SHS800X / SHS1000X
Handheld Digital Oscilloscope

Service Manual

EN01A

SIGLENT TECHNOLOGIES CO.,LTD

Contents

1 Important Safety Information

This manual contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

1.1 General Safety Summary

Carefully read the following safety precautions to avoid personal injury and prevent damage to the instrument and any products connected to it. To avoid potential hazards, please use the instrument as specified.

To Avoid Fire or Personal Injury.

Use Proper Power Adapter.
Only use the adapter provided with the instrument for connecting the instrument to mains power sources.

Connect the Signal Wire Correctly.
Do not touch the exposed contacts or components.

Look over All Terminals' Ratings.
To avoid fire or electric shock, please look over all ratings and signed instructions of the instrument. Before connecting the instrument, please read the manual carefully to gain more information about the ratings.

Equipment Maintenance and Service.
When the equipment fails, please do not dismantle the machine for maintenance. The internal devices of the equipment are sensitive to static electricity, and direct contact is easy to cause irreparable damage to the equipment. It is necessary to return to the factory or the company's designated maintenance organization for maintenance. Be sure to pull out the power supply when repairing the equipment. Live line operation is strictly prohibited. The equipment can only be powered on when the maintenance is completed and the maintenance is confirmed to be successful.

Identification of Normal State of Equipment.
After the equipment is started, there will be no alarm information and error information at the interface under normal conditions. The curve of the interface will scan from left to right freely. If there is a button in the scanning process or there is an alarm or error prompt, the device may be in an abnormal state. You need to view the specific prompt information. You can try to restart the setting. If the fault

information is still in place, do not use it for testing. Contact the manufacturer or the maintenance department designated by the manufacturer to carry out maintenance to avoid the wrong test data caused by the use of the fault or endanger the personal safety.

Not Operate with Suspected Failures.

If you suspect that there is damage to the instrument, please let qualified service personnel check it.

Avoid Circuit or Wire Exposed Components Exposed.

Do not touch exposed contacts or components when the power is on.

Do not operate in wet/damp conditions.

Do not operate in an explosive atmosphere.

Keep the surface of the instrument clean and dry.

Only probe assemblies that meet the requirement of UL61010-031 and CAN/CSA-C22.2 No.61010-031 shall be used.

Only a lithium battery with the same specifications as the original battery should be used to replace the battery on board.

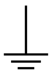
Not to use the equipment for measurements on voltage exceed the voltage range describe in the manual.

The responsible body or operator should refer to the instruction manual to preserve the protection afforded by the equipment. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Any parts of the device and its accessories are not allowed to be changed or replaced, other than authorized by the manufacturer or agent.

1.2 Safety Terms and Symbols

When the following symbols or terms appear on the front or rear panel of the instrument or in this manual, they indicate special care in terms of safety.

	This symbol is used where caution is required. Refer to the accompanying information or documents to protect against personal injury or damage to the instrument.
	This symbol warns of a potential risk of shock hazard.
	This symbol is used to denote the measurement ground connection.
	This symbol is used to denote a safety ground connection.
	This symbol shows that the switch is an On/Standby switch. When it is pressed, the oscilloscope's state switches between Operation and Standby. This switch does not disconnect the device's power supply. To completely power off the oscilloscope, the battery must be removed after the oscilloscope is in the standby state.
	This symbol is used to represent alternating current, or " AC ".
CAUTION	The " CAUTION " symbol indicates a potential hazard. It calls attention to a procedure, practice, or condition which may be dangerous if not followed. Do not proceed until its conditions are fully understood and met.
WARNING	The " WARNING " symbol indicates a potential hazard. It calls attention to a procedure, practice, or condition which, if not followed, could cause bodily injury or death. If a WARNING is indicated, do not proceed until the safety conditions are fully understood and met.

2 First Steps

2.1 Delivery Checklist

First, verify that all items listed on the packing list have been delivered. If you note any omissions or damage, please contact your nearest **SIGLENT** customer service center or distributor as soon as possible. If you fail to contact us immediately in case of omission or damage, we will not be responsible for replacement.

2.2 Quality Assurance

The oscilloscope has a 3-year warranty (1-year warranty for probes and accessories) from the date of shipment, during normal use and operation. **SIGLENT** can repair or replace any product that is returned to the authorized service center during the warranty period. We must first examine the product to make sure that the defect is caused by the process or material, not by abuse, negligence, accident, abnormal conditions, or operation.

SIGLENT shall not be responsible for any defect, damage, or failure caused by any of the following:

a) Attempted repairs or installations by personnel other than **SIGLENT**.

b) Connection to incompatible devices / incorrect connection.

c) For any damage or malfunction caused by the use of non-**SIGLENT** supplies. Furthermore, **SIGLENT** shall not be obligated to service a product that has been modified. Spare, replacement parts, and repairs have a 90-day warranty.

The oscilloscope's firmware has been thoroughly tested and is presumed to be functional. Nevertheless, it is supplied without warranty of any kind covering detailed performance. Products not made by **SIGLENT** are covered solely by the warranty of the original equipment manufacturer.

2.3 Maintenance Agreement

We provide various services based on maintenance agreements. We offer extended warranties as well as installation, training, enhancement and on-site maintenance, and other services through specialized supplementary support agreements. For details, please consult your local **SIGLENT** customer service center or distributor.

3 Document Conventions

For convenience, text surrounded by a box border is used to represent the button of the front panel. For example, Acquire represents the "Acquire" button on the front panel.

4 Prepare for Using

4.1 Adjust the Supporting Leg

Properly adjust the supporting leg and place the oscilloscope steadily for better operation and observation of the display screen.

Figure 1 Adjust the Supporting Leg

4.2 Battery Installation

When the oscilloscope leaves the factory, the battery and the host are separated. Please install the battery as follows:

1. Remove the three screws on the battery cover with a screwdriver, as shown in Figure 2.
2. Remove the battery cover, as shown in Figure 3.
3. Put the battery into the battery slot and close the battery cover, as shown in Figure 4.
4. Lock the screws with the screwdriver, as shown in Figure 2, and then turn on the oscilloscope to check whether the battery is installed successfully.

Figure 2

Figure 3

Figure 4

Important tips:

- Pay attention to the direction of the battery cover, with the serial number at the bottom.
- Anti-reverse connection design is adopted for battery slot. Please put the battery in gently, do not use force.
- If the battery fails to power on after successful installation, it may be that the battery has run out. Please charge it in time.
- When the oscilloscope is idle, the battery needs to be charged every 3 months.

4.3 Connect the Power Supply

The power requirement of the oscilloscope is 100-240 V, 50/60Hz. Please use the power adapter provided to connect the oscilloscope to the power source.

Figure 5 Connect to Power Supply

4.4 Power-on Inspection

When the oscilloscope is energized, press the power key at the lower-left corner of the front panel to start the oscilloscope. During the start-up process, the oscilloscope performs a series of self-tests and you can hear the sound of relay switching. After the self-test is finished, the welcome screen will be displayed.

4.5 Connect the Probe

1. Connect the BNC terminal of the probe to a channel BNC connector.
2. Connect the probe tip to the circuit point to be tested and connect the ground alligator clip of the probe to the circuit ground terminal.

4.6 Function Inspection

1. Press the Default button on the front panel to restore the instrument to its default configuration.
2. Connect the ground alligator clip of the probe to the "Ground Terminal" under the probe compensation signal output terminal.
3. Use the probe to connect the input terminal of CH1 of the oscilloscope and the "Compensation Signal Output Terminal" of the probe.
4. Press the Auto Setup .
5. Observe the waveform on the display. In normal condition, the display should be a square waveform as shown in the figure below:

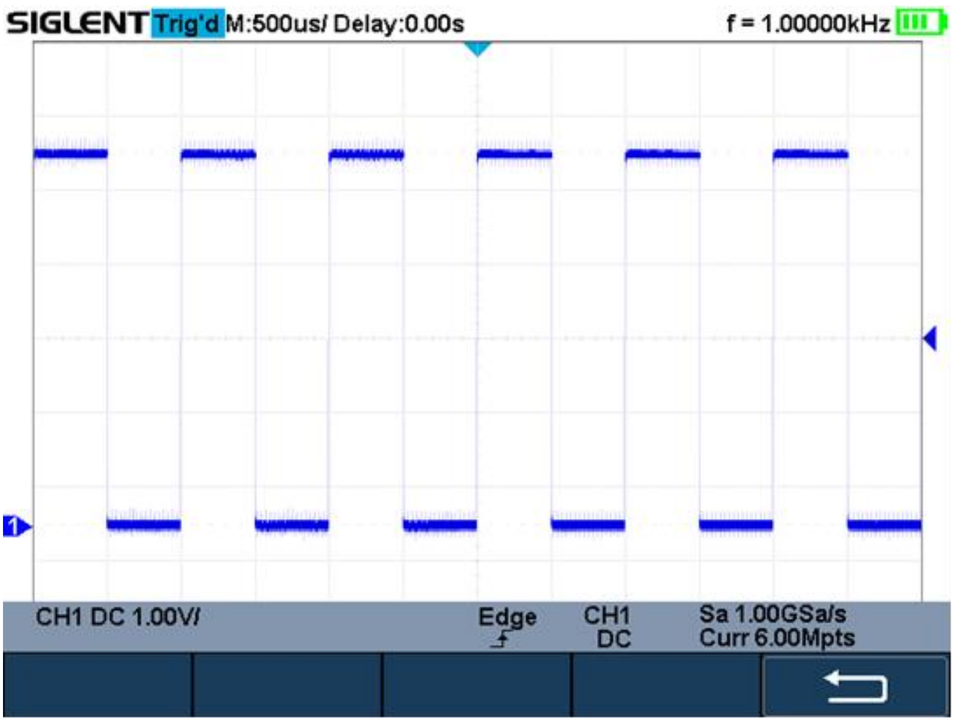


Figure 6 Function Inspection

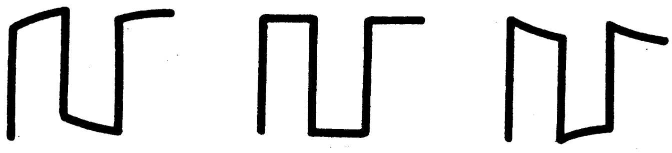
6. Use the same method to test the other channels. If the square waveforms shown do not match that in the figure above, please perform "Probe Compensation" in the next section.

	**WARNING** To avoid electric shock during the use of probe, please make sure that the insulated wire of the probe is in good condition and do not touch the metallic part of the probe when the probe is connected to high voltage source.

4.7 Probe Compensation

When the probes are used for the first time, you should compensate the probes to match the input channels of the oscilloscope. Non-compensated or poorly compensated probes may cause measurement inaccuracy or error. The probe compensation procedures are as follows.

1. Set the switch to 10X on the probe.
2. Perform steps 1, 2, 3 and 4 of “Function Inspection” in the previous section.
3. Check the waveforms displayed and compare them with the following:



Under Compensated | Perfectly Compensated | Over Compensated

4. Use a nonmetallic driver to adjust the low-frequency compensation adjustment hole on the probe until the waveform displayed is as the “Perfectly compensated” in the figure above.

4.8 Multimeter Meter Pen

To avoid obtaining no measurements or unnecessary damage to the SHS800X/SHS1000X, you should use the right jack when measuring current, voltage and other measurement.

5 Performance Test

This chapter explains testing the oscilloscope to verify performance specifications. For accurate test results, please let the test instruments and the oscilloscope warm-up 30 minutes before testing.

Below is the required equipment for the test:

Table 1 Test equipment

Equipment	Description	Test item
Fluke 9500B + 9530 Active Heads	High-Performance Oscilloscope Calibrator	DCG\Offset\ Clock accuracy\BW\BWL\trigger sensitivity\ Input impedance…
Terminal Load 50Ω	Impedance Match	BW\BWL\trigger sensitivity
Fluke5522A + Dual Banana Cable	Multimeter Calibrator	DCV/ACV/RES/CAP/DCI/ACI

The figures below show the interconnections between the test equipment to the oscilloscope under test:

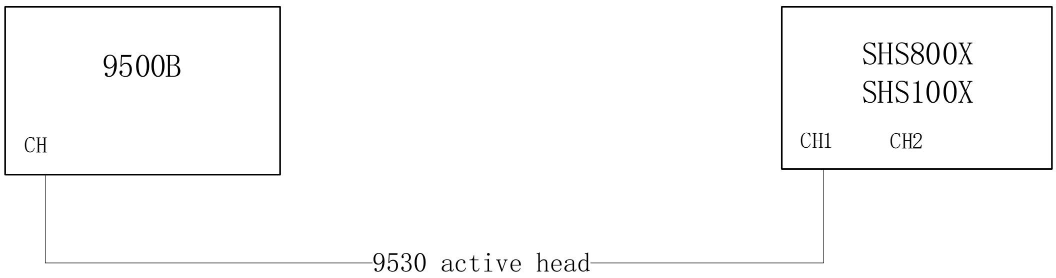


Figure 7 Connecting test instruments for DCG/Offset/Timebase/Triglevel/Impedance

Note: “CH” in Figure 7 represents one channel of the 9500B with a 9530 active head; It connects to any channel of the scope according to test.

