

RIGOL

Service Guide

MSO5000-E Series Digital Oscilloscope

Sept. 2019
RIGOL (SUZHOU) TECHNOLOGIES INC.

Guaranty and Declaration

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Contact Us

If you have any problem or requirement when using our products or this manual, please contact **RIGOL**.

E-mail: service@rigol.com

Website: www.rigol.com

Safety Requirement

General Safety Summary

Please review the following safety precautions carefully before putting the instrument into operation so as to avoid any personal injury or damage to the instrument and any product connected to it. To prevent potential hazards, please follow the instructions specified in this manual to use the instrument properly.

Use Proper Power Cord.

Only the exclusive power cord designed for the instrument and authorized for use within the local country could be used.

Ground the Instrument.

The instrument is grounded through the Protective Earth lead of the power cord. To avoid electric shock, connect the earth terminal of the power cord to the Protective Earth terminal before connecting any input or output terminals.

Connect the Probe Correctly.

If a probe is used, the probe ground lead must be connected to earth ground. Do not connect the ground lead to high voltage. Improper way of connection could result in dangerous voltages being present on the connectors, controls or other surfaces of the oscilloscope and probes, which will cause potential hazards for operators.

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 the instrument.

Use Proper Overvoltage Protection.

Ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the operator might be exposed to the danger of an electric shock.

Do Not Operate Without Covers.

Do not operate the instrument with covers or panels removed.

Do Not Insert Objects Into the Air Outlet.

Do not insert anything into the holes of the fan to avoid damaging the instrument.

Use Proper Fuse.

Please use the specified fuses.

Avoid Circuit or Wire Exposure.

Do not touch exposed junctions and components when the unit is powered on.

Do Not Operate With Suspected Failures.

If you suspect that any damage may occur to the instrument, have it inspected by **RIGOL** authorized personnel before further operations. Any maintenance, adjustment or replacement especially to circuits or accessories must be performed by **RIGOL** authorized personnel.

Provide Adequate Ventilation.

Inadequate ventilation may cause an increase of temperature in the instrument, which would cause damage to the instrument. So please keep the instrument well ventilated and inspect the air outlet and the fan regularly.

Do Not Operate in Wet Conditions.

To avoid short circuit inside the instrument or electric shock, never operate the instrument in a humid environment.

Do Not Operate in an Explosive Atmosphere.

To avoid personal injuries or damage to the instrument, never operate the instrument in an explosive atmosphere.

Keep Product Surfaces Clean and Dry.

To avoid dust or moisture from affecting the performance of the instrument, keep the surfaces of the instrument clean and dry.

Prevent Electrostatic Impact.

Operate the instrument in an electrostatic discharge protective environment to avoid damage induced by static discharges. Always ground both the internal and external conductors of cables to release static before making connections.

Use the Battery Properly.

Do not expose the battery (if available) to high temperature or fire. Keep it out of the reach of children. Improper change of a battery (lithium battery) may cause an explosion. Use the **RIGOL** specified battery only.

Handle with Caution.

Please handle with care during transportation to avoid damage to keys, knobs, interfaces, and other parts on the panels.

Safety Notices and Symbols

Safety Notices in this Manual:



WARNING

Indicates a potentially hazardous situation or practice which, if not avoided, will result in serious injury or death.



CAUTION

Indicates a potentially hazardous situation or practice which, if not avoided, could result in damage to the product or loss of important data.

Safety Terms on the Product:

DANGER It calls attention to an operation, if not correctly performed, could result in injury or hazard immediately.

WARNING It calls attention to an operation, if not correctly performed, could result in potential injury or hazard.

CAUTION It calls attention to an operation, if not correctly performed, could result in damage to the product or other devices connected to the product.

Safety Symbols on the Product:



Hazardous Voltage



Safety Warning



Protective Earth Terminal



Chassis Ground



Test Ground

Document Overview

Format Conventions in this Manual

1. Key

The key on the front panel is denoted by the format of "Key Name (Bold) + Text Box" in the manual. For example, **Utility** denotes the "Utility" key.

2. Menu

The menu items are denoted by the format of "Menu Word (Bold) + Character Shading". For example, **System** denotes the "System" menu item under **Utility**.

3. Operation Procedures:

→ denotes the next step of operation. For example, **Utility** → **System** denotes that first press **Utility**, and then press the **System** softkey.

Content Conventions in this Manual

MSO5000-E series includes the following models. Unless otherwise specified, this manual takes MSO5152-E as an example to illustrate the disassembly and assembly of the MSO5000-E series.

Model	Max. Analog Bandwidth	No. of Analog Channels	No. of Channels of Function/AWG	No. of Digital Channels
MSO5152-E	150 MHz	2	1 (option)	16 (Required to purchase the probe)

Manuals of this Product

The manuals of this product mainly include Quick Guide, User Guide, Programming Guide, Data Sheet, and etc. For the latest version of this manual, download it from the official website of **RIGOL** (www.rigol.com).

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Chapter 1 Disassembly and Assembly

Notices to Disassembly and Assembly

Notices:

- Do not disassemble the instrument unless for working requirement.
- Only authorized personnel are allowed to disassemble the instrument.
- Cut off the power supply before disassembling the instrument.
- Please wear anti-static wrist strap or make other anti-static precaution when disassembling the instrument.
- Please use proper tools and follow the correct steps.
- Take care not to deform the metal structure or get hurt when disassembling the metal structures.
- To avoid causing damage to the instrument due to improper operation and to save your time, we recommend you to follow the disassembly steps and methods in this guide manual.

