Beginners How to Test DSO138mini

You have finished assembling your DSO138mini kit. You may be anxious to see it works. But you might not be familiar with oscilloscope and you could encounter unexpected problems. This article is trying to smooth the path of testing your DSO138mini and help you learn how to use the oscilloscope easier.

Before the tests you need to prepare a USB cable with Micro-USB style connector and a USB power source. The power source should be able to source at least 150mA current. Most chargers for cellphone can be used as power supply for these tests.

1. Quick Tests

Let us do some quick tests to be sure of that the scope is working. Before doing this please make sure you have successfully completed STEP1 to STEP3 in the User Manual and the scope can display trace on screen. Otherwise, please following the Troubleshooting Guide (available at the webpage www.jyetech.com/Products/LcdScope/e138mini.php) to resolve any possible problems.

It is strongly suggested to carefully read the "Display and Controls" section in the user manual before starting the tests below. Make sure you know the screen displays and various controls.

Ø Finger test

Attach hook probes to J1. Apply power to the oscilloscope at USB connector J7 on the main board. Set oscilloscope parameters according to the table below.

Table. 1

Parameter	**Setting**	**How to set**
Couple	AC	Move [CPL] switch to AC position
Sensitivity	2V	Move [SEN1] switch to 1V position. Move [SEN2] switch to X2 position
Timebase	5ms	Press [SEL] so that the parameter to be changed is highlighted. Press [+] or [-] to set it to the wanted value.
Trigger mode	AUTO	
Trigger slope	Negative	
Trigger source	Internal	
Trigger level	Around 0V	
Horiz. position	Close to center	
Vertical position	Center	

Touch the red hook with your fingers. The black hook can be left floating. You should see waveform similar to Fig. 1. If you see waveform very different don't worry. It is okay as long as you see activities on the screen when you touch the red hook. This test ensures you that the oscilloscope is doing something.

