

Instructions

Tektronix

P5200
High Voltage Differential Probe
070-9018-01

Copyright © Tektronix, Inc. 1994. All rights reserved.

Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supercedes that in all previously published material. Specifications and price change privileges reserved.

Printed in the U.S.A.

Tektronix, Inc., P.O. Box 1000, Wilsonville, OR 97070-1000

TEKTRONIX and TEK are registered trademarks of Tektronix, Inc.



EC Declaration of Conformity

We

Tektronix Holland N.V.
Marktweg 73A
8444 AB Heerenveen
The Netherlands

declare under sole responsibility that the

P5200 Active Differential Probe

meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the official Journal of the European Communities:

EN 50081-1 Emissions:

EN 55011	Radiated, Class A
EN 55011	Conducted, Class A
EN 60555-2	Power Harmonics

EN 50082-1 Immunity:

IEC 801-2	Electrostatic Discharge
IEC 801-3	RF Radiated
IEC 801-4	Fast Transients
IEC 801-5	Surge

EN 61010-1:

Safety requirements for electrical equipment for measurement, control, and laboratory use.

EN 61010-2-031, 1994:

Particular requirements for hand-held probe assemblies for electrical measurement and test.



Table of Contents

General Safety Summary	1
Features and Accessories	5
Getting Started	9
Specifications	11
User Service	15
Performance Verification	17
Replaceable Parts	20

General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

Only qualified personnel should perform service procedures.

Observe Maximum Working Voltage

Do not use the P5200 High Voltage Differential Probe above 1,000 V (DC + peak AC) from ground on either input or 1,300 V (DC + peak AC) between the leads.

Ground the Product

This product is grounded through the BNC shell and grounding conductor of the power cord of the measurement instrument. Before making connections to the input terminals of the product, ensure that the output connector is attached to the BNC of the measurement instrument and the measurement instrument is properly grounded.

Do Not Operate Without Covers

To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Do Not Operate in Wet/Damp Conditions

To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in Explosive Atmosphere

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Avoid Exposed Circuitry

To avoid injury, remove jewelry such as rings, watches, and other metallic objects. Do not touch exposed connections and components when power is present.

Keep Probes and Input Leads Clean

To avoid electric shock and erroneous readings, keep probes and input leads clean.

Use Proper Power Source

Only the supplied AC adapter is warranted to operate with the product and meet safety and electromagnetic compliances. Do not operate this product from a power source that applies more than the voltage specified or that is not rated for double insulated use.

Do Not Operate With Suspected Failures

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

Do Not Immerse in Liquids

Clean the probe using a damp cloth. Refer to the cleaning instructions on page 15.

Safety Terms and Symbols

Terms in This Manual

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.

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

The following symbols may appear on the product:



DANGER
High Voltage



Protective Ground
(Earth) Terminal



ATTENTION
Refer to
Manual



Double
Insulated

Certifications and Compliances

CSA Certified Power Modules

CSA Certification includes the products and power modules appropriate for use in the North America power network. All other power modules supplied are approved for the country of use.

Compliances

Consult the product specifications for IEC Installation Category, Pollution Degree, and Safety Class.



Features and Accessories

The P5200 High Voltage Differential Probe (Figure 1) provides a safe means of measuring circuits with floating potentials up to 1,000 volts from earth ground and up to 1,300 volts differential. The probe converts floating signals to a low-voltage, ground-referenced signal for display on any oscilloscope or other measurement instrument. The probe is a safe alternative to the extremely dangerous practice of disconnecting the oscilloscope ground to achieve a floating measurement.

The P5200 High Voltage Differential Probe allows clear and accurate measurements of high-speed transitions and provides excellent common-mode rejection of noisy signals. Both inputs have high impedance and low capacitance. Because of these features, the probe can safely measure the fast voltage transients in switching power devices such as IGBTs, power MOSFETs, thyristors, GTOs, and bipolar transistors without damaging these devices.

Other applications for the P5200 High Voltage Differential Probe include testing high-voltage motor control circuits and line connected circuits in switch-mode power supplies.

