Tektronix®

2 Series MSO

MSO24, MSO22

Quick Start Guide

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www.tek.com/register

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These are the original instructions in English.

Go to tek.com/eula to read the Tektronix End User License Agreement.



Contacting Tektronix

Tektronix, Inc.
13725 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:

In North America, call 1-800-833-9200.

Worldwide, visit www.tek.com to find contacts in your area.

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Important safety information

This manual contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

General safety summary

Use the product only as specified. Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. Carefully read all instructions. Retain these instructions for future reference.

This product shall be used in accordance with local and national codes.

For correct and safe operation of the product, it is essential that you follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

The product is designed to be used by trained personnel only.

Only qualified personnel who are aware of the hazards involved should remove the cover for repair, maintenance, or adjustment.

Before use, always check the product with a known source to be sure it is operating correctly.

This product is not intended for detection of hazardous voltages.

Use personal protective equipment to prevent shock and arc blast injury where hazardous live conductors are exposed.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

When incorporating this equipment into a system, the safety of that system is the responsibility of the assembler of the system.

Service safety summary

The *Service safety summary* section contains additional information required to safely perform service on the product. Only qualified personnel should perform service procedures. Read this *Service safety summary* and the *General safety summary* before performing any service procedures.

To avoid electric shock

Do not touch exposed connections.

Do not service alone

Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect power

To avoid electric shock, switch off the product power and disconnect the power cord from the mains power before removing any covers or panels, or opening the case for servicing.

Use care when servicing with power on

Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

Verify safety after repair

Always recheck ground continuity and mains dielectric strength after performing a repair.

To avoid fire or personal injury

Use proper power cord

Use only the power cord specified for this product and certified for the country of use. Do not use the provided power cord for other products.

Ground the product

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded. Do not disable the power cord grounding connection.

Power disconnect

The power cord disconnects the product from the power source. See instructions for the location. Do not position the equipment so that it is difficult to operate the power cord; it must remain accessible to the user at all times to allow for quick disconnection if needed.

Use proper AC adapter

Use only the AC adapter specified for this product.

Connect and disconnect properly

Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Use only insulated voltage probes, test leads, and adapters supplied with the product, or indicated by Tektronix to be suitable for the product.

Observe all terminal ratings

To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not exceed the Measurement Category (CAT) rating and voltage or current rating of the lowest rated individual component of a product, probe, or accessory. Use caution when using 1:1 test leads because the probe tip voltage is directly transmitted to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Do not float the common terminal above the rated voltage for that terminal.

The measurement terminals on this product are not rated for connection to Category III or IV circuits.

Do not connect a current probe to any wire that carries voltages above the current probe voltage rating.

Do not operate without covers

Do not operate this product with covers or panels removed, or with the case open. Hazardous voltage exposure is possible.

Avoid exposed circuitry

Do not touch exposed connections and components when power is present.

Do not operate with suspected failures

If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Disable the product if it is damaged. Do not use the product if it is damaged or operates incorrectly. If in doubt about safety of the product, turn it off and disconnect the power cord. Clearly mark the product to prevent its further operation.

Before use, inspect voltage probes, test leads, and accessories for mechanical damage and replace when damaged. Do not use probes or test leads if they are damaged, if there is exposed metal, or if a wear indicator shows.

Examine the exterior of the product before you use it. Look for cracks or missing pieces.

Use only specified replacement parts.

Replace batteries properly

Replace batteries only with the specified type and rating.

Recharge batteries for the recommended charge cycle only.

Wear eye protection

Wear eye protection if exposure to high-intensity rays or laser radiation exists.

Do not operate in wet/damp conditions

Be aware that condensation may occur if a unit is moved from a cold to a warm environment.

Do not operate in an explosive atmosphere

Keep product surfaces clean and dry

Remove the input signals before you clean the product.

Provide proper ventilation

Refer to the installation instructions in the manual for details on installing the product so it has proper ventilation.

Slots and openings are provided for ventilation and should never be covered or otherwise obstructed. Do not push objects into any of the openings.

Provide a safe working environment

Always place the product in a location convenient for viewing the display and indicators.

Avoid improper or prolonged use of keyboards, pointers, and button pads. Improper or prolonged keyboard or pointer use may result in serious injury.

Be sure your work area meets applicable ergonomic standards. Consult with an ergonomics professional to avoid stress injuries.

Use only the Tektronix rackmount hardware specified for this product.

Probes and test leads

Before connecting probes or test leads, connect the power cord from the power connector to a properly grounded power outlet.

Keep fingers behind the protective barrier, protective finger guard, or tactile indicator on the probes. Remove all probes, test leads, and accessories that are not in use.

Use only correct Measurement Category (CAT), voltage, temperature, altitude, and amperage rated probes, test leads, and adapters for any measurement.

Beware of high voltages

Understand the voltage ratings for the probe you are using and do not exceed those ratings. Two ratings are important to know and understand:

- The maximum measurement voltage from the probe tip to the probe reference lead.
- The maximum floating voltage from the probe reference lead to earth ground.

These two voltage ratings depend on the probe and your application. Refer to the Specifications section of the manual for more information.

WARNING: To prevent electrical shock, do not exceed the maximum measurement or maximum floating voltage for the oscilloscope input BNC connector, probe tip, or probe reference lead.

Connect and disconnect properly.

Connect the probe output to the measurement product before connecting the probe to the circuit under test. Connect the probe reference lead to the circuit under test before connecting the probe input. Disconnect the probe input and the probe reference lead from the circuit under test before disconnecting the probe from the measurement product.

De-energize the circuit under test before connecting or disconnecting the current probe.

Connect the probe reference lead to earth ground only.

Ground-referenced oscilloscope use

Do not float the reference lead of the probe when using with ground-referenced oscilloscopes. The reference lead must be connected to earth potential (0 V).

Floating measurement use

Do not float the reference lead of the probe above the rated float voltage.

Terms in this manual and on the product

These terms may appear in this manual:

WARNING: Warning statements identify conditions or practices that could result in injury or loss of life.

CAUTION: Caution statements identify conditions or practices that could result in damage to this product or other property.

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

Symbols on the product



When this symbol is marked on the product, be sure to consult the manual to find out the nature of the potential hazards and any actions which have to be taken to avoid them. (This symbol may also be used to refer the user to ratings in the manual.)

The following symbols may appear on the product.



CAUTION: Refer to Manual



Protective Ground (Earth) Terminal



Earth Terminal



Chassis Ground



WARNING: High Voltage



Connection and disconnection to hazardous bare wire permitted.



Standby



Functional Earth Terminal



Use only on an insulated wire.



Breakable. Do not drop.



Do not connect to or remove from an uninsulated conductor that is HAZARDOUS LIVE.

Compliance information

This section lists the safety and environmental standards with which the instrument complies. This product is intended for use by professionals and trained personnel only; it is not designed for use in households or by children.

Compliance questions may be directed to the following address:

Tektronix, Inc. · PO Box 500, MS 19-045 · Beaverton, OR 97077, US

tek.com

Safety compliance

This section lists other safety compliance information.

Equipment type

Test and measuring equipment.

Safety class

Class 1 – grounded product.

Pollution degree rating

Pollution Degree 2 (as defined in IEC 61010-1). Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.

A measure of the contaminants that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.

Mains overvoltage category rating

Overvoltage Category I (as defined in IEC 60364). For equipment intended to be connected to a mains supply in which means have been taken to substantially and reliably reduce transient overvoltages to a level where they cannot cause a hazard.

NOTE: Only mains power supply circuits have an overvoltage category rating. Only measurement circuits have a measurement category rating. Other circuits within the product do not have either rating.

Environmental compliance

This section provides information about the environmental impact of the product.

Product end-of-life handling

Observe the following guidelines when recycling an instrument or component:

Equipment recycling

Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. To avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.



This symbol indicates that this product complies with the applicable European Union requirements according to Directives 2012/19/EU and 2006/66/EC on waste electrical and electronic equipment (WEEE) and batteries. For information about recycling options, check the Tektronix website (https://www.tek.com/services/recycle).

Battery recycling

This product contains a small installed lithium metal button cell. Please properly dispose of or recycle the cell at its end of life according to local government regulations.

This product may also be packed with a lithium-ion rechargeable battery pack. Please dispose of or recycle the battery pack at its end of life according to local government regulations.

- Rechargeable batteries are subject to disposal and recycling regulations that vary by country and region. Always check and follow your applicable regulations before disposing of any battery. Contact Rechargeable Battery Recycling Corporation (www.rbrc.org) for U.S.A. and Canada, or your local battery recycling organization.
- Many countries prohibit the disposal of waste batteries in standard waste receptacles.
- Place only discharged batteries in a battery collection container. Use electrical tape or other approved covering over the battery connection points to prevent short circuits.

Perchlorate materials

This product contains one or more type CR lithium batteries. According to the state of California, CR lithium batteries are classified as perchlorate materials and require special handling. See www.dtsc.ca.gov/hazardouswaste/perchlorate for additional information.

Transporting batteries

The small lithium primary button cell contained in this equipment does not exceed 1 gram of lithium metal content per cell.

The small lithium-ion rechargeable battery that may also be packed with this equipment does not exceed a capacity of 100 Wh per battery or 20 Wh per component cell. Each battery type has been shown by the manufacturer to comply with the applicable requirements of the UN Manual of Tests and Criteria Part III, Subsection 38.3. Consult your carrier to determine which lithium battery transportation requirements are applicable to your configuration, including to its re-packaging and re-labeling, prior to reshipment of the product by any mode of transport.

If the instrument is being transported to Tektronix for service, remove the rechargeable batteries before repacking the instrument and do not include the batteries in the shipment. Do not ship removable batteries to Tektronix Service Centers.

Operating safely with battery power

For safe operation, the instrument chassis should always remain at earth ground potential.

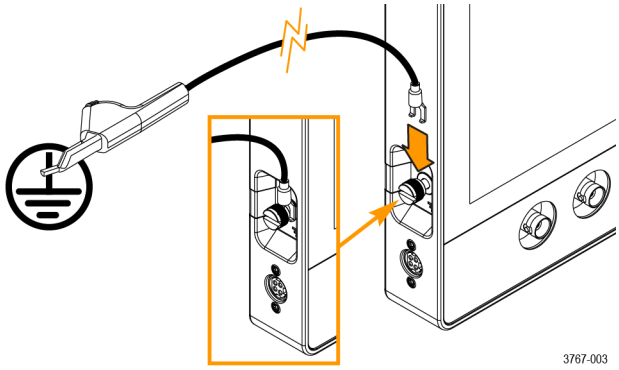
WARNING: To avoid electric shock, always use the Tektronix-provided grounding cable when the oscilloscope is operating on battery power and not connected to the external power supply. The Tektronix-provided grounding cable is not for permanent usage.

Without a connection between the chassis and earth ground, you may receive a shock from exposed metal on the chassis if you connect an input to a hazardous voltage (>30 V_{RMS}, >42 V_{pk}). To protect yourself against possible shock, attach the Tektronix-provided grounding cable.

The grounding cable is necessary to provide protective bonding between the oscilloscope and a dedicated earthing terminal, in accordance with the NEC, CEC, and local codes. Consider having a qualified electrician to approve the installation.

The grounding cable shall be connected before powering on the oscilloscope and before attaching the probes to any circuit. Connect the grounding cable from the ground lug terminal on the side panel of the instrument to a dedicated earthing terminal. Make sure the teeth of the alligator clip makes good electrical contact and is secured against slipping.

The alligator clip on the grounding cable must be connected to a dedicated earthing terminal, an earthing terminal bar, or identified equipment grounding points (a rack cabinet for example). Make sure you have a good electrical connection to an appropriate grounding device that is identified with a Protective Earth symbol, or the word **GROUND**/**GND**, or the color green (green ground screw/conductor). If none of these are present, assume the connection is not earthed.



Always verify that the grounding cable is making good electrical contact by using an ohmmeter or continuity meter between the dedicated earthing terminal and the ground lug terminal on the side panel of the oscilloscope. Verify again anytime the oscilloscope has been left unattended.

Make sure the dedicated earthing terminal is located in close proximity to the circuit under test. Keep the grounding cable clear of heat sources and mechanical hazards such as; sharp edges, screw threads, moving parts, and closing doors/ covers. Inspect the cable, insulation, and terminal ends for damage before use. Do not use a damaged grounding cable. Contact Tektronix for a replacement.

If you choose not to attach the grounding cable, you are not protected against electric shock if you connect the oscilloscope to a hazardous voltage. You can still use the oscilloscope if you do not connect a signal greater than 30 V_{RMS} (42 V_{pk}) to the probe tip, the BNC connector center, or the common lead. Make sure all probe common leads are connected to the same voltage.

WARNING: Hazardous voltages may exist in unexpected places due to faulty circuitry in the device under test.

CAUTION: When operating the instrument on battery power do not connect a grounded device, such as a printer or computer, to the oscilloscope unless the instrument grounding cable is connected to the earth ground.

Operating requirements

Use the instrument within the required operating temperature, power, altitude, and signal input voltage ranges to provide the most accurate measurements and safe instrument operation.

Environment requirements

Characteristic	Description
Temperature	Operating instrument: 0°C to +50°C (+32°F to 120°F), with 5 °C/minute maximum gradient, noncondensing (NC).
	Operating with battery: 0 °C to 45 °C (+32 °F to 113 °F).
	For proper cooling, keep the rear of the instrument clear of obstructions for 2 inches (51 mm).
Operating humidity	5% to 90% relative humidity at temperatures up to +30°C.
	5% to 60% relative humidity at temperatures greater than +30°C and up to +50°C.
Operating altitude	Up to 3000 meters (9842 feet).
Battery power	Requires 2-BATPK battery pack with 2 slots for batteries to be ordered with instrument or 2-BP battery pack with 2 slots for batteries to be ordered post instrument purchase.
	Supports up to 2 TEKBAT-XX Li-Ion rechargeable batteries. Operating time; Up to 4 hours single battery and up to 8 hours dual batteries.
	Tektronix recommends using the TEKCHG-XX external battery charger to charge the TEKBAT-XX batteries in ambient environments greater than +30°C.

Power requirements

Characteristic	Description
Power source voltage	24 V DC
Power source current	2.5 A

Input signal requirements

Keep the input signals within allowed limits to ensure the most accurate measurements and prevent damage to the analog and digital probes or instrument.

Make sure that input signals connected to the instrument are within the following requirements.

Input	Description
Analog input channels and **AUX In**, 1 MΩ setting, maximum input voltage at BNC	300 V_{RMS}
	Measurement Category II
Digital input channels, maximum input voltage range at digital inputs	Observe probe ratings
	P6316 Logic Probe

Security disclaimer

This Software and its associated Equipment are not designed or intended to be used with unsecure networks. You acknowledge that use of the Equipment may rely upon certain networks, systems, and data communication mediums that are not controlled by Tektronix and that may be vulnerable to data or security breaches, including, without limitation, internet networks used by Your internet providers and the databases and servers controlled by Your internet providers. Tektronix shall not be liable for any such breaches, including without limitation, damages and/or loss of data related to any security breach, and disclaims all warranties, including any implied or express warranties that any content will be secure or not otherwise lost or altered.

For the avoidance of doubt, if You choose to connect this Software or Equipment to a network, it is Your sole responsibility to provide and continuously ensure a secure connection to that network. You agree to establish and maintain appropriate measures (e.g., firewalls, authentication measures, encryption, anti-virus applications, etc.) to protect the Software and Equipment and any associated data against security breaches including unauthorized access, destruction, use, modification, or disclosure.

Notwithstanding the foregoing, You shall not use any Products in a network with other products or services that are incompatible, insecure or not compliant with applicable laws.

Preface

This manual provides product safety and compliance information, describes how to connect and power on the oscilloscope, and introduces the instrument features, controls and basic operations. See the product Help document for more detailed information. Go to tek.com/warranty-status-search for warranty information.

