

SDS5000X Series

Digital Oscilloscope

Service Manual

E01A



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



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1 General Safety Summary

This chapter contains information and warnings that must be followed to keep the instrument operating under the appropriate safety conditions. In addition to the safety precautions specified in this section, you must also follow recognized safety procedures.

1.1 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 documentation 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 scope's state switches between Operation and Standby. This switch does not disconnect the device's power supply. To completely power off the scope, the power cord must be unplugged from the AC socket after the oscilloscope is in the standby state.
	This symbol is used to represent an 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.

1.2 Working Environment

This instrument is intended for indoor use and should be operated in a clean, dry environment with an ambient temperature range of 0 °C - 40 °C.

Temperature

Operating: 0 °C to +40 °C

Non-operation: -20 °C to +60 °C

Humidity

Operating: 85% RH, 40 °C, 24 hours

Non-operating: 85% RH, 65 °C, 24 hours

Altitude

Operating: ≤ 3,000 m

Non-operating: $\leq 15,266$ m

Note: Direct sunlight, radiators, and other heat sources should be taken into account when assessing the ambient temperature.



WARNING: Do not operate the oscilloscope in an explosive atmosphere or wet and damp conditions.

The design of the instrument has been verified to conform to EN 61010-1 safety standard per the following limits:

- Installation (overvoltage) Category: II (Mains Supply Connector)
- Degree of Pollution: II
- Degree of Protection: IP20

Note:


Installation (Overvoltage) Category II refers to the local distribution level, which applies to equipment connected to the mains supply (AC power source).


Degree of Pollution II refers to a working environment which is dry and non-conductive pollution occurs. Occasional temporary conductivity caused by condensation is expected.



CAUTION: Protect the display touch screen of the scope from


	excessive impact.
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	CAUTION: Do not exceed the maximum specified front panel terminal (CH1, CH2, CH3, CH4, EXT) voltage levels. Refer to Specifications for more details.
---	--

	CAUTION: Do not connect or disconnect probes or test leads while they are connected to a voltage source.
---	---

1.3 Cooling Requirements

This instrument relies on forced air cooling with internal fans and ventilation openings. Care must be taken to avoid restricting the airflow around the apertures (fan holes) at each side of the scope. To ensure adequate ventilation it is required to leave a 15 cm (6 inch) minimum gap around the sides of the instrument.

	CAUTION: Do not block the ventilation holes located on both sides of the scope.
---	--

	CAUTION: Do not allow any foreign matter to enter the scope through the ventilation holes, etc.
---	--

1.4 AC Power

The instrument operates with a single-phase, 100 to 240 Vrms (+/-10%) AC power at 50/60 Hz (+/-5%), or single-phase 100 - 120 Vrms (+/-10%) AC power at 400Hz (+/-5%).

No manual voltage selection is required because the instrument automatically adapts to line voltage.

Depending on the type and number of options and accessories (probes, PC port plug-in, etc.), the instrument can consume up to 100 W of power.


Note: The instrument automatically adapts to the AC line input within the following ranges:

Voltage Range:	90 - 264 Vrms	90 - 132 Vrms
Frequency Range:	47 - 63 Hz	380 - 420 Hz

1.5 Power and ground connections


The instrument includes a grounded cord set containing a molded three-terminal polarized plug and a standard IEC320 (Type C13) connector for making line voltage and safety ground connection. The AC inlet ground terminal is connected directly to the frame of the instrument. For adequate protection against electrical shock hazard, the power cord plug must be inserted into a mating AC outlet containing a safety ground

contact. Use only the power cord specified for this instrument and certified for the country of use.

	<p>Warning:Electrical Shock Hazard!</p> <p>Any interruption of the protective ground conductor within or outside of the scope or disconnection of the safety ground terminal creates a hazardous situation.</p> <p>Intentional interruption is prohibited.</p>
---	---

The position of the oscilloscope should allow easy access to the socket. To make the oscilloscope completely power off, unplug the instrument power cord from the AC socket.

The power cord should be unplugged from the AC outlet if the scope is not to be used for an extended period.


	<p>CAUTION: The outer shells of the front panel terminals (CH1, CH2, CH3, CH4, EXT) are connected to the instrument's chassis and therefore to the safety ground.</p>
---	--

1.6 Calibration

The recommended calibration interval is one year. Calibration should be only performed by qualified personnel.

1.7 Cleaning

Clean only the exterior of the instrument, using a damp, soft cloth. Do not use chemicals or abrasive elements. Under no circumstances allow moisture to penetrate the instrument. To avoid electrical shock, unplug the power cord from the AC outlet before cleaning.

	<p>Warning:Electrical Shock Hazard!</p> <p>No operator serviceable parts inside. Do not remove covers.</p> <p>Refer servicing to qualified personnel</p>
---	---

1.8 Abnormal Conditions

Only operate the instrument for the purposes specified by the manufacturer.

Do not operate the scope if there are any visible signs of damage or if it has been subjected to severe transport stresses.

If you suspect the scope's protection has been impaired, disconnect the power cord and secure the instrument against any unintended operation.

Proper use of the instrument requires reading and understanding all of the instructions and labels.



Warning: Any use of the scope in a manner not specified by the manufacturer may impair the instrument's safety protection. This instrument should not be directly connected to human subjects or used for patient monitoring.

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) 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) The use of non-SIGLENT accessories or 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.

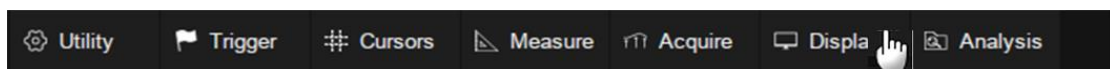
The oscilloscope's firmware has been thoroughly tested and is presumed to be functional. Nevertheless, it is supplied without warranty of any kind covering detailed performance. Products not made by SIGLENT are covered solely by the warranty of the original equipment manufacturer.

2.3 Maintenance Agreement

We provide various services based on a maintenance agreement. 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, Print represents the "Print" button on the front panel. Italicized text with shading is used to represent the touchable or clickable menu/button/region on the touch screen. For example, DISPLAY represents the "DISPLAY" menu on the screen:



For the operations that contain multiple steps, the description is in the form of "Step 1 > Step 2 >...". As an example, follow each step in the sequence to enter the upgrade interface:

Utility > System Setting > Upgrade

Press the Utility button on the front panel as step 1, click the System Setting option on the screen as step 2, and click the Update option on the screen as step 3 to enter the upgrade interface.

4 Prepare Information

Before initiating performance verification or any adjustments, it is recommended the user follow these procedures. The following topics are discussed in this chapter.

- How to perform functional checks
- How to operate four standard interface tests
- How to use the self-calibration routine
- How to recall factory default settings

For more detailed information about oscilloscope operation, please refer to the User Manual.

4.1 Functional Checking

The functional checking details four types of checks used to determine if the oscilloscope is operating properly.

4.1.1 Power-on Inspection

The standard power supply for the instrument is 100~240 V, 50/60 Hz, or 100~120 V, 400 Hz. Please use the power cord provided with the

instrument to connect it to AC power.



Figure 1 Connect the power cord



CAUTION: To avoid electric shock, make sure that the instrument is correctly grounded to the earth before connecting AC power.

Press the Power button located at the lower-left corner of the front panel and note that several buttons will be lighted for about 6 seconds simultaneously until the boot screen appears. The oscilloscope will then begin to perform its power-on tests automatically, after which the Default button can be pressed to recall the factory default settings.

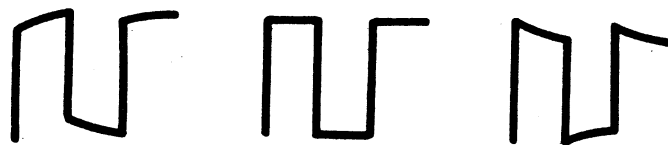
4.1.2 Probe Compensation

When a probe is used for the first time, you should compensate it to match the input channel of the oscilloscope. Non-compensated or poorly compensated probe may increase measurement inaccuracy or error. The probe compensation procedures are as follows:

1. Connect the coaxial cable interface (BNC connector) of a passive probe to any channel of the oscilloscope.
2. Connect the probe to the "Compensation Signal Output Terminal" (Cal) on the front of the oscilloscope. Connect the ground alligator clip of the probe to the "Ground Terminal" under the compensation signal output terminal.



3. Press the Auto Setup button.
4. Check the waveform displayed and compare it with the following.



Under Perfectly Over
Compensated Compensated Compensated

5. Use a non-metallic 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.

4.1.3 Auto Setup

Press the Auto Setup button to enable the waveform auto setting function. The oscilloscope will automatically adjust the horizontal time base, vertical scale, and trigger mode according to the input signal to obtain an optimum waveform display.

- Auto Setup will not work on all signal types, especially time-varying bursts or slow signals (< 100 Hz). If Auto Setup cannot achieve desired settings, you can manually adjust the vertical, horizontal, and trigger systems.
- Select the channel with the lowest frequency when several channels are connected to signals.

4.1.4 Self-Calibration

The self-calibration program can quickly calibrate the oscilloscope to reach the best working state and the most precise measurement. It is recommended to perform a self-calibration if the change of ambient temperature is more than 5 °C. Make sure the oscilloscope has been warmed up or operated for more than 30 minutes before the self-calibration.

Please perform the self-calibration as follows:

1. Disconnect everything from all inputs.
2. Operate Utility>Do Self Cal, and it will pop up the following dialog.
Select Continue to start the self-cal program.

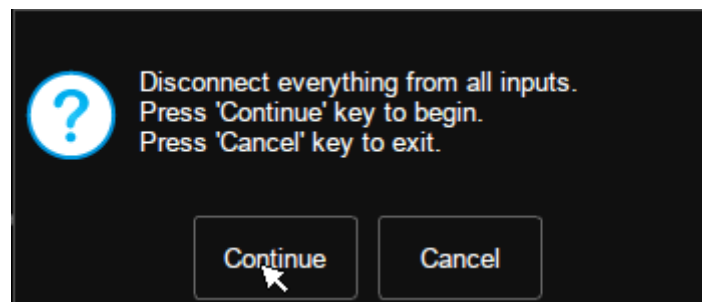


Figure 2 CalibrationInterface

3. The oscilloscope will not respond to any operations until the self-cal is finished. After the self-cal is completed, touch the screen or press any button to exit.

4.2 Interface Test

The SDS5000X series oscilloscope is designed with four standard interfaces: USB Host, USB Device, LAN, and Pass/Fail. Connecting to other instruments via these interfaces enables the oscilloscope to achieve additional capabilities. To ensure the oscilloscope is operating properly, it is recommended that the user first test the interfaces.

4.2.1 USB Host Test

To test whether the USB Host interface is operating correctly.

Tools:

A U-disk

Steps:

1. Insert a U-disk (flash drive) into the USB Host interface on the front panel of the oscilloscope.
2. A message prompt "USB flash drive detected." appears on the screen, and an icon will be shown in the lower right corner of the screen which confirms the U-disk has been successfully recognized.



Figure 3 USB drive detected

4.2.2 USB Device Test

To test if the USB Device interface is operating correctly.

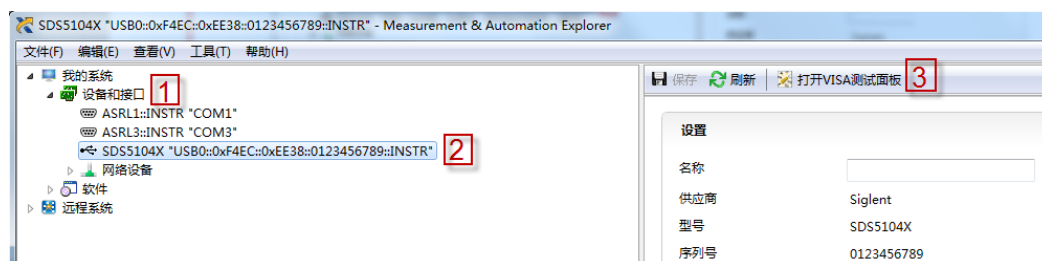
Tools:

- A computer with a USB interface
- A standard USB cable(TypeAB)
- National Instruments NI-Max software

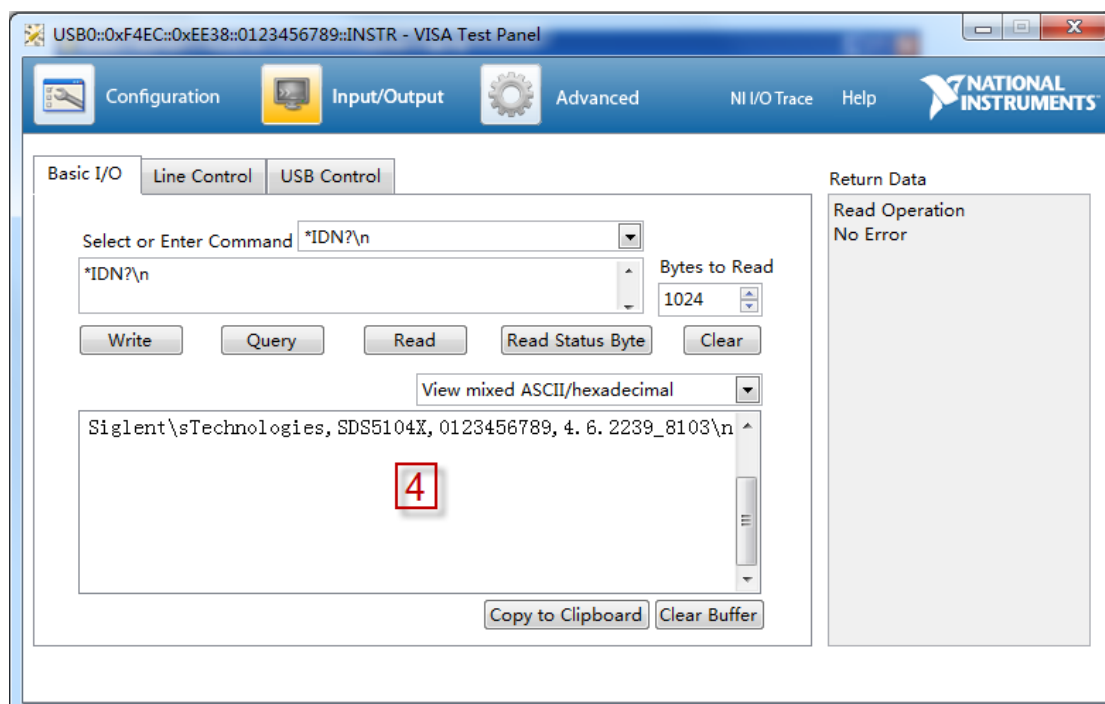
Steps:

1. Set up the NI-Max software on a computer and install the driver step by step following the instructions.

2. Connect the oscilloscope to the computer using a USB cable.
3. Run NI-MAX software. Click “Device and Interface” at the upper left corner of the NI software interface and immediately the “USBTCM” device symbol is displayed.



4. Click “Open VISA Test Panel” option button, and then the following Interface will appear. Next, click the “Input/Output” option button and click the “Query” option button to view the Read operation information.



