

CT4200 Series
Passive Voltage Oscilloscope Probes

CT4200 Series Oscilloscope Probe User Manual

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Safety Summary

To avoid personal injury and/or product damage, review and comply with the following safety precautions. These precautions apply to both operating and maintenance personnel and must be followed during all phases of operation, service, and repair of this probe.



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.



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.

Comply with Voltage Derating Curve

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.

Dry Conditions

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

Hazardous Contact

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

Use Only in Office-Type Indoor Setting

These probes are 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.
- In environments where there is a danger of any liquid being spilled on the probe.
- In air temperatures exceeding the specified operating temperatures.
- In atmospheric pressures outside the specified altitude limits or where the surrounding gas is not air.

Only Qualified Personnel

These probes are intended for personnel who are trained, experienced, or otherwise qualified to recognize hazardous situations and who are trained in the safety precautions necessary to avoid possible injury when using such a device.

Must be Grounded

Use only with test instruments having their BNC input connected to earth ground. Always properly ground the oscilloscope probe with its ground lead before connecting to circuits. Always disconnect the probe from circuits before disconnecting the ground lead. Do not connect the probe ground lead to any point which is at a potential other than earth ground.

Cleaning

Use a soft cotton cloth lightly moistened with a mild solution of detergent and water. Do not allow any portion to be submerged at any time. Dry thoroughly before attempting to make voltage measurements. Do not use solvents or solvent fumes as they may cause deterioration or damage.

Compliance and Certifications

CE Compliance

This product meets the essential requirements of the applicable European Directives as follows:

- 2014/30/EU: Electromagnetic Directive (EMC)
- 2014/35/EU: Low-Voltage Directive (safety)
- 2011/65/EU: Restriction of Hazardous Substances Directive (RoHS)

Safety

This product meets the follow standard(s) of safety for electrical equipment for measurement, control and laboratory use:

- IEC/EN 61010-031:2015

Disposal





(Applicable in the European Union and other European countries with separate collection systems). 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 and Symbols

The following symbols may appear on the product or in its documentation:

 Direct current

 Both direct and alternating current

 Caution, possibility of electric shock

 Caution, see documentation for details

 Earth ground

Definitions

MEASUREMENT CATEGORY - classification of testing and measuring circuits according to the types of mains circuits to which they are intended to be connected.

MEASUREMENT CATEGORY II (CAT II) - measuring circuits connected directly to utilization points of the low-voltage mains installation Assemblies without a **MEASUREMENT CATEGORY (0)** - measuring circuits not directly connected to the mains supplies.

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 - only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is expected.

Introduction

The CT4200 Series of high impedance, passive voltage oscilloscope probes are designed for use with most general-purpose oscilloscopes. Their miniature 2.5 mm size provides easy probing of today's high density circuits. The series includes 1x, 10x, 20x, and 100x attenuation ratio models interfacing with scopes having either 1 M Ω or 50 Ω input impedances. Bandwidths range from 55 MHz up to 1.5 GHz. Each probe comes complete with a full range of performance accessories.



WARNING Do not exceed the voltage or category rating of the probe (See voltage derating curve on page 16).

WARNING For probe assemblies which do not have a rating for MEASUREMENT CATEGORY II, do not use for measurements on mains circuits.

Table 1: Probe Models

Model	Attn.	Input Impedance		B/W	Rise Time	Max Input Voltage (AC RMS)	Scope Input	Comp. range
		R	C					
CT4200	1x	1 M Ω	39 pF	55 MHz	6.36 ns	55 V CAT II ^b	1 M Ω	- ^e
CT4201	10x	10 M Ω	10 pF	200 MHz	1.75 ns	400 V ^a 300 V CAT II ^b	1 M Ω	10-25 pF
CT4202	10x	10 M Ω	10 pF	350 MHz	1.0 ns	400 V ^a 300 V CAT II ^b	1 M Ω	10-25 pF
CT4203	10x	10 M Ω	10 pF	500 MHz	0.7 ns	400 V ^a 300 V CAT II ^b	1 M Ω	10-25 pF
CT4204	10x	500 Ω	1.8 pF	1.5 GHz	0.24 ns	8.5 V ^c	50 Ω	-
CT4205	20x	20 M Ω	7.6 pF	500 MHz	0.7 ns	400 V ^a 300 V CAT II ^b	1 M Ω	7-25 pF
CT4206	100x	5 k Ω	2.2 pF	1.5 GHz	0.24 ns	21 V ^c	50 Ω	-
CT4207 ^d	10x	10 M Ω	10 pF	700 MHz	0.5 ns	400 V ^a 300 V CAT II ^b	1 M Ω	10-25 pF

