
DP0030A/31A/32A/33A

High Voltage Differential Active Probes & Probe Accessories

Notices

© Keysight Technologies, 2024

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Keysight Technologies, Inc. as governed by United States and international copyright laws.

Manual Part Number

DP0030-97000

Edition

First Edition, February 2025

Published by:
Keysight Technologies, Inc.

1900 Garden of the Gods Road
Colorado Springs, CO 80907 USA

Warranty

The material contained in this document is provided “as is,” and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Keysight disclaims all warranties, either express or implied, with regard to this manual and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Keysight shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Keysight and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

U.S. Government Rights

The Software is "commercial computer software," as defined by Federal Acquisition Regulation ("FAR") 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement ("DFARS") 227.7202, the U.S. government acquires commercial computer software under the same terms by which the software is customarily provided to the public. Accordingly, Keysight provides the Software to U.S. government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA), a copy of which can be found at

<http://www.keysight.com/find/sweula>. The license set forth in the EULA represents the exclusive authority by which the U.S. government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Keysight: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform, display, or disclose commercial computer software or commercial computer software documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in writing elsewhere in the EULA. Keysight shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the U.S. government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any

technical data. 52.227-14 (June 1987) or DFAR 252.227-7015 (b)(2) (November 1995), as applicable in any technical data.

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

Introduction	6
Key Features	7
Compatibility with Keysight Oscilloscopes	9
Probe Dimensions	10
Standard Accessories	11
Orderable Accessories	12
Additional Accessory Kit (DP0040A)	12
Additional Accessory Kit (DP0041A)	12
Characteristics and Specifications	13
Electrical Specifications and Characteristics	13
Environmental Characteristics (for all DP003xA probes)	14
Mechanical Characteristics	14

2 General Information

Inspecting the Probe	16
Cleaning & Handling Probes	17
Cleaning the Probe	17
Handling the Probe	17
Returning the Probe for Service	18
Contacting Keysight Technologies	19

3 Safety and Regulatory Information

Safety Checks and Warnings	22
Instrument Markings and Symbols	25
About Measurement Category	27
About Pollution Degrees	28

4 Setting up and Using the Probe

Grounding the Probe	29
Using the Supplied Accessories	29
Connecting the Probe to an Oscilloscope	30
Using Channel Identification Rings	30
Configuring the DP003xA Settings in the Oscilloscope Software GUI	31
On an Infiniium Oscilloscope	31
On an InfiniiVision Oscilloscope	32

5 Performance Plots

Typical Voltage Derating (Mains Isolated)	38
Typical Input Impedance	41
Frequency Response	44
DP003xA Frequency Response Test Setup	45
Differential Probe Gain and CMRR plots over Frequency	46
Differential Probe Gain High Attenuation Plot	46
Differential Probe Gain Low Attenuation Plot	47
CMRR High Attenuation Plot	48
CMRR Low Attenuation Plot	49

6 Performance Verification

Before you Start	52
Recommended Test Interval	52
DC Gain Accuracy Verification	53
Required Test Equipment	53
Procedure	53
Bandwidth Verification	55
FFT Magnitude (Using External Pulse Generator)	55
Performance Test Record	64

Index

1 Overview

Introduction	6
Key Features	7
Compatibility with Keysight Oscilloscopes	9
Standard Accessories	11
Orderable Accessories	12

Introduction

The DP0030A/31A/32A/33A probes are high-voltage differential active probes. While you can use these probes with a Keysight oscilloscope having $1\text{M}\ \Omega$ input impedance, the DP0030A model is compatible with other (non-Keysight) oscilloscopes with $1\text{M}\ \Omega$ input impedance and 25/250 attenuation ranges.

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 and 25/250 attenuation ranges.



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		
3000 X-Series	None	InfiniiVision 7.65 or higher
4000 X-Series		
6000 X-Series		
HD3-Series		InfiniiVision 10.06 or higher

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.

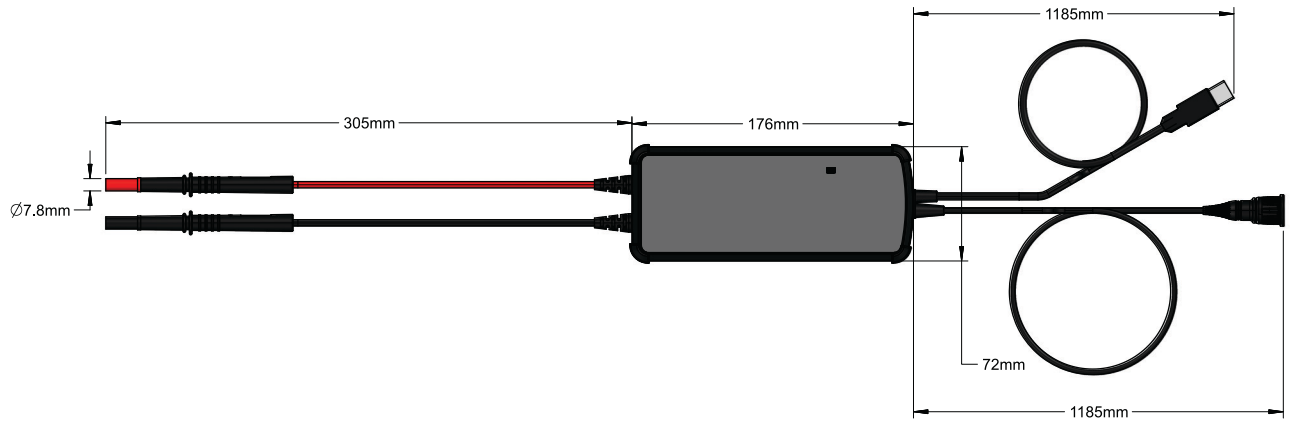


Figure 3 DP0030A dimensions

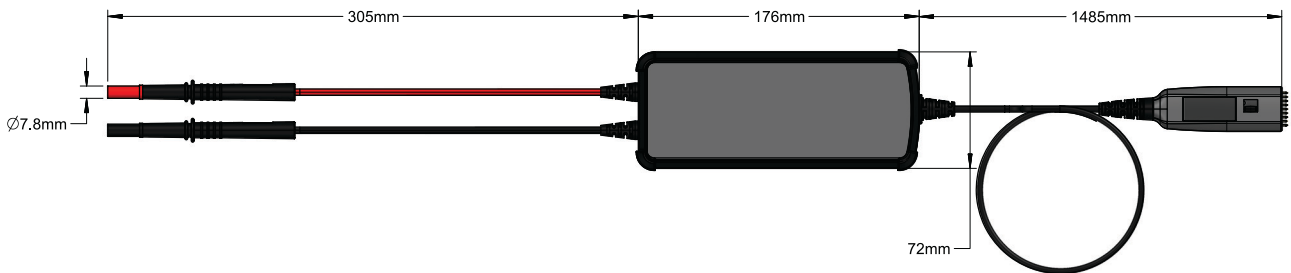


Figure 4 DP0031A/32A/33A dimensions






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 M Ω	5 M Ω	10 M Ω	20 M Ω
Input C (diff.)			2 pF	
Max. differential input range (high) mains-isolated	$\pm 750 V_{\text{peak}}$	$\pm 750 V_{\text{peak}}$	$\pm 1500 V_{\text{peak}}$	$\pm 3000 V_{\text{peak}}$
Max. differential input range (low) mains-isolated	$\pm 75 V_{\text{peak}}$	$\pm 75 V_{\text{peak}}$	$\pm 150 V_{\text{peak}}$	$\pm 300 V_{\text{peak}}$
Max. common-mode input range mains-isolated	$\pm 750 V_{\text{peak}}$	$\pm 750 V_{\text{peak}}$	$\pm 1500 V_{\text{peak}}$	$\pm 3000 V_{\text{peak}}$
Offset (diff.)	Scope offset only	Scope offset only	Scope offset only	Scope offset only
Offset error	N/A		$\pm 0.2\%$ of range	
Offset drift		$< 100 \mu\text{V}/^\circ\text{C}$		
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)	$< 50 \text{ mV}_{\text{rms}}$	$< 50 \text{ mV}_{\text{rms}}$	$< 150 \text{ mV}_{\text{rms}}$	$< 250 \text{ mV}_{\text{rms}}$
Noise (low range)	$< 20 \text{ mV}_{\text{rms}}$	$< 20 \text{ mV}_{\text{rms}}$	$< 30 \text{ mV}_{\text{rms}}$	$< 50 \text{ mV}_{\text{rms}}$
CMRR (high range)	DC: $> 80 \text{ dB}$ 1 kHz: $> 50 \text{ dB}$ 1 MHz: $> 40 \text{ dB}$ 100 MHz: $> 20 \text{ dB}$		DC: $> 80 \text{ dB}$ 1 kHz: $> 65 \text{ dB}$ 1 MHz: $> 55 \text{ dB}$ 100 MHz: $> 30 \text{ dB}$	
Output drive		1 M Ω		

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

Inspecting the Probe	16
Cleaning & Handling Probes	17
Returning the Probe for Service	18
Contacting Keysight Technologies	19

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.

