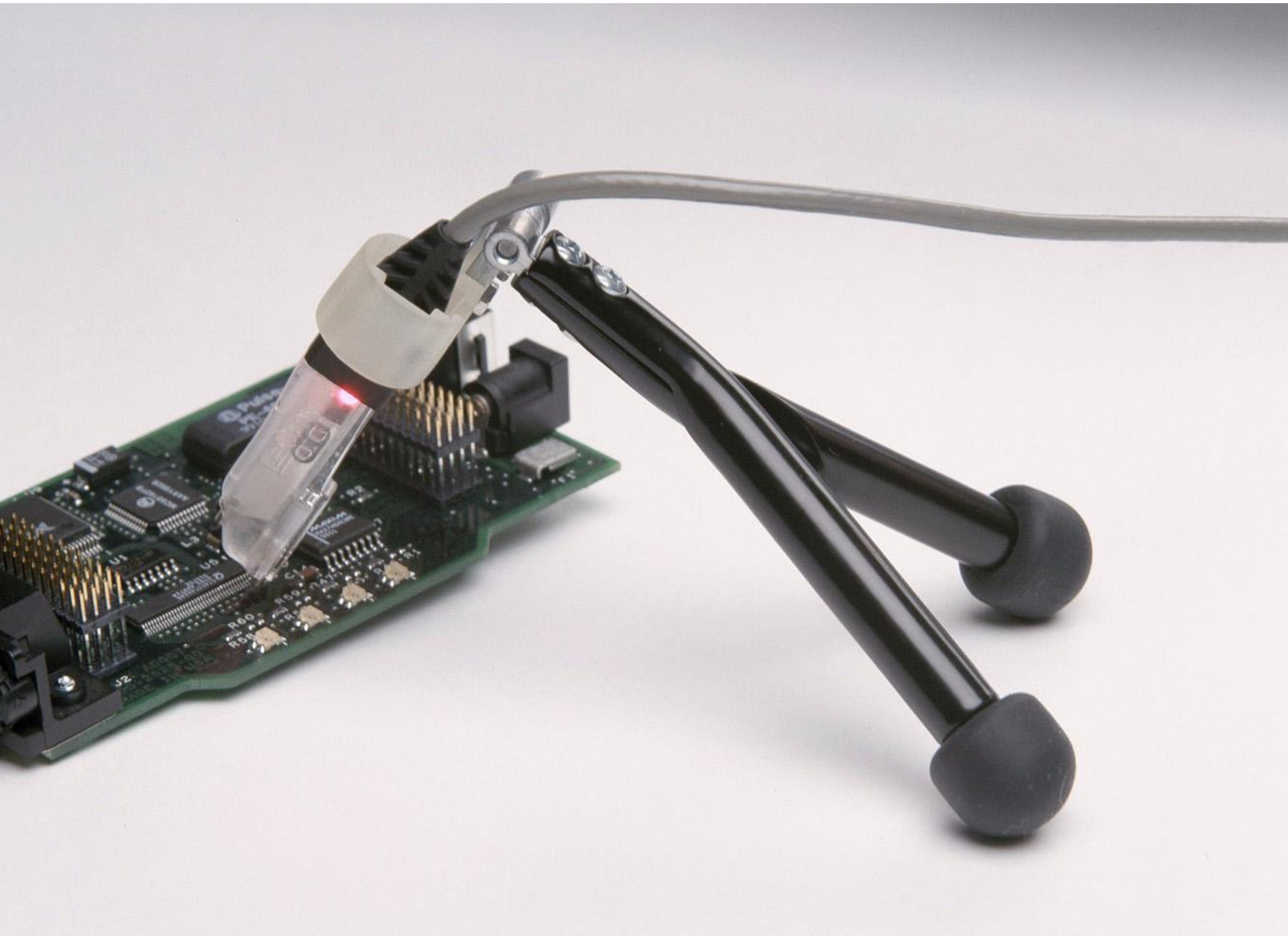


Operator's Manual

HFP1500

High Frequency Probe

HFP1500 High Frequency Probe

Operator's Manual

TELEDYNE LECROY
Everywhereyoulook™

Warranty

Teledyne LeCroy warrants this oscilloscope accessory for normal use and operation within specification for a period of one year from the date of shipment. Spare parts, replacement parts and repairs are warranted for 90 days.

In exercising its warranty, Teledyne LeCroy, at its option, will either repair or replace any assembly returned within its warranty period to the Customer Service Department or an authorized service center. However, this will be done only if the product is determined by Teledyne LeCroy's examination to be defective due to workmanship or materials, and the defect is not caused by misuse, neglect, accident, abnormal conditions of operation, or damage resulting from attempted repair or modifications by a non-authorized service facility.

The customer will be responsible for the transportation and insurance charges for the return of products to the service facility. Teledyne LeCroy will return all products under warranty with transportation charges prepaid.

This warranty replaces all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability, fitness or adequacy for any particular purposes or use. Teledyne LeCroy shall not be liable for any special, incidental, or consequential damages, whether in contract or otherwise.

922252-00 Rev A
April 2013

TABLE OF CONTENTS

Safety Instructions

This section contains instructions that must be observed to keep this oscilloscope accessory operating in a correct and safe condition. You are required to follow generally accepted safety procedures in addition to the precautions specified in this section. **The overall safety of any system incorporating this accessory is the responsibility of the assembler of the system.**

Symbols

These symbols may appear on the probe body or in this manual to alert you to important safety considerations.

WARNING. High Voltage, risk of electric shock.

CAUTION. Potential for damage to probe or instrument it is connected to. Attend to the accompanying information to protect against personal injury or damage. Do not proceed until conditions are fully understood and met.

CAUTION

ELECTROSTATIC DISCHARGE (ESD) HAZARD. The probe is susceptible to damage if anti-static measures are not taken.

DOUBLE INSULATION

PROTECTIVE (EARTH) TERMINAL

Precautions

To avoid personal injury or damage to probe or the instrument it is connected to, review and comply with the following safety precautions.

Use product only as specified.

Connect and disconnect properly. Connect probe to the measurement instrument before connecting the test leads to a circuit/signal being tested.

Use only accessories compatible with the probe. Use only accessories that are rated for the application. Ensure connections between probe input leads and probe accessories are secure before connecting them to a voltage source.

Comply with voltage derating curve. When measuring higher frequency signals, comply with the Input Voltage vs. Frequency Curve (see Figure 1).

Do not overload. To avoid electric shock or damage to probe or instrument it is connected to, do not apply any potential that exceeds the maximum rating of the probe and/or the probe accessory, whichever is less. Observe all terminal ratings of the instrument before connecting the probe.

Be careful not to damage the insulation surface when making measurements.

Use only within operational environment listed. Do not use in wet or explosive atmospheres. Keep product surfaces clean and dry. Use indoors only.

Handle with care. Probe accessory tips are sharp. They can puncture skin or cause other bodily injury if not handled properly.

Keep fingers behind the finger guard of the probe accessories.

Do not operate with suspected failures. Before each use, inspect the probe and accessories for any damage such as tears or other defects in the probe body, cable jacket, accessories, etc. If any part is damaged, cease operation immediately and sequester the probe from inadvertent use.

Operating Environment

The accessory is intended for indoor use and should be operated in a clean, dry environment. Before using this product, ensure that its operating environment is maintained within these parameters:

Temperature: 0° to 50° C.

Humidity: ≤ 80% max up to 31 °C, decreasing linearly to 45% max at 50 °C

Altitude: up to 2000 m (6562 feet)

Introduction

The 1.5 GHz HFP1500 is a small, high frequency active probe designed to meet today's increasing demand for measurements on a variety of test points. With low input capacitance and high input resistance, circuit loading is minimized.

The HFP1500 can be used with Teledyne LeCroy's WavePro™, Waverunner™ oscilloscopes, and LC series oscilloscopes with firmware version 8.7.0 or higher.

When the probe is used with any of these oscilloscopes, an AutoColor ID feature automatically illuminates the probe head in the default trace color of the channel to which the probe is connected, eliminating the need for color bands or other markers.

With the ProBus interface, the HFP1500 becomes an integral part of the oscilloscope. The probe can be controlled from the oscilloscope's front panel. The oscilloscope provides power to the probe, so there is no need for a separate power supply or batteries.

Key Benefits

- High frequency performance
- Low input capacitance
- Wide dynamic range
- ProBus interface
- AutoColor ID feature matches the probe color to the oscilloscope's default trace color
- Five interchangeable tips for probing a variety of test points
- Replaceable probe tip socket
- Hands free probing with *FreeHand* Probe Holder

Standard Accessories

The HFP1500 probe is shipped with the following standard accessories:

Item:	**Quantity:**
Straight Tip	4
Sharp Tip	4
IC Lead Tip	4
SMD Discrete Tip	4
Bent Sharp Tip	4
Clip, 0.8 mm	2
Square Pin Ground Spring	1
Short Right Angle Lead	2
Long Right Angle Lead	2
Short Single Lead	1
Long Single Lead	1
Replaceable Cartridge	1
FreeHand Probe Holder	1

Soft Accessory Case	1
Instruction Manual	1
Certificate of Calibration	1

Optional Accessories

The following items are available as optional accessories for the HFP1500 probe:

Micro Clip

High Frequency Cartridge

For part number information for standard and optional accessories refer to page 18, Replaceable Parts List.

