

# **INSTRUCTION MANUAL**

## **MODEL 21**

### **MULTI-TESTER**

#### **5 IN 1**

*SOUND LEVEL*

*LIGHT*

*HUMIDITY*

*TEMPERATURE*

*MULTIMETER*

# **.TABLET OF CONTENTS**

## TITLE

1.	INTRODUCTION.....	2
2.	INFORMATION FOR SAFETY.....	2
3.	FEATURES.....	4
4.	SPECIFICATIONS.....	4
5.	PANEL DESCRIPTION.....	8
6.	OPERATING INSTRUCTION.....	9
7.	MAINTENANCE.....	15

## **1. INTRODUCTION**

The 5 in 1 digital multi-tester has been designed to combine the functions of Sound Level Meter, Light Meter, Humidity Meter, Temperature Meter and Digital Multimeter.

It is an ideal multi-function Instrument with scores of practical applications for professional and home use.

The Sound Level function can be used to measure noise in factories, schools, offices, airports, home, etc., checking acoustics of studios, auditoriums and hi-fi installations.

The Light function is used to measure illuminance in the field. It is fully cosine corrected for the angular incidence of light. The light sensitive component used in the meter is a very Stable, long life silicon diode.

The Humidity/Temperature is for use a humidity/semiconductor sensor and K type thermocouple. This operations manual contains general information and specification.

The digital Multimeter performs AC/DC Voltage, DC Current, Resistance measurement and Audible Continuity, Diode, Transistor hFE test.

## **2. INFORMATION FOR SAFETY**

The following safety information must be observed to insure maximum personal safety during the operation at this meter:

- Do not use the meter if the meter or test leads look damaged, or  
if you suspect that the meter is not operating properly.
- Never ground yourself when taking electrical measurements. Do not touch exposed metal pipes, outlets, fixtures, etc., which might be at ground potential. Keep your body isolated from ground by using dry clothing, rubber shoes, rubber mats, or any approved insulating material.
- Turn off power to the circuit under test before cutting, unsoldering, or breaking the circuit. Small amounts of current can be dangerous.
- Use caution when working above 60V dc or 30V ac rms. such voltages pose a shock hazard.
- When using the probes, keep your fingers behind the finger guards on the probes.
- Measuring voltage which exceeds the limits of the multimeter may damage the meter and expose the operator to a shock hazard. Always recognize the meter voltage limits as stated

on the front of the meter.

## SAFETY SYMBOLS



Indicates operators must refer to the explanation in this manual.



Indicates terminals at which dangerous voltage maybe present.

## FEATURES

- 11 functions measure Sound level, Light, Humidity, Temperature, DC Voltage, AC Voltage, DC Current, Resistance, Transistor, Diode and Continuity test.
- 3 1/2 large LCD display with units of Lux, °C, % and dB indication.
- Easy to use with single function switch operating, pocket size and light weight.
- Sound level measures from 35dB to 100dB for C weighting checking with 0.1dB resolution.
- Light measuring levers ranging from 0.1 lux to 20,000 lux.
- Humidity measurement from 25%RH to 95%RH with 0.1%RH resolution and fast time response.

## 4. SPECIFICATIONS

**Display:** 1999 counts LCD display with function of Lux, °C, % and dB indication.

**Polarity:** Automatic, (-) negative polarity indication.

**Over-range:** “OL” mark indication.

**Low battery indication:** The “BAT” is displayed when the battery voltage drops below the operating level.

**Measurement rate:** 1.5 times per second, nominal.

**Operating environment:** 0 °C to 50 °C (32 °F to 122 °F) at < 70 % relative humidity.

**Storage temperature:** -10 °C to 60 °C (14 °F to 140 °F) at < 80 % relative humidity.

**Power:** One standard 9V, NEDA1604 or 6F22 battery.

**Dimensions:** 121.5 (H) x 60.6 (W) x 40 (D) mm

**Weight: Approx.:** 280g including holster.

Accuracy is given at 18 °C to 28 °C (65 °F to 83 °F), less than 70 % RH

## **Sound Level**

Measurement range: 35-100dB

Resolution: 0.1dB

Typical instrument frequency range: 30Hz-10KHz

Frequency Weighting: C –weighting

Time Weighting: Fast

Accuracy:  $\pm 3.5$  dB at 94 dB sound level, 1KHz sine wave.

