

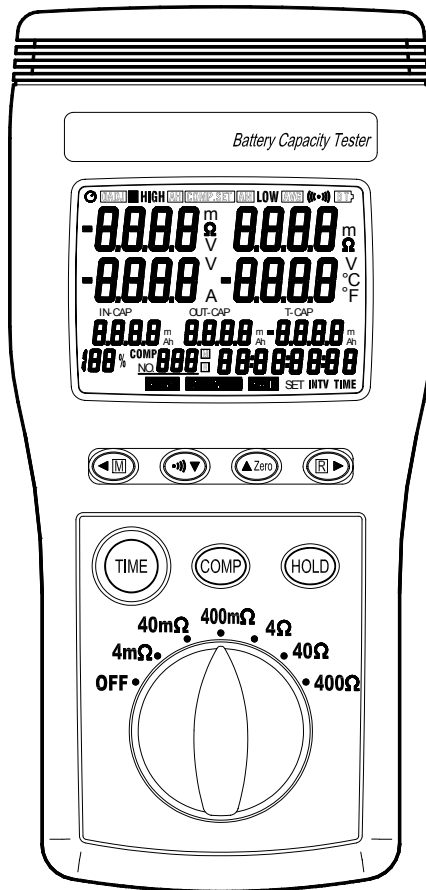


Battery Capacity Tester

TES - 33

INSTRUCTION MANUAL

Enclosed CD : Software & Protocol Inside.



TES ELECTRICAL ELECTRONIC CORP.

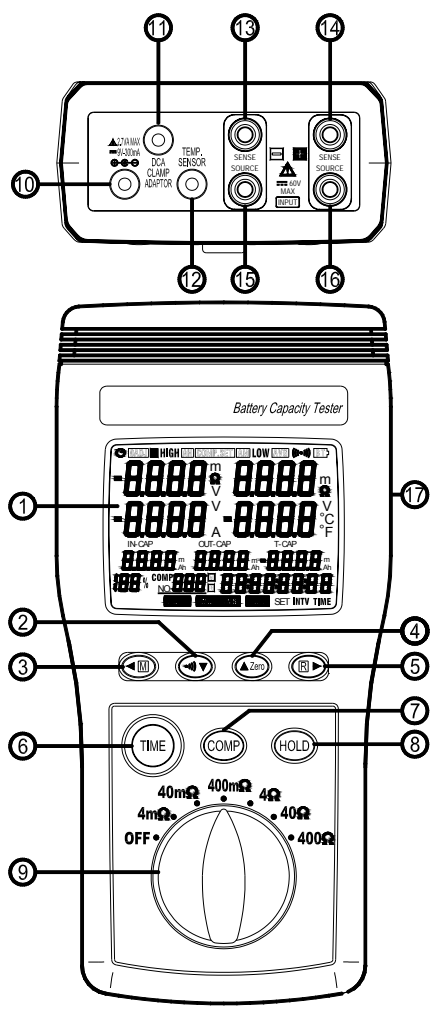
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1. FEATURES

- The Battery Tester is designed for measuring the internal resistance, open-circuit voltage, and terminal temperature of the secondary batteries, including lead storage cells, nickel-cadmium batteries, lithium-ion batteries and nickel-metal hydride batteries.
- AC four-terminal method to measure the internal resistance by eliminating lead resistance and contact resistance to get the accurate results.
- Dual display to show the internal resistance and voltage of the battery simultaneously.
- It has 99 sets of composite comparator function, which can be set at resistance and voltage values to get the reliable detection of battery deterioration.
- Pin type lead, which can easily contact the battery electrodes supplied as standard to get more accurate 4-terminal measurement.
- Clip type lead with temperature sensor.
- Clamp adaptor for DC current measurements.

2. NAMES AND FUNCTIONS OF PARTS



Switches and input terminals

1. LCD display.
2. key :
 - ① to turn the beeper on or off.
 - ② to decrease the displayed value.
 - ③ keep pressing this key 2 seconds to change the temperature units.

3. ◀ **M** key :

- ① to store one sets reading to memory.
- ② to move the cursor to the left.
- ③ keep pressing this key 2 seconds to auto-memory mode, press this key again to exit.
- ④ keep pressing this key 4 seconds to auto data logging mode, press this key again to exit.

