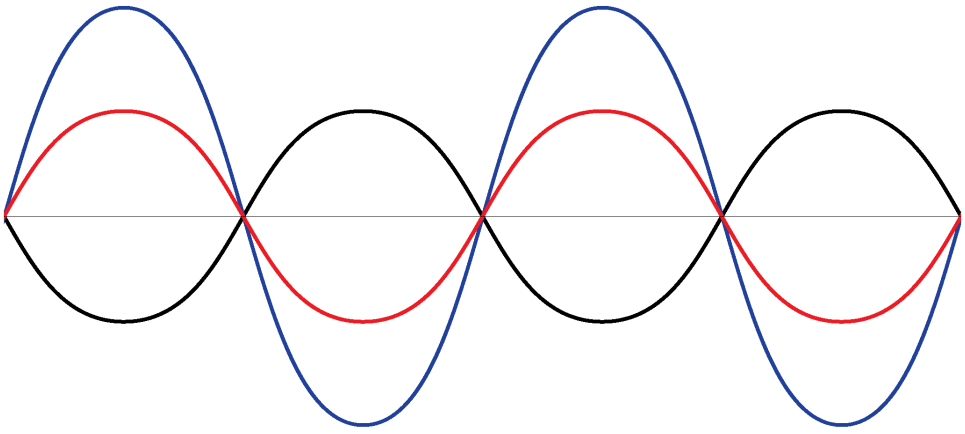
CT4432
10 kV High-Voltage Oscilloscope Probe, cTUVus Listed

User Manual



Cal Test ELECTRONICS

Notices

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Warranty

LIMITED ONE-YEAR WARRANTY

Cal Test Electronics, Inc warrants these products to be free from defective material or workmanship for a period of 1 year from the date of original purchase. Under this warranty, Cal Test Electronics, Inc is limited to repairing this product when returned to the factory, shipping charges prepaid, within the warranty period.

Units returned to Cal Test Electronics, Inc that have been subject to abuse, misuse, damage, or accident, or have been connected, installed, or adjusted contrary to the instructions furnished by Cal Test Electronics, Inc, or that have been repaired by unauthorized persons, will not be covered by this warranty.

Cal Test Electronics, Inc reserves the right to discontinue models, change specifications, price, or design of this device at any time without notice and without incurring any obligation whatsoever.

The purchaser agrees to assume all liabilities for any damages and/or bodily injury which may result from the use or misuse of this device by the purchaser, his employees, or agents.

THIS WARRANTY IS IN LIEU OF ALL OTHER REPRESENTATIONS OR WARRANTIES EXPRESSED OR IMPLIED AND NO AGENT OR REPRESENTATIVE OF CAL TEST ELECTRONICS, INC IS AUTHORIZED TO ASSUME ANY OTHER OBLIGATION IN CONNECTION WITH THE SALE AND PURCHASE OF THIS DEVICE.

Contents

Compliance Information

Safety

EC Declaration of Conformity - Low Voltage

Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive: 2014/35/EU.

EN 61010-031:2015 Ed 2.0. 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.

U.S. and Canadian Recognized Agency Certification

The probe is has been certified by TUV Rheinland Taiwan Ltd. (TUV) to conform to the following safety standard and bears the cTUVus mark.

IEC 61010-031:2015 Ed. 2.0. 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.

Environmental

Restriction of Hazardous Substances (RoHS 2)

The product and its accessories conform to the Directive 2011/65/EU (RoHS 2) on the restriction of the use of certain hazardous substances in electrical and electronic equipment, inclusive of any modification and addendum to said Directive.

EN ISO 63000:2018 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

China RoHS 2 refers to the Ministry of Industry and Information Technology Order No. 32, effective July 1, 2015. See “Hazardous Substances Disclosure Table” on page 19.

Product End-of-Life Handling

The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product’s end of life. To avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product to an appropriate system that will ensure that most of the materials are reused or recycled appropriately.

