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USG3000V/USG5000V Series RF Vector Signal Generators

Quick Start Guide

This document applies to the following models:

USG5000V series

USG3000V series

V1.0

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UNI-T guarantees that the Instrument product is free from any defect in material and workmanship within three years from the purchase date. This warranty does not apply to damages caused by accident, negligence, misuse, modification, contamination, or improper handling. If you need a warranty service within the warranty period, please contact your seller directly. UNI-T will not be responsible for any special, indirect, incidental, or subsequent damage or loss caused by using this device. For the probes and accessories, the warranty period is one year. Visit instrument.uni-trend.com for full warranty information.

USG3000V

USG5000V

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Chapter 1 USG3000V&5000V Series Overview

USG5000V Series adopts Direct Digital Synthesis (DDS) technology, enabling the generation of high-precision, stable waveforms across a frequency range of 9 kHz to 22 GHz. It supports analog demodulation functions such as AM, FM, ΦM, and I/Q modulation, and is also equipped with pulse modulation, pulse train generation, and a power meter function. With its user-friendly operation, superior technical specifications, and intuitive graphical display, the USG5000V Series serves as a versatile tool for learning, testing, and improving work efficiency.

The basic operating principles are consistent across both the USG3000V and USG5000V Series; however, differences exist in hardware configurations and system parameters. This manual introduces the user interface and provides descriptions of the various keys for the USG5000V Series. For specific models, the parameter configurations and ranges of each menu key may vary. Please refer to the respective data sheets for detailed specifications.

1.1 Front Panel

The product has a front panel of simple, intuitive, and easy to use, as shown in the following figure.

USG5000V Front Panel

USG3000V Front Panel

1. Display Screen

   The 5-inch capacitive touch screen clearly distinguishes function menus, control statuses, and

other important information using distinct color tones. Parameter adjustments and output controls are accessible through the touch screen, and the user-friendly system interface enhances human-computer interaction, improving work efficiency.

2. Function Key

   The function buttons are Home, Utility, Mode, Sweep, AM, FM/ΦM, Pulse, and IQ. Pressing the Home button returns to the home page; the Mode button enables RF modulation; the Sweep button enables RF sweep; the AM button configures the AM setting for RF; the FM/ΦM button configures the FM/ΦM setting for RF; the Pulse button configures the pulse setting for RF; the IQ button configures the IQ setting for RF; and the Utility button is used to set the auxiliary functions.

3. Numeric keypad

   The numeric keypad includes digit keys 0–9, a decimal point ()., a sign key (+/–), and unit keys for parameter input. The left arrow key functions as a backspace to delete the previous digit in the current entry.

4. Multifunction Rotary Knob / Arrow Keys

   The multifunction rotary knob is used to change values (rotate clockwise to increase the number) or function as an arrow key. Press the knob to select a function or confirm a setting. When using the multifunction rotary knob and arrow key to set parameters, they can be used to switch between digit positions, clear the previous digit, or move the cursor left or right.

5. RF/LF/MOD Output Button

   Press the RF button to enable or disable the RF signal output. Press the LF button to enable or disable the LF signal output. Press the MOD button to turn each modulation mode on or off. The key backlight illuminates when the function is enabled and turns off when it is disabled.

6. LF Output Interface

   This interface is equipped with a backlight indicator. When the backlight is illuminated, the port is outputting a signal; when it is off, there is no signal output.

7. RF Output Interface

   This interface is equipped with a backlight indicator. When the backlight is illuminated, the port is outputting a signal; when it is off, there is no signal output.

8. USB Port

   This port is used to connect to an external USB storage device. It allows the instrument to read or import arbitrary waveform data files stored on the USB flash drive. It can also be used to upgrade the instrument system, ensuring that the firmware and arbitrary waveform generator software are kept up to date.

9. Power Supply Switch

Press the power switch to turn on the instrument; press it again to turn it off.

Note

The LF output interface is equipped with an overvoltage protection function. This protection is triggered when any of the following conditions are met:

- The instrument output amplitude is ≤ 4 Vpp, while the input voltage exceeds ±3 V, and the frequency is below 10 kHz.
- When overvoltage protection is triggered, the channel output will be automatically disabled.

1.2 Rear Panel

The rear panels of USG3000V and USG5000V are shown in the figure below.

