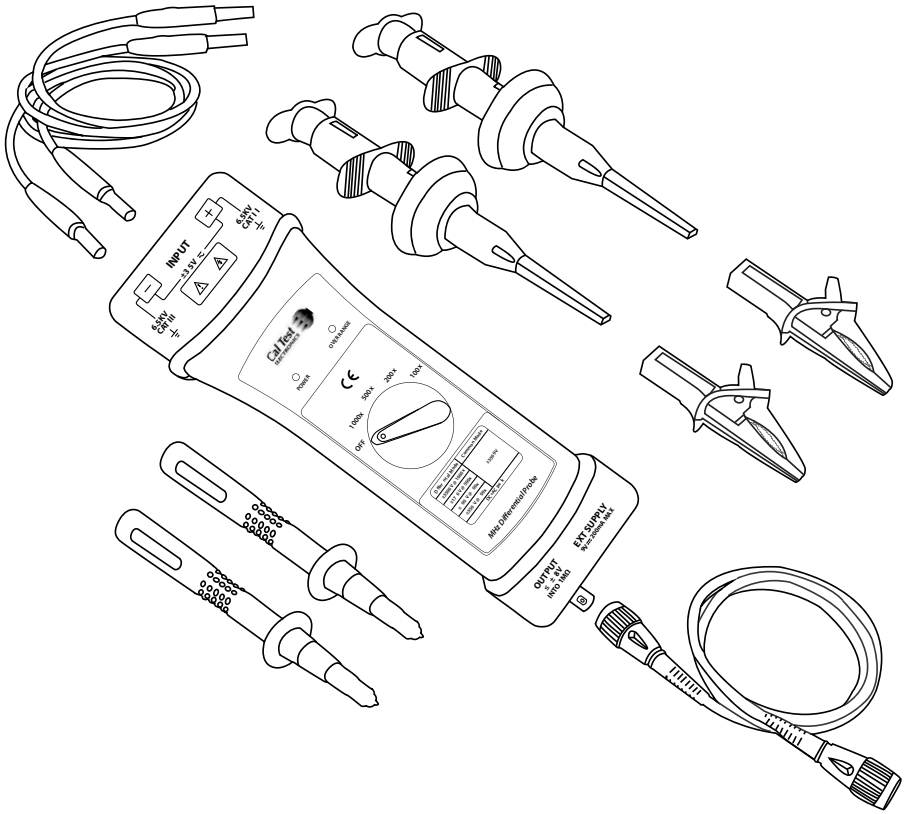
Cal Test ELECTRONICS



CT4071
CT4072
User Manual

CT4071 and CT4072 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 [redacted] 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.

Compliance Statements

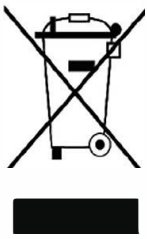
EC Declaration of Conformity

CE The product conforms to the applicable European Union requirements per IEC/EN 601010-031:2015 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.

EU RoHS Compliance

The probe and accessories conform to the 2011/65/EU RoHS2 Directive.

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 to CT4071 and CT4072

Overview

The CT4071 and CT4072 differential probes allow safe, accurate measurements between two voltage points where neither point is referenced to ground. The CT4071 offers a 50 MHz bandwidth and the CT4072 offers a 100 MHz bandwidth. Both are compatible with oscilloscopes from all major manufacturers. The probes are exclusively powered by the included 9 V power adapter.

Features

- Meets IEC 61010-031 safety standard
- Selectable attenuation settings of 100x, 200x, 500x, and 1000x
- 50 MHz bandwidth (CT4071) and 100 MHz bandwidth (CT4072)
- Up to ±3500 V (DC + AC peak) common mode
- 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 probes, black & red (CT4072 only)
- (2) Retractable sheathed 4 mm banana plug test leads, silicone jacketed, black and red
- Insulated BNC cable, 100 cm
- 9 V power adapter
- User manual