This product is subject to Directive 2012/19/EU of the European Parliament and the Council of the European Union on waste electrical and electronic equipment (WEEE), and in jurisdictions adopting that Directive, is marked as being put on the market after August 13, 2005, and should not be disposed of as unsorted municipal waste. Please utilize your local WEEE collection facilities in the disposition of this product.

Terms & Symbols

The following terms, symbols, and definitions, individually or combination may appear on the product or in this user manual.

Terms

CAUTION A caution statement calls attention to an operating procedure, practice, or condition, which, if not followed correctly, could result in damage to or destruction of parts or the entire product.

MISE EN GARDE Une mise en garde attire l'attention sur une procédure, une pratique ou une condition d'utilisation qui, si elles ne sont pas suivies correctement, pourraient endommager ou détruire une partie du produit ou le produit entier.

WARNING A warning statement calls attention to an operating procedure, practice, or condition, which, if not followed correctly, could result in injury or death to personnel.

AVERTISSEMENT Un avertissement attire l'attention sur une procédure, pratique ou condition de fonctionnement qui, si elles ne sont pas suivies correctement, pourraient entraîner des blessures, voire la mort de l'utilisateur.

NOTE A note statement calls attention to an operating procedure, practice, or condition, which, should be noted before proceeding.

REMARQUE Un énoncé de note attire l'attention sur une procédure, une pratique ou une condition d'exploitation, qui doit être notée avant de continuer.

Symbols

CAUTION – Statements or instructions that must be consulted in order to find out the nature of the potential hazard and any actions which must be taken.

WARNING - HIGH VOLTAGE - possibility of electric shock.

The Conformitè Europëenne (CE) Mark is the European Union's (EU) mandatory conformity marking for regulating the goods sold within the European Economic Area (EEA).

Safety Information

Usage Precautions

WARNING The high-voltage probe is designed to prevent accidental shock to the operator when properly used. This operating note must be read and understood prior to using the probe. Improper procedure or incorrect analysis of the measurement situation can result in serious shock.

AVERTISSEMENT La sonde haute tension est conçue pour éviter les chocs accidentels à l'opérateur lorsqu'elle est correctement utilisée. Cette notice d'utilisation doit être lue et comprise avant d'utiliser la sonde. Une procédure incorrecte ou une analyse incorrecte de la situation de mesure peut entraîner un choc grave.

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 to the safety precautions that are necessary to avoid possible injury when using such a device.

AVERTISSEMENT Cette sonde haute tension ne doit être utilisée que par du personnel formé, expérimenté ou autrement qualifié pour reconnaître les situations dangereuses et qui est formé aux précautions de sécurité nécessaires pour éviter les blessures possibles lors de l'utilisation d'un tel appareil.

WARNING When measuring higher frequency signals, be sure to comply with the Voltage vs Frequency Derating Curve. Do not apply to the input any potential that exceeds the maximum rating of the probe.

AVERTISSEMENT Lors de la mesure de signaux de fréquence plus élevée, assurez-vous de respecter la courbe de déclassement tension/fréquence. N'appliquez à l'entrée aucun potentiel qui dépasse la valeur nominale maximale de la sonde.

WARNING This high-voltage probe is designed for use with Measurement Category *other than* II, III and IV only (formally CAT I). Do not use the probe for measurements performed on circuits defined by any other measurement category or transient overvoltages of more than 1500 V. Refer to IEC Measurement Category Definitions on page 9 for a definition of measurement categories.

AVERTISSEMENT Cette sonde haute tension est conçue pour être utilisée avec des catégories de mesure autres que II, III et IV uniquement (anciennement CAT I). N'utilisez pas la sonde pour des mesures effectuées sur des circuits définis par une autre catégorie de mesure ou des surtensions transitoires de plus de 1 500 V. Reportez-vous à Définitions des catégories de mesure CEI à la page 9 pour une définition des catégories de mesure.

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.

