User and Service Guide

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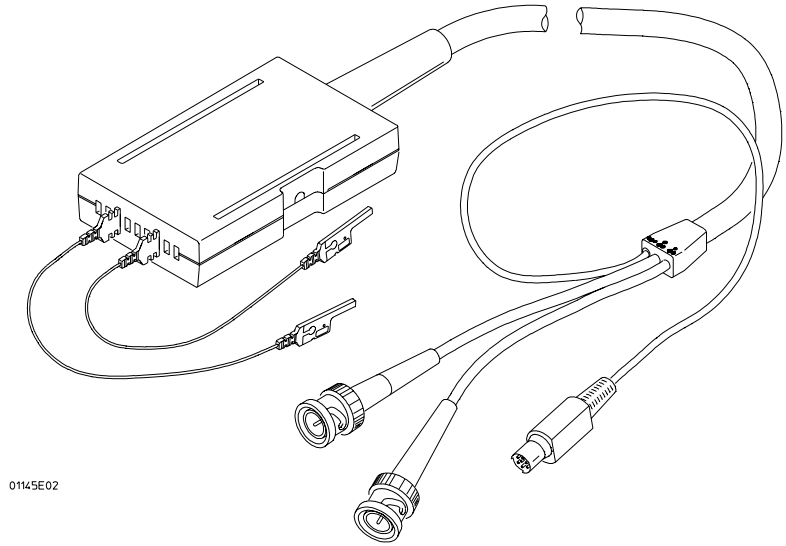
July 2003



For Safety, Regulatory, and publishing information, see the pages at the back of this book.

1145A 2-Channel Active Probe

Contents

The 1145A 2-Channel Active Probe

The 1145 2-Channel Active Probe is a 10:1 probe with a 750 MHz bandwidth. The FET amplifier allows a high input resistance and low input capacitance which minimizes the loading of the circuit under test. The output impedance of the probe is 50 Ω, which allows the probe cable to be extended with a 50-Ω coaxial cable.

The probe can be powered by the probe power outputs of the 54520 and 54540 series oscilloscopes. To use the probe with other instruments, you can use the 1142A power supply.

Accessories Supplied

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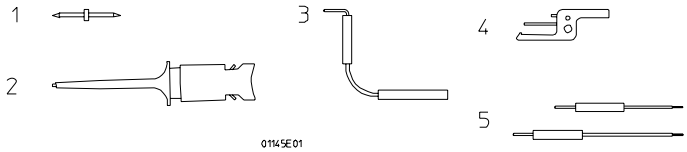


1 Probe pin, quantity supplied 4, kit #16517-82107

2 SMT grabber, quantity supplied 5, kit #5090-4833

3 Ground lead pin-socket, quantity supplied 2, kit #16517-82106

4 Ground extender, quantity supplied 2, kit #16517-82105

5 SMT leads, quantity supplied 2 red and 2 black, kit #16517-82104

You can order additional quantities of the above parts, see page 8 for ordering information

Accessories Available

You can order the following accessories from Agilent Technologies.

- E.F. Johnson socket adapter, Agilent Technologies part number 01145-63201
- Calibration kit, Agilent Technologies part number 01145-68701

Specifications

Bandwidth [1] ≥750 MHz

Rise Time [1,2] ≤470 ps

Attenuation [3] 10:1 ±3%

Input Resistance 1 MΩ, ±2%

Maximum Input Voltage ±40 V (dc + peak ac)

1. Above 35 °C, bandwidth and risetime degrade approximately 1/2%/°C
2. Rise time figure calculated from tr = 0.35/Bandwidth.
3. When connected to an instrument input of 50 Ω, ±0.5%

Characteristics

Input Capacitance 2 pF (typical)

Overshoot and Ringing Less than ±10% for the first 6 ns, ±4% from 6 ns to 20 µs, ±1.5% thereafter.

