



P/N: 110401110457X
REV.0 2021.09.16





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I. Overview

TIS 280 DMM is a small auto range, hand-held 3 1/2~3 5/6 bit true RMS multimeter featuring complete function, novel structure, high reliability and safety as well as large screen for display . It can be used for measuring AC/DC voltage and current, variable frequency voltage (V.F.C), resistance, diode, circuit on-off, capacitance, frequency ratio, NCV non-contact AC voltage sensing and so on, is an ideal portable maintenance instrument for users.

II. Accessory

Unpack and take out the instrument, please check following attachments carefully for completeness or intactness. In case of any shortage or damage, please contact your supplier.

1. An operating instruction manual
2. A test lead (CATIII 600V)
3. Point-type K (nickel chromium~nickel silicon) thermocouple
4. An optional current clamp

III. Safety Operation Regulation

TIS 280 is designed in compliance with standards such as IEC/EN61010-1, pollution grade II, overvoltage (CATIII 600V) and double insulation standards. Please comply with operation instruction specified in the Manual; otherwise the protection provided by the instrument may be affected.

1. It is forbidden to use the product without having rear cap in place, or otherwise there will be electric shocking.
2. Prior to use, inspect the insulation layer of test lead for intactness, confirming no breakage and broken line.
3. When LCD display shows the icon "  ", it is required to replace the battery in time to ensure the measurement accuracy.
4. Range switch shall be set at the correct measurement position.

5. In case of electric shock and damage to the instrument, signals being measured shall not exceed rated limit value.
6. To prevent any damage to the instrument, it is forbidden to change the gear of range switch in measurement.
7. After each measurement, disconnect test lead and the circuit being measured; after the current measurement, especially the measurement of large current, it is necessary to power off before disconnecting test lead and the circuit being measured.
8. In case of electric shock, it is required to be cautious when voltage being measured higher than DC 60V or AC 30Vrms.
9. Do not use the product in high-temperature or high-humidity environment, particularly in the damp environment in where the instrument performance may be severely degraded
10. Refrain from changing the internal wiring in the clamp ammeter to guard against damage to the meter and danger.
11. Clean the meter case with damp cloth and mild detergent rather than the abrasive material and solvent.

IV. Electric Symbol

	Low electricity of internal battery
	Buzzing On-off
	Diode
	AC/DC
	Warning
	Battery to be measured
	Grounding
	Current clamp
	Double Insulation
	Comply with European Union Directive

V. Comprehensive Specification

1. Maximum voltage between input terminal and grounding: see instruction about each input terminal protection voltage.
2. 10A terminal (CE) is equipped with:
F 10A H 600V fast-acting fuse (Φ6x25) mm
3. mA/µA terminal (CE) is equipped with:
FF 0.6A H 600V fast-acting fuse (Φ6x32) mm
4. Maximum display: 6000 Refresh 2~3 times per second, display "OL" in case of overrange.
Capacitance and frequency : 9999 count.
Duty ratio : 1~99.9%
Diode:3.2V, displaying "OL" in case of overrange.
Range: auto/manual
Polarity: auto
Working temperature: 0°C~40°C
Relative humidity: ≤75% when 0°C~30°C, and ≤50% when 30°C~40°C
Storage temperature: -10°C~50°C
5. Electromagnetic compatibility:
In 1V/m radio frequency (RF) field: Overall accuracy=specified accuracy + 5% of range, and no specified index for RF over 1V/m.
6. Operating ASL: 0~2000m
7. Internal battery: 2 x 1.5V LR6 AA
8. Low electricity: LCD displays.
9. Contour dimension: about (175×80×48.5) mm
10. Weight: about 350g (with batteries)
11. Safety Standard: IEC/EN 61010-1: CATIII 600V; Pollution grade II
12. Accreditation: CE

