

Documentation

Version 1.1, November, 2016

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Chapter 1 - Overview

Welcome

Thank you for purchasing Picotest's GaN probe. The Picotest GaN Probe extends the measuring range of your oscilloscope to high voltages safely and easily.

This high voltage probe is suitable to view the fastest GaN and SiC edges for timing and switching losses of high voltage power switches, as well as EMC testing or glitch detection.

Anyone testing high speed, high voltage switches can use this probe. ¹

Probe Feature and Benefit Summary

- Voltage probe for All SiC and GaN circuitry
- Bandwidth 700MHz+
- Passive, Attenuation 100:1
- Generic BNC works with all 1M Ω instruments
- Rise Time 500ps
- Input Voltage 1KV RMS Voltage
- Input Impedance 50M Ω , 7pF
- Compensation Range: 10 - 50 pF
- Slim body
- Full range of accessories

¹ https://www.picotest.com/products_GaN_Probe.html

What's Included

Your Picotest Probe kit (P2000A) includes one or more of the following:

- One (1) GaN Probe, two (2) if the Probe 2-Pack is purchased
- Probe Tip Accessories Kit (plastic box)
- Probe Case



Documentation and Support

This documentation details the use of the probe. Specifications are also included.

The support section of Picotest's web site, <https://www.picotest.com/support.html>, contains additional documentation and various publications on testing power supplies, regulators, and other equipment using the Picotest probes and test equipment.

Warranty

Picotest warrants this probe for normal use and operation within specifications for a period of two (2) years from date of shipment and will repair or replace any defective product which was not damaged by negligence, misuse, improper installation, accident or unauthorized repair or modification by the buyer. This warranty is applicable only to defects due to material or workmanship. Picotest disclaim any other implied warranties of merchantability or fitness for a particular purpose. Picotest will not be liable for any indirect, special, incidental, or consequential damages (including damages for loss of profits, loss of business, loss of use or data, interruption of business and the like), even if Picotest has been advised of the possibility of such damages arising from any defect or error in this manual or product.

For warranty service or repair this product must be returned to a service facility designated by Picotest. Please contact your local service representative for further assistance.

Calibration

The probes do not require calibration though the test setup where they are used normally requires calibration. See the instrument guide you are using the probes with for calibration instructions (usually measurement and setup dependent).

Declaration of Conformity



(EC conformity marking)

The manufacturer declares the conformity of this product with the actual required safety standards in accordance with the Low Voltage Directive (LVD) 2006/95/EC:

CEI/IEC 61010-031:2008

Safety requirements for electrical equipment for measurement, control and laboratory use -

Part 031:

Safety requirements for hand-held probe assemblies for electrical measurement and test

WEEE/ RoHS Directives



(EC conformity marking)

This electronic product is classified within the WEEE/ RoHS* category list as monitoring and control equipment (category 9). Category 9 products are exempted from the restrictions under the scope of the RoHS directive.

Your help and efforts are required to protect and keep clean our environment. Therefore, return this electronic product at the end of its life either to the manufacturer or take care of separate WEEE collection and professional WEEE treatment yourself. Do not dispose as unsorted municipal waste!

* EC Directives:

WEEE Directive 2002/96/EC

RoHS Directive 2002/95/EC

Waste Electrical and Electronic Equipment

Restriction of the use of certain Hazardous

Substances in Electrical and Electronic Equipment

IEC Measurement Categories P2000A

Definitions and Examples (Clause 6.5.2)

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

Examples: 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, requires that the transient withstand capability of the equipment is made known to the user.

**Measurement Category II
CAT II** **Definition:** Measurement category II is for measurements performed on circuits directly connected to the low voltage installation.

Examples: Household appliances, portable tools and similar equipment.

**Measurement Category III
CAT III** **Definition:** Measurement category III is for measurements performed in the building installation.

Examples: 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 connection to the fixed installation.

**Measurement Category IV
CAT IV** **Definition:** Measurement category IV is for measurements performed at the source of the low-voltage installation.

Examples: Electricity meters and measurements on primary over current protection devices and ripple control units.

