

# **Service Manual**

**SDS1000CML/CNL/DL  
Series Digital Oscilloscope**



# Guaranty and Declaration

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## General Safety Summary

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:



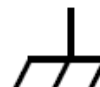
**Hazardous  
Voltage**



**Refer to  
Instructions**



**Protective  
Earth  
Terminal**



**Chassis  
Ground**



**Test  
Ground**

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## Contents

|  |           |
|--|-----------|
| <b>Guaranty and Declaration</b> .....            | <b>I</b>  |
| <b>General Safety Summary</b> .....              | <b>II</b> |
| <b>General Features and Specifications</b> ..... | <b>1</b>  |
| General Features .....                           | 1         |
| Specifications .....                             | 2         |
| <b>Prepare Information</b> .....                 | <b>6</b>  |
| Functional checking .....                        | 6         |
| Power-on Inspection .....                        | 6         |
| Default Setup .....                              | 7         |
| Probe Compensation .....                         | 9         |
| Auto Setup .....                                 | 10        |
| Self Calibration .....                           | 10        |
| Interface Test .....                             | 12        |
| USB Host Test .....                              | 12        |
| USB Device Test.....                             | 14        |
| LAN Test .....                                   | 15        |
| Pass/Fail Test .....                             | 16        |
| <b>Performance Test</b> .....                    | <b>18</b> |
| Verify Test Results .....                        | 19        |
| Self Test.....                                   | 19        |
| Self Calibration .....                           | 19        |
| To verify DC Gain Accuracy .....                 | 20        |
| To verify Bandwidth.....                         | 21        |
| To verify Time Base Accuracy .....               | 23        |
| To verify Trigger Sensitivity .....              | 24        |
| <b>Adjusting Procedures</b> .....                | <b>26</b> |
| Warming up .....                                 | 26        |
| Self calibration .....                           | 26        |
| Required Equipments .....                        | 26        |
| Software Installation.....                       | 26        |
| Adjusting steps .....                            | 26        |
| <b>Assembly Procedures</b> .....                 | <b>28</b> |
| Security Consideration.....                      | 28        |
| List of Modules.....                             | 28        |
| Required Tools.....                              | 29        |
| Disassembly Procedures .....                     | 29        |
| Removing the Rear Panel .....                    | 31        |
| Removing the Top Metal Cover .....               | 33        |
| Removing the Rear Metal Cover.....               | 32        |
| Removing the Power Supply Module.....            | 34        |
| Removing the Interface Module .....              | 错误！未定义书签。 |
| Removing the Fan Module .....                    | 38        |
| Removing the Main Board.....                     | 36        |
| Removing the Metal Shelf.....                    | 35        |
| Removing the Display Module .....                | 39        |
| Removing the Front Panel Module.....             | 错误！未定义书签。 |

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|   |           |
|---|-----------|
| Removing the Keypad.....                            | 40        |
| Removing the Front-Panel Knobs .....                | 30        |
| <b>Troubleshooting .....</b>                        | <b>41</b> |
| General troubles .....                              | 41        |
| Troubleshooting the Hardware Failures .....         | 43        |
| ESD Precautions .....                               | 43        |
| Required Equipments .....                           | 43        |
| Main Board Drawing .....                            | 44        |
| Troubleshooting Flowchart.....                      | 45        |
| Check the Power Supply.....                         | 46        |
| Check the Main Board .....                          | 47        |
| Check the Display Module .....                      | 48        |
| Troubleshooting the General Hardware Failures ..... | 49        |
| <b>Maintenance .....</b>                            | <b>50</b> |
| Maintain summary.....                               | 50        |
| Inspecting and Care.....                            | 50        |
| General Inspecting.....                             | 50        |
| General Care and Cleaning .....                     | 51        |
| Extended Service.....                               | 错误！未定义书签。 |
| Extended Service Details.....                       | 错误！未定义书签。 |
| Contact SIGLENT .....                               | 53        |
| <b>Replaceable Parts .....</b>                      | <b>52</b> |





# General Features and Specifications

## General Features

SDS1000CML/CNL/DL series oscilloscope is two-channel instrument in small, lightweight, benchtop chassis that you can use to take ground-referenced measurements.

Table 1-1 General features

| Model      | Channels | Bandwidth | Sampling Rate | Memory Depth        |
|------------|----------|-----------|---------------|---------------------|
| SDS1072CML | 2        | 70MHz     | 1GSa/s        | 2Mpts(Depth memory) |
| SDS1102CML | 2        | 100MHz    | 1GSa/s        | 2Mpts(Depth memory) |
| SDS1152CML | 2        | 150MHz    | 1GSa/s        | 2Mpts(Depth memory) |
| SDS1072CNL | 2        | 70MHz     | 1GSa/s        | 40Kpts              |
| SDS1102CNL | 2        | 100MHz    | 1GSa/s        | 40Kpts              |
| SDS1022DL  | 2        | 25MHz     | 500MSa/s      | 32Kpts              |
| SDS1052DL  | 2        | 50MHz     | 500MSa/s      | 32Kpts              |
| SDS1102DL  | 2        | 100MHz    | 500MSa/s      | 32Kpts              |
| SDS1202DL  | 2        | 200MHz    | 500MSa/s      | 32Kpts              |

- The volume of the oscilloscope is cabinet and it is portable.
- 7" Color TFT LCD display.
- 2 channels, Bandwidth: 25MHz ~200 MHz.
- Single real-time sampling rate are: 500MSa/s(SDS1000DL); 1Gsa/s (SDS1000CML /CNL); Equivalent sampling rate is 50GSa/s.
- Trigger types: Edge, Pulse, Video, Slope and Alternative.
- Unique Digital Filter function and Waveform recorder function.
- Auto measure thirty two parameters and support all measurement function.
- Two groups' reference waveforms and twenty groups' capture waveforms and twenty groups' setups internal save/recall function and USB flash drive save/recall function.
- Cursor types: Manual mode, Track mode and Auto mode.
- Channel waveform and its FFT waveform display on split screen.

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- Waveform Intensity and Grid Brightness can be adjusted.
- Menu display in the form of pop-up that in order to convenience users to use it.
- Multiple Language User Interface.
- Support Multilingual online help system.
- Standard interface: USB Host, USB Device, RS-232, Pass/Fail Out.

## Specifications

These specifications apply to SDS1000CML/CNL/DL series Digital Storage Oscilloscopes. To verify that an oscilloscope meets specifications, it must first meet the following conditions:

- The oscilloscope must have been operating continuously for thirty minutes within the specified operating temperature.
- You must perform the Do Self Cal operation, accessible through the Utility menu, if the operating temperature changes by more than 5 °C.
- The oscilloscope must be within the factory calibration interval of one year.

All specifications are guaranteed unless noted “typical”.

Table 1-2 Oscilloscope specifications

| <b>Inputs</b>           |                                     |
|-------------------------|-------------------------------------|
| Input Coupling          | AC, DC, GND                         |
| Input Impedance         | (1MΩ±2%)    (16Pf±3Pf)              |
| Maximum input voltage   | 400Vpk, CAT II                      |
| Probe attenuation       | 1X, 10X                             |
| Probe attenuation ratio | 1X, 5X, 10X, 50X, 100X, 500X, 1000X |

| <b>Vertical System</b> |  |
|------------------------|--|
| Volts/Div Range        | 2mV/div~10V/div( in 1, 2, 5 sequence)    |
| Channel Voltage        | 2mV~200mV: ±1.6V                         |
| Offset Range           | 206 mV~10V: ±40V                         |
| Vertical Resolution    | 8 bit                                    |
| The number of channel  | 2  |
| Analog Bandwidth       | 25M (SDS1022DL)                          |
|                        | 50M (SDS1052DL)                          |
|                        | 70M (SDS1072CML, SDS1072CNL)             |
|                        | 100M (SDS1102CML, SDS1102CNL, SDS1102DL) |
|                        | 150M (SDS1152CML)                        |
|                        | 200M (SDS1202DL)                         |

|                                    |   |
|------------------------------------|---|
| Lower Frequency Limit (AC Coupled) | ≤10Hz at BNC  |
| DC Gain Accuracy                   | ≤±3.0%: 5mV/div to 10V/div<br>≤±4.0%: typical for 2mV/div           |
| DC Measurement Accuracy            | ±[3%( reading  +  offset ) +1%  offset  +0.2div +2mV], ≤100mV/div   |
|                                    | ±[3%( reading  +  offset ) +1%  offset  +0.2div +100mV], >100mV/div |
| Rise Time                          | <14nS (SDS1022DL )  |
|                                    | <7.0nS (SDS1052DL )   |
|                                    | <5.0nS (SDS1072CML, SDS1072CNL)                                     |
|                                    | <3.5nS (SDS1102CML,SDS1102CNL<br>SDS1102DL)                         |
|                                    | <2.3nS (SDS1152CML)   |
|                                    | <1.8nS (SDS1202DL)  |
| Math Operation                     | +, -, *, /, FFT   |
| FFT                                | Window mode: Hanning, Hamming, Blackman, Rectangle                  |
|                                    | Sampling points: 1024   |
| Bandwidth Limit                    | 20MHz   |

**Horizontal System**

|                          |  |
|--------------------------|--|
| Real Time Sampling Rate  | CML/CNL: 1GSa/s for single channel<br>500MSa/s for double channels |
|                          | DL: 500MSa/s for single, 500MSa/s for double channels              |
| Equivalent Sampling Rate | 50GSa/s  |
| Sec/Div Range            | 2.5nS/div~50S/div  |
| Scan Range               | 100mS/div~50S/div (in 1-2.5-5 sequence)                            |
| Time base Accuracy       | ±50ppm (in range of over 1ms time interval)                        |

**Measure System**

|                       |         |  |
|-----------------------|---------|--|
| Automatic Measurement | Voltage | Vpp, Vmax, Vmin, Vamp, Vtop, Vbase, Vavg, Mean, Vrms, Crms, FOV, FPRE, ROV, RPRE |
|                       | Time    | Period, Frep, +Wid, -Wid, Rise Time, Fall Time, Bwid, +Dut, -Dut                 |
|                       | Delay   | Phase, FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF                                    |

**Trigger System**

|                  |   |
|------------------|---|
| Trigger Types    | Edge, Pulse, Video, Slope, Alternative  |
| Trigger Source   | CH1, CH2, EXT, EXT/5, AC Line   |
| Trigger Modes    | Auto, Normal, Single  |
| Trigger Coupling | DC, allow to pass the whole signal  |
|                  | AC, prevent DC part of the whole signal and attenuate signal that lower than 50Hz |

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|------------------------|--|---|
|                        | HF REJ, attenuate signal that higher than 150KHz   |   |
|                        | LF REJ, attenuate signal that lower than 7KHz  |   |
| Trigger Range          | Level  | CH1/CH2: $\pm 6$ divisions from center of screen                    |
|                        |  | EXT: $\pm 1.2V$   |
|                        |  | EXT/5: $\pm 6V$   |
| Trigger Sensitivity    | CH1/CH2  | 1division DC~10MHz<br>1.5divisions 10MHz~BWmax                      |
|                        | EXT  | 200mV DC~10MHz<br>300mV 10MHz~BWmax                                 |
|                        | EXT/5  | 1Vpp DC~10MHz<br>1.5Vpp 10MHz~BWmax                                 |
| Trigger Level Accuracy | CH1/CH2  | $\pm 0.4$ division (within $\pm 4$ divisions from center of screen) |
|                        | EXT  | $\pm(6\%$ of setting + 40mV)  |
|                        | EXT/5  | $\pm(6\%$ of setting + 200mV)                                       |
| Trigger Location       | Pre-trigger: (Memory depth/ (2 $\times$ sampling rate) ) ,<br>Delay Trigger: 268.04div               |   |
| Holdoff Range          | 100ns ~1.5s  |   |
| Edge Trigger           | Trigger Mode: Rising slope, Falling slope, Rising and Falling slope                                  |   |
| Pulse Trigger          | Trigger Mode   | <, >, = (positive pulse width)<br><, >, = (negative pulse width)    |
|                        | Pulse Width Range: 20 ns ~10s  |   |
|                        | Support signal Formats: Pal/Secam, NTSC  |   |
| Video Trigger          | Trigger condition: Odd Field, Even Field, All Lines, Line Num  |   |
| Slope Trigger          | Trigger Mode   | >, <, = (rising slope)<br>>, <, = (falling slope)                   |
|                        | Time: 20ns ~10s  |   |
| Alternative Trigger    | Allow two channels trigger simultaneously, and support four trigger mode: Edge, Pulse, Video, Slope, |   |

|                     |   |
|---------------------|---|
| <b>X-Y Mode</b>     |   |
| X axis/Y axis input | CH1/CH2   |
| Sampling Rate       | XY Mode breaks the limit of sampling rate at 1MSa/s of traditional oscilloscope, and supports sampling rate between 25KSa/s~250MSa/s. |

|                                   |   |
|-----------------------------------|---|
| <b>Hardware Frequency Counter</b> |   |
| Readout Resolution                | 1Hz   |
| Frequency Range                   | From 10Hz to rated Bandwidth  |
| Signal Types                      | Apply to all signals that can correctly trigger except for Pulse signal and Video signal. |

