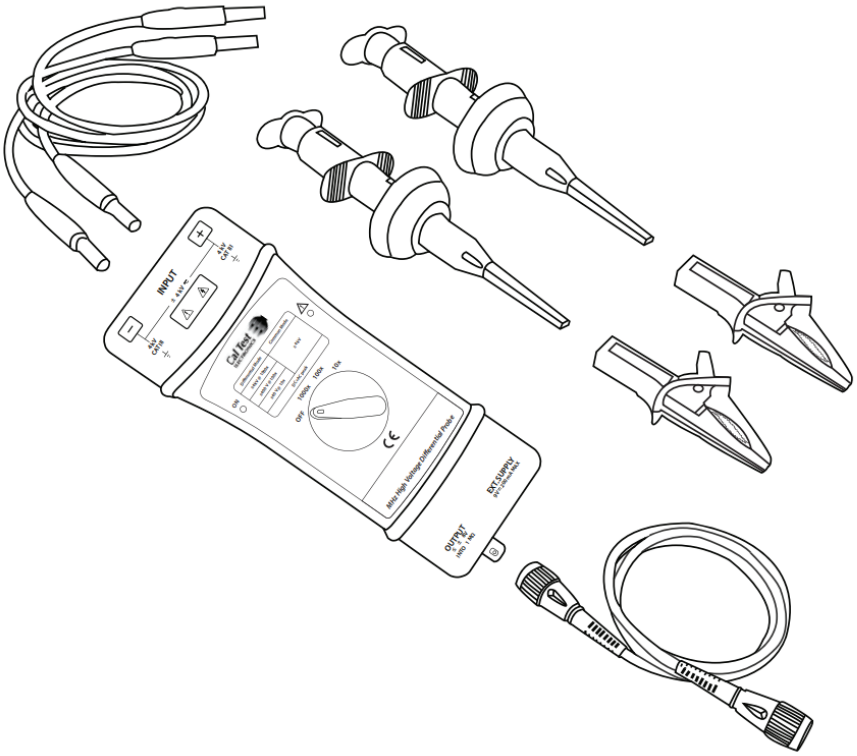
Cal Test ELECTRONICS



CT4197
CT4198
User Manual

CT4197 and CT4198 Differential Probes User's Manual

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.

Do Not Work Alone

Do not work alone when working with high voltages.

Inspect the Probe

Inspect the probe and accessories for cracks and frayed or broken leads before each use. If defects or damages are noted, DO NOT USE 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.

Do Not Remove the Probe's Casing

Removal of the probe's casing may expose you to electric shock. If necessary, disconnect the inputs and outputs of the probe before opening the case.

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.

Unexpected Charges

Hazardous voltages may be present in unexpected locations in circuitry being tested when a fault condition in the circuit exists.

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

Use Only in Office-Type Indoor Setting

The probe is designed to be used in office-type indoor environments. Do not operate the probe:

- 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.

Not for Critical Applications

This probe is not authorized for use in contact with the human body or for use as a component in a life-support device or system.

Do Not Substitute Parts

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

Only Qualified Personnel

Only qualified personnel should use this probe. This differential voltage probe is designed to be used by 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.

Observe Maximum Working Voltage

Do not use any probe above its maximum working voltage ranges. See “Electronic Characteristics” on page 11.

Use Proper Power Source

Do not operate this probe from a power source that applies more than the voltage specified.

Must be Grounded

This probe is grounded by the shell of the BNC connector through the grounding conductor of the power cord of the measurement instrument. Before making connections to the input leads of this probe, ensure that the output BNC connector is attached to the BNC connector of the measurement instrument, and that the measurement instrument is properly grounded. Whenever it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.

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 Substance Directive (RoHS)

Electromagnetic Compatibility

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

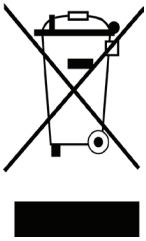
- IEC/EN 61326-1
- IEC/EN 55011

Safety

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

- IEC/EN 61010-1

Disposal of Old Electrical & Electronic Equipment



(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 and otherwise observe all applicable requirements.

