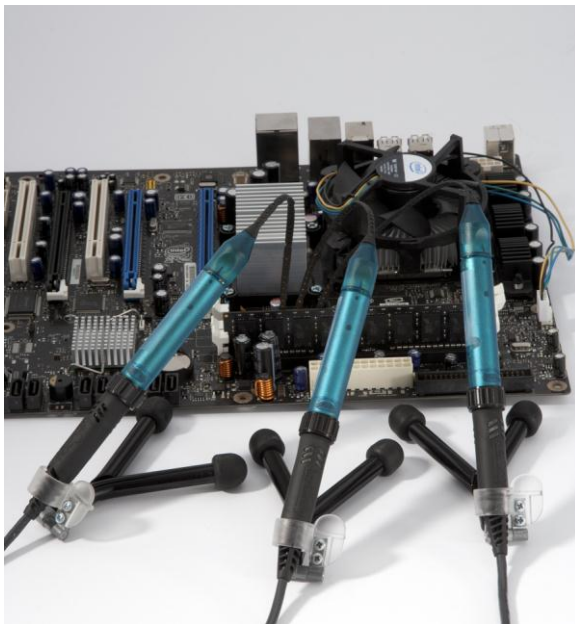




Operator's Manual

WaveLink Series

Differential Probe (8-13 GHz)





WaveLink Series Differential Probe (8-13 GHz) Operator's Manual



PRELIMINARY VERSION



LeCroy Corporation

700 Chestnut Ridge Road
Chestnut Ridge, NY, 10977-6499
Tel: (845) 578-6020, Fax: (845) 578 5985
www.lecroy.com

WaveLink Series Medium Bandwidth Differential Probe (8-13 GHz) Operator's Manual

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Introduction

LeCroy's WaveLink 8-13 GHz Differential Probes are a medium bandwidth, moderate cost general purpose probing solution with high input dynamic range and offset and support for solder-in, browser, square-pin and SMA/SMP cabled tip/lead connections. The range of capabilities is ideal for a variety of high speed DDR signals where high dynamic range and high offset requirements are common

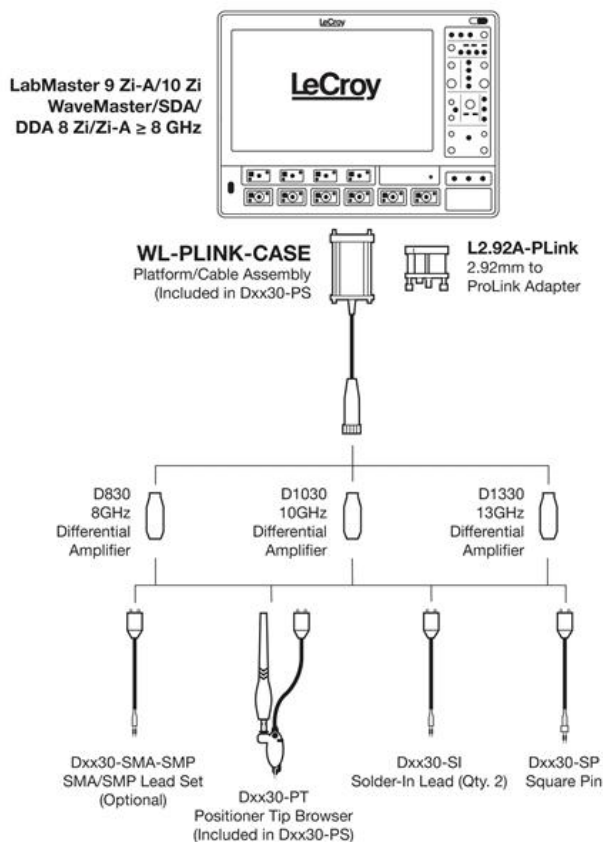
The Dxx30-SI solder-in tip utilizes an external terminating resistor located as close to the circuit as possible to minimize tip inductance, maximize tip resistance, and provide the highest possible impedance and best loading over a broad range of frequencies. The Dxx30-PT tip utilizes pogo pin tips for positive contact and a wide tip adjustment spread, with bandwidth up to 10 GHz. SMA/SMP lead sets provide an economical means to leverage the Dxx30 probe amplifier for SMA/SMP cabled connections without requiring the purchase of an expensive, additional dedicated SMA/SMP probe. Lastly, a square pin connection is also provided for convenience.

The WaveLink Series of Medium Bandwidth Differential Probes utilize digital filtering to optimize the system frequency response. The design of the WaveLink probe amplifier is such that there is a very wide bandwidth response that exceeds the oscilloscope bandwidth. At time of initial shipment, each probe undergoes a rigorous calibration and performance verification process that results in a stored response file on-board the probe. When the probe is connected to a LeCroy oscilloscope, the probe and oscilloscope responses are optimized to each other to provide a probe + oscilloscope response identical to that of the raw oscilloscope channel. LeCroy has provided this capability since the introduction of the first WaveLink probes in 2003. All that is left for the operator is to de-embed the probe loading from the circuit using LeCroy's Virtual Probe software option, if desired (available in October 2012).

Modular Advantage

These probes use a pioneering modular design first introduced by LeCroy's initial WaveLink product releases. The modular design consists of a **Platform/Cable Assembly, Differential Amplifier Small Tip Module with Solder-in Interconnect Leads, Square Pin Lead, SMA/SMP Lead, or Positioner Tip (Browser)**.

You may order nearly any combination of Platform/Cable Assembly and Amplifier Module (supplied with Interconnect Leads), depending on the oscilloscope you have and your requirements. At time of shipment, LeCroy serializes the individual components and calibrates them as a system. To achieve maximum performance and warranted specifications, the components should be used together, as serialized. If additional Interconnect Leads or other components are purchased, you may return the serialized system to LeCroy for re-calibration to ensure maximum performance.



WaveLink Dxx30 Probe Family

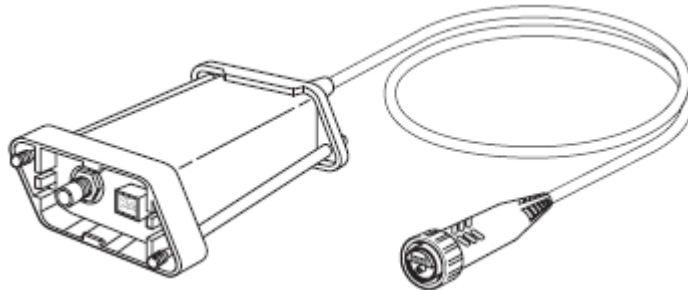
Standard Accessories	WL-PLINK-CASE	Dxx30	Dxx30-PS	Dxx30-PT-KIT
SMA/SMP Lead (optional accessory)	-	-	-	-
Solder-in Lead	-	2 Each	2 Each	-
Square Pin Lead	-	1 Each	1 Each	-
Tip Retaining Clips	-	2 Each	2 Each	-
Adhesive Tape	-	1 Set	1 Set	-
Amplifier Module	-	1 Each	1 Each	-
Spare Damping Resistors for Solder-in Lead Set	-	5 Each	5 Each	-
Ground Lead	-	1 Each	1 Each	-
Ground Clip	-	1 Each	1 Each	-
Platform/Cable Assembly	1 Each	-	1 Each	-
Deluxe Protective Storage Case	1 Each	-	1 Each	-
Freehand Probe Holder	1 Each	-	1 Each	-
Deskew Fixture	1 Each	-	1 Each	-
Platform/Cable Assembly Mounting Clamp	1 Each	-	1 Each	-
Probe Cable Clamp	2 Each	-	2 Each	-
ESD Wrist Strap	1 Each	-	1 Each	-
Soft Carrying Case	1 Each	-	1 Each	-
Performance Verification Certificate	1 Each	-	1 Each	-
Positioner Tip (Browser)	-	-	1 Each	1 Each
Replacement Pogo Pins	-	-	1 Set	1 Set
Positioner Tip Probe Guides	-	-	1 Each	1 Each
XYZ Positioner	-	-	1 Each	1 Each
Adhesive Tape	-	-	1 Set	1 Set
Browser Wand	-	-	1 Each	1 Each
Interlock Pieces	-	-	1 Each	1 Each
Swivel	-	-	1 Each	1 Each
Quick Start Guide	1 Each	1 Each	1 Each	1 Each

NOTE: While the amplifiers can be used with any of the leads or tips, bandwidth is limited by the lowest bandwidth component. System calibration is required for all interconnected components to guarantee system performance.

Modular Probe Components

Platform/Cable Assembly

The WL-PLINK-CASE Platform/Cable Assembly forms the foundation of the probe and provides an attachment for the probe amplifier to the oscilloscope.



WL-PLINKCASE Platform/Cable Assembly

The platform/cable assembly performs the following important functions:

- It provides power to the probe amplifier from the oscilloscope.
- It communicates to the oscilloscope the identifying characteristics of the amplifier that is connected to the probe so that the oscilloscope channel can be set to the correct probe attenuation value automatically. Software prompts you to specify the type of tip connected to the amplifier when this occurs.
- It transmits the amplifier output signal along a well-defined low loss transmission line into the oscilloscope input, and terminates the probe appropriately at that point.

The WL-PLINK-CASE is a ProLink compatible platform/cable assembly with a variety of accessories, including a deluxe soft carrying base that will hold all the items that can be purchased with a Dxx30 probe.

NOTE: The previously released WL-PLINK is a ProLink compatible platform/cable assembly (shown in the image above) with a variety of accessories and is supplied with a standard soft carrying case. The WL-PLINK-CASE is identical except for the upgrade to a deluxe soft carrying case that houses all probe components. Otherwise, the electrical operation and provided accessories of the WL-PLINK-CASE is identical to that of the previously released WL-PLINK.

Differential Amplifier Small Tip Modules

This module contains the active amplifier circuitry and performs the important task of amplifying the low-level signal at the probe tip for transmission to the oscilloscope via the Platform/Cable Assembly.

The Differential Amplifier Small Tip Module models D830, D1030, and D1330 connect to the WL-PLINK platform/cable assembly and accepts differential interconnect leads and tips to provide the user with flexibility in connecting the probe to the circuit under test without degrading the electrical performance.



Differential Amplifier Small Tip Module

The amplifier modules are sold with a set of solder-in interconnect leads and a square-pin lead. See **Solder-in Interconnect Lead** (on page 6) and **Square-Pin Lead** (on page 20).

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Amplifier Modules (includes Solder-in interconnect leads)	Product Code
8 GHz WaveLinkWaveLink D830 8 GHz/3.5Vp-p, +/-4V Offset Range, and +/-4V Common Mode Range Differential Amplifier Small Tip Module with Dxx30-SI Solder-in Tip (Qty. 2) and Dxx30-SP Square Pin (Qty.1). Also Includes Replacement Resistors (Qty. 10), Tip Retaining Clips (Qty. 2), and Protective Storage Case. Must be ordered with a WL-PLINK-CASE 13 GHz Platform/Cable Assembly to achieve warranted calibration.	D830
10 GHz WaveLinkWaveLink D1030 10 GHz/3.5Vp-p, +/-4V Offset Range, and +/-4V Common Mode Range Differential Amplifier Small Tip Module with Dxx30-SI Solder-in Tip (Qty. 2) and Dxx30-SP Square Pin (Qty.1). Also Includes Replacement Resistors (Qty. 10), Tip Retaining Clips (Qty. 2), and Protective Storage Case. Must be ordered with a WL-PLINK-CASE 13 GHz Platform/Cable Assembly to achieve warranted calibration.	D1030
13 GHz WaveLinkWaveLink D1330 13 GHz/3.5Vp-p, +/-4V Offset Range, and +/-4V Common Mode Range Differential Amplifier Small Tip Module with Dxx30-SI Solder-in Tip (Qty. 2) and Dxx30-SP Square Pin (Qty.1). Also Includes Replacement Resistors (Qty. 10), Tip Retaining Clips (Qty. 2), and Protective Storage Case. Must be ordered with a WL-PLINK-CASE 13 GHz Platform/Cable Assembly to achieve warranted calibration.	D1330

Solder-in Interconnect Leads

The probe lead provides ability to access the signal on the device under test (DUT) without disturbing the operation of the DUT. The solder-in probe lead provides the highest possible performance at the expense of a non-movable installation. The design of the solder-in lead minimizes customer circuit loading with the probe connected by providing high probe AC loading and a wide frequency range where AC circuit loading is minimized.