VI. Appearance Structure (See Figure 1)

1. Case
2. LCD Display
- 3/4/7.: Selection buttons
5. Range Switch
6. Measuring input terminal

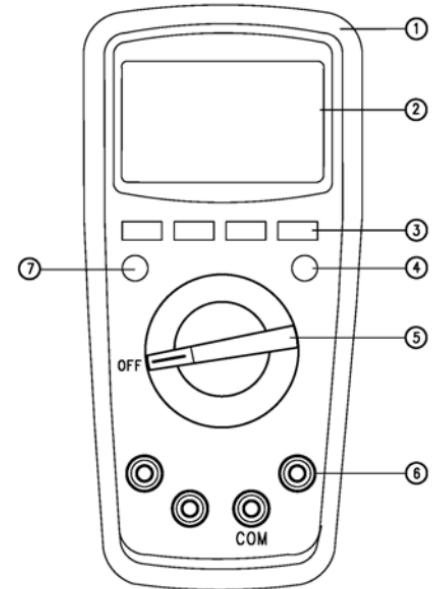


Figure 1

VII. LCD Display (See Figure 2)

TIS 280-LCD



	Symbol	Instruction
1	H	Data hold prompt
2	—	Negative reading
3	AC/DC	AC/DC measurement
4	MAX-MIN	Maximum/Minimum/Maximum-Minimum value measurement prompt
5		Under-voltage internal battery
6	Auto Range	Automatic range prompt

7		Diode measurement prompt
8		Circuit on-off measurement prompt
9		Relative measurement prompt
10		Resistance units: Ohm, Kilohm and Megohm
11		Frequency units: Hz, kHz, MHz
12		Duty ratio measurement unit
13		Voltage units: mV, V
14		Current units: μA, mA, A
15		Capacitance units: nF, μF, mF
16		Centigrade temperature unit
17		Fahrenheit temperature unit
18		Non-contact AC voltage sensing
19		Auto power-off
20		Current clamp

VIII. Knobs and Keys for Range selection

Range Location	Function
$V\sim$, $V\equiv$, $V\triangle$	AC or DC voltage measurement
Ω	Resistance measurement
\blacktriangleright	Measurement of diode PN junction voltage
$\bullet\bullet\bullet$	Measurement of circuit on-off
$\perp\perp$	Capacitance measurement
Hz	Frequency measurement
%	Duty ratio measurement
$^{\circ}C/F$	Temperature measurement
$\mu A\sim$ $\mu A\equiv$ $10A\sim$	AC/DC current measurement
$60A\triangleleft$	AC/DC current clamp measurement
NCV	Non-contact AC voltage sensing
OFF	Switch off internal electric power

Button:

RANGE button: it can be used for selecting auto/manual range. After pressing, it will switch one gear of switch, when reading the highest gear, jump to the lowest gear range and in turn. When the time of pressing button is $\geq 2s$ or switching a range, exit the manual range mode. (Only applicable for $V\sim/\Omega/I\sim$)

MAX/MIN button:

It can be used to automatically enter the manual range mode. In such case, auto shutdown function is disabled and maximum value is displayed, after another pressing on the button, the minimum value will be displayed and values are displayed in turn (maximum value-minimum value). When the time of pressing button is $\geq 2s$ or switching a range, exit data recording mode (only applicable for $V\sim$, Ω , $I\sim$ and $^{\circ}C/F$)

REL button:

It can be used to automatically enter the manual range mode. The current displayed value will be taken as the reference value and then the difference between the measured value and reference value will be displayed, after another press, you'll exit the relative measurement mode. (Only applicable for $V\sim$, Ω , $I\sim$, $^{\circ}C/F$ and $\perp\perp$)

Hz/% button

It can be used to select the mode Hz/%, only applicable for the selection of frequency, AC voltage/ current measurement modes.

SELECT button:

It can be used to select range (only applicable for multi-range). Under AC mode, press the button $\geq 2s$, display "UFC", enter V.F.C measurement mode and measure the variable frequency voltage. After another $\geq 2s$ pressing on the button, display "End" and exit the V.F.C measurement mode.

