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Instruction Manual

**ZD Series Differential Probes
(ZD500, ZD1000, ZD1500)**





ZD Series Differential Probes

Instruction Manual



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ZDSERIES-GSM-REVA

919316-00 Rev A

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Introduction

The ZD Series of Differential Probes (ZD500, ZD1000 and ZD1500) are high bandwidth 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 ZD Series probes can be used with LeCroy’s WaveSurfer, WaveRunner, WavePro, and WaveMaster series platforms with firmware version 6.4.1.x or later.

With the ProBus interface, the ZD Series probes become 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

The ZD Series probes feature:

- High frequency performance
- Low input capacitance
- Wide dynamic range
- ProBus interface
- A wide variety of tips, leads, and grabbers for probing

Standard Accessories

The ZD Series probe is shipped with the following standard accessories:

Standard Accessory	Quantity	Part Number
Straight Tip	4	PACC-PT001
Solder-in Lead	2	PACC-ZD002
Right Angle Connector (Long)	2	PACC-LD004
Micro-Grabber	2	PK006-4

ZD Series Differential Probes

Standard Accessory	Quantity	Part Number
Mini-Grabber	2	PACC-CL001
Spring-loaded Ground (Long)	2	PACC-ZD003
Spring-loaded Ground (Short)	2	PACC-CD008
Small IC Adapter	2	PACC-ZD006
Tip Saver	2	PACC-ZD004
Y-lead Adapter	1	PACC-ZD001
Swivel Tip Adapter	1	PACC-ZD005
Probe Calibration Fixture	1	PCF200
Instruction Manual	1	
Certificate of Calibration	1	

Features and Accessories

The ZD Series probes are provided with numerous features and accessories to make probing and connecting to different test points easier than ever.

- 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 ground socket will accept several different ground leads to provide a short ground path for low noise susceptibility.

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

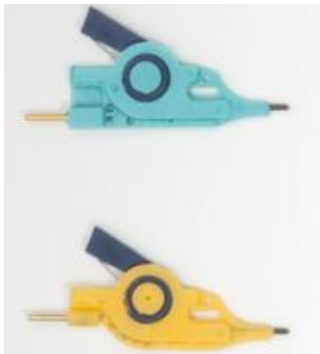
To prevent excessive wear on the probe input leads, it is recommended to use tip saver in most probing scenarios. The tip saver offers full system bandwidth and will not degrade signal under test.



Grabbers

Micro- and Mini-Grabbers

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



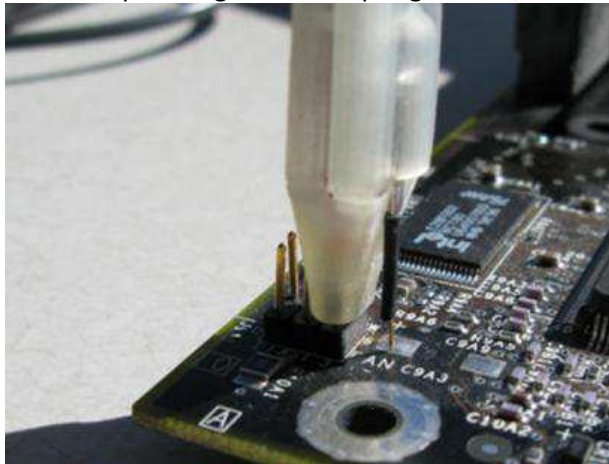
Grounds

Long and Short Spring Loaded Bendable Ground

The bendable ground leads are designed to be attached to the offset ground socket or be attached to either socket of the probe head.



The following image is an example using the short spring-loaded, bendable ground.



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 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.



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.



Solder-In Lead

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



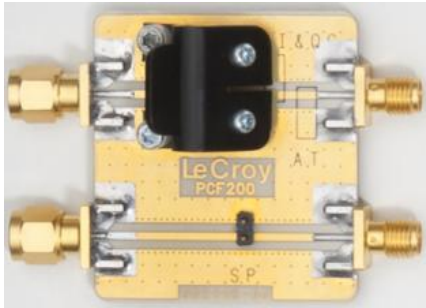
Small IC Adapter

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.



Probe Calibration Fixture

The probe deskew fixture (PCF-200) is provided as a standard accessory with ZD500, ZD1000, and ZD1500 probes.