This probe is in compliance with IEC-61010-031 CAT II, Pollution Degree 2.

Terms and Symbols

The following symbols 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
⧈	Double insulation
⏚	Earth Ground

Definitions

Measurement Category II (CAT II) - refers to local-level electrical distribution, such as that provided by a standard wall outlet or plug-connected equipment. Examples of CAT II measurements would be household appliances, portable tools, and similar modules.

Measurement Category III (CAT III) - refers to measurements on hard-wired equipment in fixed installations, distribution boards, and circuit breakers that form part of a building wiring installation. Other examples are wiring, including cables, bus bars, junction boxes, switches, socket outlets in the fixed installation, and stationary motors with permanent connections to fixed installations

Pollution Degree 2 - refers to an operation environment where normally only dry, non-conductive pollution occurs. Temporary conductivity caused by condensation can be expected.

Working CAT rating is equal to that of the lowest rated element within the test set-up.

1 Introduction

Overview

The CT4197 and CT4198 differential probes allow safe, accurate measurements between two voltage points where neither point is referenced to ground. Both offer a 50 MHz bandwidth, and they are compatible with oscilloscopes from all major manufacturers. The probes are exclusively powered by the included 9 V power adapter.

Features

- Meets IEC 61010-1 safety standard
- Selectable attenuation settings: 10x, 100x, and 1000x (CT4197) and 20x, 200x, and 2000x (CT4198)
- 50 MHz bandwidth (CT4197 and CT4198)
- Up to ±4 kV (DC + ACpeak) common mode (CT4197) and ±8 kV (DC + ACpeak) common mode (CT4198)
- High accuracy (±2%)
- Power indicator LED
- Over range indicator LED

Initial Inspection

These units are tested prior to shipment. They are therefore ready for immediate use upon receipt. An initial physical inspection should be made to ensure that no damage has been sustained during shipment. After the inspection, verify the contents of the shipment. The included accessories for this product are:

- Differential probe
- (2) High voltage hook probes, black & red
- (2) Alligator clips, black & red
- (2) 4 mm sheathed banana plug test leads, black and red
- Insulated BNC cable, 100 cm
- 9 V power adapter
- User manual

