Service Manual

SDS1000X/SDS1000X+ Series Digital Oscilloscope

SM0101X-E01B

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Review the following safety precautions to avoid personal injuries and prevent damages to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injuries

Use Proper Power Cord. Use only the power cord specified for this product and approved by local state.

Avoid Electric Shock. To avoid injuries or losses of life, do not connect or disconnect probes or test leads while they are connected to a voltage source.

Ground the Product. This product is grounded through the protective terra conductor of the power line. To avoid electric shock, the grounding conductor must be connected to the earth. Make sure the instrument is grounded correctly before connecting its input or output terminals.

Connect the Probe Properly. Do not connect the probe ground lead to a high voltage since it has the isobaric electric potential as ground.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markers on the instrument and check your manual for more information about ratings before connecting.

Use Proper Fuse. Use only the specified fuse.

Do Not Operate Without Covers. Do not operate this instrument with covers or panels removed.

Avoid Circuit or Wire Exposed. Do not touch exposed junctions and components when the unit is powered.

Do Not Operate With Suspected Failures. If you suspect damage occurs to this instrument, have it inspected by qualified service personnel before further operation. Any maintenance, adjustment or replacement especially to the circuits or accessories should be performed by SIGLENT authorized personnel.

Keep Product Surfaces Clean and Dry.

Do Not Operate in Wet/Damp Conditions. To avoid electric shock, do not operate the instrument in wet or damp condition.

Do Not Operate in an Explosive Atmosphere. To avoid injuries or fire hazards, do not operate in an explosive atmosphere.

Safety Terms and Symbols

Terms on the Product. These terms may appear on the product:

DANGER: Indicates an injury or hazard that may immediately happen.

WARNING: Indicates an injury or hazard may be accessible potentially.

CAUTION: Indicates damage to the instrument or other property may occur.

Symbols on the Product. These symbols may appear on the product:


Hazardous Voltage
Refer to Instructions
Protective Earth Terminal
Chassis Ground
Test Ground

Contents

General Features

General Features

SDS1000X Series Super Phosphor Oscilloscopes are available in two bandwidths, 100 MHz and 200 MHz, a sample rate of 1 GSa/s, and a standard record length of 14 Mpts. The most commonly used functions can be accessed with its user-friendly one-button design.

The SDS1000X series employs a new generation of SPO technology. With excellent signal fidelity, background noise is lower than similar products in the industry. The SDS1000X has a minimum vertical input range of 500uV/div, an innovative digital trigger system with high sensitivity and low jitter, and a waveform capture rate of 40,000 frames/sec. It also employs not only the common 256-level intensity grading display function but also a color temperature display mode not found in other models in this class. Siglent's new oscilloscope offering supports multiple powerful triggering modes including serial bus triggering and decoding. History waveform recording and sequential triggering allow for extended waveform records to be captured, stored, and analyzed. Add an impressive array of measurement and math capabilities, options for an integrated 25 MHz arbitrary waveform generator, as well as serial decoding, and the features and high-performance of the SDS1000X oscilloscopes cannot be matched at anywhere at this price.

Table 1 General features

Model	Bandwidth	Sampling Rate	Memory Depth	AWG
SDS1052X	50MHz	1GS/s	14Mpts	24kpts
SDS1072X	70MHz	1GS/s	14kpts	24kpts
SDS1072X+	70MHz	1GS/s	14kpts	24kpts

SDS1102X	100MHz	1GS/s	14kpts	24kpts
SDS1102X+	100MHz	1GS/s	14kpts	24kpts
SDS1202X	200MHz	1GS/s	14kpts	24kpts
SDS1202X+	200MHz	1GS/s	14kpts	24kpts

- 200MHz, 100MHz bandwidth models
- Real-time sampling rate up to 1GSa/s
- Record length of 14Mpts
- Waveform capture rate up to 40,000 wfs/s
- New generation of SPO technology
- Supports 256 intensity grading and color temperature display
- Intelligent trigger: Edge, Pulse, Window, Runt, Interval, Time out (Dropout), Pattern
- Serial bus triggering and decode, supports protocols IIC, SPI, UART, RS232,CAN,LIN
- Video trigger, supports HDTV
- Low background noise, supports 500μV / div to 10V / div voltage scales
- 10 types of one-button shortcuts, supports Auto Setup, Default Setup, Cursor, Measure, Roll, History, Persist, Clear Sweep, Zoom and Print
- Segmented acquisition (Sequence) mode, the maximum record length can be divided into 1000 segments, according to trigger conditions set by the user, with a very small dead time segments to capture qualifying event
- History waveform record (History) function, the maximum recorded waveform length is 80,000 frames
- 36 automatic measurement function, supports statistics calculations, Gating measurement, Math measurement, History measuring, Ref measurement
- Waveform math function (FFT, addition, subtraction, multiplication, division,

integration, differentiation, square root)

- High Speed hardware based Pass/ Fail function
- 25MHz DDS arbitrary waveform generator, built-in 10 kinds of waveforms (SDS1000X-S models)
- Large 8 inch TFT-LCD display with 800 * 480 resolution, Abundant interfaces: USB Host, USB Device (USBTMC), LAN (VXI-11), Pass / Fail, Trigger Out
- Support SCPI remote control commands
- Supports Multi-language display and embedded online help

Prepare Information

Before doing performance verifying or procedure adjusting, you should master the following operations to make the oscilloscope work in a good state or deal with some simple functional problems. The following contents are included in this chapter:

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

For more detailed information about oscilloscope operation, please refer to the Quick Start.

Functional checking

This functional checking covers three kinds of checks, by which you can verify whether the oscilloscope is working correctly.

Power-on Inspection

The normal operating voltage for SDS1000X+ series digital oscilloscope is in range of 100-240VRMS with frequency from 50Hz/60Hz/440Hz. Connect the power line to the socket on the rear panel of the oscilloscope.

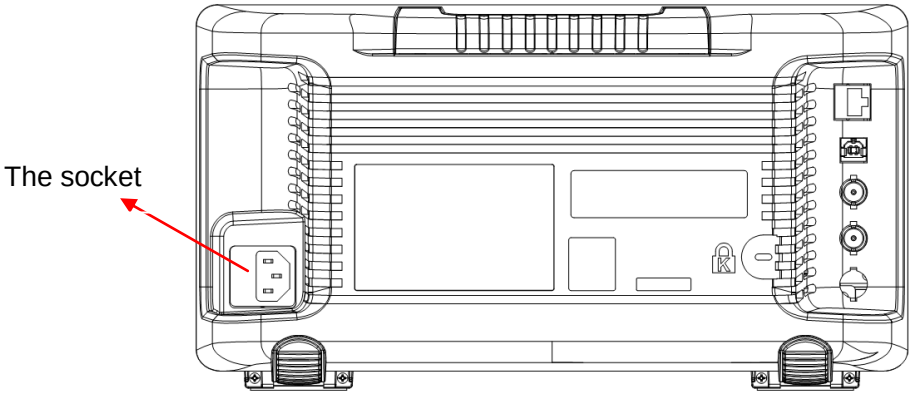


Figure 1 Connect power line

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

Press the power-on button located at the lower left corner of the front panel and some keys will be lighted for about 6 seconds simultaneously until the boot screen appears. Then the oscilloscope begins to perform its power-on tests automatically, after that you can press the DEFAULT SETUP button to recall the factory default settings.

Default Setup

When you press DEFAULT SETUP button, the oscilloscope displays waveforms of CH1 and removes waveforms of the other channels.

Table 2 Default settings

Horizontal	
T/div	1μS/div
Delay	0 S
Zoom	Off
Format	Y-T
Vertical	
Channel on/off	CH1

V/div	1 V/div
Offset	0 V
Coupling	DC
BW Limit	Full
Adjust	Coarse
Probe	1X
Impedance	1 MΩ
Unit	V
Invert	Off
Acquire	
Acquisition	Normal
Sinx/x	Sinx
Mem Depth	14 Mpts
Trigger	
Type	Edge
Source	CH1
Slope	Rising
Holdoff	Off
Coupling	DC
Noise Rejest	Off
Mode	Auto
Display	
Type	Vectors
Color	Off
Persist	Off
Grid	
Intensity	50%
Brightness	40%
Transparence	50%
Cursor	
Mode	Off
Type	X1

Source	CH1
X1	-3.5μs
X2	3.5μs
Save/Recall	
Type	Setups
Save To	Internal
Setup	NO.1
Utility	
IO Set	
USB Device	USBTMC
Aux Output	Trig Out
Sound	
Sound	On
Pass/Fail	
Enable Test	Off
Source	CH1
Operate	Off
Mes Display	Off
X Mask	0.2
Y Mask	0.2
Location	Internal
Fail To Stop	Off
Output	
System Setup	
Quick-Cal	Off
Screen Saver	30min
Math	
Operate	Off
+	
Source A	CH1
Source B	CH1
Invert	Off

V/div	1.00 V/div
offset	0V
-	
Source A	CH1
Source B	CH1
Invert	Off
V/div	1.00 V/div
offset	0 V
*****	
Source A	CH1
Source B	CH1
Invert	Off
V/div	1.00 V^2/div
offset	0 V^2
/	
Source A	CH1
Source B	CH1
Invert	Off
V/div	1.0/div
offset	0
FFT	
Source	CH1
Window	Hanning
Horizontal	1X
Vertical Scale	20 dBVrms
Display	Split
Horizontal Scale	100MHz
d/dt	
Source	CH1
Vertical Scale	1.00 (MV/S)/div
Vertical Offset	0
dx	0.2 div
∫dt	
Source	CH1
Offset	0
Vertical Scale	1.00 μVS/div

Vertical Offset	0
√	
Source	CH1
Vertical Scale	1.00 $V^{1/2}$/div
Vertical Offset	0
REF	
Source	CH1
Location	REF A
Display	Off
Decode	
Serial 1	
Serial	I2C
Display	Off
List	Off
Serial 2	
Serial	SPI
Display	Off
List	Off
I2C	
SCK	CH1
Threshold	1.60V
SDK	CH2
Threshold	1.60V
Address	7 位
SPI	
CLK	CH1
Threshold	1.60V
Edge Select	Rising
MISO	CH2
Threshold	1.60V
MOSI	CH1
Threshold	1.60V
CS Type	CS
CS	CH2

Idle Level	Low
Bit Order	LSB
Data Length	8
UART/RS232	
RX	CH1
Threshold	1.60V
TX	CH2
Threshold	1.60V
Bound	9600
Parity Check	None
Stop Bit	1
Idle Level	Low
Data Length	8
CAN	
CAN-H	CH1
Threshold	1.60V
CAN-L	CH2
Threshold	1.60V
Bound	100kb/S
Decode Source	CAN_H
LIN	
Source	CH1
Threshold	1.60V
Baud	2400
Wave Gen	
Function	Off
Wave Type	Sine
Output Load	High-Z
Sine	
Frequency	1 KHz
Amplitude	4 Vpp
Offset	0 Vdc
Square	
Frequency	1 KHz
Amplitude	4 Vpp

Offset	0 Vdc
Duty	50%
Ramp	
Frequency	1 KHz
Amplitude	4 Vpp
Offset	0 Vdc
Symmetry	50%
Pulse	
Frequency	1 KHz
Amplitude	4 Vpp
Offset	0 Vdc
Width	200μs
DC	
Offset	0.0mVdc
Noise	
Stdev	448 mV
Mean	0 mV
Cardiac	
Frequency	1 KHz
Amplitude	4 Vpp
Offset	0 Vdc
Gaus Pulse	
Frequency	1 KHz
Amplitude	4 Vpp
Offset	0 Vdc
Exp Rise	
Frequency	1 KHz
Amplitude	4 Vpp
Offset	0 Vdc
Exp Fall	
Frequency	1 KHz
Amplitude	4 Vpp
Offset	0 Vdc

Probe Compensation

It is better for you to compensate the probe at first use so as to match to the probe ratio of current input channel. Non-compensated or poorly compensated probe may cause measurement inaccuracy or error. The probe compensation steps are as follows:

1. Set the attenuation switch on the probe to 10X.

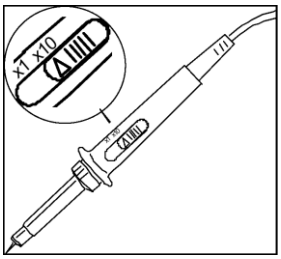
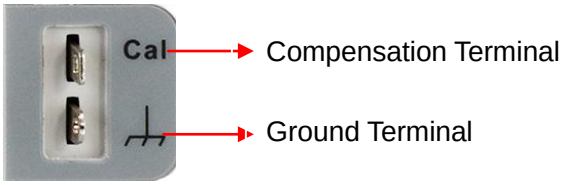


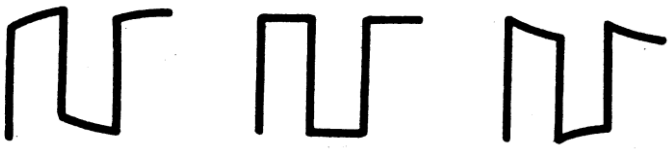
Figure 2 Set the attenuation switch

2. Connect the alligator clip of the probe to the Ground Terminal on the front panel firstly, and then use the probe to connect CH1 BNC connector and the Compensation Signal Output Terminal.



3. Press AUTO.

4. Observe waveform on the screen. The displaying should be a square waveform as shown in the figure below in normal condition:



Under Compensated	compensated correctly	over compensated

5. If the waveform does not show as “compensated correctly”, you should use a nonmetallic driver to adjust the low-frequency compensation adjustment hole on the probe until the waveform displays correctly.

