



## **3 Series MDO Mixed Domain Oscilloscope Installation and Safety Manual**

### **Warning**

The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

Supports 3 Series MDO Product Firmware V1.1 and above

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USA

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

- In North America, call 1-800-833-9200.
- Worldwide, visit [www.tek.com](http://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.

To safely perform service on this product, see the *Service safety summary* that follows the *General safety summary*.

## 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.

### 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.

**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 rating 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.

**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.

**Use proper fuse.** Use only the fuse type and rating specified for this product.

**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.

**Connect and disconnect properly.** De-energize the circuit under test before connecting or disconnecting the current probe.

Connect the probe reference lead to earth ground only.

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

**Inspect the probe and accessories.** Before each use, inspect probe and accessories for damage (cuts, tears, or defects in the probe body, accessories, or cable jacket). Do not use if damaged.

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

## 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.

## Terms in the manual

These terms may appear in this manual:



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

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

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## Terms on the product

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



Chassis Ground



Standby



Earth Terminal



---

# Preface

This manual provides product safety and compliance information, describes how to connect and power on the oscilloscope, and introduces the basic instrument features, controls, and operations. See the product Help file for more detailed information.

## Key features

Welcome to the 3 Series MDO. The 3 Series MDO Oscilloscopes (MDO32 and MDO34) are 2- and 4-channel oscilloscopes, enabling you to efficiently and cost-effectively perform mixed domain debugging.

- A dedicated RF input channel for frequency domain measurements
- Bandwidths from 100 MHz to 1 GHz
- 2- and 4-channels for time domain measurements
- Sixteen-channel digital input option
- Large 11.6" HD (1920 x 1080 pixel) capacitive touchscreen display
- User interface optimized for touchscreen use
- Sample rates of 2.5 GS/s on all analog channels (5 GS/s on 1 or 2 channels for the MDO34 or MDO32 with the 1 GHz option)
- 10 M points record length on all channels
- Maximum waveform capture rate: 280,000 waveforms/second, with FastAcq: >50,000 waveforms/second with normal operation
- Advanced triggering and analysis: I2C, SPI, USB 2.0, CAN, CAN FD, LIN, FlexRay, RS-232, RS-422, RS-485, UART, I2S, Left Justified (LJ), Right Justified (RJ), TDM, MIL-STD-1553, ARINC429 (with the appropriate option), and Parallel
- Power analysis (optional)
- Arbitrary function generator and 16 digital channels (optional)
- Digital voltmeter and trigger frequency counter free with product registration

## Related documents

Use the related documents for more information on instrument functions, how to remotely program or operate the instrument, understand theory of operation, replace suspected modules, and other tasks.

### MDO34, MDO32 documents

| To learn about   | Use this document  |
|--|--|
| How to use instrument functions  | 3 Series MDO (MDO34, MDO32) Installation and Safety Manual (This document, Tektronix part number 071-3608-xx); standard accessory with the instrument. Single document with English, Japanese, and Simplified Chinese languages.<br><br><i>3 Series MDO Help</i> (Printable version of the instrument Help that contains context-sensitive descriptions of all instrument functions; available at <a href="http://www.tek.com/downloads">www.tek.com/downloads</a> ) |
| How to remotely control the instrument   | <i>3 Series MDO Programmer Manual</i> (Tektronix part number 077-1498-xx; available at <a href="http://www.tek.com/downloads">www.tek.com/downloads</a> )  |
| Instrument specifications and procedures to verify the instrument meets specifications | <i>3 Series MDO (MDO34, MDO32) Specifications and Performance Verification Technical Reference</i> (Tektronix part number 077-1499-xx; available at <a href="http://www.tek.com/downloads">www.tek.com/downloads</a> )   |
| Instrument theory of operation, troubleshooting, disassembly, and replaceable parts    | <i>3 Series MDO (MDO34, MDO32) Service Manual</i> (Tektronix part number 077-1500-xx; available at <a href="http://www.tek.com/downloads">www.tek.com/downloads</a> )  |
| Installing the instrument in a rack  | <i>RM3 Rack Mount Kit Instructions</i> (Tektronix part number 071-3609-xx; available at <a href="http://www.tek.com/downloads">www.tek.com/downloads</a> )   |

# Installing your instrument

## 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](http://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 options, tap **Help > About** to confirm that the option(s) are listed in the **Installed Options** table.

### Standard accessories

| Item  | Quantity               | Tektronix part number |
|---|------------------------|-----------------------|
| 3 Series MDO (MDO34, MDO32) Installation and Safety Manual  | 1                      | 071-3608-xx           |
| Passive Voltage Probe, depends on instrument bandwidth<br>(350 MHz, 500 MHz, and 1 GHz bandwidth)<br>(100 MHz and 200 MHz bandwidth)            | One per analog channel | TPP0500B<br>TPP0250B  |
| Accessory bag   | 1                      | 016-2144-xx           |
| Power cord  | 1                      | Depends on region     |
| Calibration certificate   | 1                      | N/A                   |
| OpenChoice® Desktop Software (available for download from <a href="http://www.tek.com/software/downloads">www.tek.com/software/downloads</a> .) |                        |                       |

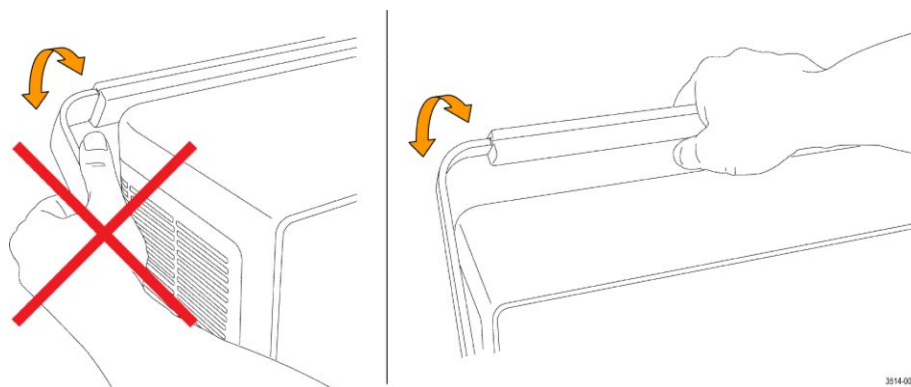
## Safely rotate the handle

Use the correct process to eliminate the chance of pinching your thumb or rear-panel-connected cables while rotating the handle.



**CAUTION.** Hold the top of the handle to rotate the handle on the instrument. Do not hold the handle from the sides and rotate, as this can pinch the base of your thumb between the handle and the case.

If you have routed any cables between the handle and the case, be careful when rotating the handle so that you do not pinch the cables.



## Operating requirements

Use the oscilloscope 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  |
|-----------------------|--|
| Operating temperature | -10 °C to +55 °C (+14 °F to +131 °F)<br><br>For proper cooling, keep the sides and rear of the instrument clear of obstructions for 2 inches (51 mm).        |
| Operating humidity    | 5% to 90% relative humidity (% RH) up to +40 °C (+104 °F), Noncondensing.<br><br>5% to 60% RH above +40 °C up to +55 °C (+104 °F to +131 °F), Noncondensing. |
| Operating altitude    | Up to 3000 meters (9842 feet)  |

### Power requirements

| Characteristic         | Description  |
|------------------------|--|
| Power source voltage   | 100 V - 240 V <sub>AC RMS</sub> , ±10%, single phase   |
| Power source frequency | 50/60 Hz, 100-240 V<br><br>400 Hz ±10% at 100 to 132 V |

## 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 are within the following requirements.

**Table 1: Maximum analog input**

| Input   | Description   |
|---|---|
| Analog input channels, 1 M $\Omega$ setting, maximum input voltage at BNC | 300 V <sub>RMS</sub><br><br>Measurement Category II<br>De-rate at 20 dB/decade between 4.5 MHz and 45 MHz, De-rate 14 db between 45 MHz and 450 MHz. Above 450 MHz, 5 V <sub>RMS</sub> .  |
| Analog input channels, 50 $\Omega$ setting, maximum input voltage at BNC  | 5 V <sub>RMS</sub> with a peak at $\pm 20$ V. (DF $\leq$ 6.25%).  |
| RF input maximum input voltage  | Average Continuous Power: +20 dBm (0.1 W)<br>DC maximum before damage: $\pm 40$ VDC<br>Max no damage +33 dBm (2 W) CW<br>Peak Pulse Power: +45 dBm (32 W)<br>Peak Pulse Power defined as <10 $\mu$ s pulse width, <1% duty cycle, and reference level of $\geq$ +10 dBm |