4.2.3 LAN Port Test

Use to test if the LAN interface operates correctly when connected with NI Visasoftware.

Tools:

- A computer with a LAN interface
- A standard LAN cable
- National Instruments NI-MAX software

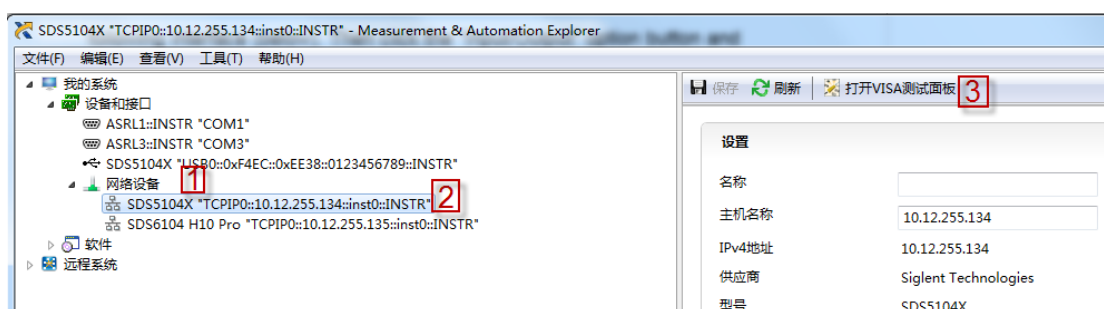
Steps:

1. Set up theNI-MAX software on a computer and install the driver using the following instructions.
2. Perform Utility>System Setting>I/O Setting>LAN Config to open the LAN Config dialog box. And input usable IP Address and Subnet Mask.



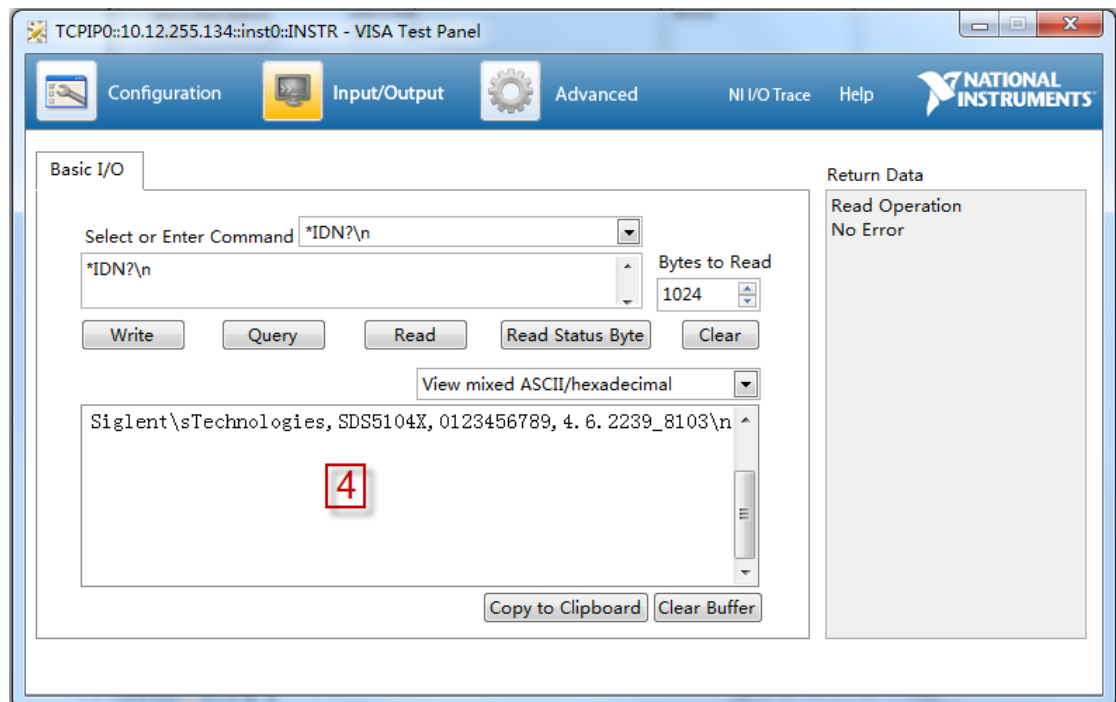
Figure 4 IP Setting interface

1. Connect the oscilloscope to the computer using a LAN cable via the LAN interface ports.
2. Run NI-MAX software. Click “Device and Interface” at the upper left corner of the NI software interface and select the “LAN” device symbol.



3. Click “Open VISA Test Panel” option button, which then displays the following interface (below). Then click the “Input/Output” option button and click the “Query” option button. The

“Read” operation information will be displayed.



4.2.4 Pass/Fail out Test

To test the Mask Test function and signal output by viewing on another oscilloscope.

Tools:

- A second oscilloscope
- Two BNC cables

Steps:

1. Turn on the SDS5000X oscilloscope.
2. Enable Channel 1.
3. Perform *Analysis>MaskTest* to open the Mask Test dialog box, and touch *Mask Setup>Create Mask* to set the mask. Set the items as below:

Table 1 Mask Test Settings

Parameter	Setting
Enable to Test	On
Source	CH1
Type	All in
Display Info	On
Mask Setting	
Mask X	0.32
Mask Y	0.32

Note: press *Create Mask* to complete Mask setting, after mask x setting and mask y setting.

After selecting the corresponding items as shown in the table above, the screen will appear as in Figure 5:

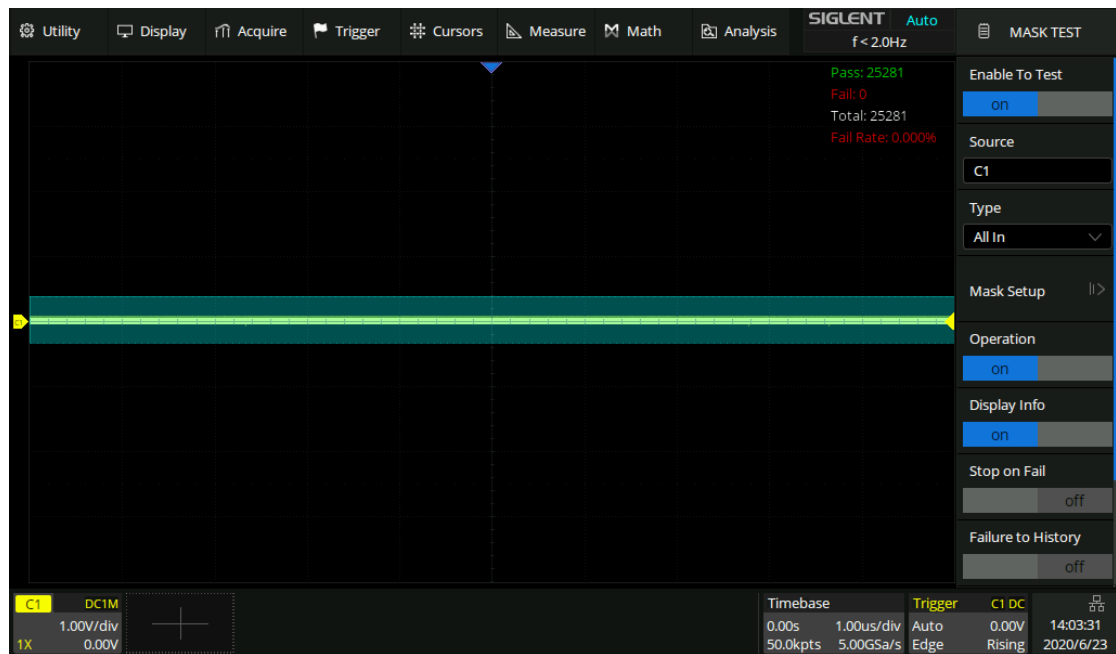


Figure 5 Mask Test Interface

All data points of waveform must be inside the mask to pass the test. Even a single point outside the mask will cause a failure.

1. Connect the Pass/Fail output signal (on the rear panel) to the input terminal of another oscilloscope.
2. Move the waveform on the screen up, down, or sideways so that any portion of it falls outside of the Pass/Fail mask. If the interface is operating normally then a pulse will appear on the second

oscilloscope. Adjust the second oscilloscope's time base and voltage scale as needed. If there is no viewable pulse on the second oscilloscope then there may be a problem with this function.

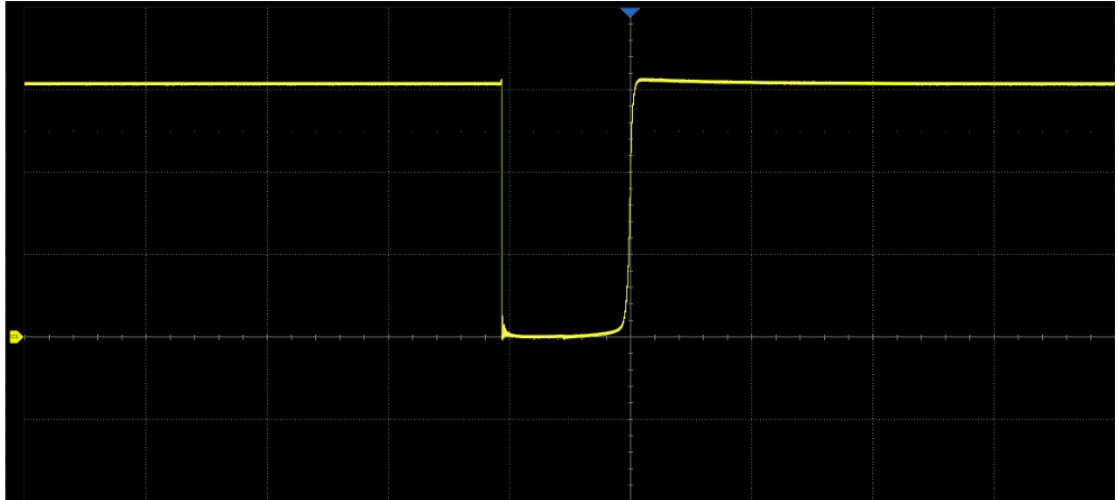


Figure 6 Pulse Waveform

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 2 Test equipment

Equipment	Description	Test item
Fluke 9500B + Active Heads	High-Performance Oscilloscope Calibrator	DCG\Offset\ Clock accuracy\Trigger delay \BW\BWL\trigger sensitivity\ Input impedance\ Ext Trigger delay\Ext Trigger level...
GPIB Card and Cable	For communication between the computer and the 9500B	
USB Cable(or Ethernet Cable)	For communication between the computer and the SDS5000X	
BNC Cables	BNC(m) to BNC(m), Approx.1m long	
BNC T Connectors	For signal distribution	DCG\Offset
Computer		

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

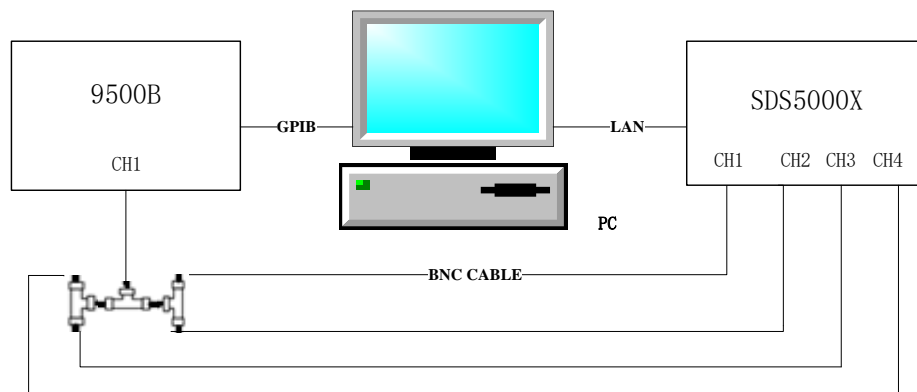


Figure 7Connecting test instruments for DCG\Offset

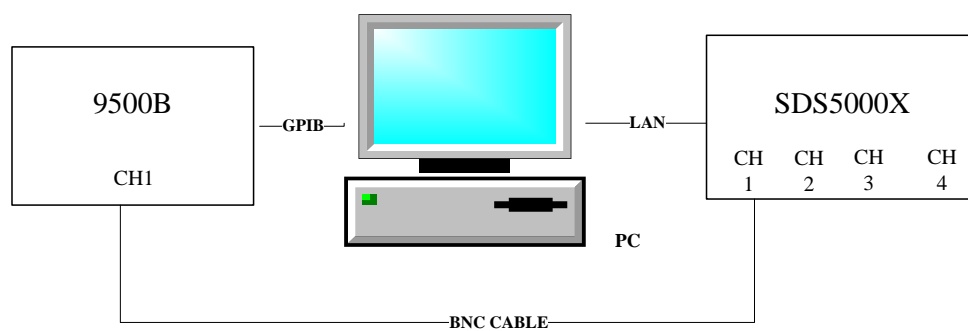


Figure 8Connecting test instruments for Clock\Trigger Delay\Trig Level

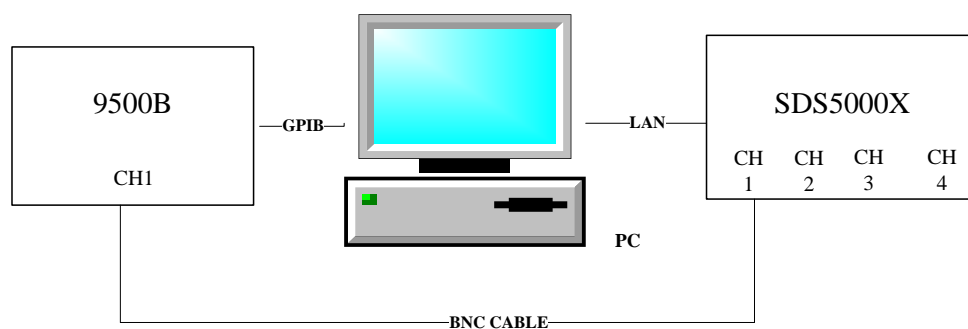


Figure 9Connecting test instruments for BW\BWL\Trigger Sensitivity

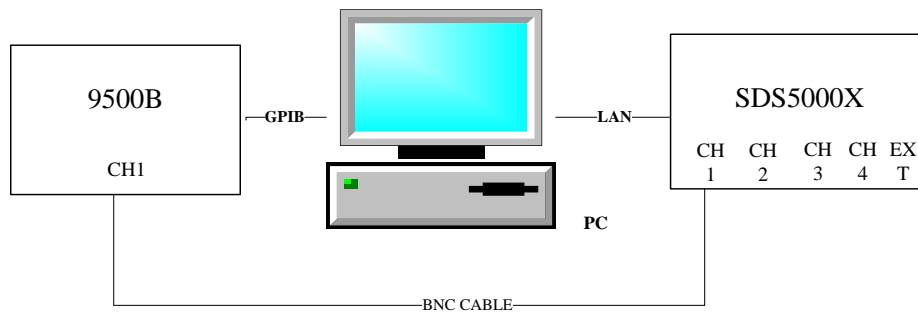


Figure 10Connecting test instruments for Input impedance

The figures below show the interconnections between the test equipment and PC to Ext Trigger test:

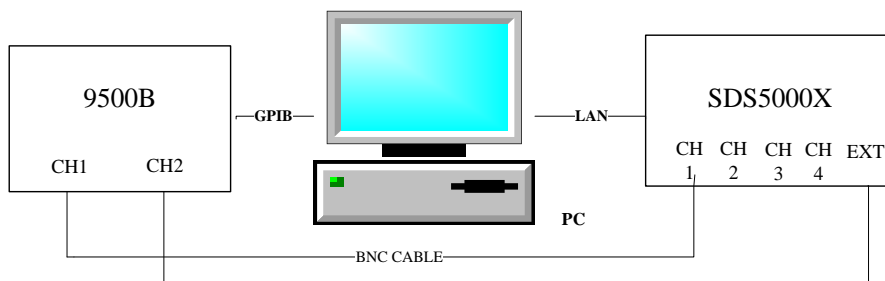


Figure 11Connecting test instruments for Ext Trigger Delay\ Ext Trigger Level

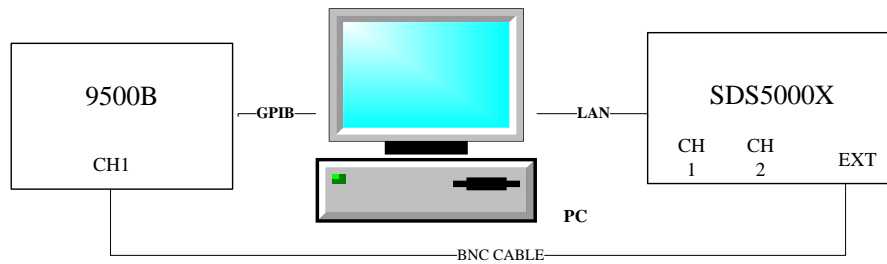


Figure 12 Connecting test instruments for Ext Trigger Sensitivity

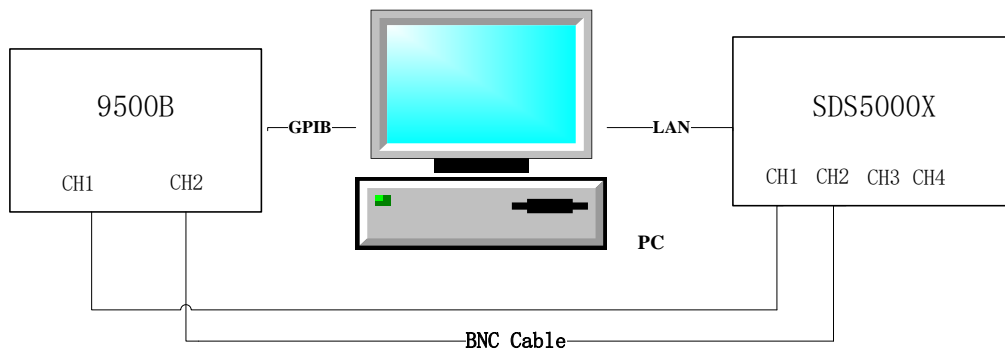


Figure 13 Connecting test instruments for Channel Skew

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

The Self Calibration procedure is described in section **Self-Calibration**. If the environmental temperature changes by more than 5°C, the Self

Calibration operation must be performed to achieve the specified performance.

5.1 To Verify DC Gain Accuracy

DC Gain Accuracy Slope = LINEST($V_{\text{error}1}:V_{\text{error}5}$, $V_{\text{Setting}1}:V_{\text{Setting}5}$)

Note: " V_{Setting} " represents the DC voltage output level setting.

" V_{error} " represents the difference between the output setting and the measurement.

This test verifies non-interleaved mode DC Gain Accuracy of all channels.

Steps:

1. Set the 9500B output to on.
2. Connect all channels of the oscilloscope to the 9500B as shown in Figure 7.
3. Set Volts/Div of the oscilloscope to 1 mV/div. Press the Measure button on the front panel of the oscilloscope to display Mean measurement.
4. Set DC voltage output level of the 9500B according to Table 3, and record the mean value of the oscilloscope as V_{mean} .
5. Calculate V_{error} ($V_{\text{error}} = V_{\text{Setting}} - V_{\text{mean}}$), and set the next output level as step 4.
6. Make a linear regression with these 5 data points:
 $V_{\text{Setting}1} \sim V_{\text{Setting}5}$, $V_{\text{error}1} \sim V_{\text{error}5}$. Check if the slope falls within the range shown in Table 3.
7. Set the oscilloscope Volts/Div to the other settings in Table 3, and

repeat step 4 to step6.

8. Turn the 9500B output off.
9. Disconnect the connections to all the channels.

Table 3DC Gain Accuracy

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

5.2 To Verify Offset Accuracy

$$\text{Offset Accuracy Slope} = \text{LINEST}(\text{Offset}_{\text{error1}}:\text{Offset}_{\text{error5}}, \text{Offset}_{\text{out1}}:\text{Offset}_{\text{out5}})$$

Note: “Offset_{out}” represents DC voltage output level setting;

“Offset_{error}” represents the difference between the output setting and the measurement.

This test verifies the non-interleaved mode Offset Accuracy of all the channels.

Steps:

1. Set the 9500B output to on.
2. Connect all channels of the oscilloscope to 9500B as shown in Figure 7.
3. Set the Volts/Div of the channel to 1 mV/div. Press the Measure button on the front panel of the oscilloscope to display Mean measurement.
4. According to Table 4, set offset of the channel to -Offset, and set the 9500B output level to equal the offset, then record the mean value of the oscilloscope as V_{mean}. When the offset is 0, set the 9500B output to off and record the mean value of the oscilloscope as V_{zero}.
5. Calculate Offset_{error} (Offset_{error}= V_{mean}- Offset), and adjust the 9500B to the output level as step 4.

6. Make a linear regression with these 5 data points:
Offseterror1~Offseterror5, Offsetout1~Offsetout5. Check to verify that the slope is within the limits specified in Table 4.
7. Check to verify that $\text{abs}(V_{\text{zero}})$ in step 4 is within the limits specified in Table 4.
8. Set the oscilloscope Volts/Div to the other settings in Table 4, and repeat the steps 4 to 6.
9. Turn the 9500B output off.
10. Disconnect the connections to all the channels.

Table 4 Offset Accuracy

Volt/Div	Offset	Slope error	Zero input(V)
10 V/div	35 V, 30 V, 0, -30 V, -35 V	$\pm 1.5\%$	± 1.202
5 V/div	30 V, 25 V, 0, -25 V, -30 V	$\pm 1.5\%$	± 0.602
2 V/div	20 V, 10 V, 0, -10 V, -20 V	$\pm 1.5\%$	± 0.242
1 V/div	10 V, 5 V, 0, -5 V, -10 V	$\pm 1.5\%$	± 0.122
500 mV/div	5 V, 2.5 V, 0, -2.5 V, -5 V	$\pm 1.5\%$	± 0.062
200 mV/div	2 V, 1 V, 0, -1 V, -2 V	$\pm 1.5\%$	± 0.026
100 mV/div	1 V, 0.5 V, 0, -0.5 V, -1 V	$\pm 1.5\%$	± 0.014
50 mV/div	500 mV, 250 mV, 0, -250 mV, -500 mV	$\pm 1.5\%$	± 0.008
20 mV/div	200 mV, 100 mV, 0, -100 mV, -200 mV	$\pm 1.5\%$	± 0.0044

10 mV/div	100 mV, 50 mV, 0, -50 mV, -100 mV	±1.5%	±0.0032
5 mV/div	50 mV, 25 mV, 0, -25 mV, -50 mV	±1.5%	±0.0026
2 mV/div	20 mV, 10 mV, 0, -10 mV, -20 mV	±1.5%	±0.00224
1 mV/div	10 mV, 5 mV, 0, -5 mV, -10 mV	±1.5%	±0.00224

5.3 To Verify Time Base Accuracy

This test verifies the time base accuracy of the oscilloscope. In the test, the impedance of both the 9500B and the oscilloscope should be set to 1 MΩ.

Time Base Accuracy: Frequency Error < 10 Hz

Steps:

1. Connect the selected channel of the oscilloscope to the 9500B.
2. Set the oscilloscope Volts/Div to 100 mV/div.
3. Set the oscilloscope Sec/Div to 50ms/div.
4. Set the Memory Depth to 12.5Mpts.
5. Set waveform of the 9500B to sine, amplitude to 600 mV, and frequency to the value (10MHz).
6. Check if the trigger (hardware-measured) frequency which is on the top right of the screen is in the range of 999910~1000010.

7. Disconnect the test connection.
8. To Verify Trigger Delay
9. This test checks the trigger delay of the analog channels. In this test, the impedance of both the 9500B and the oscilloscope should be set to 50 Ω .

5.4 To Verify Trigger Delay

This test checks the trigger delay of the analog channels. In this test, the impedance of both the 9500B and the oscilloscope should be set to 50 Ω .

Channel Trigger Delay Limit: $\text{abs}(T@L) \leq 150 \text{ ps}$

Steps:

1. Connect the selected channel of the oscilloscope to the 9500B shown as in Figure 8.
2. Press the 'Aux' key at the right of the 'OSCILLOSCOPE CALIBRATOR' panel of the 9500B and select Skew function.
3. Set the impedance of the 9500B to 50 Ω , frequency to 1 kHz, and amplitude to 0.6 V.
4. Set the oscilloscope Volts/Div to 100mV/div.
5. Set the oscilloscope Sec/Div to 2ns/div, trigger source is the selected channel.

6. Press Measure button on the front panel of the oscilloscope to display Time@Level measurement.
7. Check if the result is in the limited range above.
8. Disconnect the test connection.
9. Check other channels in the same way as steps 1 to 7.

5.5 To Verify Ext Trigger Delay

This test checks the trig delay between the external channel and analog channels. In the test, the impedance of the 9500B should be set to 50 Ω and external channel and selected analog channel both set to 50 Ω .

CH-Ext Trigger Delay Limit: $\text{abs}(\text{Delay}) \leq 1 \text{ ns}$

Steps:

1. Connect selected analog channel and external channel of the oscilloscope to the 9500B with active heads (CH1/CH2) shown as in Figure 11.
2. Press the 'Aux' key at the right of the 'OSCILLOSCOPE CALIBRATOR' panel of the 9500B and select the Skew function.
3. Set impedance of the 9500B to 50 Ω , frequency to 1 kHz, and amplitude to 0.6 V.
4. Set the oscilloscope Volts/Div to 100mV/div.

5. Set the oscilloscope Sec/Div to 2ns/div.
6. Set the oscilloscope trigger source to EXT, the trigger slope to Rising, and the trigger level to 0.
7. Press Measure button on the front panel of the oscilloscope to display Delay measurement.
8. Check if the delay is within the limited range above (≤ 1 ns).
9. Disconnect the test connection.
10. Check the other analog channel in the same way as steps 1 to 9.

5.6 To Verify Trigger Level

This test checks the trigger level accuracy of the ext trigger. In this test, the impedance of both the 9500B and the oscilloscope should be set to 50 Ω .

CH Trigger Level Error Limit: $\text{abs}(\text{Error}) \leq 20\text{mV}$

Steps:

1. Connect selected channel of the oscilloscope to the 9500B.
2. Set impedance of the 9500B to 50 M Ω , frequency to 2 kHz, amplitude to 800 mV, and waveform to sine.
3. Set the oscilloscope Sec/Div to 50 us/div.

4. Set the oscilloscope Volts/Div to 100mV/div, trigger source to selected channel, trigger slope to positive and coupling mode to DC.
5. Set the trigger level to 300mV.
6. Press **Measure** button on the front panel of the oscilloscope to display Level@xmeasurement.
7. Record the value of Level@x, calculate the level error(error = 300mV - Level@x).
8. Check if the trigger level error is in the limited range above.
9. Set the trigger level to 0 mV and -300mV,repeat step 5 to step8.
10. Set trigger slope to negative, repeat steps step5 to step9.
11. Disconnect the test connection.
12. Check the other analog channels in the same way as steps 1 to 11.

5.7 To Verify Ext Trigger Level

This test checks the trigger level accuracy of the external trigger channel. In this test, the impedance of both the 9500B and the oscilloscope should be set to 1 M Ω .

Table 5EXT Trigger Level Error Limit

Trigger Channel	Volt/div	Trigger Level Error Limited Range
EXT	150 mV	Abs(Error) < 45mV

EXT/5	435mV	Abs(Error) < 103.5mV
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Steps:

1. Connect channel 1 and external trigger channel of the oscilloscope to the 9500B with a BNC T connector, as shown in Figure 11.
2. Set the oscilloscope Sec/Div to 500 us/div.
3. Set the oscilloscope Volts/Div to 150mV/div, trigger source to EXT, trigger slope to positive and coupling mode to DC.
4. Set the impedance of the 9500B to 1 M Ω , frequency to 1 kHz, amplitude to 4*Volts/Div, and waveform to sine.
5. Set the trigger level to 450mV.
6. Press the Measure button on the front panel of the oscilloscope to display Level@x measurement.
7. Record the value of Level@x, calculate the level error (error = 300mV - Level@x).
8. Check if the trigger level error is in the limited range above.
9. Set the trigger level to 0 mV and -450mV, repeat step 5 to step 8.
10. Set trigger slope to negative, repeat step 5 to step 9.
11. Set the oscilloscope Volts/Div to 345mV/div, trigger source to EX/5, trigger slope to positive, and coupling mode to DC.
12. Set the impedance of the 9500B to 1 M Ω , frequency to 1 kHz, amplitude to 4*Volts/Div, and waveform to sine.
13. Set the trigger level to 1035mV.
14. Record the value of Level@x, calculate the level error (error = 300mV -

Level@x).

15. Check if the trigger level is in the limited range in Table 5.
16. Set the trigger level to 0mV and -1035mV, repeat step 13 to step 15.
17. Set trigger slope to negative, repeat step 13 to step 16.
18. Disconnect the test connection.

5.8 To Verify Noise Floor

This test checks the noise floor of the analog channels and varies from models. In this test, do not connect any testing devices to the oscilloscope.

Table 6 Noise Floor Limited Range

Volt/Div	pkpk/stddev Limited Range	SNR Limited Range	Volt/Div	pkpk/stddev Limited Range	SNR Limited Range
500 μ V	[1,15]	[24,55]	100 mV	[1,15]	[38,55]
1 mV	[1,15]	[25,55]	200 mV	[1,15]	[38,55]
2 mV	[1,15]	[27,55]	500 mV	[1,15]	[38,55]
5 mV	[1,15]	[31,55]	1 V	[1,15]	[38,55]
10 mV	[1,15]	[35,55]	2 V	[1,15]	[38,55]
20 mV	[1,15]	[38,55]	5 V	[1,15]	[38,55]
50 mV	[1,15]	[38,55]	10 V	[1,15]	[38,55]

Steps:

1. Set the oscilloscope Sec/Div to 1ms/div.
2. Set the oscilloscope Volts/Div to 500uV/div.
3. Press the **Measure** button on the front panel of the oscilloscope to display Stdev and Peak-Peak measurement.
4. Calculate SNR ($SNR = 20 * \log_{10} \frac{8 * v_{div}}{2 * \sqrt{2} * stdev}$), pkpk/stdev.
5. Check if the SNR and pkpk/stdev are in the limited range shown in Table 5.
6. Check the other analog channels in the same way as steps 1 to 5.
7. Set the oscilloscope Volts/Div to the others in the table above, and repeat the steps 3 to 5.

