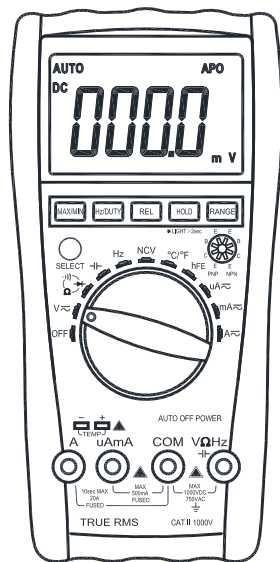


# DIGITAL MULTIMETER

## Operation Manual



### 1. General Description

This is a 3 3/4 digital multimeter with high stability and performance. It uses a LCD with 20mm high figure, which makes the reading clearer and the operation more convenient. It can test DCV, ACV, DCA, ACA, resistance, capacitance, frequency, NCV, duty cycle, temperature, diode, and continuity. This meter also designed with functions including unit symbol display, data hold, lighting, auto range, auto power off and warning functions. To assure high accuracy and resolution, it adopts integrated circuit 8-bit microprocessor and a dual integral A/D conversion as LCD driver, giving high resolution and high accuracy. It is an ideal tool for labs, factories and radio-technology.

### 2. Safety Instructions

The instrument VC97A is designed in compliance with IEC1010 standard (safety standard issued by International Electro technical Committee). Please read the following safety instructions before operation.

2.1 Check the connection and insulation of test leads to avoid electric shock.

2.2 To avoid electric shock and damage to the meter, do not input voltage exceeding rated value.

2.3 When measuring voltage higher than DC 60V or AC 40V, please be careful and avoid

electric shock.

2.4 Select correct function and range to avoid wrong operation.

2.5 Move the test leads away from test points when switching to other function.

2.6 Don't input voltage in current terminal.

2.7 Don't make any modification to the circuit. It may damage the meter or jeopardize safety.

2.8 Safety symbols:

“” GND, “” Refer to manual, “

### 3. Features

3.1 General Characteristics

3.1.1 Display: LCD;

3.1.2 Max display: 4000 (3 3/4 digits, automatic polarity, and unit symbol display);

3.1.3 Measurement method: Analog to digital converter (in micro processor ADC+MCU);

3.1.4 Sampling rate: approx.3 times/sec.

3.1.5 Over-range display: “OL” displayed.

3.1.6 Low battery indicator: “

3.1.7 Working environment: (0~40)°C, relative humidity: <80%;

3.1.8 Store condition: (-10~50)°C, relative humidity: <80%

3.1.9 Battery: 2 pieces 1.5V battery (“AAA” 7# battery);

3.1.10 Dimension: 185×93×35mm (length x width x height);

3.1.11 Weight: approx. 290g (including battery);

3.1.12 Accessories: test leads, TP01 thermocouple, user manual, holster, gift box, and 2\*1.5V batteries.

### 3.2 Technical Features

3.2.1 Accuracy:  $\pm (a\% \times \text{reading} + \text{digits})$ . To assure accuracy, the ambient temperature should be  $(23 \pm 5)^\circ\text{C}$ , relative humidity <75%. One year accuracy is guaranteed since production date.

#### 3.2.2 DC Voltage (DCV)

Range	Accuracy	Resolution
400mV	$\pm(0.5\%+5d)$	0.1mV
4V		1mV
40V		10mV
400V		100mV
1000V	$\pm(1.0\%+5d)$	1V

Input impedance: at 400mV range >40M $\Omega$ , at other ranges is 10M $\Omega$ .

Overload protection: 1000VDC or 750VAC peak value.

#### 3.2.3 AC Voltage (ACV) (True RMS)

Range	Accuracy	Resolution
400mV	$\pm(1.5\%+10d)$	0.1mV
4V		1mV
40V		10mV
400V	$\pm(0.8\%+10d)$	100mV
750V		1V

Input impedance: at 400mV range >40M $\Omega$ , at other ranges is 10M $\Omega$ .

Overload protection: 1000VDC or 750VAC peak value.

