DSO Shell DIY Kit

User Manual

Rev. 07

Applicable models: 15001K, 15002K

Applicable firmware version: 113-15001-061 or later

Before you start

1. Check kit contents and part quantities/values by the photo at right and part list in page 2 and page 3. Report missing or wrong parts to your vendor.
2. Resistor values are easy to mis-read. It is strongly suggested to check their values by ohm-meter before soldering them to board.
3. Make sure you understand the polarities and orientations of all parts.

Important !!!

If you have purchased 15002K kit (SMD not pre-soldered) you must install all SMD parts before mounting the through-hole parts. Please refer to the instructions below for SMD part installation. Otherwise, proceed to page 2 to start through-hole part assembly.

SMD parts are only installed to the analog board (PCB PN# 109-15001-xxx).

How to Solder SMD Parts

1. Before soldering check components against the part list to make sure you have correct parts.
2. Identify IC orientation and diode polarity (see photos).
3. Do not put iron on one pad for too long time. Otherwise, traces may peel off and get damaged.

SMD Part List (For PCB 109-15001-00F)

<table>
<thead>
<tr>
<th>Loc/Ref</th>
<th>Qty</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>1</td>
<td>TL084, SO14</td>
</tr>
<tr>
<td>U2</td>
<td>1</td>
<td>74HC4053, SO16</td>
</tr>
<tr>
<td>U3</td>
<td>1</td>
<td>74HC4051, SO16</td>
</tr>
<tr>
<td>U4</td>
<td>1</td>
<td>78L05, SOT89</td>
</tr>
<tr>
<td>U5</td>
<td>1</td>
<td>ICL7660, SO8</td>
</tr>
<tr>
<td>U6</td>
<td>1</td>
<td>79L05, SOT89</td>
</tr>
<tr>
<td>R19, R20</td>
<td>2</td>
<td>1K, 1%, 0805</td>
</tr>
<tr>
<td>R17, R16</td>
<td>2</td>
<td>10K, 1%, 0805</td>
</tr>
<tr>
<td>C3, C5</td>
<td>2</td>
<td>Cap trimmer, 30pF</td>
</tr>
<tr>
<td>C9, C12, C13, C14, C15, C16, C17, C18</td>
<td>8</td>
<td>0.1uF, 50V, 0805</td>
</tr>
</tbody>
</table>

Identify IC orientation

Place IC in front of you so that its marking read from left to right. The first pin at lower-left corner is pin 1.

Solder ICs

Apply solder to a corner pad
Solder IC to the pad. Make sure pins are aligned to pads
Solder the pin at the opposite corner so as chip is fixed
Solder all the rest pins one by one

Solder two-terminal parts

Apply solder to one pad
Solder part to the pad
Solder the other pad

Note:

Photos here are for illustration only. They may not match the real board.
Important
If your kit does not have SMD device pre-soldered you are strongly suggested to install all SMD parts before mounting through-hole parts. Please see instructions at Page 1.

Tools you need
① 20 - 25W iron for most of parts. For the BNC connector higher power iron (50 - 100W) is recommended if available.
② Rosin solder wire (0.8 - 1mm dia.)
③ Digital multimeter
④ Screw driver (phillips, size# 0)
⑤ Flush cutter
⑥ Tweezers
⑦ DC 9V power supply with 200mA (or higher) current capacity and 5.5 x 2.1mm plug.
⑧ Needle-nose pliers
⑨ Small slotted screwdriver (2mm width, for cap trimmer adjustment)

Soldering Hints
① Put leads through mounting holes from the side with part outline. Ensure component evenly touch PCB.
② Solder leads at the other side. Solder should fully fill and cover soldering pads. Avoid bridges between neighboring pads.
③ Cut unused leads flush with cutter.

