RIGOL
Quick Guide

MSO1000Z/DS1000Z Series
Digital Oscilloscope

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RIGOL Technologies, Inc.

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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 use the instrument only specified by this manual.

Use Proper Power Cord.
Only the 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, it is essential to connect the earth terminal of power cord to the Protective Earth terminal before any inputs or outputs.

Connect the Probe Correctly.
If a probe is used, do not connect the ground lead to 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 Overvoltage Protection.
Make sure that no overvoltage (such as that caused by a thunderstorm) can reach the product, or else the operator might expose to danger of electrical shock.

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

Do Not Insert Anything into the Holes of Fan.
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.

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

Keep Well Ventilation.
Inadequate ventilation may cause increasing of temperature or damages to the device. So please keep well ventilated and inspect the intake and fan regularly.

Do Not Operate in Wet Conditions.

In order to avoid short circuiting to the interior of the device or electric shock, please do not operate in a humid environment.

Do Not Operate in an Explosive Atmosphere.

In order to avoid damages to the device or personal injuries, it is important to operate the device away from an explosive atmosphere.

Keep Product Surfaces Clean and Dry.

To avoid the influence of dust and/or moisture in air, please keep the surface of device clean and dry.

Electrostatic Prevention.

Operate in an electrostatic discharge protective area environment to avoid damages induced by static discharges. Always ground both the internal and external conductors of the cable to release static before connecting.

Proper Use of Battery.

If a battery is supplied, it must not be exposed to high temperature or in contact with fire. Keep it out of the reach of children. Improper change of battery (**note:** lithium battery) may cause explosion. Use **RIGOL** specified battery only.

Handling Safety.

Please handle with care during transportation to avoid damages to buttons, knob interfaces and other parts on the panels.

Safety Terms and Symbols

Terms Used in this Manual. These terms may appear in this manual:

⚠	**WARNING** Warning statements indicate the conditions or practices that could result in injury or loss of life.

⚠	**CAUTION** Caution statements indicate the conditions or practices that could result in damage to this product or other property.

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

DANGER indicates an injury or hazard may immediately happen.
WARNING indicates an injury or hazard may be accessible potentially.
CAUTION indicates potential damage to the instrument or other property might occur.

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

Hazardous Voltage	**Safety Warning**	**Protective Earth Terminal**	**Chassis Ground**	**Test Ground**

Allgemeine Sicherheits Informationen

Überprüfen Sie diefolgenden Sicherheitshinweise sorgfältigumPersonenschädenoderSchäden am Gerätundan damit verbundenen weiteren Gerätenzu vermeiden.Zur Vermeidung vonGefahren, nutzen Sie bitte das Gerät nur so, wiein diesem Handbuchangegeben.

Um Feuer oder Verletzungen zu vermeiden, verwenden Sie ein ordnungsgemäßes Netzkabel.
Verwenden Sie für dieses Gerät nur das für ihr Land zugelassene und genehmigte Netzkabel.

Erden des Gerätes.
Das Gerät ist durch den Schutzleiter im Netzkabel geerdet. Um Gefahren durch elektrischen Schlag zu vermeiden, ist es unerlässlich, die Erdung durchzuführen. Erst dann dürfen weitere Ein- oder Ausgänge verbunden werden.

Anschluss einesTastkopfes.
Die Erdungsklemmen der Sonden sindauf dem gleichen Spannungspegel des Instruments geerdet. SchließenSie die Erdungsklemmen an keine hohe Spannung an.

Beachten Sie alle Anschlüsse.
Zur Vermeidung von Feuer oder Stromschlag, beachten Sie alle Bemerkungen und Markierungen auf dem Instrument. Befolgen Sie die Bedienungsanleitung für weitere Informationen, bevor Sie weitere Anschlüsse an das Instrument legen.

Verwenden Sie einen geeigneten Überspannungsschutz.
Stellen Sie sicher, daß keinerlei Überspannung (wie z.B. durch Gewitter verursacht) das Gerät erreichen kann. Andernfallsbestehtfür den Anwender die GefahreinesStromschlages.

Nicht ohne Abdeckung einschalten.
Betreiben Sie das Gerät nicht mit entfernten Gehäuse-Abdeckungen.

Betreiben Sie das Gerät nicht geöffnet.
Der Betrieb mit offenen oder entfernten Gehäuseteilen ist nicht zulässig. Nichts in entsprechende Öffnungen stecken (Lüfter z.B.)

Passende Sicherung verwenden.
Setzen Sie nur die spezifikationsgemäßen Sicherungen ein.

Vermeiden Sie ungeschützte Verbindungen.
Berühren Sie keine unisolierten Verbindungen oder Baugruppen, während das Gerät in Betrieb ist.

Betreiben Sie das Gerät nicht im Fehlerfall.
Wenn Sie am Gerät einen Defekt vermuten, sorgen Sie dafür, bevor Sie das Gerät wieder betreiben, dass eine Untersuchung durch qualifiziertes Kundendienstpersonal durchgeführt wird.Jedwede Wartung, Einstellarbeiten oder Austausch von Teilen am Gerät, sowie am Zubehör dürfen nur von **RIGOL** autorisiertem Personal durchgeführt werden.

Belüftung sicherstellen.
Unzureichende Belüftung kann zu Temperaturanstiegen und somit zu thermischen Schäden am Gerät führen. Stellen Sie deswegen die Belüftung sicher und kontrollieren regelmäßig Lüfter und Belüftungsöffnungen.

Nicht in feuchter Umgebung betreiben.
Zur Vermeidung von Kurzschluß im Geräteinneren und Stromschlag betreiben Sie das Gerät bitte niemals in feuchter Umgebung.

Nicht in explosiver Atmosphäre betreiben.
Zur Vermeidung von Personen- und Sachschäden ist es unumgänglich, das Gerät ausschließlich fernab jedweder explosiven Atmosphäre zu betreiben.

Geräteoberflächen sauber und trocken halten.
Um den Einfluß von Staub und Feuchtigkeit aus der Luft auszuschließen, halten Sie bitte die Geräteoberflächen sauber und trocken.

Schutz gegen elektrostatische Entladung (ESD).
Sorgen Sie für eine elektrostatisch geschützte Umgebung, um somit Schäden und Funktionsstörungen durch ESD zu vermeiden. Erden Sie vor dem Anschluß immer Innen- und Außenleiter der Verbindungsleitung, um statische Aufladung zu entladen.

Die richtige Verwendung desAkku.
Wenneine Batterieverwendet wird, vermeiden Sie hohe Temperaturen bzw. Feuer ausgesetzt werden.Bewahren Sie es außerhalbder Reichweitevon Kindern auf.UnsachgemäßeÄnderung derBatterie(**Anmerkung:**Lithium-Batterie)kann zu einer Explosion führen. VerwendenSie nur von RIGOLangegebenenAkkus.

Sicherer Transport.
Transportieren Sie das Gerät sorgfältig (Verpackung!), um Schäden an Bedienelementen, Anschlüssen und anderen Teilen zu vermeiden.