5.9 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, 50Ω, and 1MΩ. The bandwidth should be verified at each coarse Volts/DIV, except for 1mV/div and 2mv/div.

Steps:

1. Connect the selected channel of the oscilloscope to the 9500B via the active head, as shown in Figure 9.
2. Set the oscilloscope Volts/Div to 5mV/div, the Sec/Div to 500us/div, impedance to 50 Ω.

3. Press the **Measure** button on the front panel of the oscilloscope to display Peak-Peak measurement.
4. Set waveform of the 9500B to sine, amplitude to 30mV, and impedance to 50 Ω , and set the impedance of the oscilloscope channels to 50 Ω .
5. Set frequency of the 9500B to the frequency in Table 7.

Table 7 Frequency points in the test

Scope Model	Impedance	Frequency Point (Hz)
SDS5104X	50 Ω	0.05M, 21M, 52M, 74M, 98M, 121M, 168M, 201M, 251M, 301M, 351M, 401M, 451M, 501M, 601M, 701M, 801M, 901M, 1001M, 1002M, 1201M, 1401M, 1601M, 1801M, 2001M
SDS5054X	50 Ω	0.05M, 21M, 52M, 74M, 121M, 168M, 201M, 234M, 268M, 301M, 334M, 367M, 401M, 434M, 468M, 500M, 601M, 801M
SDS5034X	50 Ω	0.05M, 21M, 52M, 74M, 121M, 168M, 201M, 234M, 268M, 301M, 316M, 331M, 351M, 371M, 451M
SDS5104X	1 M Ω	0.05M, 21M, 52M, 74M, 98M, 121M, 168M, 201M, 251M, 301M, 351M, 401M, 451M, 484M, 501M, 601M
SDS5054X	1 M Ω	0.05M, 21M, 52M, 74M, 98M, 121M, 168M, 201M, 251M, 301M, 351M, 401M, 451M, 484M, 501M, 601M
SDS5034X	1M Ω	0.05M, 21M, 52M, 74M, 98M, 168M, 201M, 251M, 301M, 351M, 401M, 501M

1. Every time the frequency is changed, it is recommended to adjust the Sec/Div to a proper value to display a complete waveform.
2. Record the Peak-Peak measurement of the waveform.
3. Set the oscilloscope Volts/Div to the setting choices, and repeat step2 to step7. Set amplitude of the 9500B to 600 mV when testing at 100 mV/div, and set to 1.2 V when testing at 200 mV/div.
4. Check other channels in the same way as step1 to step 8.
5. Disconnect the test connection
6. After the test, calculate the dB value at every frequent point. Check if the value is in the limited range inTable 8.

Table 8Limited Range

Scope Model	Impedance	Frequency (Hz)	Point	Range
SDS5104X	50 Ω	$\leq 98\text{M}$		(-0.5,0.5) dB
		$\leq 301\text{M}$		(-0.8,0.8) dB
		$\leq 601\text{M}$		(-1.2,1) dB
		$\leq 1001\text{M}$		(-2.5,1) dB
		$\leq 1401\text{M}$		(-15,3) dB
		$\leq 2001\text{M}$		(-44,3) dB
SDS5054X	50 Ω	$\leq 52\text{M}$		(-0.5,0.5) dB
		$\leq 168\text{M}$		(-0.8,0.8) dB
		$\leq 334\text{M}$		(-1.2,1) dB
		$\leq 501\text{M}$		(-2.5,1) dB

		$\leq 1001\text{M}$	(-45,3) dB
SDS5034X	50 Ω	$\leq 36\text{M}$	(-0.5,0.5) dB
		$\leq 118\text{M}$	(-0.8,0.8) dB
		$\leq 234\text{M}$	(-1.2,1) dB
		$\leq 351\text{M}$	(-2.5,1) dB
		$\leq 501\text{M}$	(-44,3) dB
SDS5104X	1 M Ω	$\leq 98\text{M}$	(-0.8,0.5) dB
		$\leq 121\text{M}$	(-0.8,0.8) dB
		$\leq 168\text{M}$	(-0.8,1.3) dB
		$\leq 251\text{M}$	(-0.5,1.9) dB
		$\leq 301\text{M}$	(-0.8,1.3) dB
		$\leq 351\text{M}$	(-3,0.8) dB
		$\leq 401\text{M}$	(-6,0) dB
SDS5054X	1 M Ω	$\leq 601\text{M}$	(-6,0.98) dB
		$\leq 52\text{M}$	(-1,0.5) dB
		$\leq 168\text{M}$	(-2,0.8) dB
		$\leq 301\text{M}$	(-2.5,1) dB
		$\leq 384\text{M}$	(-3,1) dB
		$\leq 501\text{M}$	(-5,1) dB
SDS5034X	1M Ω	$\leq 1001\text{M}$	(-44,3) dB
		$\leq 35\text{M}$	(-1,0.5) dB
		$\leq 118\text{M}$	(-2,0.8) dB

		$\leq 234\text{M}$	(-3,1) dB
		$\leq 351\text{M}$	(-5,1) dB
		$\leq 501\text{M}$	(-44,3) dB

5.10 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 50Ω . Test the bandwidth at 100mV/div, 200 mV/div

Steps:

1. Connect channel 1 of the oscilloscope to the 9500B via the active head, as shown in Figure 9.
2. Set the oscilloscope Volts/Div to 100mV/div, the Sec/Div to 50ms/div, and set the BW Limit button to 20MHz.
3. Press the **Measure** button on the front panel of the oscilloscope to display Peak-Peak measurement.
4. Set the amplitude of the 9500B to 600mV, and impedance to 50Ω , and set the impedance of the oscilloscope channels to 50Ω .
5. Set frequency of the 9500B to the frequency in Table 9.

Table 9 Frequency points in the test

Frequency Point (Hz)

1k,10k,100k,1M,10M,12M,14M,16M,18M,20M,22M,24M,26M,28M,30M

1. Every time the frequency is changed, it is recommended to adjust the Sec/Div to a value that displays a complete waveform.
2. Record the Peak-Peak measurement value of the waveform.

Table 10 Limited Range

Scope Model	Impedance	Frequency Point (Hz)	Range
SDS5104X/SDS5054	50 Ω	$\leq 12\text{M}$	(-2,1.15) dB
		$\leq 14\text{M}$	(-2.4,2) dB
		$\leq 20\text{M}$	(-3.4,2) dB
		$\leq 25\text{M}$	(-6,2) dB
		$\leq 30\text{M}$	(-8,2) dB

1. Calculate the dB value at the frequency point. If the value Check if the value is in the limited range.
2. Check the other channels in the same way as in step1 to step8.
3. Disconnect the test connection.

5.11 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 11 Trigger sensitivity data

Volts/Div	Frequency	Trigger Range
100 mV/div	10 MHz	9.9~10.1 MHz
100 mV/div	bandwidth	bandwidth \pm 1%

Steps:

1. Connect the selected channel of the oscilloscope to the 9500B, as shown in Figure 9.
2. Set the oscilloscope Volts/Div to 100mV/div, Sec/Div to 50ns/div, coupling mode to AC.
3. Set impedance of the 9500B to 50 Ω , frequency to 10 MHz, and amplitude to 80 mV, and set the impedance of the oscilloscope channels to 50 Ω .
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 on the top right

of the screen, and check that it is in the specified trigger range listed in Table 11.

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. Set Sec/Div to 2 ns/div, then repeat steps 4 to 8.
10. Check the other channels in the same way as steps 1 to 9.
11. Disconnect the test connection.

The steps above are for testing the trigger level when using the internal trigger using the analog input channels. The following steps are used to test the external trigger sensitivity.

Steps:

1. Connect the external trigger channel of the oscilloscope to the 9500B, as shown in Figure 12.
2. Set the impedance of the 9500B to 50 Ω , amplitude to 200 mV, frequency to 10MHz.
3. Set the trigger source of the oscilloscope to EXT, trigger slope to Positive.
4. Press Trigger Level knob to set the level to the center of the waveform.
5. Adjust the trigger level within the range of [-100 mV, 100 mV] to achieve a stable waveform and then record the (hardware-measured) frequency, located at the top right area of the screen.

6. Check if the frequency is within the specified trigger range listed in Table 10.
7. Set trigger slope to Negative, repeat steps 4 to 6.
8. Set frequency of the 9500B to the oscilloscope's bandwidth frequency, amplitude to 300 mV. Repeat steps 3 to 7. In step 5, the range changes to [-150 mV, 150 mV].
9. Set frequency of the 9500B to 10 MHz, amplitude to 1 V.
10. Set the trigger source of the oscilloscope to EXT/5, trigger slope to Positive.
11. Press Trigger Level knob to set the level to the center of the waveform.
12. Adjust the trigger level within the range of [-500mV, 500mV] to achieve a stable waveform and then record the hardware-measured value which is on the top right of the screen.
13. Check if the frequency is within the specified range listed in Table 13.
14. Set the trigger slope to Negative, repeat steps 11 to 13.
15. Set the frequency of the 9500B to the oscilloscope's bandwidth frequency, amplitude to 1.5 V. Repeat steps 11 to 14. In step 6, the range changes to [-750 mV, 750 mV].
16. Disconnect the test connection.

5.12 To Verify Channel Skew

This test checks the skew between two analog channels. In this test, the impedance of both the 9500B and the oscilloscope should be set to 50 Ω .

Channel Skew Limit: $\text{abs}(T@L) \leq 150 \text{ ps}$

Steps:

1. Connect two selected channels of the oscilloscope to the 9500B shown as in Figure 13.
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 50Ω , frequency to 1 kHz, and amplitude to 0.6 V.
4. Set the oscilloscope Volts/Div to 100mV/div.
5. Set the oscilloscope Sec/Div to 2ns/div, trigger source is the selected channel.
6. Press the Measure button on the front panel of the oscilloscope to display Skew measurement.
7. Check if the result is in the limited range above.
8. Disconnect the test connection.
9. Check other channels in the same way as steps 1 to 7.

5.13 To Verify Input Impedance

This test checks the input impedance of all analog channels and the ext trigger channel with different coupling modes and vertical scales (100 mV/div, 200 mV/div and 2 V/div).

Table 12 Input Impedance data

Channel	Coupling and impedance type	Impedance Range	
CH	AC/1 M Ω	0.1V/div	1176000~1224000 Ω
		0.2V/div, 2 V/div	980000~1020000 Ω
	DC/1 M Ω	980000~1020000 Ω	
	DC(AC)/50 Ω	49.15~50.85	
Ext	1 M Ω	980000~1020000 Ω	
	50 Ω	49.15~50.85	

Steps:

1. Connect the selected channel of the oscilloscope to the 9500B, as shown in Figure 10.
2. Set the oscilloscope Volts/Div to 100 mV/div, coupling mode of the channel to AC.
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 DC. Record the reading displays on the screen of the 9500B.
5. Check if the impedance is within the specified range in Table 12.
6. Test at 2 V/div and 200mV/div, using the same procedure as steps 2

- to 5.
7. Check the other analog channels in the same way as steps 1 to 6.
 8. Disconnect the test connection

When checking the EXT trigger channel, it is the same as checking analog channel. Record the reading displays on the screen of the 9500B, and check to verify it is within the specified range in Table 12.

6 Disassembly Procedures

This chapter describes how to remove major parts from the SDS5000X 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 power supply on and without protective covers. Only qualified personnel with proper tools and protection should perform the maintenance. Perform the maintenance with the power cord disconnected whenever possible.

WARNING

AVOID ELECTRICAL SHOCK



Hazardous voltages exist on the power supply module and LCD module. 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 lose of functionality. As 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 power on is not allowed, or damage to the components may occur.

6.2 Tools Lists

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

- Multifunction 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 Rear Cover and Knobs

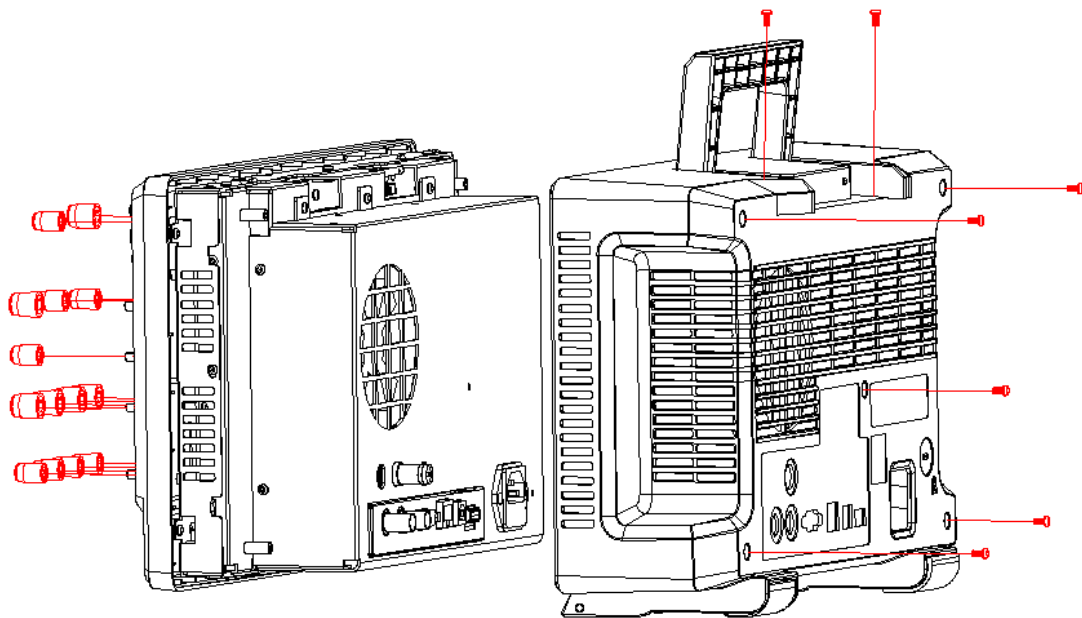


Figure 14 To remove the rear cover and knobs

Steps:

1. Remove each front-panel knobs by firmly grasping the knob (with pliers protected by a soft cloth to prevent scratches, if necessary) and pull it away from the front panel.
2. Remove the seven PMW3*8 screws on the rear cover.

