DP0030A/31A/32A/33A
High Voltage Differential Active Probes & Probe Accessories

KEYSIGHT

Notices

Manual Part Number

DP0030-97000

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Warranty

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Safety Notices

CAUTION

A **CAUTION** 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 damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

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.

Contents

1 Overview

KEYSIGHT
TECHNOLOGIES

Introduction

The DP0030A/31A/32A/33A probes are high-voltage differential active probes. While you can use these probes with a Keysight oscilloscope having 1M Ω input impedance, the DP0030A model is compatible with other (non-Keysight) oscilloscopes with 1M Ω input impedance.

The DP0031A/32A/33A probes come with the Keysight Autoprobe 1 interface (via I2C) to connect to a Keysight oscilloscope. This interface provides the probe power, offset, and auto-configuration of probe type and attenuation setting on connection.

Figure 1   DP0031A/32A/33A probes

The DP0030A model does not have an Autoprobe interface. It has a cable with BNC for RF and a cable with USB-A connector on it to be powered by a USB port on the host scope. Both of these cables are 1 m long. DP0030A probes do not support controlling any probe settings via the USB interface–it is power-only. The USB cable is hard-wired into the probe body. Since this probe model has a universal BNC and USB interface, it is compatible with any oscilloscope with 1M Ohm BNC inputs, including Keysight's InfiniiVision 1000X and 2000X-Series oscilloscopes.

Figure 2   DP0030A probe

Key Features

- **Supports Differential and Single-ended Measurements**: You can use these probes to measure differential as well as single-ended signals.
- **Auto Attenuation Ranges**: These probes support the following auto attenuation ranges.

Table 1   Auto attenuation ranges for DP003xA probes

Probe model	Scale (V/div) to change from High to Low attenuation
DP0031A	<25 V/div
DP0032A	<45 V/div
DP0033A	100 V/div

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 11 for standard accessories that are shipped with these probes. Additional accessories are also available for these probes that you can order separately (see page 12 for optional accessories).

CAUTION	Before using these probes, refer to "Safety and Regulatory Information" on page 21.

Compatibility with Keysight Oscilloscopes

Compatible Oscilloscopes	Adapter(s) Required	Required Software Version
Infiniium Oscilloscopes		
EXR-Series	None	Infiniium 11.62 or higher
MXR-Series		
InfiniiVision Oscilloscopes		
1000 X-Series*	None	Last supported version available
2000 X-Series*		
3000 X-Series		
4000 X-Series		InfiniiVision 7.65 or higher
6000 X-Series		
HD3-Series	None	InfiniiVision 10.06 or higher

* The 1000 X-Series and 2000 X-Series Oscilloscopes support DP0030A Probes only.

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.

Probe Dimensions

The DP003xA probe dimensions shown below are in millimeters.
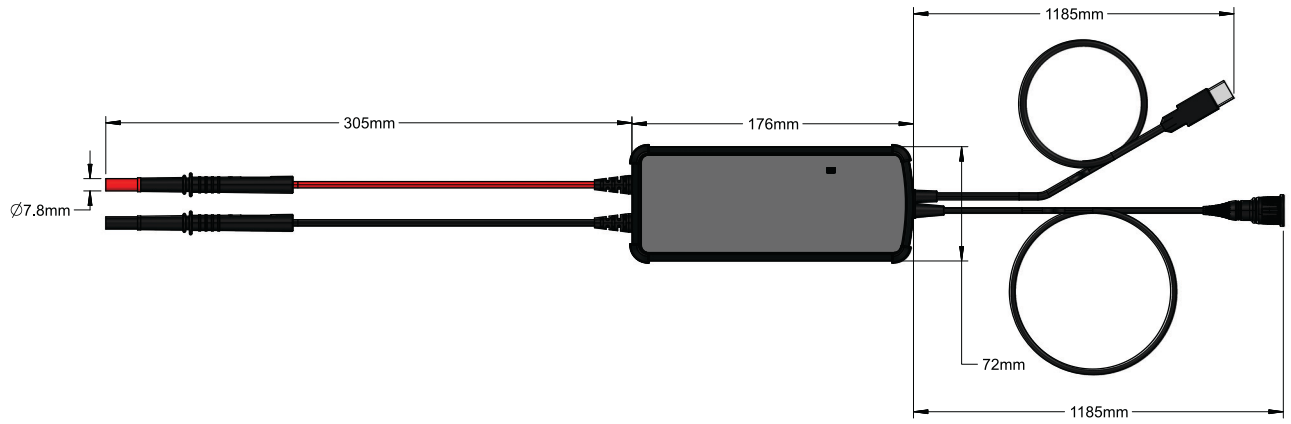
Figure 3   DP0030A dimensions
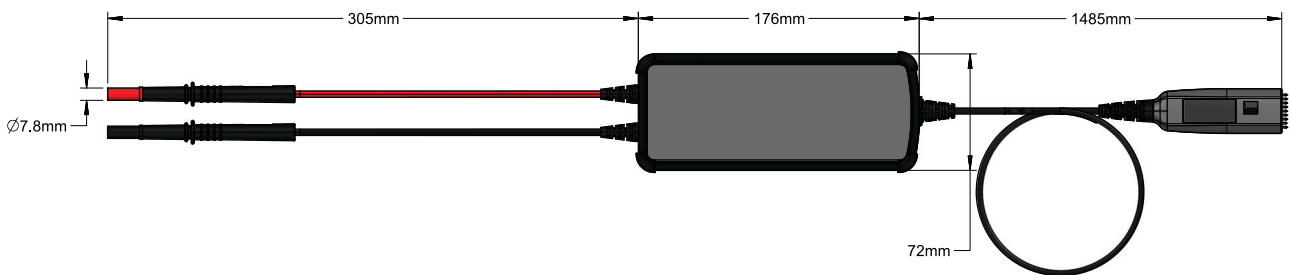
Figure 4   DP0031A/32A/33A dimensions

Standard Accessories

The accessories shown below ship standard with these probes. You can use these accessories interchangeably across DP0030A/31A/32A/33A probes.

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

Table 2   Parts in the DP0040A Accessory kit / DP0041A Value Accessory kit for DP003xA probes

Image	Description	Part No.	Included with		Probes that support each part				Bandwidth (at 500:1 attenuation range)
			DP0040A	DP0041A	DP0030A	DP0031A	DP0032A	DP0033A	
	Extension lead set, 7 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III, 1 m (black and red)	DP0040-68702	Yes	Yes	Yes	Yes	Yes	Yes	20 MHz
	Jaws test clip set, 1.5 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III (black and red)	DP0040-68703	Yes	No	No	Yes	Yes	Yes	100 MHz
	Hook test clip set, 1.5 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III (black and red)	DP0040-68704	Yes	Yes	Yes	Yes	Yes	Yes	200 MHz
	Alligator test clip set, 3 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III (black and red)	DP0040-68705	Yes	Yes	Yes	Yes	Yes	Yes	200 MHz
	Alligator test clip set, 7 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III (black and red)	DP0040-68706	Yes	No	No	No	No	No	200 MHz

Orderable Accessories

Besides the standard accessories that are shipped with DP0030A/31A/32A/33A probes, additional accessories are also available that you can order separately as the following accessory kits.

Additional Accessory Kit (DP0040A)

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

Accessory Included in the Kit	Quantity
Extension lead set, 1 m (black and red) 7 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III	1 set
Jaws test clip set, (black and red) 1.5 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III	1 set
Hook test clip set, (black and red) 1.5 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III	1 set
Alligator test clip set, (black and red) 3 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III	1 set
Alligator test clip set, (black and red) 7 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III	1 set

Additional Accessory Kit (DP0041A)

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

Accessory Included in the Kit	Quantity
Extension lead set, 1 m (black and red) 7 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III	1 set
Hook test clip set, (black and red) 1.5 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III	1 set
Alligator test clip set, (black and red) 3 kV$_{peak}$ MAINS ISOLATED, 1 kV$_{rms}$ CAT III	1 set

Characteristics and Specifications

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 DP0030A/31A/32A/33A probes attached directly to a DUT (without any accessories).

Warranted Specification	DP0030A	DP0031A	DP0032A	DP0033A	Notes
Probe Bandwidth (-3 dB)	100 MHz	200 MHz	200 MHz	200 MHz	In high attenuation only
Gain accuracy	<2%		<1%		DC; after user calibration

Elec. Characteristics	DP0030A	DP0031A	DP0032A	DP0033A
Input Resistance (diff.)	5 MΩ	5 MΩ	10 MΩ	20 MΩ
Input C (diff.)		2 pF		
Max. differential input range (high) mains-isolated	$\pm750\ V_{peak}$	$\pm750\ V_{peak}$	$\pm1500\ V_{peak}$	$\pm3000\ V_{peak}$
Max. differential input range (low) mains-isolated	$\pm75\ V_{peak}$	$\pm75\ V_{peak}$	$\pm150\ V_{peak}$	$\pm300\ V_{peak}$
Max. common-mode input range mains-isolated	$\pm750\ V_{peak}$	$\pm750\ V_{peak}$	$\pm1500\ V_{peak}$	$\pm3000\ V_{peak}$
Offset (diff.)	Scope offset only	Scope offset only	Scope offset only	Scope offset only
Offset error	N/A	$\pm0.2\%$ of range		
Offset drift	<100 uV/°C			
Max. voltage to earth safety rating	300 V_{rms} CAT III 600 V_{rms} CAT II	300 V_{rms} CAT III 600 V_{rms} CAT II	600 V_{rms} CAT III	600 V_{rms} CAT III
Noise (high range)	<50 mV_{rms}	<50 mV_{rms}	<150 mV_{rms}	<250 mV_{rms}
Noise (low range)	<20 mV_{rms}	<20 mV_{rms}	<30 mV_{rms}	<50 mV_{rms}
CMRR (high range)	DC: >80 dB 1 kHz: >50 dB 1 MHz: >40 dB 100 MHz: >20 dB		DC: >80 dB 1 kHz: >65 dB 1 MHz: >55 dB 100 MHz: >30 dB	
Output drive	1 MΩ			

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 (for all DP003xA probes)

Environmental Condition	Operating	Non-Operating
Temperature	0 °C to +55 °C	-40 °C to +70 °C
Humidity	Up to 95% RH at +40 °C	-
Altitude	2,000 m (6,561 ft))	10,000 m (32,808 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

Warranted Specification	DP0030A	DP0031A	DP0032A	DP0033A	Notes
Switchable attenuation	Yes, via physical button/switch	Yes, via Autoprobe			10X difference between ranges
Zero function	No	Yes, via Autoprobe			DC; after user calibration
Overload indication LEDs	No	Yes			
Attenuation range LEDs	No	Yes			
Scope interface	BNC + USB power	Autoprobe 1			
Output cable length	1 m	1.5 m			
Accessories included	Partial kit (DP0041A)	Full kit (DP0040A)			

2 General Information

KEYSIGHT
TECHNOLOGIES

Inspecting the Probe

- Inspect the shipping container for damage.

  Keep the damaged shipping container or cushioning material until the contents of the shipment have been checked for completeness and the probe has been checked mechanically and electrically.

- Check the accessories.
- If the contents are incomplete or damaged, notify your Keysight Technologies Sales Office.
- Inspect the probe. If there is mechanical damage or defect, or if the probe does not operate properly or pass calibration tests, notify your Keysight Technologies Sales Office.

