MX0030A/31A/32A InfiniiMax 4 Series RCRC Probe Amplifiers & Probe Heads

KEYSIGHT

USER GUIDE

Notices

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WARNING

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

Contents

1 MX0030A/31A/32A Probe Amplifiers – Overview

This user's guide describes how to set up and use the following InfiniiMax 4 series probe amplifiers with their InfiniiMax 4 probe heads.

Probe Amplifiers
MX0030A 42 GHz (AutoProbe III Interface)
MX0031A 52 GHz (AutoProbe III Interface)
MX0032A 52 GHz with 40 GHz Bessel-Thomson (AutoProbe III Interface)

Probe Heads
MX0041A InfiniiMax 4 Differential Solder-in Probe Head
MX0042A InfiniiMax 4 Differential Solder-in Probe Head

Refer to the Keysight N2830/1/2A and N7000/1/2/3A InfiniiMax III+ Series Probes User's Guide for details on the following InfiniiMax III/III+ probe heads that are recommended for use with InfiniiMax 4 series probe amplifiers.

- N5445A Differential Browser
- N5444A 2.92 / 3.5 mm SMA Head
- MX0109A Extreme Temperature Solder-in Probe Head
- N5439A ZIF Probe Head
- N2836A Solder-in Probe Head

Introduction

The InfiniiMax 4 series probe amplifiers provide the highest bandwidth (maximum up to 52 GHz) and an RCRC input impedance profile to support maximum speed with minimal loading.

With measurements ranging up to 52 GHz, these amplifiers are suitable for assessing next-generation high-speed signals with performance and precision.

You can use these amplifiers to probe differential as well as single-ended signals.

These amplifiers support a wide variety of flexible connectivity solutions, covering emerging signaling standards such as PCIe 6/7, IEEE 802.3CK and other high-speed signal debug and validation test needs.

With a broad range of supported probe heads and accessories (new as well as backward compatibility to most InfiniiMax III / III+ probe heads), these probe amplifiers cater to a wide variety of probing situations including faster and harder to probe small geometry target devices.

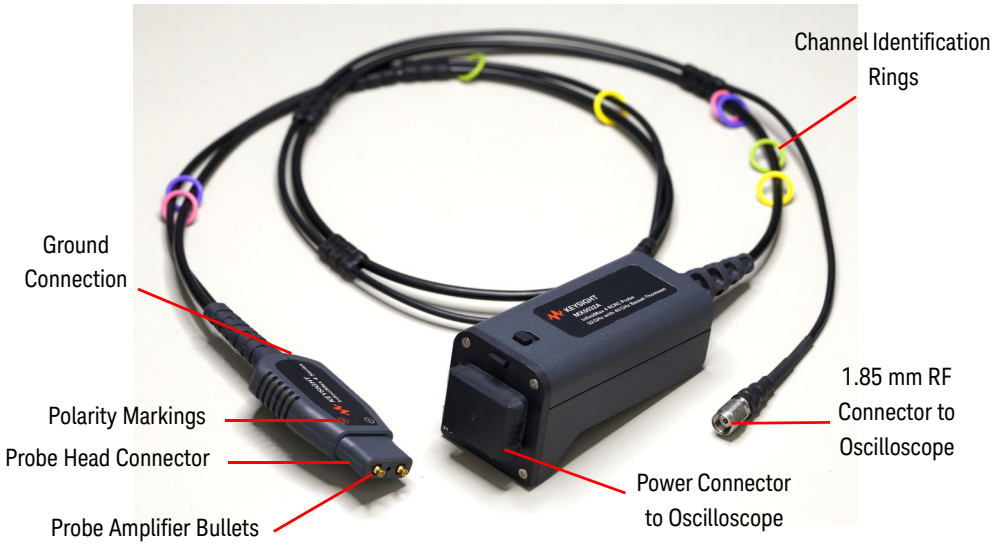


Figure 1 InfiniiMax 4 Series Probe Amplifier

Table 1 InfiniiMax 4 Series Probe Amplifier Components

Probe Amplifier Component	Description/Usage
AutoProbe III Interface	The MX0030A/31A/32A probe amplifiers have the Keysight AutoProbe III interface to connect these to a compatible Keysight oscilloscope (see page 11). This interface has two components - Power Connector and RF Connector.

Table 1 InfiniiMax 4 Series Probe Amplifier Components

Probe Amplifier Component	Description/Usage
Power Connector	Through the Power Connector, the probe gets its power, probe offset, and auto configuration of probe type and attenuation setting from the oscilloscope's AutoProbe interface.
1.85 mm RF Connector to Oscilloscope	Through the RF connector, the probe transmits output to Keysight AutoProbe III Interface oscilloscope.
Channel Identification Rings	When multiple probes are connected to the oscilloscope, use the channel identification rings to associate the channel inputs with each probe. Place one colored ring near the probe's output connector and place an identical color ring near the probe head connector.
Polarity Markings (+ and -)	Polarity markings to indicate the + and - inputs of the probe amplifier.
Probe Head Connector	Use this connector to connect your probe amplifier to one of the supported probe heads (see page 14).
Ground Connection	Allows you to connect the DUT ground to the probe amplifier ground using a ground lead wire. This is needed if the DUT is not grounded to the oscilloscope via the AC mains ground.
Probe Amplifier Bullets	Refer to the topic "Replacing a Damaged Probe Amplifier Bullet" on page 36 to know how to identify a damaged bullet and how to replace it.

InfiniiMax 4 Series Probe Amplifiers Key Features

"RCRC" Input Impedance Architecture

These probe amplifiers have the RCRC input impedance profile to meet the high accuracy probing solution requirements for high-speed digital designs. In the RCRC architecture, the input impedance profile of the probe is dominated by the probe's resistance from low frequencies to high frequencies, then probe's capacitance, then resistance again, and then capacitance again.

See Also: Demystifying RCRC and RC probes Application Note

Yielding Accurate Measurements

These probe amplifiers have built-in probe specific s-parameter correction filter to ensure a flat frequency response. This unique s-parameter of the probe amplifier is used with the s-parameters of various supported probe heads to further flatten the magnitude and phase response of the probe for high accuracy measurements. Each probe head has different s-parameters stored in the oscilloscope's firmware. On selecting the probe head in the oscilloscope's software, the appropriate s-parameters for the probe head are used in conjunction with the probe amplifier's s-parameters to compute the overall probe correction for your measurement case.

Two Input Attenuation Ranges

These probe amplifiers support the following two input attenuation settings.

- 1 Vpp, ±0.5V @5:1 Highest precision measurement on 1 Vpp (Maximum Input Range)
- 2 Vpp, ±1V @10:1 High voltage measurement on 2 Vpp (Maximum Input Range)

The input range is automatically configured depending on the vertical scale of the oscilloscope.

High Bandwidth Probing Requirements

These probe amplifiers efficiently fulfill the probing bandwidth requirements up to 52 GHz (52 GHz Brickwall response and 40 GHz Bessel Thompson response) ensuring it meets the demands of next-generation testing requirements. This includes support for faster DDR, PCIe, and 400G/800G technologies.

Applicable System Bandwidth

For any combination of a probe head with these probe amplifiers, the applicable system bandwidth is the lesser of the supported bandwidths of the probe head or the probe amplifier. For instance, the MX0032A supports 52 GHz bandwidth. Therefore, if, for example, you use it with the MX0042A probe head, which supports a 42 GHz bandwidth, then this combination would produce a system with a 42 GHz bandwidth.

InfiniiMax 4 Modular Design

InfiniiMax 4 is a modular probing system comprising of probe amplifier, the probe head connector, and two flexible printed circuit (FPC) probe heads of varying lengths (MX0041A and MX0042A), catering to diverse testing needs. This modular design facilitates rapid attachment of the amplifier to different probe head connectors. Additionally, the three different mounting cradles aid in precisely aligning the probe and DUT.

Compatibility with Keysight Oscilloscopes

Compatible Oscilloscope	Adapter Required	Required Infiniium Software Version
Infiniium Oscilloscopes with AutoProbe III Interface		
UXR-Series (1.85 mm models)	1.85 mm F - F Adapter (p/n - 85058-60114)	11.60 or higher
UXR-Series (1 mm models)	1 mm F - 1.85 mm F Adapter (p/n - Y1901B)	11.60 or higher

NOTE These probe amplifiers are NOT compatible with InfiniiVision or any previous generation Infiniium Keysight oscilloscopes.

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.

2 Compatible Probe Heads and Accessories – Overview

This chapter provides an overview of various probe heads and accessories that are available for use with the InfiniiMax 4 series probe amplifiers.

Supported Probe Heads for InfiniiMax 4 Series Probe Amplifiers

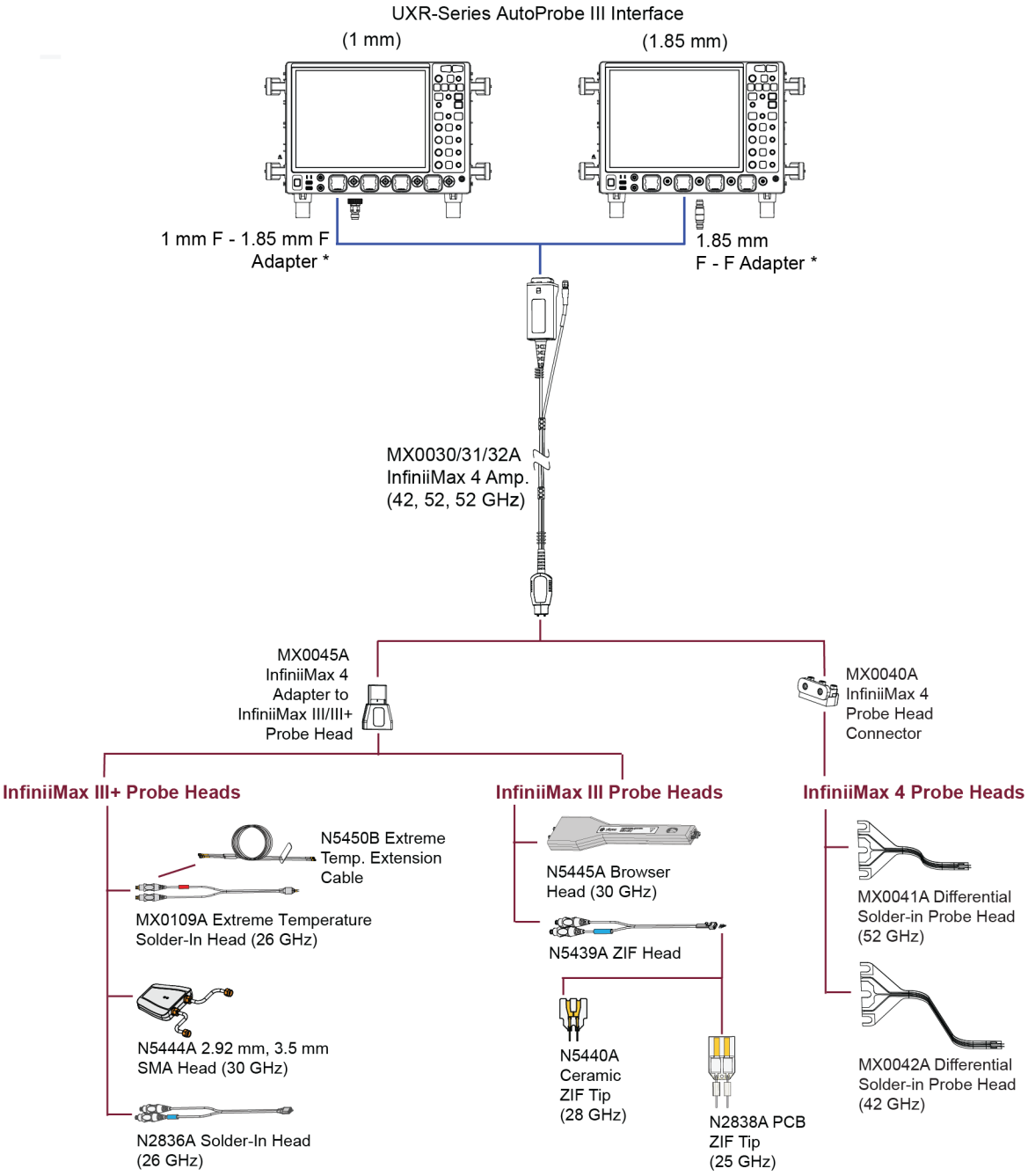
A probe amplifier connects to a DUT via a probe head.
When using an InfiniiMax 4 series probe amplifier, you can choose from a wide variety of probe heads and accessories to support your specific probing and DUT connectivity requirements.

The probe heads available for InfiniiMax 4 series probe amplifiers are primarily categorized as follows:

Recommended Probe Heads		Where to Find Detailed Information
New InfiniiMax 4 Probe Heads *(supporting higher bandwidths up to 52 GHz)*	▪ MX0041A InfiniiMax 4 Differential Solder-in Probe Head ▪ MX0042A InfiniiMax 4 Differential Solder-in Probe Head	Detailed information on each of these probe heads is available as separate chapters in this guide.
Recommended InfiniiMax III and III+ Probe Heads (*supporting bandwidths up to 12 GHz)*	▪ N5445A Differential Browser ▪ N5444A 2.92 / 3.5 mm SMA Head ▪ MX0109A Extreme Temperature Solder-in Probe Head ▪ N5439A ZIF Probe Head ▪ N2836A Solder-in Probe Head	Detailed information on each of these probe heads is available in the *Keysight N2830/1/2A and N7000/1/2/3A InfiniiMax III+ Series Probes User's Guide*. This guide is available for download from: https://www.keysight.com/us/en/assets/9018-04112/user-manuals/9018-04112.pdf.
Other Compatible Probe Heads		**Where to Find Detailed Information**
All existing InfiniiMax III and III+ probe heads are compatible for use with InfiniiMax 4 series probe amplifiers.		See the Probe Resource center (https://www.keysight.com/find/PRC) for detailed information on each of these probe heads.

NOTE InfiniiMax I, II, and Ultra probe heads are NOT compatible for use with the InfiniiMax 4 series probe amplifiers.

InfiniiMax 4 Series Probe Family Diagram



The InfiniiMode feature of the InfiniiMax III+ probe heads can be enabled only with InfiniiMax III+ probe amplifiers. InfiniiMax 4 series probe amplifiers do not support InfiniiMode.

** Oscilloscope Accessory*

When to Use Which Recommended Probe Head

The following table provides a high-level comparison of the recommended probe heads to help you assess when to use which probe head with your InfiniiMax 4 series probe amplifier.

These probe heads are listed in the order of their maximum supported bandwidth when used with an InfiniiMax 4 series probe amplifier.

Table 2 Recommended Probe Heads (Sheet 1 of 2)

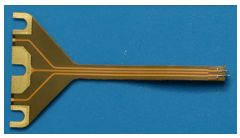
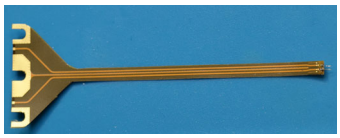
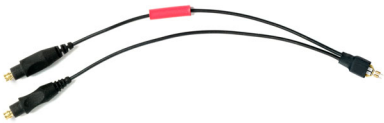
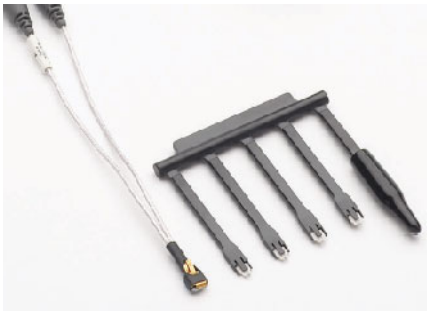
Probe Head (listed in the order of BW)	**Recommended Usage**	**Bandwidth**[a]	**Cdiff** [b] **(pF)**	**Cse** [c] **(pF)**
1. MX0041A InfiniiMax 4 Differential Solder-in Probe Head (refer to page 49 for details)				
	▪ Light, flexible, and smallest probe head designed to access small geometry target devices ▪ Offers highest bandwidth with best performance	52 GHz	Not Applicable	
2. MX0042A InfiniiMax 4 Differential Solder-in Probe Head (refer to page 49 for details)				
	▪ Light, flexible, and small probe head designed to access small geometry target devices ▪ Supports high bandwidth with convenience of the longer tip	42 GHz	Not Applicable	
3. N5445A Differential Browser (refer to N2830/1/2A and N7000/1/2/3A InfiniiMax III+ Series Probes User's Guide)				
	▪ Best choice for quick general-purpose troubleshooting of differential signals with its z-axis compliance and variable spacing from 20 mil to 125 mil (0.5 mm to 3.1 mm) ▪ Adjustable spring-loaded tips with variable spacing for different circuit geometries	30 GHz	35 fF	50 fF
4. N5444A 2.92 / 3.5 mm SMA Head (refer to N2830/1/2A and N7000/1/2/3A InfiniiMax III+ Series Probes User's Guide)				
	▪ Suitable for differential cabled measurement using only one channel of the oscilloscope ▪ Offset matched SMA cables adapt to variable spacing ▪ Can terminate to a non-ground voltage ▪ NOTE: The InfiniiMax 4 probe amplifier supports vterm on N5444A (±3.4 V) when loaded with 50 ohms. User-supplied V_{term} is not supported.	30 GHz	Not Applicable	

Table 2 Recommended Probe Heads (Sheet 2 of 2)

Probe Head (listed in the order of BW)	**Recommended Usage**	**Bandwidth**[a]	**Cdiff**[b] **(pF)**	**Cse**[c] **(pF)**
5. MX0109A Extreme Temperature Solder-in Probe Head (refer to N2830/1/2A and N7000/1/2/3A InfiniiMax III+ Series Probes User's Guide)				
	▪ Solder-in hands free connection ▪ ***NOTE***: Though the probe head is suitable for extreme temperature range measurements (–55 to +150 °C), the InfiniiMax 4 probe amplifiers do not support extreme temperature testing.	26 GHz	108 fF	140 fF
6. N5439A ZIF Probe Head (refer to N2830/1/2A and N7000/1/2/3A InfiniiMax III+ Series Probes User's Guide)				
	▪ Ideal for probing multiple signals in tight spaces, hard to reach targets, and very small fine pitch targets ▪ ZIFs can be installed at multiple locations on your DUT and can be left on the DUT while moving the probe head to various locations ▪ ZIF feature allows connection without compressing the delicate wires which cannot support this compression ▪ The long-wired ZIF tips connection is ideal for variable pitch targets, including larger pitches	**With N5440A ZIF Tip** 28 GHz	32 fF	44 fF
		With N2838A ZIF Tip 25 GHz	95 fF	130 fF
7. N2836A Solder-in Probe Head (refer to N2830/1/2A and N7000/1/2/3A InfiniiMax III+ Series Probes User's Guide)				
	▪ Solder-in hands free connection	26 GHz	108 fF	140 fF

a The bandwidth listed in this table is the maximum bandwidth supported by each probe head. For any combination of a probe head with a probe amplifier, the applicable bandwidth is the lesser of the supported bandwidths of the probe head or the probe amplifier.

b Capacitance seen by differential signals

c Capacitance seen by single-ended signals

See Chapter 7, "MX0045A InfiniiMax 4 Adapters" to know how to connect the InfiniiMax III+ / III probe heads to the InfiniiMax 4 Series Probe Heads.

Other Recommended Accessories and Kits

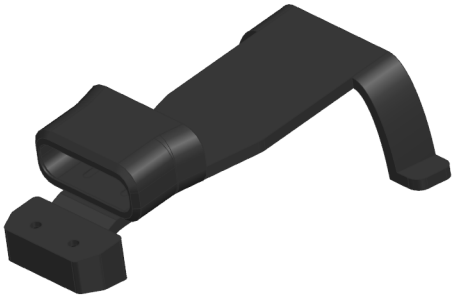
In addition to the probe heads listed in the previous section, there are a number of kits and accessories available for use with the InfiniiMax 4 series probe amplifiers.