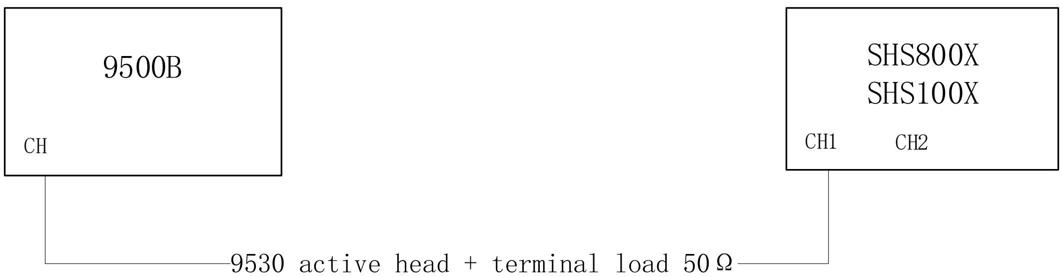


Figure 8 Connecting test instruments for Bandwidth/Bandwitdth limit/Trigger Sensitivity

Note: "CH" in Figure 8 represents one channel of the 9500B with a 9530 active head and a terminal load 50 Ω; They connect to any channel of the scope according to test.

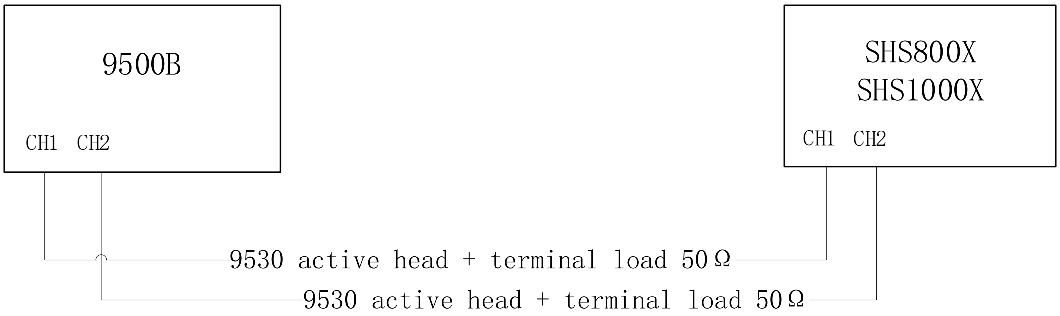


Figure 9 Connecting test instruments for Skew

Note: "CH1" and "CH2" in Figure 9 of the 9500B represents any two channels of the 9500B with a 9530 active head and a terminal load 50Ω; They connect to any two channels of the scope according to test.

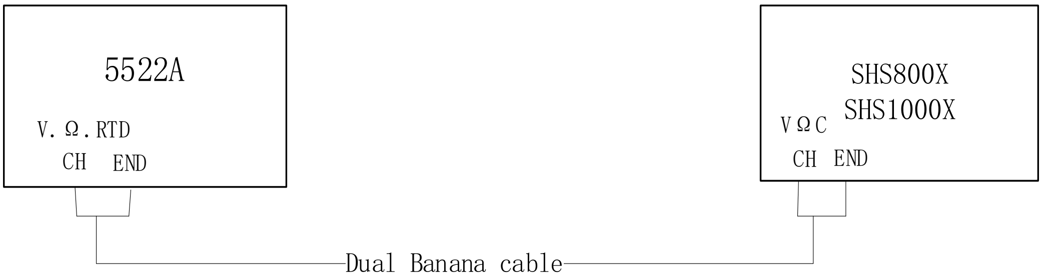


Figure 10 Connecting test instruments for meter's DCV/ACV/RES/CAP

Note: "CH" and "END" in Figure 10 of the 5522A represents voltage/resistance/capacitance output of the 5522A with a dual banana cable connect to the "VΩC" input of the scope meter mode.

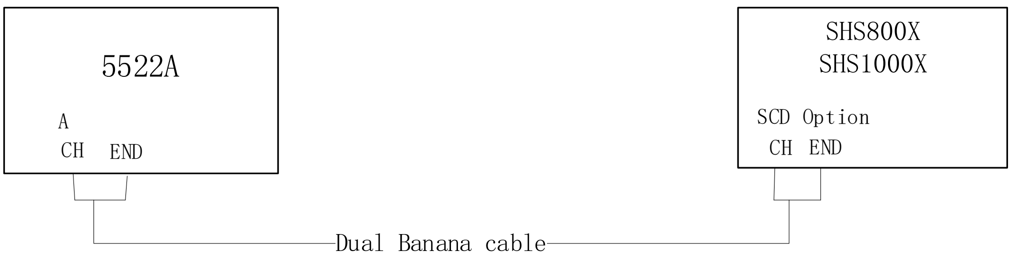


Figure 11 Connecting test instruments for meter's DCI/ACI

Note: “CH” and “END” in Figure 11 of the 5522A represents the current output of 5522A with a dual banana cable, connect to SCD600mA (10A) option that installed on the input of scope meter according to test.

Verify Test Results

To verify whether or not a test passes (i.e., whether the readings are within the appropriate limits), it is necessary to record the readings in the Performance Test located in the Test Record.

Self-Calibration

If the environmental temperature changes by more than 5℃, the Self Calibration operation must be performed to achieve the specified performance.

5.1 To Verify DC Gain Accuracy

To calculate the DC gain error of a vertical scale, at least five input and reading values are required to generate a two-dimensional array.

Use the least square method below to fit the DC Gain error:

Gain error = LINEST (V_{error1}:V_{error5}, $V_{setting1}$:$V_{setting5}$)

Notes:

“LINEST” is a function in EXCEL to calculate the characteristic value of a fitted line which fitting a two-dimensional array by using the least square method, and then returns an array describing the line. The first value of the returned array represents the slope of the fitting line.

“$V_{setting}$” represents the DC voltage output of the 9500B.

“$V_{measure}$” represents the measurement value on scope.

“V_{error}” represents the difference between the voltage setting and the measurement value.

Table 2 Instance of Gain Error Calculation

	$V_{setting}$ (mV)	$V_{measure}$ (mV)	V_{error} (mV)	Gain error
Point1	-3	-2.99	0.01	0.4%
Point2	-1.5	-1.49	0.01	
Point3	0	0.00297	0. 00297	
Point4	1.5	1.49	-0.01	
Point5	3	2.99	-0.01	

Steps:

1. Set the 9500B output to on.
2. Connect a selected channel of the oscilloscope to the 9500B with an active head as shown in Figure 7.
3. Set the timebase of the oscilloscope to 5 ms/div, set the “Mem Depth” in the menu of Acquire to 600k.
4. Set the vertical scale of the selected channel to 100 V/div, set the position to 0 V. Select the Measure menu of the oscilloscope to display “Mean” measurement of the selected channel.
5. Set DC voltage output level of the 9500B according to Table 3, and record the “Mean” value of the channel as V_{mean}.
6. Calculate V_{error} ($V_{error}= V_{mean} – V_{setting}$), and set the next output level as step 5.
7. Calculate gain error with these 5 data points: $V_{setting1}$~$V_{setting5}$, V_{error1}~V_{error5} by using the ‘LINEST’ function. Check if the slope falls within the range shown in Table 3.
8. Set the next vertical scale of the selected channel to the other settings in Table 3, and repeat steps 4 to 7.
9. After measuring all vertical scales of the selected channel in turn, turn the 9500B output off.
10. Connect the other channel of the oscilloscope to the 9500B with the active head. Check the other channel in the same way as step 3 to step 9.

Table 3 DC Gain Accuracy Setting

Vertical Scale	DC voltage output levels	DC Gain Accuracy error
100 V/div	200V, 100 V, 0 V, -100 V, -200 V	±2%
50 V/div	150 V, 75 V, 0 V, -75 V, -100 V	±2%
20 V/div	60 V, 30 V, 0 V, -30 V, -60 V	±2%
10 V/div	30V, 150 V, 0 V, -15 V, -30 V	±2%
5 V/div	15 V, 7.5 V, 0 V, -7.5 V, -15 V	±2%
2 V/div	6 V, 3 V, 0 V, -3 V, -6 V	±2%
1 V/div	3 V, 1.5 V, 0 V, -1.5 V, -3 V	±2%
500 mV/div	1.5 V, 0.75 V, 0 V, -0.75 V, -1.5 V	±2%
200 mV/div	600 mV, 300 mV, 0 V, -300 mV, -600 mV	±2%
100 mV/div	300 mV, 150 mV, 0 V, -150 mV, -300 mV	±2%
50 mV/div	150 mV, 75 mV, 0 V, -75 mV, -150 mV	±2%

Vertical Scale	DC voltage output levels	DC Gain Accuracy error
20 mV/div	60 mV, 30 mV, 0 V, -30 mV, -60 mV	±2%
10 mV/div	30 mV, 15 mV, 0 V, -15 mV, -30 mV	±2%
5 mV/div	15 mV, 7.5 mV, 0 V, -7.5 mV, -15 mV	±3%

5.2 To Verify Offset Accuracy

Two components must be verified for the offset accuracy. First part is the offset gain error relative to the setting of offset value. Second part is the error only relative with the setting of the vertical scale.

Table 4 Components of Offset Accuracy

	Gain Component	Full scale Component
Offset accuracy	1.5%*offset	1.5%*8* vertical scale +5mV

For the offset is 0 V, the vertical scale is 100 mV/div.

Use the method below to calculate the offset accuracy:
Offset accuracy = 1.5%*0 V + 1.5%*8*100mV + 5mV = 17 mV

To calculate the offset gain error of a vertical scale, at least five input and reading values are required to generate a two-dimensional array.

Use the least square method below to fit the Offset Gain error:
Offset Gain error = LINEST ($Offset_{error1}$:$Offset_{error5}$, $Offset_{setting1}$:$Offset_{setting5}$)

Notes:
“LINEST” is a function in EXCEL to calculate the characteristic value of a fitted line which fitting a two-dimensional array by using the least square method, and then returns an array describing the line. The first value of the returned array represents the slope of the fitting line.
“$V_{setting}$” represents DC voltage output of the 9500B.
“$Offset_{setting}$” represents the offset value setting on scope.
“V_{mean}” represents the measurement value on scope.
“$Offset_{error}$” represents the difference between V_{mean} and $V_{setting}$.

Table 5 Instance of Offset Gain Error Calculation

	$V_{setting}$ (V)	$Offset_{setting}$ (V)	V_{mean} (V)	$Offset_{error}$ (V)	Offset Gain error
Point1	10	-10	10.1	-0.1	-1%
Point2	5	-5	5.05	-0.05	
Point3	0	0	0	0	
Point4	-5	5	-5.05	0.05	
Point5	-10	10	-10.1	0.1	

Steps:

1. Set the 9500B output to on.
2. Connect a selected channel of the oscilloscope to the 9500B with an active head as shown in Figure 7.
3. Set the timebase of the oscilloscope to 5 ms/div, set the “Mem Depth” in the menu of Acquire to 600k.
4. Set the vertical scale of the channel to 50 V/div. Select the Measure menu of the oscilloscope to display “Mean” measurement of the selected channel.
5. According to Table 6, set offset of the channel to $Offset_{setting}$, and set the 9500B output level to $V_{setting}$ = - $Offset_{setting}$, then record the “Mean” value of the oscilloscope as V_{mean}.
6. Calculate $Offset_{error}$ ($Offset_{error}$= $V_{setting}$ - V_{mean}), and set the next $Offset_{setting}$ as step 5.
7. Calculate offset slope with these 5 data points: $V_{setting1}$~$V_{setting5}$, $Offset_{error1}$~$Offset_{error5}$ by using the ‘LINEST’ function. Check if the slope falls within the range of slope error shown in Table 6.
8. Set offset of the channel to 0 V, and turn the 9500B output off, then record the “Mean” value of the oscilloscope as V_{zero}. Check if the V_{zero} falls within the range of zero input. Turn the 9500B output on for next.
9. Set the vertical scale of the channel to the other settings in Table 6, and repeat the steps 4 to steps 8.
10. Turn the 9500B output off.
11. Connect another channel of the oscilloscope to the 9500B with the active head. Check the other channel in the same way as step 3 to step 10.

Table 6 Offset Accuracy

Vertical Scale	$Offset_{setting}$	Slope error	Zero input (V)
50 V/div	-210 V, 105 V, 0 V, 105 V, 210 V	±1.5%	±6.005
20 V/div	-210 V, 105 V, 0 V, 105 V, 210 V	±1.5%	±2.405
10 V/div	-210 V, 105 V, 0 V, 105 V, 210 V	±1.5%	±1.205
5 V/div	-80 V, -40 V, 0 V, 40 V, 80 V	±1.5%	±0.605
2 V/div	-80 V, -40 V, 0 V, 40 V, 80 V	±1.5%	±0.245
1 V/div	-80 V, -40 V, 0 V, 40 V, 80 V	±1.5%	±0.125
500 mV/div	-80 V, -40 V, 0 V, 40 V, 80 V	±1.5%	±0.065
200 mV/div	-5 V, -2.5 V, 0 V, 2.5 V, 5 V	±1.5%	±0.029
100 mV/div	-5 V, -2.5 V, 0 V, 2.5 V, 5 V	±1.5%	±0.017
50 mV/div	-5 V, -2.5 V, 0 V, 2.5 V, 5 V	±1.5%	±0.011
20 mV/div	-5 V, -2.5 V, 0 V, 2.5 V, 5 V	±1.5%	±0.0074
10 mV/div	-5 V, -2.5 V, 0 V, 2.5 V, 5 V	±1.5%	±0.0062
5 mV/div	-5 V, -2.5 V, 0 V, 2.5 V, 5 V	±1.5%	±0.0056

5.3 To Verify DC Measurement Accuracy

Some products did not list the DC measurement accuracy in the datasheet, but it can be calculated by combine the DC gain Accuracy and Offset Accuracy. Verify this specification is not necessary if the DC gain accuracy and Offset accuracy had been verified.