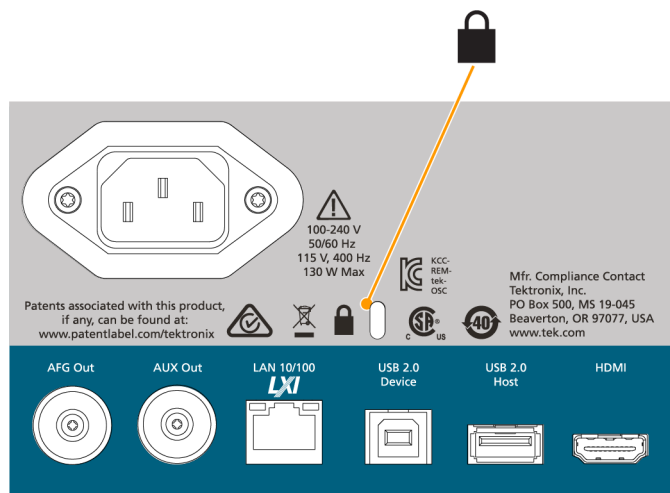
**Table 2: Maximum input with a P6316 Digital Probe**

| Input  | Description  |
|--|--|
| Threshold Accuracy                           | $\pm(100 \text{ mV} + 3\% \text{ of threshold setting after calibration})$ |
| Threshold Range                              | +25 V to -15 V   |
| Maximum nondestructive input signal to probe | +30 V to -20 V   |
| Minimum signal swing                         | 500 mV <sub>peak-to-peak</sub>   |
| Input resistance                             | 101 k $\Omega$   |
| Input capacitance                            | 8.0 pF typical   |
| Pollution Degree                             | 2, indoor use only   |
| Humidity                                     | 5% to 95% relative humidity  |

## Secure (lock) the oscilloscope

Lock an oscilloscope to a test bench or equipment rack to prevent property loss.

Attach a standard laptop security lock to the rear panel of the oscilloscope, to secure the oscilloscope to a workbench, rack, or other location.



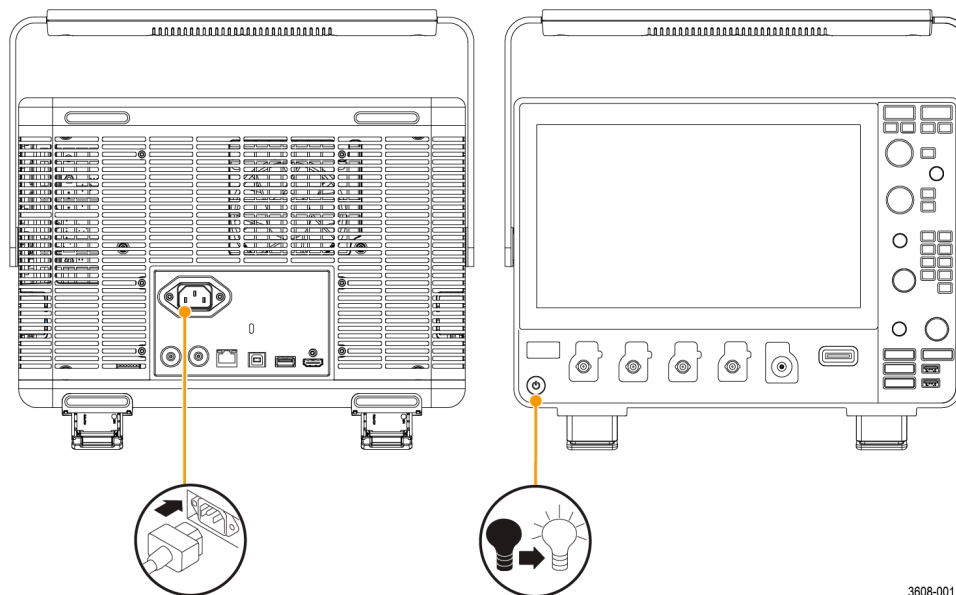
3608-003

## Powering the oscilloscope

Use this procedure to connect the oscilloscope to line power and power on and off the oscilloscope. Always connect the oscilloscope to AC power using the power cord that shipped with the instrument.

Prerequisite: Use the AC power cord that shipped with your oscilloscope.

1. Connect the supplied power cord to the oscilloscope power connector.



3608-001

**Figure 1: Power cord connector and power standby switch**

2. Connect the power cord to an appropriate AC mains source.  
Power is supplied to the power supply and some other boards whenever the AC power cord is connected to a live mains circuit, putting the instrument in standby mode.
3. Push the front panel power button to power the instrument on and off.  
The power button color indicates instrument power states:  
Unlit – no AC power applied  
Yellow – standby mode  
Blue – powered on
4. To completely remove power from the instrument, disconnect the power cord.

## Check that the oscilloscope passes power-on self tests

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

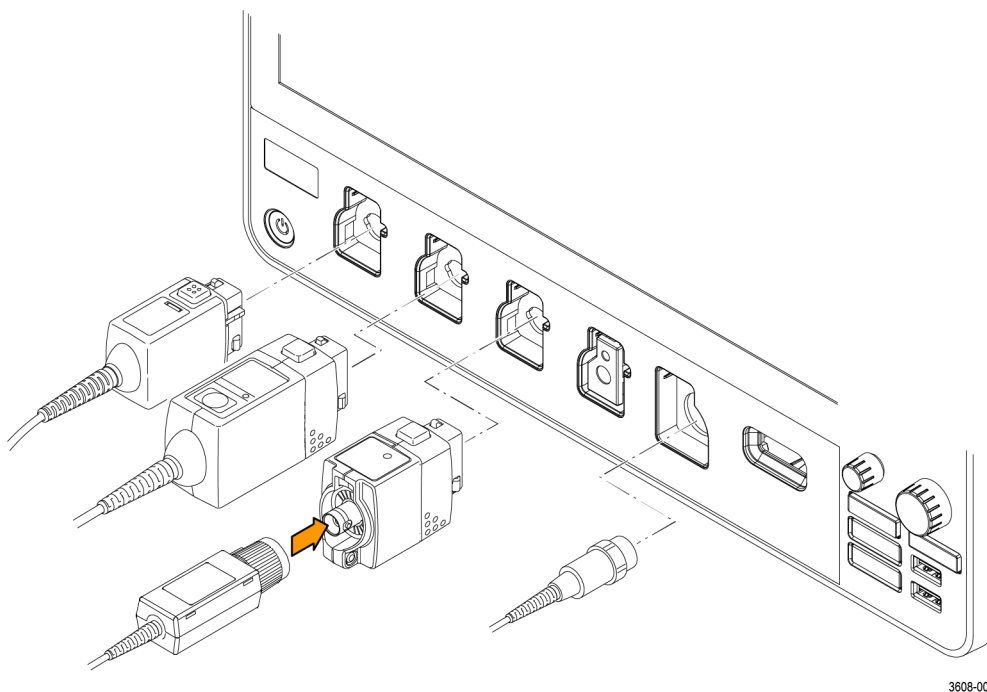
1. Power on the oscilloscope and wait until the oscilloscope screen appears.
2. Select **Utility > Self Test** from the top-edge Menu bar to open the **Self Test** configuration menu.
3. Check that the status of all power-on self tests are **Passed**.

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

- a. Power cycle the oscilloscope.
- b. Tap **Utility > Self Test**. If one or more power-on self tests still shows **Failed**, contact Tektronix Customer Support.

## Connecting probes

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



**Figure 2: Connecting probes to the instrument**

1. Tektronix Versatile Probe Interface (TekVPI)

These probes support two-way communication with the oscilloscope through on-screen menus and remotely through programmable support. The remote control is useful in applications like ATE where you want the system to set probe parameters.

2. Tektronix Versatile Probe Interface (TekVPI) for Passive Probes

These probes build upon the functionality of the TekVPI interface. Each probe is matched with its corresponding oscilloscope channel, allowing the oscilloscope to optimize the signal input path. This provides AC compensation across the frequency band.

**3. TPA-BNC Adapter**

The TPA-BNC Adapter allows you to use TEKPROBE II probe capabilities, such as providing probe power and passing scaling and unit information to the oscilloscope.

**4. BNC Interfaces**

Some of these use TEKPROBE capabilities to pass the waveform signal and scaling to the oscilloscope. Some only pass the signal and there is no other communication.

**5. Logic Probe Interface**

The P6316 probe provides 16 channels of digital (logical one or zero) information.

**6. The TPA-N-VPI Adapter allows you to use TekVPI probes with the RF input.**

Connect TPP0250, TPP0500B, TPP1000, TekVPI+, TekVPI, or other supported Tektronix analog probes by pushing them into an input connector. The probe base latch locks with a 'click' when the probe is fully seated.

TekVPI probes automatically set the channel input parameters for that probe (bandwidth, attenuation, termination, and so on). If a probe has a **Menu** button, push that button to open an on-screen configuration menu. Follow instructions provided with active probes to set their parameters (auto zero, degauss, and so on).

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

For more information on the many probes available for use with 3 Series MDO oscilloscopes, visit the Oscilloscope Probe and Accessory Selector Tool on the Tektronix website at [www.tektronix.com](http://www.tektronix.com).

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**NOTE.** Connecting a probe does not automatically enable that channel (make it active). Use the instrument controls or programmatic interface to turn on a channel and open its configuration menu to verify or change probe or cable settings (bandwidth, attenuation, termination and so on).