HOLD button: (Applicable for full range)

It can be used to lock and hold the displayed value, in such case, LCD displays the prompt " H ", after another press, it is unlocked and enter the normal measurement mode.

IX. Measurement Instruction

Check the built-in 2x1.5V AA batteries, display will show the symbol “” when lack of power, and then replace battery in time. It is required to pay attention to the symbol “” beside the test pen socket, which reminds one of the fact that in case of measurement safety, testing voltage or current shall not exceed the specified value

1. AC and DC Voltage Measurement (See Figure 3)

- 1) Connect the instrument with the load in parallel for measurement.
- 2) When the input impedance of the instrument is about $10M\Omega$, the load may cause measurement error in the circuit with high impedance. In most cases, the error can be neglected (0.1% or lower) if the circuit impedance is under $10k$

Notes:

- It is forbidden to input voltage higher than 600Vrms, despite of the possibility of measuring higher voltage, as it may damage the instrument.
- It is required to avoid the electric shock in measuring high voltage.

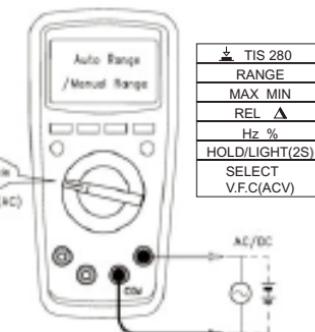


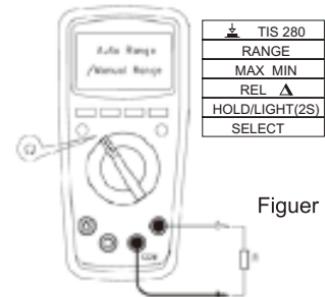
Figure 3

2. Resistance Measurement (See Figure 4a)

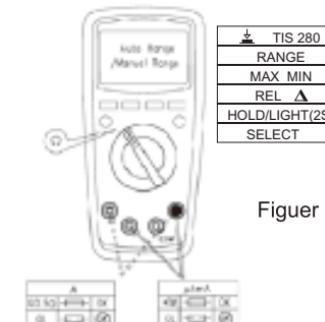
Connect the instrument with the load in parallel for measurement.

Notes:

- * The display will show “OL” when the measured resistance open-circuit or resistance value exceeds the maximum range of the instrument.
- * Prior to measuring online resistance, it is necessary to switch off all powers in the circuits to be measured, and release all residual charges to ensure the measurement accuracy.
- * In measuring low resistance, a measurement error in resistance of about $0.1\Omega \sim 0.2\Omega$ will be resulted by the test lead. In order to acquire accurate reading, it is required to short circuit the test lead, take REL relative measurement mode to ensure the measurement accuracy.
- * Check the test lead for any loosening or other reasons in case there is a resistance value no less than 0.5Ω when test lead is short circuited.
- * Several seconds may be required for the reading stability when measuring high resistance, which is normal for high resistance measurement.
- * By using the resistance measurement function, it is allowed to make self-checking of the built-in fuse, see (Figuer 4b).
- * No input higher than DC 60V or AC 30V is allowed.



Figuer 4a



Figuer 4b

3. Circuit on-off measurement (See Figure 5)

If the resistance of two terminals to be measured is bigger than 150Ω , there will be a circuit break and buzzer will make no sound; if the resistance is $\leq 10\Omega$, the circuit is deemed with good conductivity and buzzer will continuously sound.

⚠ Notes

- * Prior to measuring online circuit on-off, it is necessary to switch off all power supplies in the circuits to be measured and release all residual charges to ensure the measurement accuracy.
- * To prevent personal injury, it is not allowed to input the voltage higher than DC 60V or AC 30V.

4. Diode measurement (Figure 6)

“OL” will be displayed when the diode to be measured is an open circuit or polarity is reversely connected. For Silicon PN junction, the normal value is normally 500~800mV.