a: Without a Measurement Category; 1250 V transient overvoltage

b: Measurement Category II

c: Without a Measurement Category; 0 V transient overvoltage

d: This probe is specifically designed to operate with the Keysight InfiniiVision® X Series oscilloscopes with 1 M Ω impedance

e: This probe is designed to work with oscilloscopes with an input capacitance around 15 pF

*Keysight and InfiniiVision are trademarks of Keysight Technologies, inc.

Initial Inspection

This unit is tested prior to shipment. It is therefore ready for immediate use upon receipt. An initial inspection should be made to ensure that no damage has been sustained during shipment. After the inspection, verify the contents of the shipment.

Probe Compensation

Proper compensation of the probe is required to assure amplitude accuracy of the waveform being measured by matching the probe to the oscilloscope's input capacitance. Low frequency compensation should be adjusted whenever the probe is connected to or transferred between oscilloscopes.

Procedure:

Low Frequency (LF):

- Apply a 1 kHz square wave to the probe or connect to the oscilloscope's calibrator output.
- Adjust the trimmer located on the probe body (LF) for a flat topped square.

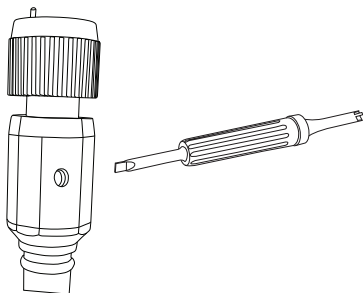


Figure 1: LF Compensation

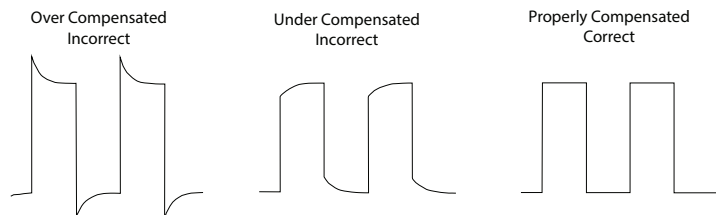


Figure 2: LF Waveform Compensation

High Frequency (HF):

(Should seldom be required, however, if adjustment is necessary)

- Apply a 1 MHz square wave to the probe (< 0.7 ns rise-time).
- Adjust trimmers located on the BNC box (HF) for a flat-topped square wave.

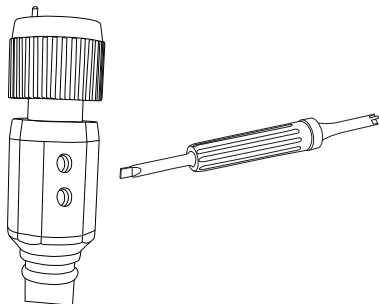
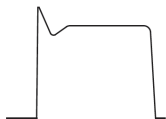


