TELEDYNE LECROY
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User Manual

ZD500, ZD1000, ZD1500
High Impedance
Differential Probes

ZD Series High Impedance Differential Probes User Manual

936471-00 Rev A
zd-series-probes-manual_12dec23.pdf
December, 2023

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.

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.

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

DOUBLE INSULATION

Precautions

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

Use only within operational environment listed. Do not use in wet or explosive atmospheres.

Use indoors only.

Keep product surfaces clean and dry.

Be careful with sharp tips. The tips may cause bodily injury if not handled properly.

Do not operate with suspected failures. Do not use the probe 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: 5° to 40° C

Humidity: Maximum relative humidity 90 % for temperatures up to 31° C decreasing linearly to 50 % relative humidity at 40° C

Altitude: Up to 10,000 ft (3,048 m)

Introduction

The ZD series of differential probes (ZD500, ZD1000 and ZD1500) are high bandwidth, high impedance, active differential probes. The probes feature low noise, very high input impedance and high common mode rejection, and are ideally suited for signal integrity measurements in high-speed digital systems. With low input capacitance and high input resistance, circuit loading is minimized.

The probes can be used with a variety of Teledyne LeCroy oscilloscopes running MAUI firmware version 6.4.1.x or later. See the oscilloscope product page at teledynelecroy.com/oscilloscopes for probe compatibility.

With the ProBus interface, the probe becomes an integral part of the oscilloscope, able to 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 Features

Key Benefits	Features
1 MOhm input resistance Low input capacitance Wide dynamic range ProBus interface	Small, low mass probe head is designed for ease of use and high performance. Probe tip socket fits easily onto 0.025 inch square pins for direct access to test points. Several available adaptors connect directly to the probe socket. Complete accessory kit.

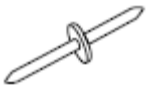
Standard Accessories

The ZD series probes are provided with numerous standard accessories to make probing different test points easier than ever.

Standard Accessory	Quantity	Part Number
Straight Tip	4	PACC-PT001
Swivel Tip Adapter	1	PACC-ZD005
Tip Saver	2	PACC-ZD004
Solder-in Lead	2	PACC-ZD002
Long Right-Angle Lead	2	PACC-LD004
Y-lead Adapter	1	PACC-ZD001
Small IC Adapter	2	PACC-ZD006
Spring-loaded Ground (Long)	2	PACC-ZD003
Spring-loaded Ground (Short)	2	PACC-CD008
Micro-Grabber	2	PK006-4
Mini-Grabber	2	PACC-CL001
Freehand Probe Holder	1	PACC-MS001
Probe Calibration Fixture	1	PCF200
User Manual	1	N/A
Certificate of Calibration	1	

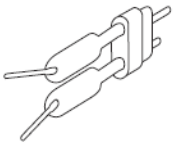
Tips

Straight Tip



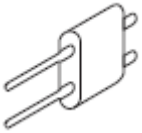
The straight tip is rugged and designed for general probing. Fits in either probe socket.

Swivel Tip Adapter



The swivel tip adapter is designed for multi-purpose browsing and features adjustable tip spacing to reach test points .300” apart with Z-axis compliance. Resistive compensation to reduce inductive peaking is included.

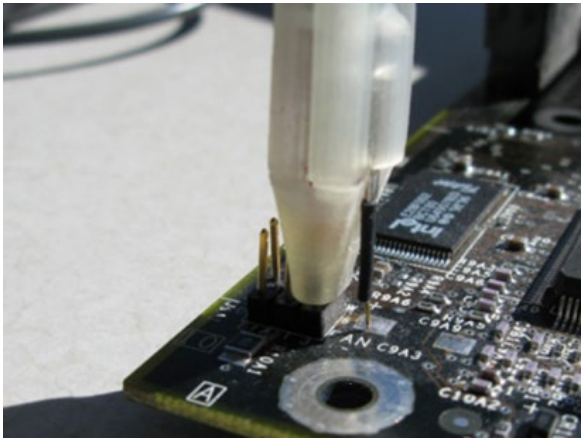
Tip Saver



To prevent excessive wear on the probe input leads, it is recommended to use tip saver in most probing scenarios. The tip saver offers full system bandwidth and will not degrade signal under test.