Auto Setup

Press **Auto Setup** softkey 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.

Table 3 Auto setting menu

Option	Introduction
 （Multi-cycle sine）	Display several periods waveform
 （Single-cycle sine）	Display single period waveform
 （Rising edge）	Display the rising edge of waveform
 （Falling edge）	Display the falling edge of waveform
 （Undo Setup）	Recall the previous setup of oscilloscope

- The input signal frequency must be higher than 20Hz, with the amplitude higher than 8mV.
- Selecting channel with the lowest frequency while several channels are connected with signal.

Self Calibration

The self-calibration program can quickly make the oscilloscope reach the best working state to get the most precise measurement values. You can perform self-calibration at any time especially when the change of the environment temperature is up to or more than 5 ℃. Make sure that the oscilloscope has been warmed up or operated for more than 30 minutes before the self-calibration.

Do the following steps to do self calibration:

1. Disconnect all the input channels.
2. Press the **Utility** button on the front panel，and then press the **Do Self Cal** softkey, and the oscilloscope will pop-out the message box shown as below:

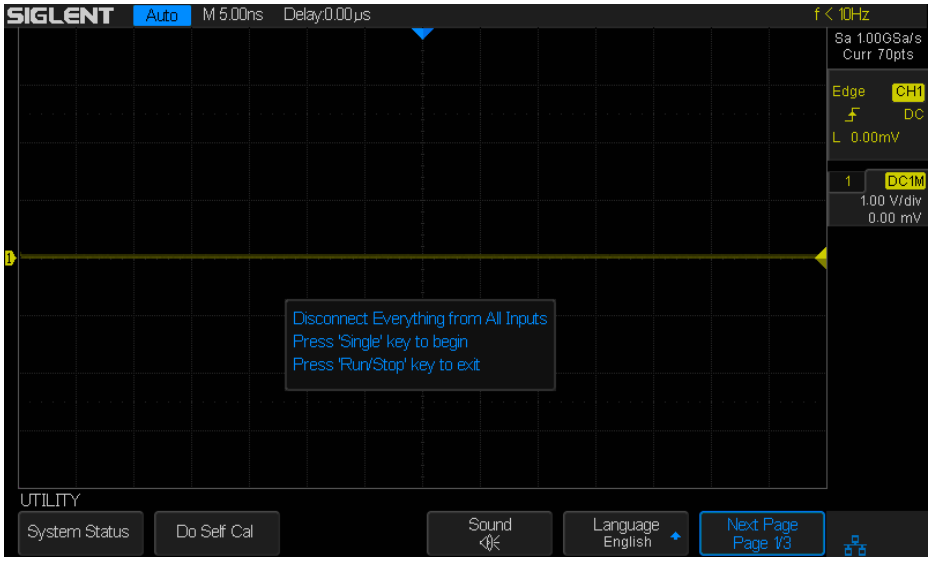


Figure 3 Calibration interface

3. Press the **Single** button on the front panel to perform the self calibration program. During the calibration, most of the keys are disabled.
4. When the self calibration program is finished, it will pop-out the message "**press Run/Stop key to exi**t". Press the **Run/Stop** button on the front panel to exit the calibration interface.

Note: In normal condition, the self calibration will take about 20 seconds, if it do not complete within the period or stop at one of the calibration items, there may be a trouble inside the instrument.

Interface Test

The SDS1000X/SDS1000X+ series oscilloscope is designed with four standard interfaces: USB Host, USB Device, LAN and Pass/Fail interface. Being connected to other instruments via these interfaces enables the oscilloscope to realize some advanced functions. To make sure the oscilloscope can work normally, it is necessary for you to test the interfaces.

USB Host Test

To test if the USB Host interface works normally.

Tools:

● A SDS1000X digital oscilloscope

● An U disk

Steps：

1. Insert a U disc into the USB Host interface on the front panel of the oscilloscope.
2. Quickly a prompt message “USB Flash Drive Plug In!” appears on the screen, and an icon will be shown on lower right corner of the screen which suggests the U disk has been recognized successfully.

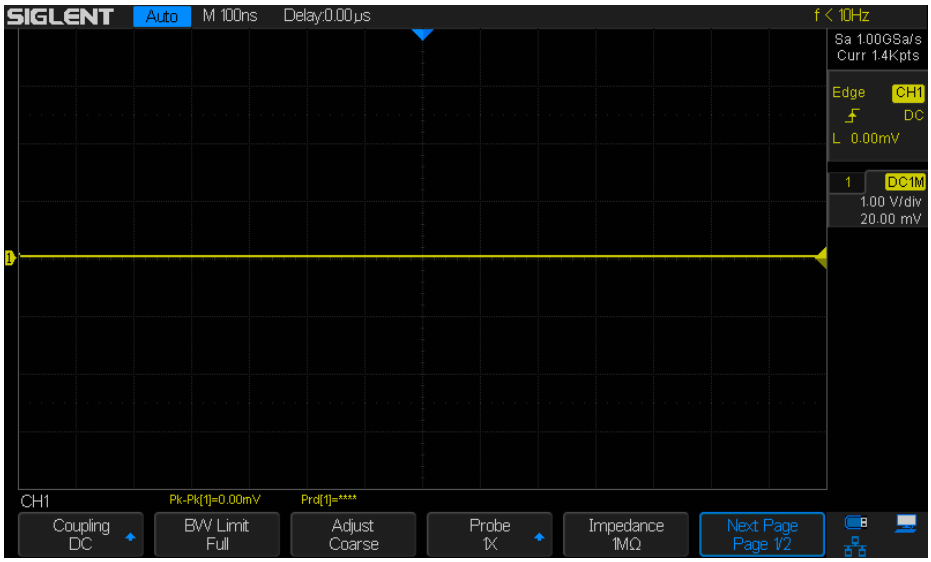


Figure 4 USB drive in interface

USB Device Test

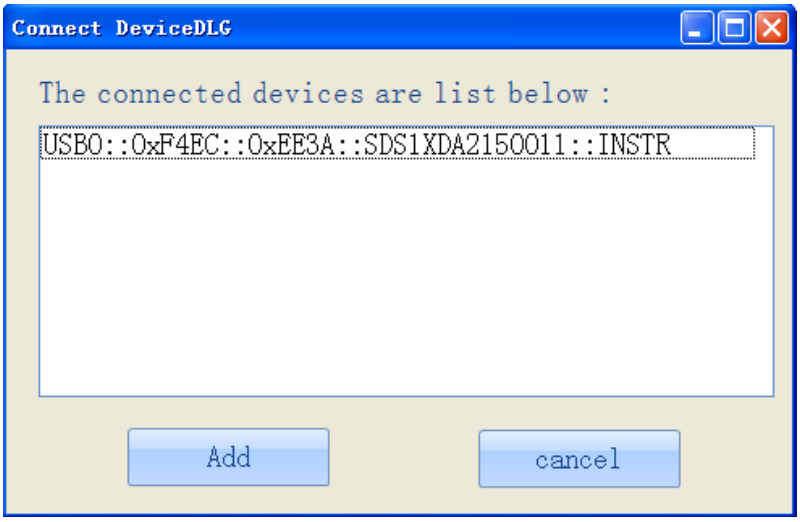
To test if the USB Device interface works normally connected with EasyScopeX software.

Tools：

- A SDS1000X oscilloscope
- A computer with USB interface
- A standard USB cable (Type AB)
- EasyScopeX software

Steps：

1. Set up EasyScopeX software in a computer and Install the driver step by step following the instructions.
2. Connect the oscilloscope and the computer using an USB cable.
3. Run EasyScopeX. Click “Add Device” at the upper left corner of the EasyScope interface and immediately displays the “USBTMCDeviceDLG” interface, then click the “Add” on the interface to complete the connection.



LAN Port Test

To test if the LAN interface works normally connected with NI Visa software.

Tools：

- A SDS1000X Oscilloscope
- A computer with LAN interface
- A standard LAN cable
- EasyScopeX software

Steps：

1. Set up EasyScopeX software in a computer and Install NI Visa driver step by step following the instructions.
2. Press **Utility** → Page2/3 → I/O → LAN, input usable IP Address and Subnet Mask.

Figure 5 IP Setting interface

3. Connect the oscilloscope and the computer using an LAN cable via LAN interface.

Figure 6 LAN interface

4. Run the EasyScopeX and click “Add Device” to turn to the following interface:

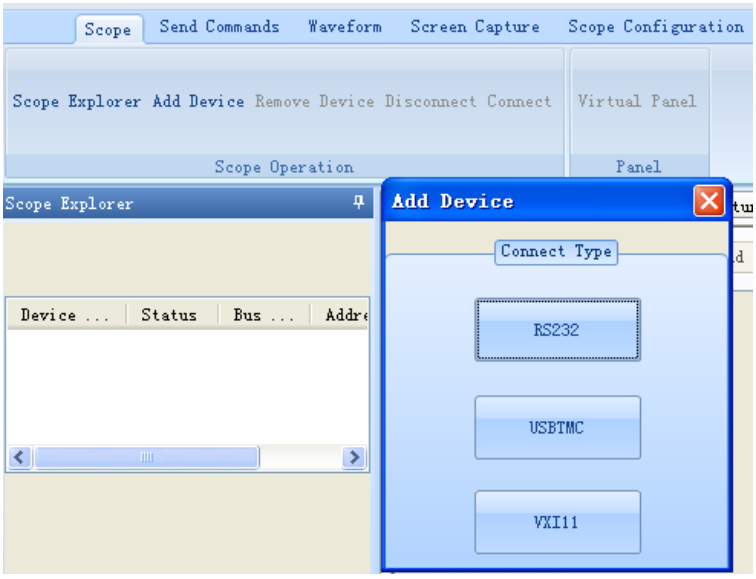


Figure 7 Add device Interface

5. Click “VXI11” button on the above interface, then displays the following interface; Press “OK” option button after inputting the right IP address.

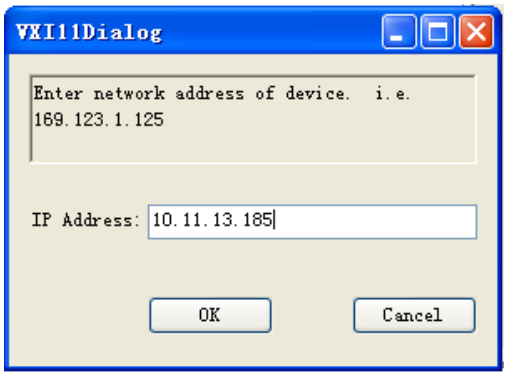
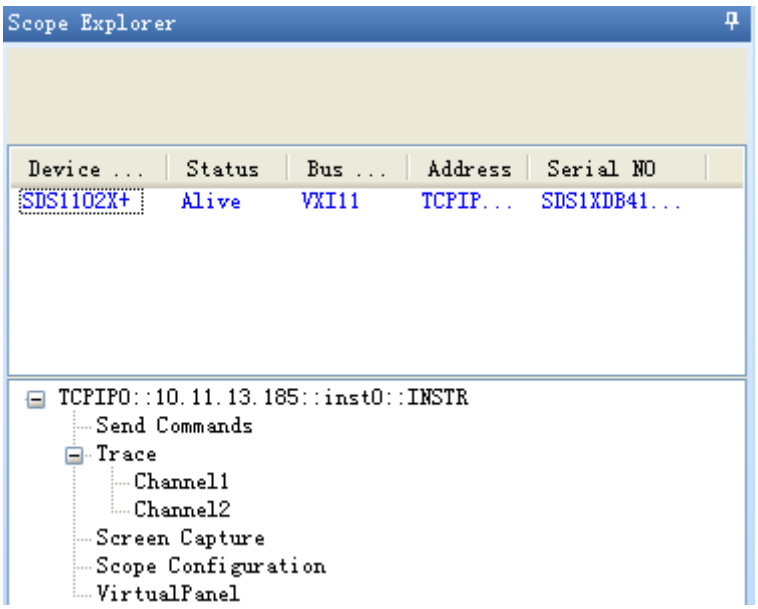


Figure 8 Input IP address

6. You will see the following interface on the left of the EasyScopeX. It indicates the LAN port is ok.



Pass/Fail out Test

To test if the Pass/Fail interface works normally connected with another oscilloscope.

Tools：

- A SDS1000X+/SDS1000X Oscilloscope
- Another Scope
- Two BNC cables

Steps：

1. Turn on the SDS1000X oscilloscope.
2. Enable the channel 1.
3. Press **Utility** → Page2/3 → Pass/Fail, set the submenu items under Pass/Fail menu as below:

Table 4 Pass/Fail submenu items

Submenu	**Setting**
Enable Test	On
Source	CH1
Msg Display	On
Mask setting	
X Mask	0.32div
Y Mask	0.32div

Note: remember to press “Create Mask” to complete Mask setting after x mask setting and y mask setting.

