

User's Guide

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Agilent 10400B Series Miniature Passive Oscilloscope Probes

Contents



Inspect the probe	2
Probe parts supplied	4
Probe characteristics	8
Bandwidth considerations	10
Safety considerations	11
Cleaning the probe	11
To connect oscilloscope probes	12
To operate the probe	13
Compensation adjustments	16

Inspect the probe

Inspect the shipping container for damage.

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

Check the accessories.

Any accessories that were supplied with the probe are listed in "Available accessories" in this manual.

- If the contents are incomplete or damaged, notify your Agilent Technologies Sales Office.

Inspect the instrument.

- If there is mechanical damage or defect, or if the probe does not operate properly or pass performance tests, notify your Agilent Technologies Sales Office.
- If the shipping container is damaged, or the cushioning materials show signs of stress, notify the carrier as well as your Agilent Technologies Sales Office. Keep the shipping materials for the carrier's inspection. The Agilent Technologies office will arrange for repair or replacement at Agilent Technologies' option without waiting for claim settlement.

Agilent 10400B Series Miniature Passive Oscilloscope Probes

The Agilent 10400B Series Miniature Passive Oscilloscope Probes provide improved usability and performance of the Agilent 10400A Series Probes, and they offer a broader range of accessories. The Agilent 10400B Series Probes replace the Agilent 10400A Series, but maintain compatibility with them. To select the appropriate replacement probe, see the following table.

Agilent 10400A Family	Agilent 10400B Family
10430A, 10431A, 10441A	10441B
10432A, 10433A, 10435A	10433B
10434A, 10436A	10436B
10437A	10437B
10438A, 10439A	10439B
10440A	10440B
10442A	10442B
10444A	10073B

The Agilent Technologies B Series of miniature probes significantly reduces the problem of probing densely populated integrated circuit components and characteristically small conductors on printed circuit boards. These small, light-weight probes allow measurements that were previously very difficult, while reducing the hazard of shorting. The probe body fits in the hand as comfortably as a pencil.

Each probe includes a browser tip that will not slip off of the test point being probed and short to some adjacent point. The browser uses a crown point that “digs in” to solder, and will not slip.

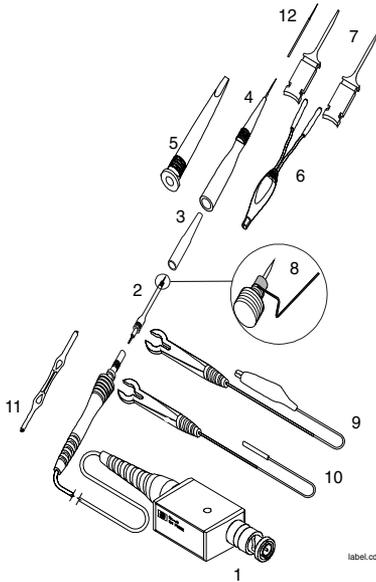
These probes include a variety of ground leads for attaching to many different ground points. Probe packaging provides convenient storage and ordering information for replacement parts.

Other key features

- Narrow, sharp, replaceable probe tip.
- Browser attachment with ultra-sharp crown point. Use this to probe the circuit in debug mode. The crown point will not easily slip off of the lead you are probing. The pogo pin allows hand movement without losing contact.
- An assortment of long and short ground leads for connecting to a wide variety of points.
- Handle unscrews and pulls back to reduce the size of the probe.
- General-purpose retractable hook tip made of strong, durable music wire.
- Flexible, light-weight cable with kevlar strengthener.
- Multi-position barrel insulator exposes as much or as little probe ground as desired at the probe tip.
- Probe comes in a convenient storage box, with labeled information on how to reorder parts.
- Automatic Probe Identification Pin (Agilent 10441B only).

Probe parts supplied

Parts supplied with the Agilent 10400B Series Probes are shown below.