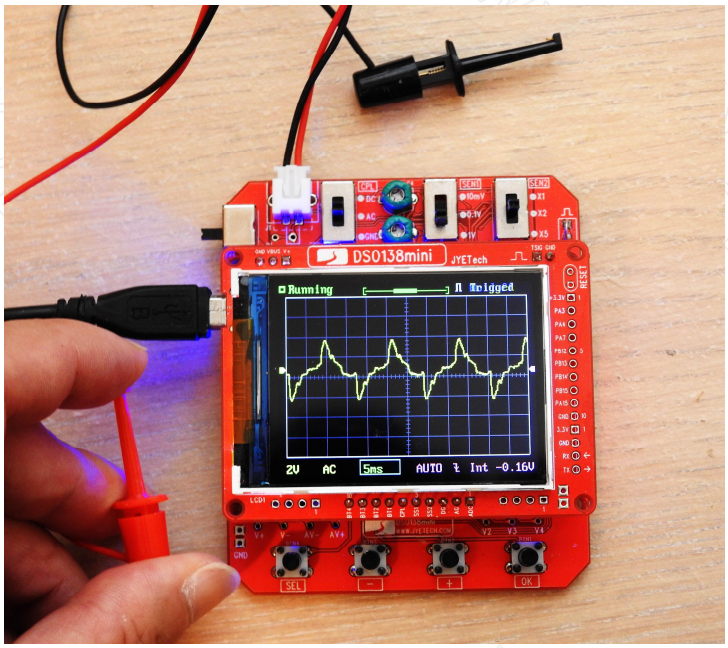

Fig. 1

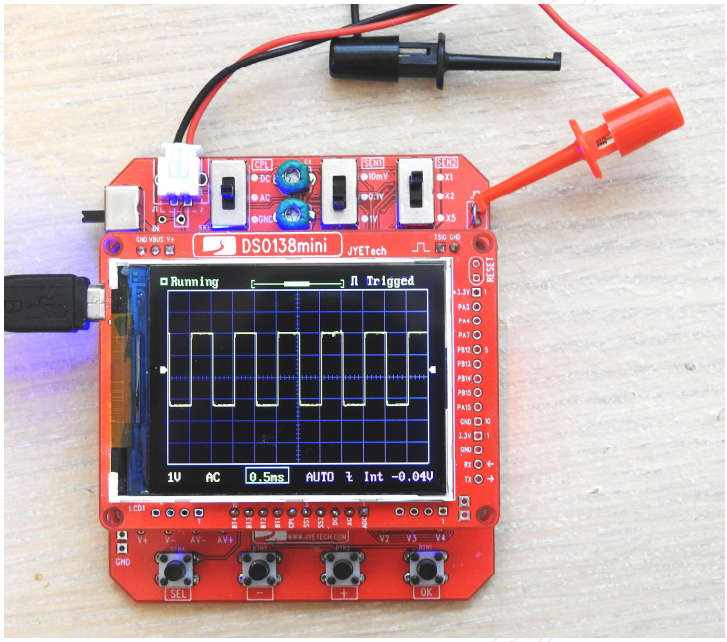

Fig. 2

Ø Viewing the test signal

Change sensitivity to 1V and timebase to 0.5ms. Keep all other settings unchanged. Connect the red hook test signal output terminal at J4 on analog board. You should see waveform similar to Fig. 2.

If you get similar waveform as both Fig. 1 and Fig. 2 that means your oscilloscope is basically working. Then we can do more tests.

2. Understand Basic Oscilloscope Parameters

Now you have known your oscilloscope is basically working. In order to be able to use the scope effectively you need to understand its working parameters. The following are some essential parameters that every user should understand.

Ø Vertical Sensitivity

Vertical Sensitivity (sometimes we just call it Sensitivity) is the vertical scale by which we measure signal amplitude (i.e. voltage). It is expressed as Volt per division (V/Div). For DSO138mini this parameter is displayed at the lower-left corner in yellow ("/Div" is omitted). By sensitivity setting we can read signal amplitude directly on screen. In Fig. 2, for example, the vertical sensitivity setting is 1V/Div. So we know the test signal amplitude is about 3.2V peak to peak by counting the height of the signal in terms of divisions.

Ø Couple

Couple is the way how a signal is connected to the input of an oscilloscope. Usually couple has only two settings, DC or AC. The Fig. 3 below shows the couple circuit of DSO138mini. It can be seen that couple is set by changing the positions of SW1. When the switch is set to DC position signal is connected directly to the scope input. When the switch is set to AC position signal is connected to the scope input through a capacitor.

