



This Multifunctional tester and meter, can be used as school teaching objects! Lessons in soldering and electrical component knowledge is necessary! You need soldering experience in soldering small components on pcb's. There is no need to know the science behind the tester, how it operates. A soldering iron of min 35Watts with a small soldering tip is needed. Tools, like standard electro workbench repair centers, are recommended. Solder like leadfree SN95Sb5 with flux core, is also recommended.

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## **1.1 Build guidance.**

### 1.1.1 Item list.

Item	Component Name	Component parameters	Footprint	Number of Component
R19 ,R20	Metal film resistor	1K $\Omega$ 1/4W 1%	Axial0.3	2
R16	Metal film resistor	2.2K $\Omega$ 1/4W 1%	Axial0.3	1
R12 ,R7	Metal film resistor	3.3K $\Omega$ 1/4W 1%	Axial0.3	1
R22,R17,R18,R11,R21,R13	Metal film resistor	10K $\Omega$ 1/4W 1%	Axial0.3	6
R24	Metal film resistor	20K $\Omega$ 1/4W 1%	Axial0.3	1
R15,R8	Metal film resistor	27K $\Omega$ 1/4W 1%	Axial0.3	2
R10	Metal film resistor	33K $\Omega$ 1/4W 1%	Axial0.3	1
R9	Metal film resistor	100K $\Omega$ 1/4W 1%	Axial0.3	1
R23	Metal film resistor	180K $\Omega$ 1/4W 1%	Axial0.3	1
R14	Metal film resistor	220 $\Omega$ 1/4W 1%	Axial0.3	1
R4,R2,R6	Metal film resistor	470K $\Omega$ 1/4W 1%	Axial0.3	3
R1,R3,R5	Metal film resistor	680 $\Omega$ 1/4W 1%	Axial0.3	3
Y1	Quartz crystal	8Mhz	HC-49	1
C7 ,C8	ceramic capacitor	22pF 20% silk(220)	RAD0.2	2
C1	ceramic capacitor	1000pF 20% silk( 102)	RAD0.2	1
C2	ceramic capacitor	10nF 20% silk( 103)	RAD0.2	1
C3,C4,C5,C6,C11	ceramic capacitor	100nF 20% silk( 104)	RAD0.2	5
CESD	ceramic capacitor	100nF 20% no silk	0805	1
C9,C10	Aluminum electrolytic capacitor	10uF 20%	RB.2/.4	2
T3	bipolar junction transistor	PNP silk(9012)	TO-92	1
T1 , T2	bipolar junction transistor	NPN silk(9014)	TO-92	2
U1	AVR MCU	ATMEGA328P-PU	DIP28	1
U2	Regulator	HT7550	TO-92	1
U3	Precision References	TL431	TO-92	1
ESD	Low Capacitance TVS Diode Array	SRV05-4 silk(MC5)	SOT-23 6L	1

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ZD	Transient Voltage Suppressors ( TVS)	P6KE6V8 silk(6V8C)	1812	1
LED1	Light Emiting diode	3mm		1
J3	Test bench	14p	DIP14	1
DC1	DC jack	5,5 – 2.1 mm	DC-005	1
Test button	Rotary pulse encoder			1
J4, J5, JP1	Terminals	Lead space 5,08mm		3
J2	Pin header	8p		1
Display	TFT LCD module	60 * 77mm		1

1.1.2 The Build:

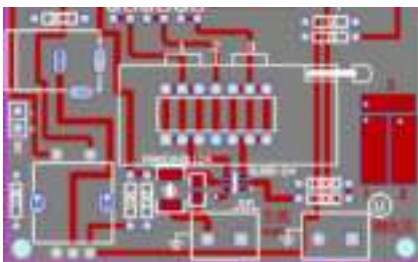
**Note:**

The Tester has three SMT Components:  
Items; ZD,CESD and ESD.

These three components should be soldering first, because they are the smallest size of all. Their role is to protect the MCU against Transient high voltage. In fact, the Transistor Tester can normally work without they three part. The ZD and CESD have no polarity, so you can soldering this two with no matter. The ESD have six pins . need first to find she's PIN 1, follow photo will help you



(note: on the top, the silk maybe “MC5” or “VC5” or “LC5”, they mean same)



In the Transistor Tester main board PCB, the ESD is the most difficult part to soldering, it is small and please do not use to much of heat while soldering. First solder the individual pads with a very little of solder, then solder the components. Use good glasses, for better view.