This section provides an overview to these recommended accessories and kits. You can either order these at the time of ordering the probe amplifier or separately later.

MX0046A InfiniiMax 4 Mounting Cradles

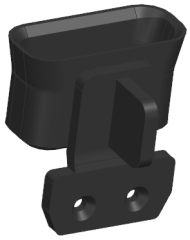
It is strongly recommended that you use these mounting cradles to precisely align the InfiniiMax 4 probing setup (probe amplifier and probe head) with DUT and to provide strain relief while soldering and making a measurement.

The following three variants are available to accommodate different probing setups.



Horizontal Cradle

Vertical Cradle



Cradle Positioner

Figure 2 Mounting Cradles for InfiniiMax 4 Probes

Mounting Cradle	Usage
Vertical Cradle	Used to position the InfiniiMax 4 probe head and probe amplifier setup vertically.
Horizontal Cradle	Used to position the InfiniiMax 4 probe head and probe amplifier setup horizontally.

Cradle Positioner	Used with the N2787A 3D Probe Positioner to hold the InfiniiMax 4 probing setup in place and to maintain a steady contact of probe tips with the deskew fixture during the calibration procedure.

The following figures show how you can use these cradles in your InfiniiMax 4 probing setup. For details on how to connect the probe amplifier and probe head to these cradles, refer to the topics "Safely Connecting/Disconnecting Probe Amplifier and Probe Head to Oscilloscope" on page 64 and "Calibrating your InfiniiMax 4 Probe Amplifier" on page 82.

Vertical Cradle

Horizontal Cradle

Cradle Positioner with the N2787A 3D Probe Positioner

Figure 3 Cradles connected to the MX0041A InfiniiMax 4 Probe Head and Probe amplifier

Custom Mounting Cradles

NOTE You can also use your custom mounting cradles to mount InfiniiMax 4 probe head and probe amplifier. The 3D models of MX0046A cradles is available on www.keysight.com to help you design your custom cradles for use with InfiniiMax 4 probe amplifiers.

MX0102A Soldering Toolkit

The MX0102A soldering toolkit provides tools that can make soldering tasks easier. For instance, you can use the tools available in this kit while soldering the lead wires of the MX0041A probe head to a DUT (see page 69 for details).

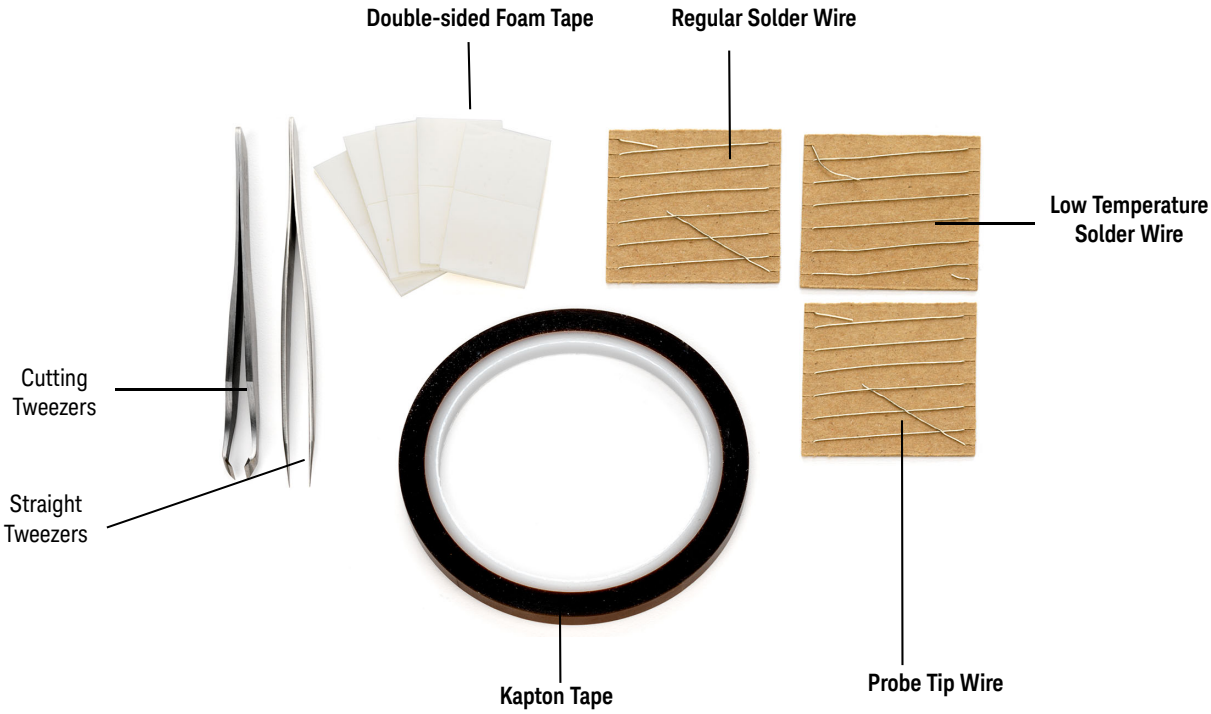


Figure 4 MX0102A soldering toolkit contents

Table 3 Accessories supplied in the soldering toolkit

Description	Qty Supplied	Part Number [a]
Straight Tweezers (Anti-magnetic straight pointed tip 120mm) For general purpose manipulation / movement of components such as probe tip wires and probe head.	1	8710-2837
Cutting Tweezers (Narrow oblique head 115 mm) To cut a probe tip wire to a desired length.	1	8710-2838
Kapton Tape (36 yards roll) To provide strain-relief to the neck portion of the probe head by taping it to a flat surface (such as a DUT circuit board).	1	0460-3121
Double-sided Foam Tape To provide strain-relief to either the neck portion of the probe head or the plastic housings by taping it to a flat surface such as a tabletop or a DUT circuit board.	10	0460-3122

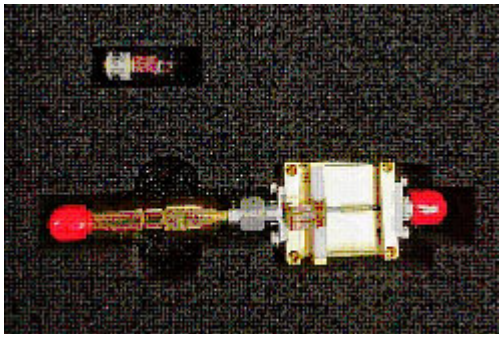
Description	Qty Supplied	Part Number [a]
Regular Solder Wire Lead free, .009" diameter, 2 feet long To attach the probe tip wires to a DUT using standard lead-free soldering temperatures (330 °C to 350 °C). (NOTE: This alloy melts at 217 °C.)	1	MX0102-21302
Low Temperature Solder Wire Lead free, .010" diameter, 2 feet long To attach the probe tip wires to a DUT using a low temperature setting on your soldering iron. (NOTE: This alloy melts at 138 °C.)	1	MX0102-21303
Probe Tip Wire .004" diameter, 2 feet long To add ground wires to your probe tip if InfiniiMode measurements (differential, single ended, and common mode signals with the same probing setup) are desired. Clip as short as possible using the cutting tweezers included in the kit.	1	MX0102-21301

a You can reorder these items using the part numbers included in the table above.

CAUTION Care should be taken while handling the probe amplifier's RF pigtail cable. Avoid bending this cable backwards or kinking the cable to ensure measurements accuracy.

MX0104A Performance Verification and Deskew Fixture Kit

You can use this kit to calibrate and verify the performance of InfiniiMax 4 probes.



This kit contains the following items.

Item	Qty Supplied
50 Ω SMA Terminator	1
Deskew Fixture	1

The MX0104A fixture is used with the following two components to promote the proper positioning of the probe during the deskew/PV procedure.

Table 4 MX0104A Optional Components

Option		Usage
N2787A 3D Probe Positioner		For more sophisticated probe head positioning. Highly recommended for browser probe heads.
Option 001: Performance Verification Stand		For convenient, handy, and low-cost probe head positioning.

- To know how to use this fixture for deskew/calibration of your probe, refer to the chapter "Performing DC Attenuation / Offset and Skew Calibration" on page 83.
- To know how to use this fixture for performance verification of your probe, refer to the chapter "Performance Verification" on page 97.

N5448B (25cm) Coaxial Phase Matched Cable Pair

The N5448B (25 cm) phase matched cable pair allows you to extend the cable length of the N5444A SMA probe head and add flexibility and convenience to the probing setup. You can easily replace the supplied rigid cables of the SMA probe head with these cables. These cables support 2.92 mm male-to-2.92 mm male connection. Skew error between two cables are matched to within 5 psec, and the cable supports up to 40 GHz.
For detailed specifications of these cables, refer to the user's guide available in the **Document Library** tab of www.keysight.com/find/N5448B.

Figure 5 N5448B Coaxial Phased Matched Cable Pair

CAUTION The maximum bend radius for this coaxial cable pair is 30 mm. Bending these cables at too tight a radius or twisting the cables can cause damage, reduce performance, and impact the precision of these cables.

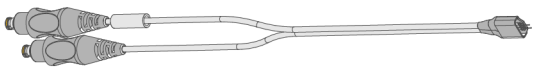
N2835A InfiniiMax III+ Differential Connectivity Kit and Accessories

In addition to the individual probe heads, the N2835A differential connectivity kit is also available. You can order this kit either at the same time as the probe amplifier or separately later.

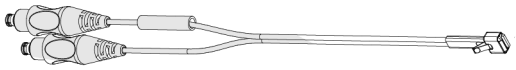
The kit provides multiple quantities of the:

- following four InfiniiMax III+ probe heads supported for use with the InfiniiMax 4 probe amplifier.
- accessories needed for these four probe heads.

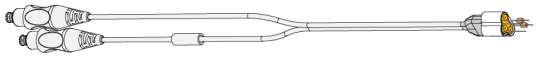
N2836A Differential Solder-In (quantity 2)



N5439A Differential ZIF Solder-In (quantity 2)



N2848A QuickTip (quantity 2)



N5445A Differential Browser (quantity 1)

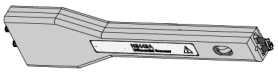


Figure 6 Probe Heads Included in the N2835A Differential Connectivity Kit (not to scale)

Table 5 Probe Heads and Accessories Supplied with the Kit

Description	Qty Supplied	Part Number
N2836A InfiniiMax III 26 GHz Differential Solder-In Probe Head	2	N2836A
Replacement Axial Resistors Kit	10	N2836-68701
N5439A InfiniiMax III 28 GHz Differential ZIF Solder-in Probe Head	2	N5439A
N2838A InfiniiMax III 25 GHz ZIF Tip Kit	2 kits (5 tips in each kit)	N2838A
N2848A InfiniiMax III QuickTip Probe Head	2	N2848A
N2849A InfiniiMax QuickTip Tips Kit	2 kits (4 tips in each kit)	N2849A
N5445A InfiniiMax III Browser Probe Head	1	N5445A
Replacement Tips	4	N5476A
Tweezer for replacing tips	1	N5445-23801
Screw Driver	1	N5445-23802
Protective End Cap	1	N5445-44101
Ground Blades	4	N5445-68700

3 Safety and Regulatory Information

Safety Checks and Warnings

This manual provides information and warnings essential for operating this probe and probe heads in a safe manner and for maintaining these in safe operating condition. To ensure safe operation and to obtain maximum performance from the probe, carefully read and observe the following warnings, cautions, and notes.

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

Note the external markings on the products that are described in this document.

To avoid personal injury and to prevent fire or damage to these products or products connected to these, review and comply with the following safety precautions.

WARNING

Use Only Grounded Instruments. Do not connect the probe's ground lead to a potential other than earth ground. Always make sure the probe and oscilloscope are grounded 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.

WARNING

Connect and Disconnect Properly.
See page 64 for the sequence in which connection/disconnection needs to be done.

WARNING

Observe Probe Voltage Ratings.
Do not apply any electrical potential to the probe input which exceeds the maximum rating of the probe. See page 43 for maximum input voltage ratings.
These amplifiers and probe heads are for use only on circuits that are MAINS ISOLATED (NOT directly connected to mains). These are NOT intended for measurements on CAT II, CAT III, or CAT IV circuits.

WARNING

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

WARNING

Never leave the probe connected to a conductor while it is not connected to an oscilloscope or voltage measuring instrument.

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

WARNING **If the probe/probe heads are used in a manner not specified by the manufacturer, the protection provided by these may be impaired.**

WARNING **Do not install substitute parts or perform any unauthorized modification to the probe amplifier / probe head.**
Do not attempt internal service or adjustment. Service should be carried out by a Keysight Technologies authorized service personnel. For any service needs, contact Keysight Technologies. See page 113 **to know more.**

CAUTION The probe cable is a sensitive part of the probe and, therefore, you should be careful not to damage it through excessive bending or pulling. Avoid any mechanical shocks to this product in order to guarantee accurate performance and protection.

Concerning the Oscilloscope to Which the Probe is Connected

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

WARNING **Before turning on the instrument, you must connect the protective earth terminal of the instrument to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. You must not negate the protective action by using an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two-conductor outlet is not sufficient protection.**

Instrument Markings and Symbols

Symbol	Description
	This symbol indicates the Environmental Protection Use Period (EPUP) for the product's toxic substances for the China RoHS requirements.
	The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by the EU DIRECTIVE and other National legislation. Please refer to keysight.com/go/takeback to understand your Trade in options with Keysight in addition to product takeback instructions.
	This symbol indicates that it is necessary for you to follow the instructions in the user's guide to protect against damage to the product or personal injury.
	Contains parts or assemblies susceptible to damage by electrostatic discharge (ESD). Use electrostatic discharge protective handling procedures. See page 32 to know more.
	Earth (ground) TERMINAL. Refer to the instructions accompanying this symbol in this guide.
	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)
	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.
	KC certification mark to demonstrate compliance with the South Korean EMC requirements. South Korean Class A EMC declaration: This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

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.
MAINS ISOLATED	IEC Measurement Category MAINS ISOLATED is for measurements performed on circuits not directly connected to mains.

4 Proper Handling of Probe Amplifier and Probe Heads

This chapter provides cautions, warnings, and tips to properly handle your probe/ probe heads to prevent damage and maintain accurate and high performance.

Avoiding Damage and Costly Repairs

Using a static-safe workstation

InfiniiMax 4 probes and accessories are ESD sensitive devices. Before using or handling any of these, always wear a grounded ESD wrist strap and ensure that cables and probe heads are discharged before being connected. All work, including connecting probe amplifiers to the oscilloscope, should be performed at a static-safe work station as shown in the following figure.

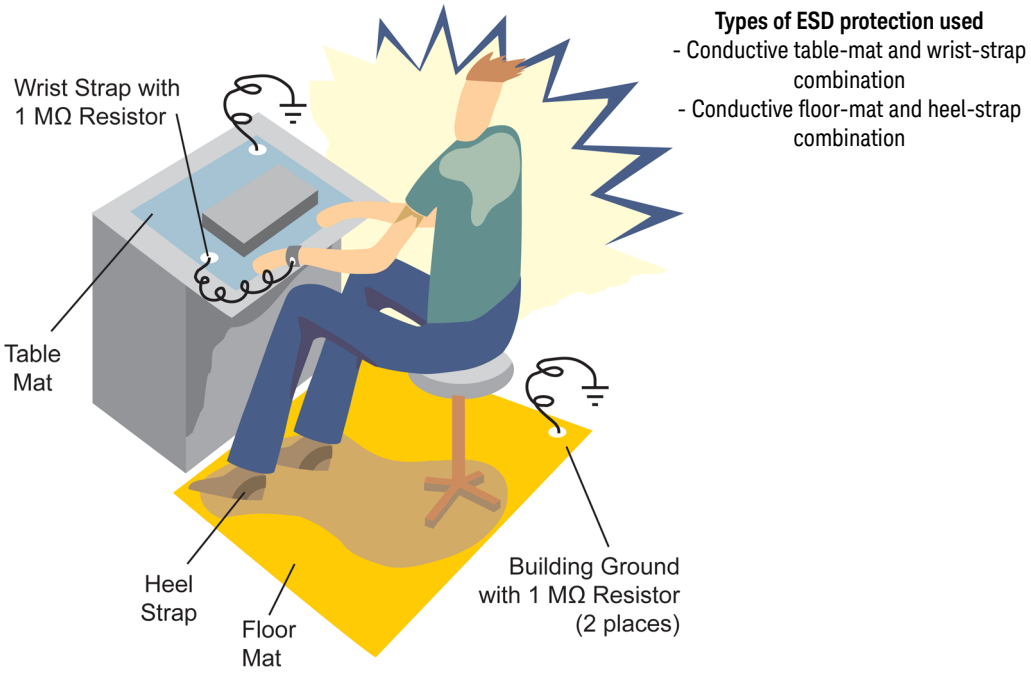


Figure 7 Static-Safe Workstation

Both types of ESD protection illustrated in the above figure, when used together, provide a significant level of ESD protection. When used alone, only the table-mat and wrist-strap combination provides adequate ESD protection. To ensure user safety, the static-safe accessories must provide at least 1 MΩ of isolation from ground. Purchase acceptable ESD accessories from your local supplier.

You can plug the ESD wrist strap into the front-panel ground socket of the oscilloscope as seen in the following picture.

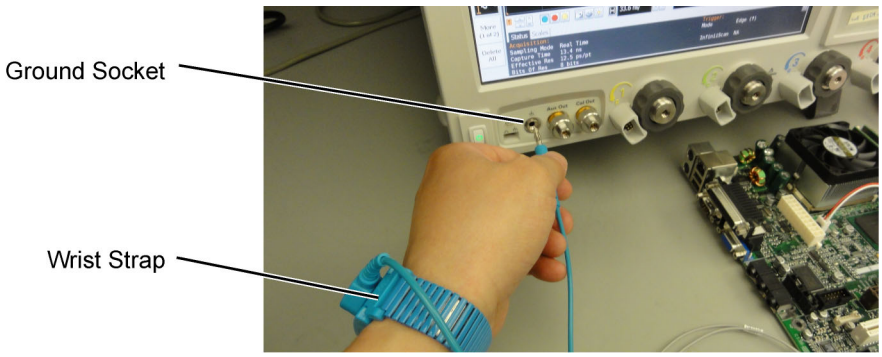


Figure 8 Wrist Strap Connected to Oscilloscope's Ground Socket

WARNING **These techniques for a static-safe workstation should not be used when working on circuitry with a voltage potential greater than 500 volts.**

Probe Handling Precautions

You must make sure to handle MX0030A/31A/32A probes delicately. Some important points to remember when handling these probes are:

- The probe cable has a natural tension, try not to fight it too forcefully when probing.
- Do not pull the front of the probe amplifier too hard when it is connected to the oscilloscope.
- Do not bend or twist the cable of the probe aggressively
  - Avoid too much twisting of the cable

  - Avoid severe bending of the cable

Probe Amplifier and Probe Heads Handling Precautions

Precautions for the Probe Amplifier

The probe amplifier has been designed to withstand a moderate amount of physical and electrical stress. Store the probe and its probe heads in a shock-resistant case such as the foam-lined shipping case which came with the probe.

CAUTION Do not apply excessive force to the probe end and prevent it from receiving mechanical shock. This damage is considered to be abuse and will void the warranty when verified by Keysight Technologies service professionals.

CAUTION Do not drop heavy objects on the probe, drop the probe from large heights, spill liquids on the probe, etc. Any of these examples can significantly degrade the performance of the probe.