3. Lift the rear cover up and off carefully.

6.3.2 To Remove the Rear Metal Module

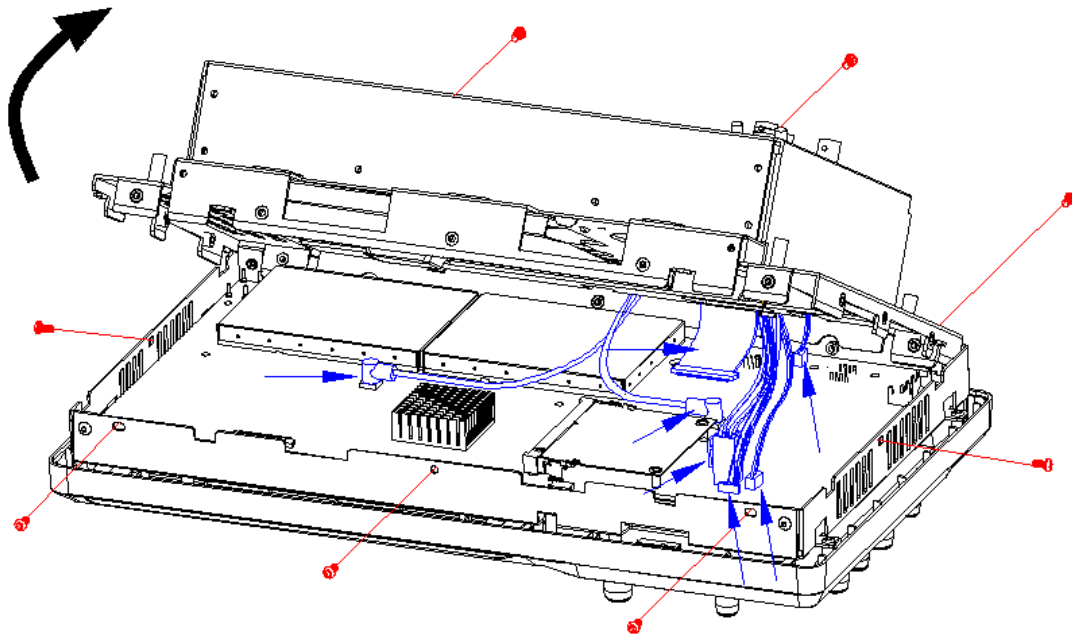


Figure 15 To remove the rear metal module

Steps:

1. Remove the eight PM3*6 screws outside of the rear metal module.
2. Unplug the connecting cable from the mainboard.
3. Remove the rear metal module.

6.3.3 To Remove the Power Supply Module and Fan

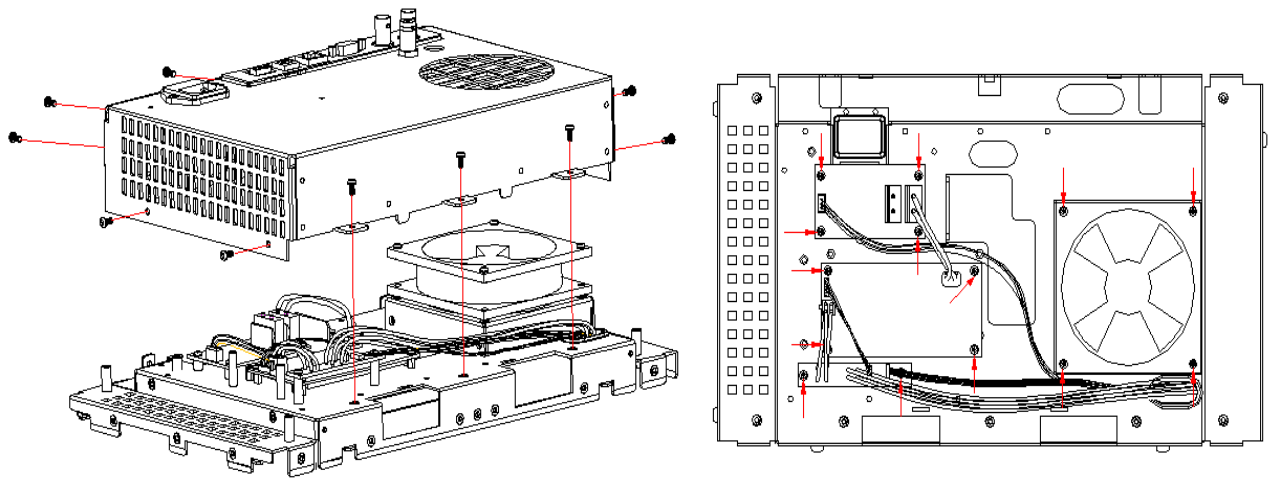


Figure 16 To remove the power supply module and Fan

Steps:

1. Remove the ten PM3*6 screws outside the metal rear cover.
2. Remove the metal rear cover.
3. Unplug the connecting cable from the power module.
4. Remove the ten screws on the power supply module (Six PM3*6 screws, four PMW3*6 screws).
5. Remove the power supply module.
6. Remove the four KM3*32 screws and nuts on the fan and remove the fan.

6.3.4 To Remove the Front Panel and Rubber Keypad

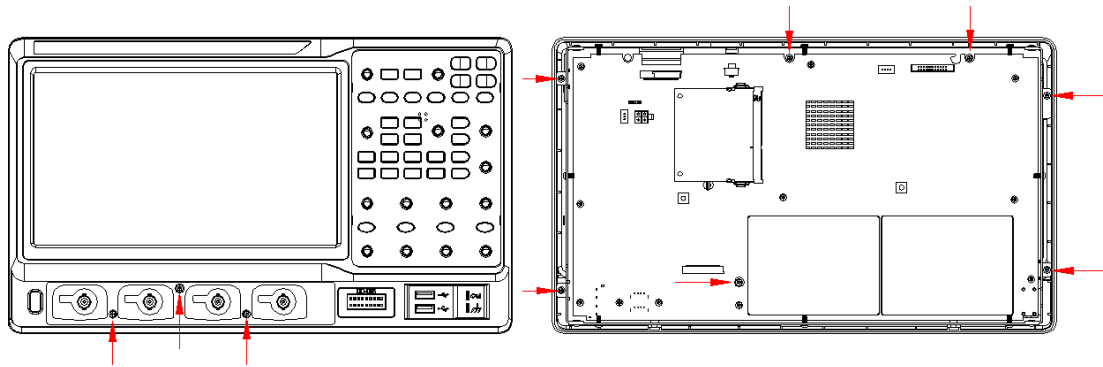


Figure 17 To remove the front panel and rubber keypad

Steps:

1. Place the oscilloscope back-side down on a soft surface such as an anti-static mat.
2. Remove the three PM3*6 screws on the front of the panel.
3. Remove the seven PB3*6 screws on the back of the panel.
4. Remove the front panel and rubber keypad.

6.3.5 To Remove the Keyboard and Probe Interface Board

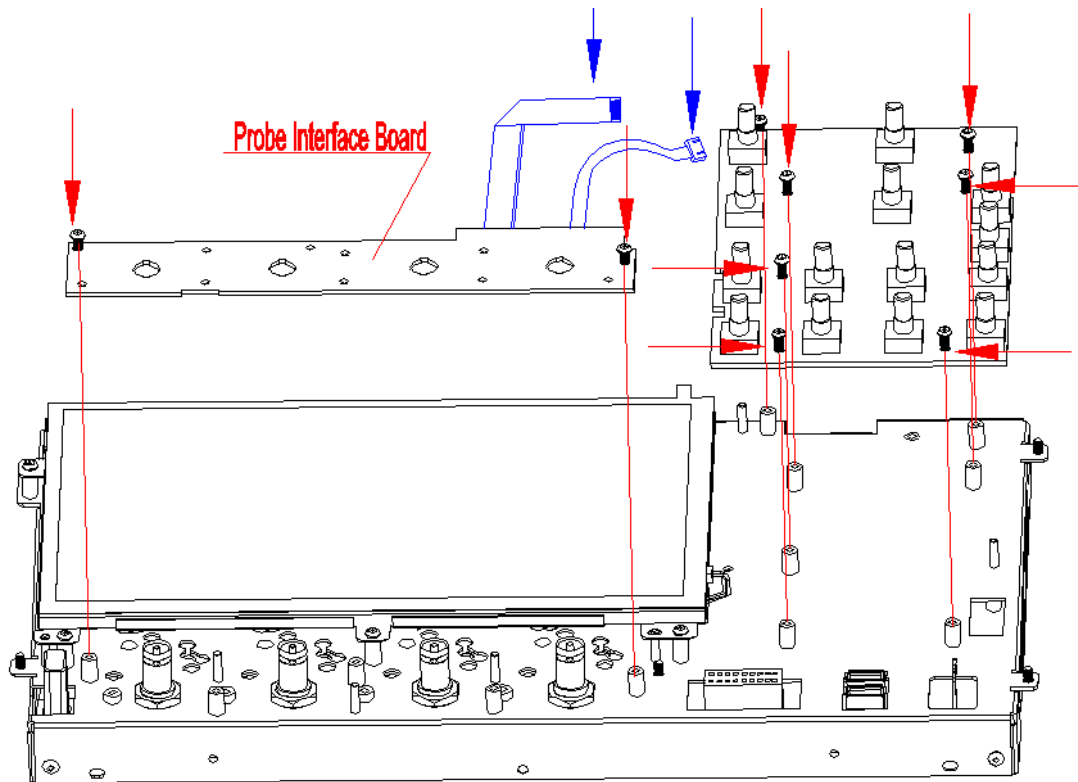


Figure 18 To remove the keyboard and probe interface board.

Steps:

1. Remove the seven PM3*6 screws on the keyboard.
2. Disconnect the cable between the probe interface board and the keyboard.
3. Remove the keyboard.
4. Disconnect the cable between the mainboard and probe interface board.
5. Remove the two PM3*6 screws on the probe interface board.
6. Remove the probe interface board.

6.3.6 To Remove the Acquisition board

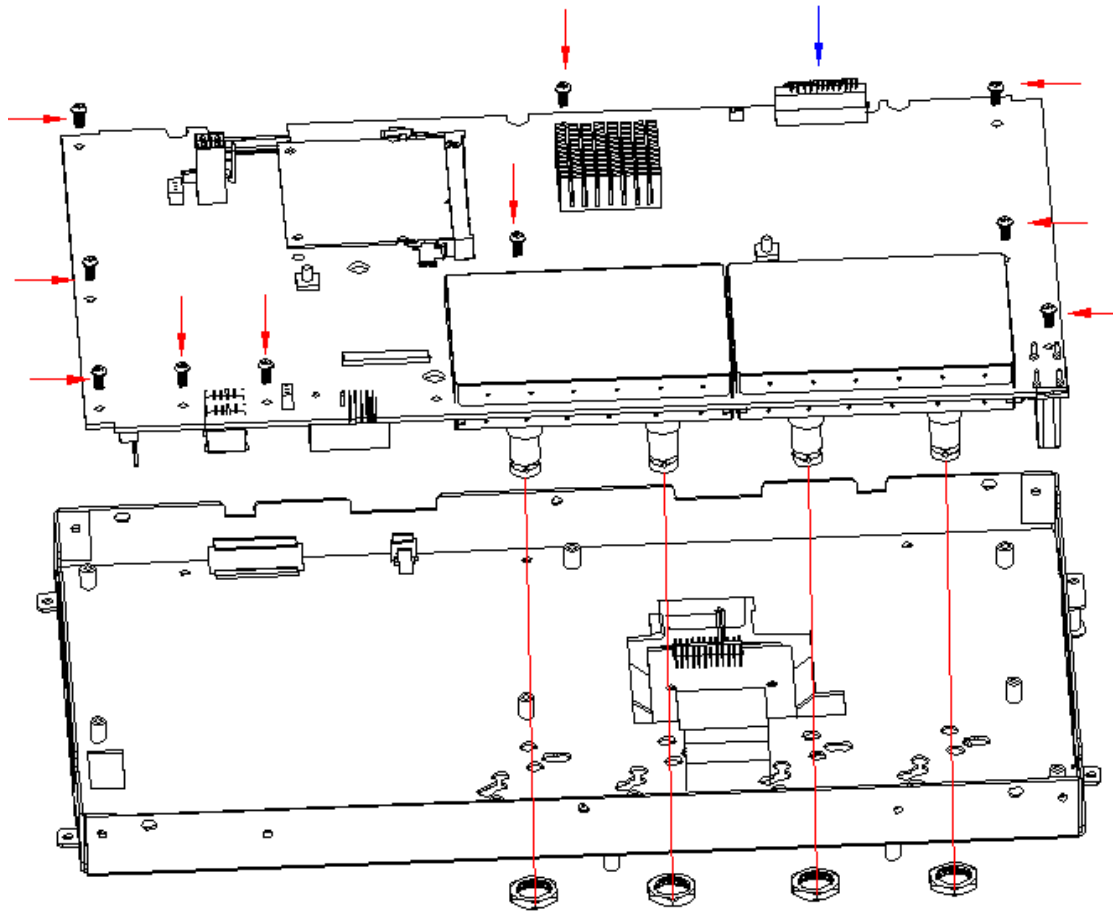


Figure 19 To remove the acquisition board

Steps:

1. Disconnect the cable between the Acquisition board and the LCD interface board.
2. Remove the four BNC nuts and gaskets on the front side of the metal frame.
3. Remove the ten PM3*6 screws on the acquisition board.
4. Remove the acquisition board.

6.3.7 To Remove the LCD Module and LCD Interface Board

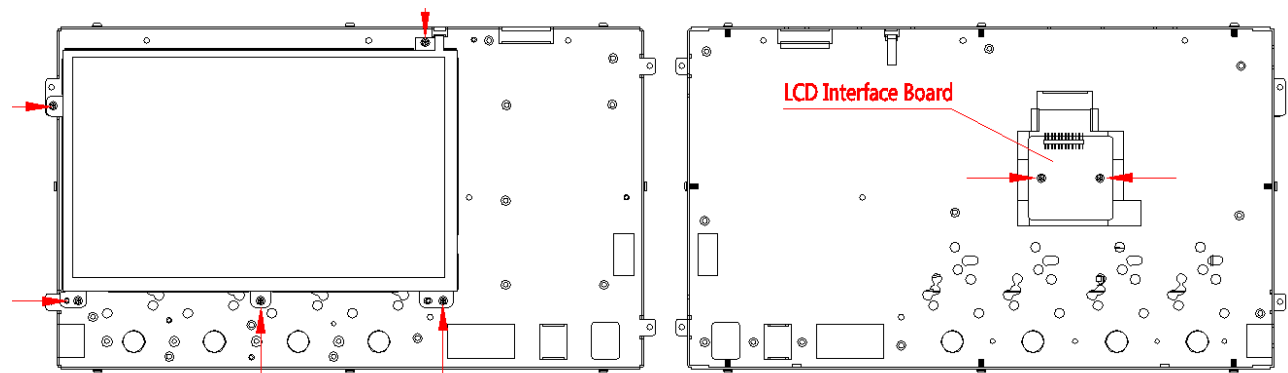


Figure 20 To remove the LCD module and LCD interface board

Steps:

1. Remove the five PM3*6 screws on the LCD module.
2. Disconnect the cable between the LCD and LCD interface board.
3. Remove the LCD module.
4. Remove the two PM3*6 screws on the LCD interface board.
5. Remove the LCD Interface board.

7 Solving General Problems

This chapter includes suggestions for solving general problems.

If there is no display

Is the light of the power button glowing?

If yes:

- Go to the **Troubleshooting** chapter and check the power supply modules and acquisition board.