After selecting the corresponding item as table above, you will see the waveform displays as the following:

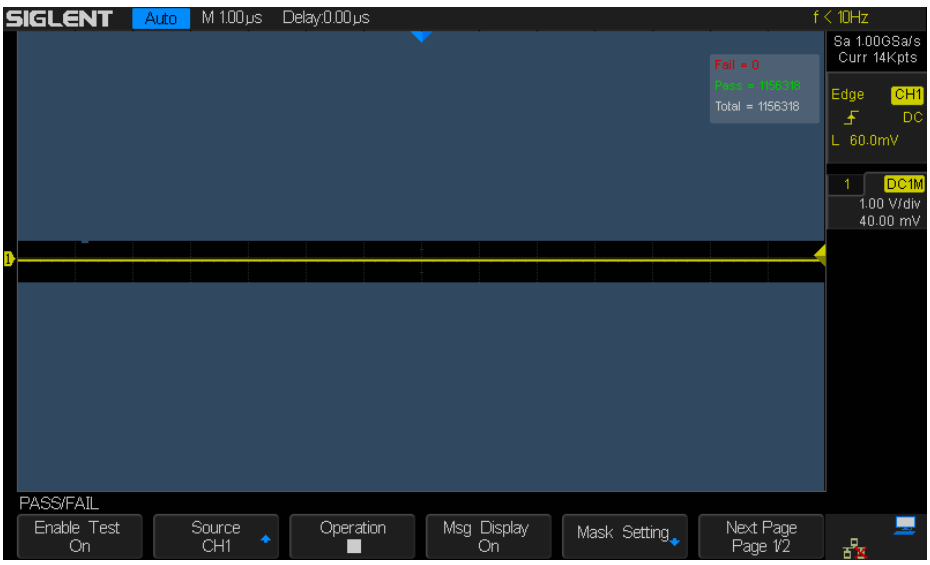


Figure 9 Pass/Fail Waveform

If the waveform is in the range that set under menu of Mask setting, it is allowed to pass. Otherwise, it fails to pass.

4. Connect the Pass/Fail terminal to a channel BNC terminal of another oscilloscope.
5. Move the waveform out of the mask, if the interface works normally, then you will see a pulse wave as below displays on another oscilloscope by properly adjusting its time base and voltage scale. Otherwise, there might be errors to the interface.

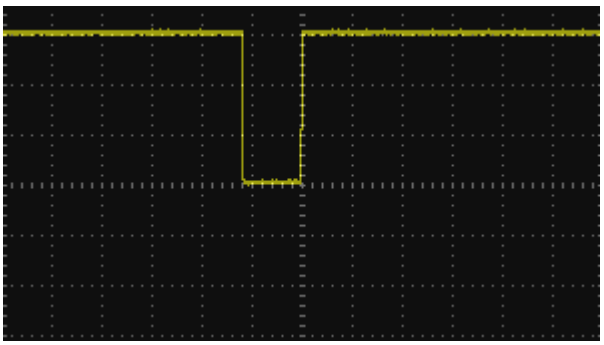


Figure 10 Pulse Waveform

Performance Test

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

Below is the required equipment for the test:

Table 5 Test equipments

Equipment	Description	Test item
Fluke 9500B + Active Heads	High Performance Oscilloscope Calibrator	DCG\Offset\ Ext Trigger delay\Clock accuracy\Trigger delay\BW\BWL\trigger sensitivity\ Input impedance
Siglent SDM3055	Multimeter	AWG
Agilent U2004A	Power meter	AWG
GPIB Card and Cable	For communication between computer and the 9500B	
USB Cable	For communication between the computer and the SDS1000X	
BNC Cables	BNC(m) to BNC(m), Approx 1m long	
BNC T Connector	For signal distribution	DCG\Offset
Computer		

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

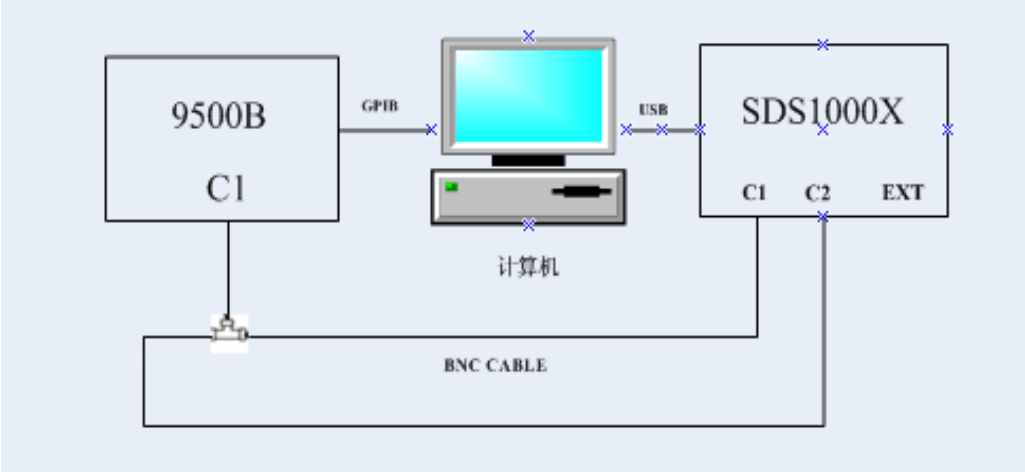


Figure 11 Connecting test instruments for DCG\Offset

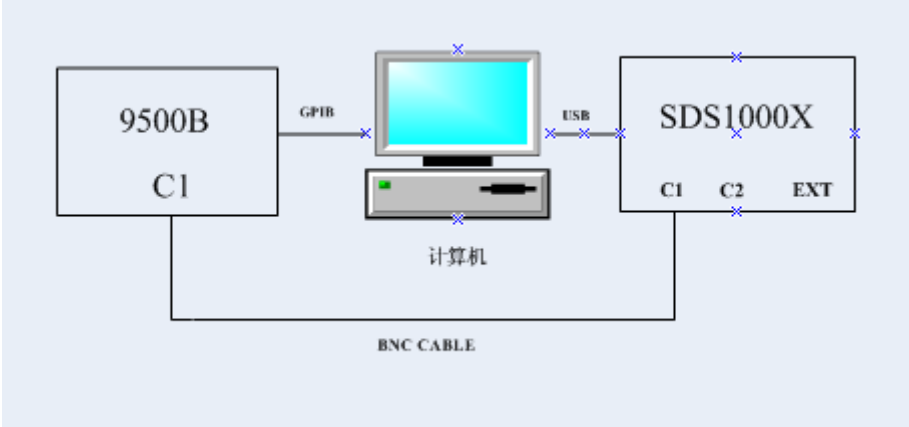


Figure 12 Connecting test instruments for Clock /Trigger Delay

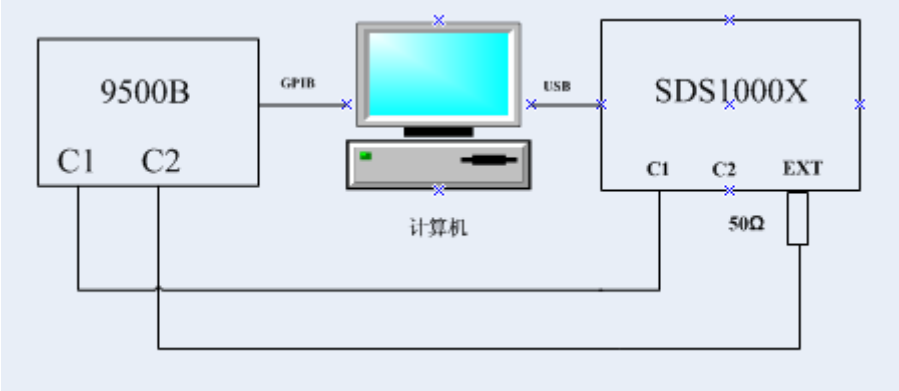


Figure 13 Connecting test instruments for Ext Trigger Delay

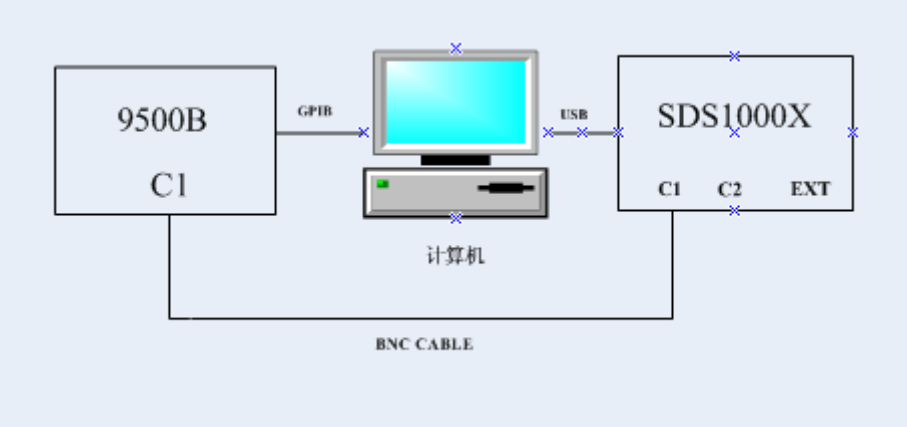


Figure 14 Connecting test instruments for BW\BWL\ Trigger Sensitivity\ Input Impedance

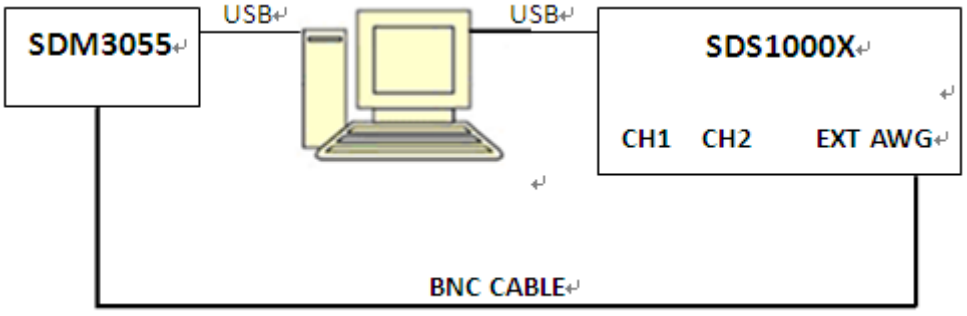


Figure 15 Connecting test instruments for AWG Offset Accuracy

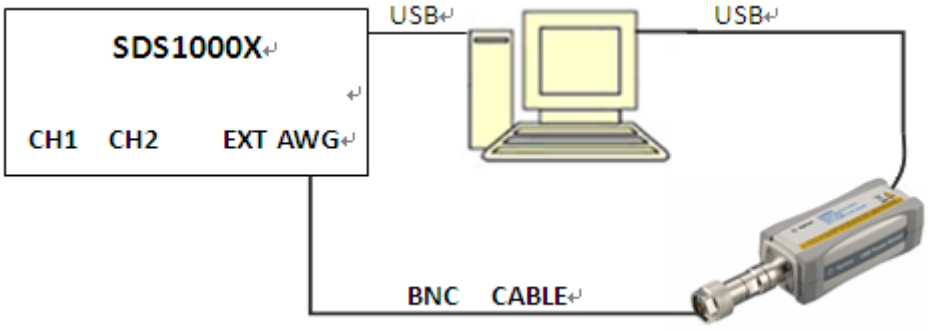


Figure 16 Connecting test instruments for AWG Frequency Response

Verify Test Results

To verify whether 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 Test

This internal procedure is automatically performed every time the oscilloscope is powered on. No test equipments are required. Verify that no error messages are displayed before continuing with the procedure.

Self Calibration

The Self Calibration procedure is described in Chapter "错误！未找到引用源。". If the environmental temperature changes by more than 5℃, the Self Calibration operation must be performed for achieving the specifications.

To Verify DC Gain Accuracy

DC Gain Accuracy Slope = LINEST (V_{error1}: V_{error5}, $V_{Setting1}$: $V_{Setting5}$)

Note: "$V_{Setting}$" represents DC voltage output level;

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

This test verifies 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 11.
3. Set Volts/Div of the oscilloscope to 2mV/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 6, and record mean value of the oscilloscope as V_{mean}.
5. Calculate V_{error} (V_{error} = $V_{Setting}$—V_{mean}), and set the next output level as step 4.
6. Make a linear regression with these 5 data points: $V_{Setting1}$ ~ $V_{Setting5}$, V_{error1} ~V_{error5}. Check if the slope falls within the range shown in Table 6.
7. Set the oscilloscope Volts/Div to the others in Table 6, and repeat steps 4 to 6.
8. Set the 9500B output to off.
9. Disconnect the connection of all the channels.

Table 6 DC Gain Accuracy

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

50 mV/div	150 mV,75 mV,0,-75 mV, -150 mV	3%
20 mV/div	60 mV,30 mV,0,-30 mV, -60 mV	3%
10 mV/div	30 mV,150 mV,0,-150 mV, -30 mV	3%
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	4%

To Verify Offset Accuracy

Offset Accuracy Slope = LINEST (Offset$_{error1}$: Offset$_{error5}$, Offset$_1$: Offset$_5$)

Note: "**Offset$_{out}$**" represents DC voltage output level;

"**Offset$_{error}$** "represents the difference between the setting output and the measurement.

This test verifies Offset Accuracy of all channels.

Steps:

1. Set the 9500B output to on.
2. Connect all channels of the oscilloscope to 9500B as shown in Figure 11.
3. Set the Volts/Div of channel to 2mV/div. Press Measure button on the front panel of the oscilloscope to display Mean measurement.
4. According to 错误！未找到引用源。, set offset of the channel to -Offset, and set the 9500B output level to equal the offset, then record mean value of the oscilloscope as V_{mean}.
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: $Offset_{error1}$ ~ $Offset_{error5}$, $Offset_1$ ~$Offset_5$. Check to verify that the slope is within the limits specified below.
7. Set the oscilloscope Volts/Div to the other settings in Table 7, and repeat the steps 4 to 6.
8. Set the 9500B output off.
9. Disconnect the connection of all the channels.