The solder-in lead supplied with the kit consists of two small, pre-installed and pre-trimmed attenuating (damping) resistors connected to a flexible transmission line terminating in a connector mating with the amplifier. Because resistors and resistor lengths are small, this solder-in lead provides the maximum signal fidelity and minimum circuit loading at the highest frequencies. The resistors are soldered directly into the connection points of the circuit under test, providing a reliable, intermittence-free connection.

Five replacement damping resistors are provided with each solder-in lead. Resistors may be replaced in the field if the tip is damaged. See **Replacing Damping Resistors on the Solder-in Interconnect Lead** (on page 34) for more information.

LeCroy's solder-in probe lead uses resistors at the tip that are precisely pre-cut to the correct length. This design provides the following advantages:

- It locates the damping resistance of the probe tip as close to the DUT as possible.
- It eliminates the need for long lengths of wire between the DUT and the damping resistor, which impacts loading and frequency response. The resistors may still be spaced as desired to connect to a wide variety of circuits.
- It eliminates the need to precision cut and solder small lengths of wire to the end of the solder-in lead, and then solder these wires to the DUT.
- The damping resistors are easily replaced in the field to provide maximum serviceability and life of the solder-in probe lead.

Square Pin Lead

Square Pin interconnect lead assembly can be used on boards where standard 0.025" square pins are used for interconnect. The highly flexible, 145 mm (5.7") long Square Pin Interconnect lead connects directly with a pair of square pins mounted on standard 0.100" (2.54 mm) centers.

Because of the parasitic inductance of the square pin to which the probe is connected, the system will not support maximum bandwidth or the minimum rise time when used with an oscilloscope with bandwidth greater than 3 GHz. The added inductance of the square pins limits the measurements to signals of 3 GHz bandwidth. A low-cost alternative is to provide vias in the circuit to be tested, and to insert the flexible tips of the very low-loading Adjustable Tip module into these vias.

SMA/SMP Lead Set

The SMA/SMP interconnect has two parts:

- An interconnect "lead" which plugs into the amplifier module, and
- Two cables (either SMA terminated or SMP terminated) which plug into the interconnect lead and connect to female SMA or SMP connectors.

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SMA/SMP Lead Set

A network at the end of this interconnect lead, at the point where the SMA cables attach, attenuates the signal for the correct scale factor as well as provides some response compensation. The SMA Input cables must always be used with the SMA interconnect Lead. Calibration is not dependent on these leads. However they are a matched pair, so individual cables should not be interchanged between probes.

The SMA DC Blocking adapters (supplied with the SMA Interconnect Lead) can be used to extend the common mode or differential mode range by removing any DC component which exceeds the range. This would most likely be a common mode component.

NOTE: The SMA input cables use the same connectors as in the interconnect leads and will physically mate with the amplifier module. However, the system will not work properly in this configuration. No damage to the probe or amplifier will occur. However maximum voltage to prevent destruction will be much lower and the susceptibility to ESD is reduced.

Positioner Tip (Browser)

The **Positioner Tip (Browser)** provides the ability to access the signal on the DUT without permanently attaching a lead or other device to the DUT. The positioner tip combines high performance with quick access to a variety of probe points when it's used as a hand-held browser (using the **Wand** attachment) or as a fast and convenient method to re-position a fixed test point (using a positioner tool, like LeCroy's **Freehand Positioner**, **XYZ Positioner** or **EZ Probe** . The tips are adjustable from 0 to 3.5 mm (0 to 0.14") and have 0.6 mm (0.024") of

NOTE: Some mechanical positioners (such as the EZ Probe) might have the capability to exert excessive Z-Axis compliance during setup, so be extra careful with these types of mechanical positioners.

Two replacement resistive tips are provided with the Positioner Tip. These tips may be replaced in the field if the tip is damaged. See **Replacing Spring-Loaded Tips and Tip Sockets on the Positioner Tip** (on page 37) for more information.



Positioner Tip (Browser) Kit

Positioner Tip (Browser) Kit (includes tip and accessories)	Product Code
WaveLink Dxx30-PT (10 GHz rating) Adjustable Positioner Tip Kit. For use with D830, D1030, and D1330 amplifiers. Includes XYZ Positioner Assembly with Mechanical Interconnects, Adhesive Kit, Connection Guides, Hand-held Wand, and replacement Pogo-Pin Tips (Qty. 2).	Dxx30-PT-KIT

Complete Probe System

By design, the WaveLink probes are modular in nature. However, to make selection easy, a complete probe system (-PS) is available for purchase. These probe systems are all-inclusive and contain the following items:

- Platform/Cable Assembly
- L2.92A to ProLink Adapter (10 and 13 GHz kits only)
- Amplifier Module with Solder-in Interconnect Leads and Square Pin Lead
- Positioner Tip Browser Kit

Just choose the appropriate bandwidth (8, 10, or 13 GHz) for the probe system.

NOTE: The 13 GHz probe system browser is rated to 10 GHz. The SMA/SMP Interconnect Lead is not supplied as part of the complete probe system but may be purchased as an accessory item.



Dxx30-PS Complete Probe System

Standard Accessories	Dxx30-PS
WL-PLINK-CASE Platform/Cable Assembly	1 Each
Dxx30 Amplifier Module with Solder-in Interconnect Leads and Square Pin Lead	1 Each
Dxx30-PT-KIT Positioner Browser Kit	1 Each

Probe Operation

LeCroy WaveLink probes are factory calibrated and performance verified on shipment. During factory calibration and performance verification, each probe amplifier has a response file created and stored on-board. When the probe is connected to your LeCroy oscilloscope, the response file is read by your oscilloscope and a combined optimized probe + oscilloscope response is created for your particular oscilloscope and channel to which the probe is connected. The response is identical to that of the oscilloscope channel.

All that is left for the operator is to de-embed the probe loading from the circuit using LeCroy’s Virtual Probe software option, if desired. Since the LeCroy probe impedance is very high across the passband, this may not even be necessary.

NOTE: With your probe set up and system turned on, allow for a 15-minute warm-up of your probe prior to use. A properly warmed-up probe ensures optimal measurements.

System Calibration

By design, the D830, D1030, and D1330 Amplifier Modules and Interconnect Leads deliver the specified performance when inter-changed on a WL-PLINK platform/cable assembly.

Each configured probe is shipped with a Certificate of Calibration indicating that the system performance was validated and found to meet or exceed the warranted specifications with those models and accessories listed in the Certificate.

As only this configuration was validated, the certificate is only valid for the configuration indicated. This is why all modular probe components are serialized, calibrated, and tested as a system before being shipped from the LeCroy factory, to ensure guaranteed performance.

A serial number is affixed to each module and the operator must ensure serial numbers on all modules match.

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NOTE: If you do not verify that serial numbers on the modules match, performance is not guaranteed. If an incorrect, uncalibrated combination of amplifier modules and platform/cable assemblies is connected together, a warning pop-up dialog will be displayed on the oscilloscope screen.

The interconnect tips are designed to keep response within a narrow range so they are interchangeable, and interconnect leads manufactured at the same time have nearly identical performance. Likewise, if a damping resistor on the solder-in lead is replaced using the procedure for **Replacing Damping Resistors on the Solder-in Interconnect Lead** (on page 34), performance is still guaranteed. If an interconnect lead tip is damaged beyond field repair and requires factory replacement, LeCroy recommends you return the probe platform/cable assembly and amplifier module to the factory for a complete calibration and test to ensure guaranteed performance. This is because there may be small differences in performance of interconnect leads supplied at different times.

If a positioner tip (PT) is purchased at time of original shipment of the other probe components, this is also calibrated and serialized with the other components. If it is purchased at a later date and you have provided LeCroy with the original probe serial number the tip is used with, LeCroy calibrates the positioner tip to your existing components and supplies a file on a USB memory stick for installation on your oscilloscope. Follow the instructions provided with the file and memory stick in order to load this file and ensure proper calibrated performance with your existing probe components.

Finally, if the spring-loaded tips and tip sockets need to be replaced on your positioner tip, see **Replacing Spring-Loaded Tips and Tip Sockets on the Positioner Tip** (on page 37) for more information.

De-Embedding Probes

LeCroy probes are calibrated at the factory using a Vector Network Analyzer (VNA) to measure a system (probe plus test fixture) frequency response. The test fixture is de-embedded from the measurement using LeCroy's Eye Doctor tools so the remaining frequency response is due to the combination of the test signal and the probe loading on the test circuit. The system frequency response is then calculated for these remaining circuit elements.

If you wish to de-embed the effect of probe loading on your circuit, you can use the appropriate equivalent circuit model in **Probe Input Impedance and Loading** (on page 49) and LeCroy's Eye Doctor tools to accomplish this.

Beginning October 2012, you can also use LeCroy's Virtual Probe option. This option allows you to select the probe tip from a list of supported tips. Your selection applies a corresponding s-parameter file that is derived from the equivalent circuit model of the tip.

Handling the Probe

The WaveLink series probe is a precision test instrument. Exercise care when handling and storing the probe. Always handle the probe by the platform/cable assembly. Avoid putting excessive strain on any cable or interconnect lead or exposing the probe cables to sharp bends.



ESD Sensitive: The tips of the probe 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.



Solder-in Tips: Prevent damage to the solder-in tips by carefully storing them in the plastic protective storage case when not in use.

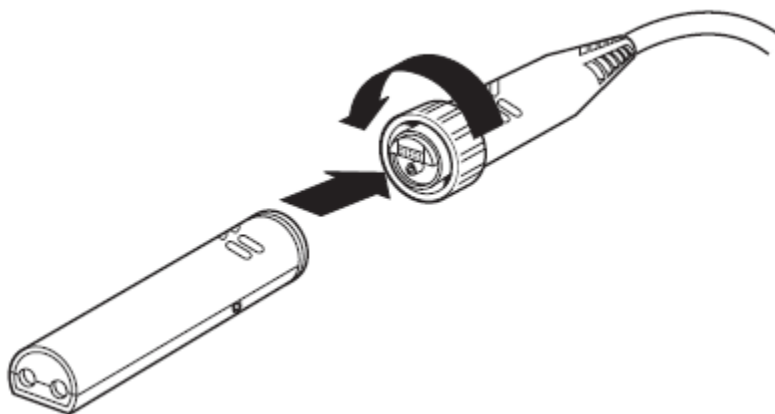
Positioner Tip: The PT tips are very small and are fragile. When not in use, store in the provided case.

Connecting the Platform/Cable Assembly, Amplifier Module, and Interconnect Lead

Follow these instructions to properly connect the main probe components.

Connecting an Amplifier Module to a Platform/Cable Assembly

Attach an Amplifier Module to the Platform/Cable Assembly by aligning the connectors of the module with the receptacles in the platform/cable assembly and pressing the two together. Be sure to finger-tighten the assembly by rotating the threaded collar onto the module.



Connecting the Amplifier Module to the Platform/Cable Assembly

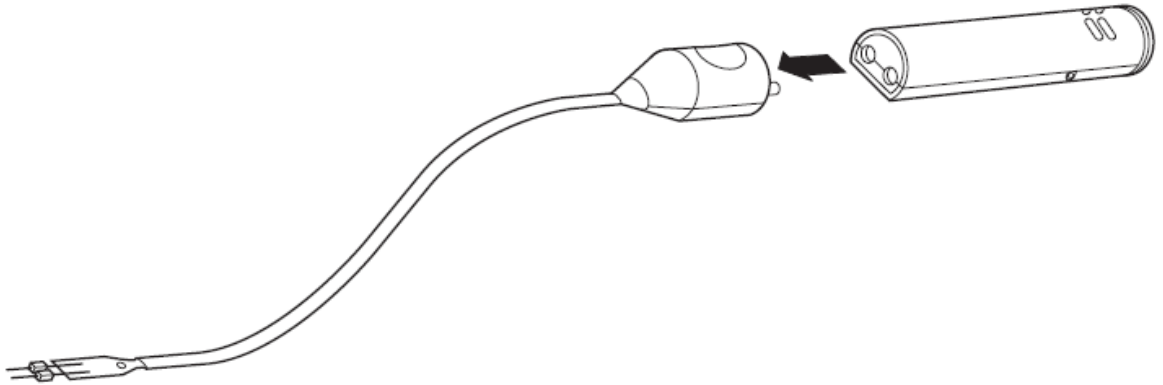


Do not use pliers or any other tools to tighten the collar.