Sicherheits Begriffe und Symbole

Begriffe in diesem Guide. Diese Begriffe können in diesem Handbuch auftauchen:

 WARNING
Die Kennzeichnung WARNING beschreibt Gefahrenquellen die leibliche Schäden oder den Tod von Personen zur Folge haben können.

 CAUTION
Die Kennzeichnung Caution (Vorsicht) beschreibt Gefahrenquellen die Schäden am Gerät hervorrufen können.

Begriffe auf dem Produkt. Diese Bedingungen können auf dem Produkt erscheinen:

DANGER weist auf eine Verletzung oder Gefährdung hin, die sofort geschehen kann.
WARNING weist auf eine Verletzung oder Gefährdung hin, die möglicherweise nicht sofort geschehen.
CAUTION bedeutet, dass eine mögliche Beschädigung des Instruments oder anderer Gegenstände auftreten kann.

Symbole auf dem Produkt. Diese Symbole können auf dem Produkt erscheinen:

Gefährliche Spannung   **Sicherheits-Hinweis**   **Schutz-erde**   **Gehäuse-masse**   **Erde**

Measurement Category

Measurement Category
MSO1000Z/DS1000Z series digital oscilloscopes can make measurements in Measurement
Category I.

⚠ **WARNING**
This oscilloscope can only be used for measurements within its specified
measurement categories.

Measurement Category Definitions
Measurement category I is for measurements performed on circuits not directly connected to
MAINS. Examples are measurements on circuits not derived from MAINS, and specially protected
(internal) MAINS derived circuits. In the latter case, transient stresses are variable; for that reason,
the transient withstand capability of the equipment is made known to the user.

Measurement category II is for measurements performed on circuits directly connected to the low
voltage installation. Examples are measurements on household appliances, portable tools and
similar equipment.

Measurement category III is for measurements performed in the building installation. Examples are
measurements on distribution boards, circuit-breakers, wiring, including cables, bus-bars, junction
boxes, switches, socket-outlets in the fixed installation, and equipment for industrial use and some
other equipment, for example. Stationary motors with permanent connection to the fixed
installation.

Measurement category IV is for measurements performed at the source of the low-voltage
installation. Examples are electricity meters and measurements on primary overcurrent protection
devices and ripple control units.

Ventilation Requirement

This oscilloscope uses fan to force cooling. Please make sure that the air intake and exhaust areas
are free from obstructions and have free air. When using the oscilloscope in a bench-top or rack
setting, provide at least 10 cm clearance beside, above and behind the instrument for adequate
ventilation.

⚠ **WARNING**
Inadequate ventilation may cause temperature increase which would damage the
instrument. So please keep the instrument well ventilated during operation and
inspect the intake and fan regularly.

Working Environment

Temperature
Operating: 0℃ to +50℃
Non-operating: -40℃ to +70℃

Humidity
0℃ to +30℃: ≤95﹪ relative humidity
+30℃ to +40℃: ≤75﹪ relative humidity
+40℃ to +50℃: ≤45﹪ relative humility

⚠ **WARNING**
To avoid short circuit inside the instrument or electric shock, please do not operate in humid environment.

Altitude
Operating: less than 3 km
Non-operating: less than 15 km

Installation (overvoltage) Category
This product is powered by mains conforming to installation (overvoltage) category II.

⚠ **WARNING**
Make sure that no overvoltage (such as that caused by thunderbolt) can reach the product, or else the operator might expose to danger of electric shock.

Installation (overvoltage) Category Definitions
Installation (overvoltage) category I refers to signal level which is applicable to equipment measurement terminals connected to the source circuit. In these terminals, precautions are done to limit the transient voltage to the corresponding low level.

Installation (overvoltage) category II refers to the local power distribution level which is applicable to equipment connected to the AC line (AC power).

Pollution Degree
Degree 2

Pollution Degree Definitions
Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. For example: a clean room or air-conditioned office environment.

Pollution degree 2: Normally only dry, non-conductive pollution occurs. Occasionally a temporary conductivity caused by condensation may occur. For example: general indoor environment.

Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. For example: Sheltered outdoor environment.

Pollution degree 4: Pollution that generates persistent conductivity through conductive dust, rain, or snow. For example: outdoor locations.

Safety Class
Class 1 – Grounded Product

General Care and Cleaning

General Care:
Do not store or leave the instrument in where the instrument will be exposed to direct sunlight for long periods of time.

Cleaning:
Clean the instrument regularly according to its operating conditions. To clean the exterior surface, perform the following steps:
1. Disconnect the instrument from all power sources.
2. Clean the loose dust on the outside of the instrument with a lint- free cloth (with a mild detergent or water). When cleaning the LCD, take care to avoid scarifying it.

⚠ **CAUTION**
To avoid damages to the instrument, do not expose them to liquids which have causticity.

⚠ **WARNING**
To avoid injury resulting from short circuit, make sure the instrument is completely dry before reconnecting to a power source.

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. In order to avoid release of such substances into the environment and harm to human health, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately. Please contact your local authorities for disposal or recycling information.

Document Overview

This manual is used to guide users to quickly get familiar with the front panel, rear panel, user interface and basic operation method of MSO1000Z/DS1000Z series digital oscilloscope. You can download the newest version of the manual from www.rigol.com.

Format Conventions in this Manual:

1. Button

The front panel keys are denoted by the format of "Button Name (Bold) + Text Box". For example, **Utility** denotes the "Utility" key.

2. Menu

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

3. Operation Step

The next step of operation is denoted by an arrow "→". For example, **Utility** → **System** denotes pressing **Utility** and then pressing **System**.

4. Knob

Logo	Knob	Logo	Knob
HORIZONTAL SCALE	Horizontal Scale Knob	**VERTICAL SCALE**	Vertical Scale Knob
HORIZONTAL POSITION	Horizontal Position Knob	**VERTICAL POSITION**	Vertical Position Knob
TRIGGER LEVEL	Trigger Level Knob	--	--

Content Conventions in this Manual:

MSO1000Z/DS1000Z series includes the following models. In this manual, MSO1104Z-S is taken as an example to illustrate the functions and operation methods of MSO1000Z/DS1000Z series.

Model	Analog Bandwidth	Analog Channels	Source Channels	Digital Channels
MSO1104Z-S	100 MHz	4	2	16
MSO1074Z-S	70 MHz	4	2	16
MSO1104Z	100 MHz	4	——	16
MSO1074Z	70 MHz	4	——	16
DS1104Z-S	100 MHz	4	2	——
DS1074Z-S	70 MHz	4	2	——
DS1104Z	100 MHz	4	——	——
DS1074Z	70 MHz	4	——	——
DS1054Z	50 MHz	4	——	——

Contents

Quick Start

General Inspection

1. **Inspect the shipping container for damage.**
   Keep the damaged shipping container or cushioning material until the contents of the shipment have been checked for completeness and the instrument has passed both electrical and mechanical tests.

   The consigner or carrier shall be liable for the damage to instrument resulting from shipment. **RIGOL** would not be responsible for free maintenance/rework or replacement of the unit.