Features and Accessories

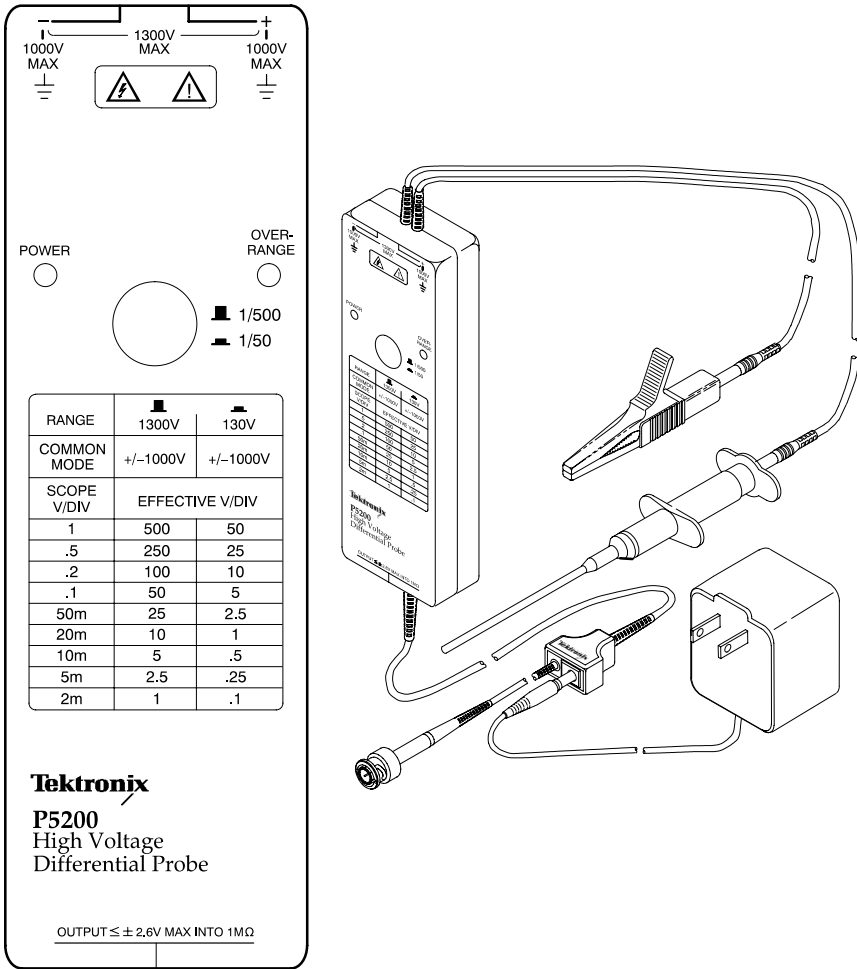


Figure 1: P5200 High Voltage Differential Probe



Power Indicator. The power indicator lights green to show that power from the AC adapter is present.



Overrange Indicator. The overrange indicator lights red if the voltage of the input signal exceeds the linear range of the range setting. When this happens, the signal on the probe output does not accurately represent the signal on the probe input.



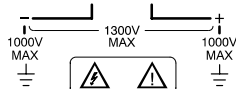
Range Button. In the raised position the range button sets the attenuation to 1/500. In the lowered position the range button sets the attenuation to 1/50.

Use the 1/500 position for connections above 130 V up to a maximum of 1,300 V (DC + peak AC) differential. Use the 1/50 position for better signal resolution on connections below 130 V. Both range settings are rated for a maximum of 1,000 V (DC + peak AC) common mode.

RANGE	1300V	130V
COMMON MODE	+/-1000V	+/-1000V
SCOPE V/DIV	EFFECTIVE V/DIV	
1	500	50
.5	250	25
.2	100	10
.1	50	5
50m	25	2.5
20m	10	1
10m	5	.5
5m	2.5	.25
2m	1	.1

Scale Conversion Chart. The chart lists the effective volts per division for the 1/500 and 1/50 range settings and scale factors of 2 mV to 1 V on the measurement instrument.