AVERTISSEMENT Le fil de terre est essentiel au fonctionnement sûr de la sonde. Le non-respect de cette connexion lors de mesures à haute tension peut entraîner des blessures corporelles ou endommager la sonde ou l'oscilloscope. Cette connexion doit toujours être effectuée AVANT que la pointe de la sonde n'entre en contact avec la haute tension et ne doit pas être retirée tant que la pointe de la sonde n'a pas été retirée de la source haute tension.

WARNING Do not exceed 60 seconds of contact between the probe and the circuit-under-test when measuring voltages ≥8 kV DC, ≥5 kV ACrms, or ≥15 kVpk-pk AC. It is recommended to wait 5 minutes between measurements.

AVERTISSEMENT Ne pas dépasser 60 secondes de contact entre la sonde et le circuit à tester lors de la mesure de tensions ≥8 kV DC, ≥5 kV ACrms ou ≥15 kVpk-pk AC. Il est recommandé d'attendre 5 minutes entre les mesures.

WARNING Hands, shoes, floor, and work bench must be dry. Avoid making measurements under humidity, dampness, or other environmental conditions that might affect safety.

AVERTISSEMENT Les mains, les chaussures, le sol et l'établi doivent être secs. Évitez d'effectuer des mesures dans des conditions d'humidité, d'humidité ou d'autres conditions environnementales susceptibles d'affecter la sécurité.

WARNING To avoid injury, remove jewelry such as rings, watches, and other metallic objects. Do not touch exposed connections and components when power is present.

AVERTISSEMENT Pour éviter les blessures, retirez les bijoux tels que bagues, montres et autres objets métalliques. Ne touchez pas les connexions et composants exposés lorsque l'alimentation est présente.

WARNING Do not work alone when working with high-Voltage Circuits.

AVERTISSEMENT Ne travaillez pas seul lorsque vous travaillez avec des circuits à haute tension.

WARNING The probe is designed to be used in office-type indoor environments.

- Do not operate in the presence of noxious, corrosive, flammable fumes, gases, vapors, chemicals, or finely-divided particulates.
- Hands, shoes, floor, and workbench must be dry. Avoid making measurements under humid, damp, or other environmental conditions that might effect the safety of the measurement situation.
- The probe body should be kept clean and free of any conductive contamination. Refer to the section on cleaning.

AVERTISSEMENT La sonde est conçue pour être utilisée dans des environnements intérieurs de type bureau.

- Ne pas utiliser en présence de fumées nocives, corrosives, inflammables, de gaz, de vapeurs, de produits chimiques ou de particules finement divisées.

- Les mains, les chaussures, le sol et l'établi doivent être secs. Évitez d'effectuer des mesures dans des conditions environnementales humides, humides ou autres qui pourraient affecter la sécurité de la situation de mesure.
- Le corps de la sonde doit être maintenu propre et exempt de toute contamination conductrice. Reportez-vous à la section sur le nettoyage.

WARNING To reduce the risk of shock or fire:

- Connect the probe to the oscilloscope before connecting probe to the circuit under test. Disconnect the probe input from the circuit before disconnecting the probe from the oscilloscope.
- Do not exceed the voltage rating category rating of the probe. Use only accessories provided with probe.

- Keep finger behind the finger guard of the probe body.
- For your own safety, inspect the probe for cracks and frayed or broken leads before each use. If defects are noted, DO NOT use the probe.
- Keep the probe's output cables away from the circuit under test, as they are not intended to be in contact with these circuits.

AVERTISSEMENT Pour réduire le risque de choc ou d'incendie:

- Connectez la sonde à l'oscilloscope avant de connecter la sonde au circuit à tester. Déconnectez l'entrée de la sonde du circuit avant de déconnecter la sonde de l'oscilloscope.
- Ne dépassez pas la catégorie de tension nominale de la sonde. Utilisez uniquement les accessoires fournis avec la sonde.
- Gardez le doigt derrière le protège-doigts du corps de la sonde.
- Pour votre propre sécurité, inspectez la sonde à la recherche de fissures et de fils effilochés ou cassés avant chaque utilisation. Si des défauts sont constatés, NE PAS utiliser la sonde.
- Gardez les câbles de sortie de la sonde éloignés du circuit à tester, car ils ne sont pas destinés à être en contact avec ces circuits.