IEC Pollution Degrees P2000A

Definitions (Clause 3.5.6)

- Pollution Degree 1** No POLLUTION or only dry, non-conductive POLLUTION.
NOTE: The POLLUTION has no influence.
- Pollution Degree 2** Only- non-conductive POLLUTION. Occasionally, however, a Temporary conductivity caused by condensation must be accepted.
- Pollution Degree 3** Conductive POLLUTION occurs or dry, non-conductive POLLUTION occurs which becomes conductive due to condensation which is to be expected.

Chapter 2 –GaN Probe Usage

Introduction

The P2000A is the Picotest general purpose high voltage GaN probe with a 100:1 attenuation. Its fast rise time and accurate frequency response make it suitable for a variety of measurement applications. The very sharp probe tip is spring loaded and minimizes the pressure to the DUT (device under test). It also prevents the probe from slipping on the board surface, especially when probing at an angle. The probe tips are changeable. Replacement tips are provided within the accessory pack.

Edge Speed Measurement Demands New Probe Capabilities

The P2000A high voltage probe is suitable for measuring the fastest GaN (Gallium Nitride), eGaN, and SiC (Silicon Carbide) edges for timing and switching losses of high voltage power switches, as well as, EMC testing or glitch detection.

The key characteristics of the probe are as follows:

Characteristic	Rating
Bandwidth	700MHz
Input Capacitance:	<7pF
Probe impedance	1M Ohms
Maximum voltage	1000V AC _{RMS} OF DC CAT II
Probe connections	BNC
Rise time	500 ps
Attenuation	100: 1



Note that the max. input voltage rating of the probe decreases as the frequency of the applied signal increases (see Electrical Specification section).

Changing the Probe Tips

To change the probe tip, use pliers to grip and pull it carefully straight out of its contact socket, along the axis of the probe. Do not grip the white plastic insulator or the housing with pliers, because the tip could be squeezed and cannot be removed and respectively the probe could be damaged. If the probe tip is removed, the new tip can be inserted with pliers into the contact socket, along the axis of the probe. To insert the probe tip completely into the housing, press the probe tip against a hard surface carefully.

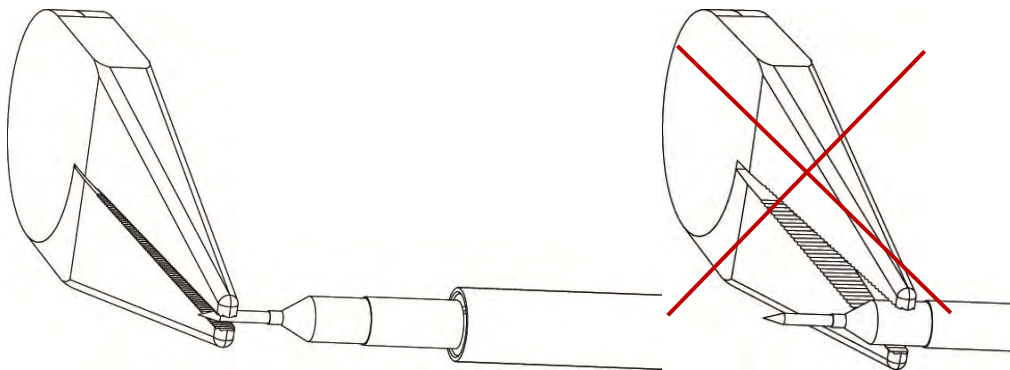


Figure 1: Use pliers to grip and pull the probe tip carefully out of its contact socket (left). Do not grip the white plastic insulator or the probe housing with pliers (right).

Important Note: Pressing too hard on the ground pin while making a measurement can cause the ground pin to break.