The effective volts per division is the attenuation factor of 500 or 50 multiplied by the scale factor of the measurement instrument. For example, with the range set to 1/500 and the measurement instrument sensitivity set to 0.5 volts/division, the effective volts per division equals 500×0.5 or 250 V.



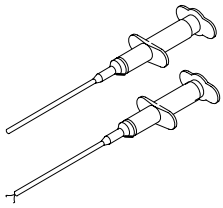
Differential Inputs. The inputs accept a maximum of 1,000 V between either input and ground and a maximum difference of 1,300 V between the inputs. These input ratings are valid for both range settings.



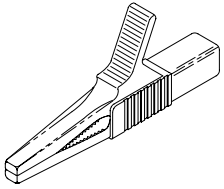
Input Leads. The input leads of the differential probe connect to the crocodile clips and plunger probes that come with the probe. The connectors are double insulated for safety.

NOTE. Use only the accessories provided with the P5200 High Voltage Differential Probe.

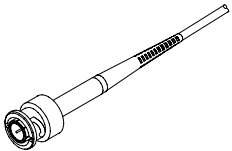
Features and Accessories



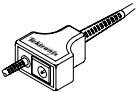
Plunger Probes. The plunger probes have long probe sleeves with retracting hooks. These probes connect safely to recessed test points that are otherwise difficult to reach. The connectors are double insulated for safety.



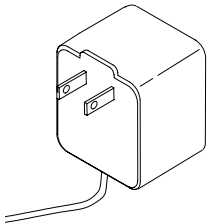
Crocodile Clips. The large insulated clips connect easily to large bolts or bus bars. The connectors are double insulated for safety.



Output Lead. The BNC output connection to the oscilloscope is calibrated to drive a high impedance (1 M Ω) load.



Adapter Jack. The power supply jack on the probe output connects to the 9 VDC plug of the AC adapter.



AC Adapter. The adapter converts AC line voltage to 9 VDC for the probe power supply.

NOTE. The AC adapter that accompanies the P5200 High Voltage Differential Probe is the only adapter specified for this probe. Using any other adapter voids the product warranty and may also produce electromagnetic interference. Adapters for the line voltages of other countries are also available. (Refer to the *Replaceable Parts* section that begins on page 20.)

Getting Started

To safely install and functionally check the P5200 High Voltage Differential Probe, follow the procedures in this section.

Installation

Install the P5200 High Voltage Differential Probe as follows:

1. Connect the output of the probe to the BNC input of the oscilloscope or other measurement instrument. The measurement instrument input must have a ground reference.
2. Connect the AC adapter to the jack located on the output lead of the probe.
3. Connect the AC adapter to the proper line voltage. The green power led on the probe should light.
4. Adjust the vertical offset (or position) of the measurement instrument input.
5. Select the proper range setting. For higher resolution and less noise when measuring signals below 130 V, switch the attenuation to 1/50. If the overrange indicator lights or flashes, the output signal may not be accurate. Use the 1/500 setting instead.
6. Set the volts per division setting on the measurement instrument to the range indicated in the table on the front panel of the probe.



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. Make sure that the test leads are in good condition. Use only the accessories supplied with the P5200 High Voltage Differential Probe.

7. Using the appropriate probe accessories, connect the inputs of the probe to the voltage source.



CAUTION. To avoid damaging the input circuitry of the P5200 High Voltage Differential Probe, do not apply a voltage that is in excess of 1,000 V (DC + peak AC) between either input and ground or more than 1,300 V (DC + peak AC) between the two inputs. This voltage rating applies to both 1/50 and 1/500 settings.

Functional Check

To make a simple functional check of the P5200 High Voltage Differential Probe, select a source that supplies AC line voltage and use the following procedure. This procedure verifies a majority of the circuitry within the probe. (For a complete performance verification, refer to page 17.)

1. Use the installation procedure starting on page 9 to connect the output of the P5200 High Voltage Differential Probe to a measurement instrument.
2. See Table 1 on page 10. Connect the inputs, set the range, and perform the check as each line of Table 1 indicates.

This completes the functional check procedure.