4. ▲ **Zero key** :

- ① to turn the zero adjustment function on or off.
- ② to increase the displayed value.

5. **R** ▶ key :

- ① to manual recorded data reading mode, press this key again to exit.
- ② to move cursor to the right.

6. **TIME key** :

- ① to average number setting mode, press this key again to exit.
- ② keep pressing this key 2 seconds to real-time setting mode, press this key again to exit.
- ③ keep pressing this key 4 seconds to auto-memory and auto data logging interval time setting mode, press this key again to exit.

7. **COMP key** :

- ① to turn the comparator function on and off.
- ② keep pressing this key 2 seconds to comparator setting mode, press this key again to exit.

8. **HOLD key** :

- ① to turn the data hold function on or off.
- ② keep pressing this key 2 seconds to turn the auto-hold function on, press this key again to exit.

9. **Rotary switch** : Power on/off and resistance range selector switch.

10. **AC adaptor input jack** : Connects to the black plug of the ac adaptor.

11. **DCA CLAMP ADAPTOR input jack** : Connects to the yellow plug of the DCA current adaptor.

12. **TEMP. SENSOR input jack** : Connects to the blue plug of the clip type test lead.

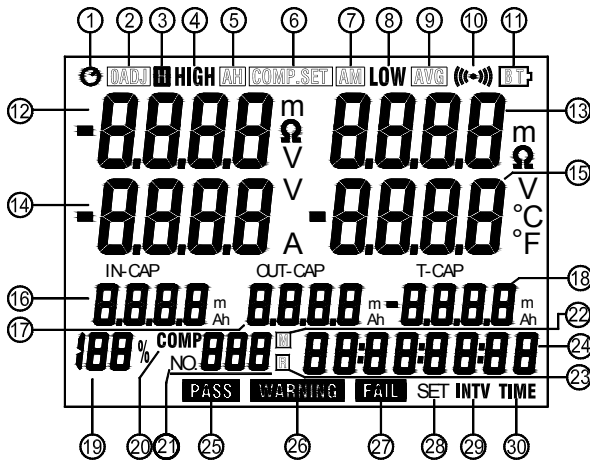
13. **SENSE – input terminal** : Connects to the blue banana plug of the test lead.

14. **SENSE + input terminal** : Connects to the yellow banana plug of the test lead.

15. **SOURCE – input terminal** : Connects to the black banana plug of the test lead.

16. **SOURCE + input terminal** : Connects to the red banana plug of the test lead.

17. RS232 optical interface : PC interface connector.
Display



1. : auto power off function is on.
2. **OADJ** : resistance zero adjustment function is on.
3. **H** : display is locked.
4. **HIGH** : comparator value setting function is on.
5. **AH** : auto-hold function is on.
6. **COMP.SET** : comparator value setting function is on.
7. **AM** : auto-memory function is on.
8. **LOW** : comparator value setting function is on.
9. **AVG** : average function is on.
10. : beeper is turned on.
11. **BT** : battery of the meter is low.
12. **-0.000** m V : Measured voltage or comparator resistance high limit setting.
13. **0.000** m Ω : Measured resistance or comparator resistance low limit setting.
14. **-0.000** VA : Measured DC current or comparator voltage high limit setting.
15. **-0.000** v : Measured temperature or comparator voltage low limit setting.

16. **IN-CAP** **8888** mAh : Measured battery charge capacity.
17. **OUT-CAP** **8888** mAh : Measured battery discharge capacity.
18. **T-CAP** **8888** mAh : Measured battery total capacity.

$$(T-CAP) = (IN-CAP) - (OUT-CAP)$$
19. **100%** : the remaining of capacity of the calculated battery.
20. **COMP** : Appears when the comparator function is on.
21. **NO** **888** : Indicates the number of data memory (1-999) or the comparator table number (1-99).
22. **M** : Flashes once when the one sets data stored to memory.
23. **R** : Appears when the read function is on.
24. **88:88:88:88** : Indicates the elapsed time or the real time (day : hour : minute : seconds).
25. **PASS** : Indicates that the tested battery is satisfactory for operation.
26. **WARNING** : Indicates that the tested battery is beginning to deteriorate.
27. **FAIL** : Indicates that the tested battery has deteriorated.
28. **SET** : Appears when setting the average number, the time, and the interval time function is on.
29. **INTV** : Appears when setting the memory interval time function is on.
30. **TIME** : Appears when setting the real time function is on.