Figure 3: HF Compensation

Over Compensated
Incorrect



Under Compensated
Incorrect



Properly Compensated
Correct



Figure 4: HF Waveform Compensation

Accessories

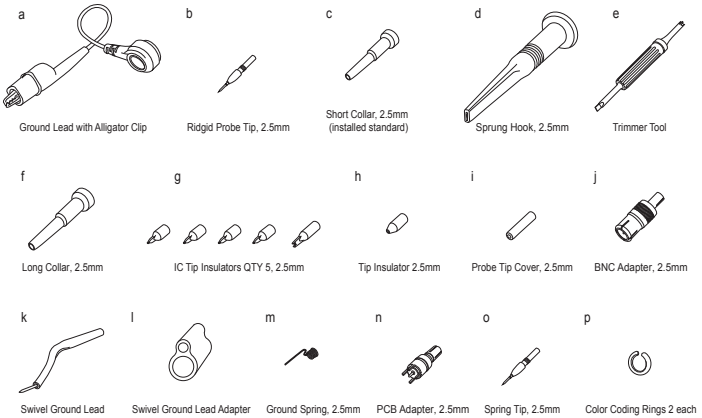


Figure 5: Accessory Diagram

Table 2: List of Included Accessories

<i>Item</i>	<i>CT Part #</i>	<i>Description</i>	<i>Quantity</i>	CT4200 CT4204 CT4206	CT4201 CT4202 CT4203 CT4205 CT4207
a	CT4208-10-8	Ground Lead w/ Alligator Clip	1	✓	✓
b	CT4209-0	Rigid Probe Tip	2	✓	✓
c	CT4208-8	Short Collar, 2.5 mm	1	✓	✓
d	CT4211-8	Sprung Hook, 2.5 mm	1	✓	✓
e	CT4212	Trimmer Tool	1	-	✓
f	CT4213-8	Long Collar, 2.5 mm	1	✓	✓
g	CT4214	IC Tip Insulators, 2.5 mm	5	✓	✓
h	CT4215-0	Tip insulator, 2.5 mm	1	✓	✓
i	CT4216-8	Probe Tip Cover, 2.5 mm	1	✓	✓
j	CT4217	BNC Adapter, 2.5 mm	1	✓	✓
k	CT3649	Swivel Ground Lead	1	✓	✓
l	CT4218-8	Swivel Ground Lead Adapter	1	✓	✓
m	CT4219	Ground Spring, 2.5 mm	1	✓	✓
n	CT4220	PCB Adapter, 2.5 mm	1	✓	✓
o	CT4221-0	Spring Tip, 2.5 mm	1	✓	✓
p	CT4222	Color Coding Rings (Blue, Green, Red, Yellow)	2 each	✓	✓

Probes come assembled with Rigid Probe Tip, Ground Lead with Alligator Clip, Short Collar, and Probe Tip Cover.

To use or replace accessories use the following guides.

Probe Tips

The rigid and the spring loaded probe tips screw into the probe end. The rigid probe tips are black while the spring loaded tips are gray. The spring loaded tips help to reduce susceptibility to slight movements and work equally well whether partially or completely compressed.

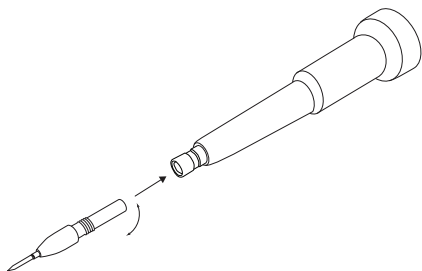


Figure 6: Probe Tip Attachment

Sprung Hook

The sprung hook snaps directly onto the probe, over the probe tip and the short collar. Push firmly until you feel it snap into place. If the sprung hook is not snapped into place it could fall off or significantly degrade signal quality during measurements.

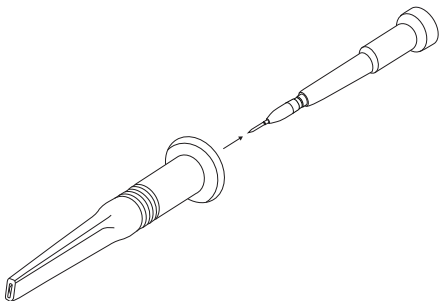


Figure 7: Sprung Hook Attachment

Tip Insulators

The tip insulator and IC insulators slide directly over the rigid or spring loaded probe tip and provide protection from shorts when taking measurements in sensitive locations.

The IC tip insulators align the probes to individual IC pins. The different colors correspond to different IC chip pitches.