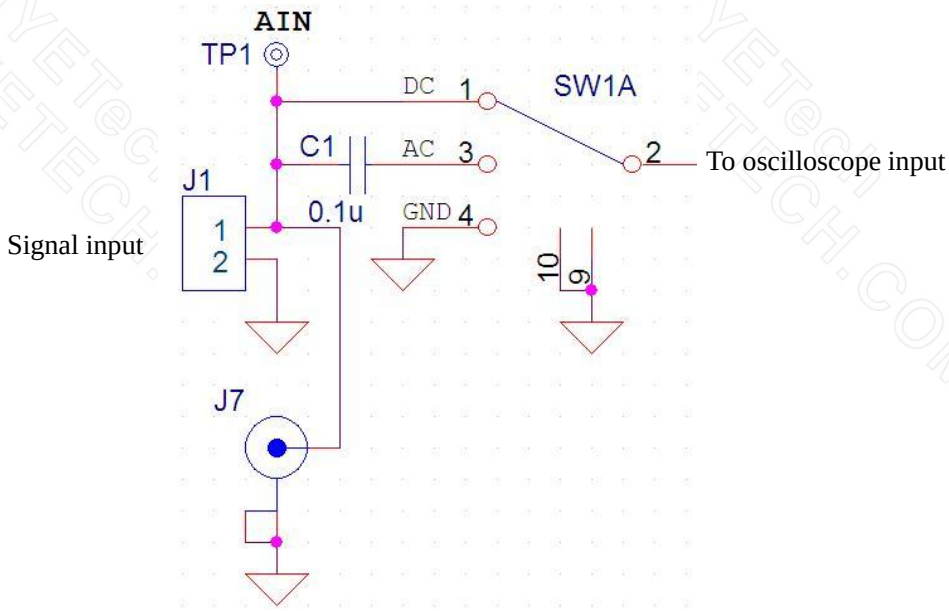

Fig. 3

You might ask why we need a capacitor there. As you know it is common that a signal may contain bothe AC and DC components. When viewing an AC/DC mixed signal we may just want to just see its AC component only. By placing a capacitor in between signal and scope input the DC component will be blocked so we will only see its AC part. Particularly, when DC component is much large than AC component you may not be able to view the signal at all without the capacitor since the large DC component would shift trace out of oscilloscope display range. You must use AC couple in this case.

For DSO138mini couple parameter is displayed at the lower-left corner next to sensitivity display.

On many oscilloscopes there is another setting, GND, for the couple parameter. It is the same for DSO138mini. This setting is not really a couple. When couple switch is set to this position external signal is in fact disconnected. Oscilloscope input is connected to ground. The usefulness of this setting is to force a 0V signal at oscilloscope input for reference or calibration purpose.

- Vertical Position (VPos)

  Vertical Position is for the convenience of waveform viewing and measurement. By changing vertical position we can shift waveform up and down. Sometimes signal amplitude may larger than that the screen can display. Changing vertical position can move the un-displayed portion into screen so as it is visible.

  On DSO138mini vertical position is indicated by a small arrow on screen left border. This arrow points at the 0V level so you know where 0V is on the screen. In real world due to component variance the arrow and 0V line are not always aligned by default. DSO138mini implemented a "VPos Alignment" function to fix this mis-alignment issue if it happens. Please see Section 3 below for details.

- Timebase

  Timebase is the horizontal scale by which we read the time information of a signal. It is expressed as second per division (s/Div, ms/Div, or us/div). For DSO138mini this parameter is displayed at bottom close to center in green ("/Div" is omitted). By timebase setting we can read the time information of a signal directly on screen. For example you can read a signal cycle by counting divisions that a cycle lasts. When you get cycle you can calculate signal frequency.

- Horizontal Position (HPos)

  Horizontal Position is also for convenience of waveform viewing and measurement. By changing horizontal position you can shift waveform left and right.

  On DSO138mini horizontal position is indicated by a line in brackets and a bar at the screen top. The line represents the whole waveform buffer. The bar is corresponding to the displayed portion of the buffer. Usually waveform buffer is much larger than the range that a screen can display. The screen is like a window through which you peek a signal waveform. When changing horizontal position you are actually moving the window so as waveform at different part of the buffer can be seen.

3. Further Tests

Now we have had some ideas about basic oscilloscope parameters. With this knowledge we can do some further tests to verify that your oscilloscope is working correct. Let's proceed step by step.

- Restore Factory Default Settings

  Before doing anything it is a good idea to perform a forced factory default restore. This will make sure all oscilloscope parameters are with valid values. To do this press and hold the center two buttons ([+] and [-]) for about 3 seconds. The oscilloscope parameters will be set to the default values as shown in the table below.

Table. 2

Parameter	Setting	Remarks
Couple	Depending on SW1 [CPL]	Not affected by default restore.
Sensitivity	Depending on SW2 [SEN1] and SW3 [SEN2]	Not affected by default restore.
Timebase	1ms	
Trigger mode	AUTO	
Trigger slope	Negative	
Trigger source	Internal	
Trigger level	0V	
Horiz. position	Center	
Vertical position	Center	

The screen display should look like Fig. 4.