2 Product Overview

Probe Description

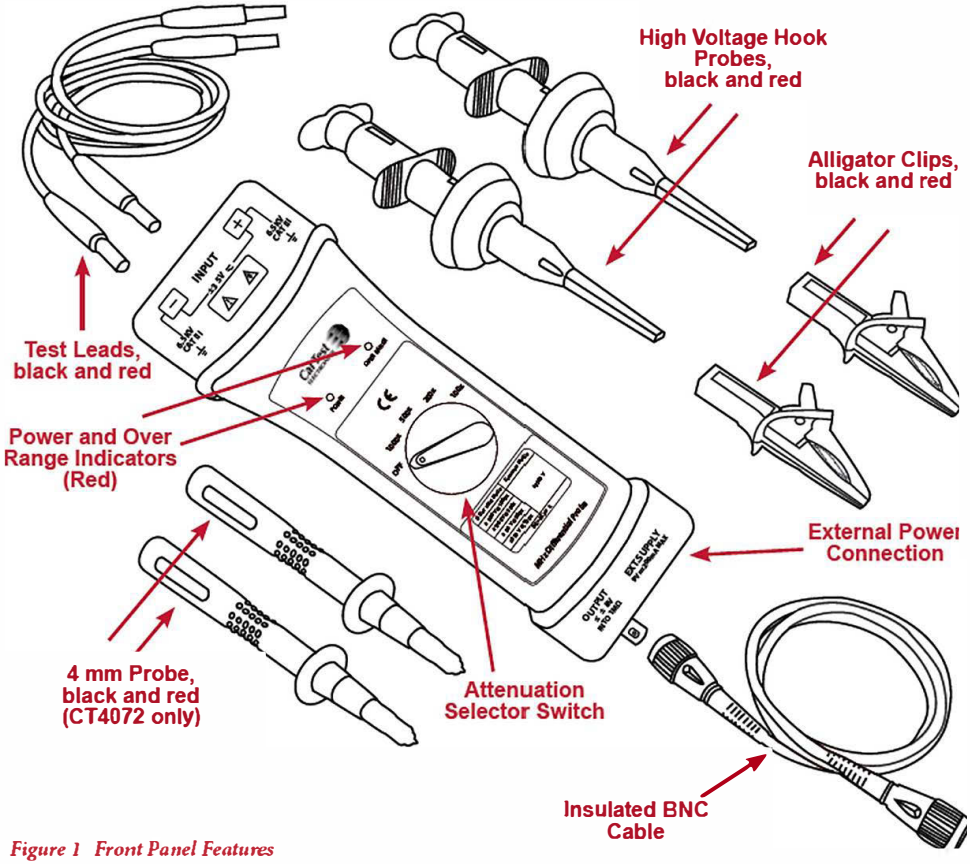


Figure 1 Front Panel Features

3 Using the Probe

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.

Inspection Procedure

1. Connect the BNC output connector to the vertical input of the oscilloscope.
2. Power on the probe.
3. Set the attenuation setting on the oscilloscope to match the probe.
4. Connect the input of probe to a function generator. Then select a square-wave output of 10 V amplitude and 100 kHz frequency.
5. The square-wave will be displayed on the screen of the oscilloscope. This indicates the probe is working properly.

Note that the oscilloscope should show the same voltage and frequency as the function generator.

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. When measuring signals below 350 V, switch the attenuation ratio to 100x in order to get higher resolution and less noise ratio. For voltages up to 700 V, set the attenuation ratio to 200x, for voltages up to 1750 V set the attenuation ratio to 500x, and for voltages up to 3500 V set the attenuation ratio to 1000x.
4. The power indicator LED should turn on.
5. Plug the hook probes, alligator clips, or 4 mm probes (CT4072) 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	50x	50x	0.5 V/div	25 V/div
1 MΩ	200x	200x	0.5 V/div	100 V/div
50 Ω	20x	40x	0.5 V/div	20 V/div
50 Ω	50x	100x	0.5 V/div	50 V/div
50 Ω	200x	400x	0.5 V/div	200 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.