Color	Pitch
Green	0.5 mm
Blue	0.65 mm
Gray	0.8 mm
Brown	1 mm
Black	1.27 mm

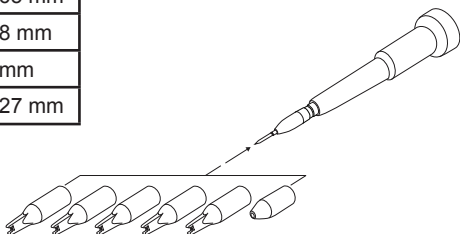


Figure 8: Tip Insulator Attachment

Ground Spring

The ground spring slides onto the probe directly over the probe tip and offers very low inductance.

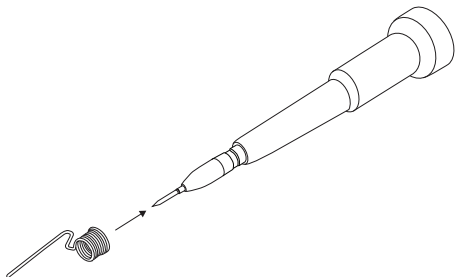


Figure 9: Ground Spring Attachment

BNC Adapter

The BNC adapter slides directly over the rigid or the spring loaded tip by pressing until the adapter end meets the plastic collar.

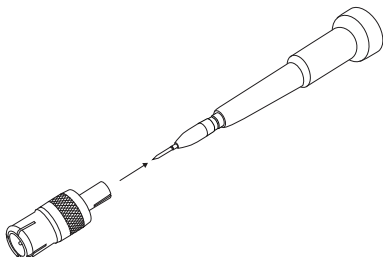


Figure 10: BNC Adapter Attachment

Ground Lead w/ Alligator Clip

The ground lead slides directly over the probe tip once the short collar is unscrewed and removed. This ground can reach locations much further with its 15 cm lead. The added length means added inductance and this must be taken into account for accurate measurements.

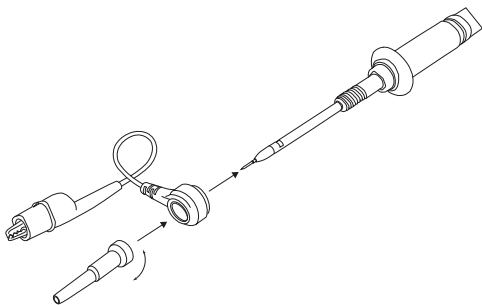


Figure 11: Ground Lead w/ Alligator Clip Attachment

Swivel Ground Lead

To attach the swivel ground lead, the short collar is removed as well as any other ground attachment currently connected. Slide the swivel ground lead adapter onto the probe then screw the short collar back. Press the swivel ground lead directly into the smaller opening of the swivel ground adapter. Position as needed for measurement.

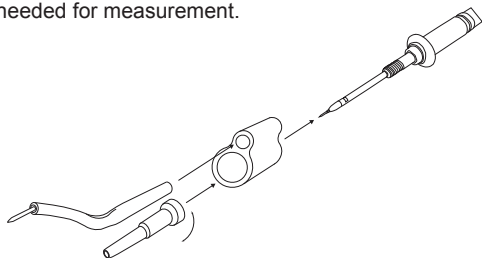


Figure 12: Swivel Ground Lead

PCB Adapter

The PCB adapter is intended to be soldered directly onto a PCB for a high performance test point .

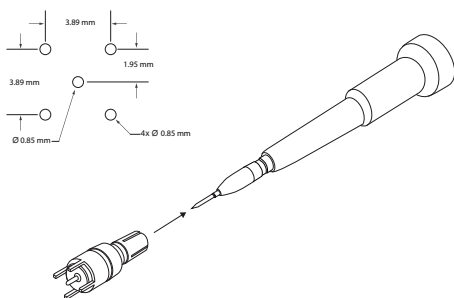


Figure 13: PCB Adapter Attachment

Specifications

All specifications apply to the unit after a temperature stabilization time of 20 minutes over an ambient temperature range of $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

Table 3: Mechanical Characteristics

Mechanical Characteristics	
Weight	48.5-53.5 g
Cable Length	1.3 m
Probe Barrel Diameter	2.5 mm

