	
			Overload Values	Overload Duration
Ω	-1.08 V	0.8+5	1000 V DC AC eff/rms Sine wave	Max 10 S
	-1.08 V	0.8+5		
	-1.08 V	1.0+5		
	-1.08 V	2.0+5		
Beeper	-3.3 V	0.8+5		
Diode	-3.3 V	2.0+10		
F	—	3.0+40		
		2.0+10		
		2.0+10		
		2.0+10		
		2.0+10		
		5.0+10		
		5.0+10		
		5.0+10		
Hz	10 Hz (F min) —	0.2+2 [2]		
%	0.9% (% min)	10 Hz... 1 kHz ± 5Digit 3) 1 kHz...10 kHz:± 5 Digit/kHz [3]		
°C / °F	—	2.0+3 [4]		

4) Without sensor
5) Display with (clip-on) current transformers 1000:1
6) For Model 613 (without FUSE) 16A 10 min
For Model 615/616 (without FUSE) 12A 5min /16A 30s
Fuse will blow for current input >16A to safeguard the instrument and user

Influence Quality	Range of Influence		Measured Quantity/ Measuring Range	Variation [1] ±(% of RDG+digits)
Temperature	0 °C +21 °C and +25 °C...+40°C		VDC	1 x Intrinsic error
			VAC	
			ADC	
			AAC	
			Ω	
			Diode	
			F	
			Hz	
			%	
			°C	
Frequency of the measured quantity	20 Hz....< 50 Hz		660 mV~	1.0+3
	> 50 Hz... 200 Hz			5.0+3
	20 Hz....< 50 Hz		66 to 1000 V~	1.0+3
	> 50 Hz... 2 Khz			5.0+7
	20 Hz ...< 50 Hz		A~	1.0+3
	>50 Hz... 2 kHz			5.0+3
	Crest Factor CF	1 to 1.4 [2]	V~[3], A~[3]	± 1 % of rdg
		1.4 to 5		± 5 % of rdg
Battery Voltage	[4] ...< 2.49 V > 2.49V ...3 V		VDC	5 Digit
			V~,ADC	10 Digit
			AAC	6 Digit
			660Ω	5 Digit
			6.600 kΩ -66.00 MΩ	4 Digit
			nF,F,mF	3 Digit
			Hz	5 Digit
			%	5 Digit
Relative Humidity	75% 3 days Meter off		V~,VDC	1 x Intrinsic error
			A~,ADC	
			Ω	
			F	
			H	
			°C	
			%	

1) With temperature: Error data apply per 10K change in temperature

With frequency: Error data apply to a display from 300 digits onwards

2) With unknown waveform (crest factor CF>2), measure with manual range selection.

3) With the exception of sinusoidal waveform

4) After the "▭" symbol is displayed

Influence Quality	Range of Influence	Measuring Ranges	Attenuation
Common mode interference voltage	Noise quantity max. 1000 V	V⎓	> 100 dB
		V~	> 100 dB
	Noise quantity max. 1000 V~ 50 Hz, 60 Hz sinusoidal	V⎓	> 100 dB
		V~	> 60 dB
Normal mode interference voltage	Noise quantity V~ value of the measuring range at a time max. 1000 V ~, 50 Hz, 60 Hz. sinusoidal	660mV, 6.6V, 660V, 1000V DC	> 43 dB
		66 VDC	> 35 dB
	Noise quantity max. 1000 V -	V~	> 45 dB

Display

LCD display field (63mm x 43mm) with digital display and display of unit of measure, current type and various special functions.

Analog

Indication	LCD scale with bar graph
Scale length	55mm
Scaling	65 scale divisions
Polarity indication	Automativ reversal
Overrange indication	Triangle
Sampling rate	28 times/s

Digital

Main display character height	7 segment digits - 12 mm
Sub display character height	7 segment digits - 7 mm
Number of counts	4 digit - 6600 counts
Overflow display	"OL"
Polarity display	"–" sign is displayed when positive pole is at "⊥"
Sampling rate	2.8 times/s

Power Supply		
Battery	2 AA batteries alkaline manganese cells per IEC LR6	
Service Life	for 612, 613, 615	600 hrs VDC / ADC
		300 hrs VDC / ADC
	for 616	400 hrs VDC / ADC
		200 hrs VDC / ADC
Battery test	Automatic display of "▭" symbol when battery voltage falls below following value: approximately 2.	