Output Voltage Offset Error at output Less than ±1 mV

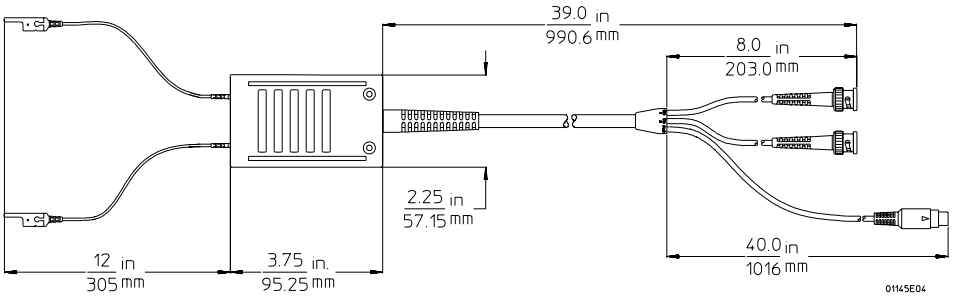
Input Dynamic Range 0 to ±6.0 V

Output Load Requirement 50Ω

General Characteristics

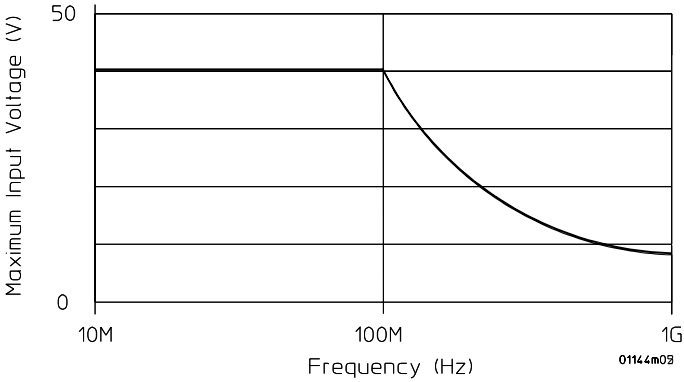
Environmental Conditions	**Operating**	**Non-operating**
Temperature	0 C to +55 °C (32 °F to +131 °F)	-40 °C to +70 °C (-40 °F to +158 °F)
Humidity	up to 95% relative humidity (non- condensing) at +40 °C (+104 °F)	up to 90% relative humidity at +65°C (+149 °F)
Altitude	up to 4,600 meters (15,000 ft)	up to 15,300 meters (50,000 ft)
Vibration	Random vibration 5 to 500 Hz, 10 minutes per axis, $0.3g_{rms}$.	Random vibration 5 to 500 Hz, 10 min. per axis, 2.41 g_{rms}. Resonant search 5 to 500 Hz swept sine, 1octave/min. sweep rate, (0.75g), 5 min. resonant dwell at 4 resonances per axis.
Power Requirements	dc ±6 V to ±3% (at approximately 150 mA each supply)	
Weight	Net: approximately 8 oz. Shipping: approximately 1 kg (2.2 lb)	
Dimensions	Refer to the outline drawing below.	

1145A Dimensions

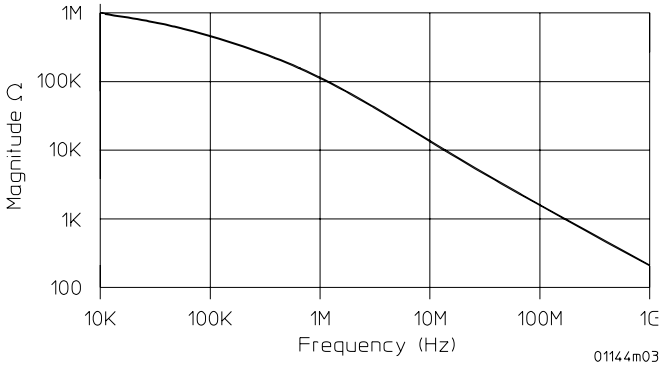


Operating the Probe

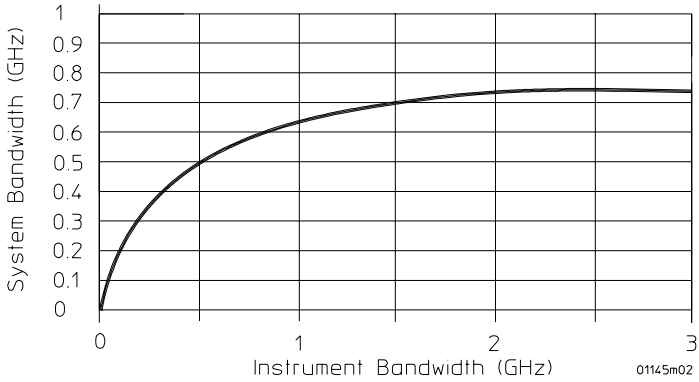
The following information will help you get the most out of your measurement when operating the probe.