Remove the Amplifier Module by loosening the threaded collar from the module and pulling the two assemblies apart.

By design, the amplifier module works with the **WL-PLINK-CASE** platform/cable assembly and the **Dxx30-SI Lead**, **Dxx30-SP Lead**, **Dxx30-SMA-SMP Lead**, or **Dxx30-PT Tip**.

Connecting an Amplifier Module to an Interconnect Lead



Connecting a solder-in interconnect lead to an amplifier module. The positioner browser tip and other leads connect in the same manner.

Align the flat side of the lead with the flat side of the amplifier module and press together.

NOTE:

- Although interconnect leads for the D830, D1030, and D1330 mechanically mate with any module, they are only compatible with a Dxx30. No damage results; however, performance may be reduced when switching leads between modules, and the response is not calibrated. Be sure to only use leads with serial numbers that match with the differential amplifier module.
- Different colors indicate different bandwidths and/or product classes. Avoid accidental interchanging by matching the color coding of the interconnect lead tip housing with the color of the corresponding amplifier module.

Connecting the Probe to a LeCroy Oscilloscope

The WL-PLINK-CASE platform/cable assembly has been designed for use with the ProLink interface of LeCroy's LabMaster 9 Zi-A, WaveMaster 8 Zi/Zi-A, SDA/DDA 8 Zi/Zi-A, WavePro 7 Zi/Zi-A, SDA/DDA 7 Zi/Zi-A, and other models that use the ProLink interface.

Attach the WL-PLINK-CASE platform/cable assembly to the ProLink interface by aligning the connector with the input connector and pushing the interface toward the instrument.

A click is heard when the probe interface latches to the test instrument. The probe also uses thumbscrews to secure the interface to the instrument. **Do not overtighten the thumbscrews.**

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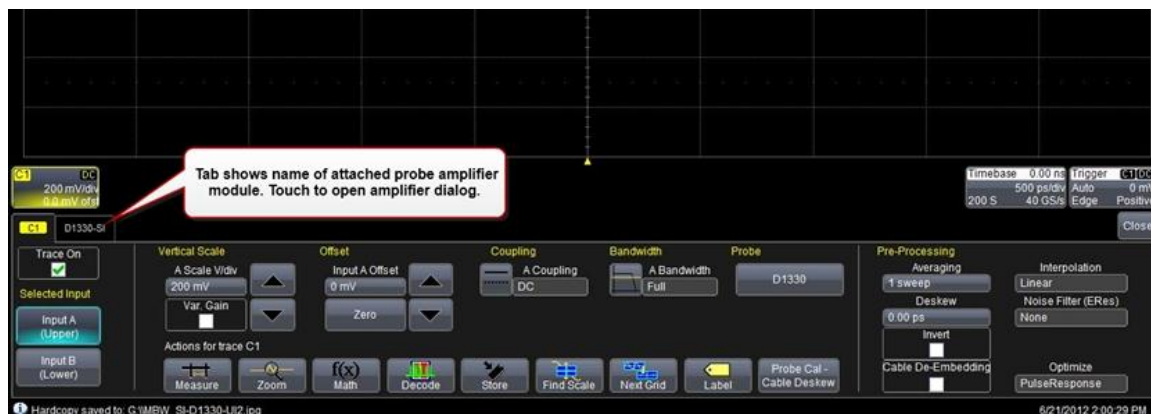
Remove the platform/cable assembly from the instrument by unscrewing the thumbscrews and moving the interface up and down while pulling gently until a click is heard. This click indicates the platform/cable assembly is detached from the instrument.

Operation with a LeCroy Oscilloscope

NOTE:

- Download the latest version of X-Stream software to run your WaveLink probe with maximum performance.
- Ensure your Windows updates are current.

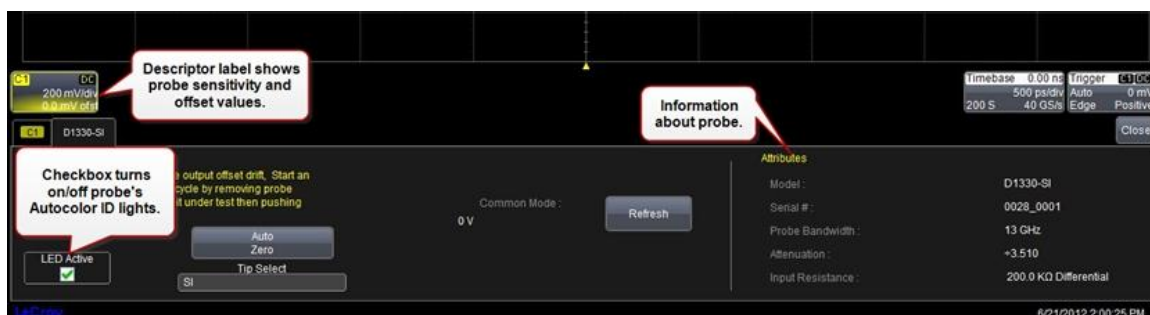
When the probe platform/cable assembly is connected to a probe amplifier module, and this assembly is then attached to an X-Stream oscilloscope's input, the oscilloscope recognizes the probe and activates the vertical channel functions in the user interface (shown previous). Refer to your oscilloscope's instruction manual for specific operation.



Vertical dialog - Amplifier tab label corresponds to your attached probe.

On the Channel dialog, the corresponding Amplifier tab shows the name of the module attached. Touch the tab to activate the probe Amplifier dialog, which allows you to control the probe through the oscilloscope's interface.

- The Attributes section of the dialog includes useful information such as amplifier bandwidth and attenuation of your probe signal.
- In some applications, it may be desirable to use this dialog to turn the probe's AutoColor ID off or on by touching the **LED Active** checkbox.



The Amplifier dialog enables some control of the probe and displays its attributes.

Tip Select

Make the appropriate selection by touching inside the **Tip Select** control and choosing the Lead/Tip you're using. The dialog tab is labeled with the name of the corresponding tip you selected.



Select attached tip; the selection appears on the tab label.

NOTE: It's crucial to make the tip selection on this field as it results in the amplifier and tip combination having the response calibrated for at the factory. Failure to select the proper tip may result in inaccurate measurements.

Connecting the Probe to the Test Circuit

Connecting the Probe to the Test Circuit Overview

For all amplifier modules and interconnect leads, positive voltages applied to the + input relative to the – input deflects the oscilloscope trace towards the top of the screen.

Exercise care when connecting the probe to the test circuit to maintain the high frequency capability of the probe in measurement applications. Increasing the parasitic capacitance or inductance in the input path may introduce a ring, or slow the rise time of fast-rising signals. Any extension of the signal path with extra wire leads, etc. adversely affects the probe's performance.

A ground connection is generally not required here. Refer to **Probe Grounding** (on page 22) for more details.

Follow these instructions to connect your SI lead to the probe circuit.

Solder-in Interconnect Lead

The Solder-in Lead for the amplifier module is supplied with two pre-installed resistors, which are intended to be soldered to the runs or pad test points on the board under test. Because the resistors and the leads are small, this interconnect lead provides the maximum signal fidelity at the highest frequency response.

Follow these instructions to ensure optimal response for your SI Lead.

SI LEAD ATTACHMENT WITH PROPER STRESS RELIEF

Using a small soldering iron tip, attach the free wires of the resistors to the appropriate test points by carefully following the directions in the following sections.



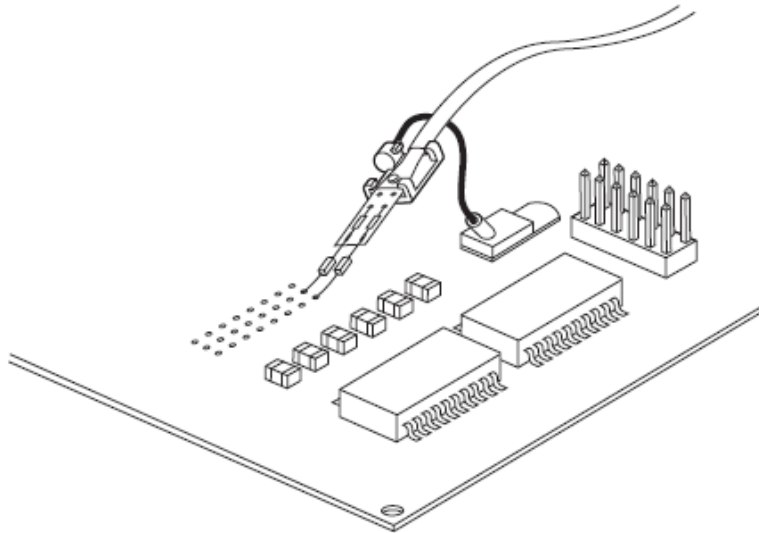
The resistors are small in order to maintain high-frequency performance. However, they are not sturdy enough to bear the weight of the probe module. It should be supported by other means.

A positioning tool, such as the Platform/Cable Assembly Mounting Clamp, the Probe Tip Retaining Clip, or EZ Probe positioner can be used to support the probe.

NOTE: The tip clip helps secure and reinforce the SI resistive tips. Best practice is to consistently position the tip at the correct angle to the device under test which it is connected. Refer to **Proper SI Lead Positioning** for more information. The solder-in lead provides better signal fidelity performance with high frequency signals if it is elevated in this manner. The tip clip also helps to secure and reinforce the SI resistive tips, and can position the resistor leads when soldering the resistors to the test points.

PROPER SI LEAD POSITIONING

When wires are attached to a probe's tips or leads to make probing of the circuit under test easier to perform, additional inductance and/or capacitance is added to the input, lowering the resonance frequency of a series resonance circuit, which may cause oscillations with frequencies within the passband of the probe. These effects, or excessive ringing, degrade the performance of the probe, resulting in incorrect presentation of the input signal, reduced bandwidth, and changes in loading impedance.



Measuring with SI Interconnect Lead

NOTE:

- The entire SI tip should be positioned with the resistor side upright facing (away from the PCB plane).
- Keep a 45 degree angle between the SI tip ends and the PCB plane.

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Square Pin Lead

Square Pin interconnect lead assembly can be used on boards where standard 0.025" square pins are used for interconnect. The highly flexible, 145 mm (5.7") long Square Pin Interconnect lead connects directly with a pair of square pins mounted on standard 0.100" (2.54 mm) centers.

Because of the parasitic inductance of the square pin to which the probe is connected, the system will not support maximum bandwidth or the minimum rise time when used with an oscilloscope with bandwidth greater than 3 GHz. The added inductance of the square pins limits the measurements to signals of 3 GHz bandwidth. A low-cost alternative is to provide vias in the circuit to be tested, and to insert the flexible tips of the very low-loading Adjustable Tip module into these vias.

SMA/SMP Lead

The SMA Interconnect System has been designed to connect directly to female SMA connectors as well as to the higher performance 3.5 mm and 2.92 mm female connectors. The Interconnect Lead connects to the Probe Module and the matched pair of SMA Leads connects to the Interconnect Lead.

The SMA leads use the same connectors as in the interconnect leads and will physically mate with the probe tip module. However, the system will not work properly in this configuration. No damage to the probe or amplifier will occur. However, maximum voltage to prevent destruction will be much lower and the susceptibility to ESD is reduced.

