DIY Kit
User Manual Rev. 06

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 page2 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 your 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 page2 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 Lis   (For E version PCB)

Loc/Ref	Qty	Descriptions
U1	1	TL084, SO14
U2	1	74HC4053, SO16
U3	1	74HC4051, SO16
U4	1	78L05, SOT89
U5	1	ICL7660, SO8
U6	1	79L05, SOT89
R19	1	1K,1%, 0805
R17, R18	2	10K,1%, 0805
C3, C5	2	Cap trimmer, 30pF
C9, C12, C13, C14, C15, C16, C17, C18	8	0.1uF, 50V, 0805

Identify IC orientation
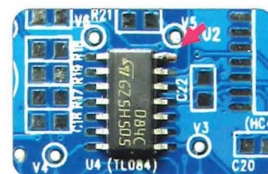
TL084C
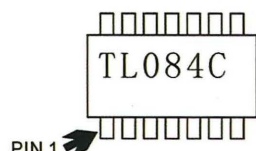
PIN 1

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.
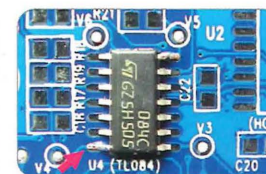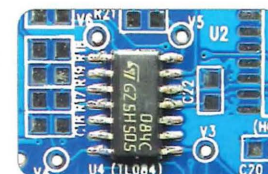
Solder ICs

Pin1
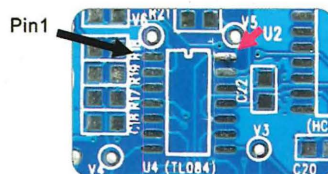
Apply solder to a corner pad

Solder IC to the pad. Make sure pins are aligned to pads
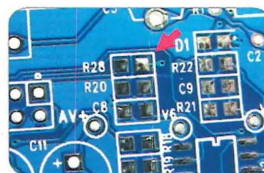

Solder the pin at the opposite corner so as chip is fixed
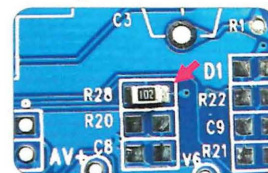

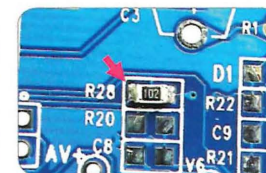Solder all the rest pins one by one

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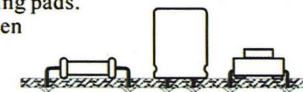
Step 1 — Assembly the Main Board (follow the order as numbered)

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.

② Check display
① Apply power

2. Test Signal Terminal

☐ 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)

☐ J6 : 0.1" pitch, rightangle

4. Slide Switch

☐ SW5   : DPDT

5. Pin-header (male)

☐ J2   : 1X4 pin, 0.1" pitch

6. Tact Switches

☐ SW1, SW2,   : 12x12x7mm
SW3, SW4

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.

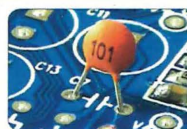## Step 2 — Assembly the Analog Board (follow the order as numbered)

1. Resistors

Note:
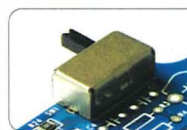Always meter resistor values before soldering

☐ R1   : 510K Ω
☐ R2   : 5.1M Ω
☐ R3   : 1. 2M Ω
☐ R4   : 11K Ω
☐ R5, R6, R14 : 1K Ω
☐ R7   : 300 Ω
☐ R8, R16   : 150 Ω
☐ R9   : 91 Ω
☐ R10   : 30 Ω
☐ R11, R12   : 15 Ω
☐ R13   : 3K Ω
☐ R15   : 130 Ω

2. Ceramic Capacitors

☐ C1   : 0.1 μ F
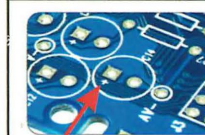☐ C2   : 330pF
☐ C4   : 1pF
☐ C6   : 150pF

3. Slide switch

☐ SW1   : 2P3T

4. Electrolytic capacitors

Solder positive pole (the longer lead) to the square pad

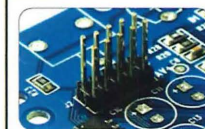☐ C8, C10, C11   : 100 μ F/16V

5. BNC connector

☐ J1   : BNC

Note:
The thicker pins need to heat up longer to get good soldering result.