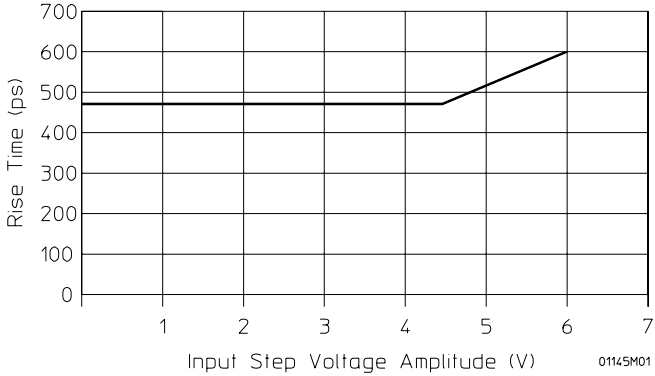
Typical Input Impedance vs. Frequency



Typical System Bandwidth



Typical Rise Time vs. Input Voltage

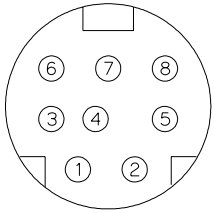


CAUTION Be sure to limit the input of this probe to voltages within the specified working voltage. Though the probe is designed with safeguards against static electricity and noise, the input is sensitive to and may be damaged by excessive voltage.

CAUTION This probe is a delicate device. Dropping it or exposing it to strong vibration or shock can damage it and cause a malfunction. Please handle it with care.

Probe Power Connection

The following drawing shows the input power connections. The power requirements are given in the General Characteristics.



01144E07

Pin 8, -6 V
Pin 3, +6 V
Pin 7, Ground
Shell, Cable Shield

Cleaning the Probe

Do not use petroleum based solvents to clean the probe. Clean the probe with a mild soap and water and immediately wipe the probe with a dry cloth.

Service Strategy

If your probe fails during warranty, normal warranty service apply. If the probe is not under warranty when it fails, you can order any of the following parts from Agilent Technologies.

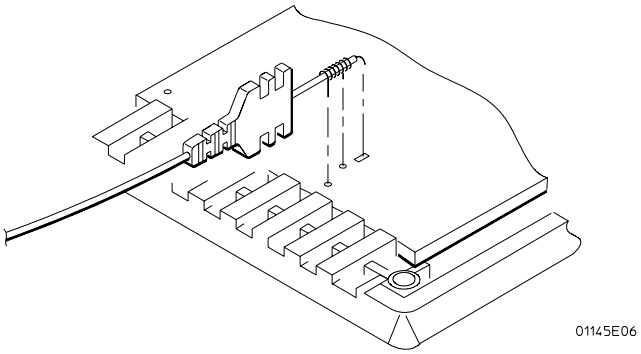
Part Number	Description
01145-66501	Loaded Board
01145-61601	Main Cable
01145-60602	Probe tip and cable
16517-82104	SMT lead kit, 4 red and 4 black
16517-82105	Ground extender kit, box of 20
16517-82106	Ground lead pin-socket kit, box of 20
5090-4833	SMT grabber kit, box of 20
16517-82107	Pin probe kit pin, box of 4

To replace the main cable

Due to the difficulty in soldering the main cable to the printed circuit assembly, Agilent Technologies recommends that you return the probe to an Agilent Technologies Service Center if the main cable or printed circuit assembly need to be replaced. Because there are low temperature solder connections inside the main cable, make sure you heat sink the main cable before soldering on it.

To replace the probe tip and cable

1. Use a Torx 10 screwdriver to remove the four screws holding the clamshell pod case together.
2. Lift off the tip of the clamshell pod case.
3. Use a solder iron to unsolder the center conductor wire of the faulty probe lead from the bonding pas on the printed circuit assembly.
4. Because the ground legs plug into small sockets under the cable, use a pair of needle nose pliers to lift the faulty probe lead away from the printed circuit assembly.
5. Flow enough solder onto the vacant solder pad for a good solder joint.
6. Inter the probe ground legs of the new cable into the circuit board pin sockets.
7. While holding the probe ground legs in place, place the notched strain relief into the slot of the lower half of the clamshell cover.
8. Because the wire to the center lead is very fragile, use caution when soldering it. Resolder the center lead on the vacant solder joint. The resulting solder joint should be very similar to the other probe lead.
9. Inspect the solder joint for good soldering integrity.
10. Check the cable alignments inside of the pod. Replace the top of the pod, then install the four screws.