Table 1-3 Oscilloscope general specifications

| <b>Display System</b>                  |  |         |
|--|--|---------|
| Display Type                           | Color TFT 7in.(178mm) Liquid Crystal Display   |         |
| Resolution                             | 480 horizontal by 234 vertical pixels  |         |
| Display Color                          | 24 bit   |         |
| Display Contrast<br>(Typical state)    | 150:1  |         |
| Backlight Intensity<br>(Typical state) | 300nit   |         |
| Wave display range                     | 8 x 18 div   |         |
| Wave Display Mode                      | Dot, Vector  |         |
| Persist                                | Off, 1 sec, 2 sec, 5 sec, Infinite   |         |
| Menu Display                           | 2 sec, 5 sec, 10 sec, 20 sec, Infinite   |         |
| Screen-Saver                           | Off, 1min, 2min, 5min, 10min, 15min, 30min,<br>1hour, 2hour, 5hour   |         |
| Skin                                   | Classical, Modern, Tradition, Succinct   |         |
| Waveform<br>Interpolation              | Sin(x)/x   |         |
| Screen Display                         | Normal , Invert  |         |
| Language                               | Simplified Chinese, Traditional Chinese, English,<br>Arabic, French, German, Russian, Portuguese,<br>Japanese, Korean, Italian |         |
| <b>Power Supply</b>                    |  |         |
| Input Voltage                          | 100~240 VAC, CAT II, Auto selection  |         |
| Frequency Scope                        | 45Hz to 440Hz  |         |
| Power                                  | < 50VA   |         |
| <b>Environments</b>                    |  |         |
| Temperature                            | Operating:10℃ to +40℃<br>Not operating: -20℃ to +60℃   |         |
| Cooling                                | The fan forces it cold.  |         |
| Humidity                               | Operating: 85%RH, 40℃, 24 hours<br>Not operating: 85%RH, 65℃, 24 hours   |         |
| Height                                 | Operating: 3000m<br>Not operating: 15,266m   |         |
| <b>Mechanical</b>                      |  |         |
| Dimension                              | length   | 323.1mm |
|  | Width  | 135.6mm |
|  | Height   | 157mm   |
| Weight                                 | 2.5kg  |         |

## 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. This chapter includes the following contents:

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

Fore more detailed information about oscilloscope operation, please refer to you Quick Guide.

## Functional checking

This functional checking covers three kinds of checks, by which you can verify whether the oscilloscope works normally.

### Power-on Inspection

The normal operating voltage for SDS1000CML/CNL/DL series digital oscilloscope is in range of 100 ~240VRMS with frequency from 45Hz to 440Hz. Connect the power line to the socket on the rear panel of the oscilloscope.



Figure 2-1 Connect power line

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

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Press the Power button located at the top of the oscilloscope 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 CH2.

Table 2-1 Default settings

| Menu or System | Option          | Default setting  |
|----------------|-----------------|------------------|
| CH1/CH2        | Coupling        | DC               |
|                | Bandwidth limit | Off              |
|                | Volts/Div       | Coarse           |
|                | Probe           | 1x               |
|                | Invert          | Off              |
|                | Filter          | Off              |
| MATH           | Operation       |                  |
|                | FFT Operation   | +                |
|                | Source          | CH1              |
|                | Window          | Hanning          |
|                | FFT Zoom        | 1X               |
|                | Scale           | dBVrms           |
|                | Display         | Split            |
| HORIZONTAL     | Delay           | Off              |
|                | Sec/Div         | 500us            |
|                | Position        | 0s               |
|                | Window Zone     | 50us             |
| CURSOR         | Type            | Off              |
|                | Source          | CH1              |
|                | Voltage         | +/-3.2 divisions |
|                | Time            | +/-8 divisions   |
| ACQUIRE        | Acquisition     | Sampling         |
|                | Sin x /x        | Sin x            |
|                | Mode            | Real Time        |
| DISPLAY        | Type            | Vectors          |
|                | Persistence     | Off              |
|                | Intensity       | 60%              |
|                | Brightness      | 40%              |
|                | Format          | YT               |
|                | Menu Display    | Infinite         |
| SAVE/RECALL    | Type            | Setups           |
|                | Save to         | Device           |
|                | Setup           | No.1             |

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|               |           |                     |
|---------------|-----------|---------------------|
| UTILITY       | Counter   | On                  |
|               | Pass/Fail | Off                 |
|               | Record    | Off                 |
| TRIGGER       | Type      | Edge                |
| Edge TRIGGER  | Source    | CH1                 |
|               | Slope     | Rising              |
|               | Mode      | Auto                |
|               | Coupling  | DC                  |
|               | Level     | 0V                  |
| Pulse TRIGGER | Source    | CH1                 |
|               | Condition | = at positive pulse |
|               | Set Width | 1.00ms              |
|               | Mode      | Auto                |
|               | Coupling  | DC                  |
| Video TRIGGER | Source    | CH1                 |
|               | Polarity  | Negative            |
|               | Sync      | All lines           |
|               | Standard  | NTSC                |
|               | Mode      | Auto                |
| Slope TRIGGER | Source    | CH1                 |
|               | Condition | > at Rising slope   |
|               | Time      | 1.00ms              |
|               | Mode      | Auto                |
|               | Vertical  | The higher level    |
| Alternative   | Source    | CH1                 |
|               | Mode      | Edge                |
|               | Coupling  | DC                  |
|               | Slope     | Rising              |



## Probe Compensation

It is better for you to compensate the probe at first use so as to match it 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 to 10X on the probe.

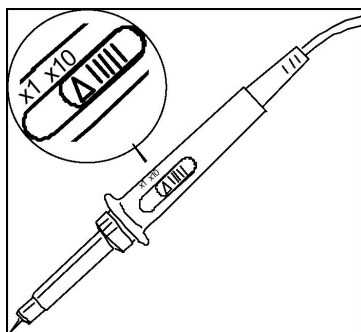
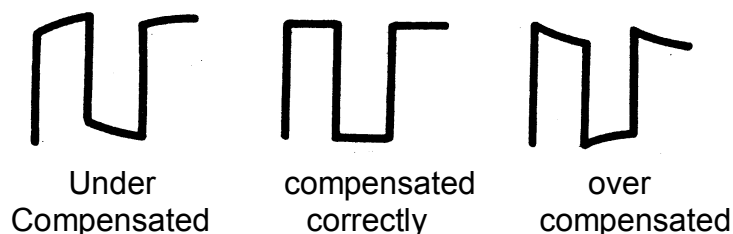


Figure 2-2 Set probe attenuation switch

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 display should be a square waveform as shown in the figure below in normal condition:








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

Table2-2 Auto setting menu

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

Four parameters will display on the screen after the stability of the waveform. Which channel to select as the trigger source when several channels are on based on the following conditions:

- The input signal frequency must be higher than 10Hz, with the amplitude higher than 8MV.
- Selecting channel with the lowest frequency while several channels are connected with signal.

## Self Calibration

The self Calibration procedure can quickly optimize the signal path thus to obtain the best measurement precision. It is essential for you to run the procedure if the environmental temperature changes by 5 °C or more. Otherwise, please perform self calibration according to your actual conditions.

You can perform the Self Calibration procedure as the following steps:

### Steps:

1. Disconnect any probes or cables from all BNC connectors.
2. Press the button UTILITY and then select the Do Self Cal option to enable the Self Calibration function. The oscilloscope will turn to interface below:

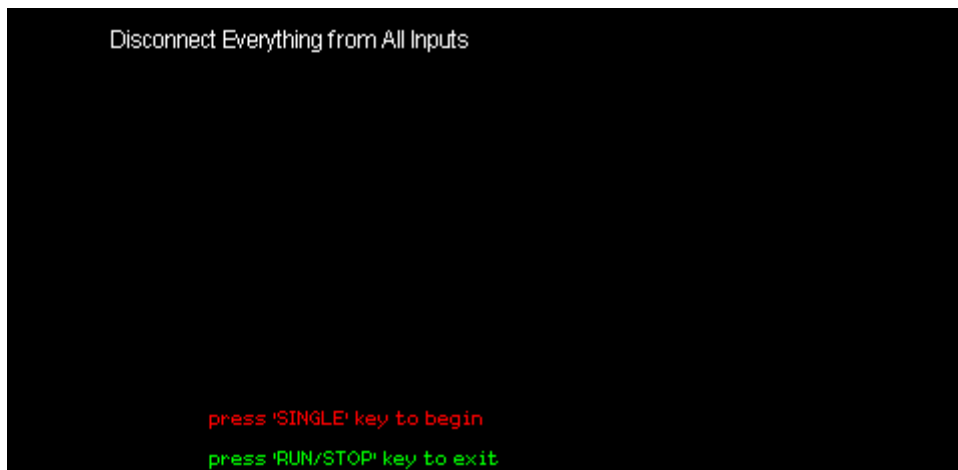


Figure 2-3 Calibration interface

3. Press “SINGLE” to begin.

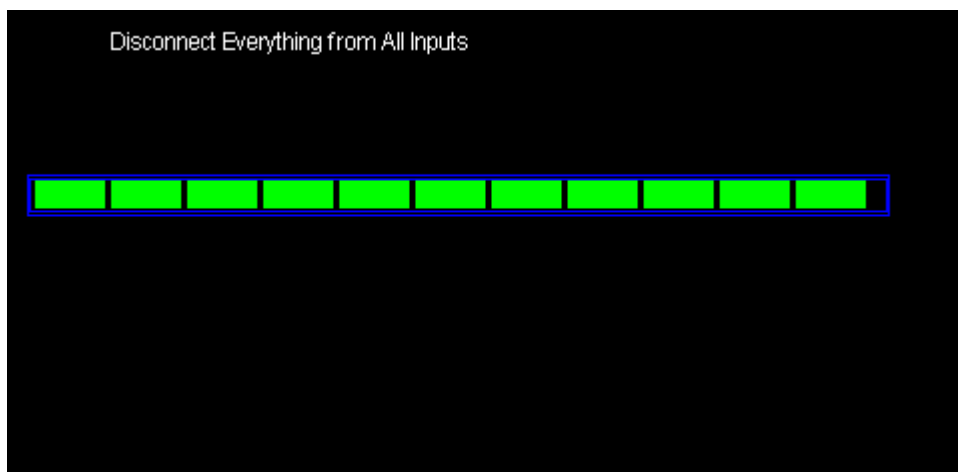


Figure 2-4 Calibration interface

4. After the Self Calibration completed, Press “RUN/STOP” key to exit.

**Note:** In normal condition, the self calibration will take about 20 seconds. If it does not complete within this period or stop at one of the calibration items, there may be failures inside the instrument.

## Interface Test

The SDS1000CML/CNL/DL oscilloscope is designed with four standard interfaces: USB Host interface on the front panel, USB Device interface, RS-232 interface and Pass/Fail interface on the rear panel. Being connected to other instruments via these interfaces enables the oscilloscope to realize some advanced functions. To make sure the oscilloscope can work normally, please test the interfaces at first.

### USB Host Test

To test if the USB Host interface works normally.

Tools:

- An SDS1000CML/CNL/DL digital oscilloscope
- An U disk

Steps:

1. Insert an U disk 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, which suggests the U disk has been recognized successfully.

