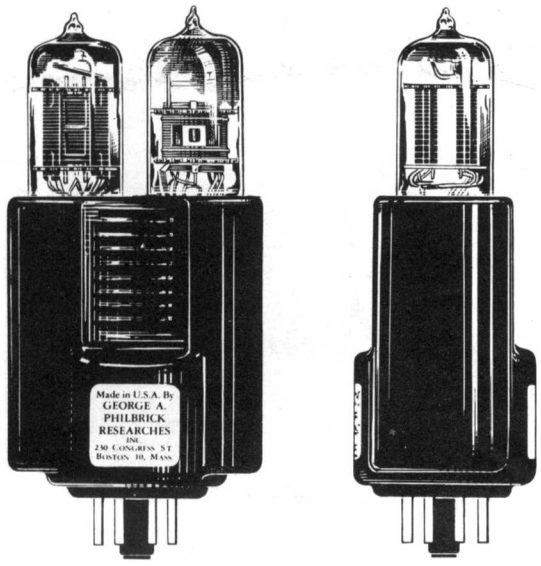
GAP/R MODEL K2-X

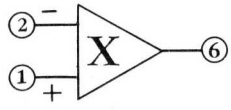
Model K2-X Operational Amplifier



Model K2-X is a more potent version of the well-known K2-W, offering higher performance with similar stability. It is not intended to replace the latter amplifier, but will serve for more demanding applications in which its higher power consumption and slightly greater cost may be justified.

Functionally, this model will perform all the operations described in the K2-W bulletin; it plugs into the same sockets and employs the same connections for power and for computing signals. In most installations, the K2-X will not tolerate quite as large a direct capacitive load as does the K2-W. Furthermore, its output should not be "grounded" during operation, since this will carry the final triode beyond the normal wattage range.

OPERATIONAL SYMBOL



BASE PIN CONNECTIONS

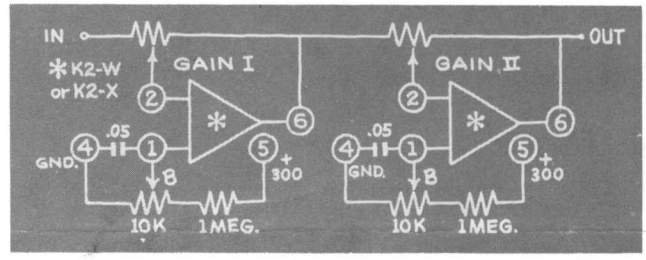
1: Pos. Input	4: Ground	7 & 8:
2: Neg. Input	5: Plus 300VDC	Heaters,
3: Minus 300VDC	6: Output	6.3V AC or DC

APPLICATIONS

The K2-X Operational Amplifier, like the K2-W, may be employed for analog computation in feedback systems of any complexity. It is physically interchangeable with the K2-W and the two types may co-exist in instrumental assemblages which are conceived to exploit their separate and special talents. Where necessary or desired, the K2-X Amplifier will permit steeper wave-fronts and greater signal excursions. It will also enable the usage of resistive computing elements having lower values than are practical with the K2-W.

For straight amplification the tandem arrangement shown below with two amplifiers is worth mentioning since it offers more than tenfold speeding-up of the response time for higher gains. Separate resistors may be employed for each of the feedback and feed-forward elements, with binary or decade switching, or the two controls as shown may be ganged to provide a single gain adjustment of extraordinary dynamic range. In a recent trial, the effective input noise proved to be within 1 Millivolt; if lower values are desired, automatic stabilization can be provided. (See bulletin on the Model K2-P Stabilizing Amplifier).

EXTRA WIDE-RANGE AMPLIFIER



DC BIAS

The method of applying bias which appears in the above example is currently the most popular. Other methods are shown on the reverse side of this sheet. The actual bias voltage required for the K2-X is somewhat less than the plus 1.5V needed for the K2-W. If automatic DC stabilization is added, as may be justifiable in a low-level or critical application, the normal bias adjustment may be left installed: it can then serve as a "vernier" setting to refine the zero level attained by the auxiliary stabilizing device.

AUGMENTED POWER: "CASE HP"

With the normal power and signal connections as used for the K2-W, the K2-X will handle most computing networks with the higher performance already described. For still higher speed and greater output, at the option of the user, a 100K two-watt resistor may be connected in the external circuit from the output terminal (pin 6) to —300 VDC (pin 3). The added "push" thus provided is obtained at the expense of somewhat greater power consumption (see example below).

GENERAL SPECIFICATIONS

GAIN:
30,000 DC, open-loop

POWER REQUIREMENTS:
7.5 Milliamps. at +300 VDC
5.2 Milliamps. at −300 VDC
Note: Add 3.0 Milliamps to both, for Case HP*
0.75 Amperes at 6.3V

TUBE COMPLEMENT:
1 12AX7, 1 6AN8

BASING: Octal plug

CASE: Molded plastic

INPUT IMPEDANCE:
Above 100 Megohms

OUTPUT IMPEDANCE:
Below 300 ohms under open-loop operation, to less than 0.2 ohms when fully fed back

DRIFT RATE:
5 Millivolts *per diem,* referred to the input.

HEIGHT: 4½ Inches overall

WEIGHT: 3 ounces

VOLTAGE RANGE:
−50 VDC to +50 VDC for inputs (together):
−100 VDC to +100 VDC for output

INPUT CURRENT:
Less than 0.1 Microamp., for either input

OUTPUT CURRENT:
(Normally) −2 Ma. to +2 Ma., driving 50 K load from −100 to +100 VDC

INPUT BIAS:
Positive input should be made to operate about 1.2V *high* at balance, normally requiring adjustable bias

RESPONSE:
1-Microsecond rise time, with band-width over 250 KC when used as inverter.