USG5000V Rear Panel

USG3000V Rear Panel

1. GPIB Port

   Connects the signal generator to a PC, allowing instrument control via PC software.

2. USB Port

   Connects the signal generator to a PC, allowing instrument control via PC software.

3. Local Area Network (LAN)

   Connects the instrument to a LAN for remote control.

4. Q OUT_N

   When the I/Q modulation source is internal, enabling I/Q Output allows the analog quadrature (Q) component of the I/Q modulation to be output from the built-in baseband generator.

5. Q OUT_P

   Operates with Q OUT_N to provide a balanced baseband signal output.

6. I OUT_N

   When the I/Q modulation source is internal, enabling I/Q Output allows the analog in-phase (I) component of the I/Q modulation to be output from the built-in baseband generator.

7. I OUT_P

   Operates with I OUT_N to provide a balanced baseband signal output.

8. I IN

   Used to input an externally modulated I-channel baseband signal when the I/Q modulation source is external.

9. Q IN

   Used to input an externally modulated Q-channel baseband signal when the I/Q modulation source is external.

10. PATTERN

    Pattern trigger input.

11. EVENT

    Outputs an auxiliary pulse signal when the played Arb (arbitrary waveform) contains a marker. The output pulse level corresponds to the marker polarity:

    - Positive polarity: the marker point in the waveform is at a high level (approximately 3.3 V)
    - Negative polarity: the marker point in the waveform is at a low level (approximately 0 V)

12. BB TRIG

    Baseband trigger input.

13. External Analog Modulation Input

    During RF amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM), when the modulation source is set to External or Internal + External, the modulation signal is applied through the external analog modulation input port. The corresponding modulation depth, frequency offset, phase offset, or duty cycle deviation is controlled by a 4 Vpp high-impedance input signal.

14. Valid Output

    This active output provides a pulse signal. When parameters such as frequency or amplitude are being adjusted, the Valid output remains at a high level. After the parameter settings are completed, the Valid output switches to a low level.

15. TRIG In/Out

    For LF Sweep: When trigger output is enabled, a TTL-compatible square-wave trigger signal is output through this connector. During RF pulse modulation, this connector can also output a

synchronization signal.

For External Triggering: When the trigger mode of the RF Sweep or LF Sweep is set to External, this connector accepts a TTL pulse of the specified polarity as the trigger input signal.

16. Pulse Signal Output

    During pulse modulation, this port outputs the internally generated "Pulse In" signal.

17. Pulse Signal Input

    This port accepts external pulse signals when the pulse type is set to External Trigger, External Trigger Pulse Pair, Gate, or External Pulse.

18. External 10MHz Input Port

    Establish synchronization between multiple generators or with an external 10 MHz clock signal. If the instrument detects an external 10 MHz clock signal at the 10MHz IN connector (input requirements: frequency of 10MHz, amplitude ≥ 0 dBm/50 Ω), it will automatically switch to this signal as the external clock source, indicated by the first icon 

in the status bar. In Auto mode, when the external clock source is lost, exceeds limits, or disconnected, the instrument clock source will automatically switch to the internal clock, and the icon 

will update to 

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19. Internal 10MHz Output Port

    Establish synchronization between multiple signal generators or the output of a 10 MHz reference clock signal to an external source.

20. Ground Terminal

    The ground terminal provides an electrical connection point for attaching an antistatic wrist strap to reduce electrostatic discharge (ESD) when handling or connecting the DUT.

21. Main Power Supply Switch

    When the power switch is set to "I", the instrument is powered on. When the power switch is set to "O," the instrument is powered off (the power switch on the front panel does not function).

