

Keysight N2771B 15 kV High Voltage Probe



Notices

© Keysight Technologies, Inc. 2012-2016

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

Manual Part Number

N2771-92013

Edition

Sixth edition, 2016

Published in USA

Keysight Technologies, Inc.
1400 Fountaingrove Parkway
Santa Rosa, CA 95403 USA

Warranty

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

Technology Licenses

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

U.S. Government Rights

The Software is "commercial computer software," as defined by Federal Acquisition Regulation ("FAR") 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement ("DFARS") 227.7202, the U.S. government acquires commercial computer software under the same terms by which the software is customarily provided to the public. Accordingly, Keysight provides the Software to U.S. government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA), a copy of which can be found at www.keysight.com/find/sweula. The license set forth in the EULA represents the exclusive authority by which the U.S. government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Keysight: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform, display, or disclose commercial computer software or commercial computer software documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in writing elsewhere in the EULA. Keysight shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the U.S. government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any technical data.

Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

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

WEEE Compliance



This product complies with the WEEE Directive 2012/19/EU marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a "Monitoring and Control Instrumentation" product.

Do not dispose in domestic household waste.

To return unwanted products, contact your local Keysight office, or see www.keysight.com for more information.

Introduction

The Keysight N2771B High Voltage Divider Probe is an accessory to be used with analog or digital oscilloscopes having input resistance of $1\text{ M}\Omega$ ($\pm 1\%$) and nominal input capacitance between 6 and 20 pF. The N2771B is a 1000:1 divider which extends the voltage measurement capability to maximum 15 kV (DC + AC peak), $10\text{ kV}_{\text{rms}}$ AC, or $30\text{ kV}_{\text{peak}}$ ($< 20\text{ ns}$ pulse width).

Contents

Safety Precautions	4
IEC Measurement Category Definitions	6
Operation	7
Frequency Compensation Adjustment	9
Cleaning	9
Characteristics	10
Contacting Keysight	12

Safety Precautions



WARNING

This high voltage probe is designed to prevent accidental shock to the operator when properly used. This user guide must be read and understood prior to using the probe. Improper procedures or incorrect analysis of the measurement situation can result in serious shock.

If the probe is subjected to voltages over 15kV (DC + AC peak) or 10 kV rms then **DO NOT USE**. The probe could potentially be damaged. Return the probe immediately to a Keysight service center for performance validation.

WARNING

This high voltage probe is designed for use within Measurement Category I (CAT I) only. Do not use the probe for measurements performed on circuits defined by any other measurement category or transient overvoltages of more than 1500V. Refer to "[IEC Measurement Category Definitions](#)" on page 6 for a definition of measurement categories.

WARNING

Do not exceed 60 seconds of contact between the probe and circuit-under-test when measuring voltages ≥ 8 kV (DC) or ≥ 5 kV (AC, rms). Keysight recommends that an interval of 5 minutes be taken between measurements.

WARNING

This high voltage probe must only be used by personnel who are trained, experienced, or otherwise qualified to recognize hazardous situations and who are trained in the safety precautions that are necessary to avoid possible injury when using such a device.

WARNING

Do not work alone when working with high voltage circuits.

WARNING

For your own safety, inspect the probes for cracks and frayed or broken leads before each use. If defects are noted, **DO NOT** use the probe.

WARNING

Hands, shoes, floor and work bench must be dry. Avoid making measurements under humid, damp or other environmental conditions that might effect the safety of the measurement situation.

WARNING

It is advisable to turn the high voltage source off before connecting or disconnecting the probe.

WARNING

The probe body should be kept clean and free of any conductive contamination. Refer to the section on cleaning.

WARNING

The ground lead is critical to the safe operation of the probe. Failure to make this connection when making high voltage measurements may result in personal injury or damage to the probe or oscilloscope. This connection must always be made **BEFORE** the probe tip comes in contact with the high voltage and must not be removed until the probe tip has been removed from the high voltage source.

WARNING

Do not attempt to take measurements from sources where the chassis or return lead is not grounded.