Microphone: Electric condenser microphone.

## **Light**

Measuring Range: 200, 20,000lux (20,000lux range reading x10)

Overrate Display: Highest digit of “1” is displayed .

Accuracy:  $\pm 5\%$  rdg + 10 dgts (calibrated to standard incandescent lamp at color temperature 2856 k) .

Repeatability:  $\pm 2\%$ .

Temperature Characteristic:  $\pm 0.1\%$  / °C.

Photo detector: One silicon photo diode with filter. Humidity/Temperature

Measurement Range:

Humidity 25%~95%RH

Temperature -20°C~+200°C, -20°C~+1300°C,

Resolution : 0.1% RH, 0.1°C, 1.0°C.

Accuracy (after calibration):

Humidity:

$\pm 5\%$ RH (at 25°C , 35% ~ 95% RH ).

$\pm 6\%$ RH (at 25°C , 10% ~ 35% RH ).

Temperature:

$\pm 3\%$ rdg  $\pm 1^\circ\text{C}$  (at -20°C~+200°C)

$\pm 3.5\%$ rdg  $\pm 5$ dgts (at -20°C~+1300°C)

Response Time:

humidity 45% RH→95% RH  $\leq 10$  min.

95% RH→45% RH  $\leq 15$  min.

Temperature : 1°C/ 2 sec

## Multimeter

### DC Voltage

Range	Resolution	Accuracy
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200.0mV	0.1mV	$\pm 0.5\%$ of rdg $\pm 2$ dgts
20.00V	10mV	
600V	1V	$\pm 1.0\%$ of rdg $\pm 2$ dgts

Input Impedance:  $1M\Omega$ .

Overload Protection: 220Vdc or ac rms. for 200mV range and 600V dc or 600V ac rms. for other ranges.

### AC Voltage

Range	Resolution	Accuracy
200.0V	100mV	$\pm 1.2\%$ of rdg $\pm 10$ dgts
600V	1V	$\pm 1.2\%$ of rdg $\pm 10$ dgts

Input Impedance:  $1M\Omega$

Frequency Range: 45 to 450Hz

Maximum Input: 600V dc or 600V ac rms.

### DC Current

Range	Resolution	Accuracy
200.0uA	0.1uA	$\pm 1.0\%$ of rdg $\pm 2$ dgts
200.0mA	100uA	$\pm 1.2\%$ of rdg $\pm 2$ dgts
10A	10mA	$\pm 2.0\%$ of rdg $\pm 5$ dgts

Overload Protection: 0.2A / 250V fuse (10A range unfused).

Measuring voltage drop: 200mV.

### Resistance

Range	Resolution	Accuracy
200.0 $\Omega$	0.1 $\Omega$	$\pm 0.8\%$ of rdg $\pm 4$ dgts



2.000k $\Omega$	1 $\Omega$	$\pm 0.8\%$ of rdg $\pm 2$ dgts
200.0k $\Omega$	100 $\Omega$	
2.000M $\Omega$	1k $\Omega$	$\pm 1.0\%$ of rdg $\pm 2$ dgts

Overload Protection: 15 seconds maximum 250V dc or 250V ac rms. on all ranges.

Maximum open circuit voltage: 2.8V.

### Transistor hFE

Range: 0~1000

Base current: 10uA dc approx. ( $V_{ce}=2.8V$  dc)

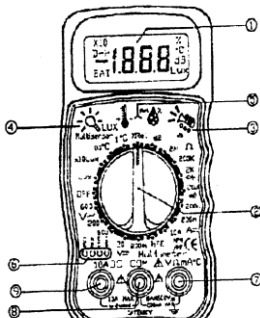
### Diode and Continuity check

Diode: Test current 1.4mA dc and open circuit voltage 2.8V dc.