Connect the probe to the oscilloscope input and connect the ground lead to earth ground before performing any measurements. Note that all accessible metal parts are connected to the BNC instrument connector (GND), except for the probe tip and the BNC centre-conductors

LF Compensation

LF needs to be adjusted when the probe is connected to the oscilloscope input the first time. LF compensation matches the probes cable capacitance to the oscilloscope input capacitance. This matching assures good amplitude accuracy from DC to upper bandwidth limit frequencies. A poorly compensated probe clearly influences the overall system performance (probe + scope) and introduces measurement errors resulting in inaccurate readings and distorted waveforms. The low frequency probe compensation is accessible through the trimmer hole in the probe connector base. The cover can be removed by gripping the connector and pulling the housing back away from the connector. This will expose a second trimmer for DC. The metal barrel rotates for high frequency compensation. The LF compensation is the one available without removing the cover.

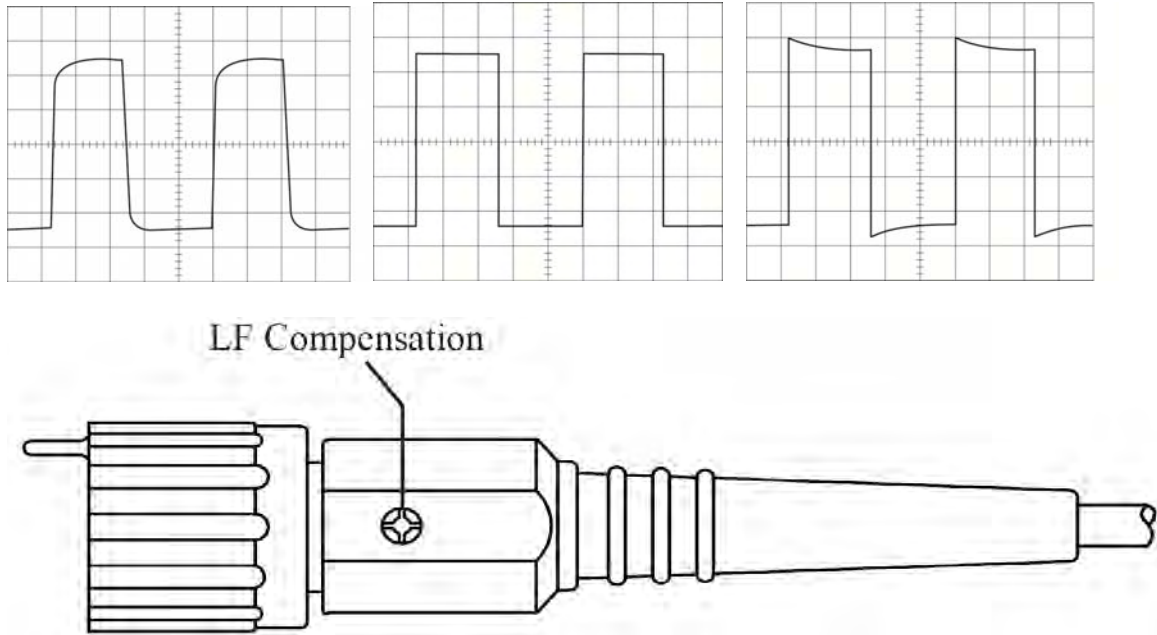


Figure 2: LF compensation is performed by connecting the probe to the CAL – output on the oscilloscope front panel and adjusting the LF compensation trimmer to optimum square wave response.

HF Compensation

HF needs to be adjusted when the probe is connected to the scope input the first time. HF adjustment is performed by connecting the probe to the rectangular wave generator with a fast rise time. Adjust trimmers for optimum square wave response.

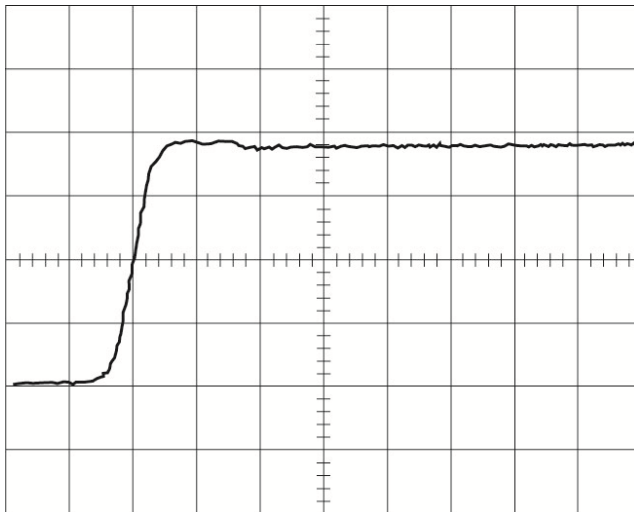


Figure 3: Optimum GaN probe response.