Parts of the Agilent 10400B Series Probes

Agilent 10400B Series Probe Parts

Item	Description	Quantity
1	Probe	1
2	Probe tip	2
3	Barrel insulator	2
4	Browser	1
5	General-purpose retractable hook tip	1
6	Dual-lead adapter	1
7	SMD clip	2
8	Spring ground	4
9	Alligator ground lead	1
10	Socketed ground lead	1
11	Screwdriver	1
12	Browser pogo pin (spare)	1

You can order additional quantities of these parts. See the ordering information in this manual.

To order replaceable parts

To order a replaceable part, in the United States call our toll-free hotline at 1-877-447-7278, or call your local Agilent Technologies Sales Office.

The following table shows replacement parts that you can order directly from Agilent Technologies.

Replacement Parts for Agilent 10400B Series Probes

Item	Replacement Part	Agilent Part Number
1	10400B Series Probe (For replacement, order the entire probe assembly.)	Models: 10433B, 10436B, 10437B, 10439B, 10440B, 10441B, or 10442B.
2	10433B probe tip (quantity 5) — Blue	5063-2167
2	10436B probe tip (quantity 5) — Green	5063-2168
2	10437B probe tip (quantity 5) — Black	5063-2138
2	10439B probe tip (quantity 5) — Black	5063-2138
2	10440B probe tip (quantity 5) — Yellow	5063-2171
2	10441B probe tip (quantity 5) — Violet	5063-2172
2	10442B probe tip (quantity 5) — Grey	5063-2139
3	Barrel insulator (quantity 4)	See * below
4	Browser (quantity 1)	5063-2115
5	General-purpose retractable hook tip (quantity 2)	5063-2135
6	Dual-lead adapter (quantity 1)	5063-2147; See ** below
7	SMD clip (quantity 5)	5063-2149
8	Spring ground (quantity 4)	See * below
9	Alligator ground lead (quantity 2)	5063-2140
10	Socketed ground lead (quantity 1)	5063-2120
11	Screwdriver	See * below
12	Browser pogo pin (quantity 4)	See * below
	Accessory kit *	01160-68701

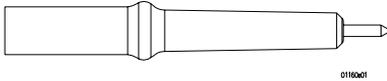
* Accessory kit includes 4 spring grounds, 4 browser pogo pins, 4 barrel insulators, and 1 screwdriver.

** Provides interface with the Agilent Wedges.

Probe parts supplied

Available accessories

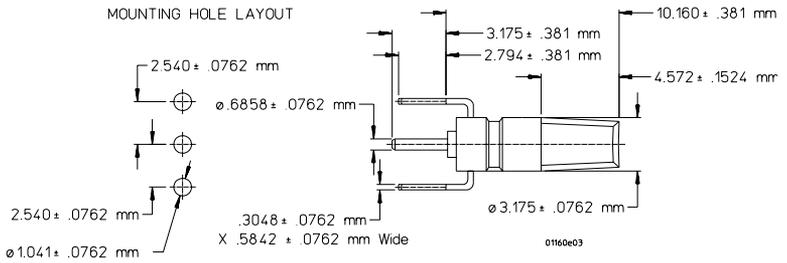
- Agilent 10467-68701 SMD microclips for connection to SMT parts with lead spacings of 0.5 mm (0.020 inch) to 0.8 mm (0.032 inch).
- Agilent 5063-2143 probe tip-to-BNC adapter.
- Agilent 10100C BNC(m)-to-BNC(f) 50Ω feedthrough terminator.
- Agilent N2844A flexible tip jack adapter



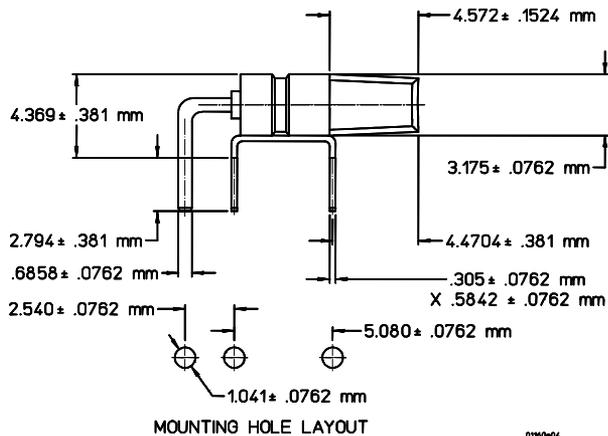
- Agilent E9639A 5 mm socket adapter.