Table 7 Offset Accuracy

Volt/Div	Offset	error
10 V/div	35 V,30 V,0,-30 V,-35 V	1.5%
5 V/div	30 V,25 V,0,-25 V,-30 V	1.5%
2 V/div	20 V,10 V,0,-10 V,-20 V	1.5%
1 V/div	10 V,5 V,0,-5 V,-10 V	1.5%
500 mV/div	5 V,2.5 V,0,-2.5 V,-5 V	1.5%
200 mV/div	2 V,1 V,0,-1 V,-2 V	1.5%

100 mV/div	1 V,0.5 V,0,-0.5 V,-1 V	1.5%
50 mV/div	500 mV,250 mV,0,-250 mV,-500 mV	1.5%
20 mV/div	200 mV,100 mV,0,-100 mV,-200 mV	1.5%
10 mV/div	100 mV, 50 mV,0,- 50 mV, -100 mV	1.5%
5 mV/div	50 mV,25 mV,0,-25 mV -50 mV	1.5%
2 mV/div	20 mV, 10 mV,0,-10 mV, -20 mV	1.5%

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 50 Ω.

Time Base Accuracy: Frequency Error < 250Hz

Steps:

1. Connect selected channel of the oscilloscope to the 9500B.
2. Set the oscilloscope Volts/Div to 100mV/div.
3. Set the oscilloscope Sec/Div to 50ms/div.
4. Set the Memory Depth to 14Mpts, and the sample rate will be automatically set to 10MSa/s.
5. Disable the ROLL mode if it is enabled.
6. Set waveform of the 9500B to sine, amplitude to 600mV, and frequency to the value which is equal to the sample rate of the oscilloscope.
7. Press Measure button on the front panel of the oscilloscope to display Freq measurement.
8. Check if the Freq measurement is within the range of 250Hz.
9. Disconnect the test connection.

To Verify Trigger Delay

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

Channel Trigger Delay Limit: Delay < 100ps

Steps:

1. Connect selected channel of the oscilloscope to the 9500B.
2. Set frequency of 9500B to 50MHz, amplitude to 600mV, and waveform to Sine.
3. Set the oscilloscope Volts/Div to 100mV/div.
4. Set the oscilloscope Sec/Div to 2ns/div.
5. Press Measure button on the front panel of the oscilloscope to display Time@Mid measurement.
6. Check if the result is in the limited range above.
7. Disconnect the test connection.
8. Check other channels in the same way as steps 1 to 7.

To Verify Ext Trigger Delay

This test checks the delay between ext trigger channel and analog channels. In the test, the impedance of both the 9500B and the oscilloscope should be set to 50 Ω, and a 50Ω feedthrough termination need to be connected with the ext trigger channel.

CH-Ext Trigger Delay Limit: Delay < 1ns

Steps:

1. Connect selected analog channel and ext trigger channel of the oscilloscope to the 9500B with active heads (CH1/CH2).
2. Press the ‘Aux’ key at the right of the ‘OSCILLOSCOPE CALIBRATOR’ panel of the 9500B and select the Zero Skew function.
3. Set frequency of the 9500B to 1KHz, amplitude to 1V.
4. Set the oscilloscope Volts/Div to 200mV/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 in the limited range above(<1 ns).
9. Disconnect the test connection.
10. Check the other analog channel in the same way as step 1 to 9.

To Verify Noise Floor

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

Table 8 Noise Floor Limited Range

Volt/Div	Limited Range	Volt/Div	Limited Range
500 uv	stdev<350 uv	100 mV	stdev <20 mV
1 mV	stdev <0.4 mV	200 mV	stdev <40 mV
2 mV	stdev <0.4 mV	500 mV	stdev <100 mV
5 mV	stdev <1 mV	1 V	stdev <200 mV
10 mV	stdev <2 mV	2 V	stdev <400 mV
20 mV	stdev <4 mV	5 V	stdev <1 V
50 mV	stdev <10 mV	10 V	stdev <2 V

Steps:

1. Set the oscilloscope Sec/Div to 1 ms/div.
2. Set the oscilloscope Volts/Div to 500 uV/div.
3. Press Measure button on the front panel of the oscilloscope to display Stdev measurement.
4. Check if the Stdev is in the limited range above.
5. Check the other analog channel in the same way as steps 1 to 4.
6. Set the oscilloscope Volts/Div to the others in Table 8, and repeat the steps from 3 to 5.

To Verify Bandwidth

This test checks the bandwidth of all input channels.

The bandwidth should be verified at 2V/div、200mV/div and 100mV/div.

Steps:

1. Connect channel 1 of the oscilloscope to the 9500B via the active head.
2. Set the oscilloscope Volts/Div to 2V/div, the Sec/Div to 50ms/div, the impedance of the channel to 50Ω.
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 5.5 V, and impedance to 50 Ω.
5. Set frequency of the 9500B to the frequency in Table 9. When testing at 200mV/div or 100mV/div, set start frequency at 100 kHz. Set frequency start frequency at 1 MHz when testing at 2 V/div.

Table 9 Frequency points in the test

Scope Model	Frequency Point(Hz)
SDS1052X	100K,500K,1M,5M,10M,20M,30M,40M,50M,60M
SDS1072X/ SDS1072X+	100K,500K,1M,5M,10M,20M,40M,60M,70M,80M
SDS1102X/ SDS1102X+	100K,500K,1M,5M,10M,30M,50M,70M,100M, 110M,120M,150M
SDS1202X/ SDS1202X+	100K,500K,1M,5M,10M, 50M, 100M,140M,180M 200M,220M,250M

6. Every time the frequency is changed, it is recommended to adjust the Sec/Div to a proper value thus to display a perfect waveform.
7. Record the Peak-Peak measurement of the waveform.
8. Set the oscilloscope Volts/Div to the setting choices, and repeat the steps from 2 to 7. 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.
9. Check other channels in the same way as steps 1 to 8.
10. Disconnect the test connection.

After the test, calculate the dB value at every frequent point. Check if the value is in the limited range in Table 10.

Table 10 Limited Range

Scope Model	Frequency Point(Hz)	Range
SDS1052X	≤5M	(-1,1) dB
	≤25M	(-2,2) dB
	>25M	(-3,2) dB
SDS1072X/ SDS1072X+	≤7M	(-1,1) dB
	≤35M	(-2,2) dB
	>35M	(-3,2) dB
SDS1102X/ SDS1102X+	≤10M	(-1,1) dB
	≤50M	(-2,2) dB
	>50M	(-3,2) dB
SDS1202X/ SDS1202X+	≤20M	(-1,1) dB
	≤100M	(-2,2) dB
	>100M	(-3,2) dB

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.

Test the bandwidth at 2V/div、200mV/div and 100mV/div

Steps:

1. Connect channel 1 of the oscilloscope to the 9500B via the active head.
2. Set the oscilloscope Volt/Div to 2 V/div, the Sec/Div to 50 ms/div, the impedance of the channel to 50 Ω, and set BW Limit button to 20 MHz.
3. Press the Measure button on the front panel of the oscilloscope to display Peak-Peak measurement.
4. Set amplitude of the 9500B to 5.5 V.
5. Set frequency of the 9500B to the frequency in Table 11. When testing at 200 mV/div or 100 mV/div set the start frequency to 100 kHz. When testing at 2 V/div set start frequency to 1 MHz.

Table 11 Frequency points in the test

Frequency Point(Hz)
100K,500K,1M,5M,10M,12M,13M,14M,15M,16M,17M,18M, 19M,20M,21M,22M,23M,24M,25M,26M,27M,28M,29M

6. Every time the frequency is changed, it is recommended to adjust the Sec/Div to a proper value thus to display a perfect waveform.
7. Record the Peak-Peak measurement of the waveform.
8. Calculate the dB value at frequency point. If the value isn't in the range of (-3, 2) but the frequency is in the range of (12MHz, 28MHz), the Bandwidth Limit of the oscilloscope pass. Else, test at next frequency point. When the test finished, if none of the frequency points satisfy the requirement above, the Bandwidth Limit of the oscilloscope fail.
9. Set the oscilloscope Volts/Div to the other settings and repeat the steps from 2 to 7. Set amplitude of the 9500B to 600 mV when testing at 100 mV/div, and set to 1.2 V when at 200 mV/div.
10. Check the other channels in the same way as step 1 to 9.
11. Disconnect the test connection.

To Verify Trigger Sensitivity

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

Table 12 Trigger sensitivity data

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

Steps:

1. Connect the selected channel of the oscilloscope to the 9500B.
2. Set the oscilloscope Volts/Div to 100 mV/div, Sec/Div to 50 ns/div, coupling mode to AC, and impedance to 50 Ω.
3. Set waveform of the 9500B to sine, amplitude to 60 mV, frequency to 10 MHz, and impedance 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 reach stable trigger.
7. Record the hardware frequency which is on the top right of the screen, and check if it is in the limited trigger range in Table 12.
8. Set the oscilloscope trigger slope to Negative, repeat step 6 to step 8.
9. Set the frequency of the 9500B to the bandwidth frequency. Set the oscilloscope Sec/Div to 5ns/div if you are testing SDS1052X or SDS1072X or SDS1102X, and set Sec/Div to 2 ns/div if you are testing SDS1202X. Then repeat steps 6 to 8.
10. Check the other channel 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 internal trigger using the analog input channels. The following steps are used to test the EXT trigger sensitivity.

Steps:

1. Connect the ext trigger channel of the oscilloscope to the 9500B.
2. Set amplitude of the 9500B to 100 mV, frequency to 10 MHz.
3. Set trigger source of the oscilloscope to EXT, trigger slope to Positive.
4. Press Trigger Level knob to set the level to center of the waveform.

5. Adjust the trigger level within the range of (-100 mV, 100 mV) in order to achieve a stable waveform, and then record the (hardware-measured) frequency, located at the top right of area of the screen.
6. Check if the frequency is within the specified trigger range listed in Table 12.
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 150 mV. Repeat steps 3 to 7. In step 6, the range changes to (-150mV, 150mV).
9. Set frequency of the 9500B to 10 MHz, amplitude to 500 mV.
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 screen.
13. Check if the frequency is within the specified range listed in 错误！未找到引用源。.
14. Set the trigger slope to Negative, repeat steps 11 to 13.
15. Set frequency of the 9500B to the oscilloscope's bandwidth frequency, amplitude to 750 mV. Repeat steps 11 to 14. In step 6, the range changes to (-750mV, 750mV).
16. Disconnect the test connection.

To Verify Input Impedance

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

Table 13 Input Impedance data

Channel	Coupling and impedance type	Impedance Range	
CH	AC/1 MΩ	0.1 V/div	1176000~1224000 Ω
		0.2 V/div, 2 V/div	980000~1020000 Ω
	DC/1 MΩ	980000~1020000 Ω	
	AC/50 Ω	49~51 Ω	
	DC/50 Ω	49~51 Ω	
Ext	1 MΩ	980000~1020000 Ω	

Steps:

1. Connect the selected channel of the oscilloscope to the 9500B.
2. Set the oscilloscope Volts/Div to 100 mV/div, coupling mode of the channel to AC, impedance to 1 MΩ.
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 impedance of the channel to 50 Ω, and then record the reading displays on the screen of the 9500B.
5. Set coupling mode of the channel to DC, and impedance of the channel to 1 MΩ. Record the reading displays on the screen of the 9500B.
6. Set impedance of the channel to 50Ω, and record the reading displays on the screen of 9500B.
7. Check if the impedance is within the specified range in Table 13.
8. Test at 2 V/div and 200 mV/div, using the same procedure as in steps 2 to 7.
9. Check the other analog channel in the same way as steps 1 to 8.
10. Disconnect the test connection.

When checking EXT trigger channel, record the reading displays on the screen of the 9500B, and check to verify it is within the specified range in Table 13.

To Verify AWG

This test checks the Wave Generate option of oscilloscope, using a Siglent SDM3055 multimeter and an Agilent U2004A power meter.

This test includes three items: Offset Accuracy, Amplitude Accuracy, and Frequency Response.

Table 14 Offset Accuracy

DC Volt	Limit Range	DC Volt	Limit Range
3 V	2.9736~3.0264 V	-3 V	-3.0264~-2.9736 V
1 V	0.9896~1.0104 V	-1 V	-1.0104~-0.9896 V
0.1 V	0.0968~0.1032 V	-0.1 V	-0.1032~-0.0968 V
0.01 V	0.00752~0.01248 V	-0.01 V	-0.01248~-0.00752 V
0 V	-0.0024~0.0024 V		

Table 15 Amplitude Accuracy

Amplitude	Limit Range
80 mV	26.7~29.9 mV
400 mV	136.4~146.4 mV
1 V	342.2~365 mV
4 V	1.371~1.4574 V

Table 16 Frequency Response

Amplitude	Frequency	Power Range
2 V	10 K,100 K,1 M,2 M, 3 M,…15 M,16 M,…24 M,25 M	3.6794~4.2794 dBm
5 V	10 K,100 K,1 M,2 M, 3 M,…15 M,16 M,…24 M,25 M	11.64~12.24 dBm

Steps:

1. Connect the AWG channel of the oscilloscope to the Multimeter.
2. Press Wave Gen button on the front panel of the oscilloscope to enable AWG.