Grounds

The bendable ground leads on the Long and Short Spring-Loaded Bendable Grounds are designed to be attached to the offset ground socket or be attached to either socket of the probe head.



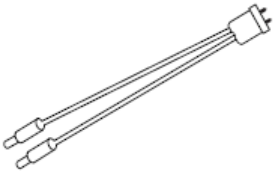
Short, spring-loaded bendable ground in use.

Leads

Long Right Angle Lead

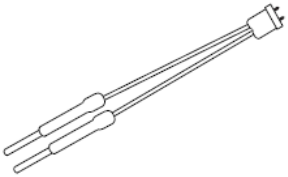
This lead has a socket on one end and a square pin on the other to connect to the input or ground socket of the probe body, and may be used for general purpose probing or can be connected to the Mini-Grabber or Micro-Grabber accessories.

Solder-In Lead



This lead can be soldered directly to the test points for a secure probe connection.

Y Lead Adapter

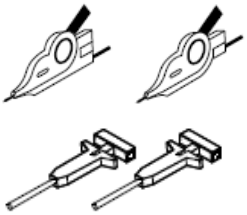


This lead is used for both ground and input lead simultaneously. It has two sockets on one end and two square pins on the other and may be used for general purpose probing. Resistive compensation to reduce inductive peaking is included.

Small IC Adapter

The Small IC adapters are designed for probing the leads of an IC. One side is insulated to prevent shorting one pin to the adjacent pin. The IC adapters can probe between IC legs with a width as narrow as .010” up to .100”. Resistive compensation to reduce inductive peaking is included.

Micro- and Mini-Grabbers



The micro- and mini-grabbers are ideal for connecting to small IC legs or pins very tightly spaced.

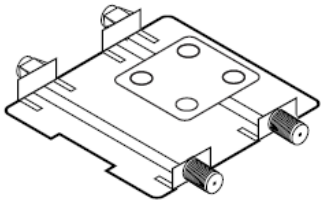
Freehand Probe Holder

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

Probe Calibration Fixture



The PCF-200 probe calibration fixture may be used to determine the effect of probe input loading on the circuit under test, for verification of the probe response to the signal being measured, or as a convenient way to deskew several probes/oscilloscope channels.

