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# AP031/AP032 Differential Probe Operating Instructions

AP031/032-OM-E  
Revision B - November 1996



# **I. Application**

## **a. Overview**

The AP031 / AP032 are fully differential active probes designed for applications where electrical signals must be measured relative to a floating voltage different to the oscilloscope ground potential.

These probes are specifically designed for situations where:

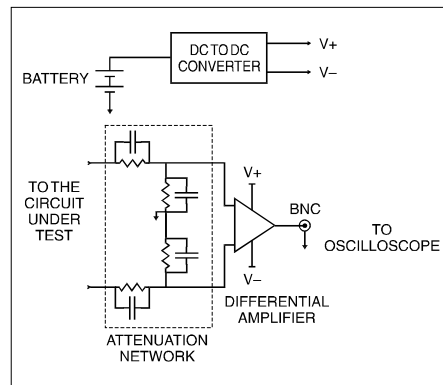
- The reference voltage may be several hundreds volts above or below ground.
- Measurements require the rejection of common mode signals.
- Ground loops and currents produce to excessive signal interference.

The use of these probes ensures safe operation of the oscilloscope and maintains high signal fidelity with good common mode rejection and dynamic range.

## **b. Fully Differential Inputs**

The probe is a fully differential active device. The differential capability allows measurements to be made between two points in a circuit without reference to ground. The two input signals are processed inside the probe (see figure 1) and the resulting single-ended signal may be measured by any grounded oscilloscope. Because the differential voltage is calculated within the probe, with only the resultant difference signal being passed to the oscilloscope, a large dynamic range can be achieved with excellent rejection of common mode signals.

**Figure 1**



### **c. Making Measurements**

Ensure the probe is fitted with four high-quality, AA cells. These should be cells that are protected from leakage which could damage the power supply contacts in the probes.

Before making any measurements or connections refer to the safety information contained in this document.

Connect the probe to one of the oscilloscope input channels ensuring the BNC connector is fully mated, and the safety ground lead to the oscilloscope CAL BNC connection.

Select the proper range setting on the probe using the slide-switch on the probe body.

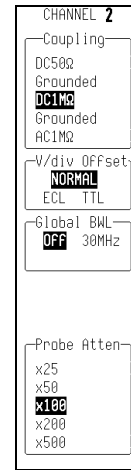
Adjust the input coupling impedance and attenuation of the oscilloscope channel to which the probe is connected using the input coupling menu as shown in Figure 2.

Ensure 1 M $\Omega$  input impedance ( 'DC1M $\Omega$ ' or 'AC1M $\Omega$ ' ) is selected. The use of 50  $\Omega$  input impedance will unduly load the output of the differential probe resulting in reduced amplitude output and incorrect scaling.

To ensure the oscilloscope correctly interprets the vertical waveform scale be sure to adjust the probe attenuation setting using the 'Probe Atten' menu controls. The example shown, x100 probe attenuation, would achieve correct vertical scaling AP031 operating with a maximum range of  $\pm 700$  V ( see figure 3 below ).

Finally, adjust the vertical sensitivity and offset of the oscilloscope channel to which the probe is connected to achieve an optimum display.

**Figure 2**



**Figure 3**

Probe Model	Range Setting	Probe Operating Range ( DC + Peak AC )
AP031	1/10	$\pm 70$ V
	1/100	$\pm 700$ V
AP032	1/20	$\pm 140$ V
	1/200	$\pm 1400$ V

## II. Specifications

### GENERAL CHARACTERISTICS

	AP031	AP032
Bandwidth	25 MHz	
Rise Time	14 ns	
Attenuation	1:10 / 1:100	1:20 / 1:200
Atten. Accuracy	±2 %	
Input Resistance	4 M $\Omega$	
Input Capacitance	10 pF each side to ground	
Input Configuration	Differential	
Input Voltage:		
Max. Differential	<b>1:100 Range</b> ±700 V ( DC + peak AC ) or 500 V r.m.s.	<b>1:200 Range</b> ±1400 V ( DC + peak AC ) or 1000 V r.m.s.
	<b>1:10 Range</b> ±70 V ( DC + peak AC ) or 50Vrms	<b>1:20 Range</b> ±700 V ( DC + peak AC ) or 100Vrms
Max. Common Mode	±700 V ( DC + peak AC ) or 500 V r.m.s.	±1400 V ( DC + peak AC ) or 1000 V r.m.s.
Max. Absolute	±1400 V ( DC + peak AC ) or 1000 V r.m.s.	
CMRR:		
50 Hz	- 86 dB	- 80 dB
20 kHz	- 66 dB	- 60 dB
200 kHz	- 56 dB	- 50 dB
Output Offset ( Typical )	<±5 mV	
Output Noise ( Typical )	1.5 to 2 mV typical	

## **GENERAL CHARACTERISTICS**

### **Ambient Temperature**

Operating -10° C to 40° C

Storage -30° C to 70° C

### **Power requirement**

Four internal 1.5 V AA size batteries or 6 V d. c. / 60 mA  
mains adaptor ( Not supplied )

### **Dimensions**

6.6" ( 168 mm ) x 2.4" ( 62 mm ) x 0.79" ( 20 mm )  
( excluding casing )

### **Cables**

BNC: 95 cm ( RG58 / U ), Input Lines: 45 cm ( PVC, double  
insulation )

### **Accessories**

2 x Safety Hooks, 4 mm compatible ( 1 red, 1 black )

### **Weight**

9.35 oz ( 285 g ) excluding batteries and casing

### **Safety Certification**

IEC-1010, CAT III Approval

### III. Safety Information

International Electrical Symbols that appear on the product:



Attention: Refer to this manual before using the probe.

Danger, High Voltage.

The probe has been designed to comply with IEC1010-1, IEC1010.2-031 Installation Category ( Over-voltage Category ) III, Pollution Degree 2. It is designed to be safe under the following environmental conditions:

- Indoor use.
- Altitude to 2000 m.
- Temperature - 10 °C to 40 °C.
- Maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 40 % relative humidity at 50 °C.

#### OPERATOR SAFETY

The probe is designed to make differential voltage measurements. It is not to be used to insulate the circuit under test from the measuring instrument.

When using the probe ensure that your fingers are well clear from any exposed connections and behind the safety hooks shield. Use of other hooks than the provided ones is not recommended.

In addition, the following guidelines should be observed and followed:

#### MAXIMUM WORKING VOLTAGE

To avoid injury, do not use the probe above where the potential between each input lead and ground or the differential voltage between the two input leads exceeds 1000 V r.m.s. ( 1400 V DC + peak AC ).

#### GROUNDING PRECAUTIONS

Ensure the BNC cable is connected to a grounded oscilloscope before connecting the measuring inputs.

Ensure the safety ground lead is always connected to the oscilloscope CAL connector.

**CLEANING**

The exterior of the probe only should be cleaned with a soft cloth moistened with either water or isopropyl alcohol.

**USAGE AND MAINTENANCE**

The probe user should note that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

To guarantee accurate performance characteristics, mechanical shocks should be avoided, as well as damage to the cable through excessive bending.

Do not use the probe if any part is damaged.

All maintenance should be referred to qualified personnel.

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