DP0010A/11A/12A/13A Differential Active Probes

User's Guide

Notices

Manual Part Number

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WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

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1 Overview

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Introduction

The DP0010A/11A/12A/13A probes are mid-voltage differential active probes that you can use with a Keysight oscilloscope having 50 Ω input impedance. The probe comes with the AutoProbe I interface to connect to the oscilloscope. This interface provides the probe power, offset, and auto-configuration of probe type and attenuation setting on connection.

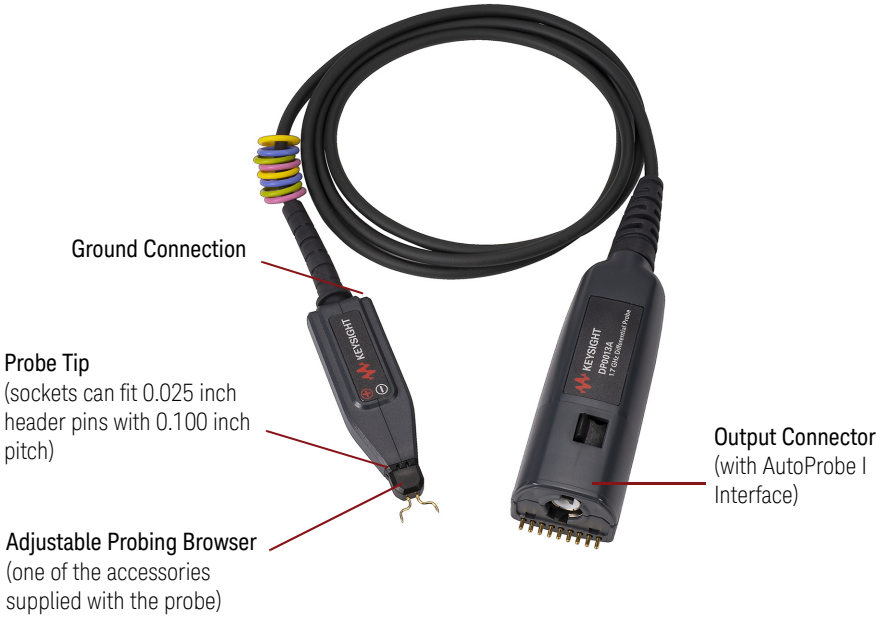


Figure 1 DP0013A probe (shown connected to one of its standard accessories)

Key Features

- **Supports Differential and Single-ended Measurements**: You can use these probes to measure differential as well as single-ended signals. See page 32 to know more.
- **Auto Attenuation Ranges**: These probes support two auto attenuation ranges (~17:1 and ~85:1). The probe's attenuation is automatically set to the value necessary to make the dynamic range of the probe greater than or equal to the level required to measure the input signal. The input range is automatically configured depending on the vertical scale of the oscilloscope. For volts/division setting <=2 V/div, the attenuation range of ~17:1 is applicable and for volts/division setting >2 V/div, the attenuation range of ~85:1 is applicable. Based on these ranges, the attenuation for the probe is set when the probe is calibrated. You can view the attenuation setting for the probe in the Infiniium/InfiniiVision software GUI.

- **DUT Connectivity Options**: You can connect the probe tip either directly to DUT header pins or use the supplied/optional accessories as per your probing scenario.

  These probes support a variety of accessories to suit various DUT connection scenarios and to make the connection to compact target devices possible. See page 9 for standard accessories that are shipped with these probes. Additional accessories are also available for these probes that you can order separately (see page 11 for optional accessories).

- **Easy Deskew and Performance Verification**: You can easily deskew/calibrate and verify performance of these probes using the DP0020A Deskew and Performance Verification kit. This PV fixture comes with header pins preinstalled on it. You can simply connect the probe tip either directly to these header pins or use one of the probe accessories. See page 26 to know more.

CAUTION Before using these probes, refer to "Safety and Regulatory Information" on page 33.

Compatibility with Keysight Oscilloscopes

Compatible Oscilloscopes	Adapter(s) Required	Required Software Version
Infiniium Oscilloscopes		
EXR-Series	None	Infiniium 11.25 or higher
MXR-Series	None	Infiniium 11.25 or higher
S-Series	None	Infiniium 6.71 or higher
V-Series	N5442A adapter	Infiniium 6.71 or higher
Z-Series	N5442A adapter	Infiniium 6.71 or higher
UXR-Series (3.5 mm models)	N5442A adapter	Infiniium 11.25 or higher
UXR-Series (1 and 1.85 mm models)	N5442A + N2852A adapters	Infiniium 11.25 or higher
InfiniiVision Oscilloscopes		
3000T X-Series	None	InfiniiVision 7.50 or higher
4000 X-Series		
6000 X-Series		

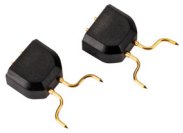
Is your oscilloscope software up-to-date?

Keysight periodically releases software updates to support your probe, fix known defects, and incorporate product enhancements. To download the latest firmware, go to www.Keysight.com and search for your oscilloscope's model number. Click the "**Drivers, Firmware & Software**" tab under the **Technical Support** link.

Standard Accessories

The accessories shown below ship standard with these probes. You can use these accessories interchangeably across DP0010A/11A/12A/13A probes.

WARNING **Use only Keysight approved accessories with these probes.**

Standard Accessory		Use
Probe Tip Saver (2 pieces)		Use on the probe tip to avoid damaging the tip from repeated attach / detach when probing directly using the probe tip.
Adjustable Probing Browser (2 pieces)		Adjustable tip to support different circuit geometries. Max. tip span: 8.6 mm
Straight Pin (set of 10 pins)		Insert the pins into the probe tip.
Solder-in Y-lead Tip (2 pieces)		Solder-in tip is intended to be soldered directly to your test device. Solder the tip end to the circuit board /device and then connect the snap-on end to the probe.
Socketed Y-lead Tip (2 pieces)		The tip with two sockets that can attach to: - 0.8 mm round pins - 0.64 mm square pins

Standard Accessory		Use
Micro Circuit Hook Test Clips (2 pieces)		To probe miniature IC and components. Attach these clips to the two sockets of the socketed Y-lead tip.
Ground Lead (1 piece)		90° socketed lead to connect the DUT ground to the probe ground. This is needed if the DUT is not grounded to the oscilloscope via the AC mains ground (see page 32).

Orderable Accessories

Besides the standard accessories that are shipped with DP0010A/11A/12A/13A probes, replacement and additional accessories are also available that you can order separately as the following accessory kits.

Replacement Accessory Kit (DP0021A-001)

The quantity for each accessory in this replacement kit is the same as the quantity of accessories originally provided with the probe.

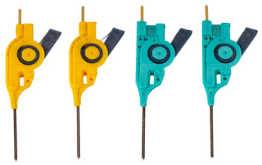
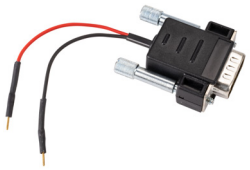
Accessory Included in the Kit	Quantity
Probe Tip Saver	2 pieces
Adjustable Probing Browser	2 pieces
Straight Pin	set of 10 pins
Solder-in Y-lead Tip	2 pieces
Socketed Y-lead Tip	2 pieces
Micro Circuit Hook Test Clips	2 pieces
Ground Lead	1 piece

Ordering Individual Accessories

The following standard accessories can also be ordered individually as additional accessories using the part number mentioned in the table below.

Accessory	Part Number	Quantity
Socketed Y-lead Tip	DP0021A-002	2 pieces
Solder-in Y-lead Tip	DP0021A-003	2 pieces
Micro Circuit Hook Test Clips	DP0021A-004	2 pieces
Adjustable Probing Browser	DP0021A-005	2 pieces
Straight Pin	DP0021A-006	set of 10 pins

Optional Accessories

	Accessory	Part Number	Quantity	Use
	SMT Test Clips	DP0021A-007	2 pieces	To conveniently probe surface mount capacitors
	Micro-grabber Pincer Test Clips	DP0021A-008	4 pieces	To probe miniature IC and components. Attach these clips to the two sockets of the socketed Y-lead tip.
	Automotive Accessory Kit (D-Subminiature 9-Pin (male) to 0.8 mm Pin Tips Adapter)	DP0021A-009	1 piece	To probe automotive differential serial buses such as CAN, CAN FD, and FlexRay,

Deskew and Performance Verification Fixture Kit (DP0020A)

DP0020A Kit	Accessory Included in the Kit	Quantity
	Deskew Fixture	1
	SMA (male) to SMA (male) Adapter	1
	SMA (male) to BNC (female) Adapter	1
	BNC (male) to SMA (male) Adapter	1
	50 Ω SMA Terminator	1

You can use the DP0020A kit to calibrate / deskew or verify the performance of DP0010A/11A/12A/13A probes.

- See "Performing Atten / Offset and Skew Calibration on Infiniium GUI" on page 26.
- See "Performance Verification" on page 47.

CAUTION The DP0020A PV fixture is meant only for deskew and performance verification of your probe. It is not designed for any other testing purpose. This fixture is safely rated to the maximum of 30 Vrms/42 Vpk/60 Vdc. Do not use it on voltages higher than this rating.

2 Characteristics and Specifications

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Electrical Specifications and Characteristics

NOTE All entries included in this chapter are characteristics unless explicitly mentioned as warranted specifications.

These specifications and characteristics are the typical performance values of the DP0010A/11A/12A/13A probes attached directly to a DUT (without any accessories).