2 General Information

3 Safety and Regulatory Information

Safety Checks and Warnings	22
Instrument Markings and Symbols	25
About Measurement Category	27
About Pollution Degrees	28

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
	<p>This mark indicates that this product has been evaluated against the US and Canadian Safety Standards.</p>
	<p>This symbol indicates the Environmental Protection Use Period (EPUP) for the product's toxic substances for the China RoHS requirements.</p>
	<p>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.</p>
	<p>The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.</p>
 <p data-bbox="477 1262 651 1314">CAN ICES/NMB-001(A) ISM GRP 1-A</p>	<p>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.</p>
<p>MAINS ISOLATED</p>	<p>IEC Measurement Category MAINS ISOLATED is for measurements performed on circuits not directly connected to mains.</p>
 <p data-bbox="496 1629 597 1682">Kst-1A21762</p>	<p>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.</p>
 <p data-bbox="496 1818 597 1871">Kst-1A21763</p>	<p>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.</p>

Symbol	Description
	<p>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.</p>
	<p>This mark denotes compliance with the essential requirements of the following applicable UK regulations:</p> <ul style="list-style-type: none"> ▪ 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.

<p>사용자 안내문</p>
<p>이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.</p>

※ 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

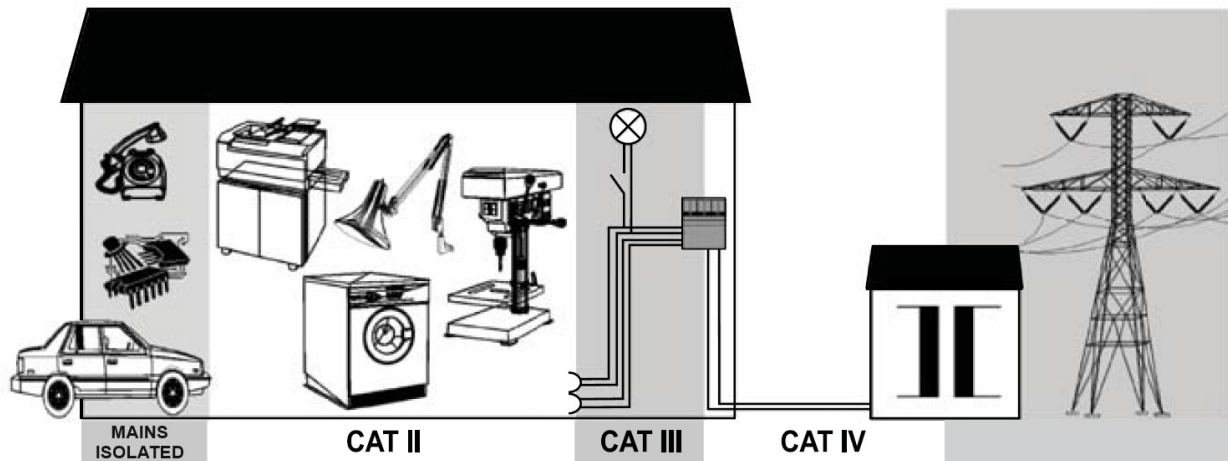
The DP003xA has a safety rating of CAT III, as indicated in the table in **“Electrical Specifications and Characteristics”** on page 13.

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.



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

Connecting the Probe to an Oscilloscope **30**

Configuring the DP003xA Settings in the Oscilloscope Software GUI **31**

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.

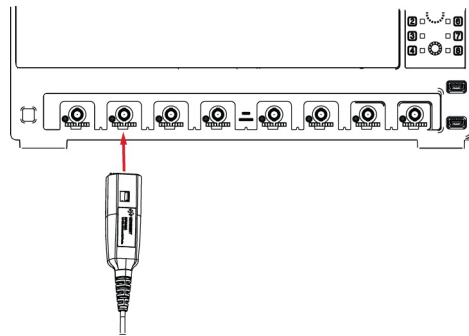
Use the hook clips to clamp onto smaller components and the alligator clips to clamp onto thicker gauge devices.

Connecting the Probe to an Oscilloscope

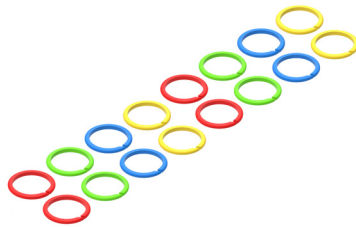
NOTE

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.

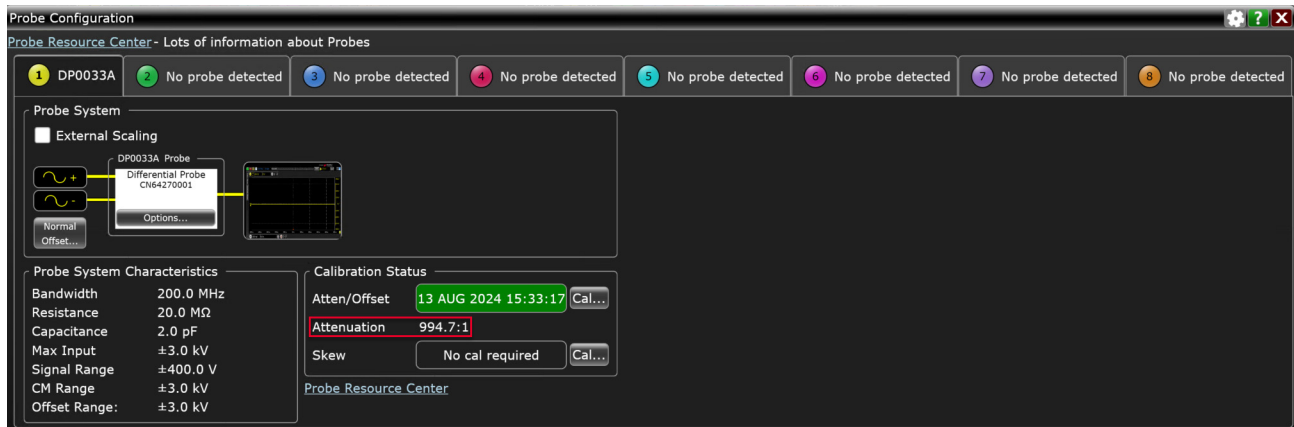
On an Infiniium Oscilloscope

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.

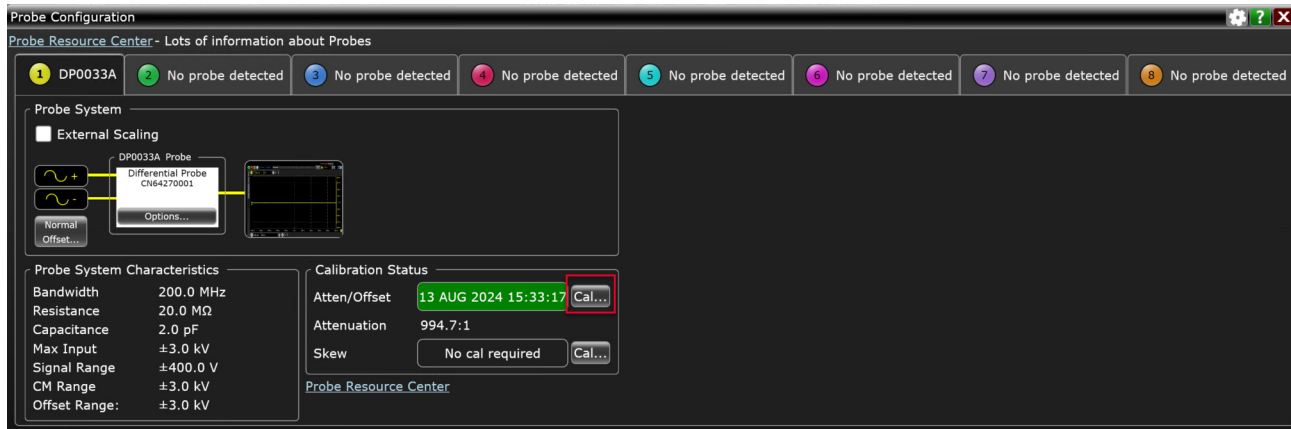
The Attenuation Setting LED on the probe indicates the currently set attenuation. You can also view the currently set attenuation in the Infiniium GUI's **Probe Configuration** dialog box as displayed below.



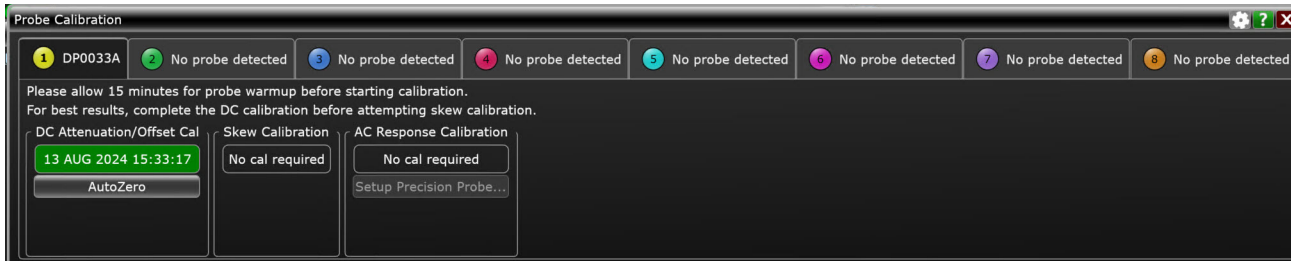
Performing DC Offset Calibration

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 corresponding 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

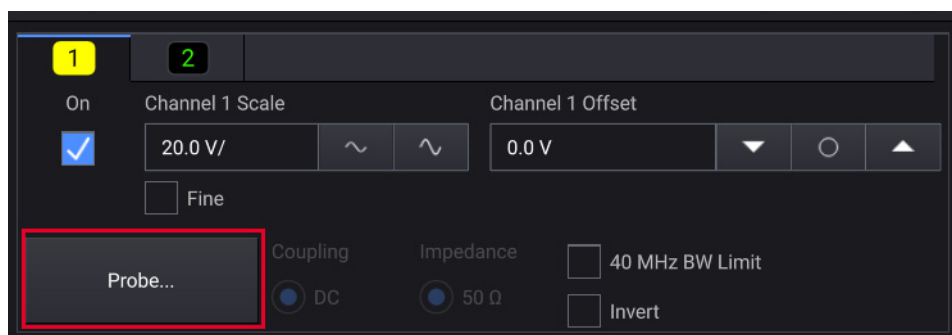
If there is an overvoltage condition and the Overload Indicator LED on the probe lights up, you need to adjust the probe's attenuation to resolve this overload condition.