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Next:

The Metal film resistors can now be soldered. On the Transistor Tester main board PCB, all of the resistor's installation site, is printed with the value. So you can easily find out the right resistor.

Here's a help:

Kleur	Mantissa/waarde	Vermenigvuldingsfactor	Tolerantie	Temperatuurcoëfficiënt	Eeksbuuggetje
zilver		$10^{-2}$	10%		
goud		$10^{-1}$	5%		
zwart	0	$10^1$		250 ppm/K	Zl
bruin	1	$10^1$	1%	100 ppm/K	BRongt
rood	2	$10^1$	2%	50 ppm/K	ROren
oranje	3	$10^3$		15 ppm/K	Op
geel	4	$10^1$		25 ppm/K	GFris
groen	5	$10^3$	0.5%	20 ppm/K	GRaf
blauw	6	$10^3$	0.25%	10 ppm/K	Bl
violet	7	$10^2$	0.1%	5 ppm/K	Vies
grijs	8	$10^4$	0.05%	1 ppm/K	GRJS
wit	9	$10^4$			Weer

Next:

the ceramic capacitors can be soldered, ceramic capacitor do not have polarity . The Transistor Tester main board PCB is printed the capacitor's value for the capacitors.

22pF , on the PCB is printed "22"

The Aluminum electrolytic capacitors do have polarity, the positive have the longer lead than the negative. Aluminum electrolytic capacitor, a band with white color is pointing the negative lead.



Next:

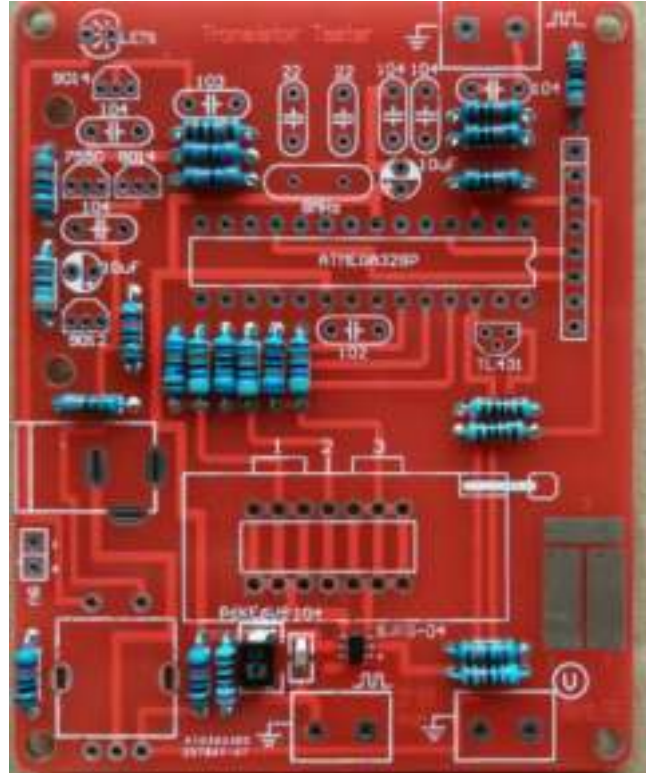
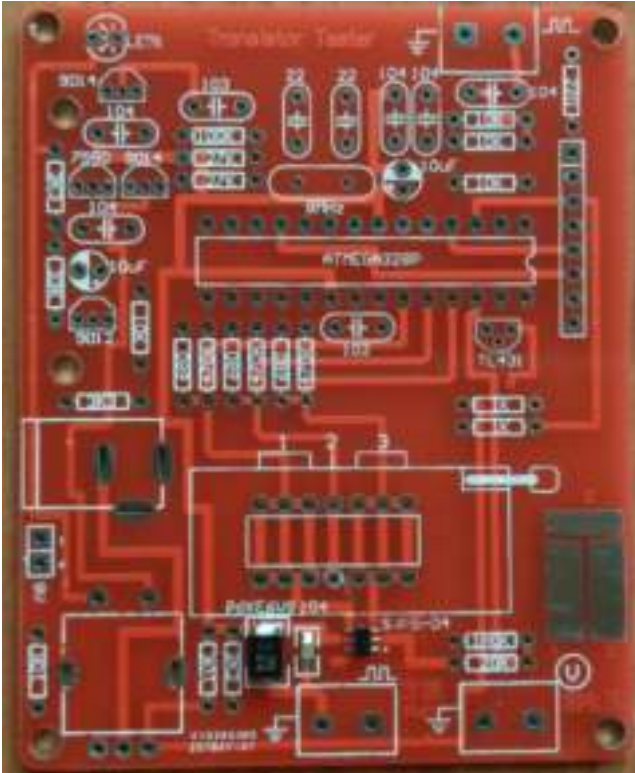
The light-emitting diode have polarity, like the Aluminum electrolytic capacitor, the positive have the longer lead than it negative.