- Agilent N2767A (Qty 5) or Agilent N2768A (Qty 25) vertical mini-probe socket.



- Agilent N2765A (Qty 5) or Agilent N2766A (Qty 25) horizontal mini-probe socket.



Probe characteristics

Agilent 10400B Series Probes Operating Characteristics

Approximate Lengths of Probe

Approximate probe length = 1 meter
 Approximate probe length = 1.5 meters
 Approximate probe length = 2 meters

Propagation Delay

4.5 ns
 6.7 ns
 9 ns
 Meets IEC1010-2-31

Safety

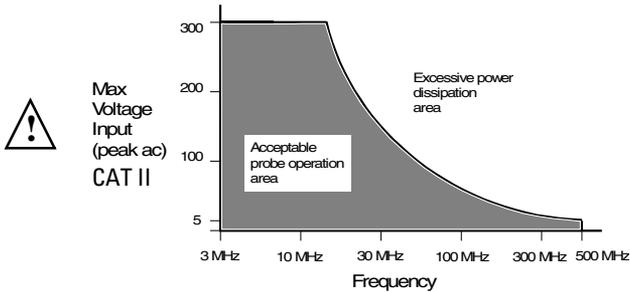
Pull strength (BNC to probe tip)

≤12 lb static pull

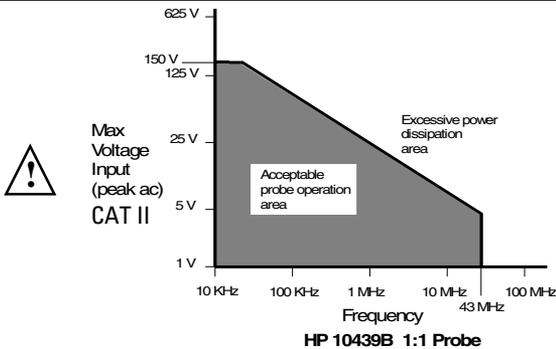
Pollution degree 2

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

Voltage versus Frequency Rating Curve (except Agilent 10439B)



Voltage versus Frequency Rating Curve (Agilent 10439B)



The above curve only applies to 10 M Ω , 10:1 probes with the oscilloscope's input impedance set to 1 M Ω .

The Agilent 10437B 50 Ω probe is rated at 5 V_{RMS} maximum (CAT I).

The Agilent 10442B 500 Ω probe is rated at 10 V_{RMS} (dc + ac_{RMS}) maximum (CAT I).

Environmental Characteristics

Temperature (operating)	0 °C to +55 °C
Humidity (operating)	Up to 95% relative humidity at 40 °C
Altitude (operating)	Up to 4,600 meters (15,000 ft)
Shock	50 g (400 g tip only)
Weight	2.6 oz.

Indoor Use



This symbol indicates that the Agilent 10400B Series Probes are in compliance with European product regulations, including the EMC Directive and the Low Voltage Directive.



This symbol indicates that the Agilent 10400B Series Probes are in compliance with Australian product regulations.

CAT I and CAT II Definitions

Installation category (overvoltage category) I: Signal level, special equipment or parts of equipment, telecommunication, electronic etc., with smaller transient overvoltages than installation category (overvoltage category) II.

Installation category (overvoltage category) II: Local level, appliances, portable equipment etc., with smaller transient overvoltages than installation category (overvoltage category) III.

