Description

The Model 152 is an economical, general purpose operational amplifier featuring very low input bias current and high input impedance. It is designed for applications involving high source resistances. The Model 155 has all these same features but is better suited for applications requiring low voltage drift.

A versatile circuit building kit, the Model MK150, is available. It makes it easy to connect an amplifier in a wide variety of standard op-amp circuits. These include inverting and non-inverting amplifier, integrator, summer, etc. A potentiometer for nulling the input offset and test jacks are provided.

Inverting/Filter Amplifier

The basic inverting amplifier shown in Figure 1 is useful where a signal inversion or a simple low/high pass filter function is required. The basic inverting amplifiers are used where high slew rate and or high linearity is needed.

Basic Design Equations:

GAIN .... G = R6 / (R1 + R14)
0.1 < G < 100
R6 + RLoad > 2 kohms
Either R1 or R14 can be zero ohms (jumper) for convenience

INPUT IMPEDANCE ... Zin = R1 +R14

BANDWIDTH .... bw = 3 MHz/(1+G) in Hz

Value For R5 .... R5 = Zin II R6

For a low pass filter function add C2 by the following equation,

Fc = 1 / (2 x pi x R6 x C2)   100 pF < C2 < 1 µF

Where Fc is the -3 dB frequency in Hz of the low pass function. The roll off is 6 dB per octave or -20 dB per decade of frequency.

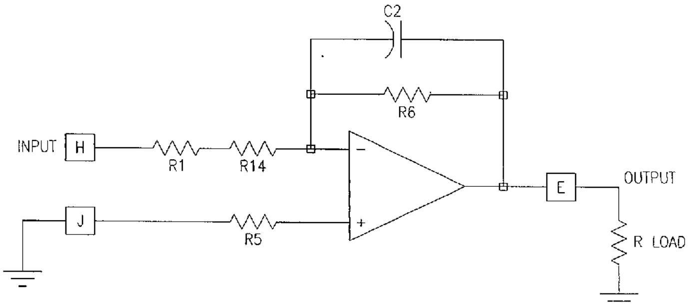

FIGURE 1. Inverting Amplifier

Inverting Summing Amplifier

Figure 2 shows the basic inverting summing amplifier configuration. This amplifier provides the function of summing inputs and providing gain. The summed output can be low pass filtered to reduce high frequency noise if required.

Basic Design Equations:

GAIN	G1 = R6/(R1 +R14)	Input to Pin H
	G2 = R6/R2	Input to Pin K
	G3 = R6/R3	Input to Pin L
	G4= R6/R4	Input to Pin M
	0.1 < G < 100	for any input
	R6 II RLoad > 2k ohms	
	Either R1 or R14 can be zero ohms (jumper) for convenience.	
INPUT IMPEDANCE ...	Zin = (R1 +R14) or R2 or R3 or R4	
BANDWIDTH	bw = 3 MHz/(1+R6/Zin) in Hz	
Value For R5	R5 = Zin II R6	

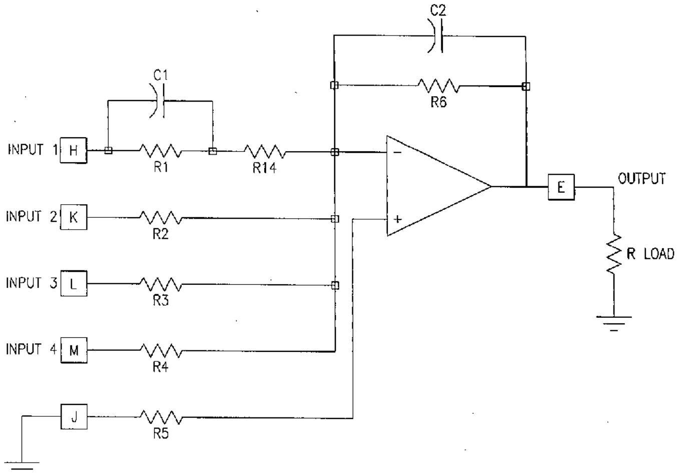

FIGURE 2. Inverting Summing Amplifier

CALEX 2401 Stanwell Drive
Concord, CA 94520-4841
800-542-3355

Amplifiers

AC Coupled Inverting Amplifier

An AC coupled amplifier or high pass filter amplifier (Figure 3) is also easy to construct with MK 150. This amplifier is useful for audio and other applications where the DC content of the signal is not important.