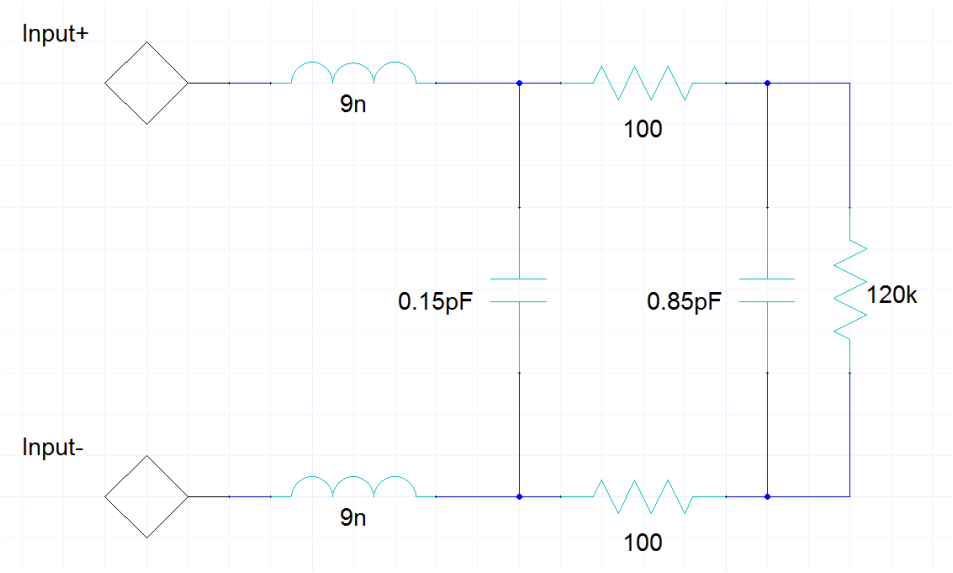
Deskewing with the PCF-200

1. Connect a fast edge to one or both PCF-200 inputs and terminate the corresponding output to any oscilloscope channel. Trigger on this channel for a common time reference.
2. Connect the probe tip(s) to the appropriate PCF-200 connection point (solder-in tips may be inserted under the clamping mechanism).
3. Display the probe signals on the oscilloscope screen and use the Horizontal adjust controls to align them to a common point.

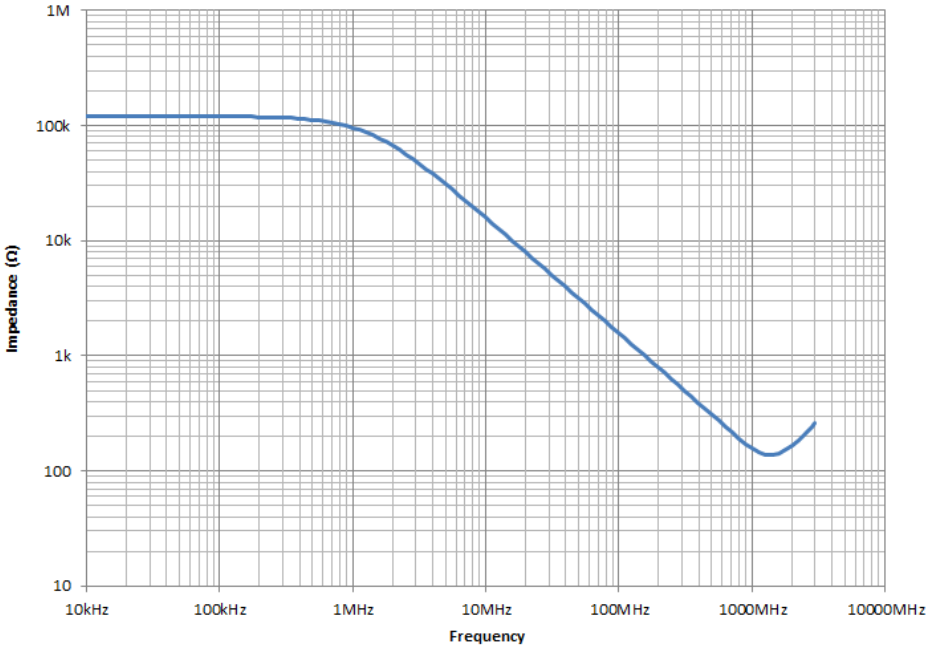
Probe Input Loading

Attaching any probe to a test circuit adds some loading to the circuit under test. In most applications, the high impedance of the probe, compared to the impedance of the circuit under test, imparts an insignificant load to the test circuit. However, at very high frequencies the capacitive reactance of the probe tip or lead may load the circuit enough to affect the measurement. The ZD series probes are designed to minimize these effects at high frequencies. Refer to the figures below for differential input equivalent circuit and impedance vs. frequency derating.

ZDxxxx Differential Input Equivalent Circuit



ZDxxxx Impedance vs. Frequency Derating Curve



Probe Operation

Handling the Probe

The ZD series probes are precision test instruments. 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.

ESD Sensitive: The tips of the ZD series probes are sensitive to Electrostatic Discharge (ESD). Avoid causing damage to the probe by always following anti-static procedures (wear wrist strap, etc.) when using or handling the probe.