Precautions for the Probe Cable

CAUTION Care should be taken while handling the probe amplifier's RF pigtail cable. Avoid bending this cable backwards or kinking the cable to ensure measurements accuracy.

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

CAUTION When storing the probe, it is best to coil the cable in a large radius and avoid a net twist in the cable during the process. This can be done in a similar manner to how garden hoses or extension cords are typically coiled.

Replacing a Damaged Probe Amplifier Bullet

The InfiniiMax 4 probe amplifier has two bullets on its probe head connector side to make connections to probe heads.

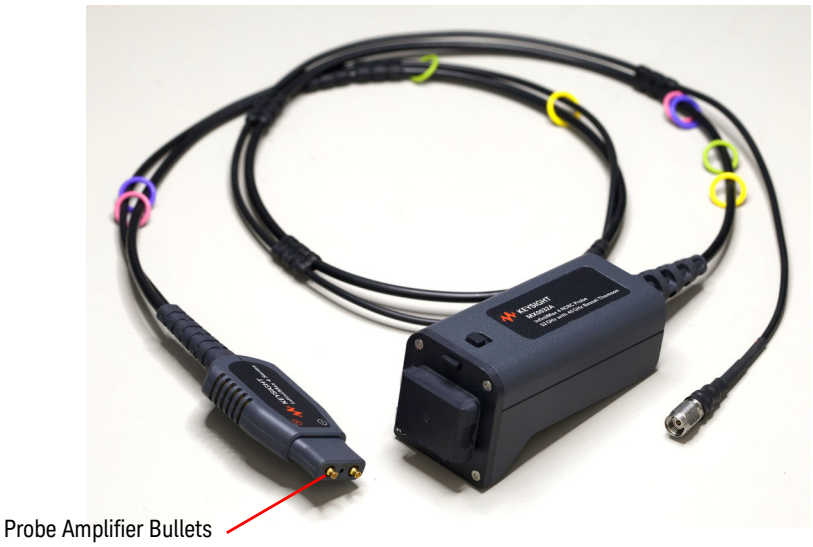


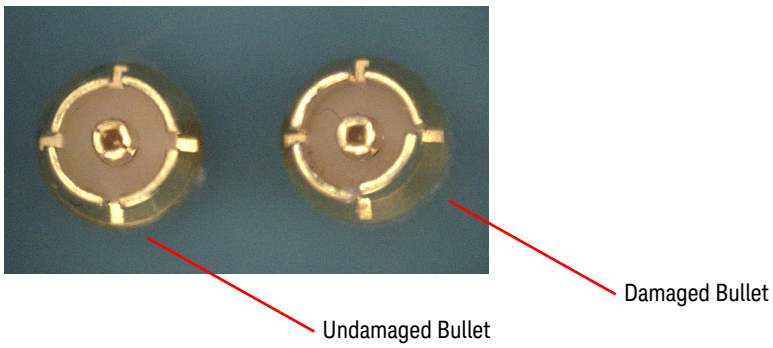
Figure 9 Bullets on InfiniiMax 4 Probe Amplifier

CAUTION A damaged bullet is not covered under warranty.
Handle these bullets with care by keeping the probe amplifier connector covered with the supplied cap when not in use.

Identifying a Damaged Bullet

The visual inspection of the bullet can help you identify any damage to the bullet.

The following figure shows an undamaged and a damaged bullet. If the fingers of the bullet are bent (as shown in the figure below), the bullet needs to be replaced.



Removing a Damaged Bullet

You can easily remove a damaged bullet using needle-nose pliers. Grip the bullet in the middle and pull it out.

CAUTION **Use ESD safe precautions when replacing the bullet to avoid damaging your probe amplifier.**

Installing a New Bullet

You can reorder these bullets using the part number 1250-4709.

To install a new bullet, push it straight into the probe amplifier's connector until it clicks, with axial pressure at the end of the bullet.

CAUTION **To avoid damaging the bullet in the installation process:**
> Do not squeeze while trying to insert the bullet.
> Do not use pliers to insert the new bullet.

The following figure shows a properly installed bullet in the InfiniiMax 4 probe amplifier.

Strain Relieving Techniques for Probe Heads

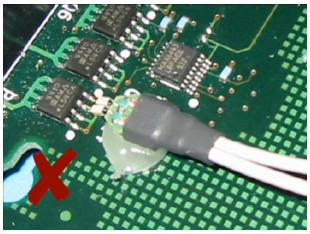
High-performance probes have small physical geometries to ensure the lowest possible loading and the best electrical response. Because of their small size, probe heads are often delicate. It is important to mechanically secure your probe heads to protect both your equipment and designs from damage.

Keysight strongly recommends the usage of MX0046A mounting cradles as a strain relief method. In addition to providing strain relief, a cradle also ensures that the probe tip can be kept perpendicular to the solder point.

For securing the cradle feet to DUT board, the following are recommended on mounting locations.

- Tack putty
- Low-temperature hot glue
- epoxy

Correct securing method with
InfiniiMax 4 probe amplifier and probe head secured
using MX0046A vertical cradle and putty



Incorrect securing method with
glue on the probe head tip

Figure 10 Correct and incorrect strain relief techniques

CAUTION Do not use aggressive adhesives, super glues, or high temperatures.

Only use *low-temperature* hot glue. To remove the hot glue, warm it with a heat gun set on low. Only heat the hot glue enough to remove it.

Do not get the low temperature hot glue on the probe head tip as this can damage the precision components of your probing system.

You can also use putty with a positioner such as the N2787A.

Tips for Soldering Probe Heads

Given below are a few soldering tips that apply to all probe heads that require soldering to DUT. The specific details related to the soldering procedure for each probe head are included in the chapter dedicated to that probe head.

- Use a temperature-controlled soldering iron station, if possible.
- Set the temperature of the soldering iron's tip to between 370° C and 420° C (for non RoHS standards).
- Use the smallest tip possible.
- Use an optical aid of some sort (microscope preferred).
- Employ minimal dwell times on the solder joint (< 2 seconds).
- Solder only the tip of the wire onto your DUT. The solder should not get close to the existing solder ball on the tip.
- Apply enough flux to probe head leads and wires when soldering the tips into a DUT.

See Also

- Soldering Guidelines for Keysight InfiniiMax Probes Application Note (publication number 5992-3350EN)
- "Connecting Probe Head to DUT" on page 69

Cleaning

If the probe amplifier or probe head requires cleaning:

1. Disconnect the probe head from the probe amplifier.
2. Disconnect the probe amplifier from the oscilloscope.
3. Disconnect the probe head from circuit under test.
4. Clean the external parts of the probe with a soft dry cloth or if needed, with one slightly dampened with mild soap and water solution.
5. Make sure the probe is completely dry before reconnecting it to the oscilloscope.

CAUTION Do not use too much liquid to avoid damaging sensitive electronic components.

Do not attempt to clean internally.

5 Characteristics and Specifications

The tables in this chapter list the specifications and characteristics for the InfiniiMax 4 series probe amplifiers and their recommended probe heads.

NOTE

All entries included in this chapter are characteristics unless otherwise noted. These are the typical performance values of the InfiniiMax 4 series probe amplifiers with different recommended probe heads. Bandwidth (for the probe) and DC Input Resistance are the only warranted specifications for the InfiniiMax 4 series probe amplifiers.

InfiniiMax 4 Series Probe Amplifiers Warranted Specifications

Table 6 Warranted Specifications

Probe Amplifier	Probe Head	Bandwidth	DC Input Resistance
MX0032A 52 GHz	MX0041A InfiniiMax 4 Differential Solder-in Probe Head	52 GHz brickwall	R_{diff} = 103.1 kΩ ±2% R_{se} = 51.55 kΩ ±2%
MX0031A 52 GHz		52 GHz brickwall	
MX0030A 42 GHz		42 GHz brickwall	

InfiniiMax 4 Series Probe Amplifier Characteristics

The characteristics listed in the following table are mainly determined by the probe amplifier.

Characteristic	InfiniiMax 4 Probe Amplifiers	
	With 450 Ω Probe Heads *(MX0041A, MX0042A, MX0109A, N5445A, N5439A, N2836A)*	**With N5444A SMA Probe Head**
DC Input Resistance	R_{se} = 51.55 kΩ ± 2% each input to ground R_{diff} = 103.1 kΩ ± 2% R_{cm} = 25 kΩ ± 2%	55 Ω to V_{term}
Input Resistance (>10 kHz)	R_{se} = 500 Ω ± 2% each input to ground R_{diff} = 1 kΩ R_{cm} = 250 Ω	50 Ω to 0.901 * V_{term}
Input Voltage Range (Differential or Single Ended), mains isolated	High Gain mode 5:1 1.0 Vpp, ±500 mV Low Gain Mode 10:1 2.0 Vpp, ±1 V	High Gain mode 5:1 1.0 Vpp, ±500 mV Low Gain Mode 10:1 2.0 Vpp, ±1 V
Maximum Input Power	N/A	125 mW calculated with the following equation for each input: $P_{max} = \frac{(\text{rms}_{(V_{in} - V_{term})})^2}{55}$
Input Common Mode Range	± 12 VDC to 250 Hz, ± 1.25 V > 250 Hz	± 12 VDC to 250 Hz, ± 1.25 V > 250 Hz without violating max input power
DC Attenuation Ratio	~5:1	~10:1
Offset Range (for probing a single-ended signal)	±16 V	±6 V without violating maximum input power
Input Referred Noise Spectral Density	High Gain mode 5:1 27.1 mV/rtHz Low Gain mode 10:1 43.8 nV/rtHz	
Input Referred Noise Example	High Gain mode 5:1 6.25 mVrms Low Gain mode 10:1 10.1 mVrms	
Maximum Input Voltage	18 V_{peak} mains isolated[a]	8 V_{peak} without violating maximum input power

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

InfiniiMax 4 Probe Heads Characteristics

The characteristics listed below are mainly determined by the recommended InfiniiMax probe heads.

Table 7 Characteristics for InfiniiMax Probe Heads when Used with MX0032A InfiniiMax 4 Probe Amplifier

	Input Capacitance		Bandwidth[a]	10 – 90%	20 – 80%
Probe Head	**Cdiff**	**Cse**	**(–3 dB)**	**Transition Time**	**Transition Time**
MX0041A differential solder-in probe head	32 fF	48 fF	52 GHz	10 pS	7 pS
MX0042A differential solder-in probe head	32 fF	48 fF	42 GHz	12.7 pS	8.8 pS
N5445A Differential Browser	35 fF	50 fF	30 GHz	14.5 pS	10.3 pS
N5444A 2.92 / 3.5 mm SMA Head	Not Applicable		30 GHz		
MX0109A Extreme Temperature Solder-in Probe Head	108 fF	140 fF	26 GHz	16.1 pS	11.4 pS
N2836A Solder-in Probe Head	108 fF	140 fF	26 GHz	16.1 pS	11.4 pS
N5439A ZIF Probe Head with N5440A ZIF Tip	32 fF	44 fF	28 GHz	15.5 pS	11.0 pS
N5439A ZIF Probe Head with N2838A ZIF Tip	95 fF	130 fF	25 GHz	17.4 pS	12.3 pS

a The bandwidth listed in this table is the maximum bandwidth supported by each probe head. For any combination of a probe head with a probe amplifier, the applicable bandwidth is the lesser of the supported bandwidths of the probe head or the probe amplifier.

Environmental and General Characteristics

Table 8 Environmental and General Characteristics of InfiniiMax 4 probe amplifiers and Probe Heads

Environmental Condition	Operating	Non-Operating
Temperature	+5 °C to +40 °C	–40 °C to +70 °C
	NOTE: InfiniiMax 4 probe amplifiers do not support extreme temperature testing.	
Humidity	Operating: 80% RH, non-condensing, up to +40°C	95% RH, non-condensing, up to +40°C; decreasing linearly to 50% RH at +65°C
Altitude	Up to 10000 ft (3,048 meters)	Up to 15000 ft (4,572 meters)
Dimensions	Refer to the *Dimensions* section in the chapter dedicated to each probe head.	
Pollution Degree	Pollution Degree 2 Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.	

MX0030A / 31A / 32A Probe Amplifier Dimensions

All dimensions in Figure 11 are in millimeters.

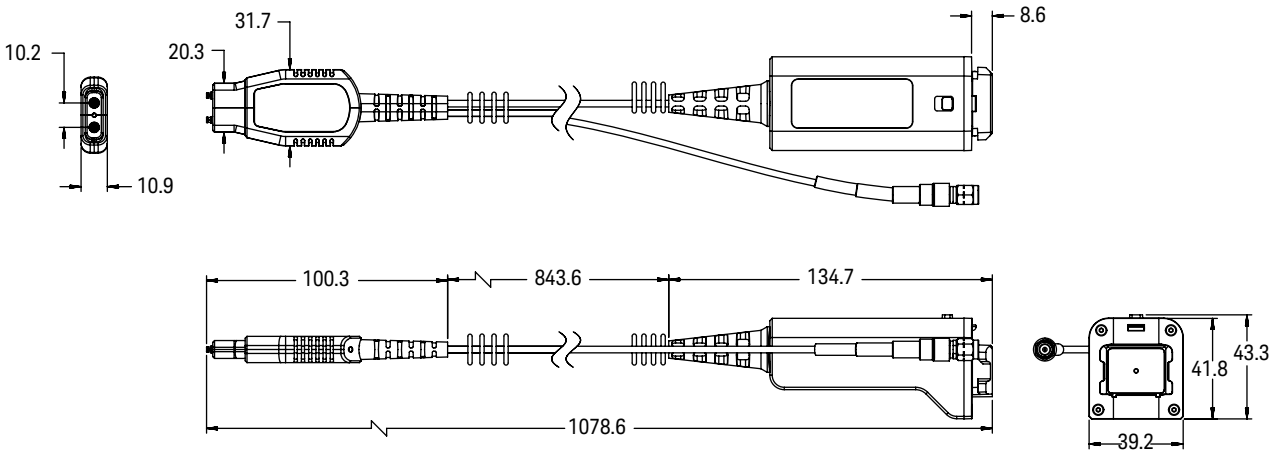


Figure 11 MX0030A / 31A / 32A Probe Amplifier Dimensions

MX0041A / 42A Probe Head Dimensions

All dimensions are in millimeters.

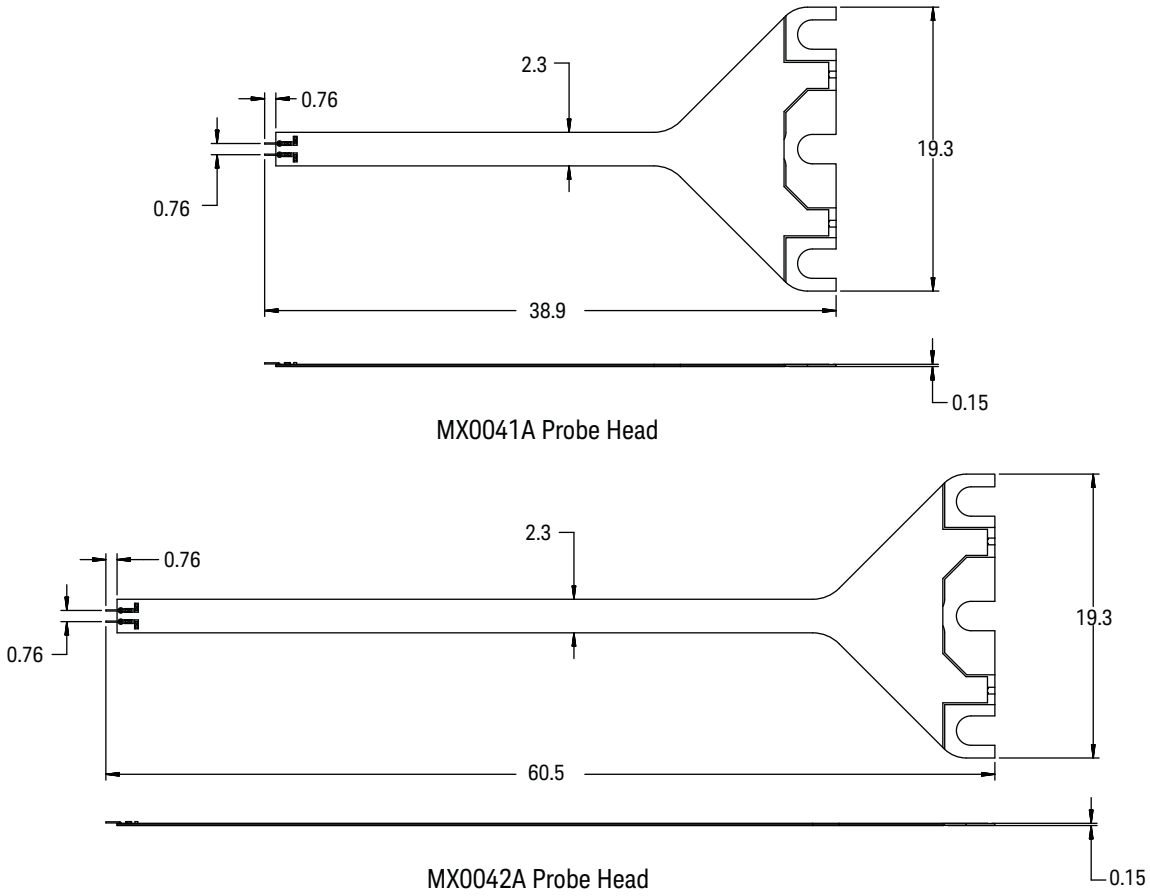


Figure 12 MX0041A and MX0042A Probe Heads Dimensions

MX0040A InfiniiMax 4 Probe Head Connector Dimensions

All dimensions are in millimeters.

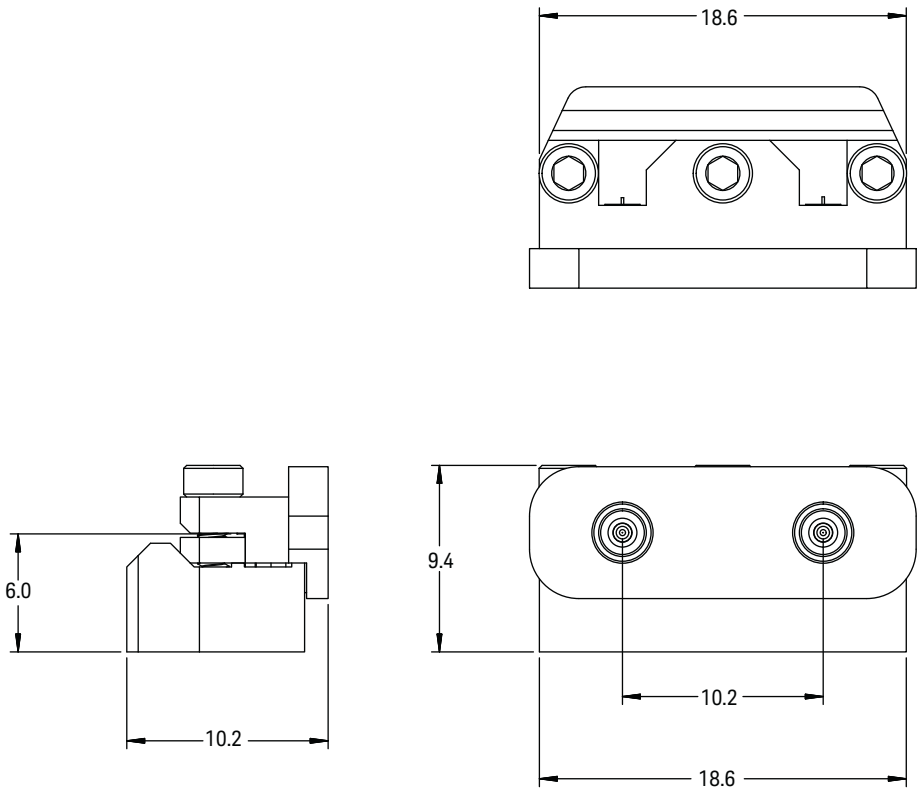


Figure 13 MX0040A InfiniiMax 4 Probe Head Connector Dimensions

6 MX0041A / 42A InfiniiMax 4 Differential Solder-in Probe Head

Overview

The MX0041A and MX0042A are solder-in probe heads designed to access small geometry target devices. These probe heads are made out of flex printed circuit (FPC), making these light, flexible, small yet highly usable.