If no:

- Check that the power cord is secured in the power receptacle.
- Check that the fuse in the power receptacle is not blown out.
- Check that the power source is alive.
- If there is still no light glowing, go to the **Troubleshooting** chapter and check the power supply modules and acquisition board.

If the display is stuck at the logo screen

- Remove all the USB FLASH drivers plugged into the oscilloscope and power cycle the oscilloscope to try again.

- Restart the oscilloscope and press the **math** button on the front panel for multiple times when the scope is starting up.
- Wait ten minutes to see if the oscilloscope can boot successfully. If not, contact SIGLENT for further instructions. If it is, try to upgrade to the latest firmware to solve the problem.
- If the display still stuck at the logo screen, contact SIGLENT for further instructions.

If there is no trace display

- Check the acquisition is running and trigger status is **Trig'd** or **Auto**.
- Check the horizontal time/division setting is reasonable and the acquisition time is short enough for fast display.
- Disconnect associated channel input and recall the default setup following the procedures in the User Manual.
- Turn on the associated channel again and press the Auto Setup key.
- If there is still no trace displayed, contact SIGLENT for further instructions.

If the baseline trace drift out of specification

- Check that the fan is running.
- Check that the vertical position setting is working.
- Perform self-calibration following the procedures in the User Manual.
- If self-calibration does not work, contact SIGLENT for further instructions.

If there is an unexpected trace when no input connected to channel input

- Power cycle the oscilloscope.
- Upgrade to the latest firmware.
- Contact SIGLENT for further instructions.

8 Troubleshooting

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

8.1 Safety Consideration and Cautions

Only qualified personnel should perform troubleshooting procedures. Disconnect the power cord whenever possible. DO NOT try to troubleshoot if visible damage is detected on the power supply module and the acquisition board, 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. The equipment must be well-grounded during operation.

WARNING**AVOID ELECTRICAL SHOCK**

Hazardous voltages exist on the power supply module and LCD module. 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 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. Disassemble or replace 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 acquisition board.

8.2 Required Equipment

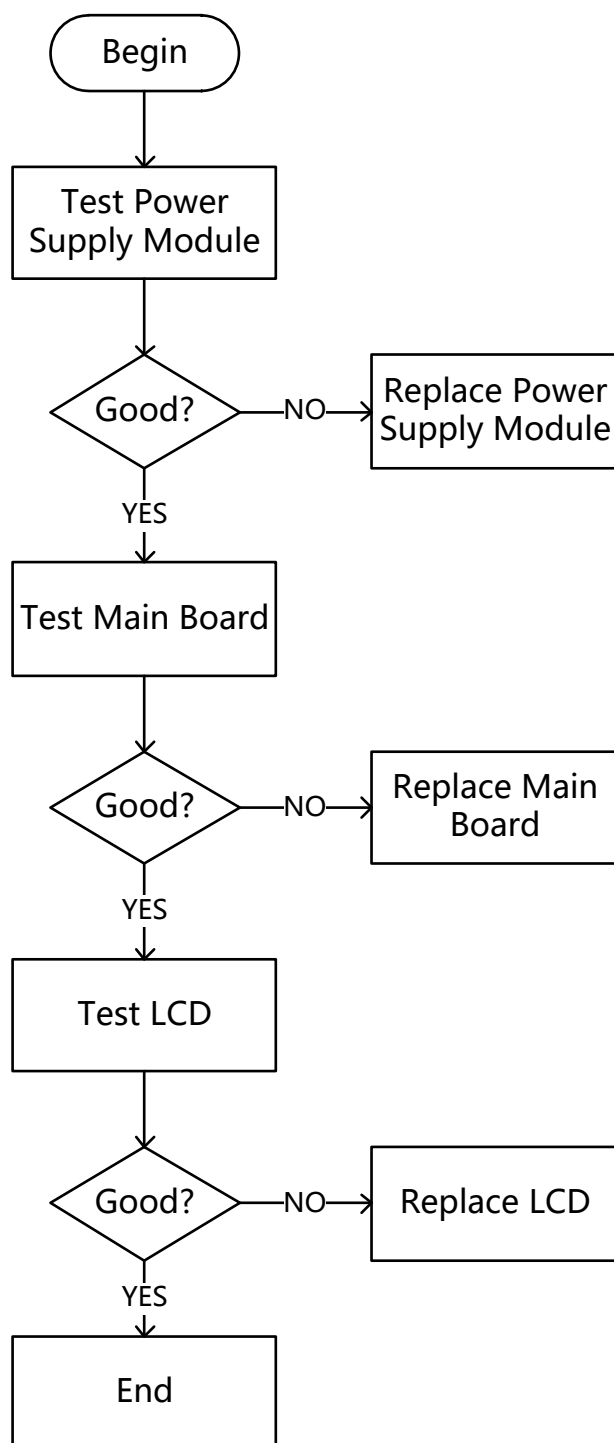
Table 13 Required Equipment

Equipment	Critical Specifications	Recommended Model
Digital Multi-meter	Accuracy $\pm 0.05\%$ 1 mV resolution	SIGLENT SDM3065X Agilent 34401A
Oscilloscope	200MHz BW 1M Ω 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 cord of the oscilloscope.
- Remove the rear plastic cover and metal cover following the instructions in chapter **Disassembly Procedures**. Note that the power supply module is on the metal frame and you do not have to remove the power supply module to check it.
- Disconnect power supply cable from the acquisition board and keep the control signal cable connected.
- Reconnect the power cord to the receptacle of the power supply module. Be cautious when working near the power supply module without the protective cover, high voltage may exist on the heat sink and other exposed conductor.
- Push the ON/OFF button to power on the power supply module.
- Test the power supply and control bus signal listed below with a multi-meter.

Table 14 Pin assignments of connectors on board

Connector	Pin Number	Direction	Designation
J24 (Power Supply)	1	Input	DC12V
	2	Input	DC12V
	3	Input	GND
	4	Input	GND
J22	1, 5	NULL	Reserved

(Control Bus)	2	Output	Vo sense+ (12V)
	3	Output	Vo sense- (GND)
	4	Output	Enable(3.3V/0V)
	6, 7	Output	GND
	8	Input	Vo Standby (5V)

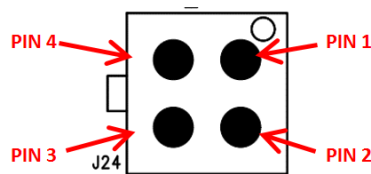


Figure 21 Pin definition of the power supply connector (J24)



Figure 22 Pin definition of the power control bus connector (J22)

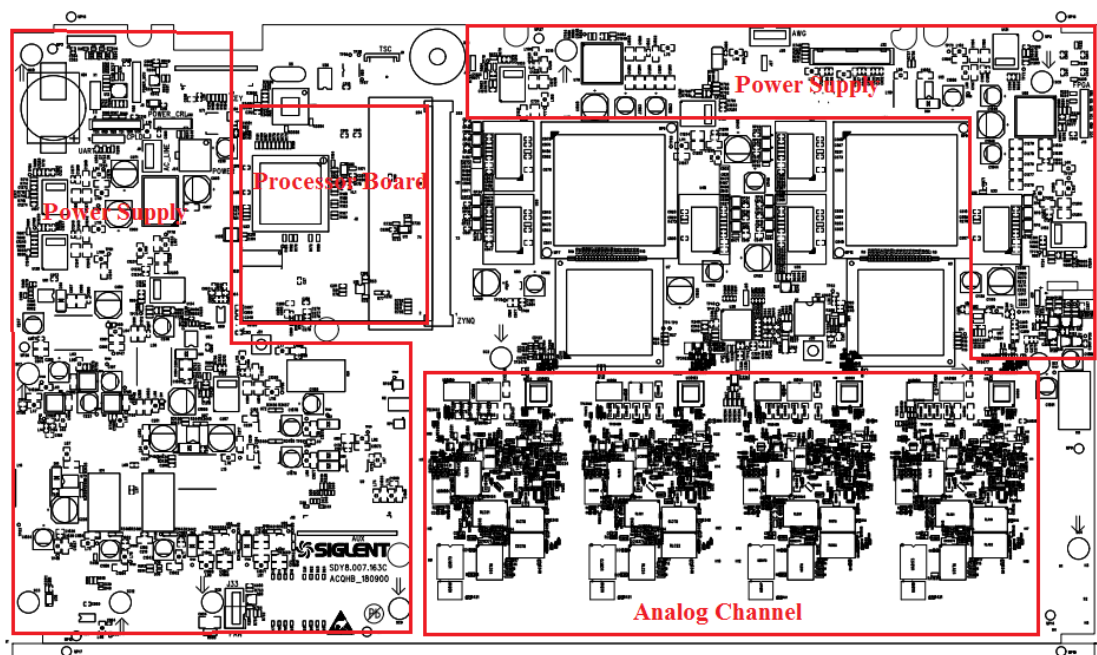
8.5 To Check the Acquisition Board

There are two different kinds of acquisition boards for the SDS5000X series.

- SDY8.007.163: Up to 1GHz bandwidth, for SDS5104X and SDS5054X
- SDY8.007.140: Up to 500MHz bandwidth, for SDS5034X only

8.5.1 Acquisition Board SDY8.007.163

8.5.1.1 Acquisition Board Drawing



- It is recommended to remove the acquisition board from the metal frame and re-assemble the power supply module to the metal frame for easy access to the test points and safety considerations. Follow the instructions in chapter **Disassembly Procedures**.
- Reconnect the power cable to the acquisition board after you have confirmed that the power supply module is in good condition.
- Power up the acquisition board by pushing the front panel power button.
- In most cases, you can hear the relays click if the acquisition board power up successfully. If you cannot hear the click or there is no sign that the acquisition 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

75/ 90

Figure 23Acquisition Board Power Supply Distribution

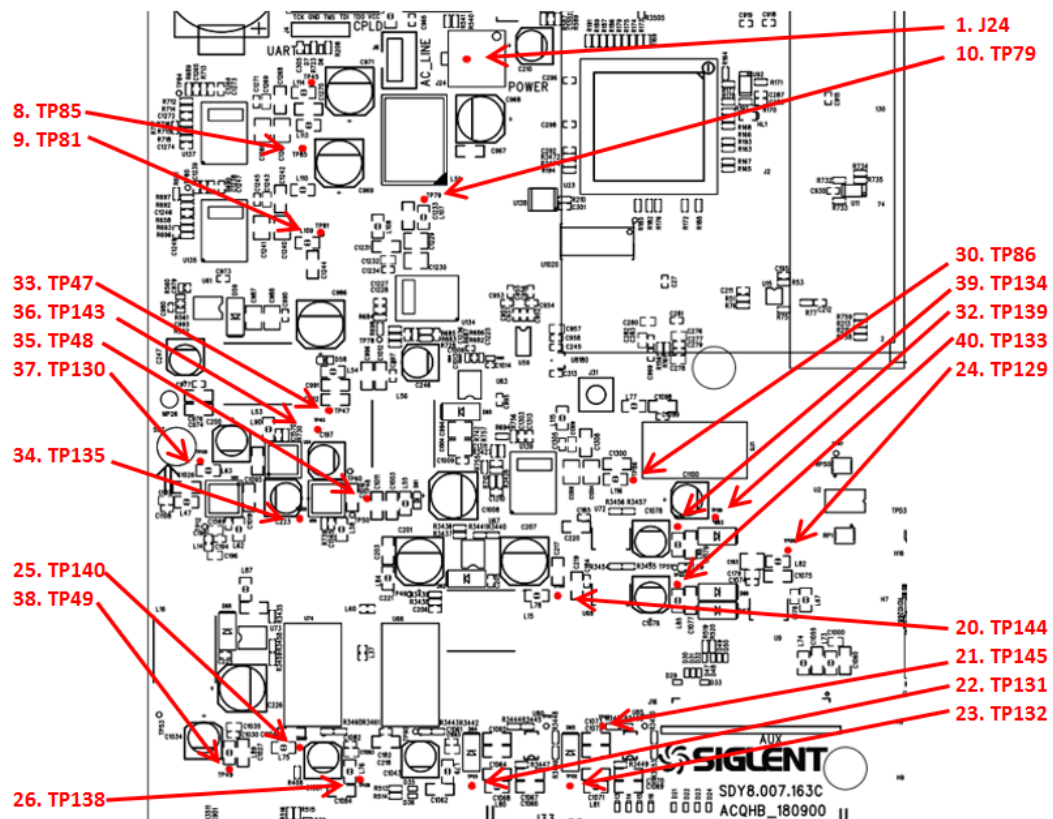


Figure 24 Test points for the Acquisition board power supplies

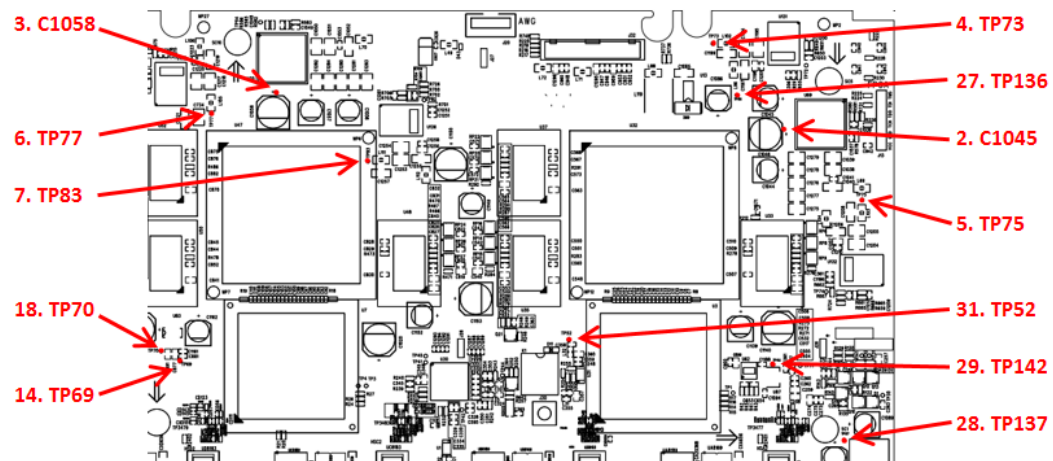


Figure 25 Test points for the Acquisition board power supplies (continued)