Basic Design Equations:

GAIN .... G = R6 / R14
0.1 < G < 100
R6 II RLoad > 2 kohms

INPUT IMPEDANCE ... Zin = R14,
Midband: DC Zin = Infinity

BANDWIDTH .... bw = 3 MHz/(1+G) in Hz

Value For R5 .... R5 = R6

Value For C1 .... C1 = 1/(2 x pi x Fc x R14) in Hz, where Fc is the lower -3 dB cutoff of the amplifier.

The low frequency roll off is +6 dB or +20 dB per decade of increasing frequency. Pick C2 to minimize overshoot or ringing with a small square wave input. Increasing C2 will reduce overshoot and ringing at the output.

Non-inverting Amplifier

Figure 4. Shows the basic non-inverting amplifier circuit. The non-inverting amplifier or voltage follower is useful where high input impedance is required and or an in phase output voltage is required.

Basic Design Equations:

GAIN .... G = 1 + R6 / (R14 + R1)
0.1 < G < 100
Either R14 or R1 can be zero ohms for convenience
R6 II RLoad > 2 kohms
if R1 + R14 are not used the gain is a precision +1 (voltage follower mode).

INPUT IMPEDANCE ... Zin = > 10 Meg

BANDWIDTH .... bw = 3 MHz/G in Hz

Value For R5 .... R5 = R6 II (R1 + R14)

The gain can be rolled off to a minimum gain of +1 by using C2 in the circuit.

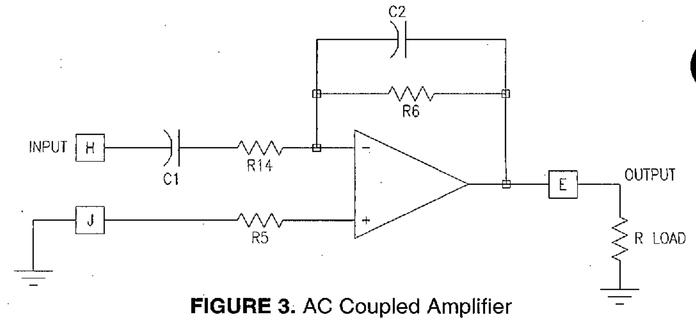

FIGURE 3. AC Coupled Amplifier

The Differentiator

The differentiator (also Figure 3) is basically a high pass filter that has the useful property of producing an output voltage that is proportional to the instantaneous derivative of the input waveform.

Basic Design Equations:

Voltage Output .... Vo = -R6 x C1 x dVi/dt
Vo should be as low as possible for maximum dynamic range.

Utility Gain Frequency . Fc = 1/(2 x pi x R6 x C1)

Value for R5 .... R5 = R6

Value for R14 and C2 Select for minimum overshoot and ringing on the output with a step input. Increase R14 and or C2 to reduce overshoot.

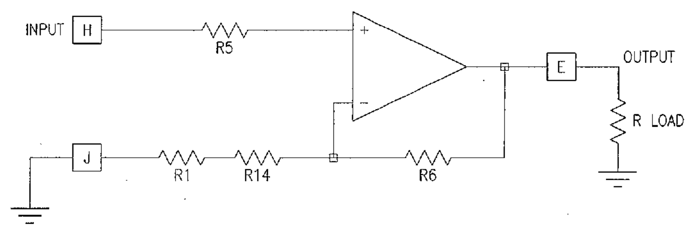

FIGURE 4. Non-inverting Amplifier Circuit

Ph: (510) 687-4411
FAX: (510) 687-3333
800-542-3355
CALEX

Specifications

Model	152	155
Open Loop Gain	90 dB	100 dB
Rated Output (R_L = 2k)	±10V	±10V
Input Offset Voltage		
Initial 25°C	6 mV	1 mV
Vs. Temperature	20 µV/°C	3 µV/°C
Input Bias Current		
Initial 25°C	200 pA	50 nA
Vs. Temperature	10 pA/°C	0.2 nA/°C
Differential Input Impedance	10^{12} ohm	4 megohm
Input Signal Range		
Common Mode	±12V	±10V
Differential	±12V	±10V
Frequency Response		
Small Signal Unity Gain Frequency	3 MHz	3 MHz
Full Power Bandwidth	5 kHz	5 kHz
Slew Rate, min.	10V/µs	10V/µs
Power Required		
Voltage	±15V	±15V
Current	±3 mA	±5 mA
Temperature Range		
Operating	0 - 70°C	0 - 70°C

General Notes

When driving capacitive loads or shielded cables of greater than 50pF remove the jumper for R11 and insert a 470 ohm resistor. This will prevent oscillation that will appear as an unstable DC offset to most measuring equipment.