Table 7 DC Measurement Accuracy

DC Measurement Accuracy	± (DC gain accuracy x |Vsetting + Offset setting|+Offset accuracy)

Use the method below to calculate the High/Low limiting for the DC measurement results:

High limit = $V_{setting}$ + (DC gain accuracy x $|V_{setting}$ + $Offset_{setting}|$ + Offset accuracy)

Low Limit = $V_{setting}$ - (DC gain accuracy x $|V_{setting}$ + $Offset_{setting}|$ + Offset accuracy)

Notes:

"$V_{setting}$" represents DC voltage output by the 9500B.

"$Offset_{setting}$" represents the offset value setting on scope.

"V_{mean}" represents the measurement value on scope.

"Limit" represents max allowance error for the measurement results.

Table 8 Instance of DC Measurement Limiting Calculation

1V/div	Vsetting (V)	$Offset_{setting}$ (V)	V_{mean} (V)	Low Limit (V)	High Limit (V)
Seting1	3	0		2.815	3.185
Seting2	-3	0		-3. 185	-2.815

HighLimit = 3V + (|3V + 0|*2% + 0V*1.5% + 1V/div*8div*1.5% + 0.005) = 3.185 V

LowLimit1 = 3V - (|3V + 0|*2% + 0V*1.5% + 1V/div*8div*1.5%+ 0.005) = 2.815 V

The instance above gives the DC measurement limiting with two different input and offset settings. Here did not list the limiting calculation with none Zero offset, because the calculate process is complicated, the manufactory does not recommend verify the device with none zero offset setting.

Steps:

The equipment and device configuration sequence are same to Offset Accuracy verification setting.

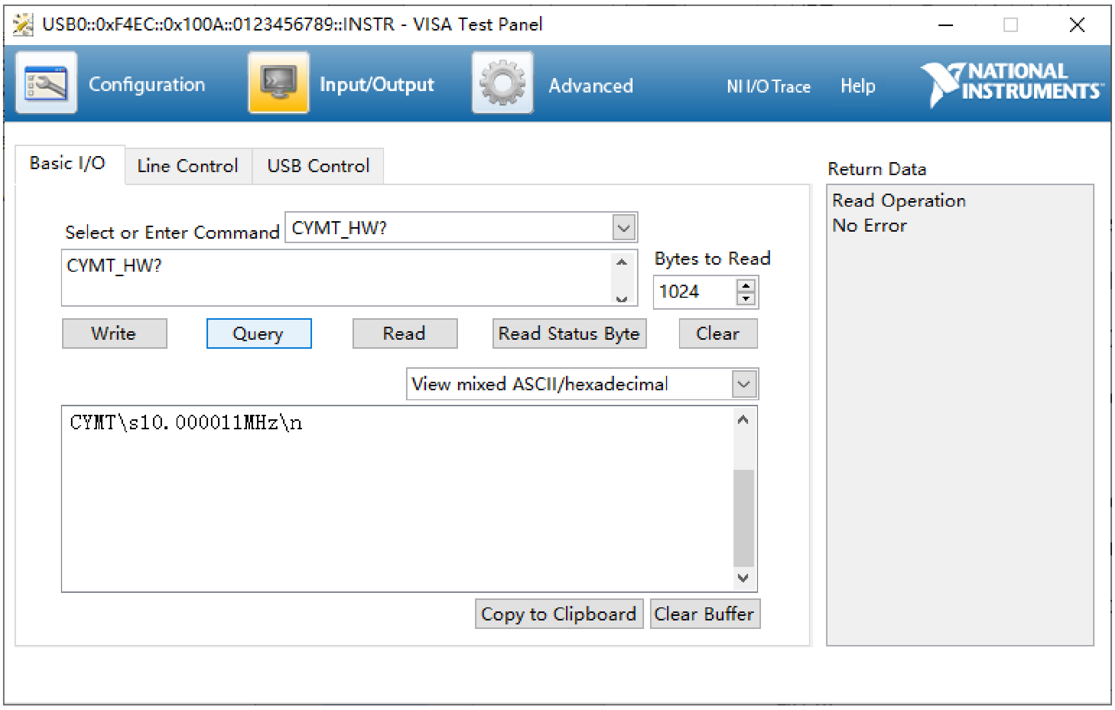
5.4 To Verify Time Base Accuracy

This test verifies the time base accuracy of the oscilloscope. In the test, the impedance of the 9500B is 1 MΩ.

Time Base Accuracy: Frequency Error < 250 Hz

Steps:

1. Connect the selected channel of the oscilloscope to the 9500B, as shown in Figure 7.
2. Set the oscilloscope vertical scale to 100 mV/div.
3. Set the timebase of the oscilloscope to 5 us/div.
4. Set the Memory Depth to 600kpts.
5. Set waveform of the 9500B to sine, amplitude to 600 mV, and frequency to 10 MHz.
6. Check if the trigger (hardware-measured) frequency which is queried by SCPI(CYMT_HW?) is in the range of 9999750 Hz to10000250 Hz. The result is shown in Figure 11.
7. Disconnect the test connection.



5.5 To Verify Trigger Level

This test checks the trigger level accuracy of the analog channels.

CH Trigger Level Error Limit: abs (Error) ≤ 20mV

Steps:

1. Connect selected channel of the oscilloscope to the 9500B as shown in Figure 7.
2. Set impedance of the 9500B to 1 MΩ, frequency to 2 kHz, amplitude to 800 mV, and waveform to sine.
3. Set the timebase of the oscilloscope to 50 us/div.
4. Set the vertical scale to 100 mV/div, trigger source to the selected channel, trigger slope to positive and coupling mode to DC.
5. Set the trigger level to 300 mV.
6. Selected the Measure menu of the oscilloscope to display “Level@x” measurement.
7. Record the value of “Level@x”, calculate the level error (error = 300 mV - Level@x).
8. Check if the trigger level error is in the limited range above.
9. Set the trigger level to 0 mV and -300 mV, repeat step 6 to step 8 in turn.
10. Set trigger slope to negative, repeat steps step 5 to step 9.
11. Disconnect the test connection.
12. Check the other analog channel in the same way as steps 1 to 11.

5.6 To Verify Trigger Sensitivity

This test checks trigger sensitivity at the frequency of 10 MHz and also at the bandwidth frequency.

In the test, the impedance of 9500B should be set to 50 Ω.

Table 9 Trigger sensitivity data

Vertical Scale	Frequency	Trigger Range
100 mV/div	10 MHz	≥ 9.9 MHz
100 mV/div	bandwidth	≥ 99%*bandwidth frequency

Steps:

1. Connect the selected channel of the oscilloscope to the 9500B with a terminal load 50 Ω, as shown in Figure 7.
2. Set the selected channel vertical scale of the oscilloscope to 100 mV/div, the timebase to 50 ns/div, coupling mode to AC.
3. Set the impedance of the 9500B to 50 Ω, frequency to 10 MHz, waveform to sine and set the output to 50 mV which measured by the oscilloscope.
4. Set trigger slope of the oscilloscope to Positive.
5. Press Trigger Level knob to set the level to the center of the waveform.
6. Adjust the trigger level within the waveform range to achieve a stable trigger.
7. Record the (hardware-measured) frequency which is which is queried by SCPI(CYMT_HW?), and check that it is in the specified trigger range listed in Table 9
8. Set the oscilloscope trigger slope to Negative, repeat steps 5 to 7.
9. Set frequency of the 9500B to the bandwidth frequency of the oscilloscope, and adjust the output to 50 mV which measured by the oscilloscope, the timebase to 2 ns/div, then repeat steps 4 to 8.
10. Check the other channel in the same way as steps 1 to 9.
11. Disconnect the test connection.

5.7 To Verify Bandwidth

This test checks the bandwidth of all analog channels. In the test, the impedance of 9500B should be set to be the same as analog channels.

Table 10 Vertical Scales should be verified

Impedance	Vertical Scale
50 Ω	200 mV, 500 mV

Steps:

1. Connect the selected channel of the oscilloscope to the 9500B via the active head with a terminal load 50 Ω, as shown in Figure 8.
2. Set the vertical scale of the selected channel to 200 mV/div, impedance to 50 Ω, set the "Mem Depth" to 600k in the menu of Acquire.
3. Press the Measure button on the front panel of the oscilloscope to display "Stdev" measurement of the selected channel.
4. Set impedance to 50 Ω of the 9500B, amplitude to 1.2V, waveform to sine, and set the impedance of the oscilloscope channels to 50 Ω.
5. Set frequency of the 9500B to the frequency in Table 11.

Table 11 Frequency points in the test

Scope Model	Terminal Load	Frequency Point (Hz)
SHS820X/SHS1202X	50 Ω	0.05M, 10M, 20M, 50M, 70M, 100M, 120 M, 150M, 200 M
SHS810X/SHS1102X	50 Ω	0.05M, 5M, 10M, 25M, 35M, 50M, 100M
SHS807X/SHS1072X	50 Ω	0.05M, 3.5M, 7M, 17.5M, 24.5M, 35M, 70M

6. It is recommended to adjust the timebase to 50 us/div at first frequency point, and adjust the timebase to 500 ns/div at the remaining frequency points to display a complete non-aliasing waveform.
7. Record the "S_{tdev}" measurement of the waveform as V_{stdev} and the first frequency point as reference value as V_{ref}.
8. Set the vertical scale of the selected channel to the setting choices, and repeat step2 to step7. Set amplitude of the 9500B to 6*vertical scale.
9. Check the other channel in the same way as step1 to step 8.
10. Disconnect the test connection.

After the test, calculate the dB value (regarding the amplitude at 50 kHz as 0 dB) at every frequency point. Check if the value is in the limited range in Table 12.

The method below to calculate dB value:

dB vaule = $20 * \log_{10} \frac{\text{Vstdev}}{\text{Vref}}$

Table 12 Limited Range

Scope Model	**Terminal Load**	**Frequency Range (Hz)**	**Range**
SHS820X/SHS1202X	50 Ω	(0.05M, 20M)	(-1, 1) dB
		(20 M, 100M)	(-2, 2) dB
		(100M, 200M)	(-3, 2) dB
SHS810X/SHS1102X	50 Ω	(0.05M, 10M)	(-1, 1) dB
		(10 M, 50M)	(-2, 2) dB
		(50M, 100M)	(-3, 2) dB
SHS807X/SHS1072X	50 Ω	(0.05M, 7M)	(-1, 1) dB
		(7 M, 35M)	(-2, 2) dB
		(35M, 70M)	(-3, 2) dB

5.8 To Verify Bandwidth Limit

This test checks the bandwidth limit of all the analog channels. The test is similar to the bandwidth test except that the bandwidth limit is turned on. In the test, the impedance of 9500B should be set to 50 Ω. Test the bandwidth at 100 mV/div, 200 mV/div

Steps:

1. Connect channel 1 of the oscilloscope to the 9500B via the active head, with a terminal load 50 Ω, as shown in Figure 7.
2. Set the vertical scale of the selected channel to 100 mV/div, impedance to 50 Ω, set the "Mem Depth" in the menu of Acquire to 600k, and set the BW Limit button to 20MHz.
3. Select the Mearsure menu of the oscilloscope to display "Stdev" measurement of the selected channel.
4. Set impedance to 50 Ω of the 9500B, and the amplitude to 600 mV. Set frequency of the 9500B

to the frequency in Table 13.

Table 13 Frequency points in the test

Frequency Point (Hz)
0.05M, 10M, 18M, 20M, 22M, 30M

5. It is recommended to adjust the timebase to 20 us/div at first frequency point, and adjust the timebase to 500 ns/div at the remaining frequency points to display a complete non- aliasing waveform.
6. Record the "S_{tdev}" measurement of the waveform as Vstdev and the first frequency point as reference value as V_{ref}.

Table 14 Limited Range

Scope Model	Terminal Load	Frequency Range (Hz)	Range
SHS820X SHS810X SHS807X SHS1202X SHS1102X SHS1072X	50 Ω	(0.05M, 24M)	(-6,0) dB
		(24M, 30M)	(-20, -3) dB

7. Use the same method as bandwidth test to calculate the dB value at the frequency point (regarding the amplitude at 50 kHz as 0 dB). Check if the value is in the limited range in Table 14.
8. Check the other channel in the same way as in step1 to step8.
9. Disconnect the test connection.

5.9 To Verify Channel Skew

This test checks the skew between two analog channels. In this test, the impedance of both the 9500B.

Channel Skew Limit: abs(T@L) ≤ 100 ps

Steps:

1. Connect two selected channels of the oscilloscope to the 9500B with a terminal load 50 Ω, shown as in Figure 9.
2. Press the 'Aux' key at the right of the 'OSCILLOSCOPE CALIBRATOR' panel of the 9500B and

select Skew function.

3. Set impedance of the 9500B to 50 Ω, frequency to 1 kHz, and amplitude to 0.6 V.
4. Set vertical scale of the selected channels to 100 mV/div.
5. Set the oscilloscope timebase to 2 ns/div, trigger source is the selected channel.
6. Press the Measure button on the front panel of the oscilloscope to display “Skew” measurement between two selected channels.
7. Check if the result is in the limited range above.
8. Disconnect the test connection.
9. Check the other channel in the same way as steps 1 to 7.