- **MX0041A** - Smallest probe head (39 mm long) and provides the highest bandwidth (up to 52 GHz) with InfiniiMax 4 series probe amplifiers.
- **MX0042A** - Small probe head (60.5 mm long) that provides connectivity convenience with a longer probe tip and high bandwidth (up to 42 GHz) with InfiniiMax 4 series probe amplifiers.

NOTE

The MX0040A InfiniiMax 4 Probe Head Connector is required to connect the MX0041A/42A probe heads to an InfiniiMax 4 series probe amplifier.

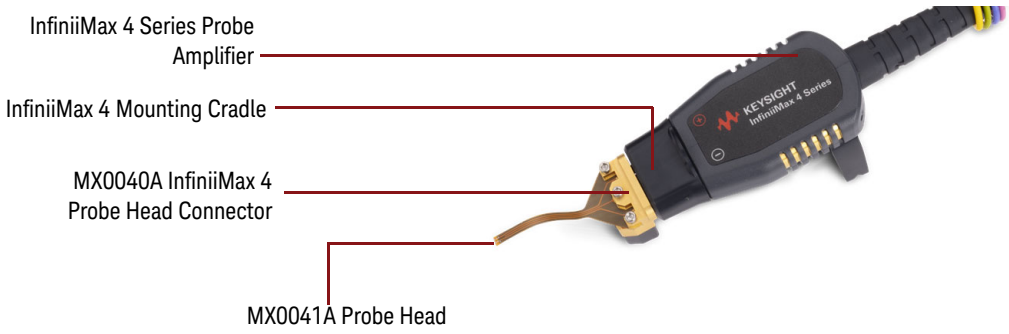


Figure 14 MX0041A probe head connected to an InfiniiMax 4 series probe amplifier

For connection to a DUT, the probe head has pre-wired and factory-trimmed probe tip leads that allow solder-in connection to very small, fine pitch targets.

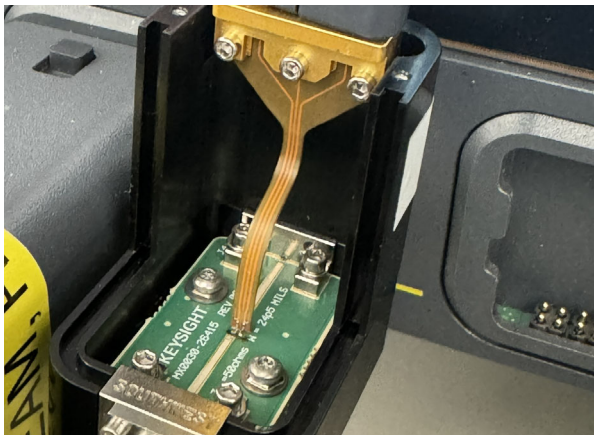


Figure 15 MX0041A probe head connected to DUT

See page 41 for characteristics and specifications of MX0041A / 42A probe heads and InfiniiMax 4 probe amplifier.

Table 9 MX0041A / 42A Probe Head Options based on Quantity

Quantity	
Option 001	**Option 002**
5	25

Checking the MX0041A / 42A probe head for any damage

You can use a Digital Multimeter to check the resistance measurement of your MX0041A / 42A probe head. If the resistance measurement between the probe head's tip and the center conductor of the SMP connector is 450 ohm, then the probe head is usable.

For a damaged probe head, the resistance measurement between the MX0041A / 42A probe head tip wire and the center conductor of the SMP connector of the MX0041A / 42A is displayed as Infinite.

MX0041A / 42A Probe Heads Input Impedance

NOTE Input impedance is a function of the probe head only. The probe amplifier bandwidth does not have any effect on the input impedance of the probe head.

This section provides:

- the SPICE model for MX0041A / 42A probe heads. This SPICE model is only for input impedance which allows modeling of the probe loading effects. Probe transfer function is generally flat to the specified bandwidth.
- an input impedance plot for MX0041A / 42A probe heads to show the matching of the measured data to the modeled data. Matching is generally very good up to the specified bandwidth of the probe head.

NOTE Refer to the chapter "InfiniiMax 4 Series Probe Amplifiers and Probe Heads System Responses" on page 95 to get a typical CMRR for the MX0041A probe head and InfiniiMax 4 probe amplifier combination.

MX0041A / 42A SPICE Model

The following SPICE model can be used to predict the probe loading effects of the InfiniiMax 4 probe amplifier and MX0041A / 42A probe head combination. This SPICE model is used for the modeled plots shown in Figure 17.

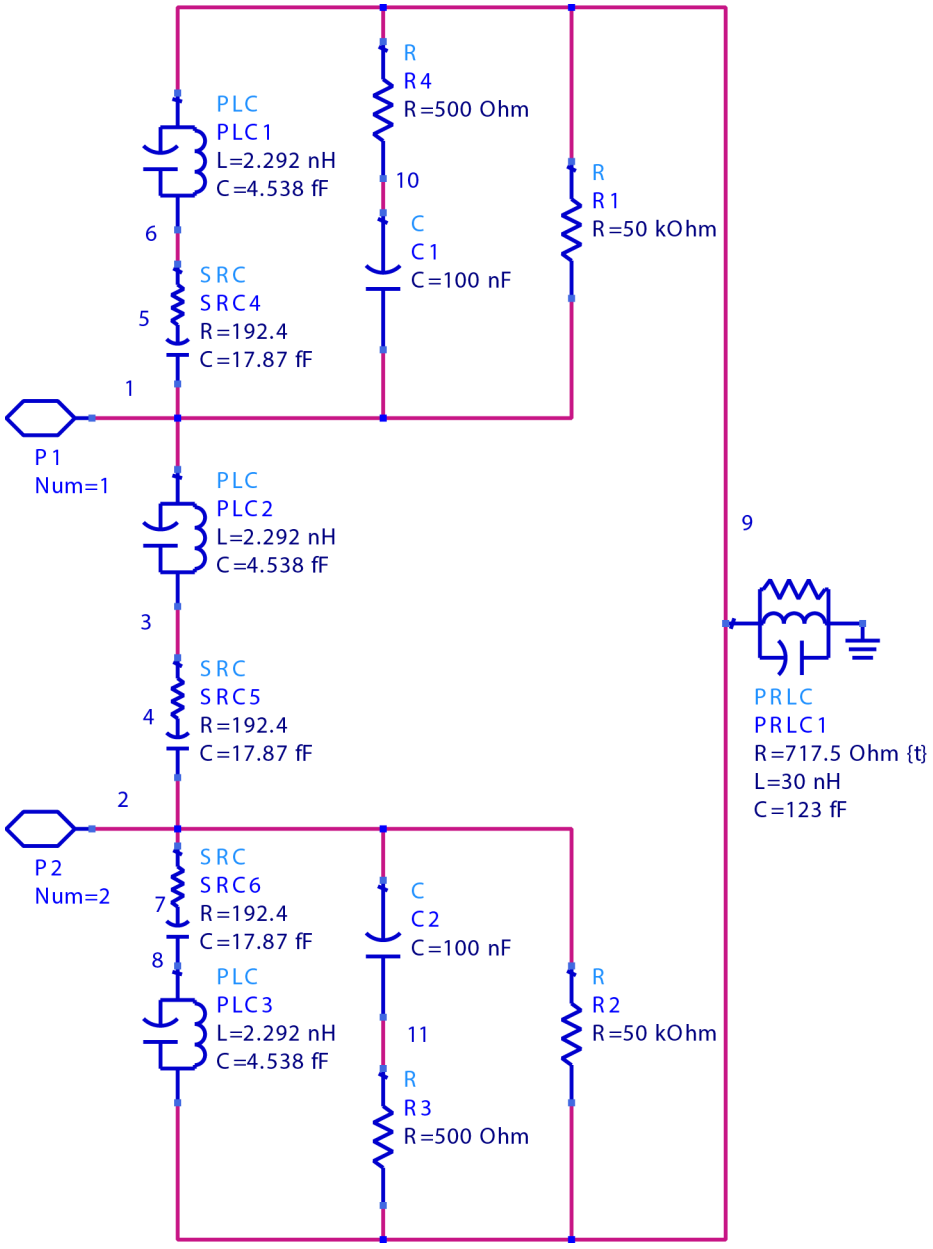


Figure 16 SPICE Model for the input impedance of the MX0041A / 42A Probe Heads

SPICE Deck and Measured/Modeled Data Matching

```
* Input impedance SPICE subckt for listed probe head
.subckt MX0041A 1 2
l_plc2 1 3 2.292n
c_plc2 1 3 4.538f
r_src5 3 4 192.4
c_src5 4 2 17.87f
l_plc1 9 6 2.292n
c_plc1 9 6 4.538f
r_src4 6 5 192.4
c_src4 5 1 17.87f
r_src6 2 7 192.4
c_src6 7 8 17.87f
l_plc3 8 9 2.292n
c_plc3 8 9 4.538f
r4 9 10 500
c1 10 1 100n
r1 9 1 50k
c2 2 11 100n
r3 11 9 500
r2 2 9 50k
r_prlc1 9 0 717.5
l_prlc1 9 0 30n
c_prlc1 9 0 123f
ends
```

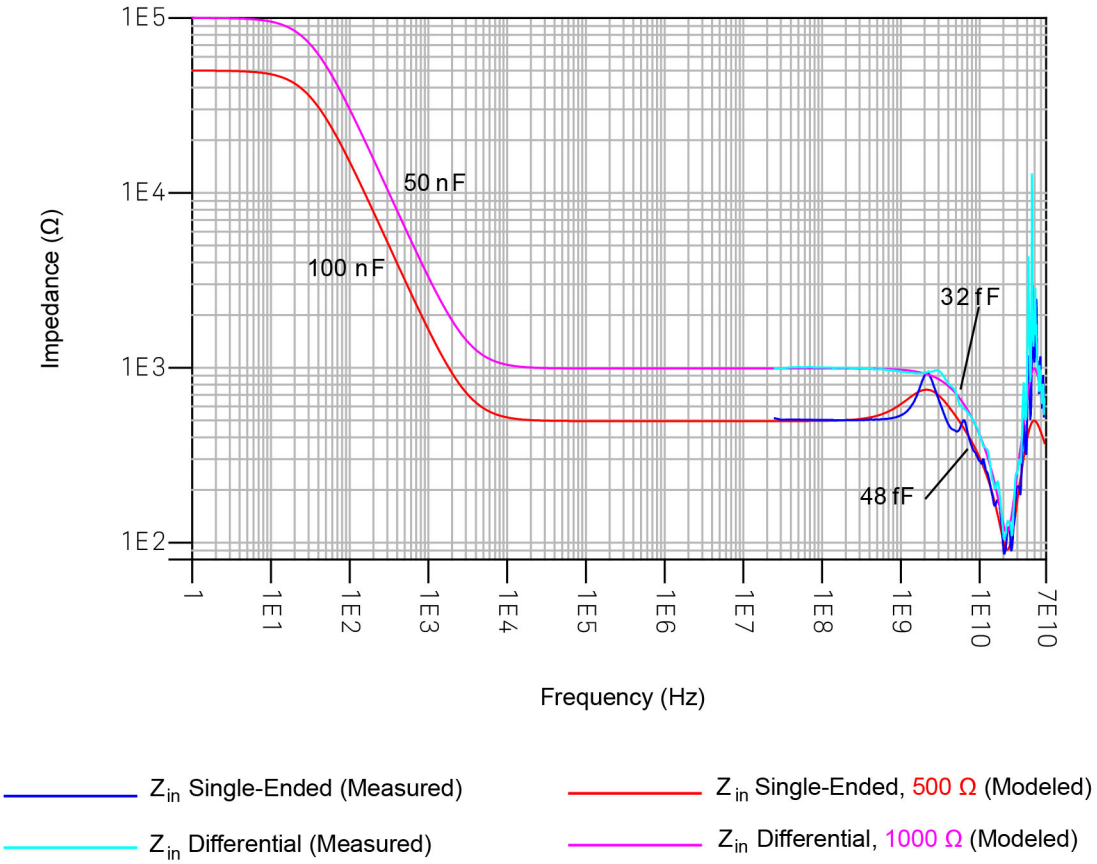


Figure 17 Input Impedances (Z_{in} Modeled and Z_{in} Measured) for the MX0041A / 42A Probe Heads

7 MX0045A InfiniiMax 4 Adapters

Overview

The MX0045A InfiniiMax 4 Adapter is required to bridge the compatibility of InfiniiMax 4 Series probes with the legacy (InfiniiMax III / III+) Probe Heads, such as:

- InfiniiMax III+ Probe Heads
  - N5444A 2.92 mm, 3.5 mm SMA Head (30 GHz)
  - N2836A Solder-In Head (26 GHz)
  - MX0109A Extreme Temperature Solder-In Head (26 GHz) [with N5450B Extreme Temp. Extension Cable]
- InfiniiMax III Probe Heads
  - N5445A Browser Head (30 GHz)
  - N5439A ZIF Head [with N2838A PCB ZIF Tip (25 GHz) and N5440A Ceramic ZIF Tip (28 GHz)]

Using MX0045A Adapter to connect InfiniiMax 4 Series Probes and InfiniiMax III/III+ Probe Heads

To connect an InfiniiMax 4 Series Probe to an InfiniiMax III/III+ Probe Head:

1 Always insert the InfiniiMax 4 Series Probe into the broad end of the MX0045A Adapter.

2 Always insert the narrow end of the MX0045A Adapter into the InfiniiMax III/III+ Probe Head.

In both instances, you can hear a faint 'click' indicating that the inserted equipment has fit into the adapter.

CAUTION

Follow proper safety measures before connecting or removing probes & probe heads using the adapter. For more information, see Chapter 4, "Proper Handling of Probe Amplifier and Probe Heads.

Figure 18 shows the order in which you must connect the MX0032A InfiniiMax 4 Probe to an N5444A SMA Head (InfiniiMax III+ Probe Head).

Figure 18 Order of connecting N5444A Probe Head & MX0032A Probe to MX0045A Adapter

Figure 19 shows the assembly of MX0032A InfiniiMax 4 Probe and N5444A SMA Head (InfiniiMax III+ Probe Head) with the MX0045A Adapter.

Figure 19 N5444A Probe Head & MX0032A Probe connected using MX0045A Adapter

Similarly, Figure 20 shows the order in which you must connect the MX0032A InfiniiMax 4 Probe to an N5445A Differential Browser Head (InfiniiMax III Probe Head).

Figure 20 Order of connecting N5445A Probe Head & MX0032A Probe to MX0045A Adapter

Figure 21 shows the assembly of MX0032A InfiniiMax 4 Probe and N5445A Differential Browser Head (InfiniiMax III+ Probe Head) with the MX0045A Adapter.

Figure 21 N5445A Probe Head & MX0032A Probe connected using MX0045A Adapter

Removing InfiniiMax 4 Series Probes and InfiniiMax III/III+ Probe Heads from the MX0045A Adapter

To remove an InfiniiMax 4 Series Probe to an InfiniiMax III/III+ Probe Head, reverse the steps performed in the previous section, as shown in Figure 22 and Figure 23.

Figure 22 Order of removing N5444A Probe Head & MX0032A Probe from MX0045A Adapter

Figure 23 Order of removing N5445A Probe Head & MX0032A Probe from MX0045A Adapter

8 Setting up the Hardware for InfiniiMax 4 Series Probe Amplifiers and Probe Heads

This chapter provides step-by-step instructions to set up the hardware for your InfiniiMax 4 probe amplifier when used with:

- InfiniiMax 4 probe heads
- InfiniiMax III/III+ probe heads

Safely Connecting/Disconnecting Probe Amplifier and Probe Head to Oscilloscope

To ensure safety, always perform the connection in the following sequence.

1	Ground the DUT to the oscilloscope via the AC mains ground or to the oscilloscope ground or to the probe amplifier ground.	
2	Connect the probe head + probe head connector + mounting cradle.	See page 66
3	Connect the probe head to the DUT.	See page 69
4	Connect the probe amplifier to the grounded oscilloscope.	See page 72
5	Connect the probe amplifier to the probe head + probe head connector + cradle setup.	See page 73

CAUTION **Never allow the probe head to be connected to the probe amplifier, if the probe amplifier is *not* connected to an oscilloscope channel.**

Always perform the disconnection in the following sequence.

1	Disconnect the probe head + probe head connector + cradle setup from the probe amplifier.
2	Disconnect the probe amplifier from the oscilloscope.
3	Disconnect / unsolder the probe head from the DUT.

This sequence is also applicable when moving the probe amplifier from one oscilloscope channel to another.

Moving the Probing Setup to Different Probing Locations

When making measurements, you may often need to probe different locations on the DUT.

- For the N5444A SMA head or the N5445A browser probe head, you can safely move the probe head from one location to another without having to first break the amplifier-to-head connection.

- For a solder-in or a ZIF tip probe head, always disconnect the probe head from the amplifier *before* unsoldering, moving to a new position, and resoldering the probe head. This is because some soldering-iron tips can hold a charge which can damage the probe amplifier.

Connecting Probe Head + Probe Head Connector + Mounting Cradle

As InfiniiMax 4 probe amplifiers can be used with InfiniiMax 4 probe heads as well as InfiniiMax III/III+ probe heads, this section is applicable to both of these connection scenarios.

1 Align and connect the appropriate probe head connector to the mounting cradle that suits your requirement.

Always use MX0040A connector for InfiniiMax 4 probe heads

Always use MX0045A Adapter for InfiniiMax III/III+ probe heads

2 Secure the probe head connector on the cradle using two screws (p/n 0515-6401)  with the T5 screwdriver as shown in the figures below.

Figure 24 MX0040A probe head connector connected to MX0046A vertical cradle

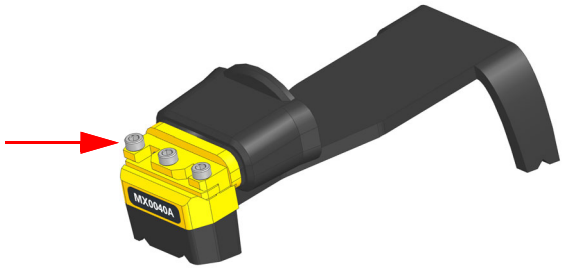
NOTE

Screw (0515-6401) specifications

M1.6X0.35 4 mm Long T5 Torx Screw 90 Degree Flat Head

3 Connect the probe head to the cradle plus connector setup created in the previous steps. In this procedure, MX0041A probe head is used as an example.

a Loosen the three screws on top of MX0040A connector.



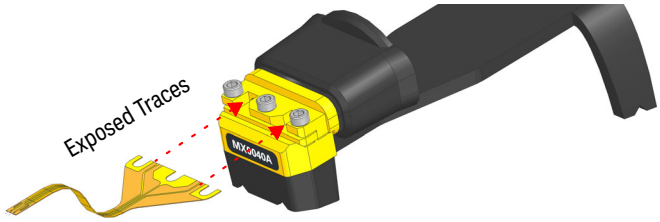
Horizontal cradle shown in this example

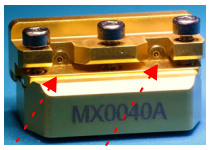
CAUTION The three screws on top of the MX0040A connector should never be fully loosened.