Frequency response: at 750V range: (40~1000)Hz, at other ranges: (40~2000)Hz

Displaying: True RMS response (calibration based on sine wave RMS)

#### 3.2.4 DC Current (DCA)

Range	Accuracy	Resolution
400uA	$\pm(1.0\%+5)$	0.1uA
4000uA		1uA
40mA		10uA
400mA		100uA
4A		1mA
20A	$\pm(2.0\%+5)$	10mA

Maximum voltage drop: 400 mV for full mA range, 200 mV for full A range.

Maximum input current: 20A (within 10 seconds).

Overload protection: 0.5/250V fuse and 13A/250V fuse.

#### 3.2.5 AC Current (ACA)

Range	Accuracy	Resolution
400uA	$\pm(1.5\%+10)$	0.1uA
4000uA		1uA
40mA		10uA
400mA		100uA
4A	$\pm(2.0\%+10)$	1mA
20A		10mA

Maximum voltage drop: 400 mV for full mA range, 200 mV for full A range.

Maximum input current: 20A (within 10 seconds).

Overload protection: 0.5/250V fuse and 13A/250V fuse.

Frequency response: at 20A range: (40~100)Hz, at other ranges: (40~400)Hz.

### 3.2.6 Resistance (Ω)

Range	Accuracy	Resolution
400Ω	±(0.8%+5)	0.1Ω
4kΩ		1Ω
40kΩ		10Ω
400kΩ		100Ω
4MΩ	±(0.8%+2)	1kΩ
40MΩ		10kΩ
	±(1.2%+5)	

Open circuit voltage: > 500mV.

Overload protection: 250V DC/AC peak value

NOTE: At 400Ω range, short the test leads first to measure the wire resistance and then subtracts it from the real measurement. Or press “REL” to clear the wire resistance and read the value directly.

### 3.2.7 Capacitance (C)

Range	Accuracy	Resolution
40nF	±(2.5%+6)	10pF
400nF		100pF
4uF		1nF
40uF	±(2.5%+5)	10nF
400uF		100nF
4mF		1uF
40mF		10uF
	±(5.0%+8)	

Overload protection: 250V DC/AC peak value.

### 3.2.8 Frequency (F)

Range	Accuracy	Resolution
10Hz	±(0.5%+4)	0.001Hz
100Hz		0.01Hz
1000Hz		0.1Hz
10kHz		1Hz
100kHz		10Hz
1MHz		100Hz
30MHz		1kHz

Input sensitivity: 0.7V rms.

Overload protection: 250V DC/AC peak value.

### 3.2.9 Transistor (hFE)

Measurement	Display Range	Test conditions
hFE NPN or PNP	0~1000	Base current is approx 15uA, Vce is about 4.5V

### 3.2.10 Diode and Continuity Test

Range	Description	Test Conditions
→ ) )	Diode forward voltage drop	Forward DC current is approx 0.8mA, reverse voltage is approx 2.2V.
	When the resistance under test is less than 50Ω, buzzer sounds continuously.	Open circuit voltage: 2V

Overload protection: 250V DC/AC peak value

**WARNING:** Do not input any voltage at this range.

### 3.2.11 Temperature (°C)

Range	Accuracy	Resolution
-40°C~1000°C	<400°C ±(1.0%+5) ≥400°C ±(1.5%+15)	1°C
0F~1832°F	<750°F ±(1.0%+5) ≥750°F ±(1.5%+15)	°F

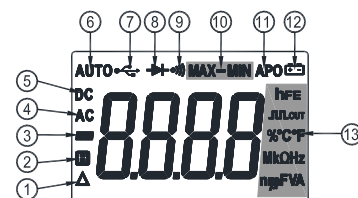
Thermocouple: K type

**WARNING:** do not input any voltage at this range.

## 4. OPERATION

### 4.1 Panel Description

①. LCD: Display the data and unit symbol



Number	Feature	Description
1	Δ	Relative (REL) mode is active.
2	H	Data Hold is active.
3	-	Indicates negative readings.
4	DC	DC voltage or current measurement.
5	AC	AC voltage or current measurement.
6	AUTO	Auto range mode.
7	Null	Null
8	Diode test	Diode test mode.

