

Keysight Technologies CX3300 Series Device Current Waveform Analyzer

CX3322A 2-Channel Model
CX3324A 4-Channel Model

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- Herstellerbescheinigung
GERÄUSCHEMISSION
Lpa < 70 dB
am Arbeitsplatz
normaler Betrieb
nach DIN 45635 T. 19
- Manufacturer's Declaration
ACOUSTIC NOISE EMISSION
Lpa < 70 dB
operator position
normal operation
per ISO 7779

South Korean Class A EMC declaration

This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

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CX3300 Device Current Waveform Analyzer - At a Glance



Model	Input channel	Maximum sample rate	Dynamic range (ADC bits)	Analog band width	Memory depth	Digital channel
CX3322A	2	1 GSa/s	14 (high speed mode) and 16 (high resolution mode)	50 MHz	4/16/64/256 Mpts	
				100 MHz	4/16/64/256 Mpts	
				200 MHz	4/16/64/256 Mpts	
CX3324A	4	1 GSa/s	14 (high speed mode) and 16 (high resolution mode)	50 MHz	4/16/64/256 Mpts	Yes
				100 MHz	4/16/64/256 Mpts	Yes
				200 MHz	4/16/64/256 Mpts	Yes

Ease of use with high performance

- Two operation modes; Scope mode and Data Logger mode (option STG)
- Two or four analog input channels with various wide-range and high-resolution sensors
- Front-panel interface provides easy access to the controls needed for time-domain waveform analysis tasks.
- Large capacitive touch screen display allows the instrument operation without an external pointing device.
- User interface with icons, windows, dialog boxes, and toolbars provides easy access to dozens of configuration and analysis tools, ensuring you can set up and make the most complex measurements.
- Current Waveform Analytics Software used on an external PC for post measurement offline data analysis (Keysight CX3300APPC)

Front-panel interface

- Run control (Run/Stop and Single) starts waveform acquisition or make a single acquisition in the Scope mode. It starts or stops waveform recording in the Data Logger mode.
- Horizontal control sets sweep speed and trigger position, also adjusts horizontal scale.
- Auto Scale acquires waveform and sets the optimum scale automatically.
- High Reso selects the 16-bit vertical resolution mode for the all analog channels.
- Clear Display clears the waveforms on the screen before one or more acquisitions.
- Default Setup sets initial configuration.
- Trigger control sets trigger source, sweep mode, trigger conditions, and trigger level for synchronization with the observing waveform.
- Vertical control for adjusting vertical scale
- Color-coded key's LED indicates if the channel is active or not.
- LEDs indicate if the channel is controllable or not.
- Zoom activates the Zoom window.

Removable solid-state drive and USB 2.0 and 3.0 ports

- Solid-state drive for fast boot-up
- Saves the setup data to reuse it another time.
- Saves and restores the setup and waveform data.
- Saves data in the dedicated report format.

Digital channel on 4-channel models

- 8 digital channels, 10 M Ω input impedance and 500 MSa/s sampling rate

In This Guide

This guide provides the information you need to begin using Keysight Technologies CX3300 Device Current Waveform Analyzer. This guide consists of the following chapters.

1. "Setting Up the CX3300"

This chapter describes the installation requirements and other setup information.

2. "Using the CX3300"

This chapter describes the product overview and how to perform basic operations.

3. "Performing User Calibration"

This chapter describes how to perform the user calibration.

4. "Safety Information"

This chapter provides general safety information and describes recommendations for working comfortably and safely while operating the CX3300.

For More Information

- For the specifications of the CX3300, see Data Sheet. To get the latest Data Sheet, go to www.keysight.com/find/cx3300a.
- For detailed information on how to use the CX3300, see *Keysight CX3300 Help (Online Manual)*.
- For information on controlling the CX3300 from a remote computer, see *Keysight CX3300 Programmer's Guide*.

NOTE

The information is subject to change without notice due to the future enhancement.

The actual screen image on the CX3300 may be different from the image shown in this guide.

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1 Setting Up the CX3300

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This chapter describes how to set up your CX3300, connect power and accessories, and verify basic operation.

Inspection

- ❑ Inspect the shipping container for damage.

Keep the shipping container and cushioning material until you have inspected the contents of the shipment for completeness and have checked the CX3300 mechanically and electrically.

If the shipping container is damaged or the cushioning materials show signs of stress, notify the carrier as well as your Keysight Technologies sales office. Keep the shipping materials for the carrier's inspection. The Keysight Technologies office will arrange for repair or replacement at Keysight Technologies' option without waiting for claim settlement.

- ❑ Pick up the packing lists and verify that you received the furnished accessories and the options and accessories you ordered and that none were damaged.

If anything is missing, notify your Keysight Technologies sales office.

- ❑ Inspect the CX3300.

If there is mechanical damage or a defect, or if the CX3300 does not pass the power on self-test or does not operate properly, notify your Keysight Technologies sales office.

See [“Verifying Basic Operation” on page 24](#) to check the operation.

Installation

- “Safety Considerations”
- “Environmental Characteristics”
- “Bench Installation”
- “Connecting a Mouse, Keyboard, and LAN Cable”
- “Connecting Power”
- “Connecting the CX1100”

Safety Considerations

Refer to “[Safety Information](#)” on [page 103](#) for general safety information. Before installation or operation, check the CX3300 and review this guide for safety warnings and instructions. Safety warnings for specific procedures are located at appropriate places throughout this guide.

Environmental Characteristics

Environmental conditions for the CX3300 are shown in [Table 1-1](#). The CX3300 is designed for use in indoor facilities.

WARNING



Do not operate the instrument in dusty environment, or in the presence of flammable gases, corrosive gases, or fumes.

Ne pas utiliser l'appareil dans un endroit poussiéreux, ou en présence de gaz inflammables, corrosifs ou de fumée.

Table 1-1 Environmental Characteristics

Characteristics	
Environment	Indoor use only
Ambient temperature	Operating: 0 °C to +40 °C Storage: –20 °C to +60 °C
Humidity	Operating: up to 80% relative humidity, non-condensing, at +40 °C Storage: up to 90% relative humidity, non-condensing, at +60 °C
Altitude	Operating: up to 2,000 m (6,561 ft.) Storage: up to 4,600 m (15,092 ft.)
Weight	11 kg
Dimensions	425.6 mm (W) × 266.1 mm (H) × 196.7 mm (D), with feet retracted
Safety	IEC 61010-1
EMC (Electromagnetic Compatibility)	IEC 61326-1
Measurement category	Measurement category 1
Power requirements	100–240 V (±10%), 50/60 Hz 250 VA, maximum power dissipated

Bench Installation

Position the CX3300 where it will have sufficient clearance for airflow around the back and sides. Fan cools the instrument by drawing air through the sides and exhausting it out the back.

Do not block the air intake at the sides and the exhaust at the rear of the CX3300. Minimum clearances for bench operation are 25 mm along the sides and 75 mm along the back.

For easier display viewing and measurement terminal access, you can tilt up the front of the CX3300. Flip down tabs behind the front feet.

Figure 1-1 **Tilting up the Front of the CX3300**



Connecting a Mouse, Keyboard, and LAN Cable

A mouse and keyboard can be plugged into the USB host ports. Three host ports are on the front panel and four host ports are on the side panel.

If you want to connect the CX3300 to the site LAN, connect your LAN cable to the RJ-45 connector on the side panel.

NOTE

To connect to the site LAN, you must set up the network. Exit the CX3300 application before you start setting up your network.

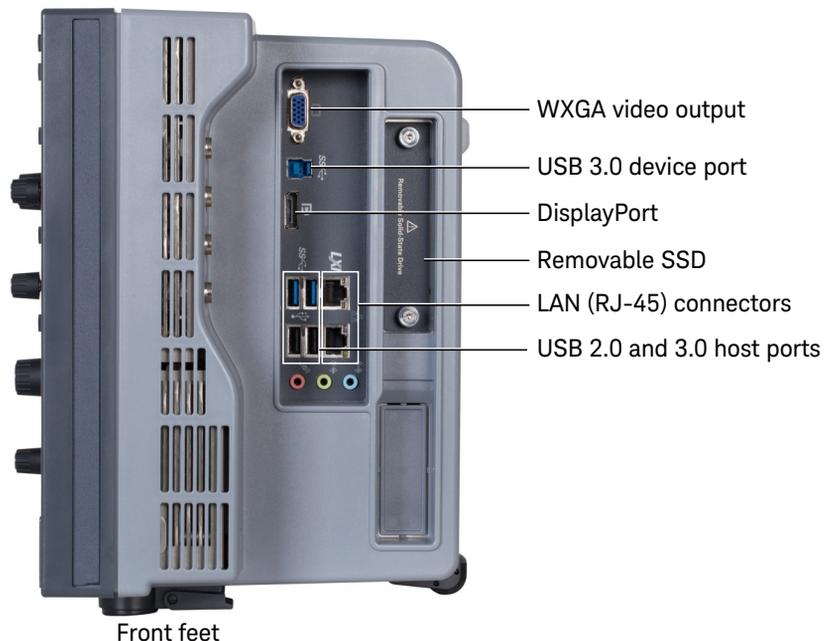
The CX3300 application does not support Windows Remote Desktop function.

If you do not know how to set up a network in the Windows operating system, see your network administrator or use the Windows operating system's online help.

Refer to [“Precautionary Statement” on page 109](#) for more precautions.

Figure 1-2

Side Panel



Connecting Power

Connect the power cord to the IEC 60320 connector on the CX3300 rear panel. If the wrong power cord was shipped with your instrument, contact Keysight Technologies. The AC input on the back of the CX3300 is a universal AC input. It accepts nominal line voltages in the range of 100 to 240 VAC.

WARNING



FIRE HAZARD: Use only the power cord supplied with your instrument. Using other types of power cord may cause overheating of the power cord, resulting in fire.

SHOCK HAZARD: The power cord provides the chassis ground through a third conductor. Be sure to connect to a three-conductor type power outlet with the correct pin grounded.

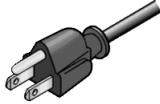
Risque d'incendie : utilisez uniquement le cordon d'alimentation fourni avec votre appareil. L'utilisation d'autres types de cordon d'alimentation peut provoquer une surchauffe du cordon d'alimentation et provoquer un incendie.

Risques de choc électrique : le cordon d'alimentation fournit la masse par le biais d'un troisième conducteur. Assurez-vous de connecter la prise d'alimentation de type trois conducteurs au boîtier exact mis à terre.

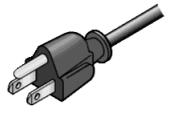
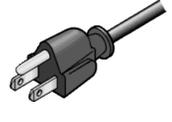
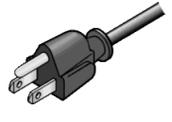
NOTE

The detachable power cord may be used as an emergency disconnecting device. Removing the power cord will disconnect AC input power to the instrument.

Table 1-2 Power Cord

Option 900	Option 901	Option 902	Option 903
			
<ul style="list-style-type: none"> • Plug: BS 1363/A, 250 V, 10 A • PN: 8120-4420 	<ul style="list-style-type: none"> • Plug: AS/NZS 3112, 250 V, 10 A • PN: 8120-4419 	<ul style="list-style-type: none"> • Plug: IEC 60277-1, 250 V, 10 A • PN: 8121-1226 	<ul style="list-style-type: none"> • Plug: NEMA 5-15P, 125 V, 10 A • PN: 8120-6825

Setting Up the CX3300
Installation

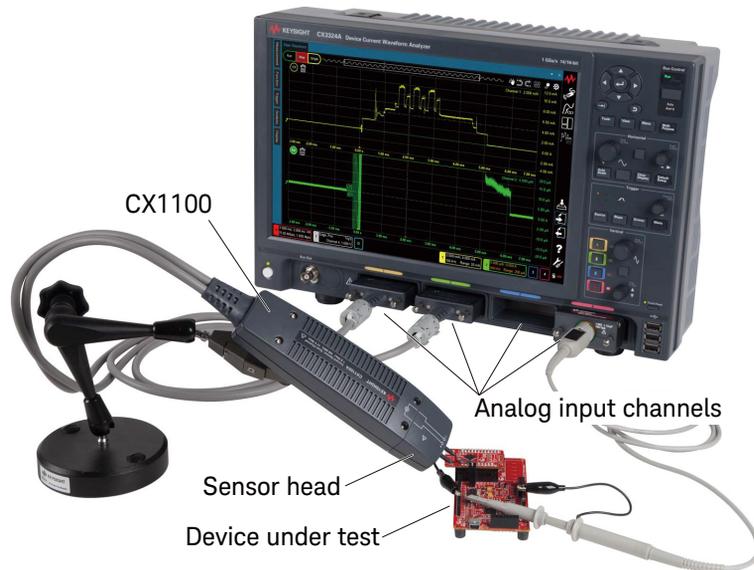
<p>Option 904</p>  <ul style="list-style-type: none"> • Plug: NEMA 6-15P, 250 V, 10 A • PN: 8120-3996 	<p>Option 906</p>  <ul style="list-style-type: none"> • Plug: SEV 1011, 250 V, 10 A • PN: 8120-4416 	<p>Option 912</p>  <ul style="list-style-type: none"> • Plug: SB 107-2-D1, 250 V, 10 A • PN: 8121-1655 	<p>Option 917</p>  <ul style="list-style-type: none"> • Plug: IS 1293 and IS 6538, 250 V, 10 A • PN: 8121-1690
<p>Option 918</p>  <ul style="list-style-type: none"> • Plug: JIS C 8303, 125 V, 12 A • PN: 8121-0743 	<p>Option 919</p>  <ul style="list-style-type: none"> • Plug: Israel SI 32, 250 V, 10 A • PN: 8121-0724 	<p>Option 920</p>  <ul style="list-style-type: none"> • Plug: IRAM 2073, 250 V, 10 A • PN: 8121-0725 	<p>Option 921</p>  <ul style="list-style-type: none"> • Plug: CEI 23-16, 250 V, 10 A • PN: 8121-0722
<p>Option 922</p>  <ul style="list-style-type: none"> • Plug: GB 1002 figure 3, 250 V, 10 A • PN: 8120-8376 	<p>Option 923</p>  <ul style="list-style-type: none"> • Plug: SANS 164-1, 250 V, 10 A • PN: 8121-0564 	<p>Option 927</p>  <ul style="list-style-type: none"> • Plug: NEMA WD-6, 250 V, 10 A • PN: 8120-0674 	<p>Option 930</p>  <ul style="list-style-type: none"> • Plug: NBR 14136, 250 V, 10 A • PN: 8121-1809
<p>Option 931</p>  <ul style="list-style-type: none"> • Plug: CNS 10917-2, 125 V, 10 A • PN: 8121-1635 	<p>Option 932</p>  <ul style="list-style-type: none"> • Plug: CS 0017, 250 V, 10 A • PN: 8121-1638 		

Connecting the CX1100

The CX1100 other than the CX1152A can be connected to the analog input channels on the CX3300 front panel.

1. Attach the connector of the CX1100 to the desired channel.
2. Fasten the screws on the connector to assure the contact.
3. If a sensor head has not been connected to the CX1101A/CX1102A/CX1104A current sensor yet, attach or connect it to the current sensor.

Figure 1-3 CX1100 Connection



CAUTION



Confirm the maximum input rating of the CX1100 and the sensor head. Do not apply any electrical potential and/or current over the value.

NOTE

Connecting the CX1102A Current Sensor to the CX3324A

Connect the Primary and Secondary connectors to the contiguous channels 1 and 2, 2 and 3, or 3 and 4. Both connectors must be connected properly.

Turning On the CX3300

Press the Standby switch to turn on or off the CX3300. The switch is located in the lower left corner of the CX3300 front panel.



Standby switch

WARNING

Whenever it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.