5.10 To Verify Input Impedance

This test checks the input impedance of two analog channels with different coupling modes and vertical scales (200 mV/div, 500 mV/div and 10 V/div).

Table 15 Input Impedance data

Channel	**Coupling**	**Impedance Range**
CH	DC	980000~1020000 Ω
Channel	**Coupling**	**Capacitance Range**
CH	DC	12 ~16 pF

Steps:

1. Connect the selected channel of the oscilloscope to the 9500B, as shown in Figure 7.
2. Set the vertical scale of the selected channel to 200 mV/div, coupling mode to DC.
3. Press the ‘Aux’ key at the right of the ‘OSCILLOSCOPE CALIBRATOR’ panel of the 9500B and select the Load Resistance Measurement Function. Record the reading displays on the screen of the 9500B.
4. Set coupling mode of the channel to AC. Record the reading displays on the screen of the 9500B.
5. Check if the impedance is within the specified range in Table 15.
6. Test at 10 V/div and 500mV/div, using the same procedure as steps 2 to 5.
7. Check the other analog channel in the same way as steps 1 to 6.
8. Set the vertical scale of the selected channel to 200 mV/div, coupling mode to DC
9. Press the ‘Aux’ key at the right of the ‘OSCILLOSCOPE CALIBRATOR’ panel of the 9500B and select the Capacitance Measurement Function.
10. Set the vertical scale of the selected channel to 100 mV/div, impedance to 1 MΩ, coupling mode

to DC, Record the reading displays on the screen of the 9500B.

11. Check if the capacitance is within the specified range in Table 15.
12. Test at 10 V/div and 500mV/div, using the same procedure as steps 8 to 10.
13. Check the other analog channel in the same way as steps 8 to 11.
14. Disconnect the test connection.

5.11 To Verify Meter DCV

This test checks the DC voltage precision of the meter mode with different range.

Table 16 The ranges of DCV should be verified

Range	Precision limit
60mV	±1%±15digit
600mV, 6V, 60V, 600V	±1%±5digit
1000V [1]	±1.5%±5digit

Note:[1] This specification is only applicable to SHS1000X.

Steps:

1. Connect the meter input to the voltage output of the 5522A, as shown in Figure 10.
2. Switch to the Meter mode of the oscilloscope. Set the Meter to “DCV”. Mode to “Manual(mV)”, Range to “60mV”.
3. Set the DC voltage of the 5522A in Table 17,and set the appropriate Mode and Range for each $DCV_{setting}$. Record the readings display on the screen of the Meter as DCV_{mearse}.
4. After the test, calculate the precision of each reading. Check if the precision is in the precision limit in Table 16.

The method below to calculate the precision:

Precision = 100 * $\frac{DCVmearse - DCVsetting}{DCVsetting}$ (%)

Table 17 $DCV_{setting}$ of the 5522A

$DCV_{setting}$	25mV, 50mV, 250mV, 500mV, 2.5V, 5V, 25V, 50V, 250V, 500V, 700V[1], 900V[1]

Note:[1] This specification is only applicable to SHS1000X.

5.12 To Verify Meter ACV

This test checks the AC voltage(45Hz~400Hz) precision of the meter mode with different range.

Table 18 The ranges of ACV should be verified

Range	Precision limit
60mV,	±1%±15digit
600mV, 6V, 60V, 600V	±1%±5digit
750V[1]	±1.5%±5digit

Note:[1] This specification is only applicable to SHS1000X

Steps:

1. Connect the meter input to the voltage output of the 5522A, as shown in Figure 10.
2. Switch to the Meter mode of the oscilloscope. Set the Meter to ACV. Mode to "Manual(mV)", Range to "60mV".
3. Set the frequency to 50Hz and the AC voltage of the 5522A in Table 19, and set the appropriate Mode and Range for each $ACV_{setting}$. Record the readings display on the screen of the Meter as ACV_{mearse}.
4. After the test, calculate the precision of each reading. Check if the precision is in the precision limit in Table 18.

The method below to calculate the precision:

Precision = 100 * $\frac{ACVmearse - ACVsetting}{ACVsetting}$ (%)

Table 19 $ACV_{setting}$ of the 5522A

$ACV_{setting}$	25mV, 50mV, 250mV, 500mV, 2.5V, 5V, 25V, 50V, 250V, 500V, 650V[1], 700V[1]

Note:[1] This specification is only applicable to SHS1000X.

5.13 To Verify Meter RES

This test checks the resistance precision of the meter mode with different range.

Table 20 The ranges of resistance should be verified

Range	Precision limit
600Ω, 6kΩ, 60kΩ, 600kΩ, 6MΩ	±1%±5digit
60MΩ	±4%±5digit

Steps:

1. Connect the meter input to the resistance output of the 5522A, as shown in Figure 10.
2. Switch to the Meter mode of the oscilloscope. Set the Meter to “Res.”. Mode to “Manual”, Range to “600Ω”.
3. Set the resistance of the 5522A in Table 21, and set the appropriate Mode and Range for each $RES_{setting}$. Record the readings display on the screen of the Meter as RES_{mearse}.
4. After the test, calculate the precision of each reading. Check if the precision is in the precision limit in Table 20.

The method below to calculate the precision:

Precision = 100 * $\frac{RESmearse - RESsetting}{RESsetting}$ (%)

Table 21 $RES_{setting}$ of the 5522A

$RES_{setting}$	200Ω, 500Ω, 2kΩ, 5kΩ, 20kΩ, 50kΩ, 200kΩ, 500kΩ, 2MΩ, 5MΩ, 20MΩ, 50MΩ

5.14 To Verify Meter CAP

This test checks the capacitance precision of the meter mode with different range.

Table 22 The ranges of capacitance should be verified

Range	Precision limit
40nF	±5%±50digit
400nF, 4uF, 40uF, 400uF	±5%±5digit

Steps:

1. Connect the meter input to the capacitance output of the 5522A, as shown in Figure 10.
2. Switch to the Meter mode of the oscilloscope. Set the Meter to "Cap." and Range to "40nF".
3. Set the resistance of the 5522A in Table 23 and set the appropriate Mode and Range for each $CAP_{setting}$. Record the readings display on the screen of the Meter as CAP_{mearse}.
4. After the test, calculate the precision of each reading. Check if the precision is in the precision limit in Table 22.

The method below to calculate the precision:

Precision = 100 * $\frac{CAPmearse - CAPsetting}{CAPsetting}$ (%)

Table 23 $CAP_{setting}$ of the 5522A

$CAP_{setting}$	10nF, 30nF, 100nF, 300nF, 1uF, 3uF, 10uF, 30uF, 100uF, 300uF

5.15 To Verify Meter DCI

This test checks the DC current precision of the meter mode with different range.

Table 24 The ranges of DCI should be verified

Range	**Precision limit**
60mA, 600mA	±4%±10digit
6A, 10A	±5%±5digit

Steps:

1. Connect the meter input with a SCD600mA option to current output of the 5522A, as shown in Figure 11.
2. Switch to the Meter mode of the oscilloscope. Set the Meter to DCI, Mode to "Manul (mA)", Range to "60mA".
3. Set the DC current of the 5522A in Table 25, and set the appropriate Mode and Range for each $DCI_{setting}$. Record the readings display on the screen of the Meter as DCI_{mearse}.
4. When the current is more than 600mA, change the meter input option to SCD10A option, and continue step3.
5. After the test, calculate the precision of each reading. Check if the precision is in the precision

limit in Table 24.

The method below to calculate the precision:

Precision = 100 * $\frac{DCImearse - DCIsetting}{DCIsetting}$ (%)

Table 25 $DCI_{setting}$ of the 5522A

$DCI_{setting}$	25mA, 50mA, 250mA, 500mA, 2.5A, 5A, 4A, 8A

5.16 To Verify Meter ACI

This test checks the AC current (45Hz~400Hz) precision of the meter mode with different range.

Table 26 The ranges of ACI should be verified

Range	Precision limit
60mA, 600mA	±4%±10digit
6A, 10A	±5%±5digit

Steps:

1. Connect the meter input with a SCD600mA option to current output of the 5522A, as shown in Figure 11.
2. Switch to the Meter mode of the oscilloscope. Set the Meter to ACI. Mode to "Manul(mA)", Range to "60mA".
3. Set the frequency to 50Hz and the DC current of the 5522A in Table 27, and set the appropriate Mode and Range for each $ACI_{setting}$. Record the readings display on the screen of the Meter as ACI_{mearse}.
4. When the current is more than 600mV, change the meter input option to SCD10A option, and continue step3.
5. After the test, calculate the precision of each reading. Check if the precision is in the precision limit in Table 26.

The method below to calculate the precision:

Precision = 100 * $\frac{ACImearse - ACIsetting}{ACIsetting}$ (%)

Table 27 $ACI_{setting}$ of the 5522A

$ACI_{setting}$	25mA, 50mA, 250mA, 500mA, 2.5A, 5A, 4A, 8A

6 Disassembly Procedures

This chapter describes how to remove major parts from the SHS800X/SHS1000X series oscilloscope.

6.1 Safety Consideration and Cautions

Only qualified personnel should perform the disassembly procedures. Disconnect the power before you begin to remove or replace the parts. Otherwise, potential personal injuries or damages to the components may occur.

WARNING	**HAZARDOUS VOLTAGES** Maintenance is performed with the power supply on and without protective covers. Only qualified personnel with proper tools and protection should perform maintenance. Perform maintenance with the power cord disconnected whenever possible.
WARNING	**AVOID ELECTRICAL SHOCK** Hazardous voltages exist on the power supply and LCD modules. To avoid electrical shock, disconnect the power cord and wait at least three minutes for the capacitors to discharge before you begin disassembly.
CAUTION	**ESD CAUTION** Electrostatic discharge (ESD) sensitive devices inside. Electronic components may be damaged without detection. Proper ESD precautions should be taken to avoid performance degeneration or loss of functionality. At a minimum, place the oscilloscope on a properly grounded ESD mat and wear a properly grounded ESD strap.
CAUTION	**REMOVE POWER TO AVOID DAMAGE** Remove power before you start to disassemble or replace parts. DO NOT disassemble or replace parts with the power on. Damage to the components may occur.

6.2 Tools Lists

Use these tools to remove or replace the modules in the oscilloscope:

- Multi-function screwdriver
- Antistatic gloves
- Custom screw hexagonal nut tool or long nose pliers

6.3 Disassembly Procedures

This section describes how to remove the modules in the oscilloscope in detail. To install the removed parts or replace a new part, follow the instructions in reverse order.

6.3.1 To Remove the Battery Cover and Battery

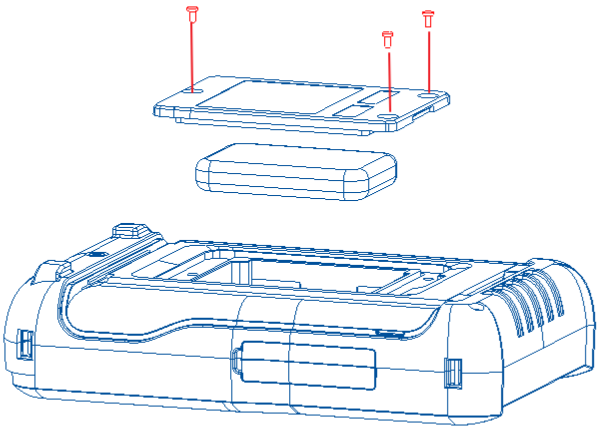


Figure 12 To remove the battery cover and battery

Steps:

1. Remove the three PWA3*8 screws on the rear cover.
2. Remove the battery cover and battery.

6.3.2 To Remove the Rear Cover

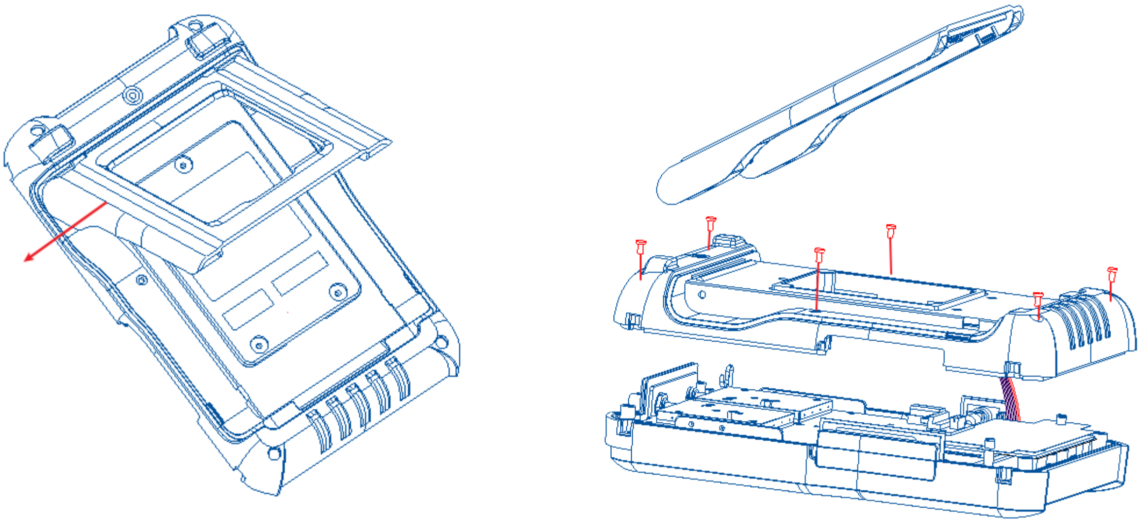


Figure 13 To remove the rear cover

Steps:

1. Force on the one side of the back frame and pull the rotation axis out of the hole, then remove the back frame.
2. Remove the six PM3*8 screws on the rear cover, lift the rear cover and unplug the connecting cable.
3. Remove the rear cover.