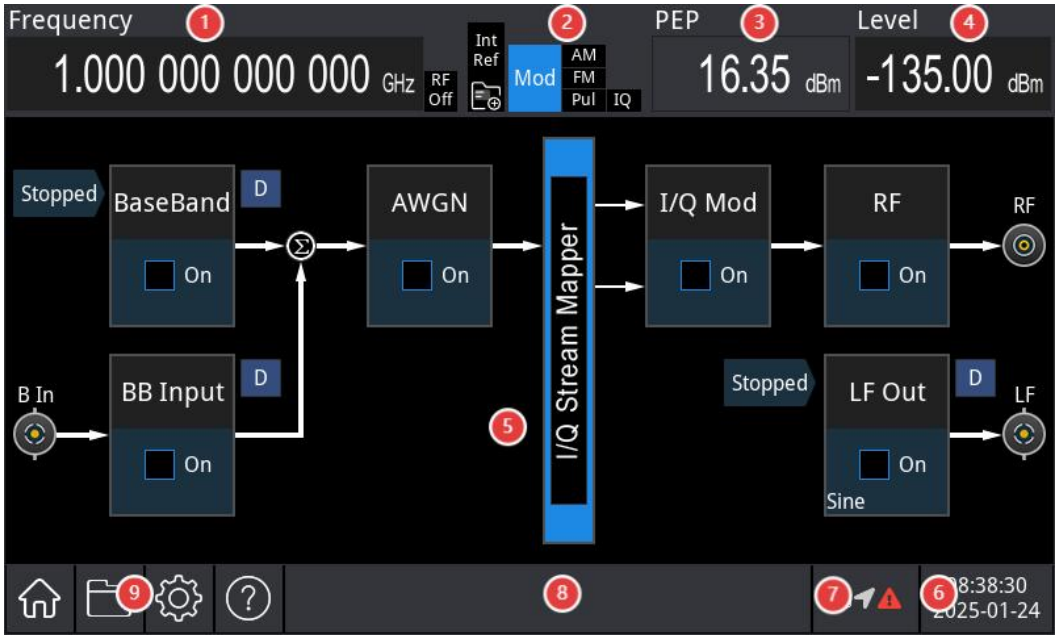
22. AC Power Input Port

    For the AC power specifications, refer to the *Connecting Power Supply* section.

23. Safety Lock

    The safety lock (sold separately) is used to secure the instrument in a fixed position.

1.3 Function Interface



1. RF Frequency (Display Frequency): Configures the RF frequency. This differs from the frequency output setting in the frequency menu, RF Frequency (Display Frequency) = Frequency Output + Frequency Offset.
2. Status Bar

   RF: Displays RF output state. Gray indicates that the output is disabled, while blue indicates that the output is enabled.

   ExtRef/IntRef: ExtRef indicates that the signal generator is using the external 10MHz reference input. IntRef indicates that the signal generator is using the internal 10MHz reference.

   AM/FM/Pul/IQ: Indicates the currently active modulation type. Gray indicates that the current modulation is disabled, while blue indicates that the current modulation is enabled.
3. PEP (Peak Envelope Power): Envelope power is defined as the average power measured over a time interval that is long compared to the highest modulation frequency period, yet short compared to the carrier period.

   The maximum value of this envelope power is called the Peak Envelope Power (PEP). PEP is an important parameter for characterizing the output power of amplitude-modulated or other varying-envelope signals.
4. RF (Display Amplitude): Configures the RF amplitude. This differs from the amplitude output setting in the frequency menu, RF Amplitude (Display Amplitude) = Amplitude Output + Amplitude Offset.
5. Parameter Setting Area

   Modulation Source: Configures the internal modulation source for RF. This includes enabling or

disabling the internal source, and setting parameters such as modulation waveform, frequency, amplitude, and phase.

Modulation Input: Configures the external modulation source for RF. This includes enabling or disabling the external input and setting the input load for the external modulation source.

Analog Modulation: Configures RF modulation parameters. This includes enabling or disabling modulation, and setting the modulation type, amplitude modulation (AM), frequency modulation (FM), phase modulation (ΦM), or pulse modulation (PM).

Baseband: Configures baseband parameters, including settings for Custom, ARB (Arbitrary Waveform), Multi-tone, and IoT modes.

Baseband Input: Configures the baseband input switch.

Noise Superposition: Configures parameters related to superimposed noise, including noise bandwidth, system bandwidth, minimum noise-to-system bandwidth ratio, and other associated parameters.

I/Q Modulation: Configures the I/Q modulation switch and related parameters, including I/Q source, I/Q adjustment, and I/Q output settings.

RF (Radio Frequency): Configures RF carrier signal parameters, including enabling or disabling the RF output, and setting frequency, amplitude, sweep, power meter, and other related parameters.

Function Generation: Configures LF (Low Frequency) signal parameters, including enabling or disabling the LF output, and setting fundamental waveform, sweep, and modulation parameters.