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

AVERTISSEMENT Il est conseillé d'éteindre la source haute tension avant de connecter ou de déconnecter la sonde. Éteindre la source haute tension.

WARNING Do not attempt to take measurements where the source and the test instrument chassis or return lead is not properly grounded.

AVERTISSEMENT N'essayez pas de prendre des mesures lorsque la source et le châssis de l'instrument de test ou le câble de retour ne sont pas correctement mis à la terre.

IEC Measurement Category & Pollution Degree Definitions

Measurement Category (CAT) - classification of testing and measuring circuits according to the types of mains circuits to which they are intended to be connected.

Measurement Category *other than* II, III, or IV: circuits that are not directly connected to the mains supply.

Measurement Category II (CAT II): test and measuring circuits connected directly to ultilzation points (socket outlets and similar prints) of the low-voltage mains installation..

Measurement Category III (CAT III): test and measuring circuits connected to the distribution part of a building's low-voltage mains installation.

Measurement Category IV (CAT IV): test and measuring circuits connected at the source of the building's low-voltage mains installation.

Pollution - addition of foreign matter, solid, liquid, or gaseous (ionized gases) that may produce a reduction of dielectric strength or surface resistivity.

Pollution Degree 2 (P2)- only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is expected.

Introduction

Overview

The Cal Test CT4432 High-Voltage divider probe can be used with analog or digital oscilloscopes that have an input resistance of 1 MΩ (±1%) and nominal input capacitance between 5 and 50 pF. The CT4432 is a 1000:1 divider which extends the voltage measurement capability to 7 kV ACrms.

Features of the probe:

- Up to 10 kV (DC + ACpeak) or 7 kV (ACrms)
- 40 MHz bandwidth (-3dB)
- ±3% accuracy
- IEC/EN 61010-031