DC Adjustment

In order to provide highest accuracy over the voltage range this probes dividing ratio is factory adjusted using 500 VDC source and a measuring device with a precision input impedance of $1\text{M}\Omega \pm 0.01\%$. Factory calibration traceable is available on request.

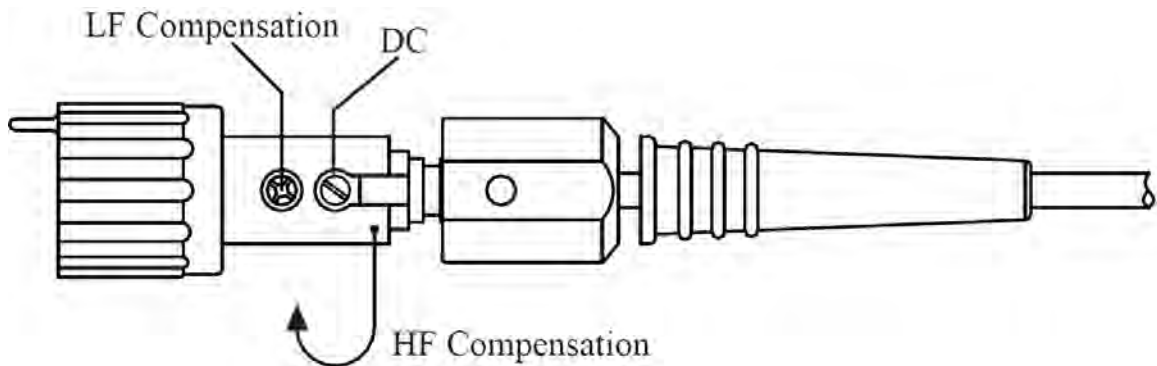


Figure 4: Adjustment trimmers for LF, HF, and DC responses.

50 Ohm Connections

For those that need a 50-ohm connection, you can use the J2180A Ultra Low Noise Preamp (shown below, https://www.picotest.com/products_J2180A.html, fixed, AC coupled 20dB gain) which converts from the 1M Ω probe impedance to 50 ohms over the frequency range of 0.1Hz to 100MHz.



Chapter 3 – Accessories and Specifications

Accessories

The probes come with the following accessories.