Connecting the Probe to an Oscilloscope

The ZD series probes has been designed for use with Teledyne LeCroy platforms equipped with the ProBus interface. When you attach the probe output connector to the oscilloscope's input connector, the oscilloscope

recognizes the probe, provides proper termination and activates 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 a ZD series probe with its small profile and low mass head ideally suited for applications in dense circuitry.

Operation with an Oscilloscope

When the probe is connected to any compatible Teledyne LeCroy oscilloscope, the displayed scale factor and measurement values are automatically adjusted.

Turning the front panel Volts/Div knob controls the oscilloscope’s scale factor to give full available dynamic range up to 2.25 V/div.

Auto Zero

Auto Zero corrects for DC offset drifts that naturally occur from thermal effects in the amplifier. The probe incorporates Auto Zero capability to remove the DC offset from the probe's amplifier output to improve the measurement accuracy.

Auto Zero is invoked manually from the ZDxxxx dialog that appears when the probe is connected to the oscilloscope.

Always perform Auto Zero after the probe is warmed up (recommended warm-up time is 20 minutes). Depending on the measurement accuracy desired and/or changes in ambient temperature where the probe is located, it may be necessary to perform Auto Zero more often. If the probe is disconnected from the oscilloscope and reconnected, repeat Auto Zero after a suitable warm-up time.

CAUTION: Disconnect the probe from the circuit before Auto Zero, or else any DC component that is part of the Signal to be measured will be zeroed out.

Care and Maintenance

Cleaning

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

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

Calibration Interval

The recommended calibration interval is one year. The Performance Verification procedure should be performed as the first part of calibration.

Service Strategy

The ZD series probes 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. Defective probes under warranty are repaired or replaced. 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.

Replacement Parts

The probe connection accessories and other common parts can be ordered through the North America Customer Care Centers. Refer to the part numbers listed on the Standard Accessories table (p.4).

Performance Verification

This procedure can be used to verify the warranted characteristics of a ZD series differential probe (ZD500, ZD1000, ZD1500). It tests:

- Output Zero Voltage
- LF Attenuation Accuracy

The recommended calibration interval for the ZD series models is one year. Complete the performance verification as the first step of annual calibration. Results can be recorded on a photocopy of the Test Record provided.

Performance verification can be completed without removing the probe covers or exposing the user to hazardous voltages. There are no adjustments.

Required Test Equipment

The following table lists the test equipment (or equivalent) that is required for performance verification of a ZD series probe. As connector types may vary on different brands and models of test instruments, additional adapters or cables may be required.

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.

NOTE: The function generator used in this Performance Verification Procedure is used for making relative measurements. Because the output of the generator is measured with an oscilloscope in this procedure, it is not required to calibrate the generator.

The warranted characteristics of the ZD probes are valid at any temperature within the Operating Environment listed in this manual (p.3). However, some of the other test equipment used to verify performance may have environmental limitations required to meet the accuracy needed for the procedure. Be sure that the ambient conditions meet the requirements of all the test equipment used in this procedure.

Table of Required Test Equipment

Description	Minimum Requirement	Example Equipment
Digital Oscilloscope	ProBus Interface Windows-based ≥ 2 GHz for Bandwidth Test	WaveRunner 8000 WavePro 7 Zi-A
Digital Multimeter (DMM) with test probe leads	4.5 digit DC: 0.1% Accuracy AC: 0.1% Accuracy	Keysight 34401A Fluke 8842A-09
Function Generator	Sine Wave output amplitude adjustable to 14.14 Vp-p (5 Vrms) into 1 MΩ at 70 Hz	Keysight 33120A Stanford Research DS340
RF Signal Generator	Sine wave output 500 MHz, 1 GHz, 1.5 GHz +6 dBm output	Anritsu MG3690C
Power Supply	0-12 V, settable to 10 mV	HP E3611A
BNC Coaxial Cable (2)	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	0.1 mm square pin head	Teledyne LeCroy PCF200
Calibration Fixture	ProBus Extender Cable	Teledyne LeCroy PROBUS-CF01
Terminator, Precision BNC	50 Ω ± 0.05%	Teledyne LeCroy TERM-CF01
Banana Plug Adapter (2)	Female BNC to Dual Banana Plug	Pomona 1269
BNC to Mini-grabber	BNC Male to Mini-grabber Cable, 36”	Pomona 5187-C-36
2.54mm Sq. Pin Short	Pins connected to short the probe inputs	Samtec TSW-102-07-G-S
SMA-BNC Adapter		