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## Rackmount information

The optional RM3 Rackmount Kit lets you install the oscilloscope in standard equipment racks. The rack mount requires six rack units (6U) of space to install.

Contact Tektronix Customer Support to purchase the rackmount kit option RM3. Follow the instructions that come with the rackmount kit (*RM3 Rackmount Kit Instructions*, Tektronix part number 071-3609-xx).

Make sure to allow at least two inches of clearance on the sides for air ventilation and on the back for any cables you attach to the rear panel.



## Remote access from a Web browser

You can remotely access your network-connected instrument from a Web browser to display the instrument user interface on a PC.

This procedure describes how to remotely access the UI controls and screen for the instrument.

Prerequisites:

- The oscilloscope must be connected to, and accessible from, the network to which the PC is connected. See [Connect to a network \(LAN\)](#) on page 34
  - Determine the IP address of the oscilloscope that you want to access. To determine the oscilloscope's IP address, select **Utility > IO** in the oscilloscope menu bar and view the network settings in the **LAN** panel.
1. Open a Web browser on a PC connected to the same network as the oscilloscope.
  2. Enter just the oscilloscope IP address on the URL line of the browser and press **Enter**. For example: 135.62.88.157. The browser searches for and opens the Web page for the oscilloscope.

## 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**.
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 rear of the instrument.
5. If using the USB connection to remotely control the oscilloscope using GPIB commands, set the **GPIB Talk/Listen Address** for your configuration (0 - 30).

## Cleaning

Use a dry, soft cotton cloth to clean the outside of the unit. 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 any liquid cleaning agents or chemicals that could damage the touchscreen, case, controls, markings or labels, or possibly infiltrate the case.

Installing your instrument

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# 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, and cursors. The connectors are where you input signals with probes or cables or insert USB devices.

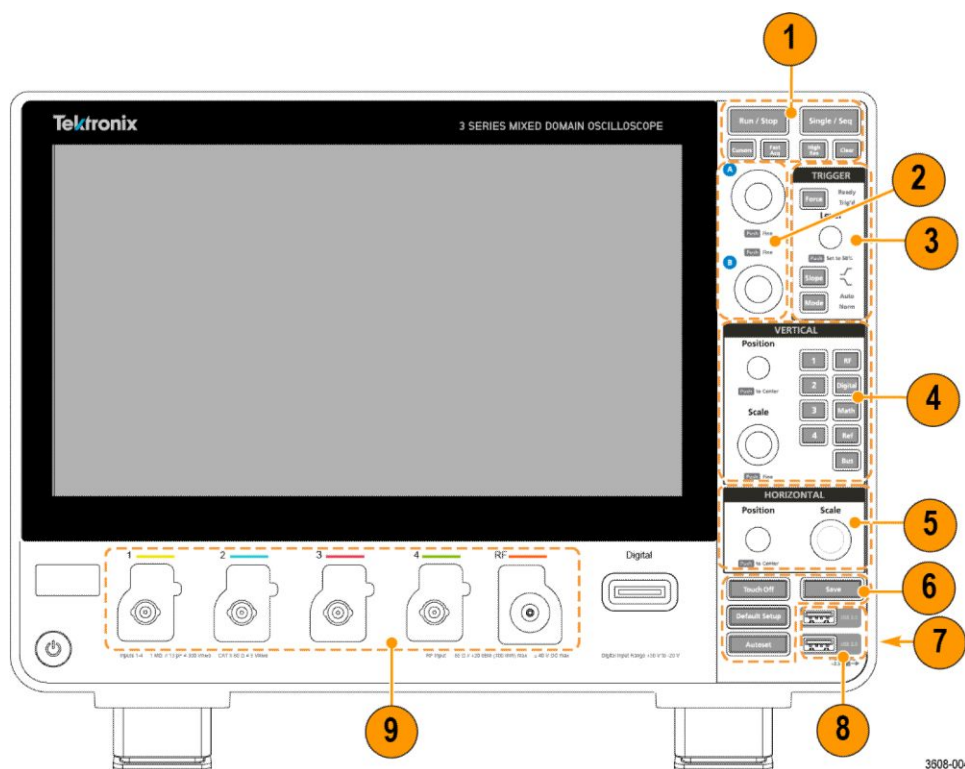
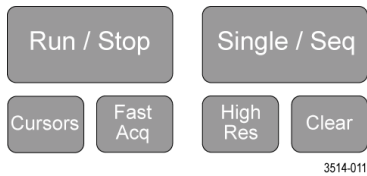


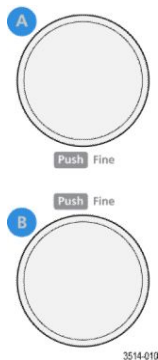
Figure 3: 3 Series MDO controls

## 1. Acquisition and Cursors controls:



- **Run/Stop** starts and stops waveform acquisition. The button color indicates the acquisition status (green = running and acquiring; red = stopped). When stopped, the oscilloscope shows waveforms from the last completed acquisition. The Run/Stop button on the screen also shows the acquisition status.
- **Cursors** button turns cursors on or off. Use the Multipurpose knobs to move the cursors. Double-tap the cursor readouts or on a cursor bar (line) to open the configuration menu to set cursor types and functionality.
- **Fast Acq™** enables or disables the fast acquisition mode. FastAcq provides high-speed waveform capture that reduces the dead time between waveform acquisitions, enabling the capture and display of transient events such as glitches and runt pulses. It is helpful in finding elusive signal anomalies. Fast acquisition mode can also display waveform phenomena at an intensity that reflects their rate of occurrence.
- **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 = single acquisition acquired; solid green = waiting for trigger event). Pushing **Single/Seq** again takes another single acquisition.
- **High Res** mode calculates the average of all the samples for each acquisition interval. High Res provides a higher-resolution, lower-bandwidth waveform.
- **Clear** deletes the current acquisitions and measurement values from memory.

## 2. Multipurpose knobs:

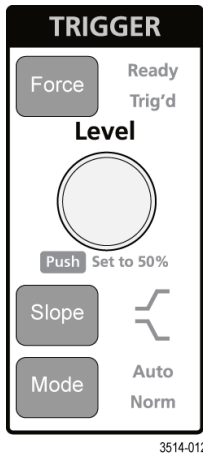


- **Multipurpose knobs (A, B)** Multipurpose knobs A and B move cursors and set parameter values in configuration menu input fields. Selecting a menu field that can use a Multipurpose knob assigns the indicated knob to change the value in that input field. The ring around each knob lights when you can 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 exit **Fine** mode.

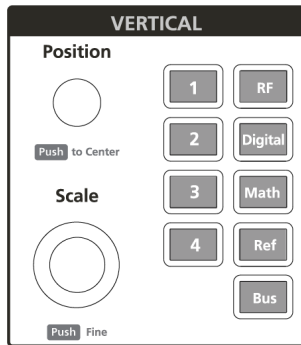
**NOTE.** If you have a mouse attached, pressing the mouse wheel toggles between **Coarse** and **Fine** adjustments.

## 3. Trigger controls:



- **Force** forces a trigger event at a random point in the waveform and captures the acquisition.
- **Level** sets the amplitude level that the signal must pass through to be considered a valid transition. The color of the **Level** knob indicates the trigger source except for dual-level triggers. The **Level** knob is disabled 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.
- **Slope** sets the signal transition direction to detect for a trigger (low to high, high to low, or either direction). Push the button to cycle through the selections. The **Slope** button is disabled when the trigger type requires other slope qualifiers (set from the **Trigger** configuration menu).
- **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.

## 4. Vertical controls:

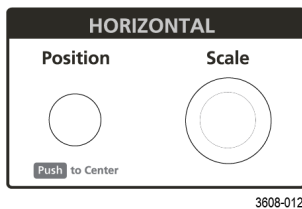


3608-011

- **Position** moves the selected waveform up or down on the screen. The color of the **Position** knob indicates which waveform the knob is controlling. Push the knob to center the waveform handle on the display.
- **Scale** sets the amplitude units per vertical graticule division of the selected waveform. The scale values are shown on the waveform badge. The color of the **Scale** knob indicates which waveform the knob is controlling.
- **Channel** buttons turn on (display), select, or turn off a channel, as follows:
  - If the channel is not displayed, pushing a Channel button turns on that channel in 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).
- The **Math** button adds or selects a Math waveform on the Waveform view, as follows:
  - If no Math waveform exists, pushing the **Math** button adds a Math waveform to the Waveform view and opens the Math configuration menu.
  - If a Math waveform is displayed but not selected, pushing the button selects the Math waveform.
  - If a Math waveform is displayed and selected, pushing the button turns off the Math waveform (removes it from Waveform view). Push the button again to display the waveform.
- The **Ref** button adds or selects a Reference (saved) waveform on the Waveform view, as follows:
  - If no Reference waveform exists, pushing the **Ref** button opens the **Browse Waveform Files** configuration menu. Navigate to and select a waveform file (\*.isf) 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.
- The **Bus** button adds or selects a bus waveform on the Waveform view, as follows:
  - If no Bus waveform exists, pushing the **Bus** 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 Bus waveforms are displayed, pushing the button cycles through selecting each Bus waveform.