6.3.3 To Remove the Power PCBA

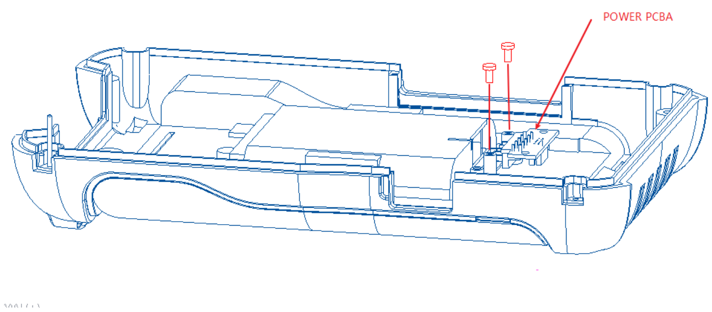


Figure 14 To remove the power PCBA

Steps:

Remove the two PC 3*6 screws on the power PCBA and remove the power PCBA.

6.3.4 To Remove the Main PCBA Cover and DMM PCBA

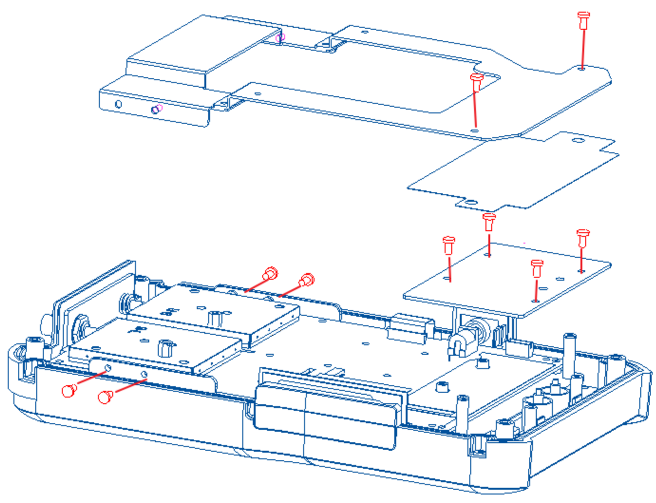


Figure 15 To remove the main PCBA cover and DMM PCBA

Steps:

1. Remove the six PM3*6 screws around the main PCBA cover and remove the main PCBA cover.
2. Remove the insulating sheet above the DMM PCBA.
3. Remove the four PC3*8 screws on the DMM PCBA and remove the DMM PCBA.

6.3.5 To Remove the Main PCBA

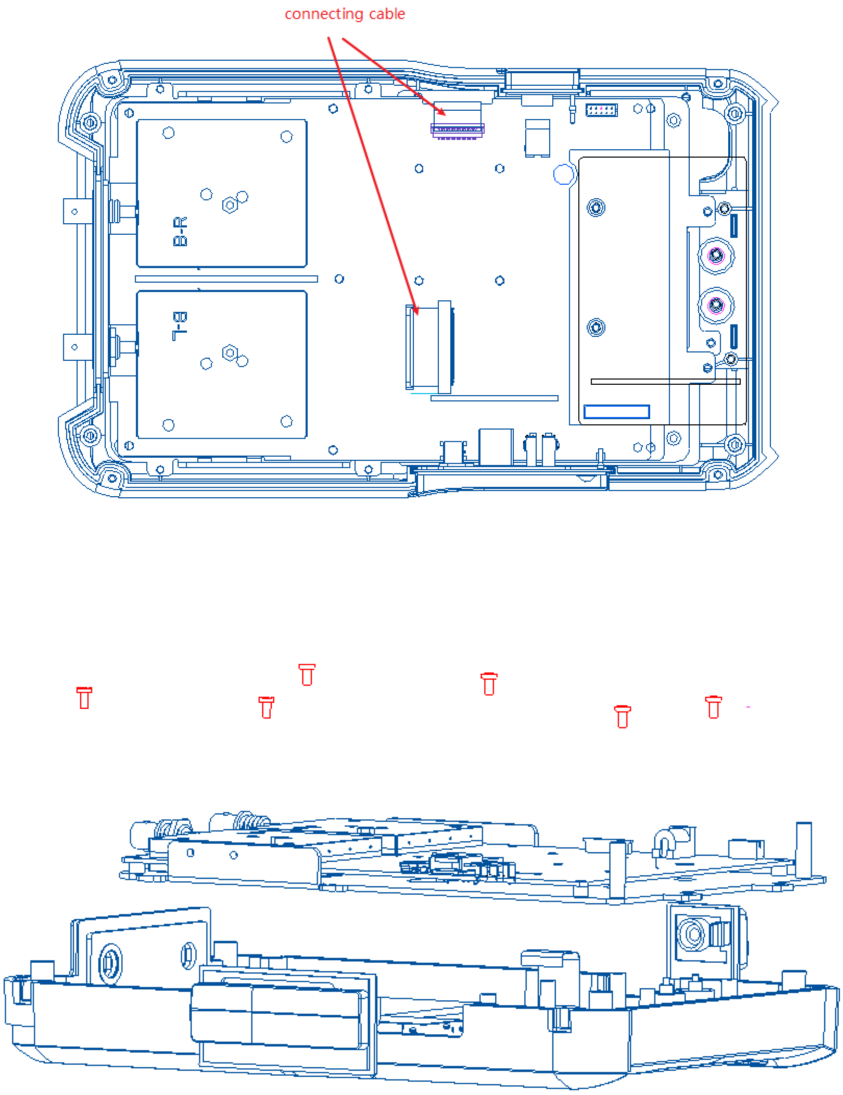


Figure 16 To remove the main PCBA

Steps:

1. Unplug the two connecting cable.
2. Remove the six PC3*6 screws on the main PCBA bracket.
3. Remove the main PCBA with the bracket.
4. Remove the connecting terminal TPU cover on the two side.

6.3.6 To Remove Key PCBA and Keyboard

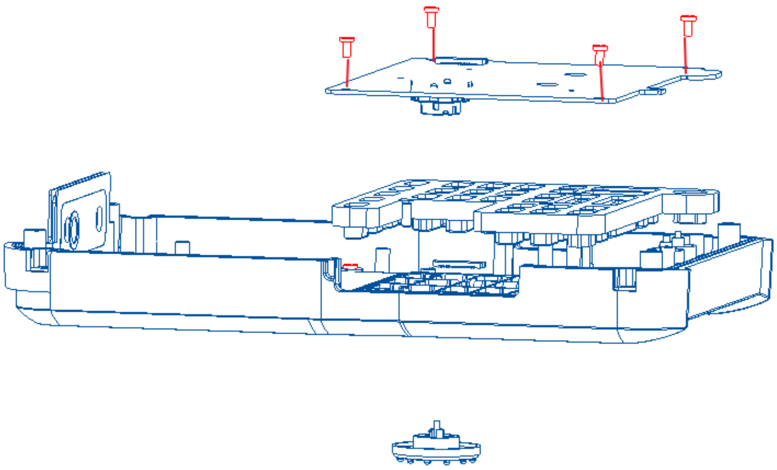


Figure 17 To remove the key PCBA and keyboard

Steps:

1. Remove the four PC3*6 screws on the key PCBA and remove the key PCBA.
2. Remove the keyboard and knob.

6.3.7 To Remove the Screen

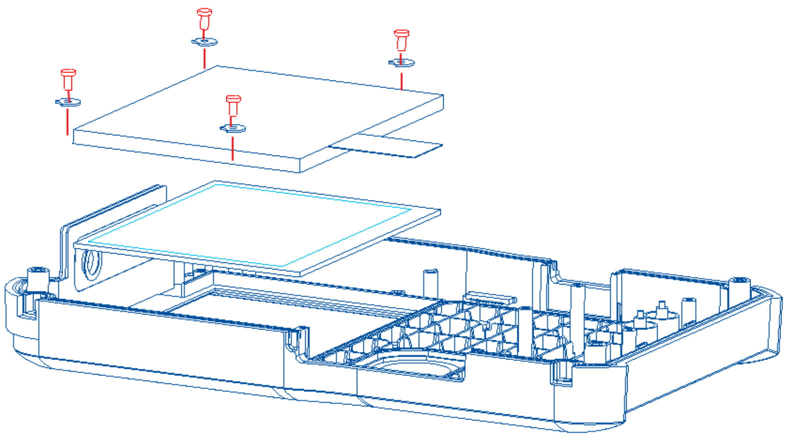


Figure 18 To remove the screen

Steps:

1. Remove the four PC3*6 screws and plane around the screen.
2. Remove the screen and protecting glass.

7 Solving General Problems

The commonly encountered failures and their solutions are listed below. When you encounter those problems, please solve them following the corresponding steps. If the problem remains still, please contact **SIGLENT** Company as soon as possible.

1. The screen is still dark (no display) after power on:

- Check whether the power is correctly connected.
- Check whether the power switch is really on.
- Check whether the fuse is burned out. If the fuse needs to be changed, please use the specified fuse.
- Restart the instrument after finishing the above inspections.
- If it still does not work correctly, please contact **SIGLENT**.

2. The signal is sampled but no waveform of the signal is displayed:

- Check whether the probe is correctly connected to the signal connecting wire.
- Check whether the signal connecting wire is correctly connected to the BNC (namely channel connector).
- Check whether the probe is correctly connected to the item to be tested.
- Check whether there are signals generated from the item to be tested (you can connect the probe compensation signal to the problematic channel to determine which has problem, the channel or the item to be tested).
- Resample the signal.

3. The tested voltage amplitude is greater or lower than the actual value (note that this problem usually occurs when probe is used):

Check whether the attenuation coefficient of the channel complies with the attenuation ratio of the probe.

4. There is waveform display but not stable:

- Check the trigger signal source: check whether the Source item at the trigger panel complies with the signal channel actually used.
- Check the trigger type: general signals should use “Edge” trigger and video signal should use “Video” trigger. Only when the proper trigger type is used, can the waveform be displayed stably.
- Change the trigger holdoff setting.

5. No display after pressing Run/Stop:

Check whether the mode at the trigger panel (TRIGGER) is on "Normal" or "Single" and whether the trigger level exceeds the waveform range. If yes, set the trigger level to the middle or set the mode to "Auto".

Note: using AUTO Setup could automatically finish the above setting.

6. The display of waveform is ladder-like:

- The horizontal time base might be too low. Increase the horizontal time base to increase the horizontal resolution and improve the display.
- If the display Type is "Vectors", the lines between the sample points may cause ladder-like display. Set Type to "Dots" to solve the problem.

7. Fail to connect PC through USB:

Check the IO Setting in Utility to ensure whether the USB device setting matches the device currently connected. If needed, restart the oscilloscope.

8. The USB storage device cannot be recognized:

- Check whether the USB storage device can work normally.
- Make sure whether the USB interface can work normally.
- Make sure that the USB storage device being used is flash storage type. This oscilloscope does not support hardware storage type.
- Restart the instrument and then insert the USB storage device to check it.
- If the USB storage device still cannot be used normally, please contact **SIGLENT**.

9. The multimeter measurements aren't correct:

- Check that if the range of the SHS800X/SHS1000X matches with the measured item.
- Make sure that if the multimeter is beyond the calibration date. If the measurements and real values are beyond the relevant precision, please contact the calibration site warranted by the **SIGLENT** company to calibrate the SHS800X/SHS1000X.
- If you can't use the SHS800X/SHS1000X normally all the same, please contact **SIGLENT**.

8 Troubleshooting

This chapter contains information and procedures to troubleshoot general hardware failures.

8.1 Safety Consideration and Cautions

Only qualified personnel should perform troubleshooting procedures. Disconnect the power adapter and battery whenever possible. DO NOT try to troubleshoot if visible damage is detected on the power adapter and battery, return it to **SIGLENT** for further repair.

WARNING	**HAZARDOUS VOLTAGES** In case maintenance is performed with power supply on and without protective covers. Only qualified personnel with proper tools and protection should perform the maintenance.
WARNING	**AVOID ELECTRICAL SHOCK** Hazardous voltages exist on the power supply and LCD modules. To avoid electrical shock, disconnect the power adapter and battery. Wait at least three minutes for the capacitors to discharge before you begin disassembly.
CAUTION	**ESD CAUTION** Electrostatic discharge (ESD) sensitive devices inside. Electronic components may be damaged without protection. Proper ESD precautions should be taken to avoid performance degeneration or loss of functionality. As a minimum, place the oscilloscope on a properly grounded ESD mat and wear a properly grounded ESD strap.
CAUTION	**REMOVE POWER SUPPLY TO AVOID DAMAGE** Remove the power supply before you start to disassemble or replace parts. Disassembling or replacing parts with power on is not allowed. Damage to the components may occur.
CAUTION	**USE AN EXTERNAL FAN** When you remove the oscilloscope metal cover, always use an external fan to provide airflow over the heat sinks and the main board.