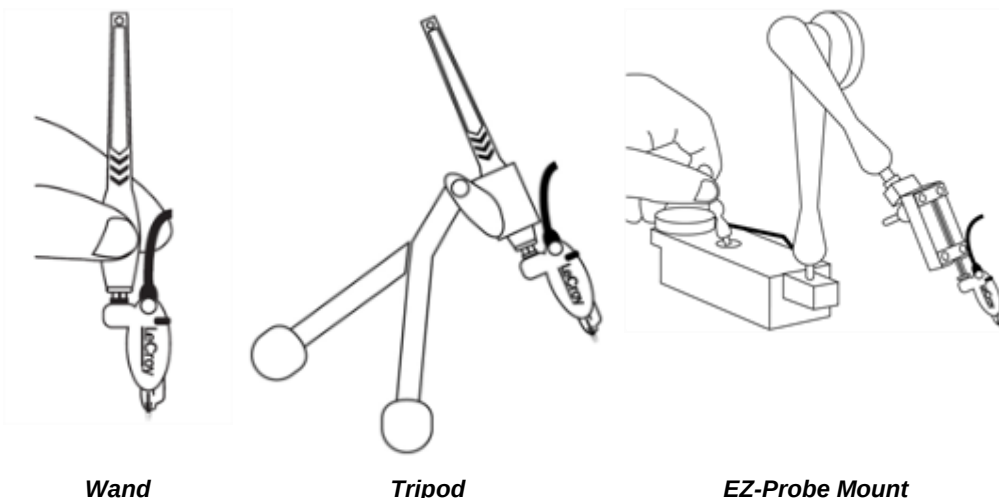
NOTE: The SMA Input Leads are supplied as a matched pair. Individual cables should not be interchanged between probes.

An SMA Finger Wrench is supplied to aid in tightening the SMA connectors. The SMA connector should be tightened to a torque of 8 in-oz. This torque can be approximated to finger tight when using the wrench.

Positioner Tip (Browser)

The Dxx30-PT Positioner Tip (Browser) has a very small form factor with very low mass. It is a good all-around browsing or mounted solution for probing in areas with a high concentration of test points or limited free space to fit a probe.

Various attachments and extenders are supplied with the Positioner Tip, allowing it to be easily held while browsing or connected to a mounting device.



Using these attachments, the tip can be positioned in many different ways to make probing possible in tight geometries.

Rotating the thumbwheel adjusts the tip spacing from 0 to 3.5 mm (0 to 0.14") in a direction perpendicular to the thumbwheel rotation. There is a positive stop on the thumbwheel to prevent it from being rotated too far in either direction.

The tip is spring-mounted to accommodate 0.6mm of Z-Axis compliance. This aids in applications where more than one Dxx30-PT tip is required to make measurements in a crowded area and the tips need to be mounted at an angle to the board under test.

Avoid applying excessive lateral pressure on the tip as breakage may result. Do not use the tip to scrape the circuit. If the tip does break, it may be replaced in the socket. If the socket also breaks, a new socket can be soldered onto the tip. See **Replacing Spring-Loaded Tips and Tip Sockets on the Positioner Tip** (on page 37) for instructions on replacing tips and sockets.

Using the DC Blocking Adapter

The DC Blocking adapter should be used when the common mode voltage of the circuit under test is unknown or exceeds the maximum common mode voltage specified. Connect the each SMA Input Lead to a DC Block and the male side of the DC Block to the SMA connector of the circuit under test. When the DC blocking adapter is used, the probe is AC coupled and the LF cut-off frequency is approximately 10 MHz.

NOTE: When using the DC Blocking Adapter set the Serial Data Analyzer's OFFSET to zero.

Probe Grounding

In most cases, when the common mode portion of the signal consists mainly of lower frequencies, the probe does not need to be connected to the ground of the circuit under test. This minimizes the effects of ground loop currents. Any signal corruption caused by not having the probe connected to ground of the signal under test is common to both inputs and is rejected by the differential operation of the probe.

Positioning of the Input Leads

Normally the performance of the Solder-in Lead and Positioner Tip Browser is not affected by the position of the amplifier module. They can be mounted straight upright or on an angle. However, when it is necessary to mount the module parallel to the board, the maximum performance is obtained when the + sign (printed near the positive input on both the SI Lead and the PT Tip) is upward facing.

NOTE: The flexible cable connecting the input tip to the amplifier module is reasonably insensitive to placement, but can be affected by large signal emitters on the device under test, so avoid placing it near these types of signals

AutoColor ID and Power Control Indicators

The AutoColor ID LED, built into the platform/cable assembly, indicates various states of the probe-oscilloscope combination:

- **AutoColor ID**

When the probe is connected to a LeCroy X-Stream oscilloscope, the LED illuminates in the default color of the channel to which the probe is connected.

- **Platform/Cable Assembly Compatibility**

- When the probe tip module is compatible with the platform/cable assembly to which it is connected, the green LED illuminates for about one second after the probe is connected to the oscilloscope.
- When the probe tip module is incompatible with the platform/cable assembly, the red LED illuminates, for example, when a Dxx30 amplifier is connected to a WL-PLINK-A platform/cable assembly.

AutoZero

WaveLink probes incorporate an AutoZero function to remove any DC offset from the probe. This function is available when the probe is used with LeCroy's X-Stream oscilloscopes, and must be invoked by the user.

After several minutes of warm-up, or when the probe is exposed to a large shift in ambient temperature, some DC offset may occur, and an AutoZero cycle should be initiated.

Start an AutoZero cycle by removing the probe from the circuit under test and touching the on-screen **AutoZero** button to remove output offset drift.

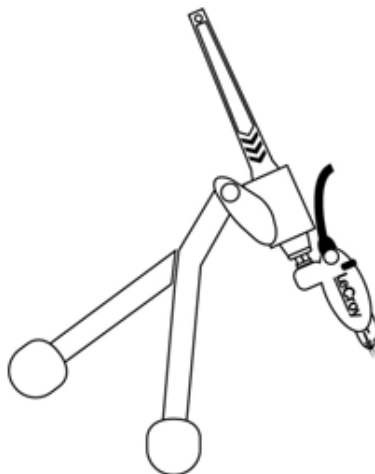
Accessory Use

A variety of accessories are provided with the probe and platform/cable assembly. These accessories help keep the probe tip in place and provide deskew capabilities or are simply common replacement parts.

Positioning Tools

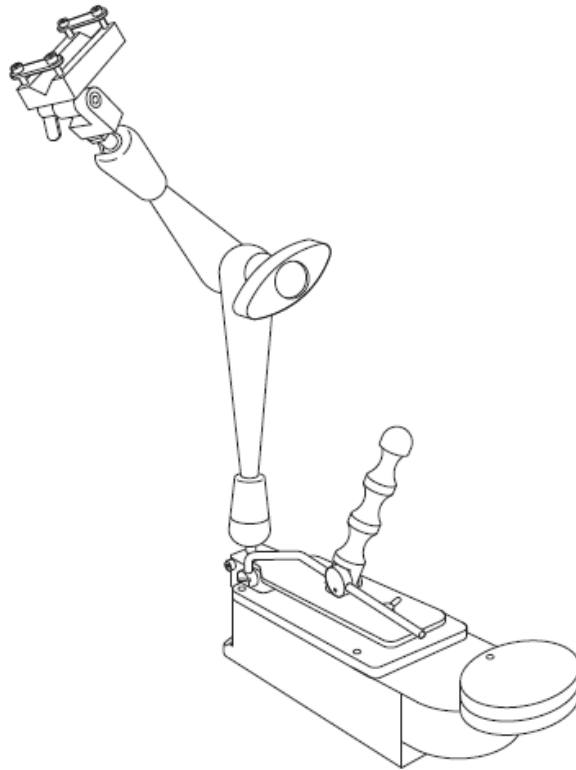
Freehand Probe Holder

The FreeHand Probe Holder (PACC-MS001) is provided as a standard accessory with the WL-PLINK-CASE. It is designed to keep most of the weight on the probe tip preventing loss of contact with the circuit under test. The FreeHand Probe Holder is a stable, quick and easy-to-set-up probe positioner, improving your ability to concentrate on the measurement by not having to hold the probe.



EZ Probe Positioner

The EZ Probe Positioner is available as an optional accessory. It provides stable, accurate positioning in the X-Y-Z Axes.



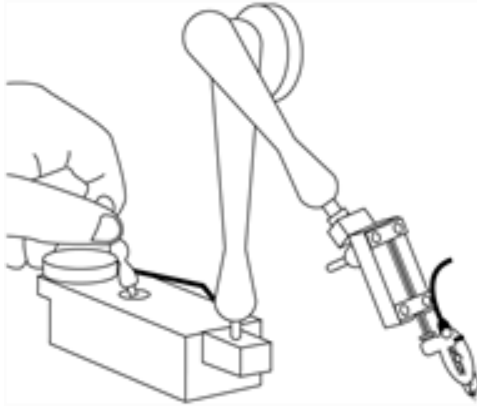
The unique 3:1 motion reduction joystick allows simple, precise positioning of the attached probe in both the horizontal and vertical measuring plane. The probe has a fully-articulating arm, providing 30 cm (12 inch) reach in virtually any direction.

The XYZ joystick has separate friction controls allowing independent X-Y plane or Z-Axis movement and is especially useful when combined with the Positioner Browser Probe Tip.

The EZ-Probe Positioner comes with a vacuum mounted base to keep the probe in place in any test environment. However, the solid base is heavy enough that the positioner can be used without the vacuum.

Long Interconnect Extender

The Long Interconnect Extender (provided with Dxx30-PT-KIT) is used to connect the probe to the EZ-Microtech Positioner Arm. Attach the probe by first removing the screws holding the top plate to the V-shaped probe holder. Rest the long interconnect extender in the V-shaped groove, and fasten the top plate to the holder, using the removed screws (as follows). Then, insert the Dxx30-PT onto the long interconnect extender.



Positioner Tip mounted to EZ Probe Positioner and Long Interconnect Extender

NOTE:

- Do not overtighten the screws.
- There is no fine adjust on the EZ probe. It is easy to exceed the Z-Axis compliance rating of the PT. Use care when positioning the PT with the EZ probe.

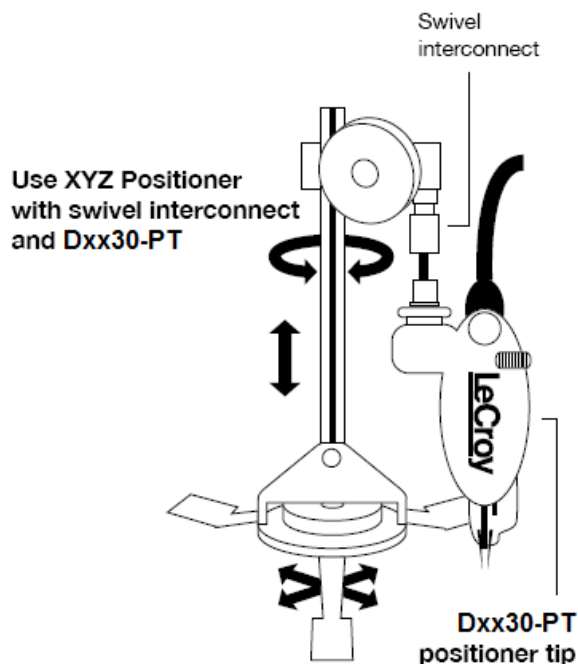
Once the probe has been attached, loosen the knob on the EZ positioner arm and position the probe close to the test point. Tighten the knob and use the joystick to fine position the probe.

Dxx30-PT-XYZ-Positioner

This positioner is a small, lightweight device that can be affixed to the printed circuit assembly using the included adhesive pads. The black adhesive pads are for more permanent attachment, whereas the white adhesive pads leave less residue when removed. The wide variety of short, long, swivel, and right angle interconnect parts can be connected to the top assembly, which can then be moved up and down along the Z-Axis to increase or release pressure on the probe points. The bottom assembly contains a tightening wheel

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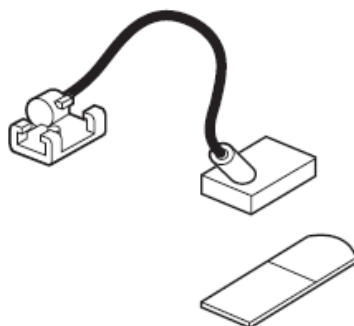
which can be loosened to allow minor X-Y Axis adjustments, and then tightened to fix the exact probing position.