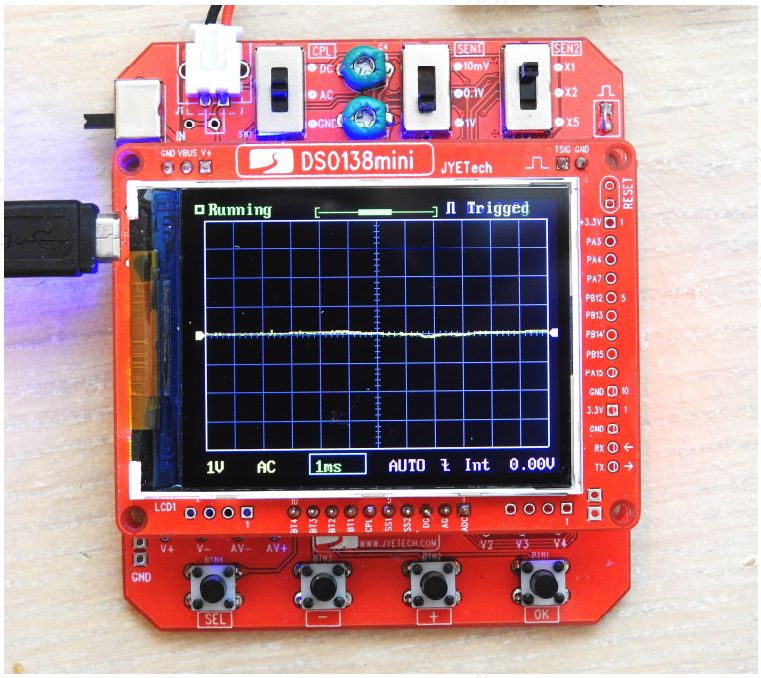

Fig. 4

Ø VPos Alignment

Due to component variance it is common that you would find the 0V line (the trace when input is a DC 0V signal. You can make a DC 0V input by placing CPL switch to GND position) is not aligned to the VPos indicator at screen left border. This causes rather inconvenience in reading waveform amplitude. By performing VPos Alignment we can make 0V trace aligned to VPos indicator and thus eliminate the inconvenience.

This is the way how VPos Alignment is done.

1) Press [SEL] button so that VPos indicator is highlighted.
2) Hold down [OK] button to enter VPos Alignment mode.

You should see screen display like this (Fig. 5).

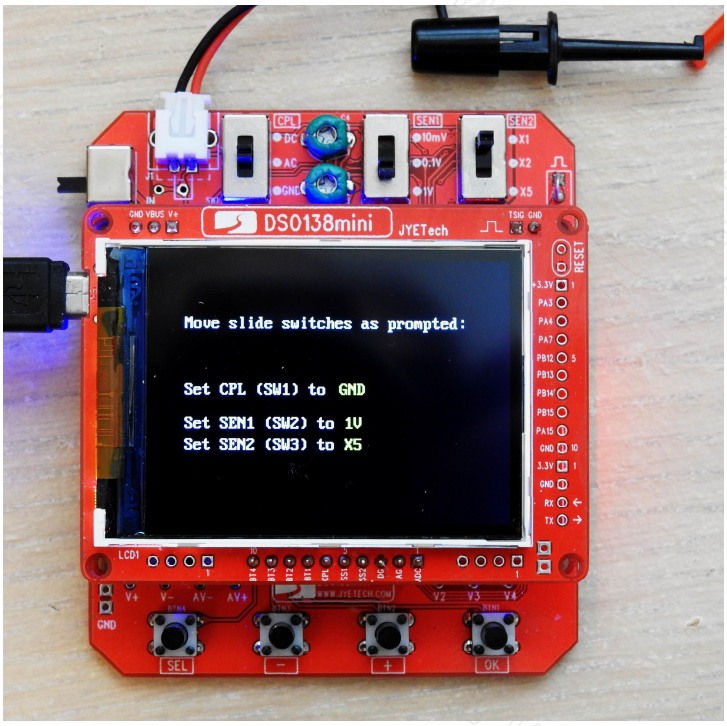

Fig. 5

Move slide switches to the positions as prompted by the blinking settings. Once switches are set to the positions the blinking will stop. When the process finishes the oscilloscope goes back to its normal working mode and VPos alignment is done.