To return the probe to Agilent Technologies for service

Before shipping the instrument to Agilent Technologies, contact your nearest Agilent Technologies sales office for additional details.

1. **Write the following information on a tag and attach it to the instrument.**
   - Name and address of owner
   - Instrument model number
   - Instrument serial number
   - Description of the service required or failure indications
2. **Remove all accessories from the instrument.**
   Accessories include all cables. Do not include accessories unless they are associated with the failure symptoms.
3. **Protect the instrument by wrapping it in plastic or heavy paper.**
   Anti-static wrapping or packaging is strongly recommended.
4. **Pack the instrument in foam or other shock absorbing material and place it in a strong shipping container.**
   You can use the original shipping materials or order materials from an Agilent Technologies Sales Office. If neither are available, place 3 to 4 inches of shock-absorbing material around the instrument and place it in a box that does not allow movement during shipping.
5. **Seal the shipping container securely.**
6. **Mark the shipping container as FRAGILE.**
   In any correspondence, refer to instrument by model number and full serial number.

Adjustments

There is no defined adjustment interval for the active probe. The adjustments are done at Agilent Technologies and does not require periodic maintenance. You should only make adjustments when replacing the probe tip and cable assembly, the printed circuit board assembly, or as you think is needed based on your past experience.

The equipment required for the adjustments is listed below. Any equipment satisfying the critical specifications listed may be substituted for the recommended model.

Allow the probe to warm up for at least 15 minutes prior to beginning adjustments.

Equipment Required

Equipment	Critical Specification	Recommended Model/Part
Signal Generator	Square wave, rise time <300 ps, OV to 1 Vp, <5% flatness	8131A/B (or equivalent)
Oscilloscope	>10 GHz bandwidth	54121T (or equivalent)
Power Supply	Power for probe under test	Oscilloscope or 1142A
Termination	SMA feedthrough, 50Ω	0955-0736
Adapter*	Type N(m) to SMA (m), 50Ω	1250-1994 (or equivalent)
Adapter*	SMA(f)-to-probe	16517-27601
Adapter	SMA (m) to BNC (f)	1250-1200
Adapter	SMA (f-f)	1250-1158

*Part of calibration kit, Agilent Technologies part number 01145-68701.

CAUTION The adjustments are easily damaged if you use the wrong tool or any force at all. Make sure you use the adjustment tools that are part of the calibration kit, Agilent Technologies part number 01145-68701.

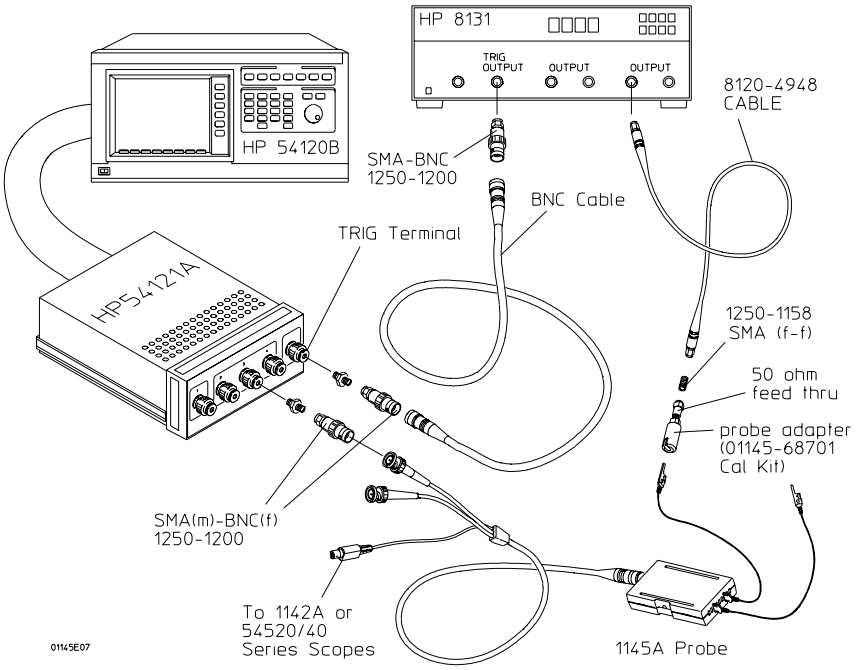
1 Connect the equipment as shown below with the following front-panel settings.