If the shipping container is damaged, or the cushioning materials show signs of stress, notify the carrier as well as your Keysight Technologies Sales Office. Keep the shipping materials for the carrier's inspection. The Keysight Technologies office will arrange for repair or replacement at Keysight Technologies' option without waiting for claim settlement.

| **WARNING** | **Must be Grounded. Before making connections to the input leads of this probe, ensure that the probe's output connector is attached to the channel input of the oscilloscope and the oscilloscope is properly grounded.** |

| **CAUTION** | To protect against electrical shock, use only the accessories supplied with this probe or in the accessory kit. |

Cleaning & Handling Probes

Cleaning the Probe

Disconnect the probe and clean it gently with a soft, damp cloth. Make sure the probe is completely dry before reconnecting it to an oscilloscope.

Handling the Probe

⚠ Handle the probe with care and refer to the "Safety and Regulatory Information" on page 21.

Note that the probe cable and the extreme temperature extension cables are sensitive parts and, therefore, you should be careful not to damage them through excessive bending or pulling. You should also avoid any mechanical shocks to this product in order to guarantee accurate performance and protection.

Returning the Probe for Service

If the probe is found to be defective, Keysight recommends sending it to an authorized service center for all repair and calibration needs. Perform the following steps before shipping the probe back to Keysight Technologies for service.

1   Contact your nearest Keysight sales office for information on obtaining an RMA number and return address.

2   Write the following information on a tag and attach it to the malfunctioning equipment.

·   Name and address of owner

·   Product model number (DP003xA)

·   Product Serial Number

·   Description of failure or service required

NOTE   Include probing accessories if the probe is not meeting performance specifications or a yearly calibration is requested.

3   Protect the probe by wrapping in plastic or heavy paper.

4   Pack the probe in the original carrying case or if not available use bubble wrap or packing peanuts.

5   Place securely in sealed shipping container and mark container as "FRAGILE".

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

Contacting Keysight Technologies

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.

- Before returning an instrument for service, you must first call the Call Center at 1 (800) 829-4444.

3 Safety and Regulatory Information

KEYSIGHT
TECHNOLOGIES

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.

WARNING **Do not use the probe if it is damaged. Before you use the probe, inspect the case. Look for any cracks or missing plastic. Pay attention, in particular, to the insulation surrounding the input cable leads.**

WARNING **To avoid personal injury and to prevent fire or damage to this product or products connected to it, review and comply with the following safety precautions. Be aware that if you use this probe assembly in a manner not specified, the protection this product provides may be impaired.**

WARNING **Use Grounded Instruments only.**

Always make sure the probe and oscilloscope are grounded properly.

WARNING **Connect and Disconnect Properly.**

Before making connections to the input leads of this probe, ensure that the probe's output connector is attached to the channel input of the oscilloscope and the oscilloscope is properly grounded. Connect the probe to the oscilloscope before connecting the probe to the circuit under test. Disconnect the probe input from the circuit under test before disconnecting the probe from the oscilloscope.

For DP0030A, connect the USB cable to the oscilloscope's USB port for power and the BNC to the channel input of the oscilloscope before connecting the probe to the circuit under test.

CAUTION

⚠

The probe inputs are safely rated to a maximum of input voltage for each specific model, as listed in "Electrical Specifications and Characteristics" on page 13. These maximum ratings apply regardless of the attenuation setting of the probe. Do not apply voltages greater than that specified for each model in "Electrical Specifications and Characteristics" on page 13.

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

Measurement Category II is for measurements on circuits directly connected to a low-voltage mains installation.

Measurement Category III is for measurements performed in the building installation.

WARNING

⚠

Observe probe and probe accessory ratings.

Do not apply any electrical potential to the probe input which exceeds the maximum ratings of the probe or the accessories (see Table 2 on page 11) connected to it. The Measurement Category and Electrical Rating that must be applied for a combination of a probe assembly and an accessory must be the lower of the two.

Make sure to comply with the voltage versus frequency derating curves, as shown in "Typical Voltage Derating (Mains Isolated)" on page 38.

WARNING

Do Not Operate Without Covers. To avoid electrical shock or fire hazard, do not operate this probe with the covers removed.

WARNING

Avoid Exposed Circuit. To avoid injury, remove jewelry such as rings, watches, and other metallic objects. Do not touch exposed connections and components when power is present.

WARNING

Periodically inspect the probe and probe wires to check for any damage. Do Not Operate With Visible or Suspected Failures. If you suspect there is damage, have it inspected by a Keysight authorized service personnel.

WARNING   **For Indoor Use Only. Do not operate in wet / damp environments to avoid electric shock. Keep product surfaces dry and clean. Do not operate in an explosive environment.**

WARNING   **Whenever it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.**

CAUTION   The small electrical components of the probe are sensitive to shock and impact. Avoid any unnecessary kinetic stress to the probe such as throwing, falling, and strong vibrations.

Instrument Markings and Symbols

Symbol	Description
C (UL) US LISTED	This mark indicates that this product has been evaluated against the US and Canadian Safety Standards.
40	This symbol indicates the Environmental Protection Use Period (EPUP) for the product's toxic substances for the China RoHS requirements.
(crossed out wheeled bin symbol)	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. 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.
CE CAN ICES/NMB-001(A) ISM GRP 1-A	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 Kst-1A21762	KC certification mark on DP0031A / DP0032A / DP0033A probes to demonstrate compliance with the South Korean EMC requirements Refer to the South Korean Class A EMC declaration following this table
KC Kst-1A21763	KC certification mark on DP0030A probes only to demonstrate compliance with the South Korean EMC requirements Refer to the South Korean Class A EMC declaration following this table

Symbol	Description
	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.
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)

South Korean Class A EMC declaration:
Information to the user:
This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference.

※ This EMC statement applies to the equipment only for use in business environment.

사 용 자 안 내 문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

※ 사용자 안내문은 "업무용 방송통신기자재"에만 적용한다.

· For DP0031A/32A/33A probes, visit

http://www.rra.go.kr/selform/Kst-1A21762

· For DP0030A probes, visit

http://www.rra.go.kr/selform/Kst-1A21763

About Measurement Category

The DP003xA has a safety rating of CAT III, as indicated in the table in "Electrical Specifications and Characteristics" on page 13.

MAINS ISOLATED Measurements performed on circuits not directly connected to the AC mains. Examples are measurements on circuits not derived from the AC mains and specially protected (internal) mains-derived circuits.

Measurement CAT II Measurements performed on circuits directly connected to a low-voltage installation. Examples are measurements on household appliances, portable tools, and similar equipment.

Measurement CAT III Measurements performed in the building installation. Examples are measurements on distribution boards, circuit- breakers, wiring, including cables, bus-bars, junction boxes, switches, socket outlets in the fixed installation, and equipment for industrial use, and some other equipment including stationary motors with permanent connection to the fixed installation.

Measurement CAT IV Measurements performed at the source of the low-voltage installation. Examples are electricity meters and measurements on primary overcurrent protection devices and ripple control units.

MAINS ISOLATED   CAT II   CAT III   CAT IV
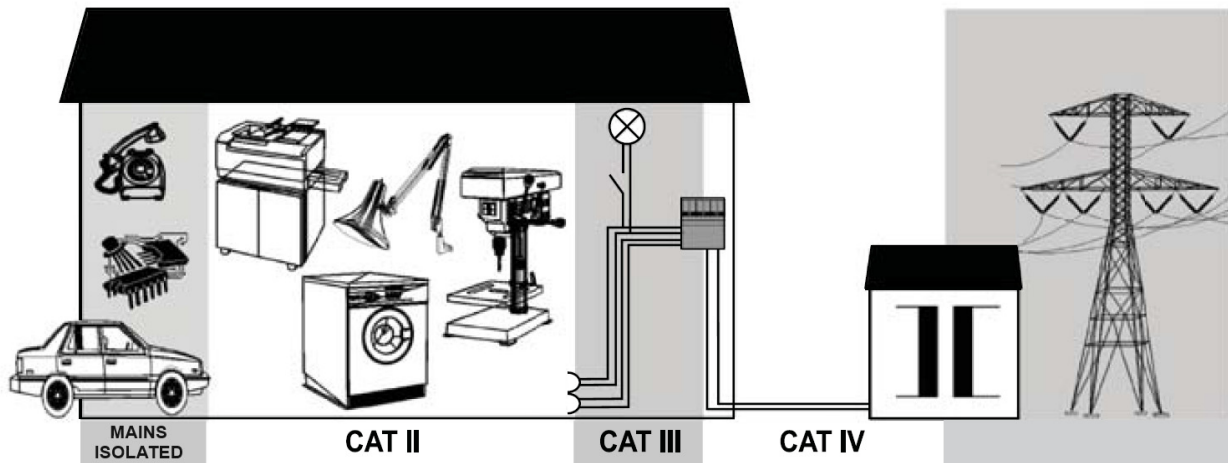
IEC 1247/10

Key

MAINS ISOLATED	Other circuits that are not directly connected to MAINS
CAT II	MEASUREMENT CATEGORY II
CAT III	MEASUREMENT CATEGORY III
CAT IV	MEASUREMENT CATEGORY IV

Figure 5   Examples of devices/equipment under each measurement category

About Pollution Degrees

The pollution degree classifies the amount of dry pollution and condensation that may occur in the environment. Products must be used only in the environment for which they are rated.

- Pollution Degree 1:

  No pollution or only dry, non-conductive pollution occurs, which has no influence.

- Pollution Degree 2:

  Only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is expected.

- Pollution Degree 3:

  Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected.

- Pollution Degree 4:

  Continuous conductivity occurs due to conductive dust, rain or other wet conditions.

4 Setting up and Using the Probe

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

Grounding the Probe

Connect the probe to the oscilloscope input before performing any measurements.

NOTE	The DP003xA probe is designed for ground-referenced measurements only.

Using the Supplied Accessories

Gently push the supplied accessories onto the probe leads.

Use the hook clips to clamp onto smaller components and the alligator clips to clamp onto thicker gauge devices.

KEYSIGHT
TECHNOLOGIES

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 oscilloscope (see "Compatibility with Keysight Oscilloscopes") 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.
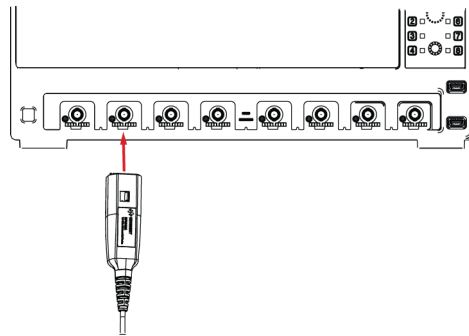
Using Channel Identification Rings
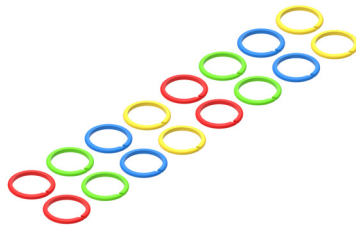
When multiple probes are connected to the oscilloscope, you can quickly identify which probe is connected to each oscilloscope channel by using the supplied channel identification rings.

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 the DP003xA Settings in the Oscilloscope Software GUI

After making hardware connections, perform the following steps in the Infiniium / InfiniiVision oscilloscope software GUI to configure probe settings such as attenuation ratio and DC offset and gain calibration. These settings are required to get accurate measurement results.

On an Infiniium Oscilloscope

Setting the Attenuation Mode

The probe supports two attenuation modes. An Infiniium oscilloscope automatically switches the attenuation mode for the probe to the value necessary to make the dynamic range of the probe greater than or equal to the level required to measure the current input signal.

The automatic switching of probe's attenuation also helps in preventing the overvoltage condition on the probe.