Warranted Specification	DP0010A	DP0011A	DP0012A	DP0013A
Probe Bandwidth (-3 dB)	250 MHz	500 MHz	1.0 GHz	1.7 GHz
Input Resistance || Capacitance	1.7 MΩ || 0.9 pF (between inputs) 850 kΩ || 1.5 pF (each side to ground)			

Characteristic	DP0010A	DP0011A	DP0012A	DP0013A
Probe Rise Time (10%-90%)	1.35 ns	715 ps	415 ps	300 ps
Auto Attenuation Ranges *(Automatically selected based on volts/division setting)*	~ 17:1 (at volts/division <= 2 V/div) ~ 85:1 (at volts/division >2 V/div)			
Absolute Max. Input Voltage for Probe and Accessories *(each side to ground)* ⚠	30 V_{RMS}, ±42 V_{PEAK}, or ±60 V_{DC} (mains isolated) [a]			
Max. Differential Measurement Range (DC + AC peak)	±8.4 Volts peak (on 17:1 auto attenuation ranges) ±42 Volts peak (on 85:1 auto attenuation ranges)			
Offset Adjustment Range	±60 V			
Offset accuracy	1% (17:1 attenuation ranges) 1.5% (5:1 attenuation ranges)			
Typical CMRR (dB)				
100 Hz	-70			
1 kHz	-70			
20 kHz	-65			
5 MHz	-30 (17:1attenuation) -25 (85:1 attenuation)			
250 MHz	-30 (17:1attenuation) -25 (85:1 attenuation)			

Characteristic	DP0010A	DP0011A	DP0012A	DP0013A
Noise Referenced to Input (probe only)		14 mV_{RMS} (17:1 attenuation) 38 mV_{RMS} (85:1 attenuation)		
Overvoltage and Measurement Category per IEC -61010-031		Non-CAT (mains isolated) [a]		
Input Coupling of the oscilloscope		50 Ω AutoProbe Interface		
Safety Conformance to		IEC/EN61010-031:2015 CAN/CSA-C22.2 No.61010-031:17		

a Mains isolated is for measurements performed on circuits not directly connected to a mains supply.

NOTE The bandwidth rating applicable for a combination of the probe and accessory is the lower of the bandwidth supported by that probe or accessory.

Environmental Characteristics

Environmental Condition	Operating	Non-Operating
Temperature	+5 °C to +40 °C	-40 °C to +70 °C
Humidity	Up to 80% RH at +40 °C	Up to 90% RH at +65 °C
Altitude	3,100 m (10,171 ft))	4,600 m (15,092 ft)
Pollution Degree	2 [a] (rated for indoor use only)	

a Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

Mechanical Characteristics

Characteristic	Value
Probe Cable Length	1.3 m
Approximate Weight (Including probe with all its standard accessories and the case)	0.48 kg (1.06 lbs.)

Accessories Dimensions

All dimensions are in millimeters.

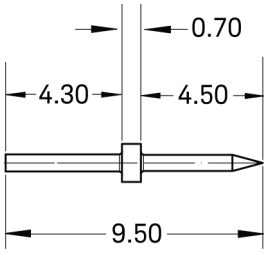

Figure 2 Straight Pin Dimensions

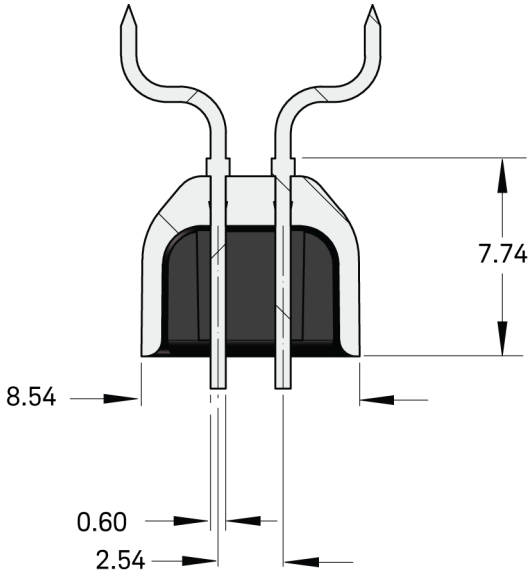

Figure 3 Adjustable Probing Browser Dimensions

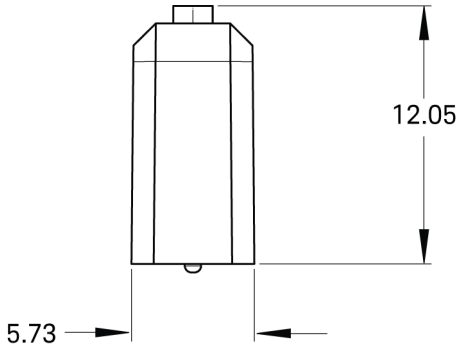

Figure 4 Probe Tip Saver Dimensions

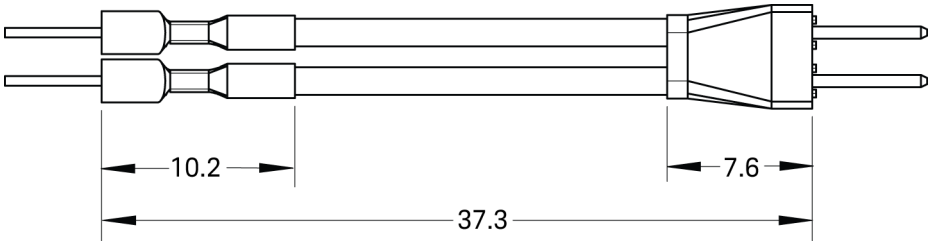

Figure 5 Solder-in Y-lead Tip Dimensions

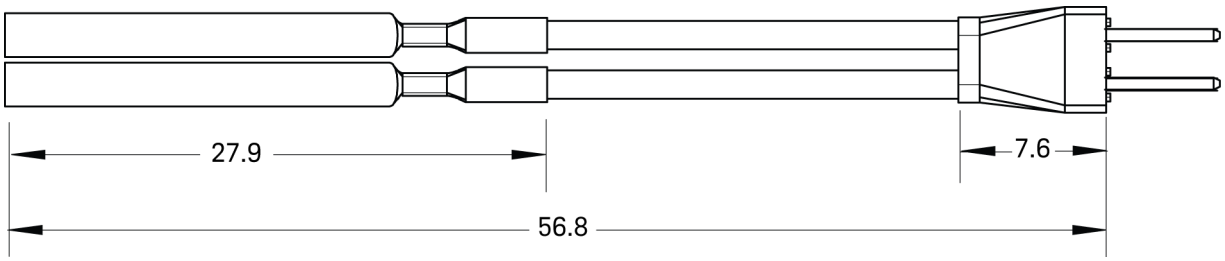

Figure 6 Socketed Y-lead Tip Dimensions

Figure 7 Ground Lead Dimensions

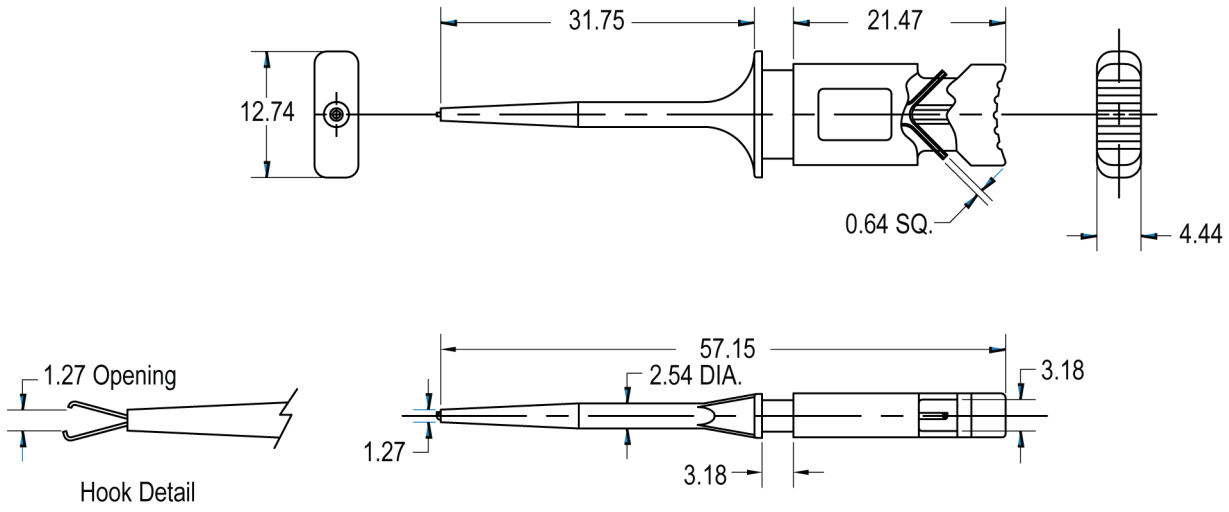

Figure 8 Micro Circuit Hook Test Clip Dimensions

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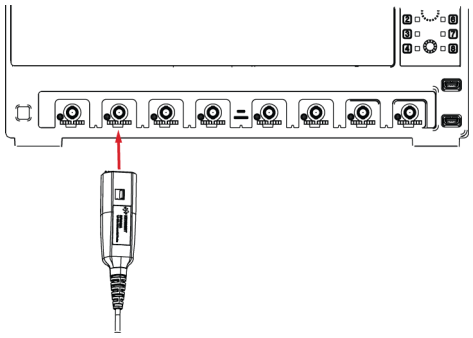
CAUTION

These probes are ESD sensitive devices, particularly at the probe tip. Follow standard ESD precautions when handling these.

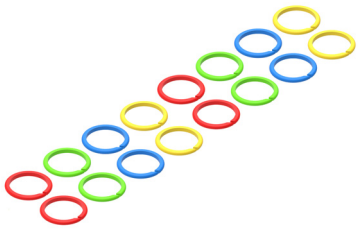
Connecting the Probe to an Oscilloscope

NOTE These probes are designed for ground-referenced measurements. Connect the probe to the oscilloscope input before performing any measurements.

1 Connect the probe to an input channel of a compatible Keysight oscilloscope by gently pushing the probe onto the connector on the oscilloscope's input channel. As the probe is pushed, the lever on top of the probe moves to the left. When the probe is fully seated, the lever returns to the locked position.



Using Channel Identification Rings



When multiple probes are connected to the oscilloscope, you can quickly identify which probe is connected to each oscilloscope channel by using the supplied channel identification rings.

Place rings of the same color on each end of the probe's cable.

Using these rings ensures that you can pick up a probe and immediately know which channel it is connected to without having to track the cable back to the oscilloscope's channel input.

Configuring Probe Settings on the Oscilloscope Software GUI

When you connect your probe to the oscilloscope, the probe is automatically detected and displayed as connected to the oscilloscope's channel in the Infiniium/InfiniiVision software GUI.

