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

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

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Overview

Introduction

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

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

Key Features

- **Supports Differential and Single-ended Measurements**: You can use these probes to measure differential as well as single-ended signals. See page 32 to know more.

- **Auto Attenuation Ranges**: These probes support two auto attenuation ranges (~17:1 and ~85:1). The probe’s attenuation is automatically set to the value necessary to make the dynamic range of the probe greater than or equal to the level required to measure the input signal. The input range is automatically configured depending on the vertical scale of the oscilloscope. For volts/division setting \( \leq 2 \text{ V/div} \), the attenuation range of ~17:1 is applicable and for volts/division setting \( >2 \text{ V/div} \), the attenuation range of ~85:1 is applicable. Based on these ranges, the attenuation for the probe is set when the probe is calibrated. You can view the attenuation setting for the probe in the Infiniium/InfiniiVision software GUI.
• **DUT Connectivity Options:** You can connect the probe tip either directly to DUT header pins or use the supplied/optional accessories as per your probing scenario.

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

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

**CAUTION** Before using these probes, refer to “Safety and Regulatory Information” on page 33.
Compatibility with Keysight Oscilloscopes

<table>
<thead>
<tr>
<th>Compatible Oscilloscopes</th>
<th>Adapter(s) Required</th>
<th>Required Software Version</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infiniium Oscilloscopes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXR-Series</td>
<td>None</td>
<td>Infiniium 11.25 or higher</td>
</tr>
<tr>
<td>MXR-Series</td>
<td>None</td>
<td>Infiniium 11.25 or higher</td>
</tr>
<tr>
<td>S-Series</td>
<td>None</td>
<td>Infiniium 6.71 or higher</td>
</tr>
<tr>
<td>V-Series</td>
<td>N5442A adapter</td>
<td>Infiniium 6.71 or higher</td>
</tr>
<tr>
<td>Z-Series</td>
<td>N5442A adapter</td>
<td>Infiniium 6.71 or higher</td>
</tr>
<tr>
<td>UXR-Series (3.5 mm models)</td>
<td>N5442A adapter</td>
<td>Infiniium 11.25 or higher</td>
</tr>
<tr>
<td>UXR-Series (1 and 1.85 mm models)</td>
<td>N5442A + N2852A adapters</td>
<td>Infiniium 11.25 or higher</td>
</tr>
<tr>
<td><strong>InfiniiVision Oscilloscopes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3000T X-Series (one channel only)</td>
<td>None</td>
<td>InfiniiVision 7.50 or higher</td>
</tr>
<tr>
<td>4000 X-Series</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6000 X-Series</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Is your oscilloscope software up-to-date?

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

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

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

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

### Micro Circuit Hook Test Clips
(2 pieces)

To probe miniature IC and components. Attach these clips to the two sockets of the socketed Y-lead tip.

### Ground Lead
(1 piece)

90° socketed lead to connect the DUT ground to the probe ground. This is needed if the DUT is not grounded to the oscilloscope via the AC mains ground (see page 32).
Orderable Accessories

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

Replacement Accessory Kit (DP0021A-001)

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

<table>
<thead>
<tr>
<th>Accessory Included in the Kit</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe Tip Saver</td>
<td>2 pieces</td>
</tr>
<tr>
<td>Adjustable Probing Browser</td>
<td>2 pieces</td>
</tr>
<tr>
<td>Straight Pin</td>
<td>set of 10 pins</td>
</tr>
<tr>
<td>Solder-in Y-lead Tip</td>
<td>2 pieces</td>
</tr>
<tr>
<td>Socketed Y-lead Tip</td>
<td>2 pieces</td>
</tr>
<tr>
<td>Micro Circuit Hook Test Clips</td>
<td>2 pieces</td>
</tr>
<tr>
<td>Ground Lead</td>
<td>1 piece</td>
</tr>
</tbody>
</table>