The Attenuation Setting LED on the probe indicates the currently set attenuation. You can also view the currently set attenuation in the Infiniium GUI's **Probe Configuration** dialog box as displayed below.
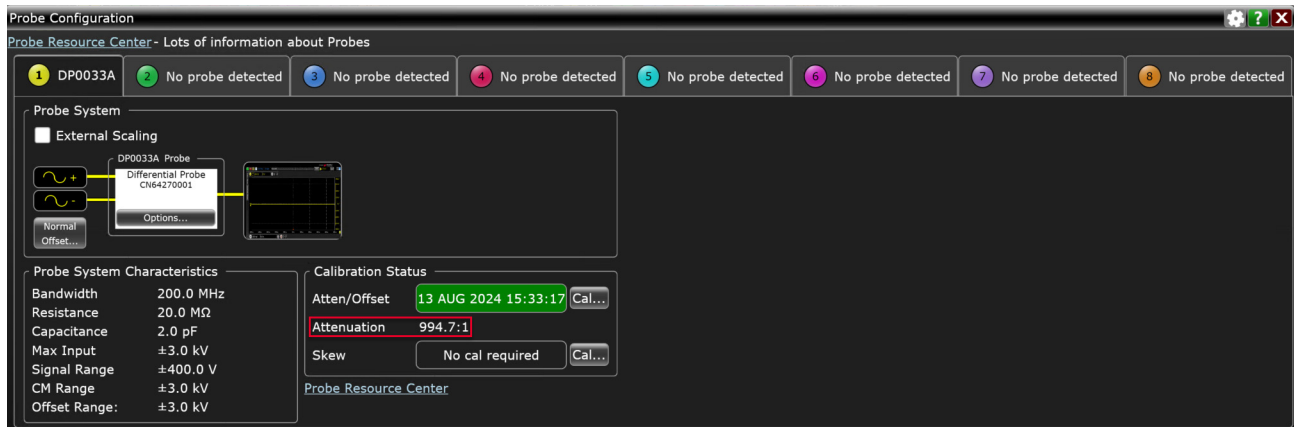
Performing DC Offset Calibration

Probe gain (or attenuation ratio) correction adjusts the oscilloscope's scaling factors of the signal displayed on screen to properly match the correct DC values. You need to perform the DC offset calibration to remove the DP003xA offset errors. The most common correction method for probes is the DC adjustment, which entails the adjustment of probe offset.

1 In the **Probe Configuration** dialog box, click the **Cal...** button orresponding to **Atten/Offset**.
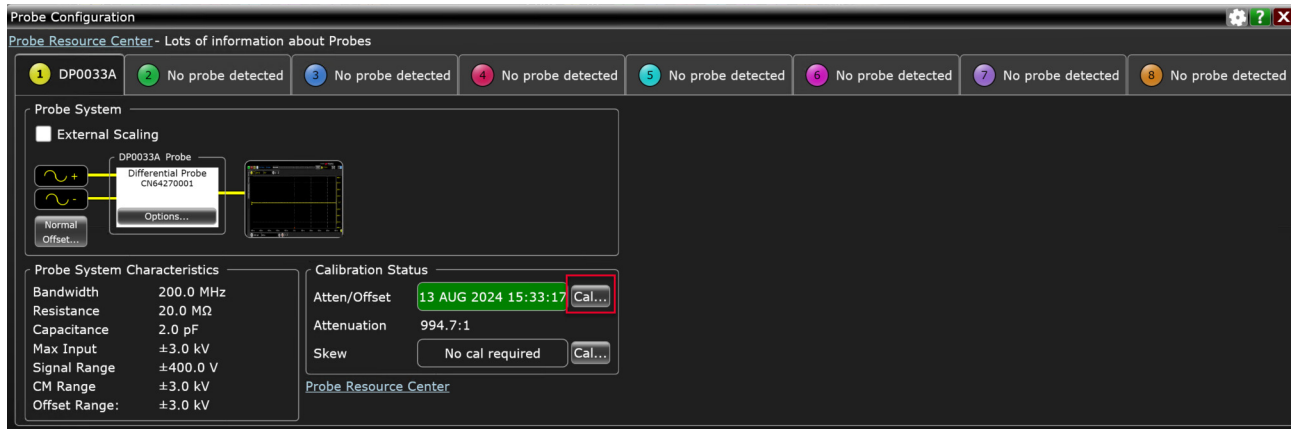
The **Probe Calibration** dialog box is displayed.
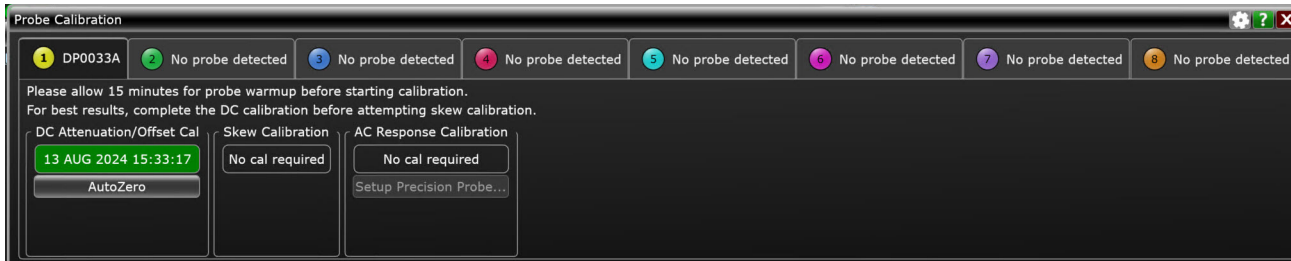
2 Ensure that the probe is connected to the oscilloscope as illustrated in the **DC Attenuation / Offset Cal** dialog box.

3 Click the **AutoZero** button to initiate calibration.

4 Follow the instructions displayed on the Infiniium GUI screens.

On an InfiniiVision Oscilloscope

Setting the Attenuation Mode

On an InfiniiVision oscilloscope, you need to manually set the attenuation mode for the probe. The probe supports four modes of attenuation so that you can set the attenuation to the value necessary to make the dynamic range of the probe greater than or equal to the level required to measure the current input signal.
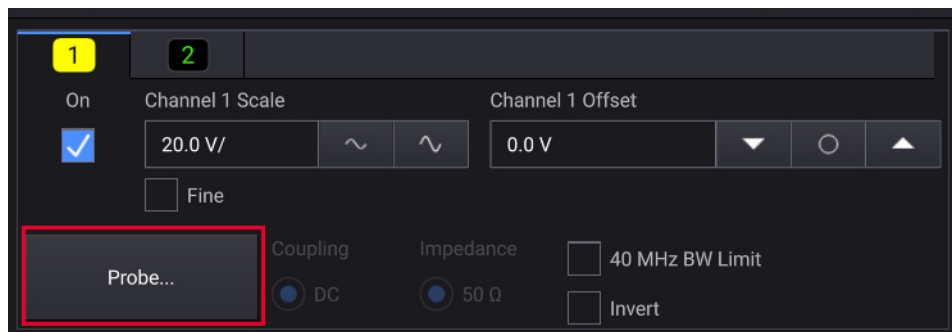
NOTE	If there is an overvoltage condition and the Overload Indicator LED on the probe lights up, you need to adjust the probe's attenuation to resolve this overload condition.

To set the attenuation mode:

1 Press the channel key to which the probe is attached to display the Channel <N> menu.
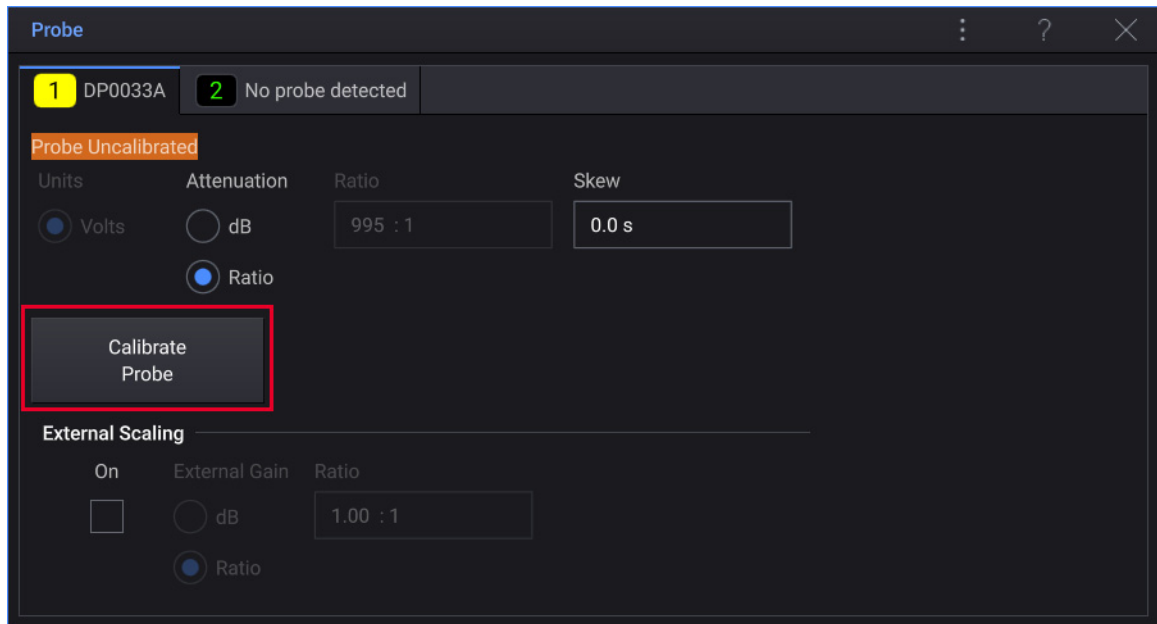

2 Press the **Probe** softkey to display the channel's probe menu.

By default, the Probe dialog displays "Probe Uncalibrated".
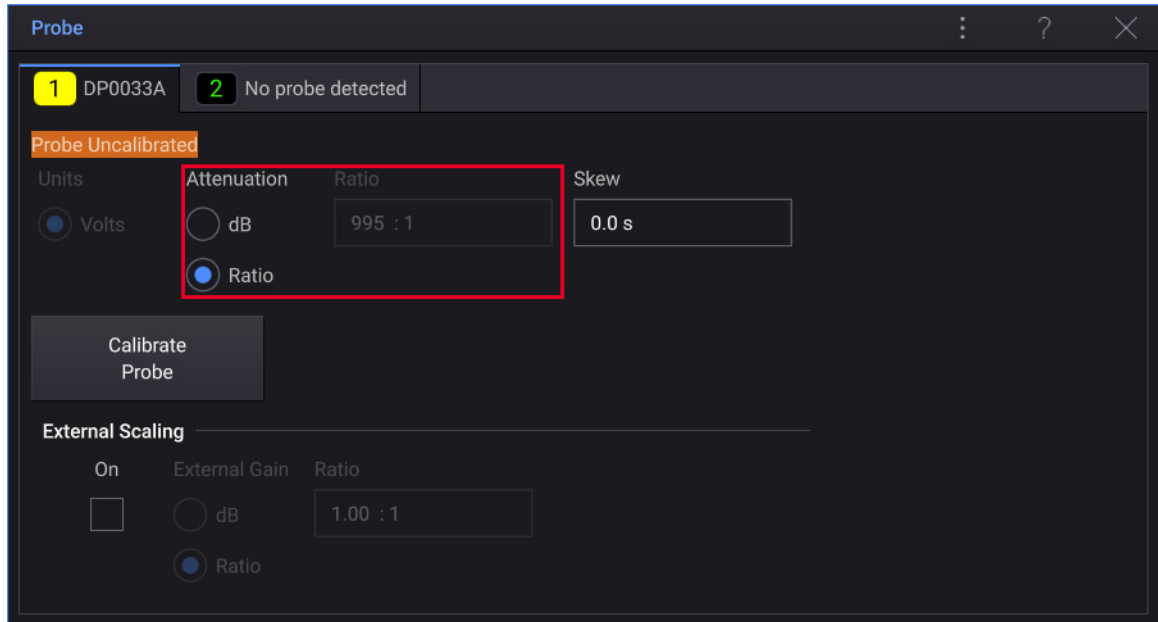
3 Click **Calibrate Probe** to initiate calibration.