The Positioner (Browser) Tip mounted to XYZ Positioner with Swivel Interconnect

Tip Retaining Clip

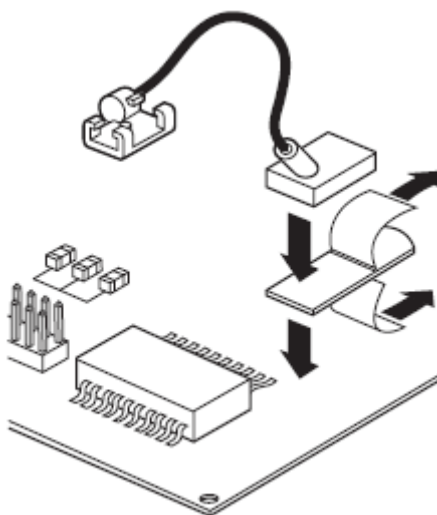
The Tip Retaining Clip (PK600ST-3) helps hold the SI Interconnect Leads in place while making measurements or when soldering the damping resistors to the test points of the board under test.



The Clip comes standard with the Differential Amplifier Small Tip Module , along with a set of 10 white and 10 black Adhesive Pads (Dxx0-PT-TAPE) used for mounting the clip to the board.

FASTENING THE CLIP TO THE BOARD

Fasten the clip to the board by removing the small piece of protection paper from one side of the adhesive pad and mount the pad to the underside of the clip. If necessary, use alcohol to clean the section of the board where the clip is mounted to remove any grease or flux residue.



Connecting the SI Module Using the Tip Retaining Clip

Remove the protective paper from the other side of the adhesive pad and mount the clip to the desired location on the board. Apply pressure to the clip for at least several seconds to assure proper adhesion (shown previous)

The adhesive pad with the tab is still visible and stays attached to the adhesive pad. The tab is used to remove the clip from the board.

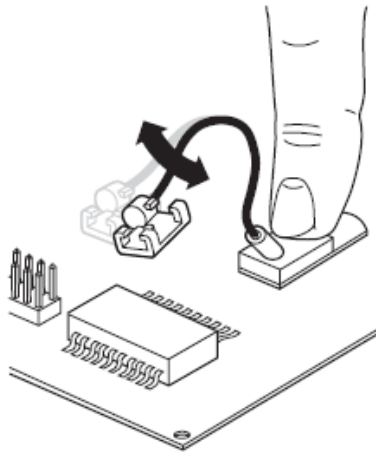
NOTE: Maximum strength of the adhesive pad is obtained after about 30 minutes.

WaveLink Series Differential Probe (8-13 GHz)

MOVING AND POSITIONING

Always apply pressure to the pad (as follows) to prevent any shifting while bending the arms and/or moving the probe adapter portion of the clip (typically done while positioning or attaching the probe).

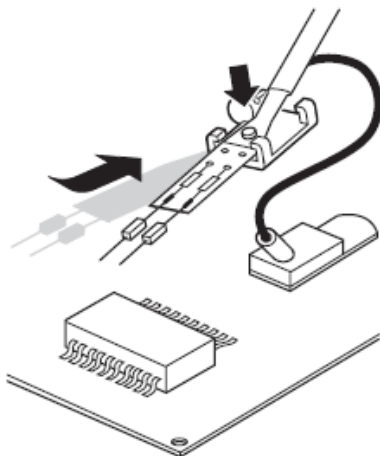
NOTE: This is especially important if moving and positioning before the adhesive pads have properly cured.



Applying pressure when adjusting the probe holder

ATTACHING THE PROBE

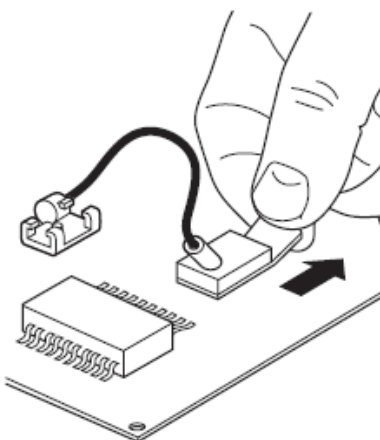
Attach the probe by positioning the cable of the module on top of the clip and sliding the input board of the module into the grooves. While moving the probe into position for measurement, apply pressure to the mounting pad to prevent the adhesive pad from moving and losing its adhesion.



Attaching the Probe

REMOVING THE TIP RETAINING CLIP

Remove the retaining clip from the board by pulling on the tab of the adhesive pad. The clip can now be removed easily without leaving any adhesive residue and can be used in another application using a new adhesive pad.



Removing the retaining clip

Platform/Cable Assembly Mounting Kit

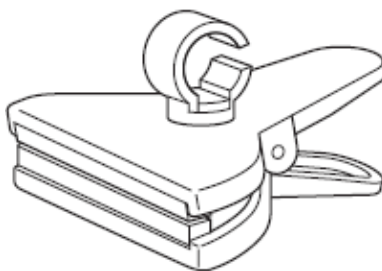
Platform/Cable Assembly Mounting Kit (PK600ST-4) can be used to support to the platform/cable assembly and relieve stress on interconnect leads when the test points are located close to the edge of the board under test.

The PK600ST-4 includes one board edge clip and four adhesive backed platform/cable assembly clamps.

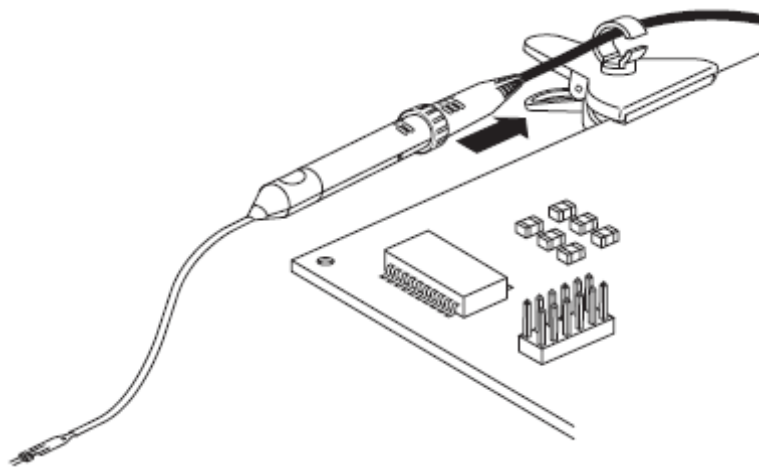


PLATFORM/CABLE ASSEMBLY BOARD EDGE CLIP

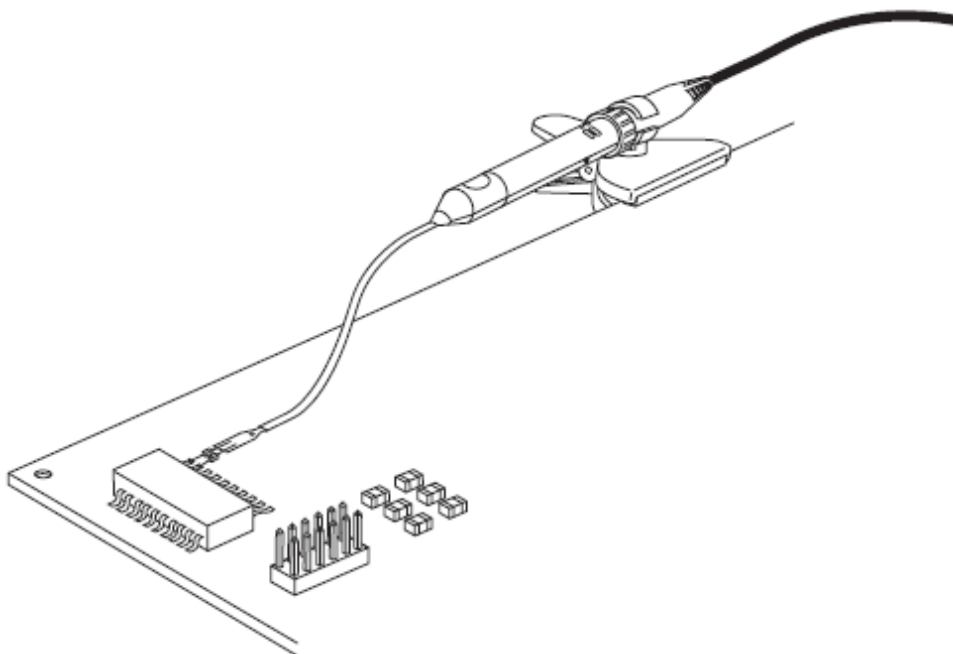
The Platform/Cable Assembly Location Clip can be used to give support to the probe and Interconnect Lead when the test points are located close to the edge of the board under test. It's also useful for holding the probe assembly while soldering the solder-in interconnect lead to your device under test.



Slide the probe cable into the clamp opening and move the probe so that the probe's strain relief is located in the opening. Close the clamp.



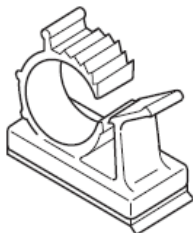
Slide the probe into the board edge clip



Insert the probe body into the board edge clip and position the clamp as desired.

ADHESIVE BACKED PLATFORM/CABLE ASSEMBLY CLAMPS (4)

The Adhesive Backed Probe Body Clamp provides additional support to the Platform/Cable Assembly and Interconnect Lead anywhere on the board under test.

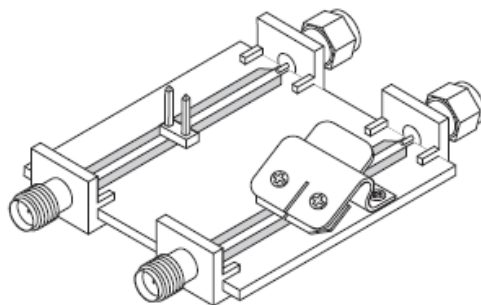


Connection Guides

Probe connection guides are designed to make it easy to electrically isolate the two probe tips when browsing. They also greatly reduce accidental and unwanted contact across probe points.

Before attaching connection guides, clean the PCA assembly area with IPA or another cleaner to remove oils. Then, apply with a light pressure, release, and let set for one hour.

Probe Deskew Fixtures



The Probe Deskew Fixture (PCF200) is provided as a standard accessory with WaveLink series Platform/Cable Assemblies.

For WaveLink probes designed to accommodate all WaveLink tips (not at full bandwidth), 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. 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/SDA/DDA 7 Zi/Zi-A, WaveMaster/SDA/DDA 8 Zi/Zi-A, or LabMaster 9 Zi-A fast edge output to one of the inputs. Set the 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.

TF-DSQ Fixture Accessory

A TF-DSQ fixture is available as a LeCroy accessory. The product is used in conjunction with the oscilloscope software to perform probe deskew and DC calibration. A manual explaining the operation of the TF-DSQ is available for download from www.lecroy.com.

To learn more about this accessory, **Contact LeCroy for Support** (on page 55).

Care and Maintenance

Cleaning

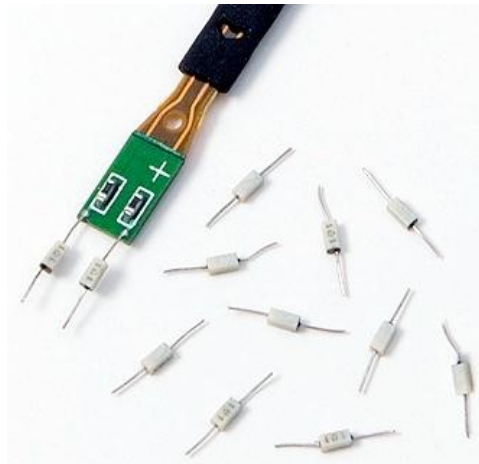
The exterior of the probe and cable should be cleaned, using a soft cloth moistened with water. The use of abrasive agents, strong detergents, or other solvents may damage the exterior of the probe.



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

Replacing Damping Resistors on the Solder-in Interconnect Lead

The external damping resistors locate the tip resistance as close to the device under test as possible, which minimizes tip inductance and capacitance and provides very favorable loading characteristics.