Press the Standby switch. After system boot up, self-test, and initialization, the CX3300 displays the Main Waveform screen. The CX3300 is ready to use.

Even though the CX3300 has turned on, you can connect or disconnect the CX1100.

NOTE

The CX3300 displays the time vs current graph for the channel enabled and connected to the current sensor. However it displays the time vs voltage graph for the channel enabled without the current sensor.

Changing the Administrator Password

On the CX3300 with the Windows operating system, the default Administrator user account password is “keysight4u”. Change the Administrator password to something more secure.

Verifying Basic Operation

The following procedures verify the basic operation which monitors the Calibration Output signal.

- “If You Use the CX1101A/CX1102A/CX1103A”
- “If You Use the CX1104A”
- “If You Use the CX1105A”

If the CX1100 has not been connected yet, connect it. See “Connecting the CX1100” on page 21.

If You Use the CX1101A/CX1102A/CX1103A

Required accessories

- CX1203A sensor head, 1 ea., furnished with the CX1101A/CX1102A, no need for the CX1103A
- Adapter (SMA plug to BNC jack), 1 ea., furnished with the current sensor
- Coaxial cable (BNC plug to BNC plug), 1 ea., furnished with the CX3300

Procedure

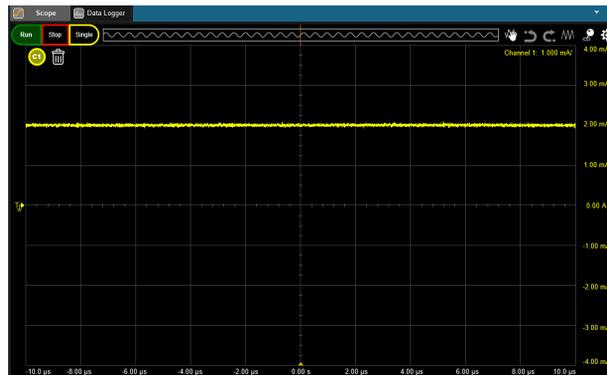
1. Connect the current sensor to the Aux Out terminal on the CX3300 front panel by using the accessories listed above.
2. Press the **1** (yellow), **2** (green), **3** (blue), or **4** (red) key associated with the channel connected to the Aux Out terminal and enable the channel.
3. Press the **Menu** key several times to open the Configuration dialog box. The **Menu** key is located above the Horizontal control on the front panel.
4. Set the following conditions on the Configuration dialog box (Configuration > Calibration Output).
 - Output State: ON
 - Source Shape: DC
 - Source Mode: Current
 - Current: 2 mA

The 2 mA DC current is applied from the Aux Out terminal.

5. Click the close (x) button located in the upper right corner on the Configuration dialog box to close the dialog box.
6. Press the **Run** key to start waveform acquisition.
7. Use the Vertical control knob to adjust the vertical scale. You will see DC current as shown in [Figure 1-4](#).

Figure 1-4

Calibration Output



If You Use the CX1104A

Required accessories

- Extension cable, 1 ea., furnished with the CX1104A
- Resistive sensor head (CX1211A, CX1212A, CX1213A, CX1214A, CX1215A, or CX1216A), 1 ea., *must be prepared by user*
- Banana adapter, 1 ea., furnished with the CX1104A
- Banana adapter (Banana plug to BNC jack), 1 ea., *must be prepared by user*
- Coaxial cable (BNC plug to BNC plug), 1 ea., furnished with the CX3300

Procedure

1. Connect the CX1104A to the Aux Out terminal on the CX3300 front panel by using the accessories listed above.

Do not forget to fasten the screws on the sensor head to assure the contact with the furnished banana adapter.

Setting Up the CX3300 Verifying Basic Operation

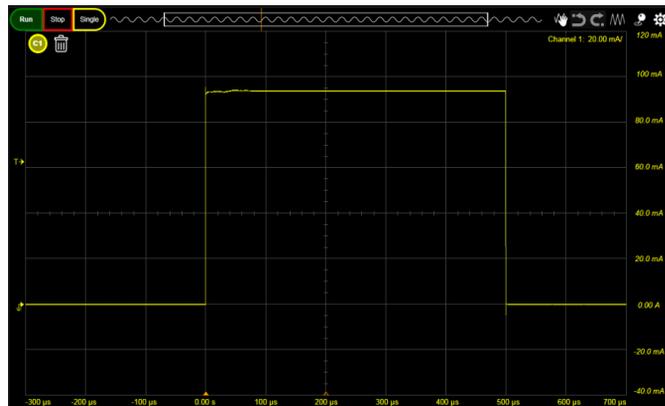
2. Press the **1** (yellow), **2** (green), **3** (blue), or **4** (red) key associated with the channel connected to the Aux Out terminal and enable the channel.
3. Press the **Menu** key several times to open the Configuration dialog box. The **Menu** key is located above the Horizontal control on the front panel.
4. Set the following conditions on the dialog box (Configuration > Calibration Output).

- Output State: ON
- Source Shape: Square

The +5 V square pulse (1 kHz, 50% duty cycle) is applied from the Aux Out terminal which has 50 Ω output impedance.

5. Click the close (x) button located in the upper right corner on the Configuration dialog box to close the dialog box.
6. Press the **Run** key to start waveform acquisition.
7. Use the Vertical control knob to adjust the vertical scale. You will see square pulse as shown in [Figure 1-5](#).

Figure 1-5 Calibration Output monitored using the CX1216A Resistive Sensor Head



If You Use the CX1105A

Required accessories

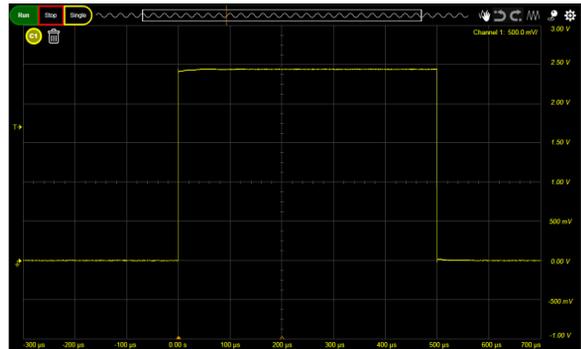
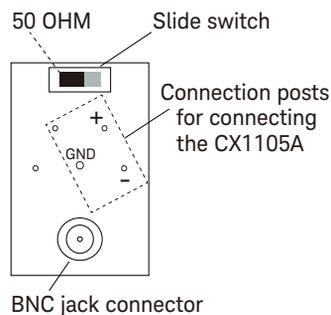
- Test adapter, 1 ea., furnished with the CX1105A
- Coaxial cable (BNC plug to BNC plug), 1 ea., furnished with the CX3300

Procedure

1. Set the slide switch on the test adapter to the 50 OHM. See [Figure 1-6](#).
2. Connect the coaxial cable between the BNC jack connector on the test adapter and the Aux Out terminal on the CX3300 front panel.
3. Connect the CX1105A to the connection posts on the test adapter as shown in [Figure 1-6](#).
4. Press the **1** (yellow), **2** (green), **3** (blue), or **4** (red) key associated with the channel connected to the Aux Out terminal and enable the channel.
5. Press the **Menu** key several times to open the Configuration dialog box. The **Menu** key is located above the Horizontal control on the front panel.
6. Set the following conditions on the dialog box (Configuration > Calibration Output).
 - Output State: ON
 - Source Shape: SquareThe +5 V square pulse (1 kHz, 50% duty cycle) is applied from the Aux Out terminal which has 50 Ω output impedance.
7. Click the close (x) button located in the upper right corner on the Configuration dialog box to close the dialog box.
8. Press the **Run** key to start waveform acquisition.
9. Use the Vertical control knob to adjust the vertical scale. You will see square pulse (approximately +2.5 V, divided by two 50 Ω) as shown in [Figure 1-6](#).

Figure 1-6

Test Adapter and Calibration Output



Changing Windows Environment

NOTE

Exit the CX3300 application before changing any Windows operating system settings or installing any software.

NOTE

In the default setting, the Administrator password is “keysight4u”. The Administrator password should be changed for security.

Changing Operating System Settings

Many Windows operating system settings can be changed to suit your own personal preferences. However, some operating system settings should not be changed because doing so would interfere with the proper operation of the CX3300.

- Do not change the Power Options.
- Do not change the Language settings.
- Do not remove Fonts.
- Do not change the screen resolution from 1280 by 800 pixels.
- Do not delete or modify the Administrator user account.

Installing Application Programs

The CX3300 has an open Windows operating system, which lets you install your own application software. Any application that runs on the Windows operating system and uses 8 GB of RAM or less may be installed on your CX3300.

CAUTION

Installing an application that does not meet these requirements may break the CX3300 application. Refer to **“Precautionary Statement” on page 109** for more precautions.

Turning Off the CX3300

Press the Standby switch. The CX3300 will go through a normal Windows operating system shutdown process.

CAUTION

If a DUT is connected to the CX3300, do not turn the CX3300 off to prevent damage on the DUT.

Maintenance

Maintenance should be performed periodically to keep the CX3300 in good condition. If problems arise, contact your Keysight Technologies sales office.

- “Cleaning”
- “Diagnosis”
- “User Calibration”
- “Calibration”
- “Troubleshooting”
- “Servicing”

Cleaning

WARNING



SHOCK HAZARD: To prevent electric shock, unplug the CX3300 before cleaning.

Risques de choc électrique : afin d'éviter tout choc électrique, débranchez le CX3300 avant d'effectuer le nettoyage.

Use a dry soft cloth or a soft cloth slightly dampened with a mild soap and water solution to clean the external case parts. Do not use detergents or chemical solvents. Do not attempt to clean internally.

CAUTION



Do not use too much liquid in cleaning the CX3300. Water can enter the CX3300 panels and damage sensitive electronic components. Make sure that the CX3300 is completely dry before reconnecting the power cord.

Diagnosis

Diagnosis allows you to verify the CX3300 operation. The CX3300 provides the following tests.

- Front Panel Key test

- Front Panel LED test
- Touch Panel test
- LCD test
- Self-Test
- ADC Open Offset test
- Sensor Floating PS test
- Sensor DC Offset Control test

It is recommended to perform the diagnosis for the following condition or purpose.

- If you feel that the instrument may be defective
- For preventive maintenance

To perform diagnosis

1. Press the **Menu** key several times to open the Configuration dialog box. The **Menu** key is located above the Horizontal control on the front panel.
2. Click **Diagnosis** to display the Configuration > Diagnosis screen.
3. Click the button for the desired test and follow the instruction.

To cancel/exit Touch Panel test:

- Press the tab, escape, up, down, left, right, or enter key.

To perform LCD test:

1. Click **LCD** on the Configuration > Diagnosis screen. You will see pink color on the LCD full screen.
2. Click on the screen or press any key. LCD will change the color to green.
3. Click on the screen or press any key. LCD will change the color to blue.
4. Click on the screen or press any key. LCD will change the color to white.
5. Click on the screen or press any key. LCD will change the color to black.
6. Click on the screen or press any key. The Finished dialog box opens.
7. Click **Yes** if LCD changes the color as shown above. Or else click **No**.

User Calibration

User calibration allows you to perform error correction of measurement data. This is effective for making more accurate measurements. For more information, see [Chapter 3, “Performing User Calibration”](#).

Calibration

For the following products, calibration and adjustments must be performed periodically so that the instruments satisfy the specifications, and keep a good condition. It is recommended to perform the calibration once a year at least. For the calibration and adjustments, contact your Keysight Technologies sales office. Trained service personnel will perform the calibration and adjustments.

- CX3322A
- CX3324A
- CX1101A
- CX1102A
- CX1103A
- CX1104A
- CX1105A
- CX1151A
- CX1211A
- CX1212A
- CX1213A
- CX1214A
- CX1215A
- CX1216A

Troubleshooting

If any problem is found on the CX3300/CX1100, perform the following troubleshooting.

1. Isolate the problem between the CX3300 and the CX1100. See [Figure 1-7](#).
2. Isolate the problem between the CX1100 and the sensor head. See [Figure 1-8](#).
3. Isolate the problem on the CX1152A. See [Figure 1-9](#).

NOTE

For troubleshooting the CX1101A or the CX1102A, if you have multiple CX1101A/CX1102A and/or CX1203A sensor head, it will be useful to swap the troublesome one with the “working” one to isolate the problem.

NOTE

For troubleshooting the CX1104A, if you have multiple CX1104A and/or CX1211A, CX1212A, CX1213A, CX1214A, CX1215A, CX1216A resistive sensor head, it will be useful to swap the troublesome one with the “working” one to isolate the problem.