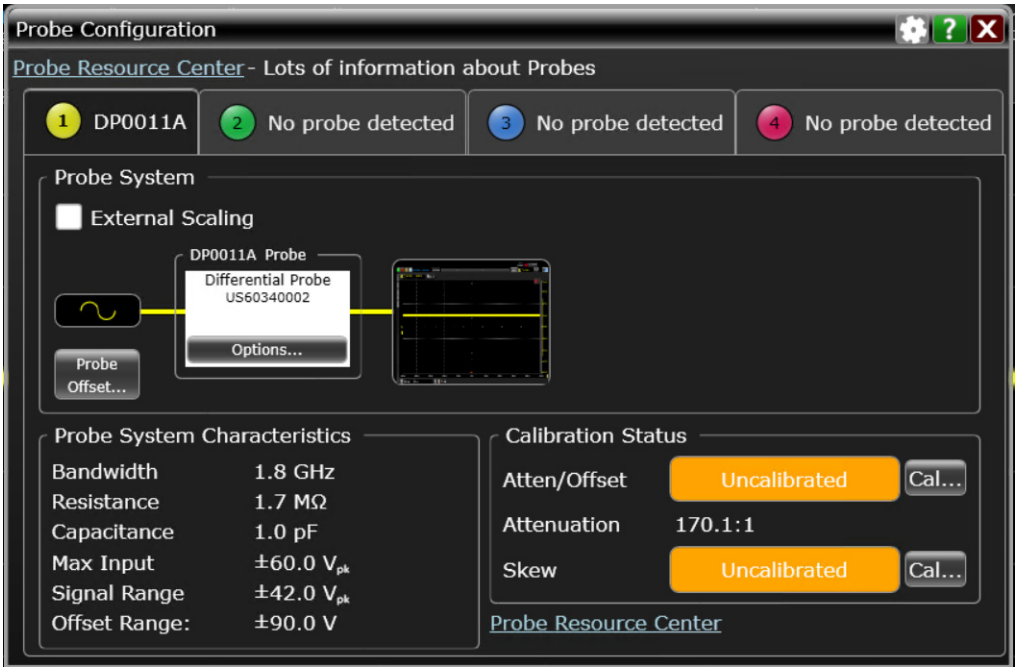


Figure 9 DP0011A probe auto-detected on the Infiniium GUI

Perform the following tasks on your oscilloscope's software GUI to get accurate measurement results.

- Configure offset behavior
- Calibrate your probe

Configuring Offset Behavior

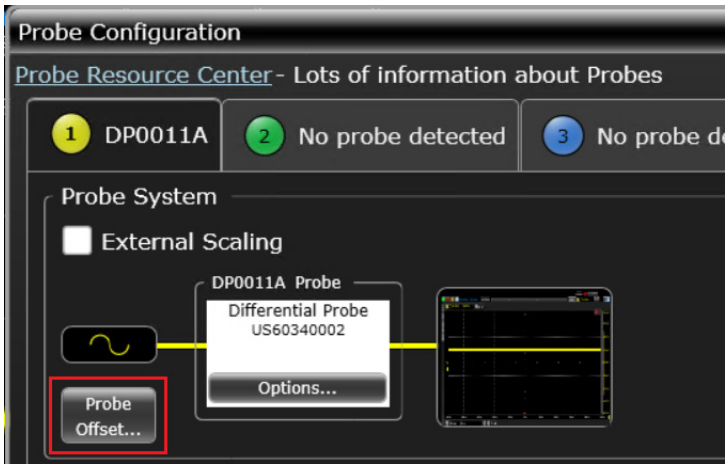
You can configure the offset behavior to ensure that you get the maximum performance and dynamic range from your probe. By applying an offset, most or all of the DC component can be subtracted and the signal can be positioned to better utilize the input's available dynamic range.

The two offset behavior options are described and compared in the table below.

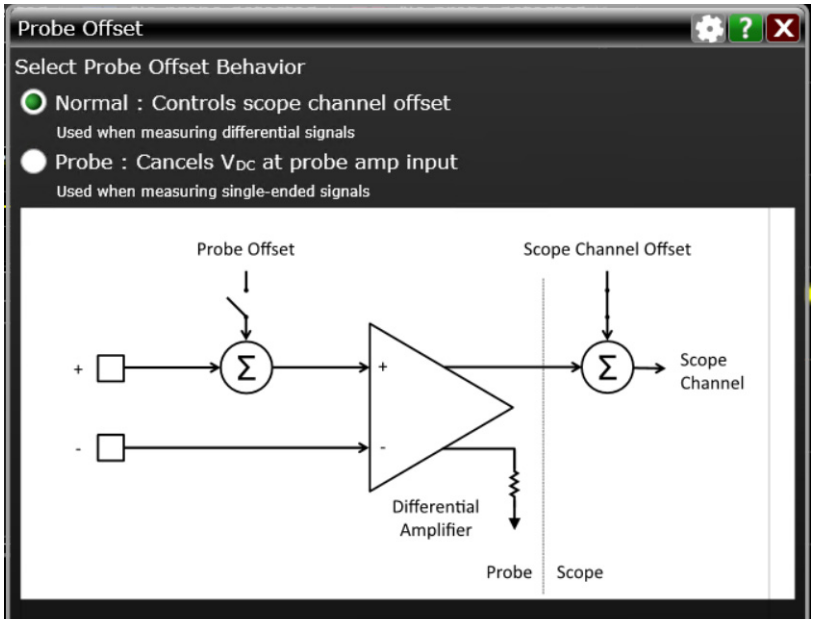
Normal Offset	Probe Offset
Offset is applied at the oscilloscope channel. The vertical offset control on the oscilloscope's front-panel controls the channel's offset.	Offset is applied at the probe. The vertical offset control on the oscilloscope's front-panel controls the probe offset.
Used when measuring differential signals	Used when measuring single-ended signals
Probe offset is not used and set to zero.	Channel offset is not used and set to zero.

On Infiniium GUI

1 Click the **Probe Offset... / Normal Offset..**.option in the **Probe System** section.

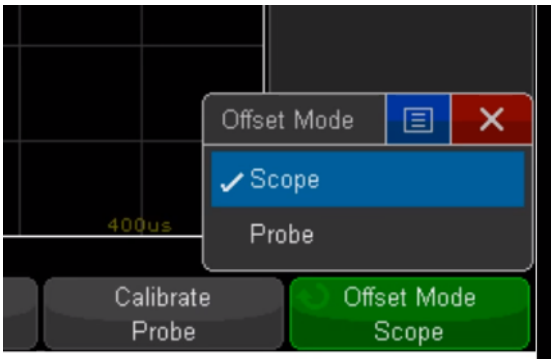


2 In the **Probe Offset** dialog box, choose the offset behavior option based on your choice of differential or single-ended measurement.



On InfiniiVision GUI

1 Press the **Offset Mode** softkey to display the offset mode options and then select the offset mode based on your measurement requirement.



Calibrating your Probe

To get the highest measurement accuracy, you must calibrate your probe before you start using it.

Calibration Overview

The following two types of calibrations are available for DP0010A/11A/12A/13A probes.

	Atten/Offset Calibration	Skew Calibration
Purpose	Adjustment of probe attenuation and probe offset. Removes any attenuation or offset errors caused by a probe.	Removes any timing delays caused by a probe.
When to perform	▪ Calibrate your probe when using it for the first time on a channel input of the oscilloscope. The probe's calibration information is then retained for that channel even when the oscilloscope is rebooted or when the probe is removed/reconnected to that channel. ▪ After the initial calibration, it is recommended to perform calibration regularly (several times a year). Calibrate the probe before making any critical measurements. ▪ Also, calibrate when the oscilloscope's calibration Δ Temp is not within ±5 °C.	

Sequence of Calibration

1 Atten/Offset calibration

2 Skew calibration

Before You Start Calibration

- Verify that the Infiniium oscilloscope has been calibrated. This information is available in the Infiniium Calibration dialog box (**Utilities** > **Calibration...**). If the oscilloscope has not been calibrated recently, calibrate the oscilloscope before calibrating the probe.
- Verify that the calibration Δ temperature is within ±5 °C. If this is not the case, calibrate the oscilloscope before calibrating the probe.
- Allow the oscilloscope and probe to warm up for 15 minutes before starting the calibration procedure.
- Make sure the probe is not connected to any signals.

Performing Atten / Offset and Skew Calibration on Infiniium GUI

On the Infiniium GUI, the probe calibration and deskew is a guided procedure that you initiate from the oscilloscope's **Probe Calibration** dialog box.

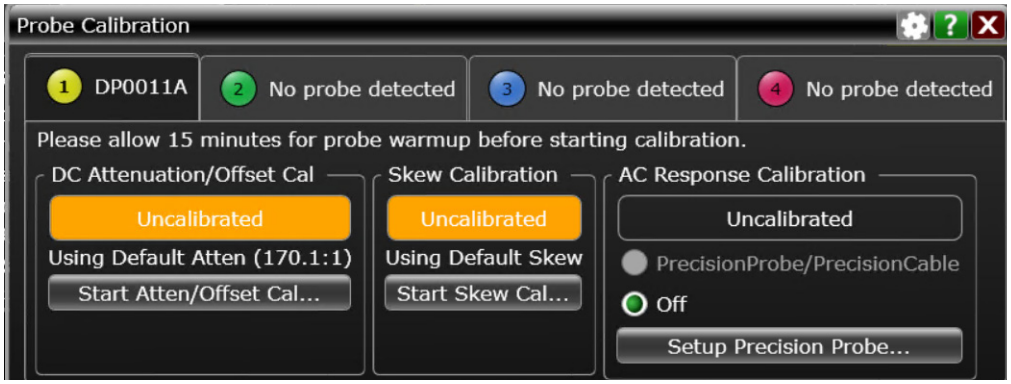
Required Accessories

Accessory	Usage
DP0020A PV/Deskew Fixture Kit	To calibrate and verify the performance of the probe
N2787A Probe Positioner (Recommended)	To hold the probe in place during the procedure

To perform calibration

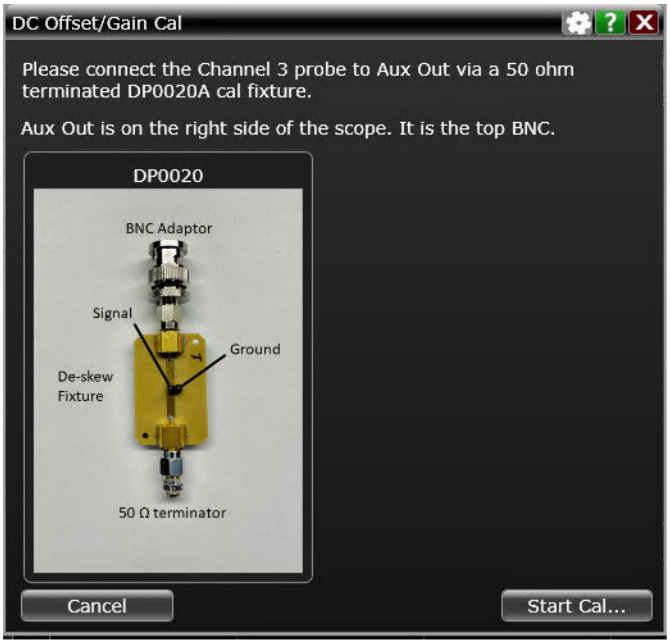
1 Connect the DP001xA probe to any available oscilloscope channel.