⚠ Notes

- * Prior to measuring online diode, it is necessary to switch off all power supplies in the circuits to be measured and release all residual charges to ensure the measurement accuracy.
- * Test voltage for diode is about: 3.2V.
- * To prevent personal injury, it is not allowed to input the voltage higher than DC 60V or AC 30V

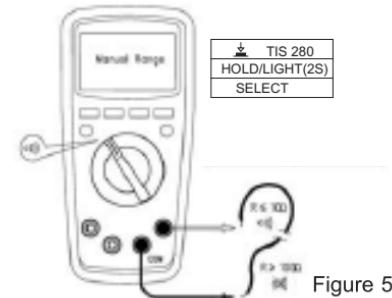


Figure 5

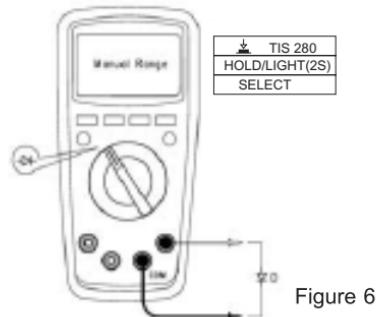


Figure 6

5. Capacitance measurement

(See Figure 7) The instrument, when without any input, will display a fixed reading which is the internal fixed capacitance value. When measuring small range gear capacitance, the above value shall be subtracted from the value to be measured to ensure the accuracy. The relative measurement REL function can be used to automatically subtract the value to facilitate the measurement.

⚠ Notes

- * The display will show “OL” when the capacitor becomes short-circuited or the capacitance value exceeds the maximum range of the instrument.
- * Generally, several seconds will be taken to measure high-capacity capacitor.
- * To prevent damage to the instrument and personal injury, it is required before testing to release all residual charges, which is particularly important for capacitor with high voltage.

6. Frequency/Duty Ratio Measurement

(See Figure 8) At the frequency measurement gear, press the button Hz% to select frequency/duty ratio measurement mode.

⚠ Notes

- * To prevent personal injury, it is not allowed to input the voltage higher than DC 60V or AC 30V

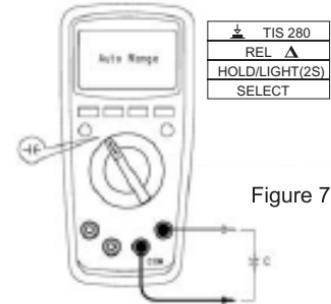


Figure 7

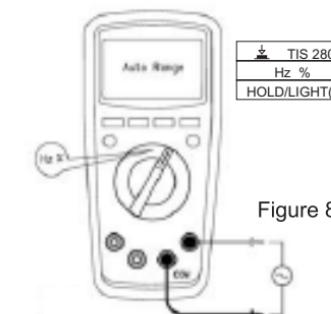


Figure 8

7. Temperature measurement

(See Figure 9) Temperature sensor: It is only applicable for K (Ni-Cr and Ni- Si) thermocouple. After startup, "OL" is displayed, complete Celsius or Fahrenheit temperature measurement by connecting the product with K-type temperature sensor.

$T=1.8^{\circ}\text{C}+32$

⚠ Notes

The point type K (Ni-Cr and Ni- Si) thermocouple is only applicable for the measurement of temperature under $230^{\circ}\text{C}/446^{\circ}\text{F}$.

8. AC and DC current measurement (See Figure 10)

Connect the instrument with the load in serial for measurement. AC measurement value will be true RMS.

⚠ Notes

- *. Before connecting instrument in serial with the loop to be measured, switch off the power supply.
- *. In measurement, it is required to use proper input terminal and function gear; if unable to estimate the current, the measurement should start with the high gear range.
- *. Fuses are provided inside the 10A, mA/ μ input jacks. It is forbidden to connect the test lead in parallel with any circuit, especially the power supply terminal, which may cause damage to the instrument and personal injury.
- For security purposes, when measuring current higher than 5A, the time of each measurement should be controlled less than 10s and an interval of at least 15min should be maintained.
- *. When measuring AC current online, it is allowed to press the button Hz/% to display online AC frequency/ duty ratio.
- *. 60A AC and DC current clamp measurement (See Figure 11). Connect as shown in the figure with the attached current clamp.

