

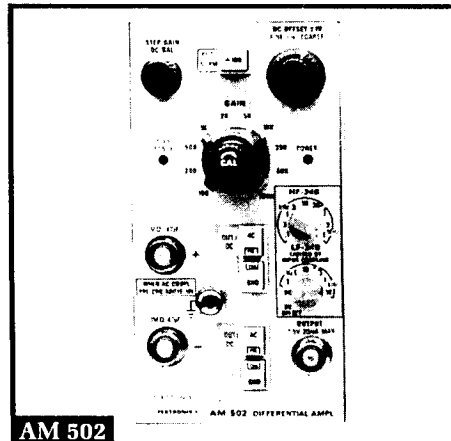
Extend the capabilities of any oscilloscope.

AM 502

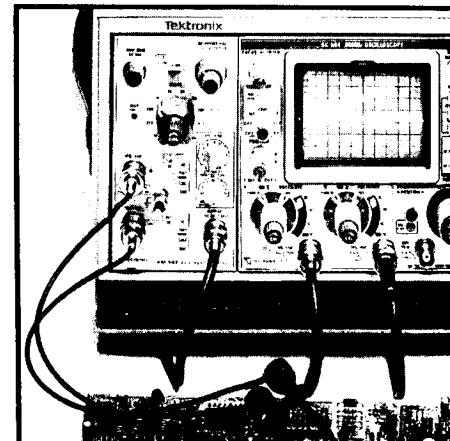
- Differential Gain
- 2% Gain Accuracy
- 100 dB CMRR to 50 kHz
- Selectable Upper and Lower -3 dB Points
- Adjustable DC Offset
- DC to 1 MHz Maximum Bandwidth

AM 501

- ± 40 V, 50 mA Output
- Open-Loop Gain 10,000
- 50 V/ μ s Slew Rate
- Symmetrical Differential Design
- Optional Circuit Board to Customize Function



AM 502



AM 502 provides differential comparator capability to scopes with single-ended inputs.

Signal Conditioners

TM 500 Signal Conditioners offer unique capabilities for solving electrical measurement and analysis problems. The compact portability and plug-in flexibility of these modules are applicable to a broad range of measurement needs including: preamplification of low-level signals, addition or removal of DC offset, integration, differentiation, filtering, summing of multiple signals, impedance transformation, level conversion (to 80 V peak-to-peak), current probe amplification and a unique time-interval to voltage converter.

AM 502 Differential Amplifier/Comparator

The versatile AM 502 lets you control gain, DC offset, and low and high frequency response for maximum rejection of unwanted signals. The AM 502 is particularly suited to sensor signal amplification or applications where one side of the measured voltage is not ground. For example, the AM 502 can amplify small voltage drops across resistors to monitor current flow to the bandwidth of the amplifier. Adjustable DC offset before attenuation/amplification allows high amplification even when low-level signals have a DC component. Adjustable filtering (with differential amplification) permits the AM 502 to emulate different loop filters on the differential phase comparator outputs in a phase locked loop design.

TRUE VS. PSEUDO DIFFERENTIAL

The AM 502 is ideal for driving oscilloscopes, chart recorders, or other instruments that do not have differential inputs. One commonly used oscilloscope technique for differential measurements is the Add/Invert function (CH 1 - CH 2). In addition to tying up both main inputs, this technique has limited dynamic range since sensitivity decreases with increasing common mode voltage.

True differential amplifiers such as the AM 502 isolate small differential voltages riding on common mode voltages which are orders of magnitude larger.

Common mode voltages may also have a large AC component at the line or switching frequency. Differential amplifiers have matched "+" and "-" input pairs which are critical for AC common mode rejection. The AM 502 has a common mode rejection ratio of at least 100 dB up to 50 kHz. High CMRR translates to greater confidence that a measured differential voltage is not corrupted by a fluctuating common mode voltage. Matched differential probe pairs such as the P6055 are recommended as the signal path from the desired test points.

TRUE DIFFERENTIAL VS. DIGITAL PROCESSING

The AM 502 enhances the capabilities of both analog and digital storage oscilloscopes. Digital post-processing capabilities such as waveform subtraction can simulate differential measurements between two simultaneously sampled signals. However, the dynamic range of digital waveform subtraction is typically limited by sampled data resolution (such as 8-bit a/d converter results) rather than the precision of the subtraction algorithm. The AM 502 as a front-end to a digital oscilloscope insures that the digital conversion capability is applied to measuring the desired difference voltage rather than as a guard to a/d converter overflow for large common mode signals.

DC OFFSET VS. OSCILLOSCOPE POSITIONING

Alternatively, a scope's vertical position control can visually "offset" a waveform by bringing an off-screen signal into viewing range. While this apparently performs the DC offset function, its dynamic range is limited. The vertical positioning capability of most oscilloscopes is typically less than ± 20 vertical divisions. The AM 502's true DC offset effectively provides thousands of vertical divisions of offset.

To order, contact your local sales office (listed on pages 536-539).

Amplifiers

Signal Conditioners

AM 502
AM 501

AMPLIFIERS

Characteristics (AM 502)

Gain – 100 to 100,000, 1 to 1000 in ± 100 Mode; 1-2-5 sequence; accurate within 2%. Continuously variable gain between steps in uncalibrated mode.

HF – 3 dB Point – Selectable in 9 steps (1-3 sequence) from 100 Hz to 1 MHz; Upper –3 dB point reduces to 500 kHz at 50K gain; 250 kHz at 100K gain.