3. SPECIFICATIONS

3-1 General Specifications :

- **Measuring method** : Resistance : AC four – terminal method.
Temperature : NTC thermistor.
DC current : Hall sensor.
- **A/D conversion** : Dual slope method.
- **Display** : LCD
- **Sampling rate** : 1.3 sets (resistance, voltage, temperature and DC current measurements)/second.
- **Open-Circuit terminal voltage** : 5V max.
- **Input over range** : “OL” display.
- **Low battery detection** “ **BT** ” display.
- **Test current fault detection** : “ - - - ” display.
- **Auto power off** : If no key operated for 10 minutes.
- **Averaging function** : OFF, 4, 8 or 16 times.
- **Beeper function** : for warning and fail results (can be turned on or off).
- **Comparator settings** : Resistance / voltage High / Low limits.
- **Number of comparator settings** : 99 sets.
- **Comparator output** : LCD display of PASS, WARNING, or FAIL results and beeper for warning and fail results.

Resistance Voltage	Lo	IN	Hi
Lo	WARNING	WARNING	FAIL
Hi	PASS	WARNING	FAIL

- **Manual and Auto Data memory** : 999 sets (can be read by meter and download by PC).
- **Continuous Data logging** : 6000 sets (only download by PC).
- **Operating environment** : 0 to 40 80%RH (no condensation)
- **Storage environment** : -10 to 50 80%RH (no condensation)
- **Power source**: Meter→ Six AA size 1.5V alkaline batteries.
DCA current adaptor→ one 9V battery.

- **Maximum power consumption** : 1.0VA
- **Continuous operating time** : 5.5 hours approx.
- **Maximum altitude value usable** : 2000m or less.
- **Size** : Meter→ 198(L)mm × 94(W)mm × 49(T)mm
DCA current adaptor → 193(L)mm × 69(W)mm × 31(T)mm
- **Weight** : Meter → 530g approx. (including batteries)
DCA current adaptor → 240g approx. (including batteries)
- **Accessories** : Clip – type test lead with temperature sensor, Pin – type test lead, 3092CP DCA current adaptor, Zero adjustment board, Instruction manual, batteries, AC adaptor, Optical RS232 cable, CD PC software, Carrying case.

3-2 Electrical Specifications

Conditions to guarantee accuracy :

Temperature : 23 ± 5

Humidity : 80%RH or less (no condensation).

Temperature coefficient : 0.10 x (specified accuracy) / . (<18 or > 28)

Zero adjustment : After zero adjustment for each range.

● Resistance measurement


Range	Resolution	Measurement current	Accuracy
4m	1μ	40mA approx.	±(3% reading ± 20 digits)
40m	10μ	40mA approx.	±(0.8% reading ± 6 digits)
400m	100μ	4mA approx.	
4	1m	400μA approx.	
40	10m	40mA approx.	
400	100m	4μA approx.	

Measuring current frequency : 1KHz ± 30Hz

● **Voltage Measurement**

Range	Resolution	Accuracy
6V	1mV	±(0.1% reading ± 6digits)
60V	10mV	

Maximum Input Voltage : 60VDC maximum, No AC voltage input.



DANGER

Do not exceed the maximum permissible input voltage to the measurement terminal. This could result in injury or damage to the unit.

● **Temperature Measurement**

Range	Resolution	Accuracy
-20 to 60	0.1	±1.0
-4 to 140	0.1	±1.8

● **DC Current Measurement**

Range	Sensitivity	Resolution	Accuracy
600A	0.6A ~ 600.0A	0.1A	±(2.0%reading±2digit)

● **Optional Accessories : PROVA 15 (including plug wire)**

DC Current Measurement

Range	Sensitivity	Resolution	Accuracy
4A	6mA ~ 4A	1mA	±(2.0%reading±2digit)
30A	60mA ~ 30A	10mA	±(2.0%reading±3digit)

4. OPERATION

4-1 Preparation

The following safety information must be observed to ensure maximum personal safety during the operation of this tester.