To set the attenuation mode:

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

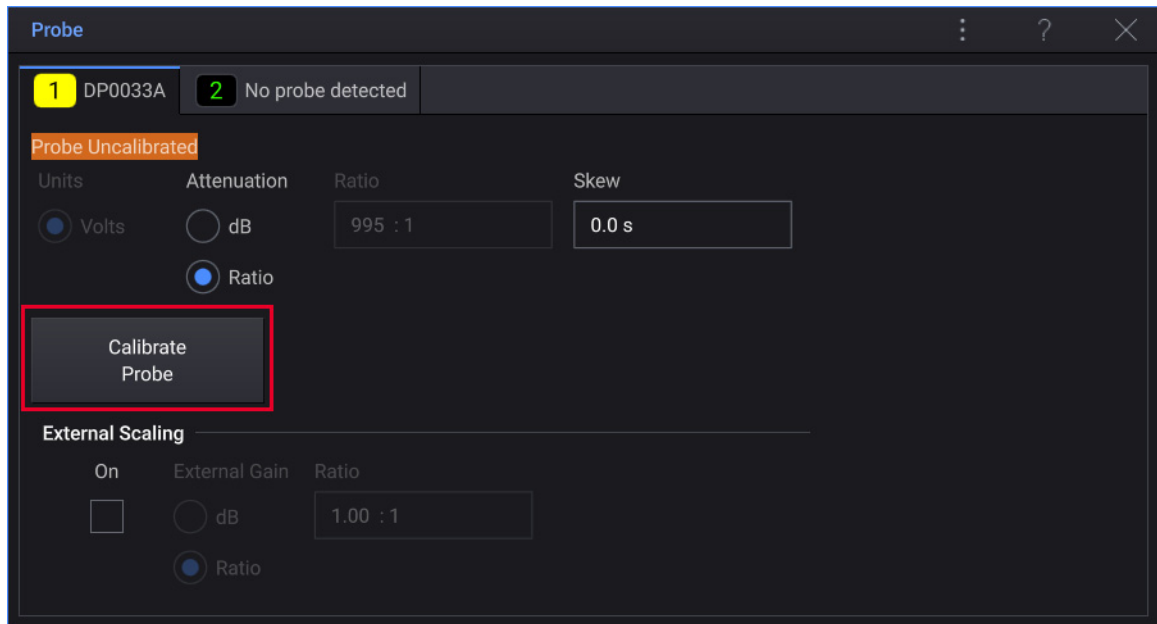


- 2 Press the **Probe** softkey to display the channel's probe menu.



By default, the Probe dialog displays “Probe Uncalibrated”.

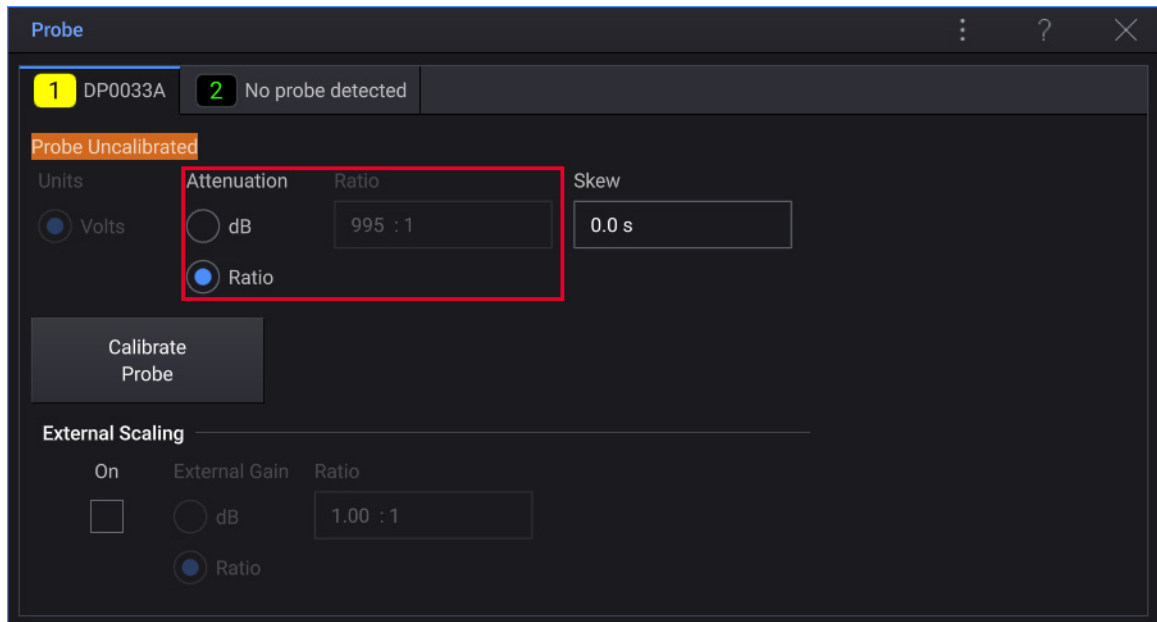
3 Click **Calibrate Probe** to initiate calibration.



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.



4 Setting up and Using the Probe

5 Performance Plots

Typical Voltage Derating (Mains Isolated)	38
Typical Input Impedance	41
Frequency Response	44
Differential Probe Gain and CMRR plots over Frequency	46

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.