Electromagnetic Capability		
Emission	EN 61326 : 2012 Table A.1, Class B	
Immunity	IEC 61000-4-2	8 kV atmosphere discharge
		4 kV contact discharge
	IEC 61000-4-3	3 V/m

Safety	IEC 61010-1-2010
Installation category	CAT IV 600 V CAT III 1000 V
Pollution degree	2
High voltage test	6.7 kV (IEC 61010-1-2010)

Fuses

Fuses for up to 660 mA ranges

FF (UR) 1.6 A / 1000 VAC/VDC; 6.3mm X 32mm; rating 10kA with 1000 VAC/VDC and ohmic load; in conjunction with power diodes, protects all current measuring ranges up to 660mA.

Fuses for up to 10A ranges (not 613)

FF (UR)16 A / 1000 VAC/VDC; 10mm x 38mm; rating 30kA with 1000VAC/DC and ohmic load; protects the 10A ranges up to 1000 VAC/VDC. See chapter 17.2 for types of fuses.

Reference Conditions

Ambient temperature	23 °C ± 2 K
Relative humidity	45% to 55% RH
Frequency of measured quantity	45 Hz to 65 Hz
Waveform of measured quantity	Sinusoidal
Battery voltage	3V ± .01V

Environmental Conditions

Functional temperature range	0 °C to 50 °C
Storage temperature range	-25°C to 70°C (w/o batteries)
Relative humidity	45% to 75%
Altitude	up to 2000m

Mechanical Configuration

Protection for the meter	IP 50
Connection sockets	IP 20 IAW DIN VDE0470 Part 1 / EN 60529
Dimensions	3.4 x 7.3 x 2.17in [86 x 185 x 55mm]
Weight	1.05lb [480g]

17.0 Maintenance

ATTENTION: The measuring ranges 16A of multimeter 613 are not protected by a fuse.

17.1 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)

Unscrew the battery compartment cover from base housing. No need to remove whole base housing.

Remove the batteries from the battery compartment Insert two new 1.5 V AA cells in accordance with the polarity symbols in the battery compartment.

Screw the base housing cover to front housing. Dispose of the dead batteries in an environmentally sound fashion. Refer to local regulations and guidelines for designated collection points or recycling facilities.

17.2 Fuses

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

Replacement of Fuses

- Place the multimeter on its face, loosen the two bottom cover screws on the rear and remove the bottom cover by, lifting it from the bottom.
- Remove the defective fuse using a fuse puller, test prod, or similar tool.
- Install a new fuse, ensuring it makes proper contact.
- Tighten the bottom cover with the two screws.

Only use the specified fuses:

For current measuring ranges up to 660mA:

- Type: FF (UR) 1.6A / 1000V (10KA)
- Size: 6.3mm × 32mm

For the 10A current measuring range:

- Type: FF (UR) 16A / 1000V (30KA)
- Size: 10mm × 38mm

ATTENTION: Use only the fuses specified above. Using a fuse with different specifications may place the operator, the system, and the meter in danger. Using repaired fuses and short-circuiting of the fuse holder is prohibited.

17.3 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.

18.0 Replacement Parts

Part Number	***Description***
ARD-PRB-STD	ARDENT standard tip test lead set, replacement, CAT IV 600V/CAT III 1000V, 48in length
ARD-PRB-FPT	ARDENT fine tip test lead set, replacement, CAT IV 600V/CAT III 1000V, 48in length
ARD-AG-CLP-1	ARDENT alligator clip set, CAT IV 600V/CAT III 1000V. For use with ARD-PRB-STD
ARD-CM-CLCT-1	ARDENT clamp-on current probe, CAT III 600V, 1-1000A
ARD-CM-CLCT-5	ARDENT clamp-on current probe, CAT III 600V, 10-1000A
ARD-TPA1	ARDENT temperature adapter and thermocouple
ARD-FS1P6A	ARDENT fuse, replacement, 1.6A
ARD-FS16A	ARDENT fuse, replacement, 16A
ARD-MM-BT-1	ARDENT rubber holster, replacement
ARD-MM-CASE-1	ARDENT carrying case, polyester canvas, 9.50 x 4.50 x 4.50in, 2 compartments

AutomationDirect
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Cumming, GA 30040
(800) 633-0405

ARD-MM612, 613, 615, 616 Rev. A: 4/30/2025