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		
Bandwidth	50 MHz (CT4071)	100 MHz (CT4072)
Rise Time	7 ns for 200x, 500x, & 1000x 14 ns for 100x	18 ns for 200x, 500x, & 1000x 25 ns for 100x
Attenuation	100x, 200x, 500x, 1000x	
Accuracy	±2% *	
AC CMRR	80 dB @ 60 Hz 60 dB @ 100 Hz 50 dB @ 1 MHz	
Maximum Input Voltage (100x) (DC + AC peak)	±350 V	
Maximum Input Voltage (200x) (DC + AC peak)	±700 V	
Maximum Input Voltage (500x) (DC + AC peak)	±1750 V	
Maximum Input Voltage (1000x) (DC + AC peak)	±3500 V	
Absolute Maximum Rate Input Voltage (each side to ground)	2500 Vrms	
Input Impedance (Differential)	54 MΩ // 1.2 pF	
Input Impedance (each side to ground)	27 MΩ // 2.3 pF	
Output Voltage Swing	±8 V (driving 1 MΩ oscilloscope input)	
Offset (typical)	±5 mV	
Noise (typical)	2 mVrms	
Source Impedance	50 Ω	
Power Supply	9 V power adapter (included)	

* Accuracy based on DMM with 10 MΩ input impedance.

Mechanical Characteristics	
Weight	280 g
Dimensions	240 x 80 x 30 mm
BNC Cable Length	100 cm
Input Leads Length	55 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 61010-031:2015 CAT II

Specifications are subject to change without notice.

6 Voltage Derating Curve

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

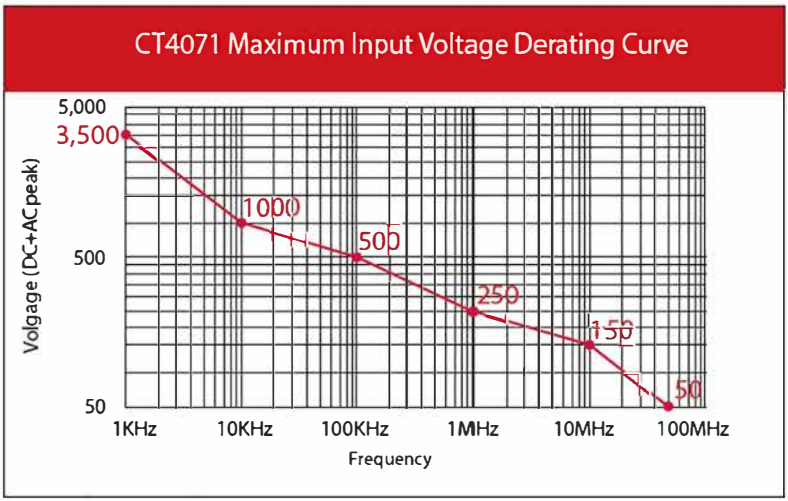


Figure 2 CT4071: Derating Curve

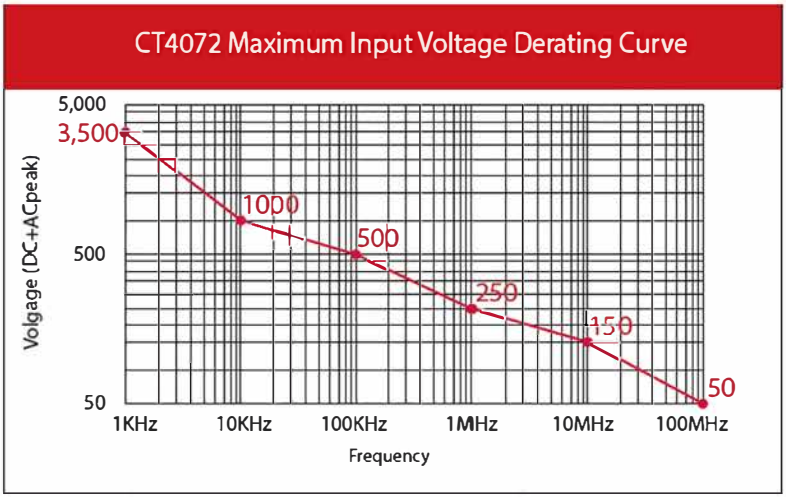


Figure 3 CT4072: Derating Curve

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