Specifications

Nominal Characteristics

Nominal characteristics describe parameters and attributes that are guaranteed by design, but do not have associated tolerances.

Input Dynamic Range	±8 V
Offset Range	±12 V 1
Maximum Input Voltage[1]	40 V pk
Attenuation	÷10
Output Connector	ProBus
Interface	ProBus
Oscilloscope Full Compatibility	Teledyne LeCroy WaveRunner and WavePro oscilloscopes, and LC series oscilloscopes with firmware version 8.7.0 or higher.

[1] Subject to input voltage vs. frequency derating. See Figure 1.

Warranted Characteristics

Warranted characteristics are parameters with guaranteed performance. Unless otherwise noted, tests are provided in the Performance Verification Procedure for all warranted specifications.

Low Frequency Attenuation Accuracy	±1% plus uncertainty of 50 Ω termination
Output Zero	≤ 8 mV, referred to the input
Offset Accuracy	±1%±Output Zero error, referred to the input

Typical Characteristics

Typical characteristics are parameters with no guaranteed performance. Tests for typical characteristics are not provided in the Performance Verification Procedure.

Output Zero	≤ 4 mV, referred to the input
Bandwidth (Probe only)	1.5 GHz
Input Capacitance	0.7 pF
DC Input Resistance	100 kΩ

Environmental Characteristics

Operating temperature	0 °C to 50 °C
Storage temperature	-40 °C to 71 °C
Relative Humidity	80% max up to 31 °C, decreasing linearly to 45% max at 50 °C
Altitude	up to 2000 m

Physical Characteristics

Probe Head Size:	
Length	61 mm (2.4 in)
Width	7.3 mm (0.29 in)
Height	13.1 mm (0.52 in)
Cable Length	1.3 m (51.1 in)
Weight:	
Probe only	100 g (3.5 oz.)
Shipping	1.45 kg (3.19 labs)
Input Sockets	Signal and ground sockets are compatible with 0.635 mm (0.025 in) square pins, and 0.91 mm (0.036 in) maximum diameter round pins

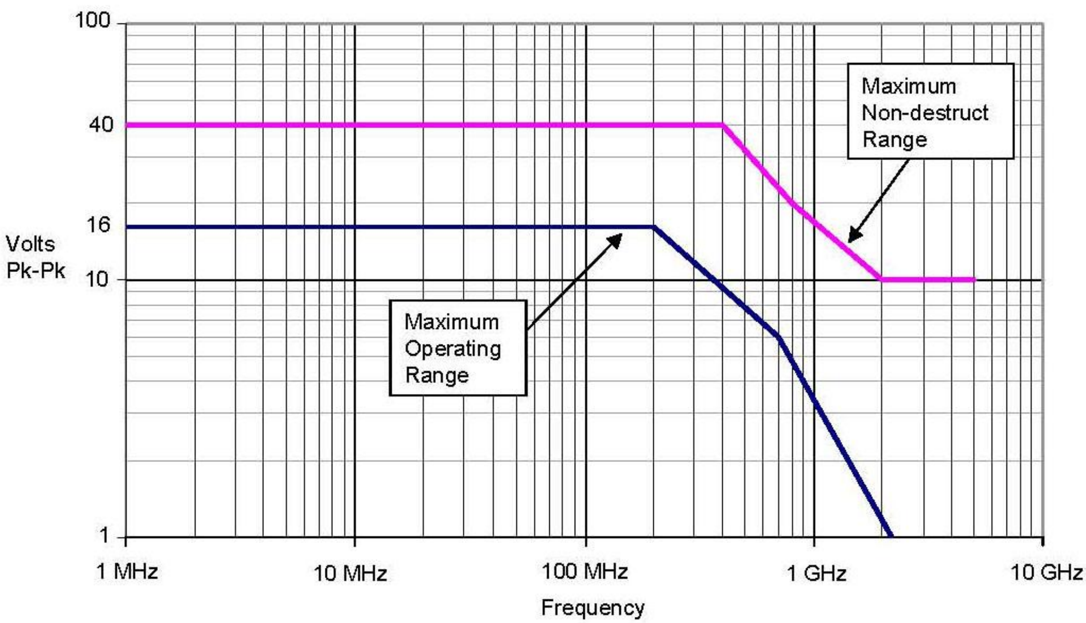


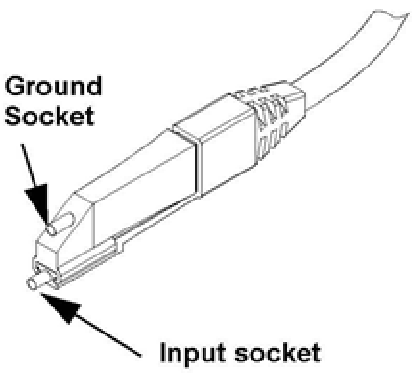
Figure 1 Input Voltage vs. Frequency

Features and Accessories

The HFP1500 probe is provided with numerous features and accessories to make probing and connecting to different test points easier than ever.

Features

Probe Head



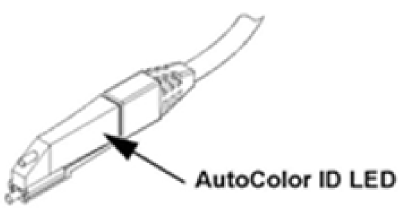
The small, low mass probe head is designed for ease of use and high performance.

The probe tip socket fits easily onto 0.025 inch square pins for direct access to test points. Several different adapters are available which connect directly in the probe socket.

The probe tip socket has a removable tip cartridge for easy replacement in case the probe socket gets damaged.

The ground socket will accept several different ground leads to provide a short ground path for high frequency performance.

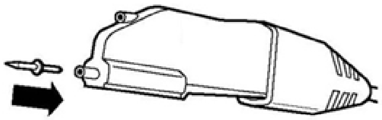
AutoColor ID



The AutoColor ID consists of an LED inside the probe head which illuminates the probe body in the default trace color of the channel to which the probe is connected.

The AutoColor ID will only function when the probe is connected to a Teledyne LeCroy oscilloscope supplied with the ProBus interface and firmware version 8.7.0 or higher. The colors are correct when factory default color scheme 1 is selected.

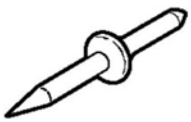
Accessory Descriptions



The following Tip and Clip accessories can be pushed into the probe tip socket, ground socket or any other socketed lead or adapter.

Tips

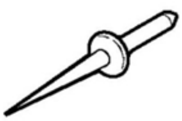
STRAIGHT TIP



The straight tip is rugged and designed for general probing. Fits in either probe socket.

PACC-PT001, package of 4.

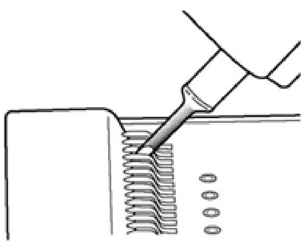
SHARP TIP



Rugged, titanium tip designed to connect to the smallest vias and small test points. Fits in either probe socket.

PACC-PT002, package of 4.

IC LEAD TIP

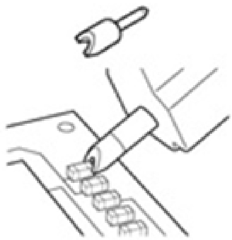


Covered in insulation on all sides (except for a small edge), this tip was designed to prevent shorting neighboring IC leads. The gold part of the tip is not insulated and should touch the IC lead to be tested. It is one-size-fits- all and will work with any IC lead pitch. Fits in either probe socket.

PACC-PT003, package of 4.

Tips, continued

SMD Discrete Tip

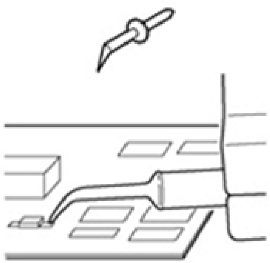


The crescent shape of this tip is designed to fit tightly on capacitors, resistors, transistors and other surface mount components with discrete leads. Fits in either probe socket.

The SMD Discrete Tip is an optional accessory for the HFP1500.

PACC-PT004, package of 4.

Bent Sharp Tip

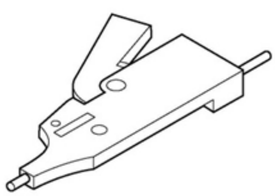


Made out of titanium, this tip is ideal for situations that require the user to hold the probe parallel to the circuit board under test. Also gives the user more control when holding the probe like a pencil. Fits in either probe socket.

PACC-PT005, package of 4.

Clips

Micro Clip (0.5 mm)



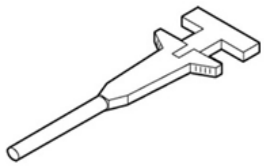
A pincher like tip designed to hold onto fine pitch leads and small components, commonly found in SMD ICs. Fits in either probe socket, or can be used with a lead.

The Micro Clip is an optional accessory for the HFP1500.

PACC-CL001, package of 4.