- The **RF** button adds the RF waveform on the Waveform view and switches from the time domain to the frequency domain. All time domain waveforms are turned off and the spectrum analyzer is turned on. When you switch back to the time domain, the time domain waveforms are restored.
- The **Digital** button adds or selects a digital waveform on the Waveform view
  - If the digital channels are not displayed, pushing a **Digital** button turns on the channels in the Waveform view.
  - If the digital channels are on the screen, but not selected, pushing the **Digital** button selects the digital channels.
  - If the digital channels are on the screen and are also selected, pushing the **Digital** button turns the digital channels off (removes them from Waveform view).

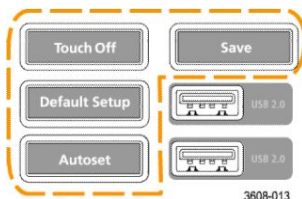
5. Horizontal controls:



3608-012

- **Position** moves the waveform from 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 of the graticule.
- **Scale** sets the time per major horizontal graticule division and samples/second parameters for the oscilloscope. Scale applies to all waveforms.

6. Miscellaneous controls:

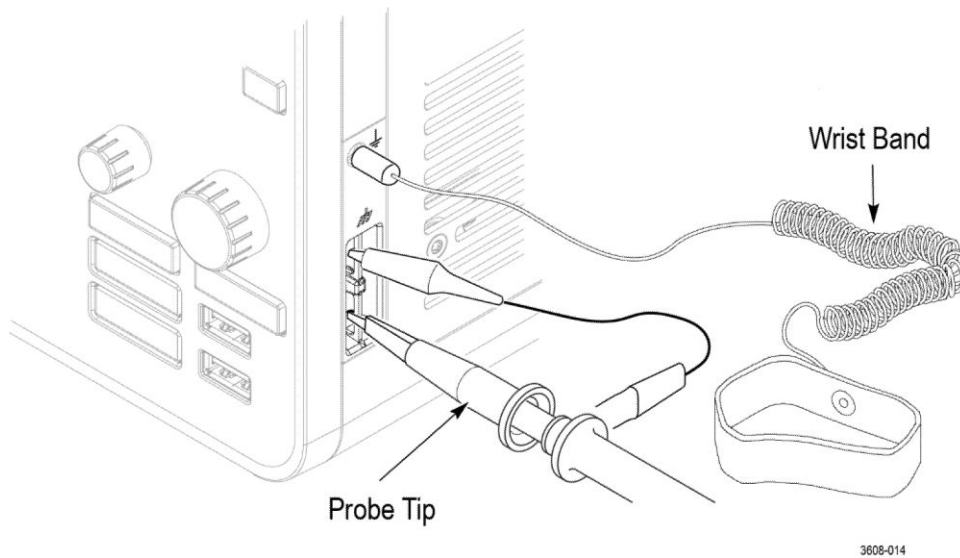


3608-013

- **Touch Off** turns touchscreen capability off. The **Touch Off** button is lighted when the touchscreen is turned off.
- **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, and so on, as follows:
  - If a **File > Save** or **File > Save As** operation has occurred since the last instrument startup, pushing **Save** 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 **Save** opens the **Save As** configuration menu. Select a tab to select the type of file to save (Screen Capture, Waveform, and so on), set any associated parameters, and where to save it, and select **OK**. The specified file or files are saved. The next time you push **Save**, the same type of files are saved.
  - **Screen Captures** capture the entire screen, including displayed configuration menus and dialog boxes.
- **Default Setup** restores the oscilloscope settings (horizontal, vertical, scale, position, and so on) to the default settings. Default Setup does not change items found in the User Preferences menu.
- **Autoset** automatically displays a stable waveform.

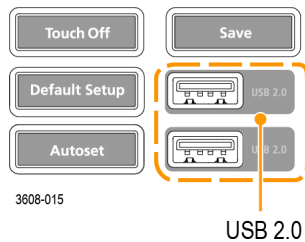
## Getting acquainted with your instrument

### 7. Ground and Probe Compensation connectors:



- The Ground and Probe Compensation connectors are located at the lower right side of the instrument, near the front panel. The Ground connector (the small hole in the case) provides an electrically grounded (through a resistor) connection point to attach an anti-static wrist strap to reduce electrostatic damage (ESD) while you handle or probe the DUT.
- The Probe Compensation connections provide a ground connector (upper tab) and 1 kHz square wave source (lower tab) for adjusting the high-frequency response of a passive probe (probe compensation). The oscilloscope uses this signal to automatically compensate supported probes, including the ones that ship with the product. See [Compensate TPP0250, TPP0500B, or TPP1000 probes](#) on page 33.

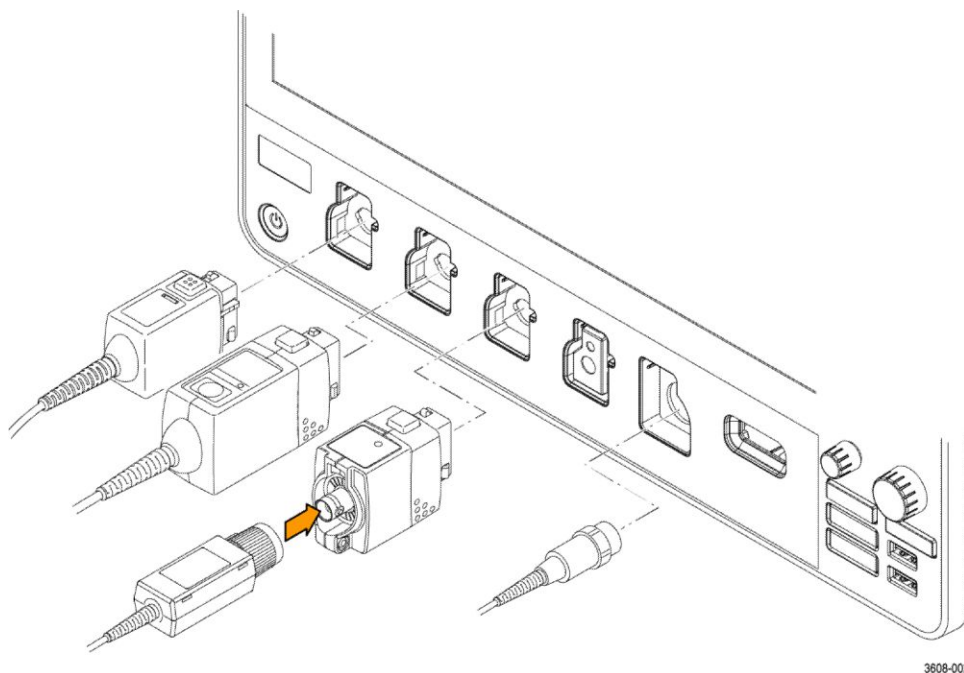
### 8. USB Host ports (USB 2.0):



- USB ports are located at the lower right corner of the front panel and on the rear panel. Connect USB flash drives to which you can save or recall data (such as instrument software updates, waveforms, settings, and screen captures) or connect peripheral devices such as a mouse or keyboard.



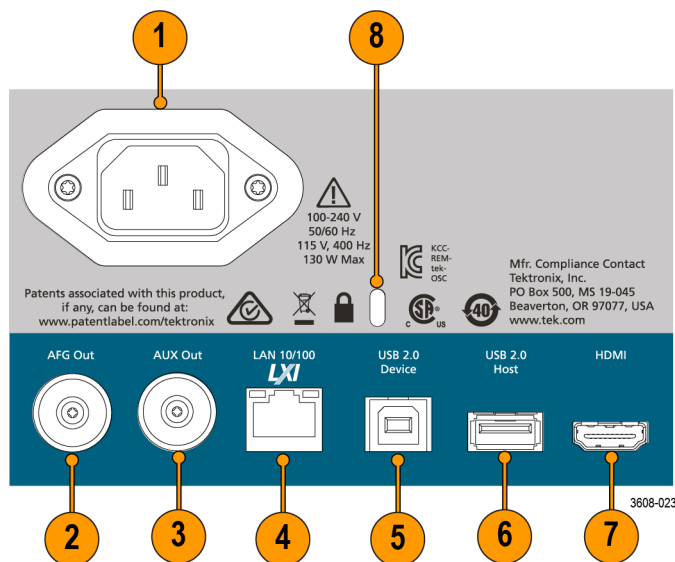
## 9. Probe connectors:



- Analog input connectors support all TekVPI+ and TekVPI measurement probes, BNC passive probes, the P6316 Logic Probe, and BNC cables. See [Connecting probes](#) on page 5.

## Rear panel connections

The rear panel connections supply power to the oscilloscope and provide connectors for network, USB devices, video, reference signals, and the AFG output.