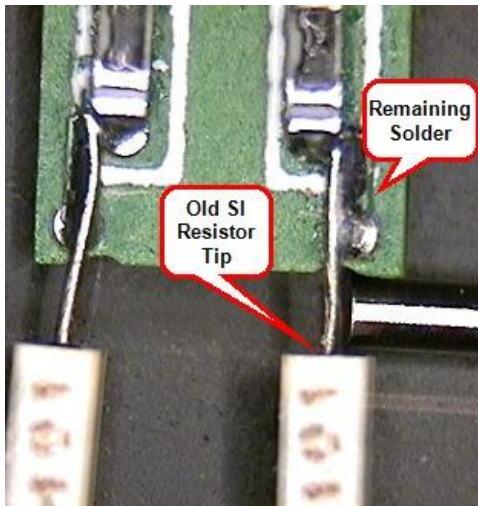


However, these resistors are subject to mechanical stress and may periodically need to be replaced even if proper stress-relief precautions are taken. Replacement damping resistors are included with the probe, and replacement of these resistors is simple. Resistors are pre-

cut to the right lead lengths; all that is required is to remove the old and attach the new resistor.

Follow these steps to correctly remove the damaged damping resistors and to solder a new resistor to your tip. It is assumed that the person performing the resistor replacement is familiar with fine pitch soldering techniques.

1. Remove the old resistor tip and any remaining solder from the long solder pad using a fine tip soldering iron taking care not to de-solder the SMT resistors.

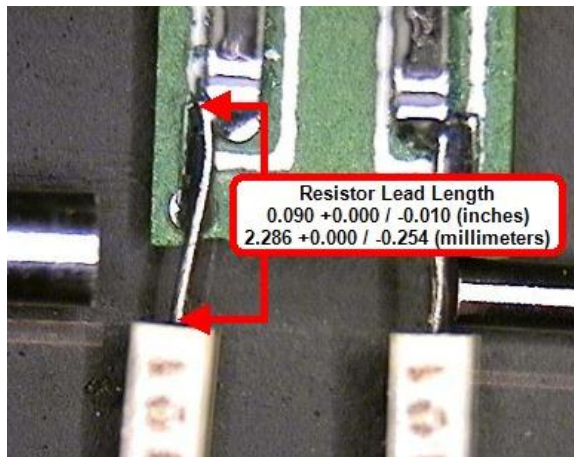


2. Use a soldering iron to pre-tin the pad. Wash the area with isopropyl alcohol to remove any residual flux.
3. Align the damping resistor lead with the end of the tin pad and solder in place running the lead along the pad and over the via. Avoid using excessive amounts of solder. Use the photographs in this topic as a reference for the proper amount of solder.
4. Verify the following dimensions for:

- **Resistor Lead Length**

0.090 +0.000 / -0.010 (inches)

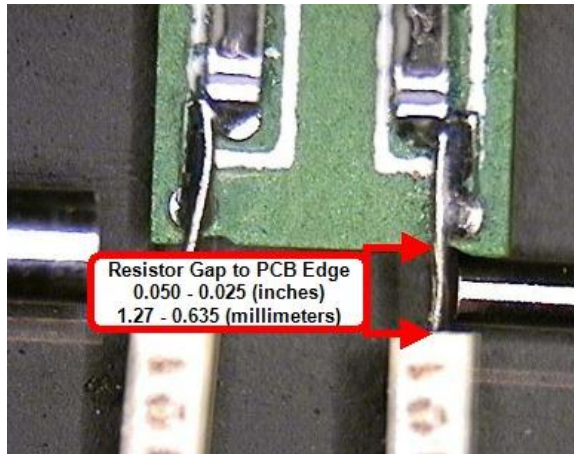
2.286 +0.000 / -0.254 (millimeters)



- **Resistor Gap to PCB Edge**

$0.050 - 0.025$ (inches)

$1.27 - 0.635$ (millimeters)



Replacing Spring-Loaded Tips and Tip Sockets on the Positioner Tip

Follow these procedures to properly replace tips on your probe.

Replacing Spring-Loaded Tips

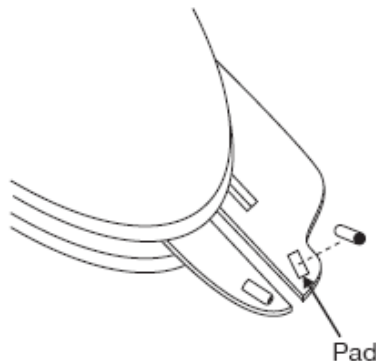
A set of 4 replacement spring-loaded tips have been supplied with the Dxx30-PT Positioner Tip. Under normal usage, the tips should last a very long time. However, in the event of breakage or damage, they can be easily replaced.

First, adjust the tip spacing to its maximum open position. Then, remove the old tip from the socket and insert a new tip, taking care to orient it in the correct direction. While replacing tips, mount the Dxx30-PT in a clamp, taking care to not adjust too tightly.

Replacing Tip Sockets

A set of 2 replacement tip sockets have been supplied with the Dxx30-PT Positioner Tip. Under normal usage, the tip sockets should not need replacement. However, in the event of breakage or damage, new sockets can be soldered into place using the following steps:

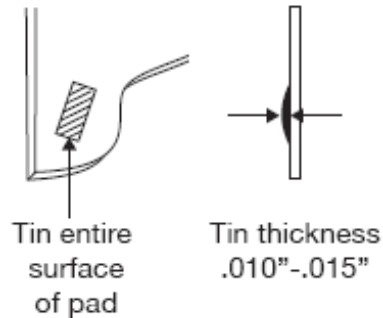
1. Secure the positioner tip in some type of clamp to immobilize it while working. Using an appropriate fine tip soldering iron for low mass components, apply heat and remove the damaged socket from the positioner tip circuit board. Clean off the pad using the soldering iron. Clean oils and dirt in the area using deionized or distilled water or isopropyl alcohol. Inspect the pad for damage - damaged or loose sockets do not adhere properly. The following figure illustrates this step.



Socket removal from the PT circuit board.

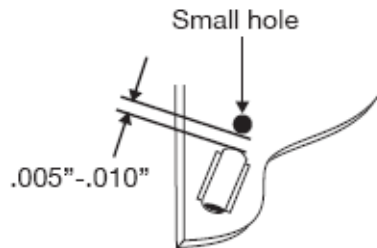
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2. Tin the pad using a no clean solder (shown as follows). Tin thickness should be .010" to .015" (2.5 to 4 mm).



Tinning of pad surface and tin thickness.

3. Locate the socket so the closed end is slightly overhanging the end of the pad. This prevents solder from flowing into the socket insert hole. Align the socket sides with the pad sides and solder as follows:



Leave proper clearance between the socket and pad sides when soldering.

4. Finally, clean the newly soldered assembly with deionized or distilled water.

Service Strategy

Defective probes or probe tip modules must be returned to a LeCroy service facility for diagnosis and repair or replacement. Defective products under warranty are repaired or replaced.

See **Service Options** (on page 46) for more details.

Returning a Product for Calibration or Service

Return a product 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**, a **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 shipments 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.

Follow these steps for a smooth product return.

1. Contact your local LeCroy sales or service representative to obtain a Return Authorization Number.
2. Remove all accessories from the device. Do not include the manual. If you need to return a Dxx30 module, be sure to include SI Interconnect Leads and Tips.
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
 - Product model and serial number

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- 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 you're returning (for at least the replacement cost).
 8. Ship the package to the appropriate address.

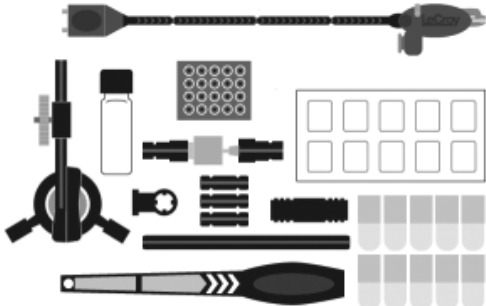
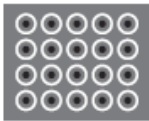
Returning a Product to a Different Country

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.

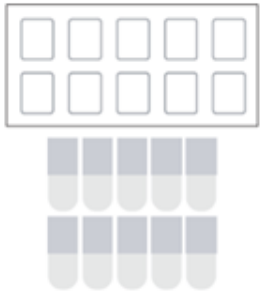
In addition to the items mentioned in the previous topic, mark shipments returned for service as a **Return of US manufactured goods for warranty repair/recalibration**. If there is a cost involved in the service, put the cost of the service in the value column and the original value of the product at time of purchase in the body of the invoice marked **For insurance purposes only**.

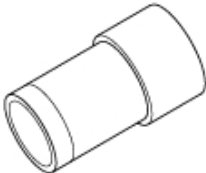
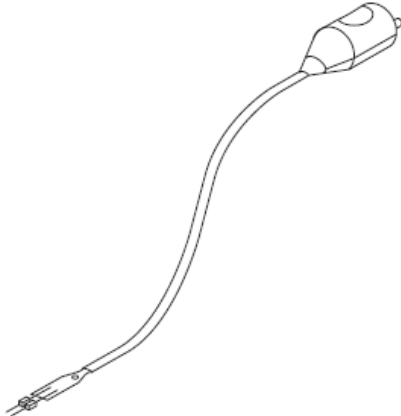
Be very specific as to the reason for shipment. Duties may have to be paid on the value of the service.

Consumables and Replacement Parts

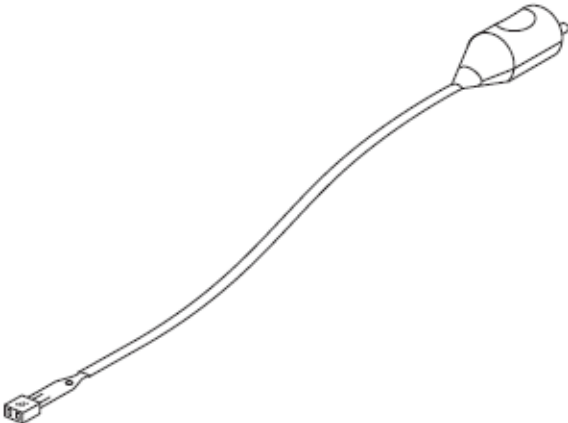
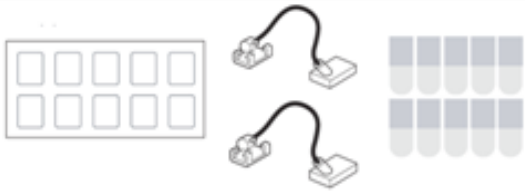
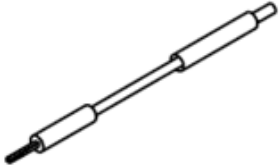
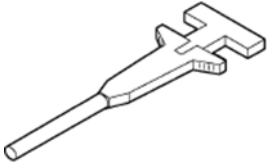
Description and Initial Product Code	Image	Replacement Product Code
Positioner Tip with Accessories Dxx30-PT-Kit		RK-Dxx30-PT-Kit
Positioner Tip (Only ordered as a replacement.)		Dxx30-PT
Pogo Pin Tips (for PT Tip) (Only ordered as a replacement.)		Dxx0-PT-Tips (Included as part of Dxx30-PT-Kit) (Qty. 4)
Pogo Tip Connection Guides (Only ordered as a replacement.)		Dxx0-PT-Guides (Included as part of Dxx30-PT-Kit)

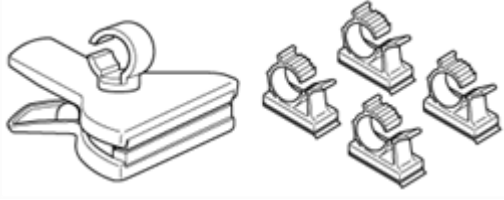
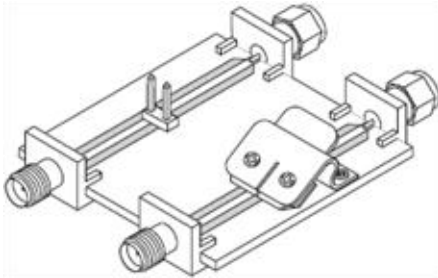
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Description and Initial Product Code	Image	Replacement Product Code
XYZ Positioner (Only ordered as a replacement.)	 A black and white illustration of an XYZ positioner. It features a central vertical rod with a horizontal adjustment knob and a circular base with three adjustable legs.	Dxx0-PT-XYZ-Positioner (Included as part of Dxx30-PT-Kit)
Adhesive Tape for XYZ Positioner (Only ordered as a replacement.)	 A black and white illustration showing a roll of adhesive tape with a grid pattern of squares.	Dxx0-PT-Tape (Included as part of Dxx30-PT-Kit) (10 Pcs. Each)
Browser Wand for PT Tip (Only ordered as a replacement.)	 A black and white illustration of a browser wand. It has a long, thin handle with a textured grip and a small, circular tip.	Dxx0-PT-Wand (Included as part of Dxx30-PT-Kit) (Qty. 1)
Interlock Pieces for PT Tip (Only ordered as a replacement.)	 A black and white illustration showing several interlock pieces. There are two small circular pieces, one with a central hole, and several rectangular pieces of varying sizes.	Dxx0-PT-Interlock (Included as part of Dxx30-PT-Kit) (6 Pcs.)