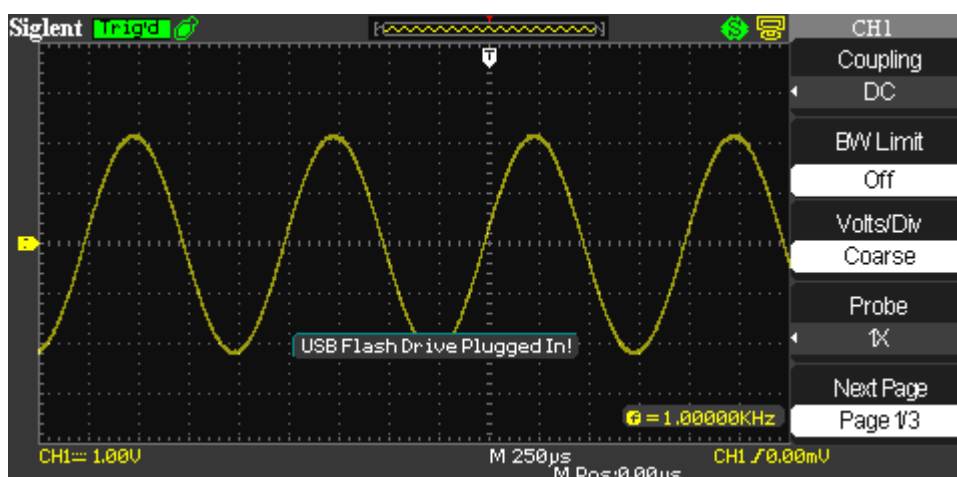


Figure 2-5 Insert U disk

3. Press Save/Recall button to display Save/Recall menu, then select “File” at the second option “Save To” and select “Save” to enter file save/recall interface.

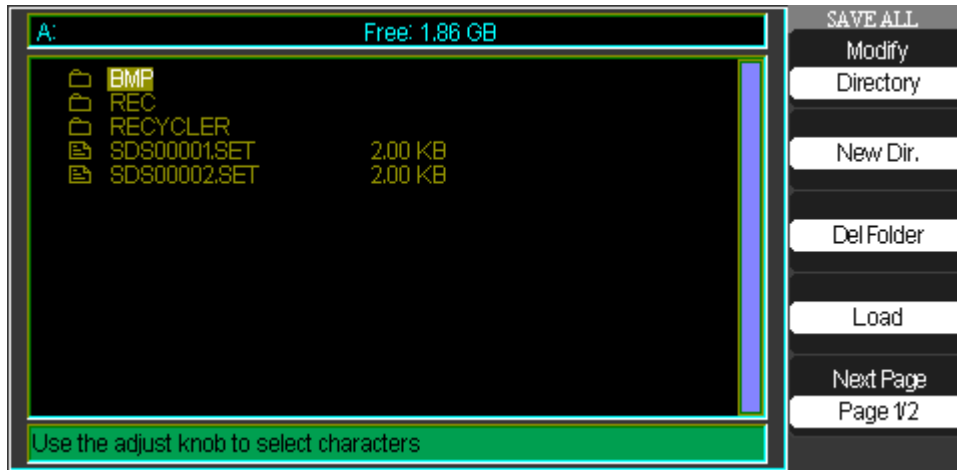


Figure 2-6 File save interface

4. Remove the U disc and quickly a prompt message “USB Flash Drive Plug Out!” appears

## USB Device Test

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

Tools:

- A SDS1000CML/CNL/DL oscilloscope
- A computer with USB interface
- A standard USB cable (Type AB)
- EasyScopeX software for SDS1000CML/CNL/DL

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, then select “USBTMC” in “Back USB” menu under the UTILITY menu.
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.



## RS-232 Test

To test if the RS-232 interface works normally through Super Terminal.

Tools:

- An SDS1000CML/CNL/DL Oscilloscope
- A computer with RS-232 interface
- A standard RS-232 cable

Steps:

1. Super Terminal is a type of software within Windows XP itself. Firstly you should set up a Super Terminal shortcut on your desktop. Remember to set the Baud Rate to 38400 during the setup procedures.
2. Connect the oscilloscope and the computer using a RS-232 cable via RS-232 interface. Open the Super Terminal shortcut that set in step 1 on your desktop.



Figure 2-7 RS-232 interface

3. You can input any letter or figure, and it will response to you. This function is designed for secondary development.

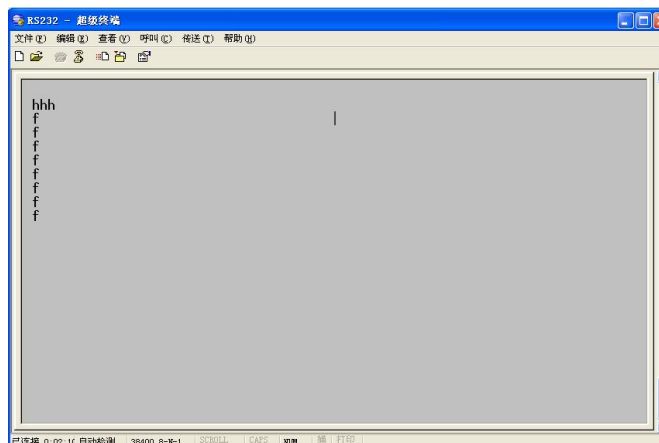


Figure 2-8 RS-232 Super Terminal interface

## Pass/Fail Test

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

Tools:

- A SDS1000CML/CNL/DL Oscilloscope
- An oscilloscope of any type
- Two BNC cables
- An arbitrary Waveform Generator

Steps:

1. Turn on the SDS1000CML/CNL/DL oscilloscope.
2. Input 1 KHz Sine signal to the oscilloscope using an arbitrary Waveform Generator through a BNC cable, then press AUTO on the front panel of the oscilloscope.
3. Press “UTILITY” button →page3/4→ Pass/Fail, set the submenus under the Pass/Fail menu as table below:

Table 2-3 Pass/Fail submenu items

| <b>Submenu</b> | <b>Setting</b>      |
|----------------|---------------------|
| Enable Test    | On                  |
| Source         | CH1                 |
| Msg Display    | On                  |
| Output         | Pass                |
| Stop On Output | Off                 |
| Mask setting   |                     |
| X Mask         | 0.24div (arbitrary) |
| Y Mask         | 0.28div (arbitrary) |

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

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



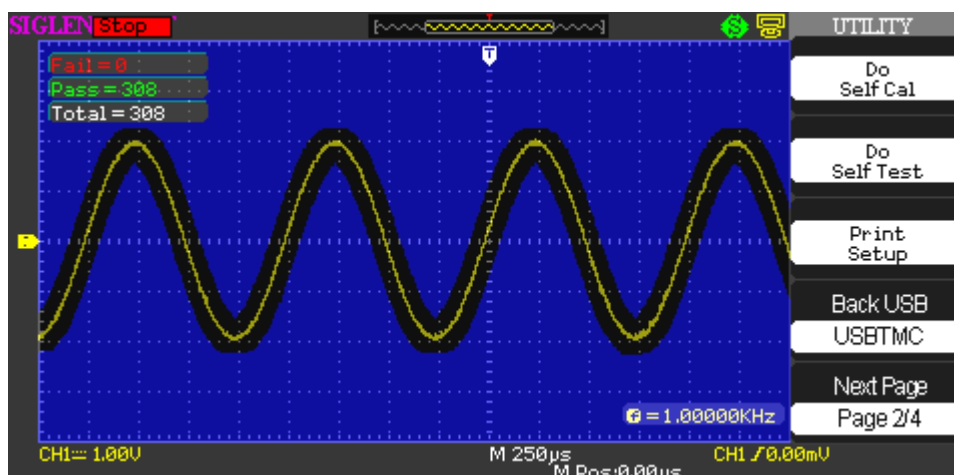


Figure 2-9 Pass/Fail Waveform

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 BNC connector of the SDS1000CML/CNL/DL oscilloscope and channel 1 BNC connector of another oscilloscope using a BNC cable.
5. If the Pass/Fail interface works normally, you will see a pulse wave displays as below by properly adjusting the time base and voltage scale. Otherwise, there might be errors to the interface.

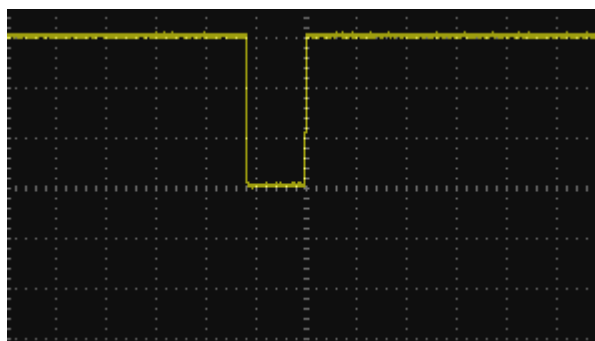


Figure 2-10 Pulse Waveform

## Performance Test

This chapter mainly explains how to perform tests to make sure that the oscilloscope meets the performance specifications. For accurate test results, please let the test requirement and the oscilloscope warm up 30 minutes before testing.

Here are the required equipments for the test:

Table 3-1 Test equipments

| Description                         | Critical Specifications                        | Example                   |
|-------------------------------------|--|---------------------------|
| DC Voltage Source                   | -6mv~30v, $\pm 0.1\%$ accuracy                 | FLUKE 9500B<br>Calibrator |
| Sine Wave Generator                 | 10Hz~300MHz,<br>$\pm 0.1\%$ amplitude accuracy |                           |
| BNC Cable                           | BNC(m) to BNC(m),<br>About 1m long             |                           |
| 50 $\Omega$ Feedthrough Termination | 50 $\Omega$ BNC(f) to BNC(m)                   |                           |

Here is the connecting between FLUKE 9500B and the oscilloscope under test:



Picture 3-1 Connecting test instruments

## **Verify Test Results**

To verify whether a test passes, whether the readings are within the limits, it is necessary for you to record the readings in the Performance Test on Test Record.

## **Self Test**

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

## **Self Calibration**

You must perform the Self Calibration operation described in chapter 2. If the environmental temperature changes by more than 5°C, you must perform the Self Calibration operation again.

## To verify DC Gain Accuracy

$$\text{DC Gain Accuracy error} = | 1 - \{ (V_{\text{pos}} - V_{\text{neg}}) / (V_{\text{Setting}(+)} - V_{\text{Setting}(-)}) \} | < 3\%$$

Note: “ $V_{\text{Setting}}$ ” represents DC voltage output level

This test verifies DC Gain Accuracy of all channels.

- Steps:
1. Set the DC voltage source output level to **0v**.
  2. Connect channel 1 of the oscilloscope to the DC voltage source of FLUKE 9500B using its specified cable.
  3. Set the Volts/Div of channel 1 to 10v/div.
  4. Set the DC voltage output level to the positive voltage listed below and then record the reading as  $V_{\text{pos}}$ .
  5. Reverse the polarity of the DC voltage source and then record the reading as  $V_{\text{neg}}$ .
  6.  $V_{\text{sub}} = V_{\text{pos}} - V_{\text{neg}}$ , calculate  $V_{\text{sub}}$  and then check to see if it is in the accuracy limits range.
  7. Set the Volts/Div of channel 1 from 5v/div to 2mv/div, and then record the reading in the same way as step 4 to 6.
  8. Set DC voltage source output level to 0v.
  9. Disconnect the connection of channel 1.
  10. Check channel 2 in the same way as step 1 to 9.

Table 3-2 DC Gain Accuracy

| Volt/Div  | DC voltage output levels | Accuracy limits range for $V_{\text{sub}}$ |
|-----------|--------------------------|--|
| 10v/div   | +30V, -30V               | 58.2V~61.8V                                |
| 5v/div    | +15V, -15V               | 29.1 V~30.9 V                              |
| 2v/div    | +6V, -6V                 | 11.64 V~12.36 V                            |
| 1v/div    | +3V, -3V                 | 5.82 V~6.18 V                              |
| 500mv/div | +1.5V, -1.5V             | 2.91 V~3.09 V                              |
| 200mv/div | +600mV, -600mV           | 1.164 V~1.236 V                            |
| 100mv/div | +300mV, -300mV           | 582 mV~618 mV                              |
| 50mv/div  | +150mV, -150mV           | 291 mV~309 mV                              |
| 20mv/div  | +60mV, -60mV             | 116.4 mV~123.6 mV                          |
| 10mv/div  | +30mV, -30mV             | 58.2 mV~61.8 mV                            |
| 5mv/div   | +15mV, -15mV             | 29.1 mV~30.9 mV                            |
| 2mv/div   | +6mV, -6mV               | 11.52 mV~12.48 mV                          |

## To verify Bandwidth

This test checks the bandwidth of two input channels. In the test, both the impedance of FLUKE and the oscilloscope are required to set to  $50\Omega$ , we could complete that for FLUKE by easy operation on the front panel. But for the oscilloscope, it proves to be a little different since it is designed with only  $1M\Omega$  in impedance. So a  $50\Omega$  feedthrough terminator is needed essential to complete the verification.