MSO22 and MSO24 key features and benefits

- Bandwidths from 70 MHz to 500 MHz
- 2- and 4- analog channel inputs
- 10.1" TFT color (1280 x 800 pixels) Capacitive multi-touch display
- User interface optimized for touch screen use
- 2.5 GS/s sample rate for half channels and 1.25 GS/s sample rate for all channels
- 10 M points record length on all channels
- Battery pack option includes 2 battery slots and hot-swap capability of the batteries within the battery pack module
- No set limit on the number of math, reference, and bus waveforms you can display (the number of waveforms depends on available system memory)
- Integrated options include 16 Channel MSO, 50 MHz Arbitrary Function Generator (AFG), and 4 Bit Digital Pattern Generator.
- Advanced serial bus triggering and analysis option lets you decode and trigger on industry standard buses
- Industry standard VESA interface can be used with several accessories offered by Tektronix and it is also compatible with off the shelf VESA mounts

Install option upgrade licenses

Option license upgrades are field-installable licenses that you can purchase after receiving your instrument to add features to your oscilloscope. You install option upgrades by installing license files on the oscilloscope. Each option requires a separate license file.

Before you begin

These instructions do not pertain to options that were purchased and pre-installed on your instrument when ordered.

A node-locked license is valid only for the specific model number and serial number of the instrument for which it was purchased; it will not work on any other instrument. The single license file does not affect options that were factory installed or any other upgrades that you may have already purchased and installed.

About this task

NOTE: You can only install a Node Locked option license one time. If you need to reinstall an uninstalled Node Locked license, contact Tektronix Customer Support.

Procedure

1. Follow the instructions you received to download the upgrade license file (<filename>.lic).
2. Copy the license file or files to a USB memory device.
3. Insert the USB drive into the powered-on oscilloscope for which the upgrade was purchased.
4. Select **Help** > **About**.
5. Select **Install License** to open the Browse License Files dialog box.

6. Find and select the upgrade license file to install.
7. Select **Open**. The oscilloscope installs the license and returns to the About screen. Verify that the installed license was added to the Installed Options list.
8. Repeat steps 5 through 7 for each upgrade license file that you purchased and downloaded.
9. Power cycle the oscilloscope to enable the installed upgrades.
10. If you installed a bandwidth upgrade, rerun signal path compensation (SPC). Then carefully remove the model/bandwidth label from the lower-left corner of the front panel and install the new model/bandwidth label that was sent through normal mail channels as part of the upgrade purchase.

Check shipped accessories

Make sure that you received everything you ordered. If anything is missing, contact Tektronix Customer Support. In North America, call 1-800-833-9200. Worldwide, visit www.tek.com to find contacts in your area.

Check the packing list that came with your instrument to verify that you have received all standard accessories and ordered items. If you purchased factory installed options such as a Serial Bus and Triggering option, tap **Help > About** to confirm that the options are listed in the **Installed Options** table.

Item	Quantity	Tektronix part number
Installation and Safety Manual	1	071-3764-xx
TPP0200 200 MHz, 10x probe	One per channel	TPP0200
Instrument stand	1	N/A
Power cord	1	Depends on region
Calibration certificate	1	N/A
Report of factory installed licenses	1	N/A

Check that the instrument passes power-on self tests

Power-on self tests verify that all instrument modules are working correctly after power up.

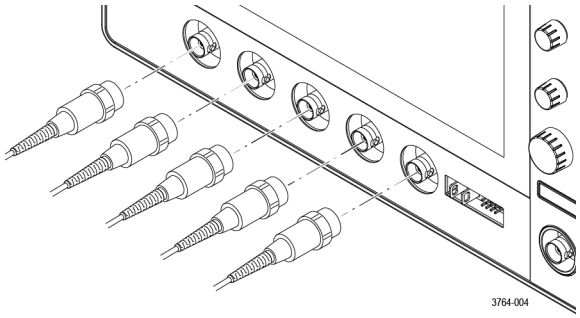
1. Power on the instrument and wait until the instrument screen appears.
2. Select **Utility > Self Test** from the top-edge Menu bar to open the **Self Test** configuration menu.
3. Check that the status of all power-on self tests are **Passed**.

If one or more power-on self tests shows **Failed**:

1. Power cycle the instrument.
2. Select **Utility > Self Test**. If one or more power-on self tests still shows **Failed**, contact Tektronix Customer Support.

Connecting probes to the instrument

Probes connect the instrument to your device under test (DUT). Use a probe that best matches your signal measurement needs.



Connect a BNC passive probe or cable by pushing it onto a channel BNC bayonet connector and turn the lock mechanism clockwise until it locks.

Rackmount option information

An optional rackmount kit lets you install the oscilloscope in standard equipment racks.

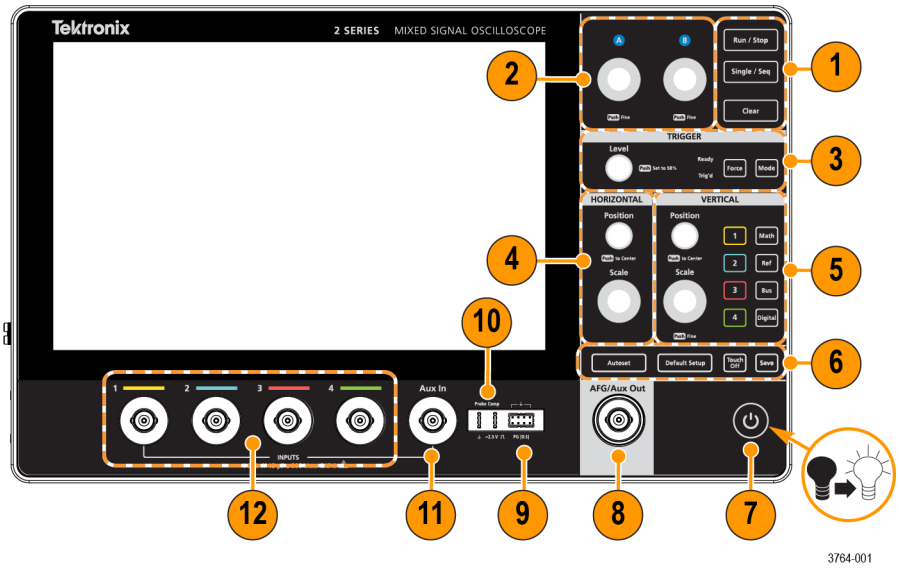
Please refer to the product datasheet at tek.com (tek.com, https://www.tek.com) for information on rackmount options.

Getting acquainted with your instrument

The following content provides a high-level description of the instrument controls and user interface. Refer to the instrument help for detailed information on using the controls and user interface to display waveforms and take measurements.

Front panel controls and connectors

The front panel controls provide direct access to key instrument settings such as vertical, horizontal, trigger, cursors, and zoom. The connectors are where you input signals with probes or cables.



3764-001

Description	
1	Use the **Acquisition** controls to start and stop waveform acquisition, enable making a single waveform acquisition, calculate the average of all the samples for each acquisition interval, and delete the current acquisitions and measurement values from memory.
2	Use the Multipurpose Knobs (A, B) to move cursors, adjust the zoom, and set parameter values in configuration menu input fields.
3	Use the **Trigger** controls to force a trigger event at a random point in the waveform and capture the acquisition, set the amplitude level that the signal must pass through to be considered a valid transition, and set how the instrument behaves in the absence or presence of a trigger event.
4	Use the **Horizontal** controls to move the waveform from side to side on the screen, and set the time per major horizontal graticule division and samples/second parameters for the oscilloscope.
5	Use the **Vertical** controls to move the selected waveform up or down on the screen, set the amplitude units per vertical graticule division of the selected waveform, turn on (display) or select channels, and add or select a math, reference (saved), bus, and digital waveform on the Waveform view.
6	Use the Miscellaneous controls to turn touchscreen capability off, restore the oscilloscope settings to the default settings, automatically display a stable waveform, and save files or settings (using the current File > Save As settings).

	Description
7	After connecting the supplied power cord, use the power button to power the instrument on and off. The power button color indicates the following instrument states; amber is standby, blue is on, unlit is off. Always allow 10 seconds between power down and power up of the instrument before operating the instrument. When the batteries in the 2-BP battery pack on your instrument have a low battery charge and the power cord is not connected, the power button will blink twice and then your instrument will turn off.
8	The **AFG/AUX Out** BNC connector is multiplexed. You must select either AFG or Aux Out to use this connector. AFG is the signal output for the optional Arbitrary Function Generator (AFG) feature. AUX Out generates a signal transition on a trigger event or outputs a synchronization signal from the AFG.
9	Pattern Generator (PG) is a signal output for four Digital signals. Wait until the instrument has completed the power on process before connecting to the PG connector. Disconnect from the PG connector before powering the instrument down.
10	Use Ground and probe compensation connectors to provide a ground connector to help reduce electrostatic damage (ESD) and adjust the high-frequency response of a passive probe.
11	Auxiliary trigger input (**Aux in**) is a connector to which you can connect an external trigger input signal. Use the Aux In trigger signal with the Edge trigger mode.
12	Use the Probe connectors to connect BNC passive probes and BNC cables.

Button and knob functions

A description of the functionality of each button and knob on your instrument.

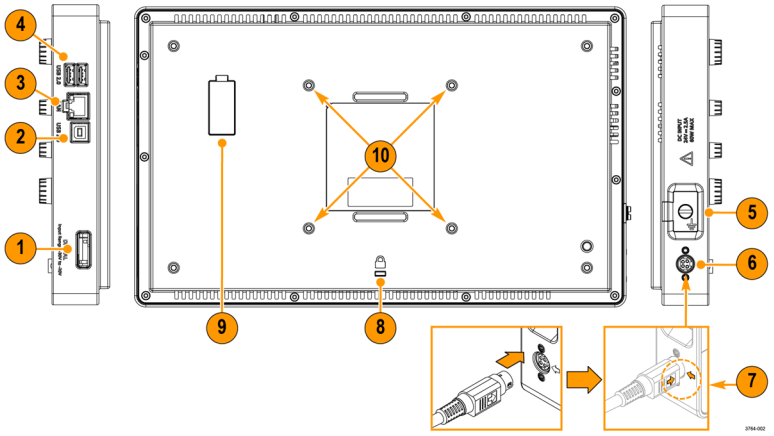
Button	Description
Run/Stop	Starts and stops waveform acquisition. The button color indicates the acquisition status (green indicates running and acquiring; red indicates stopped). When stopped, the oscilloscope shows waveforms from the last completed acquisition. The **Run/Stop** button on the screen also shows the acquisition status.
Single/Seq	Enables making a single waveform acquisition, or a specified number of acquisitions (as set in the Acquisition configuration menu). Pushing **Single/Seq** turns off **Run/Stop** mode and takes a single acquisition. The button color indicates the acquisition status (quick green flash indicates single acquisition acquired; solid green indicates waiting for trigger event). Pushing **Single/Seq** again takes another single acquisition.
Clear	Deletes the current acquisitions and measurement values from memory.
A and B knobs	The multipurpose knobs A and B move cursors and set parameter values in configuration menu input fields. Selecting an menu field that can use a multipurpose knob assigns the indicated knob to change the value in that input field. The ring around each knob lights when you can use that knob to do an action. Push a multipurpose knob to enable the **Fine** mode for making smaller increment changes. Push the knob again to close **Fine** mode.
Force	Forces a trigger event at a random point in the waveform and captures the acquisition.

Button	Description
Level	Sets the amplitude level that the signal must pass through to be considered a valid transition. The color of the **Level** knob LED indicates the trigger source except for dual-level triggers. The **Level** knob is not available when the trigger type requires two level settings or other trigger qualifiers (set from the Trigger configuration menu). Push the knob to set the threshold level to 50% of the peak-to-peak amplitude range of the signal.
Mode	Sets how the instrument behaves in the absence or presence of a trigger event.
	Auto trigger mode enables the instrument to acquire and display a waveform whether or not a trigger event occurs. If a trigger event occurs, the instrument displays a stable waveform. If a trigger event does not occur, the instrument forces a trigger event and acquisition and displays an unstable waveform.
	Normal trigger mode sets the instrument to acquire and display a waveform only when there is a valid trigger event. If no trigger occurs, the last waveform record acquired remains on the display. If no last waveform exists, no waveform is displayed.
Horizontal Position	Moves the waveform and graticule side to side on the screen (changing the trigger point position in the waveform record). Push the knob to center the trigger event to the center graticule on the Waveform view.
Horizontal Scale	Sets the time per major horizontal graticule division and samples/second parameters for the oscilloscope. Scale applies to all waveforms. Push the knob to enable the **Fine** mode for making smaller increment changes. Push the knob again to close **Fine** mode.
Vertical Position	Moves the selected waveform (Channel, Math, Reference, Bus) and its graticule up or down on the screen. The color of the knob indicates which waveform the knob is controlling. Push the knob to set the threshold level to 50% of the peak-to-peak amplitude range of the signal.
Vertical Scale	Sets the amplitude units per vertical graticule division of the selected waveform. The scale values are shown on the right edge of the horizontal graticule lines, and are specific to the selected waveform in both **Stacked** or **Overlay** modes (in other words, each waveform has its own unique vertical graticule settings regardless of display mode). The color of the knob indicates which waveform the knob is controlling.
Channel buttons	Turn on (display), select, or turn off Channel, Math, Reference, or Bus waveforms. The number of channel buttons depends on the instrument model. If the channel is not displayed, pushing a Channel button turns on that channel to the Waveform view. If the channel is on the screen and is not selected, pushing that channel's button selects that channel. If the channel is on the screen and is also selected, pushing that channel's button turns that channel off (removes it from Waveform view).
Math	Adds or selects a Math waveform on the Waveform view. If no Math waveform exists, pushing the **Math** button adds a Math waveform to the Waveform view and opens the Math configuration menu. If only one Math waveform is displayed, pushing the button turns off the Math waveform (removes it from Waveform view). Push the button again to display the waveform. If two or more Math waveforms are displayed, pushing the button cycles through selecting each math waveform.
Ref	Adds or selects a Reference (saved) waveform on the Waveform view. If no Reference waveform exists, pushing the button opens the **Browse Waveform Files** configuration menu. Navigate to and select a waveform file (*.wfm) and tap **Recall** to load and display the reference waveform. If only one Reference waveform is displayed, pushing the button turns off the Reference waveform (removes it from the Waveform View). Push the button again to display the waveform. If two or more Reference waveforms are displayed, pushing the button cycles through selecting each Reference waveform.

Button	Description
Bus	Adds or selects a bus waveform on the Waveform view. If no Bus waveform exists, pushing the button adds a Bus waveform to the Waveform view and opens the Bus configuration menu. If only one Bus waveform is displayed, pushing the button turns off the Bus waveform (removes it from Waveform view). If two or more Bus waveforms are displayed, pushing the button cycles through selecting each Bus waveform.
Digital	Adds or selects a digital waveform on the Waveform view. If no digital waveform exists, pushing the button adds a digital waveform to the Waveform view and opens the digital configuration menu. If only one digital waveform is displayed, pushing the button turns off the digital waveform (removes it from Waveform view). If two or more digital waveforms are displayed, pushing the button cycles through selecting each digital waveform.
Autoset	Automatically displays a stable waveform.
Default Setup	Restores the oscilloscope settings (such as; horizontal, vertical, scale, position) to the factory default settings.
Touch Off	Turns touch screen capability off. The button is lighted when the touch screen is turned off.
Save	Save is a one-push save operation that uses the current **File > Save As** settings to save screen-shots (including open menus and dialog boxes), waveform files, instrument settings. If a **File > Save** or **File > Save As** operation has occurred since the last instrument startup, pushing the button saves the file types to the location last set in the **Save As** configuration menu. If no file save operation has occurred since the last instrument startup, pushing the button opens the **Save As** configuration menu. Select a tab to choose the type of file to save (such as; Screen Capture and Waveform), set any associated parameters, and where to save it, and select OK. The specified file or files are saved. The next time you push the button, the same type files are saved. Screen Captures save the entire screen, including most displayed configuration menus and dialog boxes.