Continuity: Built in Buzzer will be sound if the circuit resistance is less than 100 $\Omega$ .

Overload Protection: 15 seconds maximum 250V dc or 250V ac rms.

## 5. PANEL DESCRIPTION



1. LCD display: 3 1/2 digits LCD display with units of Lux, x10 Lux, °C, %, dB and low battery “BAT” indication.
2. Power / Function / Range Switch: Turn power on (or off) and select measurement function and ranges.
3. Microphone: Electric condenser microphone inside.
4. Photo Detector: Long life silicon photo diode inside.
5. Humidity & Temperature: Humidity Sensor and Semiconductor Sensor inside.
6. Socket for Transistor hFE test.
7. V /  $\Omega$  / mA / °C Input Jack.
8. COM Input Jack.
9. 10A Input Jack.

## **6. OPERATING INSTRUCTION**

### **Measuring Sound Level**

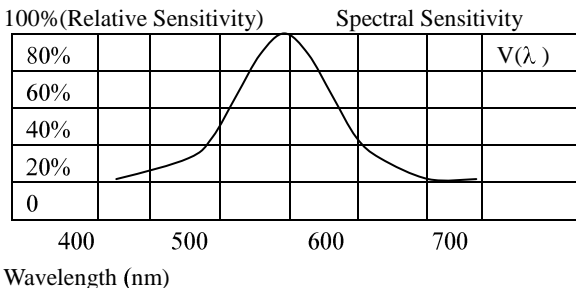
1. Turn the Power/function/range Switch to “dB” position.
2. Remove the meter and face the microphone to sound source in a horizontal position.
3. The C-weighting curve is nearly uniform over the frequency range

from 30 to 10,000Hz, thus giving an indication of overall Sound level.

4. The Fast response is suitable to measure shout bursts and peak values from sound source.
5. The sound level will be displayed.
6. Note: Strong wind (over 10m/sec.) striking the microphone can cause misreading for measurement in windy locations, a windscreen should be used in front of microphone.

## Measuring Light

1. Turn the Power/function/range Switch to select the “lux” scale and set the range to desired (“lux” or “x10 lux”) range.
2. Remove the meter and face the photo detector to light source in a horizontal position.
3. Read the illuminance nominal from the LCD display.
4. Over-range: If the instrument only display one “1” in the M.S.D. the input signal is too strong, and a higher range should be selected.
5. When the measurement is completed. Replace the photo detector from the light source.
6. Spectral sensitivity characteristic: To the detector, the applied photo diode with filters makes the spectral sensitivity characteristic almost meet C.I.E. (International Commission on Illumination) photopia curve V ( $\lambda$ ) as the following chart described.



## 7. Recommended Illumination:

Locations	Lux
<b>*Office</b>	
Conference, Reception room.	200 ~ 750
Clerical work	700 ~ 1,500
Typing drafting	1000 ~ 2,000
<b>*Factory</b>	
Packing work, Entrance passage	150 ~ 300
Visual work at production line	300 ~ 750
Inspection work	750 ~ 1,500
Electronic parts assembly line	1500 ~ 3,000
<b>*Hotel</b>	
Public room, Cloakroom	100 ~ 200
Reception, Cashier	200 ~ 1,000
<b>*Store</b>	
Indoors Stairs Corridor	150 ~ 200
Show window, Packing table	750 ~ 1,500

Forefront of show window	1500 ~ 3,000
<b>*Hospital</b>	
Sickroom, Warehouse	100 ~ 200
Medical Examination room	300 ~ 750
Operating room	
Emergency Treatment	750 ~ 1,500
<b>*School</b>	
Auditorium, Indoor Gymnasium	100 ~ 300
Class room	200 ~ 750
Laboratory Library Drafting room	500 ~ 1,500

## Measuring Humidity/Temperature

### 1. Humidity Measurement:

① Set the Power/function/range Switch to “%RH” position .

② Then the display will show the humidity reading value (%RH) directly.

③ When the tested environment humidity value changed. It need to a few minutes to get the stable “%RH” reading.