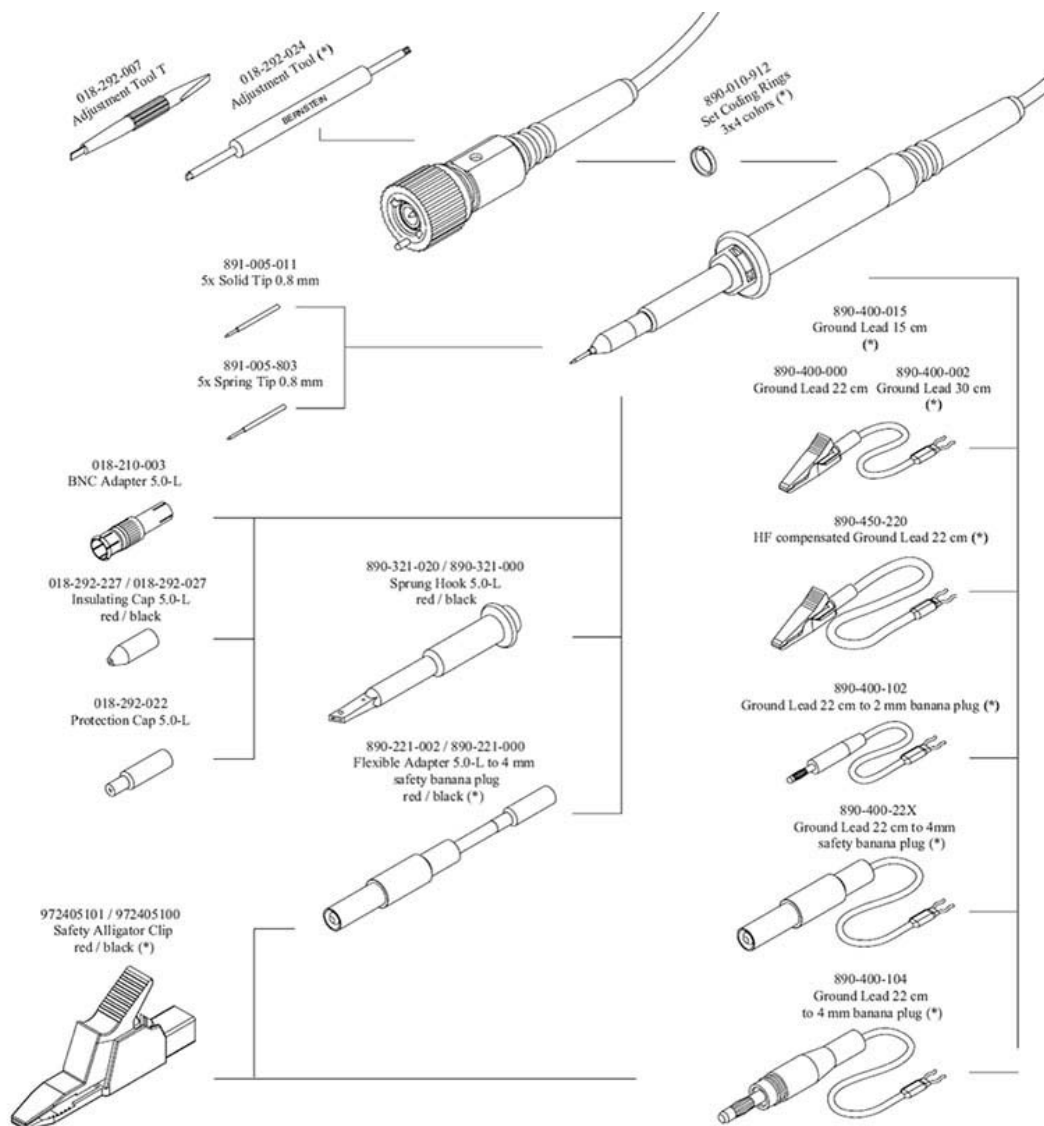


Figure 5, P2000A Probe Accessories.

The following items are included with your probe. Please check the delivery for completeness. If any item is missing, send an email to our service department and we will send you any missing items.

ACCESSORY KIT CONTENTS

Item	Qty.
Adjustment Tool T	1
Ground Lead 22 cm	1
Insulating Cap 5.0-L	1
Protection Cap 5.0-L	1
Solid Tip 0.8 mm	1
Spring Tip 0.8 mm	1
Sprung Hook 5.0-L (red)	1
BNC Adapter 5.0-L	1
Coding Rings (set) 3x4 Colors	1
Flexible Adapter 5.0-L	1
Ground Lead 22 cm to 4 mm Banana plug	1
Case	1
Safety Alligator Clip (red)	1



The BNC Adapter is rated: 100 V rms CAT II, Pollution Degree 1.



The BNC Adapter is rated: 100 V rms CAT II, Pollution Degree 1.



The accessories provided with the probe have been safety tested. Do not Use any other accessories than those “originally” provided.

Safety Information

To avoid personal injury and to prevent fire or damage to this product or products connected to it, review and comply with the following safety precautions. Be aware that if you use this probe assembly in a manner not specified, the protection this product provides may be impaired. Only qualified personnel should use this probe assembly. Do not connect the probe to any voltage that exceeds the maximum permissible input voltage specified in the data sheet. Non-compliance with this instruction carries the risk of an electric shock. Make sure not to cause any short circuits when performing measurements on sources with high output currents. Short circuits may cause injuries or burns.