Rear and side panel connections

The rear and side panel connections supply power to the instrument and provide connectors for network, USB devices, digital probes, battery pack, and instrument stand.



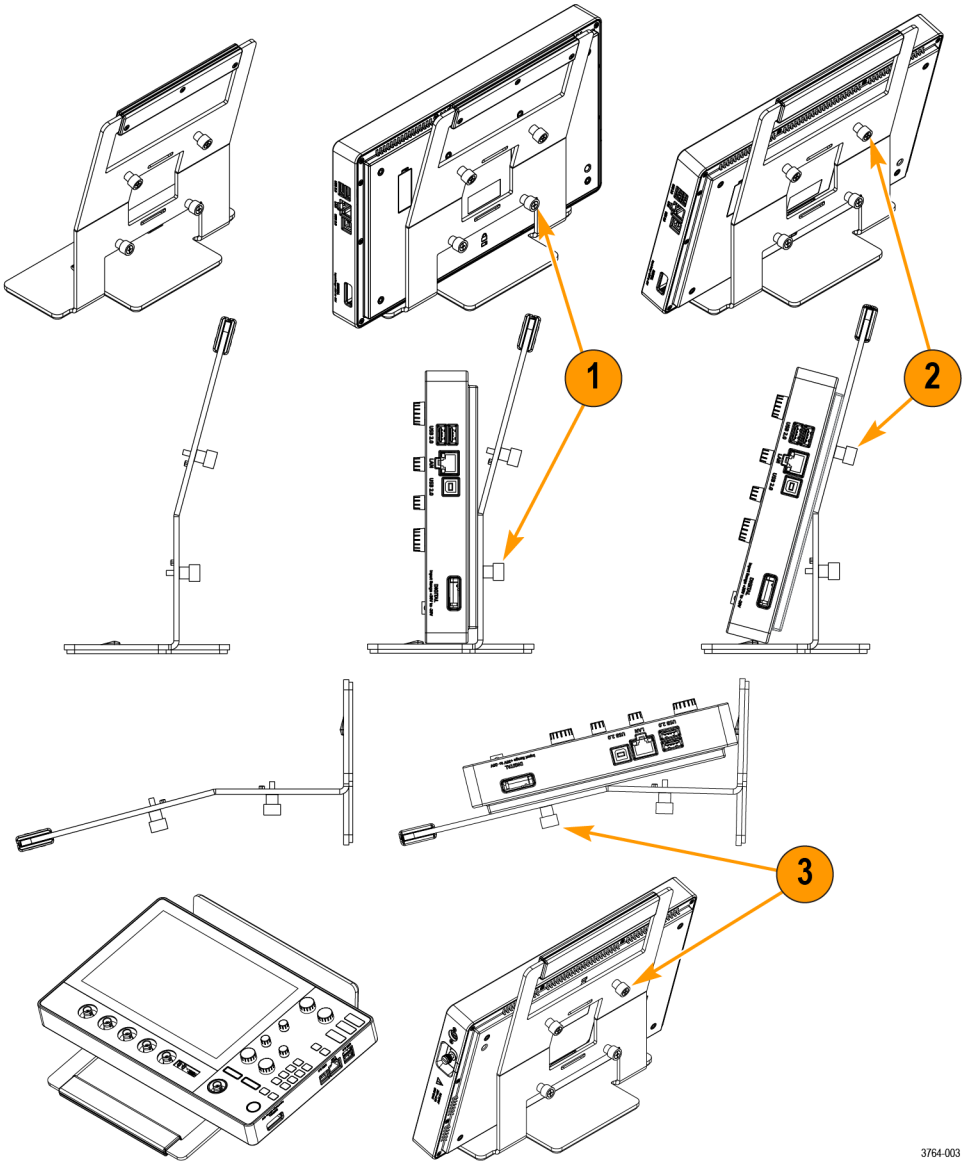
CAUTION: The battery interface connector is susceptible to Electrostatic Discharge (ESD). Use ESD precautions with installing or removing the battery pack.

Description	
1	Use the digital probe connector to connect the P6316 Logic Probe.
2	Use the **USB Device** port to connect to a PC to remotely control the oscilloscope using the USBTMC protocol.
3	Use the LAN connector (RJ-45) to connect the oscilloscope to a 10/100 Base-T local area network.
4	Use the two **USB Host** ports to connect a USB memory device, keyboard, or mouse
5	The ground lug external chassis ground point allows you to connect your instrument chassis to a ground reference. Use the ground lug when the instrument is operating on power from the optional battery pack accessory. Attach an anti-static wrist strap to the ground lug to reduce electrostatic damage (ESD) while you handle or probe the DUT.
6	To power the instrument, connect the supplied power cord to the power connector slot on the side of the instrument. Then connect the power cord to the appropriate AC mains source and use the power button. Use only the power cord specified for this product and certified for the country of use. To completely remove power from the instrument, disconnect the power cord. Use the power cord latch when removing the power cord from the power connector.
7	The power cord has a high force, latching connector to secure the power cord in place. Align the arrow on the latch with the arrow next to the connector. Push the latch in until the connector is fully seated. Hold onto the power cord latch and move it away from the power connector slot to disconnect the power cord.
8	Use the security lock connector to secure the oscilloscope to a work bench or other location with a standard PC/laptop lock cable.
9	Use the battery interface connector to connect the external battery pack to the instrument. See the instructions that come with the battery pack for more information.
10	Use the VESA mount (100mm x 100mm) screws to mount your instrument to the supplied stand or other compatible VESA accessories.

Instrument stand installation

Mount your instrument to the provided stand in three configurations.

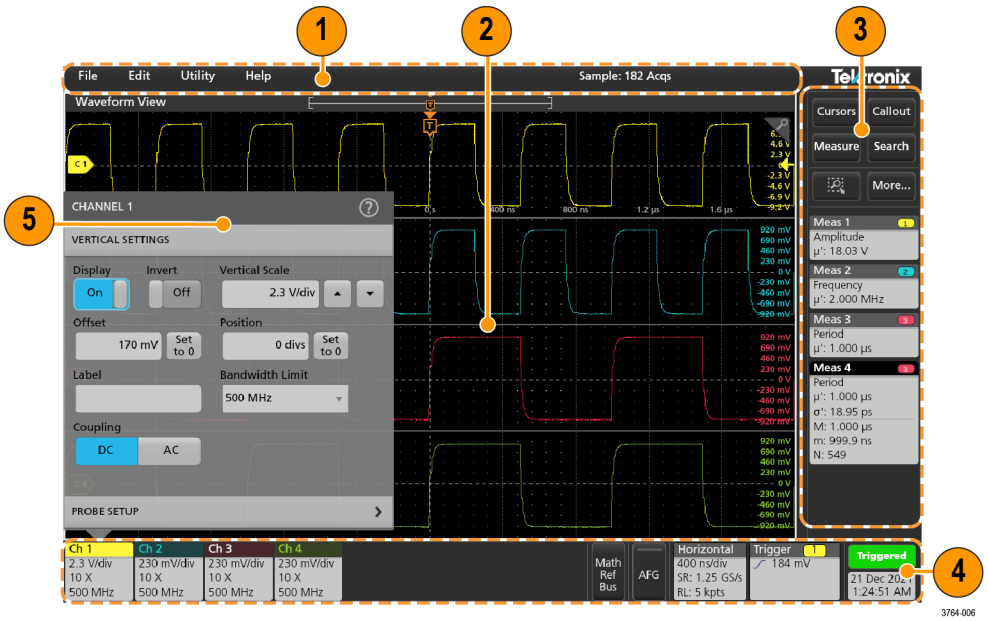
Align the stand with the four VESA screw mounts (closest to the label) on the back of the instrument.



1. Hand tighten the bottom two screws on the stand to the bottom two VESA screw mounts. The instrument is now secured to the stand straight up and down.
2. Hand tighten the top two screws on the stand to the top two VESA screw mounts. The instrument is now secured to the stand at a fifteen degree angle.
3. Turn the instrument upside-down and hand tighten the top two screws on the stand to the bottom two VESA screw mounts. The instrument is now secured to the stand at a seventy-five degree angle when the stand is laying flat.

User interface

The touch screen user interface contains waveforms and plots, measurement readouts, and touch-based controls to access all oscilloscope functions.

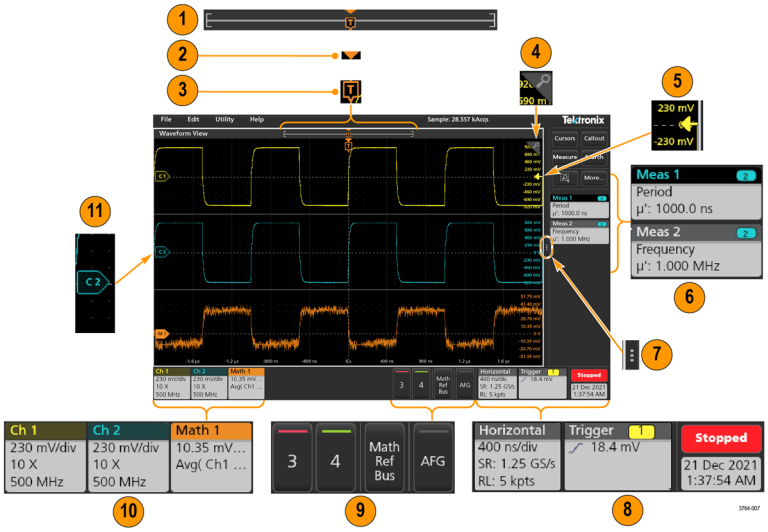


Description	
1	The menu bar provides menus for typical operations including:
	Saving, loading, and accessing files Undoing or redoing an action Setting oscilloscope display and measurement preferences Configuring network access Running self tests Erasing measurement and settings memory Loading option licenses Opening a Help viewer
2	The Waveform view area displays analog, digital, math, reference, bus, and trend waveforms. The waveforms include waveform handles (identifiers), individual vertical graticule scale labels, and trigger position and level indicators. You can set the Waveform View to stack each waveform vertically in separate graticule, called slices (the default mode), or overlay all the waveforms on the screen (traditional waveform view). You can also add Measurement Results views (plots) for individual measurements. These plot views are separate view windows that you can move on the screen by dragging their title bar to a new position.

	Description
3	The results bar contains controls for displaying cursors, adding callouts, plots, and result tables to the screen. You also are able to add badges to the results bar. To remove a measurement, search or other badge from the results bar flick-it off screen. The controls are:
	The **Cursors** button displays on-screen cursors in the selected view. Touch and drag, or use the multipurpose knobs, to move the cursors. Double-tap on a cursor, or on the cursor readouts, to open a configuration menu to set cursor types and related functions. The **Callout** button adds a callout object to the selected view. Double-tap the callout text to open a configuration menu to change the type of callout, text and font characteristics. Drag any callout other than bookmark to any location on the oscilloscope screen view. Bookmarks callout can only be added to wave views and spectrum views. The **Measure** button opens a configuration menu from which to select and add measurements to the results bar. Each measurement you add has a separate badge. Double-tap a measurement badge to open its configuration menu. The **Search** button lets you detect and mark a waveform where specified events occur. Tap **Search** to open a configuration menu and set the search conditions for analog and digital channels. You can add any number of searches to the same waveform or to different waveforms. Search badges are added to the results bar. The zoom icon button at lets you to draw a box on the screen to zoom in on an area of interest, drawing segments for mask testing, or drawing areas to define visual trigger conditions. The **More...** button allows you to select **Zoom** and **Mask**.
4	The settings bar contains the following elements. Tap a channel or waveform button to add it to the screen and display a badge. Double-tap a badge to open its configuration menu.
	System badges for setting Horizontal, Trigger, and Date/Time parameters Inactive Channel buttons to turn on channels Add New Waveform buttons to add math, reference, and bus waveforms to the display Channel and Waveform badges that let you configure the individual waveform parameters
5	Configuration menus let you quickly change the parameters of the selected user interface item. You can open configuration menus by double-tapping on badges, screen objects, or screen areas.

User interface elements

Each area of the user interface has a specific function that helps manage information or controls.



1. The Waveform Record View is a graphical high-level view of the overall waveform record length, how much of the record is on the screen (shown in brackets), the location of key time events including the trigger event, and the current position of waveforms cursors.

   If you are displaying a Reference waveform that is shorter than the current acquisition record length, or you are changing the horizontal time scale while the oscilloscope acquisition is stopped, the brackets change position to show the part of the waveform record that is being viewed relative to the current acquisition total record length.

   If cursors are active on a waveform, the Waveform Record View shows the relative cursor positions as small vertical dashed lines.

   When in Zoom mode, the Waveform Record View is replaced with the Zoom Overview.

2. The Expansion Point icon on the waveform view shows the center point around which the waveform expands and compresses when changing horizontal settings.
3. The Trigger Position Indicator shows where the trigger event occurred in the waveform record. The trigger icon is displayed in the waveform slice that is the trigger source.
4. The Zoom icon switches zoom on and off. The front panel Multipurpose knobs also turn on zoom mode and change the position and horizontal size of the Zoom Box.
5. The Trigger Level Indicator icon shows the trigger level on the trigger source waveform. Some trigger types require two trigger levels.
6. Measurement and Search badges show measurement and search results.
7. The Results Bar Handle opens or closes the results bar, to maximize waveform screen viewing when needed. To reopen the results bar, either tap the handle icon or swipe left from the right side of the display.
8. The System badges show global instrument settings (**Horizontal**, **Trigger**, Run/Stop status, and Date/Time).
9. The Inactive Channel buttons add channel waveforms to the Waveform view and add an associated Channel badge to the Settings bar.

   The optional **AFG** button opens the AFG configuration menu to set and enable the AFG output. This button is only present if the AFG option is installed.

The optional **PG** button opens the PG configuration menu to set and enable the PG output. This button is only present if the DPG option is installed.

The optional **D15-D0** button opens the digital channel configuration menu to set and enable the digital channel. This button is only present if the 2-MSO option is installed.

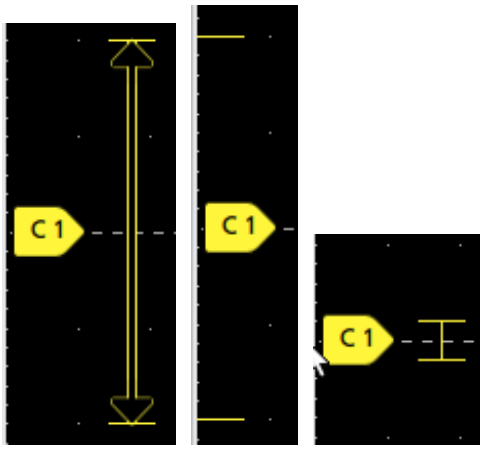
10. Double-tap a badge to open its associated configuration menu. If you add more Channel or Waveform badges than can fit in the waveform badge display area, tap the scroll buttons at each end of the waveform badge area to scroll and display hidden badges.
11. The Waveform Handles on each waveform identify the source of that waveform (C*x* for channels, M*x* for Math waveforms, R*x* for Reference waveforms, B*x* for bus waveforms). The waveform handles are at the zero-volt level of the waveform by default. The currently selected waveform handle is a solid color; unselected waveform handles are outlined.

    Double-tapping a waveform handle opens the configuration menu for that waveform.

    For digital channels, the waveform handle shows the channel number. Each individual digital signal is labeled D0–D15 and is with a different color.

    Double-tapping a digital waveform handle opens the digital channel configuration menu.

    Dragging a digital signal handle over another handle swaps those two signals on the waveform.