Required Tools:

- Phillips screwdriver T10/T20
- BNC socket wrench



WARNING

Ensure that the power supply is cut off before disassembling the instrument. Only well-trained professional personnel or qualified personnel are allowed to disassemble the instrument.

Exploded View Drawing

You need to get a basic understanding of the main parts of the instrument before disassembling and assembling the instrument. When disassembling or assembling the instrument, please follow the procedures and take care not to scratch the surfaces of the instrument. This manual mainly introduces the disassembly and assembly methods for the MSO5000-E series digital oscilloscope. The exploded view drawing of MSO5152-E is shown in Figure 1-1. For the replacement parts list, refer to Table 1-1.

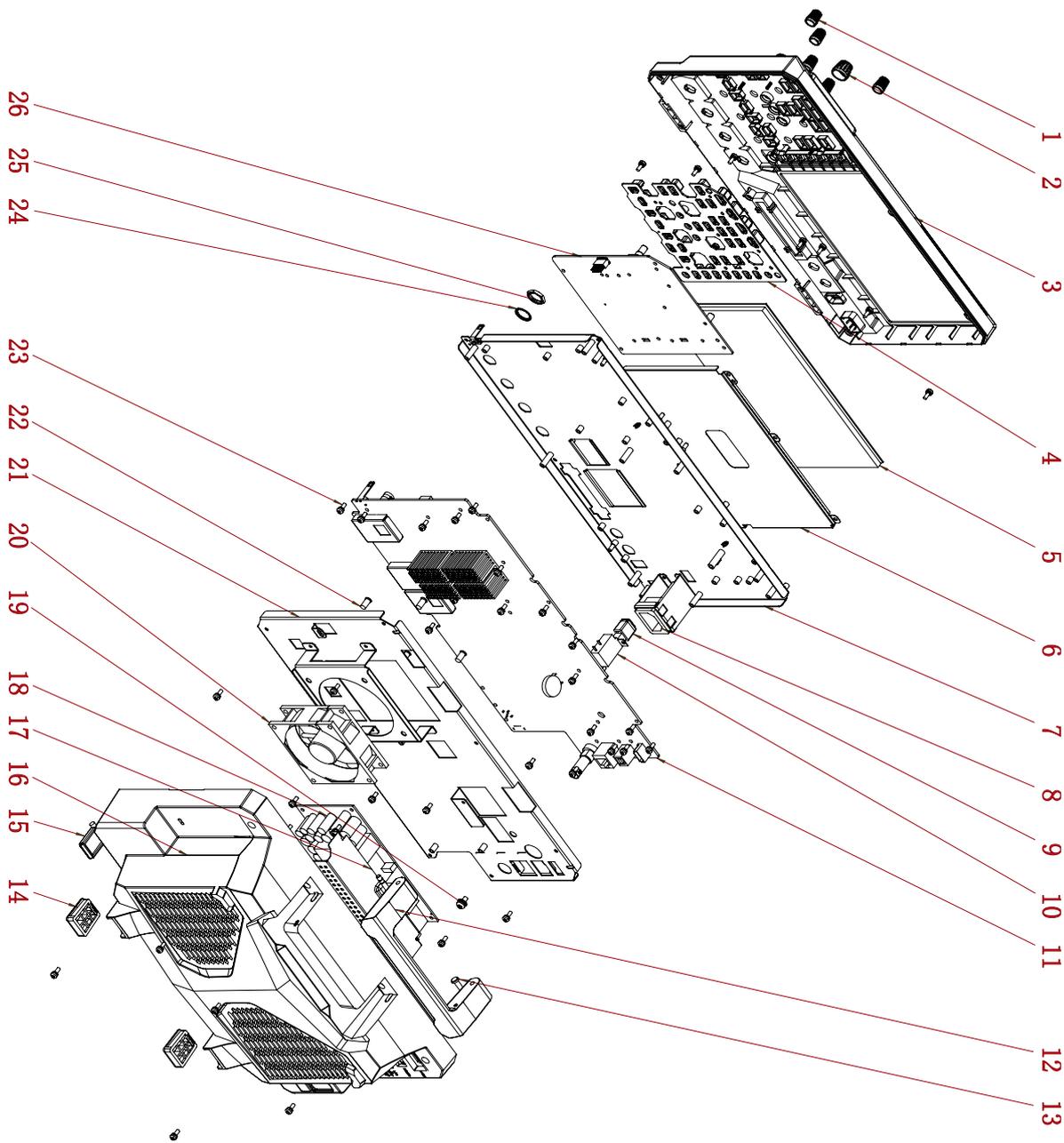


Figure 1-1 Exploded View Drawing of MSO5152-E

Table 1-1 Replacement Parts List

No.	Part No.	Qty.	Name/Description
1	2010003948	5	Small Knob
2	2010003946	3	Large Knob
3	2010004525	1	Panel
4	1020004598	1	Rubber Keypad
5	1010006312	1	LCD (Touch Screen Included)
6	1020004389	1	LCD Shield
7	1020004387	1	Metal Front Panel
8	1010006317	1	Power Cord Connector
9	2010004319	1	Power Key
10	1010006316	1	Mechanical Switch
11	2010004523	1	Main Board
12	2010003929	1	Handle
13	2010000182	2	Handle Shaft
14	2010002909	2	Anti-skid Pad
15	2010000979	2	Bracket
16	2010004526	1	Rear Panel
17	1020004391	1	Shield
18	2010004270	1	Power Supply Board