Table 3-3 Input Impedance for SDS1000CML/CNL/DL

| Model      | Channels | Bandwidth | Input Impedance |
|------------|----------|-----------|-----------------|
| SDS1072CML | 2        | 70MHz     | $1M\Omega$      |
| SDS1102CML | 2        | 100MHz    | $1M\Omega$      |
| SDS1152CML | 2        | 150MHz    | $1M\Omega$      |
| SDS1072CNL | 2        | 70MHz     | $1M\Omega$      |
| SDS1102CNL | 2        | 100MHz    | $1M\Omega$      |
| SDS1022DL  | 2        | 25MHz     | $1M\Omega$      |
| SDS1052DL  | 2        | 50MHz     | $1M\Omega$      |
| SDS1102DL  | 2        | 100MHz    | $1M\Omega$      |
| SDS1202DL  | 2        | 200MHz    | $1M\Omega$      |

The  $50\Omega$  feedthrough terminator is added to end of the probe specified for FLUKE 9500B.

To test the bandwidth at 500mv/div and 200mv/div

- Steps:
1. Connect channel 1 of the oscilloscope to Sine Wave Generator of FLUKE 9500B via its specified probe.
  2. Set the oscilloscope Volt/Div to 500mv/div, the Sec/Div to 50ms/div.
  3. Set the frequency of Sine Wave Generator of FLUKE to 10Hz.
  4. Set the amplitude of Sine Wave Generator to 3v.
  5. Press the MEASURE button on the front panel of the oscilloscope to display  $V_{pp}$  measurement.
  6. Set the frequency of Sine Wave Generator to:
    - 25MHz if you are testing a SDS1022DL
    - 50MHz if you are testing a SDS1052DL
    - 70MHz if you are testing a SDS1072CML/CNL
    - 100MHz if you are testing a SDS1102CML/CNL/DL
    - 150MHz if you are testing a SDS1152CML

- 200MHz if you are testing a SDS1202DL

Table 3-4 Bandwidth test data

| Volts/Div | Input frequency | Vpp measured |
|-----------|-----------------|--------------|
| 500mv/div | 10Hz            | 3.0v         |
|           | 100Hz           |              |
|           | 1KHz            |              |
|           | 10KHz           |              |
|           | 100KHz          |              |
|           | 1MHz            |              |
|           | 10MHz           |              |
|           | 20MHz           |              |
|           | 30MHz           |              |
|           | ...             |              |
|           | bandwidth       |              |
| 200mv/div | 10Hz            | 1.2v         |
|           | 100Hz           |              |
|           | 1KHz            |              |
|           | 10KHz           |              |
|           | 100KHz          |              |
|           | 1MHz            |              |
|           | 10MHz           |              |
|           | 20MHz           |              |
|           | 30MHz           |              |
|           | ...             |              |
|           | bandwidth       |              |

7. Every time you set to a frequency, it is better for you to adjust the Sec/Div to a proper value thus to display a perfect waveform.
8. The  $V_{pp}$  measurement of the waveform will decrease as the input frequency increases. Increasing the input frequency gradually until the  $V_{pp}$  measurement gets closest to 2.12v.
9. Disconnect the connection of channel 1.
10. Check channel 2 in the same way as step 1 to 9.

For test at 200mv/div, please perform the same operation as that at 500mv/div, except for the initial amplitude and amplitude at bandwidth listed below.

Table 3-4 Amplitude at bandwidth

| Volts/Div | Initial amplitude | Amplitude at bandwidth       | Initial frequency |
|-----------|-------------------|------------------------------|-------------------|
| 500mv/div | 3v                | $0.707 \times 3v = 2.12v$    | 10 Hz             |
| 200mv/div | 1.2v              | $0.707 \times 1.2v = 0.848v$ | 10 Hz             |

## To verify Time Base Accuracy

This test checks the time base accuracy of one channel. In the test, both the impedance of FLUKE and the oscilloscope are required to set to 50Ω. It is convenient for FLUKE by easy operation on the front panel. But for SDS1000L oscilloscope, you need to add a 50Ω feedthrough terminator at the end of spec head of FLUKE.

### **Time Base Accuracy: Freq/10M < 50ppm**

- Steps:
1. Connect selected channel of the oscilloscope to the Sine Wave Generator of FLUKE 9500B.
  2. Set the frequency of the Sine Wave Generator to 10MHz.
  3. Set the oscilloscope Volts/Div to 500mv/div.
  4. Set the oscilloscope Sec/Div to 1ms/div.
  5. Press MEASURE button on the front panel of the oscilloscope to display Freq measurement.
  6. Calculate Freq/10M to see if the value is within the range of 50ppm, which means correct time base accuracy.
  7. Disconnect the test connection.

## To verify Trigger Sensitivity

To test trigger sensitivity at the frequency of 100KHz, 10MHz and bandwidth.

Table 3-5 Trigger sensitivity data

| Volts/Div | Frequency | Trigger Range |
|-----------|-----------|---------------|
| 500mv/div | 100KHz    | 500mVpp       |
| 500mv/div | 10MHz     | 500mVpp       |
| 500mv/div | bandwidth | 750mVpp       |

- Steps:
1. connect the selected channel of the oscilloscope to the Sine Wave Generator of FLUKE 9500B.
  2. Set the oscilloscope Volts/Div to 500mv/div.
  3. Set the oscilloscope Sec/Div to 5us/div.
  4. Set the frequency of the Sine Wave Generator to 100KHz.
  5. Set the amplitude of the Sine Wave Generator to 500mVpp, so that the Vpp measurement of the oscilloscope is approximately 500mv.
  6. Press Trigger LEVEL button to move the waveform to the screen center.
  7. Adjust the Trigger LEVEL within the waveform range to check if there is stable trigger.
  8. Set the oscilloscope Sec/Div to 50ns/div.
  9. Set the frequency of the Sine Wave Generator to 10MHz.
  10. Set the amplitude of the Sine Wave Generator to 500mVpp, so that the Vpp measurement of the oscilloscope is approximately 500mv.
  11. Press Trigger LEVEL button to move the waveform to the screen center.
  12. Adjust the Trigger LEVEL within the waveform range to check if there is stable trigger.
  13. Set the oscilloscope Sec/Div to 5ns/div.
  14. Set the frequency of the Sine Wave Generator to:
    - 25MHz if you are testing a SDS1022DL
    - 50MHz if you are testing a SDS1052DL
    - 70MHz if you are testing a SDS1072CML/SDS1072CNL
    - 100MHz if you are testing a SDS1102CML/CNL/DL
    - 150MHz if you are testing a SDS1152CML
    - 200MHz if you are testing a SDS1202DL



15. Set the amplitude of the Sine Wave Generator to 750mVpp, so that the Vpp measurement of the oscilloscope is approximately 750mv.
16. Press Trigger LEVEL button to move the waveform to the screen center.
17. Adjust the Trigger LEVEL within the waveform range to check if there is stable trigger.
18. Disconnect the test connection.
19. Check CH1 in the same way as step 1 to 18.

# Adjusting Procedures

This chapter explains how to adjust the SDS1000CML/CNL/DL series oscilloscope with FLUKE 9500B for optimum operating performance. Only qualified personnel should perform this procedure.

## Warming up

Before performing the adjustment procedures, you must let the oscilloscope and other test equipments 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: Inter Pentium processor, Windows XP operating system, USB interface, Microsoft Office Excel 2003, NI-GPIB Card and corresponding NI-488.2 driver

Calibrating Software: EasyTest, Adjustment script

Test Instrument: FLUKE 9500B with active head

An USB cable (Type AB)

A GPIB cable

Two 10-inch BNC cables

A BNC T connector

## Software Installation

1. Install the NI-488.2 driver, select custom installation to install NI-VISA.
2. Install the EasyTest software.
3. Decompress **production.zip** file to E disk directory.

## Adjusting steps

1. Connect the FLUKE 9500B with PC using a GPIB cable.
2. Connect the oscilloscope with PC using an USB cable.

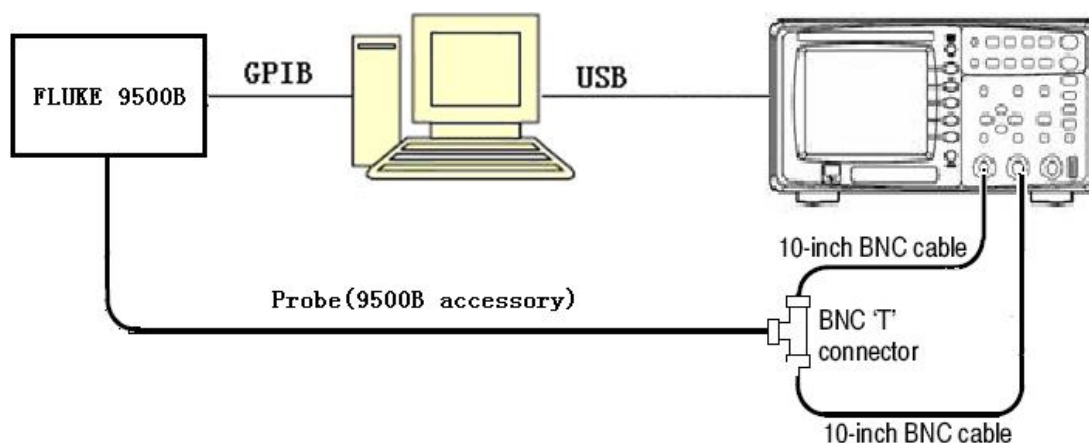


Figure 4-1 Connecting the adjusting devices

3. Turn on FLUKE 9500B, and then set its GPIB address to 22.
4. Turn on the oscilloscope and operate it for about 30 minutes, then perform the Self-Cal routine.
5. Connect the oscilloscope and FLUKE as figure above using the specified probe provided as accessory, BNC T connector and BNC cables.
6. Open the EasyTest software.
7. Click “open” under the “file” menu, and then select the corresponding Tcl script.
8. Click the “test” button to perform the adjusting procedures.