Badges

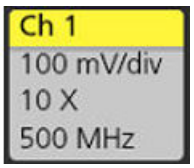
Badges are rectangular icons that show waveform, measurement, and instrument settings or readouts. Badges also provide fast access to configuration menus. The badge types are Channel, Waveform, Measurement, Search, and System.

Channel and Waveform badges

Channel and Waveform (**Math**, **Ref**, **Bus**) badges are shown in the settings bar, located along the bottom left of the screen. Each waveform has its own badge. The badges show high-level settings for each displayed channel or waveform. Double-tap a badge to open its configuration menu.



Most Channel and Waveform badges also have Scale buttons, shown by single-tapping the badge. Use the Scale buttons to increase or decrease the vertical scale setting for that waveform.



You can drag Channel and Waveform badges to change their position in the **Settings** bar and open the badge right-click menu to access a quick-action menu.

Right click menu for Channel and Waveform badges

Badge readout	Description
Turn Ch On/Off	Tap to turn On or Off the channel depending on the state.
Copy to Ref Wfm	Select Copy to Ref Wfm to save the waveform and recall it as a new reference waveform. This option is unavailable for Bus reference waveforms and SIM reference waveforms.
Configure Ch	Tap to configure instrument channel. This opens the vertical setting panel.
Termination	Set the termination value for channel waveform.
Coupling	Set the coupling value for channel waveform.
Bandwidth	Set the bandwidth for the channel waveform.
Label	Enter label text for the channel using virtual keypad or keypad connected to instrument.

There are two ways to delete Channel and Waveform badges.

- Right-click the badge and turn it off.
- Flick the badge off the bottom edge of the display to remove it from the **Settings** bar. Flicking upwards from the bottom edge of the **Settings** bar recovers the badge. Badge recovery is only possible within 10 seconds of removal.

Channel badges are listed in the channel order unless you have moved them. Channel badges may also display short error or warning messages. For more information double-tap the badge to open its configuration menu, or search the instrument Help.

Waveform badges (**Math**, **Ref**, **Bus**) are listed in the order created (unless they have been moved), and are grouped together by type. Deleting a Waveform badge does not change the order or names of the remaining badges.

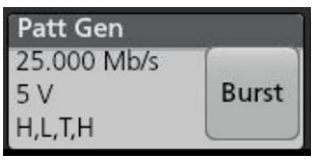
Measurement badges

Measurement badges are located in the **Results** bar. They show measurements or search results. The badge title also shows the measurement source or sources. To add a Measurement badge, tap the **Measure** button and select a measurement.

Double-tap a Measurement badge to open its configuration menu to change or refine settings. The default measurement badge readout shows the measurement's mean (μ) value.

Pattern Generator badge

The pattern generator badge display in the Settings bar when pattern generator is set to Continuous or Burst mode.



The pattern generator badge lists the bit rate, amplitude, and pattern definition. If the **Pattern Definition** is set to **Manual**, the badge shows the Bits 3 to 0. If **Pattern Definition** is set to **File**, the badge shows the file name. The Burst button displays in the badge when pattern generator **Output** is set to **Burst**.

To delete the pattern generator badge, right-click the badge and select **Output** > **Off**.

Mask Test badge

The mask test results and measurement statistics are displayed in the **Mask Test** badge in the Results bar. The badge is created when the first segment of a mask is defined.



Badge readout	Description
Label (optional readout)	A label defined in the badge configuration menu.
Tested	The total number of waveforms tested against the mask.
Passed	The number of waveforms that contained no samples that violated the mask.
Failed	The number of waveforms that contained one or more samples that violated the mask. Displays in red if greater than or equal to the total failures threshold.
Cons	The highest number of consecutively failed waveforms in the test run. Displays in red if greater than or equal to the consecutive failures threshold.
Status	The status of the mask test. It can be On, Off, Passed/Passing (green) or Failed/Failing (red).
Seg n (optional readout)	The number of waveforms that contained one or more samples that violated mask segment n.

Double-tap a Mask Test badge to open its configuration menu to change or refine settings.

You can drag the badge to change its position in the **Results** bar and open the badge right-click menu to access a quick-action menu.

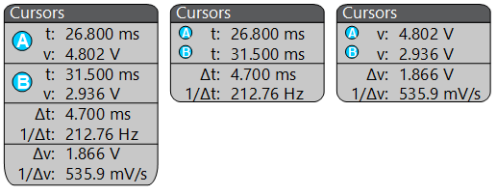
There are two ways to delete Channel and Waveform badges.

- Right-click the badge and turn it off.
- Flick the badge off the right edge of the display to remove it from the **Results** bar. Flicking left from the right edge of the **Results** bar recovers the badge. Badge recovery is only possible within 10 seconds of removal.

See for the mask test configuration settings Create a Mask for more information masks and Mask Test badge configuration menu.

Cursor badges

You can display the cursor readouts in a **Cursors** badge in the Results bar. The badge contents depend on the cursor in use.



To create a cursor readouts badge, turn on **Cursors**, double-tap a cursor readout to open its configuration menu, and set the **Readouts** mode to **Badge**.

NOTE: You can only view cursor readouts in one location at a time; either on the waveform or in a Cursors badge.

You can drag the badge to change its position in the **Results** bar and open the badge right-click menu to access a quick-action menu.

There are two ways to delete Channel and Waveform badges.

- Right-click the badge and turn it off.
- Flick the badge off the right edge of the display to remove it from the **Results** bar. Flicking left from the right edge of the **Results** bar recovers the badge. Badge recovery is only possible within 10 seconds of removal.

Search badges

Search badges are also shown in the Results bar, below the Measurement badges. A search badge lists the search source, search type, and the number of search event occurrences in the current acquisition. The instrument marks the waveform where those events occur with small down-pointing triangles along the top of the waveform graticule. Double-tap a search badge to open its configuration menu to change or refine search settings.

Search badges are created by tapping the **Search** button. Use the displayed configuration menu to set the search criteria.

Search badges have **<** (Previous) and **>** (Next) Navigation buttons that open the Zoom mode and center the waveform in the display at the position of the previous or next search mark in the waveform record. Search badge Navigation buttons are only usable when the oscilloscope is in single acquisition mode. Single-tap a badge to close the Navigation buttons.



Some searches also provide **Min** and **Max** navigation buttons that open the Zoom mode and center the waveform in the display at the minimum or maximum value for that search event in the current acquisition.

Search badges are listed in the order created. Deleting a **Search** badge does not change the order or names of the remaining badges.

You can drag Search badges to change their position in the **Results** bar and open the badge right-click menu to access a quick-action menu.

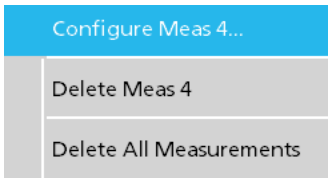
There are two ways to delete Channel and Waveform badges.

- Right-click the badge and turn it off.
- Flick the badge off the right edge of the display to remove it from the **Results** bar. Flicking left from the right edge of the **Results** bar recovers the badge. Badge recovery is only possible within 10 seconds of removal.

Deleting mass Measurements/Searches badges at once

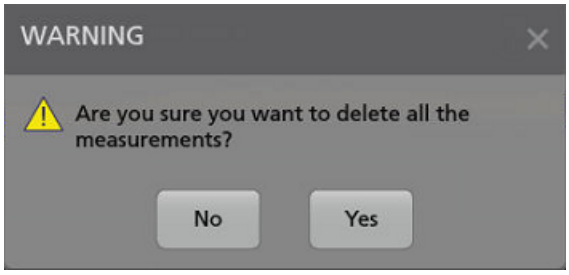
This badge helps you to delete/remove many number measurements or searches, which are in the Results bar.

1. Select and right click the Measurement/Search badge in the **Results** bar, which displays the dialog box as shown:



Controls	Description
Configure Measurement/Search	Configure Measurement or Search badges
Delete Measurement/Search	Deletes the selected Measurement (standard, etc.)/Search badge in the Results bar.
Delete All Measurement/Search	Deletes all the Measurement (standard, etc.)/Search badges in the Results bar.

2. When **Delete All Measurements** is selected, the oscilloscope asks for the confirmation to delete all the measurements/search at a time.

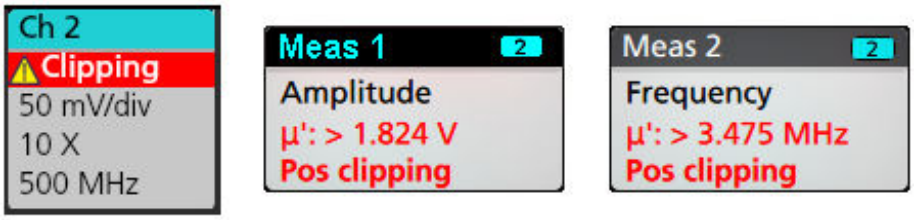


3. The dialog box provides you a checkbox that gives the choice to bypass remaining information dialogs.
   - **Don't ask for remaining items**: Default is unchecked. If you leave it unchecked and clear the information dialog, then the dialog will appear again for the next measurement deletion.
   - If the box is checked, it proceeds with deleting the rest of the items without bringing up the dialog box again. The dialog box appears for each set of measurements you want to delete.

Signal clipping and badges

WARNING: Clipping is caused by excessive or dangerous voltage at the probe tip, and/or a vertical scale setting that is not adequate to display the entire vertical range of the waveform. Excessive voltage at the probe tip can injure the operator and cause damage to the probe and/or instrument.

This instrument shows a warning triangle symbol and the words Clipping in a Channel badge when a vertical clipping condition exists. Any measurement badges associated with that channel also indicate a clipping condition by turning the measurement text red and listing the type of clipping (positive or negative).

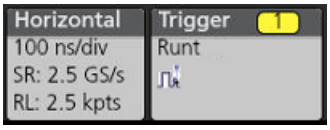


To close the clipping message, change the vertical scale to show the entire waveform, disconnect the probe tip from the excessive voltage source, and check that you are probing the correct signal using the correct probe.

Clipping causes inaccurate amplitude-related measurement results. Clipping also causes inaccurate amplitude values in saved waveform files. If a math waveform is clipped, it will not affect amplitude measurements on that math waveform.

System badges

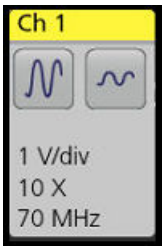
System badges (in the settings bar) display the main Horizontal and Trigger settings. You cannot delete System badges.

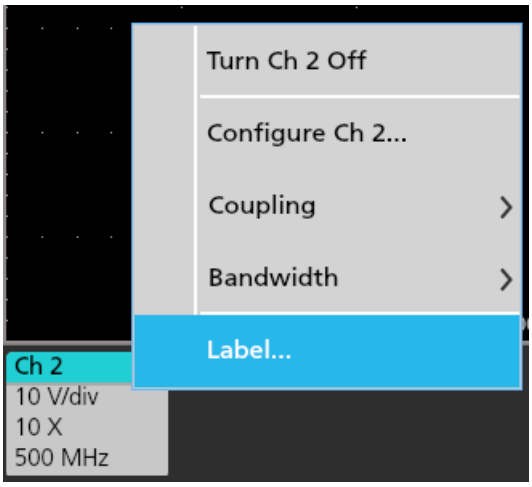


Double-tap a System badge to open its configuration menu.

The Horizontal badge also has Scale buttons, shown by single-tapping the badge. Use the Horizontal Scale buttons to increase or decrease the horizontal time settings.

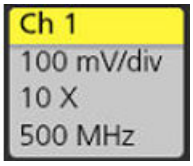
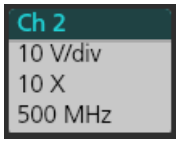
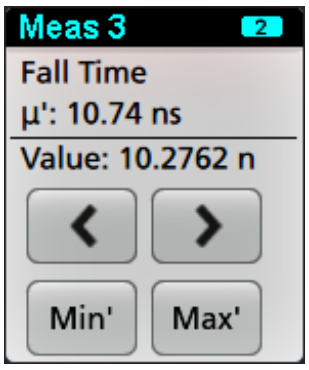
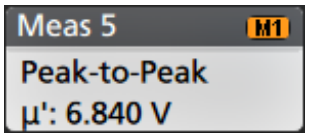
Common badge actions

Action	Result	Example
Single tap	Immediate access controls (Scale, Navigation)	
Double tap	Configuration menu with access to all settings for the badge.	

Action	Result	Example
Touch and hold	Right-click menu with single tap access to common actions. Typical actions include turning off a channel and deleting a measurement or search badge.	
Flick	Flick the badge off the bottom edge of the display to remove it from the **Settings** bar. Flick the badge off the right edge of the display to remove it from the **Results** bar. Flick from the right or bottom edge to recover a removed badge. This action is only possible within 10 seconds of badge removal.	

Badge selection status

The appearance of a badge indicates its selection status (selected or unselected), or if a measurement needs to be deleted to close a channel or waveform badge.

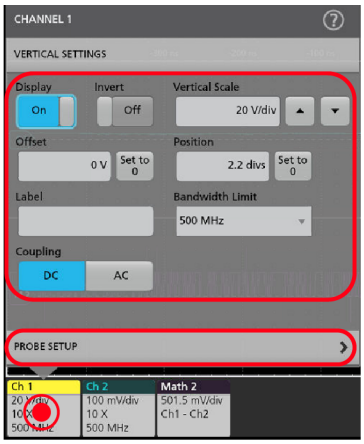
Badge type	Selected	Unselected	Turned off or in use
Channel or Waveform			
Measurement			N/A

A dimmed Channel badge means the screen waveform is turned off (but not deleted). A dimmed Waveform badge means that the waveform display is turned off, or it is being used as a source by a measurement and cannot be deleted until the measurement is deleted.

Configuration menus

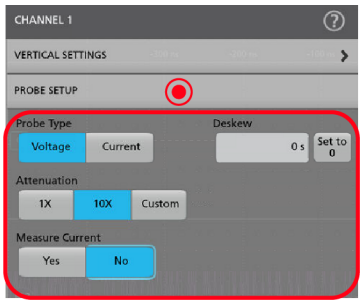
Configuration menus let you quickly set the parameters for channels, system settings (Horizontal, Trigger), measurements, cursor readouts, Waveform and Plot views, callout text, and so on.

Double-tap an item (badge, **Waveform View** or **Plot View**, cursor readouts, callout text, and so on) to open its configuration menu. For example, double-tap a Channel badge in the **Settings Bar** to open its configuration menu.



Selections or values that you enter take effect immediately. Menu contents are dynamic, and can change depending on your selections, instrument options, or attached probes.

Related settings are grouped into 'panels'. Tap the panel name to show those settings. Changes to panel settings can change the values and/or fields shown in that panel and other panels.