3. Set output load of the AWG to High-z, and Wave Type to DC.
4. According to Table 14, set offset of DC, then record the reading which displays on the screen of the SDM3055. Check if it is within the specified range in Table 14.
5. Set Wave Type to sine, frequency to 10 KHz, and offset to 0.
6. According to Table 15, set amplitude of Sine, then record the reading which displays on the screen of the SDM3055. Check if it is within the specified range in Table 15.
7. Connect the AWG channel to the Agilent U2004A.
8. Set Wave Type to sine, frequency to 10 kHz, offset to 0, and amplitude to 2 V.
9. Change the frequency, referring to 错误！未找到引用源。, then record the reading of U2004A to make certain it is within the specified range in Table 16.
10. Set amplitude of the waveform to 5 V, repeat step 9.
11. Disconnect the test connection.

Adjusting Procedures

This chapter describes how to adjust the SDS1000X series oscilloscopes for optimum performance using a Fluke 9500B calibrator. Only qualified personnel should perform this procedure.

Warming up

Before performing the adjustment procedures, the oscilloscope and other test equipments must warm up for at least 30 minutes in an ambient temperature between 20 °C and 30 °C. Adjustments performed prior to warm-up or outside this temperature range may result in poor performance.

Self calibration

The Self-Cal performs an internal routine which uses internally generated signals to optimize circuits that affect channel sensitivity, offset, and trigger parameters, to optimize the signal path in the oscilloscope. Let the oscilloscope warm up before performing this procedure.

Required Equipments

PC**:** Windows XP or Windows 7 operating system, USB interface, NI-VISA.

Calibrating Software**:** Python 2.7, PyVisa, PyQt4, PyWin32, Adjustment script (**contact SIGLENT for the scripts**)

Test Instrument**:**

- Fluke 9500B
- One USB cable (Type AB)
- One GPIB cable
- One network cable
- Three 10-inch BNC cables
- One BNC T connector (50Ω)

Software Installation

1. Install the NI-488.2 driver, select custom installation to install NI-VISA.
2. Install the Python 2.7, PyVisa, PyQt4, PyWin32.

Adjusting steps

1.Connect the 9500B with the PC using GPIB interface.

2.Connect the oscilloscope with the PC using an USB cable.

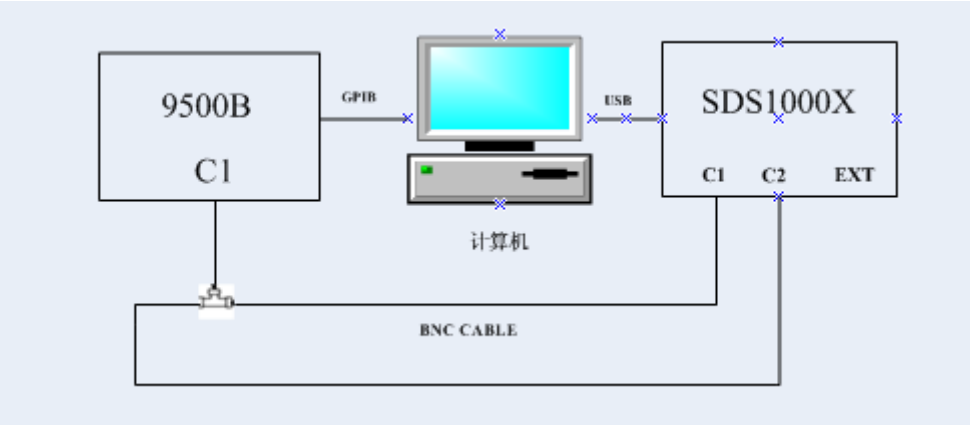


Figure 17 DAC adjusting environment

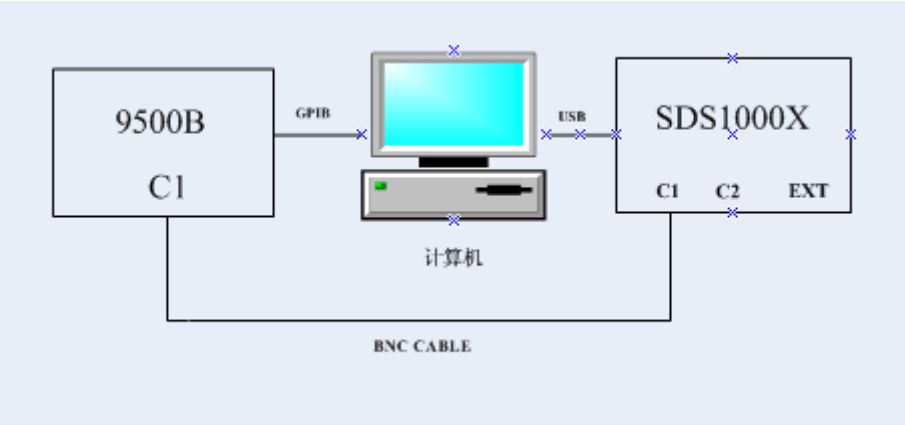


Figure 18 Clock Accuracy adjusting environment

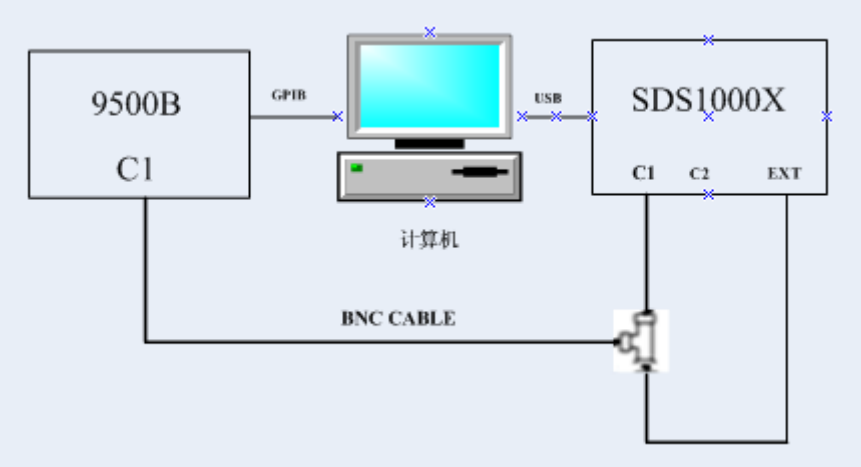


Figure 19 EXT Trigger Level adjusting environment

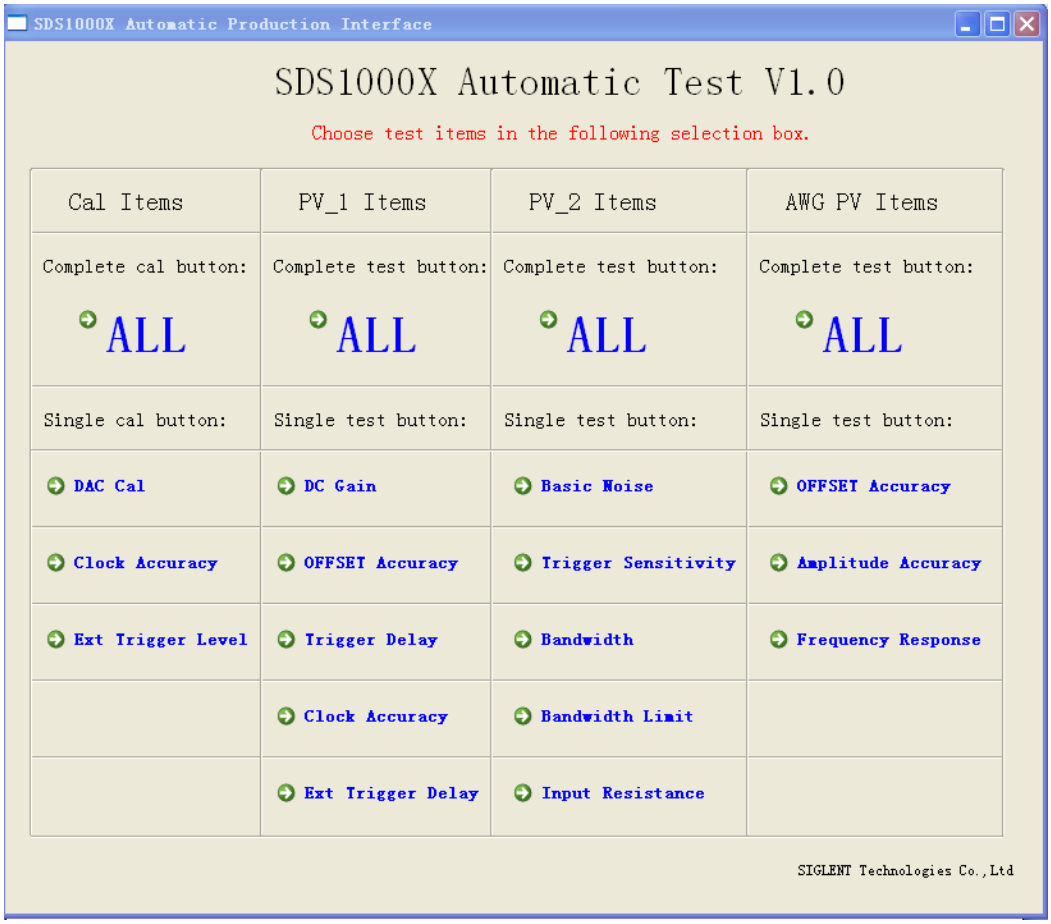


Figure 20 SDS1000X PV and Calibrate Interface

3. Turn on the oscilloscope and allow it warm-up for about 30 minutes.
4. Connect the oscilloscope and the test instruments as shown in the figures above using the BNC T connectors and BNC cables.
5. Entry Test mode, press the button: Utility-->Do Self Cal-->Display --> Utility -->Save/Recall--> Save/Recall--> Utility --> Display.
6. Open the corresponding python script.

7. Click the “ALL” button in the Cal_Items to perform the adjusting procedures.
8. When the DAC adjust finished, disconnect any probes or cables from the oscilloscope. Press UTILITY button and then select “Do Self Cal” to start the Self Calibration.
9. Perform the next step according to the message box which pops up during the adjustment process.
10. When all of these steps have been completed, disconnect all devices and close the python script.

Note: The adjusting procedures include four items as the following:

DAC, Self Calibration, Clock Accuracy, Ext trigger delay, Ext trigger level.

Ext trigger delay adjusts before the Ext trigger delay PV test.

Assembly Procedures

This chapter describes how to remove the major modules from the SDS1000X series oscilloscopes. To install the removed modules or replace new modules, please follow corresponding operating steps in reverse order.

The following contents are what mainly included in this chapter:

- **Security Consideration** which describes security information needed to considerate while operating.
- **List of Modules** in which the modules to remove are listed.
- **Required Tools** which describes the tools needed to perform the procedures.
- **Disassembly Procedures** which describes in detail how to remove and install the modules.

Security Consideration

Only qualified personnel should perform the disassembly procedures. Whenever possible, disconnect the power before you begin to remove or replace the modules. Otherwise, any personal injuries or damages to the components may occur.

Avoid Electrical Shock Hazardous voltages exist on the LCD module and power supply module. To avoid electrical shock, you should firstly disconnect the power cord from the oscilloscope, and then wait at least three minutes for the capacitors in the oscilloscope to discharge before you begin disassembly.

Preventing ESD Electrostatic discharge (ESD) can damage electronic components. When doing any of the procedures in this chapter, use proper ESD precautions. As a minimum, you should place the oscilloscope on a properly grounded ESD mat and wear a properly grounded ESD strap.

List of Modules

The following removable modules are listed in the order of performing disassembly procedures.

Table 17 List of modules

Number of Module	Module
1	Front-Panel Knobs
2	Rear Panel
3	Top Metal Cover
4	Rear Metal Cover
5	Power Supply Module
6	Metal Shelf and Interface Module
7	Main Board
8	Fan Module
9	Keypad Module
10	Display Module

Required Tools

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

- T6, T10 and T20 TORX drivers
- 5/8- inch and 9/32- inch socket drivers
- Flat head screw driver

Disassembly Procedures

This section describes how to remove and install the modules listed above in the oscilloscope in detail. Complete disassembly will be best achieved through the following operating steps.

Removing the Front-Panel Knobs

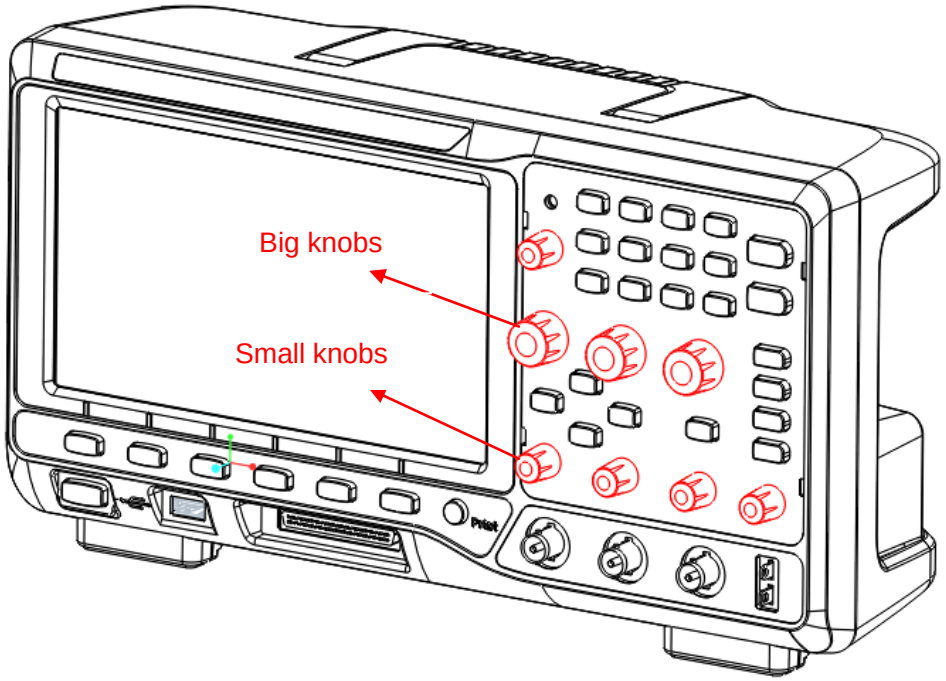


Figure 21 Removing the Front -Panel Knobs

Removing steps:

Remove each front-panel knob by firmly grasping the knob (with pliers if necessary) and pulling it away from the front panel.