Bandwidth considerations

Bandwidth considerations

The dominant probe limitation to system bandwidth is its input capacitance, assuming that the high-frequency compensation adjustments have been made. The displayed bandwidth of any measurement system using an oscilloscope and probe is determined by four factors: probe input capacitance, source impedance, source bandwidth, and oscilloscope bandwidth.

Agilent 10400B Series Probes Selection Guide

Model Number	Type of Probe	Bandwidth Scope/Probe System	Division Ratio	Input R	Input C	Scope Input R	Comp Range	Length (in meters)
10433B	High-impedance, passive	300 MHz	10:1	10 M Ω	10 pF	1 M Ω	10-16 pF	2
10436B	High-impedance, passive	300 MHz	10:1	10 M Ω	11 pF	1 M Ω	18-22 pF	2
10437B	50 Ω Resistive Divider	1 GHz	1:1	50 Ω	n/a	50 Ω	n/a	2
10439B	High-impedance, passive	n/a	1:1	1 M Ω	n/a	1 M Ω	n/a	1.5
10440B	High impedance passive	300 MHz	100:1	10 M Ω	2.5 pF	1 M Ω	6-14 pF	2
10441B	High-impedance, passive	500 MHz	10:1	1 M Ω	9 pF	1 M Ω	6-9 pF	1.8
10442B	500- Ω resistive divider	1 GHz	10:1	500 Ω	n/a	50 Ω	n/a	1.5

The Agilent 10437B and Agilent 10442B probes are compatible with any oscilloscope that has a 50 Ω input.

Safety considerations

WARNING SHOCK HAZARD!

These probes are designed for use with oscilloscopes that have a common terminal at *GROUND POTENTIAL* (in accordance with OSHA requirements and the National Electric Code). Exposed metallic surfaces of the probe and the oscilloscope *MUST BE GROUNDED*. Failure to ground the common terminal during certain applications, such as those requiring the oscilloscope to be powered from an external battery, might expose the operator to an electrical shock hazard that could be lethal (depending on voltage and current conditions.)

Cleaning the probe

If the Agilent 10400B Series Probe requires cleaning, disconnect it from all power sources and clean it with a soft cloth dampened with a mild soap and water solution. Make sure the probe is completely dry before reconnecting it to a power source.

To connect oscilloscope probes

To connect oscilloscope probes

- 1 Attach the probe connector to the desired oscilloscope channel.
- 2 Connect the probe to the circuit using any of the probing aids.

To operate the probe

When operating the Agilent 10400B Series Probes, these additional parts can help:

- **SMD Clip**
The SMD clip lets you connect the Agilent 10400B Series Probe to SMT parts with dual lead adapter. See “Available accessories” described earlier for more information.
- **BNC-to-Probe Tip Adapter**
This tip adapter lets you attach the probe to a BNC cable.
- **Spring Ground**
The spring ground attaches to the probe to make ground contact with the circuit board, while letting you angle and maneuver the probe around an area.

CAUTION

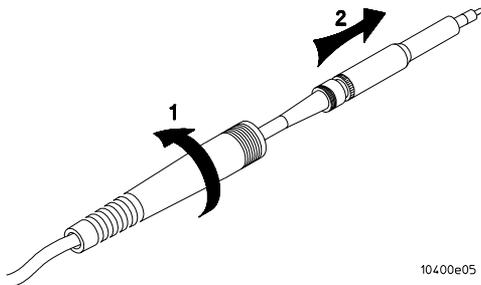
Do not solder probe tip to any surface. Solder will damage the probe tip.

CAUTION

If you are using the probe without any accessories, the probe could cause a short if you drop it within the circuit.

1 Attach the probe to the circuit.

You may use the probe tip pin without any accessories for probing in places that are difficult to reach.



10400e05

You may unscrew the cable strain relief from the probe and slide it back on the cable when using two or more probes in close proximity. When using the probe without the browser or retractable hook tip, you should use the barrel insulator (a supplied accessory) to cover the tip ground shield to prevent the hazard of shorting when you are probing the circuit. You may unscrew the barrel insulator and remove it to accommodate tight probing situations.