Clips, continued

CLIP (0.8 MM)

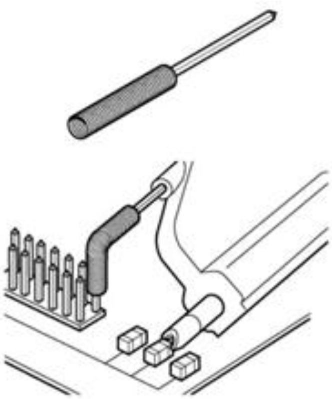


A pincher like tip designed to hold onto larger wires and components than possible with the Micro Clip, including through-hole mounted components.

This clip cannot be connected directly into either of the probe head sockets; it must be connected to a lead.

PK006-4, package of 2.

SQUARE PIN GROUND SPRING



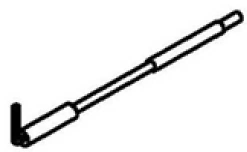
A flexible spring connected to a square pin that fits into either of the probe sockets. Designed to be attached to a square pin on the circuit under test.

PACC-LD002, package of 1.

Leads

While longer leads provide greater flexibility when connecting the probe to a circuit, the added inductance may degrade the fidelity of high frequency signals.

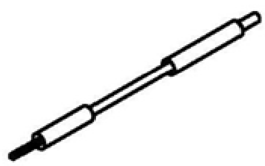
SHORT AND LONG RIGHT ANGLE LEAD



This lead has a socket on one end and a bent square pin on the other to connect to the input or ground socket of the probe body, and may be used for general purpose probing.

PACC-LD003 (short), PACC LD004 (long), packages of 2.

SHORT AND LONG SINGLE LEAD

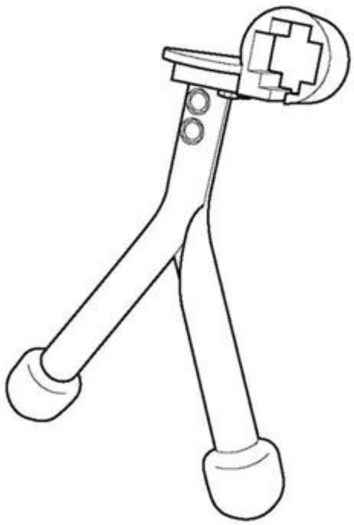


This lead can be used for either ground or input lead.

It has a socket on one end and a square pin on the other and may be used for general purpose probing.

PACC-LD005 (short) and PACC-LD006 (long), packages of 1.

Probe Holder



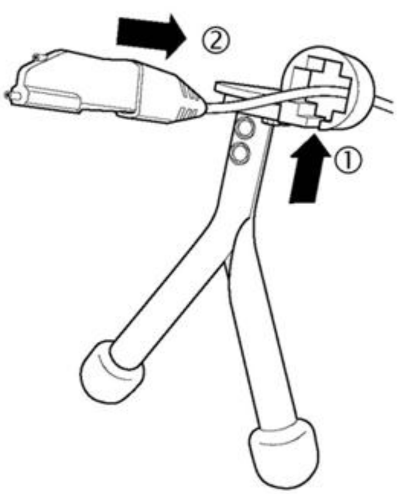
The *FreeHand Probe Holder* lets you focus on the oscilloscope screen instead of on maintaining contact to multiple test points. It allows the user to concentrate on what is really important – the waveform.

It is designed to keep most of the weight on the probe tip and will prevent lost contact when a bump to the table shakes the circuit under test.

Additionally, the HFP probe can be mounted horizontally or vertically in the *FreeHand*, giving added measurement flexibility.

PACC-MS001, package of 1.

To use the FreeHand probe holder

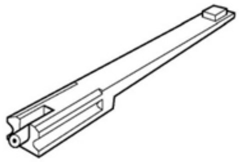


Installing probe into *FreeHand*

1. Slide the probe cable through the slot on the bottom of the translucent holder section.
2. Slide probe backwards in the probe holder.

Cartridges

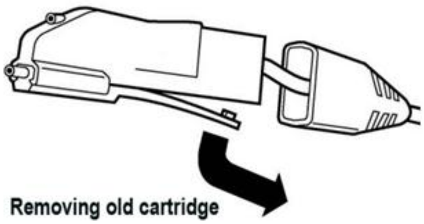
REPLACEABLE SOCKET CARTRIDGE



If the input tip socket gets damaged, you don't have to replace the entire probe, because the HFP series active probe has a removable tip socket cartridge.

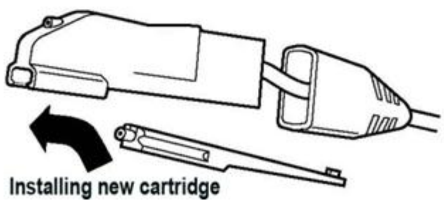
PACC-MS002, package of 1.

Removal and Installation of the Replaceable Cartridge



To remove old cartridge:

1. Slide the cable strain relief over the cable away from the probe body.
2. To release the latch, lift the part closest to the strain relief away from the probe body and slide the cartridge toward the strain relief.



To install a new cartridge:

1. Slide the new cartridge onto the probe body until the latch engages.
2. Slide the cable strain relief forward to cover the back end of the probe body.

HIGH FREQUENCY CARTRIDGE

By having a fixed tip rather than a socket, the High Frequency cartridge is able to increase signal fidelity at higher frequencies.

The High Frequency Cartridge is an optional accessory for the HFP1500.

PACC-MS003, package of 1.

NOTE: The cable strain relief is polarized and fits over the probe body in one direction only.

Operation

Handling the Probe

Exercise care when handling and storing the probe. Always handle the probe by the probe body or compensation box. Avoid putting excessive strain or exposing the probe cable to sharp bends.

Connecting the Probe to the Test Instrument

The HFP1500 probe has been designed for use with Teledyne LeCroy's WavePro™, Waverunner™ and LC oscilloscopes equipped with the ProBus interface. When you attach the probe output connector to the oscilloscope's input connector, the oscilloscope will recognize the probe, provide proper termination and activate the probe control functions in the user interface.

Connecting the Probe to the Test Circuit

To maintain the high performance capability of the probe in measurement applications, care must be exercised in connecting the probe to the test circuit. Increasing the parasitic capacitance or inductance in the input paths may introduce a "ring" or slow the rise time of fast signals. Input leads which form a large loop area will pick up any radiated electromagnetic field which passes through the loop and may induce noise into the probe input.

Using one of the available accessories makes the HFP1500 probe with its small profile and low mass head ideally suited for applications in dense circuitry.

Operation with a Teledyne LeCroy Oscilloscope

When the HFP1500 probe is connected to any Teledyne LeCroy oscilloscope, the displayed scale factor and measurement values will be automatically adjusted. Control through the oscilloscope's interface can be found in the 'Coupling' menu of the channel to which the probe is connected. Turning the **Volts/Div** knob will control the oscilloscope's scale factor to give full available dynamic range up to 2 V/div.

Use with Older Teledyne LeCroy Instruments

When used with Teledyne LeCroy instruments with software version lower than 8.7.0, the oscilloscope will provide the correct scale factor but no AutoColor ID. With V/div settings greater than 2 V/div, it is possible to display clipped waveforms on screen.

Offset

The HFP1500 has true offset capability. This allows you to remove a DC bias voltage from the input signal while maintaining DC coupling. By using probe offset rather than the 'position' control on the oscilloscope, the full dynamic range of the probe remains centered around the offset level, preventing the oscilloscope from being overdriven and causing inaccurate measurements.

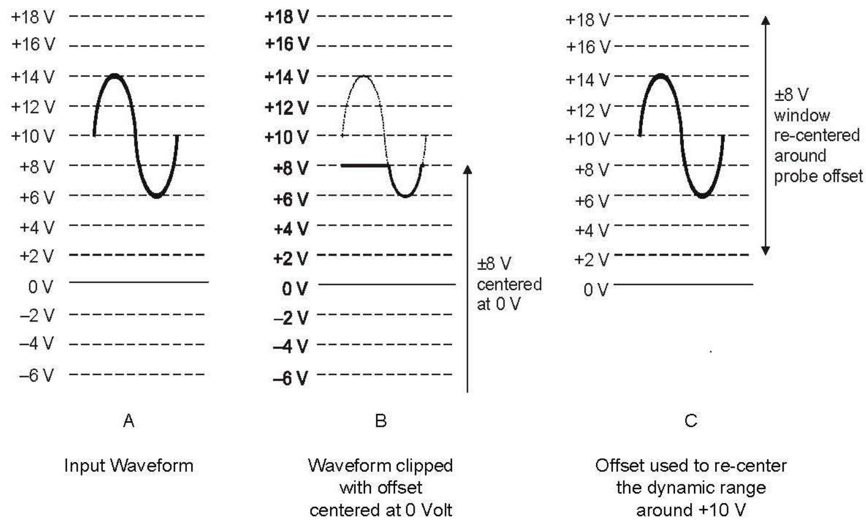


Figure 2 **Dynamic Range and Offset Effects**

With ±8 V dynamic range and ±12 V offset, the HFP1500 has a measurement range of ±20 V.

When the HFP1500 is used with a Teledyne LeCroy oscilloscope equipped with ProBus interface, the probe offset is controlled with the channel **OFFSET** knob.

NOTE: At higher frequencies the maximum linear input voltage is reduced. Refer to Specifications, for the derating curve.