To install the Front -Panel Knobs , please operate as the reverse steps.

Removing the Rear Panel

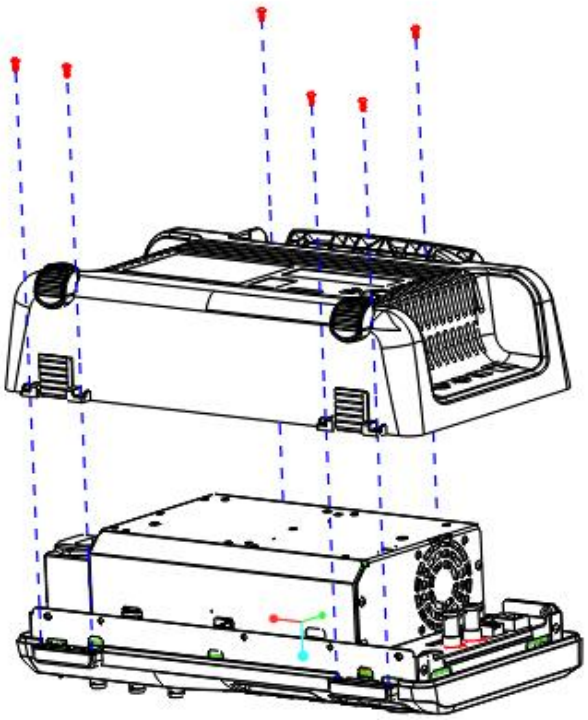


Figure 22 Removing the rear panel

Removing steps：

1. Place the oscilloscope face down on a soft surface such as an anti-static mat.
2. Remove the six screws located on the rear panel. Tilt the handle to gain better access to the top two screws.
3. Lift the rear panel up and off carefully.

To install the rear panel, please operate as the reverse steps.

Removing the Front Panel

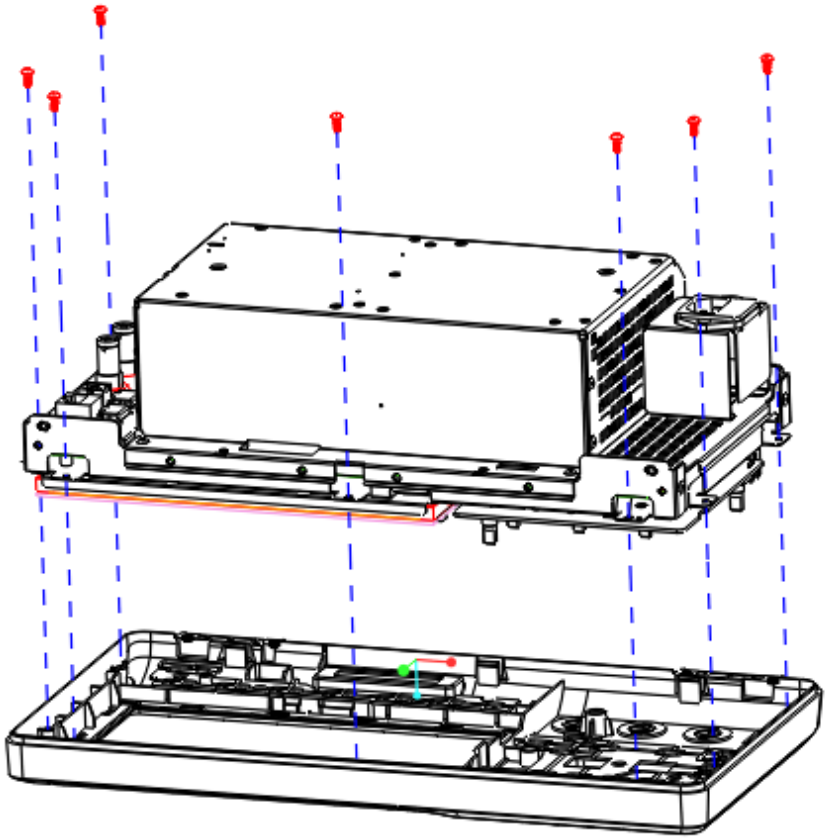


Figure 23 Removing the front panel

Removing steps:

1. Place the oscilloscope bottom down on a soft surface such as an anti-static mat.
2. Remove the seven screws located on the metal shelf.

To install the front panel, please operate as the reverse steps.

Removing the Rear Metal Cover

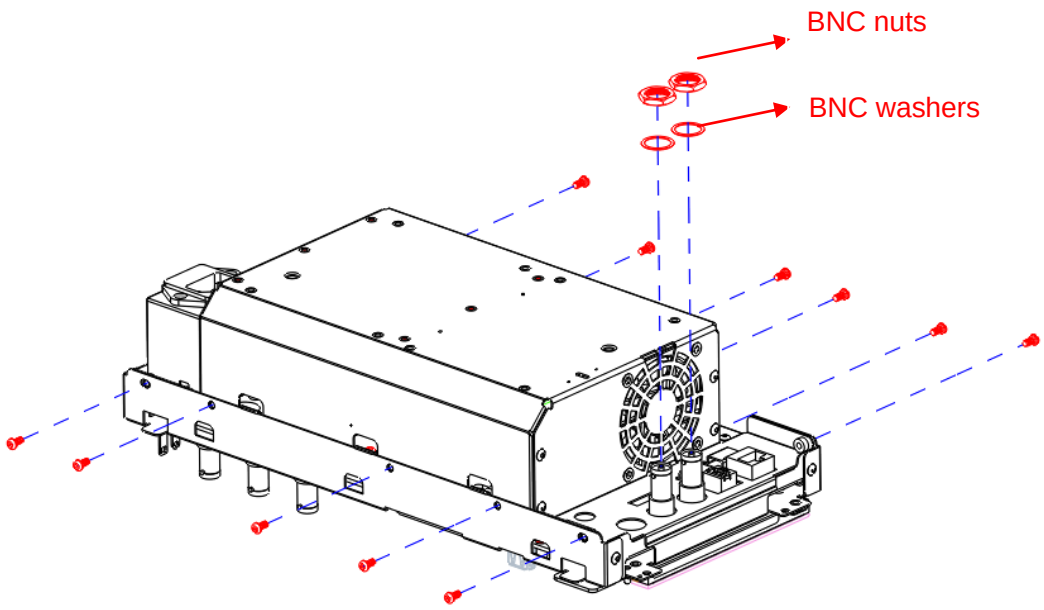


Figure 24 Removing the rear metal cover

Removing steps：

1. Place the oscilloscope face down on a soft surface such as an anti-static mat.
2. Remove the eleven screws located on the rear metal cover.
3. Remove two nuts and washers from the Back BNC terminal.
4. Disconnect the power cable connected to main board module from power supply module.
5. Since the edge of the rear metal cover is sharp, you should lift the rear metal cover up and off carefully to avoid personal injury.

To install the rear metal cover, please operate as the reverse steps.

Removing the AWG Module

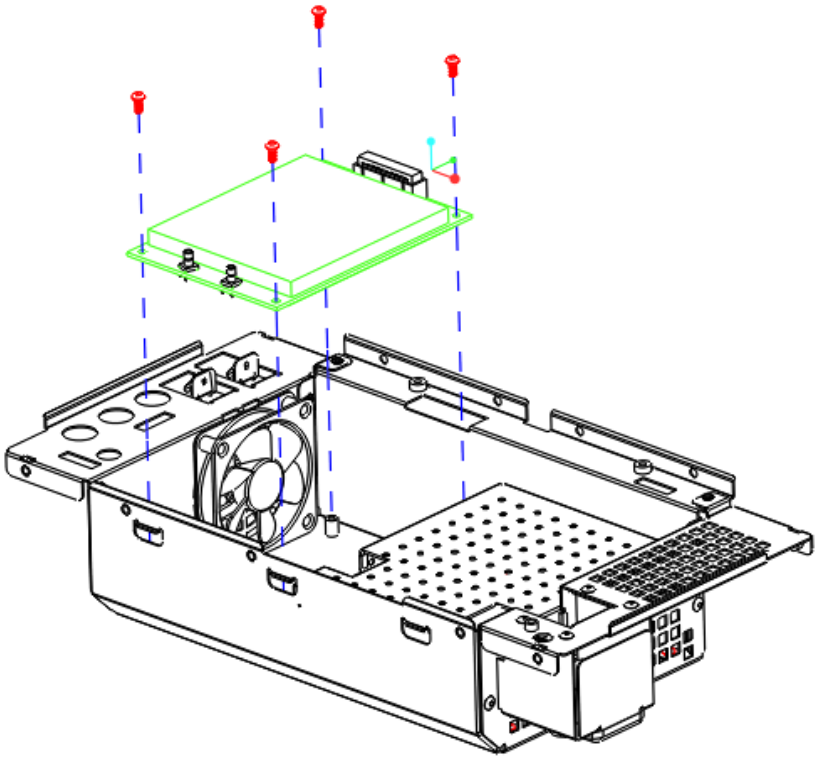


Figure 25 Removing the rear metal cover

Removing steps：

1. Remove the four screws located on the AWG PCB.

Removing the Power Supply Module

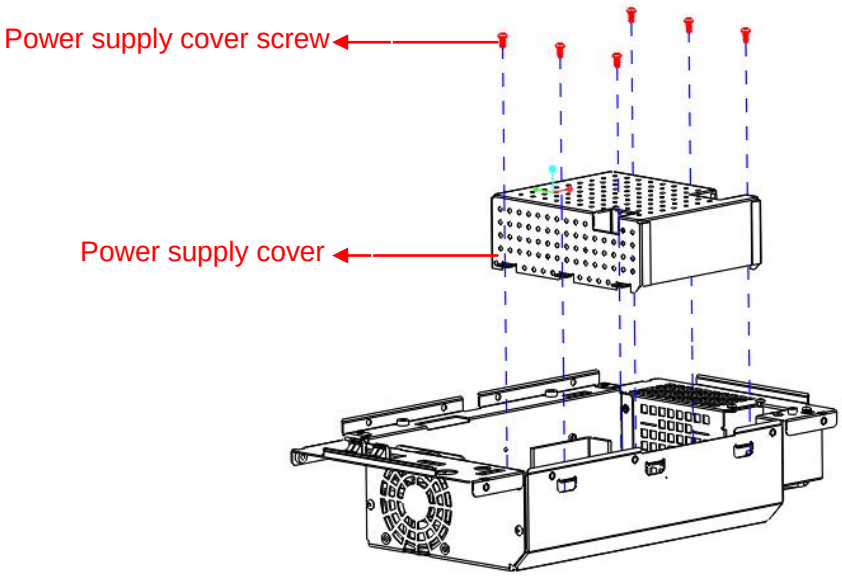


Figure 26 Removing the power supply cover

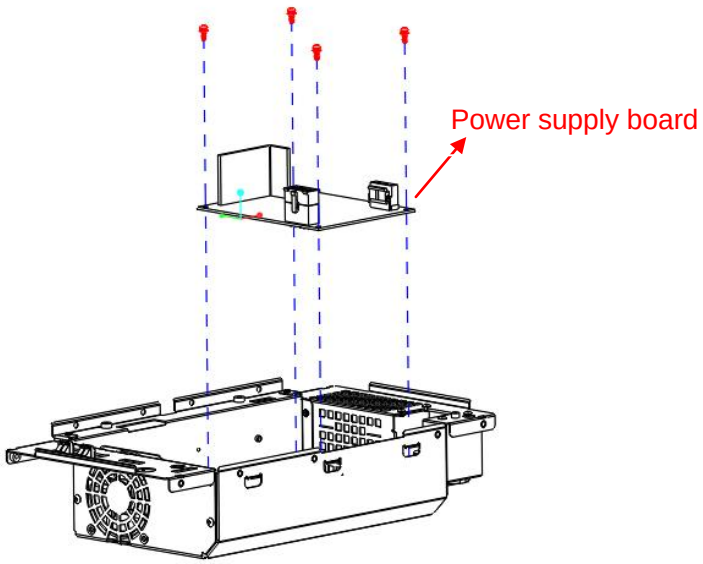


Figure 27 Removing the power supply board

Removing steps:

1. Place the rear metal cover on a soft surface such as an anti-static mat.

2. Remove the six screws located on the power supply cover.

3. Lift the cover up and off carefully.

4. Remove the four screws located on the power supply board, and lift up the board.

To install the power supply module, please operate as the reverse steps.