Risk of injury caused by pointed object

The pins of the probe are extremely pointed and can easily penetrate clothes and skin. Therefore, handle the probe pins with great care. When transporting the probe, e.g. when carrying it in a pocket or tool bag, always use the supplied case. To exchange a probe pin, use tweezers or pliers to avoid injuries.

Use only grounded instruments.

Do not connect the probe ground lead to a potential other than earth ground. Always make sure the probe and the measurement instrument are grounded properly.

Observe probe ratings.

Do not apply any electrical potential to the probe input which exceeds the maximum ratings of the probe or the accessories connected to it. In combination, the lower rating / measurement category always applies to both probe and accessories connected to it. Make sure to comply with the voltage versus frequency derating curve.

Do not operate with suspected failures.

Refer to qualified service personnel.

Indoor use only.

Do not operate in wet/damp environment. Keep product surfaces dry and clean. Do not operate the product in an explosive atmosphere.

Handling Information



Handle with care especially when fitted with the extra thin and sharp spring contact tip to avoid any injury. Note that the probe cable is a sensitive part of the probe. Do not damage through excessive bending or pulling. Avoid mechanical shock to this product in general to guarantee accurate performance and protection.



Caution: To avoid equipment damage and/or severe injuries or death ensure that the absolute maximum ratings defined in this manual are observed at all times and never exceeded.

Cleaning

To clean the exterior of the probe, use a soft cloth moistened with either distilled water or isopropyl alcohol. Before use allow the probe to dry completely.

Electrical Specifications

Specifications that are not defined to be guaranteed are typical and are published as general information to the user. In order to achieve these results, the instrument should have warmed-up for at least 20 minutes and the environmental conditions should not exceed the probe's specified limits.

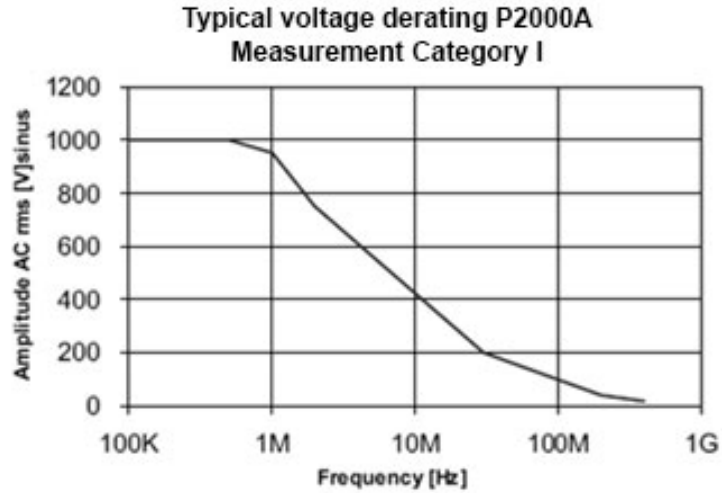
P2000A GaN Probe	
Characteristic	Rating
System Bandwidth	700 MHz (-3 dB) typical
Attenuation Ratio (1)	100:1 \pm 2 % at DC Connected to oscilloscope with an input impedance of 1 M Ω \pm 1 %.
Absolute Maximum Voltage	< 1000V _{RMS}
Voltage Coefficient	0.00025 %/V %/V (typical)
Probe Rise Time	500 psec (10 % - 90 %) (typical)
Maximum Rated Input Voltage (2)	As defined in IEC 61010-031. Also see definitions in User Manual.
Measurement category I:	1000 V _{RMS} 4000 V transient overvoltage
Measurement category II:	1000 V _{RMS} CAT II
Input Resistance (System)	50 M Ω \pm 1 %
Input Capacitance (System)	7 pF (typical)
Compensation Range	10 pF - 50 pF (typical)
Input Coupling of the Measuring Instrument	1 M Ω AC / DC
Weight (probe)	82g
Cable Length	1m
Probe Tip Diameter	5mm
Temperature Range	operating 0° C to +50° C non-operating -40° C to +71° C
Maximum Relative Humidity	operating 80% relative humidity for temperatures up to +31° C, decreasing linearly to 40% at +50° C
Usage	Indoor
Altitude	Operating up to 2000m (6,561 feet), non-operating up to 15000m (49,212 feet)
Absolute Maximum Voltage	See ratings above

The specifications are subject to change without notice.