Figure 1-7 CX3300/CX1100 Troubleshooting

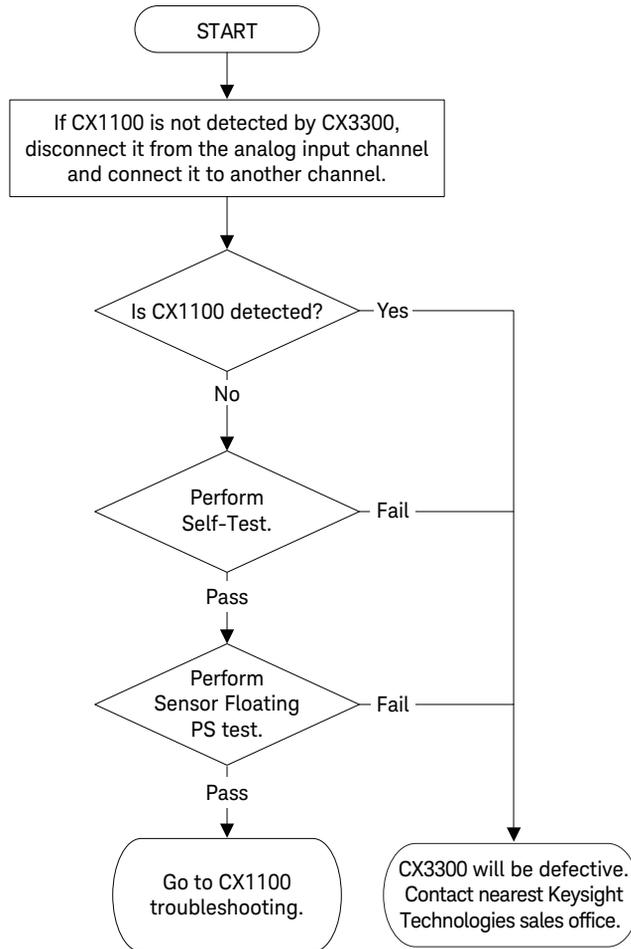


Figure 1-8 CX1100 Troubleshooting

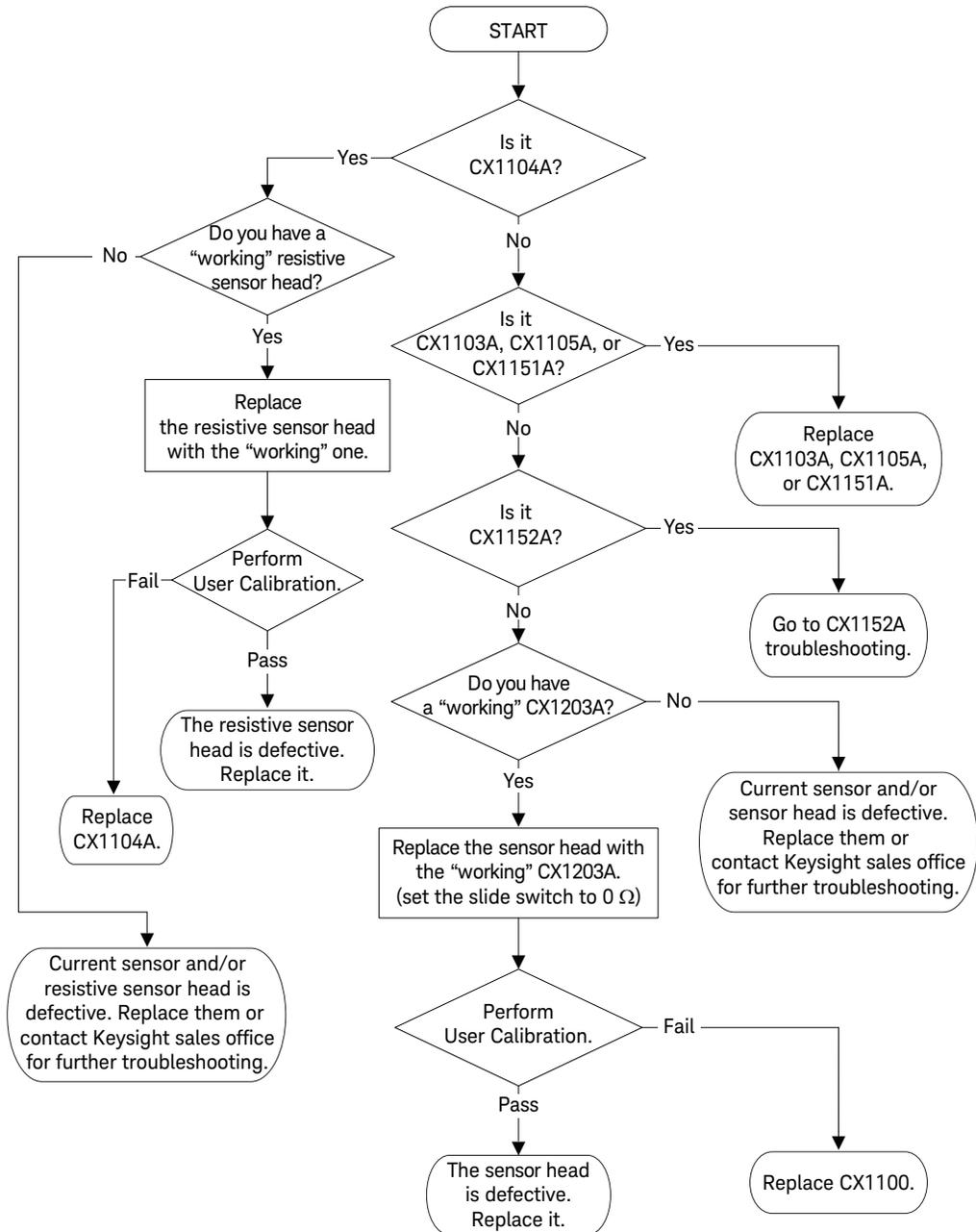
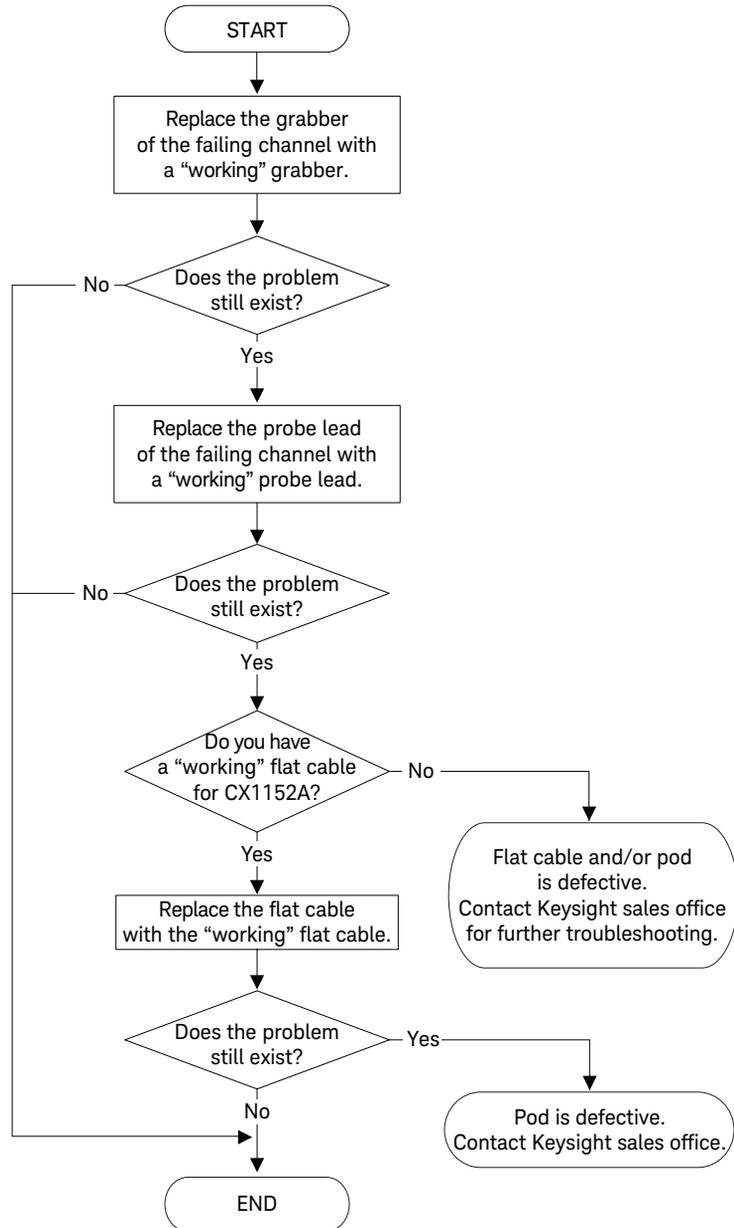


Figure 1-9 CX1152A Troubleshooting



Servicing

If the CX3300 is confirmed as defective, send it to an authorized service center for repair.

If the CX1100 is found to be defective, you can order the replacement part or you can send it to an authorized service center for repair. Also refer to *CX1100 User's Guide*.

If you are shipping the product to Keysight Technologies for service, perform the following steps before shipping.

1. Contact your nearest Keysight Technologies sales office for information on obtaining an RMA number and return address.
2. Write the following information on a tag and attach it to the malfunctioning equipment.
 - Name and address of owner
 - Product model number (for example, CX3324A)
 - Product serial number (for example, MYXXXXXXXX)
 - Description of failure or service required
3. Pack the product in the original shipping container and cushioning material, or fungible.
4. Seal the container closely and mark it as "FRAGILE".

NOTE

If any correspondence is required, refer to the product by serial number and model number.

NOTE

For servicing the CX3300 mainframe, you do not need to send the CX1100 and the sensor heads.

For servicing the CX1101A or the CX1102A, send it with the CX3300 and the CX1203A.

For servicing the CX1103A or the CX1151A, send it with the CX3300.

For servicing the CX1104A, send it with the CX3300. You do not need to send the resistive sensor head.

For servicing the CX1105A, send it with the CX3300. You do not need to send the test adapter.

2 Using the CX3300

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This chapter describes how to use the CX3300's input and output, control panel, and graphical user interface (CX3300 application).

For quick view of the CX3300 application, refer to *Quick Reference* furnished with the CX3300.

Scope Mode and Data Logger Mode

The CX3300 supports the following two operation modes.

- Scope mode** Default operation mode of the CX3300
- Captures the current waveform by a trigger like an oscilloscope in the sampling rate up to 1 GSa/s.
 - Records the waveform data up to 256 Mpts.
 - Provides dozens of the waveform analysis tools.
- Data Logger mode** Operation mode available for the CX3300 with the option STG
- Provides a data logger's long-duration measurement ability in addition to benefits of the Scope mode.
 - Captures a continuous waveform without trigger event and enables to record the fast waveform sampling rate up to 10 MSa/s.
 - Records the waveform data for the duration up to 100 hours by using internal/external storage device (HDD/SSD).
 - To analyze a huge amount of waveform data measured in the Data Logger mode, powerful tools are provided: Waveform Trend Analyzer and Waveform Analytics.

Front Panel Overview

This section describes the front panel of the CX3300.

Figure 2-1

Front Panel



1. Standby switch

Turns the instrument on. Pressing the button in the ON state makes it in the standby state. The green LED lights when it is in the ON state.



2. Aux Out terminal

BNC connector used to apply one of the following reference signals. The output signal can be set by using the Configuration dialog box. For the square pulse, the base voltage is 0 V and the output impedance is 50 Ω .

- DC current: -200 mA to $+200$ mA
- DC voltage: -7 V to $+7$ V
- Square: $+5$ V square pulse, 1 kHz, 50% duty cycle
- Pulse: $+5$ V square pulse, 20 ns to 1 ms period, programmable duty cycle



3. Analog input channels

The CX3322A has two channels and the CX3324A has four channels.

Connects the CX1100 other than the CX1152A. See [“Connecting the CX1100” on page 21](#). Also refer to *CX1100 User’s Guide* for the CX3300 accessories.

CAUTION

Confirm the maximum rating of the accessories. Do not apply any electrical potential or current over the value.

4. Three USB 2.0 host ports

Used to connect USB devices such as a keyboard, a mouse, and USB flash drives.

To remove USB devices from the instrument, use “Safely Remove Hardware” on Windows taskbar. If it is not used, the instrument may cause the internal USB communication error. If the error occurs, turn the instrument off and disconnect the power cord from it. Leave it about 30 seconds before rebooting it, and connect the power cord again, and then turn the instrument on.

5. Touch Panel switch

Works when the CX3300 application is running. Enables or disables the touch screen operation. The green LED lights when the touch screen is enabled.

6. Vertical control

Controls analog input channel and graph scale. See [“Adjusting the Vertical Settings” on page 56](#).

7. Trigger control

Controls trigger condition. See [“Setting Up Triggers” on page 59](#).

8. Horizontal control

Controls timebase and graph scale. See [“Adjusting the Horizontal Scale and Timebase Position” on page 54](#).

9. Run Control

Controls measurement execution. See [“Starting and Stopping Waveform Acquisitions” on page 53](#).

10. Navigation keys (up, down, left, right, and enter)

Supports setup or marker operation. The enter key sets the value.

11. Escape key

Cancels the last operation or closes menu or dialog box.

12. Tab key

Changes the active entry field in a dialog box.

13. **Tools**, **View**, **Menu**, and **Multi Purpose** keys

Tools key displays or switches the tool palette: Measurement, Function, Trigger, or Others.

View key switches the active view: Main Waveform, graph view, or data view.

Menu key displays or switches the dialog box: Setting, Analysis, or Configuration.

Multi Purpose key performs the user specified function. Initially, QuickSave is specified.

14. LCD panel

14.1 inch TFT WXGA display, 1280 × 800 resolution. Displays the CX3300 application window, the Windows screen, and so on. Touch screen operation is available when the Touch Panel indicator lights.

For overview of the CX3300 application window, refer to *Quick Reference* furnished with the CX3300.

Side Panel Overview

The CX3300 right side panel has the following I/O connectors.

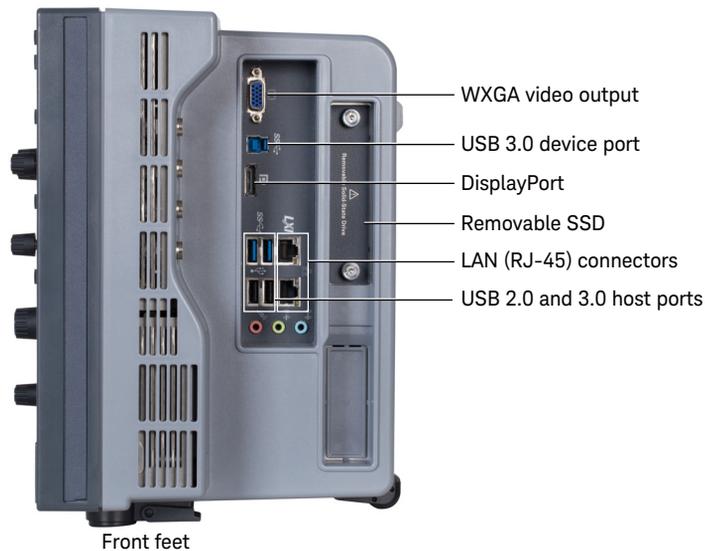
- WXGA video output, for an external display
- USB 3.0 device port, for remote control of the CX3300 from a PC
- DisplayPort, for an external display
- Removable SSD (solid state drive)

Stores operating system, CX3300 application, calibration data, user data, and so on.

- LAN (RJ-45) connectors
- Two USB 2.0 host ports and two USB 3.0 host ports
- Audio connectors (Not available)

Figure 2-2

Right Side View



Front feet You can tilt up the front of the CX3300. Flip down tabs behind the front feet for easier display viewing and measurement terminal access.

- Frequency: 10 MHz \pm 10 ppm (typical)

4. 10 MHz Out

BNC connector used to send the reference clock for the horizontal timebase system of an external equipment. The specifications of the reference clock are as follows.

- Frequency: 10 MHz \pm 5 ppm (typical)
- Level: 0 dBm \pm 3 dB into 50 Ω (typical)
- Output impedance: 50 Ω nominal

5. Digital D7-D0

For the CX3324A. Connects the CX1152A digital channel interface cable which provides eight digital channels D0 to D7 and the ground line. Supplemental characteristics are listed below.

- Maximum input voltage: \pm 40 V
- Input dynamic range: \pm 25 V
- Input impedance: 10 M Ω
- Maximum sampling rate: 0.5 GSa/s

6. Serial number

You need this serial number when using Keysight Technologies telephone assistance program.

7. AC power input

AC power cord is connected to this receptacle.

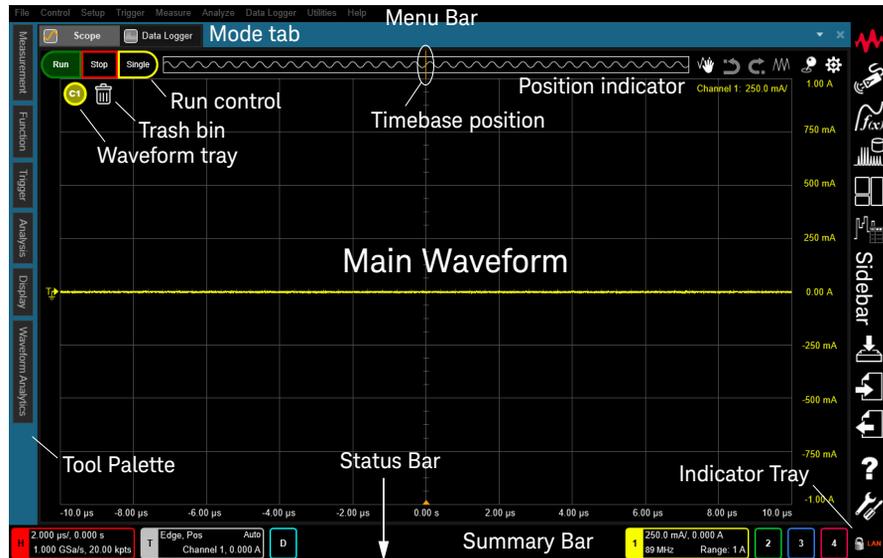
8. Security cable slot

9. Cooling fan

10. Strap handle

Power On Screen

Just after the CX3300 boots up, the CX3300 will display as shown below.



Main Waveform

The following graphical user interfaces are available on the Main Waveform.

Graph area Displays waveforms, markers, annotations, etc.

Horizontal scale Primary scale area is below the graph area.
Secondary scale area can be above the graph area.

Vertical scale Primary scale area is on the right side of the graph area.
Secondary scale area can be on the left side of the graph area.

Mode tab Switches the operation mode: Scope or Data Logger.

Run control Run, Stop, and Single icons. Controls waveform acquisition. Same as the **Run**, **Stop**, and **Single** keys.

**Waveform tray
and Trash bin**

Displays the icons for the waveforms on the graph. If no waveform is displayed on the graph, the icon and the trash bin are not displayed. There is the following types of waveform.