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

Debugvolt.tcl : indicates adjusting voltage

Debugtrig.tcl : indicates adjusting trigger

Debughori.tcl : indicates adjusting horizon

Debugtrigpre.tcl : indicates adjusting trigger accuracy

# Assembly Procedures

This chapter describes how to remove the major modules from the SDS1000CML/CNL/DL 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 Electric 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 5-1 List of modules

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

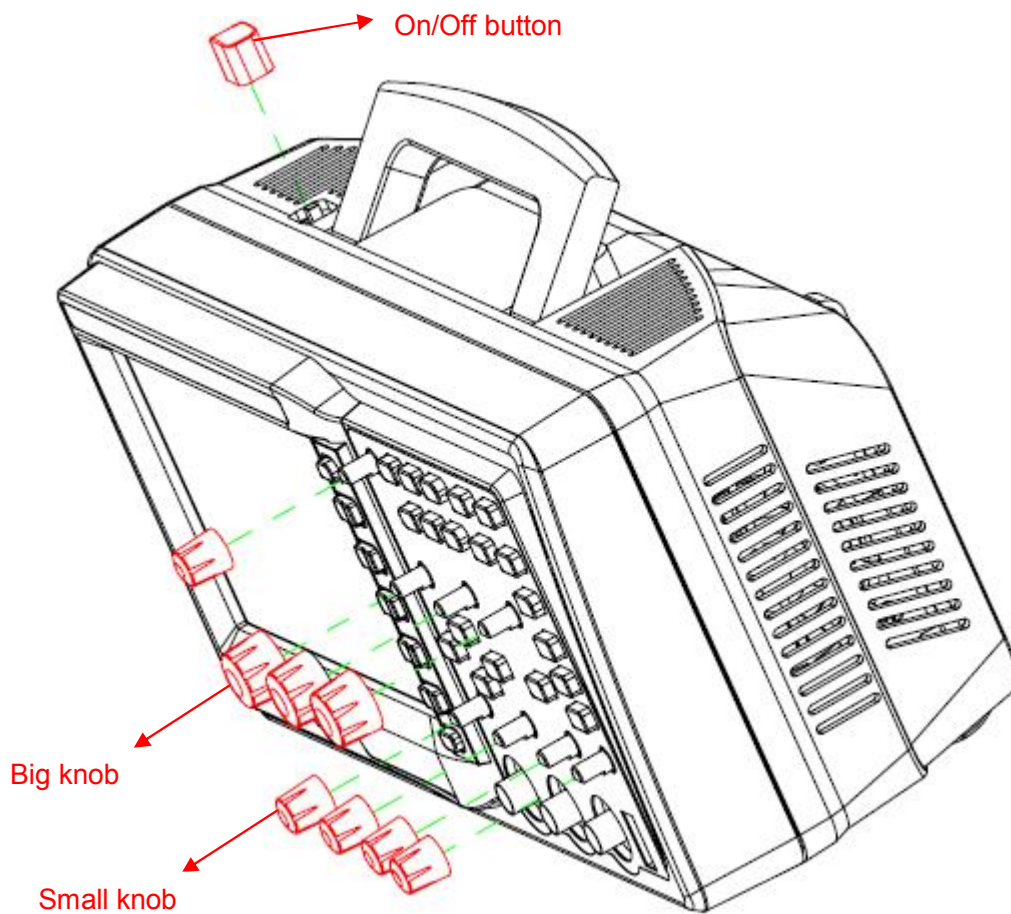


Figure 5-1 Removing the Front -Panel Knobs

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

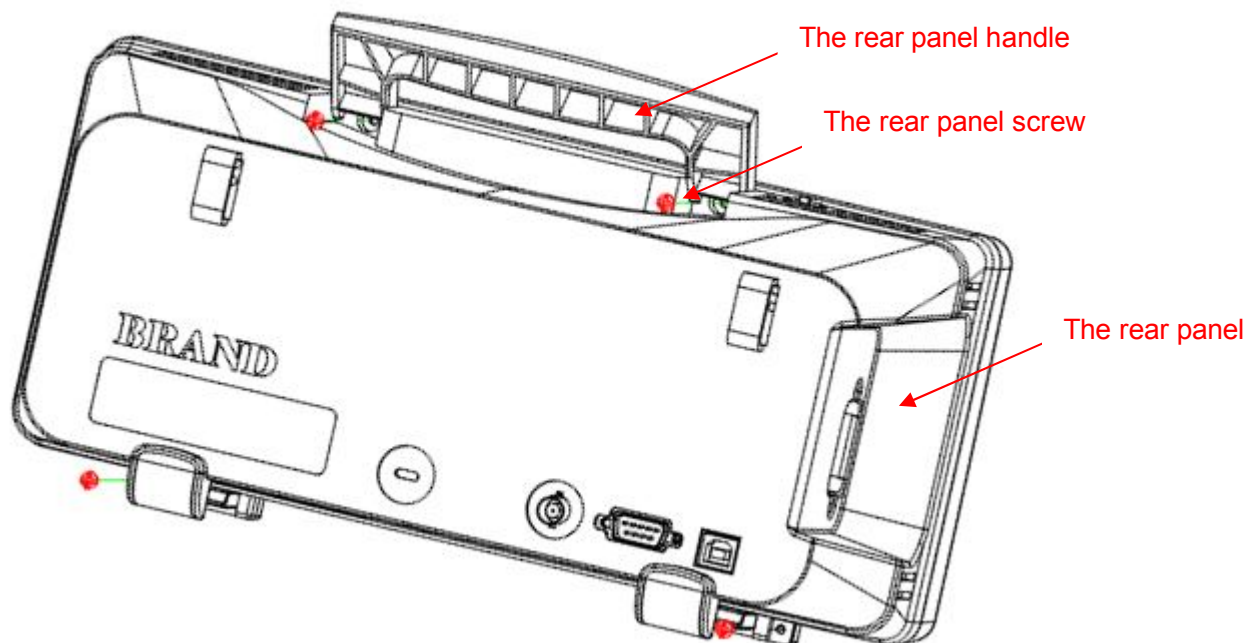


Figure 5-2 Removing the rear panel

Removing steps:

1. Place the oscilloscope face down on a soft surface such as an anti-static mat.
2. Remove the four 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 Rear Metal Cover

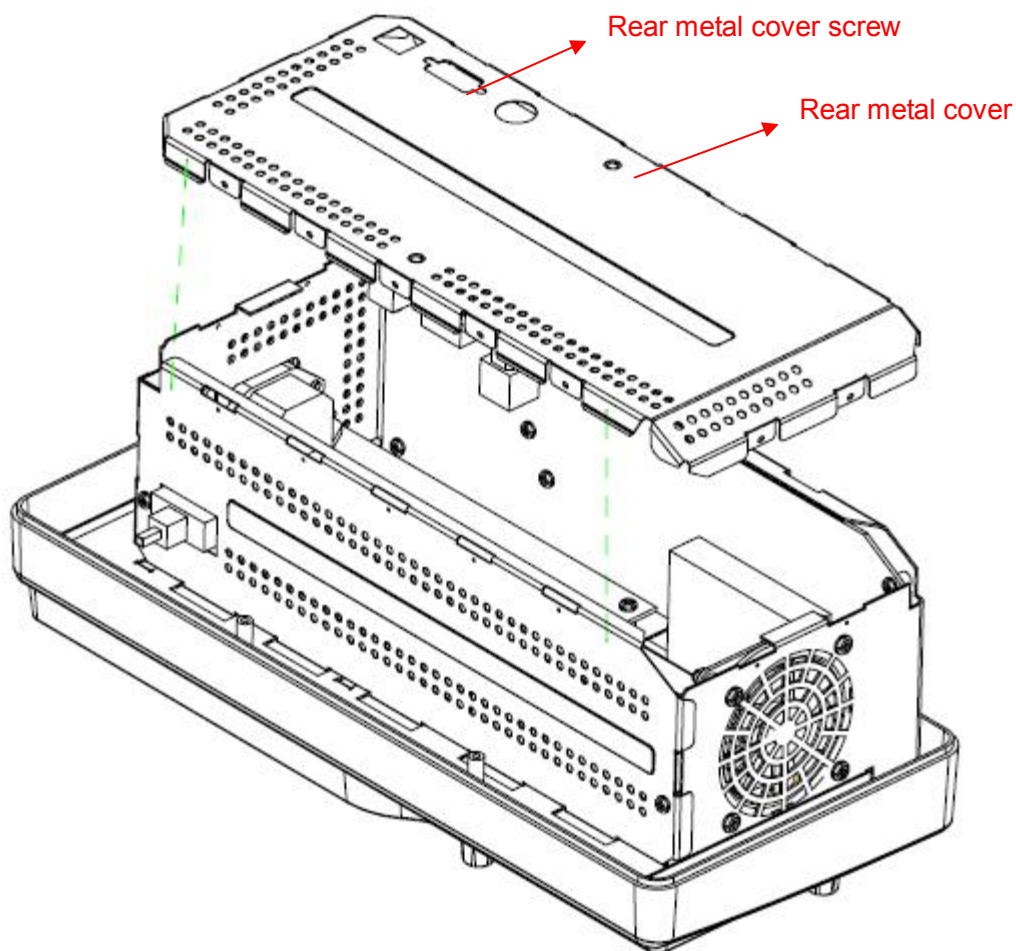


Figure 5-3 Removing the rear metal cover

Removing steps:

1. Place the oscilloscope face down on a soft surface such as an anti-static mat.
2. Remove the two screws located around the RS-232 interface.
3. Since the edge of the rear metal cover is sharp, you should lift the rear metal cover up and off carefully to avoid scratching your hand.

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



## Removing the Top Metal Cover

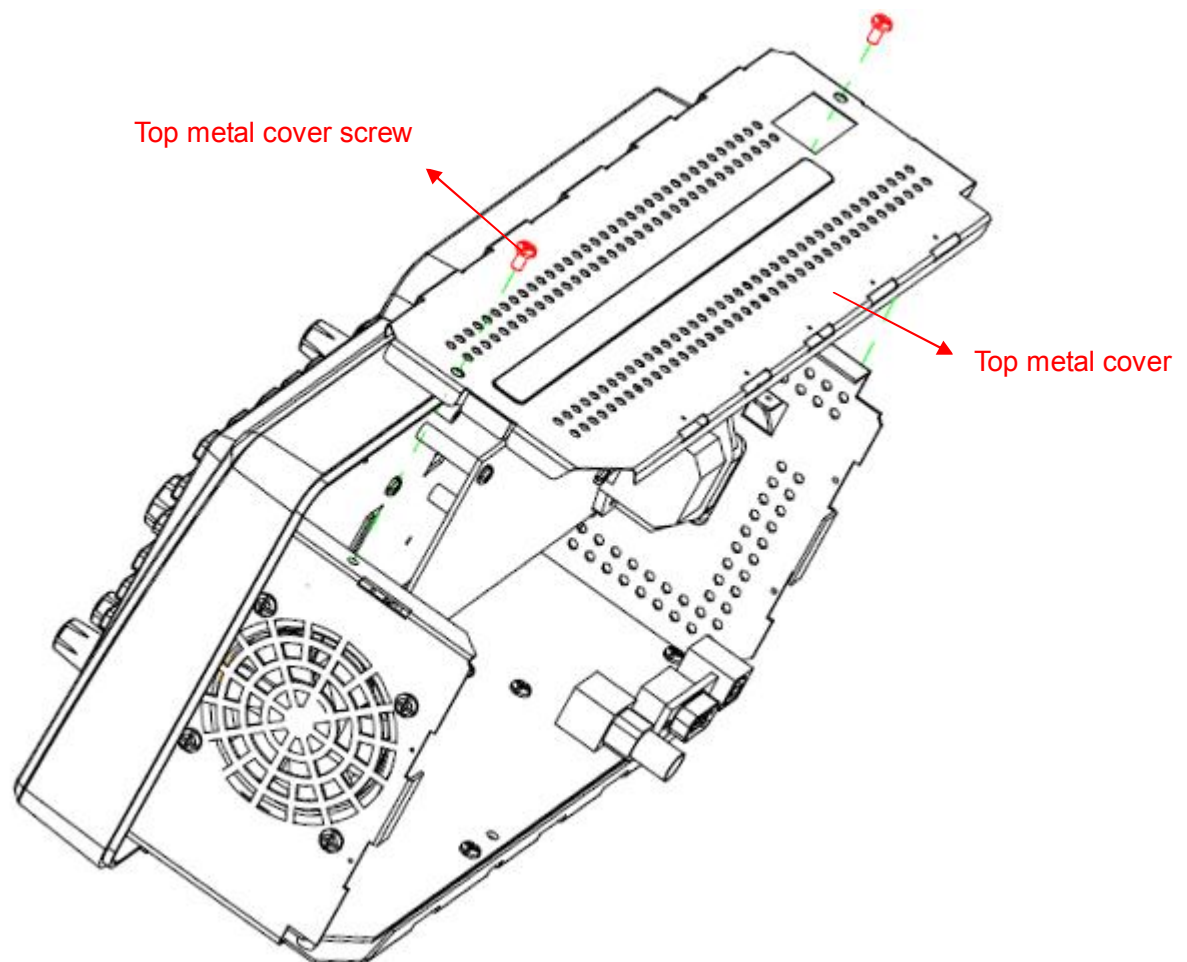


Figure 5-4 Removing the top metal cover

### Removing steps:

1. Place the oscilloscope bottom down on a soft surface such as an anti-static mat.
2. Remove the two screws located on the top metal cover.
3. Since the edge of the top metal cover is sharp, you should lift the top metal cover up and off carefully to avoid scratching your hand.