1. To avoid electric shock when replacing the batteries first disconnect the leads from the object to be measured.
2. When replacing the batteries, do not install old batteries with new ones and do not mix different types of batteries.
3. Check the battery polarity carefully when inserting the batteries.
4. Do not short-circuit used batteries, disassemble them, or throw them in a fire. Doing so may cause the batteries to explode.
5. Be sure to dispose of used batteries properly.
 - ① Remove the battery cover.
 - ② Insert the batteries into the battery compartment.

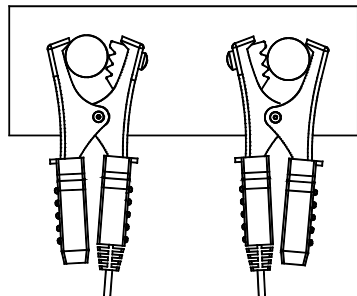
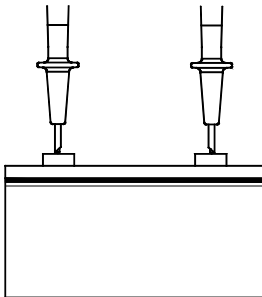
4-2 Operation



WARNING

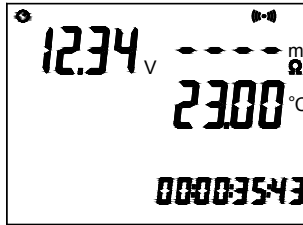
- Do not attempt to measure DC voltage exceeding 60V. Do not attempt to measure AC voltages. This could result in injury or damage to the unit.
- Do not attempt to measure the voltage of a generator. This would result in an AC voltage being applied to the voltage generating output terminals, which is dangerous.
- After measuring a high voltage battery, before continuing to measure a low voltage battery first short the measurement leads together. This will discharge the DC-elimination capacitor which is connected across the leads. Otherwise an excess voltage may be applied to the low voltage battery, which is dangerous.

1. Connect the RED test lead to the SOURCE + terminal, the BLACK test lead to the SOURCE – terminal, the YELLOW test lead to the SENSE + terminal, and the BLUE test lead to the SENSE – terminal.
2. Connect the BLUE miniature plug of the clip type test lead with temperature sensor to the TEMP. SENSOR jack.
3. Rotate the resistance range switch to the desired position.
4. Carry out the zero adjustment (for detail, see section 4-3).
5. Connect the red clip (probe) of the test lead to the positive (+) side of the battery to be tested and black clip (probe) to the negative (–) side.
The outer shield conductors of the clip (probe) are connected to the SOURCE terminals, and the inner clip (probe) conductors are connected to the SENSE terminals. When contacting the clips (probe) with the battery terminals, press to that the inner clip (probe) conductors are pushed in side, and all of the SOURCE and SENSE conductors make good contact.



6. Read the battery internal resistance, DC voltage and temperature directly from the display.

When using the clip type test lead, the temperature sensor is detected and the temperature is automatically displayed.



7. Press “**•••**” key 2 seconds will change the displayed temperature unit.

- Note**
- When the measured DC voltage or battery internal resistance value is over load, “OL” is display.
 - A resistance indication “- - - -” means the AC test current fault that the measurement could not be made, because there is a break in the test lead circuit, or the leads are not making good contact with the object to be measured, or if its resistance is extremely large compared with the measurement range.

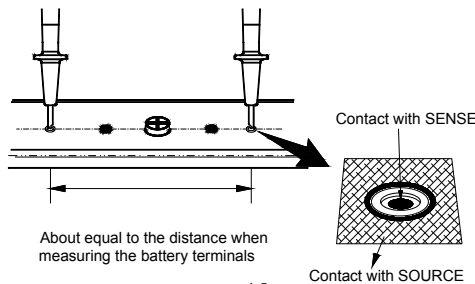
4-3 Zero Adjust Function

The zero adjustment function is to zero the range of resistance. The reading during zero adjustment will be taken as zero and will be used to calibrate subsequent measurements.

4-3-1 Pin-type Test Lead Zero Adjustment

Using the supplied zero adjustment board, zero adjustment can be carried out according to the AC four terminal method.

1. Rotate the resistance range switch to the desired position.
2. Press “**ZERO**” key to turn on the zero adjustment function on, the “**OADJ**” is displayed by flashing.
3. As shown in the illustration, push the pin type test leads onto two holes in the zero adjustment board. Choose holes symmetrically on both sides of the center screw, so that the distance between the leads is about equal to the distance when measuring the battery terminals.