19	1020003428	1	M4x8 Torx Pan Head Combination Screw
20	1020002000	1	Fan
21	1020004388	1	Metal Rear Panel
22	1020003198	4	PTF5x10 Torx Flat Countersunk Head Self-tapping Screw
23	1020000573	53	M3x8 Torx Pan Head Combination Screw
24	1020000648	4	BNC Lock Washer
25	1020000619	4	BNC Nut
26	2010004524	1	Keypad Board

The recommended disassembly procedures are as follows:

Disassemble the Rear Panel Components → Disassemble the Shield and Power Supply Board → Disassemble the Metal Rear Panel Components → Disassemble the Fan → Disassemble the Knob → Disassemble the Panel → Disassemble the Main Board → Disassemble the LCD → Disassemble the Keypad Board → Disassemble the Power Key.

Disassemble the Rear Panel Components

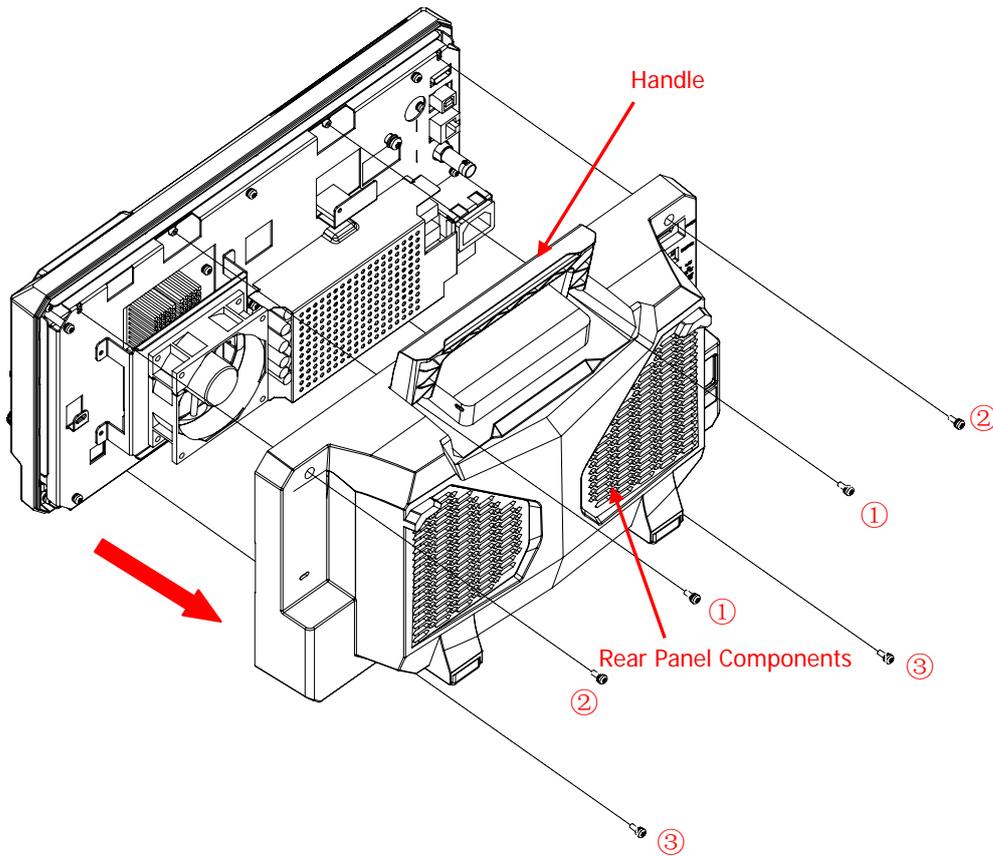


Figure 1-2 Disassemble the Rear Panel Components

Part Description:

- ① 2 screws (M3x8 torx pan head combination screw, used for fastening the handle)
- ② 2 screws (M3x8 torx pan head combination screw, used for fastening the rear panel at the top)
- ③ 2 screws (M3x8 torx pan head combination screw, used for fastening the rear panel at the bottom)

Disassembly Steps:

1. Use the T10 screwdriver to remove 2 screws (①) that secure the handle.
2. Use the T10 screwdriver to remove 2 screws (②) at the top of the rear panel.
3. Use the T10 screwdriver to remove 2 screws (③) at the bottom of the rear panel.
4. Remove the rear panel components in the arrow direction (as shown in the figure above).