Description and Initial Product Code	Image	Replacement Product Code
Swivel for PT Tip (Only ordered as a replacement.)		Dxx0-PT-Swivel (Included as part of Dxx30-PT-Kit) (Qty. 1)
Solder-in Tips (Only ordered as a replacement.)		Dxx05-SI-RESISTORS (Included as part of Dxx30) (Qty. 10)
Solder-in Lead (Only ordered as a replacement. Also, includes PK600ST-3.)		Dxx30-SI (Included as part of Dxx30)
Replacement SMA/SMP Leads (Only ordered as a replacement.)		RK-Dxx30-SMA-SMP-LEADS With DC Blocking Adapter and SMA Finger Wrenches

WaveLink Series Differential Probe (8-13 GHz)

Description and Initial Product Code	Image	Replacement Product Code
Replacement Square Pin Lead (Only ordered as a replacement.)		Dxx30-SP With Spare Resistors (Qty. 10)
Replacement Solder-in Probe Holder Kit (Only ordered as a replacement. Includes 2 tip retaining clips and 1 set of adhesive tape.)		PK600ST-3 (Included as part of Dxx05, Dxx30, D6x0/D4x0.)
Ground Lead (Only ordered as a replacement. Includes 4 leads.)		PACC-LD005 (Included as part of Dxx05, Dxx30, D6x0/D4x0.)
Ground Clip (Only ordered as a replacement. Includes 2 clips.)		PK006-4 (Included as part of Dxx05, Dxx30, D6x0/D4x0.)

Description and Initial Product Code	Image	Replacement Product Code
Platform/Cable Assembly Mounting Kit (Only ordered as a replacement.)	 A technical line drawing of the Platform/Cable Assembly Mounting Kit. It includes a large, L-shaped base plate with a circular mounting hole and a smaller, rectangular plate with four circular mounting holes. There are also four small, rectangular mounting brackets, each with a circular hole and a small protrusion.	PK600ST-4 (Included as part of WL-PLINK-Case, WL-PLINK-A, WL-PBus, and WL-2.92MM.)
Probe Deskew Fixture (Only ordered as a replacement.)	 A technical line drawing of the Probe Deskew Fixture. It is a rectangular metal frame with two vertical posts and two horizontal posts. There are two circular mounting holes on the top horizontal post and two on the bottom horizontal post. A small, rectangular plate with four circular mounting holes is attached to the center of the frame.	PCF200 (Included as part of WL-PLINK-CASE, WL-PLINK-A, WL-PBus, and WL-2.92MM.)

To learn more about these available replacement parts, **Contact LeCroy for Support.**

NOTE: For warranted accuracy, amplifiers must be returned to factory for calibration with leads.

Service Options

The following Service Options are available for your LeCroy probe product:

Service Option	Product Code
Three-Year Warranty for D830	D830-W3
Three-Year Warranty for D1030	D1030-W3
Three-Year Warranty for D1330	D1330-W3
Three-Year Warranty for WL-PLINK-Case	WL-PLINK-Case-W3
Three-Year Warranty for Dxx30-PT	Dxx30-PT-W3
Five-Year Warranty for D830	D830-W5
Five-Year Warranty for D1030	D1030-W5
Five-Year Warranty for D1330	D1330-W5
Five-Year Warranty	WL-PLINK-Case-W5
Five-Year Warranty	Dxx30-PT-W5
Three-Year Warranty and Annual NIST Calibration	D830-T3
Three-Year Warranty and Annual NIST Calibration	D1030-T3
Three-Year Warranty and Annual NIST Calibration	D1330-T3
Five-Year Warranty and Annual NIST Calibration	D830-T5
Five-Year Warranty and Annual NIST Calibration	D1030-T5
Five-Year Warranty and Annual NIST Calibration	D1330-T5
Five-Year Annual NIST Calibration	D830-C5
Five-Year Annual NIST Calibration	D1030-C5
Five-Year Annual NIST Calibration	D1330-C5
NIST Traceable Calibration with Test Data* (one module)	D830-CCNIST
	D1030-CCNIST
	D1330-CCNIST

*CCNIST NIST traceable calibration with test data is an available option for D830, D1030, and D1330 differential amplifier modules only when ordered with either a WL-PLINK-Case or WL-PBus probe platform.

To learn more about these available service options, **Contact LeCroy for Support.**

Reference Material

Specifications

Please refer to the LeCroy website at www.lecroy.com for detailed specification information.

NOTE: Specifications are subject to change without notice.

Safety Requirements



Avoid personal injury or damage to your accessory or any equipment connected to it by reviewing and complying with the following safety precautions:

- **Use only as intended.** The accessory is intended to be used only with the compatible LeCroy instruments. Use of the accessory and/or the equipment it is connected to in a manner other than specified may impair the protection mechanisms.
- **Connect and disconnect properly.** Avoid damage through excessive bending of cables and other equipment.
- **Do not use in wet/damp or explosive atmospheres.**
- **For indoor use only.** The accessory is intended for indoor use and should be operated in a clean, dry, environment.
- **Do not operate with suspected failures.** Do not use the product if any part is damaged. All maintenance should be referred to qualified service personnel.
- **Keep product surfaces clean and dry.**

WaveLink Series Differential Probe (8-13 GHz)

- **Completely assemble the measurement instrument before circuit/signal contact.** Connect accessory to the measurement instrument before connecting the probe test leads to a circuit/signal being tested.
- **Do not apply a voltage to any input that exceeds the maximum rating of that input.** Refer to the Specifications on LeCroy website at www.lecroy.com for detailed information.
- **Be careful with sharp tips.** Handle the probe with care as it has sharp tips that may cause bodily injury if not handled properly.

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 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C.

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

NOTE: Direct sunlight, radiators, and other heat sources should be taken into account when assessing the ambient temperature.

Compliance Information

This LeCroy accessory is CE Compliant and bears the CE mark.

CE Declaration of Conformity

This Wave Link Differential Probe meets intent of the European Council Directive 2006/95/EEC for Product Safety and 2004/108/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

- EN 61010-031:2008 Safety requirements for electrical equipment for measurement, control, and laboratory use.

Part 031: Safety requirements for the hand-held probe assemblies for electrical measurement and test.

The differential probe has been verified to conform to EN 61010-031 safety standard per the following limits:

- o Installation (Overvoltage) Category I: Refers to signal level which is applicable for equipment measuring terminals that are connected to source circuits in which measures are taken to limit transient voltages to an appropriate low level.
- o Pollution Degree 2: Refers to an operating environment where normally only dry non-conductive pollution occurs. Occasionally a temporary conductivity caused by condensation must be expected.
- EN 61326-1:2006, EN 61326-2-1:2006 EMC requirements for electrical equipment for measurement, control and laboratory use.
 - o EN 55011/A2:2002 Radiated and Conducted Emissions, Group 1, Class A *
 - o EN 61000-4-2:2001 Electrostatic Discharge Immunity (± 4 kV contact discharge, ± 4 kV air discharge, ± 4 kV vertical/horizontal coupling planes)
 - o EN 61000-4-3:2006 RF Radiated Electromagnetic Field Immunity (3 V/m, 80 MHz to 1 GHz; 3 V/m, 1.4 GHz to 2 GHz; 1 V/m, 2 GHz to 2.7 GHz , 80% amplitude modulated with 1 kHz sinewave)

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

Probe Input Impedance and 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 insignificant load to the test circuit. However, at very high frequencies the capacitive reactance of the Probe Tip Module or Interconnect Lead may load the circuit enough to affect the measurement. These probes are designed to minimize these effects at high frequencies. The SI Interconnect Lead tip uses a construction in which the tip termination consists of a damping resistor with very short lead length (to minimize inductance) that is soldered to the circuit. These damping resistors connect to a special

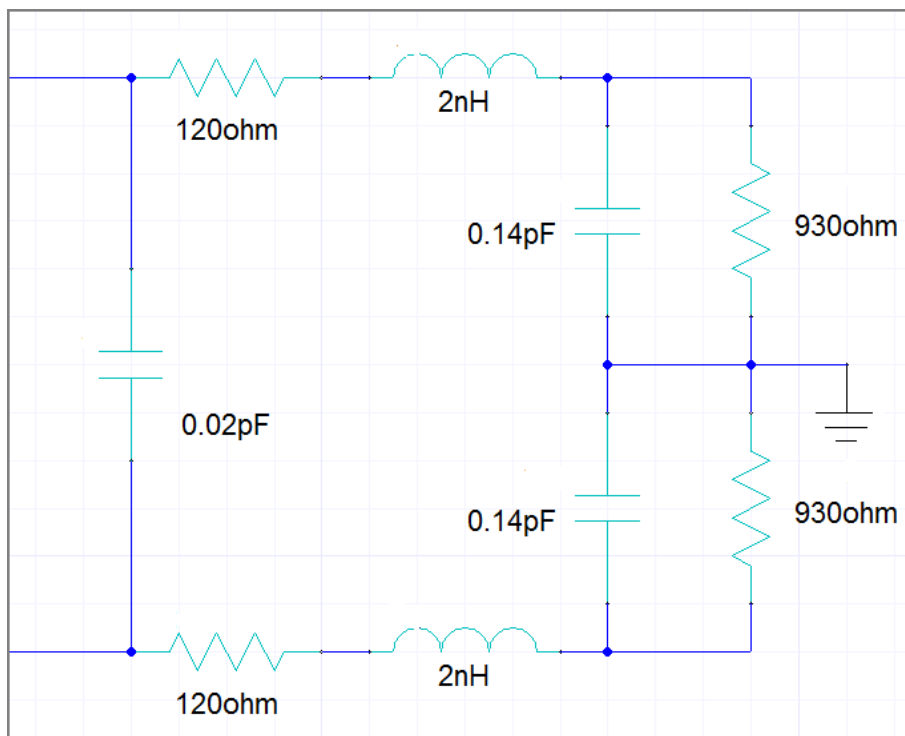
WaveLink Series Differential Probe (8-13 GHz)