2 Product Overview

Probe Description

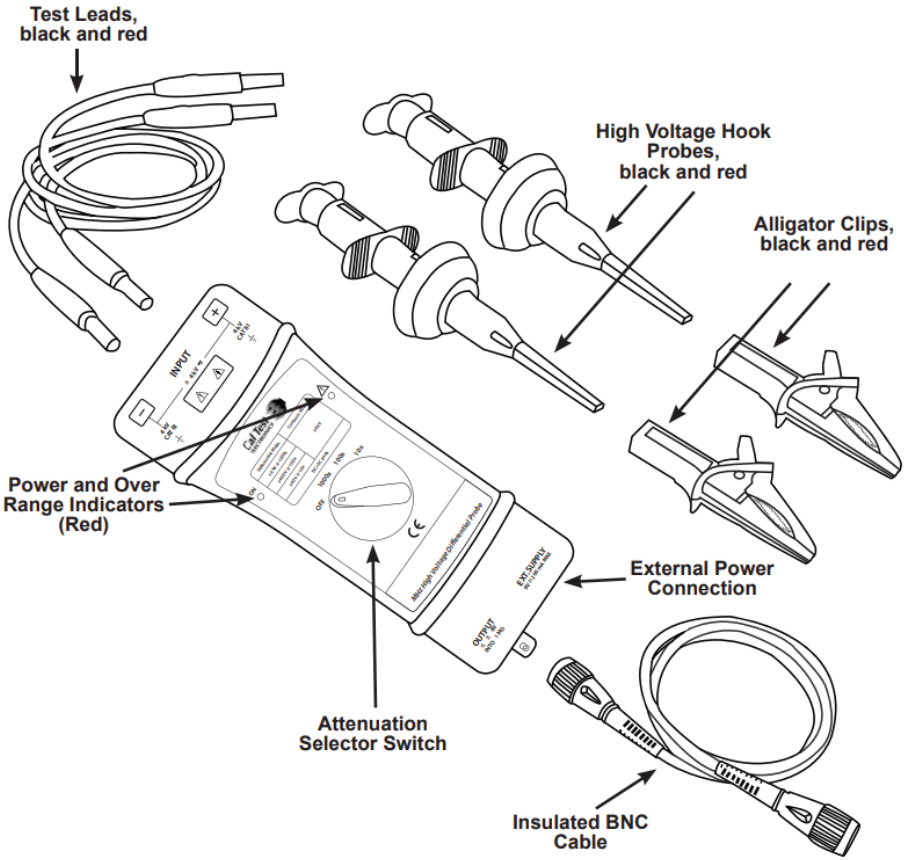


Figure 1 Front Panel Features

3 Using the Probe

WARNING At the time of powering on the probe, the input leads must not be connected to an item to be tested. Never operate the probe with the case open.

CAUTION This probe is used to carry out differential measurements between two points on the circuit under test. This probe is not designed for electrically insulating the circuit under test or the measuring instrument.

Getting Started

1. Connect the BNC output connector to the vertical input of a general purposed oscilloscope. The oscilloscope must have a ground referenced.
2. Connect power adapter.
3. Select the proper attenuation ratio. See Electrical Characteristics on page 11.
4. The power indicator LED should turn on.
5. Plug the hook probes or alligator clips onto the test leads and connect the circuit to be tested.

Vertical Scale on Oscilloscope

The actual vertical scale of the oscilloscope is equal to the attenuation factor multiplied by the range of vertical scale selected on the oscilloscope. For example, with the probe on factor 20x and the oscilloscope on 0.5 V/div, the real vertical scale is 20 x 0.5 = 10 V/div. With the probe on 100x, the real vertical scale is 200 x 0.5 = 100 V/div. These values apply when the oscilloscope is set to the typical 1 MΩ impedance input. When the scope is set to 50 Ω input, the actual vertical scale will be doubled: 20 V/div for the 20x setting and 200 V/div for the 200x setting. See the chart below.

Vertical Scale on Oscilloscope				
Scope Input Impedance	Probe Attenuation Setting	Actual Attenuation Setting	Vertical Scale Reading on the Oscilloscope	Actual Vertical Scale of the Oscilloscope
1 MΩ	20x	20x	0.5 V/div	10 V/div
1 MΩ	200x	200x	0.5 V/div	100 V/div
1 MΩ	2000x	2000x	0.5 V/div	1000 V/div
50 Ω	20x	40x	0.5 V/div	20 V/div
50 Ω	200x	400x	0.5 V/div	200 V/div
50 Ω	2000x	4000x	0.5 V/div	2000 V/div

Table 1 Oscilloscope Readings

4 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.

5 Specifications

All specifications apply to the unit after a temperature stabilization time of 20 minutes over an ambient range of 25°C ± 5°C.

Electrical Characteristics		
Probe	**CT4197**	**CT4198**
Operating Parameters		
Bandwidth (-3 dB)	50 MHz	50 MHz
Rise Time	7 ns	7 ns
Attenuation	10x / 100x / 1000x	20x / 200x / 2000x
Accuracy	±2% *	
CMRR (typical)	80 dB @ 60 Hz 60 dB @ 100 Hz 50 dB @ 1 MHz	
Maximum Input Voltage		
Differential Voltage (DC + ACpeak)	±40 V / ±400 V / ±4 kV	±80 V / ±800 V / ±8 kV
Absolute Maximum Input (DC + ACpeak)	±40 V / ±400 V / ±4 kV	±80 V / ±800 V / ±8 kV
Each Input to Ground (DC + ACpeak)	±40 V / ±400 V / ±2 kV	±80 V / ±800 V / ±4 kV
Output Voltage		
Output Voltage Swing	±4 V (driving 1 MΩ load)	
Offset (typical)	±5 mV	
Noise (typical)	2 mVrms	
General		
Input Impedance (Differential)	20 MΩ // 2 pF	30 MΩ // 1.5 pF
Input Impedance (each input to ground)	10 MΩ // 4 pF	15 MΩ // 3 pF
Source Impedance	50 Ω	
Power Supply	9 V power adapter (included)	

* Accuracy based on DMM with 10 MΩ input impedance.