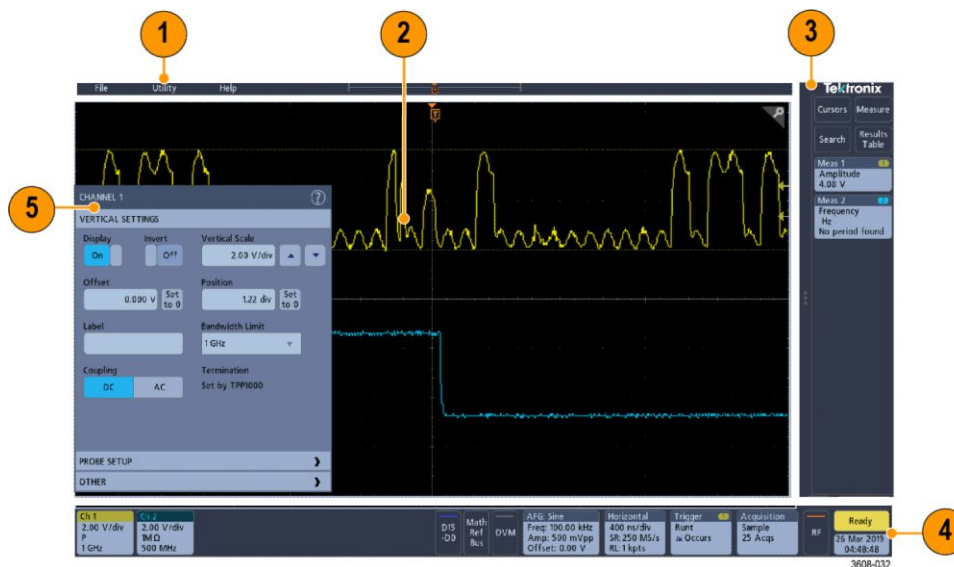
1. **Power cord** connector. Use only the power cord specified for this product and certified for the country of use.
2. **AFG Out** is the signal output for the optional Arbitrary Function Generator (AFG) feature.

## Getting acquainted with your instrument

3. **AUX Out** generates a signal transition on a trigger event or outputs a synchronization signal from the AFG.
4. **LAN** connector (RJ-45) connects the oscilloscope to a 10/100 Base-T local area network.
5. **USB Device** port lets you connect to a PC to remotely control the oscilloscope using the USBTMC protocol.
6. **USB Host** port lets you connect a USB memory device, keyboard, or mouse.
7. **HDMI** output lets you connect an external monitor or projector to show the oscilloscope screen.
8. **Security** lock connector lets you use a standard PC/laptop lock cable to secure the oscilloscope to a work bench or other location.

## The user interface screen

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

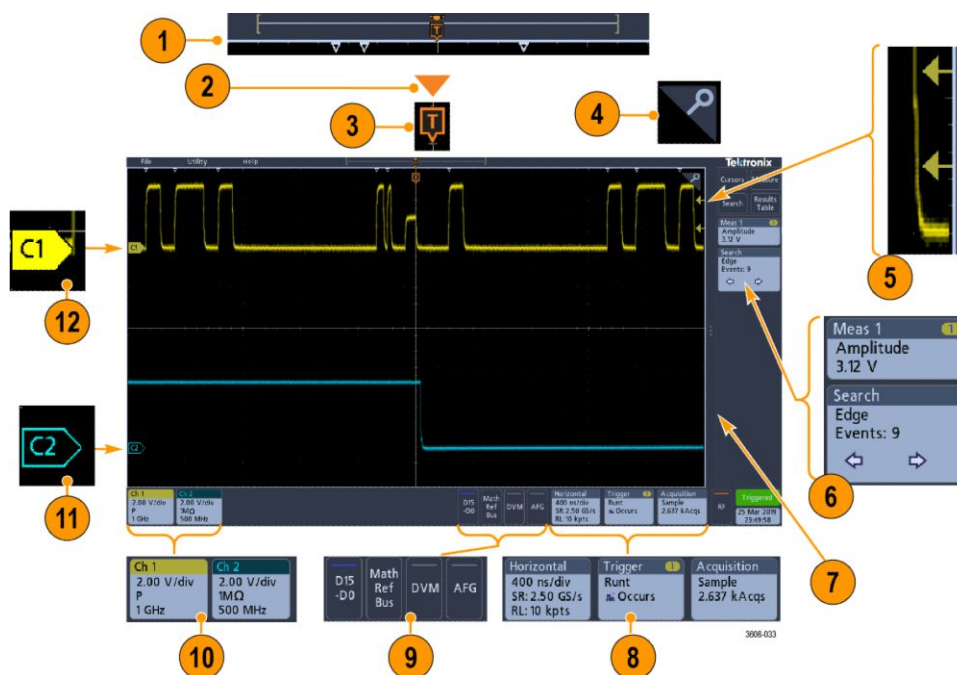


1. The **Menu bar** provides menus for typical operations including:
  - Saving, loading, and accessing files
  - Setting oscilloscope display and measurement preferences
  - Configuring network access
  - Running self tests
  - Erasing measurement and settings memory (TekSecure™)
  - Loading option licenses
  - Opening a Help viewer
2. The **Waveform View** area displays analog, digital, math, reference, and bus waveforms. The waveforms include waveform handles (identifiers), trigger position, and level(s) indicators. See [Identifying items in the time domain display](#) on page 17.

3. The **Results Bar** contains controls for displaying cursors, adding result tables to the screen, and adding measurements to the Results bar. The controls are:
  - The **Cursors** button displays on-screen cursors. 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 **Measure** button opens a configuration menu from which to select and add up to four measurements to the Results bar. Each measurement you add has a separate badge. Double-tap a measurement badge to open its configuration menu.
  - The **Results Table** button adds a Measurement, Bus, Search, and Harmonics results table to the screen. The Measure tab displays all measurements present in the Results bar. The Bus tab displays bus decode information for displayed bus waveforms. The Search tab displays search event information. The Harmonics tab displays harmonic measurement results.
  - The **Search** button lets you detect and mark a waveform where specified events occur. Tap **Search** to open a Search configuration menu and set the search conditions for analog and digital channels. Search badges are added to the **Results Bar**.
  - The **Measurement** and **Search** badges show measurement and search results and are displayed in the **Results Bar**. See [Badges](#) on page 22.
4. The **Settings Bar** contains System badges for setting Horizontal, Trigger, Acquisition, and Date/Time parameters; **Inactive Channel** buttons to turn on channels; **Math/Ref/Bus** button to add math, reference, and bus waveforms to the display; and Channel and Waveform badges that let you configure the individual waveform parameters. 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. See [Badges](#) on page 22.
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. See [Configuration menus](#) on page 27.

## Identifying items in the time domain display

Each area of the user interface has a specific function that helps manage information or controls. This topic shows and describes the key user interface elements.



1. The Waveform Record View is a graphical high-level view of the overall acquisition, how much of the acquisition 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 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. See [Zoom user interface elements](#) on page 28.

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.



4. The Zoom icon (in upper right corner of Waveform and Plot views) toggles zoom on and off.



5. The Trigger Level Indicator icon(s) shows the trigger level(s) on the trigger source waveform. Some trigger types require two trigger levels.
6. Measurement and Search badges show measurement and search results. See [Badges](#) on page 22.
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**, **Acquisition**, Run/Stop status, and Date/Time). See [Badges](#) on page 22.
9. The Inactive Channel buttons add channel waveforms to the Waveform view and add an associated Channel badge to the Settings bar.

The **Add Math Ref Bus** button expands allowing you to add a math, reference, or bus waveform to the Waveform view and add an associated Waveform badge to the **Settings** bar.

The **RF** button activates the frequency domain display and adds an RF badge. Double-tap the badge to open the RF configuration menu to configure the RF input. This button is only active if one of the RF options is enabled.

The **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 **DVM** button lets you use an analog probe to take DC, AC RMS, or DC+AC RMS voltage measurements on your DUT. Tap the button to add a DVM badge to the Results Bar and open a configuration menu. The DVM option also enables a trigger frequency counter, accessible from the **Mode & Holdoff** panel in the **Trigger** badge menu. This button is only present if the DVM option is installed.

10. Double-tap a badge to open its associated configuration menu. See [Badges](#) on page 22. See [Configuration menus](#) on page 27.

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 (Cx for channels, M for Math, Rx for Reference waveforms, Bx 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, with each individual digital signal labeled D0–D15 and displayed with a different color.