9	· ) )	The continuity beeper is on.
10	MAX-MIN	it can measure the MAX., MIN. value and difference value between MAX. and MIN..
11	APO	Auto power off symbol.
12	+	Low battery indication. Warning: To avoid error readings, which could lead to possible electric shock or personal injury, please replace the battery in time.
13	hFE Null % °C, °F MΩ, kΩ, Ω Hz, kHz, MHz mV, V uA, mA, A	hFE (Triode magnification measurement); Null; Duty cycle, Degrees Celsius, Degrees Fahrenheit; Megohm, Kilohm, Ohm; Hertz, Kilohertz, Megahertz; Millivolts, Volts; Microamp, Milliamp, Amperes (A).

②. Rotary switch: it is used to change the range and choose functions.

Switch position	Description
V	AC/DC voltage measurement. Press SELECT key to switch between frequency/ duty cycle measurements.
Ω	Resistance measurement / Diode / continuity measurement. Press SELECT key to choose diode, continuity or resistance range.
)	Capacitance measurement.
Hz	Frequency measurement, Press SELECT key to switch between frequency/ duty cycle measurements.
NCV	Non-contact voltage detector.
°C/°F	Temperature measurement, press SELECT key to choose °C or °F.
uA	DC current measurement (from 0uA to 6000uA). Press SELECT key to switch to AC current measurement (from 0uA to 6000uA).
mA	DC current measurement (from 0mA to 600mA). Press SELECT key to switch to AC current measurement (from 0mA to 600mA).
A	DC current measurement (from 0A to 10A). Press SELECT key to switch to AC current measurement (from 0A to 10A).

③ Input Terminal

Terminal	Description
TEMP	Input terminal for temperature measurement.
uAmA	Input terminal for AC and DC current from 0uA to 400mA (Max 18 hours for less than 400mA).
A	Input terminal for AC and DC current from 0A to 20.00A (Overload for max 10 seconds).
VΩHz	Input terminal for voltage, resistance, frequency, capacitance, diode, and continuity, and temperature positive (+) terminal.
COM	Common terminal for all measurements, and temperature negative (-) terminal.

④ Function Key

SELECTKey:

- Select function: Press SELECT key to choose DC or AC measurement under  $\sim$  ranges. Under  $\Omega \rightarrow |)|)$  (Diode/Continuity) range, press SELECT key can choose  $\Omega$  (resistance test),  $\rightarrow |)|)$  (diode test) or  $\cdot |)|)$  (continuity test). Under temperature ranges, press SELECT key to choose Degrees Celsius or Degrees Fahrenheit. Under ACV ranges, press SELECT key to switch between Frequency or Duty Cycle measurement.
- When there is no measurement in 15 minutes, the meter will automatically power off

and enter sleep mode. One minute before sleep mode, the buzzer will beep for 5 times to remind user. Press any button will exit the sleep mode.

- 3) Hold the SELECT key down when turn on the meter to cancel auto power off function.

RANGE Key:

Auto range is the default when you turn on the meter, and the meter displays "AUTO" symbol. Press RANGE to enter manual range mode. Press RANGE to switch between the ranges available for the selected function. Hold the RANGE button down for more than 2 seconds to return to auto ranging.

REL Key: relative value test or zeroed function key.

- 1) Under Voltage, current and resistance measurement, press REL key, the LCD appears  $\Delta$  symbol, the meter enters manual range mode and stores the present reading as a reference, then LCD displays the difference value between the stored reading and the tested reading. Press REL key again to exit relative value test mode.
- 2) Under lower range capacitance measurement, REL key is as zeroed function key, press REL key, the display is zeroed.

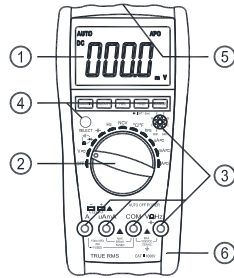
HOLD/Light Key

- 1) HOLD Key : Press HOLD key to enter HOLD mode. The current value will be hold, and symbol "H" will be displayed. Press HOLD again to exit the HOLD mode.
- 2) Light Key: Press HOLD key for more than 2 seconds to turn on the backlight. The backlight can last for 15 seconds. During 30 seconds, press "Light" key for 2 seconds again to turn off the backlight.