Mechanical Characteristics	
Weight	390 g
Dimensions	218 x 83 x 30 mm
BNC Cable Length	100 cm
Input Leads Length	60 cm each

Environmental Characteristics	
Operating Temp/Humidity	0°C to 50°C / 10% to 85% RH
Storage Temp/Humidity	-30°C to 70°C / 10% to 90% RH
Pollution Degree	Pollution Degree 2

Safety Specifications
IEC 61010 CAT III

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

6 Voltage Derating Curve

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

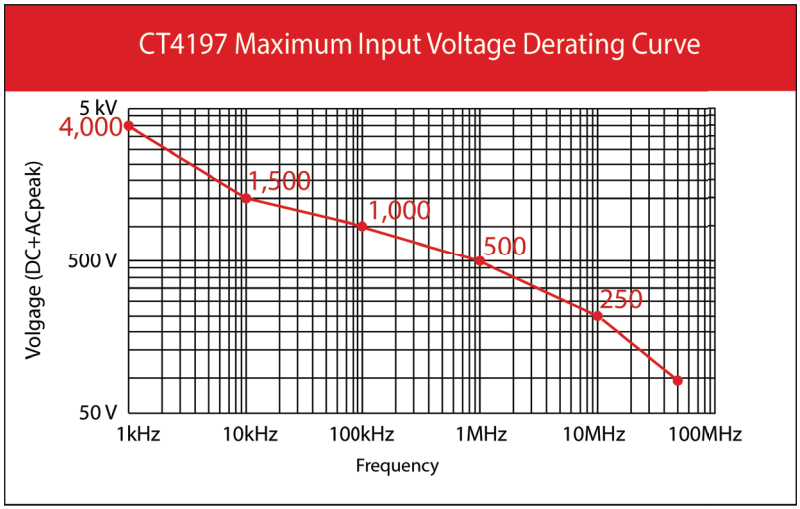


Figure 2 CT4197: Derating Curve

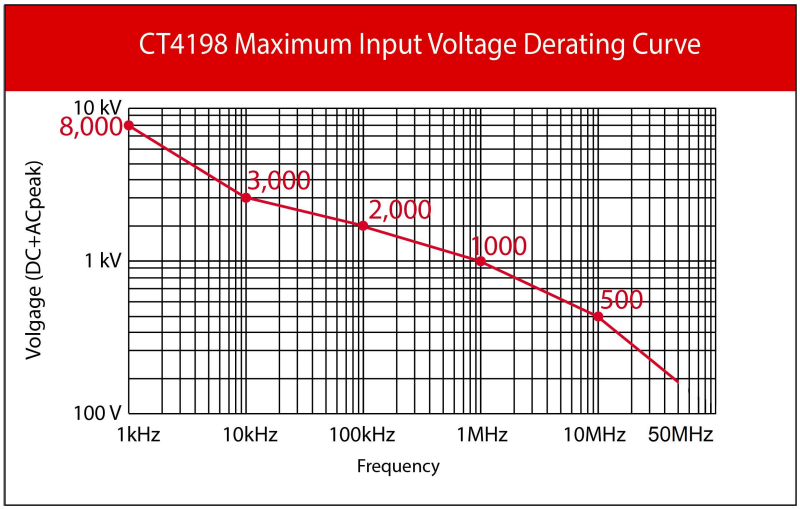


Figure 3 CT4198: Derating Curve

7 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 the defective device 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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