On the PCB, The Quartz crystal have no polarity.

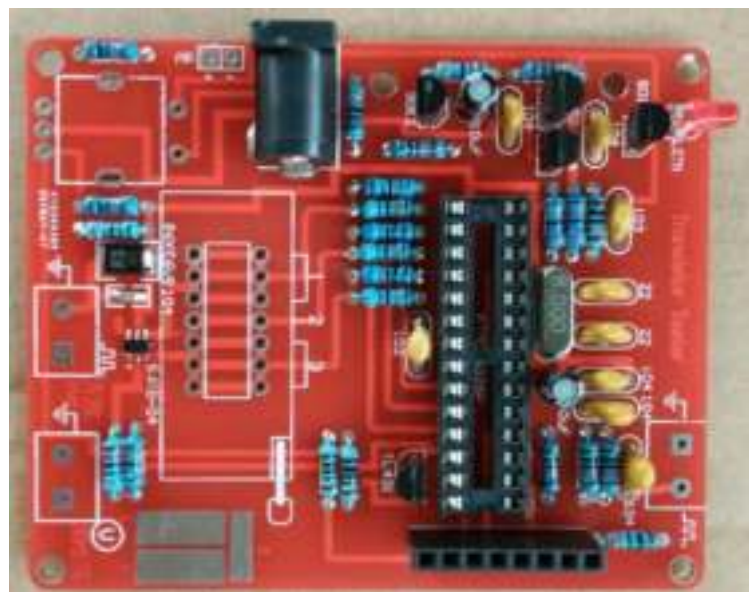
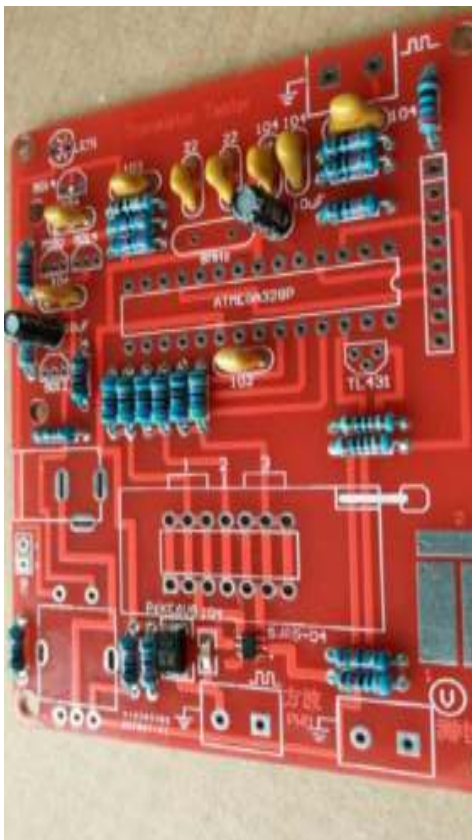
For the rest of the component package, is simple enough.

## 1.2 Step by Step:

Here are some pictures from the step by step process:





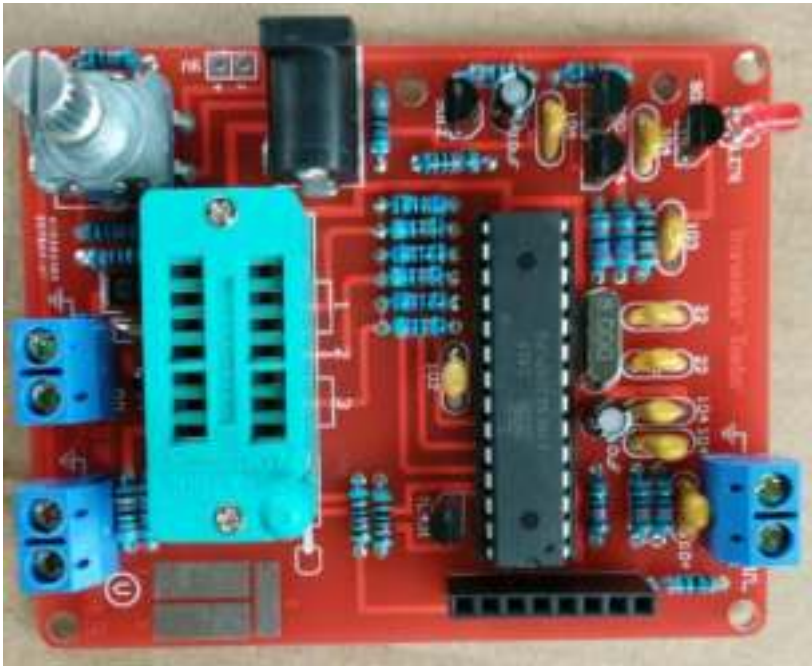


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When you solder the Test-bench,



please keep hand-shank in unlock state.



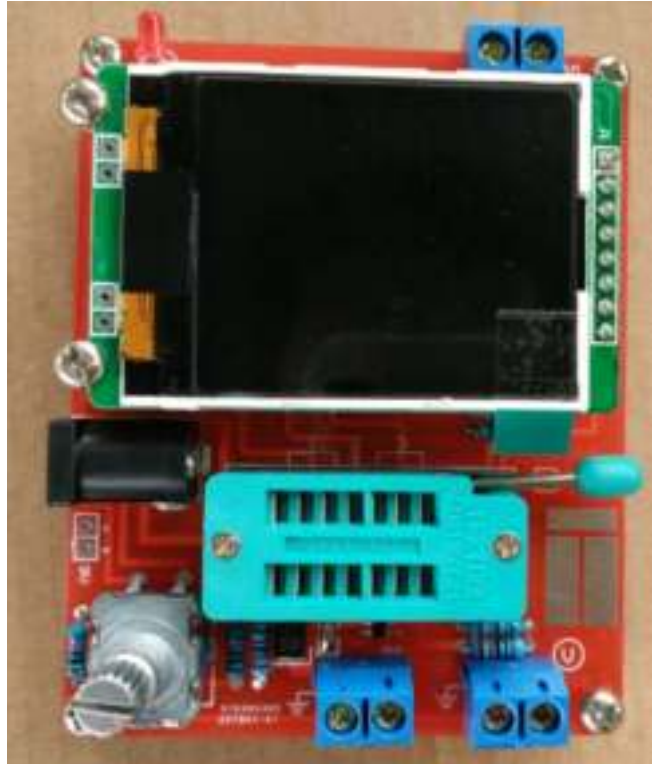
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Next:

The (already assembled display part)

This display can be pushed in the 8 pin (female) terminal connector. Do not solder!

Use the 2 bolts to secure the display.



Important note:

When you have completed the soldering, you should clean the soldering side.

(Do not use water! Best is just a good fine brush, or cleaning alcohol)

The assemble work is done.



