

THDP0400

High Voltage Differential Probe

User Manual

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These are the original instructions in English.

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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.

Contents

Important safety information	5
General safety summary	5
To avoid fire or personal injury	5
Service safety summary	7
Terms in this manual and on the product	8
Symbols on the product	8
Compliance information	9
Safety compliance	9
Environmental compliance	10
Preface	11
Model overview	11
Key features	11
Probe labels	12
Standard accessories	13
Recommended accessories	14
Operating information	15
Connecting to the instrument	15
Connecting to the circuit	16
3D probe positioners	17
Probe positioner assembly	17
Install probe in universal holder	17
Adjust the positioner arm	18
Probe Setup menu	18
AutoZero	19
Auto Range	19
Ranges	19
Specifications	20
Probe overview	20
Electrical specifications	21
Environmental requirements	22
THDP0400 model voltage derating graph	23
Mechanical specifications	23
Performance verification	24

Required equipment. 24

TekVPI Calibration Fixture. 25

DC Gain Accuracy. 26

 DC Gain Accuracy test record. 27

DC Balance. 28

 DC Balance test record. 28

Bandwidth. 29

 Bandwidth test record. 30

Rise Time. 31

 Rise Time test record. 32

Large Signal Rise Time. 33

 Large Signal Rise Time test record. 34

Maintenance. 35

 Service offerings. 35

 Cleaning. 35

 Error conditions. 35

 Repack the measurement system for shipment. 36

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.

This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.

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 voltage setting

Before applying power, make sure that the line selector is in the proper position for the source being used.

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.

Connect the probe output to the measurement instrument 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 instrument.

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

Connect the probe reference lead to earth ground only.

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.

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

Floating measurement use

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

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.

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 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.

WARNING: To avoid electric shock, keep the probe wire as far from the tip and high voltage circuits as possible. The probe wire voltage rating is less than the probe tip voltage rating. Therefore the probe wire may not provide adequate protection.

To avoid electric shock, do not use the probe if the wear indicator on the cable becomes visible. Contact Tektronix at tek.com for a replacement.

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.

Service the probe and accessories

Go to tek.com/support to find information on contacting Tektronix Service Support.

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 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



Earth Reference

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 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 61010-031. Particular requirements for handheld probe assemblies for electrical measurement and test equipment

U.S. nationally recognized testing laboratory listing

- CAN/CSA-C22.2 No. 61010-031. Particular requirements for handheld probe assemblies for electrical measurement and test equipment

Additional compliances

- IEC 61010-031. Particular requirements for handheld probe assemblies for electrical measurement and test equipment

Equipment type

Test and measuring equipment.

Safety class

Class 2 -- Double Insulated 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

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).

- Overvoltage Category I. 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.
- 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.

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

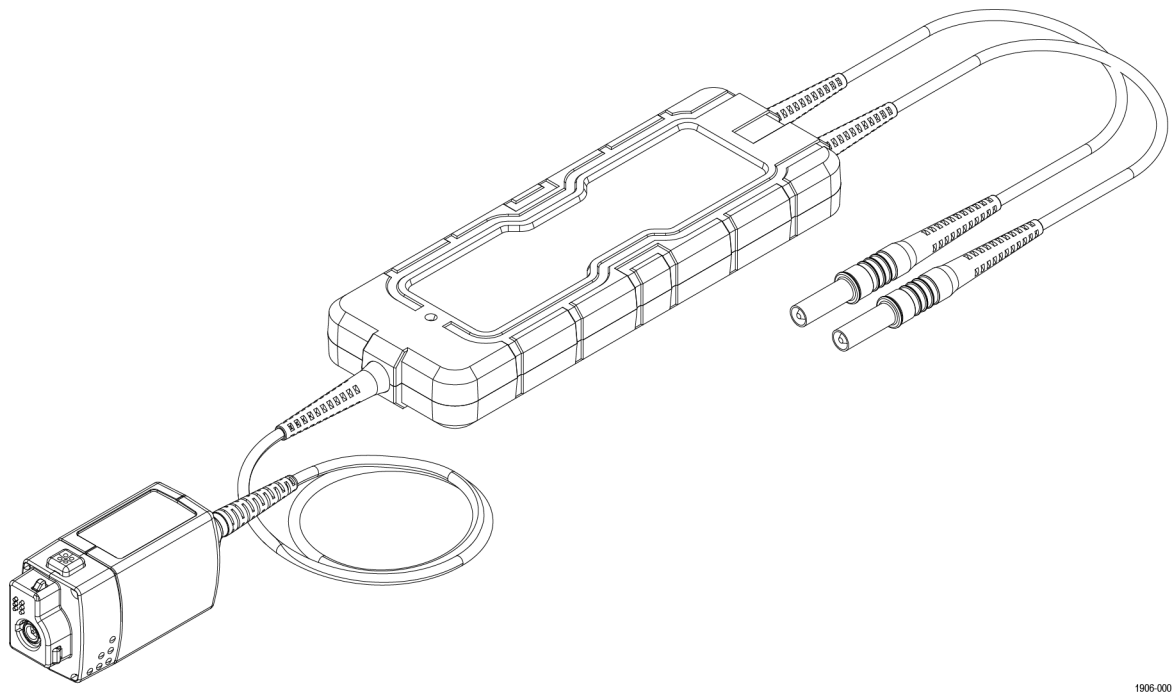
Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. To avoid release of such substances into the environment and to reduce the 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 Web site (<https://www.tek.com/productrecycle>).

Preface

This document provides information for installing and using the Tektronix THDP0400 probe. The probe is capable of safely measuring differential voltages up to $\pm 2000\text{ V}$.