Probe offset is controlled with the channel OFFSET knob in LC series oscilloscopes with software version 8.7.0 or higher. The current offset is displayed above the graticule for a few seconds after a change has been made.

Care and Maintenance

Cleaning

The exterior of the probe and cable should be cleaned only using a soft cloth lightly moistened with water or isopropyl alcohol. The use of abrasive agents, strong detergents, or other solvents may damage the probe. Always ensure that the input leads are free of debris.

⚠ The probe case is not sealed and should never be immersed in any fluid.

Calibration Interval

The recommended calibration interval is one year. (Performance Verification and Adjustment Procedures are included in this manual.)

Service Strategy

The HFP1500 probe utilizes fine pitch surface mount devices. It is therefore impractical to attempt to repair in the field. Defective probes must be returned to a Teledyne LeCroy service facility for diagnosis and exchange. A defective probe under warranty will be replaced with a factory refurbished probe.

A probe that is not under warranty can be exchanged for a factory refurbished probe for a modest fee. You must return the defective probe in order to receive credit for the probe core.

Returning a Defective Probe

Contact your local Teledyne Lecroy sales representative to find out where to return the product. All returned products should be identified by model number and serial number. Provide your name and contact number and if possible describe the defect or failure. In case of products returned to the factory, a Return Authorization Number (RAN) must be used. Contact your nearest Teledyne Lecroy office, or the New York Customer Care Center, to receive a RAN.

Return shipment should be prepaid. Teledyne Lecroy cannot accept COD or Collect Return shipments. We recommend air-freighting.

1. Contact your local Teledyne Lecroy sales or service representative to obtain a Return Authorization Number.
2. Remove all accessories from the probe. Do not include the manual.
3. Pack the probe in its case, surrounded by the original packing material (or equivalent) and box it.
4. Label the case with a tag containing:
    - The RAN
    - Name and address of the owner
    - Probe model and serial number
    - Description of failure
5. Package the probe case in a cardboard shipping box with adequate padding to avoid damage in transit.
6. Mark the outside of the box with the shipping address given to you by the Teledyne Lecroy representative; be sure to add the following:
    - ATTN: <RAN assigned by the Teledyne Lecroy representative>
    - FRAGILE
7. Insure the item for the replacement cost of the probe.
8. **If returning a probe to a different country, also:**
    - Mark shipments returned for service as a "Return of US manufactured goods for warranty repair/recalibration."
    - If there is a cost involved in the service, put the service cost in the value column and the replacement value in the body of the invoice marked "For insurance purposes only."
    - Be very specific as to the reason for shipment. Duties may have to be paid on the value of the service.

Replacement Parts

The probe connection accessories and other common parts can be ordered through the regional customer care centers. Refer to list below for Teledyne LeCroy part numbers. Defective probes can be replaced on an exchange basis. The replacement exchange probe will have been factory repaired, inspected and calibrated to the same standards as a new product. In order to obtain an exchange probe, you must return the defective probe. The returned probe should be sent back to the regional customer care center without any accessories, manual or case.

Table 1 Replaceable Parts List

Item	Teledyne LeCroy P/N	Replacement QTY
Straight Tip	PACC-PT001	4
Sharp Tip	PACC-PT002	4
IC Lead Tip	PACC-PT003	4
SMD Discrete Tip	PACC-PT004	4
Bent Sharp Tip	PACC-PT005	4
Micro Clip	PACC-CL001	4
Clip	PK006-4	2
Square Pin Ground Spring	PACC-LD002	1
Short Right Angle Lead	PACC-LD003	2
Long Right Angle Lead	PACC-LD004	2
Short Single Lead	PACC-LD005	1
Long Single Lead	PACC-LD006	1
FreeHand Probe Holder	PACC-MS001	1
Replaceable Cartridge	PACC-MS002	1
Low C Cartridge	PACC-MS003	1
Soft Accessory case	SAC-01A	1
Instruction Manual	922252-00	1

High Frequency Measurements

Input Loading

When you touch a probe to the circuit under test, the probe will affect your measurement because of the probe's input impedance introduced into the circuit. All probes present resistive, capacitive and inductive loading.

Inductive Loading (Lead Length)

A significant element in this circuit is the inductance shown in the input ground leads of the oscilloscope probe.

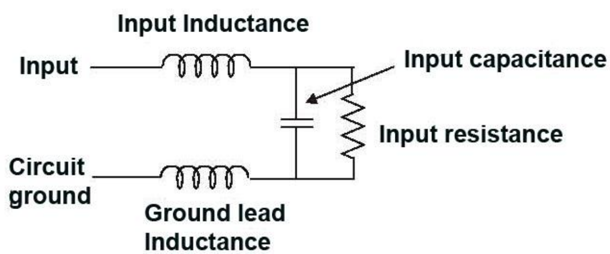


Figure 3 Probe Input Equivalent Circuit

The ground lead is the primary return path for the current resulting from the input voltage acting on the probe's input impedance. The ground lead and input lead inductances act with the probe's input capacitance to form series L-C network. The impedance of a series LC network will drop dramatically at its resonant frequency. This is the cause of the "ring" we often see after the leading edge of pulses in measured waveforms. This effect is referred to as ground lead corruption. Because it is impossible to eliminate either the L or C from this circuit, the method to improve waveform fidelity is to raise the resonant frequency beyond the bandwidth of interest in the measurement.

The resonant frequency of a simple LC circuit can be represented by:

$$F_{Resonance} = \frac{1}{2\pi\sqrt{LC}}$$

The resonant frequency of a series LC circuit can be raised by decreasing the inductance, capacitance or both.

Since the input capacitance is already very low and cannot be reduced, you can only try to reduce the inductance. This can be accomplished by using the shortest possible input lead as well as the shortest possible ground lead.

For example, to obtain the shortest possible ground lead when measuring IC related signals, attach a small piece of copper clad material to the top of the IC package and connect this to the package grounding wires. Using the shortest ground lead and input lead available makes probing signals on the package easier and makes for the shortest lead length for the best signal fidelity.

To illustrate how dramatic this effect is, we will work a simple example.

Assuming an input capacitance of 0.7 pF and a total lead length (input and ground) of 2 inches (inductance of ≈ 25 nH/inch) such a setup may cause ringing with a resonant frequency (f_0) of:

$$f_0 = \frac{1}{2\pi\sqrt{50 \times 10^{-9} \times 0.7 \times 10^{-12}}} = 851\ MHz$$

This frequency is well within the passband of the probe and will therefore show up as part of the measured signal at faster time/div settings.

To determine how fast a waveform to be measured can be without causing ringing on a probe like,this divide the BW (ringing frequency) of the probe into 0.35:

$$t_{rise} = \frac{0.35}{BW} = \frac{0.35}{851MHz} = 0.4\ ns$$

Any input signal with a rise time faster than 0.4 ns can cause ringing.

Capacitive Loading

Capacitive loading is usually the most troublesome of the three loading effects.

It can affect the rise time, bandwidth and delay time measurements.

At higher frequencies the capacitive loading can affect the amplitude as well as the waveshape of the measured signal by introducing an exponential response to the waveform.

For a simple RC network the time constant of this exponential response is:

$$t_{rise} = 2.2 \times C_{total} \times R_{total}$$

where C_{total} is the combined probe and circuit capacitance and R_{total} is combined circuit and probe resistance.

For a setup where C_t = 0.7 pF and a source resistance is 250 Ω, the measured rise time will be 0.385 ns, which will correspond to a bandwidth of 909 MHz, assuming no inductive loads.

(t_{rise}=2.2 x 0.7 X 10^{-12} x 250 Ω = 0.385 ns)

(parallel combination of 250 Ω and 100 kΩ is still 250 Ω)

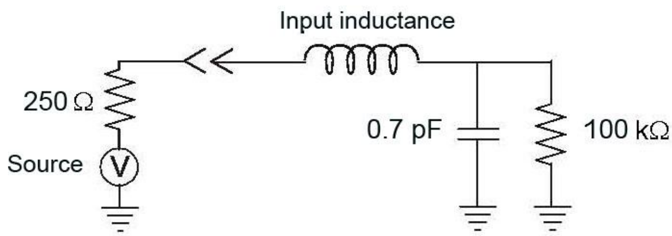


Figure 4 Probe input equivalent circuit

To illustrate the effect of capacitive loading at higher frequencies:

At a frequency of 851 MHz the reactance of the 0.7 pF capacitance is 267 Ω, and at 1.5 GHz the reactance has been lowered to 152 Ω.

If, at a given frequency, the source impedance is large with respect to the input impedance, a measurable reduction in the output signal amplitude may occur.

$$V_{out} = \frac{Z_{probe}}{Z_{probe} + Z_{source}} \times V_{in}$$

where: Z_{probe} is the probe's input impedance and Z_{source} is the source impedance.

For example: at 851 MHz, where the probe input impedance has reduced to 267 Ω, and a source resistance of 250 Ω the probe output amplitude is reduced to:

$$V_{out} = \frac{267}{267 + 250} = 0.52 \times V_{in}$$

Performance Verification

This procedure can be used to verify the warranted characteristics of the HFP1500 High Frequency Probe.