6. Date and time: Displays day and time.
7. Connection type: Displays the connection device state, such as mouse, USB flash drive, and screen lock.
8. System log dialog box: Click on the blank area on the right side of the file storage section to access the system log, view local runtime logs, alarms, notifications, and other information.
9. Function setting: Screenshot, file system, setup system, and help system.

   Hom page  : Click on this key to return to the home page, double-click on this key to take a screenshot and save it to the instrument.

   File system  : In the file system, users can save, copy, move, delete, load, and rename files, including sweep list files, pulse string files, screenshots, state files, arbitrary files, and other files.

   System information  : View basic and optional information about the instrument.

   Help system  : Open the help navigation.

Chapter 2 Instructions Manual

This manual is to introduce the safety requirements, installment and the operation of USG3000V&5000V series RF Vector Signal Generators.

2.1 Inspecting Packaging and List

Upon receiving the instrument, please check the packaging and list as follows.

1. Check whether the shipping box and cushioning materials show any signs of compression or damage from external impact. Also, inspect the instrument's exterior for visible damage. If you have any concerns about the product or require assistance, please contact your distributor or local service office.
2. Carefully remove the instrument from the package and compare the items received against the packing list.

2.2 Environmental Requirements

This instrument is designed for use under the following conditions.

- Indoor use only
- Pollution degree 2
- Overvoltage Category II: Connect this product only to a power supply that complies with Overvoltage Category II. This typically applies to equipment connected to the mains via power cords and plugs.
- Operating altitude: up to 2000 meters (about 1.24 mi); non-operating altitude: up to 15,000 meters (about 9.32 mi)
- Unless otherwise specified, the operating temperature range is +10 °C to +40 °C; storage temperature range is –20 °C to +60 °C.
- Operating relative humidity: ≤90% RH at temperatures up to +35 °C; non-operating relative humidity: ≤60% RH at +35 °C to +40 °C

Ventilation openings are on the instrument's rear and side panels. Ensure that airflow through these vents remains unobstructed. To prevent excessive dust accumulation, clean the instrument housing regularly. The housing is not waterproof, always disconnect the power supply before cleaning. Use a dry cloth or a soft cloth slightly moistened with water.

2.3 Connecting Power Supply

The AC power supply specifications are shown in the following table.

Voltage Range	Frequency
100 V-240 V AC (Fluctuations ±10%)	50/60 Hz
100-120 V AC (Fluctuations ±10%)	400 Hz

Notes:

- The maximum power consumption of the instrument does not exceed 75 W.
- Use only the supplied power cord to connect to the power inlet.

Connecting the Power Cable

This instrument is a Class I safety product. The supplied power cables have reliable performance in terms of case grounding. This instrument is equipped with a three-prong power cable that meets international safety standards. It provides good case grounding performance for the specifications of your country or region.

To install the AC power cable:

- Ensure the power cable is in good condition.
- Leave enough space to connect to the power cord.
- Plug the attached three-prong power cable into a well-grounded power socket.

2.4 Electrostatic Discharge Protection

Electrostatic discharge (ESD) can cause permanent damage to components. Such damage may not be immediately visible and can occur during transportation, storage, or operation.

To minimize the risk of ESD damage:

- Perform testing in an ESD-protected area whenever possible.
- Before connecting the power cord to the instrument, briefly ground both the inner and outer conductors to discharge any static electricity.
- Ensure all instruments are properly grounded to prevent the buildup of static charges.

2.5 Preparation Work

1. Connect the power cord. Insert the plug into a properly grounded AC outlet, then adjust the alignment jig as required.
2. Press the software switch  on the front panel to turn on the instrument.

2.6 Activation and Upgrade

To activate an optional feature, the user needs to install its corresponding license file. The user contacts UNI-T office to purchase the license.

Follow these steps to activate your purchased option:

1. Copy the license file to the root directory of a USB flash drive.
2. Insert the USB flash drive into the front-panel USB port of the instrument.
   a. On the front panel, press Utility →System Information to open the System Information window.
   b. Click Add License under the Optional Features Information table to open the Add License dialog box.
   c. Locate the license file on the USB flash drive, select it, and check the corresponding box.
   d. Once the process is complete, the status of the corresponding optional feature in the Optional Features Information table will be updated to show the activated features.