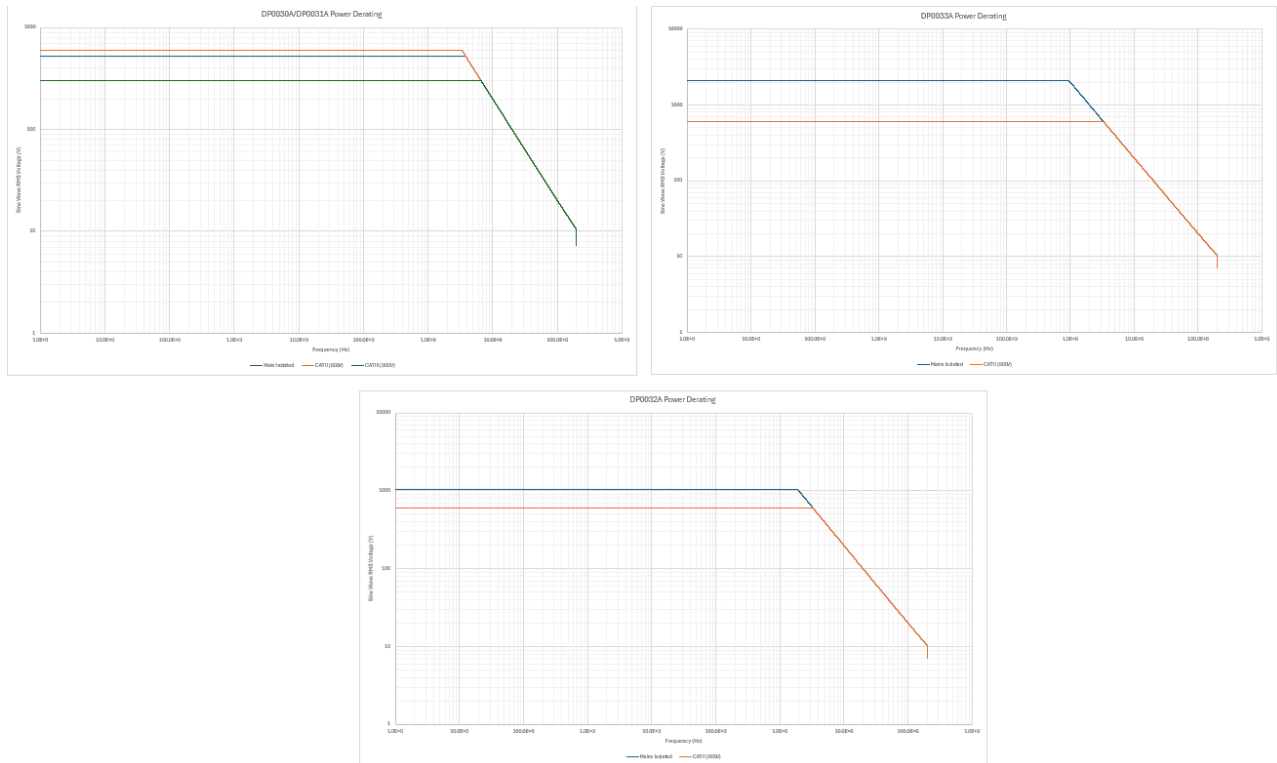


Figure 6 Summary of DP003xA Voltage Derating curves

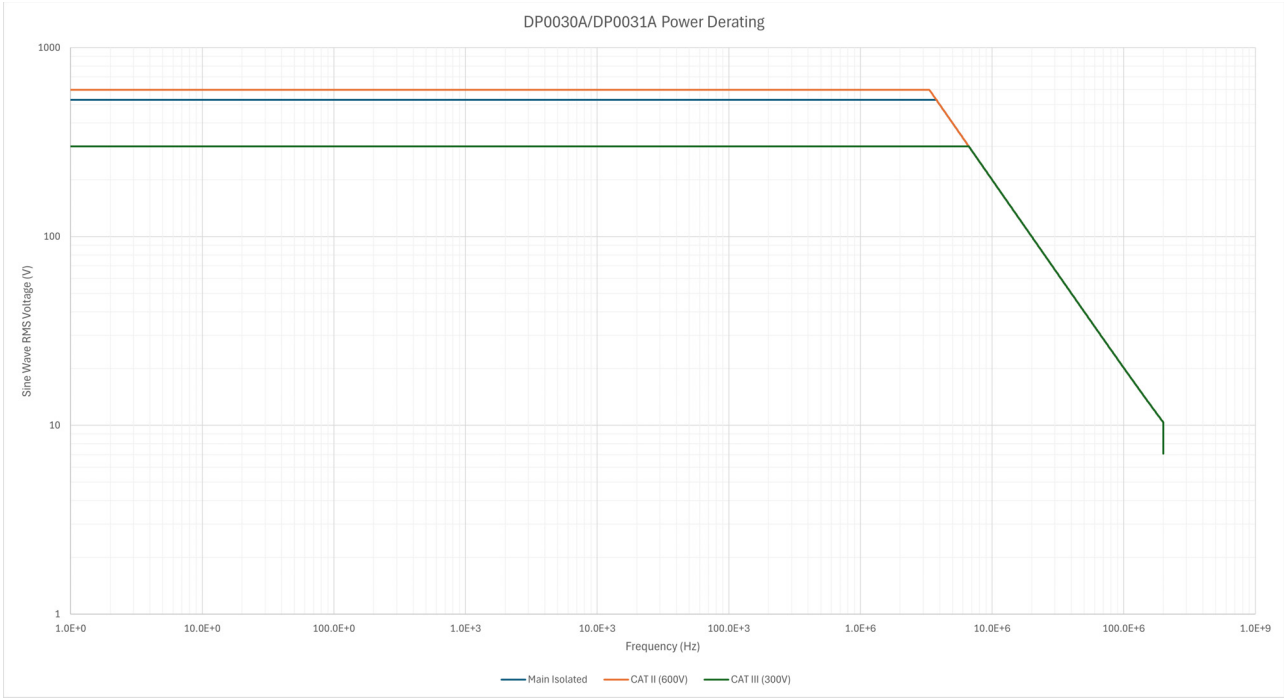


Figure 7 DP0030A/DP0031A Voltage Derating curves

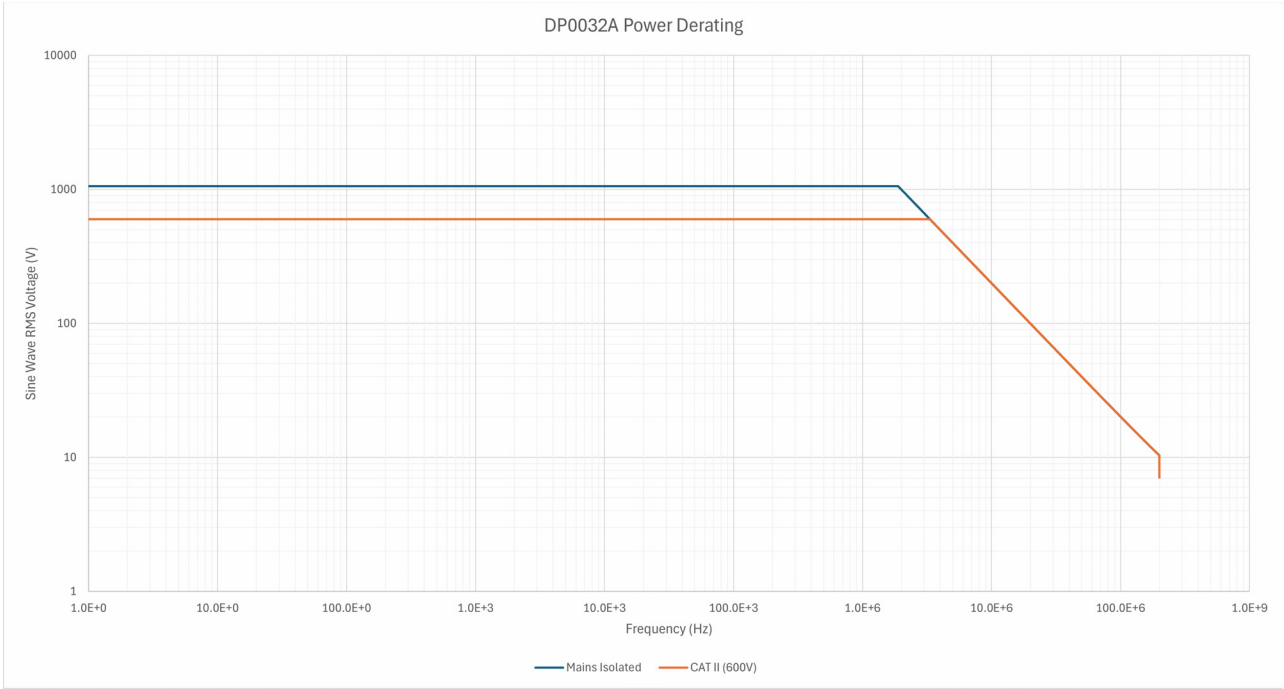


Figure 8 DP0032A Voltage Derating curves

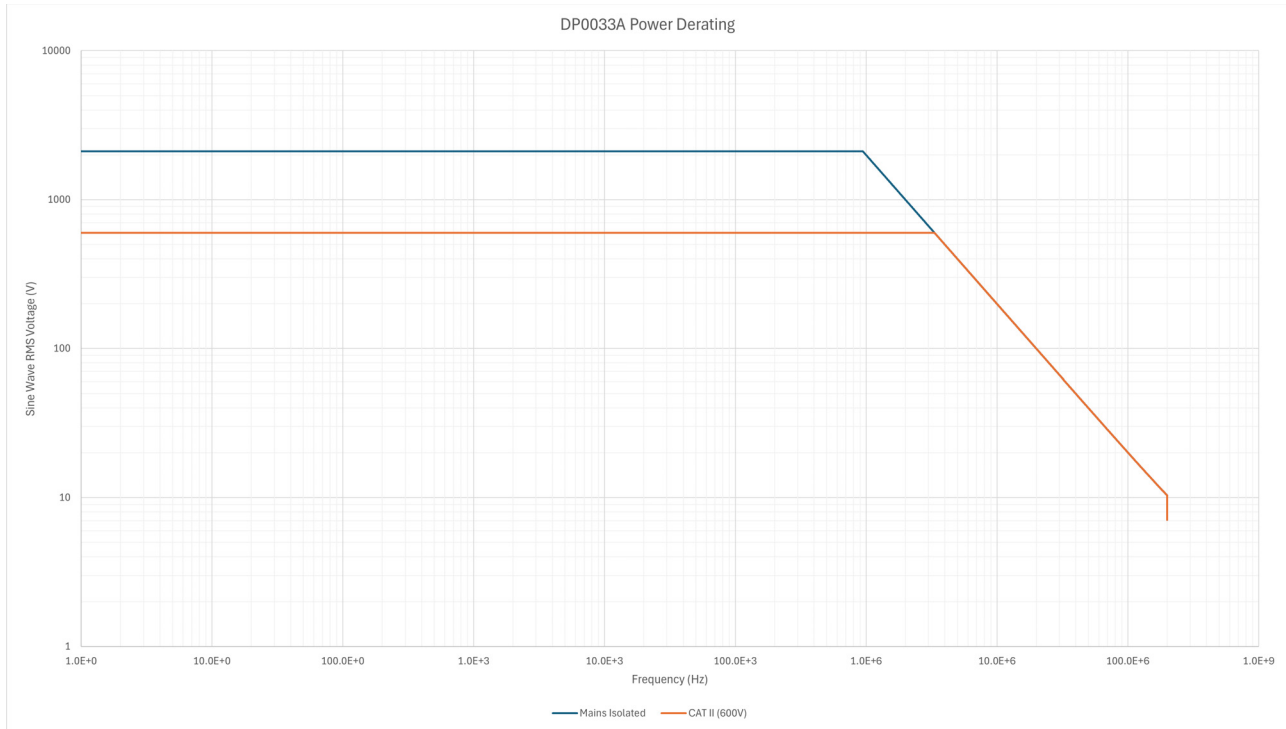


Figure 9 DP0033A Voltage Derating curves

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.