Disassemble the Shield and Power Supply Board

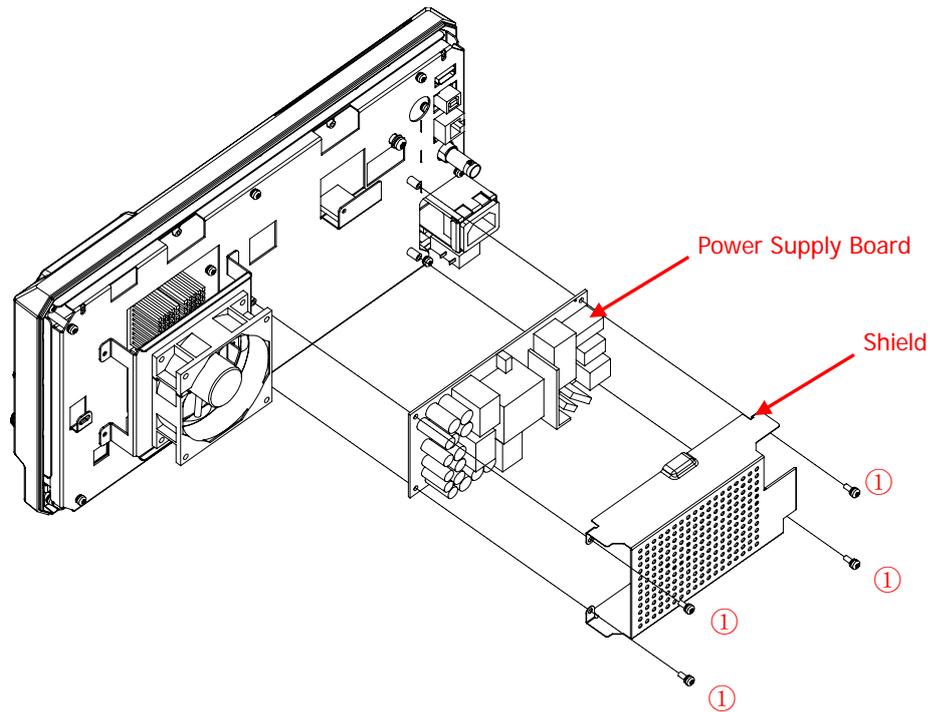


Figure 1-3 Disassemble the Shield and Power Supply Board

Part Description:

- ① 4 screws (M3x8 torx pan head combination screw, used for fastening the shield and the power supply board)

Disassembly Steps:

1. Use the T10 screwdriver to remove 4 screws (①) that secure the shield and the power supply board.
2. Take off the shield gently.
3. Remove the power cable from the power supply board.
4. Take off the power supply board gently.

Tip

Before disconnecting the cables from the power supply board, pay attention to the connecting positions of the cables to avoid incorrect connection or incomplete connection when assembling the cables.

Disassemble the Metal Rear Panel Components

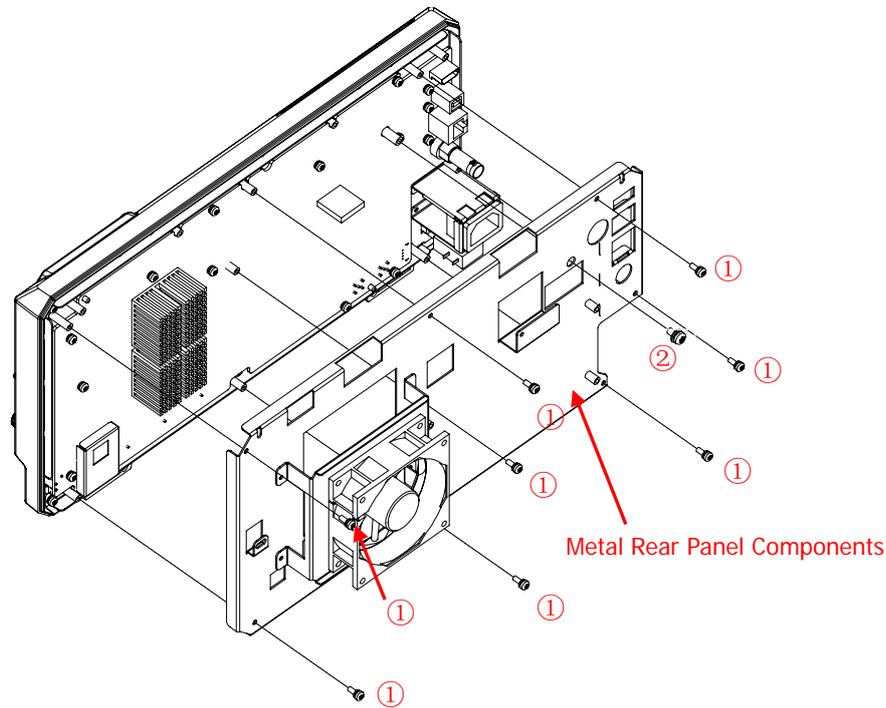


Figure 1-4 Disassemble the Metal Rear Panel Components

Part Description:

- ① 8 screws (M3x8 torx pan head combination screw, used for fastening the metal front panel and the metal rear panel components)
- ② 1 screw (M4x8 torx pan head combination screw, used for fastening the ground cable)

Disassembly Steps:

1. Disconnect the power cable and the fan cable from the main board.
2. Use the T10 screwdriver to remove 8 screws (①) that fasten the front metal panel and the metal rear panel components.
3. Use the T20 screwdriver to remove 1 screw (②) that secures the ground cable.
4. Remove the metal rear panel components gently.