NOTE **MX0040A Probe Head Connector Screws specifications**

M1.6 x 0.35 x 6 mm T6 Torx Socket Head Cap Screw

b Insert the InfiniiMax 4 Solder-in probe head into the connector by gently sliding it between the top and center pieces of the connector.





Two center pins

Correct alignment

- The three slots on the probe head should align around the three screws on the connector.
- The two exposed traces on the probe head should make contact with the two center pins on the top piece of connector.

NOTE It is recommended to use a microscope to easily align the exposed traces to center pins.

c Tighten the middle screw on the connector a bit so that if required, you can make adjustments to align the exposed traces to center pins.

d Once the probe head is aligned properly to center pins on the connector, tighten all three screws on the connector using a T6 screwdriver.

Figure 25 MX0041A probe head connected to probe head connector and vertical cradle

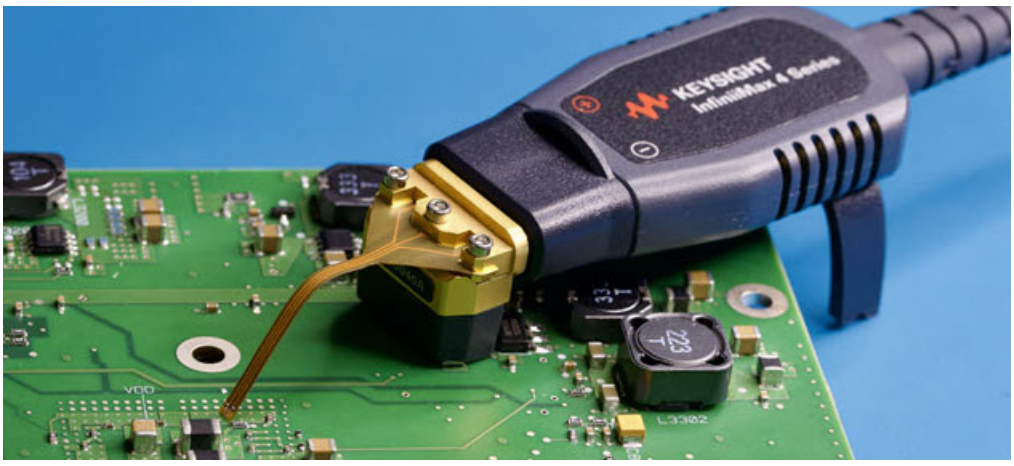


Figure 26 MX0041A probe head connected to probe head connector and horizontal cradle

Connecting Probe Head to DUT

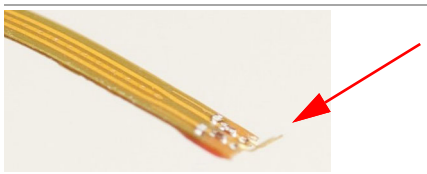
In this section, the MX0041A Solder-in probe head is used as an example to describe the soldering steps to connect the probe head to DUT.

Before You Start

NOTE Do not trim the MX0041A / 42A probe head's lead wires. These are already factory-trimmed (30 mil) to ensure signal fidelity.

NOTE You can spread the MX0041A / 42A probe head's lead wires within the range of 1 mm to 2 mm span without causing any significant variation in its available bandwidth or performance.

NOTE Bend the MX0041A / 42A probe lead wires in half forming a right angle so that these are perpendicular to the solder point. This is to ensure signal fidelity.



NOTE The MX0041A / 42A probe heads are shipped with two bends in their flex cable. Retain these pre-formed bends to ensure accurate measurements and to ensure that the probe head is not lying flat on the DUT board on soldering.

The bend radii for the flex cable should not go beyond 90 degrees.

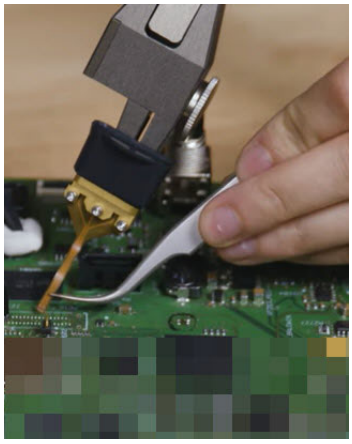
NOTE The tools included in the MX0102A soldering toolkit can be of great use while soldering the MX0041A / 42A probe head to DUT (see page 19). You can purchase this toolkit separately.

To solder the probe tip lead wires to DUT

NOTE

Use a microscope setup while performing soldering/de-soldering tasks. A microscope with the following features is recommended.
- Binocular eyepieces
- Adjustable magnification (at least 20x)
- Good working distance from the sample (at least 4 inches)
- Adjustable arm
- Integrated ring light around the objective lens

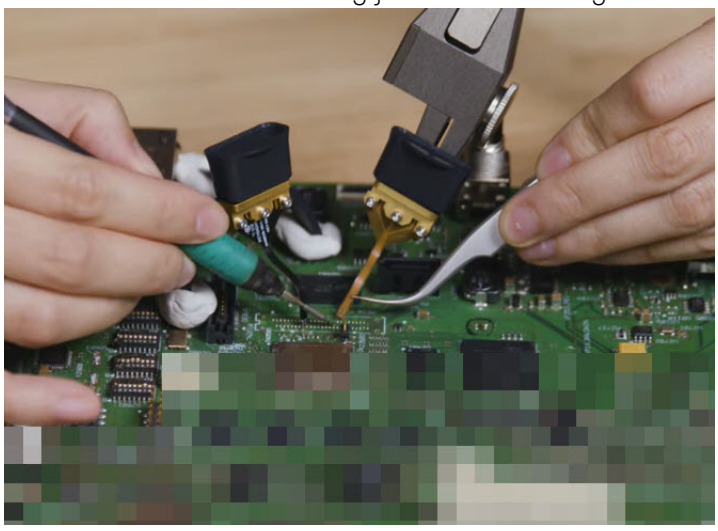
1 Place the Probe Head + Connector + Cradle setup to the required test location and then secure this setup using putty on mounting locations.



2 Apply flux to both DUT and MX0041A/ 42A probe tip lead wires. Always use plenty of flux, even if your solder already contains flux. This cleans the solder joint and allows for easier flowing solder and quicker dwell times.

3 Add solder to existing test points on DUT, if necessary. Heat momentarily and do not dwell any longer than necessary.

4 Connect the MX0041A / 42A probe head's lead wires to DUT by positioning these wires on DUT and then reflowing joint while heating momentarily.



NOTE

Keep the temperature as low as possible while still reflowing the solder at the joint of concern. The following are some of the useful tips to maintain low temperature during soldering.

- A temperature-controlled soldering iron is the best way to do this. Set it for no more than 350°C if using standard lead-free solders and 150°C for tin-bismuth solder.

- Do not rest a soldering iron on a probe joint for more than a few seconds.

NOTE

To view a demo on how to solder the lead wires to the DUT, visit https://www.keysight.com/find/prc and access the demo under the Videos section.

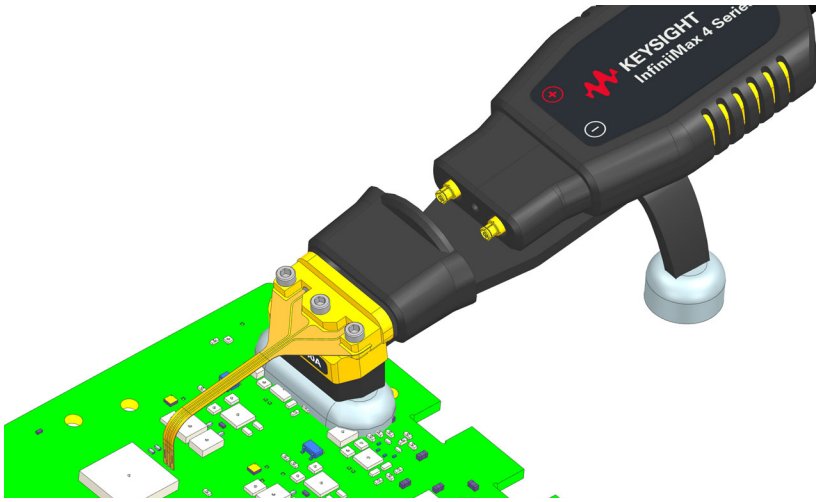
Connecting Probe Amplifier to Grounded Oscilloscope

1. First connect the AutoProbe III Power connector of the probe amplifier to the oscilloscope.
2. Then connect the 1.85 mm RF connector of the probe amplifier to the oscilloscope using the appropriate adapter (see page 11 for the list of adapters).

Figure 27 An InfiniiMax 4 series probe amplifier connected to UXR-series oscilloscope

Connecting Probe Amplifier to Probe Head + Probe Head Connector + Cradle Setup

- Gently push the probe amplifier bullets straight into the probe head connector sockets that are accessible through the mounting cradle.
- When disconnecting, pull the probe amplifier straight out of the probe head connector sockets.



CAUTION Never bend the probe amplifier to pry it loose from the cradle setup. Also, do not wiggle the probe amplifier up and down or twist it to remove the connectors from the sockets. This can damage the pins in the amplifier.

The following figure shows the complete probing setup for InfiniiMax 4 probe amplifier and probe head.

9 Configuring Software for InfiniiMax 4 Series Probe Amplifiers and Probe Heads

This chapter provides details of the steps that you need to perform to configure settings for your InfiniiMax 4 probe amplifier and probe heads using the Infiniium GUI.

See Also

The online help available with the Infiniium GUI for details on how to use this GUI.

Selecting Components Used in the Probing Setup

When you connect your InfiniiMax 4 probe amplifier to a compatible Keysight oscilloscope, the amplifier is automatically detected and displayed as connected to the oscilloscope's channel in the Infiniium software GUI.

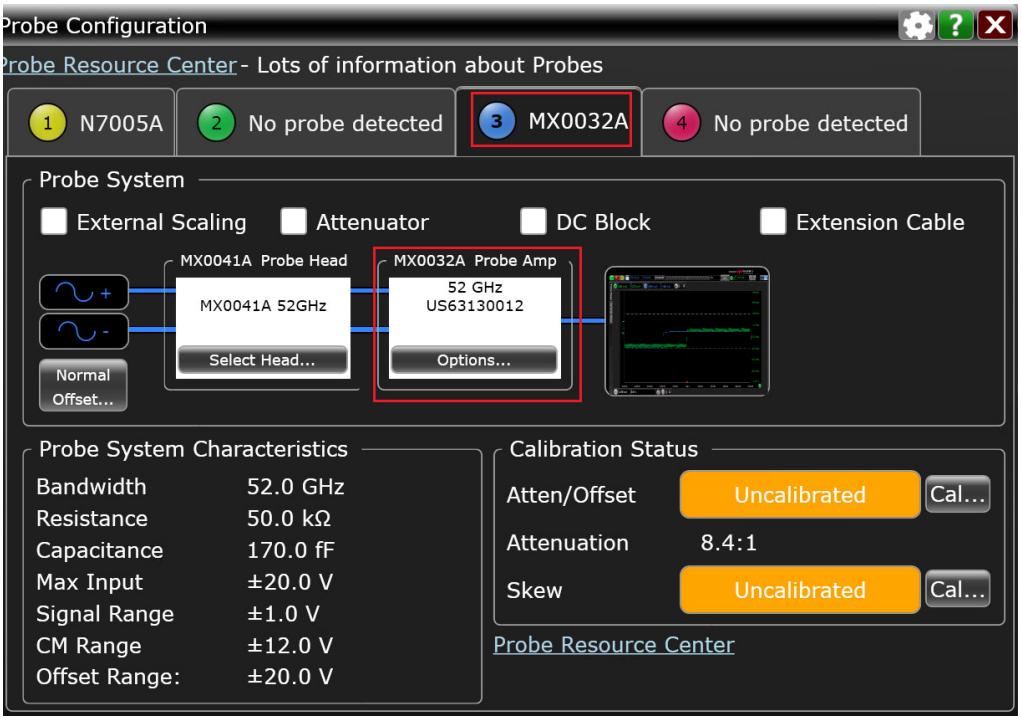


Figure 28 MX0032A auto-detected in the Infiniium GUI on connection

Although the probe amplifier is auto-detected, the probe head or other components such as attenuators, DC blocking capacitors, or extension cables that you may want to use in the probing setup are not automatically detected. To get accurate measurements, you need to ensure that all these components used in your probing setup are selected and displayed in the Probe Configuration dialog box.

To select components used in the probing setup

1 Click **Setup** > **Probe Configuration...** to access the **Probe Configuration** dialog box.

The **Probe System** section displays the probe system block diagram and various components that you can select for addition to this probe system.

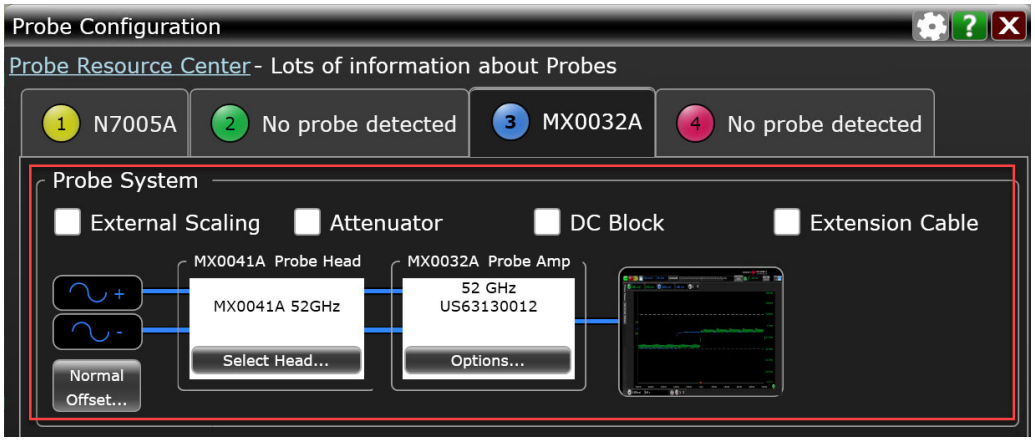
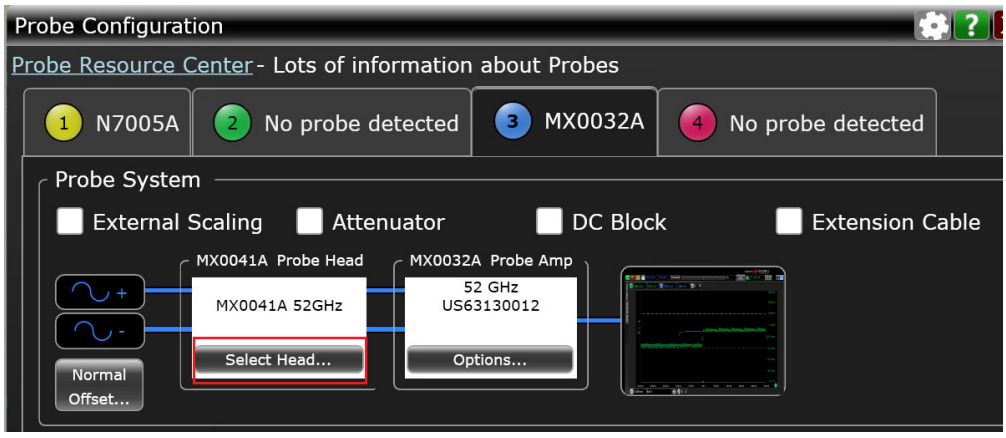


Figure 29 Probe connection diagram in the Probe System section

2 Select the checkbox displayed with the component(s) that you have used in the probing setup. The selected component(s) then get added to the probe connection diagram.

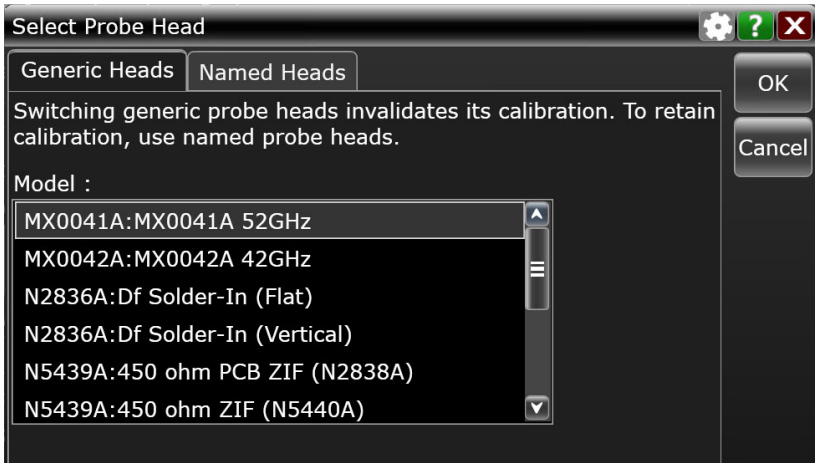
Components added to the block diagram may have the **Options** button if additional configuration options are available for these components.

3 After selecting components, you can select the type of probe head being used so that the oscilloscope can apply the appropriate correction filter (S parameter) for the probe head. Click **Select Head...** in the Probe Head block of the diagram.



The **Select Probe Head** dialog box is displayed in which you can select a generic or a named probe head. If you are planning to use more than one type of probe head with your amplifier, it is recommended to use Named heads as probe calibrations are preserved when you switch Named probe heads.

All probe heads that are supported for use with the InfiniiMax 4 series probe amplifiers are displayed in the **Model** listbox.


Select Probe Head
Generic Heads
Named Heads
OK
Cancel
Switching generic probe heads invalidates its calibration. To retain calibration, use named probe heads.
Model :
MX0041A:MX0041A 52GHz
MX0042A:MX0042A 42GHz
N2836A:Df Solder-In (Flat)
N2836A:Df Solder-In (Vertical)
N5439A:450 ohm PCB ZIF (N2838A)
N5439A:450 ohm ZIF (N5440A)

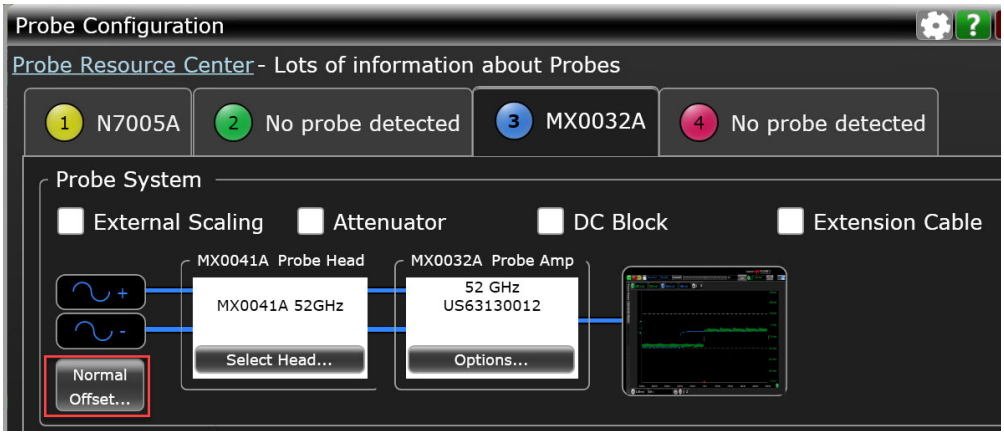
Configuring Offset Behavior

You can configure the offset behavior to ensure that you get the maximum performance and dynamic range from your InfiniiMax 4 probe amplifier. By applying an offset, most or all of the DC component can be subtracted and the signal can be positioned to better utilize the input's available dynamic range.