Test Setup and Preliminary Procedure

NOTE: The correct operation of a ZD series probe requires software version 6.4.1.x or higher. The oscilloscope software version can be verified by selecting Utilities > Utilities Setup > Status. Contact your local Teledyne LeCroy representative or visit teledynelecroy.com/softwaredownload if the software in your oscilloscope requires updating.

1. Connect the ZD series probe to oscilloscope channel 1.
2. Turn on the oscilloscope and allow at least 30 minutes warm-up time before performing the Verification Procedure.
3. Turn on the other test equipment and allow them to warm up for the manufacturer's recommended time.
4. While the instruments are reaching operating temperature, make a photocopy of the ZD Series Probe Test Record and fill in the necessary data.

Functional Check

The functional check will verify the basic operation of the probe functions. Perform the Functional Check prior to the Performance Verification.

1. Return to the factory default settings by:
   - Selecting File > Recall Setup from the menu bar.
   - Touching the Recall Default button.
2. Touch the **C1** descriptor box to open the **C1** dialog.
3. Verify that the correct probe is sensed and displayed on the tab behind the C1 dialog.

Verification Procedure

A. Output Zero Voltage

1. Leave the probe connected to oscilloscope C1. Set the vertical sensitivity for C1 to 20 mV/ and the horizontal scale to 1.0 us/.
2. Turn on measurement P1 and set it to measure the mean of C1. Turn on statistics.
3. Insert the square pin short into the probe input sockets to short the inputs.
4. Initiate an AutoZero (control on the ZD probe dialog behind C1).

5. Wait an additional 15 minutes, then clear sweeps on C1.
6. Record the value of P1: mean (C1) as Output Zero on the Test Record.
7. Verify the absolute value of Output Zero is less than the value given on the probe data sheet.

B. LF Attenuation Accuracy

1. Connect the BNC tee to the output of the function generator.
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 positive (+) signal input and the black lead to the negative (-) input of the probe head.
3. Connect the BNC connector of the mini-grabbers to the BNC tee on the output of the function generator.
4. Attach a BNC cable to the unused female port of the BNC tee, connect a dual banana plug adapter to the other end of the cable and plug the dual banana plug adapter into the DMM input. Be 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.
5. Set the DMM to read AC volt and set the range to measure 5.0 Vrms.
6. Set the function generator to output a 70 Hz sine wave, output amplitude to 5 Vrms ±10 mV as measured on the DMM.
7. 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.
8. Remove the probe from C1 of the scope and re-connect using the Probus extender cable. Connect one end of a BNC cable to the probe end of the extender cable, and the other end to the precision 50Ω adapter.
9. Set the vertical scale of C1 to 1 V/. Select the probe dialog tab and record the value listed for ‘Effective Gain, top range’ on the test record.
10. Take the recorded generator output voltage and divide by the effective gain. Record this value as ‘Expected Output Voltage, top range’ on the test record.
11. Connect the banana plugs of the precision 50Ω adapter to the input of the DMM. Measure the output voltage and record this as ‘Measured Output Voltage, top range’ on the test record.