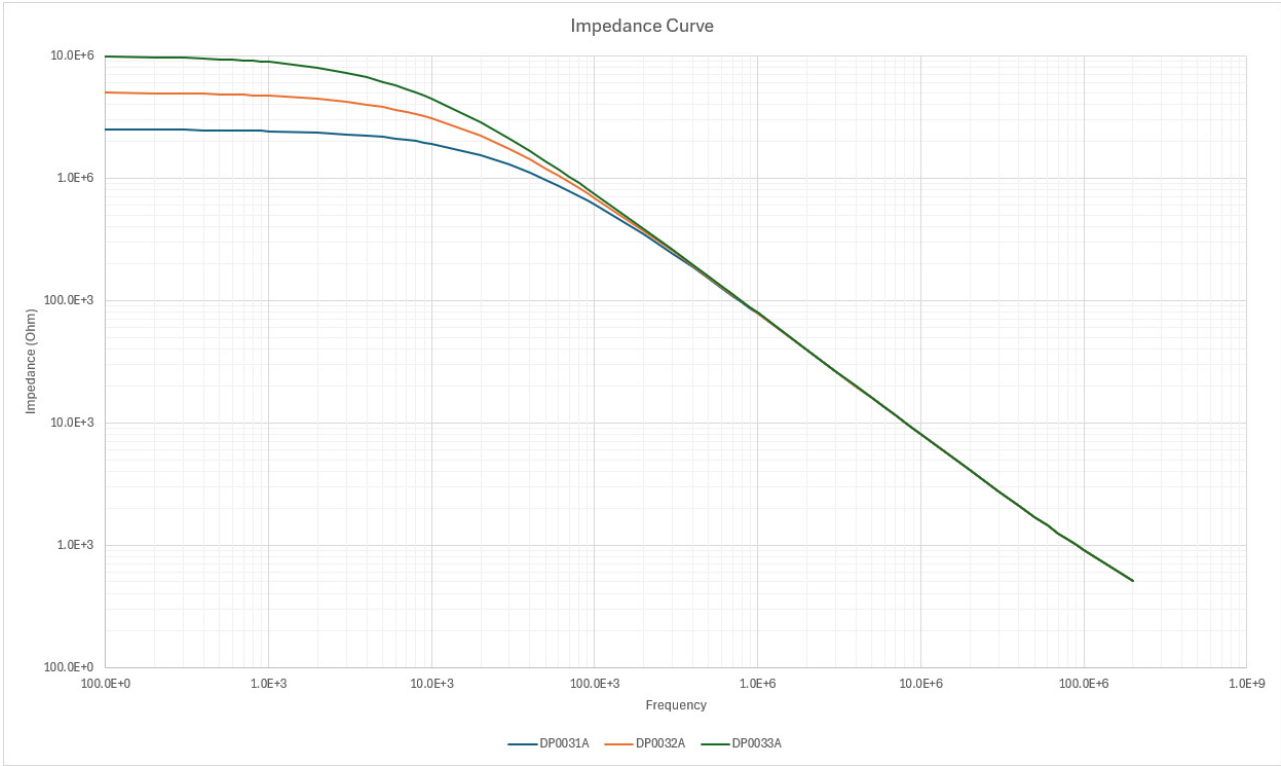


Figure 10 DP003xA Input Impedance Curves

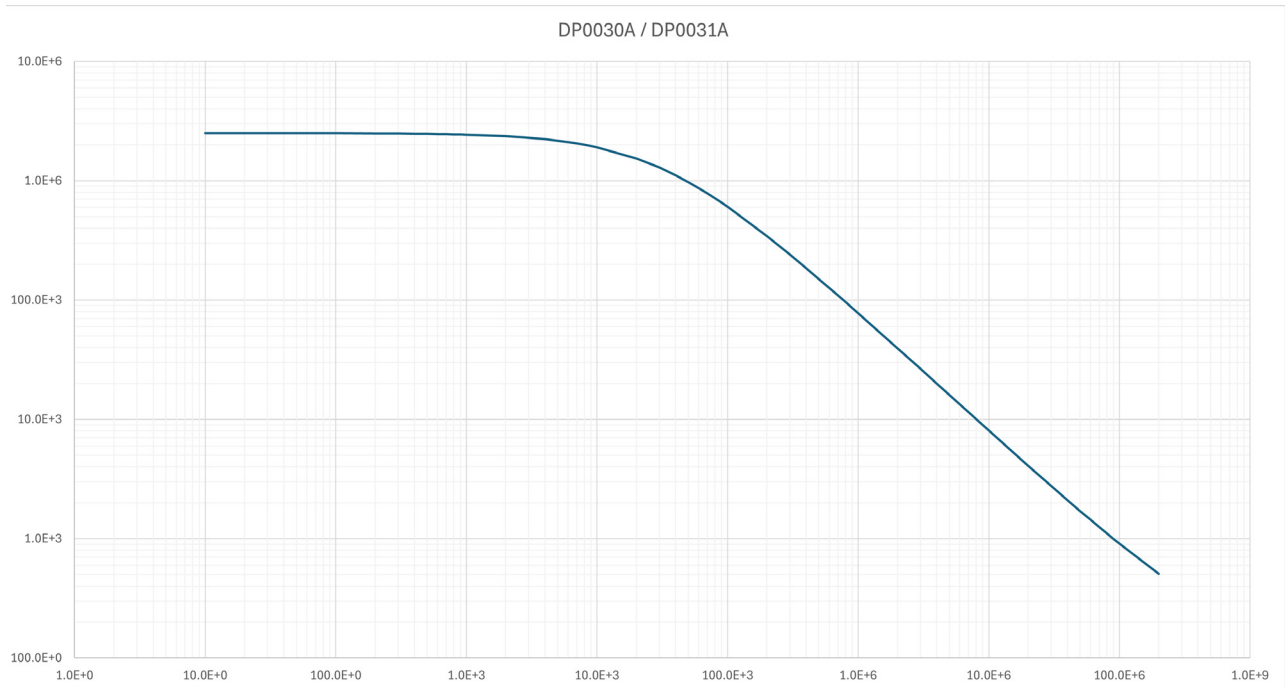


Figure 11 DP0030A/DP0031A Input Impedance Curves

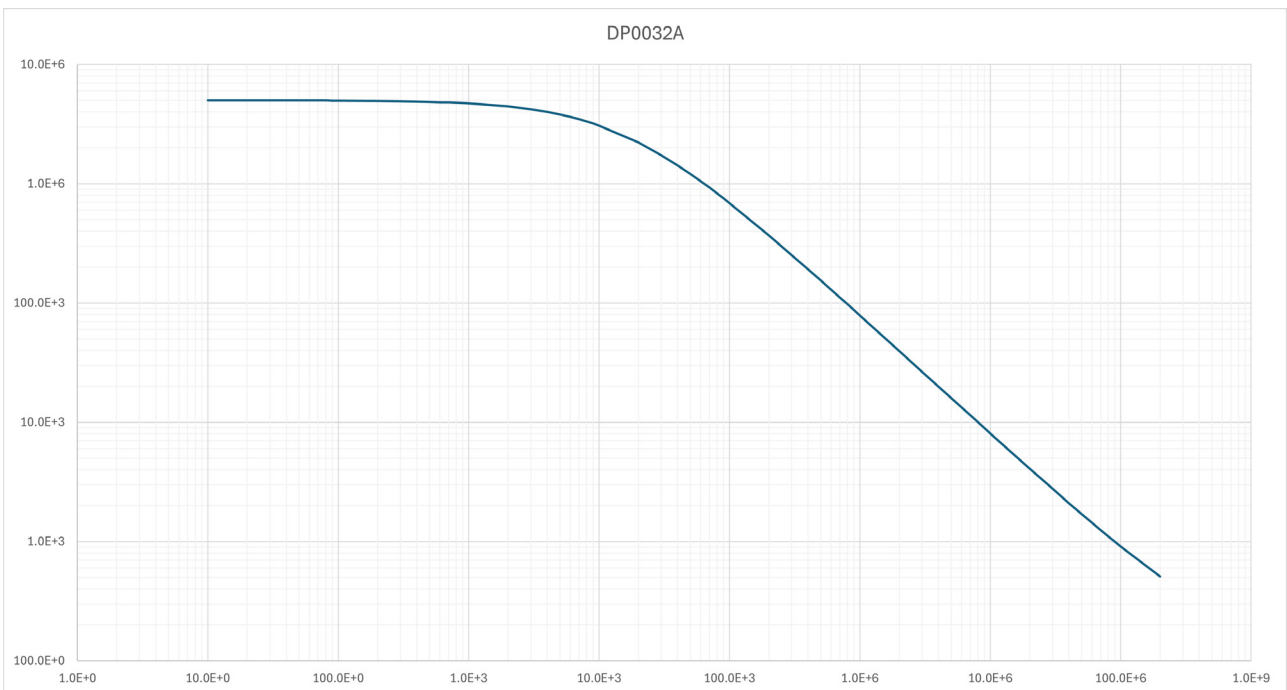


Figure 12 DP0032A Input Impedance Curves