Equipment setup

8131A/B	
Mode	Auto
Period	50 ms
Delay	0
Width/DS$C	50%
High	1 V
Low	0 V
Offset	0.5 V
Outputs	Enabled

54121T	
Time base	
Time/div	5ms/div
Delay	Min
Sweep	Trg'd
Channels	
Channels 1, 2, 4	Off
Channel 3	On
Volts/div	20 mV/div
Offset	50 mV

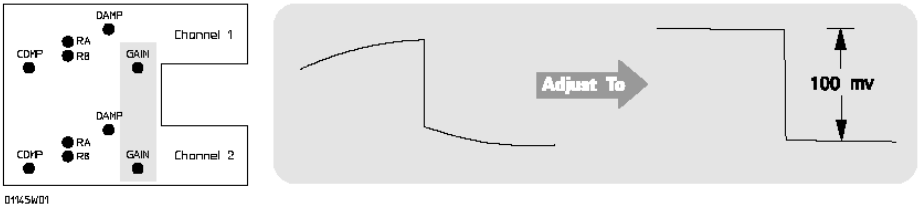
Trigger	
Slope	Pos
HF sense	Off
HF Reject	Off
Trigger level	-260 mV
Display Mode	
Average	1
Screen	Single
Graticule	Grid
Bandwidth	12.4 GHz



2 If you installed a new board or cable assembly, set all the adjustments (expect COMP) to the clockwise position. If you are tweaking the adjustments, you can set them to the clockwise position or leave them where they were last set.

3 Adjust GAIN for a flat pulse.

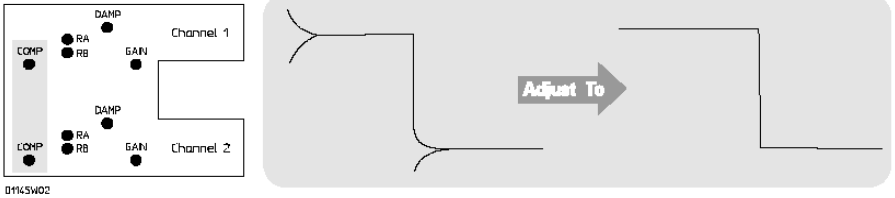
If you turn on the DeltaV marker, you can use it as a reference for a flat line.



4 Change the pulse generator to 50-µs period and change the scope to 5 µs/div.

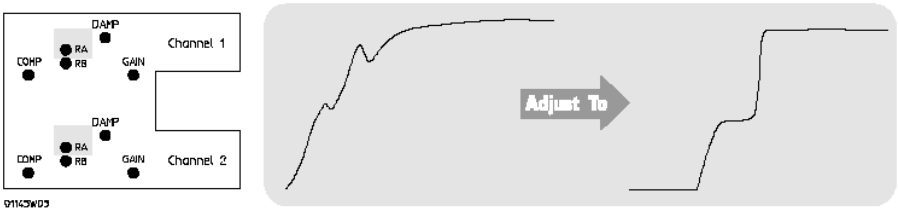
5 Adjust COMP for flat pulse.

Again, you can use the DeltaV marker as a reference for a flat line.

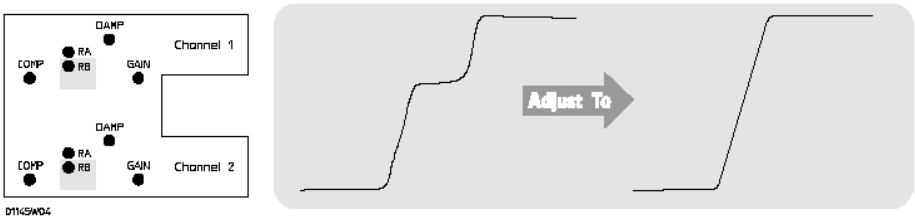


6 Change the pulse generator to a 50-ns period and change the scope to 1 ns/div. Adjust the scope's delay to position the pulse edge 2.5 ns from the left hand edge of the screen.

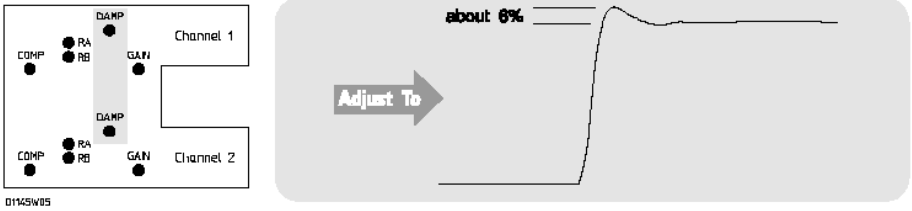
7 Adjust RA for a flat pulse top.