Table 1: Functional Check

Input 1 (+ or -)	Input 2 (- or +)	Mode	Range Setting	Check
Hot	Ground or Neutral	Differential	1/500 (out)	Measurement instrument displays or indicates the line voltage
Hot	Ground or Neutral	Differential	1/50 (in)	Overrange indicator lights if the input is > 91.5 VAC _{RMS} (130 Vp)
Hot	Hot (same connection)	Common Mode	1/50 or 1/500	No signal

Specifications

The specifications in Tables 2 through 6 apply to a P5200 High Voltage Differential Probe installed on a Tektronix TDS 460 oscilloscope. When the probe is used with another oscilloscope, the oscilloscope must have an input impedance of 1 M Ω and a bandwidth not less than 100 MHz.

The probe must have a warm-up period of at least 20 minutes and be in an environment that does not exceed the limits described in Table 2.

Specifications for the P5200 High Voltage Differential Probe fall into three categories: warranted, typical, and nominal characteristics.

Warranted Characteristics

Warranted characteristics (Tables 2 and 3) describe guaranteed performance within tolerance limits or certain type-tested requirements. Warranted characteristics that have checks in the *Performance Verification* section appear in **boldface** type.

Table 2: Warranted Electrical Characteristics

Rise Time	< 14 ns in 1/50 range setting
DC Common Mode Rejection Ratio (20–30°C, <70% RH)	> 3000:1 at 500 VDC
Bandwidth	DC to 25 MHz (–3dB) in 1/50 range setting
Maximum Operating Input Voltage	1/500 differential: ± 1.3 kV (DC + peak AC) 1/500 common mode: ± 1 kV (DC + peak AC) 1/50 differential: ± 130 V (DC + peak AC) 1/50 common mode: ± 1 kV (DC + peak AC)
Maximum Nondestructive Input Voltage	1/500 and 1/50 differential: ± 1.3 kV (DC + peak AC) 1/500 and 1/50 common mode: ± 1 kV (DC + peak AC)

Specifications

Table 2: Warranted Electrical Characteristics (Cont.)

Range Accuracy	$\pm 3\%$ at 20–30° C, <70% RH after 20 minute warm up
Temperature	Operating: 0 to 40° C Nonoperating: –30 to +70° C
Humidity	Operating: 25 to 85% RH, +25° to +35° C Nonoperating: 25 to 85% RH, +25° to +60° C
Safety Certifications	UL3111.1 CSA 1010.1, IEC 1010.2–031 Cat II, Pollution Degree 2, Safety Class 1 (ground referenced), type C

Table 3: Warranted Environmental Characteristics

Radiated and Conducted Emissions	FCC Code 47 CFR. Part 15, Subpart B, Class A VFG 0243 Enclosure: EN 5502 Class B limits for radiated emissions AC Mains: EN 55022 Class B limits for conducted emissions and EN 60555-2 AC power harmonic emissions
----------------------------------	--

To ensure compliance with the above requirements, only high quality shielded interface cables should be attached to this instrument. High quality cables have a reliable, continuous outer shield (braid and foil) that has low impedance connections to shielded connector housings at both ends. The following cables meet this criteria:

GPIB: Tektronix part numbers 012-0991-00, -01, -02, -03

RS-232: Tektronix part number 012-1380-00

Printer: Tektronix part number 012-1250-00

Immunity, Enclosure, Radio Frequency Electromagnetic Field	IEC 801–3 Tested with TDS460 set to 50 mV/Div vertically and 500 μ s/Div horizontally
Immunity, Enclosure, Electrostatic Discharge (ESD)	8 kV, IEC 801–2

Table 3: Warranted Environmental Characteristics (Cont.)

Immunity, Fast Transients, Common Mode	IEC 801-4
Immunity, AC Power Line Transients	IEC 801-5

Typical Characteristics

Typical characteristics (Tables 4 and 5) describe typical but not guaranteed performance.