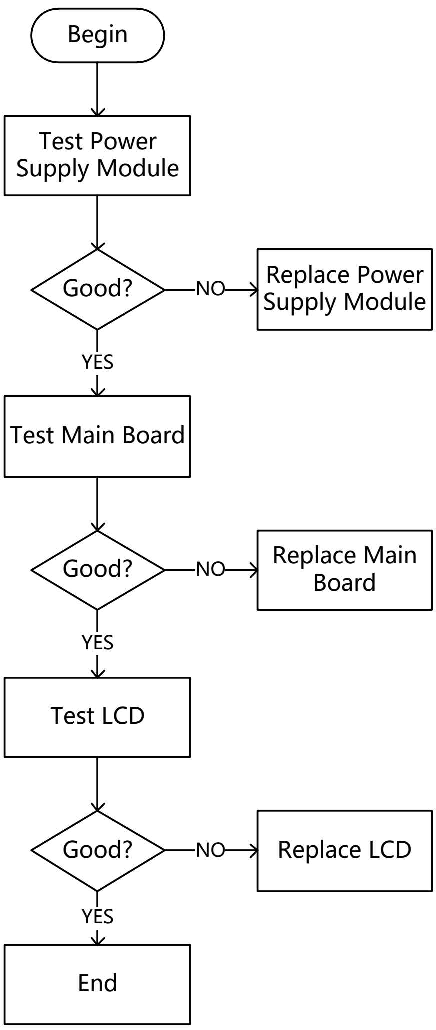
8.2 Required Equipment

Table 28 Required equipment

Equipment	Critical Specifications	Recommended Model
Digital Multi-meter	Accuracy ± 0.05% 1 mV resolution	SIGLENT SDM3065X or Agilent 34401A
Oscilloscope	200 MHz BW 1 MΩ impedance	SIGLENT SDS1204X-E

8.3 Troubleshooting Flowchart

The following flowchart describes how to troubleshoot the oscilloscope in the most general case. This does not guarantee a 100% recovery of all possible hardware failures. Contact **SIGLENT** if you cannot solve the problem.



8.4 To Check the Power Supply Module

- Disconnect all the external cables and devices from the front and back panel.
- Disconnect the power adapter of the oscilloscope.
- Remove the rear plastic cover and metal cover following the instructions in chapter **Disassembly Procedures.**
- Note that the battery and adapter board are on the back cover and you do not have to remove the battery to check it.
- Disconnect power supply cable from the main board.
- Be cautious when working near the power supply module without the protective cover, high voltage may exist on the heat sink and other exposed conductors.
- Test the battery adapter board with a multi-meter.

Table 29 Pin assignments of battery adapter board

Connector	Pin Number	Wire Color	Specification
Battery adapter board	1, 2, 3, 4, 5	-	VCC_BAT (Typically 7.2V_{DC})
	6	-	BQ_TS
	7	-	BAT_IDENTIFIER (0~0.2V_{DC})
	8	-	SMBUS_DATA
	9	-	SMBUS_CLK
	10, 11, 12, 13, 14	-	GND

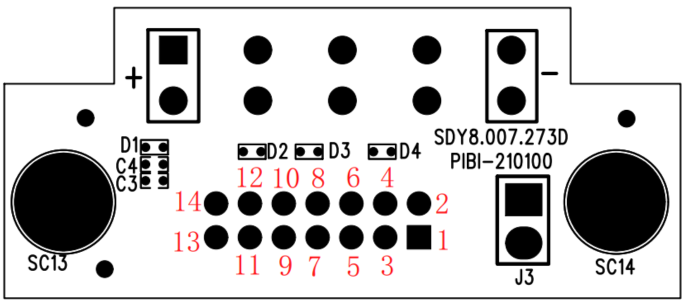


Figure 19 Pin definition of the battery adapter board

- Test the power adapter input with a multi-meter.

Table 30 Pin assignments of power adapter

Connector	Pin Number	Wire Color	Specification (SHS800X)	Specification (SHS1000X)
power supply	J2 PIN1	-	$9.3V_{DC}$~$10V_{DC}$	$11.4V_{DC}$~$12.6V_{DC}$
	R258 PIN1	-	$9.3V_{DC}$~$10V_{DC}$	$11.4V_{DC}$~$12.6V_{DC}$

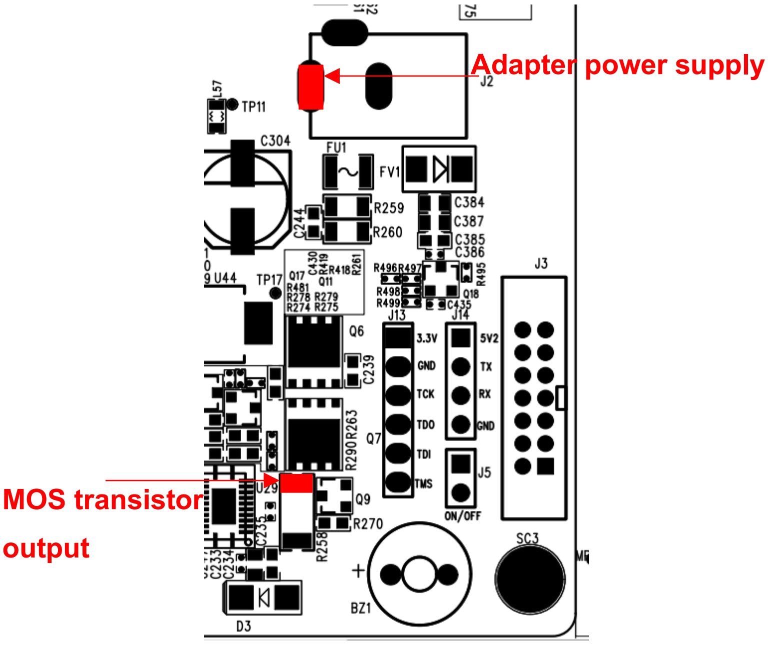


Figure 20 Pin definition of the power adapter input (SHS800X)

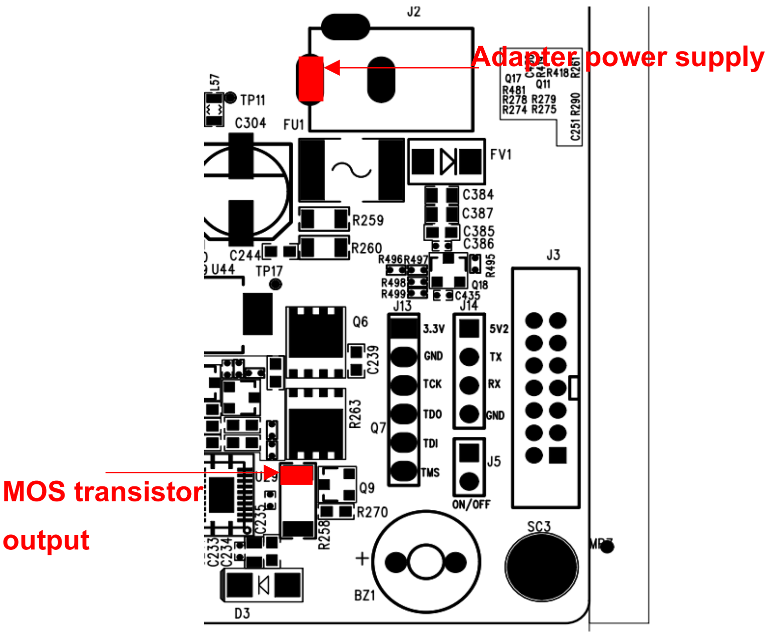
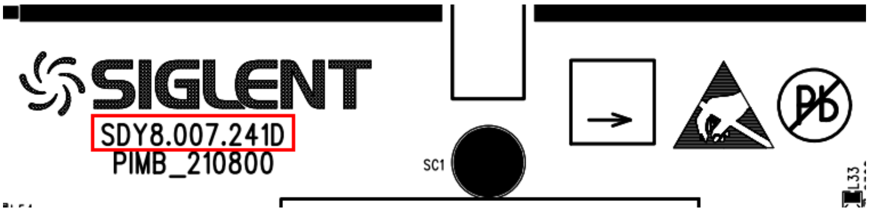
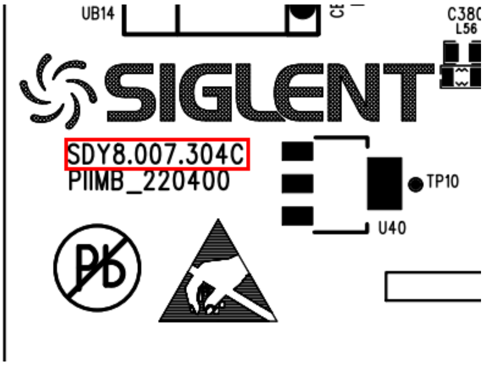


Figure 21 Pin definition of the power adapter input (SHS1000X)

8.5 To Check the Main Board

This guide is based on the main board "SHS800X" revision D (labeled SDY8.007.241D) and "SHS1000X" revision C (labeled SDY8.007.304C). Future revisions will be compatible unless described differently.





8.5.1 Main Board Drawing

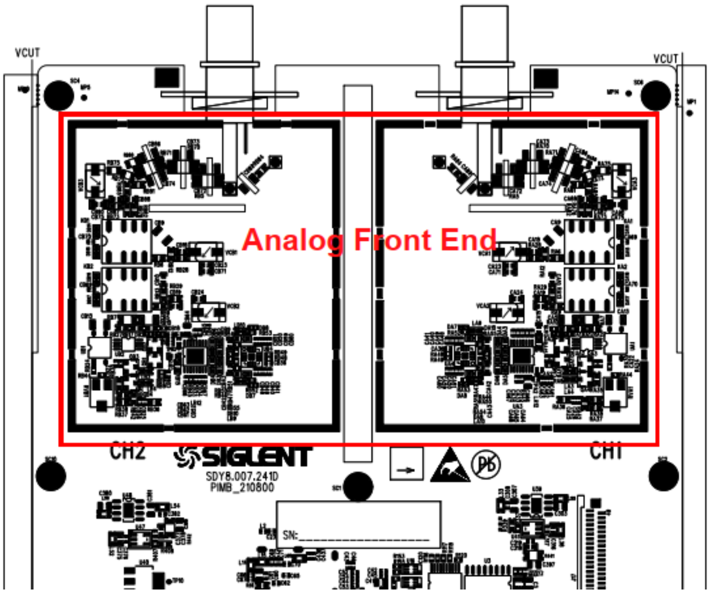


Figure 22 Analog Front End of SHS800X

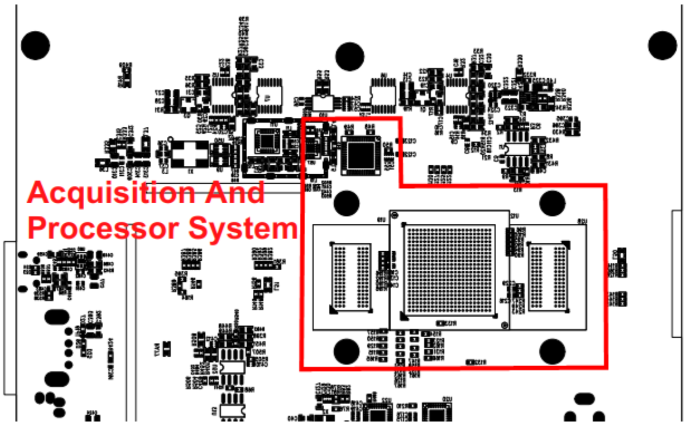


Figure 23 Acquisition And Processor System of SHS800X

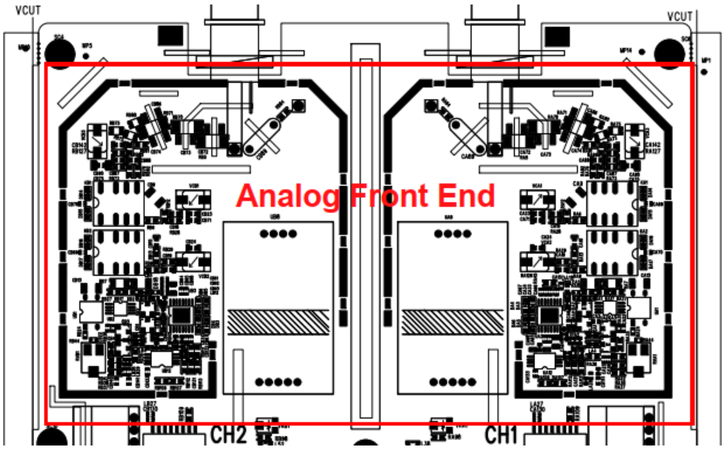


Figure 24 Analog Front End of SHS1000X

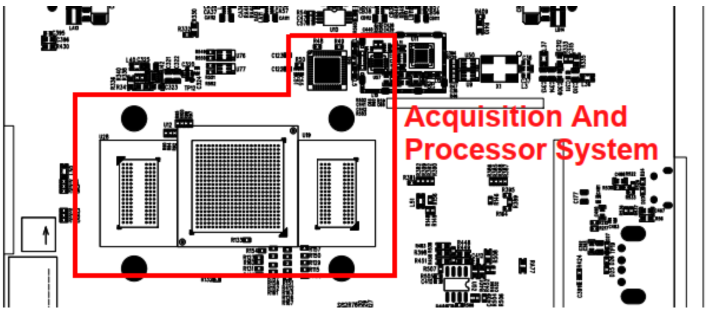


Figure 25 Acquisition And Processor System of SHS1000X

Most of the test points are located on the top side of the board, it is not necessary to completely remove the board from the chassis to do the troubleshooting unless noticed. It is recommended to re-assemble the power supply module to the metal frame for safety considerations. Follow the instructions in chapter **Disassembly Procedures.**

- Reconnect the power adapter to the main board after you have confirmed that the power supply module is in good condition.
- Power up the main board by pushing the front panel power button.
- In most cases, you can hear the relays click if the main board power up successfully. If you cannot hear the click or there is no sign that the main board is powering up, go to **To Check the Power Supply Module** section to check the stand-by power and the main power.
- If the power or the signal under test is abnormal, replace the main board.