Tip

Before disconnecting the power cable and the fan cable from the main board, pay attention to the connecting positions of the cables to avoid incorrect connection or incomplete connection when assembling the cables.

Disassemble the Fan

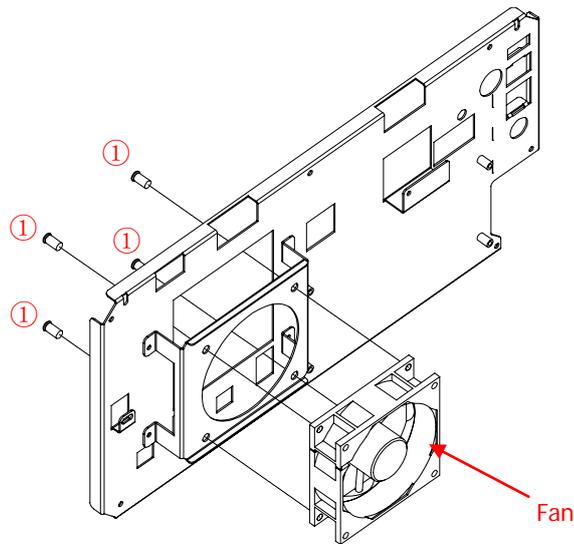


Figure 1-5 Disassemble the Fan

Part Description:

- ① 4 screws (PTF5x10 torx flat countersunk head self-tapping screw, used for fastening the fan)

Disassembly Steps:

1. Use the T10 screwdriver to remove 4 screws (①) that secure the fan.
2. Remove the fan from the metal rear panel components gently.

Tip

When disassembling the fan, pay attention to the installation position of the fan and the direction of the fan cable outlet to avoid any improper assembly operation.

Disassemble the Knob

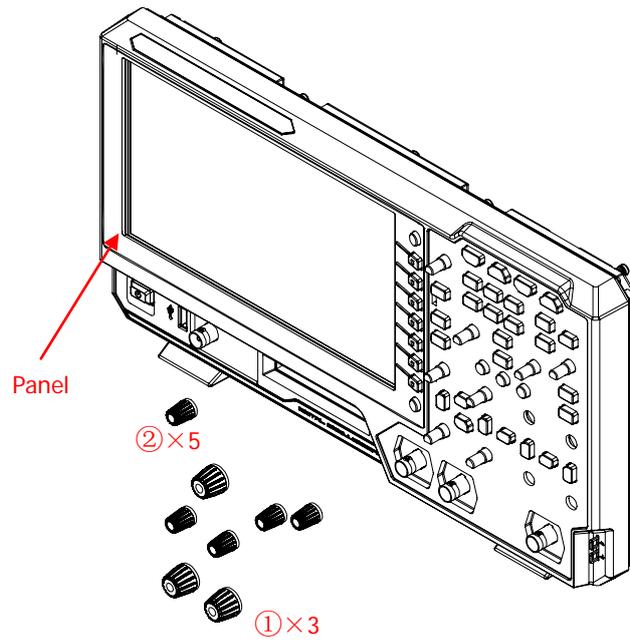


Figure 1-6 Disassemble the Knob

Part Description:

- ① 3 large knobs
- ② 5 small knobs

Disassembly Step:

Pull out the large and small knobs from the front panel.