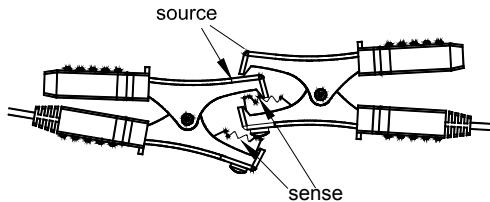
4. When the resistance reading is lower than 200 digits and stable, the zero adjustment is automatically carried out, the “**0ADJ**” is stop flashing and the beeper sounds.
5. Remove the pin type test leads from the zero adjust board and measurement starts, connect the leads to the battery to be tested.
6. Press “**Zero**” key to exit this function.

Note

- If the terminal spacing of the battery to be measured is large than the zero adjustment board, use the outer most holes for adjustment.
- The zero adjustment is valid for the currently selected range only, as long as the power remains on. Powering on the meter will resets all zero adjustment values.

4-3-2 Clip – type Test Lead Zero Adjustment

Short the SOURCE and SENSE of the clip type test lead with temperature sensor together as shown in the figure below.



The other procedure the same as the pin-type test lead zero adjustment.

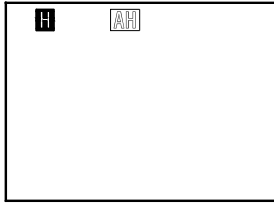
4-4 Hold and Auto – hold Functions

4-4-1 Hold function

Press **Hold** key, “ **H** ” appears on the display and display is locked.
Press **HOLD** key again to exit.

4-4-2 Auto – hold function

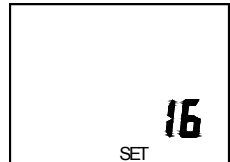
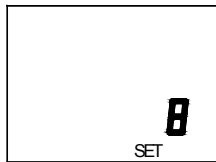
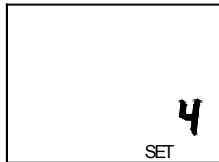
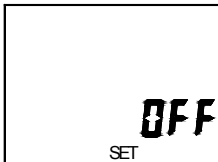
1. Press **HOLD** key 2 seconds to auto – hold function, “ **AH** ” appears on the display.
2. The meter holds the reading on the display until it detects a new stable reading. Then the meter beeps and displays the new reading. When the measured one reading are stable, “ **H** ” appears on the display.
3. Press **HOLD** key again to exit.



4-5 Moving Average Function

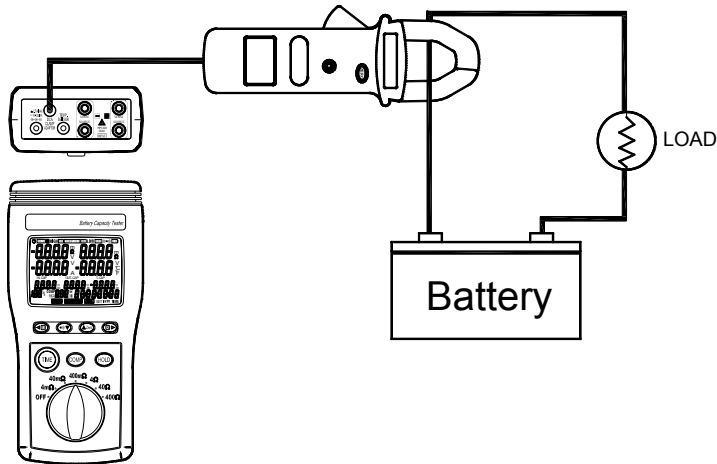
If the resistance measurement value is unstable, this can be corrected with the moving average function.

1. Press **TIME** key to samples select mode, "SET" appears on the display.
2. Press **▲ / ▼** key to select desired "OFF (no average)", "4", "8" and "16" samples for average.
3. Press **TIME** key again to stored the setting and exit.



4-6 DC Current Measurement

1. Connect the yellow miniature plug of the DCA current adaptor to the meter DCA CLAMP ADAPTOR jack.
2. Press **POWER** key of the DCA current adaptor to turn on the adaptor, the POWER LED will lighted. If the LOW BATTERY LED lighted, you should replace the battery.
3. Make sure the transformer jaw are empty, then press ZERO key to null out stray magnetism, the LCD then shows 0.0A.
4. Clamp the current transducer (jaw) around one of the conductors under test. Make sure that the clamp jaw be perfectly closed.
5. Read the meter current value.