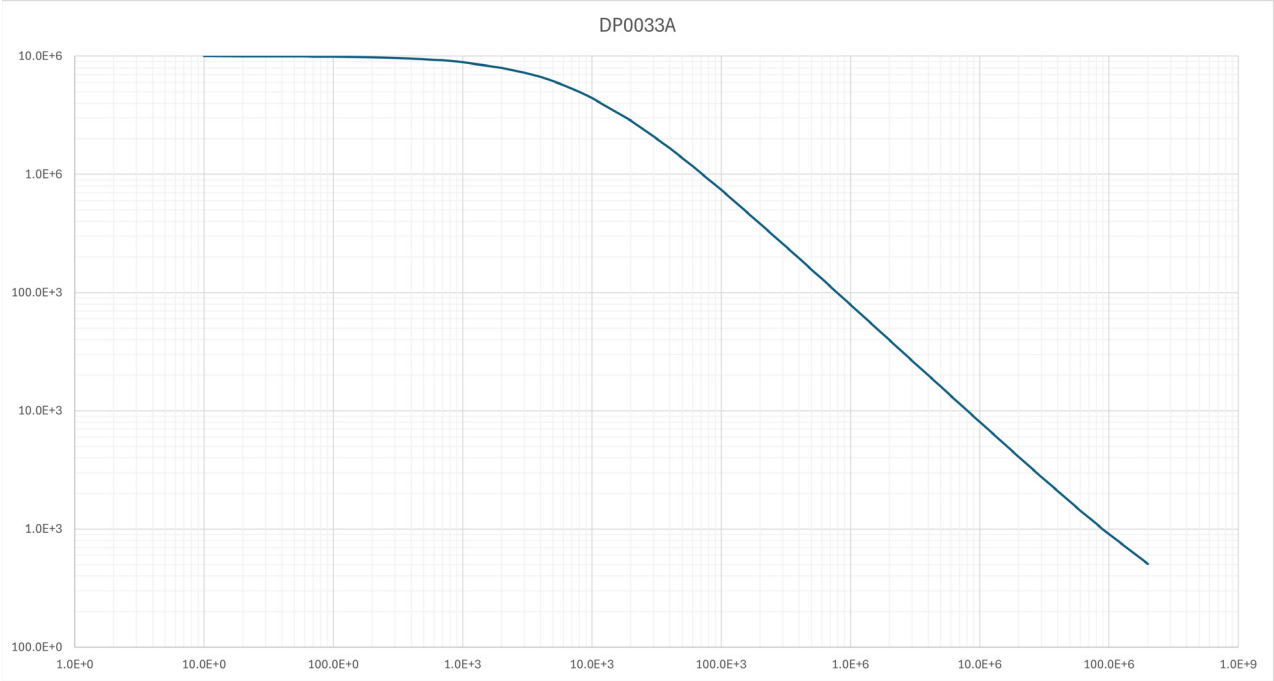


Figure 13 DP0033A Input Impedance Curves

Frequency Response

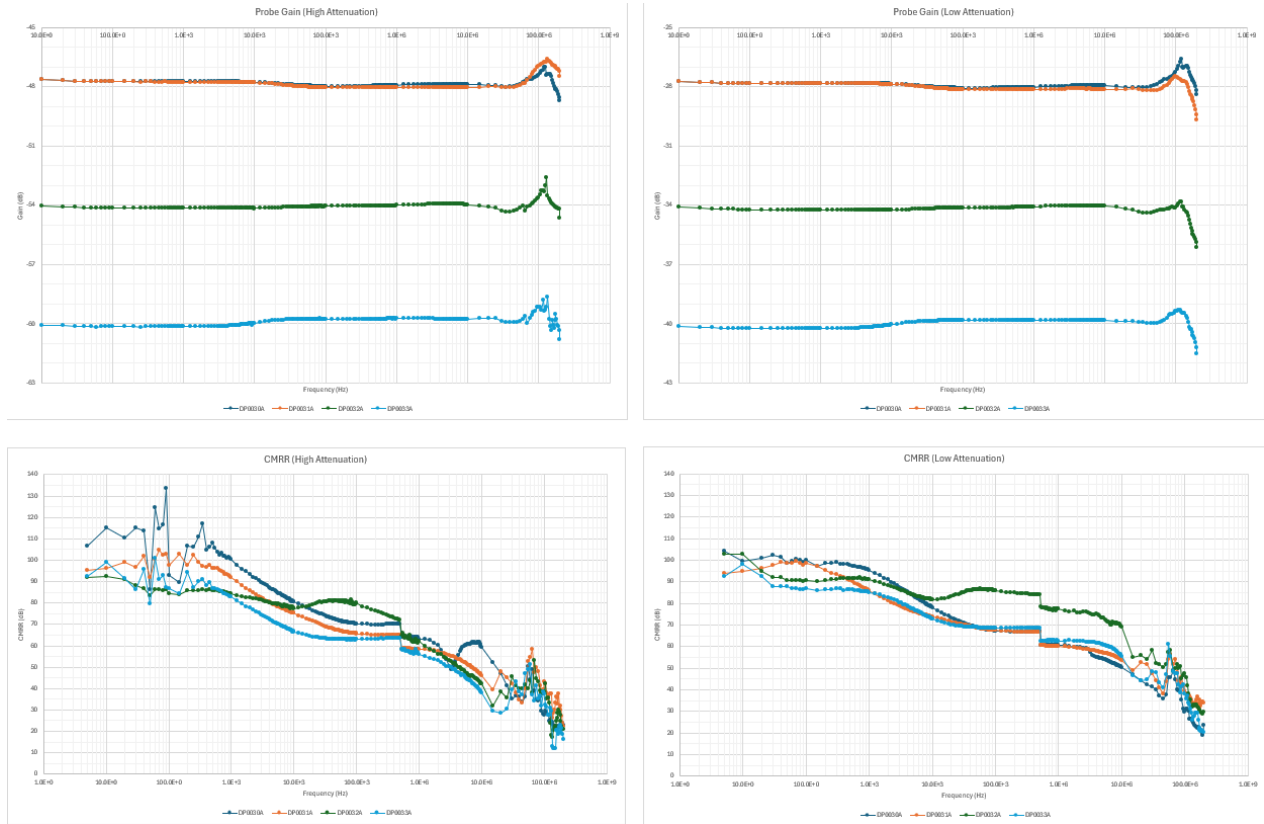


Figure 14 DP003xA Frequency response plot at four different attenuation ratio settings

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.