6. Pin-header (male)

☐ J2   : 2 X 5 pin, 2mm pitch
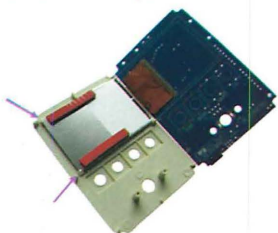
Finished

1. Solder Rotary Encoder
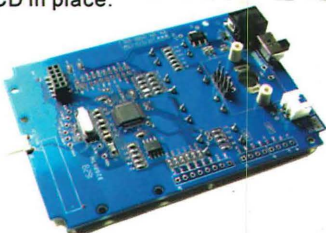
Mount to the small PCB
(PN: 109-15002-00A)

Note:
Please pay attention to the orientation of PCB. Use the side with outline marking.
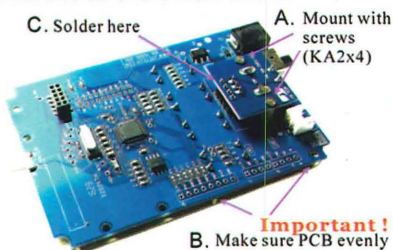
2. Assemble Front Module

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.

C. Solder here

A. Mount with screws (KA2x4)

Important !
B. Make sure PCB evenly touch the front plate while doing C.

Step 4 — Check Voltages

Important !
Always remove power before connecting or disconnecting the analog board.
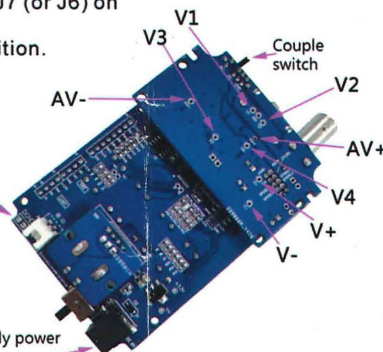
Verify voltages on the analog board

① Attach the analog board to the main board by mating J2 on the analog board to J4 on the main board (see photo).
② Apply 9V DC power supply to J7 (or J6) on the main board.
③ Set couple switch to GND position.
④ Check voltages at the points as shown in the photo.

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

References
(*) Input dependent

Input	+9.30V
V+ (*)	+8.35V
AV+	5.0V+/-2%
V- (*)	-7.86V
AV-	-5.0V+/-2%
V1	0V
V2	0V
V3	0V
V4	~1.65V

V1
V3
V2
AV-
Couple switch
AV+
V4
V+
V-

Place negative pen at DGND

Apply power here

Step 5 — Calibration

Tips:
Perform VPos alignment before calibrating C3 and C5.

Adjust trimmers C3 and C5

① Connect the red clip to the test signal terminal and leave the black clip un-connected (see photo at bottom).
② Apply power and boot. Adjust the square wave output of PWM to 1kHz, The duty cycle is adjusted to 50%, Coupling mode is selected as AC or DC
③ Set the sensitivity of the oscilloscope to 1v, The timebase is adjusted to 200us.
④ Adjust C3 or C5 so that the corner position of the waveform is right angle (B in the right figure), The adjustment of C3 or C4 is complete.

C3 C5
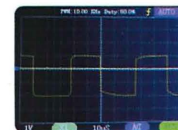
A. Not enough
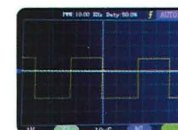
B. Good
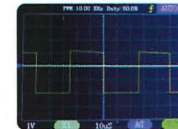
C. Too much

Step 6 — Put all parts together

Final assembly

① Screw the analog board to back cover with the top bracket attached

Top bracket
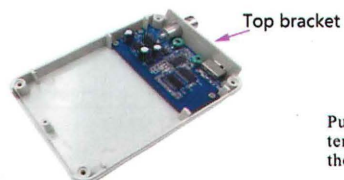
② Combine the front module and the back cover

Put test signal terminal through the small slot

③ Make sure receptacle (J4) mate with pin-header (J2)

④ Attach bottom bracket before holding the two modules together

Bottom bracket

⑤ Attach the front frame

Front frame

⑥ Firmly press the frame in

⑦ Screw up at the back

Screws PA2.3x8 (4 positions)

⑧ Attach knob cap and done!