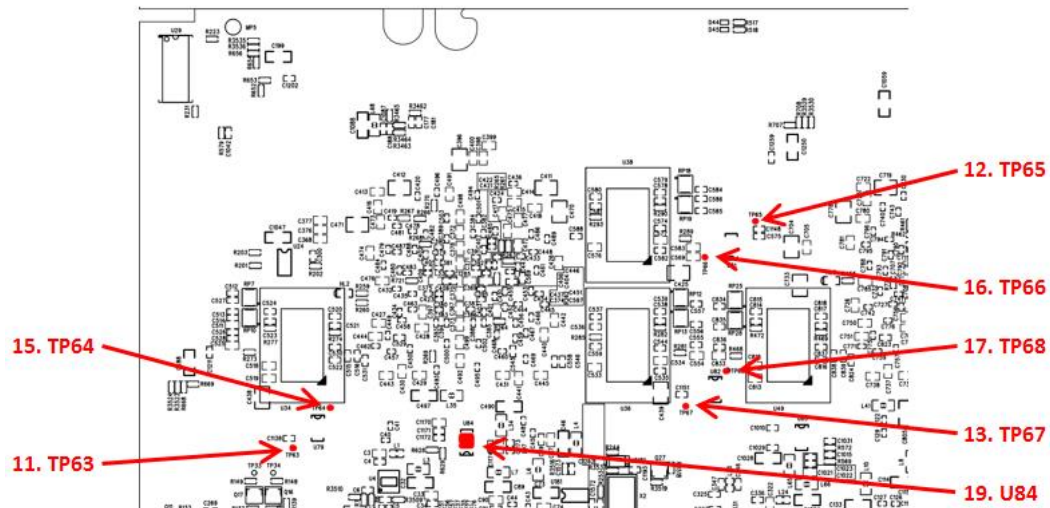


Figure 26 Test points for the Acquisition board power supplies (continued)

Table 15 Voltage parameters of the Acquisition System power supplies

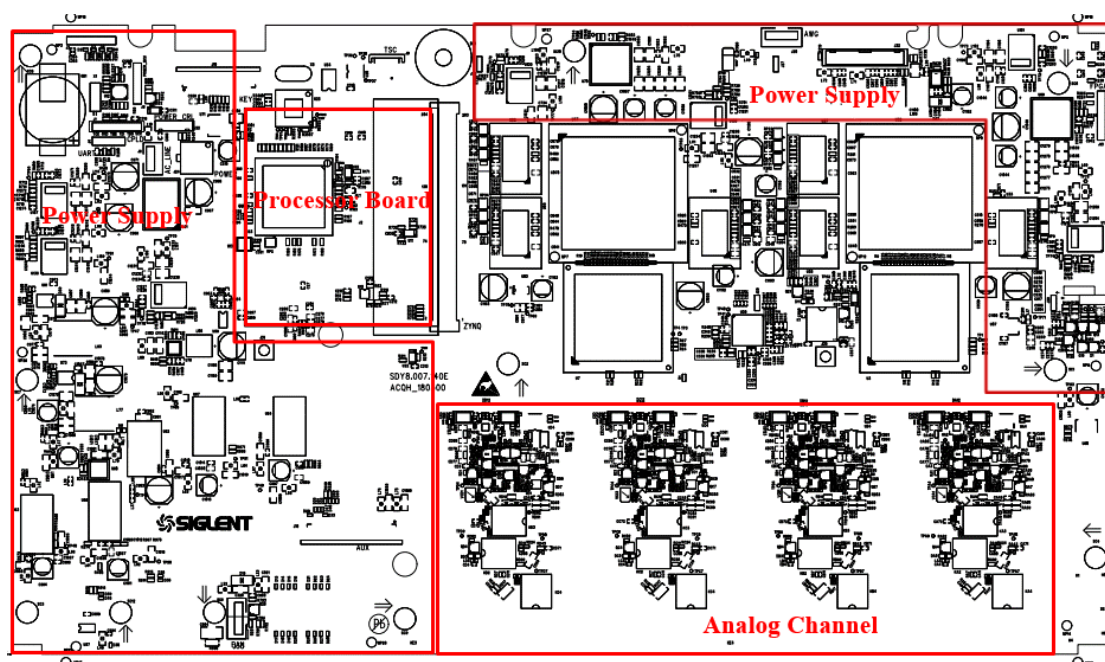
Number	Net Name	Test Point	Tolerance
1	VCC12V6	J24	$+12.6V_{DC} \pm 400mV_{DC}$
2	VCC1V0A	C1046	$+1.0 V_{DC} \pm 50mV_{DC}$
3	VCC1V0B	C1058	$+1.0 V_{DC} \pm 50mV_{DC}$
4	VCC1V8	TP73	$+1.8 V_{DC} \pm 50mV_{DC}$
5	VCC1V5A	TP75	$+1.5 V_{DC} \pm 50mV_{DC}$
6	VCC1V5B	TP77	$+1.5 V_{DC} \pm 50mV_{DC}$
7	VCC2V5	TP83	$+2.5 V_{DC} \pm 100mV_{DC}$
8	VCC3V3	TP85	$+3.3 V_{DC} \pm 100mV_{DC}$
9	VCC5V	TP81	$+5.0 V_{DC} \pm 150mV_{DC}$
10	VCC1V2	TP79	$+1.3 V_{DC} \pm 50mV_{DC}$
11	VREF_DDR_A	TP63	$+0.75 V_{DC} \pm 22.5mV_{DC}$
12	VREF_DDR_B	TP65	$+0.75 V_{DC} \pm 22.5mV_{DC}$

13	VREF_DDR_C	TP67	+0.75 $V_{DC} \pm 22.5mV_{DC}$
14	VREF_DDR_D	TP69	+0.75 $V_{DC} \pm 22.5mV_{DC}$
15	VTT_DDR_A	TP64	+0.75 $V_{DC} \pm 22.5mV_{DC}$
16	VTT_DDR_B	TP66	+0.75 $V_{DC} \pm 22.5mV_{DC}$
17	VTT_DDR_C	TP68	+0.75 $V_{DC} \pm 22.5mV_{DC}$
18	VTT_DDR_D	TP70	+0.75 $V_{DC} \pm 22.5mV_{DC}$
19	MGTAVCC	U84_PIN6	+1.0 $V_{DC} \pm 30mV_{DC}$
20	VCC7V2	TP144	+7.3 $V_{DC} \pm 200mV_{DC}$
21	VCC6V6_FE	TP145	+6.6 $V_{DC} \pm 200mV_{DC}$
22	VCC3V3_FE1	TP131	+3.3 $V_{DC} \pm 100mV_{DC}$
23	VCC3V3_FE2	TP132	+3.3 $V_{DC} \pm 100mV_{DC}$
24	AVCC5V	TP129	+5.0 $V_{DC} \pm 150mV_{DC}$
25	VCC8V4	TP140	+8.4 $V_{DC} \pm 250mV_{DC}$
26	VCC10V5_FE	TP138	+7.8 $V_{DC} \pm 250mV_{DC}$
27	VCC19V6	TP136	+19.8 $V_{DC} \pm 600mV_{DC}$
28	VCC19V_FE	TP137	+19 $V_{DC} \pm 600mV_{DC}$
29	VCC15V	TP142	+15 $V_{DC} \pm 450mV_{DC}$
30	VCC3V6	TP86	+3.6 $V_{DC} \pm 100mV_{DC}$
31	AVCC3V3	TP52	+3.3 $V_{DC} \pm 100mV_{DC}$
32	VCC3V	TP139	+3.3 $V_{DC} \pm 100mV_{DC}$
33	-6V5	TP47	-6.5 $V_{DC} \pm 200mV_{DC}$
34	AVCC-5V	TP135	-5.0 $V_{DC} \pm 150mV_{DC}$

TP43	Reference Clock Locked	LVC MOS33	High level indicates PLL locked Low level means PLL lock failed
------	---------------------------	-----------	--

8.5.2 Acquisition Board SDY8.007.140

8.5.2.1 Acquisition Board Drawings



- It is recommended that to remove the acquisition board from the metal frame and re-assemble the power supply module to the metal frame for easy access to the test points and safety considerations. Follow the instructions in chapter **Disassembly Procedures**.
- Reconnect the power cable to the acquisition board after you have confirmed that the power supply module is in good condition.
- Power up the acquisition board by pushing the front panel power button.
- In most cases, you can hear the relays click if the acquisition board powers up successfully. If you cannot hear the click or there is

no sign that the acquisition 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 acquisition board.

8.5.2.2 Check the Acquisition System power supply

Check the Acquisition System power supplies. Find and measure those test points using a multi-meter.

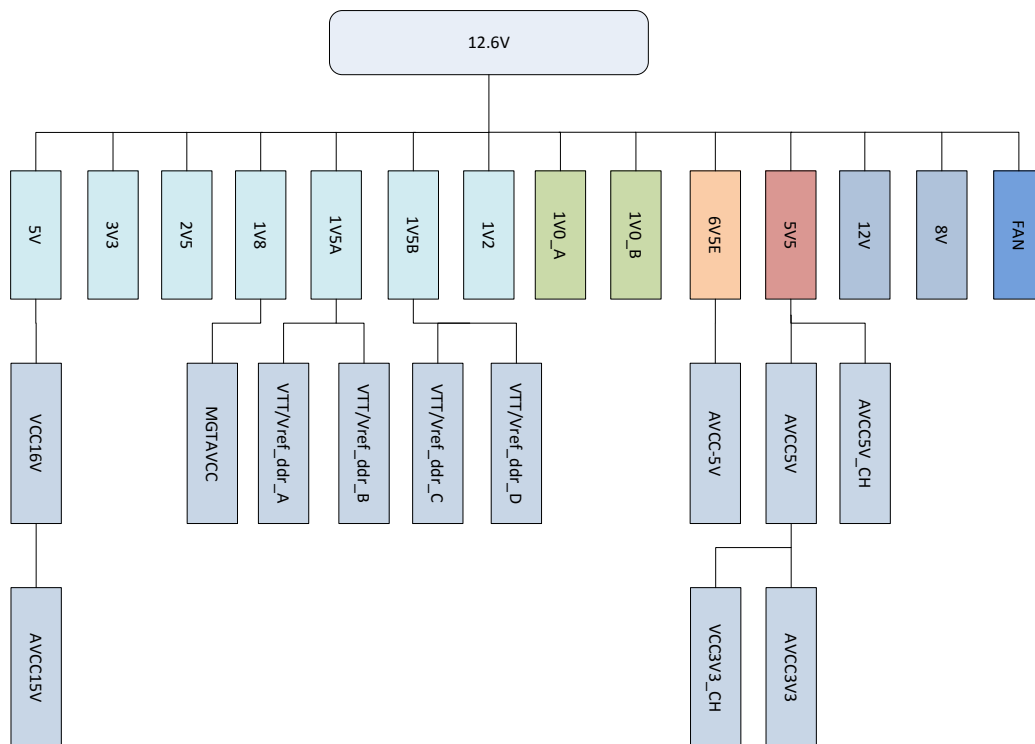


Figure 28 Acquisition Board Power Supply Distribution

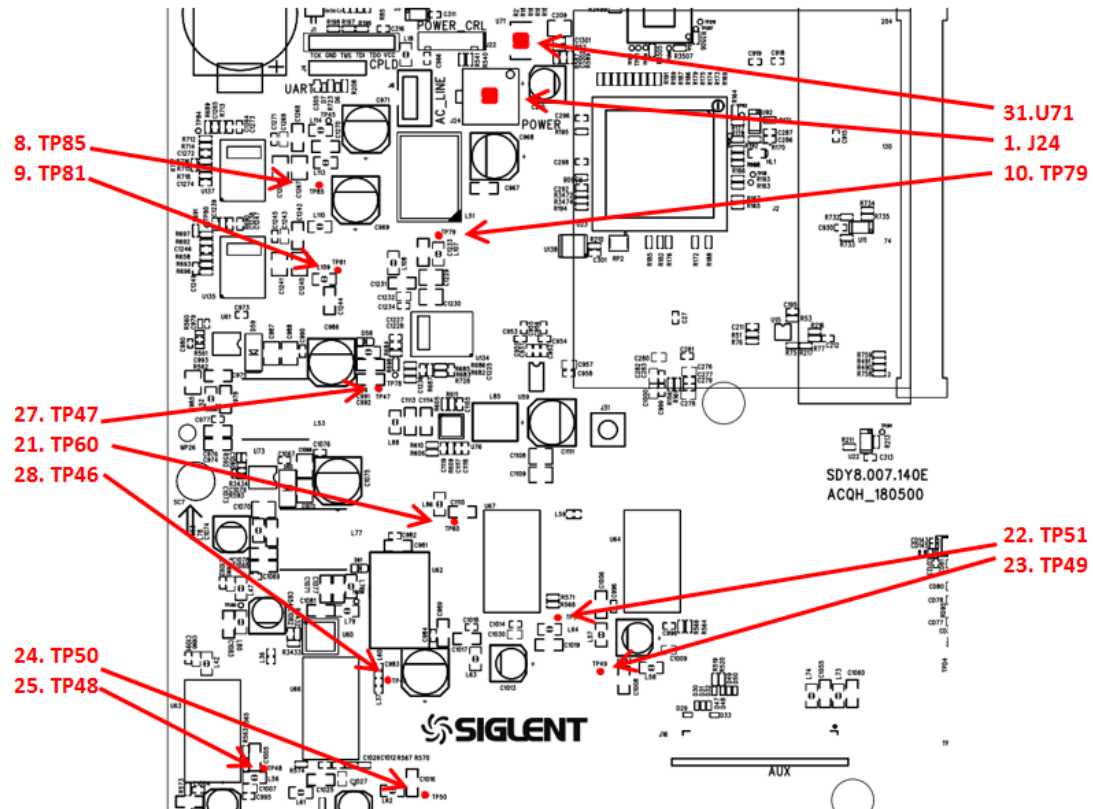


Figure 29 Test points for the Acquisition board power supplies

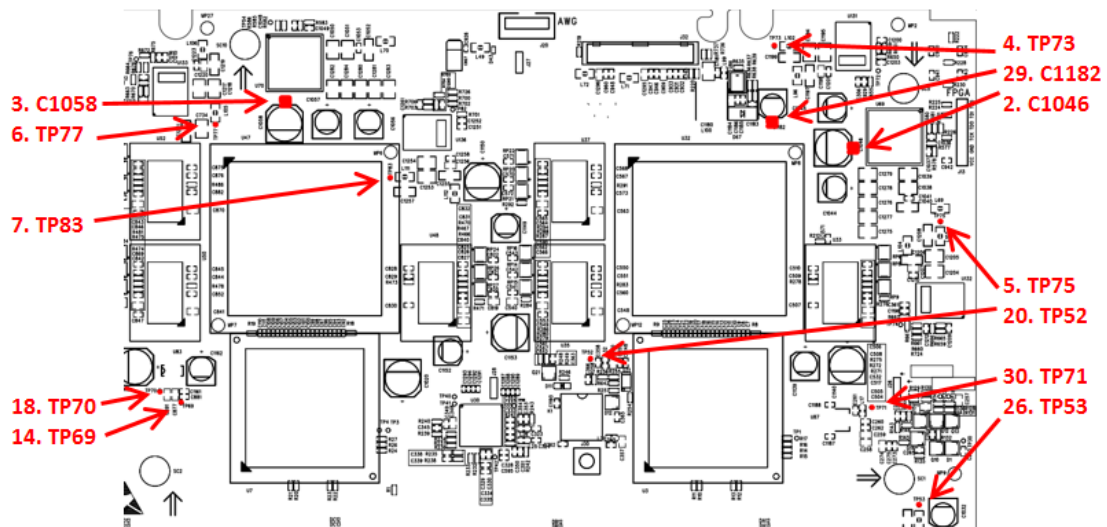


Figure 30 Test points for the Acquisition board power supplies (continued)