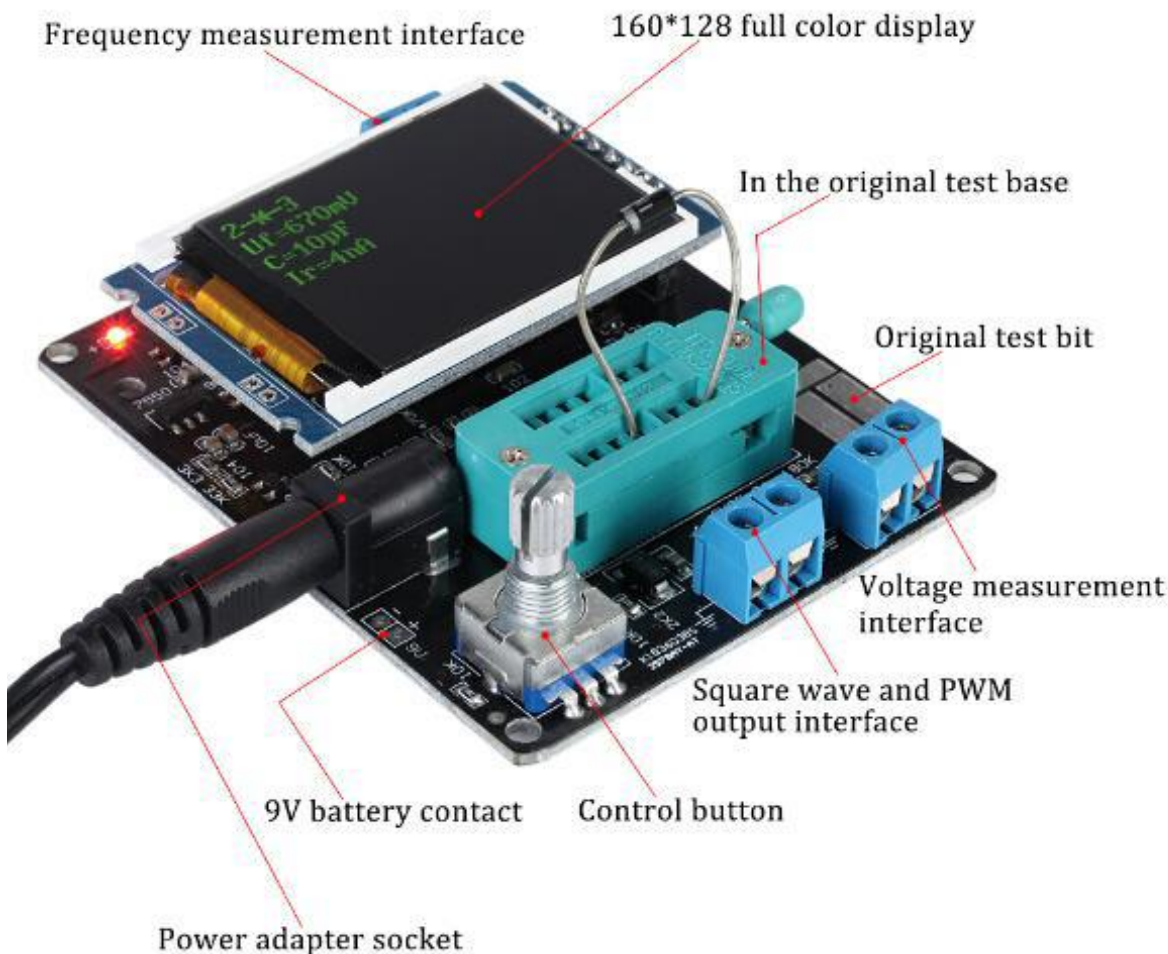
### 1.3 The Transistor Tester instructions:

Input voltage: DC6.8V-12V (Recommended power supply is 9Vdc)

The operating current is about 30mA, input a minimum of 7.5V DC voltage to start the actual measurements.

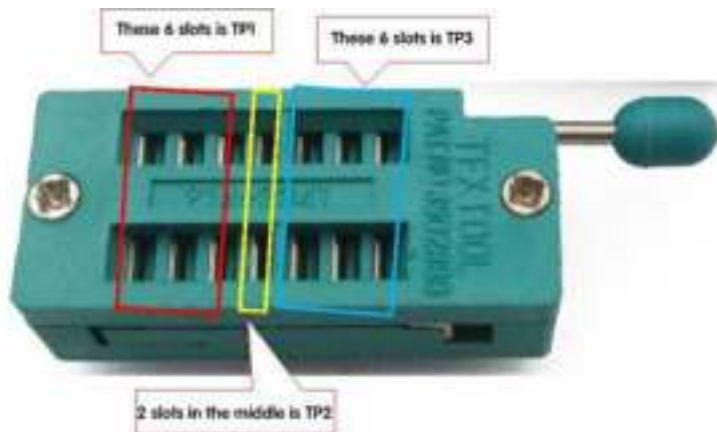
#### 1.3.1 Transistor tester control

The tester is controlled by a rotary encoder switch. The rotary-encoder-switch has 4 kinds of Operation; short press, long press, left rotation and right rotation. Short press once to turn on the power and start a test. Long press the switch or left and right rotary enters the function menu. Rotate left or right switch selects menu items up or down. Enter a certain function through short press the button. Long press the button when you need to exit.