### 2. Temperature Measurement:

① Set the Power/function/range Switch to “0.1 °C or 1 °C” position.

② Then the display will show the environment temperature reading value (°C) directly.

③ Connect the black plug of temperature probe the COM

jack and red plug to the " V /  $\Omega$  / mA /  $^{\circ}$ C " jack.

④ Touch the end of the temperature sensor to the area or surface of the object to be measured. The display will show the temperature reading value ( $^{\circ}$ C) directly.

### Caution

To avoid damage to the meter, Don't apply input which exceed the limit shown below:

Function	Red lead Connection	Input limits
DCV/ACV	"V/ $\Omega$ /mA/ $^{\circ}$ C"	600V dc or ac rms.
$\Omega$ /CONTINUITY		
/DIODE	"V/ $\Omega$ /mA/ $^{\circ}$ C"	250V dc or ac rms.
DCA	"V/ $\Omega$ /mA/ $^{\circ}$ C"	200mA dc or ac rms. (0.2A/250V fuse protected)
A	"10A"	10A dc or ac rms. (10A range unfused)

## Measuring Voltage

1. Connect the black test lead to the COM jack and red lead to the "V/ $\Omega$ /mA/ $^{\circ}$ C" jack.
2. Set the function switch at DCV or ACV ranges to be used and connect test leads connect test leads across the source or load under measurement.
3. Read LCD display. The polarity of red connection will be indicated when making a DC measurement.


### ***Measuring Current***

1. Connect the black test lead to the COM jack and the red test lead to the “V/ $\Omega$ /mA/ $^{\circ}$ C” jack for a maximum of 200mA. For a maximum of 10A, move the red lead to the “10A” jack.
2. Set the function switch at  $\mu$ A, mA or A range to be used.
3. Connect test leads in series with the load in which the current is to be measured.
4. Read LCD display, The polarity of red lead connection will be indicated.

### ***Measuring Resistance***

1. Connect the black test lead to the COM jack and the red test lead to the “V/ $\Omega$ /mA/ $^{\circ}$ C” jack.
2. Set the function switch to desired  $\Omega$  position.
3. Make sure all the power of the circuit to be measured is off.
4. Connect the test leads to the circuit to be measured.
5. The value indicated on the display is the measured value of resistance.

### **Measuring Diode**

1. Connect the black test lead to the COM jack and the red test lead to the “V/ $\Omega$ /mA/ $^{\circ}$ C” jack.
2. Set the function switch to “” position.
3. Make sure all the power of the circuit to be measured is off.
4. Connect the test leads to the anode of the diode to be measured and black test lead to cathode.

5. The forward voltage drop in mV will be displayed. If the diode is reversed, figure “1” will be shown.

## Measuring Transistor hFE

1. Set the function switch to hFE position.
2. Determine whether the transistor is NPN or PNP type and locate the Emitter, Base and Collector leads, Insert the leads into the proper holes of hFE socket on the front panel.
3. The meter will display the approximate hFE value at the condition of base current 10uA and Vce 2.8V.

## Audible Continuity Test

1. Connect the black test lead to the COM jack and the red test lead to the “V/ $\Omega$ /mA/ $^{\circ}$ C” jack.
2. Set the function switch to “)))” position.
3. Connect test leads to two points of circuit to be tested. If the resistance is lower than 100 ohm, buzzer will sound.

## 7. MAINTENANCE

### *Battery and Fuse Replacement*

If the sign “BAT” appears on the LCD display, it indicates that the battery should be replaced. Remove screws on the back cover and open the case. Replace the exhausted battery with new batteries. (1 x 9V battery NEDA 1604, 6F22 or equivalent)

Fuse rarely need replacement and blow almost always as a result of the operator’s error. Open the case as and replace the blown



fuse with ratings specified.

**Warning:**

Before attempting to open the case, be sure that test leads have been disconnected from measurement circuit to avoid electric shock hazard.

Replace fuse only with specified ratings:

Fuse: F 200mA / 250V fast blow.