8.5.2 Check the Board-Level Power Supplies

Check the board-level power supplies of SHS800X and SHS1000X. Find and measure those test points using a multi-meter.

Table 31 Voltage parameters of the board level power supplies of SHS800X

Number	Test Points	Net Name	Specification
1	TP16/L48 PIN2	VCC3V3	$3.3V_{DC}±0.1V_{DC}$
2	TP13/L42 PIN2	VCC1V	$1V_{DC}±0.1V_{DC}$
3	TP15/L46 PIN2	VCC1V5	$1.5V_{DC}±0.1V_{DC}$
4	TP14/L44 PIN2	VCC1V8	$1.8V_{DC}±0.1V_{DC}$
5	TP12	VCC1V8_ADC	$1.8V_{DC}±0.1V_{DC}$
6	TP17	VCC2V5	$2.5V_{DC}±50mV_{DC}$
7	TP4	VCC3V3_PWR	$3.3V_{DC}±0.1V_{DC}$
8	TP7/TP21	VCC5V2	$5.2V_{DC}±0.2V_{DC}$
9	TP9	VCC5V_LCD	$5V_{DC}±0.2V_{DC}$
10	TP8	VCC15V_LCD	$15V_{DC}±0.7V_{DC}$
11	TP20	VCC_LCD	$5.2V_{DC}±0.2V_{DC}$
12	TP2	VCC_VSYS	$9.3V_{DC}$~$10V_{DC}$
13	TP3	VCC_VSYS_A	$9.3V_{DC}$~$10V_{DC}$
14	TP11	VEE-5V5	$-5.5V_{DC}±0.2V_{DC}$
15	TP5	VEE-10V_LCD	$-10V_{DC}±0.5V_{DC}$
16	TPA2	AFE_CH1_VGAREF	$2.5V_{DC}±0.1V_{DC}$

17	TPB2	AFE_CH2_VGAREF	$2.5V_{DC}\pm0.1V_{DC}$
18	TP10	AVCC3V3	$3.3V_{DC}\pm66mV_{DC}$
19	TPA1/CA61 PIN2	AVCC5V_CH1	$5V_{DC}\pm0.2V_{DC}$
20	TPB1/CB61 PIN2	AVCC5V_CH2	$5V_{DC}\pm0.2V_{DC}$
21	TPA3/R441 PIN2	AVEE-5V_CH1	$-5V_{DC}\pm0.2V_{DC}$
22	TPB3/R442 PIN2	AVEE-5V_CH2	$-5V_{DC}\pm0.2V_{DC}$
23	C368 PIN1	DDR_VREF	$0.75V_{DC}\pm25mV_{DC}$
24	C369 PIN1	DDR_VTT	$0.75V_{DC}\pm25mV_{DC}$
25	TP19/C423 PIN2	USB_VBUS	$5V_{DC}\pm0.2V_{DC}$
26	TP6	LCD_VLEDP	8.4V 9.3V 10.5V

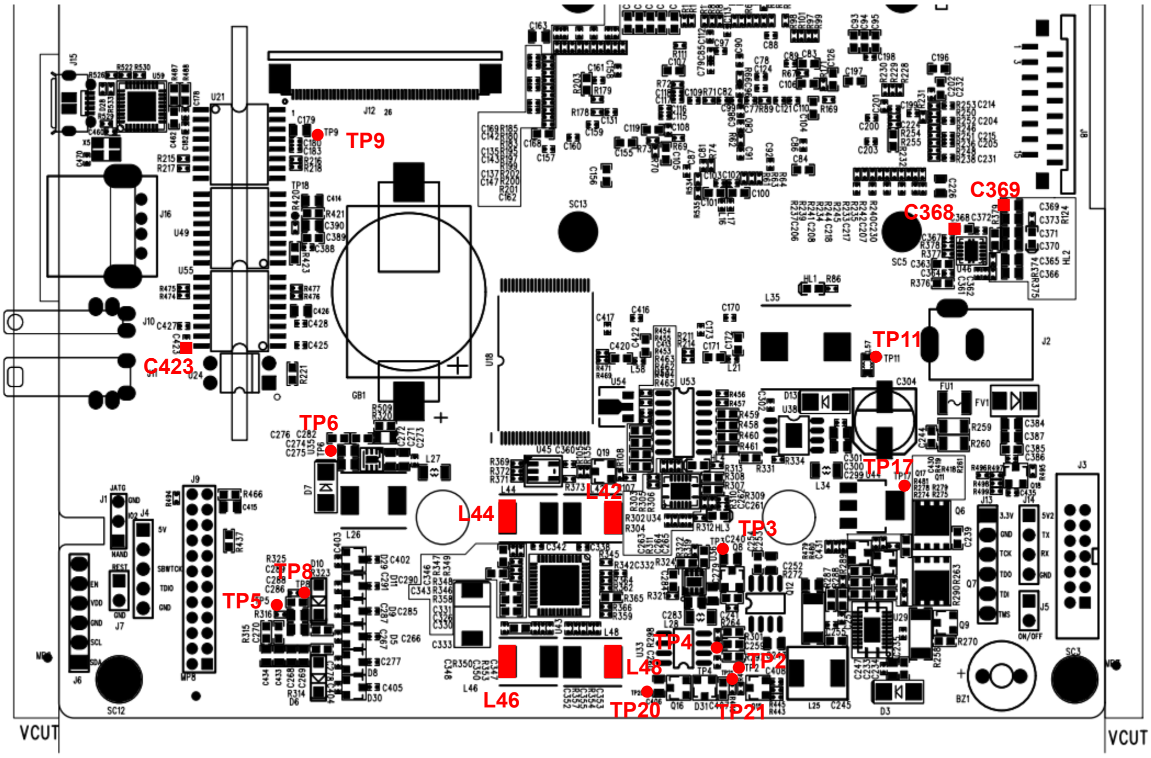


Figure 26 Test points for the main board power supplies of SHS800X

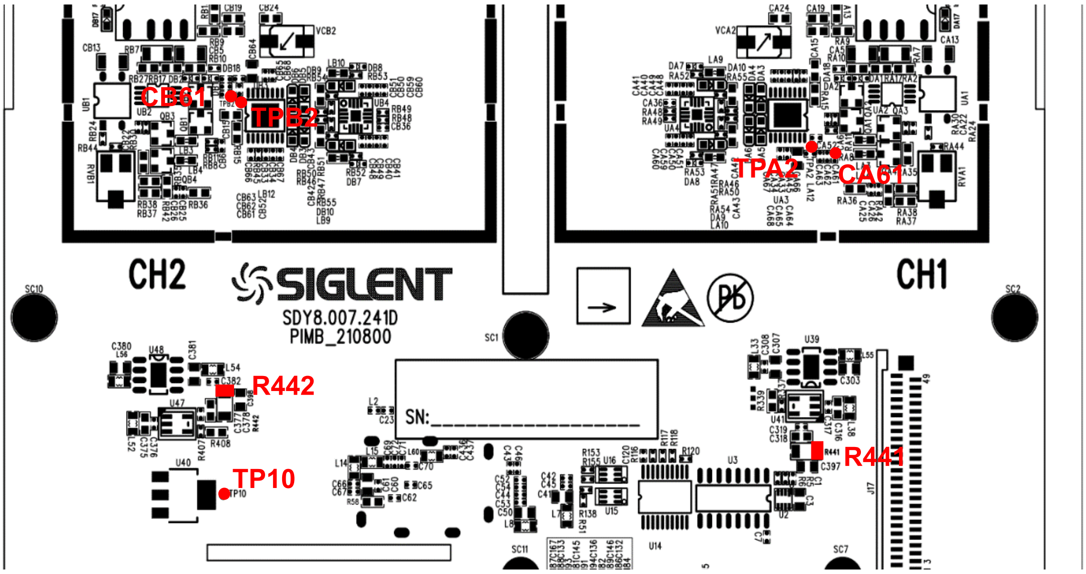


Figure 27 Test points for the main board power supplies of SHS800X (continued)

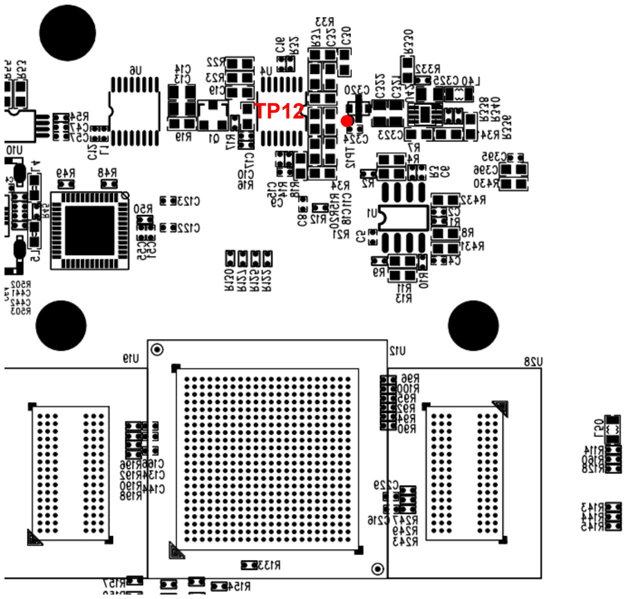


Figure 28 Test points for the main board power supplies of SHS800X (continued)

Table 32 Voltage parameters of the board level power supplies of SHS1000X

Number	Test Points	Net Name	Specification
1	TP16/L48 PIN2	VCC3V3	$3.3V_{DC}\pm0.1V_{DC}$
2	TP13/L42 PIN2	VCC1V	$1V_{DC}\pm0.1V_{DC}$
3	TP15/L46 PIN2	VCC1V5	$1.5V_{DC}\pm0.1V_{DC}$
4	TP14/L44 PIN2	VCC1V8	$1.8V_{DC}\pm0.1V_{DC}$
5	TP12	VCC1V8_ADC	$1.8V_{DC}\pm0.1V_{DC}$
6	TP17	VCC2V5	$2.5V_{DC}\pm50mV_{DC}$
7	TP4	VCC3V3_PWR	$3.3V_{DC}\pm0.1V_{DC}$
8	TP7/TP21	VCC5V2	$5.2V_{DC}\pm0.2V_{DC}$
9	TP9	VCC5V_LCD	$5V_{DC}\pm0.2V_{DC}$
10	TP8	VCC15V_LCD	$15V_{DC}\pm0.7V_{DC}$
11	TP20	VCC_LCD	$5.2V_{DC}\pm0.2V_{DC}$
12	TP2	VCC_VSYS	$9.3V_{DC}$~$10V_{DC}$
13	TP3	VCC_VSYS_A	$9.3V_{DC}$~$10V_{DC}$
14	TP11	VEE-5V5	$-5.5V_{DC}\pm0.2V_{DC}$
15	TP5	VEE-10V_LCD	$-10V_{DC}\pm0.5V_{DC}$
16	TPA2	AFE_CH1_VGAREF	$2.5V_{DC}\pm0.1V_{DC}$
17	TPB2	AFE_CH2_VGAREF	$2.5V_{DC}\pm0.1V_{DC}$
18	TP10	AVCC3V3	$3.3V_{DC}\pm66mV_{DC}$
19	L33 PIN2	AVCC5V_CH1	$5V_{DC}\pm0.2V_{DC}$
20	L54 PIN2	AVCC5V_CH2	$5V_{DC}\pm0.2V_{DC}$
21	R441 PIN2	AVEE-5V_CH1	$-5V_{DC}\pm0.2V_{DC}$
22	R442 PIN2	AVEE-5V_CH2	$-5V_{DC}\pm0.2V_{DC}$
23	TPA1/CA113 PIN1	AVCC4V5_CH1	$4.5V_{DC}\pm0.2V_{DC}$
24	TPB1/CB113 PIN1	AVCC4V5_CH2	$4.5V_{DC}\pm0.2V_{DC}$
25	TPA3/CA134 PIN1	AVEE-4V5_CH1	$-4.5V_{DC}\pm0.2V_{DC}$

26	TPB3/CB134 PIN1	AVEE-4V5_CH2	$-4.5V_{DC}\pm0.2V_{DC}$
27	LA12 PIN2	AVCC4V_CH1	$4V_{DC}\pm0.2V_{DC}$
28	LB12 PIN2	AVCC4V_CH2	$4V_{DC}\pm0.2V_{DC}$
29	C168 PIN1	DDR_VREF_0	$0.75V_{DC}\pm25mV_{DC}$
30	C232 PIN1	DDR_VREF_1	$0.75V_{DC}\pm25mV_{DC}$
31	TP19/C423 PIN2	USB_VBUS	$5V_{DC}\pm0.2V_{DC}$
32	TP6	LCD_VLEDP	8.4V 9.3V 10.5V

