Designed for direct applications in the field of aerospace instrumentation, mass spectrometers, laboratory and research experiments, medical electronics, and electro-optical systems.

Model A-101 is a hybrid charge sensitive preamplifier, discriminator, and pulse shaper developed especially for instrumentation employing photomultiplier tubes, channel electron multipliers and other low capacitance charge producing detectors in the pulse counting mode. While this unit was specifically designed for satellite instrumentation, the following unique characteristics make it equally useful for space, laboratory and commercial applications:

- Small size (TO-8 package) allows mounting close to collector of multiplier.
- Power required is typically 15 milliwatts.
- Single power supply voltage.
- Outputs interface directly with C-MOS and TTL logic.
- Input threshold is externally adjustable.
- Output pulse width is variable with external trim capacitor.
- High reliability process.
- One year warranty.

Typical Particle Counting System

AMPTEK HIGH RELIABILITY SCREENING

2. SEALING: Welded, hermetic seal.
3. STAMPING: Date code and serial number.
5. TEMPERATURE CYCLE: MIL-STD-883, method 1010, Condition C min. T = -65°C to +150°C.
6. CENTRIFUGE: 10 minutes each extreme, 5 minutes maximum transfer time.
7. ELECTRICAL TEST: MIL-STD-883, method 2001, Condition B. Y1 Axis; 10,000 G's.
8. BURN-IN TEST: As per specifications.
9. FINE LEAK TEST: MIL-STD-883, method 1015, 160 hours at +125°C.
11. ELECTRICAL TEST: MIL-STD-883, method 1014, Condition C. Fluoro Carbon; Rejection if stream of bubbles is present.
SPECIFICATIONS

(V_s = 5V, T = 25°C)

THRESHOLD: Model A-101 has a nominal threshold referred to the input of 1.6x10^-10 coulomb. This is equivalent to 10^9 electrons. The threshold can be increased by the addition of a resistor between Pins 9 and 12. See Figure 1.

STABILITY: <1.5% of threshold, 0°C to 50°C. See Figure 3.

NOISE: RMS noise level <0.4% of threshold.

PROTECTION: Back-to-back diodes to ground.

DETECTOR CAPACITANCE: 0-60 pf

OUTPUT CHARACTERISTICS

1) Pin 5 provides a positive 5 volt output pulse capable of interfacing directly with CMOS.

Pulse characteristics are:

RISETIME: 6 ns
FALLTIME: 20 ns
WIDTH: 220 ns nominal. May be increased to greater than 1 μs by the addition of a capacitor between Pins 3 and 4. See Fig. 2.

AMPLITUDE: 5 volts

2) Pin 6 is an open collector output and with an external pullup resistor provides a negative going pulse (the complement of Pin 5). This output can drive TTL and can be wired with other units. Pullup resistor may be connected to V_s or to other positive supply up to +15V.

GENERAL COUNT RATE: 4 x 10^4 CPS, Periodic
PULSE PAIR RESOLUTION: 250 ns
OPERATING VOLTAGE: +4 to +10 VDC
OPERATING CURRENT: 3mA Quiescent
4mA @ 10^8 CPS
TEMPERATURE: -55° to +70°C operational
WARRANTY: One year
RADIATION RESISTANCE: >10^4 Rads
PACKAGE: 12-Pin, TO-8 case.
SCREENING: AMPTEK HIGH RELIABILITY
TEST BOARD: PC-11

OPERATING NOTES:

POWER REQUIREMENTS:

All device specifications apply to operation at +5V. The unit can be operated up to +10V with increased power dissipation and threshold. Supply is internally bypassed. Care should be taken in circuit layout and in some applications power supply decoupling may be helpful.

The case is internally connected to Pin 1, ground.

The detector is normally capacitively coupled to Pin 12 with a capacitor of adequate voltage rating. Alternately, the detector anode can be direct coupled to the input if the cathode is at negative potential. The A-101 is sensitive to a negative charge pulse of at least 0.15 picocoulomb. This threshold may be increased by the connection of a resistor between Pins 9 and 12. Approximate values are given in Figure 1.

The A-101 can be tested with a pulser by using a small capacitor to inject a test charge into the input. The unit will trigger on the negative-going edge of the pulse which should have a transition time of less than 20 ns. Either a tail pulse with a much longer fall time (>1 μsec) or a square wave may be used. (If a square wave is used, triggering on the positive-going edge will occur for large pulses.)

Charge transfer in the test circuit is according to Q = CV where Q = Total amount of charge, C = Capacitor, and V = Voltage. Use only a small capacitor in this circuit (1-10pf). DO NOT connect a low impedance pulser through 500 pf when testing as this will produce a large pulse through the input transistor and may cause irreversable damage.

The relationship between the rise time and fall time is given by:

\[ T_r < 20 \text{ ns}, \; T_f > 1 \mu\text{s} \]

Negative going
Amplitude: 0.25 V = 0.5 picocoulomb
OUTPUTS

The output at Pin 5 is a positive, 220ns wide pulse. Pin 6 is an open collector output and should be left unconnected if not used. A negative going output can be obtained by connecting a pullup resistor (Typically 1kΩ) between V_S and Pin 6. The pullup resistor may be tied to any positive voltage up to 15V (as required for example, in interfacing with particular logic families.) In multi-detector systems, where more than one preamp drives the same counter, the open collector outputs of several A-101s can be connected together to the counter input with a single pullup resistor. DO NOT CONNECT THIS PIN DIRECTLY TO V_S (PIN 2) AS THIS MAY DAMAGE OUTPUT STAGE AND VOID WARRANTY.

The output pulse width can be increased by the connection of a capacitor between Pins 3 and 4. See Figure 2 for typical values.

![Pulse Width vs. External Capacitance](image)

*C_W (pF)*

Pulse width as a function of external capacitance

**Figure 2**

If the standard pulse width is adequate Pins 3 and 4 must be left unconnected.

![Threshold vs. Temperature](image)

**Threshold vs. Temperature (Typical)**

**Figure 3**

GENERAL

Due to its hermetic seal and small size, the A-101 is well suited to use within a vacuum chamber. In such applications the mounting should provide adequate heat dissipation and care should be taken to avoid electrical discharge near the input which can damage unit and void warranty.

Use care in soldering leads - avoid overheating.

**PIN ASSIGNMENTS**

1. GROUND
2. V_S (+4 to +10 VDC)
3. Pulse Width Adjust
4. Pulse Width Adjust
5. Positive Output
6. Open Collector Output
7. No Connection
8. No Connection
9. Threshold Adjust
10. No Connection
11. No Connection
12. Input

![Connection Diagram](image)

**TEST BOARD** (actual size)

![PC-11 Test Board for the A-101](image)
Connection of a photomultiplier tube to the A-101
Using + High Voltage


Model A-101 mounted on the MD-501 Amp-tektron®, complete with CEM, high voltage power supply and line driver.

Connection of a photomultiplier tube to the A-101
Using — High Voltage