4 Follow the instructions displayed on the InfiniiVision GUI screens.

5 Set the attenuation for your probe in the **Attenuation** area of the **Probe** dialog.

5 Performance Plots

This chapter includes plots that show the characteristic performance and an input impedance model of the DP003xA probe.

Typical Voltage Derating (Mains Isolated)

> **WARNING** The maximum input voltage rating of the probe decreases as the frequency of the applied signal increases.
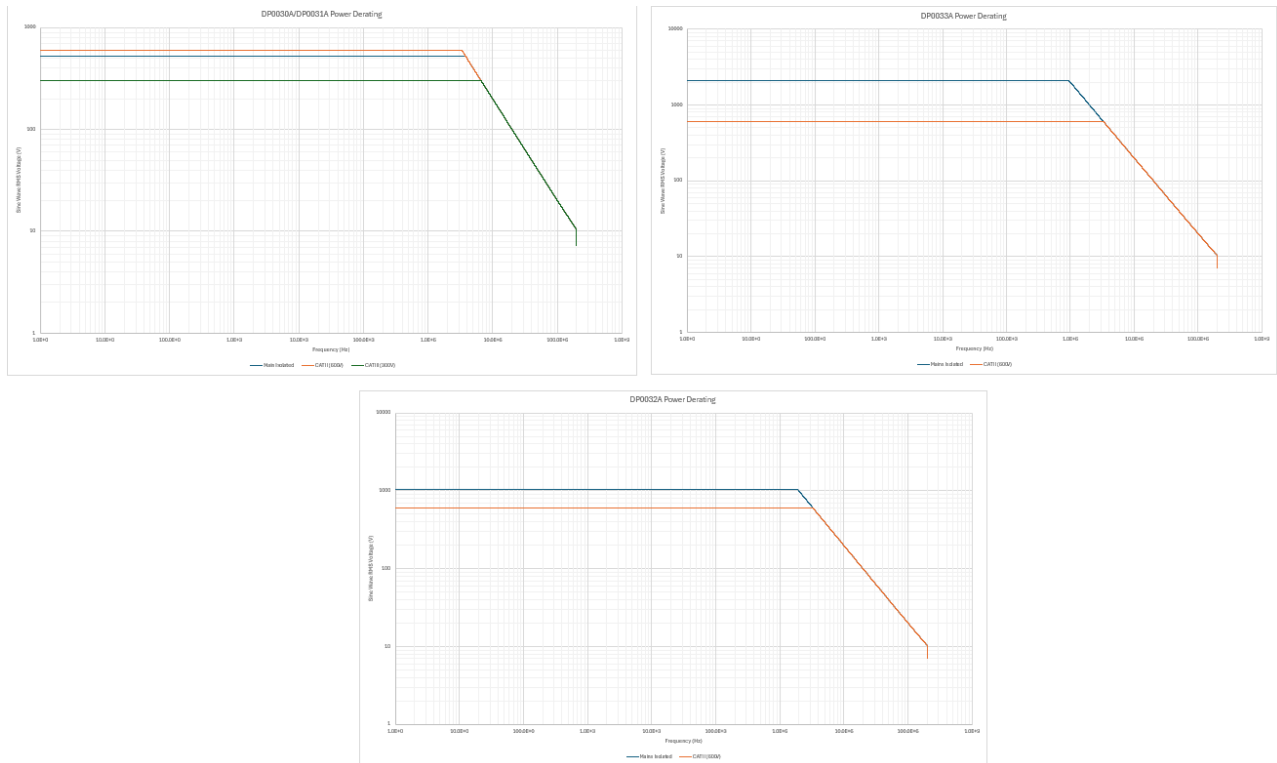
Figure 6   Summary of DP003xA Voltage Derating curves
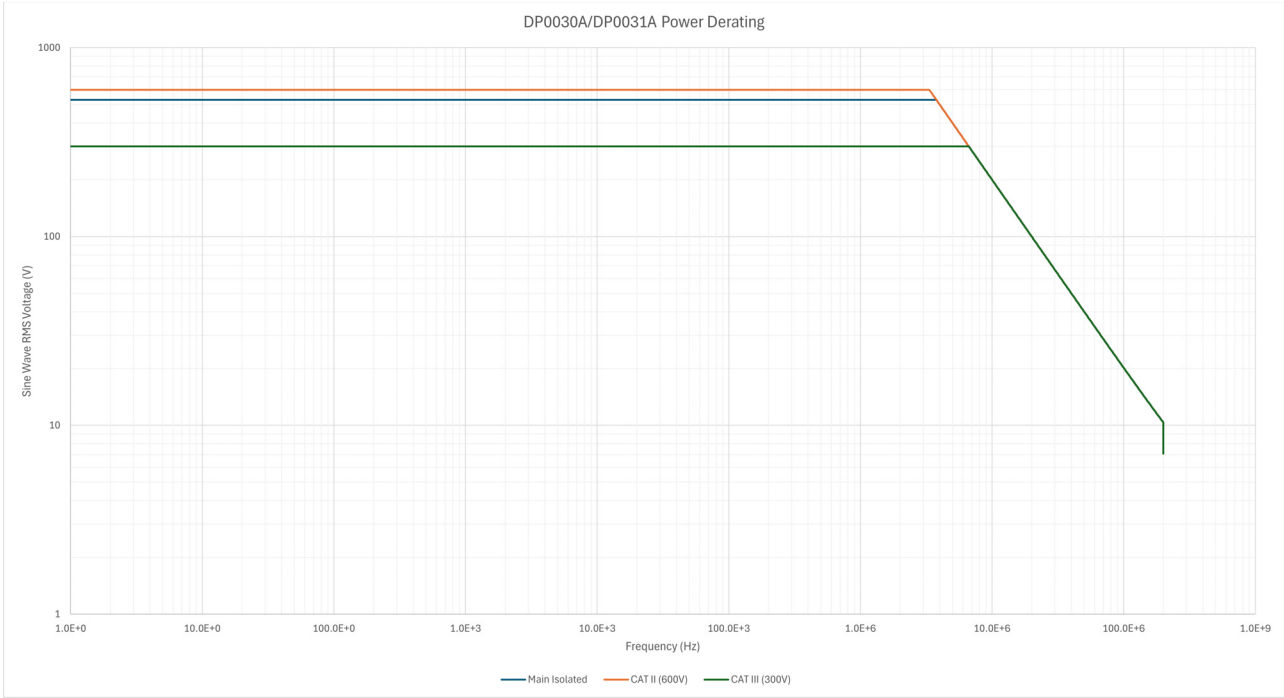
Figure 7   DP0030A/DP0031A Voltage Derating curves
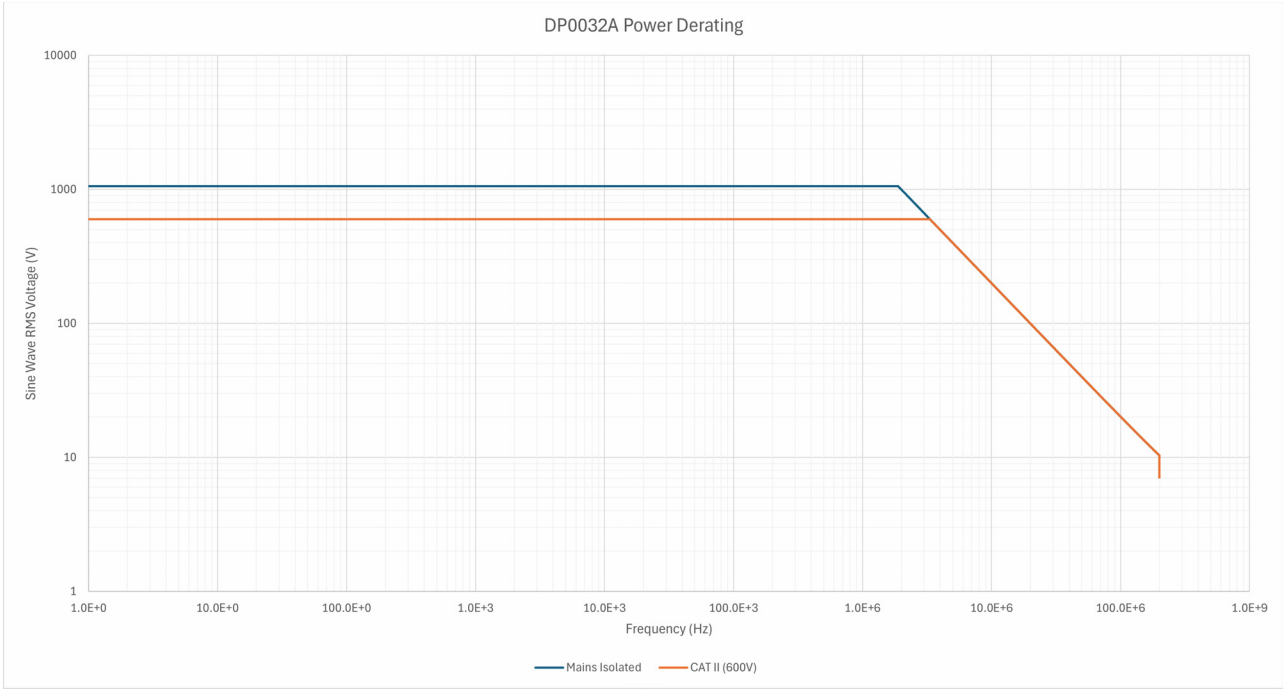
Figure 8   DP0032A Voltage Derating curves
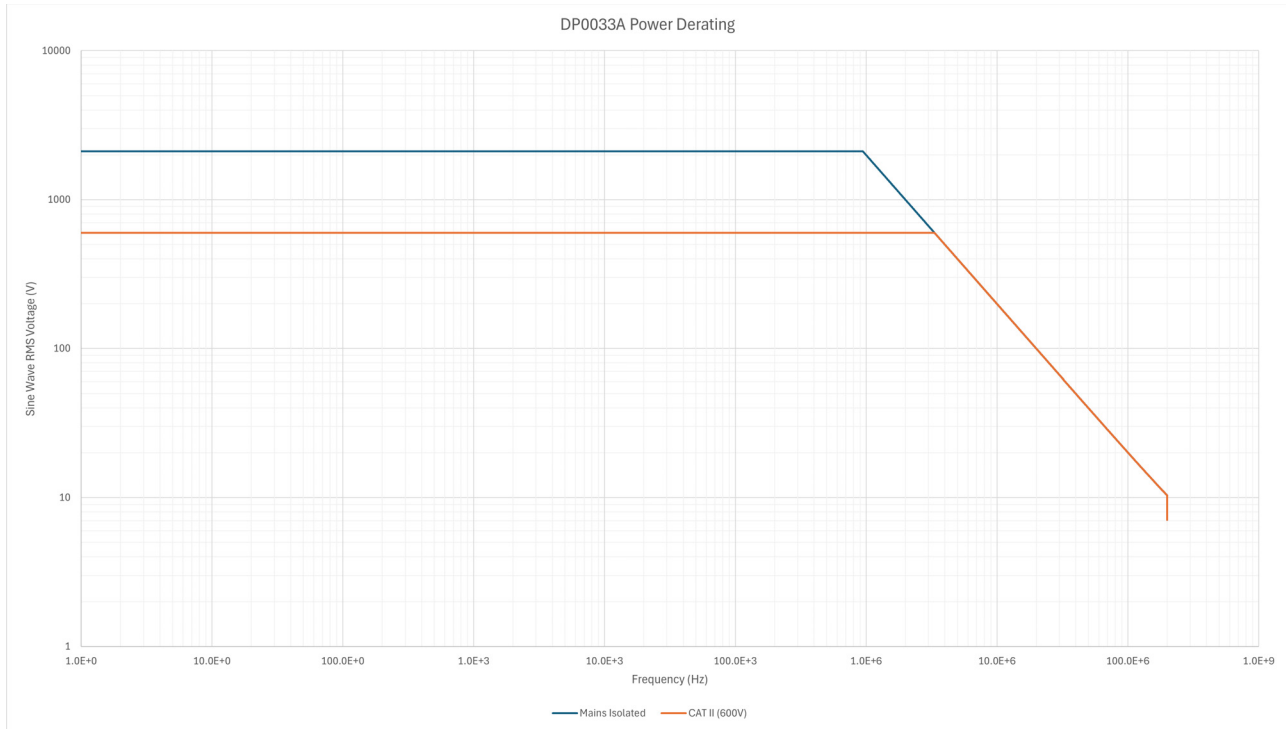
Figure 9   DP0033A Voltage Derating curves

CAUTION	Refer to the oscilloscope documentation for the oscilloscope's acceptable input range and do not exceed this limit when using the probes.