IEC Measurement Category Definitions

Definitions and Examples (Clause 6.5.2).

Measurement Category I (CAT I)

Measurement category I is for measurements performed on circuits not directly connected to a mains supply.

Example Measurements in circuits not derived from a mains supply and specially protected (internal) circuits derived from a mains supply. In the latter case, transient stresses are variable. For that reason, it is required that the transient withstand capability of the equipment is made known to the user.

Measurement Category II (CAT II)

Measurement category II is for measurements performed on circuits directly connected to the low voltage installation.

Example Household appliances, portable tools, and similar equipment.

Measurement Category III (CAT III)

Measurement category III is for measurements performed in the building installation.

Example Measurements on distribution boards, circuit breakers, wiring including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation and equipment for industrial use like, for example, stationary motors with permanent connections to the fixed installation.

Measurement Category IV (CAT IV)

Measurement category IV is for measurements performed at the source of the low-voltage installation.

Example Electricity meters and measurements on primary over-current protection devices and ripple control units.

Operation

- 1 Connect the probe to the BNC input of the oscilloscope.
- 2 Select the desired volts/division range. (If you can set probe attenuation on the oscilloscope, set it to 1000:1)
- 3 Whenever possible, turn the high voltage source off before making any connections.
- 4 Connect the divider probe ground lead (alligator clip) to a good earth ground or reliable chassis ground.
- 5 Connect the probe to the voltage source.
- 6 Before turning on the high voltage source, make sure that no part of the person holding the probe is touching the device under test. Once this is certain, turn on the high voltage source.
- 7 Measure the voltage under test and observe the waveform on the oscilloscope. Remember the actual voltage is 1000 times greater than the oscilloscope waveform if the probe attenuation on the oscilloscope has been set to 1:1.
- 8 Turn off the high voltage source.
- 9 Disconnect the Keysight N2771B High Voltage Probe from the high voltage source BEFORE disconnecting the ground clip lead.

**WARNING**

Do not attempt to take measurements from sources where the chassis or return lead is not grounded.

WARNING

The ground lead is critical to the safe operation of the probe. Failure to make this connection when making high voltage measurements may result in personal injury or damage to the probe or oscilloscope. This connection must always be made BEFORE the probe tip comes in contact with the high voltage and must not be removed until the probe tip has been removed from the high voltage source.

WARNING

Do not connect the ground clip lead to the high voltage source for any reason.

WARNING

Do not make any floating measurements with the Keysight N2771B High Voltage probe.

WARNING

Do not exceed 60 seconds of contact between the probe and circuit-under-test when measuring voltages ≥ 8 kV (DC) or ≥ 5 kV (AC, rms). Keysight recommends that an interval of 5 minutes be taken between measurements.

WARNING

This high voltage probe is designed for use within Measurement Category I (CAT I) only. Do not use the probe for measurements within the other measurement categories or transient overvoltages of more than 1500V.

Frequency Compensation Adjustment

The N2771B High Voltage Probe has a Frequency Compensation adjustment that compensates for the input capacitance of the oscilloscope being used with the probe. Use a square-wave generator set for approximately 100 Hz output. Proceed with the following steps for frequency compensation.

- 1 Connect the probe to the oscilloscope.
- 2 Connect probe tip to square-wave generator.
- 3 Adjust the square wave generator for approximately 10 volts amplitude.
- 4 Adjust the oscilloscope time base for 20 μ s/div.
- 5 Use a trimmer tool to adjust the compensation capacitor for the flattest pulse top. See the figure below for the location of the adjustment.

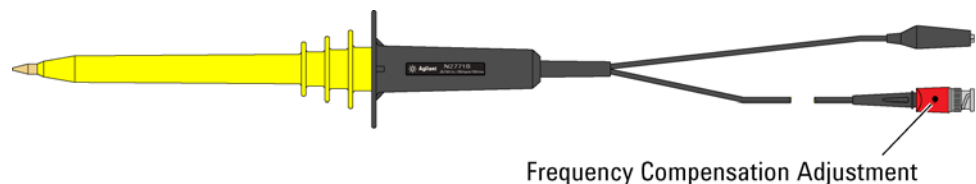


Figure 1 Location of Frequency Compensation Adjustment

Cleaning

Clean only the exterior probe body and cables. Use a soft cotton cloth lightly moistened with a mild solution of detergent and water. Do not allow any portion of the probe to be submerged at any time.