2. **Inspect the instrument.**
   In case of any damage, or defect, or failure, notify your **RIGOL** sales representative.

3. **Check the Accessories**
   Please check the accessories according to the packing lists. If the accessories are incomplete or damaged, please contact your **RIGOL** sales representative.

Appearance and Dimensions
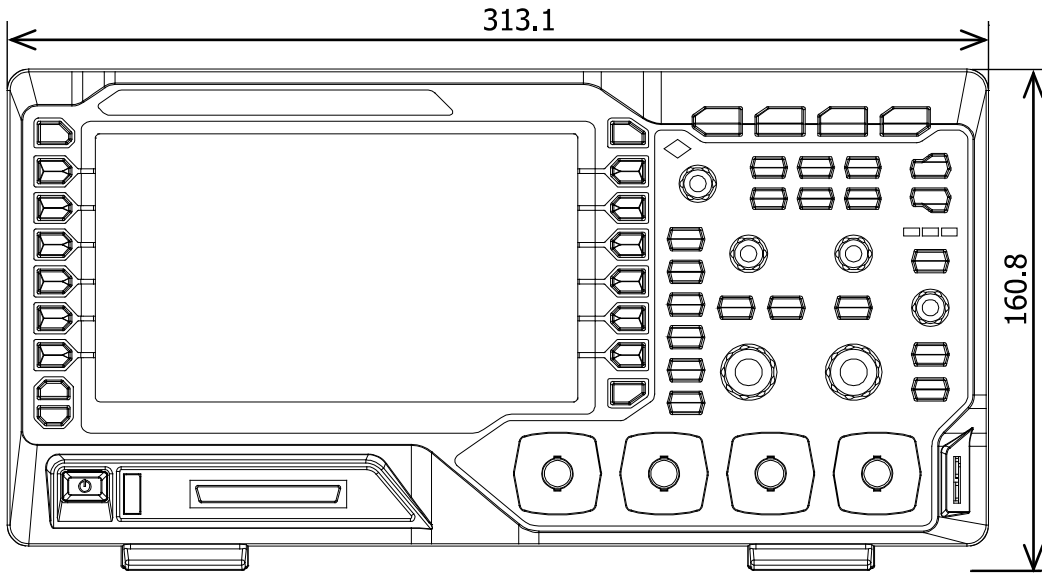
Figure 1 Front View   Unit: mm
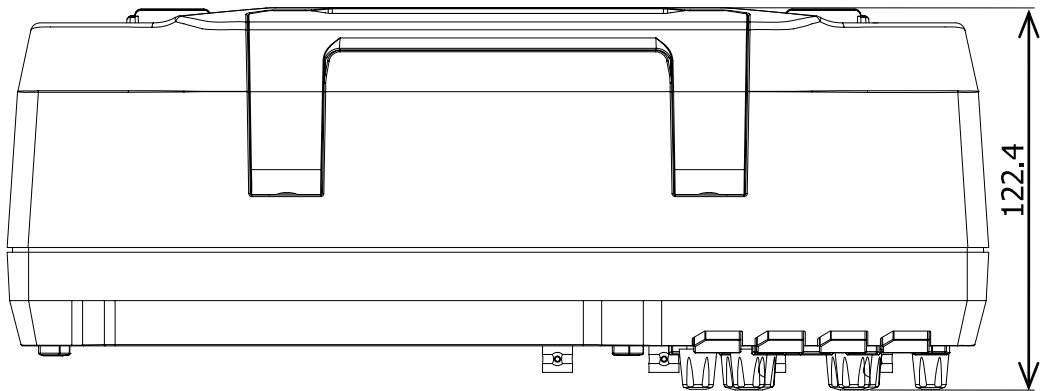
Figure 2 Top View   Unit: mm

To Prepare for Operation

To Adjust the Supporting Legs

Adjust the supporting legs properly to use them as stands to tilt the oscilloscope upwards for stable placement of the instrument as well as easier operation and observation of the instrument.
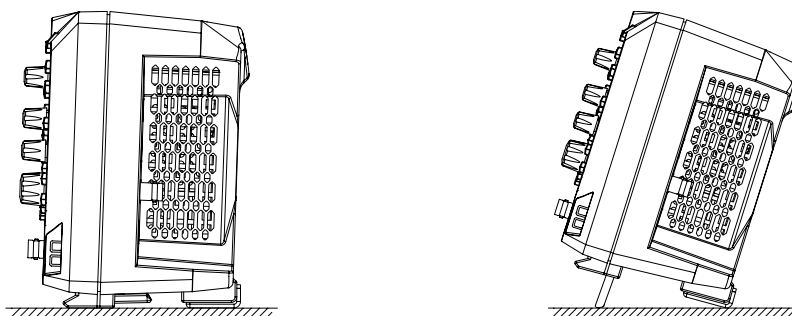
Figure 3 To Adjust the Supporting Legs

To Connect to AC Power Supply

This oscilloscope can accept 100-240 V, 45-440 Hz AC power supply. Please use the power cord supplied with the accessories to connect the oscilloscope to the power source as shown in the figure below.

Power Socket
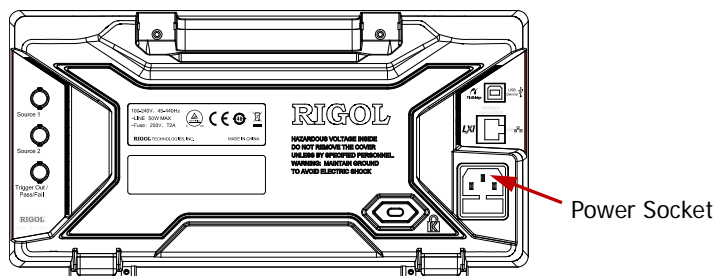
Figure 4 To Connect to AC Power Supply

Power-on Inspection

When the oscilloscope is energized, press the power key 🔲 at the lower-left corner of the front panel to turn on the oscilloscope. During the start-up process, the oscilloscope performs a series of self-test items. After the self-test is finished, the welcome screen is displayed. The instrument is installed with the trial versions of the options before leaving factory and the remaining time is about 2000 minutes. The "Installed Options" dialog box will be displayed if your instrument currently installs the trial versions of options. From this dialog box you can view the names, details, versions and the remaining time of the options currently installed.

To Connect the Probe

RIGOL provides passive probe for DS1000Z as well as passive probe and logic probe for MSO1000Z. For detailed technical information of the probes, please refer to corresponding Probe User's Guide. The following are the probes recommended for use with the oscilloscope.