Ø Verify Vertical Sensitivity

Connect the red hook to test signal output J4 on analog board. Set oscilloscope parameters as given in the Table 3 below.

Table. 3

Parameter	**Setting**	**How to set**
Couple	DC	Move [CPL] switch to AC position
Sensitivity	1V	Move [SEN1] switch to 1V position. Move [SEN2] switch to X2 position
Timebase	0.2ms	Press [SEL] so that the parameter to be changed is highlighted. Press [+] or [-] to set it to the wanted value.
Trigger mode	AUTO	
Trigger slope	Negative	
Trigger source	Internal	
Trigger level	One division above the center	
Horiz. position	Any position	
Vertical position	Center	

You should get waveform display similar to Fig. 6. From the display you can see that the amplitude of the test signal is about 3.2V (3 major divisions plus 1 minor division). The nominal value for the test signal amplitude is 3.3V. The value we got from screen reading

is pretty close.

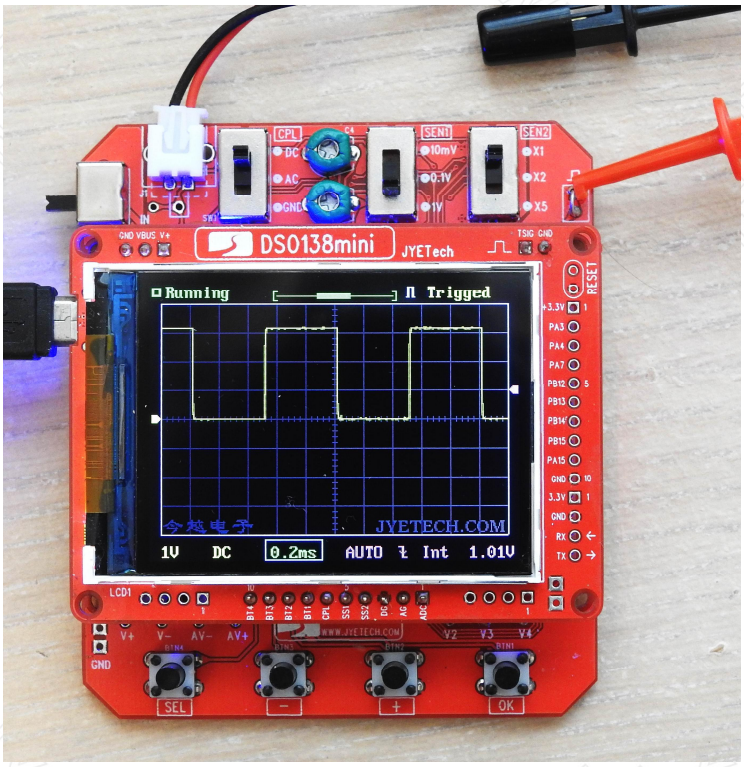

Fig. 6

Change slide switch SW3 to X2 and X5 positions respectively (for X5 setting you need to adjust trigger level lower to a location about 1/3 division above the center to get stable waveform). Read signal amplitude by counting the divisions corresponding to signal height (Fig. 7 and Fig. 8). Your readings should be close to 3.3V for both settings.