Typical Input Impedance

CAUTION	The input impedance of the probe decreases as the frequency of the applied signal increases.
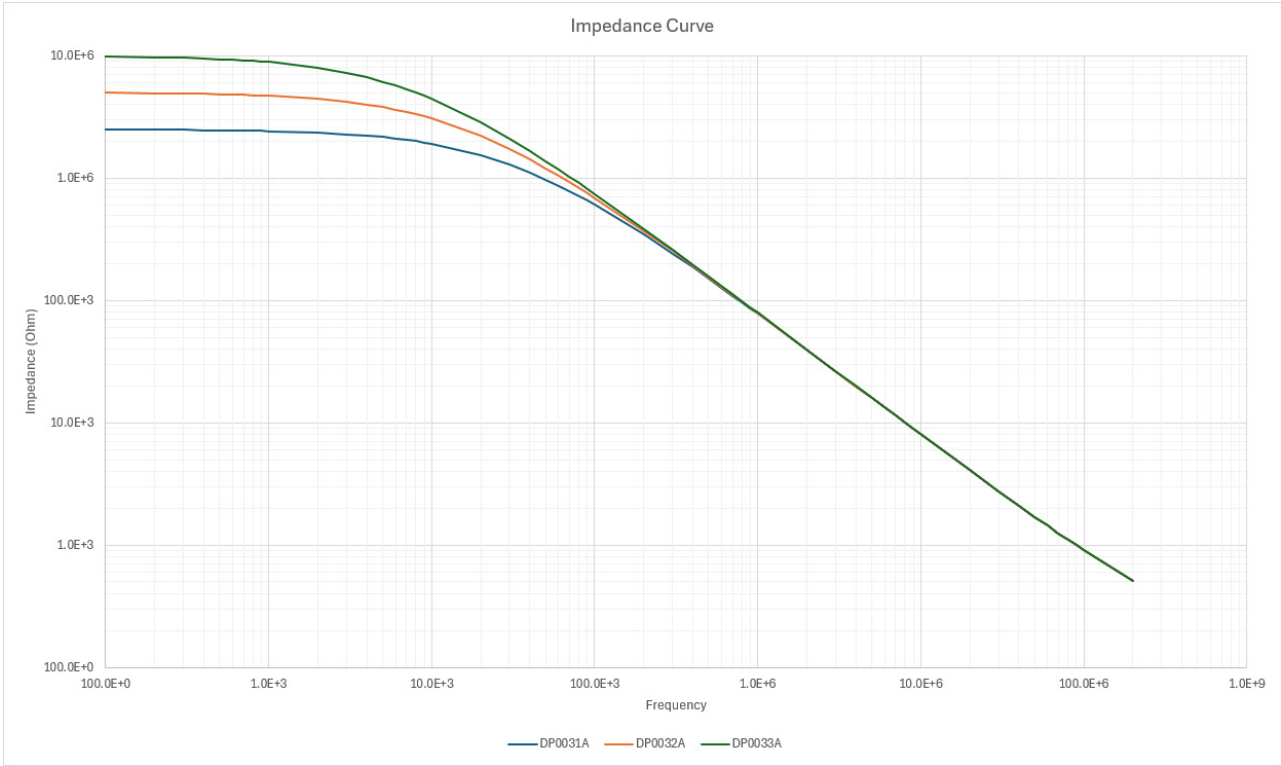
Figure 10   DP003xA Input Impedance Curves
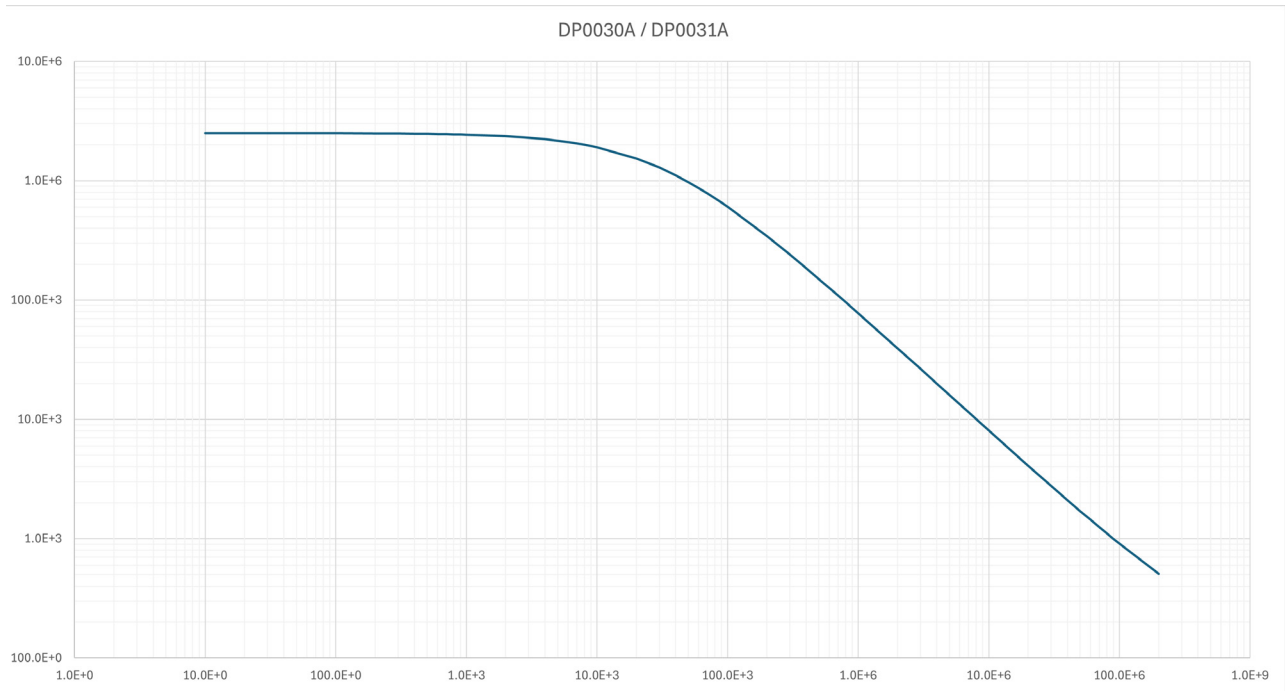
Figure 11   DP0030A/DP0031A Input Impedance Curves
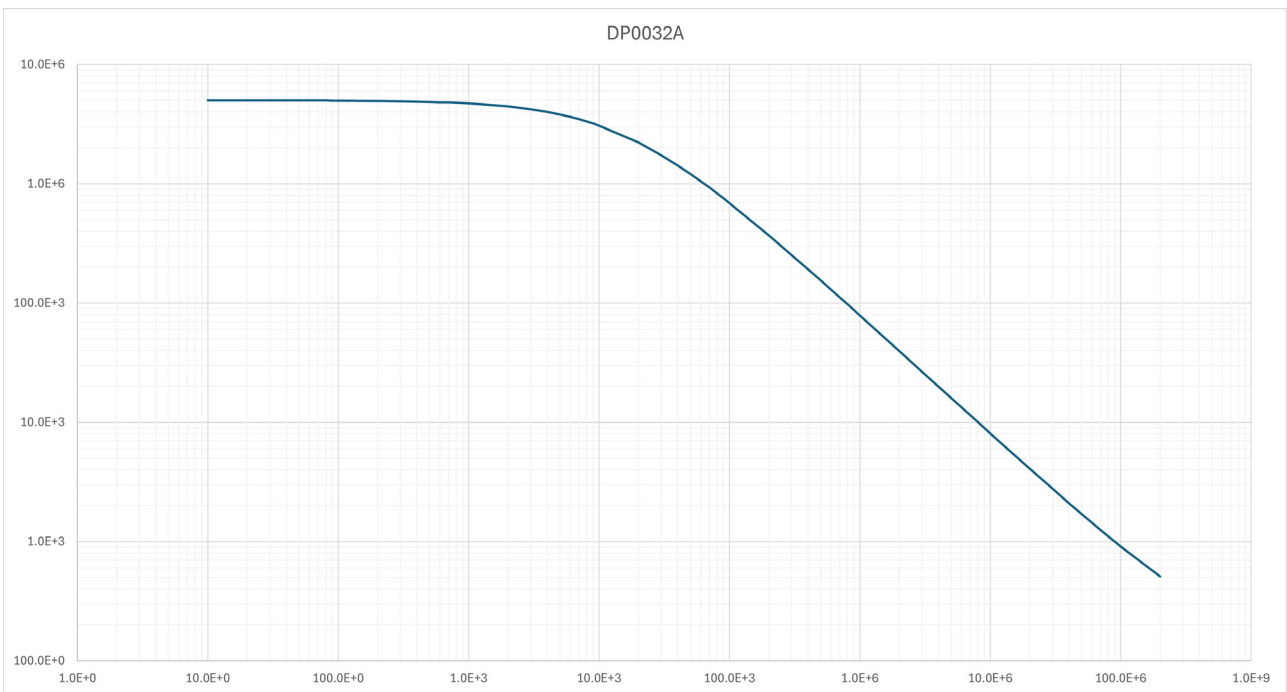
Figure 12   DP0032A Input Impedance Curves
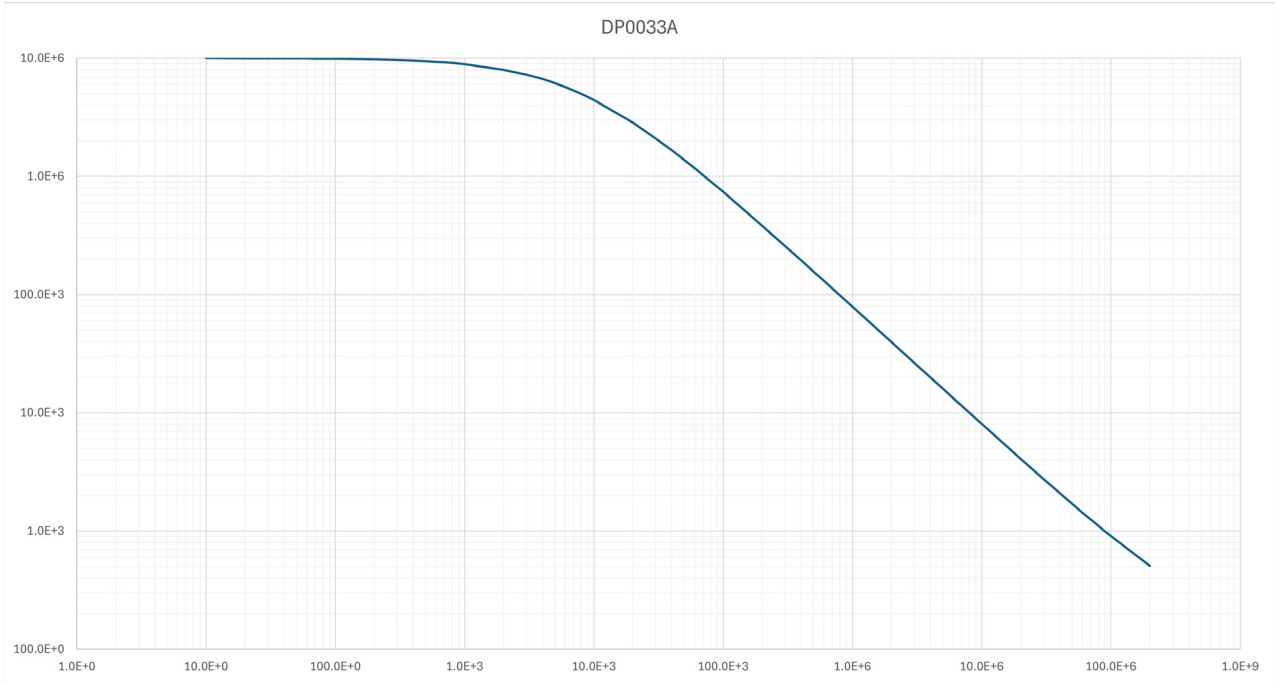
Figure 13   DP0033A Input Impedance Curves