- C: Waveform acquired by an analog input channel
- D: Waveform acquired by a digital channel
- F: Waveform given by a calculation
- W: Waveform saved in a waveform memory
- P: Waveform database saved in the storage device. Only for the Data Logger mode.

Changing the order of icons changes the drawing order of waveforms. Left is faster. Drag and drop operation allows you to change the order.

Dropping the icon into the trash bin deletes the waveform from the graph.

Dropping the C- or D-icon into the trash bin sets the channel status to OFF and deletes the waveform from the graph.

Clicking the C-icon selects the channel effective for vertical control and graph scaling.

**Position
indicator**

Waveform expresses all of the memory data. Square surrounds the data displayed on the graph. Moving the square changes data on the graph. Only for the Scope mode.

**Timebase
position**

Orange vertical line indicates the timebase position (0 second position). Only for the Scope mode.



Switches the function; Move or Zoom. Image of the icon changes and shows the function effective now. The left image of this paragraph indicates that the move function is effective.



Undo. Cancels the last move or zoom operation.



Redo. Cancels the last Undo.



Waveforms. Shows or hides the menu used for selecting the display layout: single, dual, or zoom display. Image of the icon changes and shows the present layout. The left image of this paragraph indicates that the display layout is the single.



Marker. Shows or hides the menu used for switching display ON or OFF of markers on the graph. It can be set for each marker type; Cross Hair, A-B Marker, and Area Marker.



Setting. Opens the Makers mini dialog box for quick setup.

Clicking the maximize button in the upper right corner of the mini dialog box opens the Analysis dialog box (Analysis > Display > Markers) used for detail setup.

Tool Palette

The following buttons are available on the tool palette which provides lots of icons used for the following purposes. Each feature is applied by drag-and-drop of an icon on a waveform.

For more details on the tools, see the CX3300 online help. Also see [“Making a Measurement and Using Useful Tools” on page 62.](#)

- | | |
|---------------------------|--|
| Measurement | Shows or hides the Measurement tools used for making a parameter measurement. |
| Function | Shows or hides the Function tools used for calculating and filtering a waveform data. |
| Trigger | Shows or hides the Trigger tools used for applying a trigger setup to the CX3300. |
| Analysis | Shows or hides the Analysis tools used for analyzing a waveform data. |
| Display | Shows or hides the Display tools used for displaying markers and annotations and for changing the plot appearance. |
| Waveform Analytics | Shows or hides the Waveform Analytics tools used for analyzing the waveform database which is a huge amount of waveform data measured in the Data Logger mode. |

Sidebar

The following icons are available on the sidebar.



Opens the About dialog box which displays the software revision, serial number, and so on.



Opens the Data Logger dialog box used for the Data Logger mode setups.

-  Opens the Setting dialog box used for acquisition, trigger, and channel setups.
-  Opens the Analysis dialog box used for analysis, function, and marker setups.
-  Layout. Shows or hides the menu used for setting ON/OFF of Analysis Views.
-  Application Launcher. Shows or hides shortcut to the Power and Current Profiler and the Waveform Trend Analyzer.
-  Shows or hides the Auto Save toolbar at the bottom of Main Waveform. This toolbar is used to control the automatic data save function.
-  Opens the Save dialog box used for saving data.
-  Opens the Load dialog box used for loading data.
-  Help. Shows or hides shortcut to Data Sheet, User's Guide, Online Help, etc.
-  Utilities. Shows or hides shortcut to Configuration, Demo Wizard, Show Desktop, Close Window, etc.

Summary Bar

The following summary boxes are available on the summary bar. Clicking a summary box opens or closes the mini dialog box relative to it: Horizontal, Trigger, Digital, or an analog input channel.

- H** Shows the horizontal summary: scale (s/), offset (s), high resolution mode ON (HR) or OFF (none), sampling rate (Sa/s), and number of samples (pts).
- T** Shows the trigger setup summary: trigger type, slope/polarity/window/condition, trigger sweep, trigger source, and trigger (high) level.
- D** Shows the pulse symbol which indicates the graph scale (small/medium/large) for displaying the digital channel waveform.
- 1 / 2 / 3 / 4** Shows the analog channel setup summary: vertical scale, offset, sensor setup information, bandwidth, and measurement range.

Menu Bar

This bar is displayed by placing the mouse pointer on the top of the screen in the Full Screen mode, clicking on the top of the screen/window, or pressing the Alt key. The menu bar provides the File, Control, Setup, Trigger, Measure, Analyze, Utilities, and Help menus.

The menu bar will always be displayed if Utilities > Menu Bar is checked.

Status Bar

The status bar will always be displayed if Utilities > Status Bar is checked. The status bar provides shortcut to Event Log and shows the status information such as the LAN status and the front panel lock status.

Indicator Tray

Shows the status information such as the LAN status and the front panel lock status. If the status bar is on screen, the indicator tray is merged with the status bar.

Setting the Display and the Starting Condition

The following keys are available for setting up the CX3300 display and starting condition quickly. They are located in the Horizontal control on the front panel.



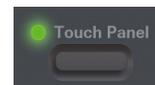
- To automatically set up the CX3300 for the present input signal(s), press the **Auto Scale** key. Auto scaling is applied to the waveform supported by the graph scale.
- To enable or disable the high resolution mode of acquisition, press the **High Reso** key. Enabling the mode automatically reduces sampling rate and memory depth to get clean waveforms. The **High Reso** key is lit when the mode is effective.
- To clear waveform on the graph, press the **Clear Display** key.

The CX3300 clears acquired waveform data from the graph in preparation for another acquisition. If the CX3300 is in Run mode and is receiving triggers, it will update the graph as it collects new waveform data.

Clearing the waveform also clears the analysis graph and data.

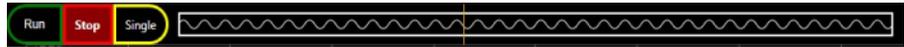
- To apply the default setup, press the **Default Setup** key.

To enable or disable the touch screen, press the **Touch Panel** key located in the lower right corner on the front panel. The indicator is lit green when the touch panel operation is effective.



For setting up the CX3300 quickly, you can reuse the saved acquisition setup. To reuse the setup, click the Load icon on the sidebar. For saving the setup, see [“Saving and Printing Data” on page 82](#).

Starting and Stopping Waveform Acquisitions



Use the Run Control keys or the run control icons to start and stop waveform acquisitions or make a single acquisition.

The **Run/Stop** key is lit green and the green Run icon is highlighted when the CX3300 is running (acquiring data). The **Run/Stop** key is red and the red Stop icon is highlighted when the acquisition is stopped.



The run control icons and the waveform memory position indicator are placed above the waveform display area. The position indicator shows how much of acquisition memory is displayed on the graph. Waveform expresses all of the memory data. Square surrounds the data displayed on the graph. Orange vertical line indicates the timebase position. Moving the square changes data on the graph.

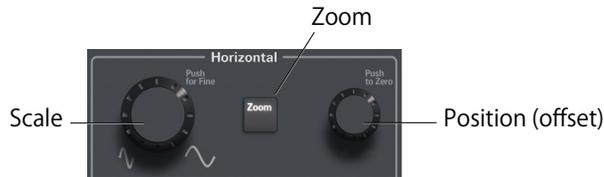
- To start waveform acquisition, press the **Run/Stop** key or click the Run icon. The CX3300 begins acquiring data. When it receives a trigger signal, it finishes acquiring data, updates the display, and then starts another acquisition cycle if it is in Trig'd or Auto trigger mode.
- To stop waveform acquisition, press the **Run/Stop** key or click the Stop icon. The CX3300 stops acquiring data. Whatever data was last acquired remains on the graph.
- To make a single acquisition, press the **Single** key or click the Single icon.

To set up how you want the signals to be sampled, such as sampling rate and mode, use the Setting dialog box (Setting > Acquisition). This dialog box is opened by clicking the Setting icon on the sidebar or pressing the **Menu** key located above the Horizontal control on the front panel.

Adjusting the Horizontal Scale and Timebase Position

Use the Horizontal control to set the horizontal scale (time per division) and the timebase (0 second) position and to magnify the waveform.

To adjust the horizontal scale and the timebase position, use the horizontal control knobs or the Setting dialog box (Setting > Timebase). This dialog box is opened by clicking the Setting icon on the sidebar or pressing the **Menu** key located above the Horizontal control on the front panel.



Horizontal setup is shown in the Horizontal summary on the summary bar which is located bottom of the screen. The summary shows the following information.

- Horizontal scale (s/, seconds per division)
- Horizontal center value (s, seconds), offset from the timebase
- High resolution mode ON (HR) or OFF (no indicator)
- Sampling rate (Sa/s, samples per second)
- Number of samples (pts, points), memory depth



Horizontal summary

Summary bar

Clicking the Horizontal summary opens/closes the Timebase mini dialog box used for quick setup.

Clicking the maximize button in the upper right corner of the mini dialog box opens the Setting dialog box (Setting > Timebase) used for detail setup.

To set timebase reference

Use the Timebase Reference slider on the Setting dialog box (Setting > Timebase). The timebase reference position can be defined by percentage of the graph width. 50% defines it as the center of the time axis. This position is indicated by the orange triangle at the bottom of the graph. See [Figure 2-4](#).

Adjusting the Horizontal Scale

- To stretch the waveform horizontally (fewer seconds per division), turn the horizontal scale knob clockwise. To shrink it horizontally (more seconds per division), turn the knob counter-clockwise.
- Pressing the knob enables or disables the fine mode which provides 1/10 setting resolution.
- Double-clicking the horizontal scale area below or above the graph opens the dialog box which allows you to specify the X-axis scale.
- Turning the mouse wheel on the horizontal scale area stretches or shrinks the waveform.

Adjusting the Horizontal Timebase Position

- To move the timebase to the right, turn the horizontal position knob clockwise. To move it to the left, turn the knob counter-clockwise.

Moving the timebase to the right shows more of the pre-trigger data (data acquired before the trigger event). Moving the waveform to the left shows more of the post-trigger data.

- Pressing the knob sets the timebase (0 second) to the timebase reference position.
- Clicking and dragging the waveform or the graph moves the waveform on the graph if the Move/Zoom icon is Move.

Magnifying a Part of the Waveform

- To magnify or demagnify the waveform, turn the mouse wheel on the X-axis.
- Clicking and dragging the graph magnifies the waveform if the Move/Zoom icon is Zoom.
- To enable or disable zoom, press the **Zoom** key in the horizontal control.

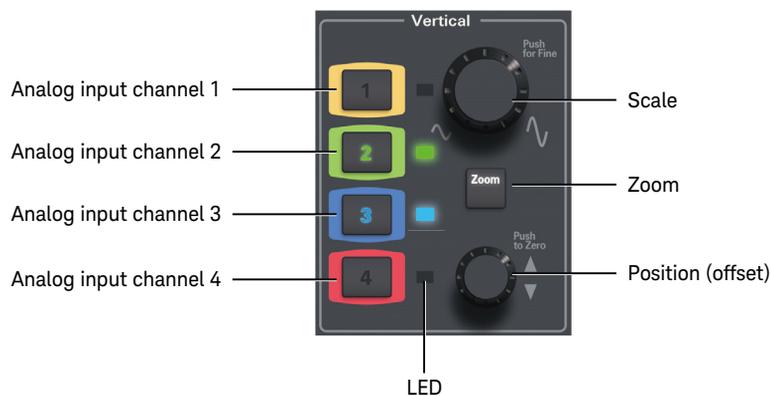
When the **Zoom** key lights, the graph area splits into two regions. The top one is the main timebase. The bottom is the zoomed timebase, which represents an expansion of the acquired waveform data. Square on the main view indicates the zoomed waveform.

The horizontal control knobs change how the waveform is shown in the zoom view. The horizontal scale knob changes the amount of magnification. The horizontal position knob moves the square.

Adjusting the Vertical Settings

Use the Vertical control to set the vertical scale (amperes per division or volts per division) and the vertical offset and to magnify the waveform.

To adjust the vertical scale and the vertical offset, use the vertical control knobs or the Setting dialog box (Setting > Channels > Channel *N*, where *N* is 1, 2, 3, or 4). This dialog box is opened by clicking the Setting icon on the sidebar or pressing the **Menu** key located above the Horizontal control on the front panel.



To change channel status

To enable or disable the analog input channel, press the # key (#: 1, 2, 3, or 4) associated with the channel.

Pressing the # key changes the channel status as shown below.



Graph displays the waveforms for the channels in the ON status.

Vertical control and graph scaling are effective only for the channel indicated by the LED which lights (ON).

Vertical setup is shown in the Channel summary on the summary bar which is located bottom of the screen. The summary shows the following information.

- Vertical scale (A/ or V/, amperes per division or volts per division)
- Vertical center value (A or V, amperes or volts), offset from 0 A or 0 V
- Sensor setup information (DC, AC, LPF, IF, or blank)
 - DC: DC coupling
 - AC: AC coupling
 - LPF: low pass filter ON
 - IF: current offset ON
- Bandwidth (Hz, hertz), approximate value automatically calculated by considering the measurement range, the sampling rate, and filters
- Measurement range



Summary bar

Channel summary

Clicking the Channel summary opens or closes the Channel *N* mini dialog box used for quick setup.

Clicking the maximize button in the upper right corner of the mini dialog box opens the Setting dialog box (Setting > Channels > Channel *N*) used for detail setup.

Adjusting the Vertical Scale

- To make the waveform bigger (fewer amperes per division or fewer volts per division), turn the vertical scale knob clockwise. To make it smaller (more amperes per division or more volts per division), turn the knob counter-clockwise.
- Pressing the knob enables or disables the fine mode which provides 1/10 setting resolution.
- Double-clicking the vertical scale area on the right or left of the graph opens the dialog box which allows you to specify the Y-axis scale.
- Turning the mouse wheel on the vertical scale area makes the waveform bigger or smaller.

Adjusting the Vertical Offset

- To move the waveform toward the top of the display, turn the vertical position knob clockwise. To move it toward the bottom, turn the knob counter-clockwise.
- Pressing the knob sets the 0 ampere or 0 volt to center (zero offset).
- Clicking and dragging the waveform or the graph moves the waveform on the graph if the Move/Zoom icon is Move.

Magnifying a Part of the Waveform

- To magnify or demagnify the waveform, turn the mouse wheel on the Y-axis.
- Clicking and dragging the graph magnifies the waveform if the Move/Zoom icon is Zoom.
- To enable or disable zoom, press the **Zoom** key in the vertical control.

When the **Zoom** key lights, the graph area splits into two regions. The top one is the main waveform. The bottom is the zoomed waveform, which represents an expansion of the acquired waveform data. Square on the main view indicates the zoomed waveform.

The vertical control knobs change how the waveform is shown in the zoom view. The vertical scale knob changes the amount of magnification. The vertical position knob moves the square.

NOTE

Turning the mouse wheel on the graph

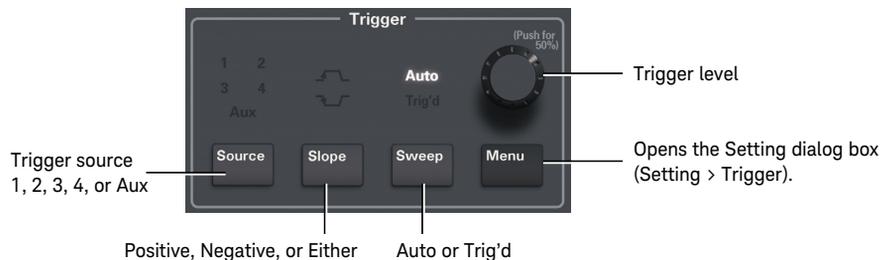
If the Move/Zoom icon is Zoom, this operation magnifies or demagnifies the waveform in the both horizontal and vertical directions.