The differential probe consists of two attenuators, which are differentially matched. The voltage measurements of these attenuators is conducted ground-referenced. The read voltages are provided to a differential amplifier, where the differential voltage is amplified according to the chosen attenuation. The output signal is fed over a driver stage to the 50Ω input of an oscilloscope.

Model overview

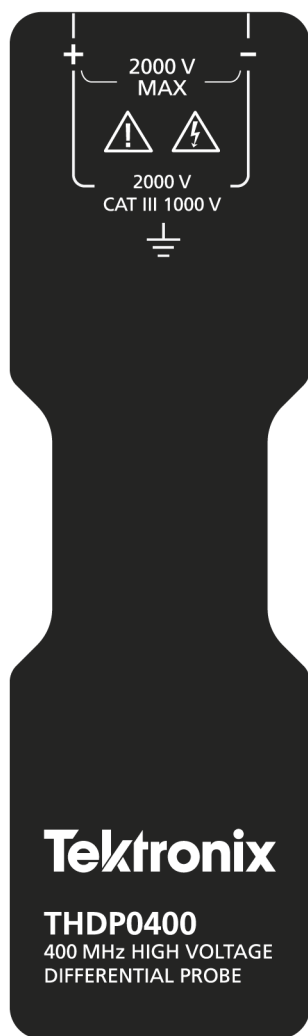
Model	Description
THDP0400	400 MHz high voltage differential probe
THDP0400KIT	Standard accessory kit (includes items in standard accessory list)

Key features

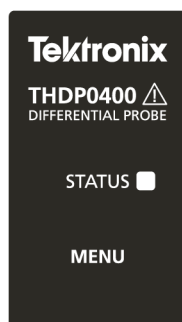
- 400 MHz bandwidth for high-speed signal measurements
- Differential voltage range up to $\pm 2\text{ kV}$
- Common-mode voltage up to $\pm 2\text{ kV}$
- Selectable attenuation: 50X, 100X, 250X, 500X
- DC gain accuracy: $\pm 1\%$

- Switchable attenuation settings for measurement flexibility
- Safety certified as per UL 61010-031 and IEC 61010-031 standards
- CAT Rating: 1000 V CAT III

Probe labels



THDP0400 Model label



THDP0400 Model composition box label

Standard accessories

The following table lists the accessories that are shipped with the probe.

Accessory	Description	Part number
	Probe tip adapters; 4mm to 0.8mm, black (qty. 2)	013-0436-XX
	Spring tips; fine (qty. 4)	214-5586-XX
	Hook clamps; red and black (qty. 2)	344-0703-XX
	Rotating grip jaw clamps (qty. 2)	344-0704-XX
	2-footed holder; black (qty. 2)	352-1192-XX
	Safety alligator clips; small (qty. 2)	344-0705-XX

Recommended accessories

The following table lists optional accessories.

Accessory	Description	Part number
	Transit hard case	016-2177-XX
	EMI noise suppression kit	276-0914-XX
	3D positioner with steel base, 200 mm span width and universal probe holder	352-1193-XX
	4 mm Coupler f-f (red), 30V AC / 60V DC	133-0698-XX
	BNC-male to dual 4 mm sockets, fully insulated	133-0699-XX

Operating information

Use this section to help you use the probe safely and effectively. Read all safety information before installing your measurement system to be aware of the operating and clearance requirements, including possible hazardous areas when the measurement system is connected to the device under test (DUT).

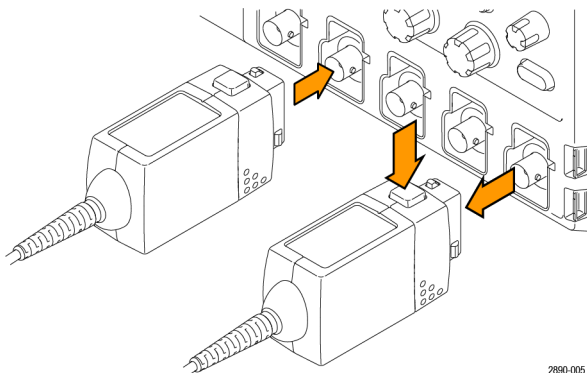
Connecting to the instrument

WARNING: To avoid electrical shock, observe proper safety precautions when working with voltages above 60 VDC or 30 VAC_{RMS}. These voltage levels pose a shock hazard. Use only the accessories specified with the probe that you are using. Make sure that the accessories are fully mated before connecting or disconnecting.

WARNING: To avoid electrical shock or fire, make sure the test leads are in good condition. The input leads and extender leads have a jacket wear indicator which becomes visible if the wire jacket becomes excessively worn. If the wear indicator is visible, do not use the probe. Contact Tektronix Service for repair or replacement.

WARNING: To avoid electrical shock or fire, keep the probe body and output cable of the probe away from the circuits being measured. The probe body and output cable are not intended to be in contact with the circuits being measured.

1. Connect the probe to the input of the oscilloscope. The Status LED goes off briefly and then lights green to indicate the probe is ready to use.