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

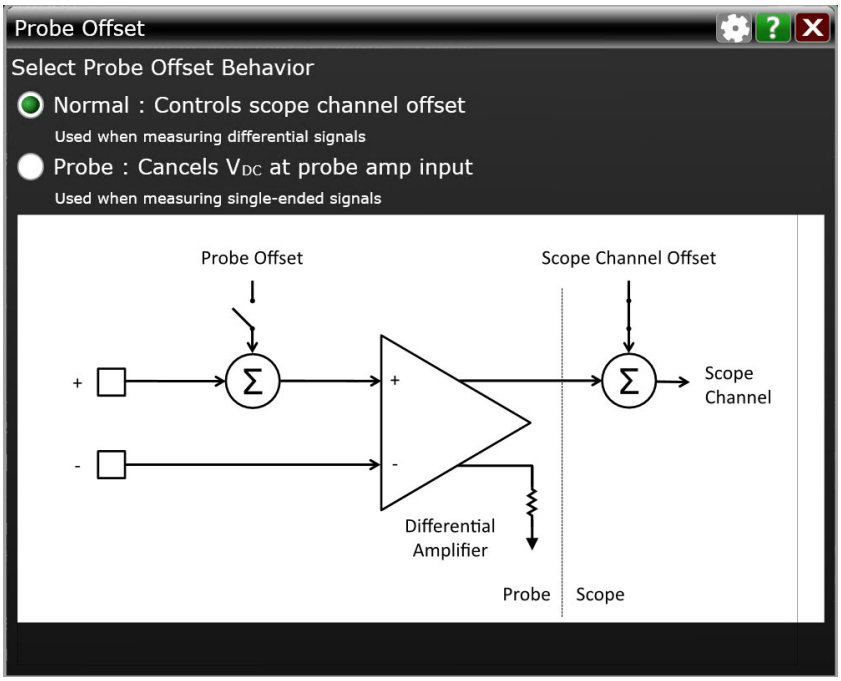
Normal Offset	Probe Offset
Offset is applied at the oscilloscope channel. The vertical offset control on the oscilloscope's front-panel controls the channel's offset.	Offset is applied at the probe. The vertical offset control on the oscilloscope's front-panel controls the probe offset.
Used when measuring differential signals	Used when measuring single-ended signals
Probe offset is not used and set to zero.	Channel offset is not used and set to zero.
Provides an offset range (up to ±2.5 V) for probing differential signals	Provides a very large offset range (up to ±16 V) for probing single-ended signals and a large common-mode range for probing differential signals.
Since the plus and minus sides of differential signals have the same dc component, the dc component is subtracted out and the probe's output by definition is centered around ground. Allows the waveform seen on screen to be moved as desired. The allowable dc component in the plus and minus signals is determined by the common mode range of the probe.	Allows the offset voltage to be subtracted from the input signal before the signal gets to the probe amplifier. Since this subtraction is done before any active circuits, the offset range is large (±16V) allowing a differential probe to make higher bandwidth and more accurate measurements on single-ended signals.

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



2 In the **Probe Offset** dialog box, the probe offset behavior options are available based on your choice of measurement mode for your probe amplifier.

- When you measure a single-ended signal using a differential probe head, you should select **Probe** as the offset behavior to be used. The offset is then applied at the probe head to preserve dynamic range. It is added to or subtracted from the positive leg of the probe head to bring the signal within the probe's dynamic range. This method of applying probe offset allows the full benefits of differential probing for single-ended signals without sacrificing offset range.
- When you measure a differential signal using a differential probe head, you should select **Normal** as the offset behavior to be used. The offset is then applied at the oscilloscope channel. Since the plus and minus sides of differential signals have the same dc component, the dc component is subtracted out and the probe's output by definition is centered around ground. Any voltage applied to the probe's offset input jack is not used and has no effect on the signal.



See Also

- Application Note: Using InfiniiMax Active Probes Offset
- "Making Measurements" on page 89

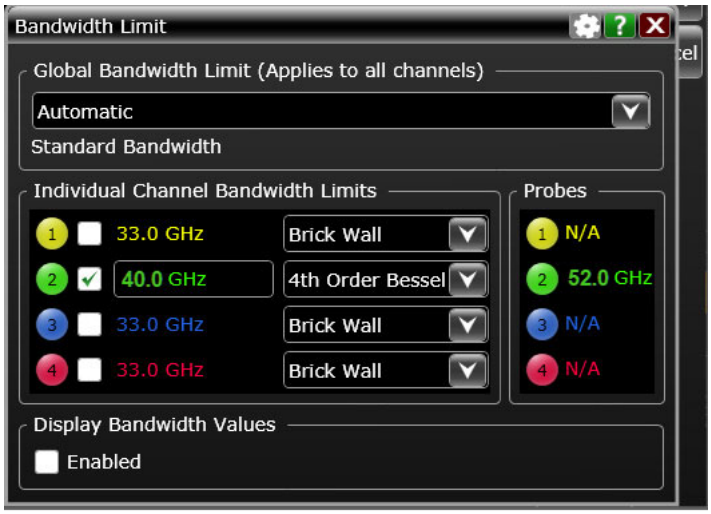
Configuring the Bandwidth Limit Filter for 4th Order Bessel Thomson Response

The MX0032A InfiniiMax 4 probe amplifier supports Brickwall and Bessel Thomson filter models with bandwidth up to 52 GHz (Brickwall) and 40 GHz (4th Order Bessel Thomson).

Based on the filter model that you want to set for your probe amplifier, you need to select the appropriate bandwidth limit filter for the oscilloscope channel to which you have connected the probe amplifier.

When setting the bandwidth limit for the oscilloscope channel, you can select one of the following two bandwidth limit filters in the **Bandwidth Limit** dialog of the Infiniium GUI.

Brickwall	4th Order Bessel Thomson
Suitable when you want to characterize the raw response of the DUT.	Suitable when you want to do reference receiver testing of DUT. This filter limits the bandwidth to optimize the signal-to-noise ratio but does not lower it down to the extent of causing inter-symbol interference. This allows the waveform to be displayed similar to what a receiver would see. The reference receiver measurement is made with a 4th Order Bessel Thomson filter set to 75% of the data rate. This reduces the effects of the transmitter's high frequency overshoot and noise.



Calibrating your InfiniiMax 4 Probe Amplifier

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

Calibration Overview

The following types of calibrations are applicable to the InfiniiMax 4 series probe amplifiers.

Table 10 Types of Calibrations

	DC Attenuation / Offset Calibration	Skew Calibration	AC Response Calibration
Purpose	Adjustment of probe gain and probe offset. Removes any attenuation or offset errors caused by a probe.	Removes any timing delays caused by a probe.	Applies AC response correction to a probe so that its frequency response is flat up to its bandwidth.
When to perform	▪ Calibrate your probe when using it for the first time on a channel input of the oscilloscope or when using it with a new probe head type. ▪ Then, it is recommended to perform calibration regularly (several times a year). ▪ Also, calibrate when the oscilloscope's calibration Δ Temp is not within ±5 °C.		Automatically performed on connection. (The oscilloscope automatically applies the appropriate correction filter for the probe amplifier and probe head to compute the overall probe correction.)

Sequence of Calibration

1. DC attenuation/Offset calibration
2. Skew calibration

Before You Start Calibration

- Verify that the Infiniium oscilloscope has been calibrated. This information is available in the Infiniium Calibration dialog box (**Utilities** > **Calibration...**). If the oscilloscope has not been calibrated recently, calibrate the oscilloscope before calibrating the probe.
- Verify that the calibration Δ temperature is within ±5 °C. If this is not the case, calibrate the oscilloscope before calibrating the probe.
- Allow the probe to warm up for 15 minutes before starting the calibration procedure.
- Remove any attenuator attached to the probe. You cannot calibrate your probe with the attenuators attached.

Performing DC Attenuation / Offset and Skew Calibration

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

Accessories Needed

Accessory	Usage
MX0104A PV/Deskew Fixture Kit	To calibrate and verify the performance of InfiniiMax 4 probes.
N2787A Probe Positioner (Recommended)	Use the probe positioner along with the cradle positioner to hold the probe in place during the calibration procedure.
MX0046A InfiniiMax 4 Cradle Positioner	

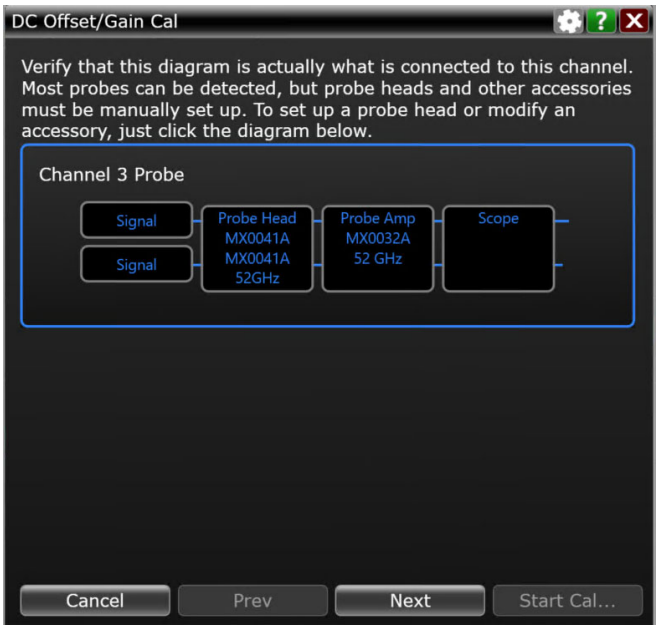
To perform calibration

1 Connect the InfiniiMax 4 probe amplifier to an oscilloscope channel.

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

3 In the tab that represents the channel to which your probe is connected, click the **Start Atten/Offset Cal...** button to initiate the DC attenuation/offset calibration.

4 The **DC Offset/Gain Cal** dialog box is displayed with a guided procedure for calibration. Verify that the probing diagram matches your probing setup. If it does not match, configure the probing components in the Probe Configuration dialog box (see page 76). If it matches, click **Next** to proceed.



The next screen in the guided procedure requires the usage of the MX0104A deskew fixture in this calibration.

5 To use the MX0104A deskew fixture:

a Connect the 50 Ω terminator to the MX0104A fixture. This terminator is provided with the fixture.

b Connect the MX0104A fixture to the **Cal Out** connector on the oscilloscope.

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

Figure 30 MX0104A deskew fixture connected to oscilloscope's Cal Out connector

d For the solder-in and ZIF probe heads, adjust the shape of the probe head tips as shown in the following figure before you clamp these to the deskew fixture. This is needed to ensure a proper contact with the deskew fixture.

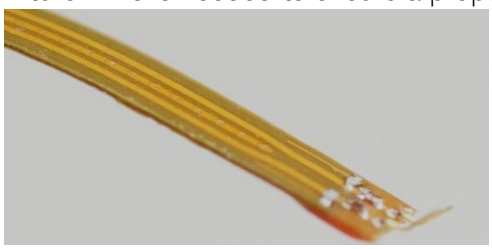
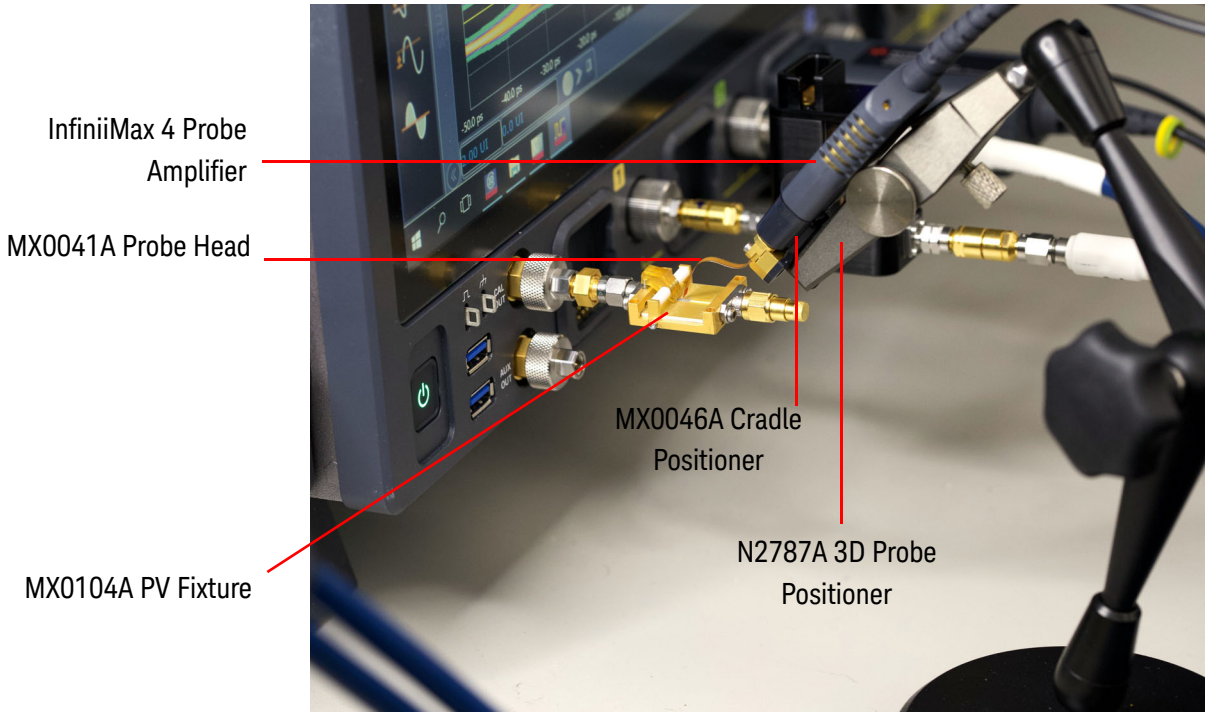


Figure 31 Probe lead wires bent in half forming a right angle

e Use the N2787A 3D Probe Positioner along with the MX0046A Cradle Postioner to hold the probe in place and to maintain a steady contact of probe tips with the deskew fixture.

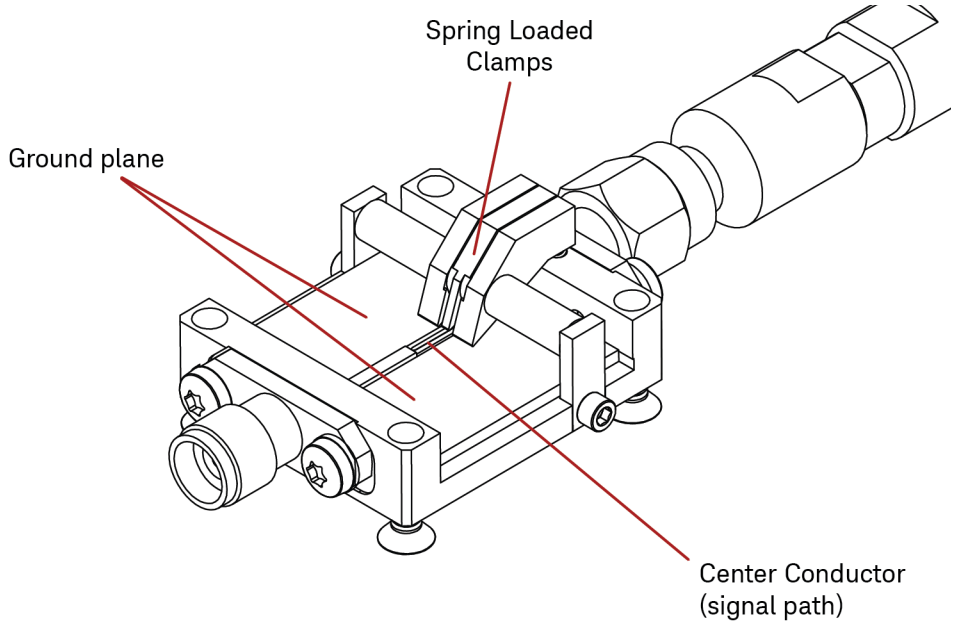
NOTE **Retain the pre-formed bends on the probe head's flex cable.**



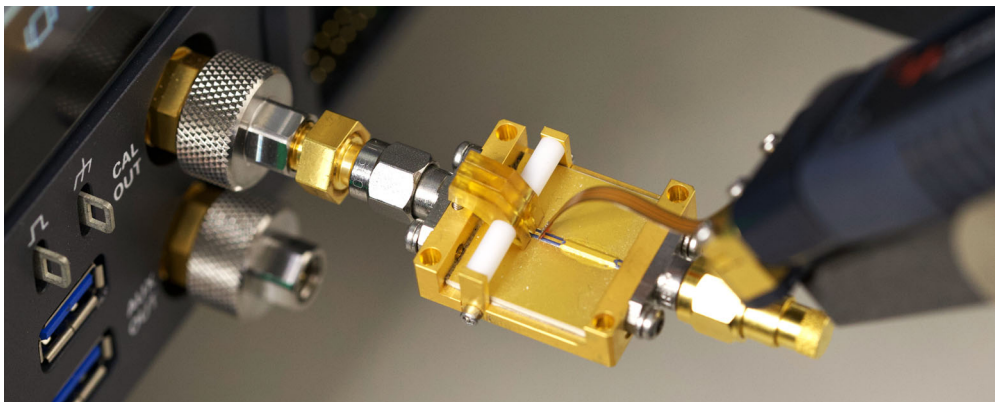
f While pressing down on the MX0104A fixture's spring-loaded clamps, insert the probe head tips beneath the clamps. Place the positive tip of the probe head on the center conductor of the deskew fixture. The negative tip or ground lead of the probe head must be connected to the ground plane on either side of the center conductor of the deskew fixture. The MX0104A's

spring loaded clamps, ground plane, and center conductor (signal path) are labeled in the following figure.

CAUTION Do not press down with much force to avoid snapping off the fixture from the Cal Out connection.
Only a light contact is needed for the calibration.



The clamping of the probe head (MX0041A in this example) to the deskew fixture is shown below.



NOTE You can verify whether or not the probe head's leads are correctly connected to the MX0104A deskew fixture by pressing the oscilloscope's autoscale button. If a stable step is displayed on screen, it indicates a good connection. You will need to re-open the Probe Calibration dialog box after performing this verification step.

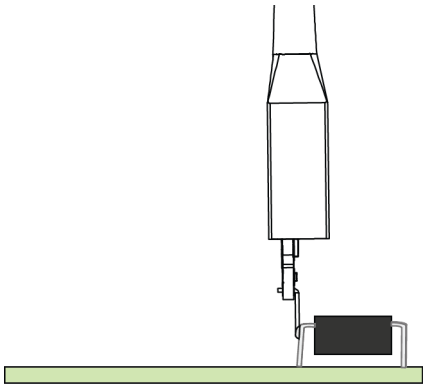
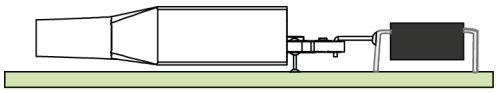
After the probe is properly connected to the deskew fixture, click the **Start Cal...** button to begin the DC gain/offset calibration.

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

10 Making Measurements

Orientation of the Probe Head

The orientation of the probe head in the probing setup plays an important role when making measurements.

	Vertical	Flat
Setup	The probe head's tip is aligned perpendicular to the surface of the DUT.	The probe head's tip is aligned parallel or at a shallow angle to the surface of the DUT.
		

NOTE

Single-ended and differential measurements require the Vertical orientation as laying the probe head flat causes coupling to the probe head tip that can degrade the probe performance.