LF – 3 dB Point – Selectable in 6 steps (1-10 sequence) from 0.1 Hz to 10 kHz; AC coupling limits – 3 dB point to 2 Hz or less.

Variable DC Offset – At least ± 1 V. Equivalent to ± 100 V in ± 100 Mode.

Common-Mode Rejection Ratio – At least 100 dB, DC to 50 kHz. ± 100 Mode: At least 50 dB, DC to 50 kHz.

Maximum Input Bias Current – ± 100 pA each input for $T \leq 30^\circ\text{C}$.

Maximum Voltage Drift – 100 $\mu\text{V}/^\circ\text{C}$ referred to input.

Maximum Noise – ≤ 25 μV (tangentially measured) referred to input.

Common Mode Voltage Range – ± 5 V, ± 100 Mode: ± 50 V.

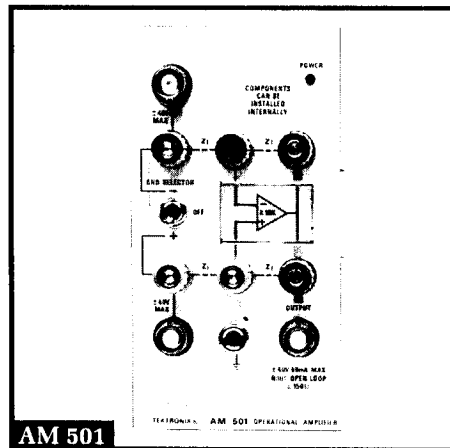
Maximum Safe Input Voltage – DC coupled: 15 V (DC + peak AC). ± 100 Mode DC coupled: 350 V (DC + peak AC). AC coupled: 350 V (DC + peak AC) with coupling capacitor precharged.

Input R and C – 1 M Ω paralleled by ≈ 47 pF. Input impedance can be increased to a FET input via a simple internal jumper change.

Maximum Output – ± 5 V, ± 20 mA, output resistance is 5 Ω or less.

Minimum Load Impedance – 250 Ω .

Over-Range – Front-panel lamp indicates most over-range conditions.



AM 501 Operational Amplifier

The AM 501 Operational Amplifier features high input impedance (FET), high slew rate, a wide range of input and output voltage, and high output current. The output (40 V and 50 mA across 800 Ω loads) can drive many electronic and electro-mechanical applications. This high-output unit has front-panel connectors that let you change configurations by selecting feedback components. The AM 501 is easily set up for differentiation, integration, summing, offsetting, and impedance-transformation problems.

The AM 501 is ideal for quickly prototyping circuits using the versatility of high-gain operational amplifier blocks. The AM 501's V_+ and V_- power is supplied by any TM 500 or TM 5000 mainframe eliminating the task of securing or dedicating a dual-output power supply. When used with the accessory board described below, the AM 501 permits rapid performance comparisons of different circuit topologies.

Characteristics (AM 501)

Open Loop Gain – At least 10,000 at 60 Hz into 800 Ω load.

Unity Gain Bandwidth – At least 5 MHz into 800 Ω load.

Common-Mode Rejection Ratio – Typically $>20,000:1$ at 60 Hz for common-mode signals up to ± 40 V.

Slew Rate – At least 50 V/ μs into an 800 Ω load.

Input Bias Current – Typically <500 pA at 25°C , <2 nA at 50°C .

Drift – <100 $\mu\text{V}/^\circ\text{C}$.

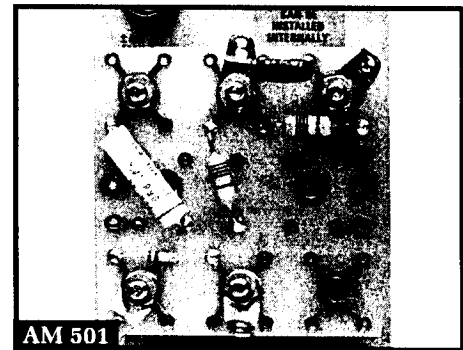
Noise – <10 μV rms.

Maximum Differential Input Voltage – 80 V.

Voltage Range – At least ± 40 V into 2 k Ω .

Current Limit – At least ± 50 mA.

Open Loop Output R – ≈ 150 Ω .



AM 501 AUXILIARY CIRCUIT BOARD KIT

The AM 501 Auxiliary Circuit Board Kit attaches to the input and output terminal plugs on the front of the AM 501 Operational Amplifier. The kit is a pc board that has six terminal studs for attachment to the amplifier's banana jacks and is approximately 2.5 inches square. This permits the designer to build a circuit of resistors, capacitors, and other components for use in conjunction with the AM 501's input, output, or feedback circuits. With several boards, the AM 501 Op Amp circuit can be changed instantly in configuration from integrator to differentiator to amplifier.

Use of the kit does not interfere with the other connectors on the face of the AM 501.

ORDERING INFORMATION

AM 502

Differential Amplifier

Includes: Instruction Manual (070-1582-01).

P6135A

Differential Probe Pair

AM 501

Operational Amplifier

Includes: Instruction Manual (070-1616-01).

AM 501 Auxiliary Circuit Board Kit – Order 013-0146-00

WARRANTY-PLUS SERVICE OPTIONS

Opt. M7 – Calibration Service

AM 502

AM 501

Opt. M9 – Repair Protection

AM 502

AM 501

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