Model	Description	Applicable Instrument
RP2200A	150 MHz, passive probe, standard	MSO1000Z/DS1000Z
RPL1116	Logic probe, standard	MSO1000Z

Connect the Probe:
1. Connect the BNC terminal of the probe to an analog channel input of the oscilloscope at the front panel.
2. Connect the ground alligator clip of the probe to the circuit ground terminal and then connect the probe tip to the circuit point under test.
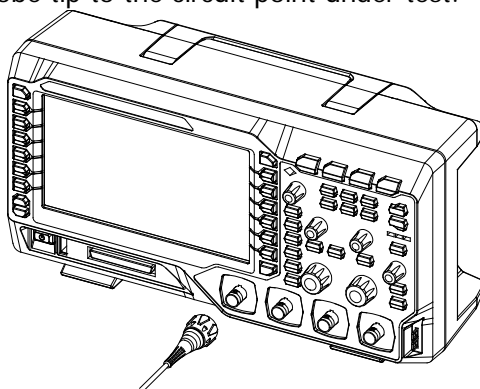
Figure 5 To Connect the Passive Probe

Connect the Logic Probe:
1. Connect the single-wire terminal of the logic probe to Digital Channel Interface at the front panel of MSO1000Z in the correct direction.
2. Connect the other terminal of the logic probe to the signal under test. MSO1000Z is provided with the RPL1116 logic probe which provides two connecting methods to connect to the signal under test to realize convenient and flexible detection. For the details, please refer to the *RPL1116 Logic Probe User's Guide*.

Digital Channel Interface
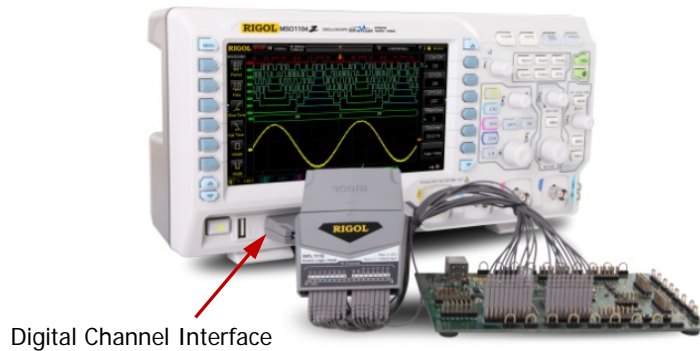
Figure 6 To Connect the Logic Probe

Function Inspection

1. Press **Storage** → **Default** to restore the oscilloscope to its default configuration.
2. Connect the earth alligator clip of the probe to the "Ground Terminal" as shown in the figure below.
3. Use the probe to connect the input terminal of CH1 and the "Compensation Signal Output Terminal" of the oscilloscope.
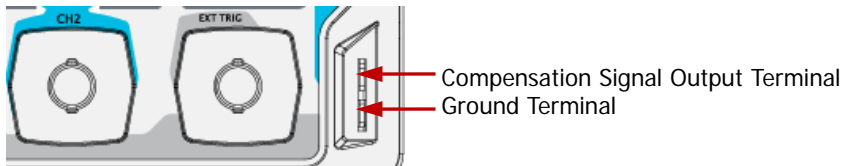
Figure 7 To Use the Compensation Signal

4. Press **AUTO**.
5. Observe the waveform on the display. In normal condition, the display should be a square waveform as shown in the figure below:
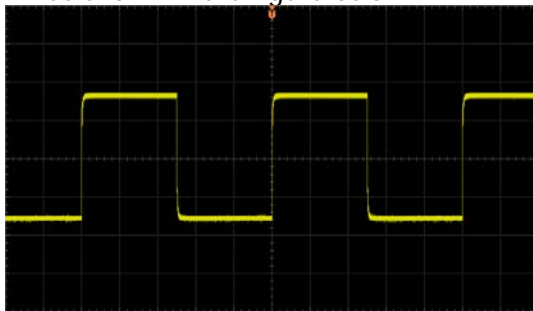
Figure 8 Square Waveform

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

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

Tip
The signal output from the probe compensation connector can only be used for probe compensation adjustment and can not be used for calibration.

Probe Compensation

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

1. Perform steps 1, 2, 3 and 4 of **"Function Inspection"**.
2. Check the displayed waveforms and compare them with the following figures.

Over compensated   Perfectly compensated   Under compensated
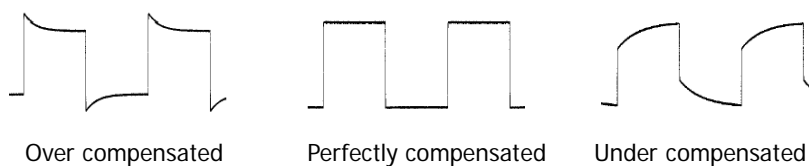
Figure 9 Probe Compensation

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

Front Panel Overview
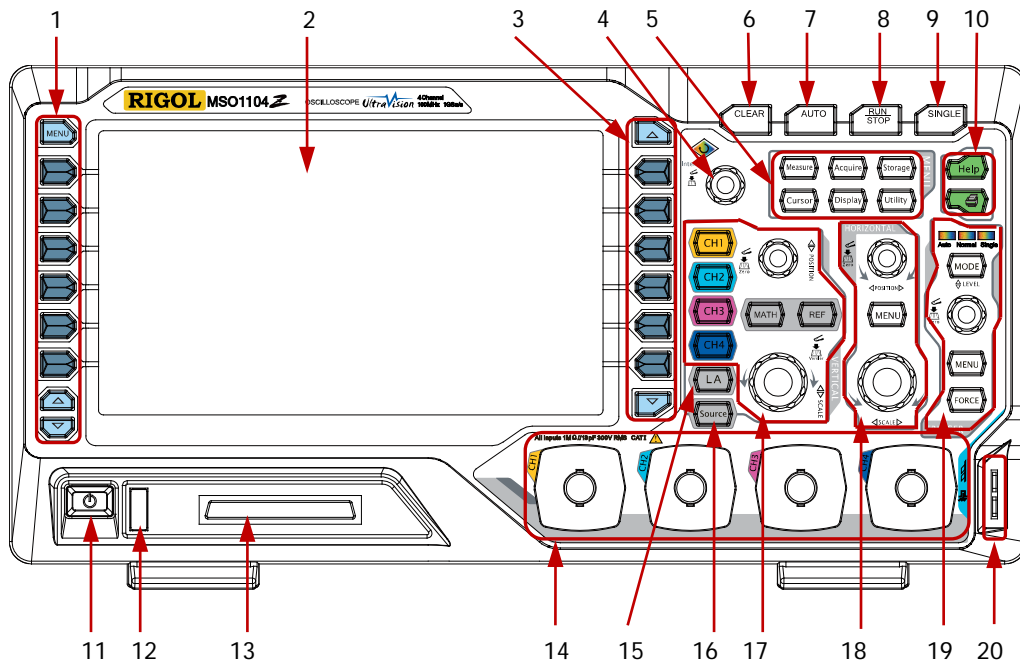
Figure 10 Front Panel Overview

Table 1 Front Panel Description

No.	Description	No.	Description
1	Measurement Menu Softkeys	11	Power Key
2	LCD	12	USB HOST Interface
3	Function Menu Softkeys	13	Digital Channel Input Interface [1]
4	Multifunction Knob	14	Analog Channel Input Interface
5	Common Operation Keys	15	Logic Analysis Control Key [1]
6	CLEAR	16	Signal Source [2]
7	AUTO	17	VERTICAL Control
8	RUN/STOP	18	HORIZONTAL Control
9	SINGLE	19	TRIGGER Control
10	Help/Print	20	Probe Compensation Signal Output Terminal/Ground Terminal

Note[1]: Only applicable to MSO1000Z-S and MSO1000Z models oscilloscopes.
Note[2]: Only applicable to MSO1000Z-S and DS1000Z-S models oscilloscopes.