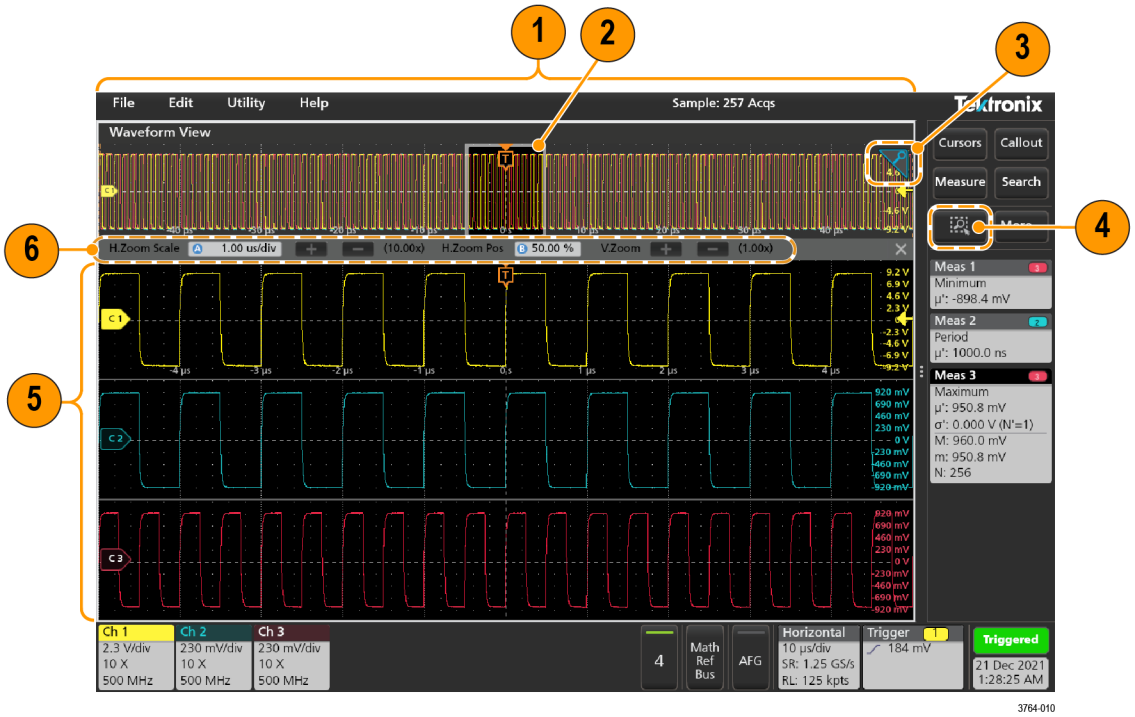


Tap anywhere outside a configuration menu to close it.

To open Help content for a configuration menu, tap the question mark icon in the upper right corner of the menu.

Zoom user interface

Use the zoom tools to magnify waveforms to view signal details.



1. The **Zoom Overview** shows the entire waveform record. All waveforms are shown in Overlay mode in the Zoom Overview area. Using pinch and expand gestures on the Zoom Overview waveforms changes the horizontal time base settings.
2. The **Zoom Box** shows the area of the Zoom Overview to display in the Zoom View (see 5). You can touch and drag the box to move the area to view. Moving the Zoom Box, or changing its position, does not change the horizontal time base settings.
3. The **Zoom** icon (in the upper right corner of the Waveform View) switches zoom mode on and off.
4. A zoom box lets you quickly draw a box around an area of interest in the Waveform or Zoom Overview. Drawing a box immediately puts the oscilloscope into zoom mode. To draw a zoom box, tap the DRAW-A-BOX button (while in Zoom mode), then touch and drag on the waveform to draw a box waveform. You can continue to draw zoom boxes until you single tap anywhere on the screen or open a menu.

   To toggle between **Zoom** mode and **Mask** mode, double-tap the **DRAW-A-BOX** button and select one of the options. Search for the **Mask Testing** topics in the oscilloscope Help for more information.
5. The **Zoom View** shows the zoomed waveforms, as marked by the Zoom Box, in the Zoom Waveform Record View. Use pinch and/or drag options in the zoom view to change the zoomed area of interest. Pinch, expand, and drag gestures in the Zoom View only change zoom magnification settings and Zoom Box position.
6. Use the **Zoom Title Bar** controls to adjust the vertical and horizontal size of the zoom area. Click or tap the + or - buttons or use the A and B multipurpose knobs.

   In a waveform view, if both Cursor and Zoom are turned on, use the **Zoom Box** and **Cursors** button to change the multipurpose knob functionality. Tap the **Zoom Title Bar** to assign the knobs to adjust the zoom or tap the **Cursors** button to assign knobs to adjust the cursors.

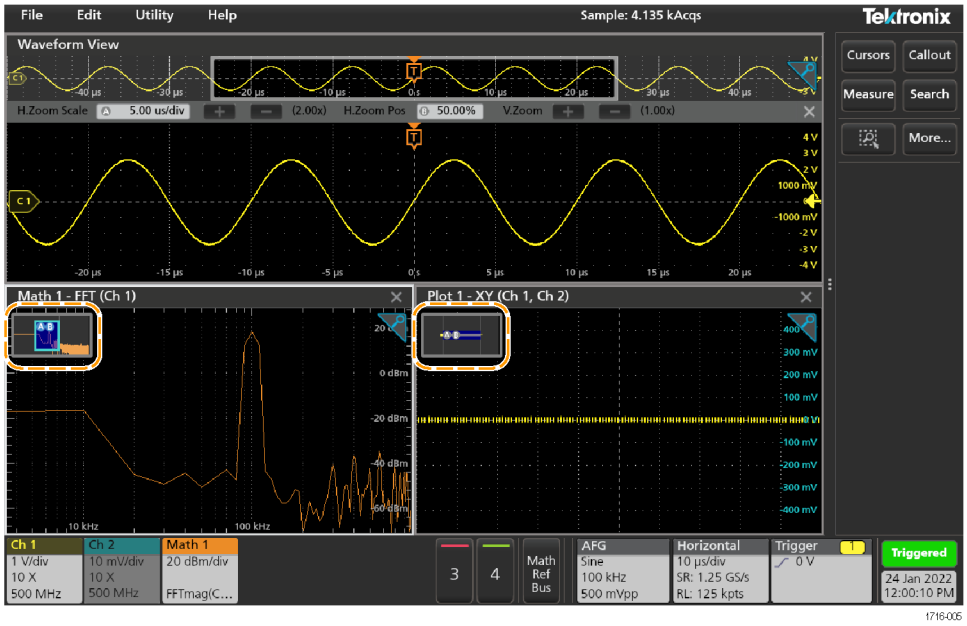
   Double tap the **Horizontal Zoom Position** or **Horizontal Zoom Scale** fields to enter a value using a numerical keypad.

   To exit the zoom display mode, tap the Zoom icon in the corner of display or tap the X in the Zoom Title Bar.

Math-FFT or XY plot view zoom

Use the A and B multipurpose knobs to adjust the zoom for Math-FFT or XY plot view.

In a Math-FFT or XY plot view, if A and B multipurpose knobs are assigned to Zoom, the zoom box is highlighted and the multipurpose knobs within the Zoom Box are enabled.



If both Cursors and Zoom are turned on in Math-FFT or XY Plot view, use the **Zoom Box** and **Cursors** button to change the multipurpose knob functionality. Tap the **Zoom Box** to assign the knobs to adjust zoom or tap the **Cursors** button to assign knobs to adjust the cursors.

To exit the zoom display mode, tap the Zoom icon in the corner of view or tap the X in the Math-FFT view or XY plot view.

Using the touch screen interface for common tasks

Use standard touch screen actions, similar to those found on smart phones and tablets, to interact with most screen objects. You can also use a mouse to interact with the UI. The equivalent mouse operation is shown for each touch operation.

The oscilloscope has a user interface tutorial. Tap **Help** > **User Interface Tutorial** to quickly learn the fundamental touch operations.

Task	Touchscreen UI action	Mouse action
Add a channel, math, reference, or bus waveform to the screen.	Tap an inactive channel button, **Add New Math**, **Add New Reference**, or **Add New Bus** button.	Click an inactive channel button, **Add New Math**, **Add New Reference**, or **Add New Bus** button.
Select a channel, math, reference, or bus waveform to make it active	Stacked or Overlay mode: Tap the Channel or Waveform badge.	Stacked or Overlay mode: Left-click the Channel or Waveform badge.
	Stacked mode: Tap the channel, math, reference, or bus waveform slice or handle.	Stacked mode: Left-click the channel, math, reference, or bus waveform slice or handle.
	Overlay mode: Tap the channel or waveform handle.	Overlay mode: Left-click the channel or waveform handle.
Display scale or navigation buttons on a badge (waveform, measurement, search, horizontal). Not all measurement or search badges display navigation buttons.	Tap the badge.	Click the badge.
Open a configuration menu on any item (all badges, views, cursor readouts, labels, and so on).	Double-tap the badge, view, or other object.	Double-click the badge, view, or other object.
Open a right-click menu (badges, views).	Touch and hold on the badge, Waveform View, Plot view, or other screen item until a menu opens.	Right-click the object.
Close a configuration menu. Some dialog boxes will not close until you click an OK, Close, or other button in the dialog.	Tap anywhere outside the menu or dialog.	Click anywhere outside the menu or dialog.
Move a menu.	Touch and hold the menu title bar or a blank area in the menu, then drag the menu to new position.	Click and hold the right mouse button on title or blank area, drag to new position.
Move a callout. Callouts are screen objects and are not associated with any particular waveform channel or slice.	Touch and hold on a callout and quickly start to drag, then move to new position. Start to move the callout as soon as selected (highlighted), otherwise the UI opens the right-click menu.	Click and hold the right mouse button on the callout and quickly start to drag, then move to the new position.

Task	Touchscreen UI action	Mouse action
Add a channel, math, reference, or bus waveform to the screen.	Tap an inactive channel button, **Add New Math**, **Add New Reference**, or **Add New Bus** button.	Click an inactive channel button, **Add New Math**, **Add New Reference**, or **Add New Bus** button.
Change horizontal or vertical settings directly on a waveform. Vertical changes only apply to the selected channel or waveform; horizontal changes apply to all channels and waveforms.	Tap a badge and use the Scale buttons.	Left-click a channel, waveform, or **Horizontal** badge and click on the Scale buttons.
	Touch and hold two fingertips on the waveform view, move them together or apart vertically or horizontally, lift from screen; repeat.	
Increase or decrease the zoom area while in Zoom mode.	Touch and hold two fingertips on the waveform view, move them together or apart vertically or horizontally, lift from screen; repeat.	Click the **+** or **-** buttons on the Zoom Title bar.
		Click the **Draw-a-Box** button, draw a box around the waveform area of interest.
Quickly scroll or pan a waveform or list.	Touch and drag in the waveform or list.	Click and drag in the waveform or list.
Close or open the **Results Bar** to increase the **Waveform View** area.	Tap on the **Results Bar Handle** (three vertical dots in border) or anywhere in the border between the **Waveform View** and the **Results Bar**.	Click the **Results Bar Handle** (three vertical dots in border) or anywhere in the border between the **Waveform View** and the **Results Bar**.
		Click and drag the Results Bar divider.
Change the position of badges in the **Settings Bar** or **Results Bar**.	Touch and drag the badge to a new position in the same bar.	Click and drag the badge to a new position in the same bar.

Configure the instrument

Configurations to help operate your instrument efficiently. Refer to the instrument help for additional configuration information.

Download and install the latest instrument firmware

Installing the latest firmware helps ensure that your instrument has the latest features and is taking the most accurate measurements.

Before you begin

Save any important on-instrument files such as waveforms, screen captures, and setups to a USB drive or network. The installation process does not remove user-created files, but it is recommended to back up important files before an update.

Determine the current version of firmware installed on the instrument using the **Help > About** menu.

Procedure

To download the instrument firmware and install onto an instrument:

1. Open up a Web browser on a PC and go to http://www.tek.com/product-support
2. Enter the instrument model number in the search field and click **Go**.
3. Scroll down the screen and click the **Software** tab.
4. If the listed available firmware version is newer than what is on your instrument, select and download that file to your PC.
5. Copy the downloaded firmware file to a USB drive.
6. Insert the USB drive with the firmware file into one of the USB ports on the instrument.
7. Power on the instrument.

   For the battery operated instrument, connect the power cord and keep it connected during the upgrade of an instrument firmware.
8. Follow on-screen instructions.

   The instrument will take a few minutes to install the new firmware. Do not remove the USB flash drive or power off the instrument during this time.

What to do next

To confirm the firmware update, locate the version number found in the **About** window under the **Help** menu. Confirm that the instrument firmware version number matches the firmware version number that you just installed.

Set the time zone and clock readout format

Set the time zone to your region so that saved files are marked with the correct date and time information. You can also set the time format (12 or 24 hour clock).

About this task

Procedure

1. Double-tap the **Date/Time** badge (bottom-right of screen) to open the configuration menu.
2. To turn off showing the date and time on the screen, tap **Display** button to **Off**.

   To turn on date/time display again, double-tap in the blank area where the date/time badge was displayed to open the configuration menu, and set the **Display** button to **On**.
3. Select a time format (**12 Hour** or **24 Hour**).
4. Tap the **Time Zone** field and select the time zone that applies to your location.
5. Tap anywhere outside of the menu to close it.

Run Signal Path Compensation (SPC)

Run SPC when you first receive an instrument and at regular intervals for best measurement accuracy. You should run SPC whenever the ambient (room) temperature has changed by more than 5 °C (9 °F), or once a week if you use vertical scale settings of 5 mV per division or less.

About this task

Signal Path Compensation (SPC) corrects for DC level inaccuracies in the internal signal path, caused by temperature variations and/or long-term signal path drift. Failure to run SPC on a regular basis may result in the instrument not meeting warranted performance levels at low volts per division settings.

Before you begin

Disconnect all probes and cables from the front-panel channel inputs and rear-panel signal connectors.

Procedure

1. Power on and warm up the instrument for at least 20 minutes.
2. Tap **Utility > Calibration**.
3. Tap **Run SPC**. The **SPC Status** readout shows **Running** while SPC is running. SPC can take three minutes approximately per channel to run, so wait until the SPC Status message changes to **Pass** before reconnecting probes or cables and using the instrument.

   CAUTION: You can abort the SPC calibration by tapping **Abort SPC**. This may leave some channels uncompensated, resulting in possible inaccurate measurements. If you do abort the SPC, make sure to run the SPC procedure completely before using the instrument to take measurements.
4. Close the **Calibration** configuration dialog when SPC has completed.

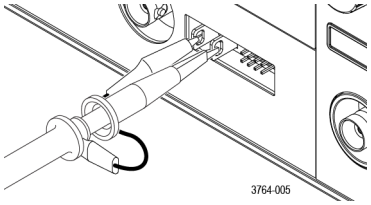
   If the SPC fails, write down any error message text. Make sure that all probes and cables are disconnected and run the SPC again. If the SPC still fails, contact Tektronix Customer Support.

Compensate the probe

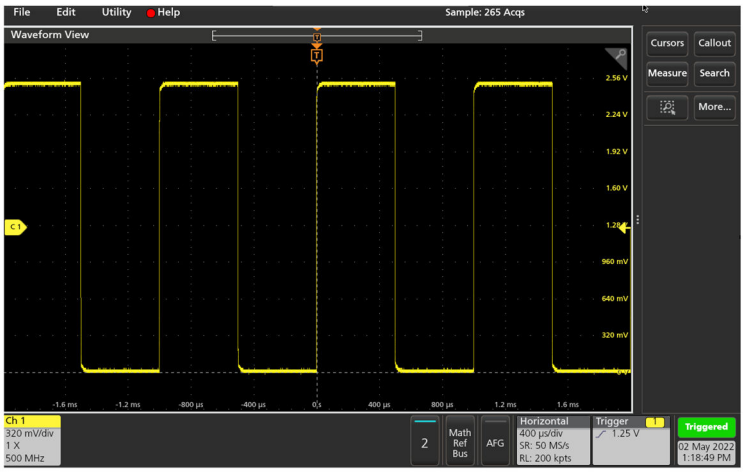
Probe compensation adjusts the high frequency response of a probe for best waveform capture and measurement accuracy. Use this procedure to adjust probe compensation for probes with a manual adjustment.

The following procedure checks the probe compensation.

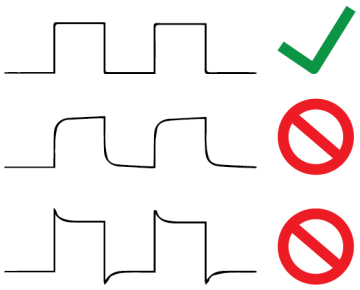
1. Connect a supported probe to Channel 1.
2. Connect the probe tip and ground lead of the probe to the **PROBE COMP** terminals. Connect only one probe at a time to the PROBE COMP terminals.