Probing Single-ended Signals

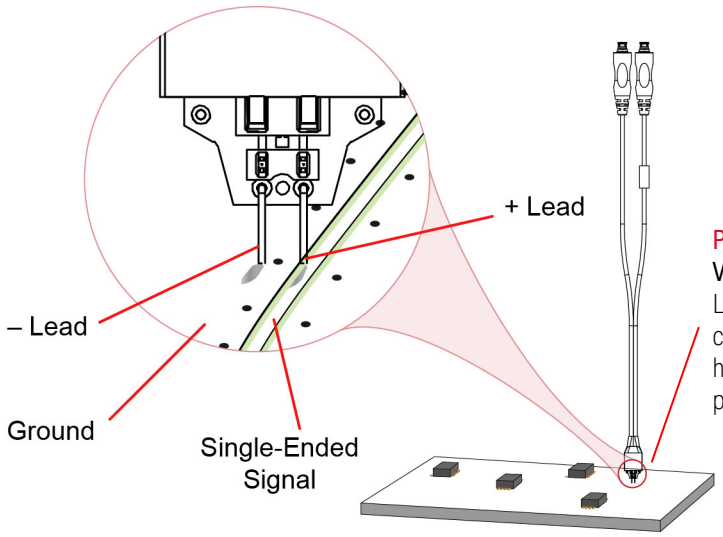
NOTE All recommended probe heads of the InfiniiMax 4 probe amplifiers are differential and are best suited to probe not just differential but also single-ended signals. Differential probe heads can help you make better measurements on single-ended signals than single-ended probe heads by providing higher bandwidth and increased accuracy. Also, any supplied offset is applied only to the probe head's plus side resulting in no offset range being sacrificed.

This scenario is applicable when you want to use the probing setup to probe single-ended signals only.

Hardware Setup

- Connect the probe head's "+" lead to the single-ended signal.
- Connect the probe head's "–" lead to ground.

The + and – connections for a probe head can be determined when the probe head is plugged into the probe amplifier. The polarity markings on the probe amplifier represent the + and - inputs on the probe head.



Probe Head Orientation
Vertical
Laying the probe head flat causes coupling to the probe head tip that can degrade the probe performance.

Software Configurations in the Probe Configuration Dialog Box

Offset Applied

Select the **Probe Offset** as the offset behavior to be used. The offset is then applied at the probe head to preserve dynamic range. It is added to or subtracted from the positive leg of the probe head to bring the signal within the probe's dynamic range. This method of applying probe offset allows the full benefits of differential probing for single-ended signals without sacrificing offset range.
See Also: "Configuring Offset Behavior" on page 79.

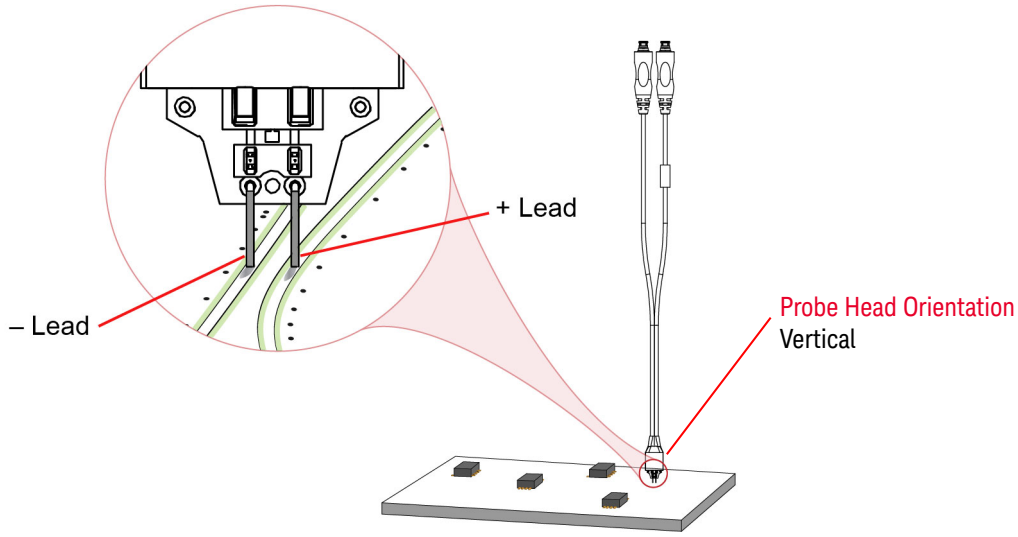
Probing Differential Signals

This scenario is applicable when you want to use the probing setup to probe differential signals only.

Hardware Setup

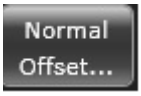
- Use the probe head's signal leads to make + and - signal connections.

The + and – connections for a probe head can be determined when the probe head is plugged into the probe amplifier. The polarity markings on the probe amplifier represent the + and - inputs on the probe head.



Software Configurations in the Probe Configuration Dialog Box

Offset to be Applied



Select the **Normal Offset** as the offset behavior to be used. The offset is then applied at the oscilloscope channel. Since the plus and minus sides of differential signals have the same dc component, the dc component is subtracted out and the probe's output by definition is centered around ground. Any voltage applied to the probe's offset input jack is not used and has no effect on the signal.

See Also: "Configuring Offset Behavior" on page 79.

Probing Ungrounded Devices

For any probing setup, the DUT needs to be grounded to the oscilloscope via the AC mains ground before connecting the DUT to a probe head. In case of ungrounded devices such as a battery-powered device where the DUT is not grounded to the oscilloscope via the AC mains ground, you can establish the ground connection in the following two ways:

- Connect the DUT ground to the probe amplifier ground.
- Connect the DUT ground to the oscilloscope ground.

Use a ground wire to make this ground connection.

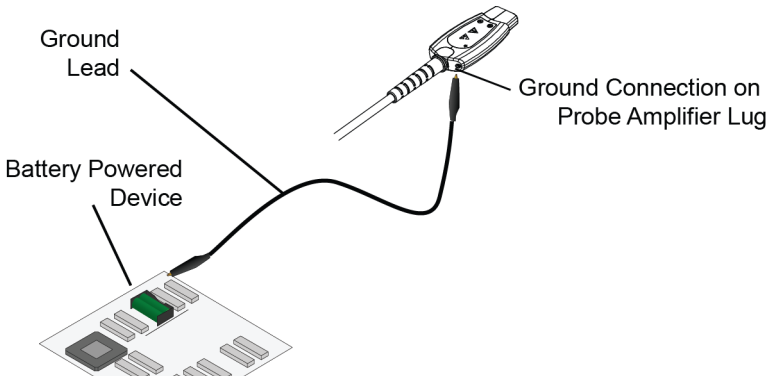


Figure 32 Connecting DUT Ground to Probe Amplifier Ground

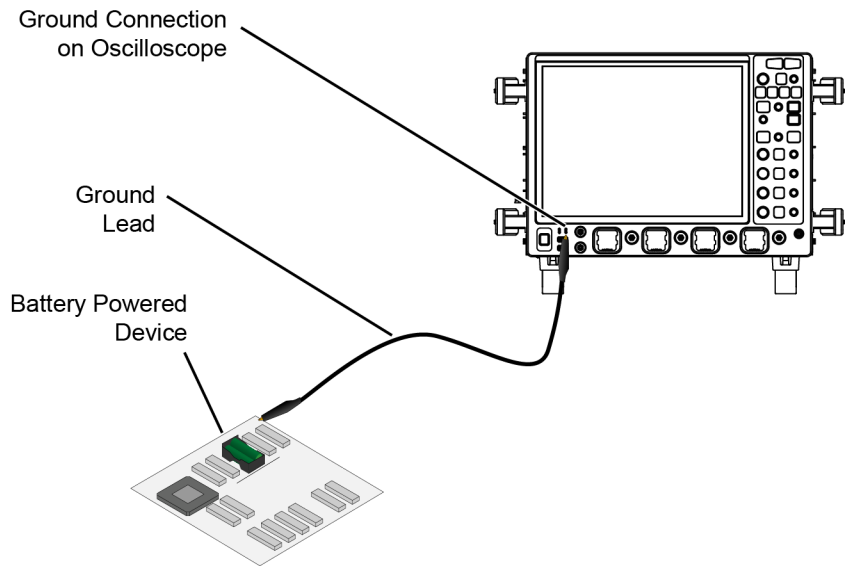


Figure 33 Connecting DUT Ground to Oscilloscope Ground

11 InfiniiMax 4 Series Probe Amplifiers and Probe Heads System Responses

InfiniiMax 4 series probe amplifiers with Infiniium real-time oscilloscopes utilize DSP correction filters to enhance the accuracy of measurements. These probe amplifiers store their unique s-parameters in on board memory for the oscilloscope to readout. Probe heads are simple passive devices and, with careful manufacture, their s-parameters don't vary significantly so these are stored as nominal s-parameters in the oscilloscope. When a probe is connected to an oscilloscope channel and the proper probe head is selected, the oscilloscope calculates a DSP correction filter that includes the probe head, probe amplifier, and oscilloscope channel. This provides the maximum measurement accuracy for the complete probe and oscilloscope channel system.

Since there are multiple probe amplifier and probe head combinations, it is not reasonable to show the frequency responses of all these combinations. This chapter provides typical CMRR for the MX0041A probe head and MX0032A probe amplifier combination. The responses would all be very much the same for all probe heads because they are all corrected to the same target system response at the bandwidth specified. The target system response is a flat magnitude, flat phase response high order low-pass Brickwall filter that maximizes measurement accuracy.

Typical CMRR

The following figure shows the typical CMRR for the MX0041A probe head and MX0032A probe amplifier combination.

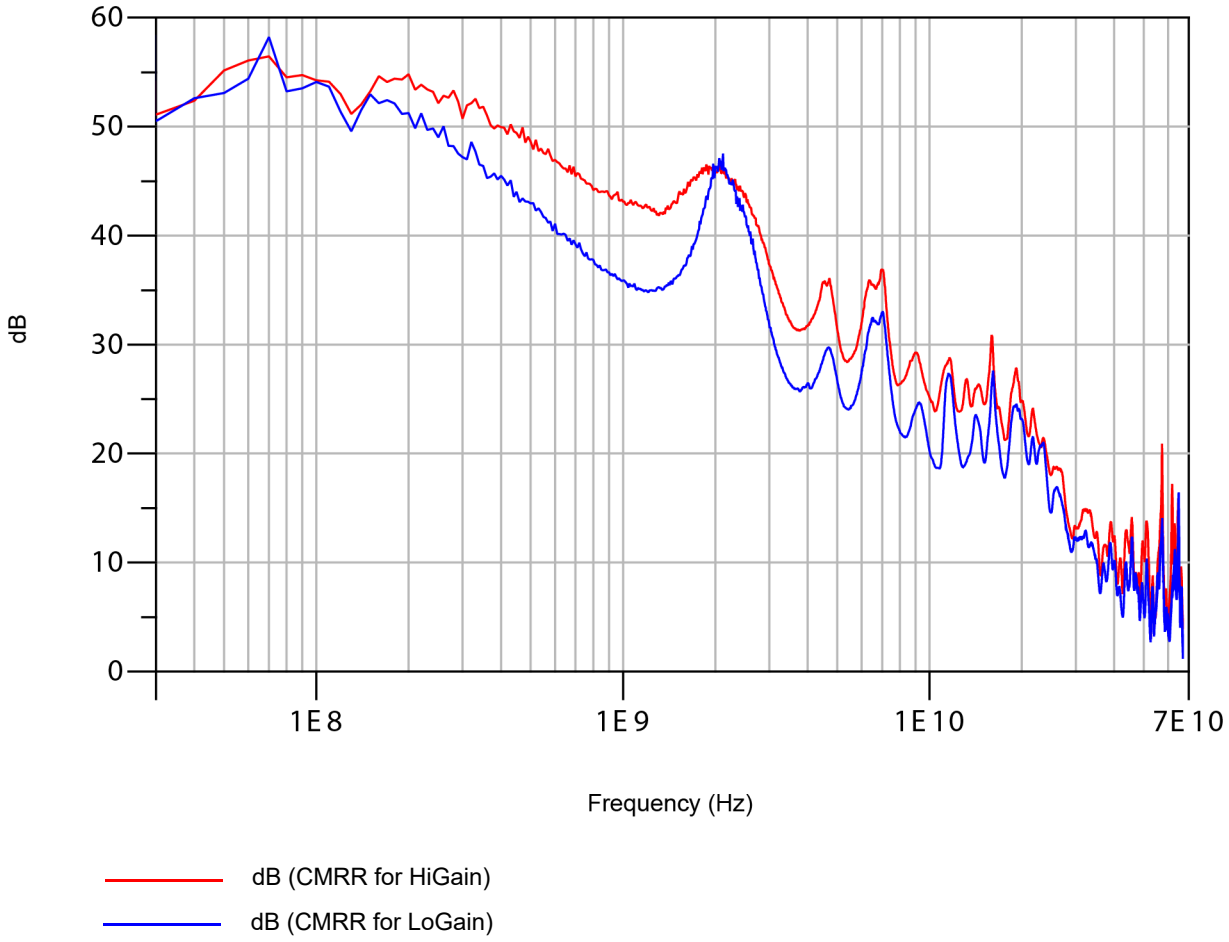


Figure 34 CMRR of MX0041A Probe Head With MX0032A Probe Amplifier

12 Performance Verification

This chapter describes how to verify the bandwidth performance of InfiniiMax 4 series probe amplifiers.
The probe amplifier used in this chapter is MX0032A.

Before you Start

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

Recommended Test Interval

The recommended test interval is 1 year.

To Test Bandwidth

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

Probe Amplifier	Probe Head	Warranted Specification
MX0030A	MX0041A InfiniiMax 4 Differential Solder-in Probe Head	42 GHz brickwall
MX0031A/32A		52 GHz brickwall

Required Test Equipment

Table 11 Required Test Equipment for Bandwidth Verification

Description and any Critical Specification(s)	Recommended Keysight Models / Part Numbers
PV / Demo Fixture	Keysight MX0030-60001 (No substitute)
InfiniiMax 4 Series Probe Amplifier (to be verified)	Keysight MX0031A/32A probe amplifier
InfiniiMax 4 Series Probe Head	Keysight MX0041A 52 GHz probe head
2-Channel / 4-Channel 70 GHz or higher Infiniium Oscilloscope with AutoProbe III Interface	▪ Keysight UXR0702A/B or UXR0704A/B ▪ Required adapter to connect the probe amplifier to the oscilloscope channel: 1.85 mm F-F Adapter (p/n 85058-60114) ▪ Required adapters to connect the PV fixture to the oscilloscope channel: 1.85 mm M - M Adapter (p/n N5520A) and 1.85 mm F-F Adapter (p/n 85058-60114) No substitute ▪ Keysight UXR1102B or UXR1104B ▪ Required adapter to connect the probe amplifier to the oscilloscope channel: 1 mm F ruggedized - 1.85 mm F Adapter (p/n Y1901B) ▪ Required adapters to connect the PV fixture to the oscilloscope channel: 1.85 mm M - M Adapter (p/n N5520A) and 1 mm F ruggedized - 1.85 mm F Adapter (p/n Y1901B) No substitute
1.85 mm Calibration Module	Keysight N2126A (No substitute)

Description and any Critical Specification(s)	Recommended Keysight Models / Part Numbers
3.5 mm FF Adapter	Keysight 5061-5311 or Any 3.5 mm, 2.92 mm, or SMA Female/Female Adapter

Procedure

CAUTION To avoid damage, ensure that you attach the N2126A Calibration module's SMA cable to the oscilloscope's "AUX OUT" front panel connector and not to the "CAL OUT" connector.

1. Power up the oscilloscope.
2. Make connections to any two input channels of the oscilloscope as described in the following steps. A sample connection setup is shown in Figure 35.
   - **a** Attach the N2126A Calibration module to oscilloscope's channel 1 AutoProbe Interface and its SMA cable to oscilloscope's "AUX OUT" connector using 3.5 mm FF adapter or equivalent. "Under/Calibration Output/Signal Output" set it to "Probe Comp".
   - **b** Attach probe amplifier to be tested to oscilloscope's channel 2 AutoProbe interface and its 1.85 mm M cable to the input of channel 2 using the appropriate adapter as listed in Table 11.
   - **c** Allow the setup to warm up for a minimum of 30 minutes.
   - **d** Attach the PV/Demo fixture's female connector to oscilloscope's channel 1 M input using the adapters listed in the Table 11.
   - **e** Attach the remote head of the N2126A module to the 1.85 mm M connector on the PV/Demo fixture.
   - **f** Attach the probe amplifier to PV/Demo fixture with its + polarity marking on the left and - polarity marking on the right as shown in the following figure.

Figure 35 Performance Verification Setup

3 Configure the oscilloscope as per the following settings.

- **a** Press **Default Setup** on oscilloscope's front panel.
- **b** Set the vertical scale of channel 1 to **125 mV/div** and offset to **-300 mV**.
- **c** Set channel 1 trigger level to **falling edge, -300 mV**.
- **d** Set the timebase to **50 pS/div** and **0.0 s** delay.
- **e** Click **Setup > Acquisition**. In the Acquisition dialog box, enable averaging and set # of Averages to **1024**.
- **f** Turn on channel 2.
- **g** Click **Setup > Probe Configuration**. Set the Probe Offset Behavior to **Probe** and ensure that the MX0041A probe head is selected for channel 2.
- **h** Set the vertical scale of channel 2 to **110 mV/div** and the offset to **-300 mV**. Close menu.
- **i** Click **Setup > Bandwidth Limit** and ensure that **Individual Channel Bandwidth Limits** checkboxes for channel 1 and channel 2 are unchecked. Close the dialog box.
- **j** Click **Math > Functions....** In the Function dialog box, define the functions f1, f2, f3, and f4 as follows.
- **k** Select the tab of the function f1 to a source of channel 1. From the Function 1 listbox, select **Math** and then **Differentiate.** Clear the **Low Pass and Align Phase** checkbox. Do not select the On checkbox for f1.

l Select the tab of the function f2 to define it. From the Function 2 listbox, select **FFT** to set f2 to be an FFT of f1. Turn the function display on for f2 by selecting the **On** checkbox.

m Set the math function 2 FFT to a stop frequency of **104 GHz**, **3 dBm/div**, and reference level of **215 dBm**. Close menu and if needed, move function 2 up or down to align the trace at one minor division from the left to center screen.

n Open channel 1 menu and set InfiniiSim Setup to **2 Port**. Note: The InfiniiSim D9020ASIA software is a licensed software.

o Click **Setup** and then based on the oscilloscope model used, select the following tf file to de-embed the channel for the PV fixture.

- **Half_MX003xA_PvFixture.tf2** for UXR0702A/B or UXR0704A/B models
- **HalfPvFxtr_185mmMM_185mmFto1mmF.tf2** for UXR1102B or UXR1104B models

p Select **Remove Filter Delay** from the pull down list.Then close the InfiniiSim setup and channel menu.

q In channel 2 menu, adjust skew to center the falling edge within a horizontal minor division of center screen. This is usually around -1.7 nS.