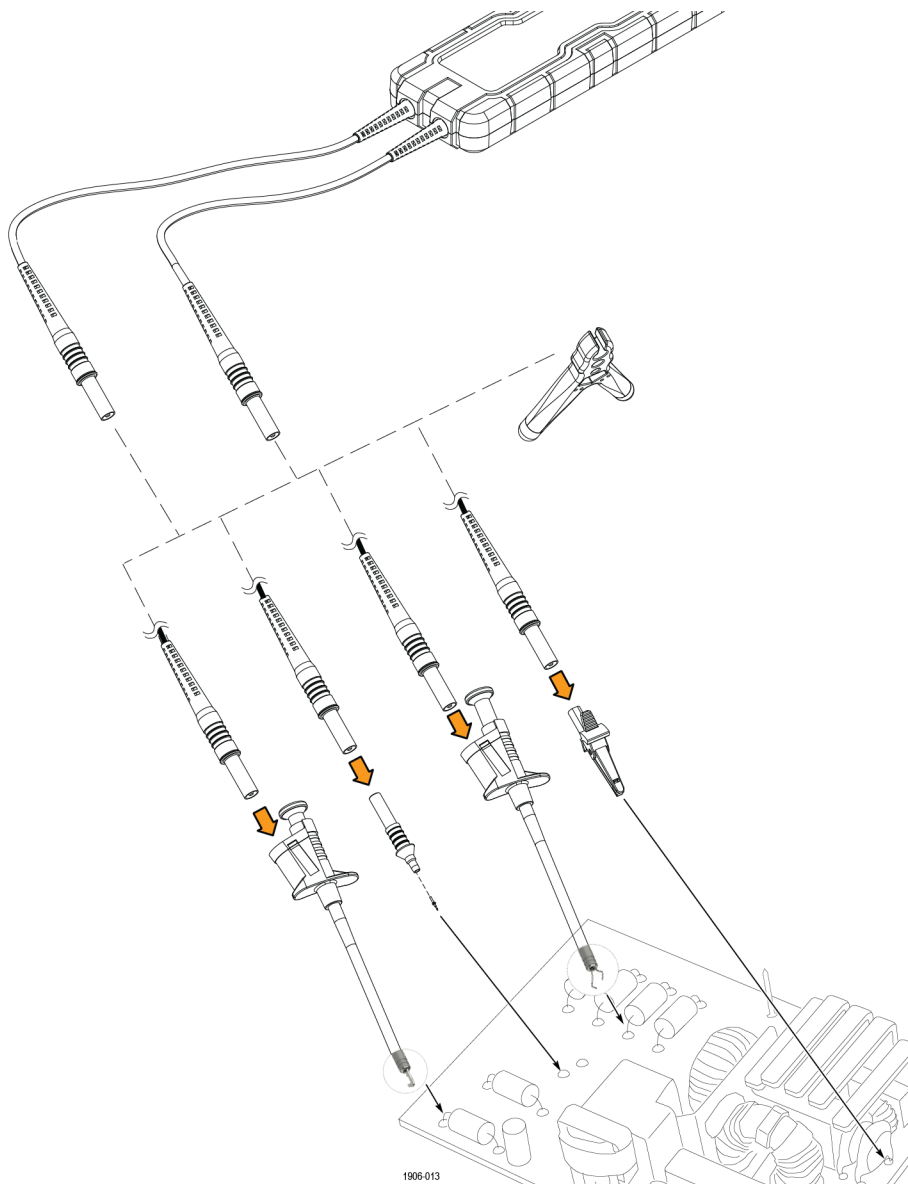


2. Adjust the vertical offset (or position) of the oscilloscope input.
3. Select the proper range setting on the oscilloscope

Connecting to the circuit

Make the connections to your circuit using the accessories that best fit your application.

WARNING: To avoid electrical shock or fire, always make the connections from the test leads to the probe accessory that you intend to use before you make any connections to a voltage source. Always ensure that the connections between the test leads and the probe accessories are secure before you connect them to a voltage source. Do not connect or disconnect accessories to a voltage source unless they are first connected to the probe.

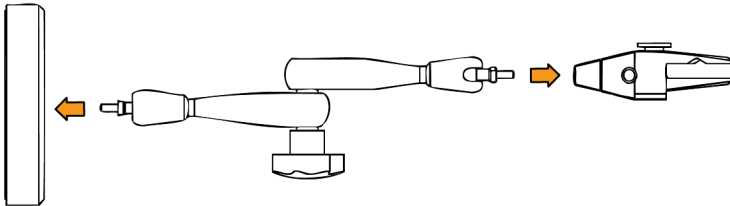


3D probe positioners

The 3D probe positioner is the third helping hand in any lab for precise and semi-permanent positioning of probes. The universal probe holder allows you to start and stop measurements without losing contact to the test point.

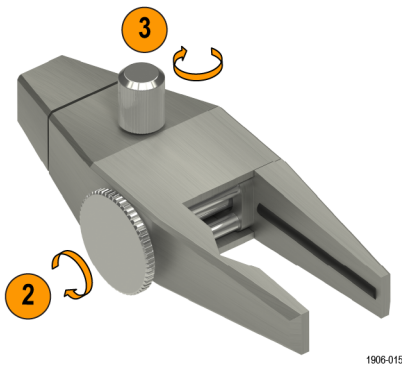
The operating and storage temperature range is 0°C to +50°C, at non-condensing humidity.

Probe positioner assembly



1. Screw the positioner arm to the base with the M6 thread, and tighten it with a 7 mm wrench.
2. Screw the other positioner arm to the universal probe holder with the M6 thread.