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

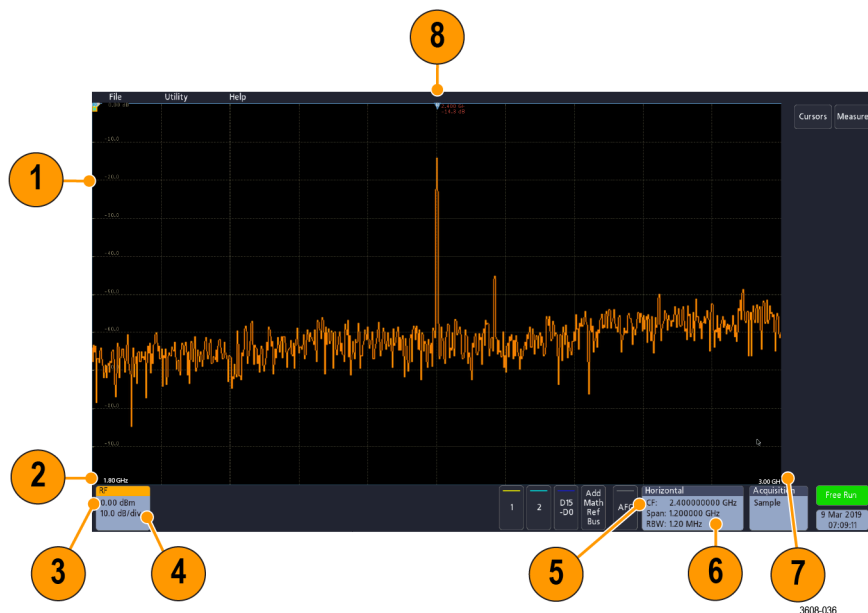
Dragging a digital signal handle over another handle swaps location of the signals in the waveform view. Dragging a digital signal handle out of the group, creates a new group. A selected digital group or signal handle can be moved using the Vertical Position control.

## Identifying items in the frequency domain display

This topic shows and describes each element of the frequency domain display.

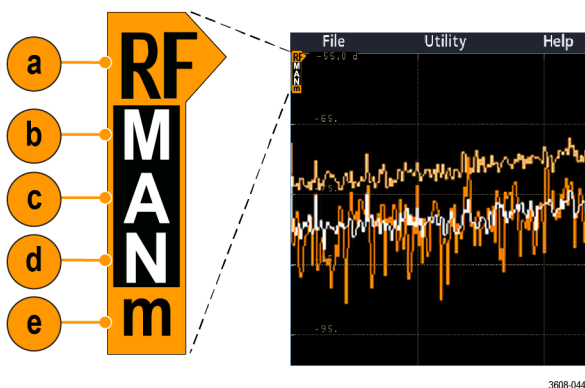
To activate the frequency domain display, press the front panel RF button or tap the RF button in the display .

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



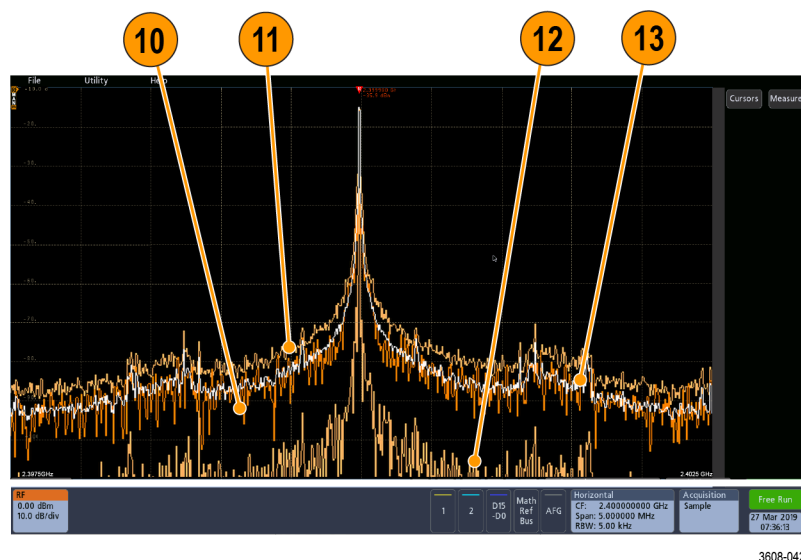
1. Vertical graticule labels
2. Start frequency
3. Reference level
4. Vertical scale
5. Center frequency
6. Span and resolution bandwidth
7. Stop frequency
8. Reference marker

## 9. Displayed trace indicators



- An RF trace indicator is placed at the Reference Level.
- A capital M appears if the maximum trace is turned on.
- A capital A appears if the average trace is turned on.
- A capital N appears if the normal trace is turned on.
- The small m appears if the minimum trace is turned on.

Orange highlighting indicates the currently selected trace. In the figures the small m, which stands for the minimum trace, is highlighted. This indicates that the minimum trace is currently selected.



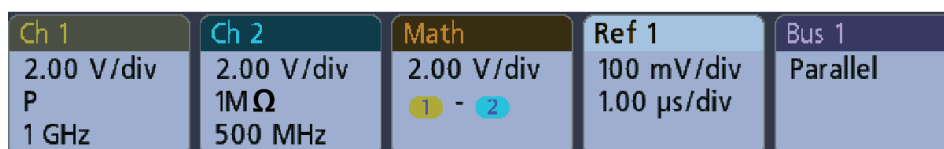
- Normal trace: Each acquisition is discarded as new data is acquired.
- Max hold trace: The maximum data values are accumulated over multiple acquisitions of the Normal trace.
- Min hold trace: The minimum data values are accumulated over multiple acquisitions of the Normal trace.
- Average trace: Data from the Normal trace is averaged over multiple acquisitions. This is true power averaging, which occurs before the log conversion. Each power of 2 averaging reduces the displayed noise by 3 dB.

## 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.

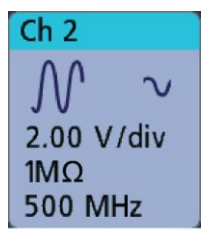
### Channel and Waveform badges

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.



1497-013

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



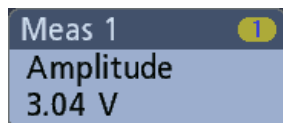
3005-019

You can drag or flick Channel and Waveform badges down off the display to turn them off. Swiping back up from the bottom of the display restores them if they were accidentally deleted.

Channel badges are listed in the channel order. For more information, double-tap the badge to open its configuration menu or search the instrument Help.

### Measurement badges

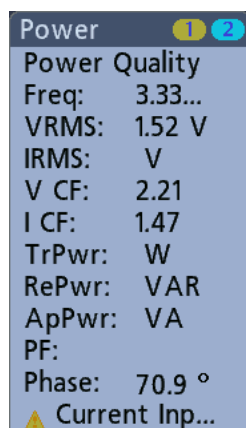
Result badges are located in the **Results** Bar. They show measurement or search results. The badge title also shows the measurement source or sources. To add a Measurement badge, tap the **Measure** button, select a measurement, and tap **Add**.



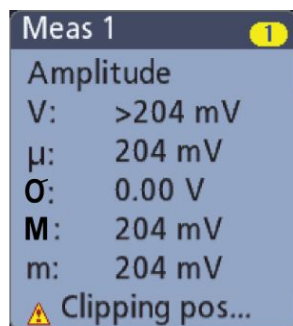
Double-tap a Measurement badge to open its configuration menu to change or refine settings.



Some measurements and their badges are only available as options. For example, Power measurements are only listed in the Add Measurement menu if the PWR option is installed.



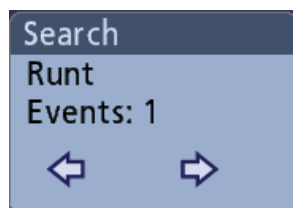
To add statistical readouts to individual measurement badges, double-tap a measurement badge to open its configuration menu and select **Show Statistics in Badge**.



You can drag or flick Measurement badges off to the right of the display to delete them. You can bring the badge back by swiping in from the right.

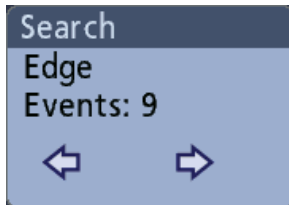
## Search badges

**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 acquisitions are stopped.



You can drag or flick a Search badge to the right, off the display, to delete it. You can bring the badge back by swiping in from the right.

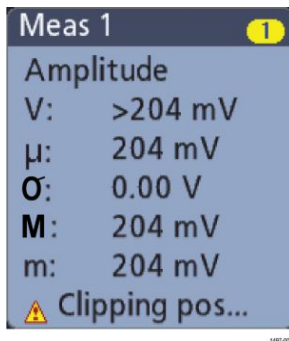
### Signal clipping and badges

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.



**WARNING.** *Clipping is caused by excessive or dangerous voltages 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 word Clipping in a Channel badge when a vertical clipping condition exists. Any measurement badges associated with that channel also indicate a clipping condition.*



*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.*

### Error messages and badges

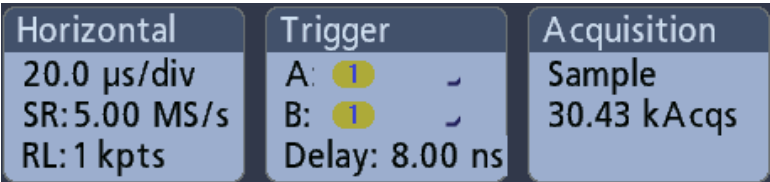
This instrument shows a warning triangle symbol and an error message abbreviation in a Channel badge when an error occurs.



To remove the message from the badge, clear the error.