Table 4: Typical Electrical Characteristics

Rise Time	< 14 ns in 1/500 range setting
Bandwidth	DC to 25 MHz (-3dB) in 1/500 range setting
AC Common-Mode Rejection Ratio (20–30°C, <70% RH)	60 Hz: > 10,000:1 100 kHz: > 300:1 1 MHz: > 300:1
Noise (measured tangentially)	< 4 mV _{RMS}
Input Impedance	8 MΩ, 3.5 pF between inputs 4 MΩ, 7 pF between each input and ground
DC Output Drift	±0.5 mV/°C
Propagation Delay	20 nS

Table 5: Typical Mechanical Characteristics

Dimensions, Case	185 mm × 66 mm × 32 mm (7.2 in × 2.6 in × 1.3 in)
Dimensions, Input Leads	46 cm (18 in)
Dimensions, Output Cable	1.8 m (6 ft)
Unit Weight (probe only)	315 g (11 oz)
Shipping Weight (with accessories)	1.42 kg (3 lb, 2 oz)

Specifications

Nominal Characteristics

Nominal characteristics (Table 6) describe guaranteed traits, but the traits do not have tolerance limits.

Table 6: Nominal Electrical Characteristics

Input Type	Balanced differential
Output Type	Single-ended, load impedance must be greater than 50 k Ω for stated accuracy
Range Settings	Switchable: 1/50 and 1/500

User Service

The P5200 High Voltage Differential Probe contains no user serviceable components or adjustments. The accessories are replaceable. For more information, see *Replaceable Parts* on page 20.

For terms of the product warranty, refer to the back of this manual. Should the probe require replacement under terms of the warranty, return the probe to a Tektronix service center. Include the following information: name of purchaser, return address, name and phone number of a person that Tektronix may contact, date of purchase, and a description of the defect.

In the U.S., call 1-800-TEK WIDE (1-800-835-9433) for further assistance.

Cleaning

To prevent damage to probe materials, avoid using chemicals that contain benzene, benzene, toluene, xylene, acetone, or similar solvents.

Do not immerse the probe or use abrasive cleaners.

Dirt may be removed with a soft cloth dampened with a mild detergent and water solution or isopropyl alcohol.

Packaging for Shipment

If the original packaging is unfit for use or not available, use the following packaging guidelines:

1. Select a sturdy shipping carton that has inside dimensions at least one inch greater than the probe dimensions.
2. Put the probe into a plastic bag or wrap to protect it from dampness.

Maintenance

3. Place the probe into the box and stabilize it with light packing material. Seal the carton with shipping tape.

Performance Verification

The following procedure verifies the warranted electrical characteristics of the P5200 High Voltage Differential Probe. Table 7 itemizes the equipment required, provides an example or part number of the equipment, and explains the purpose of the equipment.

Table 7: List of Equipment Required

Description	Minimum Requirements	Example or Part Number	Purpose
Test oscilloscope	Bandwidth: ≥ 100 MHz Vertical Accuracy: $\leq 1.5\%$	TAS 465 or TDS 320	Display probe output
Calibration generator	Amplitude Accuracy: $\leq 0.75\%$ Rise time: ≤ 3 ns	CG5011	Check probe attenuation, rise time
Calibrator	Up to 500 VDC output	Fluke 5100B	Check Common Mode Rejection Ratio
Plunger probe (2 required)	Use probes Included in accessory kit	Accessory kit 020-2106-00	Connection to binding post
BNC adapter	BNC-male-to-dual binding post	103-0035-00	Interconnection between probe and generator

Setup

1. Connect the output of the probe to the vertical input BNC of the test oscilloscope.
2. Connect the 9 VDC output plug of the AC adapter to the input jack of the probe and then connect the AC adapter to the correct line voltage. The green power LED on the probe should light.

Amplitude Accuracy

1. Connect the BNC-male-to-dual binding post to the output connector of the calibration generator.
2. Attach the plunger probes on the differential probe input leads, and connect the probe hooks to the binding posts on the calibration generator output.
3. Set the Volts/Division on the oscilloscope to 20 mV and sec/div to 0.2 ms.
4. Set the calibration generator for a 5 V standard amplitude output.
5. With the probe range button in the 1/50 position (in), check that the amplitude accuracy is $\pm 3\%$ (4.85 to 5.15 V).
6. Press the range button to select the 1/500 position (out). Set the calibration generator for 50 V output.
7. Check amplitude accuracy is $\pm 3\%$ (48.5 to 51.5 V).
8. Reduce the amplitude on the generator to minimum, and disconnect the setup.