The recommended calibration interval for the model HFP1500 is one year. The complete performance verification procedure should be performed as the first step of annual calibration. Performance verification can be completed without removing the probe covers or exposing the user to hazardous voltages.

Test results can be recorded on a photocopy of the Test Record provided in Appendix A at the end of the manual. Adjustment should only be attempted if a parameter measured in the Performance Verification Procedure is outside the specification limits.

NOTE: Adjustment should only be performed by qualified personnel.

This procedure tests the following specifications:

- Output Zero Voltage
- Offset Accuracy
- LF Attenuation Accuracy

Test Equipment Required

Table 2 List of Required Equipment lists the test equipment and accessories (or their equivalents) that are required for performance verification of the HFP1500 Probe.

This procedure has been developed to minimize the number of calibrated test instruments required.

Only the parameters listed in **boldface** in the "Minimum requirements" column must be calibrated to the accuracy indicated.

Because the input and output connectors types may vary on different brands and models of test instruments, additional adapters or cables may be required.

Table 2 List of Required Equipment

Description	Minimum Requirements	Example Test Equipment
Digital Oscilloscope	ProBus interface	Teledyne LeCroy WavePro960 Teledyne LeCroy LT344
Digital Multimeter (DMM) with test probe leads	4.5 digit DC: 0.1% Accuracy AC: 0.1% Accuracy	Agilent Technologies 34401A Fluke 8842A-09
Function Generator	Sine Wave output amplitude adjustable to 14.14 Vp-p (5 Vrms) into 1 MΩ at 70 Hz	Agilent Technologies 33120A Stanford Research Model DS340
Power Supply	0-12 V, settable to 10 mV	HP E3611A
BNC Coaxial Cable (2 ea.)	Male to Male, 50 Ω, 36" Cable	Pomona 2249-C-36 Pomona 5697-36
BNC Tee Connector	Male to Dual Female	Pomona 3285
Calibration Fixture	ProBus Extender Cable	Teledyne LeCroy PROBUS-CF01
Terminator, Precision, BNC	50 Ω ± 0.05%	Teledyne LeCroy TERM-CF01
Banana Plug Adapter (2 ea.)	Female BNC to Dual Banana Plug	Pomona 1269
BNC to Mini-grabber	BNC Male to Mini-grabber Cable, 36"	Pomona 5187-C-36

Preliminary Procedure

The warranted characteristics of the HFP1500 are valid at any temperature within the Environmental Characteristics listed in the Specifications. However, some of the other test equipment used to verify the performance may have environmental limitations required to meet the accuracy needed for the procedure. Make sure that the ambient conditions meet the requirements of all the test instruments used in his procedure.

1. Connect the HFP1500 probe to the female end of the ProBus Extension Cable. Connect the male end of the ProBus Extension Cable to channel 1 of the oscilloscope.
2. Turn the oscilloscope on and allow at least 30 minutes warm-up time for theHFP1500 and test equipment before performing the Verification Procedure.

3. Turn on the other test equipment and allow these to warm up for the time recommended by the manufacturer.
4. While the instruments are reaching operating temperature, make a photocopy of the Performance Verification Test Record (located in Appendix A), and fill in the necessary data.
5. Select the channel to which the probe is connected. Set the oscilloscope scale factor to 20mV/div.
6. Disconnect the ProBus Extender Cable from the oscilloscope. Verify that the scale factor changes from 20 mV/div to 2 mV/div.
7. Re-connect the ProBus extender Cable to the oscilloscope.

NOTE: The correct operation of the HFP1500 controls requires software version 8.7.0 or higher on LC series oscilloscopes. The software version in the test oscilloscope can be verified by pushing SCOPE STATUS, then selecting the System menu option.

Functional Check

The functional check will verify the basic operation of the probe functions. It is recommended the Functional Check be performed prior to the Performance Verification Procedure.

1. Return to the factory default settings by:
   a. Pressing the oscilloscope's front panel **PANELS** button.
   b. From the Menu buttons press **FROM DEFAULT SETUP**.
2. Select Channel 1 and enter the **Coupling** menu.
3. Verify that Probe sensed (HFP1500) is displayed on the right hand menu.
4. If the trace colors have been reassigned or you are unsure, restore the default colors by pressing the following menus: **DISPLAY, More Display Setup, Color Scheme** and in the **Color Scheme** menu press 1.
5. Verify that the probe head LED shows basically the same color as the channel 1 trace color.
6. Disconnect the probe from channel 1 and connect respectively to channel 2, 3 and 4.
7. Verify that in each case the LED color corresponds to the trace color of the channel to which the probe is connected.

Procedure

A. Output Zero Voltage

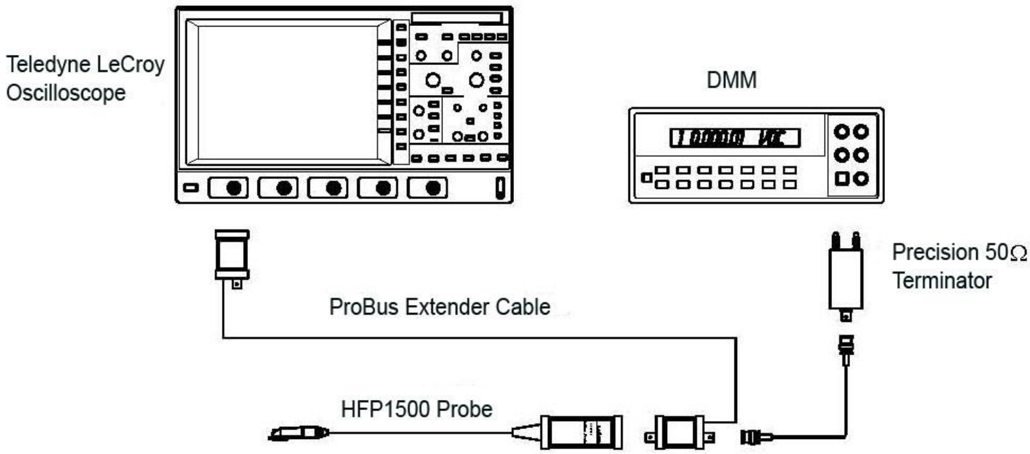


Figure 5 Output Zero Voltage Test Setup

1. Connect one end of a BNC cable to the female BNC connector on the probe end of the ProBus extender cable. Connect the precision 50 Ω terminator to the other end of the BNC cable.
2. Connect the banana plugs of the Precision terminator to the input of the DMM. Make sure that the plug corresponding to the BNC shield (marked "Ground") is connected to the **LO** or **COMMON** input of the DMM. Refer to Figure 5 Output Zero Voltage Test Setup for setup information.
3. Set the **OFFSET** on the oscilloscope to zero, as indicated by on-screen display.
4. Set the DMM to read DC Volt on the most sensitive range.
5. Record the voltage measured on the DMM to 10 μV resolution as 'Output Zero Voltage' in the Test record.
6. Check that the voltage indicated by the DMM is between ±800 μV.
7. Disconnect the DMM from the precision 50 Ω terminator. Leave the remaining setup in place for the next step.

B. LF Attenuation Accuracy

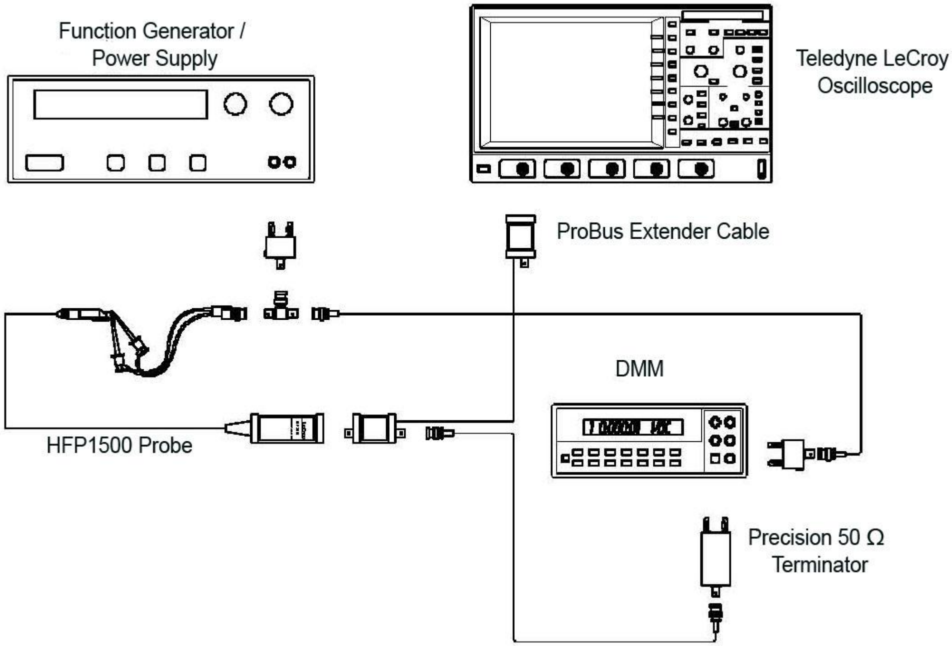


Figure 6 Attenuation Accuracy Test Setup

1. Connect the BNC end of the BNC to mini-grabber cable to a female end of the BNC tee adapter. (Refer to Figure 6 **Attenuation Accuracy Test Setup**).
2. Carefully insert the Straight Tips (supplied in accessory kit) into the sockets of the probe head. Attach the red lead of the mini-grabber to the signal input and the black lead to the ground input of the probe head.
3. Set the power supply to approximately 0 Volt.
4. Plug the dual banana plug adapter with probe attached into the output terminals of the power supply with ground side of the adapter (and the ground side of the probe head) connected to the **positive** terminal of the power supply.
5. Attach a BNC cable to the unused female port of the BNC tee and a dual banana plug adapter to the other end of the cable and plug the dual banana plug adapter into the DMM input. Make sure the side of the banana plug adapter corresponding to the BNC shield (marked "GROUND") is connected to the **LOW** or **COMMON** input of the DMM.
6. Adjust the power supply to an output of 10.0 V ± 100 mV as indicated on the DMM.