Install probe in universal holder



1. Clamp the probe into the universal probe holder.
2. Tighten the holder adjustable screw until the probe is secure.
3. To tighten the holder further, adjust the spring-mounted set-screw

Adjust the positioner arm



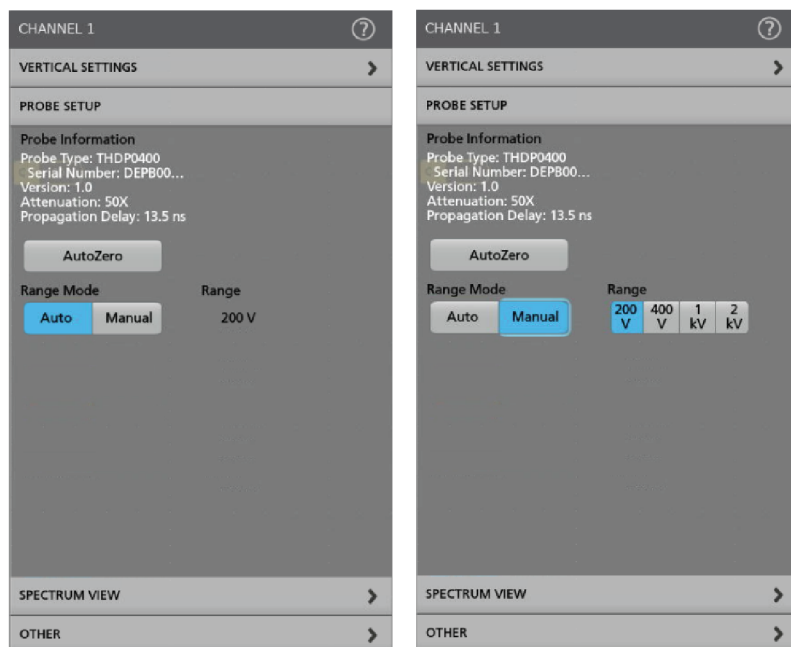
CAUTION: Do not release the tension knob completely, otherwise the 3D probe positioner will collapse and cause damage to your measurement setup.

1. Hold the 3D probe positioner and adjust center tension knob until the positioner can be moved.
2. Bring the positioner into the required position and tighten the central tensioning knob to secure it.

Probe Setup menu

Use the probe setup menu to see probe information, perform AutoZero, change the range mode, and configure the range.

To access the Probe Setup menu on the oscilloscope, double-tap the corresponding analog channel badge on the settings bar and tap Probe Setup.



AutoZero

AutoZero and self-calibration work on different parts of the measurement system. Self-calibration optimizes measurements through adjusting parameters in the probe. AutoZero is an oscilloscope function and is used when a displayed waveform is not centered correctly (for example; due to a small DC offset error). AutoZero automatically runs after self-calibration.

It is important to power-down the DUT or disconnect your probe from the DUT before running AutoZero.

Auto Range

The **Range Mode** is selectable for either **Auto** or **Manual**. When the Range Mode is set to **Auto**, the probe range is automatically selected when the V/div knob on the oscilloscope is turned. The relationship between probe range and V/div setting matches that shown in Ranges and 4/5/6 Series MSO Volts/div settings table.

Ranges

The measurement system has a variety of ranges available for you to select. In 4, 5, and 6 Series B MSO Instruments, the ranges are selectable when **Range Mode** is set to **Manual**. The recommended V/div settings are displayed in the table below. Multiply the range and V/div setting by the tip attenuation to get the values for the probe.

4/5/6 Series B MSO probe ranges	Recommended V/div setting
200 V	50 V/div
400 V	100 V/div
1000 V	500 V/div
2000 V	500 V/div

Specifications

This chapter contains specifications for the instrument. All specifications are typical unless noted as guaranteed. Typical specifications are provided for your convenience but are not guaranteed. Specifications that are marked with the ✓ symbol are guaranteed and checked in Performance Verification.

All specifications are typical and apply to all models unless noted otherwise.

To meet specifications, these conditions must first be met:

- The instrument must be operating within the environmental limits described in this manual.
- The instrument must have been operating continuously for at least 20 minutes within the specified operating temperature range.
- The measurement system is powered from a TekVPI compatible oscilloscope.

Warranted specifications describe guaranteed performance with tolerance limits or certain type-tested requirements.

Probe overview

Characteristic	Description			
Bandwidth	400 MHz			
Probe range and attenuation	2 kV: 500X	1 kV: 250X	400 V: 100X	200 V: 50X
Rise time	0.9 ns	0.9 ns	1 ns	1 ns
Noise (AC RMS)	265 mV	265 mV	225 mV	225 mV
Noise (AC RMS at 20 MHz)	55 mV	55 mV	45 mV	45 mV
DC balance (input referred)	±2 V	±1 V	±1 V	±500 mV
Maximum measurable differential Voltage (DC + peak AC)	±2000 V	±1000 V	±400 V	±200 V
Maximum Common mode Voltage to Earth	±2000 Vpk; 1400 V RMS			
Max Non-Destruct differential input Voltage to Earth	6000 Vpk (as defined in IEC 61010-031); 2000 V RMS			
	Derates with frequency. Refer to Input Voltage derating curve.			
DC gain accuracy	±1%			
Common mode voltage	±2000 Vpk			

Characteristic	Description
CMRR	DC: 80 dB
	100 kHz: 70 dB
	1 MHz: 70 dB
	10 MHz: 50 dB
	50 MHz: 45 dB
	100 MHz: 35 dB
	400 MHz: 28 dB
Input impedance	Each input to ground: $5\text{ M}\Omega \parallel 5\text{ pF}$
	Differential input impedance: $10\text{ M}\Omega \parallel 2.5\text{ pF}$
CAT rating	1000V CAT III
Propagation delay	13 ns ± 0.5 ns
Probe cable length	2 meters
Supported oscilloscopes	4 Series B, 5 Series B, and 6 Series B MSO instruments

Electrical specifications

Instrument Coupling

Connects to 50 Ω input on a compatible instrument.