4-7 Disable Auto Power off Function

If no switch operation for 10 minutes, the meter automatically powers off.

Auto data memory and continuous data logging mode will auto disable the auto power off function.

For continuous measurement, in some case it may be necessary to disable the auto power off function.

1. Rotate the resistance range switch to OFF position, turn off the meter.
2. Press and hold down “**HOLD**” key, then rotate the resistance range switch to any range to turn on the meter, the “ \odot ” symbol will disappear.

4-8 Setting the Real Time

1. Press **TIME** key 2 seconds, the “SET TIME” appears on the display.
2. Press \blacktriangle , \blacktriangledown , \blacktriangleleft and \blacktriangleright keys to set up the real time-day : hour : minute : second.
3. Press **TIME** key again to stored the setting and exit.

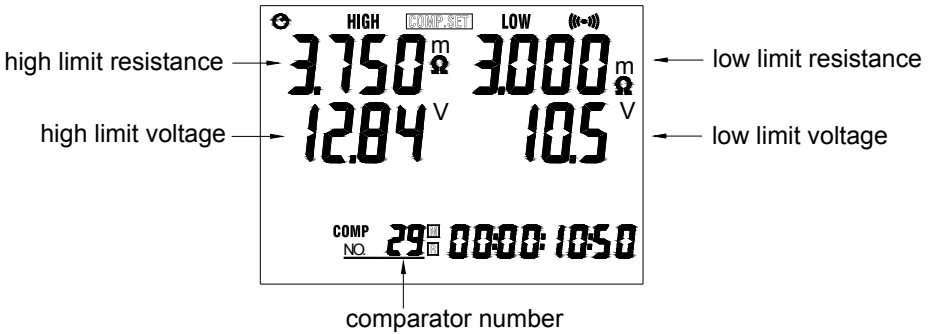
5. USING COMPARATOR FUNCTION (99 SETS)

5-1 Comparator

The comparator function compares the measured values with preset High and Low limit values for internal resistance and voltage, and determines the range that the measuring value should be. And then display the corresponding symbol, and sounds a beeper with the WARNING and FAIL cases.

5-2 Comparator Settings

1. Rotate the resistance range switch to the any range.
2. Press and hold down the “**COMP**” key for 2 seconds, the display will show **COMP.SET** to the comparator setting mode.
3. Use ▲ or ▼ key to change the comparator number, from 01 up to 99.
4. Press ► key one time, the high limit resistance of the one digit will be flashing, use the ▲ & ▼ keys to select the desired value. Repeat this step to set the next three digits, the decimal point, and the resistance units.
5. Press ► key one time, the low limit resistance of the one digit will be flashing, use the ▲ and ▼ keys to select the desired value. Repeat this step to set the next three digits, the decimal point, and the resistance units.
6. Press ► key one time, the high limit voltage of the one digit will be flashing, use the ▲ and ▼ keys to select the desired value. Repeat this step to set the next three digits and the decimal point.
7. Press ► key one time, the low limit voltage of the one digit will be flashing, use the ▲ and ▼ keys to select the desired value. Repeat this step to set the next three digits and the decimal point.
8. Repeat step 3 to step 7 to set the next comparator number.
9. Press **COMP** key again to exit.



5-3 Comparator Tables

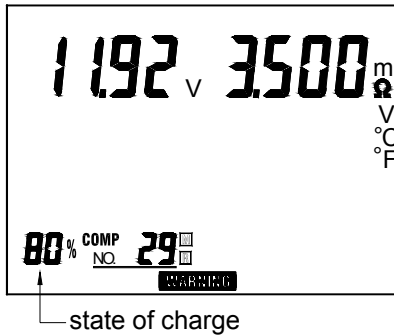
Resistance Voltage	Low limit resistance		High limit resistance	
	Lo	Middle	Hi	
Voltage Comparison	WARNING Beeper	WARNING Beeper	FAIL Beeper	

Value	Pass	WARNING Beeper	FAIL Beeper
--------------	------	-------------------	----------------

Voltage comparison value = (High limit voltage value + Low voltage value)/2

5-4 Start / Stop Controls the Comparator

1. Press **•••** key to set the beeper on, the **((•••))** indication will appear on the display, and the beeper will sound when getting the WARNING or FAIL result. Press **•••** key again to set the beeper off.
2. Press **COMP** key to start comparator function, the “COMP” indication will appear on the display, and the comparator will be operating once the measurements are taken.
3. Press **▲** and **▼** keys to select the desired comparator number (01 – 99). The selected comparator number remains in memory even the power is turned off.
4. Press **COMP** key again to stop comparator function.