8 Adjust RB for a linear rising edge.



9 Adjust DAMP for about 6% overshoot.



10 Temporarily place the cover on top of the probe body, then measure the pulse rise time.
The rise time should be ≤470 ps and overshoot about 9 to 10%. You may need to remove the cover and make minor adjustments to RA, RB, and DAMP to meet specifications.

11 Repeat steps 1 though 10 for the other channel.

12 Install the cover, and verify the performance still meets specifications.
About 9 to 10% overshoot and a rise time ≤470 ps.

Calibration Testing Procedures

The procedures in this section test the performance of the 1145A active probe to ensure that it meets its warranted specifications.

Calibrating Testing Interval

The calibration test procedures may be performed for incoming inspection of the instrument and should be performed periodically thereafter to ensure and maintain peak performance. The recommended test interval is yearly or every 2,000 hours of operation. The amount of use, environmental conditions, and the user's experience concerning need for testing will contribute to verification requirements.

Equipment Required

The equipment required for the calibration tests is listed at the test. Any equipment satisfying the critical specifications listed may be substituted for the recommended model.

CAUTION Allow the probe to warm up for at least 15 minutes prior to beginning calibration tests. Failure to allow warm-up may cause the probe to fail tests.

Input Resistance

Specification

Equipment Required

Equipment	Critical Specification	Recommended Model/Part
Digital Multimeter	Resistance ±1%	34401A

1 Connect the DMM between the probe tip and the ground at the tip of the probe.
2 Set up the DMM to measure resistance.

DC Gain Accuracy

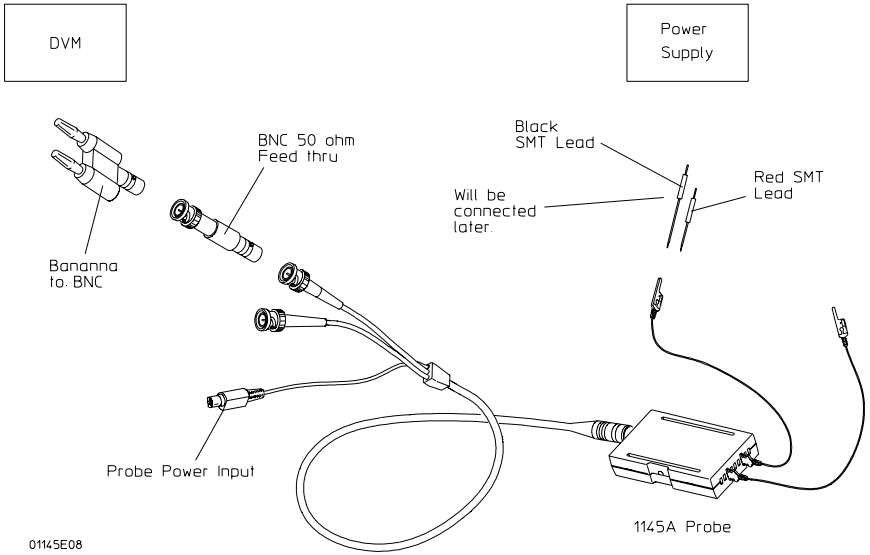
Specification

Equipment Required

Equipment	Critical Specification	Recommended Model/Part
Digital Multimeter	Better than 0.1% accuracy at 1 KHz	34401A
Power Supply	1 V ±1%	6114A (or equivalent)
Power Supply	Power for probe under test	Oscilloscope or 1142A
Termination	BNC feedthrough, 50Ω ±0.5%	11048C
Adapter	BNC (f) to banana (m)	1251-2277

1 Using the DMM, set the output of the power supply to 1.0 V ±0.1%.
Power supply voltage _____.

2 Connect the equipment as shown below.
Before you connect the power supply to the probe, you will measure the probes output offset voltage in step 3.



3 Using the DMM, measure the probe's dc output offset voltage on channel 1.
Probe output offset voltage _____.
Typically the offset will be much less than 1 mV.