To operate the probe

The barrel insulator can be screwed to multiple positions:

- With the barrel insulator screwed all the way on, you may add a spring ground (a supplied accessory) to the probe tip to provide ground contact.

2 With the barrel insulator screwed most of the way out, the barrel insulator covers the ground shield by the probe tip. Ground the probe tip and barrel insulator.

Ground the probe by attaching either the alligator ground, socket ground, or spring ground. Any of these ground accessories provides reference for a ground point.

To avoid possible shorting of other circuitry, use the barrel insulator in conjunction with any of the grounding accessories. For optimum performance, use the shortest ground lead.

3 The browser.

The browser tip has a crown point that digs into solder and will not slip. The spring-loaded pogo pin allows hand movement without losing contact.

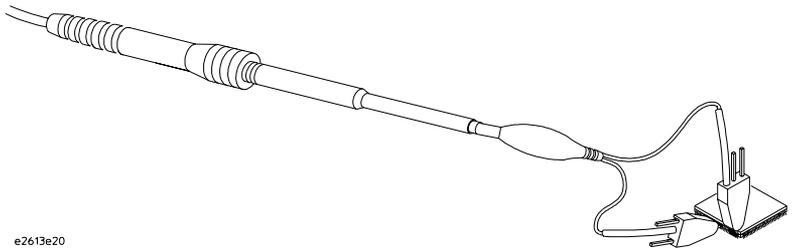
4 The retractable hook tip.

Attach the hook tip to a probing point by pressing the retractable hook tip body towards the probe body. Place the hook tip around the probing point, then release the retractable hook tip body.

The retractable hook tip is used for most typical in-circuit probing and ICs.

The Agilent Wedge Probe Adapter

The Agilent Wedge Probe Adapter makes contact with legs of the IC under test when the Agilent Wedge Probe Adapter conductors are inserted into the space between the legs of the IC. If you are using the Agilent Wedge Adapter, refer to the supplied Agilent Wedge Adapter User's Guide.



e2613e20

Connecting the Probe to an Agilent Wedge Adapter

Agilent Wedge Adapters

Agilent Model Number	Description
E2613A	One 0.5 mm x 3-signal wedge
E2613B	Two 0.5 mm x 3-signal wedge
E2614A	One 0.5 mm x 8-signal wedge
E2615A	One 0.65 mm x 3-signal wedge
E2615B	Two 0.65 mm x 3-signal wedge
E2616A	One 0.65 mm x 8-signal wedge
E2643A*	One 0.5 mm x 16-signal wedge
E2644A*	One 0.65 mm x 16-signal wedge

* 16-signal Agilent Wedge Probe Adapters include 3 removable jumpers
(Agilent part number 1258-0141 for quantity of 1 jumper)

Compensation adjustments

You can adjust the probes for both low-frequency compensation and high-frequency compensation. Low-frequency compensation is an operating adjustment. You should perform high-frequency compensation periodically according to maintenance schedules.

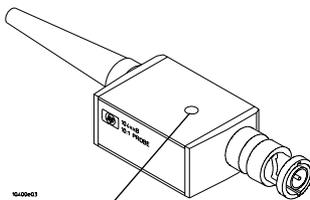
When to Adjust Probe Compensation

Low-frequency compensation is adjusted when the probe is first connected to the oscilloscope. Probe compensation will usually hold over all the attenuator ranges when used with a Agilent Technologies oscilloscope. If the input capacitance of the oscilloscope changes as ranges are switched, compensation must be adjusted each time a new range is selected.