Disassemble the Panel

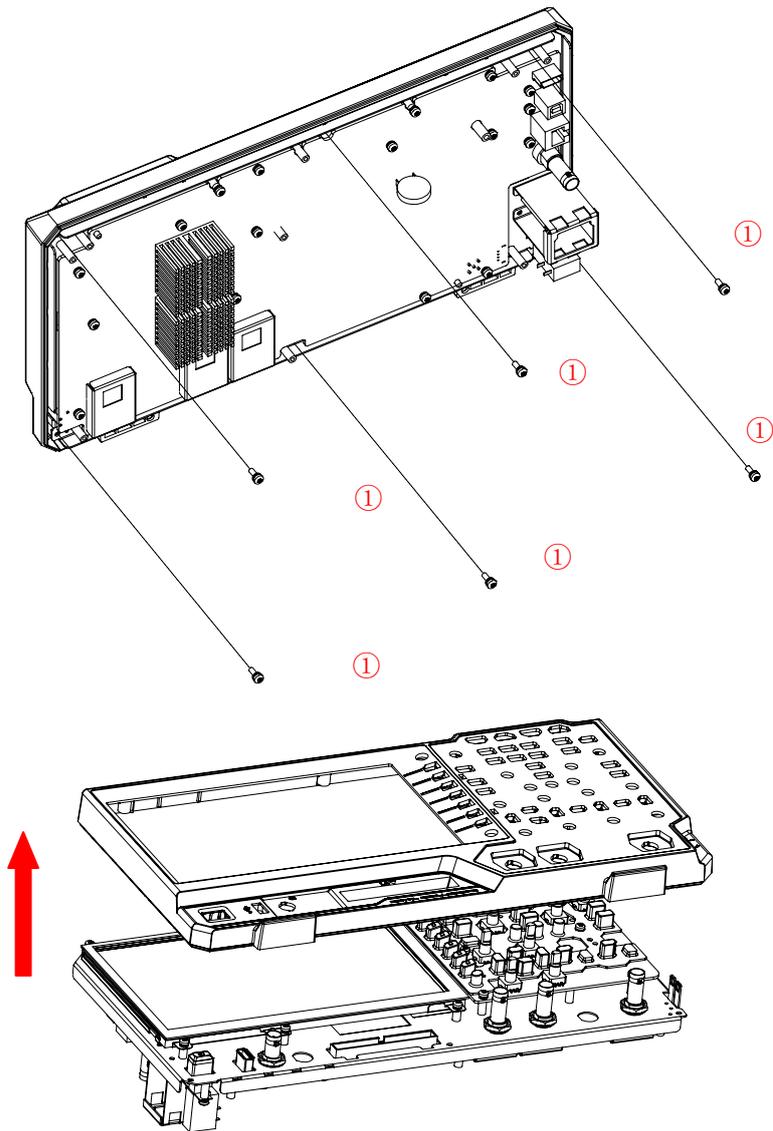


Figure 1-7 Disassemble the Panel

Part Description:

- ① 6 screws (M3x8 torx pan head combination screw, used for fastening the panel and the metal front panel)

Disassembly Steps:

1. Use the T10 screwdriver to remove 6 screws (①) that secure the panel and the metal front panel.
2. Lift the panel from the left side and remove it.
3. Take off the panel gently.

Disassemble the Main Board

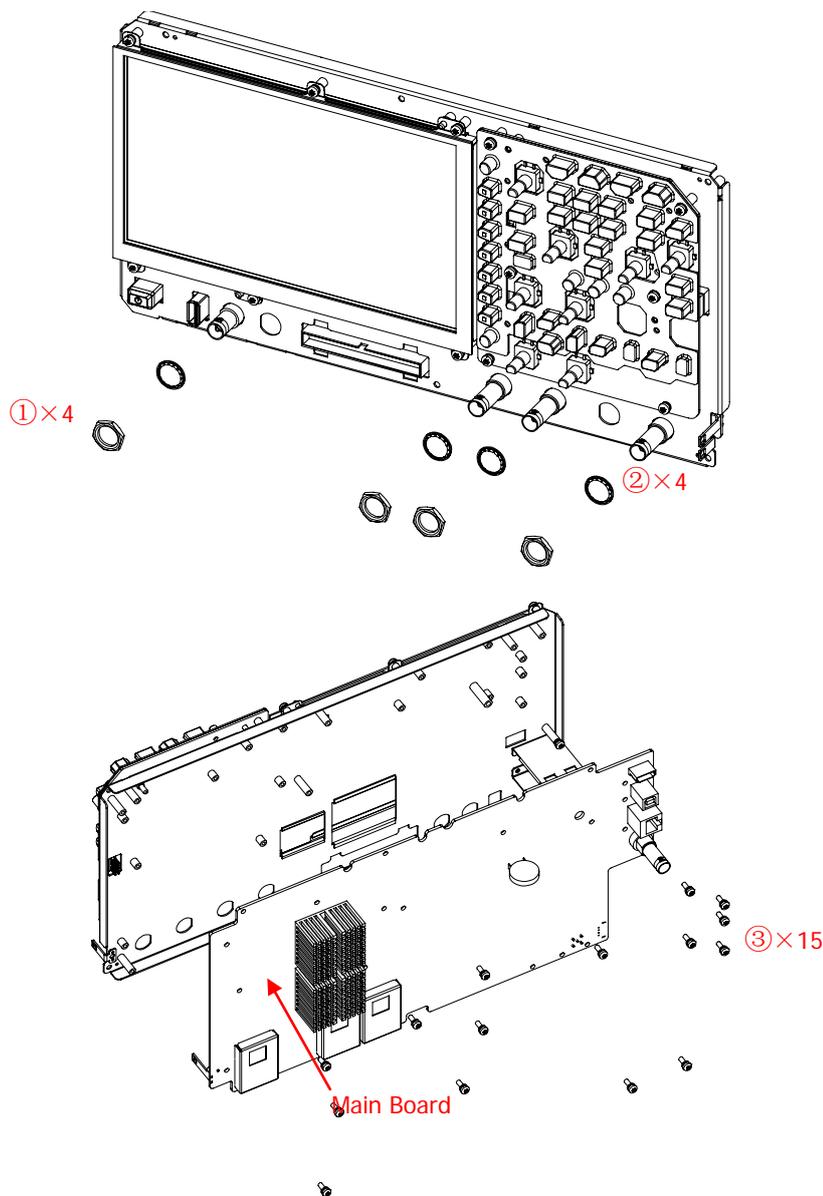


Figure 1-8 Disassemble the Main Board

Part Description:

- ① 4 BNC nuts
- ② 4 BNC lock washers
- ③ 15 screws (M3x8 torx pan head combination screw, used for fastening the main board)

Disassembly Steps:

1. Remove the touch screen cable and the LCD screen cable from the main board.
2. Use the BNC socket wrench to remove the 4 BNC lock washers and the 4 BNC nuts (①) at the BNC connectors of the main board.
3. Use the T10 screwdriver to remove 15 screws (③) that secure the main board.
4. Take off the main board gently.

Tip

Before disconnecting the cables, pay attention to the connecting positions of the cables to avoid incorrect connection or incomplete connection when assembling the cables.