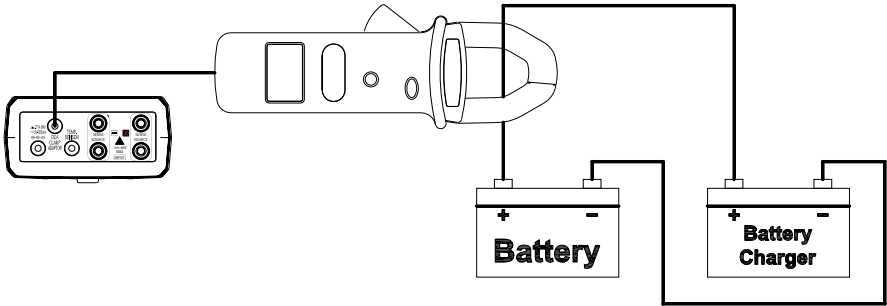
5-5 Battery State of Charge Indication

Using the comparator settings the battery high limit resistance, low limit resistance, high limit voltage, and low limit voltage values are specified in 5-2, and current measured the battery voltage and resistance values, then compute the battery state of charge (SOC) percentage.

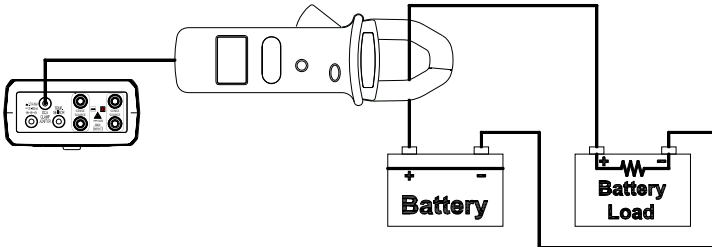
6. BATTERY CHARGE/DISCHARGE CAPACITY MEASUREMENT

1. Disable auto power off function (see section 4-7).

2. Perform the DC current measurement (see section 4-6 in steps 1 – 3).
3. Connect the full discharged battery to the Battery Charger, and use DCA current adaptor clamp the current transducer (jaw) around of the “+” conductor.



4. Power on the Battery Charger, the meter will be displayed the charge current value with a **plus sign** and the battery accumulated charging capacity (IN-CAP).
5. Connect the battery load to the battery and use DC current adaptor clamp the current transducer (jaw) around of the “+” conductor.



6. The meter will be displayed the discharge current value with a **minus sign** and the battery accumulated discharge capacity (OUT-CAP).
7. The battery charge / discharge remained capacity is :

$$(T-CAP) = (IN-CAP) - (OUT-CAP)$$

7. LOGGING FUNCTION

7-1 Manual and Auto Logging Function (999 sets)

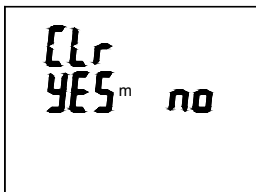
7-1-1 To clear the memorized data

When memory is full, the memory number “999” will appear on the display and memory function will be stopped.

1. Rotate the resistance range switch to OFF position to turn off the meter.
2. Press and hold **M** key, then rotate the resistance range switch to turn on,

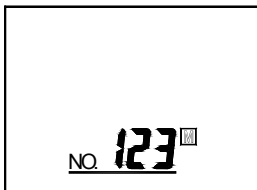
the display shows "CLr, YES, m, no" symbols.

3. Press ◀ key to select "YES" to clear the memorized data.



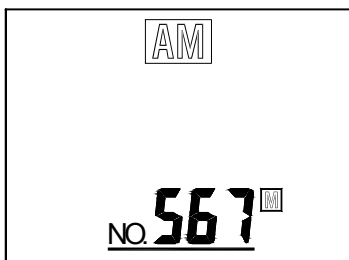
7-1-2 To manual memorized the reading

Memory the reading one by one to the memory by pressing **[M]** key, and "NO. XXX **[M]**" will appear on the display for one sec. to indicate the memorized location.