4 Connect the probe's channel 1 input connector to the power supply.

5 Using the DMM, measure the output of the probe.
Probe output voltage _____.

6 Calculate the dc gain.

$$\text{dc Gain} = \frac{\text{Probe output voltage - Probe output offset voltage}}{\text{Power supply voltage}}$$

The dc gain should be between 0.097 and 0.103 (0.10 ±3.0%)

7 Repeat steps 1 through 6 for channel 2.

Bandwidth

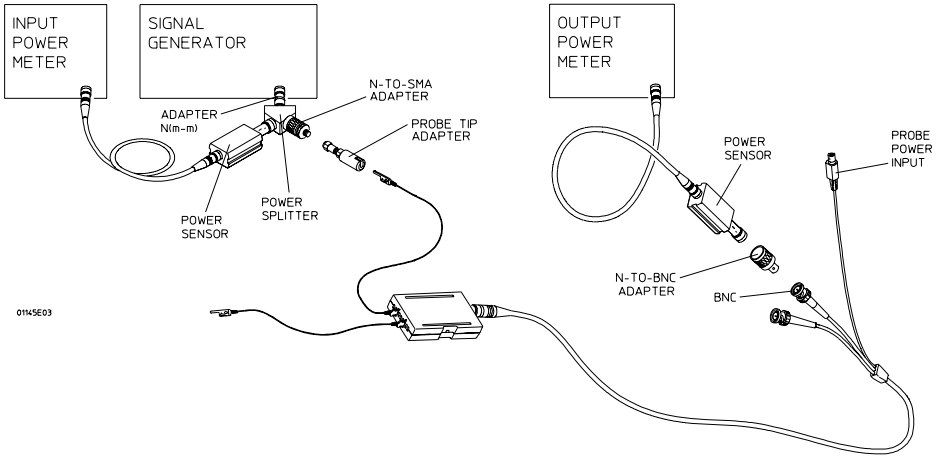
Specification down less than 3dB, dc to 750 MHz

Equipment Required

Equipment	Critical Specification	Recommended Model/Part
Signal Generator	50 MHz to 800 MHz	8663A
Power Meters (2) or one Dual-Channel	50 MHz to 800 MHz ±3% accuracy	436A (2), 437A (2), or 438A (1) (or equivalent)
Power Sensor (2)	50 MHz to 800 MHz, 300 mW	8482A
Power Splitter	Type-N, dc to 800 MHz, ≤0.2 dB tracking	11667A
Power Supply	Power for probe under test	Oscilloscope or 1142A
Termination	SMA feedthrough, 50 Ω	0955-0736
Adapter*	Type N(m) to SMA(m), 50 Ω	1250-1994 (or equivalent)
Adapter*	SMA(f)-to-probe	16517-27601
Adapter	BNC(m) to N(f), 50 Ω	1250-0077
Adapter	N(m-m), 50 Ω	1250-0778

*Part of calibration kit part number Agilent Technologies 01145-68701

1 Zero and calibrate the power meters with the power sensors.
2 Connect the equipment as in the drawing below.



3 Connect the probe power input to the oscilloscope or 1142A
4 Set the signal generator for 50 MHz at 0.0 dBm.
5 Set the power meter calibration factors to the 50 MHz value on the power sensors.
6 Adjust the signal generator power output for exactly -6.0 dBm as read on the input power meter.
7 Note the power level reading on the output power meter.
50 MHz power level _____ dBm.
8 Change the signal generator frequency to 750 MHz.
9 Set the power meter calibrating factors to the 750 MHz value on the power sensors.
10 Relevel the signal generator output power for a -6.0 dBm reading on the input power meter.
11 Note the power level reading on the output power meter.
750 MHz power level _____ dBm.
12 Subtract the reading in step 7 from the reading in step 11.
The difference should be ≤3.0 dB.

Calibration Test Record

Agilent Technologies Recommended Test Interval: 1 Year Recommended Date of Next Certification:_____ Certification Temperature:_____	1145A Active Probe Serial No.:_____ Certification Date:_____ Tested By:_____ _____ _____

Test	**Limits**	**Results**	
		Channel 1	Channel 2
Input Resistance	1.0 MΩ ±2%, 980 kΩ to 1.020 MΩ	_____	_____
dc Gain Accuracy	0.1 ±3%, 0.098 to 1.103	_____	_____
Bandwidth	down less than 3 dB at 750 MHz	_____	_____

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014

Manufacturer's Name: Agilent Technologies, Inc.