⑤ Non-contact voltage detector area.

⑥ Holster, Battery door.

See picture.



4.2 DCV measurement

4.2.1 Insert the black test lead into "COM" terminal, and the red one into "V $\Omega$ Hz" terminal;

4.2.2 Turn the rotary to switch to "V" ranges. Press "SELECT" key to choose DC measure mode;

4.2.3 Auto range is the original states, it will display "AUTO" symbol. Press "RANGE" key to change to manual range mode, and 400mV, 4V, 40V, 400V, 1000V range is selectable;

4.2.4 Connect test leads to the test point; LCD will display polarity and voltage of the test point connected by the red test lead.

NOTE:

- 1) If LCD display "OL" under manual range, it means it is over range, now you need to select a higher range.
- 2) Do not input voltage over 1000V. Or it may cause damage to the circuit of the meter,

and the built-in buzzer will alarm.

- 3) Be careful while measuring a high voltage circuit. DO NOT touch the high voltage circuit.

4.3 ACV measurement

4.3.1 Insert the black test lead into "COM" terminal, and the red one into "V $\Omega$ Hz" terminal;

4.3.2 Turn the rotary to switch to "V" ranges. Press "SELECT" key to choose AC measure mode;

4.3.3 Auto range is the original states, it will display "AUTO" symbol. Press "RANGE" key to change to manual range mode, and 400mV, 4V, 40V, 400V, 750V range is selectable;

4.3.4 Connect test leads to the test point; LCD will display voltage of the test point connected by the test leads.

NOTE:

- 1) It's only manual range available under 400mV range measurement, press RANGE key to select 400mV range before 400mV range measurement;
- 2) If LCD display "OL" under manual range, it means it is over range, now you need to select a higher range.
- 3) Do not input a voltage over 1000V. Or it may cause damage to the circuit of the meter, and the built-in buzzer will alarm.
- 4) Be careful while measuring a high voltage circuit. DO NOT touch the high voltage circuit.

4.4 DCA measurement

4.4.1 Insert the black test lead into "COM" terminal and the red one into "mA" terminal (Max. 400mA) or into "A" terminal (Max.20A);

4.4.2 Switch the knob to a proper current range, and then connect the test leads to the electric circuit. LCD will display polarity and current of the test point connected by the red test lead.

NOTE:

- 1) Firstly users should select the highest range, if users not sure about the range of current under test, and then select the proper range based on displaying value.
- 2) If the LCD displays "OL", it means the current is over range. Now you need to select a higher range.
- 3) When tested current  $\geq 10A$  at 20A range, buzzer will sound to remind user.
- 4) Maximum input current is 400mA or 20A (subject to where the red test lead insert into). Current higher than that will damage the fuse, and may cause damage to the circuit of meter.

4.5 ACA measurement

4.5.1 Insert the black test lead into "COM" terminal and the red one into "mA" terminal (Max. 600mA) or into "A" terminal (Max.20A);

4.5.2 Switch the knob to a proper current range, press "SELECT" key to select the AC mode, and then connect the test leads to the electric circuit. LCD will display current value.

NOTE:

- 1) Firstly users should select the highest range, if users not sure about the range of current under test, and then select the proper range based on displaying value.

- 2) If the LCD displays "OL", it means the current is over range. Now you need to select a higher range.

- 3) When tested current  $\geq 10A$  at 20A range, buzzer will sound to remind user.

- 4) Maximum input current is 400mA or 20A (subject to where the red test lead insert into). Current higher than that will damage the fuse, and may cause damage to the circuit of meter.

4.6 Resistance measurement

4.6.1 Insert the black test lead into "COM" terminal and the red one into "V $\Omega$ /Hz" terminal.

4.6.2 Switch the knob to " $\Omega$ " range, and connect the leads with the resistor under test.

4.6.3 Press "RANGE" key to choose auto or manual range.

4.6.4 Before measuring low resistance, you should make the test leads short-circuit at first, and then press "REL". By this way, you can get the actual value of the resistance.