Ordering Individual Accessories

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

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Part Number</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socketed Y-lead Tip</td>
<td>DP0021A-002</td>
<td>2 pieces</td>
</tr>
<tr>
<td>Solder-in Y-lead Tip</td>
<td>DP0021A-003</td>
<td>2 pieces</td>
</tr>
<tr>
<td>Micro Circuit Hook Test Clips</td>
<td>DP0021A-004</td>
<td>2 pieces</td>
</tr>
<tr>
<td>Adjustable Probing Browser</td>
<td>DP0021A-005</td>
<td>2 pieces</td>
</tr>
<tr>
<td>Straight Pin</td>
<td>DP0021A-006</td>
<td>set of 10 pins</td>
</tr>
</tbody>
</table>
Optional Accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Part Number</th>
<th>Quantity</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMT Test Clips</td>
<td>DP0021A-007</td>
<td>2 pieces</td>
<td>To conveniently probe surface mount capacitors</td>
</tr>
<tr>
<td>Micro-grabber Pincer Test Clips</td>
<td>DP0021A-008</td>
<td>4 pieces</td>
<td>To probe miniature IC and components. Attach these clips to the two sockets of the socketed Y-lead tip.</td>
</tr>
<tr>
<td>Automotive Accessory Kit</td>
<td>DP0021A-009</td>
<td>1 piece</td>
<td>To probe automotive differential serial buses such as CAN, CAN FD, and FlexRay,</td>
</tr>
</tbody>
</table>

Deskew and Performance Verification Fixture Kit (DP0020A)

<table>
<thead>
<tr>
<th>DP0020A Kit</th>
<th>Accessory Included in the Kit</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deskew Fixture</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>SMA (male) to SMA (male) Adapter</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>SMA (male) to BNC (female) Adapter</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>BNC (male) to SMA (male) Adapter</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>50 ? SMA Terminator</td>
<td>1</td>
</tr>
</tbody>
</table>

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

- See “Performing Attenu / Offset and Skew Calibration on Infiniium GUI” on page 26.
- See “Performance Verification” on page 47.

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

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Electrical Specifications and Characteristics

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

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

<table>
<thead>
<tr>
<th>Warranted Specification</th>
<th>DP0010A</th>
<th>DP0011A</th>
<th>DP0012A</th>
<th>DP0013A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe Bandwidth (-3 dB)</td>
<td>250 MHz</td>
<td>500 MHz</td>
<td>1.0 GHz</td>
<td>1.7 GHz</td>
</tr>
<tr>
<td>Input Resistance</td>
<td>$R_{\text{diff}} \ 1.7 \ \text{M}\Omega$</td>
<td>$R_{\text{diff}} \ 850 \ \text{k}\Omega$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>DP0010A</th>
<th>DP0011A</th>
<th>DP0012A</th>
<th>DP0013A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe Rise Time (10%-90%)</td>
<td>1.35 ns</td>
<td>715 ps</td>
<td>415 ps</td>
<td>300 ps</td>
</tr>
<tr>
<td>Auto Attenuation Ranges</td>
<td>~ 17:1 (at volts/division &lt;= 2 V/div)</td>
<td>~ 85:1 (at volts/division &gt;2 V/div)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absolute Max. Input Voltage for Probe and Accessories (each side to ground)</td>
<td>30 V$<em>{\text{RMS}}$, ±42 V$</em>{\text{PEAK}}$, or ±60 V$_{\text{DC}}$ (mains isolated) $^a$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Differential Measurement Range (DC + AC peak)</td>
<td>±8.4 Volts peak (on 17:1 auto attenuation ranges)</td>
<td>±42 Volts peak (on 85:1 auto attenuation ranges)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>0.9 pF (between inputs)</td>
<td></td>
<td>1.5 pF (each side to ground)</td>
<td></td>
</tr>
<tr>
<td>Offset Adjustment Range</td>
<td>±60 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offset accuracy</td>
<td>1% (17:1 attenuation ranges)</td>
<td></td>
<td>1.5% (5:1 attenuation ranges)</td>
<td></td>
</tr>
<tr>
<td>Typical CMRR (dB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 Hz</td>
<td>-70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 kHz</td>
<td>-70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 kHz</td>
<td>-65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 MHz</td>
<td>-30 (17:1 attenuation)</td>
<td>-25 (85:1 attenuation)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Characteristics and Specifications

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>DP0010A</th>
<th>DP0011A</th>
<th>DP0012A</th>
<th>DP0013A</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 MHz</td>
<td>-30 (17:1 attenuation)</td>
<td>-25 (85:1 attenuation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise Referenced to Input (probe only)</td>
<td>14 mV\textsubscript{RMS} (17:1 attenuation)</td>
<td>38 mV\textsubscript{RMS} (85:1 attenuation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overvoltage and Measurement Category per IEC -61010-031</td>
<td>Non-CAT (mains isolated) (a)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Coupling of the oscilloscope</td>
<td>50 W AutoProbe Interface</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