7. Record the DMM reading, which should be a **negative** number, to 10 mV resolution as 'Power Supply Negative Output Voltage' in the Test Record. Divide the reading recorded in step B-7 by 10 and record the result with 100 µV resolution as "Expected Output Voltage, top range" in the Test Record.
8. Add 10 (to correct for the +10 V offset as described in step B-13) to the 'PS Negative Output Voltage' recorded in step B-7. (Do NOT adjust the power supply output amplitude).
9. Divide the resulting sum by 10.
10. Record the answer to three significant places as 'Expected Negative Output Voltage" in the test record.
11. Remove the banana plug adapter, connected to the power supply, from the DMM and connect the precision 50 Ω terminator to the DMM, making sure that the banana plug side marked 'GROUND" is connected to the **LOW** or **COMMON** input of the DMM.
12. Set the DMM to read DC Volt on the most sensitive range.
13. Verify that the display for channel 1 is turned ON. Turn the oscilloscope **OFFSET** knob to read +10.00 V on the oscilloscope display.
14. After the DMM has settled, record the reading to 100 µV resolution as 'Measured Negative Output Voltage' in the Test Record.
15. Subtract the measured voltage as recorded in step B-14 from the expected output voltage recorded in step B-10. Be sure to include the sign of each of the values in the calculation.
16. Record the answer to three significant places as 'Offset Error Voltage' in the Test Record.
17. Verify that the error is between ±10.8 mV.

> **NOTE**: The error term is derived from the Offset Accuracy specification of±1% ±8 mV. Using a 10.0 V offset setting, the maximum error would be 108 mV referred to the input, which becomes ±10.8 mV error referred to the output (taking into account the ÷10 attenuation.

18. Using the oscilloscope's OFFSET knob, set the probe offset to 0 V, as indicated in the onscreen display.
19. Remove the dual banana plug adapter with the HFP1500 attached from the power supply and reconnect to the supply but now with the grounded side of the banana plug (and grounded socket of the probe head) connected to the negative terminal of the power supply output.
20. Disconnect the DMM from the precision 50 Ω terminator and connect the DMM to the dual banana plug adapter connected to the power supply output.

21. Record the DMM reading, which should be a positive number, to 10 mV resolution as ’Power Supply Positive Output Voltage’ in the Test Record.
22. Subtract 10 from the output voltage recorded in step B-21. Divide this number by 10.
23. Record the result to three significant places as ’Expected Positive Output Voltage’ in the Test Record.
24. Set the oscilloscope OFFSET to –10.00 V as read on the oscilloscope display.
25. Remove the banana plug adapter from the DMM and connect the precision 50 Ω terminator to the DMM, making sure that the banana plug side marked ’GROUND" is connected to the **LOW** or **COMMON** input of the DMM.
26. Record the DMM reading to three significant places as ’Measured Positive Output Voltage’ in the Test Record.
27. Subtract the Measured Output Voltage as recorded in step B-26 from the Expected Output Voltage recorded in step B-23. Be sure to include the sign of the values in the calculation.
28. Record the result to 100 µV resolution as ’Offset Error Voltage’ in the Test Record.
29. Verify that the output error is between ±10.8 mV.
30. Return the oscilloscope offset to 0 Volt. Leave the setup connections for the next step.

C. LF Attenuation Accuracy

1. Disconnect the BNC tee at the power supply from the dual banana plug adapter. Connect the BNC tee to the output of the function generator. (Use a 50 Ω termination if the function generator requires such a load).
2. Disconnect the DMM from the precision 50 Ω terminator and connect the DMM to the dual banana plug adapter connected to the function generator output.
3. Set the DMM to read AC Volt and set the range to measure 5.0 Vrms.
4. Set the mode of the function generator to sine wave, the frequency to 70 Hz and the output amplitude to 5 Vrms ±10 mV as measured on the DMM.
5. Record the output voltage to 1 mV resolution as ’Generator Output Voltage’ in the Test Record. Be careful not to alter the output amplitude after the reading is recorded.
6. Divide the reading recorded in step C-5 by 10 and record the result with 100 µV resolution as ’Expected Output Voltage, top range" in the Test Record.

7. Remove the banana plug adapter, connected to the function generator, from the DMM and connect the precision 50 Ω terminator to the DMM, making sure that the banana plug side marked ’GROUND" is connected to the LOW or COMMON input of the DMM.
8. After the DMM reading has stabilized, record the reading to 100 µV resolution as ’Measured Output Voltage, top range’ in the Test Record.
9. Calculate the error by dividing the measured output voltage recorded in step C-8 by the expected top output voltage recorded in step C-6. Subtract 1 from this ratio and multiply by 100% to get the error in percent.

$$Error = \left(\frac{Measured\ Output\ Voltage}{Expected\ Output\ Voltage} - 1\right) \times 100\%$$

10. Record the calculated error to two decimal places (±0.xx%) as ’Gain Error, top range’ in the test record.
11. Verify that the error is less than ±1.0 %.
12. Disconnect the precision 50 Ω terminator from the DMM.
13. Connect the banana plug adapter connected via a BNC cable to the BNC tee at the function generator to the DMM. Verify that the side of the plug marked ’Ground’ is connected to the **LOW** or **COMMON** input of the DMM.
14. Adjust the sine wave generator output amplitude to approximately 2.5 Vrms as measured on the DMM.
15. Record the reading to 1 mV resolution as ’Generator Output Voltage, mid range’ in the Test Record. Be careful not to alter the output amplitude after the reading is recorded.
16. Divide the reading recorded in step C-15 by 10.
17. Record the result to 100 µV resolution as ’Expected Output Voltage, mid range’ in the test record.
18. Remove the banana plug adapter from the DMM and connect the precision 50 Ω terminator to the DMM, making sure that the banana plug side marked ’GROUND" is connected to the **LOW** or **COMMON** input of the DMM.
19. After the DMM has stabilized, record the reading to 100 µV resolution as ’Measured Output Voltage, mid range’ in the Test record.
20. Calculate the error by dividing the measured output voltage recorded in step C-19 by the expected top output voltage recorded in step C-17. Subtract 1 from this ratio and multiply by 100% to get the error in percent.

$$Error = \left(\frac{Measured\ Output\ Voltage}{Expected\ Output\ Voltage} - 1\right) \times 100\%$$

21. Record the calculated error to two decimal places (±0.xx %) as 'Gain Error, mid range' in the Test record.

22. Verify that the mid range gain error is less than ±1.0%

This completes the Performance Verification of the HFP1500. Complete and file the Test Record, as required to support your internal calibration procedure.Apply suitable calibration label to the HFP1500 housing as required.

Adjustment Procedure

You can use this procedure to adjust the HFP1500 probe to meet the warranted specifications. This procedure should only be performed if the probe fails to meet the Performance verification tests for Output Zero or Offset Accuracy.

Gain which affects LF attenuation accuracy cannot be adjusted during routine calibration. Probes which fail LF frequency accuracy during performance verification must be returned to the factory for rework.

If the probe cannot be adjusted to meet the Performance verification limits, repair may be necessary:

- To assure probe accuracy, check the calibration of the HFP1500 every 1000 hours or once a year if used infrequently. Before calibration, thoroughly clean and inspect the probe as outlined in the Care and Maintenance section.
- To assure the probe will meet the published specifications over the entire temperature range, adjustment must be performed in a controlled ambient environment with temperature of 23 °C ±5 °C.

CAUTION: The adjustment procedure will require removal of the probe control circuit cover. This cover is part of the ESD protection system of the HFP1500. To protect the probe, you should perform the entire procedure on a static dissipating work surface. Wear an antistatic wrist strap and follow standard static control procedures.

Test Equipment Required

Table 3 List of Required Equipment lists the test equipment and accessories (or their equivalents) that are required for complete calibration of the HFP1500 Probe. Specifications given for the test equipment are the minimum necessary for accurate calibration. All test equipment is assumed to be correctly calibrated and operating within the specification listed. Detailed operating instructions for the test equipment are not given in this procedure. Refer to the test equipment manual if more information is needed

If alternate test equipment is substituted, control settings or calibration equipment setups may need to be altered.