Large signal rise time (oscilloscope and probe)

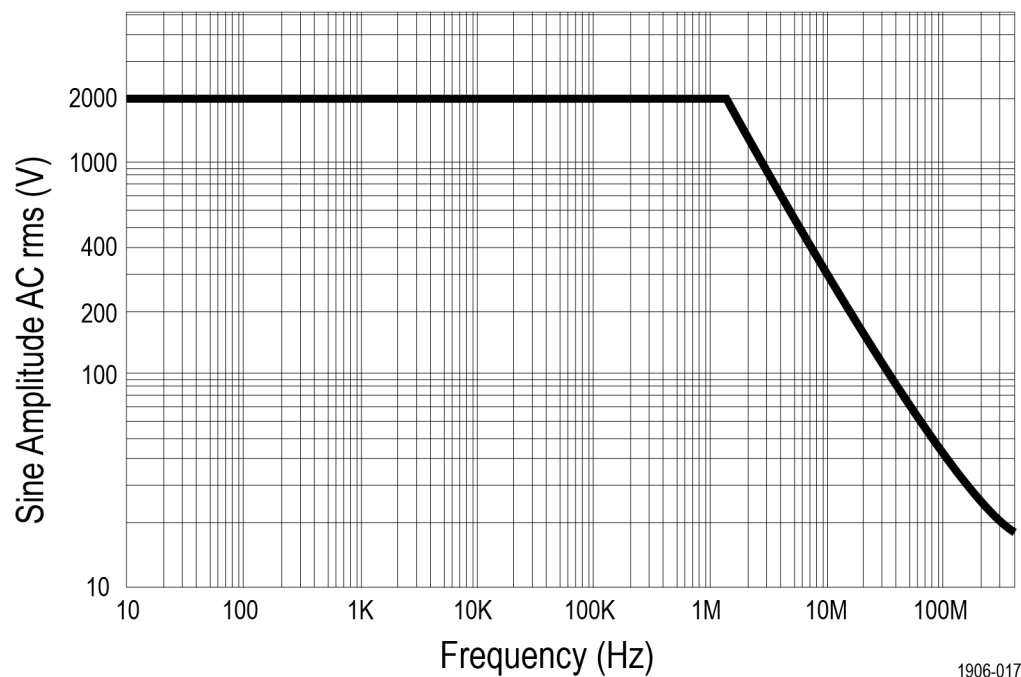
Range	Attenuation	Amplitude	Rise time limit
2 kV	500:1	$\pm 1000\text{ V}$	$\leq 14\text{ ns}$
1 kV	250:1	$\pm 500\text{ V}$	$\leq 14\text{ ns}$
400 V	100:1	$\pm 200\text{ V}$	$\leq 14\text{ ns}$
200 V	50:1	$\pm 100\text{ V}$	$\leq 14\text{ ns}$

Environmental requirements

Characteristic	Operating	Non-operating
Temperature	0° C TO +50° C	-40°C TO +71°C
Humidity	80% relative humidity (% RH) at up to +31°C, decreasing linearly to 40% at +50°C. Units to be powered up at least 30 minutes prior to testing.	5% to 95% RH (Relative Humidity) at up to +40°C, noncondensing.
Altitude	Up to 3,000 meters	Up to 15,240 meters

THDP0400 model voltage derating graph

The maximum input voltage rating of the probe decreases as the frequency of the applied signal increases.

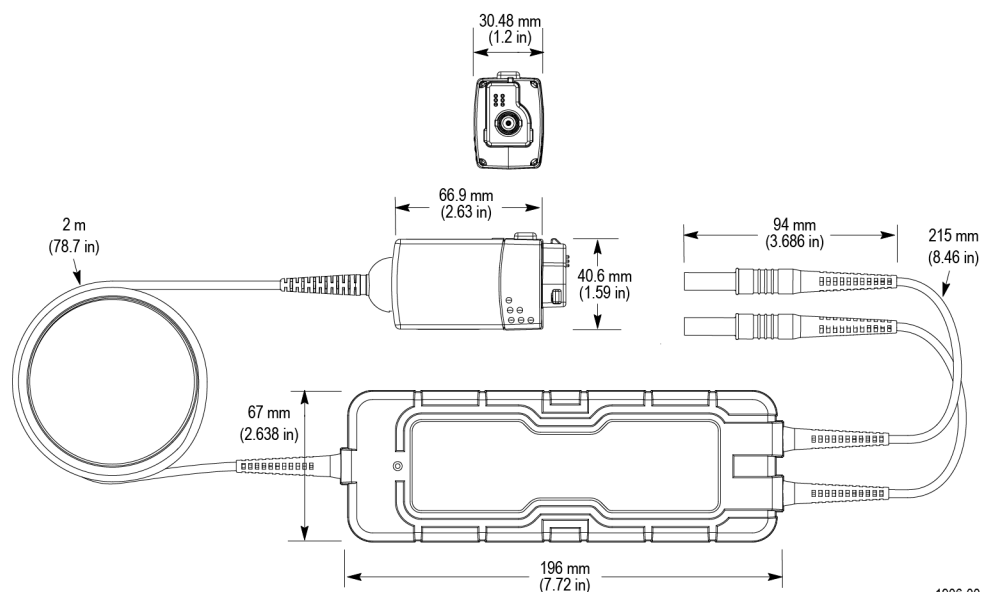


Mechanical specifications

Minimum bend radius

Probe output cable: 39 mm

Overall dimensions



Performance verification

Use the following procedures to verify the performance of the probe. Before beginning the procedures, print the test record and use it to record the performance results.