WARNING

Dry the probe thoroughly before attempting to make voltage measurements.

CAUTION

Do not subject the probe to solvents or solvent fumes as these can cause deterioration of the probe body and cables.

Characteristics

Table 1 Characteristics (Not Warranted)

Maximum Input Voltage (CAT I)	Temperature Coefficient
DC Voltage: 15 kV AC Voltage: 10 kV _{rms} Peak Voltage: 30 kV _{peak} (< 20 ns pulse width)	Less than 200 ppm/ °C
Compensation Range	Division Ratio
For input capacitance of 6 pF to 20 pF	1000:1
Bandwidth	Designed For Use In
50 MHz (-3 dB)	POLLUTION DEGREE 2
Input Resistance	Operating Temperature
100 MΩ, when terminated by 1 MΩ	0 °C to +50 °C
Cable Length:	Storage Temperature:
2 meter	-20 °C to +70 °C
Altitude:	Humidity
Up to 2,000 meters (6,561 ft)	Up to 80% relative humidity at +40 °C
Accuracy:	
DC Volts: ±2, 5% (below 10 kV) DC Volts: ±4% (between 10 kV and 15 kV) AC Volts: ±5% at 1 kHz AC Volts: ±3 dB between 1 kHz and 50 MHz	

Voltage Derating



The following graph shows the voltage versus frequency derating curve for the Keysight N2771B High Voltage Probe.

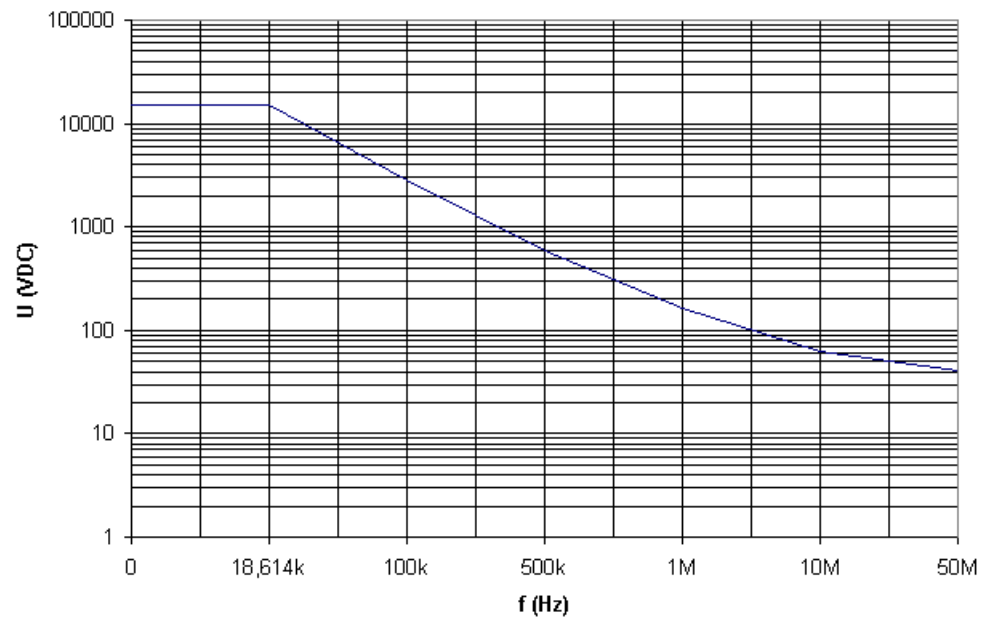


Figure 2 Voltage Versus Frequency Derating Curve

Contacting Keysight

Contacting Keysight

Information on contacting Keysight Technologies can be found at:

www.keysight.com/find/contactus