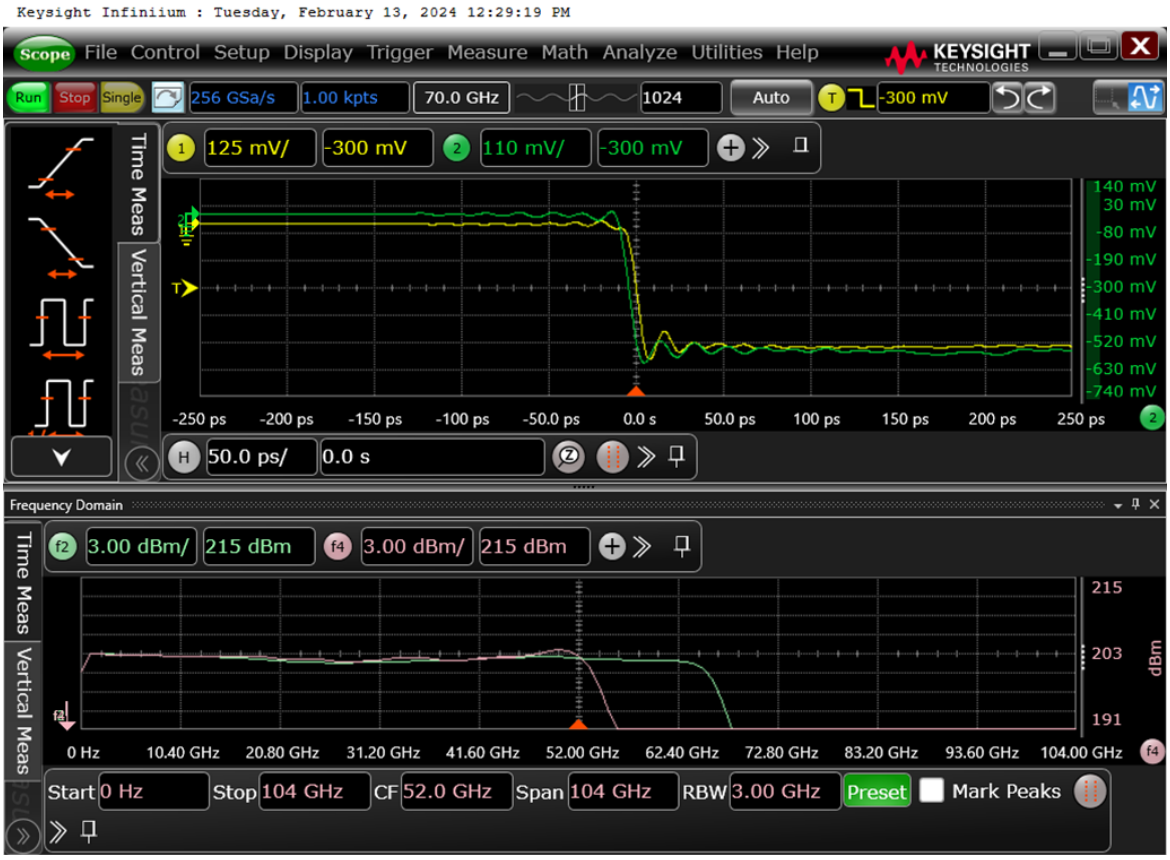
r Select the tab of the function f3 to define it. From the Function 3 listbox, select **Math** and then **Differentiate**. From the Source 3 drop-down listbox, select the input channel of the oscilloscope to which you connected the probe amplifier, that is channel 2 in this example. Deselect the **Low Pass and Align Phase** checkbox. Do not select the On checkbox for f3.

s Select the tab of the function f4 to define it. From the Function 4 listbox, select **FFT** to set f4 to be an FFT of f3. Turn the function display on for f4 by selecting the **On** checkbox.

t Set the math function 4 FFT to a stop frequency of **104 GHz**, **3 dBm/div**, and reference level of **215 dBm**. Deselect **Create New Graticule**. Close function 4 and if needed, move function 4 up or down to align the trace at one minor division from the left to center screen.

u Ensure that function 2 and function 4 overlay each other at one minor division in from the left side of screen.

4 After configuring the above-mentioned settings, the oscilloscope display should be similar to the following screen. To pass bandwidth verification, function 4 should not be more than 1 major division (3 db) below function 2 at center screen (52 GHz). This checks the bandwidth of the probe for the high gain setting of the probe amplifier.



5 Change the vertical scale of channel 2 to **130 mV/div** and again check that function 4 is not more than 1 major division below function 2. This checks the bandwidth of the probe for the low gain setting of the probe amplifier.

If the checks performed in step 4 and 5 pass, then the MX0041A and MX003xA probe system has passed the bandwidth performance verification test.

Performance Test Record

Table 12 Performance Test Record

Model #:	**Date:**	**Tested by:**	
Serial #:	**Recommended next test date:**		
Test	**Test Limits**	**Result**	**Pass/Fail**
Bandwidth	42 GHz (MX0030A) 52 GHz (MX0031A/32A)		

To Test Input Resistance

This procedure tests that the probe meets its warranted input resistance.

Probe Amplifier	Probe Head	Specification	
MX0030A/31A/32A	MX0042A	DC Input Resistance	R_{se} = 51.55 kΩ ± 2% each input to ground R_{diff} = 103.1 kΩ ± 2%

Required Test Equipment

Description	Critical Specification(s)	Recommended Models / Part Numbers	Purpose
Oscilloscope	A compatible Infiniium oscilloscope with AutoProbe interface	UXR-series (1.0 mm or 1.85 mm models)	To provide probe power
Digital Multimeter	2 wire resistance accuracy > ± 0.01%	34461A Digital Multimeter	To measure and display Input Resistance for the probe
PV Fixture		MX0104A performance Verification Fixture (recommended) or E2655C (substitute)	
Adapter	SMA (m) to BNC (f)	E2655-83201 (in E2655C Kit) or Any other equivalent SMA (m) to BNC (f) adapter	To connect the PV fixture to the DMM
Probe Amplifier (to be verified)	InfiniiMax 4 amplifier	MX0030A/31A/32A probe amplifier	
Probe Head	MX0041A/42A	MX0041A/42A	

Procedure

1. Power on the Infiniium oscilloscope and 34461A DMM.
2. Connect the probe amplifier under test to Channel 1 of the Infiniium oscilloscope.
3. Select the 2-wire Ohm display on the 34461A DMM.

4 For Differential test, perform the following steps.

a Using the PV fixture, connect the positive (+) and negative (–) probe tips to the input terminals of the 34461A DMM as shown in the following figure.

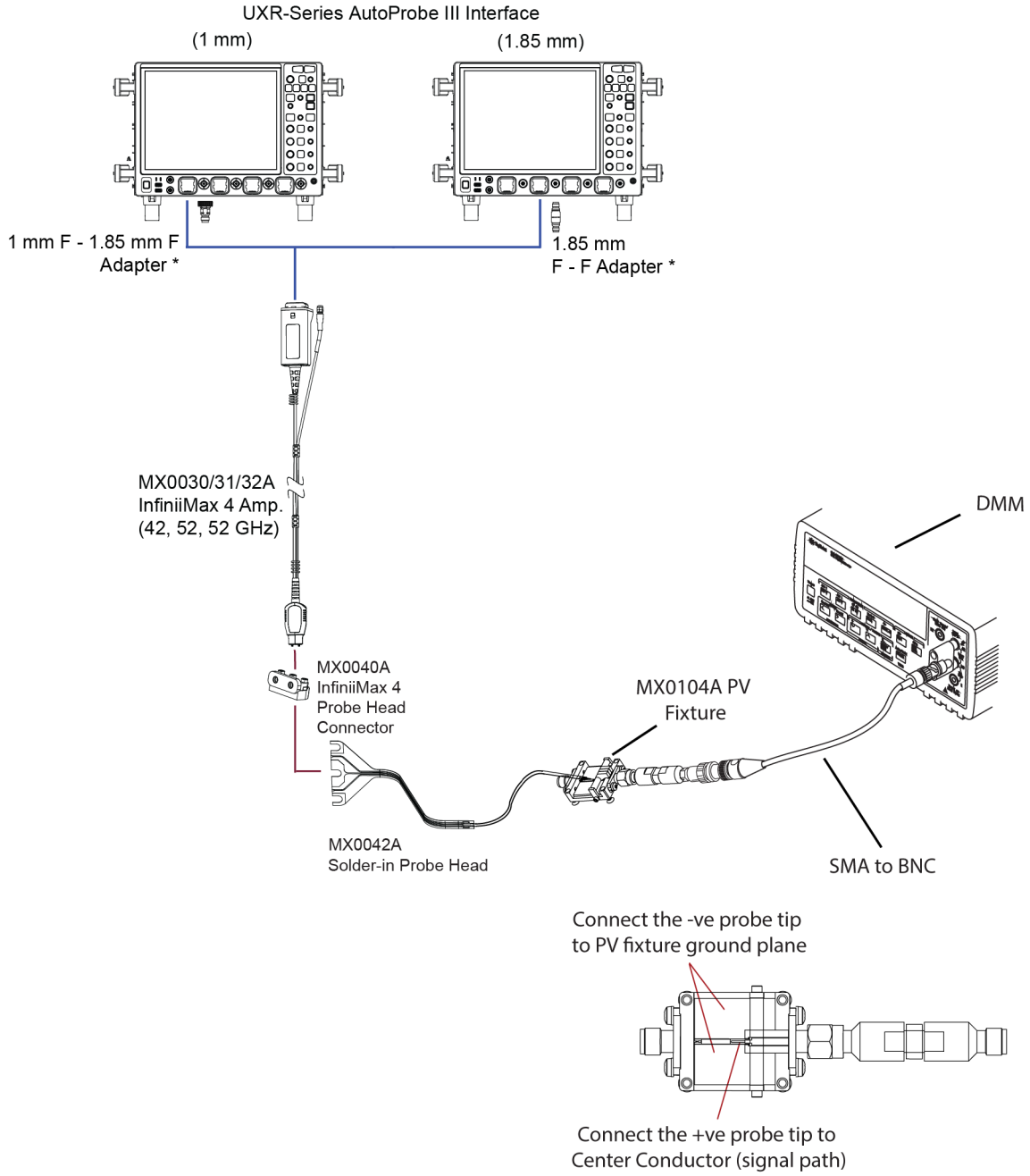


Figure 36 Connections for Differential Test

b Apply upward pressure to the clip to ensure proper electrical connection.

c Read the 34461A display for the input resistance.

d Record the result in the performance test record given at the end of this chapter. To pass this test, the result should be between 98 kΩ and 102 kΩ.

5 For Single-ended test, perform the following steps.

a Using the PV fixture, connect the positive (+) probe tip to the input terminal of 34461A DMM and connect the probe amplifier's ground to the PV fixture ground. The connections are illustrated in the following figure.

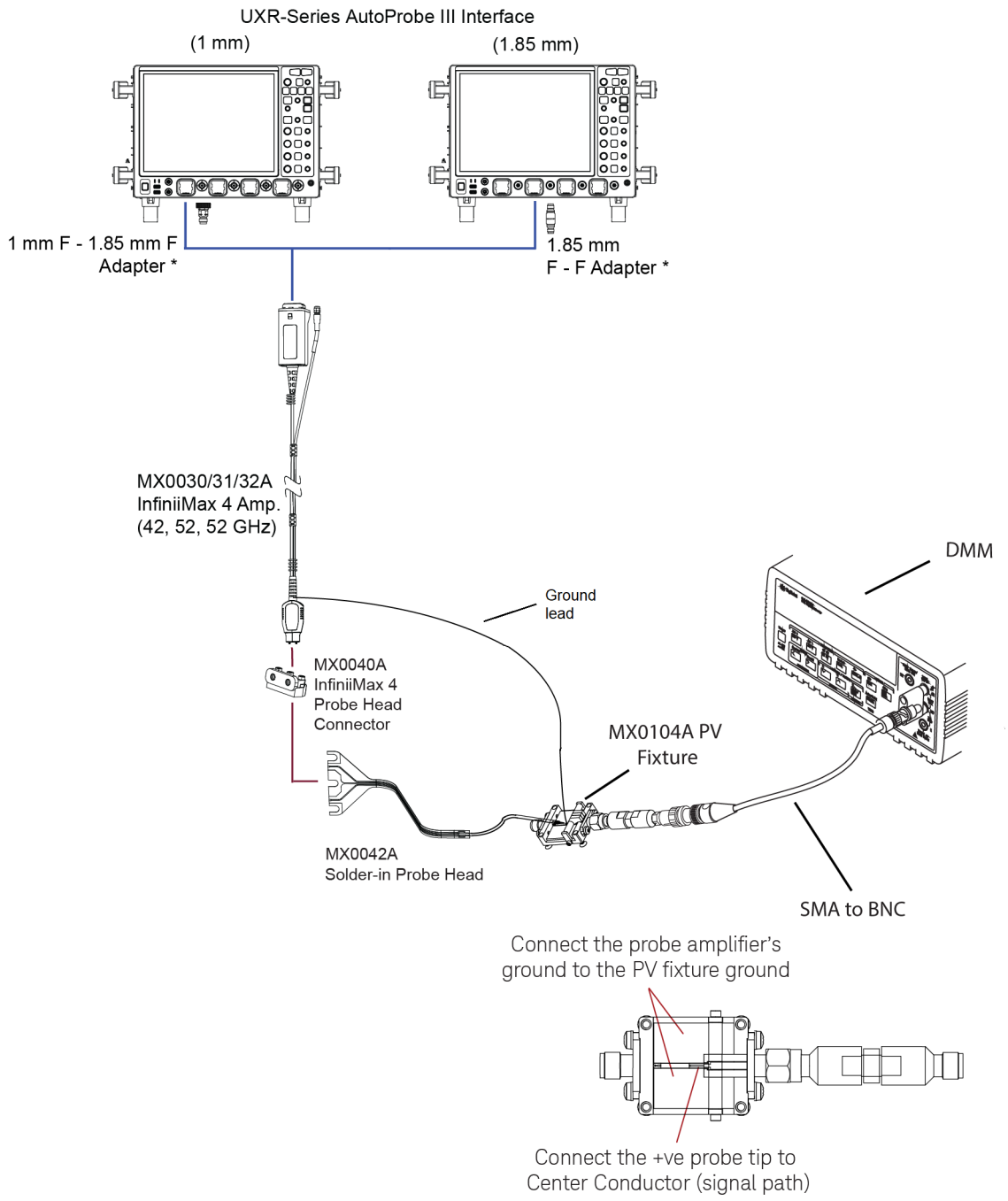


Figure 37 Connections for Single-ended Test (positive probe tip measurement)

b Apply upward pressure to the clip to ensure proper electrical connection.

c Read the 34461A display for the input resistance.

d Record the result in the performance test record given at the end of this chapter. To pass this test, the result should be between 49 kΩ and 51 kΩ.

e Using the PV fixture, connect the negative (-) probe tip to the input terminal of 34461A DMM and connect the probe amplifier's ground to the PV fixture ground. The connections are illustrated in the following figure.

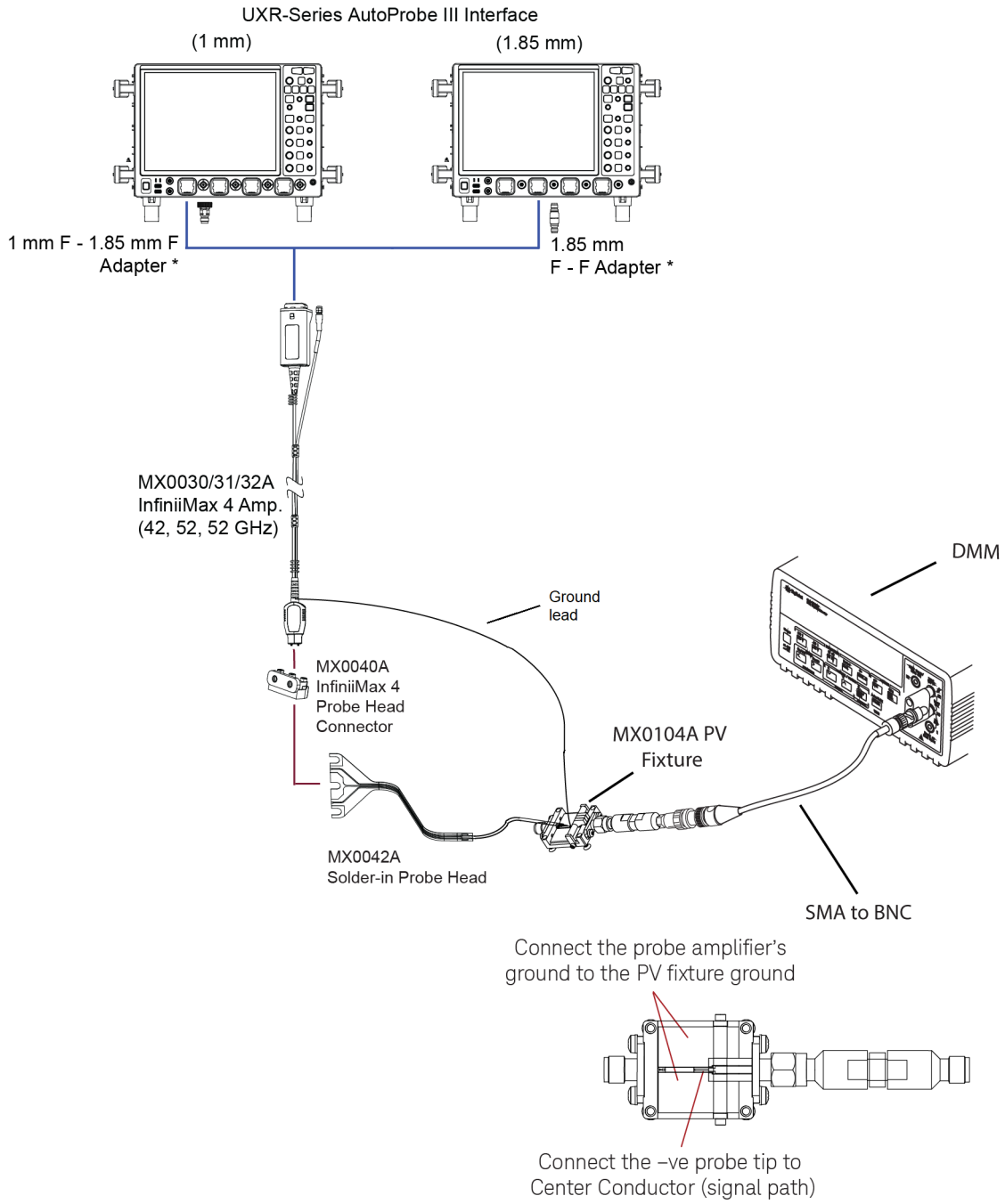


Figure 38 Connections for Single-ended Test (negative probe tip measurement)

f Apply upward pressure to the clip to ensure proper electrical connection.

g Read the 34461A display for the input resistance.

h Record the result in the performance test record given at the end of this chapter. To pass this test, the result should be between 49 kΩ and 51 kΩ.

Performance Test Record

Table 13 Performance Test Record

Model #:	**Date:**	**Tested by:**	
Serial #:	**Recommended next test date:**		
Test	**Test Limits**	**Result**	**Pass/Fail**
Input Resistance			
▪ Differential	103.1 kΩ ± 2%		
▪ Single-ended (positive probe tip measurement with input to ground)	51.55 kΩ ± 2%		
▪ Single-ended (negative probe tip measurement with input to ground)	51.55 kΩ ± 2%		

13 Returning a Probe/Probe Head for Repair/Service

If the probe amplifier / probe head is found to be defective or not meeting performance specifications, it is recommended to send it to a Keysight authorized service center for all repair and service needs.

If the probe amplifier / probe head is under warranty, normal warranty services apply. If the probe amplifier / probe head is not under warranty, repair costs will be applied.

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

Only Keysight approved accessories should be used.

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

1 Contact your nearest Keysight sales office for any additional details.

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

- Name and address of owner
- Product model number (for example, MX0031A)
- Product Serial Number (for example, MYXXXXXXXX)
- Description of failure or service required

NOTE Include probe heads and 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. Use original packaging or comparable.

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

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

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

Contacting Keysight Technologies for Technical Assistance

For technical assistance, contact your local Keysight Call Center.

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

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

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