Frequency Response
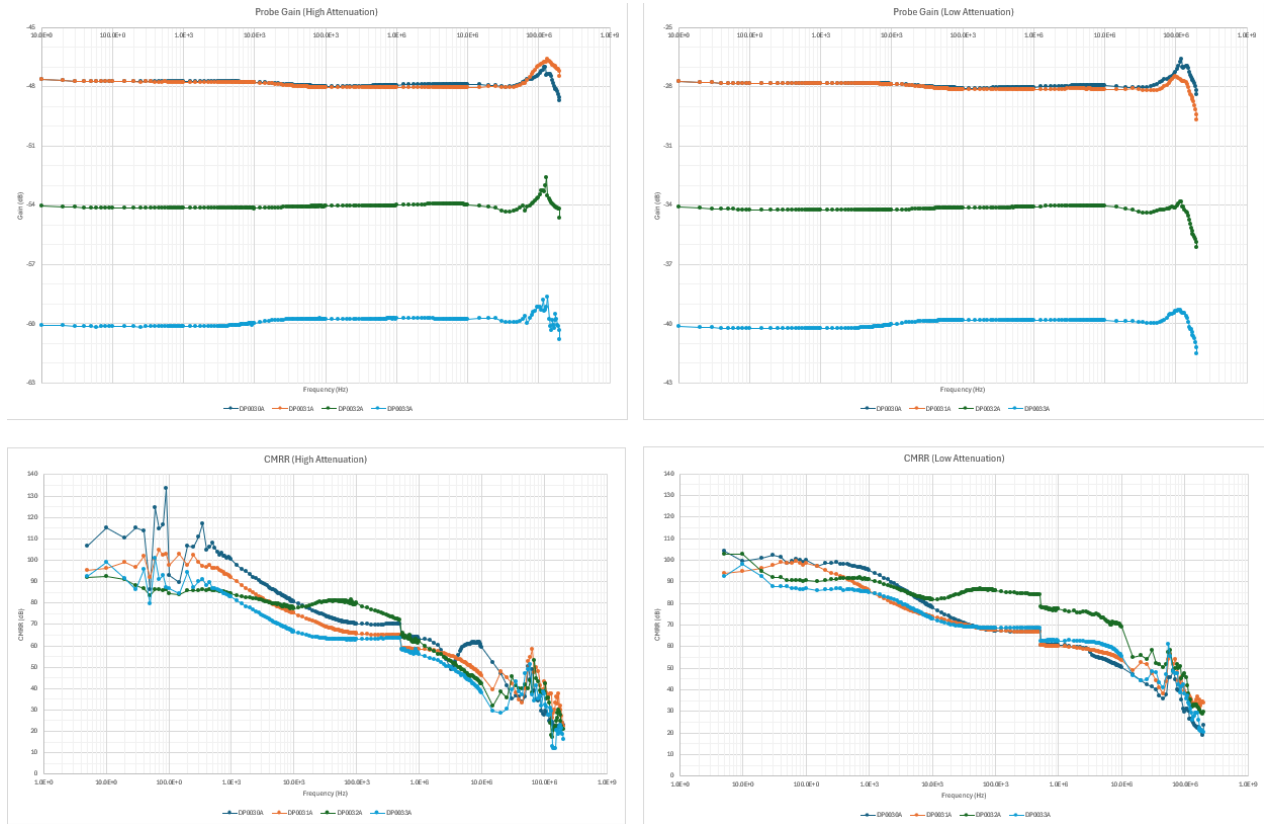
Figure 14   DP003xA Frequency response plot at four different attenuation ratio settings

DP003xA Frequency Response Test Setup

To obtain the best frequency response, Keysight recommends that the DP003xA input leads are set to run in parallel in the test setup.
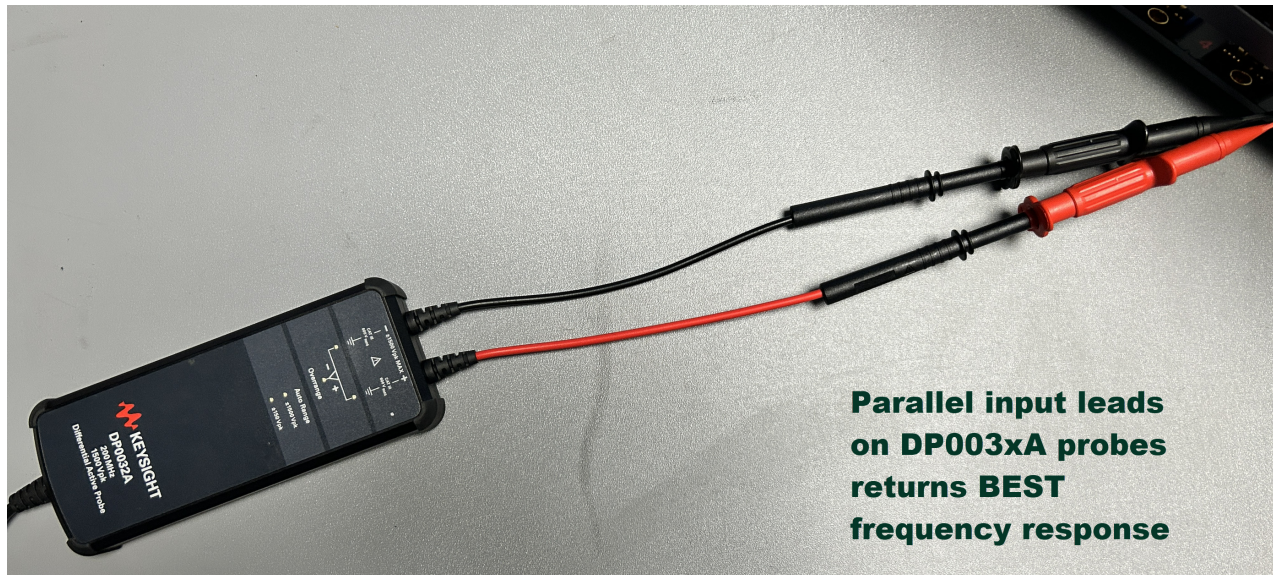
Figure 15   DP003xA Input leads set in parallel returns best frequency response

In contrast, if the DP003xA input leads are twisted in the test setup, it returns the worst frequency response.
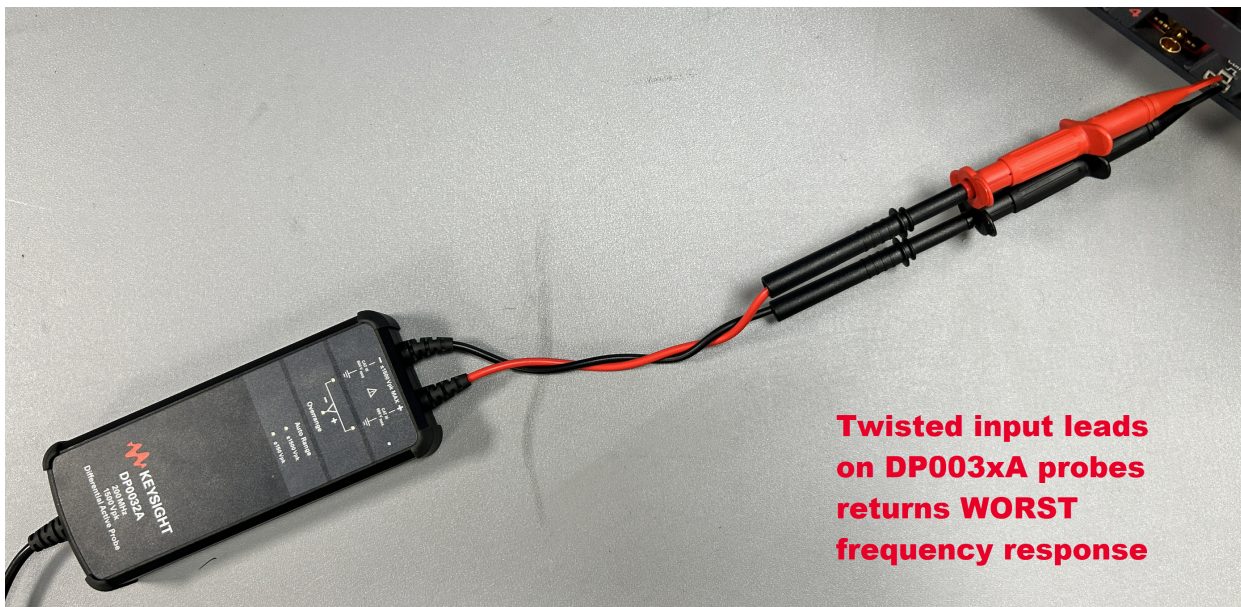
Figure 16   DP003xA Input leads set in twisted returns worst frequency response

Differential Probe Gain and CMRR plots over Frequency

This section provides the Differential Probe Gain and CMRR plots for DP003xA probes at the high and low attenuation modes.