12. Calculate the gain error by taking 100 * [(Measured Output Voltage) – (Expected Output Voltage)] / (Expected Output Voltage). Record this value as the % Gain Error. Verify that this is within the limits given on the data sheet.
13. Connect the signal generator to the DMM input and set the output amplitude of the signal generator to 500 mVrms ±1 mV as measured on the DMM.
14. Record the output voltage to 1 mV resolution as "Generator Output Voltage, low range" in the Test Record. Be careful not to alter the output amplitude after the reading is recorded.
15. Set the vertical scale of C1 to 200 mV/. Select the probe dialog tab and record the value listed for 'Effective Gain, low range' on the test record.
16. Take the recorded generator output voltage and divide by the effective gain. Record this value as 'Expected Output Voltage, low range' on the test record.
17. Connect the banana plugs of the precision 50Ω adapter to the input of the DMM. Measure the output voltage and record this as 'Measured Output Voltage, low range' on the test record.
18. Calculate the gain error by taking 100 * [(Measured Output Voltage) – (Expected Output Voltage)] / (Expected Output Voltage). Record this value as the % Gain Error. Verify that this is within the limits given on the data sheet.

C. Probe Bandwidth

1. Disconnect the probe from the mini hooks and the ProBus extender and connect it to oscilloscope channel 1.
2. Set the RF signal generator to 1.5 GHz for ZD1500, 1 GHz for ZD1000, or 500 MHz for ZD500 at +6 dBm output.
3. Using the square-pin microstrip path, connect the PCF200 to the oscilloscope C2 input using an SMA-BNC adapter. Connect the signal generator to the C2 input through the PCF200.
4. Attach the probe to the PCF200 by seating the amplifier over the square pins.
5. Set up the oscilloscope as follows:
    a. C1 and C2 Vertical Scale 200 mV/div
    b. C2 Coupling DC50Ω and Bandwidth Full
    c. Horizontal Scale (timebase) 10 ns/div
    d. Trigger on C2 Edge, Level = 0 V
    e. Measurements:
        i. P1 sdev of C1
        ii. P2 sdev of C2
        iii. P3 ratio of P1/P2
        iv. P4 freq of C2

    The probe bandwidth is defined as the frequency at which the probe amplitude is 3 dB down from the input signal amplitude. This would be the frequency at which the ratio measurement P3 drops to 0.7071.
6. Record the signal loss ratio (P3) with RF signal input and verify is it greater than 0.7071.

This completes the Performance Verification of the ZD series probe. Complete and file the Test Record as required to support your internal calibration procedure.

Apply suitable calibration label to the probe housing as required.

ZD_____ Test Record

Technician:_____

Date:_____

Equipment Used

Item	Model	Serial Number	Cal Due Date
Oscilloscope			
Function Generator			
Microwave Generator			
Digital Multimeter			
Probe			
Lead			
Tip			

A. Output Zero Voltage

Step	Description	Result
A-6	**Output Zero** (Test limit 0V ± 5 mV)	

B. LF Attenuation Accuracy

Step	Description	Result
B-7	Generator Output Voltage	V
B-9	Effective Gain, top range	
B-10	Expected Output Voltage, top range	V
B-11	Measured Output Voltage, top range	V
B-12	**Gain Error**, top range (Test Limit ≤ ± 1.0%)	%
B-14	Generator Output Voltage	V
B-15	Effective Gain, low range	
B-16	Expected Output Voltage, low range	V
B-17	Measured Output Voltage, low range	V
B-18	**Gain Error**, low range (Test Limit ≤ ± 1.0%)	%

C. Bandwidth

Step	Description	Result
C-6	Signal Loss at Max. Bandwidth	V/V

Reference

Returning a Product for Service

Contact your local Teledyne LeCroy service center for calibration or other service. If the product cannot be serviced on location, the service center will give you a Return Material Authorization (RMA) code and instruct you where to ship the product. All products returned to the factory must have an RMA.

Return shipments must be prepaid. Teledyne LeCroy cannot accept COD or Collect shipments. We recommend air freighting. Insure the item you're returning for at least the replacement cost.