Removing the Main Board

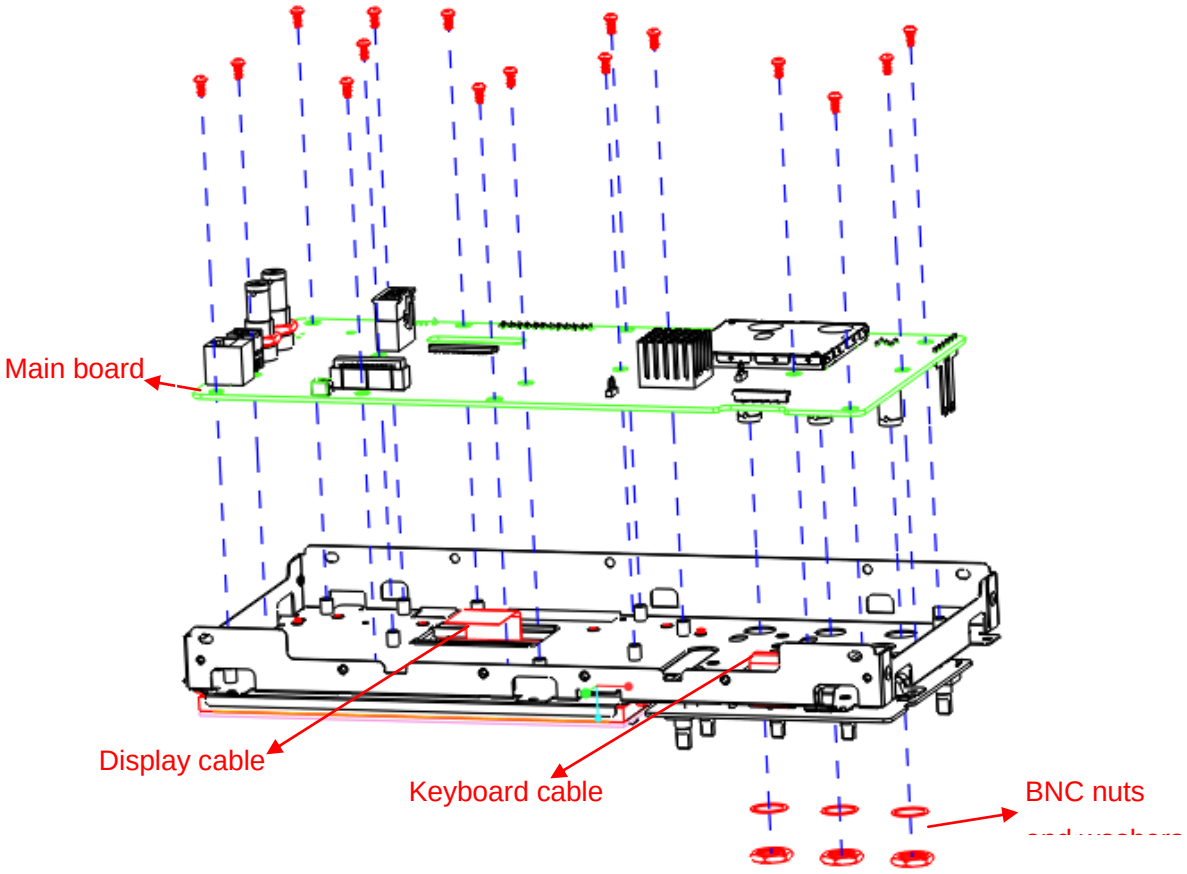


Figure 28 Removing the main board

Removing steps:

1. Remove the sixteen screws located on the main board.
2. Remove the nuts and washers located on the channel BNC terminal.
3. Disconnect the display cable and the keyboard cable.
4. Separate the main board from the metal shelf and then lift it up and off carefully to avoid personal injury from the sharp edge of the metal shelf.

To install the main board, please operate as the reverse steps.

Removing the Keypad and Display Module

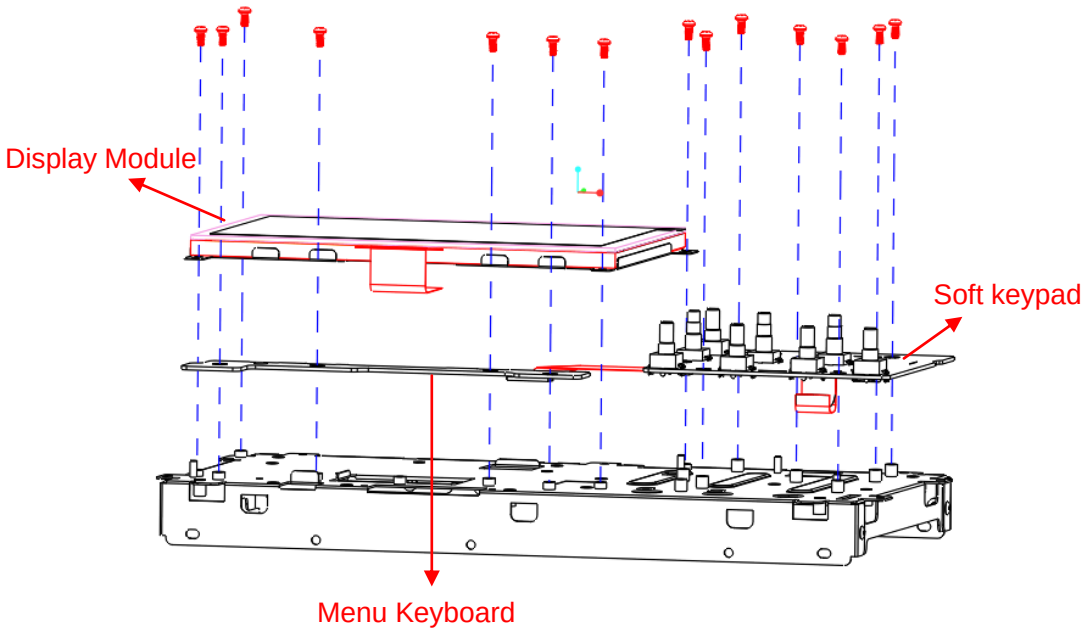


Figure 29 Removing the keypad and display Module

Removing steps:

1. Remove the seven screws loacted on the keypad board.
2. Remove the seven screws loacted on the edge of the display module.
3. Disconnect the cable that connected keypad with menu keyboard.
4. Separate the keypad and display module carefully.

To install the keypad and display module, please operate as the reverse steps.

Troubleshooting

This chapter explains how to deal with general troubles that you may encounter while operating SDS1000X(+) series oscilloscope.

General troubles

1. The screen remains dark after power on:
   (1) Check if the power cord is correctly connected.
   (2) Check whether the fuse is burned out. If the fuse needs to be changed, please contact with SIGLENT as soon as possible and return the instrument to the factory to have it repaired by qualified personnel authorized by SIGLENT.
   (3) Restart the instrument after completing inspections above.
   (4) If it still does not work normally, please refer to the Display Troubleshooting or contact SIGLENT.

2. After the signal is sampled, there is no corresponding waveform displaying:
   (1) Check if the signal connecting cord is correctly connected to BNC connector.
   (2) Check if the Intensity knob on the front panel is properly adjusted.
   (3) Check if the probe is correctly connected to the item under test.
   (4) Check if there are signal generated from the item under test
   (You can connect the probe compensation signal to the problematic channel to determine the reason to the problem)
   (5) Resample the signal.

3. The voltage amplitude measured is higher or lower than the actual value (this error usually occurs in use of probe):

   (1) Check if the attenuation coefficient of the current channel matches with the attenuation ratio of the probe.

   (2) Check if the Input impedance(only designed selectable between 1MΩ and 50Ω inside SDS1000X(+)) in CH1 menu is correctly matches with that set inside arbitrary Waveform Generator that connected.

4. There is waveform displaying but not stable:

   (1) Check the trigger source: check whether the “Source” in “Setup” of “Trigger” is the actual operating channel.

   (2) Check if the waveform is wrong: it is easy for us to regard the wrong waveform as the real when a high frequency signal is connected to the instrument. You’d better make sure that the current time base is correct for the frequency of input signal.

   (3) Check the trigger type: “Edge” trigger suits to general signal and “Video” trigger suits to video signal. Only in correct trigger type can make the waveform stably display.

   (4) Change the setting of trigger holdoff.

5. No display after pressing RUN/STOP:

   Check whether the trigger Mode is “Normal” or “Single”, and if the trigger level exceeds the waveform range. If yes, set the trigger level to the middle or change the trigger Mode to “Auto”.

   Note: press “Auto Setup” could automatically replace the above setting.

6. USB storage can’t be recognized:

   (1) Check if the USB can work normally.

   (2) Make sure that the USB disk being used is of flash type, the instrument does not support USB of hardware type.

   (3) Make sure that the capacity of the USB disk is not too large. It is suggested that the capacity of the USB disk matches to the oscilloscope is no larger than 4 G.

   (4) Restart the instrument and then insert the USB to check it.

   (5) If it is still in abnormal use, please contact with SIGLENT.

7. The signal is not display correctly in the digital mode(SDS1000X+):

   (1) Check whether the connector which between logic probe and the jump wire is connected right.

   (2) Make sure the signal that test target output is correct.

(3) If the problem is still remain, please contact with SIGLENT.

8. The AWG don't output signal(SDS1000X+):

(1) Check if the function of AWG is turn on(the "Wave Gen" key is light on).

(2) Make sure the output signal is setting right.

(3) Make sure the connector on which the signal transmission is connected right.

(4) If output still not have signal,please contact with SIGLENT.

Troubleshooting the Hardware Failures

This section provides information and procedures to help you deal with general hardware failures you encounter while operating the oscilloscope. When troubleshooting these failures, it is essential for you to take into consideration of the following notices:

1. Please disconnect the power if you find a measured voltage value is different with the standard while measuring the voltage value.

2. Before disconnecting the cables connected to main board or FAN module, please turn off the oscilloscope and cut the power cord.

3. While performing any internal testing of the oscilloscope, please take some precautions to avoid damaging internal components or modules results from electrostatic discharge (ESD).

ESD Precautions

While performing any internal testing of the oscilloscope, please refer to the following precautions to avoid damages to internal modules or components result from ESD.

- Touch circuit boards by the edges as possible as you can.
- Reduce handling of static-sensitive modules when necessary .
- Wear a grounded antistatic wrist strap to insulate the static voltage from your body while touching these modules.
- Operate static-sensitive modules only at static-free areas. Avoid handling

modules in areas that allow anything capable of generating or holding a static charge.

Required Equipments

The equipments listed in the table are required to troubleshoot the oscilloscope.

Table 18 Required equipments

Equipment	Critical Specifications	Example
Digital Multimeter	Accuracy ±0.05% 1 mV resolution	Agilent 34401A
Oscilloscope	200MHz BW 1MΩ/50 MΩ impedance	SDS1202X

Main Board Drawing

Please refer to the following drawing to quickly locate test points on the main board for easy resolution of the failures you encounter.

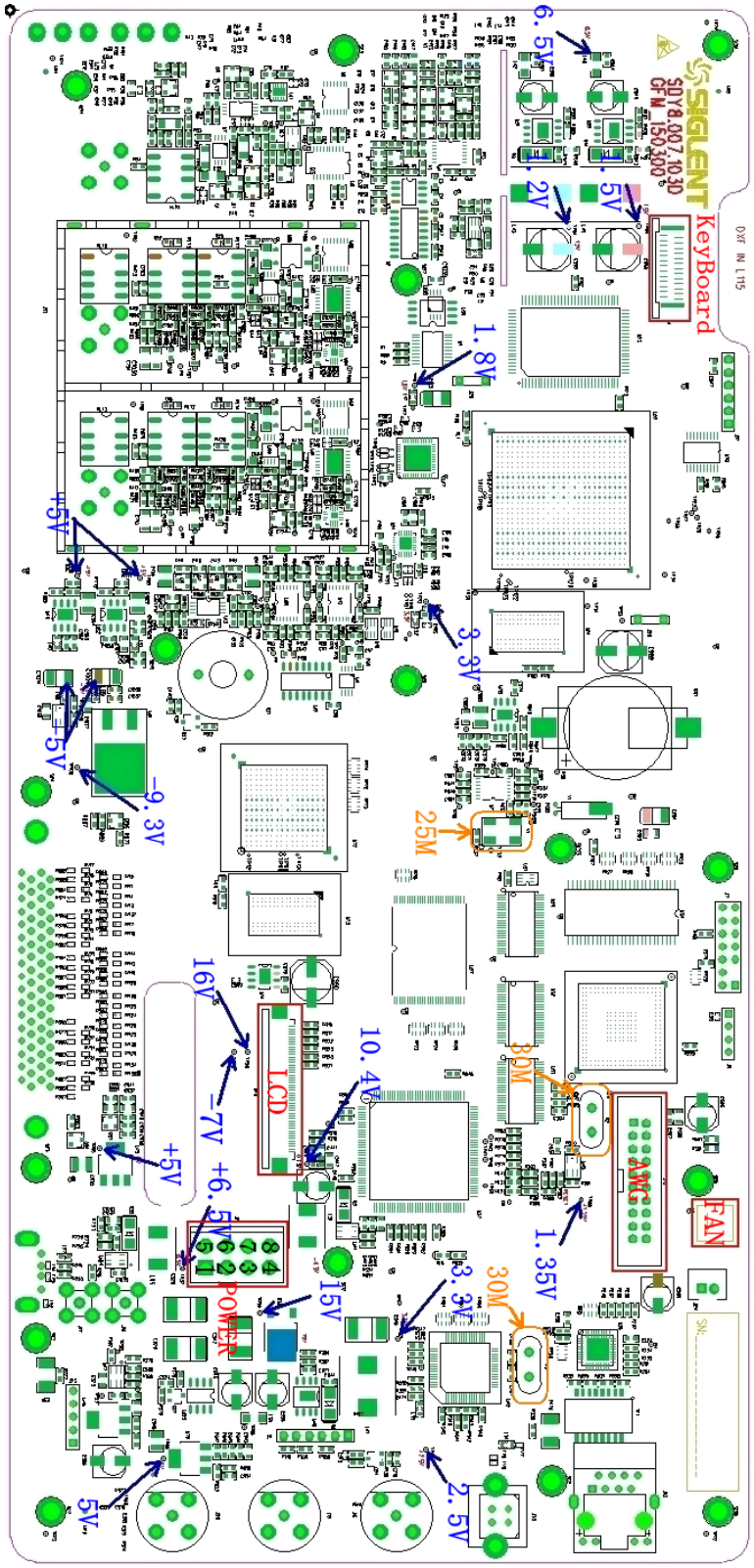


Figure 30 Main board module

AWG Board Drawing (SDS1000X+)

Please refer to the following drawing to quickly locate test points on the AWG board for easy resolution of the failures you encounter.