**NOTE**

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

<table>
<thead>
<tr>
<th>Environmental Condition</th>
<th>Operating</th>
<th>Non-Operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>+5 °C to +40 °C</td>
<td>-40 °C to +70 °C</td>
</tr>
<tr>
<td>Humidity</td>
<td>Up to 80% RH at +40 °C</td>
<td>Up to 90% RH at +65 °C</td>
</tr>
<tr>
<td>Altitude</td>
<td>3,100 m (10,171 ft)</td>
<td>4,600 m (15,092 ft)</td>
</tr>
<tr>
<td>Pollution Degree</td>
<td>2&lt;sup&gt;a&lt;/sup&gt; (rated for indoor use only)</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.
Mechanical Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe Cable Length</td>
<td>1.3 m</td>
</tr>
<tr>
<td>Approximate Weight</td>
<td>0.48 kg (1.06 lbs.)</td>
</tr>
<tr>
<td>(Including probe with all its standard accessories and the case)</td>
<td></td>
</tr>
</tbody>
</table>

Accessories Dimensions

All dimensions are in millimeters.

Figure 2  Straight Pin Dimensions

Figure 3  Adjustable Probing Browser Dimensions
**Figure 4**  Probe Tip Saver Dimensions

**Figure 5**  Solder-in Y-lead Tip Dimensions

**Figure 6**  Socketed Y-lead Tip Dimensions
**Figure 7**  Ground Lead Dimensions

**Figure 8**  Micro Circuit Hook Test Clip Dimensions
Characteristics and Specifications
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CAUTION

These probes are ESD sensitive devices, particularly at the probe tip. Follow standard ESD precautions when handling these.
Connecting the Probe to an Oscilloscope

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

Using Channel Identification Rings

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

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

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

NOTE

These probes are designed for ground-referenced measurements. Connect the probe to the oscilloscope input before performing any measurements.
Configuring Probe Settings on the Oscilloscope Software GUI

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

![Probe Configuration GUI](image)

**Figure 9**  DP0011A probe auto-detected on the Infinium GUI

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

- Configure offset behavior
- Calibrate your probe

Configuring Offset Behavior

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

The two offset behavior options are described and compared in the following table.
Setting up and Using DP0010A/12A/13A Probes

On Infinium GUI

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

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

<table>
<thead>
<tr>
<th>Normal Offset</th>
<th>Probe Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offset is applied at the oscilloscope channel. The vertical offset control on the oscilloscope’s front-panel controls the channel’s offset.</td>
<td>Offset is applied at the probe. The vertical offset control on the oscilloscope’s front-panel controls the probe offset.</td>
</tr>
<tr>
<td>Used when measuring differential signals</td>
<td>Used when measuring single-ended signals</td>
</tr>
<tr>
<td>Probe offset is not used and set to zero.</td>
<td>Channel offset is not used and set to zero.</td>
</tr>
</tbody>
</table>
On InfiniiVision GUI

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

Calibrating your Probe

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

Calibration Overview

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

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

Sequence of Calibration

1. Atten/Offset calibration
2. Skew calibration
Before You Start Calibration

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

Performing Atten / Offset and Skew Calibration on Infiniium GUI

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

Required Accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP0020A PV/Deskew Fixture Kit</td>
<td>To calibrate and verify the performance of the probe</td>
</tr>
<tr>
<td>N2787A Probe Positioner (Recommended)</td>
<td>To hold the probe in place during the procedure</td>
</tr>
</tbody>
</table>

To perform calibration

1. Connect the DP001xA probe to any available oscilloscope channel.
2. On the oscilloscope menu, click Setup > Probe Calibration to access the Probe Calibration dialog box.
3. Click the Start Atten/Offset Cal... button to initiate the Atten/offset calibration.
The **DC Offset/Gain Cal** dialog box is displayed with the calibration setup instructions. Verify that your probing setup is as per these instructions. These instructions require the usage of the DP0020A deskew fixture which is described in the next step.