Adjusting low-frequency compensation

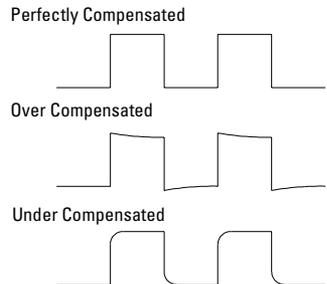
Before you can have a flat frequency response when using a compensated passive divider probe, you must compensate the probe's cable capacitance and scope input capacitance to optimize the step response for flatness. You should compensate your probe to match its characteristics to the oscilloscope. A poorly compensated probe can introduce measurement errors.

- 1 Connect the probe from the appropriate oscilloscope channel to the front-panel probe adjust signal terminal [] on the scope. You can attach the probe with the hole in the probe body facing up to allow adjustment.
- 2 Press Autoscale.
- 3 Using the wide end of the supplied screwdriver tool, set the low-frequency compensation adjustment on the probe for the flattest pulse possible as shown below.



Low-frequency compensation adjustment

Low-Frequency Adjustment and Waveforms



Adjusting high-frequency compensation

Do Low-Frequency Compensation First

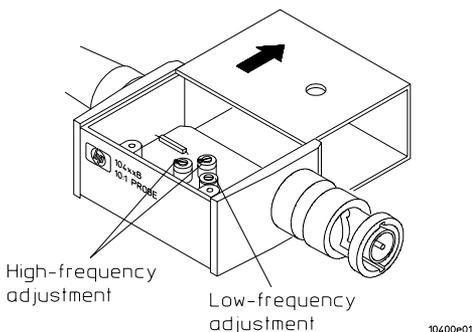
You must do the low-frequency compensation procedure described previously before doing this high-frequency compensation procedure.

To compensate for cable loss in your probe, you'll need the equipment listed below.

Equipment Required

Equipment	Specification	Agilent Part Number
50 Ω feedthrough	50 Ω BNC(m) and (f)	10100C
Adapter	BNC-to-probe tip	5063-2143

- 1 Remove the probe cover to provide access to the two high-frequency compensation adjustment resistors.



High-Frequency Adjustments

- 2 Connect a 50 Ω feedthrough to the oscilloscope BNC ac cal out.
- 3 Connect the BNC-to-probe tip adapter to the 50 Ω feedthrough.
- 4 Remove any probing aid and the barrel insulator from the probe tip.
- 5 Connect the probe tip to the BNC-to-probe tip adapter.
- 6 Connect the probe BNC to the appropriate oscilloscope channel.
- 7 Press Autoscale, then set the time base to 5 ns/div.
- 8 Set the sample mode to equivalent time, and the # of averages to 4.
- 9 Rotate the two high-frequency compensation resistors fully clockwise.
- 10 Adjust the two high-frequency compensation resistors alternately in small increments until the displayed waveform has the flattest top.

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Agilent Technologies for
use with an instrument will
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resulting from improper or
inadequate maintenance by
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maintenance.

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agreements and other
customer assistance
agreements are available for
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Agilent Technologies
Company certifies that this
product met its published
specifications at the time of
shipment from the factory.
Agilent Technologies
further certifies that its
calibration measurements
are traceable to the United
States National Institute of
Standards and Technology,
to the extent allowed by the
Institute's calibration
facility, and to the
calibration facilities of other
International Standards
Organization members.

Safety

This apparatus has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Measuring Apparatus, and has been supplied in a safe condition. To ensure safe operation and to keep the product safe, the information, cautions, and warnings in this operating manual must be heeded. In addition, note the external markings on the instrument that are described under "Safety Symbols."

Safety Symbols



Instruction manual symbol: the product is marked with this symbol when it is necessary for you to refer to the instruction manual in order to protect against damage to the product.



Hazardous voltage symbol.



Earth terminal symbol: Used to indicate a circuit common connected to grounded chassis.

WARNING

The Warning sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a Warning sign until the indicated conditions are fully understood and met.

CAUTION

The Caution sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a Caution symbol until the indicated conditions are fully understood or met.

About this edition

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New editions are complete revisions of the manual. Many product updates do not require manual changes; and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correspondence between product updates and manual updates.