Knob cap

How to Use

Display and Controls

Couple Switch

Test Signal output

BNC Connector (Signal Input)

PWM output frequency

PWM output duty cycle

Trigger : falling edge trigger/ rising edge trigger

Calibration mode open flag

Trigger mode: automatic trigger, normal trigger, single trigger

Baseline arrow

Trigger arrow, the trigger position is at the center line of the screen in single mode Auto/Nomal, trigger on the leftmost side of the screen

Vertical component

Voltage multiple

Operating status

Coupling method: GND/DC/AC

Time base

Connectors for Power Supply (5.5 x 2.1mm)

Power Switch

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.
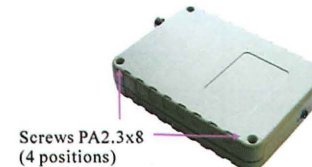
Probe: Connect probe to the BNC connector at top.

Button	Press	Hold down
V/DIV	Switch to horizontal baseline, vertical component setting	Long press in the setting except for the vertical component, Enter manual calibration mode, and also long press to exit. Under the vertical component setting, Long press the parameter X1/X10 to switch
Sec	Switch time base, PWM output setting	Save the setting parameters, if you do not save, The setting parameter state saved last time will be restored by default at the next startup. PS: Exit calibration mode will also save
TRIGGER	Switch:Trigger mode, trigger position setting	
OK	Stop/Run	Show/close detailed parameters
Encoder rotates clockwise	+	
Encoder rotates counterclockwise	-	
Press the encoder	Switch fast/slow movement-Switch settings in PWM mode	Show/close detailed parameters
Toggle Switches	Switch GND/AC/DC coupling state	

Calibration instructions:
1. Pull out the voltage probe
2. Enter calibration mode
3. Adjust the voltage range 5mV—>20V (the order does not matter)
4. Switch the coupling mode and repeat 3 operations until all three coupling modes are calibrated
5. Exit the calibration mode (the calibration parameters will be saved when you exit, if you do not exit directly, the calibration will be invalid)

Firmware upgrade instructions:
1. Need to use the CH340 serial tool to connect to the three pins RX, TX, and GND on the board
2. Press and hold the OK button to turn on —》 Enter the firmware upgrade mode
3. Open the host computer software, connect to the corresponding port, baud rate: 115200
4. Select firmware file
5. Start the download, wait for the download to complete, and restart the device

Specifications

Max realtime sample rate	1MSa/s	Timebase range	500s/Div -- 10us/Div
Analog bandwidth	0 -- 200KHz	Trigger modes	Auto, Normal, and Single
Sensitivity range	5mV/div - 20V/div	Trigger position	Center of buffer
Max input voltage	50Vpk (1X probe)	Power supply	9V DC (8 – 10V)
Input impedance	1M ohm/20pF	Current consumption	~120mA @ 9V
Resolution	12 bits	Dimension	105 x 75 x 22mm
Record length	1024 points	Weight	100 gram (without probe and PS)

Troubleshooting

Problems	Possible Causes
Bad V+	① Connector J7 defective. ② Diode D2 open or damaged.
Bad V-	① Bad C12 and/or C13. ② U5 (7660) bad soldering or defective. Hint: Check with R27 disconnected would let you know the issue is caused by load or source.
Bad AV-	① R27 bad soldering or wrong value. ② Shorts between AV- and ground.
Bad AV+	① R26 bad soldering or wrong value. ② Shorts between AV+ and ground.
V1 does not close to 0V	① SW1 not set to GND position. ② Bad soldering on R1 and/or R2. ③ Bad soldering on U1.
V2 does not close to 0V	① SW1 not set to GND position. ② Bad soldering on R3 and/or R4. ③ Bad soldering on U1.
V3 does not close to 0V	① Bad soldering on U1 and/or U2. ② Bad soldering on R5 and/or R6.
Bad V4	① Bad soldering on R13, R14, and R15.
No Trace	① Incorrect V4. If V4 is correct perform factory default restore as described in ② ② Make sure trigger mode is AUTO and timebase is 1ms. Hold down [SEC/DIV] and [TRIGGER] buttons simultaneously for 3 seconds.