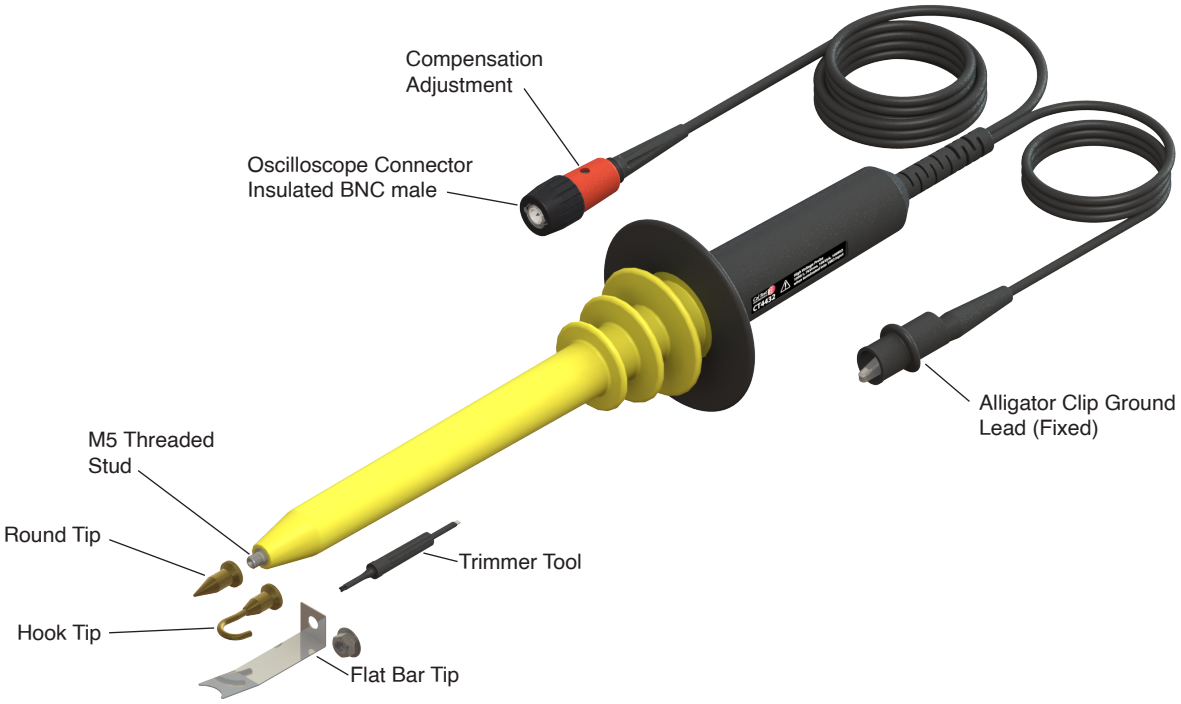


Figure 1 Probe and Supplied Accessories

Supplied Accessories

Table 1 CT4432 Accessory Replacements

Accessory	Model No.	Quantity
Round Tip	CT2960A	1
Hook Tip	CT2961A	1
Flat Bar Tip	CT2962A	1
Deluxe Trimmer Tool	CT3648	1

Using Accessories

Round Tip & Hook Tip

Thread either the Round Tip or the Hook Tip onto the probe's M5 tip stud and securely hand-tighten.

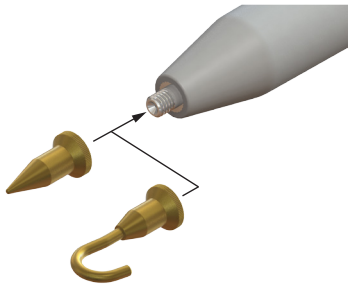


Figure 2 Attaching the Round and Hook Tips

Flat Bar Tip

The end of the Flat Bar Tip can be clamped to the device-under-test (DUT). To secure the Flat Bar Tip to the probe, use the supplied M5 flange nut (8 mm wrench or nut driver) as show in Figure 3.

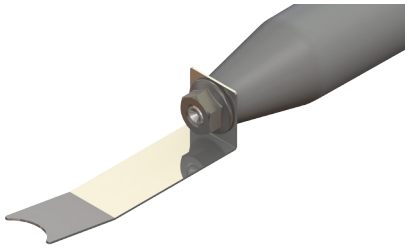


Figure 3 Attaching the Flat Bar Tip

Optional Accessory

For connecting the probe to a Digital Multimeter (DMM) you can use the CT3197B High-Voltage Probe BNC Converter. The high-voltage probe converter allows impedance matching of the probe's 1 MΩ output to a DMM's 10 MΩ input. Usable with most quality DMMs, you can order this converter separately.

Figure 4 CT3197B High-Voltage Probe BNC Converter

Measurement Instructions

⚠ Before connecting the probe for your measurement, read all the warnings in this section and all of the warnings in the section “Safety Information” on page 6.

Frequency compensate the probe to your oscilloscope prior to usage. See “Frequency Compensation” on page 14.

Steps

1. Whenever possible, turn the high-voltage source off before making any connections.
2. Connect the alligator ground clip lead to a good earth ground or reliable chassis ground.
3. Connect the probe’s BNC connector to the oscilloscope’s BNC output.
4. On the oscilloscope, select the desired volts/division range. If the oscilloscope has probe attenuation ration setting, set it to 1000:1, if available.

WARNING Before turning on the high voltage source, make sure that no part of the person holding the prove is touching the device under test.

AVERTISSEMENT Avant d’allumer la source haute tension, assurez-vous qu’aucune partie de la personne tenant la preuve ne touche l’appareil à tester.