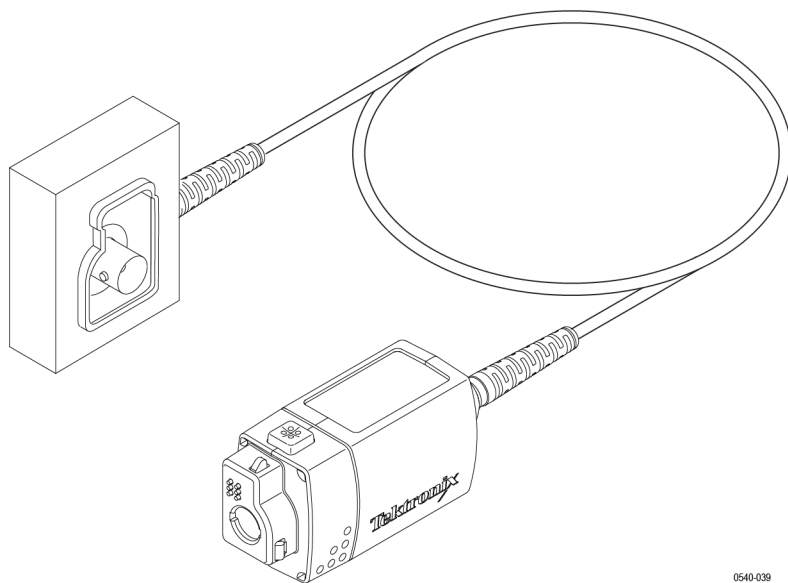
Required equipment

The equipment required to perform the performance verification procedures are shown in the following table.

Description	Minimum requirements	Example product
Supported oscilloscope with TekVPI interface	50 Ω input support, fully compatible with TekVPI interface, with Spectrum View	Tektronix 4 Series B MSO, 5 Series B MSO, or 6 Series B MSO
Power Supply	Output voltage up to ± 2000 V	Stanford Research Systems (SRS) PS325
High-voltage probe calibrator	Supports up to 1000 V and has a <12 ns pulse	PMK KHT 1000D
Digital multimeter (DMM)	6 digit, <0.01% DC accuracy	Tektronix DAQ6510
Precision 50 Ω DC Termination	0.1% accuracy	Tektronix part number 067-3281-XX
TekVPI calibration performance verification fixture		Tektronix part number 067-1701-XX
Safe High Voltage (SHV) to dual 4mm socket insulated box	± 2000 V	067-3742-XX
50 Ω BNC plug to 2 x 4mm Socket Insulated	DC - 1 GHz	133-0699-XX, 011-0049-XX
Shorting connector		133-0698-XX
SHV to SHV Cable, 10 ft		

TekVPI Calibration Fixture

This calibration fixture is required to complete a performance verification and gain accuracy adjustment procedures on the probes. It provides power to the probe and routes the probe output signal out through an SMA connector on the back of the fixture. The signal can then be measured with another instrument, such as a precision DMM, to check and adjust the gain accuracy of the probe.



DC Gain Accuracy

WARNING: This test procedure utilizes hazardous voltages. Always disable the power supply before making changes to the equipment. Use a safety enclosure and appropriate PPE when executing this test procedure.

Before you begin

1. Connect the TekVPI calibration fixture (067-1701-XX) control cable to the oscilloscope channel 1 input.
2. Connect the TekVPI calibration fixture output to the input of 50 Ω termination. The 50 Ω termination must be directly on the output of the TekVPI calibration fixture. If you are using a Tektronix 50 Ω termination, you may need a BNC to SMA adapter.
3. Connect the output of the 50 Ω termination cable assembly to a digital multimeter (DMM).
4. Connect the probe under test to the input of the TekVPI calibration fixture.
5. Connect the SHV to dual 4 mm socket insulated box to the SRS PS325 high voltage power supply with a SHV to SHV coax cable. The SRS PS325 high voltage power supply must be set to positive output mode.
6. Power up the TekVPI oscilloscope and all the test equipment and allow the probe under test to warm up for at least 30 minutes.

Procedure

1. Connect the input leads of the probe under test to the dual 4 mm sockets on the adapter box. Connect to the corresponding colors (red to red and black to black).
2. Using the **Probe Setup** menu on the oscilloscope, set the probe range to **2 kV** (500:1 attenuation).
3. Set the power supply voltage to the maximum value for the given range.
 - For the 2 kV range, set the power supply to 2000 V.
 - For the 1 kV range, set the power supply to 1000 V.
 - For the 400 V range, set the power supply to 400 V.
 - For the 200 V range set the power supply to 200 V
4. On the high voltage power supply, enable the high voltage to **ON**.
5. Record the power supply voltage displayed on the PS325 power supply in the test record.
6. Record the voltage displayed on the digital multimeter in the test record.
7. Disable the high voltage power supply and reverse the polarity of the connection between the input leads of the probe under test at the SHV to 2.4 mm adapter. Connect to opposite colors (red to black and black to red). Be sure to wear PPE for additional safety when swapping this connection.
8. Repeat steps 1 through 6 for the reversed connection. This is the negative supply measurement. Repeat steps 1 through 6 for the reversed connection for all probe ranges.
9. Calculate the DC gain accuracy for each probe range by multiplying the measured voltage from the DMM by the attenuation factor of the range (500X for 2 kV, 250X for 1 kV, 100X for 400 V, and 50X for 200 V), and calculating the percent error compared to your power supply voltage. All ranges should meet the DC Gain Accuracy specification of $\pm 1\%$. Record the results in the test record.

DC Gain Accuracy test record

Use the test record table for recording the results of the DC Gain Accuracy performance verification procedure.