Step 1
Assembly the Main Board (follow the order as numbered)

1. Check the main board
① Before mounting any parts to the main board connect a 9V power supply (center positive) to J7 on the board to check the display.
② You should see the scope boots up to a screen similar to the photo below. D1 (LED) blinks twice. Do not solder any parts to the board if you find problem. Otherwise warranty will be voided. Report the problem to vendor or JYE Tech.
③ Apply power
(DC jack is 5.5mm dia. with 2.1mm core)
④ Check display

2. Test Signal Terminal
① J8 : 4.8 x 0.8mm terminal
Note: Before soldering bend the terminal to the shape as shown in the left photo above.

3. Power Connector (optional)
① J6 : 0.1" pitch, rightangle

4. Slide Switch
① SW5 : DPDT

5. Pin-header (male)
① J2 : 1X4 pin, 0.1" pitch

6. Tact Switches
① SW3, SW2, SW1, 12x12x7mm

7. Remove Resistor R30
Let iron stay on one pad of the resistor until solder on the other pad melt and then remove the part.
Note: R30 is used to bypass SW5 so as the mainboard can be tested without the power switch. It must be removed for correct functioning of the power switch.
Now apply power again. Test power switch and tact buttons for their correct functions.

Step 2
Assembly the Analog Board (follow the order as numbered)

1. Resistors
Note: Always meter resistor values before soldering. Resistors are all 1/8W.
① R1 : 510KΩ
② R2 : 5.1MΩ
③ R3 : 1.2MΩ
④ R4 : 10KΩ
⑤ R5, R6, R14 : 1KΩ
⑥ R7 : 300Ω
⑦ R8, R16 : 150Ω
⑧ R9 : 91Ω
⑨ R10 : 30Ω
⑩ R11, R12 : 15Ω
⑪ R13 : 3KΩ
⑫ R15 : 130Ω

2. Ceramic Capacitors
① C1 : 0.1μF
② C2 : 330pF
③ C3 : 1μF
④ C6 : 150μF

3. Slide switch
① SW1 : 2P3T

4. Electrolytic capacitors
① C8, C10, C11 : 100μF / 16V

5. BNC connector
① J1 : BNC
Note: The thicker pins need to heat up longer to get good soldering result.

6. Pin-header (male)
① J2 : 2X5 pin, 2mm pitch

If you have questions post them to www.jyetech.com/forum.

www.jyetech.com - JYE Tech Ltd.

Page 2
2. Assemble Front Module

1. Fit LCD to front panel as shown below.

2. Fold the main board over while keeping LCD in place.

3. Mount rotary encoder board to the front plate with screws and solder the board to J2 of the main board.

4. Solder rotary encoder

- Note: Please pay attention to the orientation of PCB. Use the side with outline marking.

5. Attach the analog board to the main board by mating J2 on the analog board to J4 on the main board (see photo).

6. Set couple switch to GND position.

7. Check voltages at the points as shown in the photo.

- References

<table>
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<th>Input dependent</th>
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<th>Output</th>
</tr>
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<tbody>
<tr>
<td>V+</td>
<td>+9.30V</td>
<td></td>
</tr>
<tr>
<td>V-</td>
<td>-5.0V</td>
<td>+/-2%</td>
</tr>
<tr>
<td>AV+</td>
<td>0.0V</td>
<td>+4.75V</td>
</tr>
<tr>
<td>AV-</td>
<td>0.0V</td>
<td>+/-2%</td>
</tr>
<tr>
<td>V1</td>
<td>0V</td>
<td></td>
</tr>
<tr>
<td>V2</td>
<td>0V</td>
<td></td>
</tr>
<tr>
<td>V3</td>
<td>0V</td>
<td></td>
</tr>
<tr>
<td>V4</td>
<td>-1.65V</td>
<td></td>
</tr>
</tbody>
</table>

8. Screw up at the back

9. Attach knob cap and done!

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Step 3
Assembly Front Module

Step 4
Check Voltages

- Important! Always remove power before connecting or disconnecting the analog board.

Step 5
Calibration

- Adjust trimmers C3 and C5

- Connect the red clip to the test signal terminal and leave the black clip un-connected (see photo at bottom). Apply power and boot. Hold down ADJ dial for 3 seconds to bring up Test Signal amplitude display at lower-left corner. Push ADJ to set the amplitude to 0.1V.