5. After confirming that the probe operator is not touching the device under test, turn on the high-voltage source.
6. Measure the voltage under test and observe the waveform on the oscilloscope.

WARNING Remember the actual voltage is 1000 times greater than the oscilloscope waveform if the probe attenuation has not been set to 1000:1.

AVERTISSEMENT N’oubliez pas que la tension réelle est 1000 fois supérieure à la forme d’onde de l’oscilloscope si l’atténuation de la sonde n’a pas été réglée sur 1000:1.

7. Turn off the high voltage source.
8. Disconnect the probe tip from the high-voltage source.
9. Disconnect the probe’s ground clip lead.

WARNING Disconnect the probe tip from the high voltage source BEFORE disconnecting the alligator ground clip lead.

AVERTISSEMENT Déconnectez la pointe de la sonde de la source haute tension AVANT de déconnecter le fil de la pince de masse crocodile.

WARNING Do not exceed 60 seconds of contact between the probe and the circuit-under-test when measuring voltages ≥8 kV DC, ≥5 kV ACrms, or ≥15 kVpk-pk AC. It is recommended to wait 5 minutes between measurements.

AVERTISSEMENT Ne pas dépasser 60 secondes de contact entre la sonde et le circuit à tester lors de la mesure de tensions ≥8 kV DC, ≥5 kV ACrms ou ≥15 kVpk-pk AC. Il est recommandé d'attendre 5 minutes entre les mesures.

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

AVERTISSEMENT N'essayez pas de prendre des mesures à partir de sources où le châssis ou le câble de retour ne sont pas mis à la terre.

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.

AVERTISSEMENT Le fil de terre est essentiel au fonctionnement sûr de la sonde. Le non-respect de cette connexion lors de mesures à haute tension peut entraîner des blessures corporelles ou endommager la sonde ou l'oscilloscope. Cette connexion doit toujours être effectuée AVANT que la pointe de la sonde n'entre en contact avec la haute tension et ne doit pas être retirée tant que la pointe de la sonde n'a pas été retirée de la source haute tension.

WARNING Do not connect the ground clip to the high voltage source or the probe tip to the ground for any reason.

AVERTISSEMENT Ne connectez pas la pince de mise à la terre à la source haute tension ou la pointe de la sonde à la terre pour quelque raison que ce soit.

WARNING Do not make any floating measurements with the probe.

AVERTISSEMENT Ne faites aucune mesure flottante avec la sonde.

Frequency Compensation

Use the following frequency compensation adjustments to compensate the probe for the oscilloscope's input capacitance. You should preform this adjustment whenever you connect the probe to a different oscilloscope input channel or to a different oscilloscope.

Low Frequency Compensation Adjustment

1. Connect the probe to the oscilloscope.
2. Connect the probe tip to a square-wave function generator.
3. Adjust the function generator's output to square-wave, 200 Hz frequency and 10 V amplitude.
4. Adjust the oscilloscope time base for approximately 2 ms/div so that you can see several waveform cycles.
5. Using supplied trimmer tool, adjust the Low Frequency Adjustment Point (Figure 5) for the flattest square-wave top. Figure 6 shows the correctly compensated waveform.

Figure 5 Low Frequency Adjustment Point

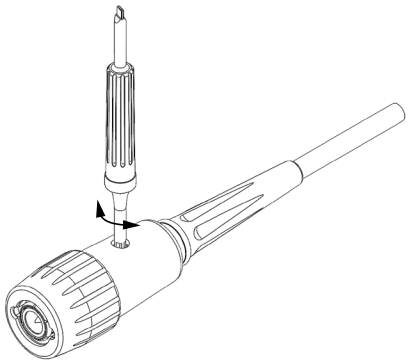
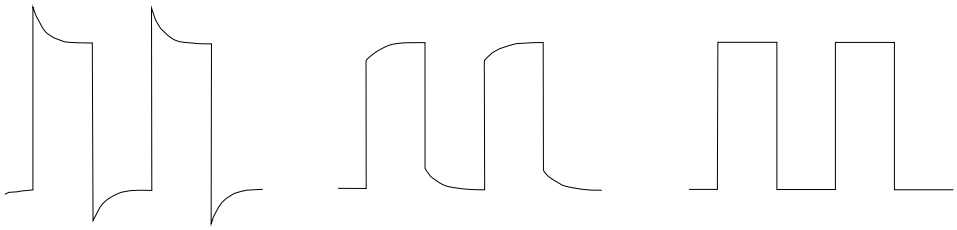