If the Move/Zoom icon is Move, this operation magnifies or demagnifies the waveform in the horizontal direction.

Setting Up Triggers

Use the Trigger control to set the conditions on which the CX3300 will trigger and acquire an input signal. Edge triggers and the parameters for edge triggering can be set up from the front panel.

You can set up a variety of trigger conditions by using the Setting dialog box (Setting > Trigger). Trigger settings you make on this dialog box are reflected in the front panel status indicators, and will remain set unless you change them or press the **Default Setup** key.



Trigger setup is shown in the Trigger summary on the summary bar which is located bottom of the screen. The summary shows the following information.

- Trigger type (Edge, Transition, Glitch, PulseWidth, and so on)
- Slope, polarity, window, or condition (Positive, Negative, Either, and so on)
- Trigger sweep (Auto or Trig'd (triggered))
- Trigger source (Channel 1, 2, 3, 4, or AUX)
- Trigger (high) level



Clicking the Trigger summary opens or closes the Trigger mini dialog box used for quick setup.

Clicking the maximize button in the upper right corner of the mini dialog box opens the Setting dialog box (Setting > Trigger) used for detail setup.

Setting the CX3300 for an Edge Trigger

1. Press the **Source** key until the desired source LED is lit.

You can choose any of the channels or the Aux Trig or Line input as the source for an edge trigger.

2. Press the **Slope** key until the desired slope LED is lit.

You can have an edge trigger on a rising or falling edge, or both.

3. Press the **Sweep** key until the desired LED is lit (Trig'd or Auto).

When Trig'd is selected, the CX3300 must find the trigger before capturing and displaying data.

When Auto is selected, if a trigger does not occur within a certain amount of time, an acquisition is automatically saved and displayed. In Auto trigger mode, you are able to see your signals while setting up the desired trigger.

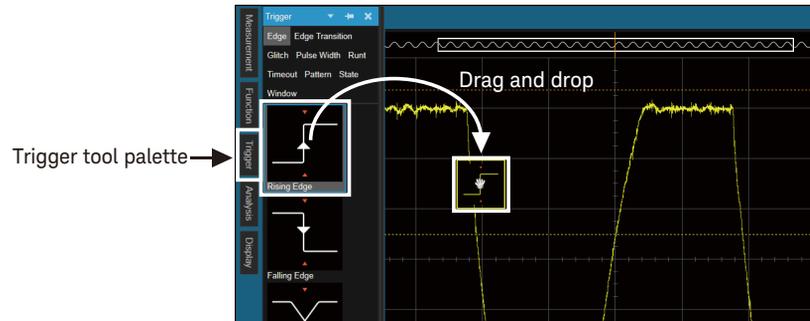
4. Turn the Level knob to adjust the current or voltage level at which the CX3300 will trigger.

You can also drag the trigger level indicator at the left side of the display to adjust the level. See [Figure 2-4](#) for the trigger level indicator.

Pressing the knob changes the trigger level to half.

NOTE

Use the Trigger tool palette to use several trigger types. Drag and drop operation applies the trigger setup to the CX3300. Double-clicking the icon can substitute for this drag and drop operation.



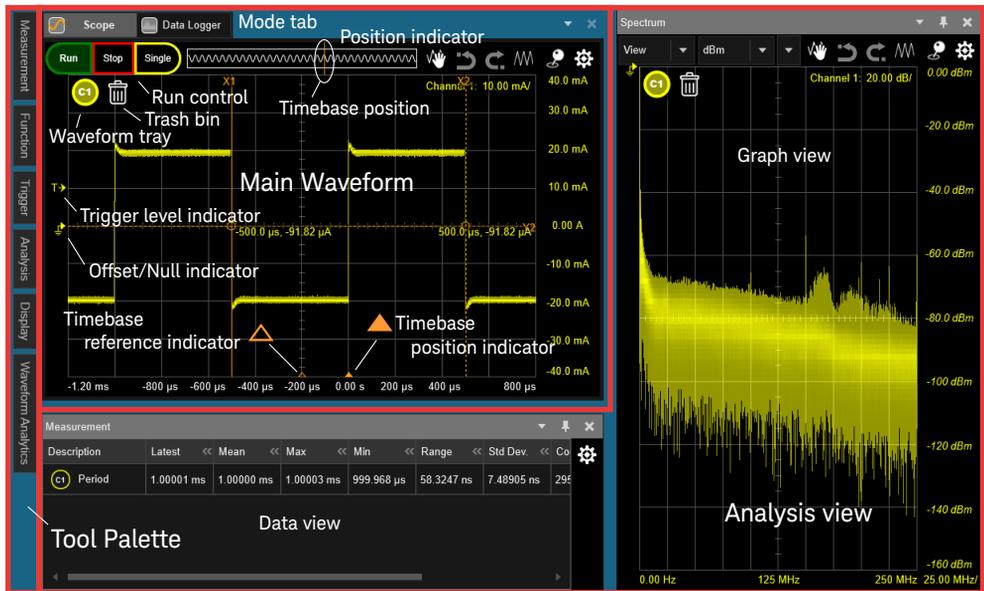
You can also use the Setting dialog box (Setting > Trigger) to select any of the different types of triggering, the parameters and conditions for each trigger type, and advanced configuration items.

Making a Measurement and Using Useful Tools

This section contains the following subsections which describe how to make a measurement and how to use markers, math functions, filters, analysis tools, quick actions, and digital channels.

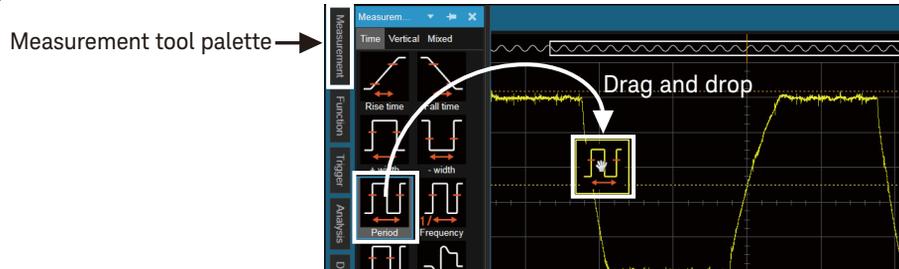
- “Making a Measurement on a Waveform”
- “Using Markers”
- “Using Math Functions and Filters”
- “Using Analysis Tools”
- “Using Quick Actions”
- “Controlling Digital Channels”

Figure 2-4 Screen Image of the CX3300 Application



Making a Measurement on a Waveform

Measurement can be activated from the Measurement tool palette. To make a measurement, drag and drop a measurement icon on the waveform event you want to measure. Double-clicking the icon can substitute for this drag and drop operation.



For example, drag and drop the Period icon on the waveform as shown above. The period of the wave is measured by using the data closest to the point where you drop the icon. The measurement value is displayed in the Measurement data view which appears below the Main Waveform as shown in [Figure 2-4](#).

The Measurement data view shows the latest value (Latest), the mean value (Mean), the maximum value (Max), the minimum value (Min), the Max-Min value (Range), the standard deviation (Std Dev.), the data count (Count), and the waveform acquisition start and stop positions (Start and Stop).

The Measurement tool palette provides several icons used for measuring the following parameters and so on.

Time Rise time, Fall time, Period, Frequency, Duty cycle, etc.

Vertical Peak-to-peak, Minimum, Maximum, Amplitude, etc.

Mixed Slew rate and Area

NOTE

When you drag an icon on a waveform, the icon outline changes color to match the color of the waveform it touches so you can easily see which waveform is target.

You can also use the Analysis dialog box (Analysis > Measurements) to make a measurement. The dialog box is opened by clicking the Analysis icon on the sidebar. You can specify the position of measurement. Initially, it is the timebase (0 second) position.

Using Markers

The CX3300 supports the following markers.

- Cross hair marker

Reads X and Y measurement data (X, Y) on a waveform and displays the values X and Y in the Marker data view below the Main Waveform. If the marker mode is set to Manual (this is as same as removing the check from Track on the context menu opened by right-clicking on the marker), the marker reads X and Y values of the specified point on the graph.

- A-B marker

Reads X and Y measurement data (X1, Y1) and (X2, Y2) on a waveform and displays the values X1, X2, Y1, Y2, X2-X1, Y2-Y1, and $1/(X2-X1)$ in the Marker data view. If the marker mode is set to Manual, the A-B marker reads X and Y values of the specified points on the graph.

- Area marker

Obtains the integration value and the average value of the data within the specified area on a waveform and displays the Area data view below the Main Waveform.

The Area data view shows Area (integration value), Average, Max, Min, P-P (peak-to-peak), RMS (root mean square), Count, Start (area minimum time), Stop (area maximum time), and Baseline (integration baseline).

Marker can be activated from the Display tool palette. To display a maker, drag and drop a marker icon on a waveform.

The Display tool palette provides the following icons used for displaying markers and annotations and for changing the plot appearance.

Markers	Cross, A-B, Area, Area (+width), Area (-width), Area (Period), and OFF
Annotations	Display and Waveform
Persistence	Normal, Infinity, 10 s, etc.
Plot	Auto, Dots, Lines, Area, Gradation, and Diamonds
Axis	Auto, Linear, Log, Invert, X1 and Y1, Show All, etc.
Waveform Memories	Memory 1 to Memory 8

NOTE

You can also use the Analysis dialog box (Analysis > Display > Markers) to display markers. The dialog box is opened by clicking the Analysis icon on the sidebar.

Using Math Functions and Filters

Math function can be activated from the Function tool palette. To use a math function, drag and drop a function icon on a waveform. The calculation result is displayed on the Main Waveform. Double-clicking the icon can substitute for this drag and drop operation.

The Function tool palette provides the following icons used for calculating and filtering a waveform data.

Math Add, Subtract, Multiply, Divide, Absolute, Average, Invert, Magnify, Max, Min, Differentiate, Integrate, Square, and Square Root

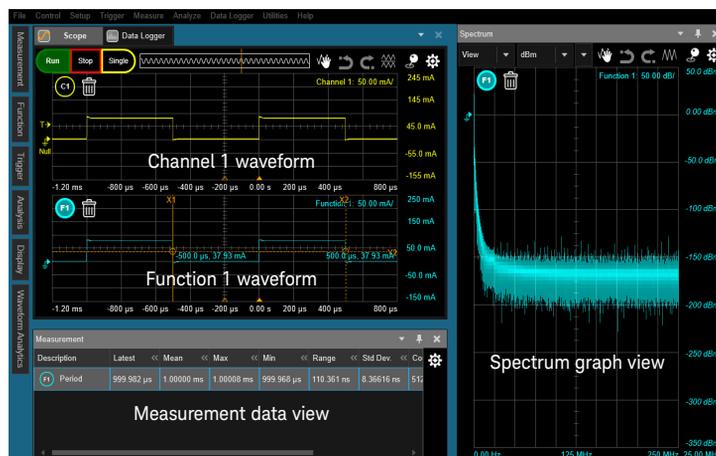
Filter High Pass filter, Low Pass filter, and Smoothing

NOTE

You can also use the Analysis dialog box (Analysis > Functions) to use the math functions. The dialog box is opened by clicking the Analysis icon on the sidebar.

For example, drag and drop the 1 MHz Low Pass filter icon on the Channel 1 waveform when no Function is used. The Channel 1 waveform is filtered by the 1 MHz low pass filter and the Function 1 waveform is plotted on the same graph.

The following image shows an example of the CX3300 screen. The Main Waveform displays two graphs. The top one shows the Channel 1 waveform and the bottom one shows the Function 1 waveform. The Measurement data view shows the Frequency measurement result of the Function 1 waveform and the Spectrum graph view shows the spectrum plot of the Function 1 waveform.



Using Analysis Tools

Analysis tool can be activated from the Analysis tool palette. To use an analysis tool, drag and drop an analysis icon on a waveform.

The Analysis tool palette provides the following icons used for analyzing a waveform data.

- Area
Same as the area marker. See [“Using Markers” on page 64](#).
- Histogram
Displays the histogram in the Amplitude graph view which appears on the right side of the Main Waveform and displays the statistical data in the Amplitude data view which appears below the Main Waveform.
- CCDF
Displays the CCDF curve in the Amplitude graph view which appears on the right side of the Main Waveform and displays the statistical data in the Amplitude data view which appears below the Main Waveform.
- Spectrum
Displays the spectrum plot in the Spectrum graph view which appears on the right side of the Main Waveform.
- Profiler
Launches the power and current profiler. Refer to the CX3300 online help.
- Memory
Saves the waveform in a usable waveform memory and displays it.
- XY
Displays the XY plot in the XY graph view which appears on the right side of the Main Waveform. The mini dialog box may be opened to specify the X and Y data.
- Trend (Data Logger mode only)
Launches the Waveform Trend Analyzer.

The Amplitude data view shows the latest value (Latest), the mean value (Mean), the maximum value (Max), the minimum value (Min), the Max-Min value (Range), the standard deviation (Std Dev.), the data count (Count), and the X and Y minimum and maximum values (X Start, X Stop, Y Min, and Y Max) of the data used for calculation.

NOTE

You can also use the Analysis dialog box (Analysis > Methods) to use the analysis tools. The dialog box is opened by clicking the Analysis icon on the sidebar.

Using Quick Actions

The CX3300 supports the following quick actions. One of these quick actions can be performed by pressing the **Multi Purpose** key. Initially, QuickSave is set.

Auto Save	Starts or stops the automatic data save.
QuickSave	Saves the specified data to a file.
QuickScreen	Saves the screen image to a file.
QuickSetup	Loads a setup file.
QuickExecute	Runs an executable file.

The action taken when the **Multi Purpose** key is pressed depends on the feature selected in the Configuration dialog box (Configuration > Multipurpose) opened by pressing the **Menu** key several times. The **Menu** key is located above the Horizontal control on the front panel.

Controlling Digital Channels

The digital channels are available for the CX3324A. Connect the CX1152A Digital Channel to the Digital D7-D0 connector on the CX3324A rear panel.

To start controlling the digital channels, use the Digital Channel summary on the summary bar which is located at the bottom of the screen. The summary shows a pulse symbol which indicates the graph scale small, medium, or large if a digital channel has been enabled. If no digital channel has been enabled, the summary shows the character “D” only.



Summary bar

Digital channel summary

Click the Digital Channel summary to open the Digital Channels mini dialog box. On the mini dialog box, check the D_n check box (n : 0, 1, 2, 3, 4, 5, 6, or 7) for the digital channels to enable.

Clicking the maximize button in the upper right corner of the mini dialog box opens the Setting dialog box (Setting > Digital Channels) used for detail setup.

Using Data Logger Mode

In the Data Logger mode, the CX3300 supports the waveform recording and the waveform playback. The waveform recording enables you to collect continuous waveform data and save it as the waveform database. The waveform playback enables you to replay and analyze the waveform database. The Data Logger mode can be used to obtain waveform data for the duration of up to 100 hours by using an internal/external storage device (HDD/SSD). To analyze such a huge amount of waveform data, Waveform Analytics tool palette and Waveform Trend Analyzer are available.

NOTE

Data Logger mode is available for the CX3300 with the option STG. License is required to use this mode. For the installation of the license, refer to the CX3300 online help.

Waveform Recording

You can capture a long-duration waveform and save it in a waveform database as shown below.

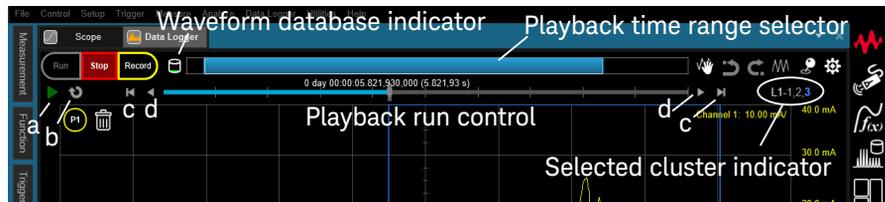
1. Perform the waveform measurement in the Scope mode with several measurement setups. Finally, decide the setup for the waveform recording and stop the waveform measurement.
2. Click the Data Logger tab on the main waveform window to switch the mode. The Data Logger dialog box will open.
3. Change the setup on the Data Logger dialog box if necessary. Refer to the CX3300 online help for details of the setup parameters.
4. Press the **Single** key or click the Record icon to start the waveform recording.