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

## Removing the Power Supply Module

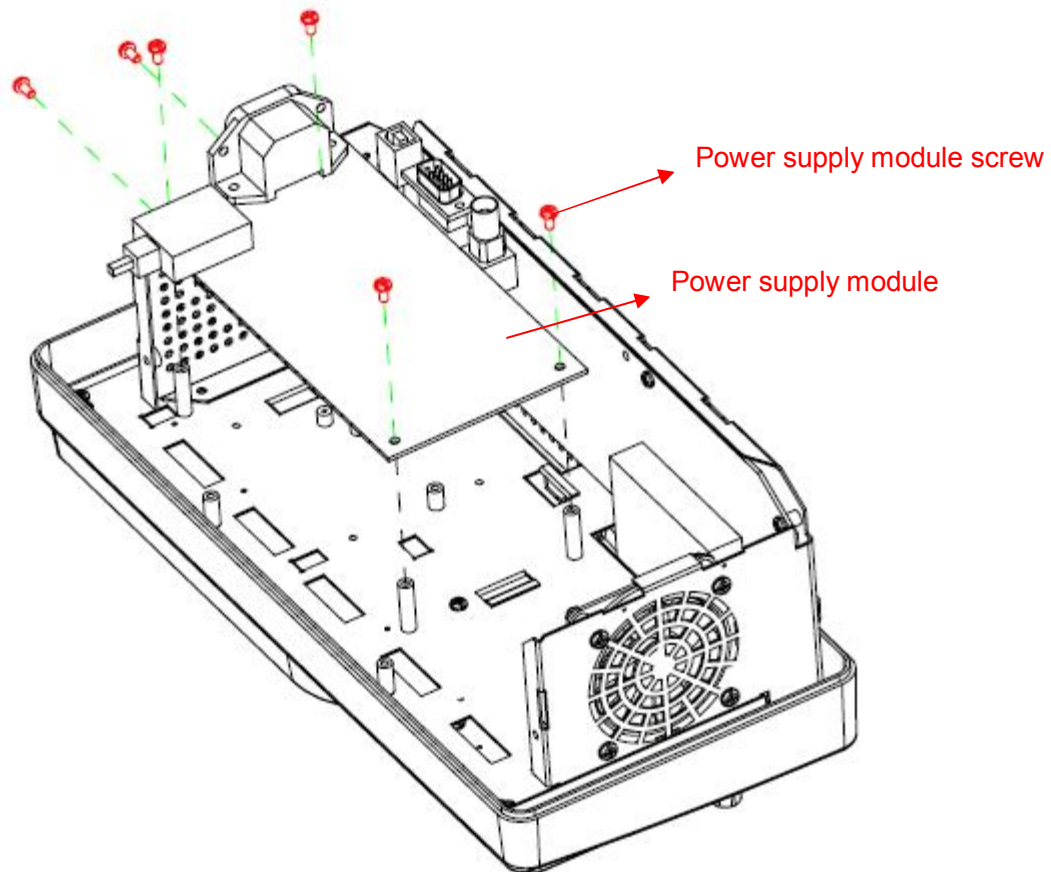


Figure 5-5 Removing the power supply module

### Removing steps:

1. Place the oscilloscope face down on a soft surface such as an anti-static mat.
2. Disconnect the backlight inverter cable connected to display module, the power cable connected to main board module and the ground wire connected to the metal shelf close to it.
3. Remove the six screws located on the edge of the power supply module.
4. Lift the power supply module up and off carefully.

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

## Removing the Metal Shelf

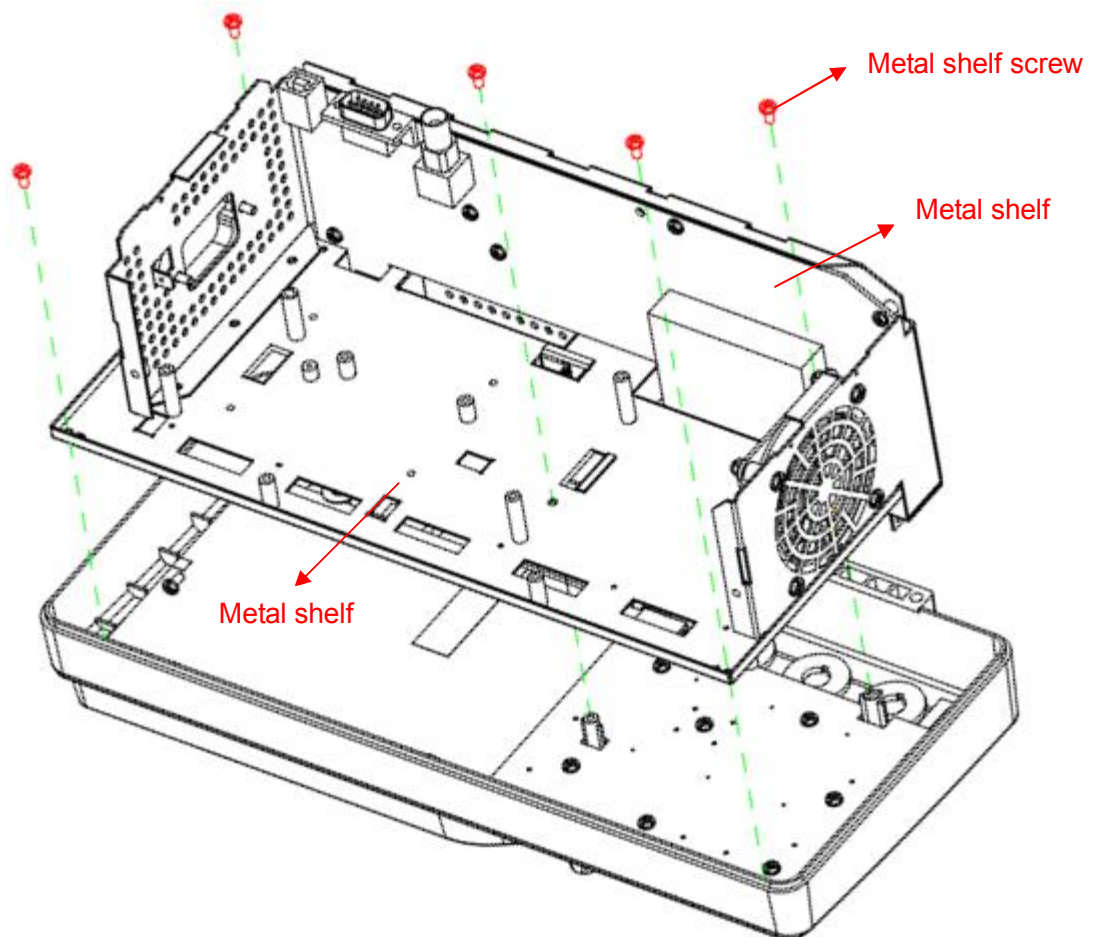


Figure 5-6 Removing the Metal Shelf

Removing steps:

1. Place the oscilloscope face down on a soft surface such as an anti-static mat.
2. Disconnect the display module cable and keypad module cable connected to the main board module.
3. Remove the five screws located on the edge of the metal shelf.
4. Separate the metal shelf from the front panel and then lift it up and off carefully to avoid your hand scratched from the sharp edge of the metal shelf.

To install the metal shelf, please operate as the reverse steps.

## Removing the Main Board Module

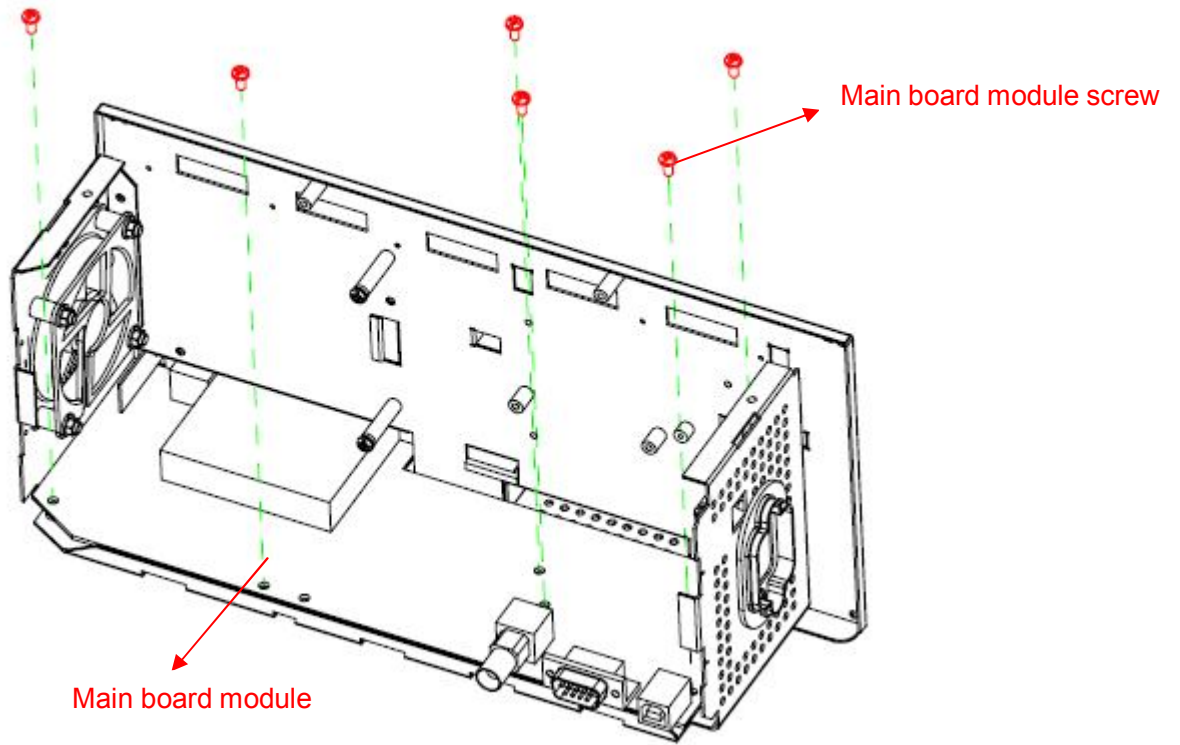


Figure 5-7 Removing the main board module

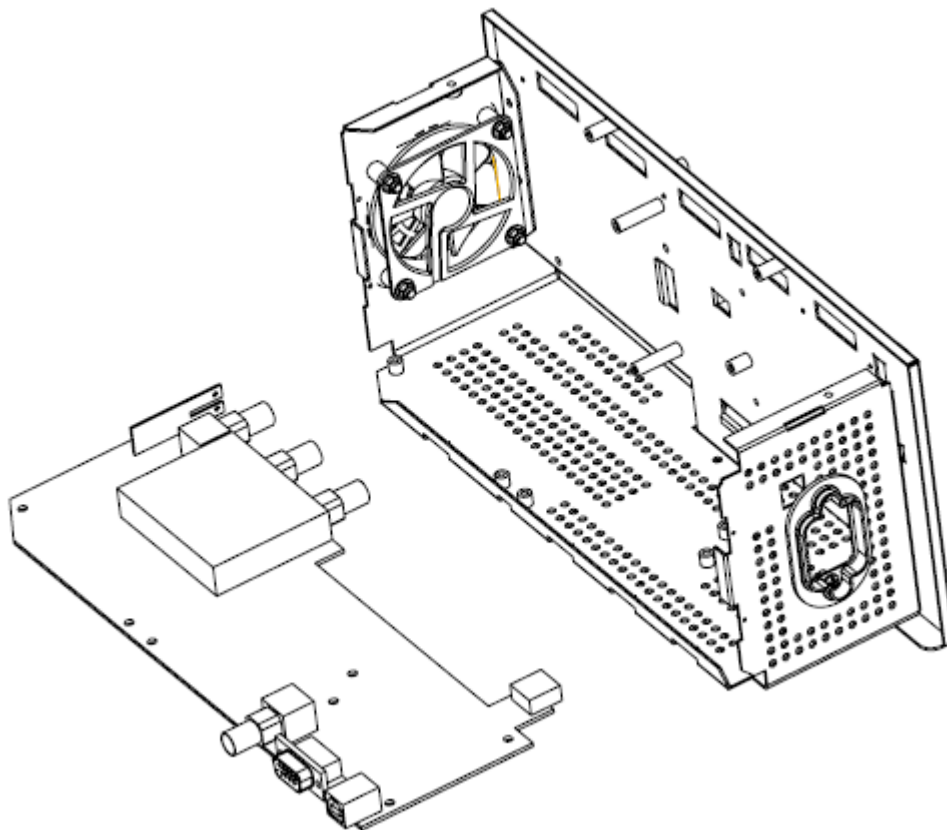


Figure 5-8 Removing the main board module

Removing steps:

1. Place the metal shelf on a soft surface as the figure above shows such as an anti-static mat.
2. Disconnect the fan module cable and power supply module cable connected to the main board module.
3. Remove the six screws located on the edge of the main board module.
4. Separate the main board module from bottom of the metal shelf and lift it up and off carefully to avoid your hand scratched from the sharp edge of the metal shelf.