NOTE:

- 1) If you are not sure about the range of current under test, please select the highest range;
- 2) If LCD displays "OL", it means it is over range. Now you need to select a higher range. When measuring value is over  $1M\Omega$ , the reading will take a few seconds to be stable. It's normal for high resistance measurement;
- 3) When input terminal is in open circuit, LCD will display "OL";
- 4) Before measuring in line resistor, make sure that the power is off and all capacitors are discharged completely;
- 5) When there is big error, it may be affected by other online component or there is voltage on the resistor;
- 6) Do not input any voltage at resistance range.

4.7Capacitance measurement

4.7.1 Switch the knob to " $\text{---}||\text{---}$ " range;

4.7.2 Insert the black test lead to "COM" terminal and the red one to "V $\Omega$ /Hz" terminal;

4.7.3 If the LCD doesn't display "0", press "REL" to clear the reading;

4.7.4 Connect the capacitor to "COM" and "V $\Omega$ Hz" terminal. (Note: the red test lead is for positive pole  $\oplus$ ).LCD displays capacitance value.

NOTE:

- 1) Don't input voltage or current under capacitance ranges;
- 2) Press "REL" to clear the reading before testing to assure the accuracy;
- 3) There is only the auto range mode under the capacitance range;
- 4) The capacitor must be completely discharged before testing to avoid damage the meter;
- 5) The reading of a higher than 200uF range will take more than 15 seconds to be stabled.

4.8 FREQUENCY MEASUREMENT

4.8.1 Insert the test leads or shielded cable into "COM" terminal and "V  $\Omega$  Hz" terminal;

4.8.2 Turn the rotary to switch to "Hz" range, connect the test leads or shielded cable to the

signal source or the load which is tested (It should over 3Hz).

4.8.3 Press “Hz/DUTY” key to choose frequency/duty cycle measurement, LCD will display the frequency or duty cycle of the tested signal source.

NOTE:

- 1) There is only the auto range mode under the frequency range;
- 2) The meter can still work if the input current is higher than 10V rms, but the accuracy is not guaranteed;
- 3) In noisy environment, it's better use shield cable to measure a low signal;
- 4) When measuring high voltage circuit, do not touch the high voltage circuit;
- 5) Don't input voltage higher than 250V DC or AC peak value, or it may damage the meter.

#### 4.9 NON-CONTACT VOLTAGE (NCV) DETECT

WARNING:

This function could be affected by different external interference sources, and then the alarm is activated by wrong signal. The measurement result is for reference only.

Turn the rotary function switch to “NCV” position. When the testing circuit is placed above the meter, the meter displays the strength of signal, and the buzzer alarms with “beep beep”.

NOTE:

- 1) Even if there is no voltage indication, there may be voltage on the circuit. Do not rely on NCV detector as the only way to detect voltage.
- 2) Voltage detecting may be affected by power socket design, type of insulation and its thickness and other factors.
- 3) Interference sources in the external environment, such as flashing light, motor, would cause wrong signal to activate alarm function.

#### 4.10 Transistor hFE measurement

4.10.1 Switch the knob to hFE range;

4.10.2 Define the transistor is NPN or PNP type, then insert the emitter, base and collector separately into the relative hole, the value will be displayed on LCD.

#### 4.11 Diode and Continuity test:

4.11.1 Insert the black test lead into “COM” terminal and the red one into “VΩHz” terminal (the polarity of red lead is “+”)

4.11.2 Switch the knob to  $\Omega \rightarrow \rightarrow \rightarrow$  range, and press “SELECT” key to select diode measurement mode, and then connect test leads with the diode under testing,

4.11.3 Forward measurement: connect red test lead to the positive polarity and the black test lead to the cathode polarity of the diode. LCD will display the approx. value of forward voltage drop.

4.11.4 Backward measurement: connect red test lead to the cathode polarity and the black test lead to positive polarity of the diode. LCD will display “OL”.

4.11.5 The complete diode testing includes forward and backward measurement, if the result doesn't meet the descriptions above; it means the diode is broken.

4.11.6 Press “SELECT” key to select the Continuity measurement mode.

4.11.7 Connect test leads to two points of tested circuit, if the resistance is less than (50±10)

Ω, the buzzer sounds.