4 To use the DP0020A deskew fixture:

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

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

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

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

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

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

These are shown in the figure below.
Use the N2787A 3D Probe Positioner to hold the probe in place and to maintain a steady contact of probe tip with the deskew fixture.

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

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

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

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

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

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

DUT Connectivity Options

**Option 1: Using Probe Tip Directly**

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

Without Probe Tip Saver

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

With Probe Tip Saver

**Option 2: Using Straight Pins**

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

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

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

These straight pins can be used to probe components with 0.100 inch pitch.
Option 3: Using Adjustable Probing Browser

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

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

Option 4: Using Solder-in Y-lead Tip

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

1. Solder the leads of this accessory to the test points.
2. Insert the soldered Y-lead tip into the probe tip.

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

Option 5: Using Socketed Y-lead Tip

This accessory allows you to extend the reach of the probe. You can use it to:
- either connect directly to 0.8 mm round pins or 0.64 mm square pins on the test board.
- or connect to the standard/optional test clip accessories available for DP001xA probes.

See page 17 for Socketed Y-lead Tip dimensions.
Option 6 - Using Micro Circuit Hook Test Clips

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

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

See page 17 for Micro Circuit Hook Test Clips dimensions.

Option 7 - Using Micro-grabber Pincer Test Clips

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

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

Option 8 - Using SMT Test Clips

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

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

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

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

![Connecting DUT Ground to Probe Ground](image)

**Figure 10** Connecting DUT Ground to Probe Ground

Probing Setup for Single-Ended Measurements

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

To probe single-ended signals:

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

Safety Checks and Warnings  34
Instrument Markings and Symbols  36
Cleaning the Probe  38
Safety Checks and Warnings

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

**WARNING**

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

**WARNING**

Observe Probe Voltage Ratings.

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

**WARNING**

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

**WARNING**

Do not install substitute parts or perform any unauthorized modification to the probe / accessory. Do not attempt internal service or adjustment. Service should be carried out by a Keysight Technologies authorized service personnel. For any service needs, contact Keysight Technologies. See page 62 to know more.

**WARNING**

Must be Grounded

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

**WARNING**

Indoor Use Only.

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

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

**CAUTION**

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

**CAUTION**

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

**CAUTION**

Handle Probe Tips and Accessories Carefully.

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>This symbol indicates the Environmental Protection Use Period (EPUP) for the product’s toxic substances for the China RoHS requirements.</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>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 <a href="http://keysight.com/go/takeback">keysight.com/go/takeback</a> to understand your Trade in options with Keysight in addition to product takeback instructions.</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>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.</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>MAINS ISOLATED indicates IEC Measurement Category MAINS ISOLATED is for measurements performed on circuits not directly connected to mains.</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>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.</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>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.</td>
</tr>
</tbody>
</table>
This mark denotes compliance with the essential requirements of the following applicable UK regulations:
- Electromagnetic Compatibility Regulations 2016 No. 1091 (as amended)
- Electrical Equipment (Safety) Regulations 2016 No. 1101 (as amended)
- The Restriction of the Use of Certain Hazardous Substances in electrical & Electronic Equipment Regulations 2012 No. 3032 (as amended)
Cleaning the Probe

If the probe requires cleaning:

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

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- Voltage Derating Curve  41
- Common Mode Rejection Ratio over Frequency  42
- Frequency Response  43
  - Low Attenuation Frequency Response (without probing accessories)  43
  - High Attenuation Frequency Response (without probing accessories)  44
  - Frequency Response (with Adjustable Probing Browser Accessory)  45
Measured Versus Modeled Input Impedance

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

Figure 12  Non destructive voltage derating with frequency for DP001xA probes
Common Mode Rejection Ratio over Frequency

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

Low Attenuation Frequency Response (without probing accessories)

![Graph showing frequency response of DP001xA probes](image)

**Figure 14** Vout/Vin frequency response of DP001xA probes (without probing accessories) on low attenuation ranges.
Figure 15  Vout/Vin frequency response of DP001xA probes (without probing accessories) on high attenuation ranges
Frequency Response (with Adjustable Probing Browser Accessory)

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

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To Verify Bandwidth  49
   Required Test Equipment  49
   Procedure  49
To Verify Input Resistance  56
   Required Test Equipment  56
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This chapter describes how to verify the bandwidth and input resistance of your DP0010A/11A/12A/13A probe.
Before you Start