2 On the oscilloscope menu, click **Setup** > **Probe Calibration** to access the Probe Calibration dialog box.



3 Click the **Start Atten/Offset Cal...** button to initiate the Atten/offset calibration.

The **DC Offset/Gain Cal** dialog box is displayed with the calibration setup instructions. Verify that your probing setup is as per these instructions. These instructions require the usage of the DP0020A deskew fixture which is described in the next step.



4 To use the DP0020A deskew fixture:

a Connect the 50 Ω terminator to the DP0020A fixture's output. This terminator is provided with the fixture.

b Connect the DP0020A fixture's input to the **Aux Out** connector on the oscilloscope. Use the BNC adapter provided with the fixture.

c Turn the nut on the Aux Out connector counter-clockwise to tighten. While holding the fixture upright with one hand, use an 8 in. lbs. torque wrench to fully tighten the connector.

d Connect the probe to the header pins preinstalled on the deskew fixture.

- Either connect the probe tip directly to the header pins on the fixture.
- Or make this connection using the probe accessory that you intend to use in your probing setup.

Connect the positive lead of the probe tip to the header pin located on the center conductor of the deskew fixture.

Connect the negative lead of the probe tip to the header pin located on the ground plane of the deskew fixture.

These are shown in the figure below.

e Use the N2787A 3D Probe Positioner to hold the probe in place and to maintain a steady contact of probe tip with the deskew fixture.

CAUTION To avoid damaging the oscilloscope's Aux Out connector, do not apply force to the PV fixture. Light probe contact is all that is needed for the calibration.

NOTE You can verify whether or not the probe tip is correctly connected to the deskew fixture by pressing the oscilloscope's autoscale button. If a stable step is displayed on screen, it indicates a good connection. You will need to re-open the Probe Calibration dialog box after performing this verification step.

5 Once the probe is properly connected to the deskew fixture, click the **Start Cal...** button to begin the DC gain/offset calibration.

Similarly, perform the skew calibration once the Atten/offset calibration is successfully done. Use the **Start Skew Cal..**. button in the Probe Calibration dialog box to initiate skew calibration.

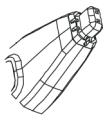
Making DUT Connections using Probe Accessories

You can connect your probe to the DUT using appropriate accessories that suit your specific probing and DUT connectivity requirements.
This section provides information on the recommended DUT connectivity options available for these probes using the supplied and orderable accessories.

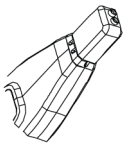
NOTE Gently press the probing accessory into the probe's tip until fully seated. The label on the probe tip indicate the probe's positive and negative leads.

DUT Connectivity Options

Option 1: Using Probe Tip Directly



Without Probe Tip Saver

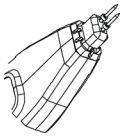


With Probe Tip Saver

The probe tip's sockets can fit 0.64 mm (0.025 inch) header pins with 0.100 inch pitch. You can connect the probe tip directly to header pins on DUT.

NOTE When connecting the probe tip directly to DUT header pins, you can also use the probe tip saver supplied with the probe. The probe tip saver helps in preventing damage to the probe tip due to repeated connections and disconnections. Its use is recommended if you expect to make more than 1000 cycles of connect/disconnect.

Option 2: Using Straight Pins



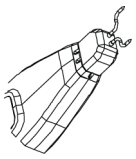
To attach a pin, gently press the ridge end of the pin into the probe's tip until it is fully seated.

To remove a pin, gently pull the pin straight off the probe tip.

Do not apply excessive force when attaching or detaching the pin.

These straight pins can be used to probe components with 0.100 inch pitch.

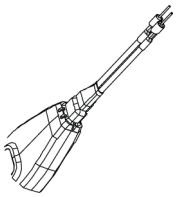
Option 3: Using Adjustable Probing Browser



This accessory has variable pitch pins to allow you to quickly probe different points on your DUT. You can adjust the spacing between these pins to span up to 8.6 mm.

Gently rotate the pins of this accessory to adjust the tip span as per your requirement.

Option 4: Using Solder-in Y-lead Tip



This accessory allows you to extend the reach of the probe with a solder-in probing option.

1. Solder the leads of this accessory to the test points.

2 Insert the soldered Y-lead tip into the probe tip.

See page 17 for Solder-in Y-lead Tip dimensions.

Option 5: Using Socketed Y-lead Tip

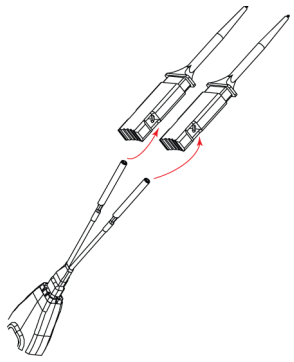
This accessory allows you to extend the reach of the probe. You can use it to:

- either connect directly to 0.8 mm round pins or 0.64 mm square pins on the test board.

- or connect to the standard/optional test clip accessories available for DP001xA probes.

See page 17 for Socketed Y-lead Tip dimensions.

Option 6 - Using Micro Circuit Hook Test Clips

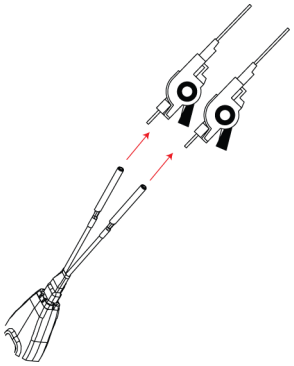


Use the red and black Micro Circuit Hook Test Clips along with the Socketed Y-lead Tip to connect to miniature IC and components on test board.

1. Connect the red test clip to the red lead of the Socketed Y-lead Tip and the black test clip to the black lead of the Socketed Y-lead Tip.
2. Push the back of the Micro Circuit Hook Test Clips to extend their hooks.
3. Use hooks to grab the circuit component to be probed.

See page 17 for Micro Circuit Hook Test Clips dimensions.

Option 7 - Using Micro-grabber Pincer Test Clips



Use the Micro-grabber Pincer Test Clips along with the Socketed Y-lead Tip to connect to miniature IC and components on test board.

1. Connect the Micro Grabber Pincer Test Clips to the leads of the Socketed Y-lead Tip.
2. Squeeze the lever on the micro grabber clips to extend their grasping jaws.
3. Use the jaws to grab the circuit component to be probed.

Option 8 - Using SMT Test Clips

Use the SMT test clips along with the Socketed Y-lead Tip for convenient hands-free probing of surface mount capacitors.

Probing Ungrounded Devices

If the DUT is not grounded to the oscilloscope via the AC mains ground, you must establish the ground connection by connecting the DUT ground to the probe ground. An example of such a situation is when you are making a differential measurement on a device with floating ground.

To make the ground connection, use the ground lead accessory supplied with the probe.

1. Connect the ground lead to the ground connection on the probe.
2. Connect the socket end of the ground lead to DUT's header pin.

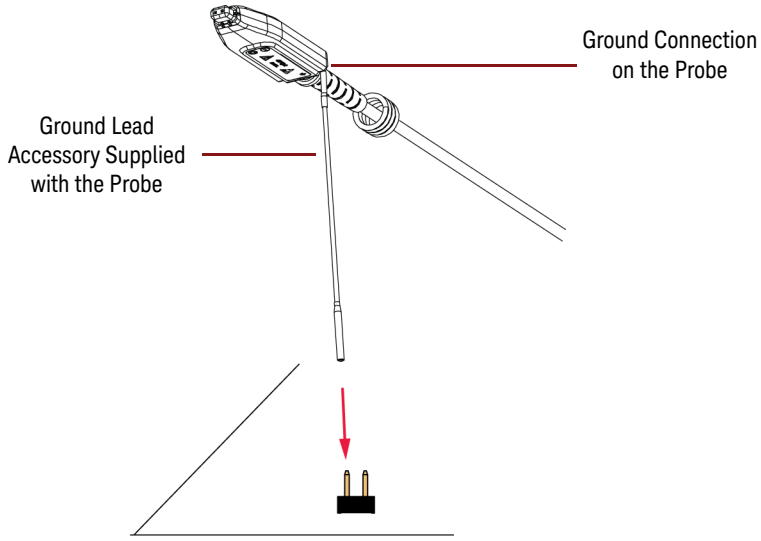


Figure 10 Connecting DUT Ground to Probe Ground

Probing Setup for Single-Ended Measurements

DP0010A/11A/12A/13A probes are differential and are best suited to probe not just differential but also single-ended signals.

To probe single-ended signals:

- Connect the probe's "+" lead to the single-ended signal.
- Connect the probe's "–" lead to ground.
- Select **Probe Offset** as the offset behavior to be used. The offset is then applied at the probe to preserve dynamic range. It is added to or subtracted from the positive leg of the probe to bring the signal within the probe's dynamic range. This method of applying probe offset allows the full benefits of differential probing for single-ended signals without sacrificing offset range.

4 Safety and Regulatory Information

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Instrument Markings and Symbols 36
Cleaning the Probe 38

Safety Checks and Warnings

These products have been designed and tested in accordance with accepted industry standards, and have been supplied in a safe condition. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain these products in a safe condition.

WARNING **If the probe assembly is used in a manner not specified by the manufacturer, the protection provided by it may be impaired.**

WARNING **Observe Probe Voltage Ratings.**

Do not apply any electrical potential to the probe input that exceeds the maximum rating of the probe. See page 14 for maximum input voltage ratings.
These probe assemblies are NOT intended for measurements on mains circuits (CAT II, CAT III, and CAT IV).

WARNING **Periodically inspect the probe wires and cables. Do not operate with visible/suspected damage. If you suspect a damage, have it inspected by a Keysight authorized service personnel.**

WARNING **Do not install substitute parts or perform any unauthorized modification to the probe / accessory.**
Do not attempt internal service or adjustment. Service should be carried out by a Keysight Technologies authorized service personnel. For any service needs, contact Keysight Technologies. See page 60 to know more.

WARNING **Must be Grounded**
Probe must be fully connected to the oscilloscope prior to connection to the device under test. The oscilloscope must be properly grounded.
Probe must be disconnected from the device under test prior to disconnecting from the oscilloscope.