Table 4: Environmental Characteristics

Environmental Characteristics	
Operating Temp/Humidity	0°C to 50°C
Storage Temp/Humidity	-30°C to 70°C
Operating Altitude	Up to 3000 meters
Humidity	5% to 95% RH (10°C to 30°C) 5% to 75% RH (30°C to 40°C) 5% to 50% RH (above 40°C)
Pollution Degree	2

Table 5: Safety Specifications

Safety Specifications
Low Voltage Directive (2014/35/EU)
IEC/EN 61010-031:2015

Specifications are subject to change without notice. To ensure the most current version of this manual, please download the current version from our website: caltestelectronics.com.

Voltage Derating Curve

The derating curve of the absolute maximum input voltage in common mode is shown as follows:

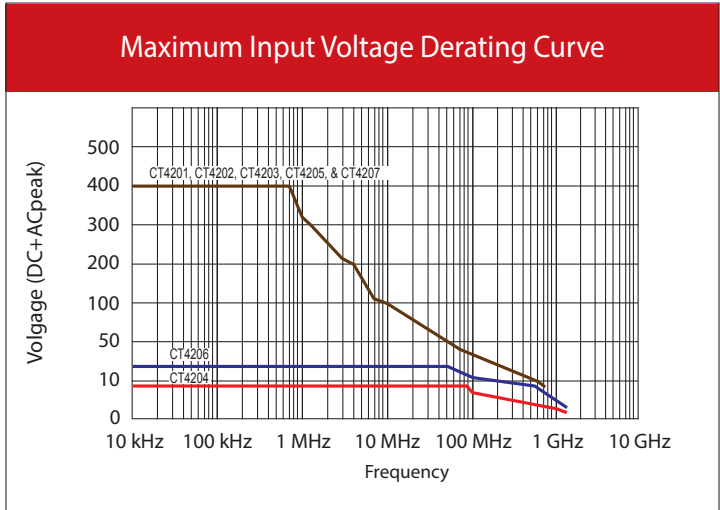


Figure 14: Voltage Derating Curve

Input Impedance Curve

The input impedance as a function of frequency:

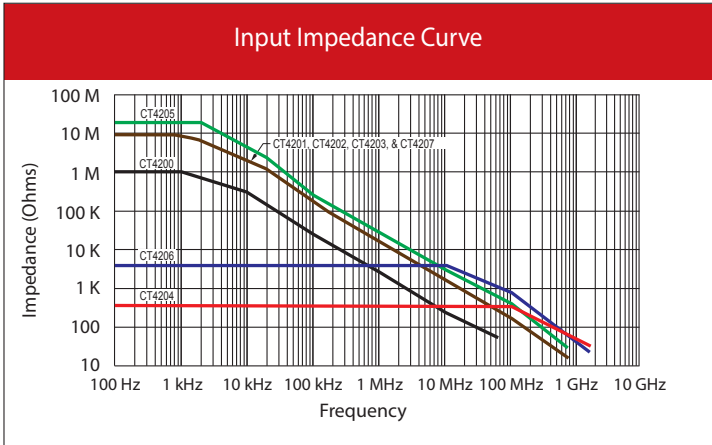


Figure 15: Input Impedance Curve

Cleaning

This probe does not require any particular cleaning. If necessary, clean the case with a soft cloth.



WARNING Dry the probe thoroughly before attempting to make voltage measurements



CAUTION Avoid immersing or using abrasive cleaners or solvents containing Benzene (or similar solvents) on the probe as these can cause deterioration of the probe body and cables.

Service & Warranty Information

Limited One-Year Warranty

Cal Test Electronics 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 is limited to repairing this product when returned to the factory, shipping charges prepaid, within the warranty period.

Units returned to Cal Test Electronics 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, or that have been repaired by unauthorized persons, will not be covered by this warranty.

Cal Test Electronics 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 is authorized to assume any other obligation in connection with the sale and purchase of this device.

Service

If you have a need for calibration or repair services, technical, or sales support, please contact us:

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Notes