The fixture can be used one of two ways:

1. The fixture may be used to determine the effect of probe input loading on the circuit under test and verification of the probe response to the signal being measured.
2. The fixture may be used as a convenient way to deskew several probes/oscilloscope channels. This can be accomplished in the following ways:
 - Connect a fast edge to one or both inputs, and terminate the corresponding connector. Connect the probe tip(s) to the appropriate connection point. Solder-in probe tips and browser tips may be inserted under the clamping mechanism. Display the probe signals on the oscilloscope screen and use the channel deskew adjust to align them to a common point.
 - Connect the WavePro 7 Zi and Zi-A or WaveMaster 8 Zi and Zi-A fast edge output to one of the inputs. Set the Zi Series oscilloscope to trigger on the internal Fast Edge source. Set the trigger delay to zero. Now, on the vertical dialog, use the Probe Cal - Cable Deskew button to align one signal/channel at a time to the specified zero delay trigger point (center of screen). Repeat for as many probes as you have connected, each time aligning them to the common point.

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 a LeCroy Oscilloscope

The ZD Series probe has been designed for use with LeCroy's WaveSurfer, WaveRunner, WaveMaster, and WavePro 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.

Operation with a LeCroy Oscilloscope

When the ZD Series probes are connected to any compatible LeCroy oscilloscope, the displayed scale factor and measurement values are automatically adjusted.

Control through the oscilloscope's interface can be found on the channel dialog that corresponds with the connected probe. Refer to your oscilloscope's manual for specific operation instructions.

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

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 ZD Series probe with its small profile and low mass head ideally suited for applications in dense circuitry.

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.



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 ZD Series 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 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.

Returning a Probe for Calibration or Service

Return a probe for calibration or service by contacting your local LeCroy sales representative. They tell you where to return the product. All returned products should be identified by both **model** and **serial number**. Provide your **name** and **contact number**, and a **description of the defect or failure** (if possible).

Products returned to the factory require a **Return Material Authorization (RMA)** acquired by contacting your nearest LeCroy sales office, representative or the North America Customer Care Center.

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

Note: It is important that the RMA be clearly shown on the outside of the shipping package for prompt redirection to the appropriate department.

Use the following steps for a smooth product return.

1. Contact your local LeCroy sales or service representative to obtain a Return Material Authorization.
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.
4. Label the case with a tag containing
 - The RMA
 - 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 LeCroy representative; be sure to add the following:
 - ATTN: <RMA assigned by the LeCroy representative>
 - FRAGILE
7. Insure the item for the replacement cost of the probe.
8. Ship the package to the appropriate address.

Returning a Probe to a Different Country

Note: Be sure to properly mark shipments returned for service from a different country to avoid customs duty for a full purchase price of a new probe or accessory.

In addition to the items mentioned in the previous topic, 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 cost of the service in the value column and the original value of the product at time of purchase 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 North America Customer Care Centers.

Replacement Part	Part Number
Straight Tip	PACC-PT001
Solder-in Lead	PACC-ZD002
Right Angle Connector (Long)	PACC-LD004
Micro-Grabber	PK006-4
Mini-Grabber	PACC-CL001
Spring-loaded Ground (Long)	PACC-ZD003
Spring-loaded Ground (Short)	PACC-CD008
Small IC Adapter	PACC-ZD006
Tip Saver	PACC-ZD004
Y-lead Adapter	PACC-ZD001
Swivel Tip Adapter	PACC-ZD005
Probe Calibration Fixture	PCF200

Performance Verification

Performance Verification Overview

This procedure can be used to verify the warranted characteristics of the ZD Series High Impedance Active Probe.

The recommended calibration interval for the models ZD Series is one year. The complete performance verification procedure should be performed as the first step of annual calibration. Test results can be recorded on a photocopy of the Test Record provided in Appendix A at the end of the manual.

Performance verification can be completed without removing the probe covers or exposing the user to hazardous voltages. 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
- LF Attenuation Accuracy

Required Test Equipment

The following table lists the test equipment and accessories (or their equivalents) that are required for performance verification of the ZD Series Probes.

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 connector types may vary on different brands and models of test instruments, additional adapters or cables may be required.