The waveform recording will be stopped after the sampling duration elapsed. You can also use the **Run/Stop** key or the Stop icon to stop the waveform recording.

After that, the recorded waveform database will be saved and loaded automatically. Then the waveform playback is ready.

Waveform Playback

You can replay and analyze the waveform database by using the tools shown below and the tools in the tool palette.



- Waveform database indicator:
Shows the waveform database information.
- Playback time range selector:
Shows the playback time range of the waveform database and allows you to set the time range by dragging each side of the selector bar.
- Playback run control (a, b, c, and d shown in the above image):
 - a. Starts or stops the playback.
 - b. Enables or disables the repeat playback.
 - c. Displays the waveform data at the beginning or end of the playback time range.
 - d. Displays the waveform data at the previous or next time interval. If the Waveform Analytics is performed and some of clusters are selected, the waveform data of the selected clusters are displayed on the graph.
- Selected cluster indicator:
Shows ID of the clusters selected in the Waveform Analytics tool palette. The above image shows that the clusters L1-1, L1-2, and L1-3 have been selected. If no cluster is selected, this indicator shows nothing.

Limitations of Waveform Recording

There are some limitations to perform the waveform recording as follows.

- Sampling Duration value:

Limited by the size of the storage device, which must be larger than the total file size.

- Sampling Rate value:

Limited by the transfer rate of the storage device, which must be faster than the data rate.

- Missing data

When the waveform recording is in progress, missing data may occur. Then, the CX3300 displays a message to report that missing data occurs and continues the waveform recording as scheduled.

There are mainly two reasons which cause the missing data.

- The transfer rate of the storage device may be slower than the data rate.
- If the slide switch of Trigger for Triggered Segmentation is set to ON (Data Logger > Recording > Trigger), it may take a long time to extract and tag the waveform segments.

To avoid the missing data:

- Set the sampling rate slower, or reduce the number of channels.
- If the slide switch of Trigger for Triggered Segmentation has been set to ON (Data Logger > Recording > Trigger), set it to OFF.
- If the slide switch of Trigger for Triggered Segmentation must be ON, change **Similarity Threshold** (Data Logger > Recording > Similarity). Lower similarity threshold reduces the number of the tags and comparisons between waveform segments. It will make the time for extracting waveform segments short.

External Storage Device

The following interfaces are available for connecting external storage devices.

Table 2-1

Interface of External Storage Devices

Interface	Maximum Transfer Rate	Maximum Raw Throughput
USB 2.0 (High-Speed)	480 Mbit/s	
USB 3.0 (SuperSpeed)	5 Gbit/s	500 MBytes/s
Gigabit Ethernet	1 Gbit/s	

USB 3.0 is required for recording the waveform data at maximum sampling rate.

USB 3.0 which supports UASP (USB Attached SCSI Protocol) is preferred. UASP device driver is pre-installed on the instrument with Windows 10. If your CX3300 is installed with Windows 7, upgrade it to use UASP device driver. Upgrade kit CX3322AU-W10 or CX3324AU-W10 is required. Contact Keysight Technologies.

Waveform Trend Analyzer

Waveform Trend Analyzer, available only for the Data Logger mode, calculates statistics throughout the waveform database quickly. The plotted statistics and histograms enable you to see the whole database at once. Refer to the CX3300 online help for more details.

Two analytical modes are provided.

Zoom	Calculates mean, maximum, minimum, and integrals, and then shows trend charts of them.
CCDF	Calculates probability distribution, cumulative frequency distribution, and CCDF based on the histogram.

Waveform Trend Analyzer is used to see the whole database at once. Other analysis tools utilized in the waveform playback are designed specifically for analyzing the waveform in detail. Combining these two functions, you can find out anomaly or failure efficiently in the obtained database.

To launch or switch to Waveform Trend Analyzer:

- In the waveform playback, drag and drop Trend icon from the Analysis tool palette on the waveform. You can apply Waveform Trend Analyzer to the waveform database loaded now.
- Choose Waveform Trend Analyzer from the Application Launcher in the sidebar, and then select the file to load. If Waveform Trend Analyzer has been already launched, it comes to foreground.

To switch to the waveform playback from Waveform Trend Analyzer:

- Click the “Apply to CX3300” button located at the upper right of the window.
- The analysis range on Waveform Trend Analyzer is applied to the waveform playback if it has loaded the same waveform database.

Waveform Analytics

Waveform Analytics is the function to detect anomalies instantly from a waveform database. This function is implemented by the following process.

- “Extracting Waveform Segments”
- “Tagging Waveform Segments”
- “Performing Clustering”

This section also describes the following topics.

- “Performing Waveform Analytics by Waveform Recording”
- “Performing Waveform Analytics by Retriggering”
- “Using Waveform Analytics Tool Palette”

Extracting Waveform Segments

Waveform segments are automatically extracted from the waveform database according to the trigger conditions during the waveform recording or Retriggering. The trigger conditions can be set by using the Data Logger dialog box. Refer to the CX3300 online help for details of the setup parameters.

Tagging Waveform Segments

Waveform segments are automatically tagged according to their similarity.

The similarity between waveform segments is calculated, and if the similarity is greater than the similarity threshold, these segments are tagged with the same. The similarity threshold can be set by using the Data Logger dialog box. Refer to the CX3300 online help for this parameter.

The tagging is performed during the waveform segment extraction.

Performing Clustering

You can perform the clustering by using the Waveform Analytics tool palette. After the clustering, each waveform segment will belong to one of the clusters based on the similarity of the waveforms. There are following three types of the clustering.

- Quick** Quick clustering will be automatically performed after the waveform recording or Retriggering.
- Only the tag information included in the waveform database is used for the clustering.
- Certainty depends on the similarity threshold at the waveform recording or Retriggering.
- Detail** Detail clustering does not use the tag information to perform the clustering.
- The waveform segments are loaded from the waveform database, and the clustering is performed.
- It is recommended to apply Detail clustering to the clusters selected from the result of Quick clustering, not to the entire waveform database.
- Retag** Retag clustering uses the re-tag information to perform the clustering.
- The similarity threshold is automatically calculated based on that of the last clustering. The new similarity threshold will be higher than the previous threshold.
- The waveform segments are loaded from the waveform database, and the tagging is performed by using the new similarity threshold. Then the clustering is performed.
- It is recommended to apply Retag clustering to the clusters selected from the result of Quick clustering, not to the entire waveform database.

Performing Waveform Analytics by Waveform Recording

You can perform Waveform Analytics during the waveform recording as shown below.

1. Open the Data Logger dialog box (Data Logger > Recording > Trigger) and set the slide switch of Trigger for Triggered Segmentation to ON.
2. Set the segment length mode to “Single”, “Dual”, or “Trigger to Trigger”.
3. Define the trigger settings.

The Import from Hardware Settings button allows you to use the trigger settings of the Scope mode.

The Generate from Displayed Waveform button allows you to use the trigger settings based on the waveform displayed.

4. Open the Data Logger dialog box (Data Logger > Recording > Similarity) and set the Similarity Threshold. Available values are 0% to 99.9999%.
5. Click **Start Recording** (Data Logger > Recording).

When the waveform recording is completed, the Quick clustering is performed. Then the waveform database will be automatically loaded, and the Waveform Analytics tool palette will appear automatically. This tool palette shows the Quick clustering results.

Performing Waveform Analytics by Retriggering

You can perform Waveform Analytics for the existing waveform database by using Retriggering without performing the measurement.

1. Load the existing waveform database.
2. Open the Data Logger dialog box (Data Logger > Retriggering) and set the slide switch of Trigger for Triggered Segmentation to ON.
3. Define the trigger settings.
4. Set the Similarity Threshold. Available values are 0% to 99.9999%.
5. Click **Start Retriggering**. The Retriggering dialog box will open, and you can change the record name if necessary. The record name must contain only ASCII characters. Then, click **Yes** to start Retriggering.

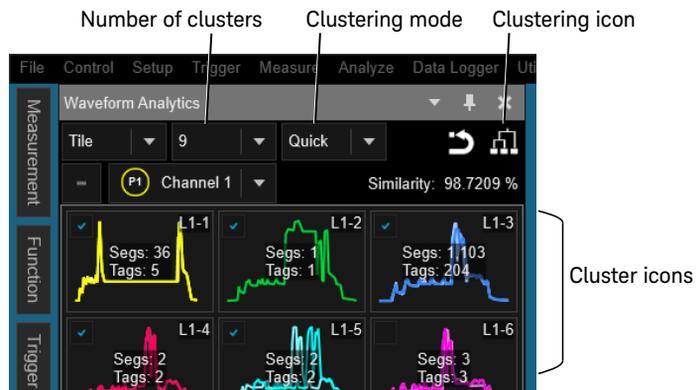
Using the CX3300 Waveform Analytics

Waveform segments are extracted from the existing waveform database, and tagged according to their similarity. The data is appended to the end of the database. And the Quick clustering is performed based on this tag information.

When Retriggering starts, the Cx3300 Database Generator window appears. After Retriggering is completed, this window displays the execution log (Logs) and the link to the Retriggering database.

Using Waveform Analytics Tool Palette

The Waveform Analytics tool palette enables you to perform the clustering under the various conditions. You can also select and display the particular waveform, and efficiently find out the specific waveform pattern or anomaly in the waveform database. Refer to the CX3300 online help for more details.



To playback the segments of the specific cluster

Drag and drop a cluster icon on the waveform. You can see the cluster icons in the Waveform Analytics tool palette. The waveform segments belonging to the selected cluster are displayed by this operation. And you can control the display of the waveform segment by using the playback run control.

To change the number of clusters

Select the number of clusters by using the selection menu in the Waveform Analytics tool palette. See the above image.

The change will be applied immediately.

To perform Detail/Retag clustering

1. Check the check box on the cluster icon to select the cluster used for the clustering. Multiple clusters can be selected.
2. Set the clustering mode to Detail or Retag. See the above image.
3. Click the clustering icon to perform the clustering. If you have selected the Retag clustering, the Retagging dialog box will open, and you can change the record name if necessary. The record name must contain only ASCII characters.

Current Waveform Analytics Software

Keysight CX3300APPC Current Waveform Analytics Software runs on a Windows PC and allows you to analyze the measurement result data and create the measurement setup data without occupying the CX3300. This software supports the CX3300 capabilities other than the measurement execution.

NOTE

License is required to use Current Waveform Analytics Software. You can install the license by using the Keysight License Manager.

The Keysight License Manager is a separate application used to manage the licenses. You can access the Keysight License Manager by clicking **License Manager...** on the Utilities menu which is displayed by clicking the Utilities icon on the sidebar.

The Keysight License Manager application has menus for installing, deleting, and transporting licenses, and it has its own online help that provides more information on its operations. For details, refer to the Keysight License Manager online help.

Simulation of Sensors

You can define a configuration with several sensors by using the Configuration dialog box (Configuration > Simulator). If the Product Model (CX3322A or CX3324A) is changed, reboot this software.

You can also load the actual configuration from the waveform database, measurement setup data, or measurement result data saved by the CX3300. On the Load dialog box, check the Reconfigure hardware simulator check box, then load the data file.

The file edited and saved by this software can be loaded on the CX3300. Then the configuration must be the same as the actual CX3300 configuration.

SCPI Control

Current Waveform Analytics Software can be controlled by using SCPI commands from a control program on an external computer via the LAN interface. Refer to Keysight CX3300 Programmer's Guide for the SCPI commands.

The following protocols are supported by this software. In the default setting, all protocols are disabled (OFF).

- VXI-11 LAN
- HiSLIP LAN
- TCP/IP Socket

To use this function, access the Configuration dialog box (Configuration > Interfaces), decide the protocol to use, set its slide switch to ON, and reboot this software.

Saving and Printing Data

To save data Click the Save icon on the sidebar and use the Save dialog box. The following data types are supported.

- Waveform (HDF5 (.cxwav or .h5), CSV, or TSV format)
Waveform data
- Report (XPS format)
Outputs the measurement and analysis result report in the dedicated style
- Composite (HDF5 (.cxcomp) format)
All setup data and waveform data
- Screen Capture (PNG, JPG, or BMP format)
Image of the CX3300 full screen
- Setup (HDF5 (.cxset) format)
All setup data or trigger setup data only (selectable)
- Setup Information (Text format)
All setup data and analysis results except waveform data
- Waveform Database (.cxwdb)
A set of files obtained by the Data Logger mode, which will be the waveform records and setup files

NOTE

Non-ASCII is not supported. Full path name must contain only ASCII characters.

To print data The CX3300 does not have the user interface for printing. To print data, save the data, minimize the CX3300 application, and use a Windows application associated with the data type. Or use an external PC.

To load data The CX3300 also supports data load to reuse the data. Click the Load icon on the sidebar and use the Load dialog box. The following data types are supported.

- Waveform (HDF5 (.cxwav or .h5) format)
- Composite (HDF5 (.cxcomp) format)
Selectable load types: Composite (Setup and Waveforms), Only Waveforms, and Only Setup
- Setup (HDF5 (.cxset) format)
- Waveform Database (.cxwdb)
Waveform database is loaded in the Data Logger mode. You can select to load waveforms with or without the setup file.

Forcing a Default Setup

If your CX3300 is not working properly when you start it up, follow these steps to perform a default setup and return the CX3300 to normal operation.

1. Press the **Default Setup** key.
2. If the CX3300 is still not working properly:
 - a. Press the **Menu** key several times to open the Configuration dialog box. The **Menu** key is located above the Horizontal control on the front panel.
 - b. Click **Setups** to display the Configuration > Setups screen.
 - c. Click **Factory Defaults** to return the CX3300 to the default settings it had when it left the factory.
3. If the CX3300 is still not working properly, turn it off.
4. Turn the CX3300 back on. If it does not successfully restart, try recycling the power again.
5. If the CX3300 still does not successfully restart, follow the instructions for recovering the SSD.

SSD Recovery

Follow these steps to recover your CX3300 solid state drive.

1. Turn off the CX3300.
2. Connect the keyboard to a USB host port of the CX3300.
3. Connect the mouse to a USB host port of the CX3300.
4. Press the Standby switch on the CX3300 front panel.
5. If you use Windows 10, restart Windows from the Windows Start menu.
6. On the Windows boot selection screen, select **Instrument Image Recovery System**.
7. Follows the on-line instruction to proceed the recovery.

Using Online Help

Most of the information about using the CX3300 effectively is included in the online help.

Accessing the Online Help

Click the Help icon on the sidebar and click the On-line Help (.chm) button to open the online help. You can move it around the screen or resize it to make it easier to use.

The online help may hide behind the Main Waveform screen. Then click the Help icon and the On-line Help (.chm) button again. It will appear on the same position with the same topic when it is hidden.

Navigating the Online Help

The online help provides several ways to find the information you need.

Use the Contents tab to browse topics in the help system by clicking topics in the left pane.

Use the Index tab to type in a keyword and search the index for that keyword or scroll through the list to find a topic.

Use the Search tab to type in a keyword and if that word exists in the online help, a list of topics containing the keyword appears.

Use the Favorites tab to add preferred help topics to a list for easy reference.

Using the CX3300
Using Online Help

3 Performing User Calibration

Using the CX1101A/CX1102A/CX1103A 88

Using the CX1104A 97

Using the CX1105A 99

Using the CX1151A 101

User calibration allows you to perform error correction of measurement data. This is effective for making more accurate measurements. This chapter describes how to perform the user calibration.