WARNING **Indoor Use Only.**
Do not operate in wet/damp environments. Keep product surfaces dry and clean.

WARNING **Do not operate the probe or oscilloscope in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.**

CAUTION Do not twist, tightly bend, or kink the probe cable to avoid degrading the probe's performance.

CAUTION This probe is to carry out differential measurements between two points on the circuit under test. This probe is not for electrically insulating the circuit under test and the measuring instrument.

CAUTION Handle Probe Tips and Accessories Carefully.

Some of the probe tips and accessories are sharp. You should handle these with care to avoid personal injury.

Instrument Markings and Symbols

Symbol	Description
	This symbol indicates the Environmental Protection Use Period (EPUP) for the product's toxic substances for the China RoHS requirements.
	The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by the EU DIRECTIVE and other National legislation. Please refer to keysight.com/go/takeback to understand your Trade in options with Keysight in addition to product takeback instructions.
	The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.
 ccr.keysight@keysight.com	The CE mark is a registered trademark of the European Community. ISM GRP 1-A denotes the instrument is an Industrial Scientific and Medical Group 1 Class A product. ICES/NMB-001 indicates product compliance with the Canadian Interference-Causing Equipment Standard.
MAINS ISOLATED	IEC Measurement Category MAINS ISOLATED is for measurements performed on circuits not directly connected to mains.
	KC certification mark to demonstrate compliance with the South Korean EMC requirements. South Korean Class A EMC declaration: This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.
	A registered trademark of the Spectrum Management Agency of Australia. This signifies compliance with the Australia EMC Framework regulations under the terms of the Radio Communication Act of 1992.

Symbol	Description
UK CA	This mark denotes compliance with the essential requirements of the following applicable UK regulations: ▪ Electromagnetic Compatibility Regulations 2016 No. 1091 (as amended) ▪ Electrical Equipment (Safety) Regulations 2016 No. 1101 (as amended) ▪ The Restriction of the Use of Certain Hazardous Substances in electrical & Electronic Equipment Regulations 2012 No. 3032 (as amended)

Cleaning the Probe

If the probe requires cleaning:

1. Disconnect the probe from the oscilloscope and device under test.
2. Wipe it with a soft cloth dampened with mild soap and water solution. Do not use too much liquid or any chemicals.
3. Make sure the probe is completely dry before reconnecting it to the oscilloscope.

5 Performance Plots

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Common Mode Rejection Ratio over Frequency 42
Frequency Response 43
- Low Attenuation Frequency Response (without probing accessories) 43
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Measured Versus Modeled Input Impedance

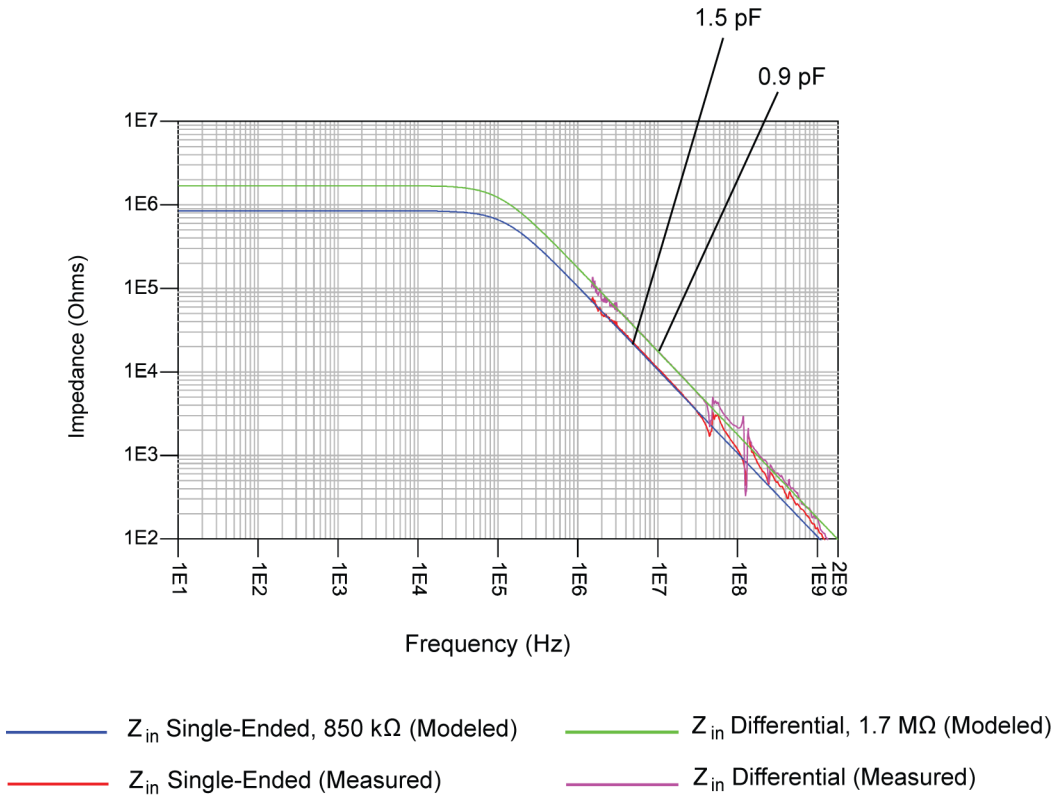

Figure 11 Magnitude plot of DP001xA probe input impedance versus frequency (differential & single-ended)

Voltage Derating Curve

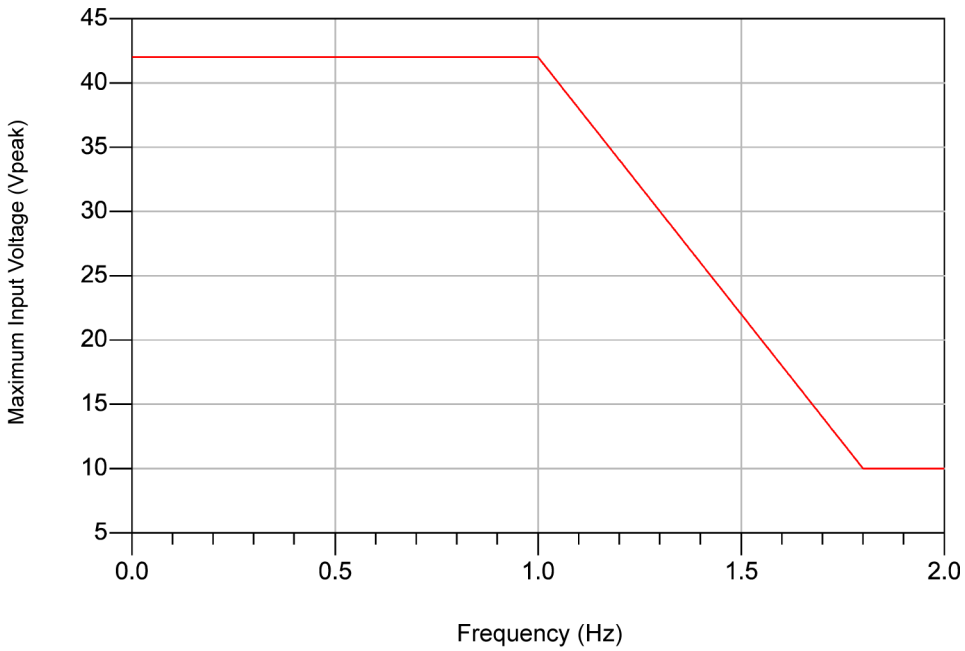

Figure 12 Non destructive voltage derating with frequency for DP001xA probes

Common Mode Rejection Ratio over Frequency

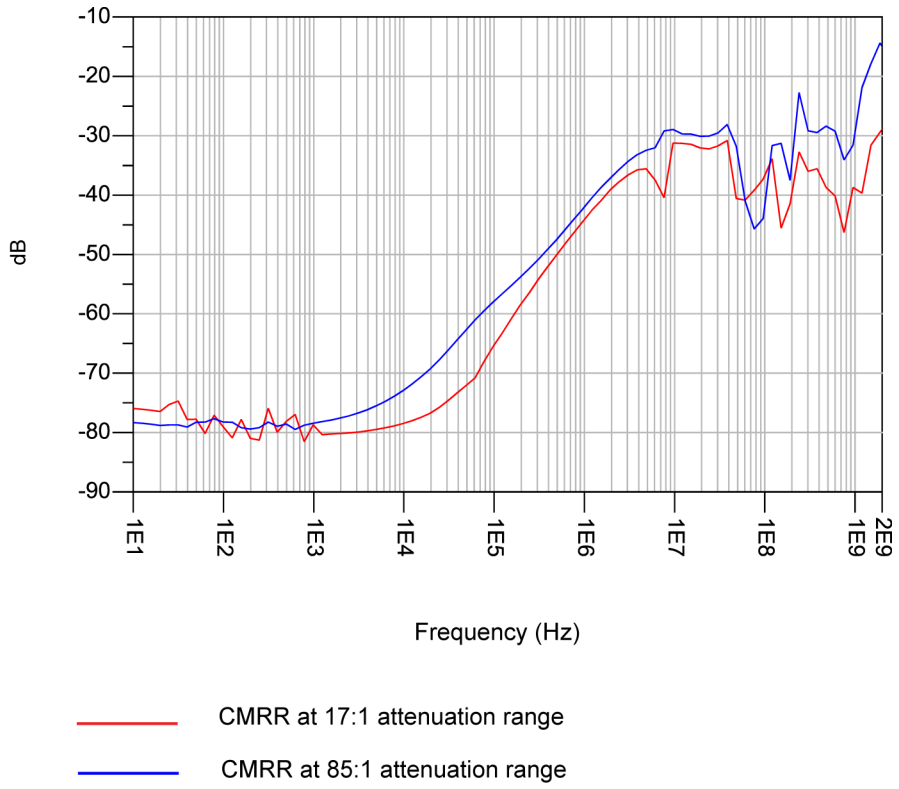

Figure 13 CMRR plots of DP001xA probes at the two supported attenuation ranges (17:1 and 85:1)

Frequency Response

Low Attenuation Frequency Response (without probing accessories)