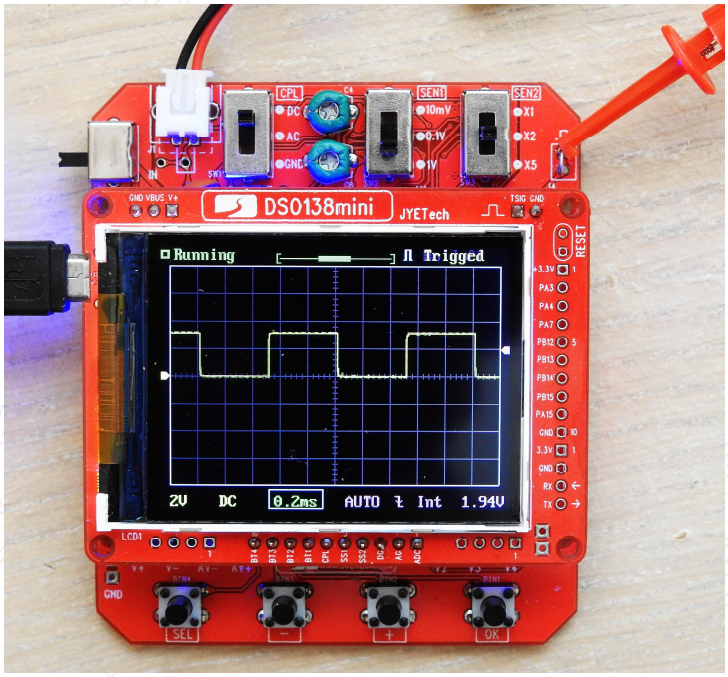

Fig. 7

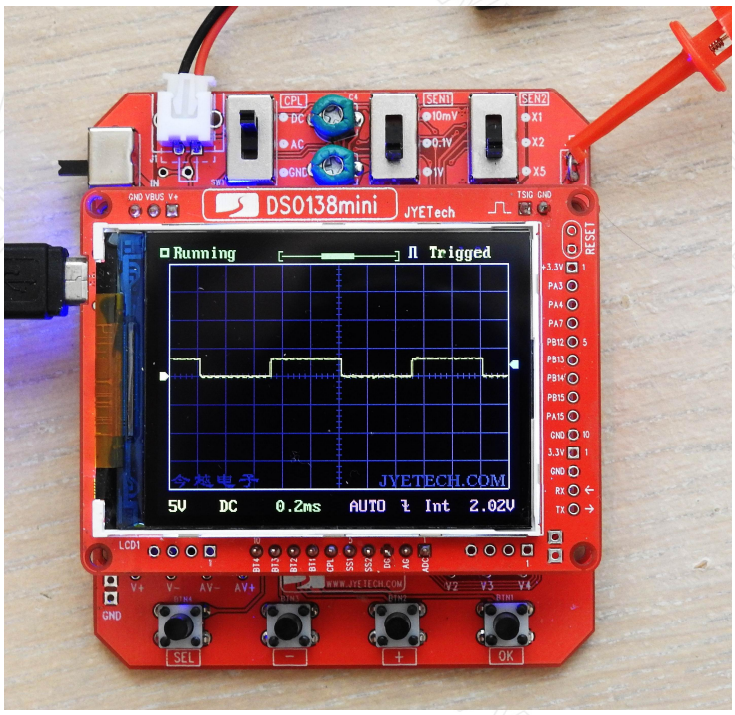

Fig. 8

Ø Verify Timebase

Set the parameters back to that given in Table 3. Keep the red hook at test signal output J4. Adjust horizontal position so that a waveform falling edge is aligned to the center line of the grids (Fig. 9). You should see the signal cycle is exactly 5 major divisions. That is 0.2ms/Div * 5 Division = 1ms, exactly the period of 1KHz.