Rise Time

1. Configure the fast rise output of the generator for a 50 Ω load.
2. Connect the BNC adapter to the generator fast-rise output.
3. Set the generator for fast rise ($< 3\text{ns}$), 100 kHz, 1 V.
4. Set the oscilloscope vertical to 5 mV/div and the horizontal to 20 ns/div.
5. Set the probe range to 1/50 (in).
6. Connect the probe inputs to the binding posts of the BNC adapter.
7. Check that the rise time is $< 14\text{ ns}$ between the 10% and 90% points of the displayed pulse.
8. Disconnect the setup.

DC CMRR

1. Set the oscilloscope input coupling to DC and the vertical to 2 mV/div. Center the trace on the display.
2. Set the range of the probe to 1/50.
3. Ground the negative terminal of the calibrator with the sliding ground spade on the calibrator.
4. Connect both probe inputs to the positive terminal of the calibrator.
5. Set the output of the calibrator to 500 V and enable the output.
6. Check that the trace on the oscilloscope shifts less than 1.6 division (3.3 mV) from center.
7. Disable the calibrator output and disconnect all test equipment.

This completes the performance verification procedure.



Replaceable Parts

This section contains a list of the replaceable modules for the P5200 High Voltage Differential Probe. Use this list to identify and order replacement parts.

Parts Ordering Information

Replacement parts are available through your local Tektronix field office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest circuit improvements. Therefore, when ordering parts, it is important to include the following information in your order:

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If you order a part that has been replaced with a different or improved part, your local Tektronix field office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

Module Exchange

You may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-TEK-WIDE (1-800-835-9433), extension 6630.

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the P5200 High Voltage Differential Probe. Use this list to identify and order replacement parts. Table 8 describes each column in the parts list.

Table 8: Parts List Column Descriptions

Column	Column Name	Description
1	Figure & Index Number	Items in this section are referenced by figure and index numbers to the exploded view illustrations that follow.
2	Tektronix Part Number	Use this part number when ordering replacement parts from Tektronix.
3 and 4	Serial Number	Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entries indicates the part is good for all serial numbers.
5	Qty	This indicates the quantity of parts used.
6	Name & Description	An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.
7	Mfr. Code	This indicates the code of the actual manufacturer of the part.
8	Mfr. Part Number	This indicates the actual manufacturer's or vendor's part number.

Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1-1972.

Replaceable Parts

Mfr. Code to Manufacturer Cross Index

The table titled Manufacturers Cross Index shows codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