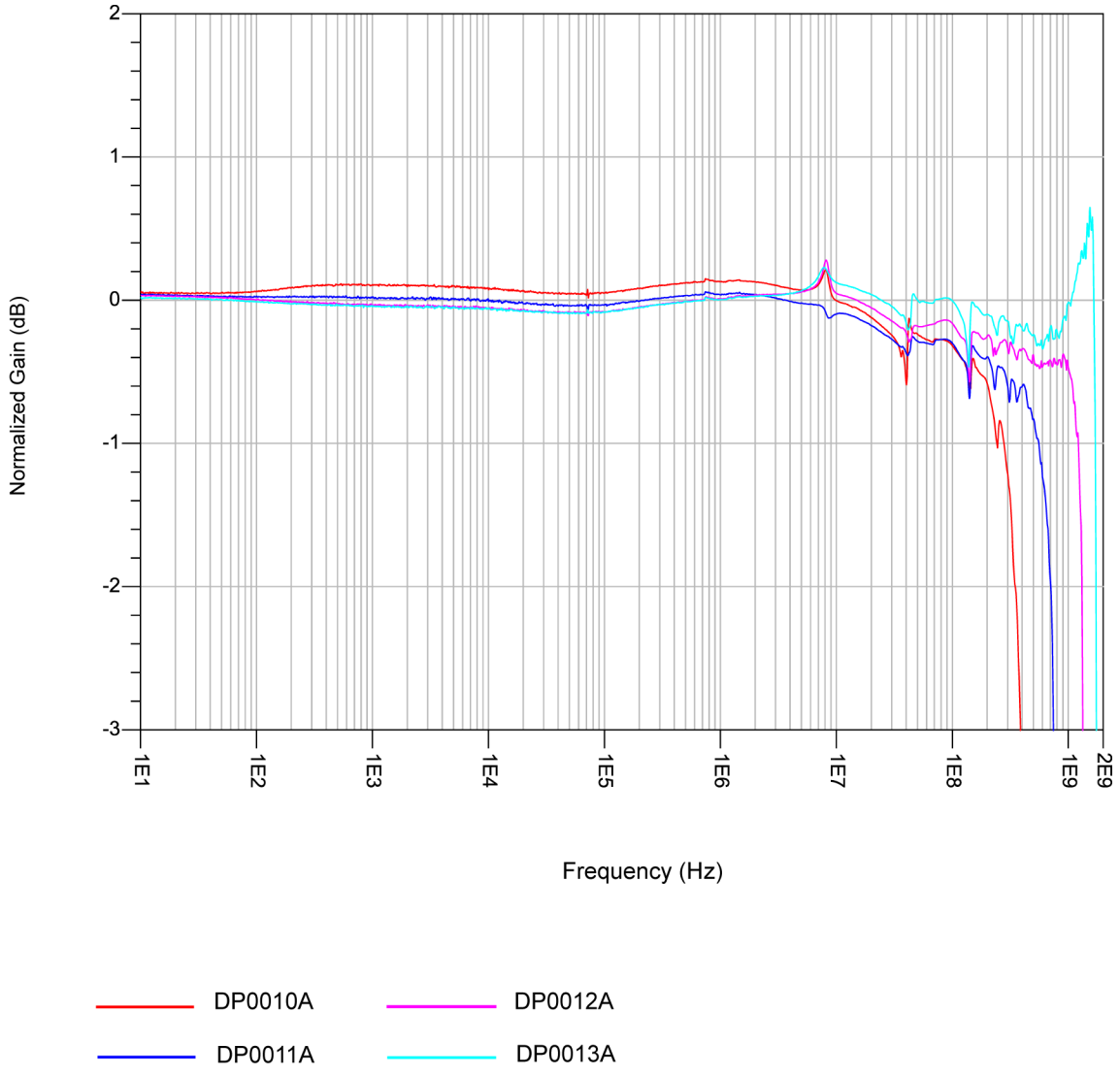

Figure 14 Vout/Vin frequency response of DP001xA probes (without probing accessories) on low attenuation ranges

High Attenuation Frequency Response (without probing accessories)

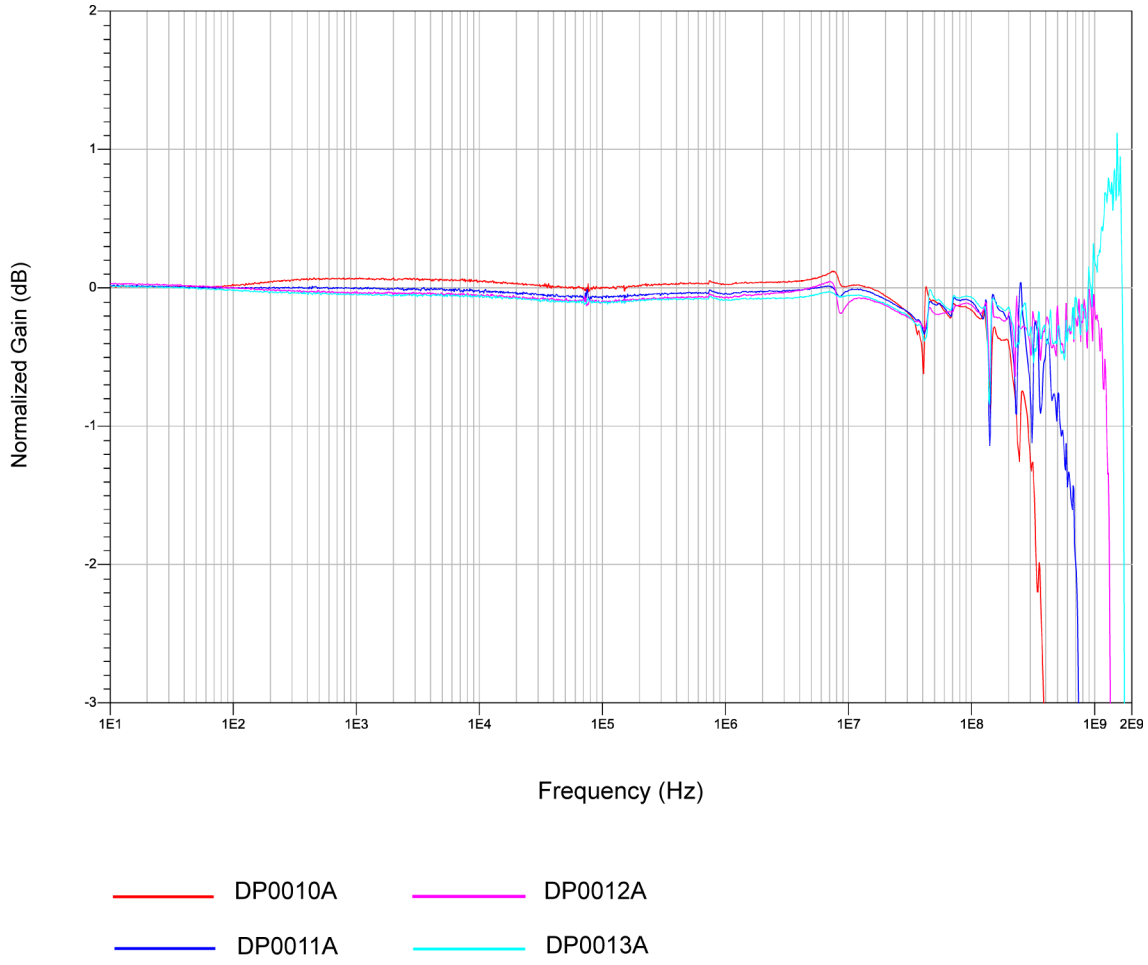

Figure 15 Vout/Vin frequency response of DP001xA probes (without probing accessories) on high attenuation ranges

Frequency Response (with Adjustable Probing Browser Accessory)

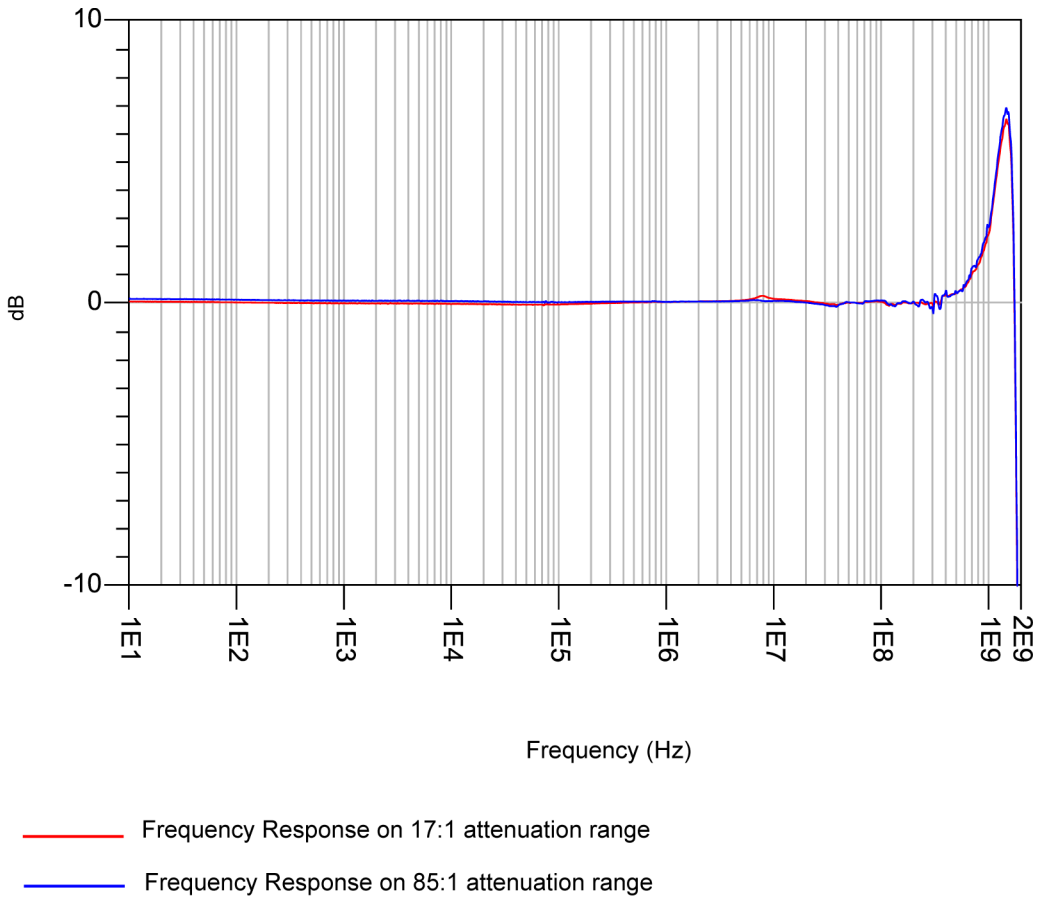

Figure 16 Vout/Vin frequency response of DP0013A probe (with Adjustable Probing Browser accessory) on high and low attenuation ranges

6 Performance Verification

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To Verify Bandwidth 49
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To Verify Input Resistance 55
Required Test Equipment 55
Procedure 55

This chapter describes how to verify the bandwidth and input resistance of your DP0010A/11A/12A/13A probe.