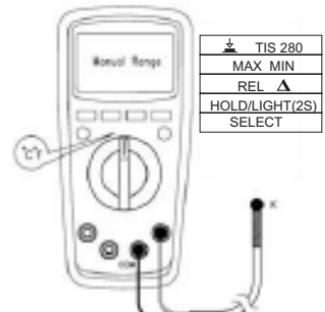


Figure 9

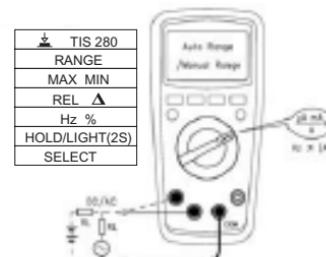


Figure 10

9. NCV Non-contact AC voltage sense (See Figure 12)

If need to detect whether there is a AC voltage or electromagnetic field, allow the front end of the instrument to be close to the object to be sensed. The analog quantity of sensed AC voltage is about: "EF" is displayed when \leq critical voltage. "—" is displayed when $TIS 280 >$ critical voltage, "----" is designed according to the size of voltage V_d and accompanied by different buzzing sounds to mark the difference of sensed voltage.

⚠ Notes

Test lead is not required for measurement when the range knob switch is set at "NCV".

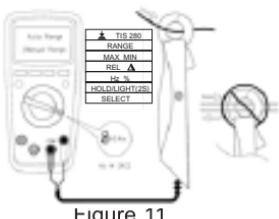


Figure 11

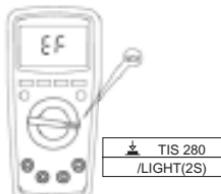


Figure 12

10. Other functions:

- *. After 2s of full display following startup, enter the normal measurement mode. "ErrE" will be displayed in case of any fault to the internal EEPROM.
- *. Auto power-off: the instrument will be "automatically powered off" to save energy in case of no operation to the knob switch within 15min. During automatic shut down state, click on any button, the instrument will "automatically wake up", or select shutdown and then restart the meter. Under power-off status, press on SELECT and power on, the buzzer will make five sounds to remind that the auto power-off function has been cancelled. Restarting the instrument after power-off will recover the auto power-off function.
- *. Buzzer: A "Beep" sound (about 0.25s) from buzzer means the function button is valid when pressing any button or turning the function button. When measuring voltage or current: AC and DC voltage > about 600V mA gear AC/DC current > 590mA When A gear AC/DC current is >10A, buzzer will make continuous sounds to remain the over-range. In addition, the buzzer make 5 continuous sounds about 1min prior to auto power-off and then make one long sound prior to power-off. When the auto power-off function is cancelled, 5 sounds will be made by the buzzer every 15min.
- *. Low-voltage detection: it is used to detect the internal VDD. When the voltage is lower than 2.4V, the battery under-voltage symbol will be displayed, and the normal operation is available; while when lower than 2.2V, no operation is allowed and only the symbol is displayed after startup.
- * When the battery supply voltage is reduced to 2.6V, the LCD backlight is weak or can not start; measurement functions can still be used normally.

X. Technical Index

Accuracy: $\pm (a\% \text{ reading} + b \text{ word number})$, 2 year warranty of guarantee period.
Ambient temperature: $23^\circ\text{C} \pm 5^\circ\text{C}$ ($73.4^\circ\text{F} \pm 9^\circ\text{F}$) Relative humidity: <75%.

1. DC voltage measurement

Range	Resolution	Accuracy
60.00mV*	10 μV	$\pm (0.5\% + 2)$
600.0mV**	0.1mV	
6.000V	1mV	
60.00V	10mV	
600.0V	0.1V	
600V	1V	

10M Ω . (There will be unstable digital display in case of " / " range open-circuit; after connecting with the load, it can be controlled $\leq \pm 1$)

* * Range: 60mV range.