1. Remove all accessories from the probe.
2. Pack the probe in its case. If possible, include all tips. Do not include the manual.
3. Pack the case in its original shipping box, or an equivalent carton with adequate padding to avoid damage in transit.
4. Mark the outside of the box with the shipping address given to you by Teledyne LeCroy. Be sure to add the following:

   ATTN:<RMA code assigned by Teledyne LeCroy>
   FRAGILE

5. If returning a probe to a different country: contact Teledyne LeCroy Service for instructions on completing your import/export documents.

Extended warranty, calibration and upgrade plans are available for purchase. Contact your Teledyne LeCroy sales representative to purchase a service plan.

Technical Support

For a complete list of offices by country, including our sales & distribution partners, visit: teledynelecroy.com/support/contact

Teledyne LeCroy
700 Chestnut Ridge Road
Chestnut Ridge, NY, 10977, USA

US Service and Support:
Ph: 800-553-2769 / 845-425-2000
FAX: 845-578-5985
customersupport@teledynelecroy.com

Certifications

CE For the full list of current certifications, see the EC Declaration of Conformity shipped with your product. The probe complies with:

EN IEC 61010-031:2021: 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.

EN IEC 61326-1:2021: EMC requirements for electrical equipment for measurement, control, and laboratory use.[1, 2]

1. This product is intended for use in nonresidential areas only. Use in residential areas may cause electro-magnetic interference (EMI).

2. Emissions exceeding the levels required by this standard may occur when product is connected to a test object.

The probe is marked with this symbol to indicate that it complies with the applicable European Union requirements to Directives 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE).

For more information about proper disposal and recycling of your Teledyne LeCroy product, visit teledynelecroy.com/recycle.

Unless otherwise specified, all materials and processes are compliant with RoHS Directive 2011/65/EU in its entirety, inclusive of any further amendments or modifications of said Directive.

UK CA The probe bears this mark to indicate it conforms to all applicable United Kingdom standards for EMC and Safety. The design of the product has been verified to conform to the applicable harmonized standards and technical specifications and is in conformity with the relevant Union harmonization legislation.

Unless otherwise specified, all materials and processes are compliant with the latest requirements of China RoHS. The hazardous substances contained in the product are disclosed in accordance with the standards.

The probe complies with the EMC provision of the Australian Communication and Media Authority (ACMA) Radio Communications Act:
AS/NZS CISPR 11:2017/A1:2020, EN 55011:2016+A2:2021 Radiated and Conducted Emissions, Group 1, Class A.

Warranty

THE WARRANTY BELOW REPLACES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS, OR ADEQUACY FOR ANY PARTICULAR PURPOSE OR USE. TELEDYNE LECROY SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT OR OTHERWISE. THE CUSTOMER IS 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 TRANSPORT PREPAID.

The product is warranted for normal use and operation, within specifications, for a period of one year from shipment. Teledyne LeCroy will either repair or, at our option, replace any product returned to one of our authorized service centers within this period. However, in order to do this we must first examine the product and find that it is defective due to workmanship or materials and not due to misuse, neglect, accident, or abnormal conditions or operation.

Teledyne LeCroy shall not be responsible for any defect, damage, or failure caused by any of the following: a) attempted repairs or installations by personnel other than Teledyne LeCroy representatives, or b) improper connection to incompatible equipment, or c) for any damage or malfunction caused by the use of non-Teledyne LeCroy supplies. Furthermore, Teledyne LeCroy shall not be obligated to service a product that has been modified or integrated where the modification or integration increases the task duration or difficulty of servicing the oscilloscope. Spare and replacement parts, and repairs, all have a 90-day warranty.

Products not made by Teledyne LeCroy are covered solely by the warranty of the original equipment manufacturer.

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700 Chestnut Ridge Road
Chestnut Ridge, NY 10977
USA

teledynelecroy.com