Voltage Derating

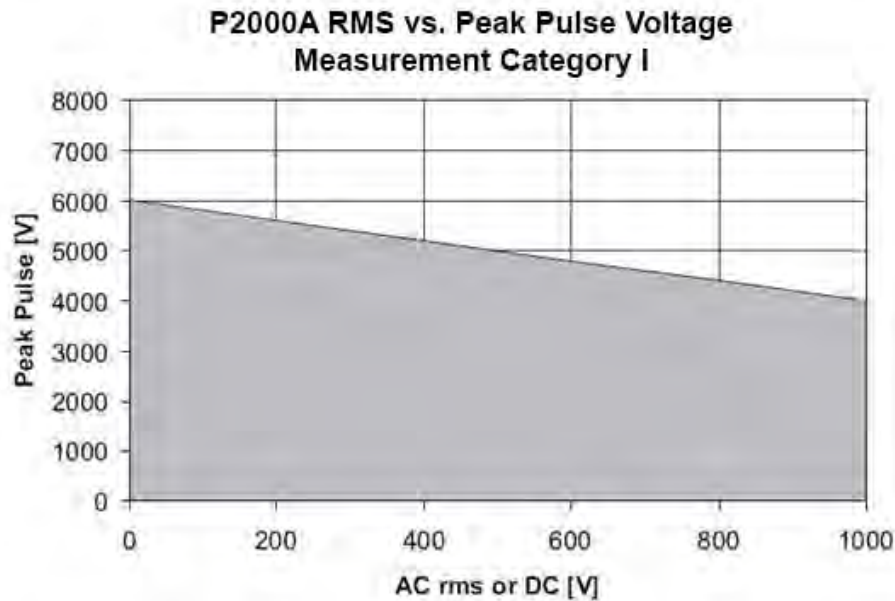


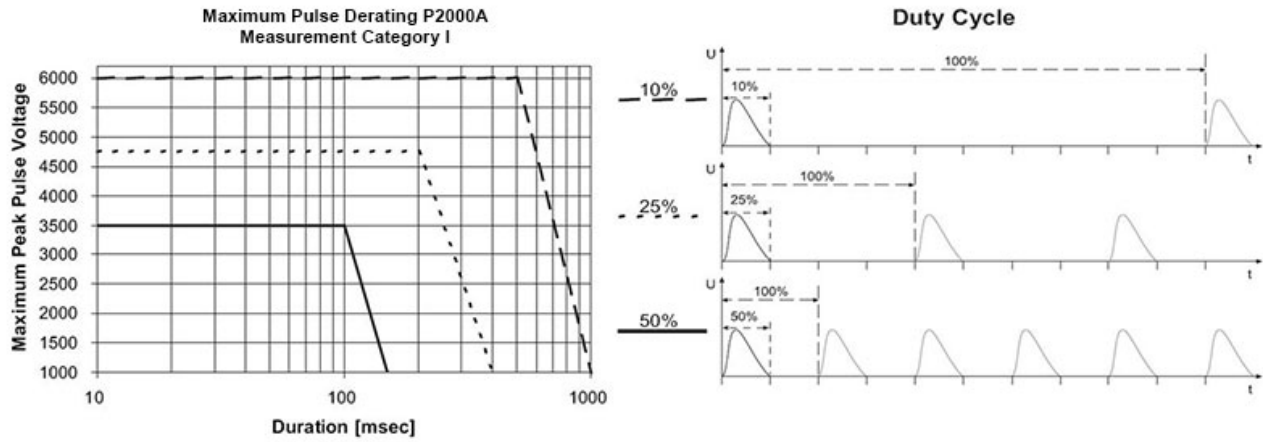
Note that the max. input voltage rating of the probe decreases as the frequency of the applied signal increases.



Maximum Pulse Ratings

For pulse measurements make sure to comply with the probe ratings.





Input Impedance



Note that the input impedance of the probe decreases as the frequency of the applied signal increases.