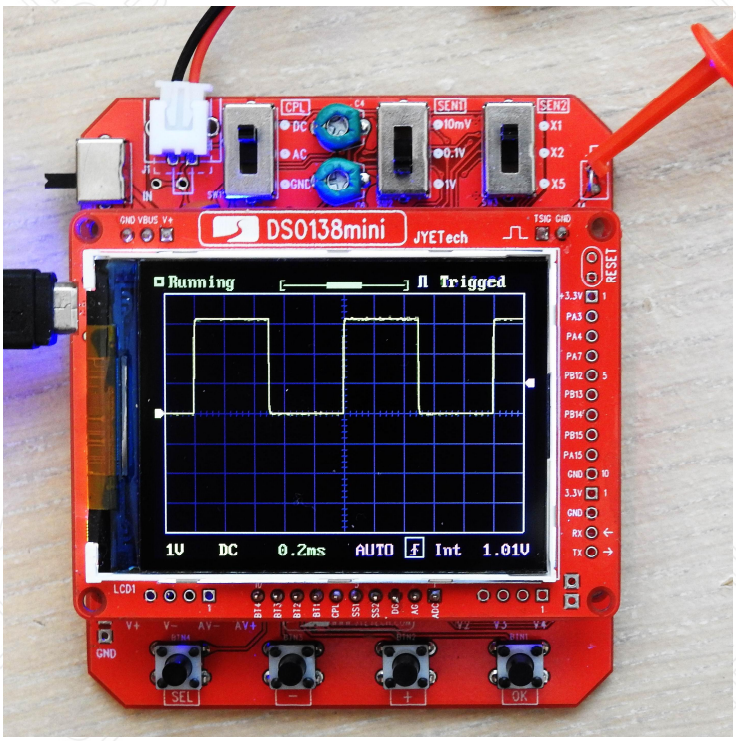

Fig. 9

4. Feel about the Trigger

Trigger is a very important part of an oscilloscope. We will talk about trigger in details in a separate article. Here we just ask beginners to get a brief feel about the trigger.

Ø Try Different Trigger Slope

Keep the same settings as above in "Verify Timebase". Change trigger slope to positive. You will see waveform flipped upside down as in Fig. 10 (comparing to Fig. 6).

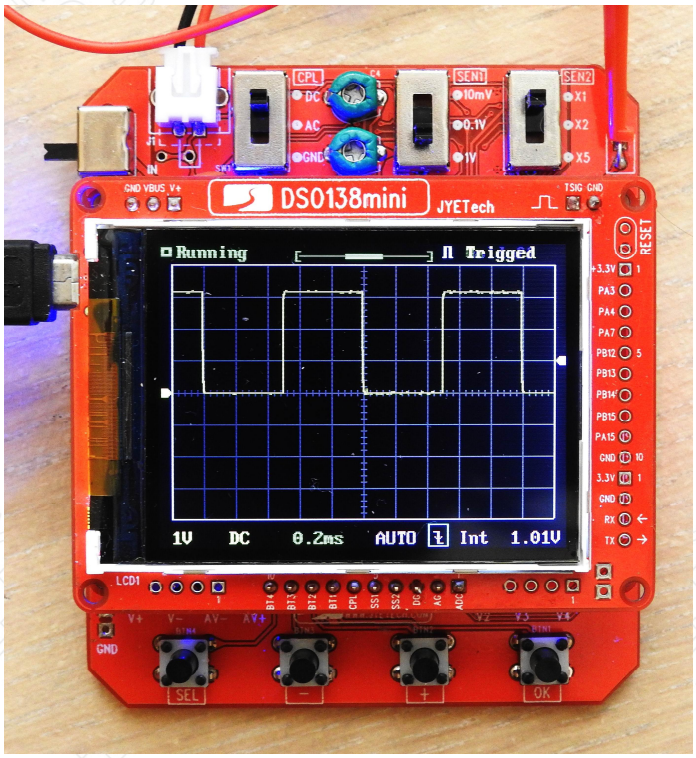

Fig. 10

Ø Change Trigger Level

Adjust trigger level down so that the arrow on the right border goes to position lower than the signal bottom. You will see waveform moving or jumping horizontally. Once you adjust the trigger level back to positions higher than the signal bottom the waveform becomes stable.

You will see similar phenomenal if trigger level is adjusted to positions around signal top.

Ø Try Different Trigger Modes

Disconnect the red hook from the test signal terminal J4 on analog board. Change trigger mode to NORM. Now touch the red hook with your fingers. You will see the trace changes when your finger touches the hook. The trace freezes once your finger is away from the hook.

After you have completed all the tests above without problem, congratulations! you have successfully assembled your DSO138mini. You can now start to use it to explore the world of electronics.

Revision History

Version	Date	Summary
v01	2018.07.05	First release.