3. Turn on the Channel 1 and turn off all other channels.
4. Tap **File** > **Default Setup**.
5. Push the **Autoset** button on the front-panel or tap **File** > **Autoset** from the menu bar. The screen should display a square wave with the levels between approximately 0 V - 2.5 V and 1 kHz.



6. Check the shape of the displayed waveform to determine if the probe needs adjusted. If the waveform has a square leading edge and a flat top and bottom, the probe does not need adjusted. If the waveform leading edge is rounded or has a spike, you need to adjust the probe compensation.



7. Use the probe adjustment tool provided with the probe to adjust the probe until the waveform has as flat a top and bottom as possible. Remove the adjustment tool before looking at the waveform. Repeat until waveform top and bottom are flat. See your probe manual for adjustment location and instructions.
8. Repeat these steps for each probe connected to each channel. You must run this procedure every time you move a probe from one channel to another.

Connect to a network (LAN)

Connecting to a network allows you to remotely access the instrument.

Work with your network administrator to obtain the required information to connect to your network (IP address, Gateway IP address, Subnet Mask, DNS IP address, and so on).

1. Connect a CAT5 cable from the instrument LAN connector to your network.
2. Select **Utility > I/O** on the menu bar to open the I/O configuration menu.
3. Obtain or enter the network address information:
   - If your network is DHCP-enabled, and the IP address field does not already show an address, tap **Auto** to obtain the IP address information from the network. DHCP mode is the default mode.
   - If your network is not DHCP-enabled, or you need a permanent (non-changing) IP address for this instrument, tap **Manual** and enter the IP address and other values provided by your IT or system administrator resource.
4. Tap **Test Connection** to verify that the network connection is working. The **LAN Status** icon turns green when the instrument successfully connects to your network. If you have problems connecting to your network, contact your system administration resource for help.

Connect the oscilloscope to a PC using a USB cable

Use a USB cable to connect the oscilloscope directly to a PC for remote instrument control.

1. On the oscilloscope, select **Utility > I/O** from the menu bar.
2. Tap **USB Device Port Settings**.
3. Confirm that the USB Device Port control is **On** (default setting).
4. Connect a USB cable from the PC to the USB **Device** port on the instrument.

Connect a keyboard or mouse

The instrument supports most standard USB-connected keyboards and mice, and wireless-connected keyboards and mice (using a USB-connected dongle).

Connect a keyboard and/or mouse by connecting their USB cable, or USB dongle, into any available USB Host port. The keyboard or mouse should work immediately. If it does not, try the following:

1. Remove and reinsert the USB cable or dongle in the same port.
2. Insert the USB cable or dongle into a different USB port.

Operating basics

These procedures are an introduction to using the interface to do common tasks. Refer to the instrument help for detailed information on menu and field settings.

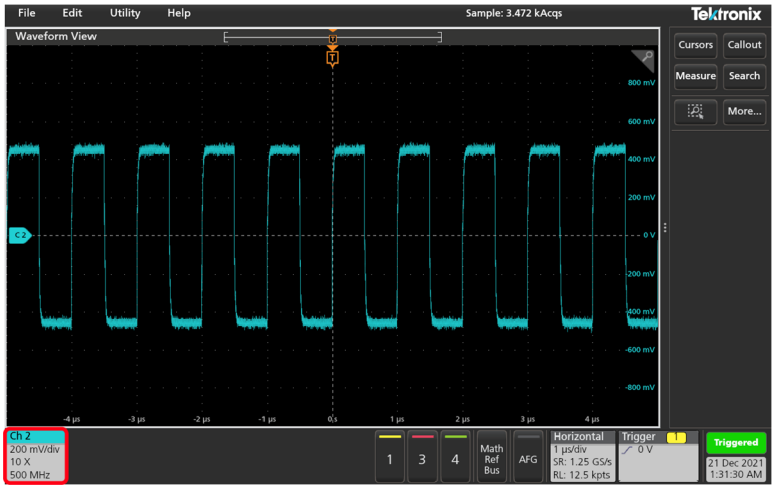
Add a channel waveform to the display

Use this procedure to add a channel signal to the Waveform View.

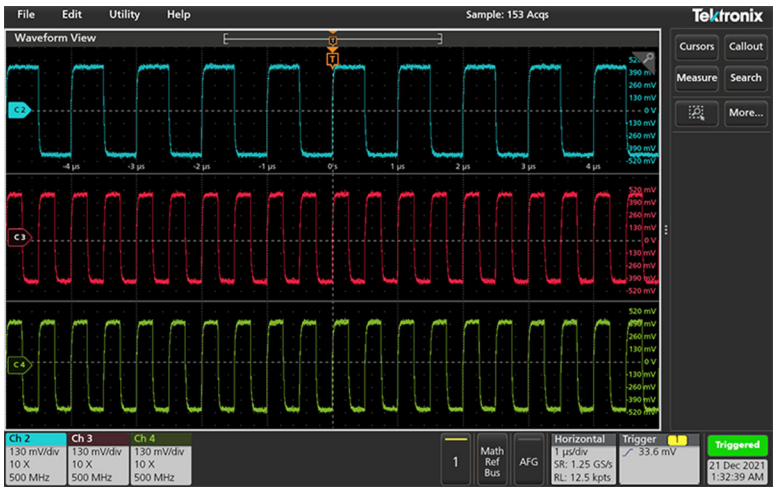
1. Connect signal(s) to the channel input(s).
2. Tap an Inactive Channel button (in the Settings bar) of a connected channel.



The selected channel is added to the Waveform View and a Channel badge is added to the Settings bar.



3. Continue tapping Inactive Channel buttons to add more channels. Channels are displayed from lowest-numbered channel at the top, to highest-numbered channel at the bottom of the view, regardless of the order they were added (in stacked mode).



4. Double-tap a channel badge to open that channel's configuration menu to check or change settings. See Configure channel or waveform settings.

Configure channel or waveform settings

Use the channel and waveform configuration menus to set parameters such as vertical scale and offset, coupling, bandwidth, probe settings, deskew values, external attenuation values, and other settings.

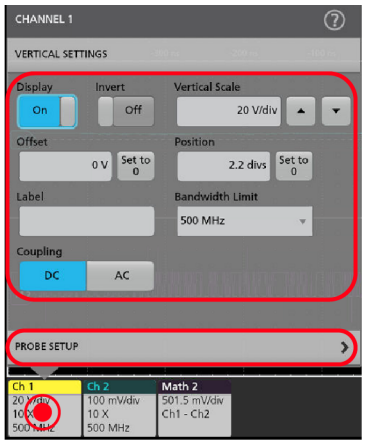
Before you begin

Prerequisite: There is a channel or waveform badge in the Settings bar.

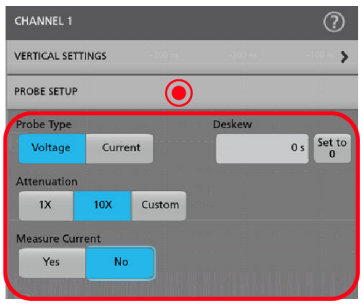
Procedure

1. Double-tap a **Channel** or **Waveform** badge to open a configuration menu for that item.

   For example, in a Channel menu, use the **Vertical Settings** panel to set basic probe parameters such as vertical scale and position, offset, coupling, termination, and bandwidth limit. Available settings depend on the probe.



2. Tap the **Probe Setup** panel to confirm probe settings and run configuration or compensation on supported probes.

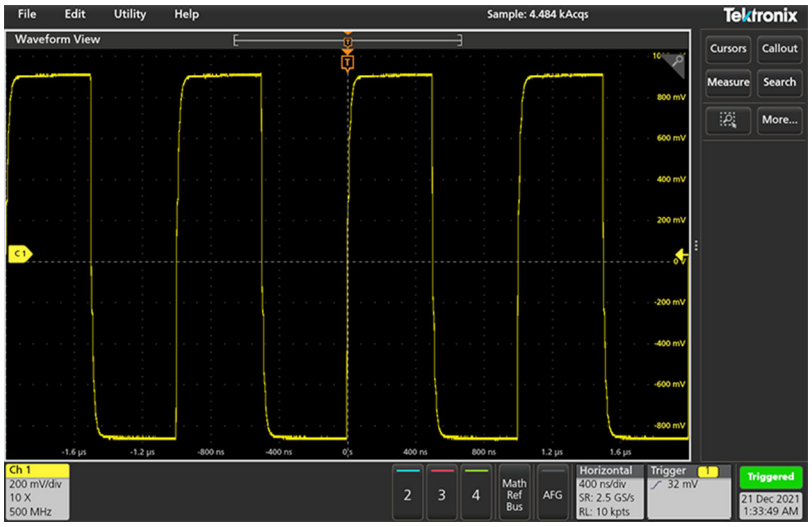


3. Tap the Help icon on the menu title to open the help topic for more information.
4. Tap outside the menu to close the menu.

Autoset to quickly display a waveform

The Autoset function analyzes the signal characteristics and changes the instrument Horizontal, Vertical, and Trigger settings to automatically display a triggered waveform. You can then make further changes to trigger and horizontal settings to view the waveform point of interest.

1. Connect the probe with the signal of interest to an available channel. The signal can be analog or digital.
2. Double-tap the **Trigger** badge and set the trigger source to that of the signal of interest.
3. Connect any other associated signal(s) to available channel input(s).
4. Add the channel waveforms to the Waveform view. See Add a channel waveform to the display (on page 43).
5. Tap **File** > **Autoset** or push the front-panel **Autoset** button. When using the Stacked Display mode, the instrument analyzes the signal characteristics of the trigger source channel and adjusts the horizontal, vertical, and trigger settings accordingly to display a triggered waveform for that channel. The Vertical scale is adjusted in each waveform slice of all active waveforms to maximize ADC utilization.



When using the **Overlay Display** mode, the instrument adjusts the horizontal and trigger settings of the trigger source channel to display a triggered waveform for that channel. Vertical scale and position adjustments for all active channels in Overlay Display mode are controlled by the **Autoset in Overlay Display Mode Optimizes** selection in the **Autoset** panel of the **User Preferences** menu. If the selection is **Visibility**, Autoset vertically scales and positions all active channel waveforms such that they are uniformly spaced on screen. If the selection is **Resolution**, Autoset vertically scales and positions all active channel waveforms such that they each use as much of the ADC's range as possible.

NOTE: You can set which parameters the instrument can adjust when running an Autoset. Access the Autoset panel in **Utility > User Preferences > Autoset.**

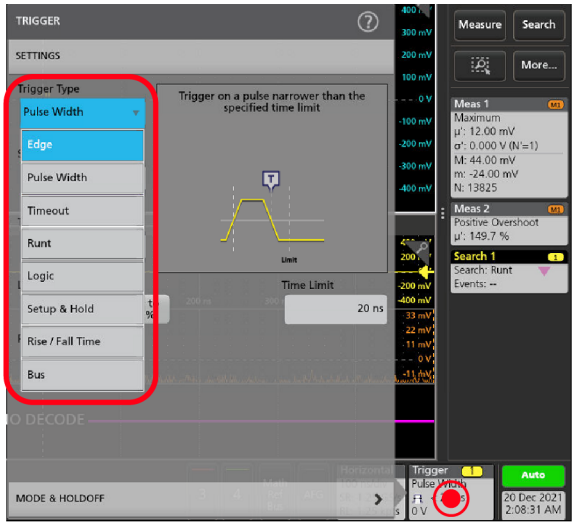
Autoset guidelines

- Autoset displays three or four cycles (depending on the detected signal) with the trigger level near the midlevel of the signal.
- The trigger is set to type Edge, rising slope, DC coupling.
- If no channels are displayed before pushing **Autoset**, the oscilloscope adds Ch 1 to the Waveform view whether it has a signal or not.
- Autoset ignores math, reference, and bus waveforms.
- A channel or waveform with a frequency less than 40 Hz is classified as no signal.

How to trigger on a signal

Use this procedure to open the Trigger menu to select and configure the trigger event type and conditions.

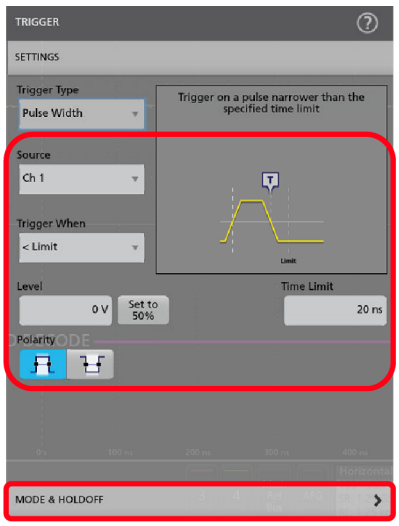
1. Double-tap the **Trigger** badge on the Settings bar to open the Trigger configuration menu.
2. Select a trigger from the **Trigger Type** list. The trigger type sets what fields are available in the menu and also updates the illustration to show a graphic of the trigger type.



To trigger on a bus, you must first add the bus to the Waveform view. See Add a math, reference, or bus waveform (on page 49).

NOTE: Triggering on buses other than Parallel requires purchasing and installing serial trigger and analysis options.

3. Select the other fields and panels to refine the trigger conditions. The menu fields and trigger graphic updates as you make changes to the trigger settings. Displayed fields depend on the selected trigger type. Selection changes take effect immediately.

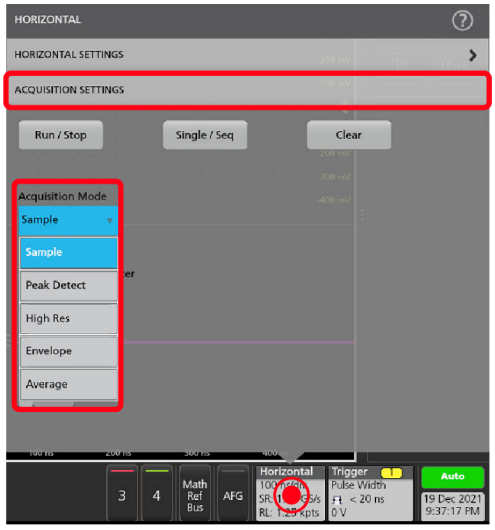


4. Tap the **Help** icon on the menu title for more information on these settings.
5. Tap outside the menu to close the menu.

Set the acquisition mode

Use this procedure to set the method the instrument uses to acquire and display the signal.

1. Double-tap the **Acquisition** badge on the Settings bar to open the Acquisition configuration menu.
2. Select the acquisition method from the **Acquisition Mode** list. Set any other parameters associated with the selected acquisition type.

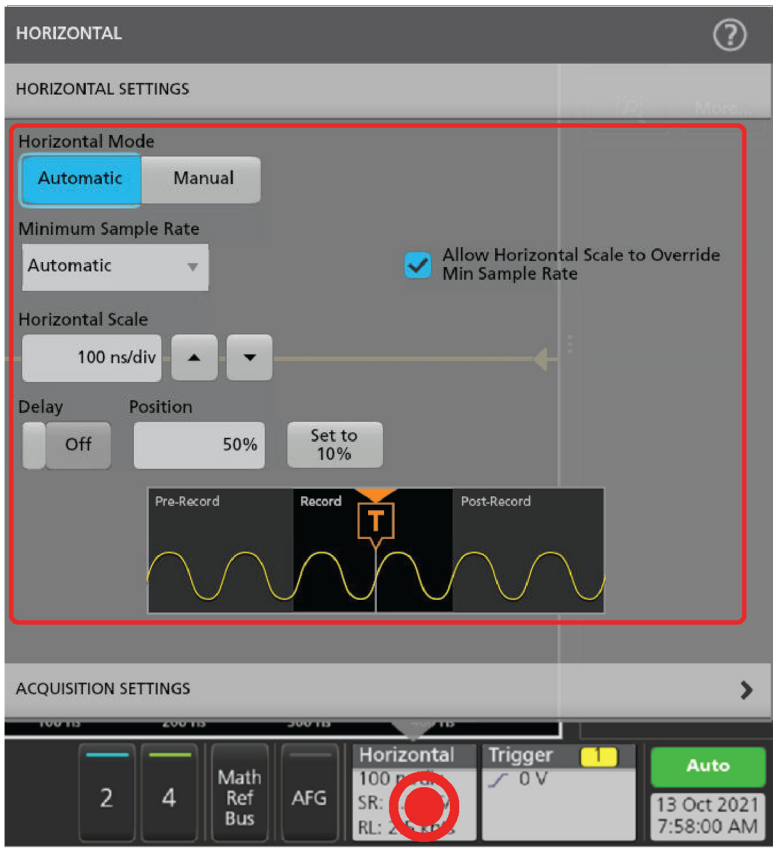


3. Tap the Help icon on the menu title for more information on these settings.
4. Tap outside the menu to close the menu.