Rear Panel Overview
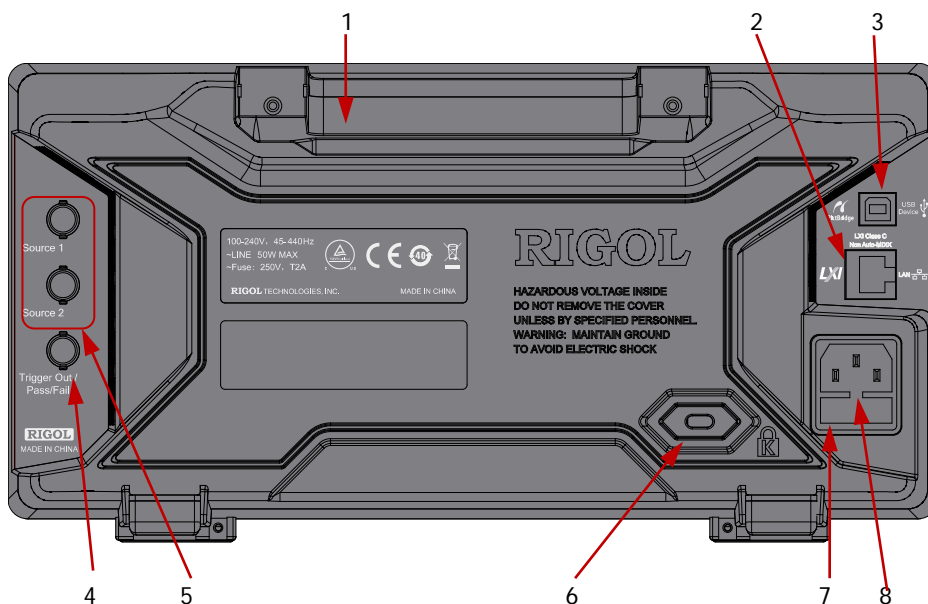
Figure 11 Rear Panel Overview

1. **Handle**
    Pull up the handle vertically for easy carrying of the instrument. When you do not need the handle, press it down.

2. **LAN**
    Connect the instrument to the network via this interface for remote control. This oscilloscope conforms to the LXI CORE 2011 DEVICE class instrument standards and can quickly build test system with other instruments.

3. **USB DEVICE**
    You can connect the oscilloscope to a PictBridge printer or PC via this interface. When a PC is connected, users can send SCPI commands using the PC software or control the oscilloscope via user-defined programming. When a printer is connected, users can print the waveforms displayed on the screen using the printer.

4. **Trigger Out and Pass/Fail**
    ● **Trigger Out:**
        The oscilloscope can output a signal that can reflect the current capture rate of the oscilloscope at each trigger via this interface. Connect the signal to a waveform display device to measure the frequency of the signal. The measurement result is equal to the current capture rate.
    ● **Pass/Fail:**

The instrument can output a positive pulse via this connector when a failed waveform is detected during the pass/fail test. The instrument continuously outputs a low level via this connector when no failed waveform is detected.

5. **Source Output**
   The output terminals of the built-in dual-channel source of the oscilloscope. When Source1 or Source2 is enabled, the signal currently set can be output through the **[Source1]** or **[Source2]** connector at the rear panel.

6. **Lock Hole**
   You can lock the instrument to a fixed location using the security lock (please buy it yourself) via the lock hole.

7. **Fuse**
   If a new fuse is required, please use the specified fuse (250V, T2A). The operation method is as follows:
   a) Turn off the instrument, disconnect the power, and then remove the power cord.
   b) Insert a small straight screwdriver into the slot at the power socket and prize out the fuse seat gently.
   c) Take out the fuse and replace it with a specified fuse. Then, install the fuse seat.

8. **AC Power Socket**
   AC power input terminal. The power requirements of this oscilloscope are 100-240 V, 45-440 Hz. Use the power cord provided with the accessories to connect the instrument to AC power. Then, you can press the power key at the front panel to start the instrument.

Front Panel Function Overview

VERTICAL
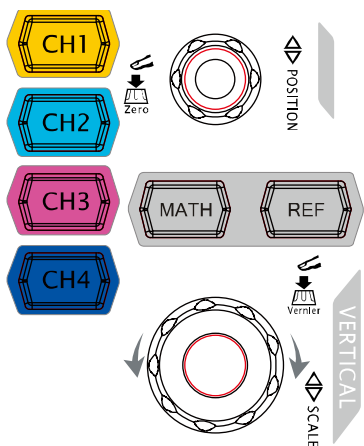
CH1, **CH2**, **CH3**, **CH4**: analog channel setting keys. The 4 channels are marked by different colors which are also used to mark both the corresponding waveforms on the screen and the channel input connectors. Press any key to open the corresponding channel menu and press again to turn off the channel.

MATH: press **MATH** → **Math**, you can open the math operation menu under which A+B, A-B, A×B, A/B, FFT, A&&B, A||B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp and Abs are provided. You can also press **MATH** to open the decoding menu and set the decoding options.

REF: press this key to enable the reference waveform function to compare the waveform actually measured with the reference waveform.

Vertical POSITION: modify the vertical position of the current channel waveform. Turn clockwise to increase the position and turn counterclockwise to decrease. During the modification, the waveform would move up and down and the position message (e.g. POS: 216.0mV) at the lower-left corner of the screen would change accordingly. Press down this knob to quickly reset the vertical position to zero.

VERTICAL SCALE: modify the vertical scale of the current channel. Turn clockwise to decrease the scale and turn counterclockwise to increase. During the modification, the amplitude of the waveform would enlarge or reduce and the scale information (e.g. 1 200mV) at the lower side of the screen would change accordingly. Press down this knob to quickly switch the vertical scale adjustment modes between "Coarse" and "Fine".

Note
How to set the vertical scale and vertical position of each channel?
The 4 channels of MSO1000Z/DS1000Z use the same **VERTICAL POSITION** and **VERTICAL SCALE** knobs. If you want to set the vertical scale and vertical position of a certain channel, please press **CH1**, **CH2**, **CH3** or **CH4** at first to select the desired channel. Then rotate the **VERTICAL POSITION** and **VERTICAL SCALE** knobs to set the values.

Logic Analyzer

Press this key to open the logic analyzer control menu. You can turn on or off any channel or channel group, modify the display size of the digital channel, modify the logic threshold of the digital channel as well as group the 16 digital channels. You can also set a label for each digital channel.

Note:
— This function is only available for MSO1000Z-S and MSO1000Z models oscilloscopes.
— Press **LA** → **D7-D0**; when "On" is selected, CH4 function is automatically disabled; when "Off" is selected, CH4 function recovers automatically. Press **LA** → **D15-D8**; when "On" is selected, CH3 function is automatically disabled; when "Off" is selected, CH3 function recovers automatically.