### System badges

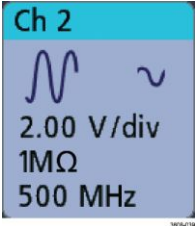

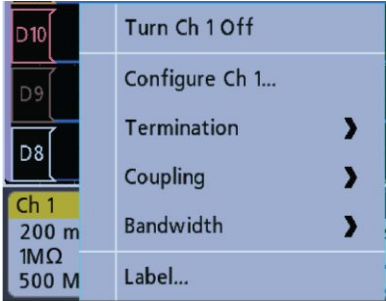
System badges (in the **Settings** bar) display the main Horizontal, Trigger, and Acquisition settings. You cannot delete System badges.



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/div setting.

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.  |   |
| 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. |  |

## Configuration menus

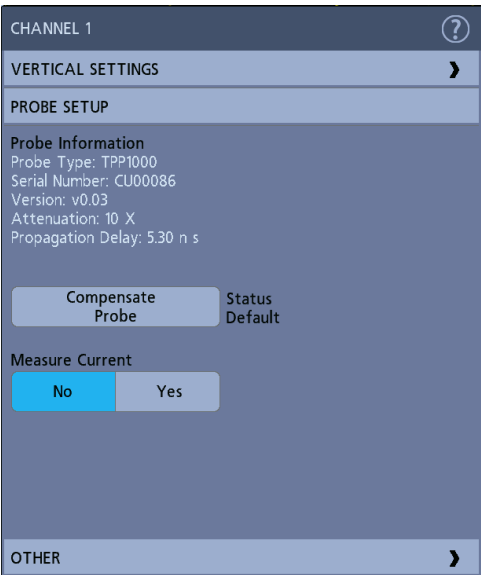
Configuration menus let you quickly set the parameters for channels, system settings (Horizontal, Trigger, Acquisition), measurements, cursor readouts, Waveform view, and so on.

Double-tap an item (badge, **Waveform View**, cursor readouts, 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.



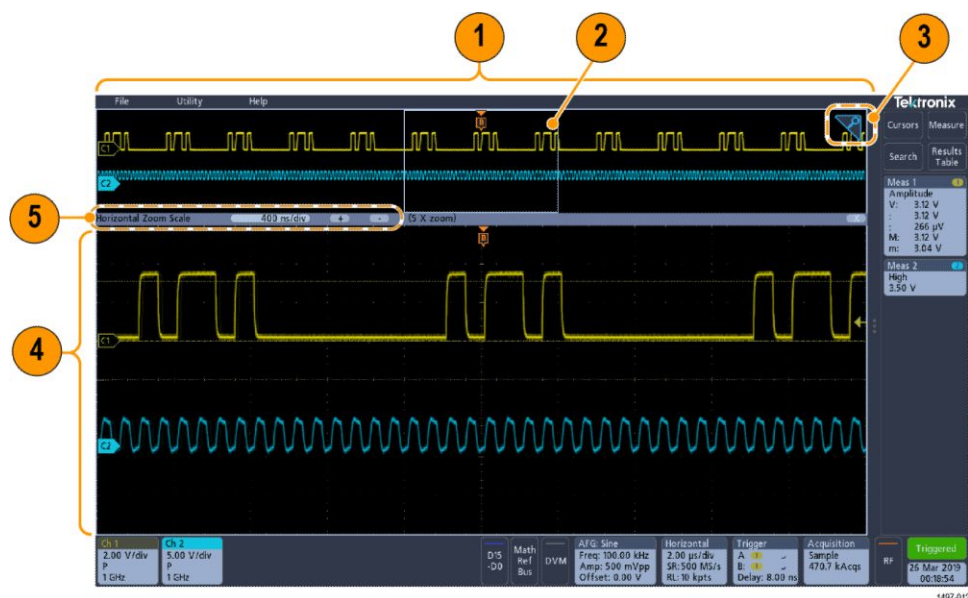
Tap anywhere outside a configuration menu to close it.

## Getting acquainted with your instrument

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

## Zoom user interface elements

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



1. The **Zoom Overview** shows the entire waveform record.

**NOTE.** 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 4). You can touch and drag the box to move the area to view.

**NOTE.** 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. The **Zoom View** shows the zoomed waveforms as marked by the Zoom Box. Use pinch and/or drag options in the zoom view to change the zoomed area of interest.

**NOTE.** Pinch, expand, and drag gestures in the Zoom View only change zoom magnification settings and Zoom Box position.

5. Use the **Zoom Title Bar** controls to adjust the horizontal size of the zoom area. Click or tap the + or - buttons.

Horizontal Zoom Scale 400 ns/div + - (5 X zoom)

## Using the touchscreen interface for common tasks

Use standard touchscreen 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.

See the table to quickly learn the fundamental touch operations.

**Table 3: Common touchscreen UI tasks (with mouse equivalents)**

| Task   | Touchscreen UI action   | Mouse action   |
|--|---|--|
| Add a channel, math, reference, or bus waveform to the screen.   | Tap an inactive channel button or the <b>Add Math Ref Bus</b> button and select a math, reference, or bus.                                | Click an inactive channel button or the <b>Add Math Ref Bus</b> button and select a math, reference, or bus.   |
| Select a channel, math, reference, or bus waveform to make it active.  | Tap the Channel or Waveform badge or waveform handle.   | Click the Channel or Waveform badge or waveform handle.  |
| Display scale or navigation buttons on a badge (waveform, measurement <sup>1</sup> , search, horizontal).  | 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, or other screen item until a menu opens.  | Right-click the object.  |
| Close a configuration menu <sup>2</sup> .  | 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 left mouse button on title or blank area and then drag to new position.   |
| Change horizontal or vertical settings directly on a waveform.<br>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. Or, use pinch/expand gestures.   | Click a channel, waveform, or <b>Horizontal</b> badge and click on the Scale buttons.  |
| 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, and repeat. | Click the + or - buttons on the Zoom Title bar.  |
| Quickly scroll or pan a waveform.  | Touch and drag in the waveform.   | Click and drag in the waveform or list.  |
| Close or open the <b>Results Bar</b> to increase the <b>Waveform View</b> area.  | Tap on the <b>Results Bar Handle</b> or anywhere in the border between the <b>Waveform View</b> and the <b>Results Bar</b> .              | Click the <b>Results Bar Handle</b> or anywhere in the border between the <b>Waveform View</b> and the <b>Results Bar</b> .<br>Click and drag the Results Bar divider. |

<sup>1</sup> Not all measurement or search badges display navigation buttons.

<sup>2</sup> Some dialog boxes will not close until you click an OK, Close, or other button in the dialog.

Getting acquainted with your instrument

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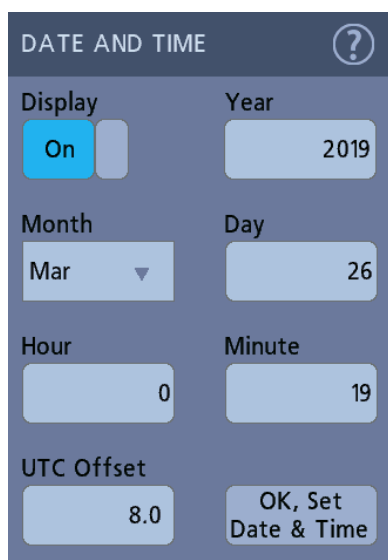


# Configure the instrument

## Set the date and time

Set the date and time so that saved files are marked with the correct date and time information.

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 the **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. You may also tap the **Year**, **Day**, **Hour**, **Minute**, or **UTC Offset** fields and use the multipurpose knobs to set the fields to the correct time.  
You may also double-tap the fields and use the numeric keypad to set the time.
4. Tap **Month** and select the month from the list.
5. Tap anywhere outside of the menu to close it.

## Download and install the latest firmware

Installing the latest firmware helps ensure that your instrument is equipped with all of the best available measurement and analysis improvements.

Prerequisite: Save any important on-instrument files (waveforms, screen captures, oscilloscope setups, and so on) to a USB drive or network. The installation process does not remove user-created files, but it is a good idea to back up important files before an update.

### Update oscilloscope firmware from a USB drive

Prerequisite: Determine the current version of firmware installed on the oscilloscope (**Help > About**)

1. Open up a Web browser on a PC and go to **www.tek.com/product-support**.
2. Enter the oscilloscope 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 oscilloscope, select and download that file to your PC.
5. Copy the firmware install file to a USB drive.
6. Insert the USB drive into any oscilloscope USB Host port:
7. Power off the oscilloscope and then power on the oscilloscope.

---

**NOTE.** Do not power off the oscilloscope or remove the USB flash drive until the oscilloscope finishes installing the firmware. The oscilloscope displays a message when it is OK to turn off the oscilloscope.

---

The oscilloscope detects the USB drive with the firmware file and starts the installation process. Follow on-screen instructions to install the firmware.

8. When the firmware install is finished, remove the USB drive and restart the oscilloscope.

To confirm the firmware installation:

- a. Tap **Help > About** in the Menu bar.
- b. Verify that the firmware version number listed on the screen is the same version that you downloaded.

## Run Signal Path Compensation (SPC)

Run SPC 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/div or less.