Before you Start

CAUTION Electrostatic discharge (ESD) can quickly and imperceptibly damage or destroy high performance probes, resulting in costly repairs. Always wear a wrist strap when handling probe components and ensure that cables are discharged before being connected.

NOTE Allow the probe to warm up for at least 20 minutes before the initiating the performance verification procedure.

Recommended Test Interval

The recommended test interval is 1 year.

To Verify Bandwidth

The following procedure can be used to test and verify that your probe meets its warranted bandwidth specification.

Probe	Warranted Specification	
DP0010A/11A/12A/13A	Bandwidth	DP0010A - 250 MHz DP0011A - 500 MHz DP0012A - 1 GHz DP0013A - 1.7 GHz

Required Test Equipment

Description	Critical Specification(s)	Recommended Models / Part Numbers and Adapters	Purpose
Oscilloscope	Infiniium oscilloscope with AutoProbe I or Infiniium oscilloscope with an adapter to AutoProbe I ▪ Minimum BW 4 GHz ▪ Minimum sample rate 16 G Samples/sec	See page 8 for the complete list of compatible oscilloscopes.	To display probe output
SMA or 2.92 mm male to male cable		N2823A coaxial phase-matched cable	To connect pulse generator to PV fixture
Deskew and Performance Verification Fixture		DP0020A Kit	To connect the probe to pulse generator and oscilloscope
Pulse Generator	2 V step with 10% to 90% transition time of less than 90 ps	Keysight 81133A or 81134A	To provide frequency content to determine BW of probe
Torque Wrench	5/16 in opening	8710-1765	To tighten SMA connectors
Open End Wrench	9/32 in opening		To hold the connector on PV fixture while tightening adapters to it

Procedure

1 Make connections as described in the following steps.

a Connect the DP0020A PV fixture to any oscilloscope channel using the SMA to BNC adapter included in the DP0020A PV kit. The channel to which the PV fixture is connected is referred to as the PV channel in this procedure.

b Connect the other end of the DP0020A PV fixture to a SMA cable using the other SMA to BNC adapter included in the DP0020A PV kit.

c Connect the other end of the SMA cable to Channel 1 output of the pulse

generator.

d Connect the DP001xA probe to any available channel of the oscilloscope. This channel is referred to as the probe channel in this procedure.

e Connect the probe input directly to the header pins on the PV fixture.

2 Configure the oscilloscope as per the following settings:

a Select **Setup** > **Factory Default** and then answer **Yes** to return the oscilloscope to a known state.

b Select **Setup** > **Acquisition** to access the **Acquisition** dialog box. In this dialog box:

- select the **Enabled** checkbox for **Averaging** with **# of Averages** as **16**.
- set the **Sampling Rate** to **16 G Samples/Sec**.

c Select **Setup** > **Horizontal...** and set the reference point to **Center** to position the trigger point midlevel on the PV channel.

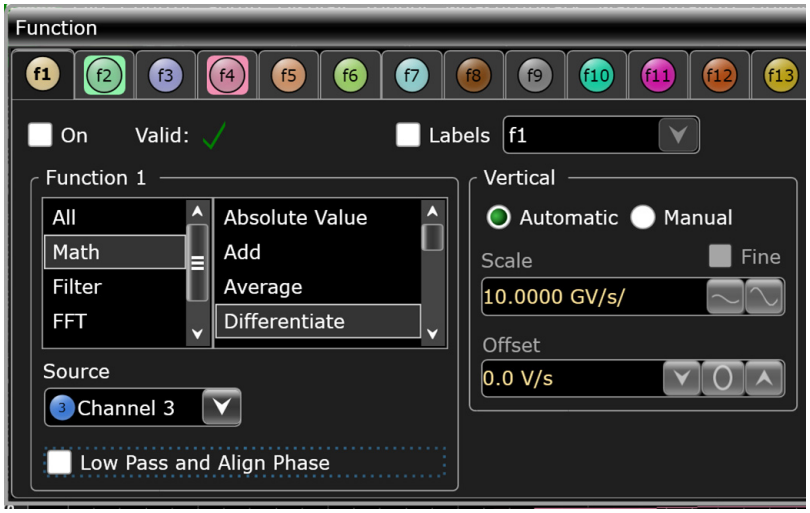
d Set the PV channel to **50 Ω** input.

e Click **Math** > **Functions....**

f In the **Function** dialog box, define the functions f1, f2, f3, and f4 as follows:

On tab f1

1. From the **Function 1** listbox, select **Math** and then **Differentiate**.
2. Deselect the **Low Pass and Align Phase** checkbox.
3. From the **Source** drop-down listbox, set the source to your PV Channel.
   In this example, the PV channel is Channel 3.
4. Do not select the **On** checkbox for f1.



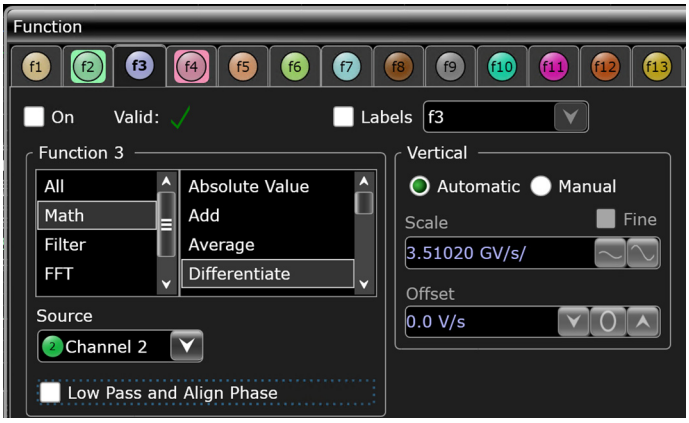
On tab f2

1. From the **Function 2** listbox, select **FFT** and then **FFT Magnitude**.
2. Turn the function display on for f2 by selecting the **On** checkbox.
3. From the **Source** drop-down listbox, set the source to **f1:Diff(Ch3)**.
4. From the **Window** listbox, select **Rectangular**
5. In the **Vertical** group box, set the **Scale** to **3 dBm/** and the **Reference Level** to **185 dBm**.
6. In the **Horizontal** group box, set the **Horizontal Scale** to **Linear**, **Span** to **2 GHz**, **Center Frequency** to **1 GHz**, and the **RBW** to **50 MHz**.

On tab f3

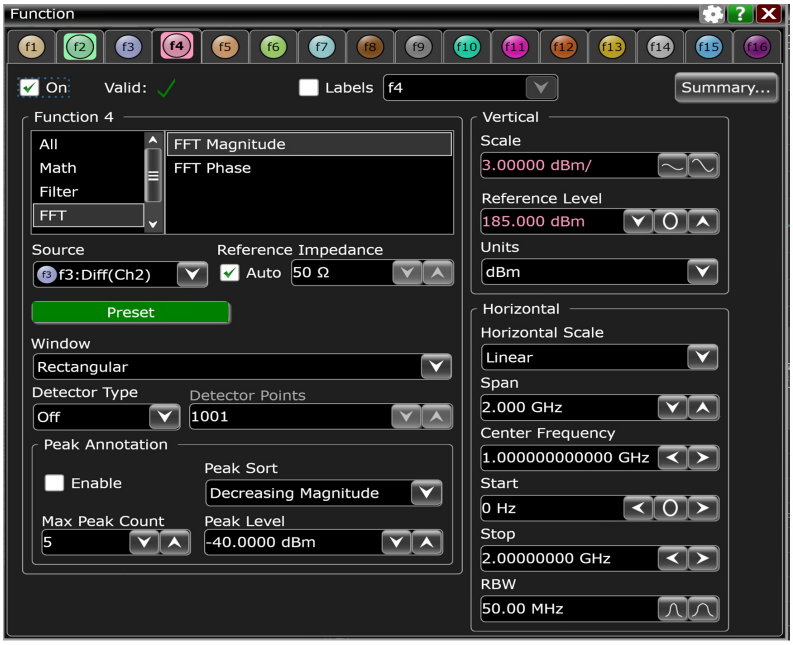
1. From the **Function 3** listbox, select **Math** and then **Differentiate**.
2. Deselect the **Low Pass and Align Phase** checkbox.
3. From the **Source** drop-down listbox, set the source to your probe Channel.
   In this example, the probe channel is Channel 2.
4. Do not select the **On** checkbox for f1.

On tab f3



On tab f4

1. From the **Function 4** listbox, select **FFT** and then **FFT Magnitude**.
2. Turn the function display on for f4 by selecting the **On** checkbox.
3. From the **Source** drop-down listbox, set the source to **f3:Diff(Ch2)**.
4. From the **Window** listbox, select **Rectangular**
5. In the **Vertical** group box, set the **Scale** to **3 dBm/** and the **Reference Level** to **185 dBm**.
6. In the **Horizontal** group box, set the **Horizontal Scale** to **Linear**, **Span** to **2 GHz**, **Center Frequency** to **1 GHz**, and the **RBW** to **50 MHz**.

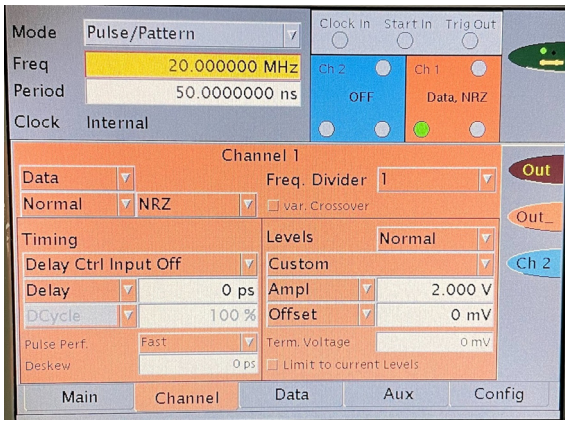


g Close the **Function** dialog box.

3 Configure the Pulse Generator as follows:

Settings should be:
- Channel 1
- Data
- Mode = Pulse/Pattern
- Freq = 20 MHz
- Ampl = 2 V
- Offset = 0 mV

Then Press the button next to **Out**.