The minimum value of load resistance is 2k ohms for a rated output swing of ±10 Volts. The external load must be considered along with the feedback resistance for the total load. For reduced swings the output load can be increased up to a maximum of 5 mA peak.

For optimum DC stability use single point "Star" grounds to Pin B. This will prevent unwanted ground loops or "unexplained" DC offsets.

When the MK150 is wired in a system and it appears that something is wrong, remove the MK150 and test it individually to make sure that it functions as expected. Then troubleshoot the system from the transducer to the end, a function block at a time.

If a high precision amplifier is required with a gain of 100 or more, the 176/178 Instrumentation amplifiers are a much better choice for most systems.

If all else fails please feel free to call our applications engineers; we spend time trouble shooting our own systems and can sometimes spot trouble right away. We even learn new tricks from our customers!

To order the MK150 for use with the 152, specify the MK150 as MK150-152. For use with the 155, specify the MK150 as MK150-155.

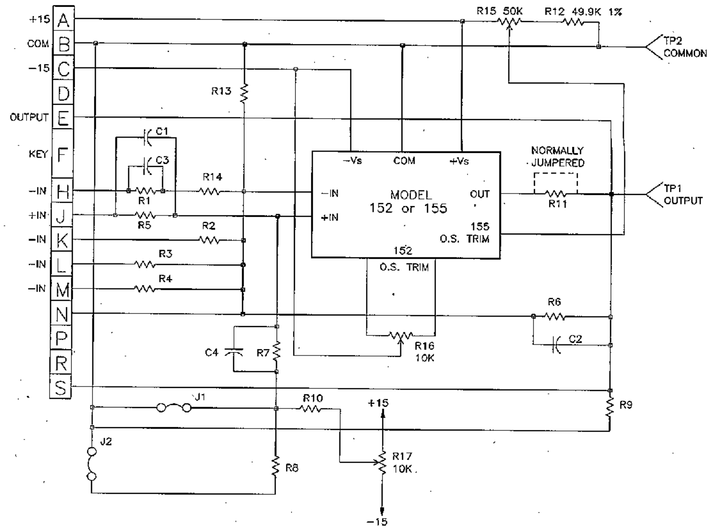

FIGURE 5. MK150 Mounting Kit Schematic

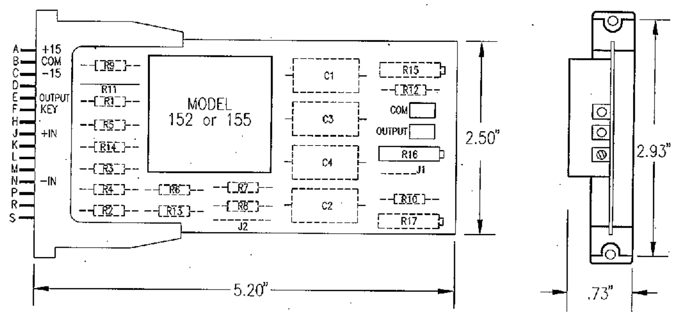

FIGURE 6. MK150 Mounting Kit Dimensions

For Model 155-TP1, TP2, R12, R15 and Jumper for R11 are factory installed.

For Model 152-TP1, TP2, R16, and Jumper for R11 are factory installed.

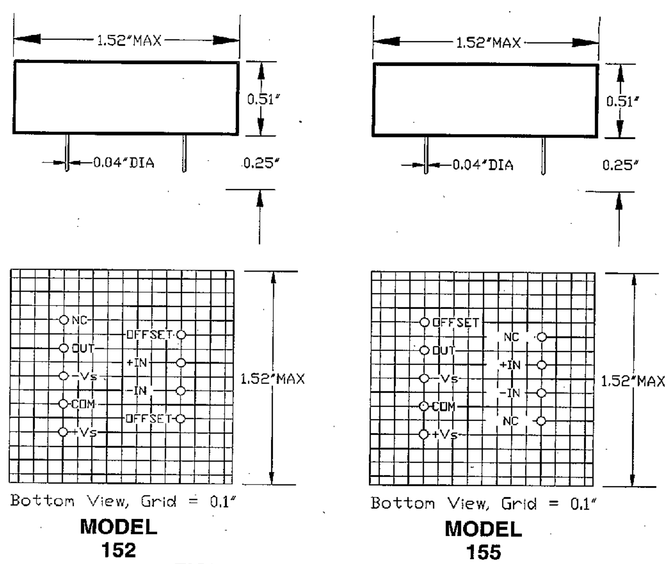

FIGURE 7. Outline Dimensions

CALEX
2401 Stanwell Drive
Concord, CA 94520-4841
800-542-3355