Differential Probe Gain High Attenuation Plot
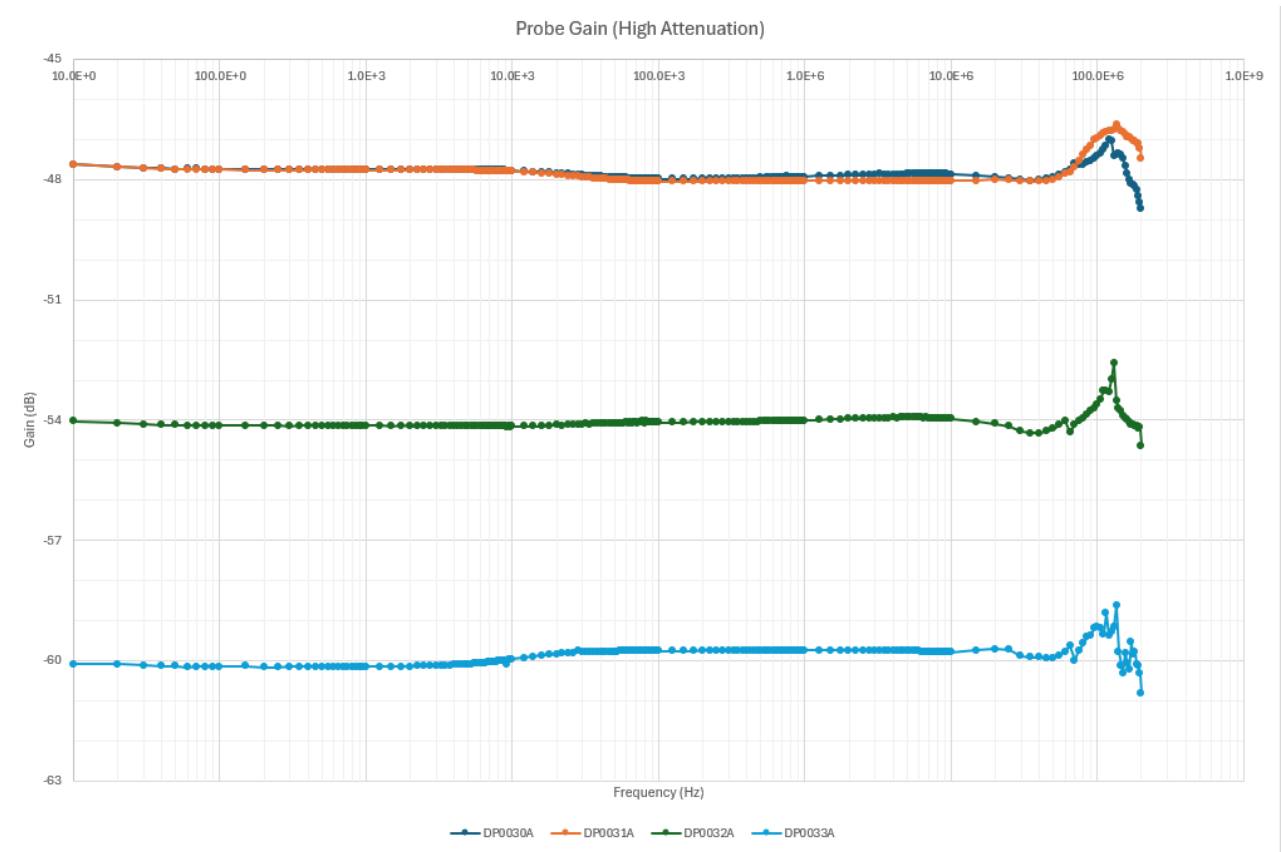
Figure 17   Differential Gain versus Frequency plot at High Attenuation

Differential Probe Gain Low Attenuation Plot
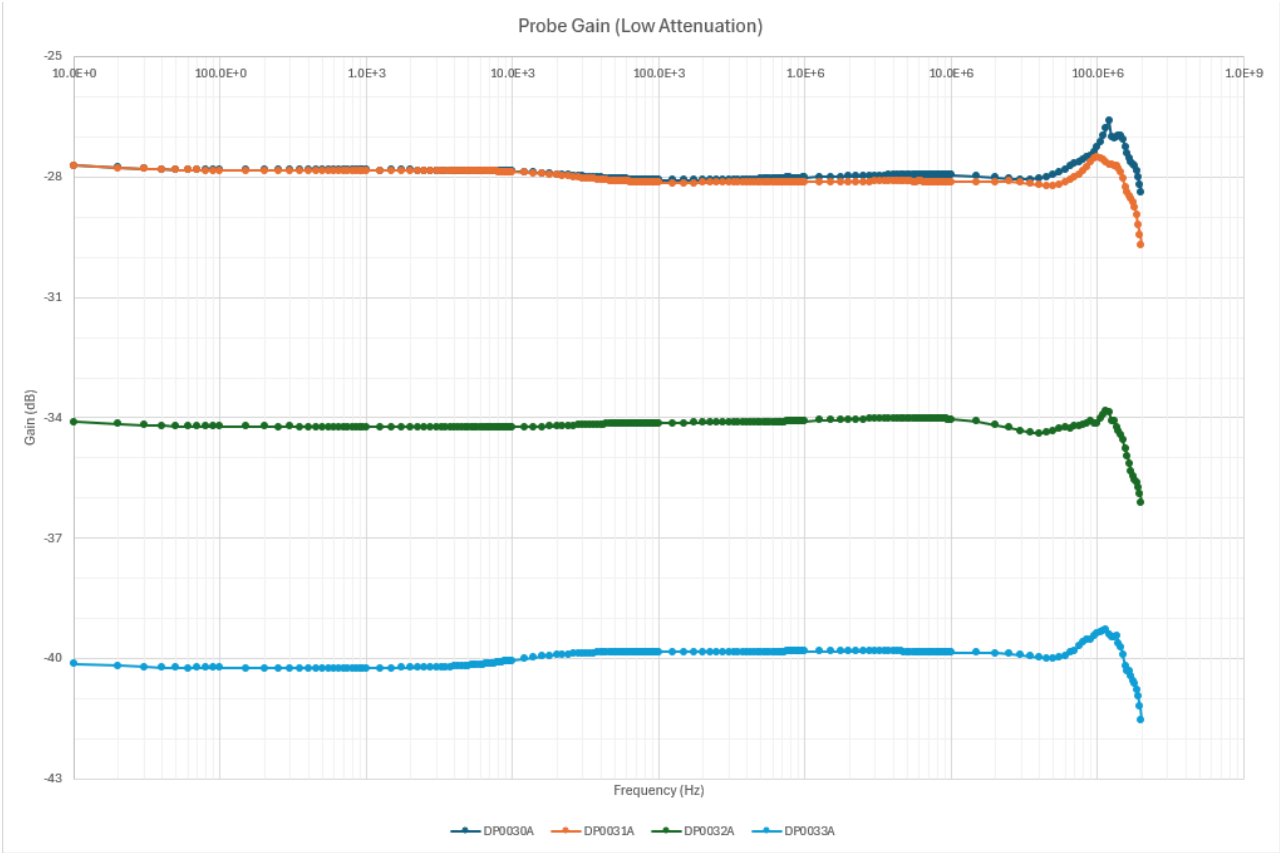
Figure 18   Differential Gain versus Frequency plot at Low Attenuation

CMRR High Attenuation Plot
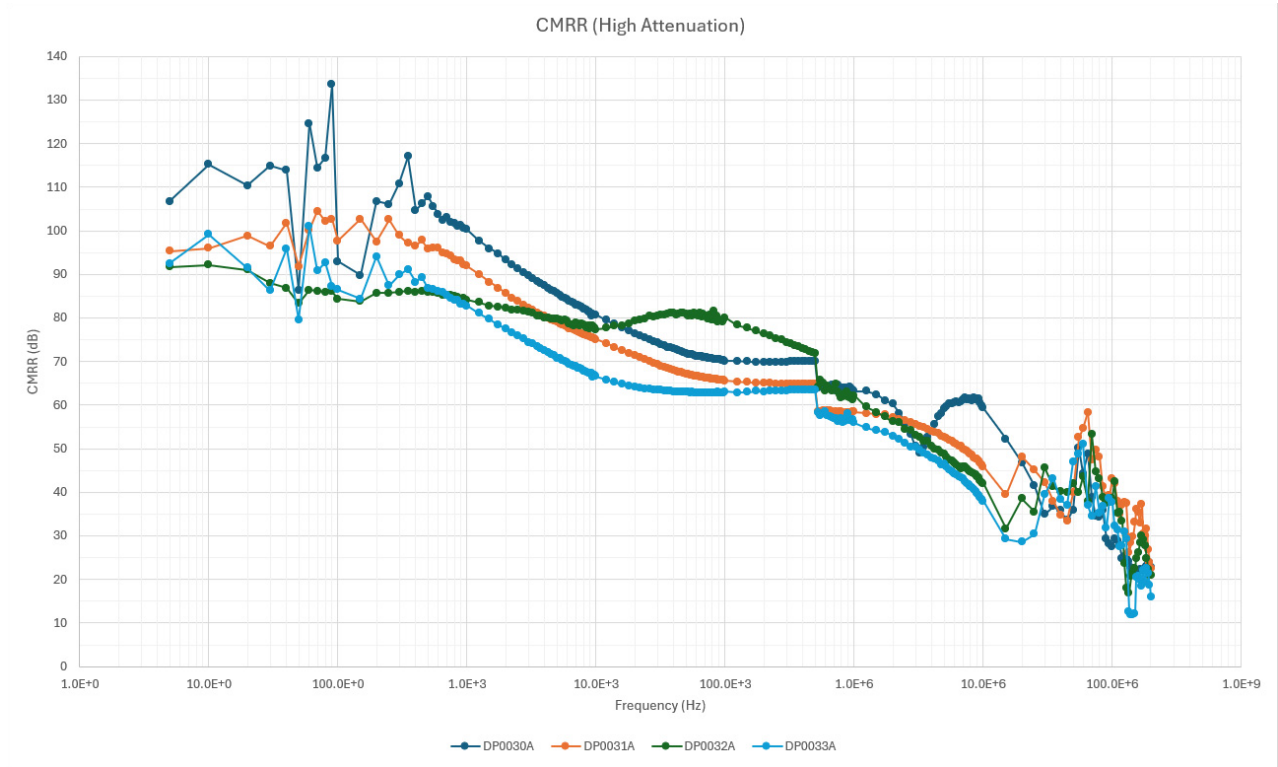
Figure 19   CMRR versus Frequency plot at High Attenuation

CMRR Low Attenuation Plot
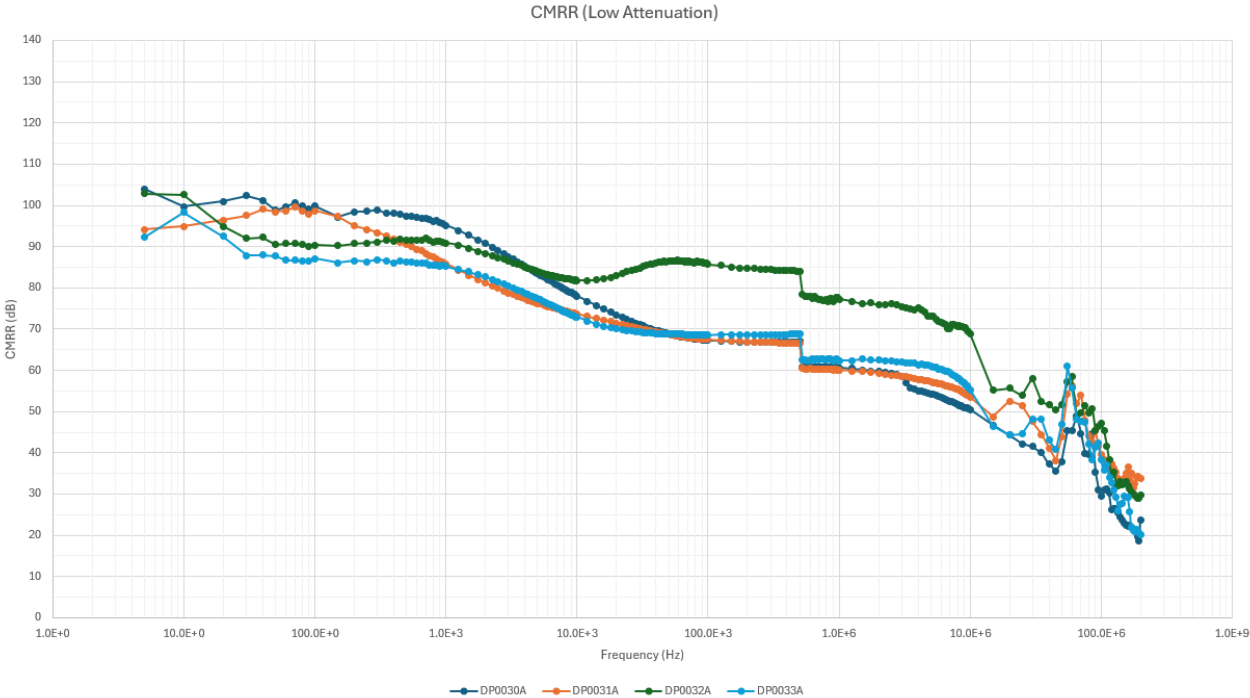
Figure 20   CMRR versus Frequency plot at Low Attenuation

6 Performance Verification

This chapter describes how to verify the warranted electrical characteristics (DC gain and Bandwidth) of the DP003xA probe.