Figure 6 Frequency Compensation Waveforms



Specifications

The probe and oscilloscope should be warmed up for at least 20 minutes before any testing and the environmental conditions should not exceed the probe's specified limits.

NOTE All entries included in the following tables are characteristics unless otherwise stated.

REMARQUE Toutes les entrées incluses dans les tableaux suivants sont des caractéristiques, sauf indication contraire.

Table 2 Safety Specifications

Parameter	Condition
IEC/EN 61010-031:2015	Measurement Category *other than* II, III, or IV (formally CAT I)

Table 3 Electrical Specifications (Not Warranted)

Parameter	Characteristic
Maximum Input Voltage	10 kV (DC + ACpeak) 7 kV (ACrms)
Maximum Loading Current	100 μA
Attenuation	1000x
Bandwidth	DC to 40 MHz (-3 dB)
Rise Time	≤ 8.8 ns
Input Resistance	100 MΩ ± 5%
Input Capacitance	2.0 pF
Accuracy	± 3% (below 10 kV) DC ± 3% at 1 kHz VAC ± 3 dB 0 to 40 MHz VAC
Temperature Coefficient	≤ 200 ppm/°C
Compensation Range	5 pF to 50 pF

Table 4 Mechanical Specifications

Parameter	Characteristic
Alligator Clip Lead Length	1 m (39”)
BNC Cable Length	2 m (6.6 ft)
Operating Temperature	0°C to 50°C (32°F to 122°F)
Storage Temperature	-20°C to 70°C (-4°F to 158°F)
Humidity	≤ 80% RH @ 40°C (104°F)
Dimensions	340 mm length, 75 mm wide, 75 mm hight
Weight	250 g (0.55 lb)

Voltage Derating

The following graph shows the voltage verses frequency derating curve for the probe.

WARNING When measuring higher frequency signals, be sure to comply with the Voltage vs Frequency Derating Curve. Do not apply to the input any potential that exceeds the maximum rating of the probe.

AVERTISSEMENT Lors de la mesure de signaux de fréquence plus élevée, assurez-vous de respecter la courbe de déclassement tension/fréquence. N'appliquez à l'entrée aucun potentiel qui dépasse la valeur nominale maximale de la sonde.