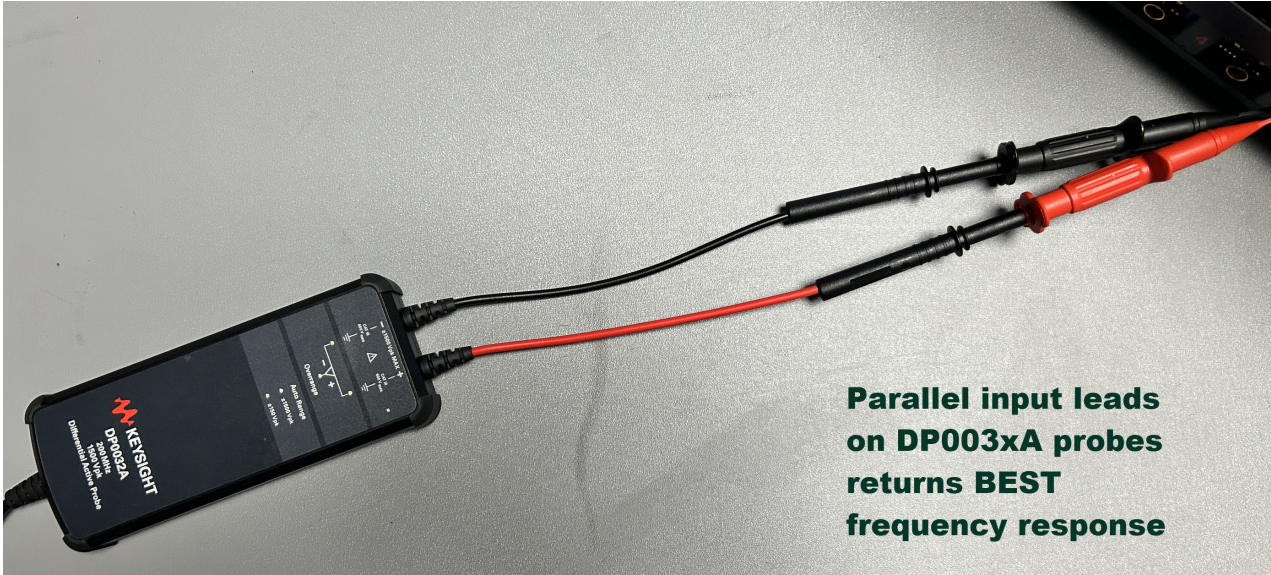


Figure 15 DP003xA Input leads set in parallel returns best frequency response

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

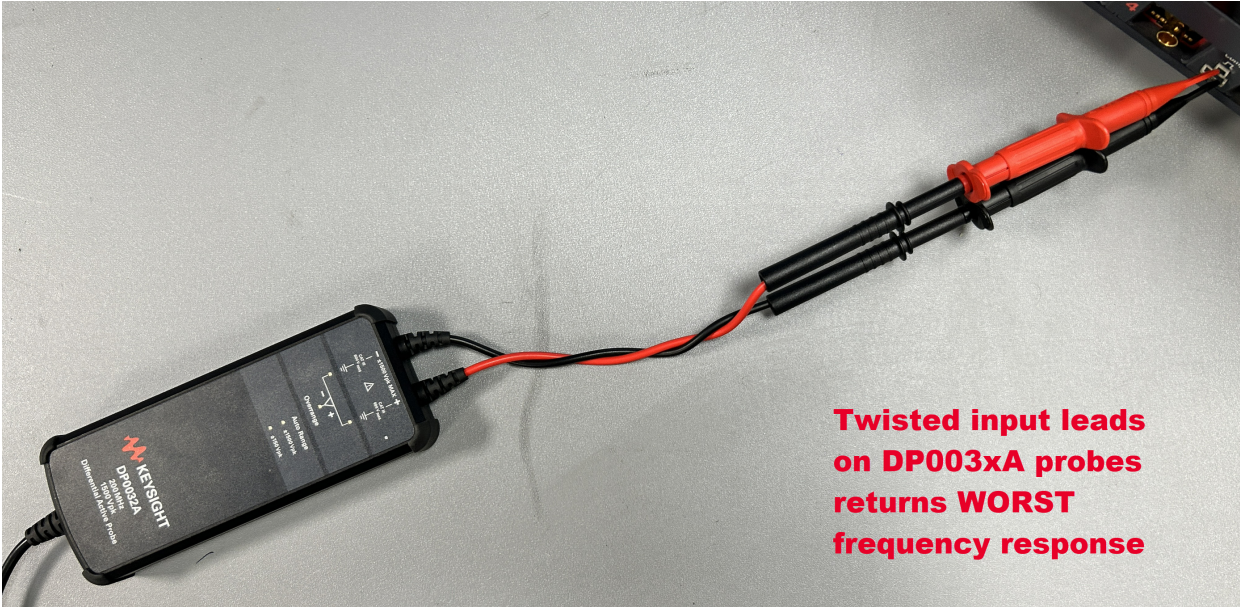


Figure 16 DP003xA Input leads set in twisted returns worst frequency response

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

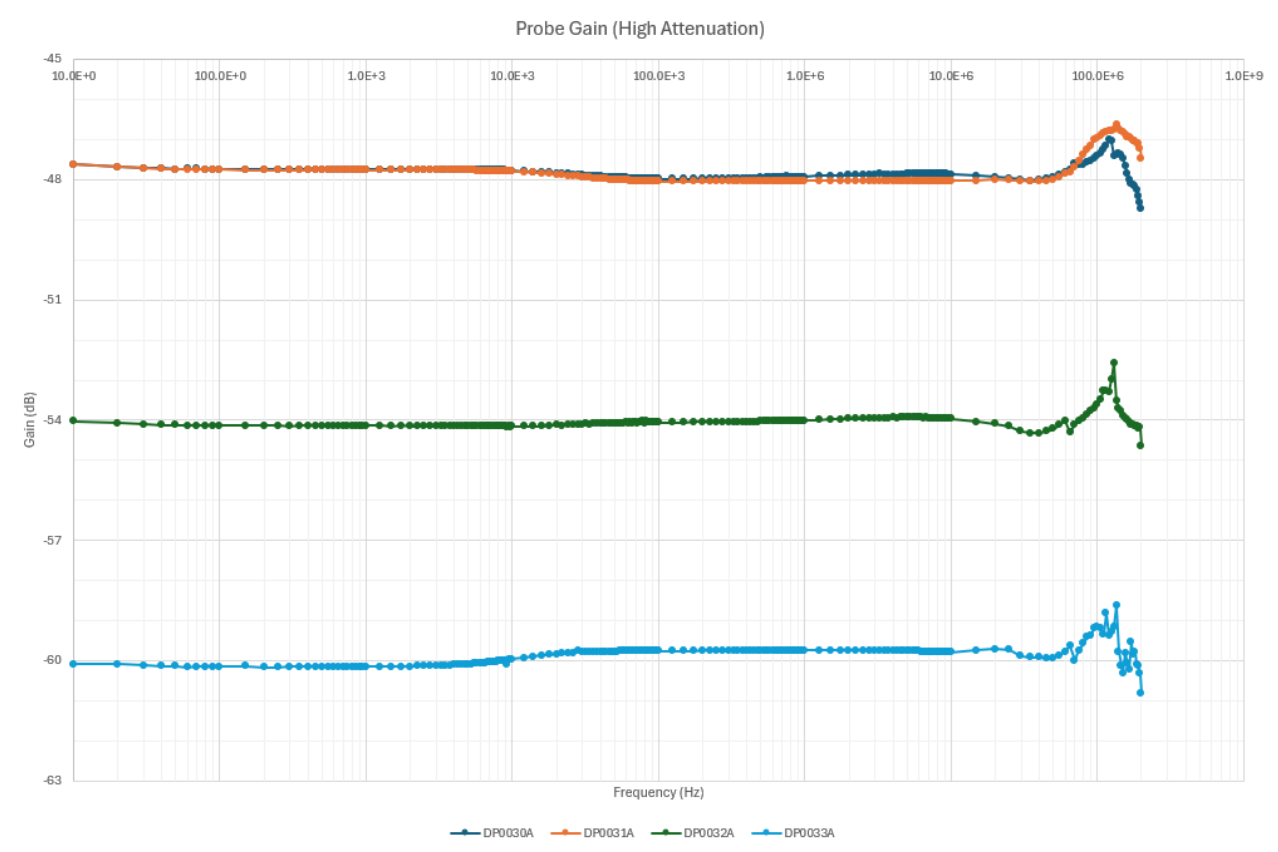


Figure 17 Differential Gain versus Frequency plot at High Attenuation

Differential Probe Gain Low Attenuation Plot

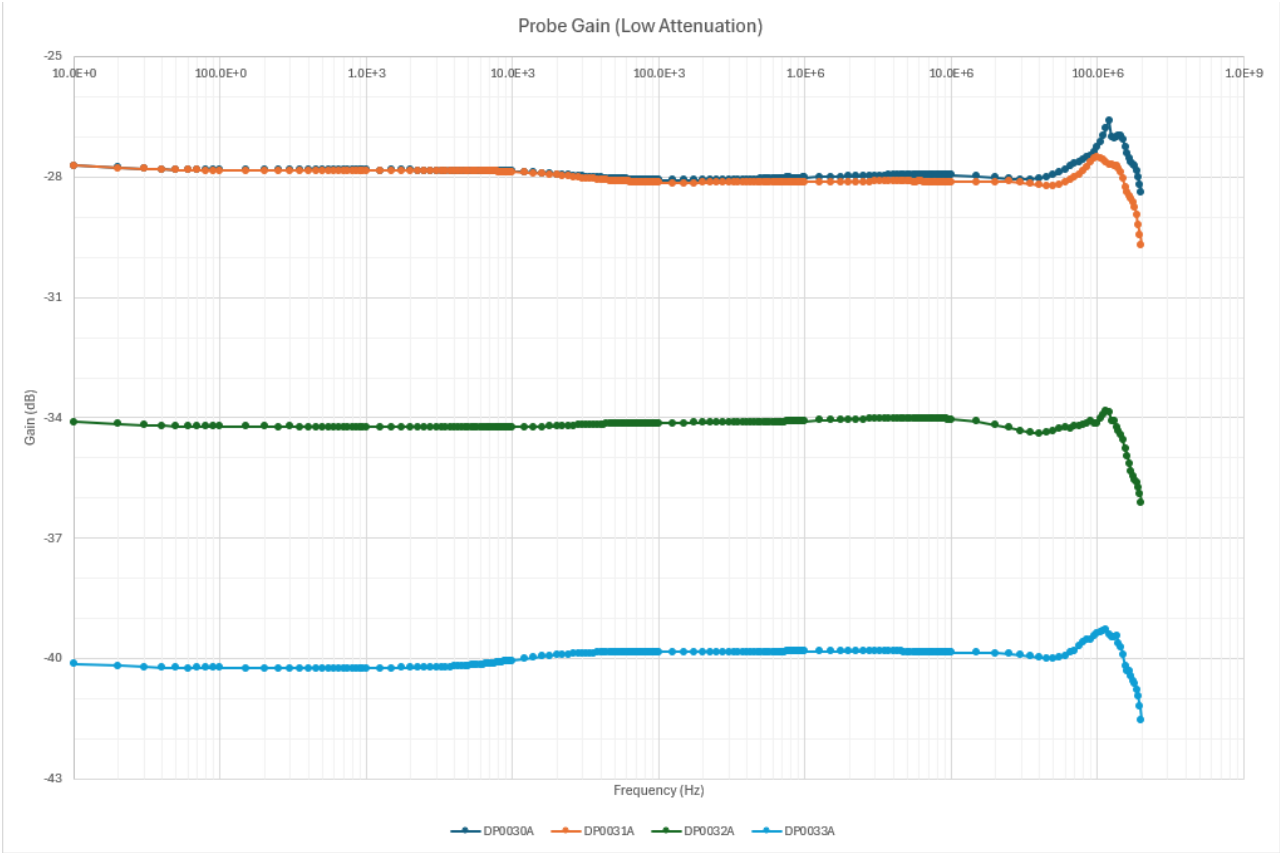


Figure 18 Differential Gain versus Frequency plot at Low Attenuation

CMRR High Attenuation Plot

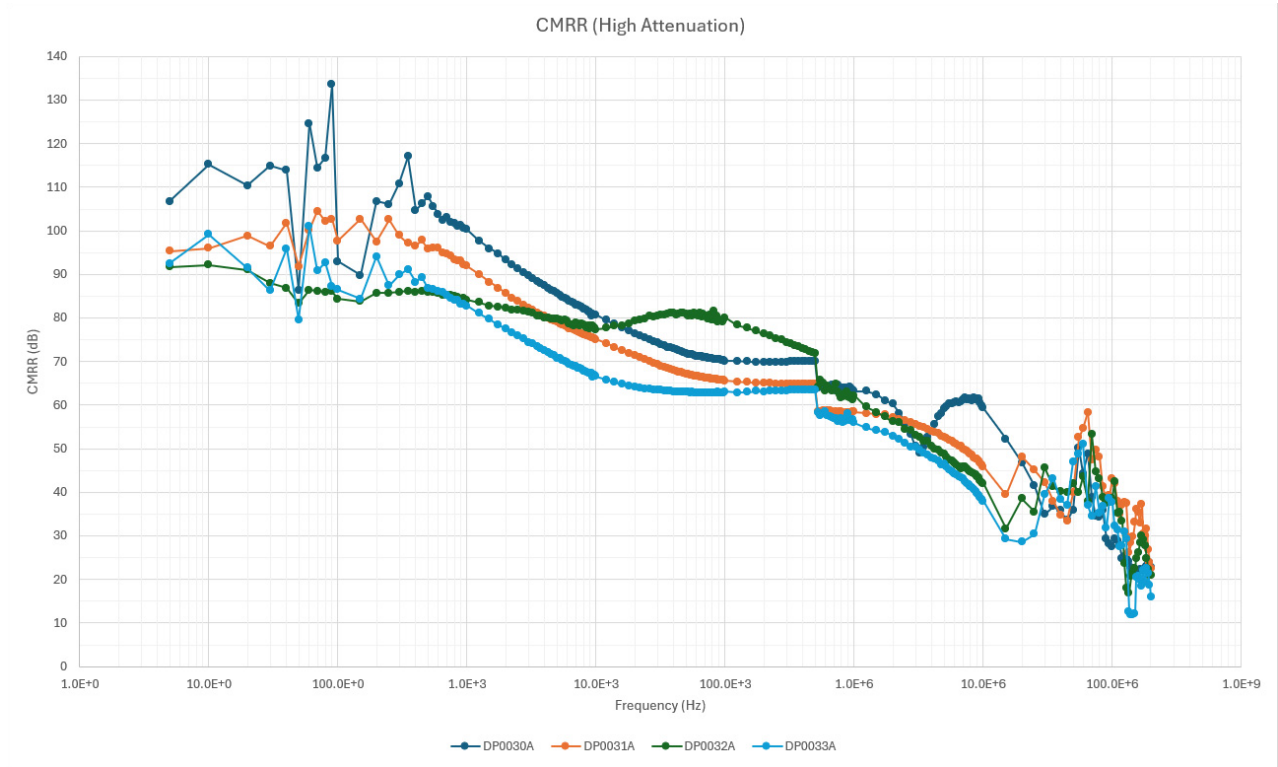


Figure 19 CMRR versus Frequency plot at High Attenuation

CMRR Low Attenuation Plot

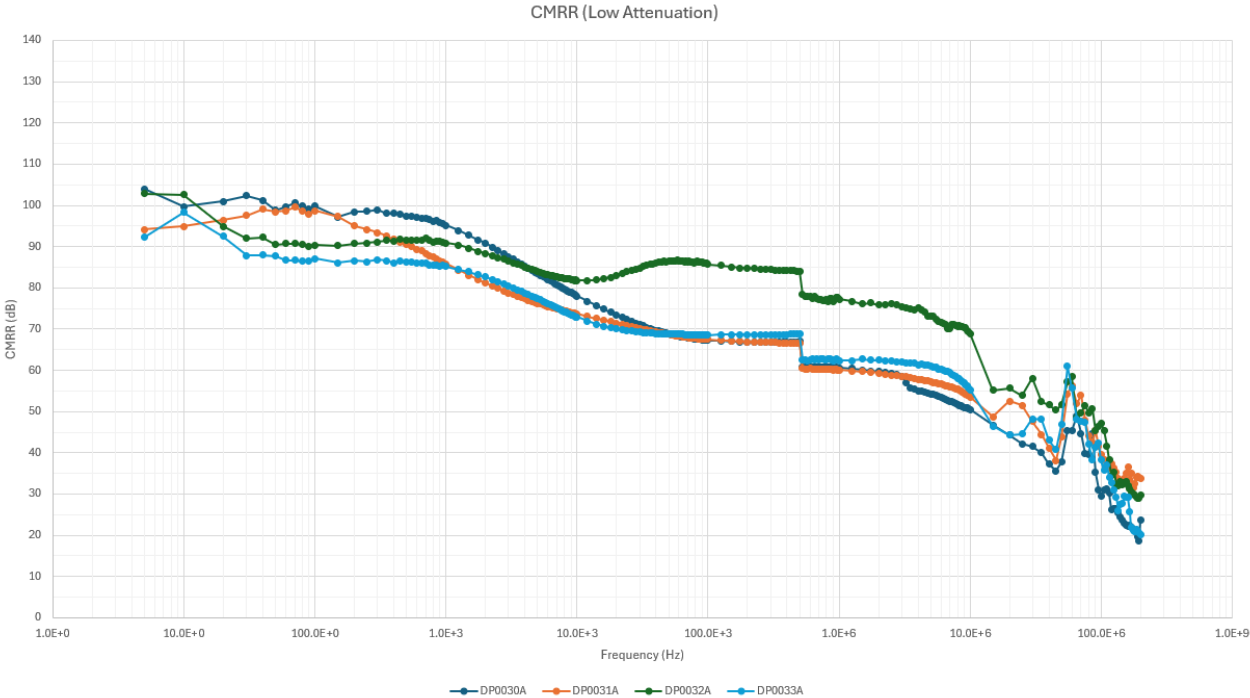


Figure 20 CMRR versus Frequency plot at Low Attenuation

6 Performance Verification

Before you Start	52
DC Gain Accuracy Verification	53
Bandwidth Verification	55
Performance Test Record	64

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

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 μ A”.
- 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.

$$\text{Probe Gain Accuracy(\%)} = [40 - (V_{\text{probeout}} - V_{\text{offset}})] / 40 \times 100$$