Table 3 List of Required Equipment

Description Examples	Minimum Requirements	Example Test Equipment
Digital Oscilloscope	ProBus interface	Teledyne LeCroy WavePro960 Teledyne LeCroy LT344
Digital Multimeter (DMM) with test probe leads	4.5 digit DC: 0.1% Accuracy AC: 0.1% Accuracy	Agilent Technologies 34401A Fluke 8842A-09
Power Supply	0-12 V, settable to 10 mV	HP E3611A
BNC Coaxial Cable (2 ea.)	Male to Male, 50 Ω, 36" Cable	Pomona 2249-C-36 Pomona 5697-36
BNC Tee Connector	Male to Dual Female	Pomona 3285
Calibration Fixture	ProBus Extender Cable	Teledyne LeCroy PROBUS-CF01
Terminator, Precision, BNC	50 Ω ± 0.05%	Teledyne LeCroy TERM-CF01
Banana Plug Adapter (2 ea.)	Female BNC to Dual Banana Plug	Pomona 1269
BNC to Mini-grabber	BNC Male to Mini-grabber Cable, 36"	Pomona 5187-C-36

Preliminary Procedure

1. Remove the two screws that secure the plastic cover on the cable end of the ProBus interface housing.
2. Gently pull on the probe cable to slide the circuit board assembly from the metal housing.
3. Connect the HFP1500 probe to the female end of the ProBus extension cable, being careful to line up all six pins of the probe connector. Connect the male end of the ProBus extension cable to channel 1 of the oscilloscope.
4. Apply power to the oscilloscope and test equipment.
5. Allow at least 30 minutes warm-up time for the HFP1500 and test equipment before starting the calibration procedure.

Procedure

Adjust Output Zero

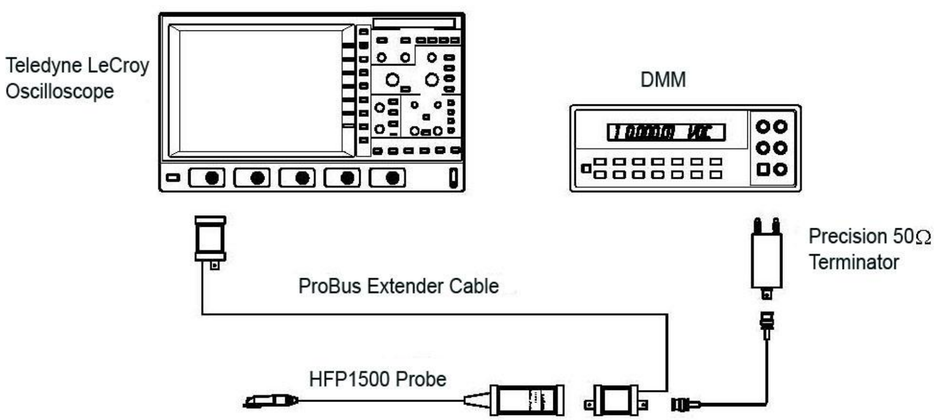


Figure 7 Output Zero Voltage Adjustment Setup

1. Connect one end of a BNC cable to the probe end of the ProBus extension cable. Connect the Precision 50 Ω Terminator to the other end of the BNC cable.
2. Connect the banana plugs of the precision 50 Ω terminator to the input of the DMM. Make sure the plug corresponding to the BNC shield (marked 'Ground') is connected to the LO or COMMON input of the DMM. Refer to Figure 7 Output Zero Voltage Adjustment Setup for setup information.

3. Select the channel to which the probe and ProBus extender is connected. Set OFFSET on the oscilloscope to zero as indicated on the on-screen display.
4. Set the DMM to read DC Volt on the most sensitive range.
5. Verify that the probe inputs are not connected to any signal.
6. Adjust OUTPUT ZERO on the board until the DMM reads 0 V ±100 µV. Refer to Figure 8 Adjustment Locations S/N 1000 and higher for adjustment location.

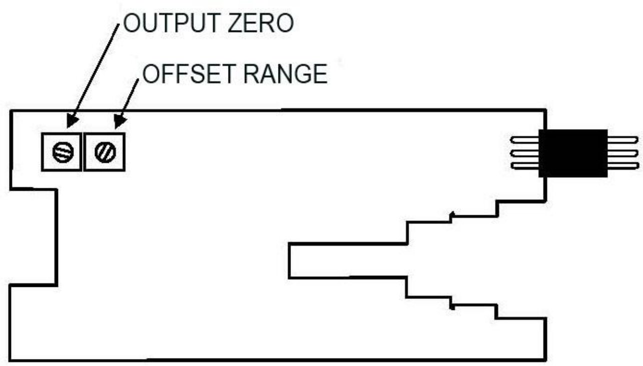


Figure 8 Adjustment Locations S/N 1000 and higher

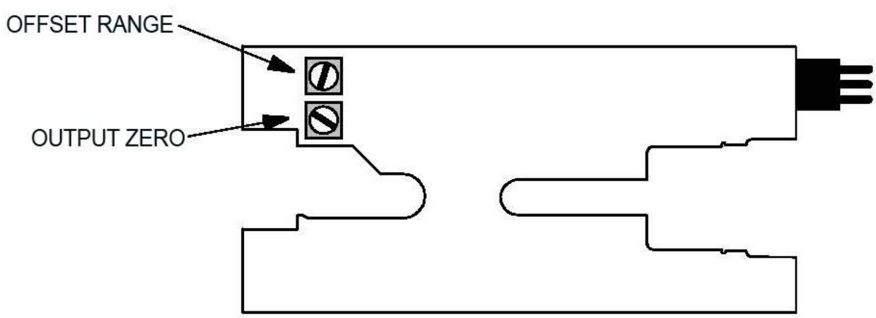


Figure 9 Adjustment Locations S/N below 1000.

Adjust Offset Range

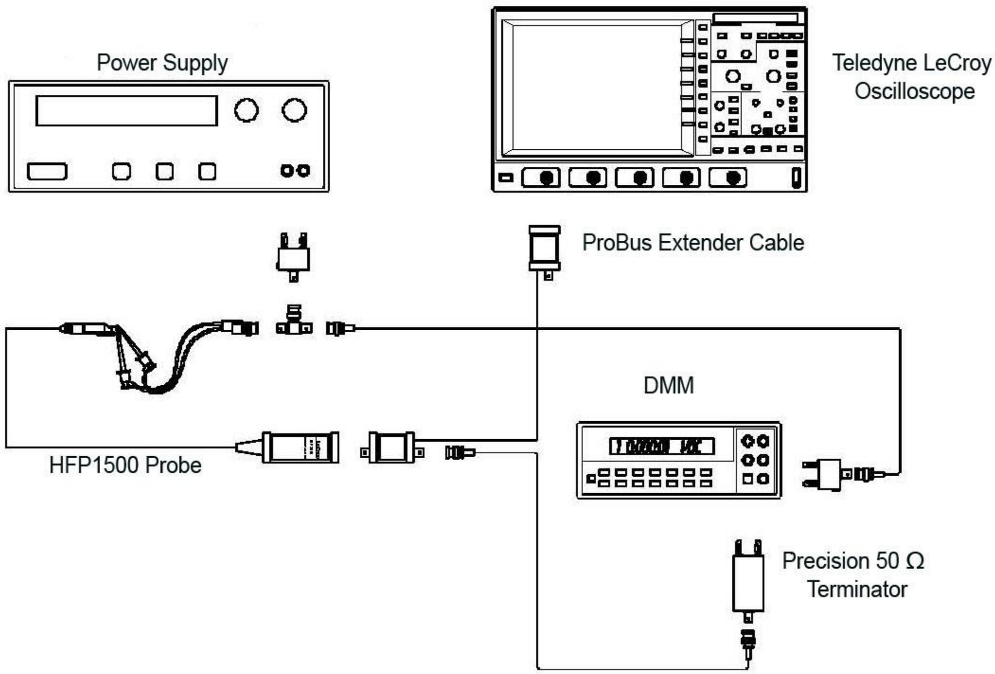


Figure 10 Offset Range Adjustment Setup

1. Connect the BNC end of the BNC to mini-grabber cable to a female end of the BNC tee adapter and a female BNC to dual banana plug adapter to the male end of the BNC tee.
2. Carefully insert Straight Tips (supplied in the accessory kit) into the HFP1500 probe head sockets. Attach the red lead of the mini-grabber to the signal input and the black lead to the ground input of the probe.
3. Set the power supply for approximately 0 Volt.
4. Plug the dual banana plug adapter, with the probe attached, into the output terminal of the power supply. Make sure the side of the banana plug corresponding to the probe ground and BNC ground is connected to the **negative** terminal of the power supply.
5. Attach a BNC cable to the unused female port of the BNC tee and a dual banana plug adapter to the other end of the BNC cable and plug this into the DMM. Make sure the side of the banana plug corresponding to the BNC shield (marked 'GROUND') is connected to the **LO** or **COMMON** input of the DMM. Refer to **Figure 10 Offset Range Adjustment Setup** for setup information.