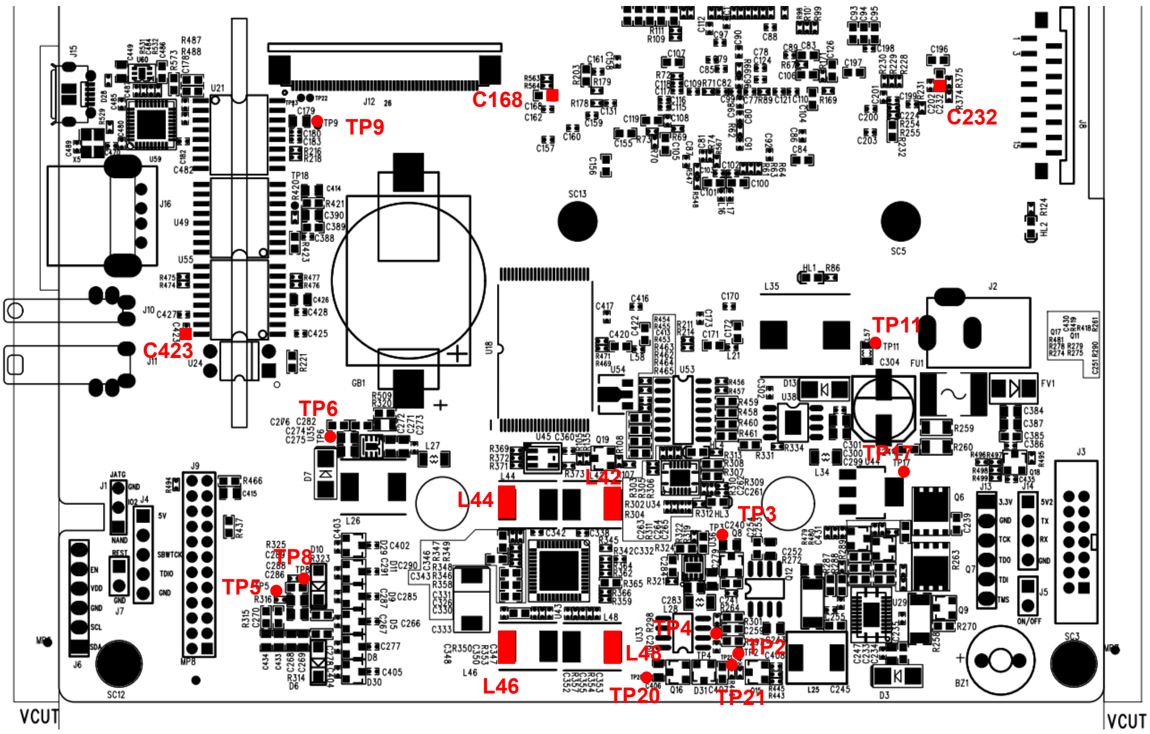


Figure 29 Test points for the main board power supplies of SHS1000X

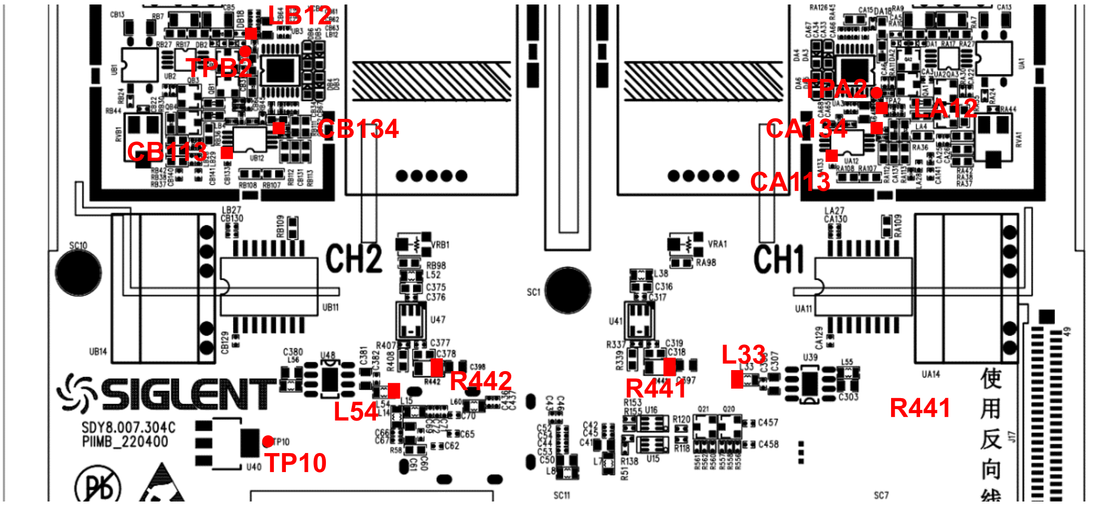


Figure 30 Test points for the main board power supplies of SHS1000X (continued)

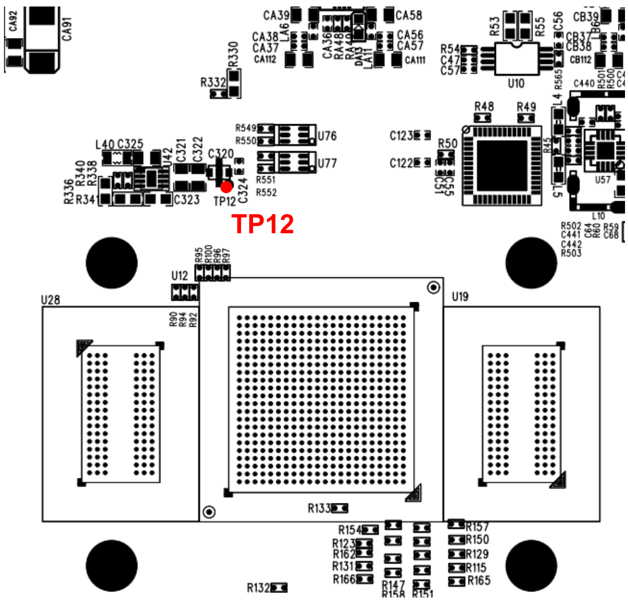


Figure 31 Test points for the main board power supplies of SHS1000X (continued)

8.5.3 Check the Clock

There are 3 clock oscillators and associated fanout buffers on board to source different circuits. Each of them serves one or more functions. The voltage compliance of all the clocks under test is LVCMOS33 or LVCMOS18.

Table 33 Clock parameters of the Acquisition System

Clock Frequency	Test Point	Served Function
25MHz±25ppm	R46	Reference Clock for PLL Tolerance may be larger if the software has malfunctioned.
	R429	Reference Clock for Ethernet
	R47	Reference Clock for ZYNQ_PL
33.33MHz±20ppm	R52	Reference Clock for ZYNQ_PS
24MHz±20ppm	R478	Reference Clock for USB1
	R57	Reference Clock for USB0

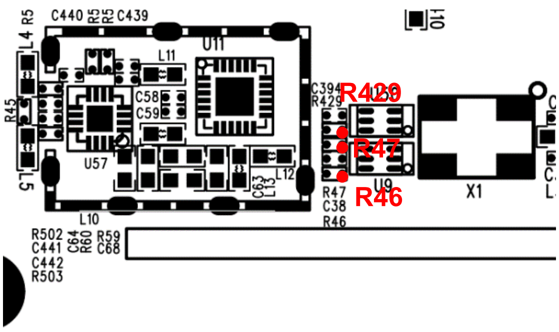


Figure 32 Test points for clock

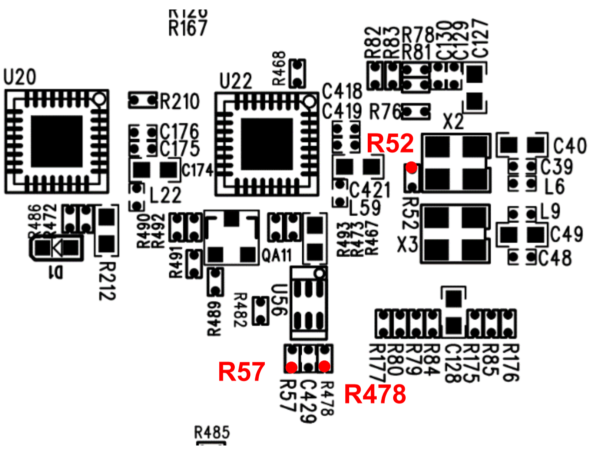


Figure 33 Test points for clock (continued)

8.6 To Check the LCD

- Reconnect the power cable to the main board after you have confirmed that the power supply module is in good condition.
- Connect the LCD cable to the main board.
- Power up the main board by pushing the front panel power button.

8.6.1 To Check the LCD Power Supply

Find connector J12 and measure those test points using a multi-meter.

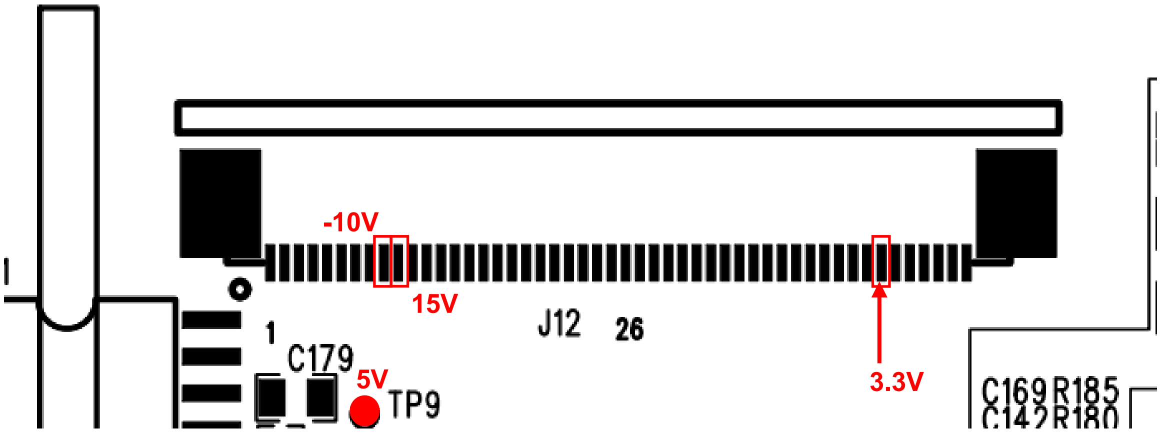


Figure 34 Test points for the LCD power supplies

If the power supply is out-of-specification, double-check with LCD cable disconnected. If the power supply is still out-of-specification, replace the main board. If the power supply is good when the LCD cable is disconnected, replace the LCD panel.

8.6.2 To Check the LCD Signal

Find connector J12, use an oscilloscope to measure the signal using the method below. Be aware that a 200 MHz oscilloscope may not be suitable for signal quality check, but good enough for signal presence detection.

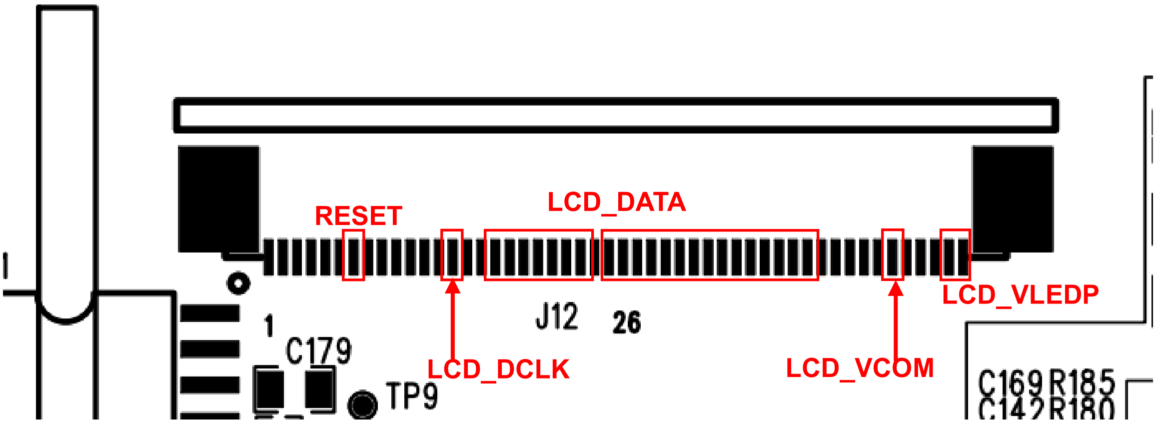


Figure 35 Test points for LCD signal

Table 34 Signal parameters of the LCD

Test Point	Signal	Description
J12 PIN49/50	LCD_VLEDP	Power for LED backlight anode, typically 9.3V_{DC}
J12 PIN45	LCD_VCOM	LCD VCOM, typically 2V_{DC}
J12 PIN14	LCD_DCLK	LCD reference clock, typically 27.5MHz
J12 PIN7	RESET	LCD reset. Always high.
J12 PIN17~23/25~39	LCD_DATA	LCD RGB DATA signal. Always active.

- If the signal is active, replace the LCD panel.
- If the signal is stuck, double-check with the LCD cable disconnected. If the signal is still stuck, replace the acquisition board. If not, replace the LCD panel.

About SIGLENT

SIGLENT is an international high-tech company, concentrating on R&D, sales, production and services of electronic test & measurement instruments.

SIGLENT first began developing digital oscilloscopes independently in 2002. After more than a decade of continuous development, SIGLENT has extended its product line to include digital oscilloscopes, isolated handheld oscilloscopes, function/arbitrary waveform generators, RF/MW signal generators, spectrum analyzers, vector network analyzers, digital multimeters, DC power supplies, electronic loads and other general purpose test instrumentation. Since its first oscilloscope was launched in 2005, SIGLENT has become the fastest growing manufacturer of digital oscilloscopes. We firmly believe that today SIGLENT is the best value in electronic test & measurement.

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