4 Click **Setup** > **<probe channel>** and set the scale for the probe channel to **2 V/Div** (Low Attenuation setting). In this example, probe channel is **Channel 2**. Then close the dialog box.

5 Set up Display as follows.

a Move both math traces to the same grid by dragging the bottom trace into the top grid.

b Press the 'X' in the middle of the bottom Frequency Domain grid that is now empty.

c Align the waveforms' scales and reference position back to **3 dBm/** and **185 dBm**.

6 Click **Control** > **Clear Display** to clear the oscilloscope display.

7 Use Marker to evaluate the results.

a To add a marker, choose **Measure/Mark** > **Add Markers...**

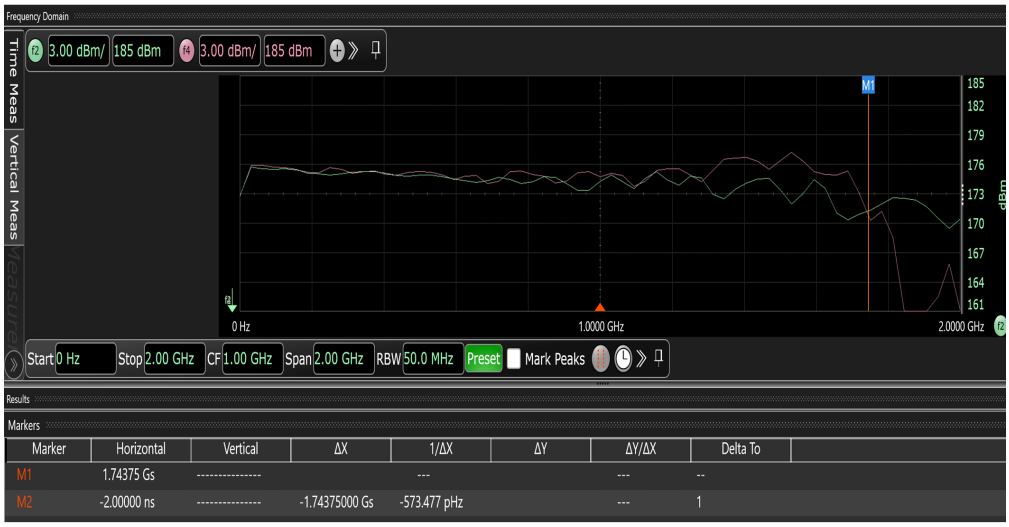
b Choose **Manual (X only)** option from the **Mode** listbox to add a pair of horizontal markers that can be moved freely.

c Select **f4:FFTM(f3)** from the **Source 1** listbox and **f2:FFTM(f1)** from the **Source 2** listbox. These are the waveforms that you want to associate with the markers.

d Press **OK** to close the Add Marker dialog box.

e Move Marker M1 until f4 crosses f2.

f Record the Horizontal Marker value. This represents the -3dB BW of the probe in the low attenuation state. In the example below, it is 1.77 GHz.



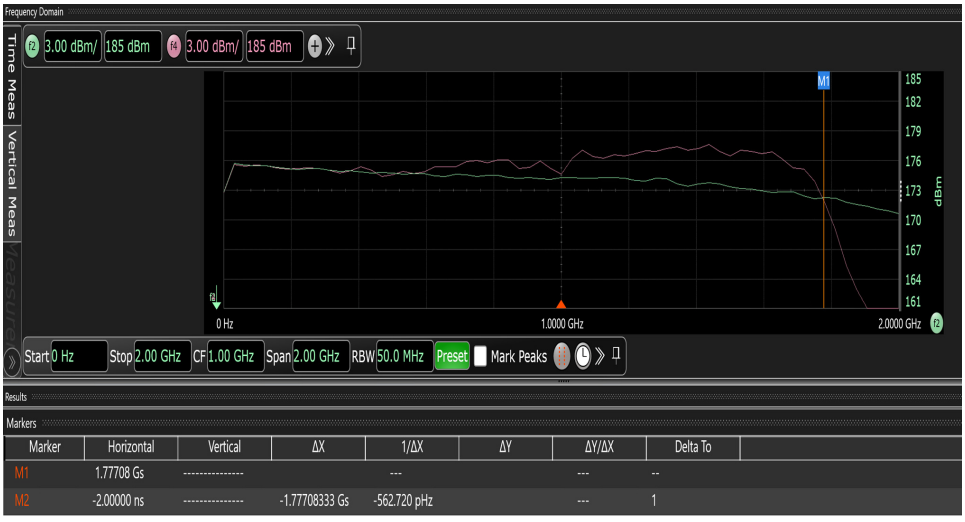
8 Click **Setup** > **<probe channel>** and set the scale for the probe channel to **2.5 V/Div**. In this example, probe channel is **Channel 2**. Then close the dialog box.

9 Click **Control** > **Clear Display** to clear the oscilloscope display.

10 Use Marker to evaluate the results.

a The marker (M1 in this case) should still be on screen. Slide it to the new crossing point of f4 and f2.

b Record the Horizontal Marker value. This represents the -3 dB BW of the probe in the low attenuation state. In the example below, it is 1.78 GHz.



11 Confirm that the measured bandwidth is above the rated bandwidth for your probe model.

To Verify Input Resistance

The following procedure can be used to test and verify that your probe meets its warranted input resistance specification.

Probe	Warranted Specification	
DP0010A/11A/12A/13A	Input Resistance	1.7 MΩ Differential 850 kΩ Single-ended

Required Test Equipment

Description	Critical Specification(s)	Recommended Models / Part Numbers and Adapters	Purpose
Oscilloscope	Infiniium oscilloscope with AutoProbe I or Infiniium oscilloscope with an adapter to AutoProbe I	See page 8 for the complete list of compatible oscilloscopes.	To display probe output
DMM		Keysight 34450A	To measure Impedance
Deskew and Performance Verification Fixture		DP0020A Kit	To connect the probe to DMM
BNC to Banana Adapter		Pomona 1270 or equivalent	To connect PV fixture to DMM

Procedure

1 Make connections as described in the following steps.

   a Connect the DP0020A PV fixture to SMA to BNC adapter. The SMA to BNC adapter is included in the DP0020A PV kit.

   b Connect the SMA to BNC adapter to the BNC to Banana adapter.

   c Ensure that the other SMA port of the DP0020A PV fixture is open.

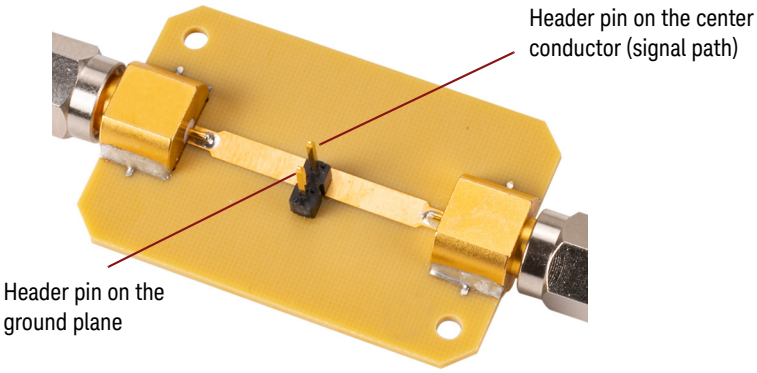
   d Connect banana pins of the BNC to Banana adapter to **V Ω input** terminal and **LO** terminal on the front panel of DMM. *(The GND pin of the BNC to Banana adapter connects to the LO terminal.)*

   e Press the **Ω 2W 4W** button on the front panel of DMM.

f Connect the DP001xA probe to any available channel of the oscilloscope.

g Connect the DP001xA probe's input directly to the header pins on the PV fixture.

- Connect the "+" lead of the probe tip to the header pin located on the center conductor (signal trace) of the deskew fixture.
- Connect the "-" lead of the probe tip to the header pin located on the ground plane of the deskew fixture.



2 Set the vertical scale of the channel to which the probe is connected to **2 V/div**.

3 Observe impedance reading and record the result.

4 Flip probe connections on the PV fixture such that the "-" lead of the probe input is now on the signal trace pin and "+" side of the probe input is now on the ground pin of PV fixture.

5 Observe impedance reading and record the result.

6 Confirm that the measured impedances are within the rated tolerance of your probe model.

7 Change the vertical scale of the channel to which the probe under test is connected to **5 V/div**.

8. Make probe tip connection on the PV fixture such that the "+" side of the probe input is now on the signal trace pin and "-" side of the probe input is now on the ground pin of PV fixture.
9. Observe impedance reading and record the result.
10. Flip probe tip connection on the PV fixture such that the "–" side of the probe input is now on the signal trace pin and "+" side of the probe input is now on the ground pin of PV fixture.
11. Observe impedance reading and record the result.
12. Confirm that the measured impedances are within the rated tolerance of your probe model.

Performance Test Record

Table 1 Performance Test Record

Model #:	**Date:**	**Tested by:**	
Serial #:	**Recommended next test date:**		
Test	**Test Limits**	**Result**	**Pass/Fail**
Bandwidth (–3 dB)	DP0010A - 250 MHz DP0011A - 500 MHz DP0012A - 1 GHz DP0013A - 1.7 GHz		
Input Resistance	1.7 MΩ Differential 850 kΩ Single-ended		

7 Returning the Probe for Repair/Service

WARNING **Do not install substitute parts or perform any unauthorized modification to the probe. Only Keysight service centers should perform repair/maintenance on the equipment.**

Only Keysight approved accessories should be used.

Perform the following steps before shipping the probe back to Keysight Technologies for repair / service.

1. Contact your nearest Keysight sales office for any additional details.
2. Write the following information on a tag and attach it to the malfunctioning equipment.
   - Name and address of owner
   - Product model number (for example, DP0010A)
   - Product Serial Number (for example, MYXXXXXXXX)
   - Description of failure or service required

NOTE Include accessories shipped with the probe.

3. Protect the probe by wrapping in plastic or heavy paper. Use original packaging or comparable.
4. Pack the probe in the original carrying case or if not available, use bubble wrap or packing peanuts.
5. Place securely in a sealed shipping container and mark container as "FRAGILE".

If any correspondence is required, refer to the product by serial number and model number.

Before returning an instrument for service, you must first call the Keysight Call Center.

Contacting Keysight Technologies for Technical Assistance

For technical assistance, contact your local Keysight Call Center.

- In the Americas, call 1 (800) 829-4444
- In other regions, visit http://www.keysight.com/find/assist

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