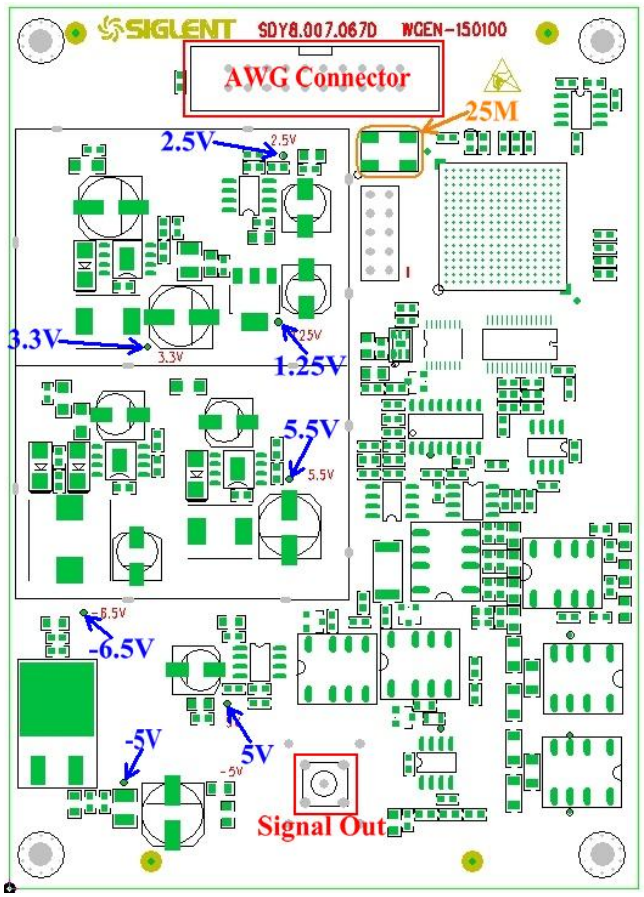


Figure 31 AWG board module

Troubleshooting Flowchart

The following flowchart describes how to troubleshoot the oscilloscope, making it easy for you to understand the troubleshooting procedures at first view.

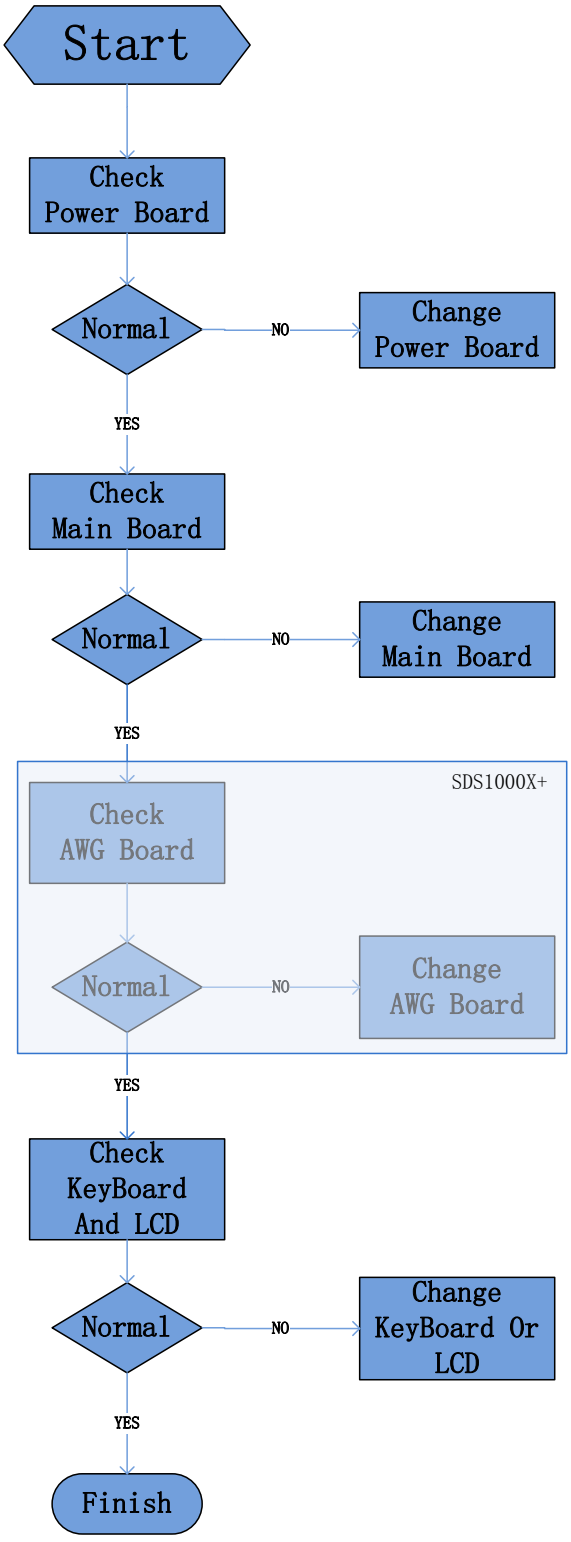


Figure 32 Troubleshooting flowchart

Check the Power Supply

Before performing the power supply testing procedure, please make sure that the oscilloscope is grounded through the protective lead of the power cord.

take care not to touch or even disassemble the power supply module without any safety precautions, or you may probably suffer from electric shock or burn. Here are procedures for testing the power supply:

1. Disconnect the power cord of the oscilloscope and then check whether the fuse has been burnt out.

2. Remove metallic cover of the power supply module using a driver, and then connect the power cord.

3. Focus at the Power Connector which contains 8 pins from Pin1 to Pin8 on the main board. You can test voltages provided by power supply at these points to check whether they are within the specified range using a digital multimeter. The corresponding voltage parameters to be tested are listed in table below:

   Table 19 Voltage parameters of the power supply module

Voltage value	**Pin**	**Normal Range**
0V	Pin4, Pin5, Pin6	NULL
-9.3V	Pin3	-9.1V~-9.5V
6.5V	Pin1, Pin2	6.3V~6.6V
15V	Pin8	14.8V~15.2V

   If each tested voltage value is within the spec range referring to the table above, then the power supply works normally. Otherwise, go to the next step.

4. Disconnect the cable connected to the main board, and then perform the testing procedures as above again:

   If each tested voltage value is within the spec range referring to the table above, then it is the abnormal of the load that leads to problematic power supply. Continuous checking or even replacing the main board is required for further test.

   If there is at least one voltage value beyond the spec range, then the power supply module proves problematic, you need replace a new one. For safety, please do not disassemble the power supply module by yourself.

Check the Main Board

If you want to remove the main board from the metal shelf inside the oscilloscope, you'd better place it on a clean, insulated mat after removing. In addition, to avoid some chips or components on the main board being damaged for overheating, please cool the main board whenever possible using a fan. Here are procedures for testing the main board:

1. Several kinds of connectors including Fan Connector, LCD Connector, Keyboard Connector and AWG Connector(SDS1000X+ used) are located on the main board. Check if they are connected properly.

2. Make sure that the connectors on the main board are connected properly firstly, then connect the power supply module cable to appointed place on the main board, lastly connect the oscilloscope power cord. Turn on the oscilloscope to check whether the voltage values at test points are within spec range using a digital multimeter. The voltage parameters to be tested are listed in table below:

Table 20 Voltage parameters of the main board

TP Voltage (V)	Normal Range (V)
-5	-5.2 ~ -4.8
5	4.9 ~ 5.1
3.3	3.15 ~ 3.45
2.5	2.25 ~ 2.75
1.8	1.7 ~ 2.0
1.5	1.425 ~ 1.575
1.35	1.235 ~ 1.47
1.2	1.14 ~ 1.26
10.4	10.2 ~ 10.6

   If there is at least one voltage value tested beyond the spec range, please turn off the oscilloscope and cut the power immediately to avoid damage to the chips or even the main board due to abnormal working. As a result, you need to replace a new main board.

   If each voltage value tested is within the spec range, please go to the next step.

3. Check if the clock of the main board can work normally using an oscilloscope. Focus at the test point marked with "30MHz" and "25MHz" on

the main board drawing.

If the clock measurement is not 30M and 25M, then the failure may come from the main board, a new one is required necessary.

If the clock measurement is 30M and 25M with abnormal working of the main board, you need to return the oscilloscope to manufacturer to have it repaired by qualified personnel.

Check the AWG Board(SDS1000X+)

If you want to remove the AWG board from the metal shelf inside the oscilloscope, you need to read notice that wrote in the first paragraph of previous section. Here are procedures for testing the AWG board:

1. There is “AWG Connector” and “Signal Out” connector are located on the AWG board. Check if they are connected properly.

2. Make sure that the connectors on the main board and AWG board are connected properly firstly, then connect the power supply module cable to appointed place on the main board, lastly connect the oscilloscope power cord. Turn on the oscilloscope to check whether the voltage values at test points are within spec range using a digital multimeter. The voltage parameters to be tested are listed in table below:

Table 21 Voltage parameters of the AWG board

TP Voltage (V)	Normal Range (V)
-6.5	-6.6~-6.4
5.5	5.4~5.6
-5	-5.2 ~ -4.8
5	4.9 ~ 5.1
3.3	3.15 ~ 3.45
2.5	2.25 ~ 2.75
1.25	1.135 ~ 1.37

If there is at least one voltage value tested beyond the spec range, please turn off the oscilloscope and cut the power immediately to avoid damage to the chips or even the AWG board due to abnormal working. As a result, you need to replace a new AWG board.

If each voltage value tested is within the spec range, please go to the next step.

3. Check if the clock of the AWG board can work normally using an oscilloscope. Focus at the test point marked with “25M” on the AWG board drawing.

   If the clock measurement is not 25M, then the failure may come from the AWG board, a new one is required necessary.

   If the clock measurement is 25M with abnormal working of the AWG board, you need to return the oscilloscope to manufacturer to have it repaired by qualified personnel.

Check the Display Module

Here are procedures for testing the Display Module:

1. Disconnect the power cord to make sure the display module cable are correctly connected.

2. Connect the power cord and turn on the oscilloscope. If the screen remains dark, then go to test the voltage value of the backlight where “16V” and “-7V” on the board.

   If the measurement of “16V”(TP99) is within the range of 15.3V ~ 16.7V, and “-7V”(TP48) is within the range of -7.7V ~ -6.3V, also the 10.4V is within the range of 10.2V ~ 10.6V. please reconnect the LCD connector to make sure its correct connecting. However, if the screen remains dark in this consequence, a new LCD is required.

   If the measurement is beyond the range, you need to replace a new power supply module.

3. If the screen gets bright displaying abnormal, then go to test the Clock located on the main board.

   If the clocks frequency that tested respectively are 25M and 30M, then the failure may come from the main board, a new one is required necessary.

   Otherwise, the failure may come from the display module, you need to return the oscilloscope to manufacturer to have it repaired by qualified personnel.

Handling General Hardware Failures

The general hardware failures are listed in the table below. Reading the following information can help you quickly handle some easy hardware failures with more convenience©

Table 22 Troubleshooting general failures

General hardware failures	Method to deal with
No start-up after pressing the ON/OFF button	Check if the power cord is correctly connected, if the power button is ok and if the fuse is damaged.
No displaying after power on	Check if the LCD connector is correctly connected.
No response after pressing any button in condition that the other parts work normally	Check if the keypad cable is correctly connected to the main board.
The USB interface works abnormally	Check if the back USB cable is correctly connected.
The LAN interface works abnormally	Restore the internet access to its initial setting.

Maintenance

Maintain Summary

SIGLENT warrants that the products it manufactures and sells are free from defects in materials and workmanship for a period of three years from the date of shipment from an authorized **SIGLENT** distributor. If a product or CRT proves defective within the respective period, **SIGLENT** will provide repair or replacement as described in the complete warranty statement.

To arrange for service or obtain a copy of the complete warranty statement, please contact your nearest **SIGLENT** sales and service office.

Except that as provided in this summary or the applicable warranty Statement, **SIGLENT** makes no warranty of any kind, express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose. In no case shall **SIGLENT** be liable for indirect, special or consequential damages.

Repackaging for Shipment

If the unit needs to be shipped to **SIGLENT** for service or repair, be sure:

1. Attach a tag to the unit identifying the owner and indicating the required service or repair.
2. Place the unit in its original container with appropriate packaging material for shipping.
3. Secure the container with strong tape or metal bands.

If the original shipping container is not available, place your unit in a container which will ensure at least 4 inches of compressible packaging material around all sides for the instrument. Use static-free packaging materials to avoid additional damage to your unit.

Contact SIGLENT

SIGLENT TECHNOLOGIES CO., LTD

Address：3/F, building NO.4, Antongda Industrial Zone, 3rd Liuxian Road, Bao'an District, Shenzhen, P.R.China

Tel：0086-755-3661 5186

E-mail：sales@siglent.com

http://www.siglent.com