Model number:

Procedure performed by:

Serial number:

Date:

Probe gain is defined as the change in Output divided by the change in input.

$$\text{Gain} = (\text{Measurement1} - \text{Measurement2}) / (\text{Input1} - \text{Input2})$$

Range	Input 1	Input 2	Measured supply (V)	Measured DMM (V)	Calculated gain
2 kV, 500X	+2000 V	-2000 V			
1 V, 250X	+1000 V	-1000 V			
400 V, 100X	+400 V	-400 V			
200 V, 50X	+200 V	-200 V			

DC Balance

Before you begin

1. Connect the TekVPI calibration fixture (067-1701-XX) control cable to the oscilloscope channel 1 input.
2. Connect the TekVPI calibration fixture output to the input of 50 Ω precision termination.
3. Connect the output of the 50 Ω termination to an SMA to BNC coax cable with a dual 4mm plug adapter connected to the BNC end of this cable.
4. Connect the dual 4mm plug to a digital multimeter (DMM).
5. Connect the probe under test to the input of the TekVPI calibration fixture.
6. Power up the TekVPI oscilloscope and all the test equipment and allow the probe under test to warm up for at least 30 minutes.

Procedure

1. Connect the input leads of the probe under test together through a shorting connector.
2. Using the **Probe Setup** menu on the oscilloscope, set the probe attenuation to **2 kV** (500:1 attenuation)
3. Record the voltage displayed on the digital multimeter in the test record.
4. Repeat steps 1 and 3 for the 1 kV, 400 V, and 200 V probe ranges.
5. Calculate and record the DC Balance by multiplying the measured DMM value by the given attenuation value for each probe range (divide by 500 for the 2 kV range, divide by 250 for the 1 kV range, divide by 100 for the 400 V range, and divide by 50 for the 200 V range). Record the results in the test record. Make sure the values calculated are lower than those listed in the DC Balance section of the datasheet or manual.

DC Balance test record

Use the test record table for recording the results of the DC Balance performance verification procedure.

Model number:

Procedure performed by:

Serial number:

Date:

The residual output for any range should be less than ± 10 mV.

Range	Limit	Measured
2 kV	± 2 V	
1 kV	± 1 V	
400 V	± 1 V	
200 V	± 500 mV	

Bandwidth

Before you begin

1. Connect the probe under test to the oscilloscope channel 1 input.
2. Connect the input leads of the probe to the output of a leveled sine wave signal source using the PMK 181-576-ISO adapter and a feed-through 50Ω termination.
3. Power up the TekVPI oscilloscope and all the test equipment and allow the probe under test to warm up for at least 30 minutes.

Procedure

1. Tap **File > Default Setup** on the oscilloscope.
2. Change the channel 1 vertical scale to **1.5 V/div**.
3. Turn on **Spectrum View** using 16 averages.
4. Configure the Spectrum badge to set the center frequency to **10 kHz** and the frequency span to **10 kHz**. Make sure there are no twists in the input leads.
5. Adjust the leveled sine wave source to display a waveform of 8 vertical divisions at the selected vertical scale with a set frequency of 10 kHz. Do not clip the analog input.: 5 Vpp is a good setting.
6. Set the probe range to **2 kV**.
7. Record the peak frequency amplitude (Xin) at 10 kHz (dBm) in the test record.
8. Repeat steps 6 and 7 for the 1 kV, 400 V, and 250 V probe ranges. The value should be very close or the same for all ranges.
9. Configure the Spectrum badge to set the center frequency to **400 MHz** and the span to **10 MHz**.
10. Adjust the signal source to output 400 MHz.
11. Set the probe attenuation to 2 kV.
12. Record the peak frequency amplitude (Xbw) at 400 MHz (dBm) in the test record.
13. Repeat steps 11 and 12 for the 1 kV, 400 V, and 200 V probe ranges.
14. Use the values of Xbw and Xin, and the following equation, to calculate the gain at bandwidth: $Gain = Xbw - Xin \text{ (dB)}$.
15. To pass, the gain should be $\geq -3 \text{ dB}$.

Bandwidth test record

Use the test record table for recording the results of the Bandwidth performance verification procedure.

Model number:Procedure performed by:

Serial number:Date:

$Gain = X_{bw} - X_{in} \text{ (dB)}$

Range	Peak (dBm) 10 kHz	Peak (dBm) 400 MHz	Gain (dBm)	Lower	Result
2 kV				-3	
1 kV				-3	
400 V				-3	
200 V				-3	

Rise Time

Before you begin

1. Connect the probe under test to the oscilloscope channel 1 input.
2. Connect the input leads of the probe to the output of a fast edge signal source using the PMK 181-576-ISO adapter and a feed-through 50Ω termination.
3. Connect the signal source external trigger output to channel 2 of the oscilloscope using a BNC cable.
4. Power up the TekVPI oscilloscope and all the test equipment and allow the probe under test to warm up for at least 30 minutes.

Procedure

1. Tap **File > Default Setup**.
2. Add a rise time measurement for CH1 as Meas 1. Double click the measurement to open the Meas 1 options window.
 - In the **Rise Time** section of the menu, select the **Show Statistics in Badge** option.
 - In the **Filter/Limit Results** section of the menu change the **Limit Measurement Population** to **On** with the default limit of **1k**.
3. Set the oscilloscope acquisition to **Manual** mode: **25 GS/s**, **5 kpoints**, **Average** mode, **16** acquisitions. Adjust the horizontal position of your signal to make sure you have the rising edge and at least 100 ns of data after the rising edge on the oscilloscope display. If you are using a particularly long cable for your trigger source, you may need to use the Deskew function in the CH1 badge under **OTHER** to make sure your signal is on the display.
4. Set the probe attenuation to **2 kV**.
5. Change the channel 1 vertical scale to **1 V/div** and the position to **1 div**.
6. Set the oscilloscope edge trigger source to channel 2.
7. Set the oscilloscope trigger to **Normal** mode.
8. Adjust the fast edge generator to output a **3 V**, **150 ps** fast edge (TriseSource) with a **1 MHz** edge frequency.
9. Record the rise time measurement (Trise-scope) from the μ (Mean) measurement in your channel badge in the test record.
10. Calculate the probe rise time response: $TriseProbe = \sqrt{TriseScope^2 - TriseSource^2}$
11. Repeat steps 3 through 9 for the 1 kV, 400 V, and 200 V probe ranges while adjusting the vertical scale accordingly.
12. Record the results in the test record. Confirm the results are less than what are stated in the Rise Time section of the manual or datasheet (<1 ns for 200 V and 400 V ranges, and <0.9 ns for 1 kV and 2 kV ranges).