The user calibration must be performed after warming-up of 30 minutes.

The user calibration is effective for:

- the environmental temperature of 0 to 40 °C
- ± 3 °C from the temperature when the last user calibration is performed
- 24 hours since the last user calibration is performed

All of the user calibration data is cleared by applying the factory default. The data is not cleared by turning the CX3300 off.

Using the CX1101A/CX1102A/CX1103A

The CX3300 provides the two types of user calibration for the CX1101A/CX1102A/CX1103A. You can select one before starting the user calibration.

- Gain/Offset user calibration

The user calibration data, Gain and Offset [A], is acquired and is used for error correction. Effective for reducing the gain error and the offset error.

- Offset user calibration

The user calibration data, Offset [A], is acquired and is used for error correction. Effective for reducing the offset error.

Preparation Before starting the user calibration, connect the CX1101A/CX1102A/CX1103A to the CX3300 analog input channel.

If you connect the CX1101A/CX1102A, attach the CX1203A sensor head to it. And set the CX1203A slide switch to 0 Ω .

After the connection, warm up them for 30 minutes.

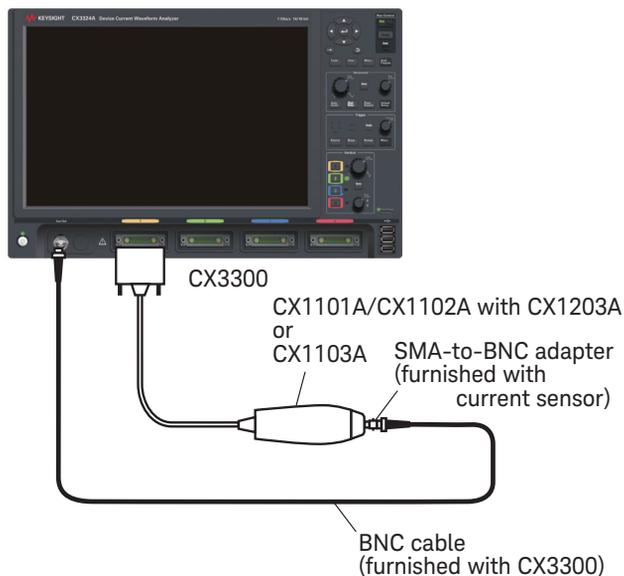
Procedure You can perform the user calibration as shown below.

1. Press the **Menu** key several times to open the Configuration dialog box. The **Menu** key is located above the Horizontal control on the front panel.
2. Click **User Calibration** to display the Configuration > User Calibration screen.
3. Click Gain/Offset or Offset radio button for the channel under user calibration.
4. Click **Execute** for the channel.

You will see a dialog box which asks you to connect the CX1101A/CX1102A/CX1103A input to the Aux Out terminal. Then connect them as shown in [Figure 3-1](#) and click Yes.

The user calibration will start.

Figure 3-1 Connection Diagram for User Calibration (CX1101A/CX1102A/CX1103A)



After the channel passed the user calibration, the ON/OFF switch will be available.

- Set ON to enable error correction.

Error correction is performed for the data measured by this channel from now on.

- Set OFF to disable error correction.

Error correction is not performed.

If the channel failed the user calibration, the ON/OFF switch is not available. Error correction is not performed.

Once you disconnect the CX1101A/CX1102A/CX1103A from the CX3300, the user calibration data for this channel will be cleared.

Using the CX1206A Sensor Head

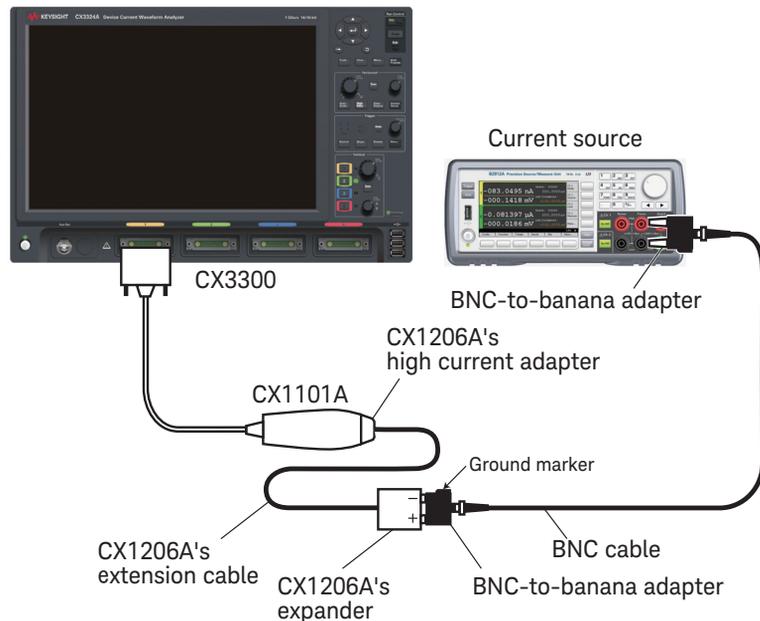
The CX3300 cannot acquire the user calibration data of the CX1101A connected to the CX1206A. Initially, the Gain value is set to 1 and the Offset value is set to 0. If you want to use the user calibration capability, you need to obtain the Gain and Offset values and enter the values to the CX3300 manually.

To obtain the user calibration data, you need a current source which supports ± 10 A output.

This section describes how to obtain the user calibration data by using the following equipment and accessories.

- Keysight B2900 (B2901A/B2902A/B2911A/B2912A) or equivalent
- BNC-to-banana adapter, 2 ea.
- BNC cable, 24 inches, 1 ea., furnished with the CX3300

Figure 3-2 Connection Diagram



- Procedure**
1. Turn the CX3300 and the current source (Keysight B2900) on.
 2. Attach the CX1206A to the CX1101A.
 3. Connect the CX1101A to the CX3300.
 4. Warm up the equipments. Required warm-up time is shown below.
 - CX3300: 30 minutes after connecting the CX1101A
 - B2900: 60 minutes after power-on
 5. Connect the equipments as shown below. Also see [Figure 3-2](#).
 - a. Connect a BNC-banana adapter to the B2900 Force terminals. Then the ground marker must come to the Low side.
 - b. Connect a BNC-banana adapter to the CX1206A input. Then the ground marker must come to the – (minus) side.
 - c. Connect a BNC cable between the BNC-to-banana adapters.
 6. Disable the user calibration for the channel connected to the CX1101A/CX1206A as shown below.
 - a. Press the **Menu** key several times to open the Configuration dialog box. The **Menu** key is located above the Horizontal control on the front panel.
 - b. Click **User Calibration** to display the Configuration > User Calibration screen.
 - c. Set the ON/OFF switch to OFF for the channel connected to the CX1101A/CX1206A.

In the example of [Figure 3-2](#), the ON/OFF switch of the Channel 1 must be set to OFF to disable the user calibration.

7. Perform a positive current measurement for both High Resolution mode OFF and ON as shown below.
 - a. Press the **Menu** key located in the Trigger control on the CX3300 front panel. And set the CX3300 as follows.

In the following condition, Channel *N* is the channel connected to the CX1101A/CX1206A. Where, *N* is the channel number 1, 2, 3, or 4.

Performing User Calibration
Using the CX1101A/CX1102A/CX1103A

Condition:

Setting > Acquisition screen:

- Acquisition Mode: Normal
- High Resolution Mode: OFF
- Sampling Rate: 1 MSa/s
- Memory Depth: 1 Mpts
- Sin(x)/x Interpolation: OFF
- Averaging: OFF

Setting > Timebase screen:

- Scale: 200 μ s/
- Position: 300 μ s
- Timebase Reference: 50%

Setting > Trigger screen:

- Source: Channel *N*
- Trigger type: Edge
- Slope: Positive
- Level: 5 A
- AND Qualifier: OFF

Setting > Trigger > Conditioning screen:

- Sweep Mode: Trig'd
- Hold-off: 100 ns
- HF Reject: OFF
- Noise Reject: OFF

Setting > Channels > Channel *N* screen:

- Channel *N*: ON
- Scale: 5 A/
- Offset: 0 A
- Bandwidth Limit: OFF
- Invert Polarity: OFF

Setting > Sensor/Probe > Channel *N* screen:

- Channel *N*: ON
- Current Range: 10 A

Setting > Digital Channels screen:

- Digital Channels: OFF

- b. Control the current source (Keysight B2900) and apply the current of the following condition. For setting up the current source, refer to its *User's Guide*.

Condition:

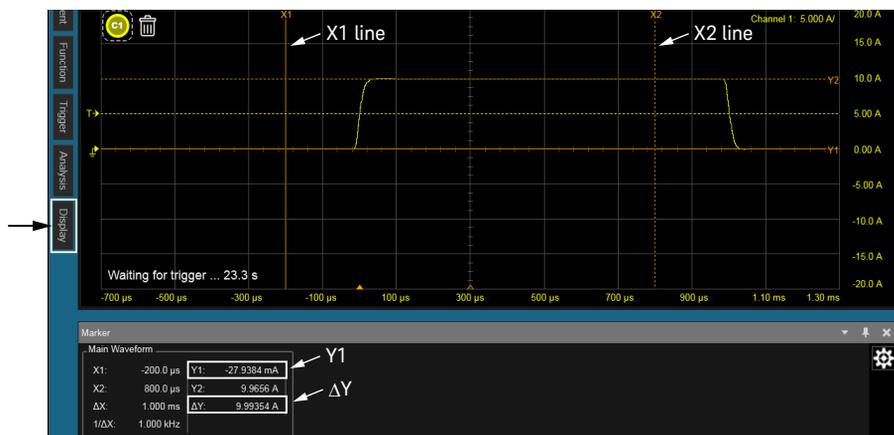
- Pulse base: 0 A
- Pulse peak: +10 A
- Pulse width: 1 ms
- Duty cycle: $\leq 2.5\%$ for the Keysight B2900 series

- c. Control the CX3300 and acquire the waveform as shown below.
 1. Press the **Run/Stop** key to start waveform acquisition.
 2. Acquire the waveform as shown in [Figure 3-3](#).
 3. Press the **Run/Stop** key to stop waveform acquisition.

Performing User Calibration
Using the CX1101A/CX1102A/CX1103A

4. Open the Display tool palette and drag and drop the A-B marker icon on the waveform.
5. Put the X1 line on the $-200\ \mu\text{s}$ position.
6. Put the X2 line on the $800\ \mu\text{s}$ position.
7. Read the marker Y1 and ΔY values and record them as follows.
 - $\text{loff_positive} = \Delta Y$
 - $\text{loff_offset} = Y1$

Figure 3-3 Positive Pulse Acquisition



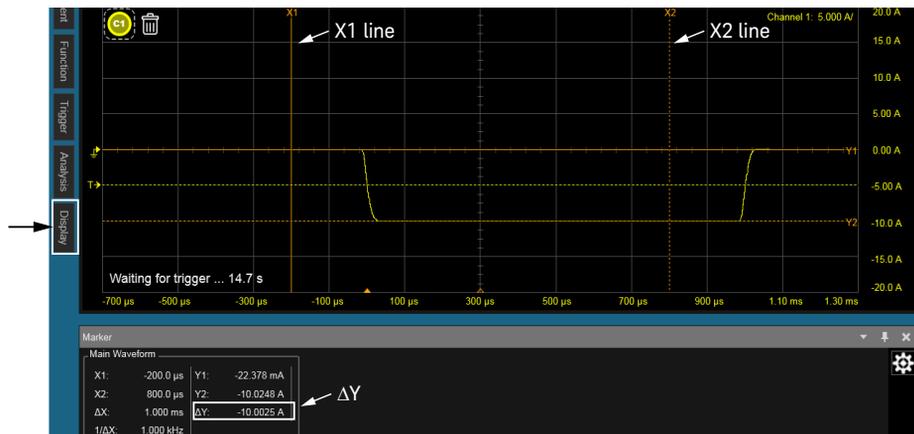
- d. Press the **High Reso** key to set the high resolution mode ON. The **High Reso** key is located in the Horizontal control on the CX3300 front panel.
- e. Control the CX3300 and acquire the waveform as same as the step 3-c. And read the marker Y1 and ΔY values then record them as follows.
 - $\text{lon_positive} = \Delta Y$
 - $\text{lon_offset} = Y1$
- f. Disable the current source (Keysight B2900) output.

8. Perform a negative current measurement for both High Resolution mode ON and OFF as shown below.
 - a. Press the **Menu** key located in the Trigger control on the CX3300 front panel. And set the following values on the Setting > Trigger screen.
 - Slope: Negative
 - Level: -5 A
 - b. Control the current source (Keysight B2900) and apply the current of the following condition.

Condition:

 - Pulse base: 0 A
 - Pulse peak: -10 A
 - Pulse width: 1 ms
 - Duty cycle: $\leq 2.5\%$ for the Keysight B2900 series
 - c. Control the CX3300 and acquire the waveform as same as the step 3-c. And read the marker ΔY value then record it as follows.
 - $\text{Ion_negative} = \Delta Y$

Figure 3-4 Negative Acquisition



Performing User Calibration
Using the CX1101A/CX1102A/CX1103A

- d. Press the **High Reso** key to set the high resolution mode OFF.
 - e. Control the CX3300 and acquire the waveform as same as the step 3-c. And read the marker ΔY value then record it as follows.
 - $\text{loff_negative} = \Delta Y$
 - f. Disable the current source (Keysight B2900) output.
9. Set the 10 A range user calibration data as shown below.
- a. Press the **Menu** key several times to open the Configuration dialog box. The **Menu** key is located above the Horizontal control on the front panel.
 - b. Click **User Calibration** and click Channel *N* to display the Configuration > User Calibration > Channel *N* screen. Where Channel *N* is the channel connected to the CX1101A/CX1206A. In the example of [Figure 3-2](#), *N* is 1.
 - c. Fill in the Gain and Offset fields as shown below.
High Resolution Mode: OFF
Gain = A
Offset = $-\text{loff_offset}$

High Resolution Mode: ON
Gain = B
Offset = $-\text{lon_offset}$
- Where, A and B values can be calculated by the following formulas.
- $A = 20 / (\text{loff_positive} - \text{loff_negative})$
 - $B = 20 / (\text{lon_positive} - \text{lon_negative})$
- d. Click the Apply button to memorize the Gain and Offset values.

To enable the user calibration, set the ON/OFF switch to ON.

Using the CX1104A

The CX3300 provides the offset user calibration for the CX1104A.

The user calibration data, Offset [A], is acquired and is used for error correction. Effective for reducing the offset error.

Preparation Before starting the user calibration, connect the CX1104A to the CX3300 analog input channel.

Prepare a resistive sensor head (CX1211A, CX1212A, CX1213A, CX1214A, CX1215A, or CX1216A).

After the connection, warm up them for 30 minutes.

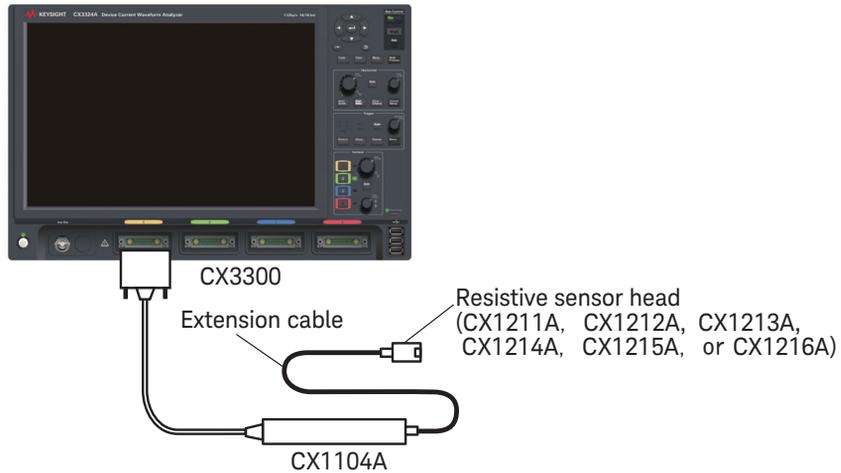
Procedure You can perform the user calibration as shown below.