- Set sensitivity to 50mV and adjust trigger level so that waveform stable (see “How to Use” at page 4).

- Tuning C3 so that sharp rectangle (photo B at left) is obtained. The adjustment is done.

- Similarly, for C5 calibration push ADJ to set test signal to 3.3V. Change sensitivity to 1V. Tuning C5 so that sharp rectangle waveform is obtained. The adjustment is done.

Step 6
Final assembly

- It is strongly recommended to read the article “FAQ, Tips, and Troubleshooting” at www.jyetech.com/forum under the sub-forum “DSO Shell”.

- Important! Always remove power before connecting or disconnecting the analog board.

- Tips: Perform VPos alignment before calibrating C3 and C5.

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- Measurements applicable for "E" version PCB (PN:109-15001-00E)
Operations

SW1 not set to GND position.
Bad soldering on U1.
Bad soldering on R5 and/or R6.
Bad soldering on R13, R14, and R15.
Shorts between AV+ and ground.

Possible Causes
R26 bad soldering or wrong value.
Diode D2 open or damaged.
Bad soldering on R3 and/or R4.
Incorrect V4. If V4 is correct perform factory default restore as described in Bad soldering on R1 and/or R2.
U5 (7660) bad soldering or defective.
Make sure trigger mode is AUTO and timebase is 1ms. Hold down [SEC/DIV] and [TRIGGER] .
Bad soldering on U1.
R27 bad soldering or wrong value.
Bad C12 and/or C13.

Troubleshooting

Attention
1. Power supply voltage must not exceed 10V. Otherwise it may damage the ICs inside.
2. Allowed maximum signal input voltage is 50Vpk (100Vpp) with the clip probe.

About Trigger State
The trigger can have three states including Holdoff, Waiting, and Trigged. They are explained below.

Holdoff: Trigger is disabled until a portion of sample buffer prior to a trigger point is filled with raw data.
Waiting: Trigger is waiting for a valid signal slope.
Trigged: A valid signal slope has been detected and registered.

Rolling Mode
When timebase is set to 50ms or slower and trigger mode is set to AUTO the scope will automatically switch to Rolling Mode where waveform shifts from right to left constantly. The trigger is disabled under this mode.

Connections

Power Supply: Connect 9V DC power supply to the 5.5x2.1mm jack at bottom (center positive). Power supply voltage must be in the range of 8 - 10V.
Probe: Connect probe to the BNC connector at top.

Specifications

Max sampling rate: 1Ms/s
Analog bandwidth: 0 - 200kHz
Trigger modes: Auto, Normal, and Single
Sensitivity range: 5mV/div - 20V/div
Max input voltage: 30Vpk (1X probe)
Input impedance: 1M ohm/20pF
Resolution: 12 bits
Record length: 1024 points

Measurements

ON/OFF
Hold down [OK] button for about 3 seconds. This will turn ON or OFF on-screen display of measurements including Vmax, Vmin, Vavr, Vpp, Vrms, Freq., Cycle, Pulse width, and Duty cycle.

Save Waveform
Press [ADJ] & [SEC/DIV] buttons simultaneously. The currently displayed waveform will be saved to EEPROM. The existing data in EEPROM will be overwritten.

Recall Waveform

Default Restore
Hold down [SEC/DIV] and [TRIGGER] buttons simultaneously for about 3 seconds.

Center HPos
Hold down [SEC/DIV] button for about 3 seconds. This will make the data at the center of capture buffer displayed.

Center Trigger Level
Hold down [TRIGGER] button for about 3 seconds. This will set the trigger level to the medium value of signal amplitude.

Fast Adjustment
Short press of [ADJ] toggles Fast Adjustment mode on and off for VPos, HPos, and Trigger Level. A ‘+’ sign appearing at top of screen indicates Fast Adjustment is ON.

More Functions

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<td>Measurements</td>
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