Manufacturer's Address: 1900 Garden of the Gods Road
Colorado Springs, CO
80907, U.S.A.

Declares, that the product

Product Name: Oscilloscope Active Probe

Model Number: 1145A

Product Options: This declaration covers all options of the above product(s).

Conforms to the following product standards:

	Standard	Limit
EMC:	IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998	Group 1, Class A[1]
	CISPR 11:1990 / EN 55011:1991	4kV CD, 8kV AD
	IEC 61000-4-2:1995+A1:1998 / EN61000-4-2:1995	3V/m 80-1000 MHz
	IEC 61000-4-3:1995 / EN 61000-4-3:1995	0.5kV signal lines, 1kV power lines
	IEC 61000-4-4:1995 / EN 61000-4-4:1995	0.5 kV line-line, 1 kV line-ground
	IEC 61000-4-5:1995 / EN 61000-4-5:1995	3V, 0.15-80 MHz
	IEC 61000-4-6:1996 / EN 61000-4-6:1996	1 cycle, 100%
	IEC 61000-4-11:1994 / EN 61000-4-11:1994	
	Canada: ICES-001:1998	
	Australia/New Zealand: AS/NZS 2064.1	

Safety: IEC 61010-1:1990+A1:1992+A2:1995 / EN 61010-1:1993+A2:1995

Conformity/Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC, and carries the CE-marking accordingly (European Union).

[1]This product was tested in a typical configuration with Agilent Technologies test systems.

Date: 06/28/2000

Ken Wyatt

Name

Ken Wyatt, Product Regulations Manager

For further information, please contact your local Agilent Technologies sales office, agent, or distributor.

Product Regulations

EMC	IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998	
	CISPR 11:1990 / EN 55011:1991	
	IEC 61000-4-2:1995+A1:1998 / EN61000-4-2:1995	A
	IEC 61000-4-3:1995 / EN 61000-4-3:1995	B
	IEC 61000-4-4:1995 / EN 61000-4-4:1995	A
	IEC 61000-4-5:1995 / EN 61000-4-5:1995	A
	IEC 61000-4-6:1996 / EN 61000-4-6:1996	A
	IEC 61000-4-11:1994 / EN 61000-4-11:1994	A
	Canada: ICES-001:1998	
	Australia/New Zealand: AS/NZS 2064.1	
Safety	IEC 348:1978 / HD 401 S1:1981	
	UL1244	
	CSA-C22.2 No. 231 (Series M-89)	

Performance Codes:
A PASS - Normal operation, no effect.
B PASS - Temporary degradation, self recoverable.
C PASS - Temporary degradation, operator intervention required.
D FAIL - Not recoverable, component damage.

Notes: (none)

Sound Pressure Level N/A

Regulatory Information for Canada

ICES/NMB-001

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est confomre à la norme NMB-001 du Canada.

Regulatory Information for Australia/New Zealand

This ISM device complies with Australian/New Zealand AS/NZS 2064.1

N10149

Safety Notices

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. This is a Safety Class I instrument (provided with terminal for protective earthing). Before applying power, verify that the correct safety precautions are taken (see the following warnings). In addition, note the external markings on the instrument that are described under "Safety Symbols."

Warnings

• 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.

• Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuseholders. To do so could cause a shock or fire hazard.

• If you energize this instrument by an auto transformer (for voltage reduction or mains isolation), the common terminal must be connected to the earth terminal of the power source.

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

• Service instructions are for trained service personnel. To avoid dangerous electric shock, do not perform any service unless qualified to do so. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

• Do not install substitute parts or perform any unauthorized modification to the instrument.

• Capacitors inside the instrument may retain a charge even if the instrument is disconnected from its source of supply.

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

• Do not use the instrument in a manner not specified by the manufacturer.

To clean the instrument

If the instrument requires cleaning: (1) Remove power from the instrument. (2) Clean the external surfaces of the instrument with a soft cloth dampened with a mixture of mild detergent and water. (3) Make sure that the instrument is completely dry before reconnecting it to a power source.

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.

Agilent Technologies
P.O. Box 2197
1900 Garden of the Gods Road
Colorado Springs, CO 80901

Notices

Manual Part Number
01145-92003, July 2003

Print History
01145-92002, August 2002
01145-92001, June 2000

Agilent Technologies, Inc.
1900 Garden of the Gods Road
Colorado Springs, CO 80907
USA

Document Warranty

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