1. Press the **Menu** key several times to open the Configuration dialog box. The **Menu** key is located above the Horizontal control on the front panel.
2. Click **User Calibration** to display the Configuration > User Calibration screen.
3. Click **Execute** for the channel under user calibration.

You will see a dialog box which asks you to connect a resistive sensor head to the CX1104A input using the extension cable. Then connect them as shown in [Figure 3-5](#) and click Yes.

The user calibration will start.

Figure 3-5 Connection Diagram for User Calibration (CX1104A)



After the channel passed the user calibration, the ON/OFF switch will be available.

- Set ON to enable error correction.

Error correction is performed for the data measured by this channel from now on.

- Set OFF to disable error correction.

Error correction is not performed.

If the channel failed the user calibration, the ON/OFF switch is not available. Error correction is not performed.

Once you disconnect the CX1104A from the CX3300, the user calibration data for this channel will be cleared.

Using the CX1105A

The CX3300 provides the offset user calibration for the CX1105A.

The user calibration data, Offset [V], is acquired and is used for error correction. Effective for reducing the offset error.

Preparation Before starting the user calibration, connect the CX1105A to the CX3300 analog input channel.

Prepare the test adapter.

After the connection, warm up them for 30 minutes.

Procedure You can perform the user calibration as shown below.

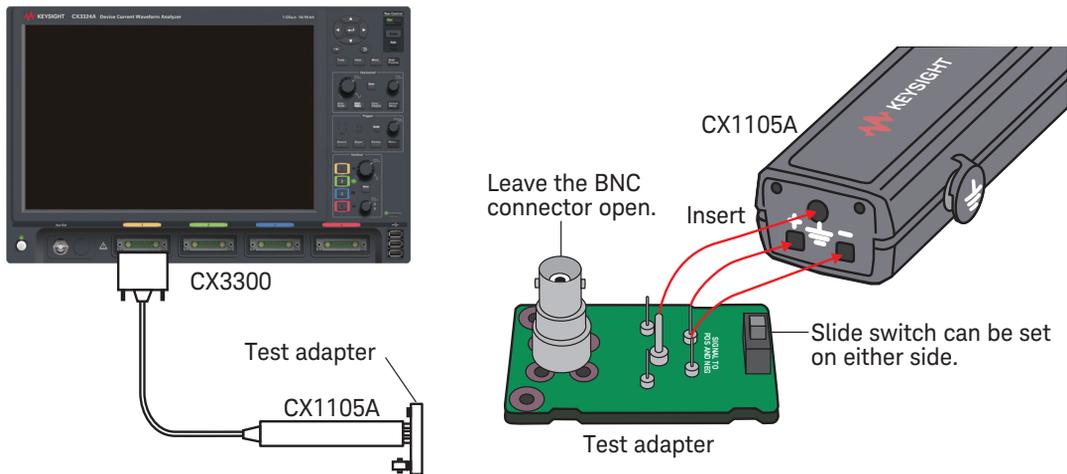
1. Press the **Menu** key several times to open the Configuration dialog box. The **Menu** key is located above the Horizontal control on the front panel.
2. Click **User Calibration** to display the Configuration > User Calibration screen.
3. Click **Execute** for the channel under user calibration.

You will see a dialog box which asks you to connect the test adapter to the CX1105A input. Then connect them as shown in [Figure 3-6](#) and click Yes.

The user calibration will start.

Performing User Calibration
Using the CX1105A

Figure 3-6 Connection Diagram for User Calibration (CX1105A)



After the channel passed the user calibration, the ON/OFF switch will be available.

- Set ON to enable error correction.

Error correction is performed for the data measured by this channel from now on.

- Set OFF to disable error correction.

Error correction is not performed.

If the channel failed the user calibration, the ON/OFF switch is not available. Error correction is not performed.

Once you disconnect the CX1105A from the CX3300, the user calibration data for this channel will be cleared.

Using the CX1151A

The CX3300 provides the two types of user calibration for the CX1151A. You can select one before starting the user calibration.

- Gain/Offset user calibration

The user calibration data, Gain and Offset [V], is acquired and is used for error correction. Effective for reducing the gain error and the offset error.

- Offset user calibration

The user calibration data, Offset [V], is acquired and is used for error correction. Effective for reducing the offset error.

Preparation Before starting the user calibration, connect the CX1151A to the CX3300 analog input channel.

After the connection, warm up them for 30 minutes.

Procedure You can perform the user calibration as shown below.

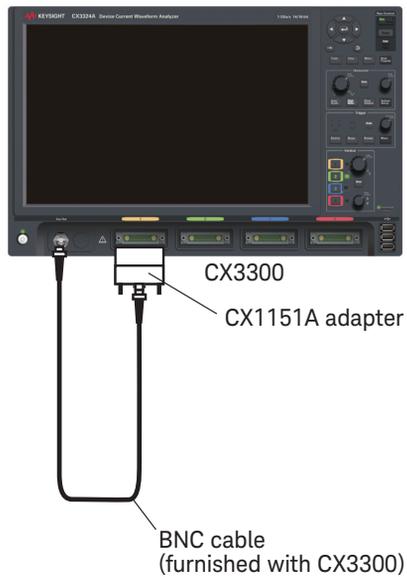
1. Press the **Menu** key several times to open the Configuration dialog box. The **Menu** key is located above the Horizontal control on the front panel.
2. Click **User Calibration** to display the Configuration > User Calibration screen.
3. Click the Gain/Offset or Offset radio button for the channel under user calibration.
4. Click **Execute** for the channel.

You will see a dialog box which asks you to connect the CX1151A input to the Aux Out terminal. Then connect them as shown in [Figure 3-7](#) and click Yes.

The user calibration will start.

Performing User Calibration
Using the CX1151A

Figure 3-7 Connection Diagram for User Calibration (CX1151A)



After the channel passed the user calibration, the ON/OFF switch will be available.

- Set ON to enable error correction.

Error correction is performed for the data measured by this channel from now on.

- Set OFF to disable error correction.

Error correction is not performed.

If the channel failed the user calibration, the ON/OFF switch is not available. Error correction is not performed.

Once you disconnect the CX1151A from the CX3300, the user calibration data for this channel will be cleared.

4 Safety Information

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Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual may impair the protections provided by the instrument. In addition, it violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements.

Product manuals may be provided on CD-ROM or in printed form. Printed manuals are an option for many products. Manuals may also be available on the Web. Go to www.keysight.com and type in the product model number in the Search field at the top of the page.

NOTE

Do not use this instrument in any manner not specified by the manufacturer. The protective features of this instrument may be impaired if it is used in a manner not specified in the operation instructions.

This instrument is an INDOOR USE product.

This instrument complies with OVERVOLTAGE CATEGORY II for mains input and POLLUTION DEGREE 2 defined in IEC 61010-1.

If an instrument is marked CAT I (IEC Measurement Category I), or it is not marked with a measurement category, its measurement terminals must not be connected to line-voltage mains.

Safety of any system incorporating the equipment is the responsibility of the assembler of the system.

- *DANGEROUS PROCEDURE WARNINGS*
Warnings, indicated by red WARNING mark, shall be complied. Procedures throughout in this manual prevent you from potential hazard. Their instructions contained in the warnings must be followed.
- *BEFORE APPLYING POWER*
Verify that all safety precautions are taken. Note the instrument's external markings described under “*Safety Symbols*”.
- *GROUND THE INSTRUMENT*
This is Safety Class I instrument. To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The power terminal and the power cord must meet International Electrotechnical Commission (IEC) safety standards.
- *DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE*
Do not operate the instrument in the presence of flammable gases, corrosive gases, or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.
- *DO NOT REMOVE COVERS*
No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.
- *IN CASE OF DAMAGE*
Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel. Return the instrument to a Keysight Technologies sales or service office for services and repair to ensure that safety features are maintained.
- *USE ONLY THE SPECIFIC ACCESSORIES*
Specific accessories satisfy the requirements for specific characteristics for using the instrument. Use the specific accessories, cables, adapters, and so on for safety reasons.

Safety Symbols

The general definitions of safety symbols used on equipment or in manuals are listed below.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

 Direct current.

 Alternating current.

 Earth ground terminal.

 Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating equipment.

 Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.

 Grounded terminal which indicates the earth potential.

 On supply.

 Off supply.

 Standby supply. The equipment will be marked with this symbol is not completely disconnected from AC mains when power switch is in the standby position.

 In position of a bi-stable push switch.

 Out position of a bi-stable push switch.



Hazardous voltage and potential for electrical shock. Do not touch terminals that have this symbol when the equipment is on.



Hot surface. Avoid contact. Surfaces are hot and may cause personal injury if touched.



Low temperature or freezing conditions. Avoid contact. Surfaces are cold and may cause personal injury if touched.



Caution, refer to accompanying documentation. The equipment will be marked with this symbol when it is necessary for the user to refer to the instruction manual.



Read operator's manual. To indicate that the operator's manual or card should be read before continuing the operation.

CAT I IEC Measurement Category I



The CE mark shows that the product complies with all applicable European Directives.



The CSA mark is a registered trademark of the Canadian Standards Association.



The RCM mark is a registered trademark of the Australian Communications Authority. This signifies compliance with the Australian EMC Framework Regulations under the terms of the Radio communications Act.

ICES/NMB-001

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme à la norme NMB-001 du Canada.

CAN ICES/NMB-001(A)

This ISM device complies with Canadian ICES-001 Class A.
Cet appareil ISM est conforme à la norme NMB-001 classe A du Canada.

ISM GROUP 1 CLASS A

This is the symbol for an Industrial, Scientific and Medical, Group 1 Class A product. (CISPR 11)



The UKCA mark shows that the product complies with all applicable UK regulations.



Korea's safety and EMC mark



China RoHS - Environmentally Green Product Label



China RoHS - Product with Toxic Substance 40 yr EPUP



The Chinese mark for paper-based packaging materials; Paperboard and Corrugated Fiberboard



Plastic Material Coding Identification



Product Stewardship



Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by the EU DIRECTIVE and other National legislation.

Please refer to <http://keysight.com/go/takeback> to understand your Trade in options with Keysight in addition to product takeback instructions.

Perchlorate Information

Perchlorate Material - special handling may apply. Visit the following website.

<http://www.dtsc.ca.gov/hazardouswaste/perchlorate/>

Equipment's real-time clock battery or coin cell battery may contain perchlorate and may require special handling when recycled or disposed of in California.

Precautionary Statement

Keysight CX3300 Device Current Waveform Analyzer operates in the Microsoft Windows environment. The CX3300 requires the CX3300 application, a specially-designed Windows application program.

About guarantee and support for the CX3300

Keysight Technologies guarantees and supports the performance of Keysight CX3300 for the same condition as the preload condition when shipped from the factory.

About updating the CX3300 application and the Windows Update

Keysight Technologies confirms the operation of the CX3300 application patch programs and important Windows security patches, and provides recommended update information. Visit the CX3300 support site, download the patches, and perform the software update.

About Windows application programs and peripherals (including driver)

Using commercial products on the CX3300 is your responsibility. Keysight Technologies cannot provide compatibility information for commercial products.

About servicing

Bench repair service is available at your nearest Keysight Technologies service center. Be aware that the CX3300 configuration might be updated to the latest one without notice because of support issues.

The solid-state drive (SSD) might be initialized during servicing. If peripherals are connected, they will be removed.

When the CX3300 is returned, the SSD might be initialized. Peripherals will be returned separately.

Other notes

- Back up the SSD to prevent loss of data by accident or failure.
- Protect the CX3300 from computer viruses.
- If you connect the CX3300 to the network, take care to protect it from computer virus.

Working in Comfort

To optimize your comfort and productivity, it is important that you set up your work area correctly and use your instrument properly. With that in mind, we have developed some set-up and use recommendations for you to follow based on established ergonomic principles.

Improper and prolonged use of keyboards and input devices are among those tasks that have been associated with repetitive strain injury (RSI) to soft tissues in the hands and arms. If you experience discomfort or pain while using the instrument, discontinue use immediately and consult your physician as soon as possible. For more information on RSI you may wish to consult the *About Repetitive Strain Injury* section.

Please study the recommendations described below. Included there are references to relevant parts of international standards, regulations and guidelines, such as ISO 9241 and the European Community Display Screen Equipment directive. You may also wish to consult your employer's human resources department or other relevant departments for guidance specific to your company.

For more information, see "Working in Comfort" located at http://about.keysight.com/en/quality/Keysight_Ergonomic_Information.pdf.

About Repetitive Strain Injury

Because your comfort and safety are our primary concern, we strongly recommend that you use the instrument in accordance with established ergonomic principles and recommendations. Scientific literature suggests that there may be a relationship between injury to soft tissues – especially in the hands and arms – and prolonged improper use of keyboards or other equipment requiring repeated motions of the hands and forearms. This literature also suggests that there are many other risk factors that may increase the chance of such injury, commonly called Repetitive Strain Injury.

What is RSI?

Repetitive Strain Injury (RSI – also known as cumulative trauma disorder or repetitive motion injury) is a type of injury where soft tissues in the body, such as muscles, nerves, or tendons, become irritated or inflamed. RSI has been a reported problem for those who perform repetitive tasks such as assembly line

work, meatpacking, sewing, playing musical instruments, and computer work. RSI also has been observed in those who frequently engage in activities such as carpentry, knitting, housework, gardening, tennis, windsurfing and lifting children.

What causes RSI?

The specific causes of RSI have not been established. Nevertheless, the incidence of RSI has been associated with a variety of risk factors, including:

- Too many uninterrupted repetitions of an activity or motion.
- Performing an activity in an awkward or unnatural posture.
- Maintaining static posture for prolonged periods.
- Failing to take frequent short breaks.
- Other environmental and psychosocial factors.

In addition, there have been reports associating the occurrence of RSI with the use of keyboards, mice, and other input devices. Also, certain medical conditions, such as rheumatoid arthritis, obesity and diabetes, may predispose some people to this type of injury.

What if I experience discomfort?

If you are experiencing any discomfort, seek professional medical advice immediately. Typically, the earlier a problem is diagnosed and treated, the easier it is to resolve.

Mice and Other Input Devices

Various aspects of using mice and other input devices may increase your risk of discomfort or injury. Observing the following recommendations may reduce that risk.

- Try to keep your hand, wrist, and forearm in a neutral position while using your mouse or other input device.
- If you use your thumb to rotate the ball on a trackball or spaceball, keep it in a relaxed, natural shape, and maintain a neutral posture in your hand, wrist, and forearm.
- Hold the mouse gently by draping your fingers over it. Keep your hand relaxed and fingers loose. Do not grip the mouse tightly.

Safety Information

Working in Comfort

- It takes very little pressure or force from your fingers to activate the buttons or scroll wheel on your mouse, scrolling mouse, trackball, or other input device. Using too much force can place unnecessary stress on the tendons and muscles in your hands, wrists, and forearms.
- If you are using a scrolling mouse, be sure to keep your fingers and hand in a relaxed, neutral position when activating the scroll wheel. Also, this type of mouse features software that can minimize the number of mouse movements or button clicks.
- When using a mouse, trackball, or other input device, position it as close to the keyboard as possible, and keep it at the same level as you do not have to stretch while using it.
- Be sure to keep your mouse and trackball clean. Regular removal of accumulated dust and dirt helps ensure proper tracking and reduces unnecessary hand and wrist motions.

This information is subject to change without notice.
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www.keysight.com