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 oscilloscope not meeting warranted performance levels at low volts per division settings.

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

1. Power on and warm up the oscilloscope 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 several minutes per channel to run, so wait until the SPC Status message changes to **Pass** before reconnecting probes and using the oscilloscope.

4. Close the **Calibration** configuration dialog when SPC has completed.
5. If SPC fails, write down any error message text. Make sure that all probes and cables are disconnected and run SPC again. If SPC still fails, contact Tektronix Customer Support.

## Compensate TPP0250, TPP0500B, or TPP1000 probes

Probe compensation adjusts the high frequency response of a probe for best waveform capture and measurement accuracy. The oscilloscope can automatically test and store compensation values for TPP0250, TPP0500B and TPP1000 probes.

The oscilloscope stores the compensation values for each probe/channel combination and automatically recalls the compensation values when you plug in the probe again. Probe compensation status is shown in the Probe Setup panel of the Channel configuration menu.

- If the Probe Compensation Status field displays **Pass**, the probe is compensated and ready for use.
- If the Probe Compensation Status field displays **Default**, the attached probe has not been compensated and needs to have this probe compensation procedure run.
- If the Probe Compensation Status field displays **Fail**, the attached probe has failed the probe compensation procedure. Reconnect the probe and run probe compensation again.
- If there is no probe compensation status field shown in the panel, the oscilloscope cannot store compensation values for that probe. See the oscilloscope Help for how to manually compensate passive probes not supported by the probe compensation function.
- Each compensation generates values for a specific probe and channel combination. If you want to use the probe on another channel and desire to compensate the new probe-channel pair, you must run a new set of compensation steps.
- Each channel can store compensation values for 10 individual probes. If you try to compensate an 11th probe on a channel, the oscilloscope will delete the values for the least recently used probe and add the values for the new probe.

Use this procedure to compensate a TPP0250, TPP0500B, TPP1000, or other supported TPP-family probe that shows a **Default** status when connected to the oscilloscope.

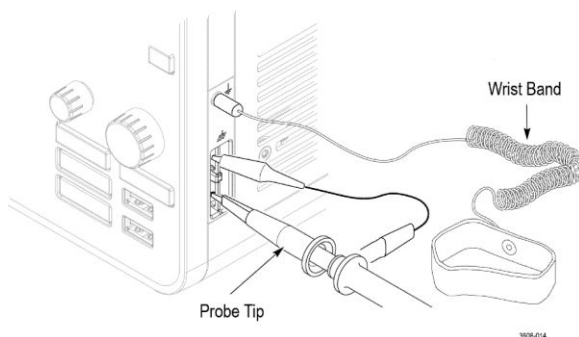
---

**NOTE.** A **Default Setup** does not delete probe compensation values. A factory calibration deletes all stored probe compensation values.

---

**Prerequisite:** The oscilloscope must be powered on for at least 20 minutes before compensating a probe.

1. Connect a supported probe to an input channel.
2. Connect the probe tip and ground lead of the probe to the PROBE COMP terminals on the lower right of the oscilloscope (see following image).



**Figure 4: Probe Comp connections.**

Connect the probe tip to the 1 kHz source and the ground clip to the ground. For best results, remove any probe tip accessories and hold the probe tip directly onto the 1 kHz connector.

---

**NOTE.** Connect only one probe at a time to the PROBE COMP terminals.

---

3. Turn off all channels.
4. Turn on the channel to which the probe is connected.
5. Push the front-panel **Autoset** button. The screen displays a square wave.
6. Double-tap the badge of the channel that you want to compensate.
7. Tap the **Probe Setup** panel.

If the Probe Compensation Status says **Pass**, the probe is already compensated for this channel. You can move the probe to another channel and start again from step 1 or connect a different probe to this channel and start from step 1.

If the Probe Compensation Status says **Default**, continue with this procedure.

8. Tap **Compensate Probe** to open the **Probe Compensation** dialog.
9. Tap **Compensate Probe** to run the probe compensation.
10. The probe compensation is finished when the Probe Compensation Status displays **Pass**. Disconnect the probe tip and ground from the PROBE COMP terminals.
11. Repeat these steps for each supported passive probe that you want to compensate for this channel.
12. Repeat these steps to compensate supported probes on other channels of the oscilloscope.

---

**NOTE.** For most accurate measurements, open the **Probe Setup** panel and verify the Probe Compensation Status is **Pass** whenever you attach a probe to a channel.

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**NOTE.** A probe compensation failure is most likely due to intermittent connection of the probe tip or ground connection during the probe compensation operation. If a failure occurs, the oscilloscope will re-use the old probe compensation values if they existed prior to the failed probe compensation operation.

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## 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 oscilloscope LAN connector to your network.
2. Select **Utility > I/O** on the menu bar to open the I/O configuration menu.
3. Tap the **LAN** panel

4. 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 static (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.
5. 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.

Configure the instrument

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# EMC safety and environmental compliance

## Compliance information

This section lists the EMC (electromagnetic compliance), 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.

Questions about the following compliance information may be directed to the following address:

Tektronix, Inc.

PO Box 500, MS 19-045

Beaverton, OR 97077, USA

[www.tek.com](http://www.tek.com)

### EMC compliance

#### EU EMC Directive

Meets intent of Directive 2014/30/EU for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

**EN 61326-1, EN 61326-2-1.** EMC requirements for electrical equipment for measurement, control, and laboratory use. <sup>1 2 3 4</sup>

- CISPR 11. Radiated and conducted emissions, Group 1, Class A
- IEC 61000-4-2. Electrostatic discharge immunity
- IEC 61000-4-3. RF electromagnetic field immunity
- IEC 61000-4-4. Electrical fast transient / burst immunity
- IEC 61000-4-5. Power line surge immunity
- IEC 61000-4-6. Conducted RF immunity
- IEC 61000-4-11. Voltage dips and interruptions immunity

**EN 61000-3-2.** AC power line harmonic emissions

**EN 61000-3-3.** Voltage changes, fluctuations, and flicker

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<sup>1</sup> This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.

<sup>2</sup> Emissions which exceed the levels required by this standard may occur when this equipment is connected to a test object.

<sup>3</sup> Equipment may not meet the immunity requirements of applicable listed standards when test leads and/or test probes are connected due to coupling of electromagnetic interference onto those leads/probes. To minimize the influence of electromagnetic interference, minimize the loop area between the unshielded portions of signal and associated return leads, and keep leads as far away as possible from electromagnetic disturbance sources. Twisting unshielded test leads together is an effective way to reduce loop area. For probes, keep the ground return lead as short as possible and close to the probe body. Some probes have accessory probe tip adapters to accomplish this most effectively. In all cases, observe all safety instructions for the probes or leads used.

<sup>4</sup> For compliance with the EMC standards listed here, high quality shielded interface cables that incorporate low impedance connection between the cable shield and the connector shell should be used.

## Australia / New Zealand Declaration of Conformity – EMC

Complies with the EMC provision of the Radiocommunications Act per the following standard, in accordance with ACMA:

- EN 61326-1 and EN 61326-2-1. Radiated and conducted emissions, Group 1, Class A.

## Safety compliance

This section lists the safety standards with which the product complies and other safety compliance information.

## EU declaration of conformity – low voltage

Compliance was demonstrated to the following specification as listed in the Official Journal of the European Union:

Low Voltage Directive 2014/35/EU.

- EN 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.
- EN 61010-2-030. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 2-030: Particular requirements for testing and measuring circuits.

## U.S. nationally recognized testing laboratory listing

- UL 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.
- UL 61010-2-030. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 2-030: Particular requirements for testing and measuring circuits.

## Canadian certification

- CAN/CSA-C22.2 No. 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

## Additional compliances

- IEC 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.
- IEC 61010-2-030. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 2-030: Particular requirements for testing and measuring circuits.

## Equipment type

Test and measuring equipment.

## Safety class

Class 1 – grounded product.

## Pollution degree description

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.

- Pollution Degree 1. No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
- Pollution Degree 2. 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.



- Pollution Degree 3. Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
- Pollution Degree 4. Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.

### Pollution degree rating

Pollution Degree 2 (as defined in IEC 61010-1). Note: Rated for indoor, dry location use only.

### IP rating

IP20 (as defined in IEC 60529).

### Measurement and overvoltage category descriptions

Measurement terminals on this product may be rated for measuring mains voltages from one or more of the following categories (see specific ratings marked on the product and in the manual).

- Measurement Category II. For measurements performed on circuits directly connected to the low-voltage installation.
- Measurement Category III. For measurements performed in the building installation.
- Measurement Category IV. For measurements performed at the source of low-voltage installation.

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**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.

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### Mains overvoltage category rating

Overvoltage Category II (as defined in IEC 61010-1)

### Environmental compliance

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

### Restriction of hazardous substances

Complies with RoHS2 Directive 2011/65/EU.

### 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 Web site ([www.tek.com/productrecycling](http://www.tek.com/productrecycling)).

**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](http://www.dtsc.ca.gov/hazardouswaste/perchlorate) for additional information.



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