Disassemble the LCD

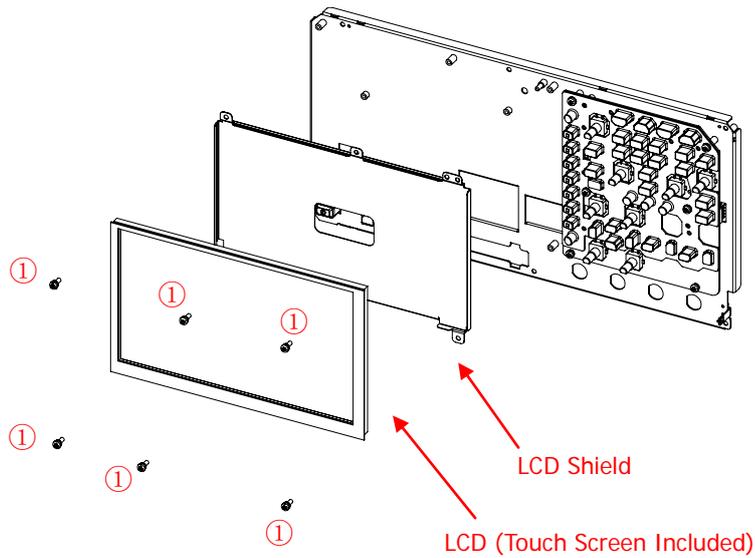


Figure 1-9 Disassemble the LCD

Part Description:

- ① 6 screws (M3x8 torx pan head combination screw, used for fastening the LCD assembly)

Disassembly Steps:

1. Use the T10 screwdriver to remove 6 screws (①) that secure the LCD assembly (LCD+LCD shield).
2. Remove the LCD assembly from the metal front panel.
3. Remove the LCD (touch screen included) from the LCD shield.

Disassemble the Keypad Board

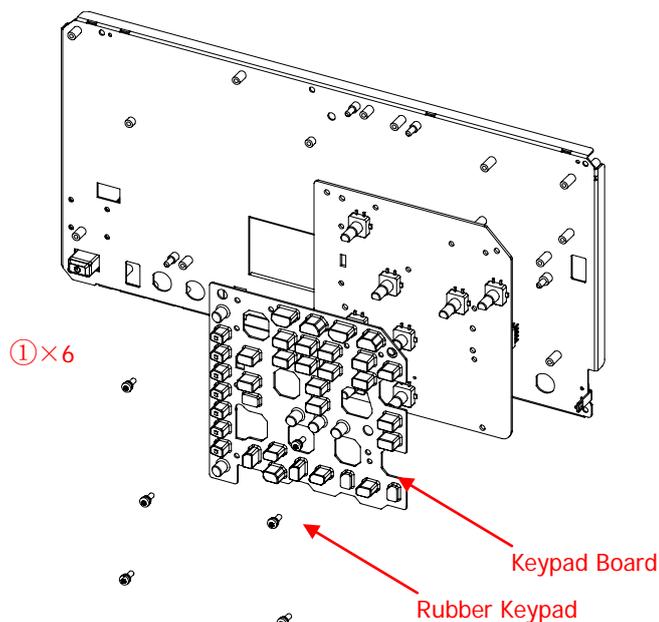


Figure 1-10 Disassemble the Keypad Board

Part Description:

- ① 6 screws (M3x8 torx pan head combination screw, used for fastening the keypad board)

Disassembly Steps:

1. Remove the rubber keypad.
2. Use the T10 screwdriver to remove 6 screws (①) that secure the keypad board.
3. Take off the keypad board gently.

Tip

- When assembling the keypad board, align the pin headers at the back of the keypad board with the slots on the main board.
- After the keyboard is properly installed, ensure that all the rubber keypads on the front panel work normally.

Disassemble the Power Key

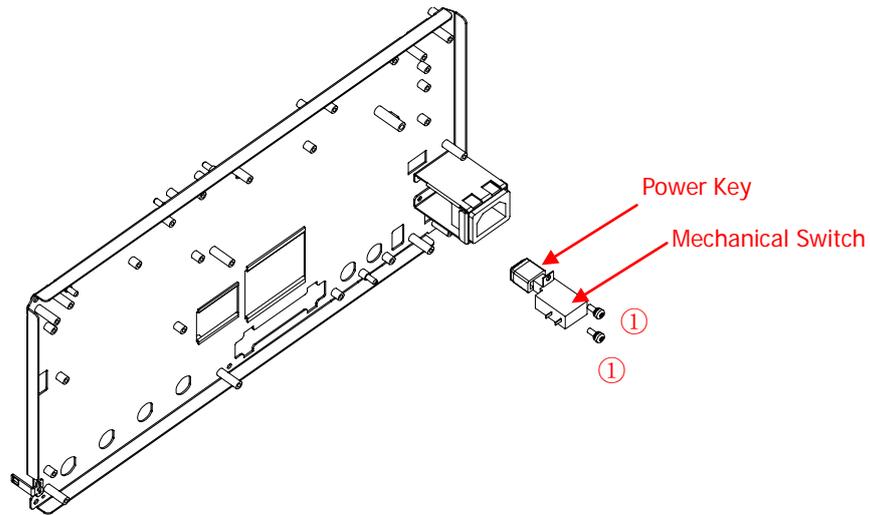


Figure 1-11 Disassemble the Power Key

Part Description:

- ① 2 screws (M3x8 torx pan head combination screw, used for fastening the power switch component)

Disassembly Steps:

1. Use the T10 screwdriver to remove 2 screws (①) that secure the power switch component (power key + mechanical switch).
2. Remove the power switch component from the metal front panel.
3. Remove the power key from the mechanical switch.