- 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
BNC (Male) To Banana Jack Dual Adapter	Pomona Electronics Product no. 72937 (Recommended)		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 using a BNC (Male) To Banana Jack Dual Adapter. This channel is referred to as the probe channel in this procedure. See [Figure 21](#) for the required connections.



Figure 21 Connecting the probe with a BNC (Male) To Banana Jack Dual Adapter

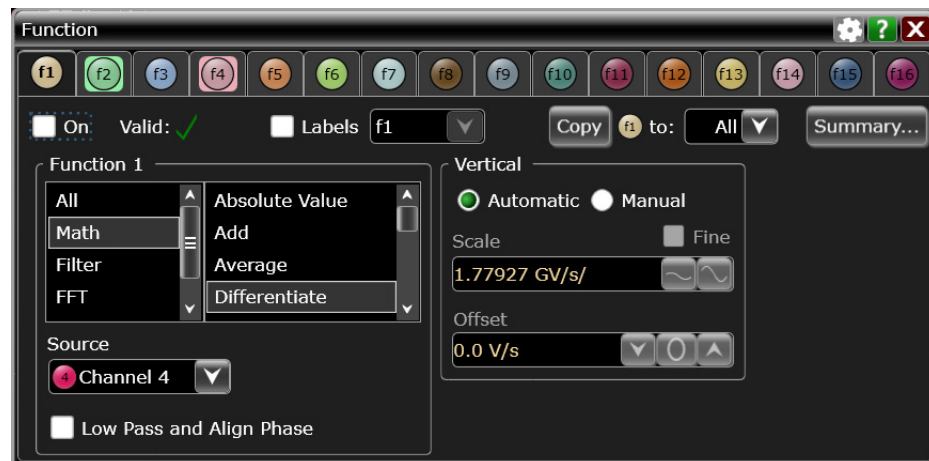
- 2 Configure the Pulse Generator:
 - a Select the preferred Channel of operation CH1/2
 - b Press the 'Cont' and 'Square' buttons
 - c Set Frequency to 20 MHz
 - d Set Amplitude to 2 V
 - e Set Offset to 0 V
 - f Set Load Impedance to 50 ohm
 - g Retain other parameters, such as:
 - Duty Cycle at 50%
 - 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*.



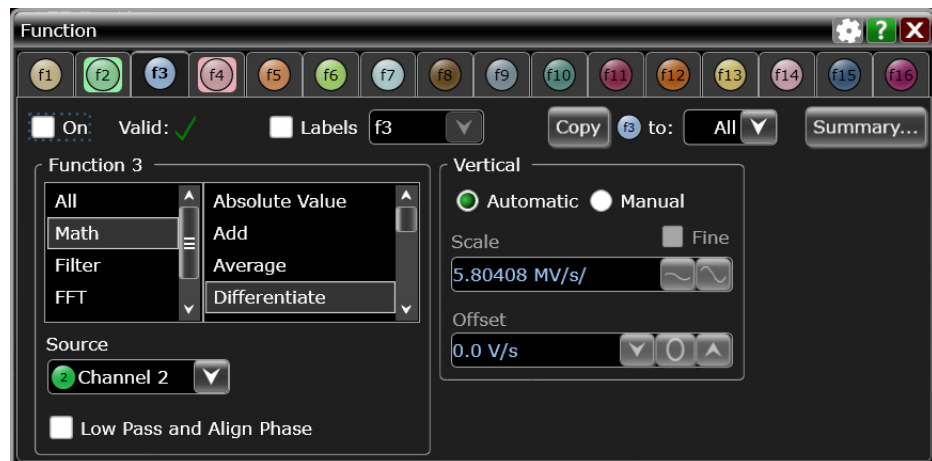
Defining f2 settings

- 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	$\pm 1.0\%$ + scope gain accuracy (for DP0031A/32A/33A probes only) (High & Low Attenuation) $\pm 2.0\%$ + 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, 64
performance verification, 51
probe
 grounding, 16

S

software, 9