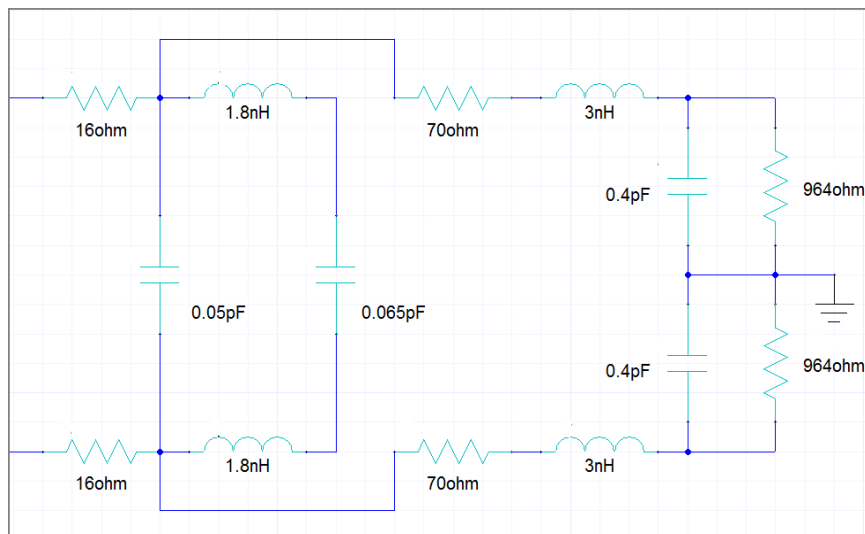
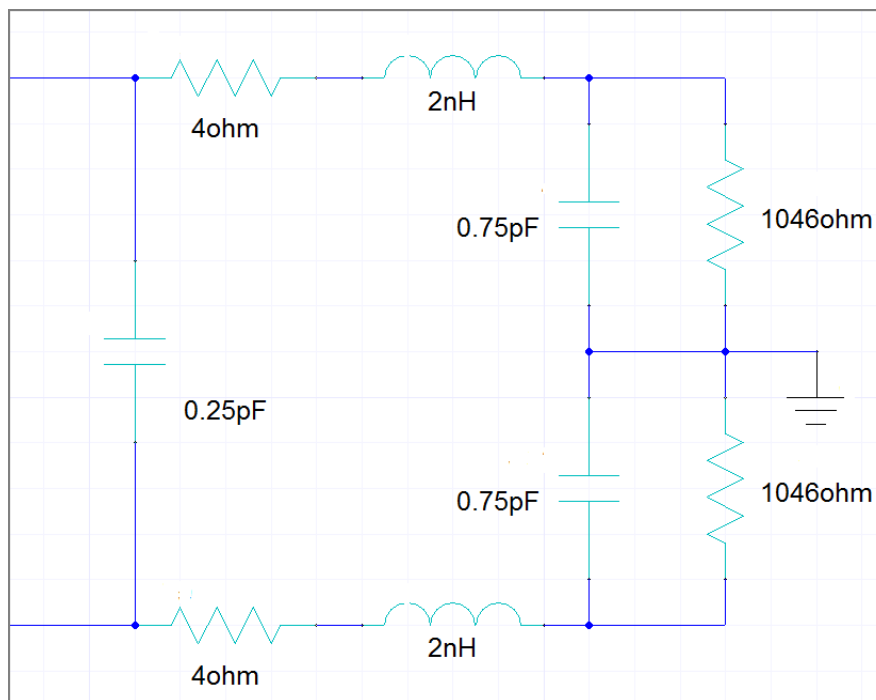
distributed resistor on the lead. The distributed resistors compensate for the inherent transmission loss of the probe system. The result is very broad frequency response with relatively high impedance. Refer to the figures in this topic for equivalent input circuit information.

These circuits represent the aggregate load placed on the test circuit, but not the actual input circuit of the probe. For critical applications, you can enter the information of your module or lead into SPICE or some other simulator to accurately represent the probe loading.

NOTE: To avoid degrading the high frequency performance of the probe **do not** extend the input leads on the solder-in interconnect lead tip.

Equivalent Circuit Model - LeCroy Dxx30 Probe with Dxx30-SI



Equivalent Circuit Model - LeCroy Dxx30 Probe with Dxx30-PT***Equivalent Circuit Model - LeCroy Dxx30 Probe with Dxx30-SP***

Differential Mode and Common Mode

Differential probes sense the voltage difference which appears between the + input and – input. This voltage is referred to as the Differential Mode or Normal Mode voltage. The voltage component which is referenced to earth and is identical on both inputs is rejected by the amplifier. This voltage is referred to as the Common Mode voltage and can be expressed as:

$$V_{CM} = \frac{V_{+input} + V_{-input}}{2}$$

Differential Mode Range and Common Mode Range

Differential Mode range is the maximum signal that can be applied between the + and - inputs without overloading the amplifier/amplifier, which otherwise would result in clipping or distorting of the waveform measured by the oscilloscope.

The Common Mode Range is the maximum voltage with respect to earth ground that can be applied to either input. Exceeding the common mode range can result in unpredictable measurements. Because the Common Mode signal is normally rejected, and not displayed on the oscilloscope, the user needs to be careful to avoid accidentally exceeding the common mode range.

Because the input signal of a differential amplifier is not referenced to ground, the concept of V_{peak} versus $V_{peak-peak}$ may be confusing.

With a ground referenced signal, V_{peak} is the maximum instantaneous voltage amplitude the signal will have with respect to ground. In a differential system, there is no ground reference. Therefore, the Differential Mode Range refers to the maximum instantaneous amplitude of the signal difference between the positive input and the negative input. Since most amplifiers have symmetrical bipolar inputs, the value is generally expressed as an absolute value, and can have either polarity.

For example, an amplifier with a differential mode rating of ± 1 V can have a maximum voltage difference appearing at any instant in time of 1 V between the inputs. The polarity could be either positive or negative. However, this does not imply that the number can be doubled to 2 volts. For clarity, consider the following table of absolute voltages applied to

the inputs of a WaveLink D1605 differential amplifier that has a differential mode range of ± 800 mV and a common mode range of ± 4 V:

Voltage on + input to ground	Voltage on - input to ground	Difference	Comment
+1.5 V	+0.8 V	+0.7 V	OK: within ± 800 mV range
-1.5 V	-0.8 V	-0.7 V	OK: within ± 800 mV range
+0.8 V	-0.1 V	+0.9 V	Out of range: exceeds ± 800 mV
+1.0 V	-1.0 V	+2.0 V	Out of range: exceeds ± 800 mV
+6.5 V	+6.0 V	0.5 V	Exceeds ± 4 V common mode range
1.5 V _{pk-pk} Sine	Ground	0.75 V _{peak}	OK: within ± 800 mV range

Some amplitude is specified as peak to peak. The differential amplifier peak-to-peak range is twice the peak differential mode range specification (at any instant in time) as the maximum voltage amplitude signal is one-half of the peak-to-peak value.

In a balanced differential system, the signal on each output is an inverted copy of the other input. For example, an LVDS system may have a pair of outputs, each of which has a voltage swing of 0 to +370 mV. A logic 1 would be represented when the + output is at +370 mV, while the - output is at 0 V. A logic zero is the opposite polarity: the + output at 0 V and the - output at +370 mV. Note that even though both outputs swing 370 mV, the maximum difference voltage between them at any instant is still within ± 370 mV. So, this signal could be measured with a differential amplifier that has a differential mode range of ± 400 mV.

Common Mode Rejection Ratio

The ideal differential probe/amplifier would sense and amplify only the differential mode voltage component and reject the entire common mode voltage component. Real differential amplifiers are not perfect, and a small portion of the common mode voltage component appears at the output. Common Mode Rejection Ratio (CMRR) is the measure of how much the amplifier rejects the common mode voltage component. CMRR is equal to

the differential mode gain (or normal gain) divided by the common mode gain. Common mode gain is equal to the output voltage divided by the input voltage when both inputs are driven by only the common mode signal. CMRR can be expressed as a ratio (e.g., 10,000:1) or implicitly in dB (e.g., 80 dB). Higher numbers indicate greater rejection (better performance).

The first order term determining the CMRR is the relative gain matching between the + and – input paths. Obtain high CMRR values by precisely matching the input attenuators in a differential amplifier. The matching includes the DC attenuation and the capacitance which determines the AC attenuation. As the frequency of the common mode component increases, the effects of stray parasitic capacitance and inductance in determining the AC component become more pronounced. The CMRR becomes smaller as the frequency increases. Therefore, the CMRR is usually specified in a graph of CMRR versus common mode frequency.

The common mode frequency in these graphs is assumed to be sinusoidal. In real life applications, the common mode signal is seldom a pure sine wave. Signals with pulse wave shapes contain frequency components much higher than the repetition rate may suggest. This makes it very difficult to predict actual performance in the application for CMRR-versus-frequency graphs. The practical application of these graphs is to compare the relative common mode rejection performance between different probes and amplifiers.

Offset

Offset for D830, D1030, and D1330

The offset for the WaveLink High Bandwidth Series probe is in the probe amplifier. Thus, these probes have full offset capability over their entire V/Div range.

When the WaveLink series probe is used with a LeCroy WaveMaster 8 Zi / Zi-A or similar oscilloscope equipped with ProLink or 2.92mm interface, the probe offset is controlled with the channel **OFFSET** knob.

Sometimes it may be desirable to display a waveform as a reference signal where a large display amplitude may not be necessary. Perhaps a timing reference when amplitude details are not needed. In such a case, the oscilloscope's zoom function can be used to reduce the displayed height of the reference signal. (Refer to your oscilloscope's online help for operation of the zoom function.)

Dynamic Range

WaveLink D830, D1030, and D1330 probes have no gain or attenuation control. However, WL-PLINK does provide gain and attenuation controls.

The system attenuation is fixed at approximately , depending on model. The actual gain value for each probe is indicated in the probe dialog box, which is displayed when the probe is connected to the scope.

The WaveLink series probes are always DC coupled (no AC coupling is provided). Therefore, care must be exercised to avoid exceeding the common mode range. Because the common mode signal is rejected by the probe and is not displayed, changes in the amplitude of the common mode component are not apparent to the user. Exceeding the common mode range may introduce distortion to the probe's output signal.

Contact LeCroy for Support

Whether you're looking for sales or technical support, our staff can provide assistance with installation, calibration, and product knowledge regarding a full-range of our software applications and accessories.

Contact Your Local LeCroy Office for Sales and Technical Assistance

United States and Canada - World Wide Corporate Office

LeCroy Corporation

700 Chestnut Ridge Road

Chestnut Ridge, NY, 10977-6499

Phone: 800-553-2769 (Sales opt. 1, Applications opt. 2, Service opt. 3) or 845-425-2000

Fax: 845-578-5985

Email: contact.corp@lecroy.com

Web: www.lecroy.com

WaveLink Series Differential Probe (8-13 GHz)

Contact Your Local LeCroy Office for Sales and Technical Assistance

United States - Protocol Solutions Group

LeCroy Corporation
3385 Scott Boulevard
Santa Clara, CA, 95054
Fax: 408-727-0800
Web: www.lecroy.com

Sales and Service:

Phone: 800-909-7211 or 408-727-6600
Email: contact.corp@lecroy.com

Support:

Phone: 800-909-7112 or 408-653-1260
Email: psgsupport@lecroy.com

European Headquarters

LeCroy Europe
4, Rue Moïse Marcinhes
Case postale 341
1217 Meyrin 1
Geneva, Switzerland
Phone: + 41 22 719 2228, +41 22 719 2323,
+41 22 719 2277
Email: contact.sa@lecroy.com,
applications.indirect@lecroy.com
Fax: +41 22 719 2233
Web: www.lecroy.com/europe

Protocol Analyzers: +44 12 7650 3971

China, Mainland

LeCroy Corporation
Beijing Office and Service Center
Rm. 2001 - Office; Rm. 2002 - Service Center
Unit A, Horizon Plaza
No. 6, Zhichun Road, Haidian District
Beijing 100088, R.O.C.
Phone: ++86 10 8280 0318 / 0319 / 0320
Service: ++86 10 8280 0245
Fax: +86 10 8280 0316
Web: www.lecroy.com.cn

China, Taiwan

LeCroy Technology Co Ltd.
Far East Century Park, C3, 9F
No. 2, Chien-8th Road
Chung-Ho City
Taipei Hsien, Taiwan, R.O.C.
Phone: ++ 886 2 8226 1366
Fax: ++ 886 2 8226 1368
Email: sales_twn@lecoln.com.tw
Web: www.lecoln.com.tw

Singapore (Oscilloscopes)

LeCroy Singapore Pte Ltd.
Blk 750C Chai Chee Road #02-08
Technopark@ Chai Chee
Singapore 469003
Phone: ++ 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
Phone: ++ 65 9760-4682

Korea - Seoul

LeCroy Korea
10th fl. Ildong Bldg.
968-5 Daechi-dong, Gangnam-gu
Seoul 135-280, Korea
Phone: ++ 82 2 3452 0400
Fax: ++ 82 2 3452 0490
Web: www.lecroy.co.kr

Japan - Tokyo

LeCroy Japan
Hobunsha Funchu Bldg, 3F
3-11-5, Midori-cho, Fuchu-Shi
Tokyo, 183-0006, Japan
Phone: ++ 81 4 2402 9400
Fax: ++ 81 4 2402 9586
Web: www.lecroy.com/japan

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Corporate Headquarters
700 Chestnut Ridge Road
Chestnut Ridge, NY 10977
USA
www.lecroy.com