Signal Source
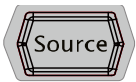
Press this key to enter the source setting interface. You can enable or disable the output of the **[Source1]** or **[Source2]** connector at the rear panel, set the output signal waveform and parameters, turn on or off the state display of the current signal.

Note: This function is only available for MSO1000Z-S and DS1000Z-S models oscilloscopes.

HORIZONTAL
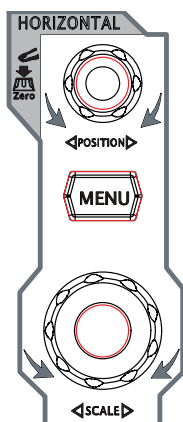
HORIZONTAL ⊙ **POSITION**: modify the horizontal position. The trigger point would move left or right relative to the center of the screen when you turn the knob. During the modification, waveforms of all the channels would move left or right and the horizontal position message (e.g. `D  -200.000000ns  `) at the upper-right corner of the screen would change accordingly. Press down this knob to quickly reset the horizontal position (or the delayed sweep position).

MENU: press this key to open the horizontal control menu where you can turn on or off the delayed sweep function and switch between different time base modes.

HORIZONTAL ⊙ **SCALE**: modify the horizontal time base. Turn clockwise to reduce the time base and turn counterclockwise to increase the time base. During the modification, waveforms of all the channels will be displayed in expanded or compressed mode and the time base message (e.g.`H  500ns  `) at the upper side of the screen would change accordingly. Press down this knob to quickly switch to delayed sweep state.

TRIGGER
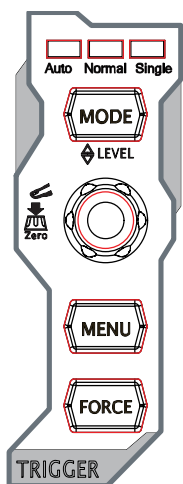
MODE: press this key to switch the trigger mode to **Auto**, **Normal** or **Single** and the corresponding state backlight of the current trigger mode would be illuminated.

TRIGGER ⊙ **LEVEL**: modify the trigger level. Turn clockwise to increase the level and turn counterclockwise to reduce the level. During the modification, the trigger level line would move up and down and the value in the trigger level message box (e.g. `Trig Level : 428mV  `) at the lower-left corner of the screen would change accordingly. Press down the knob to quickly reset the trigger level to zero point.

MENU: press this key to open the trigger operation menu. This oscilloscope provides various trigger types, please refer to the introduction in *MSO1000Z&DS1000Z User Guide.*

FORCE: press this key to generate a trigger signal forcefully.

CLEAR

Press this key to clear all the waveforms on the screen. If the oscilloscope is in "RUN" state, new waveforms will still be displayed.

AUTO

Press this key to enable the waveform auto setting function. The oscilloscope will automatically adjust the vertical scale, horizontal time base and trigger mode according to the input signal to realize optimum waveform display.

Note: Waveform auto setting function requires that the frequency of sine is no lower than 41Hz; the duty cycle should be greater than 1% and the amplitude must be at least 20mVpp for square. Otherwise, the Waveform auto setting function may be invalid and the quick parameter measurement function displayed in the menu will also be unavailable.

RUN/STOP

Press this key to "RUN" or "STOP" waveform sampling. In the "RUN" state, the key is illuminated in yellow. In the "STOP" state, the key is illuminated in red.

SINGLE

Press this key to set the trigger mode to "Single". In single trigger mode, press **FORCE** to generate a trigger signal immediately.

Multifunction Knob
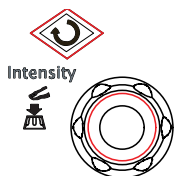
Adjust waveform brightness:
In non-menu-operation mode, turn this knob to adjust the brightness of waveform display. The adjustable range is from 0% to 100%. Turn clockwise to increase the brightness and counterclockwise to reduce. Press down this knob to reset the brightness to 60%.
You can also press **Display** → **Intensity** and use the knob to adjust the waveform brightness.

Multifunctional:
In menu operation, the backlight of the knob goes on. Press any menu softkey and turn the knob to select the submenus under this menu and then press down the knob to select the current submenu. It can also be used to modify parameters (please refer to the introduction in "**Parameter Setting Method**") and input filename.

Function Menus
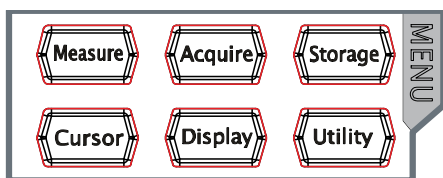
Measure: press this key to open the measurement setting menu. You can set the measurement source and turn on or off the frequency counter, all measure, statistic function etc.
Press **MENU** at the left of the screen to switch the measurement menus of 33 waveform parameters. Then, press down the corresponding menu softkey to quickly realize one-key measurement and the measurement result will be displayed at the bottom of the screen.

Acquire: press this key to enter the sample setting menu to set the acquisition mode, Sin(x)/x and memory depth of the oscilloscope.

Storage: press this key to enter file store and recall interface. The storable file types include picture, traces, waveforms, setups, CSV and parameters. Internal and external storage as well as disk management are also supported.

Cursor: press this key to enter the cursor measurement menu. The oscilloscope provides four cursor modes: manual, track, auto and XY. Note that XY cursor mode is only available when the horizontal time base is set to XY.

Display: press this key to enter display setting menu to set the display type, persistence time, wave intensity, grid type and grid brightness.

Utility: press this key to enter the system function setting menu to set the system-related functions or parameters, such as the I/O, sound and language. Besides, some advanced functions (such as the pass/fail test, waveform record, etc.) are also supported.

Print

Press this key to print the screen or save the screen to a USB storage device.

— If a PictBridge printer is connected currently and the printer is in idle state, pressing this key can print the screen.

— If no printer is connected but a USB storage device is inserted, pressing this key can save the screen to the USB storage device in ".png" format. When the storage type is picture, you can store the screen image to the USB storage device in the specified picture format.

— If both a printer and a USB storage device are connected, the printer enjoys higher priority when pressing this key.