### 1.3.2 Test the devices

Test bench has a total of 3 test points TP1,TP2,TP3. The Bench layout is as follows:



The test positions TP1,TP2,TP3 are used to test diodes, capacitors, resistors, transistors, fets, etc..

For 2 lead components, use TP1 and TP3, for 3 lead components use TP1, TP2, TP3. The consecution of the leads of a component does not matter. The Tester automatically detects the pins and shows it on the display.

#### **Note:**

**Discharge Capacitors before testing**, if not, the single chip microcomputer is likely to be damaged.

### 1.3.3 Calibration

Tester calibration is used to eliminate the error of their components to make the final test result more accurate. Calibration can be done as: fast calibration or full function calibration.

Fast calibration method of operation:

Three test points TP1, TP2 and TP3 should be connected by a wire, then press the test button and watched the screen at the same time. Screen color will become black and white word, after the prompt message appears "Selftest mode..?", click the test button to enter into the rapid calibration process.

After the prompt message appears "Selftest mode..?", a normal test procedure is carried out if no buttons action for about 2 seconds. The last show resistance value of wire where short connect TP1, TP2, TP3 three test point. After entering the rapid calibration process, there are will be some data on the screen, you don't have to deal with it. Wait until the flashing string appears on the screen "Probes isolate!", remove the short connect TP1, TP2, TP3. Until a string appears on the screen "End Test", quick calibration has finished.

Please use full function calibration method for the first time calibration.

Full function calibration needs to be entered from the menu and also need to prepare a 220nf capacitor. Full function calibration is to perform a more comprehensive calibration process and will take longer. After entering the function menu, rotate the test button into the menu item "Selftest", then press the test button to enter the full function calibration process.

First thing appeared on the display flashing string "short Probes!", three test points are

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Connected again by a wire, and wait the calibration process is carried out. When the display flashes the string "isolate Probes!", remove the short wires connected to the three test points, continue to wait for the calibration process to carry out. When the screen appears "1-||-3 > 100nF", 220nf capacitors are installed in the test point TP1 and TP3. Until a string appears on the screen "End Test", quick calibration has finished.

### 1.3.4 Function menu

#### 1. **Switch off;**

2. **Transistor;** Transistor test, which is the default function after booting.

3. **Frequency:** Measuring frequency

4. **f-Generator:** Square wave generator, there are multiple square wave frequency's that can be selected. Switch the different square wave frequency by left- or right rotation on the button. Long press the button to exit the square wave generator.

5. **10-bit PWM:** Pulse signal generator, adjust pulse duty cycle by the left- or right rotation button, from 1% to 99%. Long press the button to exit the pulse signal generator.

6. **C+ESR@TP1-3:** Capacitance measurement function on line, two wires can be drawn from TP1 and TP3. Inline measurement of the capacitance value and ESR for the 2uF-50mF capacitor. Note that capacitors to be measured, must be fully discharged before the test, if it is a measurement inline, the measured circuit needs to be cut off power!

7. **1-||-3:** Continuous measurement of resistance. Constant testing that the resistance and inductance values installed on TP1 and TP3. The inductance will be measured when the measured resistance is less than 2100 ohm, Inductance measurement range from 0.01mH to 20H. Long press the button to exit.

8. **1-||-3:** Continuous measurement of capacitance. Constant testing of capacitance value on TP1 and TP3. For small capacity capacitors, we can get the measured capacitance value only in this way. For capacitor with greater than 90nF, measuring its equivalent series resistance (ESR), ESR resolution 0.01Ω. The capacitor is above in 5000pF shows the voltage drop rate.

9. **Rotary encoder:** Rotary encoder detection, can test the coding value of the three wire rotary encoder switch.

10. **Self-Test:** Full function calibration function.

11. **Voltage:** DC voltage measurement, the maximum voltage is 50V.

12. **Front Color:** Set foreground characters color with left- or right rotation of button can change the value of the corresponding color component. Short press the button to change the red, green and blue three base colors. After the setup is complete, press the button to save and exit. Be careful not to set the foreground color and background color to the same color! If this happens, shut down immediately and then perform a quick calibration, display-colors will turn into a black background with white foreground.

13. **Back Color:** The method is same as set foreground, just this is the background color modified.

14. **Show date:** Display internal date of the tester.

**Happy Testing!**