7-1-3 To auto memorize the reading

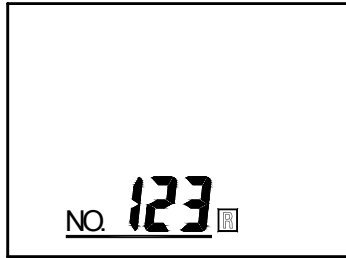
1. Press **TIME** key for 4 seconds, the display will show SET INTV. Using ▲ or ▼ key to select desired interval time from 1 second to 255 seconds. Press **TIME** key to exit.
2. Press **[M]** key for 2 seconds to auto memory mode, the "**[AM]**" symbol appears on the display. When stored one reading, the "NO. XXX **[M]**" will appear on the display for one second to indicate the memorized locations.
3. Press **[M]** key one time to exit.



7-1-4 To recall the memorized reading

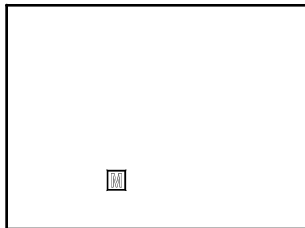
1. Press **[R]** key to review the memorized readings. The display will show "NO. XXX **[R]**".
2. Press ▲ and ▼ keys to scroll through the memorized readings.
3. Press **[R]** key again to stop viewing memorized readings.

4. The memorized data can read by transferring to PC.



7-2 Continuous Logging Function

1. Press **TIME** key for 4 seconds, the display will show **SET INTV.** Using **▲** or **▼** key to select desired interval time from 1 second to 255 seconds. Press **TIME** key again to exit.
2. Press **M** key 4 seconds to continuous logging mode, the display will show "**M**" flashing symbol.
3. Press **M** key again to exit.
4. The continuous data logging can't be read from the meter directly. Users can read the data by transferring to PC.
5. The continuous data logging can't be cleared by the meter but PC.



8. MAINTENANCE

8-1 Cleaning :

1. Repairs or servicing not covered in this manual should only be performed by qualified personnel.
2. Periodically wipe the case with a dry cloth. Do not use abrasives or solvents on this instrument.

8-2 Battery Check & Replacement :

As the battery power is not sufficient, the **BT** will be shown on LCD.
Replacement of six new 1.5V batteries is required.

9. RS-232 INTERFACE, SOFTWARE INSTALLATION AND OPERATION

- For the detailed instruction, please refer to the content of attached CD, which has the complete instruction of RS-232 interface, software operation and relevant information.
- RS-232 protocol : enclosed in the supplied CD.

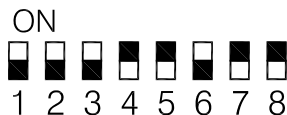
10. BATTERY REFERENCE TABLE

Battery Types	Reference Value
Motorcycle	6V : 2Ah ~ 10.5Ah
	12V : 2.5Ah ~ 20Ah
Automobile	12V : 21Ah ~ 80Ah
Truck	12V : 83Ah ~ 160Ah
Household Appliances	9V : 625mAh (Alkaline)
	AA : 2850mAh (Alkaline)
	AAA : 1250mAh (Alkaline)
	C : 8350mAh (Alkaline)
	D : 20500mAh (Alkaline)
Lithium Notebook Battery	14.8V : 3600mAh ~ 4800mAh

	11.1V : 3600mAh ~ 7200mAh
Lithium Digital Camera Battery	3.7V : 650mAh ~ 1350mAh
Lithium Cordless Phone Battery	3.7V : 800mAh ~ 1250mAh

11. OPTIONAL THERMAL PRINTER

1. Rotary range switch to “OFF” position.
2. Connect RS232 cable to printer.
3. Setting printer switch position :



4. Press and hold down “▲ Zero” key then rotary range switch to desire range.
5. Setting the meter interval time “INTV” must be greater or equal 12 seconds.
6. Example : Vo1 : 1.230v
Ohm : 0.15Ω
Amp : 0.0A
Temp : 75.2F



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