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

## Removing the Fan Module

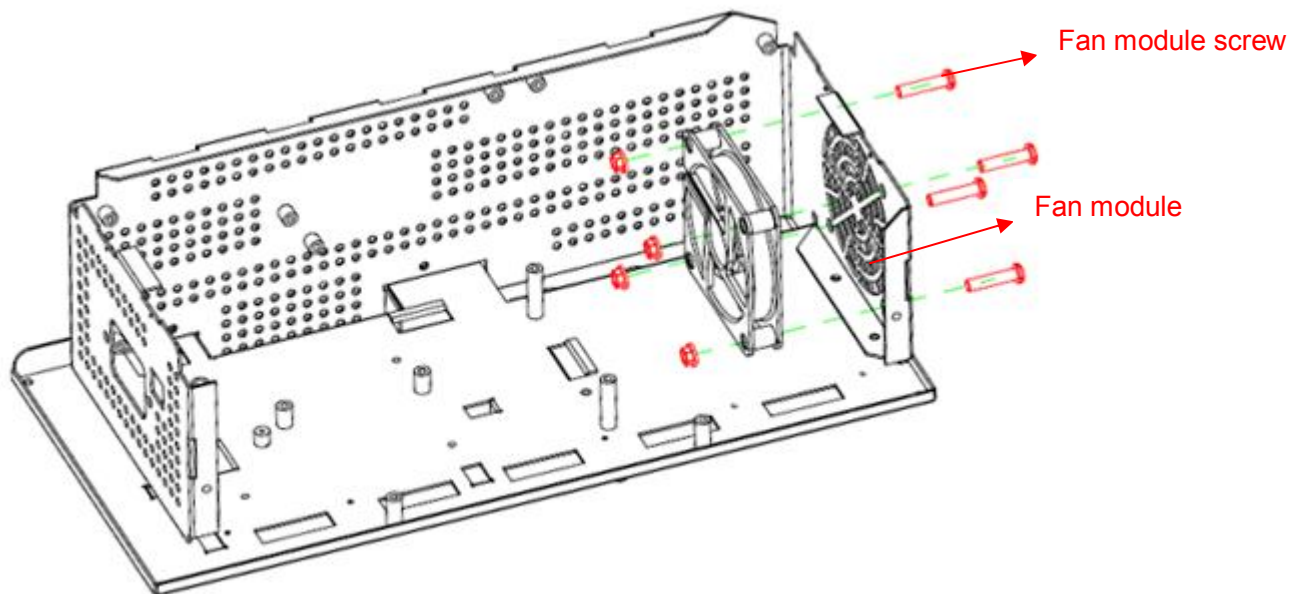


Figure 5-9 Removing the fan module

Removing steps:

1. Place the metal shelf on a soft surface as the figure above shows such as an anti-static mat.
2. Remove the four screws located on the fan module.
3. Separate the fan from the metal shelf and then remove it away carefully.

To install the fan module, please operate as the reverse steps.

## Removing the Display Module

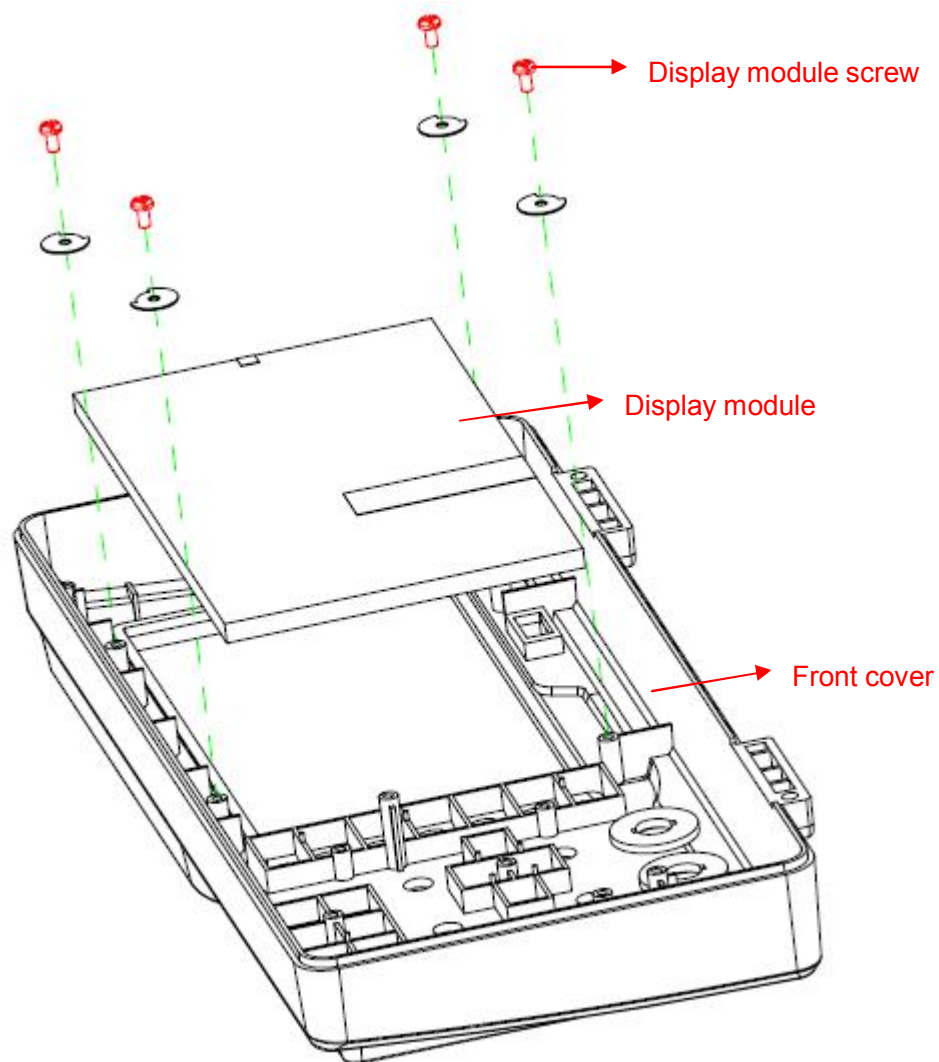


Figure 5-10 Removing the Display Module

Removing steps:

1. Place the front panel module on a soft surface as the figure above shows such as an anti-static mat.
2. Disconnect the display cable from the front panel module.
3. Remove the four screws located on the edge of the display module.
4. Separate the display module from the front cover and then lift it up and off carefully to avoid scratching the LCD screen.

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

## Removing the Keypad Module

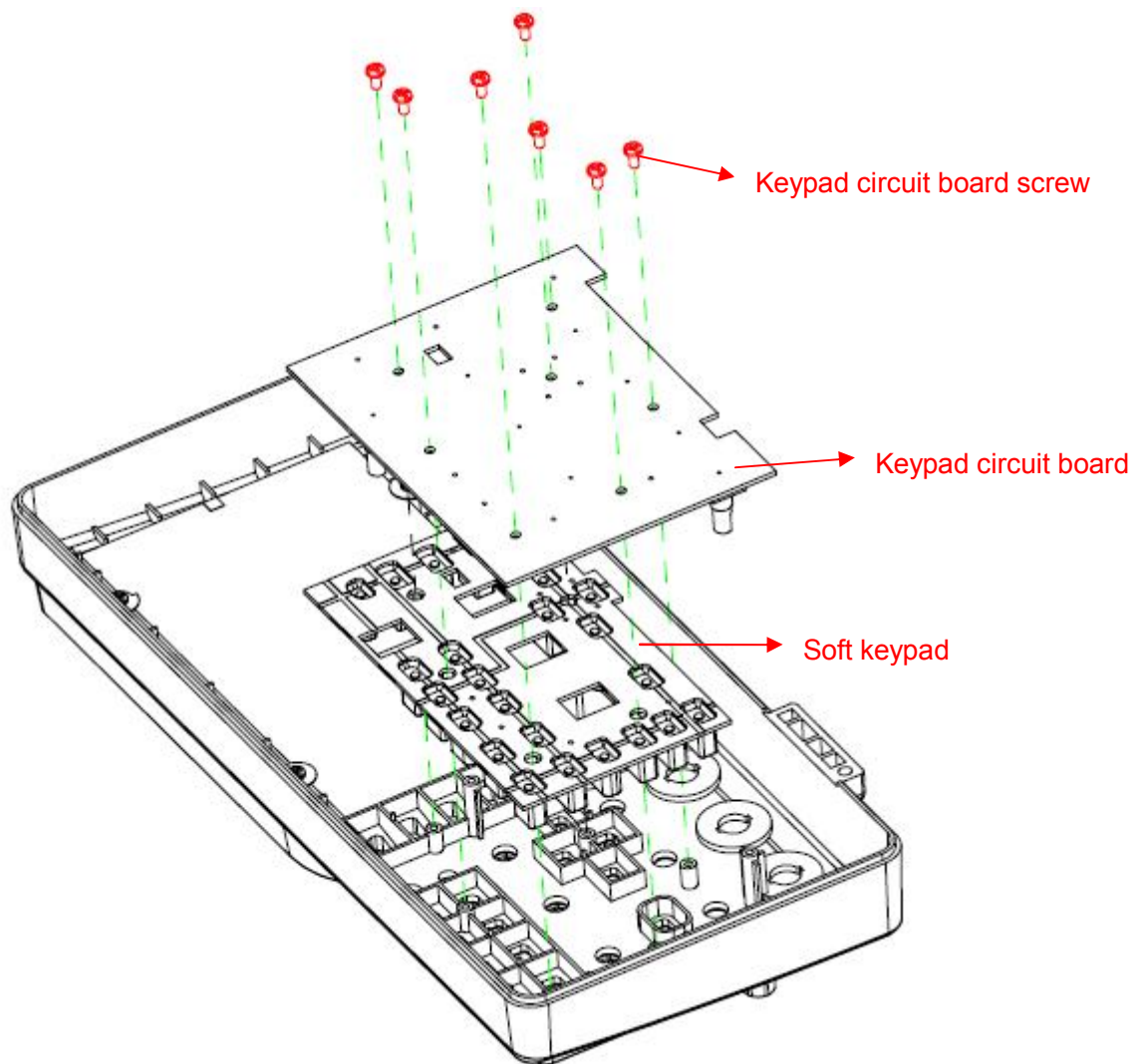


Figure 5-11 Removing the Keypad Module

Removing steps:

1. Place the front panel module on a soft surface as the figure above shows such as an anti-static mat.
2. Remove the keypad circuit board from the soft keypad, which is made of silica gel to avoid touching the electrical contacts.
3. Separate the soft keypad from the front panel and then remove it carefully.

To install the keypad, please operate as the reverse steps.



---

# Troubleshooting

This chapter explains how to deal with general troubles you may encounter while operating SDS1000CML/CNL/DL 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 BW Limit under the menu of CH1/CH2 is on. If it is on, the amplitude of the waveform is lower than the actual value.
  
4. There is waveform displaying but not stable:
  - (1) Check the trigger source: check whether the "Source" in menu of "TRIG" 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 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 could automatically replace the above setting.

6. The waveform displays like ladder:

(1) The horizontal time base may be too low, you could increase it to improve the horizontal resolution so as to obtain a good waveform displaying.

(2) The lines between the sample points may also cause ladder-like displaying if the “Type” in menu of “DISPLAY” is “Vectors”. Please turn the “Type” to “Dots” to solve the problem.

7. U disk can't be recognized:

(1) Check if the U disk can work normally.

(2) Check if the USB Device interface can work normally.