6. Using the DMM to monitor the voltage, adjust the power supply to an output of 10.00 V ±10 mV. Record the reading.
7. Remove the banana plug adapter from the DMM connect the precision 50 Ω terminator into the DMM Input. Make sure the side of the banana plug corresponding to the BNC shield (marked 'GROUND') is connected to the LO or COMMON input of the DMM.
8. Verify that the display for channel 1 is turned on. Set the oscilloscope OFFSET knob to –10.00 V. as read on the oscilloscope screen.
9. Set the DMM to read DC Volt on the most sensitive range.
10. Subtract 10.0 V from the power supply output voltage recorded in step B-7. Be sure to keep track of the sign of the result.
11. Adjust OFFSET RANGE until the DMM reads the same voltage ±1 mV as calculated in step B-11. Be sure the sign agrees.
12. Repeat steps A-3 through A-7 of the Adjust Offset Zero procedure.
13. Disconnect the probe from the ProBus extender and re-install the circuit board into the probe case, being careful to align the ProBus interface connector with the opening on the other end of the case.

Verify Calibration

Repeat the Performance Verification procedure to ensure compliance with the warranted specifications.

Apply a calibration sticker, if required, in accordance with your quality control procedures.

Reference

Certifications

This section contains the probe's Electromagnetic Compatibility (EMC), Safety and Environmental certifications.

EMC Compliance

EC DECLARATION OF CONFORMITY - EMC

The probe meets intent of EC Directive 2004/108/EC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61326-1:2006, EN 61326-2-1:2006 EMC requirements for electrical equipment for measurement, control, and laboratory use.

Electromagnetic Emissions:

CISPR 11:2003, Radiated and Conducted Emissions Group 1, Class A [1 2]

Electromagnetic Immunity:

EN 61000-4-2:2001 Electrostatic Discharge, 4 kV contact, 8 kV air, 4 kV vertical/horizontal coupling planes [3]

EN 61000-4-3:2006 RF Radiated Electromagnetic Field, 3 V/m, 80-1000 MHz; 3 V/m, 1400 MHz - 2 GHz; 1 V/m, 2 GHz - 2.7 GHz [3]

1 Emissions which exceed the levels required by this standard may occur when the probe is connected to a test object.

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

3 Meets Performance Criteria “B” limits of the respective standard: during the disturbance, product undergoes a temporary degradation or loss of function or performance which is self-recoverable.

European Contact:

Teledyne LeCroy Europe GmbH
Waldhofer Str 104
D-69123 Heidelberg
Germany
Tel: (49) 6221 82700

Australia & New Zealand Declaration of Conformity—EMC

The probe complies with the EMC provision of the Radio Communications Act per the following standards, in accordance with requirements imposed by Australian Communication and Media Authority (ACMA):

CISPR 11:2003 Radiated and Conducted Emissions, Group 1, Class A, in accordance with EN61326-1:2006 and EN61326-2-1:2006.

Australia / New Zealand Contacts:

Vicom Australia Ltd.
1064 Centre Road
Oakleigh, South Victoria 3167
Australia

Vicom New Zealand Ltd.
60 Grafton Road
Auckland
New Zealand

Safety Compliance

EC Declaration of Conformity – Low Voltage

The probe meets intent of EC Directive 2006/95/EC for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements

EN 61010-2:030:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Particular requirements for testing and measuring circuits

EN 61010-031/A1:2008 Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test.

Environmental Compliance

End-Of-Life Handling

The probe is marked with this symbol to indicate that it complies with the applicable European Union requirements to Directives 2002/96/EC and 2006/66/EC on Waste Electrical and Electronic Equipment (WEEE) and Batteries.

The probe is subject to disposal and recycling regulations that vary by country and region. Many countries prohibit the disposal of waste electronic equipment in standard waste receptacles. For more information about proper disposal and recycling of your Teledyne LeCroy product, please visit teledynelecroy.com/recycle.

Restriction of Hazardous Substances (RoHS)

This probe has been classified as Industrial Monitoring and Control Equipment and is outside the scope of the 2011/65/EU RoHS Directive until 22 July 2017 (per Article 4, Paragraph 3).

Contact Teledyne LeCroy

Teledyne LeCroy Service Centers	
United States and Canada - World Wide Corporate Office Teledyne LeCroy Corporation 700 Chestnut Ridge Road Chestnut Ridge, NY, 10977-6499, USA Ph: 800-553-2769 / 845-425-2000 FAX: 845-578-5985 teledynelecroy.com **Support**: contact.corp@teledynelecroy.com **Sales**: customersupport@teledynelecroy.com	***United States - Protocol Solutions Group*** Teledyne LeCroy Corporation 3385 Scott Boulevard Santa Clara, CA, 95054, USA FAX: 408-727-0800 teledynelecroy.com **Sales and Service**: Ph: 800-909-7211 / 408-727-6600 contact.corp@teledynelecroy.com **Support**: Ph: 800-909-7112 / 408-653-1260 psgsupport@teledynelecroy.com
European Headquarters Teledyne LeCroy SA 4, Rue Moïse Marcinhes Case postale 341 1217 Meyrin 1 Geneva, Switzerland Ph: + 41 22 719 2228 / 2323 /2277 FAX:+41 22 719 2233 contact.sa@teledynelecroy.com applications.indirect@teledynelecroy.com teledynelecroy.com/europe **Protocol Analyzers:** Ph: +44 12 765 03971	***Singapore, Oscillosocpes*** Teledyne LeCroy Singapore Pte Ltd. Blk 750C Chai Chee Road #02-08 Technopark @ Chai Chee Singapore 469003 Ph: ++ 65 64424880 FAX: ++ 65 64427811 ***Singapore, Protocol Analyzers*** Genetron Singapore Pte Ltd. 37 Kallang Pudding Road, #08-08 Tong Lee Building Block B Singapore 349315 Ph: ++ 65 9760-4682
China Teledyne LeCroy Corporation Beijing Rm. 2001 - Office; Rm. 2002 - Service Center Unit A, Horizon Plaza No. 6, Zhichun Road, Haidian District Beijing 100088, China Ph: ++86 10 8280 0318 / 0319 / 0320 FAX:++86 10 8280 0316 **Service:** Rm. 2002 Ph: ++86 10 8280 0245	***Korea*** Teledyne LeCroy Korea 10th fl.Ildong Bldg. 968-5 Daechi-dong, Gangnam-gu Seoul 135-280, Korea Ph: ++ 82 2 3452 0400 FAX: ++ 82 2 3452 0490
Taiwan LeColn Technology Co Ltd. Far East Century Park, C3, 9F No. 2, Chien-8th Road, Chung-Ho Dist., New Taipei City, Taiwan Ph: ++ 886 2 8226 1366 FAX: ++ 886 2 8226 1368	***Japan*** Teledyne LeCroy Japan Hobunsya Funchu Bldg, 3F 3-11-5, Midori-cho, Fuchu-Shi Tokyo 183-0006, Japan Ph: ++ 81 4 2402 9400 FAX: ++ 81 4 2402 9586 teledynelecroy.com/japan

Appendix A

Performance Verification Test Record

This record can be used to record the results of measurements made during the performance verification of the HFP1500 High Frequency Probe.

Photocopy this page and record the results on the copy. File the completed record as required by applicable internal quality procedures.

The section in the test record corresponds to the parameters tested in the performance verification procedure. The numbers preceding the individual data records correspond to the steps in the procedure that require the recording of data. Results to be recorded in the column labeled "Test Result" are the actual specification limit check. The test limits are included in all of these steps. Other measurements and the results of intermediate calculations that support the limit check are to be recorded in the column labeled "Intermediate Results".

Permission is granted to reproduce these pages for the purpose of recording test results.

Probe Model: HFP1500

Serial Number: ______________________

Asset or Tracking Number: ______________________

Date: ______________________

Technician: ______________________

Equipment Used:

	MODEL	SERIAL NUMBER	CALIBRATION DUE DATE
OSCILLOSCOPE			
DIGITAL MULTIMETER			
FUNCTION GENERATOR[1]			**N/A**

1 The function generator used in this Performance Verification Procedure is used for making relative measurements. The output of the generator is measured with a DMM or oscilloscope in this procedure. Thus, the generator is not required to be calibrated.

HFP1500 TEST RECORD

Step	Description	Intermediate Data	Test Result
Output Zero Voltage			
A-5	**Output Zero Voltage** (Test limit ≤± 800 µV)		__________ V
Offset Accuracy			
B-7	Power Supply Negative Output Voltage	__________ V	
B-10	Expected Negative Output Voltage	__________ V	
B-14	Measured Negative Output Voltage	__________ V	
B-16	**Offset Error Voltage** (Test limit ≤± 10.8 mV)		_________mV
B-21	Power Supply Positive Output Voltage	__________ V	
B-23	Expected Positive Output Voltage	__________ V	
B-26	Measured Positive Output Voltage	__________ V	
B-28	**Offset Error Voltage** (Test limit ≤± 10.8 mV)		_________mV
LF Attenuation Accuracy			
C-5	Generator Output Voltage	__________ V	
C-6	Expected Output Voltage, top range	__________ V	
C-8	Measured Output Voltage, top range	__________ V	
C-10	**Gain Error**, top range (Test limit ≤± 1.0%)		__________%
C-15	Generator Output Voltage	__________ V	
C-17	Expected Output Voltage, mid range	__________ V	
C-19	Measured Output Voltage, mid range	__________ V	
C-21	**Gain Error**, mid range (Test limit ≤± 1.0%)		__________%

TELEDYNE LECROY
Everywhereyoulook™

700 Chestnut Ridge Road
Chestnut Ridge, NY 10977
USA

teledynelecroy.com