User Interface

MSO1000Z/DS1000Z provides 7.0 inches, WVGA (800*480) 160,000 color TFT LCD.
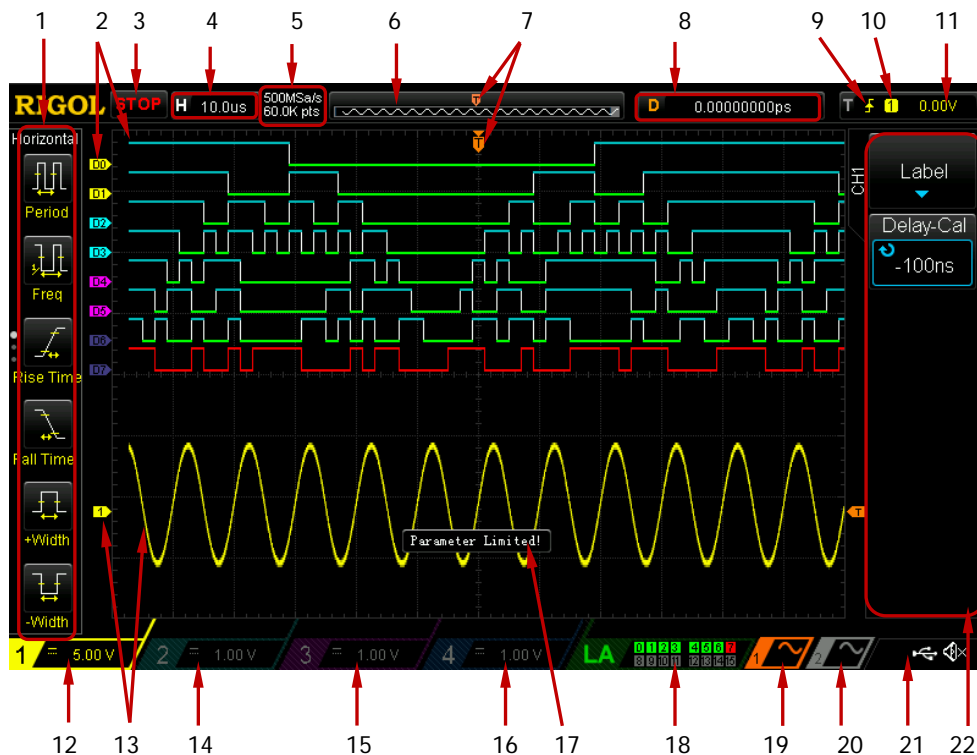
Figure 12 User Interface

1. **Auto Measurement Items**
   Provide 16 horizontal (HORIZONTAL) and 17 vertical (VERTICAL) measurement parameters. Press the softkey at the left of the screen to activate the corresponding measurement item. Press **MENU** continuously to switch between the horizontal and vertical parameters.

2. **Digital Channel Label/Waveform**
   The logic high level of the digital waveform is displayed in blue and the logic low level in green. Its edge is displayed in white. The label and waveform of the digital channel currently selected are displayed in red. The group set function in logic analyzer menu can divide the digital channels into four groups, channel labels in the same group are marked with the same color, labels in different groups are marked with different colors.
   Note: This function is only applicable to MSO1000Z-S and MSO1000Z models oscilloscopes.

3. **Status**
   Available states include RUN, STOP, T'D (triggered), WAIT and AUTO.

4. **Horizontal Time Base**
   - Represent the time per grid on the horizontal axis on the screen.
   - Use **HORIZONTAL** ◎ **SCALE** to modify this parameter. The range available is from 5 ns to 50 s.

5. **Sample Rate/Memory Depth**
   - Display the current sample rate and memory depth of the oscilloscope.
   - The sample rate and memory depth will change in accordance with the horizontal time base.

6. **Waveform Memory**
   Provide the schematic diagram of the memory position of the waveform currently on the screen.

   waveform on the screen
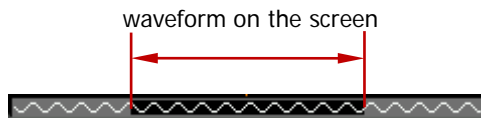
7. **Trigger Position**
   Display the trigger position of the waveform in the waveform memory and on the screen.

8. **Horizontal Position**
   Use **HORIZONTAL** ◎ **POSITION** to modify this parameter. Press down the knob to automatically set the parameter to zero.

9. **Trigger Type**
   Display the currently selected trigger type and trigger condition setting. Different labels are displayed when different trigger types are selected.
   For example: ⬆ represents triggering on the rising edge in "Edge" trigger.

10. **Trigger Source**
    Display the trigger source currently selected (CH1-CH4, AC Line or any channel of D0-D15). Different labels are displayed when different trigger sources are selected and the color of the trigger parameter area will change accordingly.
    For example: 🔟 denotes that CH1 is selected as the trigger source.

11. **Trigger Level**
    - When the trigger source is set to analog channel, you need to set proper trigger level.
    - 🔼 at the right of the screen is the trigger level label and the trigger level value is displayed at the upper-right corner of the screen.
    - When using **TRIGGER** ◎ **LEVEL** to modify the trigger level, the trigger

level value will change with the up and down of .
Note: in slope trigger, runt trigger and windows trigger, there are two trigger level labels (and).

12. CH1 Vertical Scale
- Display the voltage value per grid of CH1 waveform vertically.
- Use **VERTICAL** ⊚ **SCALE** to modify this parameter.
- The following labels will be displayed according to the current channel setting: channel coupling (e.g.) and bandwidth limit (e.g.).

13. Analog Channel Label/Waveform
Different channels are marked with different colors and the colors of the channel label and waveform are the same.

14. CH2 Vertical Scale
- Display the voltage value per grid of CH2 waveform vertically.
- Use **VERTICAL** ⊚ **SCALE** to modify this parameter.
- The following labels will be displayed according to the current channel setting: channel coupling (e.g.) and bandwidth limit (e.g.).

15. CH3 Vertical Scale
- Display the voltage value per grid of CH3 waveform vertically.
- Use **VERTICAL** ⊚ **SCALE** to modify this parameter.
- The following labels will be displayed according to the current channel setting: channel coupling (e.g.) and bandwidth limit (e.g.).

16. CH4 Vertical Scale
- Display the voltage value per grid of CH4 waveform vertically.
- Use **VERTICAL** ⊚ **SCALE** to modify this parameter.
- The following labels will be displayed according to the current channel setting: channel coupling (e.g.) and bandwidth limit (e.g.).

17. Message Box
Display prompt messages.

18. Digital Channel Status Area
Display the current status of the 16 digital channels. The digital channels currently turned on are displayed in green, the digital channel currently selected is displayed in red and the digital channels turned off are displayed in grey.
Note: This function is only applicable to MSO1000Z-S and MSO1000Z models oscilloscopes.

19. Source1 Waveform
- Display the type of waveform currently set for Source1.
- When the modulation is enabled, will be displayed at the bottom of the Source1 Waveform.

● When the impedance of signal source is set to 50 Ω, ⬛ will be displayed at the bottom of the Source1 Waveform.
● Only available to MSO1000Z-S and DS1000Z-S.

20. Source2 Waveform
● Display the type of waveform currently set for Source2.
● When the modulation is enabled, ⬛ will be displayed at the bottom of the Source2 Waveform.
● When the impedance of signal source is set to 50 Ω, ⬛ will be displayed at the bottom of the Source2 Waveform.
● Only available to MSO1000Z-S and DS1000Z-S.

21. Notification Area
Display sound icon and USB disk icon.
● Sound Icon: Press **Utility** → **Sound** to enable or disable the sound. When the sound is enabled, ⬛ will be displayed; when the sound is disabled, ⬛ will be displayed.
● USB Disk Icon: when a USB disk is detected, ⬛ will be displayed.