Assembly Procedures

The assembly procedures are simply the reversal of the disassembly procedures. Check whether the cables are correctly connected and whether all the screws are installed after completing each assembly procedure.

Chapter 2 Troubleshooting&Maintenance

Basic Troubleshooting

The commonly encountered failures of the oscilloscope and their solutions are listed below. If the following problems occur, locate and resolve the problems according to the following steps. If the problems still persist, contact **RIGOL** and provide your instrument information to us.

- 1. The screen is still dark after pressing the power key.**
 - (1) Check whether the power switch is really on.
 - (2) Check whether the power is correctly connected.
 - (3) Check whether the fuse is burned out. If the fuse needs to be changed, please use the specified fuse.
 - (4) Restart the instrument after finishing the above inspections.
 - (5) If it still does not work correctly, please contact **RIGOL**.

- 2. No waveform of the signal is displayed on the screen.**
 - (1) Check whether the probe is properly connected to the item under test.
 - (2) Check whether there are signals generated from the item to be tested (you can connect the probe compensation output signal to the faulty channel to locate the problem, and then determine whether the channel or the item to be tested has a problem).
 - (3) Resample the signal.

- 3. The display of waveform is ladder-like.**
 - (1) The horizontal time base might be too low. Increase the horizontal time base to improve the display effects.
 - (2) If the display type is "Vector", the lines between the sample points may cause ladder-like display results. Press **Display** → **Type** to select "Dots".

- 4. The USB storage device cannot be recognized.**
 - (1) Check whether the USB storage device can work normally.
 - (2) Make sure the USB storage device used is FAT32-format Flash storage type, as this instrument does not support USB3.0 storage device and hardware storage type.
 - (3) Check whether the capacity of the USB storage device is too large. It is recommended that the capacity of the USB storage device should not exceed 8 GB for this oscilloscope.
 - (4) Restart the instrument and insert the USB storage device to check it.
 - (5) If the USB storage device still cannot work normally, please contact **RIGOL**.

- 5. The touch functions cannot be used normally.**
 - (1) Check whether you have enabled the touch screen. If not, please press the front-panel touch screen switch key **Touch Lock** to enable the touch screen function.
 - (2) Check whether the screen or your finger is stained with oil or sweat. If yes, please clean the screen or dry your hands.
 - (3) Check whether there is a strong magnetic field around the instrument. If the instrument is close to the strong magnetic field (e.g. a magnet), please move the instrument away from the magnet field.
 - (4) If the problem still persists, please contact **RIGOL**.

Maintenance

System Maintenance

In order to ensure the performance and prolong the service life of the instrument, please follow the recommendations below.

1. Get a full understanding of the instrument performance and its basic operating method before using it.
2. In order to ensure the measurement accuracy and prolong the service life of the instrument, protect the instrument against dust, shock, moisture, magnetic field, and static electricity. Moreover, the instrument should not be exposed to sunlight for long periods of time.
3. Do not operate the instrument with functional failures. If a certain function of the instrument fails to work normally during its operating period, locate the problem and resolve it, then you can continue to operate the instrument. Besides, regular test and calibration should be performed to ensure the accuracy of its performance.
4. Arrange the instrument properly after you complete the operation.
5. Keep instrument accessories properly for future use.

Warranty

RIGOL (SUZHOU) TECHNOLOGIES INC. (hereinafter referred to as **RIGOL**) warrants that the product will be free from defects in materials and workmanship within the warranty period. If a product proves defective within the warranty period, **RIGOL** guarantees free replacement or repair for the defective product.

To get repair service, please contact with your nearest **RIGOL** sales or service office.

There is no other warranty, expressed or implied, except such as is expressly set forth herein or other applicable warranty card. There is no implied warranty of merchantability or fitness for a particular purpose. Under no circumstances shall **RIGOL** be liable for any consequential, indirect, ensuing, or special damages for any breach of warranty in any case.

Care and Cleaning

Care

Do not store or leave the instrument where it may be exposed to direct sunlight for long periods of time.

Cleaning

Clean the instrument regularly according to its operating conditions.

1. Disconnect the instrument from all power sources.
2. Clean the external surfaces of the instrument with a soft cloth dampened with mild detergent or water. When cleaning the LCD, take care to avoid scarifying it.



CAUTION

To avoid damage to the instrument, do not expose it to caustic liquids.



WARNING

To avoid short-circuit resulting from moisture or personal injuries, ensure that the instrument is completely dry before connecting it to the power supply.

Environmental Considerations

The following symbol indicates that this product complies with the WEEE Directive 2002/96/EC.



Product End-of-Life Handling

The equipment may contain substances that could be harmful to the environment or human health. To avoid the release of such substances into the environment and avoid harm to human health, we recommend you to recycle this product appropriately to ensure that most materials are reused or recycled properly. Please contact your local authorities for disposal or recycling information.