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

(4) Make sure that the capacity of the U disk is FAT32 file system.

(5) Restart the instrument and then insert the U disk to check it.

(6) If it is still in abnormal use, please contact 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 measured voltage value is different from the standard.
2. Before disconnecting the cables connected to main board or display module, please turn off the oscilloscope and cut the power.
3. While performing any internal testing of the oscilloscope, please take some precautions to avoid damages to 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 6-1 Required equipments

| Equipment          | Critical Specifications                  | Example        |
|--------------------|--|----------------|
| Digital Multimeter | Accuracy $\pm 0.05\%$<br>1 mV resolution | Agilent 34401A |
| Oscilloscope       | 100MHz Bandwidth                         | MSO7012B       |

## 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.

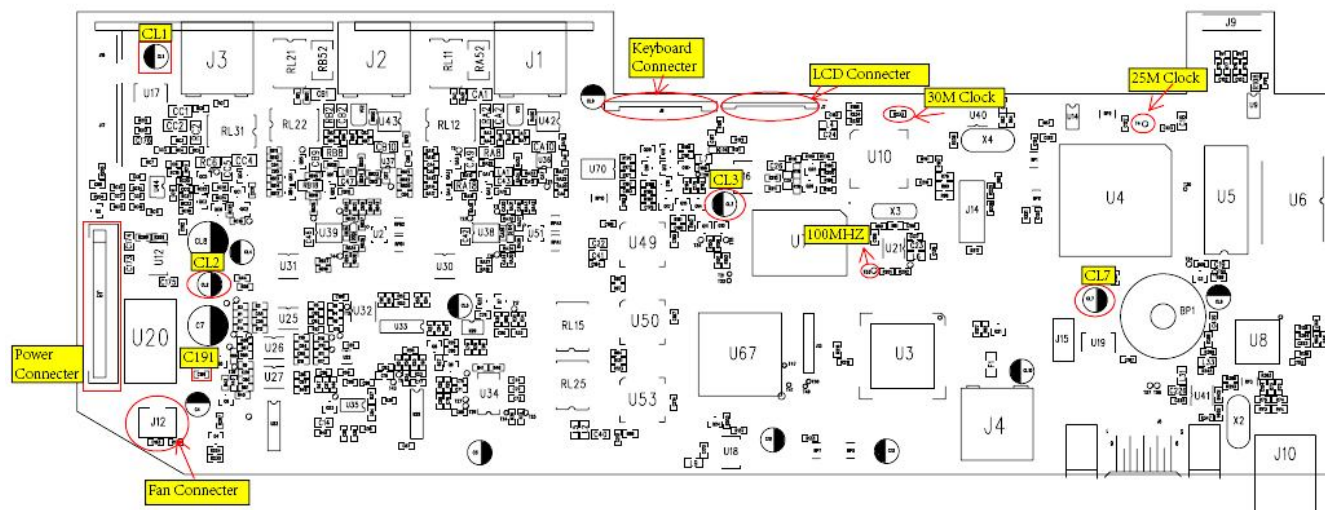


Figure 6-1 Main board module

## Troubleshooting Flowchart

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

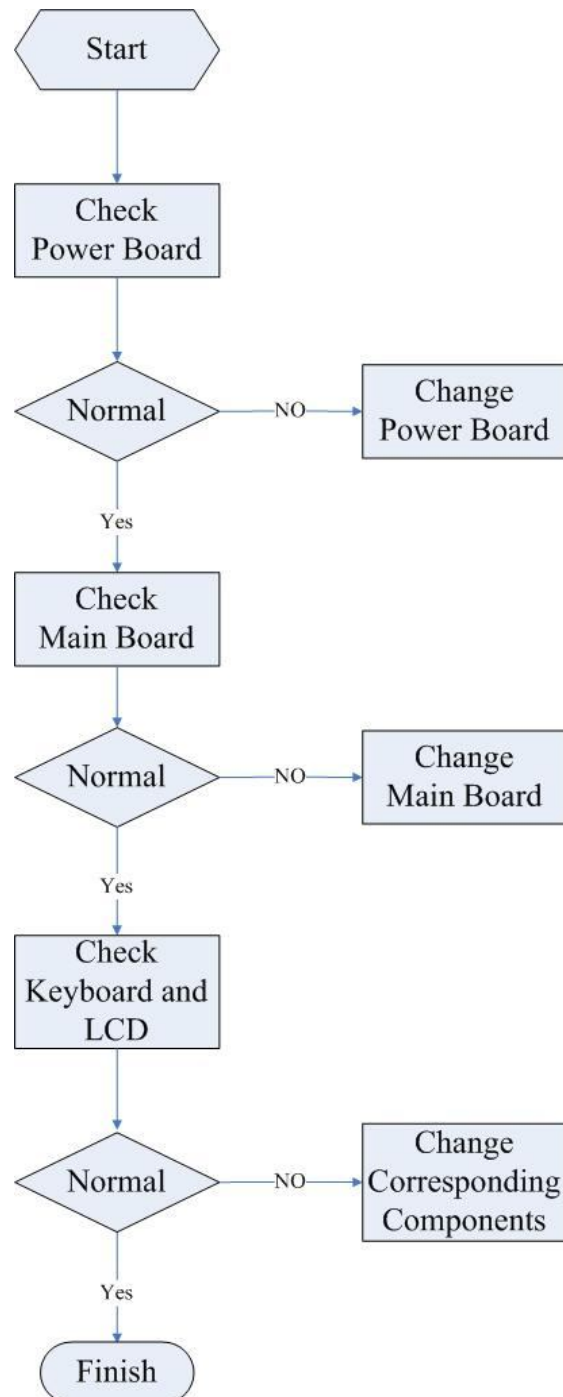


Figure 6-2 Troubleshooting flowchart

## 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 12 pins from Pin1 to Pin12 on the main board. You can test voltages provided by power supply at these points to check whether the voltage values are within specified range using a digital multimeter. The voltage parameters to be tested are listed in table below:

Table 6-2 Voltage parameters of the power supply module

| <b>Voltage value(V)</b> | <b>Pin</b>              | <b>Error</b> |
|-------------------------|-------------------------|--------------|
| 0 (GND)                 | Pin1, Pin5, Pin8, Pin12 | NULL         |
| 15                      | Pin2                    | 5%           |
| 6.3                     | Pin3, Pin4              | 10%          |
| 3.3                     | Pin6, Pin7              | 5%           |
| -9                      | Pin9                    | 10%          |

If each tested voltage value is within the spec range referring to the table above, then check the power-supply ripple using an oscilloscope. If the ripple appears small, then the power supply works normally. Otherwise, it proves to be faulted;

If there is at least one tested voltage value beyond the spec range, please go to the next step.

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

If each tested voltage value is within spec range referring to the table above, then it is the failure of the main board 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 tested voltage value beyond the spec range, then the power supply module proves faulted and a new one is needed. 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. In addition, to avoid some chips or components on the main board being damaged for overheating, it is essential to 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 and Keypad Connector are located on the main board. Check if all these connectors are connected properly.
2. Make sure that the connectors on the main board are properly connected, then connect the power supply module cable to appointed place of the main board, lastly connect the oscilloscope power cord and turn on the oscilloscope. Check if the voltage values at all test points are within the spec range using a digital multimeter. The voltage parameters to be tested are listed in table below:

Table 6-3 Voltage parameters of the main board

| Components tested | Voltage (V) | Error (V) |
|-------------------|-------------|-----------|
| C191              | -5          | ±0.1      |
| CL1               | 5           | ±0.1      |
| CL2               | 5           | ±0.1      |
| CL3               | 2.5         | ±0.1      |
| CL7               | 1.25        | ±0.1      |

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

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

3. Check if the Clock on the main board works normally using an oscilloscope. Focus at the test clock T53 marked with "100M Clock" on the main board drawing.

If the clock measured is not 100M, then the failure may come from the main board, a new one is required necessary.

If the clock measured is 100M, then go on to test if the clock T4 is 25MHz. If it is, then the main board proves normal. Or 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 and make sure the display module cable and the backlight inverter 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 inverter cable.

If the measurement is within the range of  $-11V \sim -9V$ , please reconnect the backlight inverter cable to make sure its correct connecting. If the screen still remains dark as a consequence, a new LCD is required.

If the measurement is beyond the range of  $-11V \sim -9V$ , you need to replace a new power supply board.

3. If the screen gets bright but displaying abnormal, then go to test the “30M Clock” point located on the main board.

If the Clock tested is 30M, then the failure may come from the display module, you need to return the oscilloscope to manufacturer to have it repaired by qualified personnel.

Otherwise, the failure may come from the main board, a new one is required necessary.



## Quick Guide for 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 6-3 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 ON/OFF button is faulted and if the fuse is burned-out. |
| No displaying after power on  | Check if the backlight inverter cable 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   |
| Every time the oscilloscope is turned on, the Time displays at the lower right corner restores to its initial value.                                | Check and replace the button battery on the main board.  |
| There is No 1KHz square waveform outputting after performing appropriate compensation to the probe connected to the SDS1000CML/CNL/DL oscilloscope. | Upgrade current software release, or replace a new main board.   |

# 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

## Inspecting and Care

This section explains how to inspect the oscilloscope and shipping container as well as general care and cleaning of the oscilloscope. Here are detailed contents about this.

### General Inspecting

1. Inspect the shipping container.

Keep the damaged shipping container or cushioning material until the contents of the shipment have been completely checked and the instrument has passed both electrical and mechanical tests.

The consigner or carrier will be responsible for damages to the instrument resulting from shipment. **SIGLENT** would not provide free maintenance or replacement.

2. Inspect the instrument.

If there are instruments found damaged, defective or failure in electrical and mechanical tests, please contact **SIGLENT**.

3. Check the accessories.

Please check the accessories according to the packing list. If the accessories are incomplete or damaged, please contact your **SIGLENT** sales representative.

**Standard Accessories:**

- Two pieces 1:1/(10:1) Passive Probes
- A Quick Startl
- A Certification
- A Guaranty Card
- An CD(including EasyScope3.0 computer software system)
- A Power Cord that fits the standard of destination country
- An USB Cable

**General Care and Cleaning****Care:**

Do not store or leave the instrument in direct sunshine for long periods of time.

**Notice:**

- To avoid damages to the instrument or probe, please do not leave them in fog, liquid, or solvent.

**Cleaning:**

Please perform the following steps to clean the instrument and probe regularly according to its operating conditions.

1. Disconnect the instrument from all power sources, and then clean it with a soft wet cloth.
2. Clean the loose dust on the outside of the instrument and probe with a soft cloth. When cleaning the LCD, take care to avoid scarifying it.

**Notice:**

- To avoid damages to the surface of the instrument and probe, please do not use any corrosive liquid or chemical cleanser.
- Make sure that the instrument is completely dry before restarting it to avoid short circuits or personal injuries.

## Replaceable Parts

**SIGLENT** provides a list of replaceable parts for SDS1000CML/CNL/DL oscilloscopes. Within the list, you could exchange or purchase wanted modules for new manufactured. Please see the following table for detailed information.

Table 7-1 Updating Parts Item

| No. | Module Name      | Specification |
|-----|------------------|---------------|
| 1   | On-Off button    |               |
| 2   | Back Rind        |               |
| 3   | Big knobs        |               |
| 4   | Small knobs      |               |
| 5   | Bolts            | PM2.5*10      |
| 6   | Bolts            | PA3*8         |
| 7   | Bolts            | PA3*10        |
| 8   | Back cover board |               |
| 9   | Bolts            | KM3*8         |
| 10  | Top cover board  |               |
| 11  | Bolts            | KM3*30        |
| 12  | Fan              |               |
| 13  | Bolts            | BM3*8         |
| 14  | Bolts            | PA3*8         |
| 15  | Metal shelf      |               |
| 16  | Silica gel key   |               |
| 17  | Bolts            | BM3*8         |
| 18  | Main board       |               |
| 19  | BNC nuts         |               |
| 20  | LCD              |               |
| 21  | Bolts            | KM3*8         |
| 22  | Keyboard         |               |
| 23  | Front panel      |               |

All the replaceable parts above are available through contacting your local **SIGLENT** office or representative. For more information about the module exchange, please refer to "Contact **SIGLENT**".

# **Contact SIGLENT**

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