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

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

Recommended Test Interval

The recommended test interval is 1 year.
To Verify Bandwidth

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

<table>
<thead>
<tr>
<th>Probe</th>
<th>Warranted Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP0010A/11A/12A/13A</td>
<td>Bandwidth</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Required Test Equipment

<table>
<thead>
<tr>
<th>Description</th>
<th>Critical Specification(s)</th>
<th>Recommended Models / Part Numbers and Adapters</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oscilloscope</td>
<td>Infinium oscilloscope with</td>
<td>MSOS804A</td>
<td>To display probe output</td>
</tr>
<tr>
<td></td>
<td>AutoProbe I or Infinium</td>
<td>Substitutes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>oscilloscope with an adapter to</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AutoProbe I</td>
<td>MSO9404A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Minimum BW 4 GHz</td>
<td>DSOS804A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Minimum sample rate 16 G</td>
<td>DS091304A</td>
<td></td>
</tr>
<tr>
<td>Samples/sec</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMA or 2.92 mm</td>
<td>N2823A coaxial phase-matched cable</td>
<td>To connect pulse generator to PV fixture</td>
<td></td>
</tr>
<tr>
<td>male to male cable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deskew and</td>
<td>DP0020A Kit</td>
<td>To connect the probe to pulse generator and oscilloscope</td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification Fixture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse Generator</td>
<td>2 V step with 10% to 90%</td>
<td>81134A</td>
<td>To provide frequency content to determine BW of probe</td>
</tr>
<tr>
<td></td>
<td>transition time of less than 90 ps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Torque Wrench</td>
<td>5/16 in opening</td>
<td>8710-1765</td>
<td>To tighten SMA connectors</td>
</tr>
<tr>
<td>Open End Wrench</td>
<td>9/32 in opening</td>
<td></td>
<td>To hold the connector on PV fixture while tightening adapters to it</td>
</tr>
</tbody>
</table>

Procedure

1. Make connections as described in the following steps.
   a. Connect the DP0020A PV fixture to any oscilloscope channel using the SMA to BNC adapter included in the DP0020A PV kit. The channel to which the PV fixture is connected is referred to as the PV channel in this procedure.
   b. Connect the other end of the DP0020A PV fixture to a SMA cable using the other SMA to BNC adapter included in the DP0020A PV kit.
   c. Connect the other end of the SMA cable to Channel 1 output of the pulse
generator.

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

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

2 Configure the oscilloscope as per the following settings:

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

b) Select Setup > Acquisition to access the Acquisition dialog box. In this dialog box:
   - select the Enabled checkbox for Averaging with # of Averages as 16.
   - set the Sampling Rate to 16 G Samples/Sec.

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

d) Set the PV channel to 50 Ω input.

e) Click Math > Functions....

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

### On tab f1

1. From the Function 1 listbox, select Math and then Differentiate.
2. Deselect the Low Pass and Align Phase checkbox.
3. From the Source drop-down listbox, set the source to your PV Channel.
   In this example, the PV channel is Channel 3.
4. Do not select the On checkbox for f1.
On tab f2

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

On tab f3

1. From the Function 3 listbox, select Math and then Differentiate.
2. Deselect the Low Pass and Align Phase checkbox.
3. From the Source drop-down listbox, set the source to your probe Channel.
   In this example, the probe channel is Channel 2.
4. Do not select the On checkbox for f1.
Close the Function dialog box.
3 Configure the Pulse Generator as shown in the following screens and then press the button next to Out.

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

5 Set up Display as follows.
   a Move both math traces to the same grid by dragging the bottom trace into the top grid.
   b Press the 'X' in the middle of the bottom Frequency Domain grid that is now empty.
   c Align the waveforms' scales and reference position back to 3 dBm/ and 185 dBm.

6 Click Control > Clear Display to clear the oscilloscope display.
7 Use Marker to evaluate the results.
   a To add a marker, choose Measure/Mark > Add Markers...
   b Choose Manual (X only) option from the Mode listbox to add a pair of horizontal markers that can be moved freely.
   c Select f4:FFTM(f3) from the Source 1 listbox and f2:FFTM(f1) from the Source 2 listbox. These are the waveforms that you want to associate with the markers.
   d Press OK to close the Add Marker dialog box.
   e Move Marker M1 until f4 crosses f2.
   f Record the Horizontal Marker value. This represents the -3dB BW of the probe in the low attenuation state. In the example below, it is 1.77 GHz.