22. Operation MENU
Press any softkey to activate the corresponding menu.
The following symbols might be displayed in the menu:
⬛　Denote that you can rotate the multifunction knob ↻ to modify parameters. The backlight of ↻ turns on during the parameter modification.
⬛　Denote that you can rotate ↻ to select the desired item, the item currently selected is displayed in blue, press down the knob to enter the corresponding menu. The backlight of ↻ is constant on after menus with this symbol are selected.
⬛　Denote that press ↻ to input desired paramrter values directly using the pop-up numeric keyboard. The backlight of ↻ is constant on after menus with this symbol are selected.
⬛　Denote that the current menu has several options.
⬛　Denote that the current menu has a lower level menu.
⬛　Press this key to return to the previous menu.
⬛　The number of the dots denotes that the number of the pages the current menu has.

Parameter Setting Method

This oscilloscope provides two methods to set the basic parameters.

Method 1:
When ⟳ is displayed on the menu, you can rotate ⟳ to set the desired value directly.

Method 2:
When ⟳ is displayed, press down ⟳ and the numeric keyboard is displayed, as shown below. Rotate the knob to select the desired value, and then press down the knob to input the value. After all the value input, rotate the knob to select the desired unit, press down the knob to finish your input.

Figure 13 Numeric Keyboard

To Use the Security Lock

If needed, you can use the security lock (please buy it yourself) to lock the oscilloscope to a fixed location. The method is as follows, align the lock with the lock hole and plug it into the lock hole vertically, turn the key clockwise to lock the oscilloscope and then pull the key out.
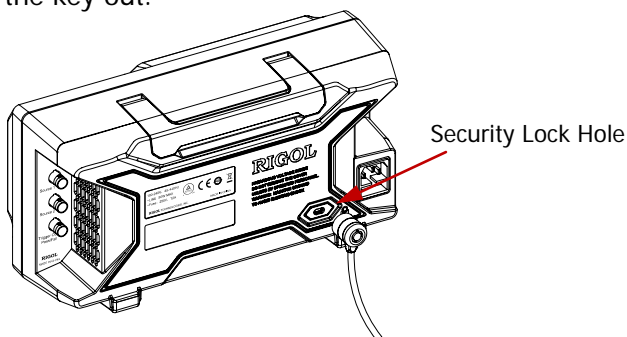

Security Lock Hole

Figure 14 To Use the Security Lock

Note: please do not insert other articles into the security lock hole to avoid damaging the instrument.

To Use the Built-in Help System

The help system of this oscilloscope provides instructions for all the function keys (including menu keys) at the front panel. Press **Help** to open the help interface and press again to close the interface. The help interface mainly consists of two parts. The left is "Help Options" and the right is "Help Display Area".
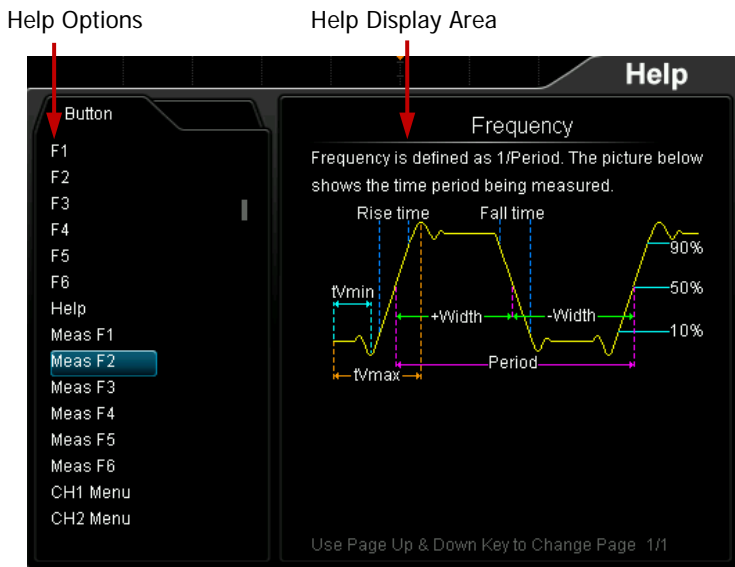
Help Options   Help Display Area

Figure 15 Help Information

You can press the button (except the power key ⬛, the knob ↻ and the menu page up/down key ⬘/⬙) at the front panel directly to get the corresponding help information in the "Help Display Area".

Troubleshooting

The commonly encountered failures and their solutions are listed below. When you encounter those failures, please solve them following the corresponding steps. If the problem remains still, please contact **RIGOL** and provide your device information (acquisition method: **Utility** → **System** → **System Info**).

1. **The screen is still dark (no display) after power on:**
   (1) Check whether the power switch is turned 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. **The signal is sampled but no waveform of the signal is displayed:**
   (1) Check whether the probe is correctly connected to the item under tested.
   (2) Check whether there are signals generated from the item under test (you can connect the probe compensation signal to the problematic channel to determine which has problem, the channel or the item under test).
   (3) Resample the signal.

3. **The voltage amplitude measured is greater or lower than the actual value (note that this failure usually only occurs when probe is used):**
   Check whether the attenuation ratio of the channel complies with the attenuation ratio of the probe.

4. **There is waveform display but not stable:**
   (1) Check the trigger signal source: press **MENU** of the TRIGGER Control Area of the front panel, then press **Source** to confirm whether the setting complies with the signal channel actually used.
   (2) Check the trigger type: general signals should use "Edge" trigger and video signal should use "Video" trigger. Only when the proper trigger type is used, can the waveform be displayed stably.
   (3) Check the trigger level: adjust the trigger level to the middle of the signal.
   (4) Change the trigger holdoff setting.

5. **No display after pressing RUN/STOP:**
   Check the TRIGGER Control Area of the front panel to confirm whether the trigger mode is "Normal" or "Single" and whether the trigger level exceeds the waveform range. If yes, set the trigger level to the middle or press the **MODE** to set the trigger mode to "Auto".
   Note: Using **AUTO** could automatically finish the above setting.

6. **The display of waveform is ladder-like:**
   (1) The horizontal time base might be too low. Increase the horizontal time base to increase the horizontal resolution and improve the display.
   (2) If the display **Type** is "Vectors", the lines between the sample points may cause ladder-like display. Press **Display** → **Type** , set the display type to "Dots" to solve the problem.

7. **Fail to connect PC or PictBridge through USB:**
   (1) Press **Utility** → **IO Setting** → **USB Device** to check whether the setting matches the device currently connected.
   (2) Check whether the USB cable is correctly connected to the instrument and PC.
   (3) Check whether the USB cable is in good condition. If needed, restart the oscilloscope.

8. **The USB storage device cannot be recognized:**
   (1) Check whether the USB storage device can work normally.
   (2) Check whether the USB storage device being used is flash type. This oscilloscope does not support hardware type USB storage device.
   (3) Check whether the capacity of the USB storage device is too large. It is recommended that the capacity of the USB storage device being used with this oscilloscope is no larger than 8 GBytes.
   (4) Restart the instrument and then insert the USB storage device to check it.
   (5) If the USB storage device still cannot be used normally, please contact **RIGOL**.