Rise Time test record

Use the test record table for recording the results of the Rise Time performance verification procedure.

Model number:

Procedure performed by:

Serial number:

Date:

$$TriseProbe = SQRT(TriseScope^2 - TriseSource^2)$$

Range	Measured (ps)	Rise Time (ps)	Upper (ps)	Result
2 kV			900	
1 kV			900	
400 V			1000	
200 V			1000	

Large Signal Rise Time

WARNING: This test procedure utilizes hazardous voltages. Always disable the power supply before making changes to the equipment. Use a safety enclosure and appropriate PPE when executing this test procedure.

Before you begin

1. Connect the probe under test to the oscilloscope channel 1 input.
2. Connect the input leads of the probe to the output of the KHT 1000D Probe Calibration Generator. Connect the corresponding colors (red to red and black to black).
3. Power up the TekVPI oscilloscope and all the test equipment and allow the probe under test to warm up for at least 30 minutes.

Procedure

1. Tap **File > Default Setup** on the oscilloscope.
2. Add a rise time measurement for CH1 as Meas 1. Double click the measurement to open the Meas 1 options window.
 - In the **Rise Time** section of the menu, select the **Show Statistics in Badge** option.
 - In the **Filter/Limit Results** section of the menu change the **Limit Measurement Population** to **On** with the default limit of **1k**.
3. Add a rise time measurement for CH1 as Meas 2. Double click the measurement to open the Meas 2 options window.
 - In the **Rise Time** section of the menu, select the **Show Statistics in Badge** option.
 - In the **Filter/Limit Results** section of the menu change the **Limit Measurement Population** to **On** with the default limit of **1k**.
4. Change the horizontal settings to **40 ns/div**.
5. Power on the generator and Set the polarity to positive.
6. Set the probe range to **2 kV**.
7. Change the channel 1 vertical scale to **200 V/div** for the 2 kV range, 100 V/div for 1 kV range, 50 V/div for the 400 V range, and 25 V/div for the 200 V range.
8. Set the trigger level through the trigger menu and the vertical offset through the channel badge to **500 V** for the 2 kV range, 250 V for the 1 kV range, 100 V for the 400 V range, and 50 V for the 200 V range (half of the generator output voltage).
9. Set the output voltage of the generator to **1000 V** for the 2 kV range, 500 V for the 1 kV range, 200 V for the 400 V range, and 100 V for the 200 V range.
10. Enable the generator in pulse mode.
11. Record to the mean rise time measurement in the test record.
12. Disable the probe calibration generator output.
13. Repeat steps 6 through 12 for other probe attenuation settings while using the appropriate scope settings and generator output voltage settings: 1 kV: 1000 V, 400 V: 200 V, 200 V: 100 V.
14. Set the polarity of the generator to negative.
15. Repeat steps 6 through 13. Change the trigger and offset values to negative and the trigger type to falling edge. Take your mean measurements from the fall time measurement.
16. Record your results in the test record. Make sure all rise times and fall times are <14 ns.

Large Signal Rise Time test record

Use the test record table for recording the results of the Large Signal Rise Time performance verification procedure.

Model number:

Procedure performed by:

Serial number:

Date:

Range	Polarity	Amplitude (V)	Measured (ns)	Upper (ns)	Result
2 kV	Positive	1000		14	
1 kV	Positive	500		14	
400 V	Positive	200		14	
200 V	Positive	100		14	
2 kV	Negative	-1000		14	
1 kV	Negative	-500		14	
400 V	Negative	-200		14	
200 V	Negative	-100		14	

Maintenance

Information to isolate possible failures and procedures for maintaining your probe.

Service offerings

Tektronix provides service to cover repair under warranty and other services that are designed to meet your specific service needs.

Tektronix service technicians are well equipped to service your probe. Services are provided at Tektronix Service Centers and on-site at your facility, depending on your location. Visit tek.com/service to view all available services. Check the status of your warranty at tek.com/warranty-status-search.

Cleaning

CAUTION: To prevent damage to the measurement system, do not expose it to sprays, liquids, or solvents. Avoid getting moisture inside the comp box or sensor head when cleaning the exterior.

Maintain the integrity of the connectors by keeping them free of contamination. Remove any debris from the connectors using low-pressure, clean, dry, compressed air.

Error conditions

LEDs do not remain lit

If none of the LEDs remain lit after you connect the probe, a probe/oscilloscope interface fault may exist. Perform the following steps until you clear the fault or isolate the problem:

- Disconnect and reconnect the probe.
- Connect the probe to a different channel on the oscilloscope.
- Disconnect the probe from the oscilloscope, power-cycle the oscilloscope, and then reconnect the probe.
- Connect the probe to a different oscilloscope.

If the symptoms remain, then contact a Tektronix Service Center.

Signal display

If the probe is connected to an active signal source and you do not see the signal displayed on the oscilloscope:

- Check that the probe accessories that you are using are fully connected.
- Check the probe connection on your circuit.

Repack the measurement system for shipment

If you need to return the measurement system to Tektronix for repair, use the original packaging. If this is unavailable or not fit for use, contact your Tektronix representative to obtain new packaging.

When you return the measurement system to Tektronix, attach a tag showing the following information:

- Name of the product owner
- Address of the owner
- Instrument serial number
- A description of problems encountered and/or service required