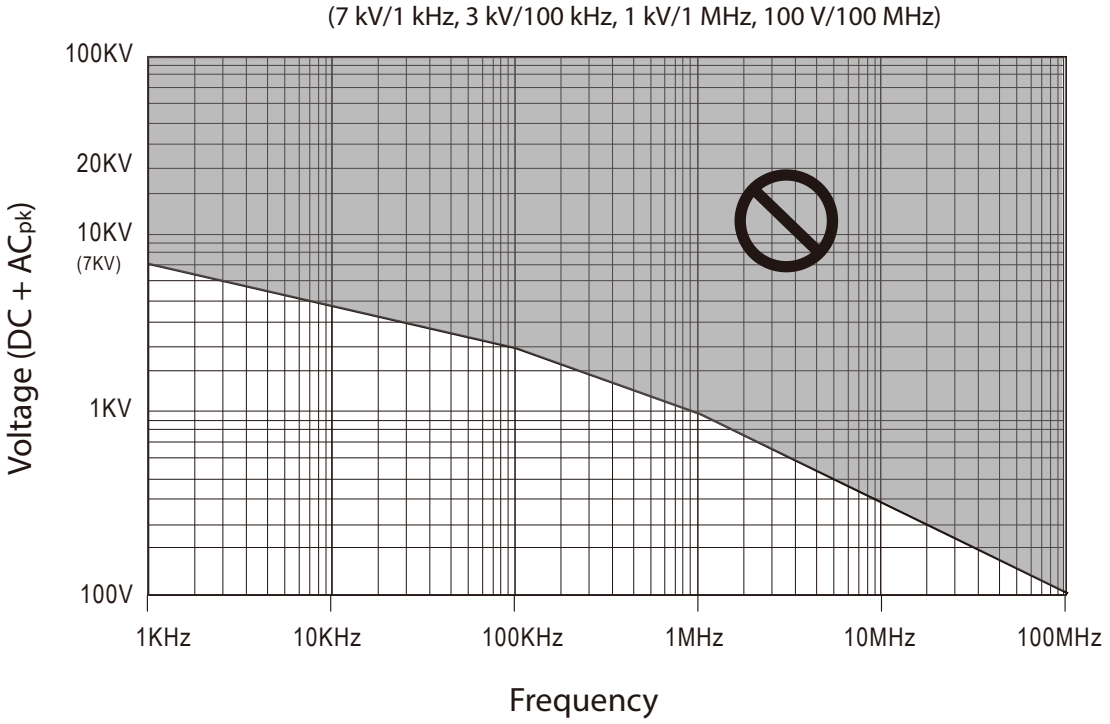


Figure 7 Voltage Derating Curve

Cleaning

Clean only the exterior probe body and cables. Use a soft cotton cloth light 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.

AVERTISSEMENT Séchez soigneusement la sonde avant d'essayer d'effectuer des mesures de tension.

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

MISE EN GARDE Ne soumettez pas la sonde à des solvants ou à des vapeurs de solvants car ceux-ci peuvent détériorer le corps de la sonde et les câbles.

China RoHS 2

Hazardous Substances Disclosure Table

China RoHS 2 refers to the Ministry of Industry and Information Technology Order No. 32, effective July 1, 2015, titled Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products. To comply with China RoHS 2, we determined this product's Environmental Protection Use Period (EPUP) to be 25 years in accordance with the Marking for the Restricted Use of Hazardous Substances in Electronic and Electrical Products, SJT 11364.

中國 RoHS 2 指工業和信息化部令第 32 號，自 2015 年 7 月 1 日起生效，題為《電氣電子產品有害物質限制使用管理辦法》。為符合中國 RoHS 2，我們根據電子電氣產品有害物質限制使用標誌 SJT 11364 將本產品的環保使用期限 (EPUP) 確定為 25 年。

Part Name 零件名稱	Hazardous Substance 有害物質					
	Lead (Pb) 鉛	Mercury (Hg) 汞	Cadmium (Cd) 鎘	Hexavalent Chromium (Cr (VI)) 六價鉻	Polybrominated biphenyls (PBB) 多溴聯苯	Polybrominated diphenyl ethers (PBDE) 多溴二苯醚
Printed Circuit Board Assemblies 印刷電路板組件	X	O	O	O	O	O
Electrical Components 電氣元件	X	O	O	O	O	O
Metal Components 金屬部件	X	O	O	O	O	O
Plastic Components 塑料部件	O	O	O	O	O	O

This table is made per guidance of SJ/T 11364.
該表是根據 SJ/T 11364 的指南製作的。

O: Indicates that this hazardous substance contained in all of the homogeneous materials for the part is below the limit requirement in GB/T 26572.

O: 表示該有害物質在該部件的所有均質材料中的含量低於 GB/T 26572 中的限量要求。

X: Indicates that this hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572.

X: 表示該有害物質在用於該部件的至少一種均質材料中的含量高於 GB/T 26572 中的限量要求。

Electronic Format Only

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