* * Range: 600mV range.

Maximum input voltage: $\pm 600\text{V}$

2. AC voltage measurement

Range	Accuracy	Resolution
60.00mV	$\pm (1.0\%+3)$	10 μ V
600.0mV		0.1mV
6.000V		1mV
60.00V	$\pm (0.8\%+3)$	10mV
600.0V		0.1V
600V	$\pm (1.0\%+3)$	1V
V.F.C 200.0V~600V	0.1/1V	$\pm (4.0\%+3)$

⚠ Input impedance: about 10M Ω .

Display the true RMS. Frequency response: 45~1kHz.(VFC: 45~400Hz)

Assurance of accuracy: 5~100% range, an allowance of <10 words of residual reading for short-circuit.
It will be up to 3.0 when AC crest factor reaches full value (with except for 600V range, which is up to 1.5 when the range reaches the full value). Maximum input voltage: 600Vrms

3. Resistance measurement

Range	Accuracy	Resolution
600.0 Ω *	$\pm (1.0\%+2)$	0.1 Ω
6.000k Ω		1 Ω
60.00k Ω	$\pm (0.8\%+2)$	10 Ω
600.0k Ω		100 Ω
6.000M Ω	$\pm (1.2\%+3)$	1k Ω
60.00M Ω	$\pm (1.5\%+5)$	10k Ω

⚠ Range: measured value = displayed value – short-circuit value of test lead.

*. Open-circuit: about *1V

*. Overload protection: 600V-PTC

4. Circuit on-off, diode measurement

Range	Resolution	Remark
	0.1 Ω	Circuit breakage resistance value is set as: $>150\Omega$, buzzer is soundless. Good conductivity is set as: $\leq 10\Omega$ buzzer sounds.
	1mV	Open circuit voltage is about 3.2V Normal voltage value of silicon PN junction is about 0.5~0.8V.

⚠ Overload protection: 600V-PTC

5. Capacitance Measurement

Range	Resolution	Accuracy
9.999nF	1pF	Under REL status: $\pm(4\%+10)$
99.99nF~999.9 μ F	10pF~0.1 μ F	$\pm(4\%+5)$
9.999mF~99.99mF	1 μ F~10 μ F	$\pm 10\%(\leq 2mF)$

⚠ Overload protection: 600V-PTC

For capacitor $\leq 1\mu$ F, it is recommended to adopt REL measurement mode to ensure measurement accuracy.

6. Frequency/duty ratio measurement

Range	Resolution	Accuracy
9.999Hz~9.999MHz	0.001Hz~0.001MHz	±(0.1%+4)
1%~99.9%	0.1%	Not defined

⚠ Over-load protection: 600V-PTC

Input range a: (DC level is zero)

≤100kHz: 100mVrms ≤ a ≤ 20Vrms

>100kHz~1MHz : 200mVrms ≤ a ≤ 20Vrms

>1MHz : 500mVrms ≤ a ≤ 20Vrms

5MHz~10MHz : 900mVrms ≤ a ≤ 20Vrms

Duty ratio %: only applicable for measurement ≤100kHz

Note:

*. During measurement of AC voltage or AC current, if need to read online frequency value or duty ratio, following input should be met: frequency response: ≤1kHz;

*. AC voltage: mV range input ≥100mV; V range input ≥ range ×6%

*. AC current: input range a

4000/6000μA, 400/600mA, 10A range: a ≥ range ×20%

400/600μA, 40/60mA, 4/6A range: a ≥ range ×60%

7. Temperature measurement

Range		Resolution	Accuracy
°C	-40~1000°C	-40~0°C	±3
		>0~100°C	±(1.0%+3)
		>100~1000°C	±(2.0%+3)
°F	-40~1832°F	-40~32°F	±5
		>32~212°F	± (1.5%+5)
		>212~1832°F	± (2.5%+5)