Set Horizontal parameters

Use this procedure to set the horizontal time base parameters such as mode, minimum sample rate, horizontal scale, delay, and trigger delay time (relative to the center of the waveform record.)

1. Double-tap the **Horizontal** badge on the Settings bar to open the Horizontal configuration menu.



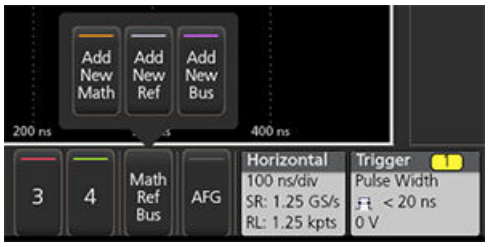
2. Use the menu selections to set horizontal parameters.
3. Tap the Help icon on the menu title for more information on these settings.

Add a math, reference, or bus waveform

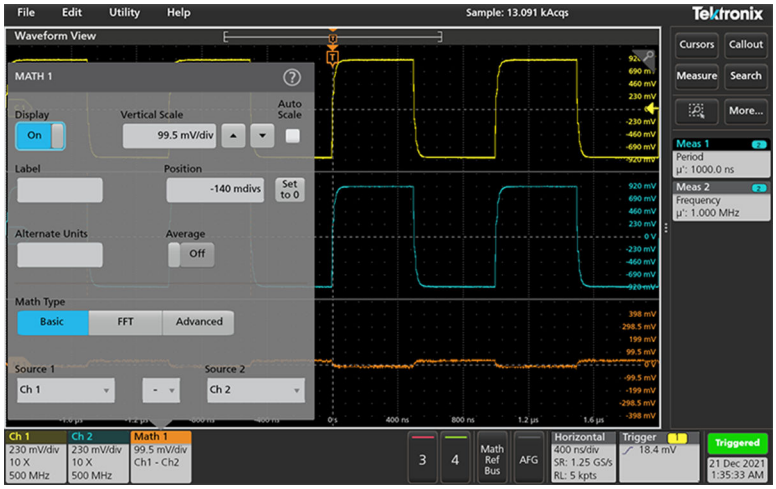
Math waveforms let you create new waveforms based on operations between two or more waveforms or by applying equations to waveform data. A reference waveform is a static waveform record displayed for comparison. Bus waveforms let you view and analyze serial or parallel data.

There is no set limit to the number of Math, Reference, or Bus waveforms you can add to the Waveform View, other than system physical memory constraints.

1. Tap the **Math Ref Bus** > **Add New Math**, **Add New Ref**, or **Add New Bus** button in the Settings bar.

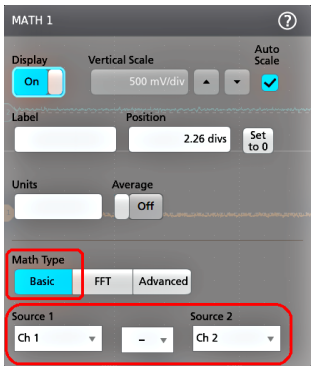


2. The instrument adds the waveform to the Waveform view, adds a Waveform badge to the Settings bar, and opens a configuration menu. This example shows adding a Math waveform.



3. Use the configuration menus to refine the waveform parameters. Displayed fields depend on the waveform and selections made in the menu. Selection changes take effect immediately.

   This example shows adding a Math waveform, using the Math **Source** fields to select Ch 1 and Ch 2 as the waveform sources, set the math type to **Basic** math operation, and subtracting channel 2 from channel 1.



4. When adding a Reference waveform, the instrument displays a **Recall** configuration menu. Navigate to and select the reference waveform file (*.wfm) to recall, then tap the **Recall** button. The instrument displays the Reference waveform.

5. Double-tap a math, reference, or bus badge to check or change the waveform settings. See Configure channel or waveform settings.
6. Tap the Help icon on a configuration menu title for more information on math, reference, and bus waveform settings.
7. Tap outside the menu to close the menu.

Add a measurement

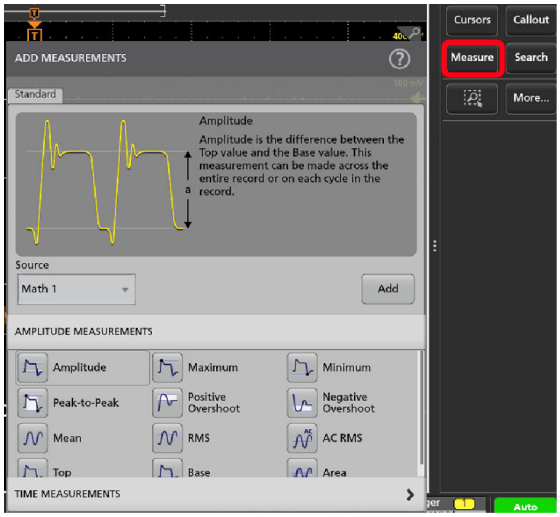
Use this procedure to select and add measurements.

1. Acquire the channel(s) and/or waveform(s) on which you want to take measurements.



NOTE: Waveforms do not need to be displayed to be used for measurements, as long as the channel or waveform badge is on the **Settings** bar and is acquiring the signal to measure.

2. Tap the **Measure** button to open the **Add Measurements** configuration menu or drag the Measure button onto a waveform in the waveform display area to automatically set the source.

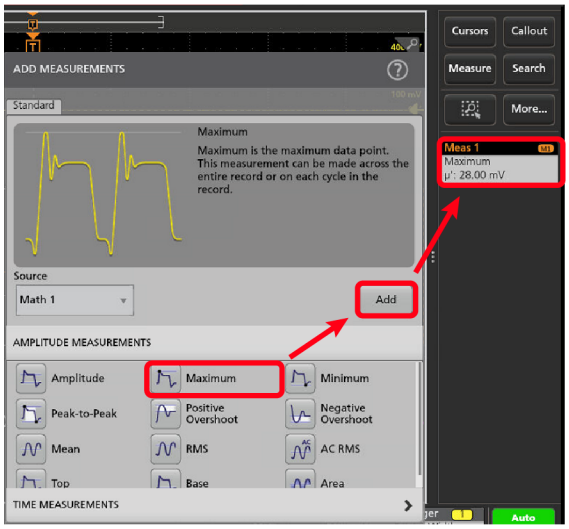


NOTE: If the menu shows tabs other than **Standard**, then optional measurement types have been installed on the instrument. Select a tab to show the measurements for that option.

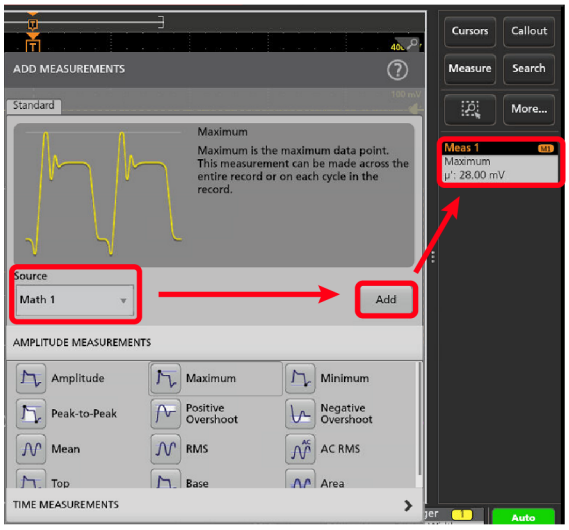
3. Tap the **Source** field and select the measurement source.



4. Select a measurement category panel, such as **Amplitude Measurements** or **Time Measurements**, to display measurements for those categories.
5. Select a measurement and tap **Add** to add the measurement to the **Results** bar. You can also double-tap a measurement to add it to the **Results** bar.



6. Select and add other measurements for the current source. Tap the measurement category panels to display and select other measurements to add.
7. To add measurements for other sources, select a different source, select a measurement, and add the measurement.

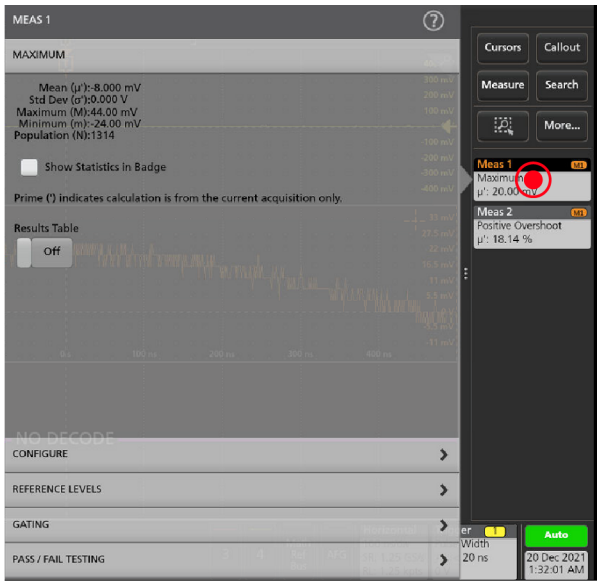


8. Tap outside the **Add Measurements** menu to close the menu.
9. To further adjust a measurement's settings, double-tap a measurement badge to open a configuration menu for that measurement. See Configure a measurement (on page 52).
10. Tap the Help icon on the menu title for more information on settings.

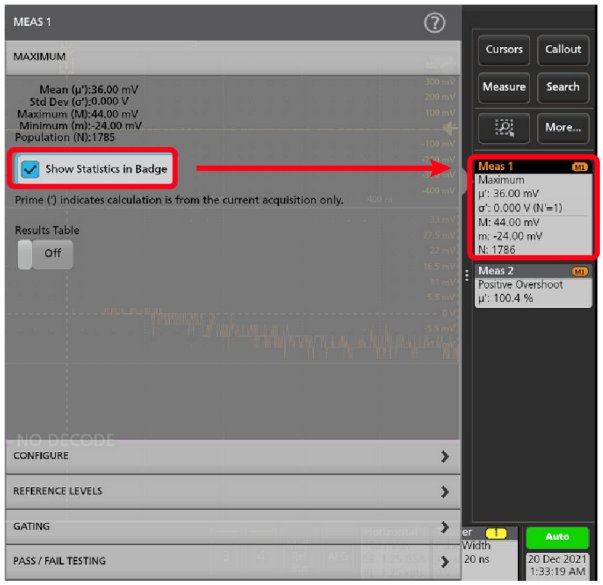
Configure a measurement

Use this procedure to add statistical readouts to the measurement badge, display plots for the measurement, and refine measurement parameters (configuration, global versus local scope of settings, gating, filtering, and so on).

1. Double-tap a measurement badge to open its **Measurement** configuration menu.



2. Tap **Show Statistics in Badge** to add statistical readouts to the measurement badge.



3. Tap available panel titles to make changes for those categories.



4. Use the available fields to refine the measurement conditions. Displayed fields depend on the measurement. Selection changes take effect immediately. Selection changes can also change fields in other panels.
5. Tap the Help button on the menu title for more information on this menu's settings.
6. Tap outside the menu to close the menu.

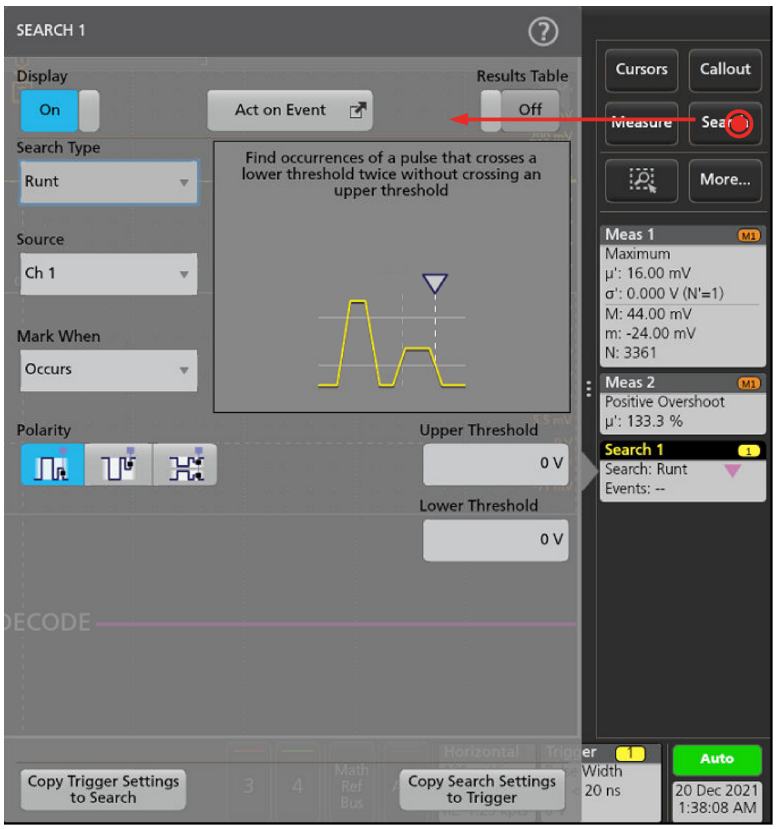
Add a Search

Use this procedure to set search criteria and mark a waveform where those events occur.

You can search on analog and digital signals, math waveforms, and reference waveforms. You can add searches to different waveforms and multiple searches to the same waveform.

Prerequisite: Display the channel or waveform signal on which to search. The waveform must be displayed to create a search for it.

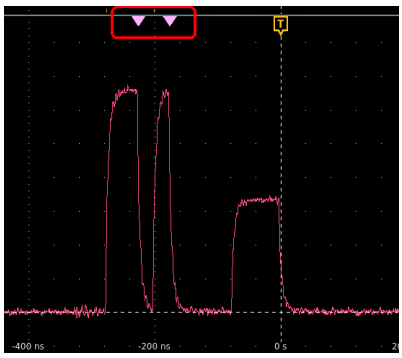
1. Tap the **Search** button to open the Search configuration menu.



2. Use the configuration menu fields to set the search criteria in the same way that you would set for a trigger condition (select the **Search Type**, **Source**, and conditions on which to search).

NOTE: You cannot search for sequential events (there is no Sequence search type).

3. The searched waveform is marked with one or more triangles as soon as the search criteria becomes true. Each search uses a different color for its markers. The example image shows search criteria set to find positive pulse widths that are less than 70 ns wide.



4. To stop showing marks on a waveform, double-tap the **Search** badge and tap **Display** to **Off**.
5. To move the waveform to center marks on the display, push the **Run/Stop** front panel button to stop acquisition, single-tap a **Search** badge, and tap the < or > Navigation button.



NOTE: Navigation buttons are only functional when the oscilloscope acquisition mode is set to **Stop**.

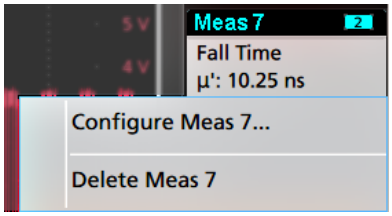
This opens the **Zoom** mode and moves the waveform to the previous or next event mark on the waveform.