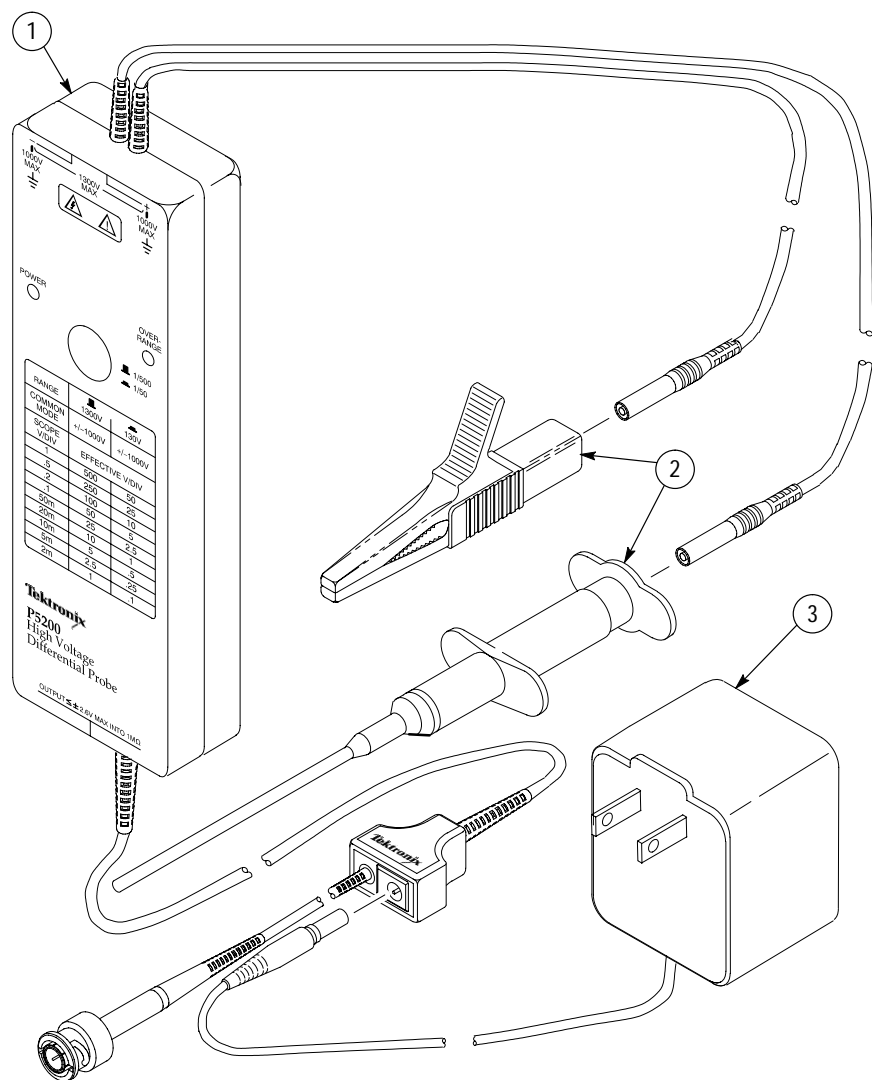


Figure 2: P5200 High Voltage Differential Probe and Replaceable Accessories

Fig. & Index No.	Tektronix Part No.	Serial No.		Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont				
2-1	119-4784-00			1	PROBE,DIF ACT:POWER,1KV,25 MHZ	80009	119478400
					STANDARD ACCESSORIES		
-2	020-2106-00			1	ACCESS PKG:(1) RED,(1) BLACK CROCODILE CLIP& (1) RED, (1) BLACK INSULATED PLUNGER CLAMP CLIP,COMPONENT KIT	80009	020210600
-3	119-3306-00			1	POWER SUPPLY:4.5W;9V 500MA, UNREGULATED, 120VAC 60HZ,183CM CABLE W/5.5MM OD,2.1MM ID COAX PLUG (UNITED STATES)	80009	119330600
	119-4240-00			1	POWER SUPPLY:PLUG-IN WALL MOUNT,IN 220VAC,EUROPEAN TYPE,OUT 9VDC 1A,W/6FT CABLE,W/2 POLE POWER PLUG CONN,VDE APPROVED (OPTIONS A1 & A5)	80009	119424000
	119-4239-00			1	POWER SUPPLY:PLUG-IN WALL MOUNT,IN 240VAC,UK TYPE,OUT 9VDC 1A,W/6FTCABLE,W/2 POLE POWER PLUG CONN,BSI APPROVED (OPTION A2)	80009	119423900
	119-4238-00			1	POWER SUPPLY:PLUG-IN WALL MOUNT,IN 240VAC,AUSTRALIA TYPE,OUT 9VDC1A,W/6FT CABLE,W/2 POLE POWER PLUG CONN,SAA APPROVED (OPTION A3)	80009	119423800
	119-4241-00			1	POWER SUPPLY:PLUG-IN WALL MOUNT,IN 100VAC,JAPAN TYPE,OUT 9VDC 1A,W/6 FT CABLE,W/2 POLE POWER PLUG CONN,MITI APPROVED (OPTION A6)	80009	119424100
	070-9018-00			1	MANUAL,TECH:INSTRUCTIONS,P5200,DP	80009	070901800

Replaceable Parts

CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001

Replaceable Parts

WARRANTY

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; or c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY TEKTRONIX WITH RESPECT TO THIS PRODUCT IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.