ZD Series Differential Probes

Description	Minimum Requirement	Test Equipment Examples
Digital Oscilloscope	ProBus Interface; Windows-based	LeCroy WaveRunner Zi or WaveSurfer Xs
Digital Multimeter (DMM) with test probe leads	4.5 digit DC: 0.1% Accuracy AC: 0.1% Accuracy	Agilent Technologies 34401A or 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 or 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 or Pomona 5697-36
BNC Tee Connector	Male to Dual Female	Pomona 3285
Calibration Fixture	ProBus Extender Cable	LeCroy PROBUS-CF01
Terminator, Precision, BNC	50 Ω ± 0.05%	LeCroy TERM-CF01
Banana Plug Adapter (2 ea.)	Female BNC to Dual Banana Plug	Pomona 1269
BNC to Mini-grabber	BNC Mail to Mini-grabber Cable, 36"	Pomona 5187-C-36

List of Required Equipment.

Preliminary Procedure

1. Connect the ZD Series 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 the ZD Series and test equipment before performing the Verification Procedure.
3. Turn on the other test equipment and allow them to warm up for the manufacturer's recommended timeframe.
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 20 mV/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. Reconnect the ProBus extender Cable to the oscilloscope.

The warranted characteristics of the ZD Series 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. Be sure that the ambient conditions meet the requirements of all the test instruments used in this procedure.

Note: The correct operation of the ZD Series controls requires software version 6.4.1.x or higher. The software version in the test oscilloscope can be verified by selecting **Utilities, Utilities Setup...** from the menu bar, then the **Status** tab.

Contact your local LeCroy representative or visit www.lecroy.com if the software in your oscilloscope requires updating.

Functional Check

The functional check will verify the basic operation of the probe functions.

It is recommended that the Functional Check be performed prior to the Performance Verification Procedure.

1. Return to the factory default settings by:
 - a. Selecting **File, Recall Setup...** from the menu bar.
 - b. Then touching the **Recall Default** button.
2. Touch the **C1** trace label to open the **C1 Vertical Adjust** dialog.
3. Verify that the probe sensed (ZD Series) is displayed as a dialog tab.

Verification Procedure

A. Output Zero Voltage

1. Connect the appropriate calibration fixture to the output of the probe to be tested (shown in the following figure).
2. Provide power to the probe by connecting the ProLink-CF01 to any input of a WavePro (any model) or WaveMaster (any model) oscilloscope.
3. No signal input connection to the oscilloscope is required for the Output Zero test.
4. 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.
5. Connect the Precision 50 Ω Terminator, using another BNC cable, to the free end of the BNC Tee.
6. Set the DMM to DC volts.
7. Connect the Precision 50 Ω Terminator to the DMM input.
8. After a warm-up time of at least 20 minutes, measure the output voltage and record the result as **Output Voltage** on the Test Record.
9. Initiate an AutoZero
10. Wait an additional 15 minutes, then record the DMM reading to 1 mV resolution in the Test Record as **Output Voltage after AutoZero**.
11. Take the difference of the two readings recorded steps 8 and 10 (previous)
12. Record the result as **Output Zero** on the Test Record.
13. Verify the absolute value of Output Zero is less than 10 mV.

B. 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. 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 tee to the output of the function generator. (Use a 50 Ω termination if the function generator requires such a load.)
4. Attach a BNC cable to the unused female port of the BNC tee and 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 mode of the function generator to sine wave, the frequency to 70 Hz and the output amplitude to 5 Vrms \pm 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. Divide the reading recorded in step B-7 by the Effective Gain noted in step 6 and record the result with 100 μ V resolution as "Expected Output Voltage, top range" in the Test Record.
9. 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.
10. After the DMM reading has stabilized, record the reading to 100 μ V resolution as "Measured Output Voltage, top range" in the Test Record.
11. Calculate the error by dividing the measured top range output voltage recorded in step B10 by the expected top range output voltage recorded in step B-8. Subtract 1 from this ratio and multiply by 100% to get the error in percent.
12. Record the calculated error to two decimal places (\pm 0.xx%) as "Gain Error, top range" in the test record.
13. Verify that the error is less than \pm 1.0 %.
14. Disconnect the precision 50 Ω terminator from the DMM.
15. 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.