6. If available for a search, tap the **Min** or **Max** button to center the waveform in the display at the minimum or maximum value of the search events in the waveform record.
7. To return the instrument to normal acquisition mode, tap the **Zoom** icon in the upper right corner of the Waveform View to turn off **Zoom** mode, and push the **Run/Stop** front-panel button to set it to Run mode.

Delete a Measurement or Search badge

Use this procedure to remove a Measurement or Search badge from the Results bar.

1. Touch and hold the Measurement or Search badge that you want to delete. The instrument opens a right-click menu.
2. Select **Delete Meas** to delete that badge from the Results bar.



NOTE: You can undo a measurement delete.

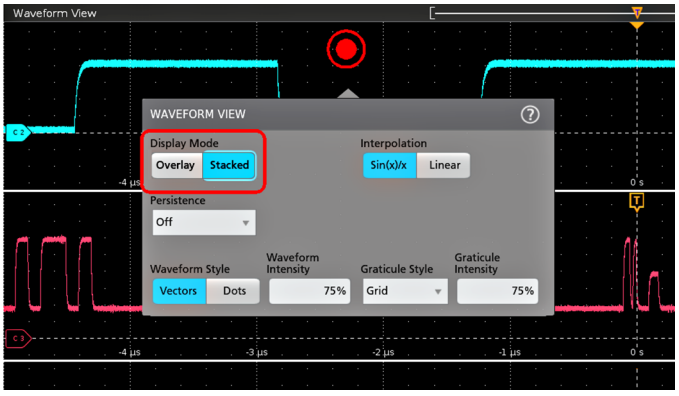
3. The second way to delete a Measurement or Search badge is by flicking it off the right edge of the display. Flicking to the left from the right edge of the display recovers the badge.

NOTE: Badge recovery is possible within 10 seconds only of removal.

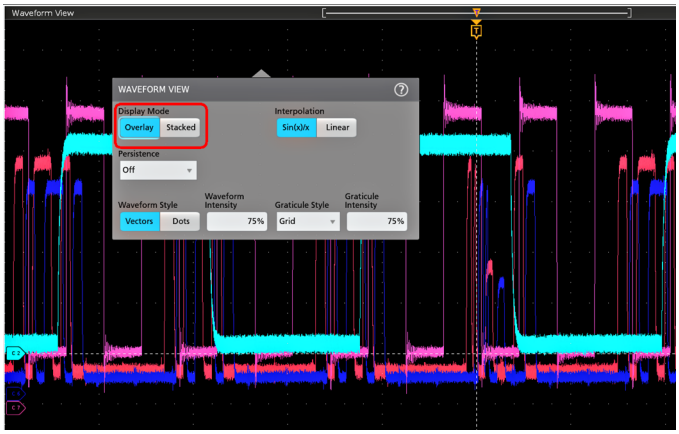
Change waveform view settings

Use this procedure to change the waveform display mode (Stacked or Overlay), waveform trace interpolation algorithm, waveform persistence, style and intensity, and graticule style and intensity.

1. Double-tap on an open graticule area to open the **Waveform View** configuration menu.



2. Tap the buttons in the **Display Mode** to toggle between **Overlay** and **Stacked** modes.

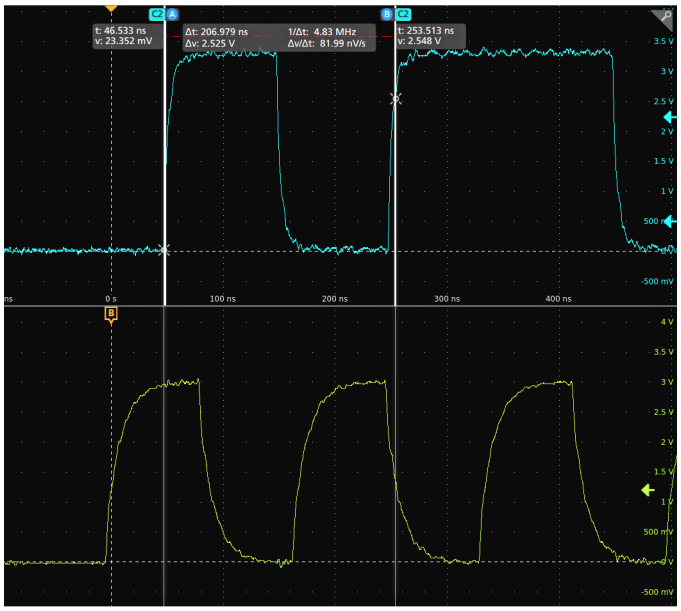


3. Use the other controls to set the waveform interpolation algorithm, waveform point persistence, style, and intensity, and graticule style and intensity.
4. Tap the **Help** icon on the menu title to open the Waveform View menu help topic for more information on the waveform view parameters.
5. Tap outside the menu to close the menu.

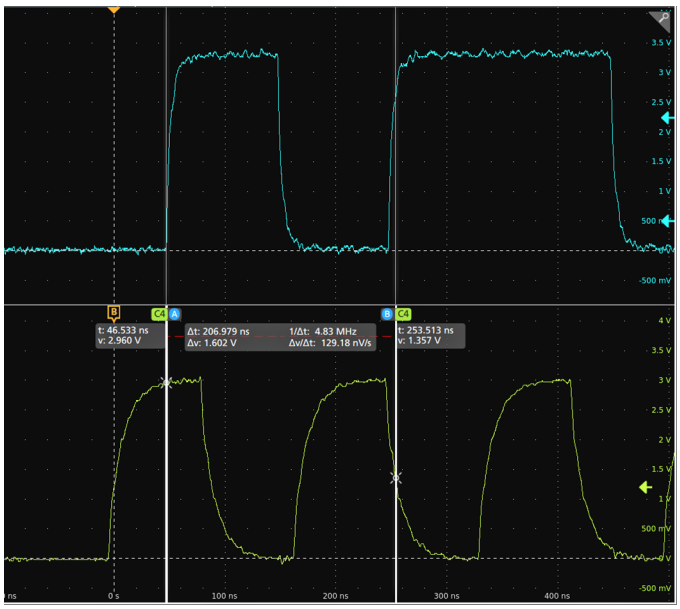
Display and configure cursors

Cursors are on-screen lines that you can move to take measurements on specific parts of a waveform or between two different waveforms. Cursor readouts show both current position values and the difference (delta) between cursors. Polar cursor readouts are available through the cursor configuration menu for XY plots.

1. Tap the waveform slice (in Stacked mode), or the channel or waveform badge (in Overlay mode) to which you want to add cursors.
2. Tap the **Cursors** button. The cursors are added to the display.

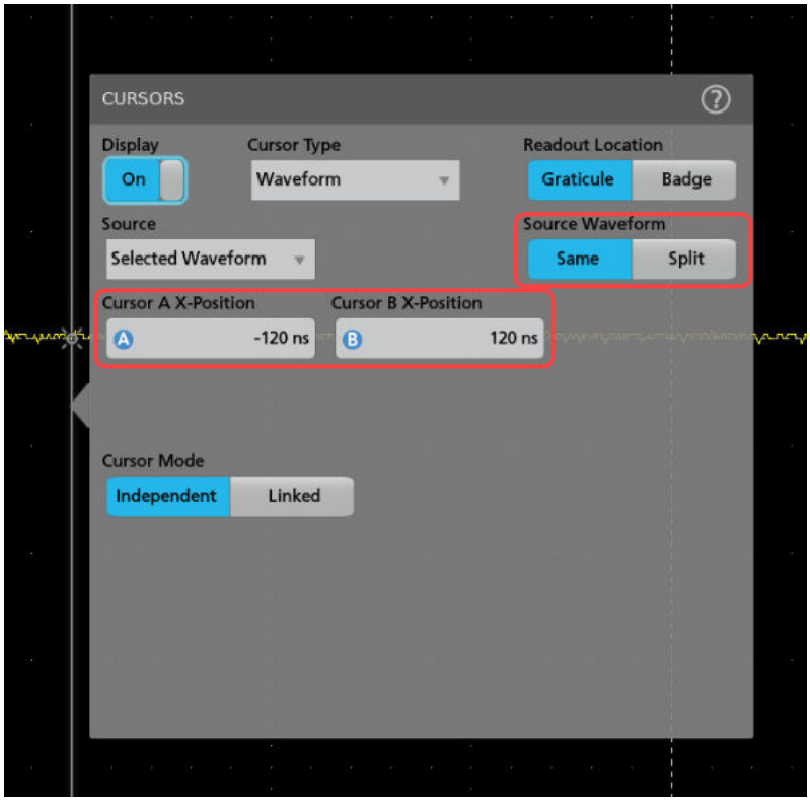


3. Use Multipurpose Knobs **A** and **B** to move the cursors, or touch and drag a cursor. Cursors show readouts that show position and difference measurements between the cursors.
4. To move the cursors to a different channel or waveform, just tap in that waveform graticule.



5. To further configure cursors, double-tap on either cursor line or the cursor readouts to open the **Cursors** configuration menu. For example, tap the Cursor type to select the cursors to display, such as Waveform, V Bars, H Bars, and V&H Bars.

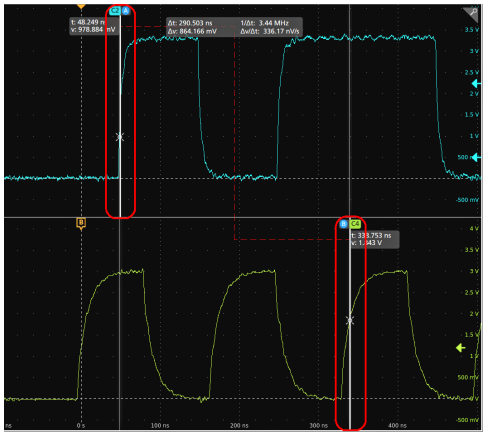
   The cursor configuration menu in the waveform view.



   The cursor configuration menu in an XY plot.



6. To split the cursors between two waveforms, tap the **Source** field and select **Split** and select the source for each cursor. The cursors are moved to the specified waveforms.



7. Tap the Help icon on the menu title for more information on the menu settings.
8. To stop showing cursors, open the Cursors configuration menu and set Display to **Off**.

Connect the oscilloscope to a PC using a USB cable

Use a USB cable to connect the oscilloscope directly to a PC for remote instrument control.

1. On the oscilloscope, select **Utility > I/O** from the menu bar.
2. Tap **USB Device Port Settings**.
3. Confirm that the USB Device Port control is **On** (default setting).
4. Connect a USB cable from the PC to the USB **Device** port on the instrument.

ESD Prevention Guidelines

Electrostatic discharge (ESD) can damage oscilloscope and some probe inputs. This topic discusses how to avoid this type of damage.

Electrostatic discharge (ESD) is a concern when handling any electronic equipment. The instrument is designed with robust ESD protection, however it is still possible that large discharges of static electricity directly into the signal input may damage the instrument. Use the following techniques to prevent electrostatic discharge from damaging the instrument.

- Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while connecting and disconnecting cables, probes, and adapters. The instrument provides a ground connection to which to attach a wrist strap (near the Probe Comp ground connector).
- A cable that is left unconnected on a bench can develop a large static charge. Discharge the static voltage from all cables before connecting them to the instrument or device under test by momentarily grounding the center conductor of the cable, or by connecting a 50 Ω termination to one end, before attaching the cable to the instrument.
- Before you apply power, connect the instrument to an electrically-neutral reference point, such as earth ground. To do this, plug the three-pronged power cord into an outlet grounded to earth ground. Grounding the oscilloscope is necessary to ensure safety and to take accurate measurements.
- If you are working with static sensitive components, ground yourself. Static electricity that builds up on your body can damage static-sensitive components. Wear a wrist strap to safely send static charges on your body to earth ground.
- The oscilloscope must share the same ground as any circuits that you plan to test.

Maintenance

Information for periodic and corrective maintenance on the instrument.

Inspection and cleaning

This section describes how to inspect for dirt and damage. It also describes how to clean the exterior and interior of the instrument. Inspection and cleaning are done as preventive maintenance. Preventive maintenance, when done regularly, may prevent instrument malfunction and enhance its reliability.

Preventive maintenance consists of visually inspecting and cleaning the instrument and using general care when operating it.

How often to perform maintenance depends on the severity of the environment in which the instrument is used. A proper time to perform preventive maintenance is just before instrument adjustment.

Exterior cleaning (other than display)

Clean the exterior surfaces of the chassis with a dry lint-free cloth or a soft-bristle brush. If any dirt remains, use a cloth or swab dipped in a 75% isopropyl alcohol solution. Use a swab to clean narrow spaces around controls and connectors. Do not use abrasive compounds on any part of the chassis that may damage the chassis.

Clean the On/Standby switch using a cleaning towel dampened with deionized water. Do not spray or wet the switch itself.

CAUTION: Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Use only deionized water when cleaning the front-panel buttons. Use a 75% isopropyl alcohol solution as a cleaner for cabinet parts. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

Inspect the outside of the instrument for damage, wear, and missing parts. Immediately repair defects that could cause personal injury or lead to further damage to the instrument.

External inspection checklist

Item	Inspect for	Repair action
Cabinet, front panel, and cover	Cracks, scratches, deformations, damaged hardware	Repair or replace defective module
Front-panel knobs	Missing, damaged, or loose knobs	Repair or replace missing or defective knobs
Connectors	Broken shells, cracked insulation, and deformed contacts. Dirt in connectors	Repair or replace defective modules. Clear or brush out dirt
Carrying handle and cabinet feet	Correct operation	Repair or replace defective module
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors	Repair or replace damaged or missing items, frayed cables, and defective modules

Flat panel display cleaning

Clean the flat panel display surface by gently rubbing the display with a clean-room wipe (such as Wypall Medium Duty Wipes, #05701, available from Kimberly-Clark Corporation), or an abrasive-free cleaning cloth.

If the display is very dirty, moisten the wipe or cloth with distilled water, a 75% isopropyl alcohol solution, or standard glass cleaner, and gently rub the display surface. Use only enough liquid to dampen the cloth or wipe. Avoid using excess force or you may damage the display surface.

CAUTION: Improper cleaning agents or methods can damage the flat panel display.

- Do not use abrasive cleaners or surface cleaners to clean the display.
- Do not spray liquids directly on the display surface.
- Do not scrub the display with excessive force.

CAUTION: To prevent getting moisture inside the instrument during external cleaning, do not spray any cleaning solutions directly onto the screen or instrument.

Check for common problems

Use the following table to help isolate possible failures. The table lists problems and possible causes. The list is not exhaustive, but it may help you eliminate a problem that is quick to fix, such as a loose power cord.

Failure symptoms and possible causes

Symptom	Possible cause(s)
Instrument will not power on	Power cord not plugged in.
	Faulty power supply.
	Defective micro-controller assembly.
Instrument powers on, but one or more fans will not operate	Faulty fan power cable.
	Fan power cable not connected to circuit board.
	Defective fan .
	Faulty power supply.
	One or more defective point of load regulators.
Flat-panel display blank or has streaks in display	Faulty LCD screen or video circuitry.

Service the instrument

For more information on troubleshooting, maintenance, and replacing parts on your instrument refer to the instrument service manual or contact a Tektronix Service Center.

Returning instrument for service

Use the following instructions for returning your instrument for service.

When repacking the instrument for shipment, use the original packaging. If the packaging is not available or unfit for use, contact your local Tektronix representative to obtain new packaging.

If you need to return your instrument for repair or calibration, call 1-800-438-8165 or complete the form at tek.com/services/repair/rma-request. When you request service, have the serial number, firmware, and software version of the instrument.

If you want to see the warranty or service agreements on your products, or if you want to create your own service price estimate, visit our quick service quote site at tek.com/service-quote.