⚠ Over-load protection: 600V-PTC

Note: The K type point (Ni-Cr and Ni- Si) thermocouple is only applicable for the measurement of temperature under 230°C/446°F

8. DC current measurement

	Range	Accuracy	Resolution
μ A	600.0μA	± (0.7%+2)	0.1μA
	6000μA		1μA
mA	60.00mA		10μA
	600.0mA		0.1mA
A	6.000A	± (1.0%+3)	1mA
	10.00A		10mA

⚠ Over-load protection:

μ A mA range: F1 fuse: (φ6×32) mm FF0.6A H 600V (CE)

10 A range: F2 fuse: (φ6×25)mm F 10A H 600V (CE)

9. AC current measurement

	Range	Resolution	Accuracy
μ A	600.0μA	0.1μA	±(1.0%+3)
	6000μA	1μA	
mA	60.00mA	10μA	
	600.0mA	0.1mA	
A	6.000A	1mA	±(1.2%+3)
	10.00A	10mA	

Frequency response: 45~1kHz

Display: true RMS.

Assurance of accuracy: 5~100% range, an allowance of <2 words of residual reading for short-circuit.

It will be up to 3.0 when AC crest factor reaches full value.

⚠ Over-load protection: (the same as the DC current over-load protection)

10. (60A) current clamp measurement

Range	Resolution	Accuracy
60A dc		±(1.0+3)
60A ac	0.01A	±(1.2+3)

⚠ Over-load protection: 600V-PTC

XI. Upkeep and Maintenance

⚠ Warning: Power shall be switched off before opening the rear cover of the instrument; and the test leads shall be away from the input terminal and circuit to be measured.

1. Conventional upkeep and maintenance
 - * For upkeep and maintenance, wet cloth and mild cleanser rather than abrasive or solution shall be used to clean the meter housing.
 - * Please stop using and send for maintenance in case of any abnormal condition about the instrument.
 - * The inspection or maintenance for instrument, if necessary, shall be performed by the qualified professional maintenance personnel or designated maintenance department.

2. Battery or fuse tube replacement (See Figure 13)

Built-in battery shall be replaced in time when LCD displays the under-voltage prompt “  ”, otherwise measurement accuracy may be affected.

Battery specification: 2 x 1.5V AA

Operating steps:

1. Set the power switch at “Off”, take the test lead away from the input jack and remove the protective sleeve.
2. Screw off one screw securing battery rear cover with screwdriver driver, remove the cover and replace:
The under-voltage used battery and burnout fuse:
F1 fuse: (φ6×32) mm FF0.6A H 600V (CE)
3. Screw off the second screw securing the rear cover with screw driver and remove the cover to replace the burnout F2 fuse (φ6×25) mm F 10A H 600V (CE).

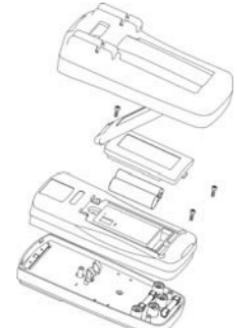


Figure 13



DISPOSAL OF THIS PRODUCT

This product must not be disposed of in general bins. The Crossed Out Wheeled Bin symbol above means that it must not be disposed of with general household or in regular recycling bins.

E-waste needs to be separated from other waste due to the potentially damaging hazardous substances to the environment & health.

Before disposal, the batteries should be removed & disposed of separately at a designated battery collection point.

It is recommended that all components of this product are disposed of at an approved authorised treatment facility (AATF)

MANUFACTURER & AFTER SALES CONTACT DETAILS

TEST INSTRUMENT SOLUTIONS LIMITED

Units 12 to 15 Luddite Business Park

Rawfolds Way

Rawfolds

Cleckheaton

BD19 5DQ

Tel: 01274 752407



www.testinstrumentsolutions.co.uk

The User Manual is subject to modification without further notice.