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Before you Start

WARNING	**The procedures documented in this chapter require the application of high voltage to the inputs of the DP003xA probe. Ensure that you follow all pertinent safety rules and guidelines for elevated voltage measurements. Only qualified personnel should perform any testing with voltage levels exceeding 30 Vrms.**

WARNING	**Generators produce hazardous voltages. To avoid risk of shock, do not touch exposed metal parts after the generator output is enabled.**

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.

DC Gain Accuracy Verification

The procedure described in this section can be used to test and verify the DC gain accuracy of the DP003xA probes.

Required Test Equipment

Table 3   Required Test Equipment for DC Gain Accuracy

Description	Critical Specifications	Recommended Model / Part Number & Adapters	Purpose
Oscilloscope	Infiniium / InfiniiVision oscilloscope with AutoProbe I interface	Recommended: MXR608A/B Alternate: EXR604A/B	To display probe output
DC Voltage Generator	Capable of going up to 100 V with 6.5 digit accuracy	B2962B	To provide a reference voltage

Procedure

1   Connect the probe (+) tip to the precision DC voltage positive input and the probe (–) tip to the voltage generator negative input.

2   Connect the probe to the oscilloscope and allow it to warm up for at least 20 minutes at room temperature (20 °C - 25 °C).

3   While waiting for the probe to warm up, on the oscilloscope GUI, click **Setup** > **Acquisition**.Select **Setup** > **Acquisition** to access the **Acquisition** dialog. In this dialog:

   ·   select the **Enabled** check box for **Analog Averaging**

   ·   set **# of Averages** as **4096**.

4 Configure the DC voltage generator as a voltage source. Set the voltage level to "40 V" and the current limit to "100 µA".

5 Without powering on the DC source, measure the probe offset voltage and record it. Ensure the probe is in a high attenuation state by adjusting the V/div knob. (For example: 26 V/div for DP0031A).

6 Power on the DC source and read the voltage value shown on the oscilloscope.

7 Calculate the probe gain accuracy.

Probe Gain Accuracy(%) = [40 − ($V_{probeout}$ − V_{offset})] / 40 x 100

8 Verify that the probe gain accuracy does not exceed 1% + scope gain accuracy.

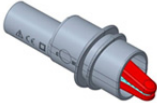9 Repeat the test for low attenuation by adjusting the V/div knob.

Bandwidth Verification

The FFT Magnitude procedure described in this section can be used to test and verify the bandwidth of the DP003xA probes.

FFT Magnitude (Using External Pulse Generator)

Equipment Required

Table 4   Required Test Equipment for Bandwidth Verification

Description	Critical Specification(s)	Recommended Model / Part Number & Adapters	Purpose
SMA or 2.92 mm male to male cable		N2823A coaxial phase-matched cable	To connect pulse generator to PV fixture
Oscilloscope	Infiniium / InfiniiVision oscilloscope with AutoProbe I interface	Recommended: MXR608A/B Alternate: EXR604A/B	To display probe output
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	81160A	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
Alligator Clip Accessory	Safety alligator clips supplied with the probe		To connect the DP0001A probe leads to the PV fixture

Procedure

1 Make connections as described in the following steps.

   a Connect the DP0020A Performance Verification fixture to any oscilloscope channel using the SMA to BNC adapter included in the DP0020A PV kit. The

channel where the PV fixture is connected to, 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 OUT1 of the pulse generator.

d Connect the DP003xA 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 to the header pins on the PV fixture using the alligator clip provided in the accessory kit.

f Place the positive (+) tip of the probe (red alligator clip) on the center conductor (signal path) of the PV fixture.

g Place the negative (–) tip of the probe (black alligator clip) to the ground plane located on either side of the center conductor of the PV fixture.

2 Configure the Pulse Generator:

a Select the preferred Channel of operation CH1/2

b Press the 'Cont' and 'Square' buttons

c Set Frequency to 20 MHz

d Set Amplitude to 2 V

e Set Offset to 0 V

f Set Load Impedance to 50 ohm

g Retain other parameters, such as:

- Duty Cycle at 50%

- Delay at 0 s

- Polarity set to Normal

- Coupling Frequency set to off

h Press the OUT1 button

3 Configure the oscilloscope:

a Select **Setup** > **Factory Default**. On the dialog, select **Yes** to return the oscilloscope to a known state.

b Set the PV Fixture channel to **50 Ω** input.

c Set the vertical scale of the PV fixture channel to **500 mV/div** and center the waveform.

d Set the trigger level on the PV fixture channel to **~ 500mV** positive slope.

e Set the horizontal scale to **4.5 nS/div**.

f Set the vertical scale of the probe channel to change the desired attenuation ratio. Adjust as needed to overlap the fixture channel signal. Due to high attenuation, the signal display on the scope may not be clearly visible.

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

· select the **Enabled** check box for **Analog Averaging** with **# of Averages** as **4096**.

· set the **Analog Sampling Rate** to **16.00 G Sa/s**

h Select **Setup** > **Horizontal...** and set the reference point to Center to position the trigger point mid-level on the PV Fixture channel.

i Click **Math** > **Functions...**.

j In the **Function** dialog box, define the functions f1, f2, f3, and f4 as described further.

Defining f1 settings

1 Do not select the **On** check box for f1.

2 In the **Function 1** area, select **Math** and **Differentiate**, respectively from each list.

3 Clear the **Low Pass and Align Phase** check box.

4 From the **Source** drop-down options, select your PV fixture channel. In the following image, the PV fixture channel is set to *Channel 4*.
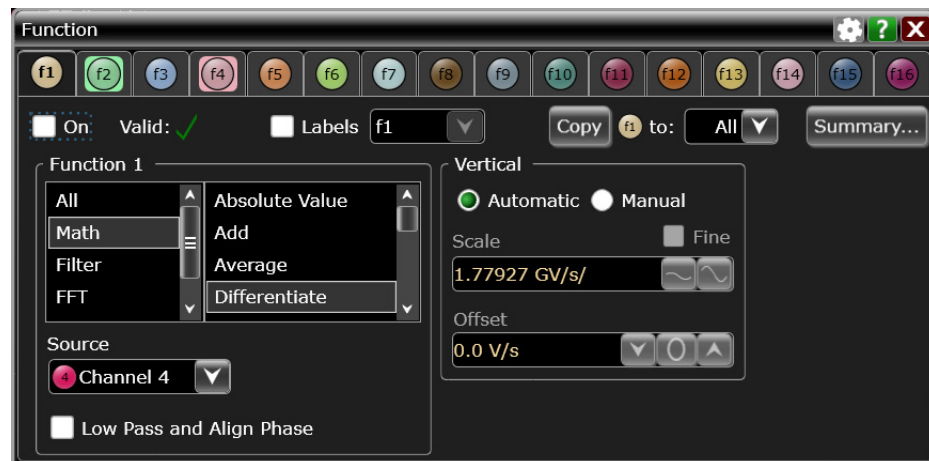
Defining f2 settings

1 Select the **On** check box for f2.

2 In the **Function 2** area, select **FFT** and **FFT Magnitude**, respectively from each list.

3 From the **Source** drop-down options, set the source to **f1:Diff(Ch4)**.

4 From the **Window** drop-down options, select **Hanning**.

5 In the **Vertical** area, set the **Scale** to **3.00000 dBm/** and the **Reference Level** to **172.000 dBm**.

6 In the **Horizontal** area, set the **Horizontal Scale** to **Logarithmic**, **Start** to **1 Hz**, **Stop** to be **1.00000000 GHz** and **RBW** to **30.00 MHz**.

Defining f3 settings

1 Do not select the **On** check box for f3.

2 In the **Function 3** area, select **Math** and **Differentiate**, respectively from each list.

3 Clear the **Low Pass and Align Phase** check box.

4 From the **Source** drop-down options, select your Probe channel. In the following image, the Probe channel is set to *Channel 2*.
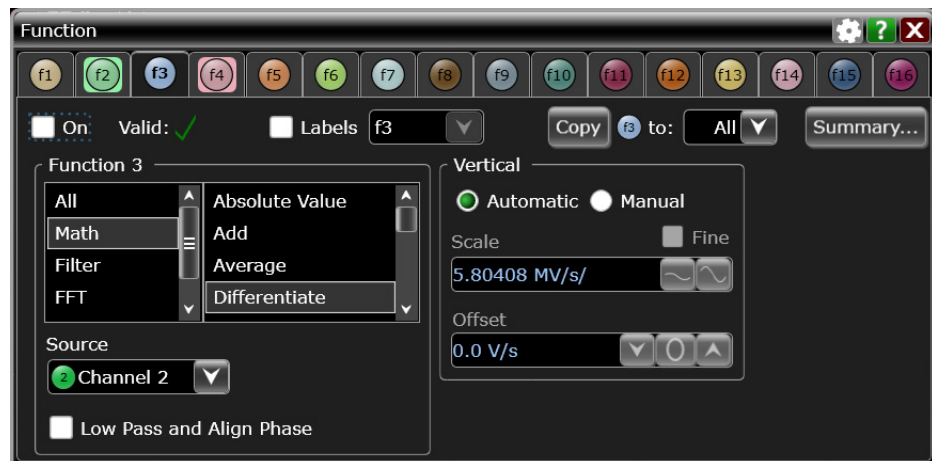
Defining f4 settings

1 Select the **On** check box for f4.

2 In the **Function 4** area, select **FFT** and **FFT Magnitude**, respectively from each list.

3 From the **Source** drop-down options, set the source to **f3:Diff(Ch2)**.

4 From the **Window** drop-down options, select **Hanning**.

5 In the **Vertical** area, set the **Scale** to **3.00000 dBm/** and the **Reference Level** to **145.000 dBm** for Low Attenuation (and **125.000 dBm** for High Attenuation) for DP0031A probes.

  · Adjust accordingly for the remaining probe models

6 In the **Horizontal** area, set the **Horizontal Scale** to **Logarithmic**, **Start** to **1 Hz**, **Stop** to be **1.00000000 GHz** and **RBW** to **30.00 MHz**.

Drag the mouse cursor to move both f2 and f4 traces up to the center screen. Overlay the left side of the traces.

Check the probe response FFT (f4). It should not be more than 3 db below the PV fixture response FFT (f2).

Performance Test Record

Table 5   Performance Test Record

Model #:	Date:		Tested by:	
Serial #:	Recommended next test date:			
Test	**Test Limits**		**Result**	**Pass/Fail**
DC Gain Accuracy	± 1.0% + scope gain accuracy (for DP0031A/32A/33A probes only) (High & Low Attenuation) ± 2.0% + scope gain accuracy (for DP0030A probe only) (High & Low Attenuation)			
Bandwidth (–3 dB)	200 MHz (for DP0031A/32A/33A probes only) 100 MHz (for DP0030A probe only)			

Index

A

adapter, 9
auto attenuation ranges, 7

C

CMRR, 44

G

grounding probe, 16

I

Infiniium oscilloscopes, 9
Infiniium software version, 9

P

performance test record, 63
performance verification, 51
probe
grounding, 16

S

software, 9

Index