Firmware Upgrade

After downloading the firmware upgrade package from the official UNI-T website, follow these steps to perform the upgrade:

1. Extract the upgrade package to the root directory of a USB flash drive. The package should contain four files: fpga_bin.md5, fpga_bin.upg, usg_xxxx.md5, and usg_xxxx.upg, as shown in the figure below.

Figure 1-1 Upgrade Package

2. Insert the USB flash drive into the front-panel USB port.
   a. Press the File System button at the bottom left of the screen, then navigate to File System →U Drive →Upgrade Package → and select the fpga_bin.upg file.
   b. Click Load on the right-hand menu and confirm the upgrade.
   c. The instrument will restart automatically after the first package is installed.
3. After the restart, repeat the same steps to load the second file.

a. Press the File System button  at the bottom left of the screen, then navigate to File System →U Drive →Upgrade Package → and select the usg_xxxx.upg file.

b. Once the installation is complete, the instrument will restart again.

c. The upgrade process is now finished.

Note

- Use a USB drive formatted in FAT32.
- Do not power off or remove the USB flash drive during the upgrade process.
- Avoid performing other operations during the upgrade to prevent failure, which may cause the device to malfunction.

2.7 Remote Control

USG3000V&5000V series RF Vector Signal Generator supports communication with a computer via USB, LAN, and GPIB interfaces. Users can send SCPI (Standard Commands for Programmable Instruments) commands over USB or LAN, using programming languages or NI-VISA, to remotely control the instrument as well as other SCPI-compliant instruments.

For detailed information about installation, remote control modes, and programming, please refer to the *USG Series RF Vector Signal Generator Programming Manual* on the official website: http://www.uni-trend.com.

2.8 Help Information

USG3000V&5000V series has a built-in help system for each function key and menu control key. From the main interface, press the Help icon  to open the help system and navigate to the relevant page for detailed information.

Chapter 3 Quick Start Guide

3.1 Output RF Signal

3.1.1 Output Frequency Setting

By default, the RF output is configured as a continuous wave with a frequency of 1 GHz and an amplitude of –135 dBm.

To change the frequency to 2.5 GHz, follow these steps:

1. Press the Freq key.
2. Use the numeric keypad to enter 2.5.
3. Select GHz as the unit for the frequency parameter.

3.1.2 Frequency Offset Setting

Default RF waveform configuration: The frequency offset is set to 0 Hz.

To change the frequency offset to 100 kHz, follow these steps:

1. On the screen, press the Home key in the analog stream mapper.
2. Press the RF →Freq→Freq Offset key.
3. Use the numeric keypad to enter 100 and select kHz as the unit.
4. Press the Freq Offset key again to enable the setting.

Note: The multifunction knob and arrow keys can also be used together to set this parameter.

3.1.3 Frequency Reference Setting

Default RF waveform configuration: The frequency reference is set to 0 Hz.

To change the frequency reference to 200 MHz, follow these steps:

1. On the screen, press the Home key in the analog stream mapper.
2. Press the RF →Freq→Freq Ref key.
3. Use the numeric keypad to enter 200 and select MHz as the unit.
4. Press the Freq Ref key again to enable the setting.

3.1.4 Phase Offset Setting

Default RF waveform configuration: The phase offset is set to 0°.

To change the phase offset to 90°, follow these steps:

1. On the screen, press the Home key in the analog stream mapper.
2. Press the RF →Freq→Phase Offset key.
3. Use the numeric keypad to enter 90 and select deg as the unit.

3.1.5 Phase Offset Setting

Default RF waveform configuration: The internal TB calibration is set to 0 ppb.

To change the internal TB calibration to 30 ppb, follow these steps:

1. On the screen, press the Home key in the analog stream mapper.
2. Press the RF →Freq→Inner TB key.
3. Use the numeric keypad to enter 30 and select ppb as the unit.

3.1.6 Internal TB Calibration Setting

Default RF waveform configuration: The internal TB calibration is set to 0 ppb.

To change the internal TB calibration to 30 ppb, follow these steps:

1. On the screen, press the Home key in the analog stream mapper.
2. Press the RF →Freq→Inner TB key.
3. Use the numeric keypad to enter 30 and select ppb as the unit.