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

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

10 Use Marker to evaluate the results.
   a The marker (M1 in this case) should still be on screen. Slide it to the new crossing point of f4 and f2.
   b Record the Horizontal Marker value. This represents the -3 dB BW of the probe in the low attenuation state. In the example below, it is 1.78 GHz.
11 Confirm that the measured bandwidth is above the rated bandwidth for your probe model. Refer to the “Performance Test Record” on page 59 for test limits.
To Verify Input Resistance

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

<table>
<thead>
<tr>
<th>Probe</th>
<th>Warranted Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP0010A/11A/12A/13A</td>
<td>Input Resistance 1.7 MΩ Differential</td>
</tr>
</tbody>
</table>

Required Test Equipment

<table>
<thead>
<tr>
<th>Description</th>
<th>Critical Specification(s)</th>
<th>Recommended Models / Part Numbers and Adapters</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oscilloscope</td>
<td>Infiniium oscilloscope with AutoProbe I or Infiniium oscilloscope with an adapter to AutoProbe I</td>
<td>MSOS804A</td>
<td>To display probe output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Substitutes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MSO9404A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• DSOS804A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• DSO91304A</td>
<td></td>
</tr>
<tr>
<td>DMM</td>
<td>3458A</td>
<td></td>
<td>To measure Input Resistance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Substitutes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 34470A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 34401A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 34450A</td>
<td></td>
</tr>
<tr>
<td>Deskew and Performance Verification Fixture</td>
<td>DP0020A Kit</td>
<td></td>
<td>To connect the probe to DMM</td>
</tr>
<tr>
<td>BNC to Banana Adapter</td>
<td>Pomona 1270 or equivalent</td>
<td></td>
<td>To connect PV fixture to DMM</td>
</tr>
</tbody>
</table>
Procedure

1. Make connections as described in the following steps.
   a. Connect the DP0020A PV fixture to SMA to BNC adapter. The SMA to BNC adapter is included in the DP0020A PV kit.
   b. Connect the SMA to BNC adapter to the BNC to Banana adapter.
   c. Ensure that the other SMA port of the DP0020A PV fixture is open.
   d. Connect banana pins of the BNC to Banana adapter to VΩ input terminal and LO terminal on the front panel of DMM. (*The GND pin of the BNC to Banana adapter connects to the LO terminal.*)
   e. Press the Ω 2W 4W button on the front panel of DMM.
   f. Connect the DP001xA probe to any available channel of the oscilloscope.
   g. Connect the DP001xA probe’s input directly to the header pins on the PV fixture.
      - Connect the “+” lead of the probe tip to the header pin located on the center conductor (signal trace) of the deskew fixture.
      - Connect the “-” lead of the probe tip to the header pin located on the ground plane of the deskew fixture.
2. Set the vertical scale of the channel to which the probe is connected to 5 V/div.
3. Observe the Input Resistance reading and record the result.
4. Confirm that the recorded reading is within the rated tolerance of your probe model. Refer to the “Performance Test Record” on page 59 for test limits.
## Table 1  Performance Test Record

<table>
<thead>
<tr>
<th>Model #:</th>
<th>Date:</th>
<th>Tested by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial #:</td>
<td>Date:</td>
<td>Tested by:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test</th>
<th>Test Limits</th>
<th>Result</th>
<th>Pass/Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth (–3 dB)</td>
<td>DP0010A - 250 MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DP0011A - 500 MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DP0012A - 1 GHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DP0013A - 1.7 GHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Resistance</td>
<td>1.68 MΩ to 1.72 MΩ (Differential)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Performance Verification
7 Returning the Probe for Repair/Service

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

Only Keysight approved accessories should be used.

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

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

2. Write the following information on a tag and attach it to the malfunctioning equipment.
   - Name and address of owner
   - Product model number (for example, DP0010A)
   - Product Serial Number (for example, MYXXXXXXXX)
   - Description of failure or service required

**NOTE**
Include accessories shipped with the probe.

3. Protect the probe by wrapping in plastic or heavy paper. Use original packaging or comparable.

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

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

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

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

For technical assistance, contact your local Keysight Call Center.

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