NOTE:

- 1) Don't input voltage at “ $\Omega \rightarrow \rightarrow \rightarrow$ ” range.
- 2) When test circuits, make sure the power is off and all capacitors are discharged. Any potential or AC signal will activate the buzzer.

#### 4.12 TEMPERATURE MEASUREMENT


4.12.1 Turn the rotary switch to “C/F” range. Press “SELECT” key to select °C or °F mode.

4.12.2 Insert the cold end (free end) black plug of thermocouple in “TEMP- (or COM)” terminal, insert red plug of thermocouple in “TEMP+ (or VΩHz)” terminal, and put the working end (temperature measuring end) of thermocouple on the surface or inside the tested object. Then LCD will display the temperature of tested object, and the reading is in °C/°F (when the polarity is contrary. The reading will decrease when the temperature of the tested object increase).

NOTE:

- 1) When the input terminal is open circuit, it will display the environment temperature.
- 2) Don't change the temperature probe randomly, or the accuracy will not be guaranteed.
- 3) Don't input voltage at temperature range.

#### 4.13 Data hold

Press HOLD will enter HOLD mode, the current value will be held on LCD and  symbol will be displayed. Press HOLD again can exit the HOLD mode.

#### 4.14 Auto power off

4.14.1 If there is no measurement in 15 minutes, the meter will turn into dormancy mode. 1 minute before the auto power off the built-in buzzer will be sound 5 times. Press any key to restart the meter.

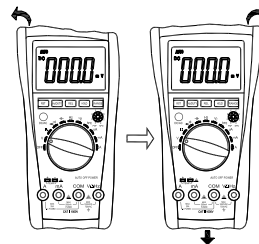
4.14.2 Keep “SELECT” key down when turn on the meter, auto power off function will be canceled.

### 5. METER MAINTENANCE


The meter is a precise instrument. Random changes to the circuit are not allowed.

NOTE:

- 1) Don't input the voltage value higher than DC 1000V or AC 750V rms.
- 2) Don't input voltage at current, resistance, diode and continuity range.
- 3) Don't make any measurements when the battery isn't installed or the back cover isn't fixed.
- 4) Before replacing fuse, please remove the test leads from the measuring point and turn off the power.
- 5) Keep the meter away from water, dust and shock.
- 6) Don't expose the meter under high temperature, high humidity, combustible, explosive and strong magnetic place.
- 7) Wipe the case with a damp cloth and detergent. Do not use abrasives and alcohol to clean the meter.
- 8) If do not operate for a long time, you



should take out the battery to avoid leakage damage.

9) When “” symbol is displayed, you should replace the battery according to the following steps:

9-1) Follow picture 2, and remove the holster at first.

9-2) Screw off the fixing screws of the battery door and remove the cover;

9-3) Take off the old battery and replace with a new one. To extend the using life, it's better to use alkaline battery.

9-4) Fix the battery door.

9-5) Follow the picture to put on the holster.

10) Fuse replacement: When replacing fuse, please use fuse with same type and specification.

10-1) Remove the holster first, then screw off the fixing screws of the battery door and back cover to remove the cover;


10-2) Take off the old fuse and replace with a new one.

10-3) Install the back cover, then fix the screws of the battery door and back cover. Put on the holster.

### 6. Trouble Shooting

If the meter does not work properly, please check the meter as following steps:

(If the problems still cannot be solved, please refer to repairing center or contact the local dealers.)

Fatult	Solution
No reading on LCD	<ul style="list-style-type: none"> <li>■ Turn on the power;</li> <li>■ Release the HOLD key;</li> <li>■ Replace battery.</li> </ul>
 signal appears	<ul style="list-style-type: none"> <li>■ Replace battery.</li> </ul>
No current input	<ul style="list-style-type: none"> <li>■ Replace fuse.</li> </ul>
Big error Value	<ul style="list-style-type: none"> <li>■ Replace battery.</li> </ul>

- The specifications are subject to changes without prior notice;
- The content of this manual is regarded as correct. If users find out any mistakes or omissions, please kindly contact the manufacturer;
- The manufacturer will not be responsible for accidents and damage caused by improper operations;
- The functions described in this User Manual shall not be considered as the reason for any special usages;