3.1.7 Reference Source Setting

Default RF waveform configuration: The reference source is set to Auto.

To change the reference source to internal, follow these steps:

1. On the screen, press the Home key in the analog stream mapper.
2. Press the RF →Freq→ Ref Oscillator →Internal key.

3.1.8 Output Amplitude Setting Output Amplitude Setting

Default RF waveform configuration: The amplitude is set to -135 dBm.

To change the amplitude to 0 dBm, follow these steps:

1. On the screen, press the Home key in the analog stream mapper.
2. Press the RF →Ampt→Ampt key.
3. Use the numeric keypad to enter 0 and select dBm as the unit.

3.1.9 Amplitude Offset Setting

Default RF waveform configuration: The amplitude offset is set to 0 dB.

To change the amplitude offset to 10 dB, follow these steps:

1. On the screen, press the Home key in the analog stream mapper.
2. Press the RF →Freq→Ampt Offset key.
3. Use the numeric keypad to enter 10 and select dB as the unit.
4. Press the Ampt Offset key again to enable the setting.

3.1.10 Amplitude Reference Setting

Default RF waveform configuration: The amplitude reference is set to 0 dB.

To set the amplitude reference, follow these steps:

1. On the screen, press the Home key in the analog stream mapper.
2. Press the RF →Ampt→Ampt Ref key. The amplitude reference will automatically update to the current amplitude value.

3.1.11 User-defined Maximum Power Setting

Default RF waveform configuration: The user-defined maximum power is set to 25 dBm.

To set the user-defined maximum power to 20 dBm, follow these steps:

1. On the screen, press the Home key in the analog stream mapper.
2. Press the RF →Ampt→User Power Max key.
3. Use the numeric keypad to enter 20 and select dBm as the unit.
4. Press the User Power Max key again to enable the setting.

3.1.12 Attenuation Setting

Default RF waveform configuration: The attenuation is set to 0 dB.

To change the attenuation to 10 dB, follow these steps:

1. On the screen, press the Home key in the analog stream mapper.
2. Press the RF →Ampt→Set Atten key.
3. Use the numeric keypad to enter 10 and select dB as the unit.

3.1.13 ALC Setting

Default RF waveform configuration: The ALC (Automatic Level Control) is enabled.

To change the ALC state to Auto, follow these steps:

1. On the screen, press the Home key in the analog stream mapper.
2. Press the RF →Ampt→ ALC State.
3. In the drop-down menu, select Auto to complete the setting.

Chapter 4 Troubleshooting

The following lists faults and troubleshooting methods during the instrument's operation. Please follow the corresponding steps to resolve them. If the issue cannot be resolved, contact the distributor or local office, and provide the instrument's device information (obtainment method: press the keys in sequence: Utility → System Information).

4.1 No Display (Blank Screen)

If the signal generator remains blank with no display after pressing the front-panel power switch:

1) Verify that the power supply is properly connected.
2) Ensure that the front-panel power switch has been fully pressed.
3) Restart the instrument.
4) If the instrument still does not operate normally, contact your distributor or local service center for assistance.

4.2 No Waveform Output

If the settings are correct but the instrument does not output a waveform:

1) Verify that the BNC cable and output terminal are properly connected.
2) Ensure that the LF or RF key is enabled.
3) If the instrument still does not operate, contact your distributor or local service center for maintenance.

Chapter 5 Maintenance

5.1 Maintenance and Cleaning

(1) General Maintenance

Keep the instrument away from the direct sunlight.

Caution

Keep sprays, liquids, and solvents away from the instrument or probe to avoid damaging the instrument or probe.

(2) Cleaning

Inspect the instrument regularly according to its operating conditions. Follow these steps to clean the external surfaces:

a) Use a soft cloth to remove dust from the exterior of the instrument.

b) When cleaning the LCD screen, handle it carefully to protect the transparent display.

c) When cleaning the dust screen, remove the screws of the dust cover with a screwdriver, then take out the dust screen. After cleaning, reinstall the dust screen in the correct sequence.

d) Disconnect the power supply before cleaning. Wipe the instrument with a damp, but not dripping, soft cloth. Do not use abrasive chemical cleaners on the instrument or probes.

Warning

Please confirm that the instrument is completely dry before use, to avoid electrical shorts or even personal injury caused by moisture.