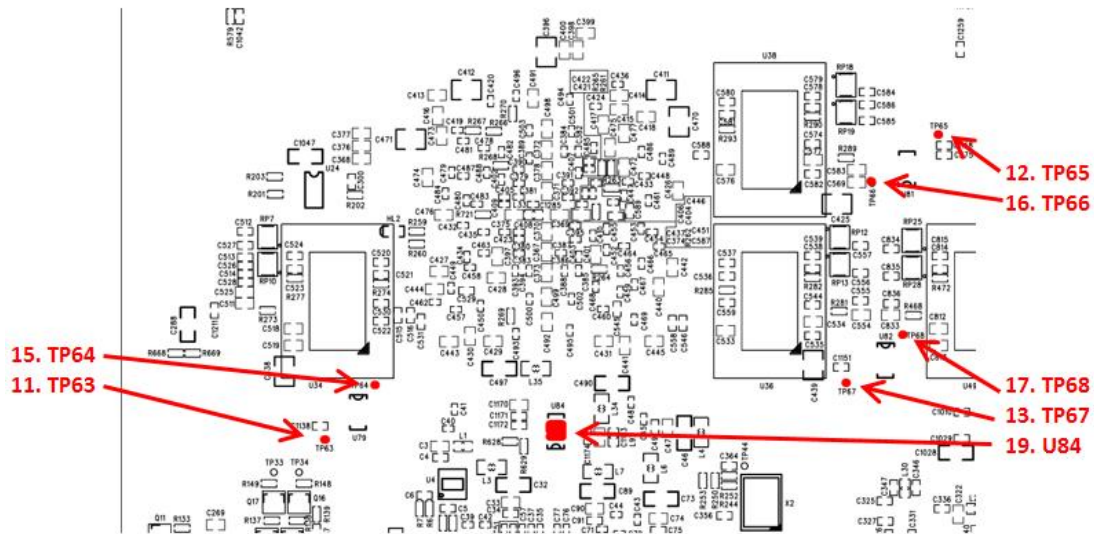


Figure 31 Test points for the Acquisition board power supplies (continued)

Table 17 Voltage parameters of the Acquisition System power supplies

Number	Net Name	Test Point	Tolerance
1	VCC12V6	J24	$+12.6V_{DC} \pm 400mV_{DC}$
2	VCC1V0A	C1046	$+1.0V_{DC} \pm 50mV_{DC}$
3	VCC1V0B	C1058	$+1.0V_{DC} \pm 50mV_{DC}$
4	VCC1V8	TP73	$+1.8V_{DC} \pm 50mV_{DC}$
5	VCC1V5A	TP75	$+1.5V_{DC} \pm 50mV_{DC}$
6	VCC1V5B	TP77	$+1.5V_{DC} \pm 50mV_{DC}$
7	VCC2V5	TP83	$+2.5V_{DC} \pm 100mV_{DC}$
8	VCC3V3	TP85	$+3.3V_{DC} \pm 100mV_{DC}$
9	VCC5V	TP81	$+5.0 V_{DC} \pm 150mV_{DC}$
10	VCC1V2	TP79	$+1.3V_{DC} \pm 50mV_{DC}$
11	VREF_DDR_A	TP63	$+0.75V_{DC} \pm 22.5mV_{DC}$
12	VREF_DDR_B	TP65	$+0.75V_{DC} \pm 22.5mV_{DC}$

13	VREF_DDR_C	TP67	$+0.75V_{DC} \pm 22.5mV_{DC}$
14	VREF_DDR_D	TP69	$+0.75V_{DC} \pm 22.5mV_{DC}$
15	VTT_DDR_A	TP64	$+0.75V_{DC} \pm 22.5mV_{DC}$
16	VTT_DDR_B	TP66	$+0.75V_{DC} \pm 22.5mV_{DC}$
17	VTT_DDR_C	TP68	$+0.75V_{DC} \pm 22.5mV_{DC}$
18	VTT_DDR_D	TP70	$+0.75V_{DC} \pm 22.5mV_{DC}$
19	MGTA VCC	U84_PIN6	$+1.0V_{DC} \pm 30mV_{DC}$
20	AVCC3V3	TP52	$+3.3V_{DC} \pm 100mV_{DC}$
21	VCC5V5	TP60	$+5.5V_{DC} \pm 150mV_{DC}$
22	AVCC5V	TP51	$+5.0V_{DC} \pm 150mV_{DC}$
23	AVCC5VCH	TP49	$+5.0V_{DC} \pm 150mV_{DC}$
24	VCC8V	TP50	$+10.0V_{DC} \pm 300mV_{DC}$
25	VCC12V	TP48	$+12V_{DC} \pm 360mV_{DC}$
26	VCC3V3CH	TP53	$+3.3V_{DC} \pm 100mV_{DC}$
27	-6V5	TP47	$-6.5V_{DC} \pm 100mV_{DC}$
28	AVCC-5V	TP46	$-5V_{DC} \pm 150mV_{DC}$
29	VCC16V	C1182	$+16V_{DC} \pm 500mV_{DC}$
30	VCC15V	TP71	$+15V_{DC} \pm 450mV_{DC}$
31	VSRART	U71_pin3	$+5.0V_{DC} \pm 150mV_{DC}$
32	VSTART_3V3	U71_pin2	$+3.3V_{DC} \pm 100mV_{DC}$

8.5.2.3 Check the clock

Check the oscillator X2. Use an oscilloscope to measure the clock signal

using the method below.

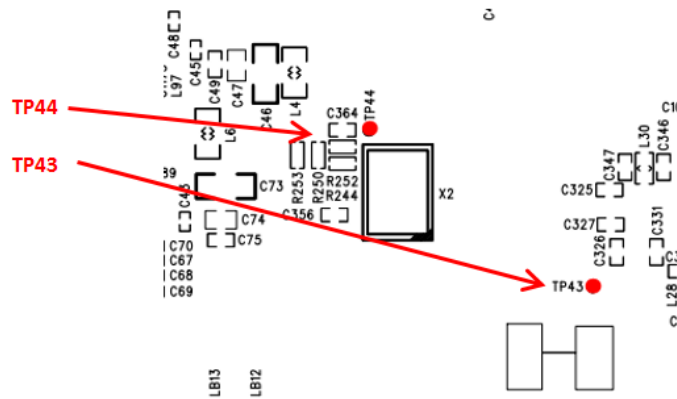


Figure 32 Test points for clock

Table 18 Clock parameters of the Acquisition System

Test Point	Clock Domain	Level	Description
TP44	PLL Reference Clock	LVC MOS33	Typical 10 MHz
TP43	Reference Clock Locked	LVC MOS33	High level indicates PLL locked Low level means PLL lock failed

8.6 To Check the Processor Board

The processor board is mounted on the acquisition board as a daughter card.

8.6.1 Check the processor power supplies

Check the power rails. Find and measure those test points using a multi-meter.

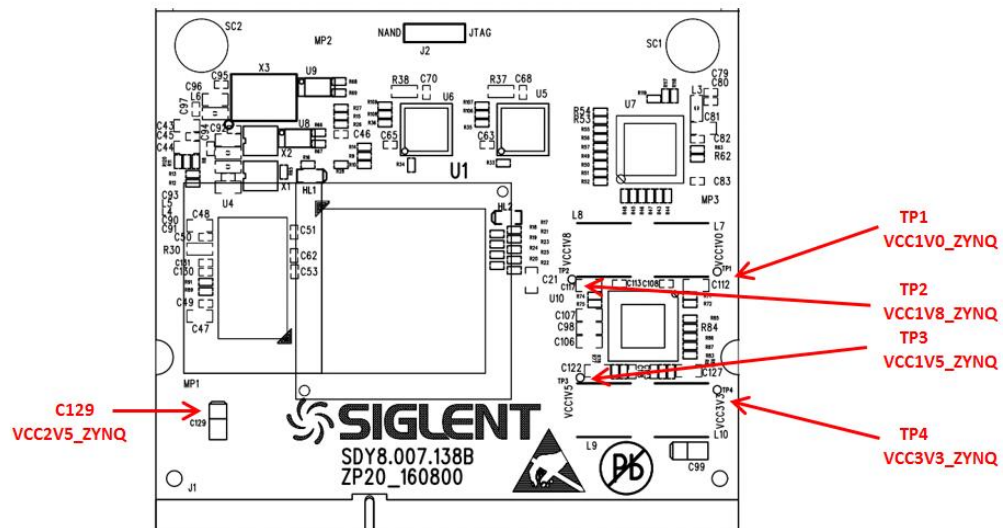


Figure 33 Test points for the processor power supplies

Table 19 Voltage parameters of the processor power supplies

Net Name	Test Point	Tolerance
DVCC1V0_ZYNQ	TP1	+1.0 $V_{DC} \pm 50mV_{DC}$
DVCC1V8_ZYNQ	TP2	+1.8 $V_{DC} \pm 50mV_{DC}$
DVCC1V5_ZYNQ	TP3	+1.5 $V_{DC} \pm 50mV_{DC}$
DVCC3V3_ZYNQ	TP4	+3.3 $V_{DC} \pm 100mV_{DC}$
DVCC2V5_ZYNQ	C129	+2.5 $V_{DC} \pm 100mV_{DC}$

8.6.2 Check the clock

Check the three oscillators X1, X2, and X3. Use an oscilloscope to measure the clock signal using the method below.

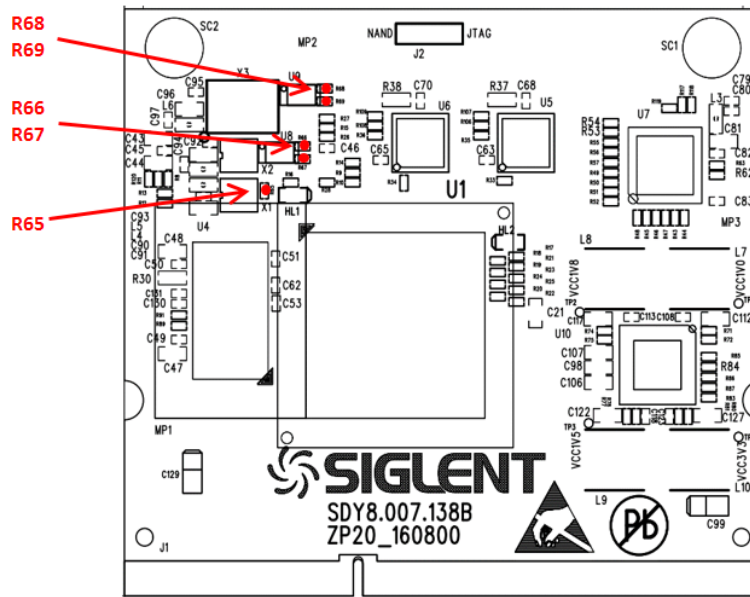


Figure 34 Test points for clock

Table 20 Clock parameters of the Processor System

Test Point	Clock Domain	Level	Frequency Tolerance
R65	Processor Reference	LVC MOS33	33.333333 MHz \pm 50PPM
R66	USB Host Reference	LVC MOS33	24.000000 MHz \pm 50PPM
R67	USB Device Reference	LVC MOS33	24.000000 MHz \pm 50PPM
R68	Ethernet Reference	LVC MOS33	25.000000 MHz \pm 50PPM
R69	Programmable Logic Reference	LVC MOS33	25.000000 MHz \pm 25PPM

8.7 To Check the LCD

- Reconnect the power cable to the acquisition board after you have confirmed that the power supply module is in good condition.

- Connect the LCD cable to the acquisition board.
- Power up the acquisition board by pushing the front panel power button.

8.7.1 To Check the LCD Power Supply

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

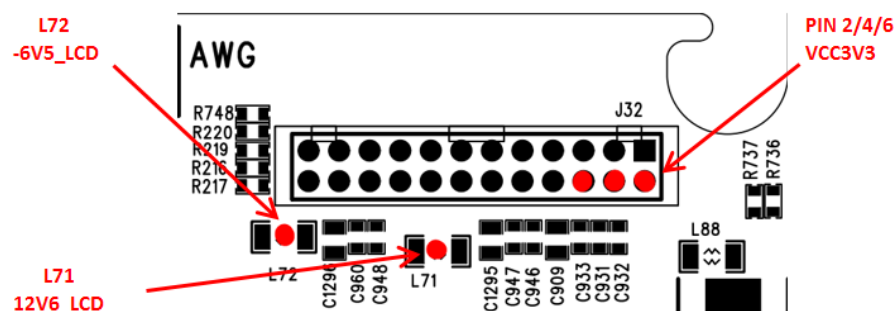


Figure 35 Test points for the LCD power supplies

Table 21 Voltage parameters of the LCD power supplies

Net Name	Test Point	Tolerance
12V6_LCD	L71	$+12.6V_{DC} \pm 10\%$
-6V5_LCD	L72	$-6.5V_{DC} \pm 10\%$
VCC3V3	J32 PIN 2/4/6	$3.3V_{DC} \pm 10\%$

If the power supply is abnormal, replace the acquisition board.

8.7.2 To Check the LCD Signal

Locate connector J32, use an oscilloscope to measure the signal using the method below.

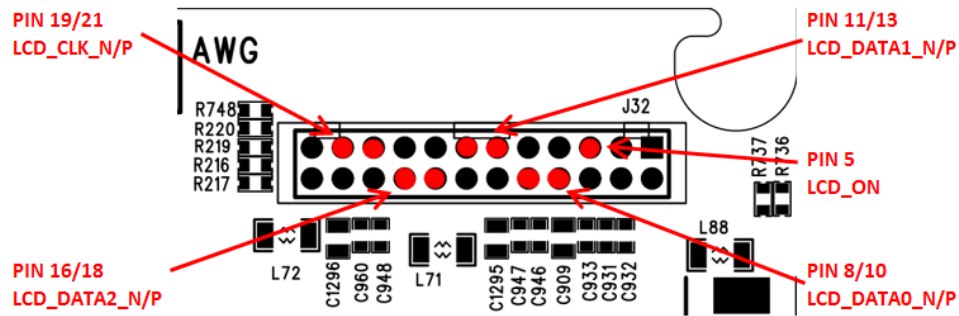


Figure 36 Test points for LCD signal

Table 22 Signal parameters of the LCD

Test Point	Signal	Level	Description
J32 PIN5	LCD_ON	LVC MOS33	PWM signal to control the brightness of the LCD. Normally 50% duty cycle.
J32 PIN8/10	LCD_DATA0_N/P	LVDS	LCD DATA signal. Always active.
J32 PIN11/13	LCD_DATA1_N/P	LVDS	LCD DATA signal. Always active
J32 PIN16/18	LCD_DATA2_N/P	LVDS	LCD DATA signal. Always active
J32 PIN19/21	LCD_CLK_N/P	LVDS	LCD reference clock, typical 50MHz

- If the signal is good, replace the LCD panel.
- If the signal is dead, replace the acquisition board.

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, function/arbitrary waveform generators, RF generators, digital multimeters, DC power supplies, spectrum analyzers, vector network analyzers, isolated handheld oscilloscopes, electronic load and other general purpose test instrumentation. Since its first oscilloscope, the ADS7000 series, 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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