*CASE HP: (±3 Ma.)
100K, twoW resistor added, from output to −300 VDC

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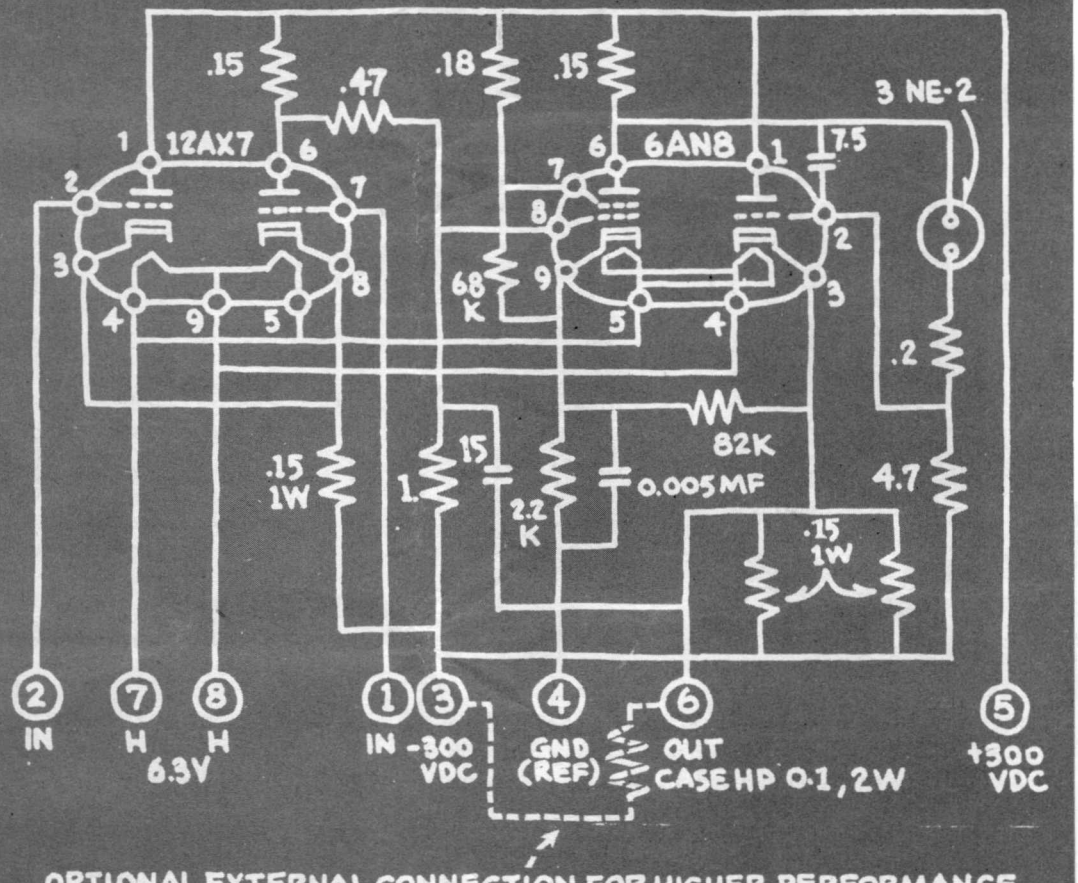
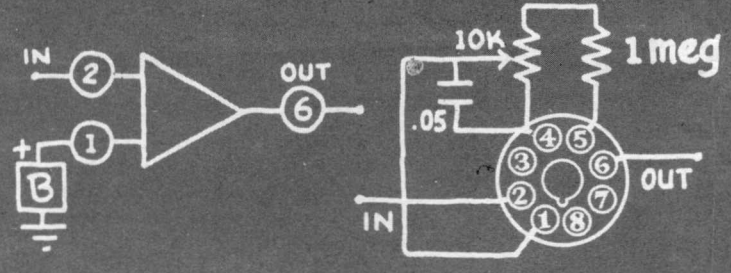
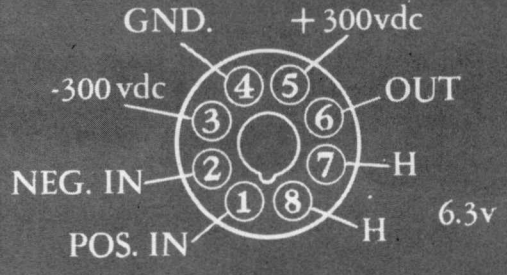
IN THE BIASING METHODS SHOWN BELOW, THE POTENTIOMETER IS SET FOR ZERO DC ERROR UNDER FEEDBACK. FOR THIS PURPOSE IT MAY BE ADVISABLE TO GROUND THE INPUT OF THE COMPUTING NETWORK.



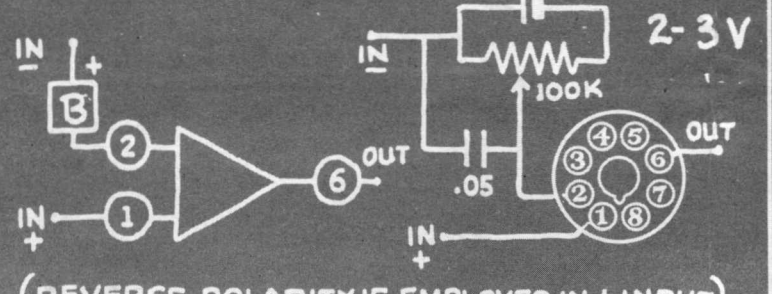
RESISTIVE METHOD OF BIAS
PRINCIPALLY FOR POSITIVE INPUT





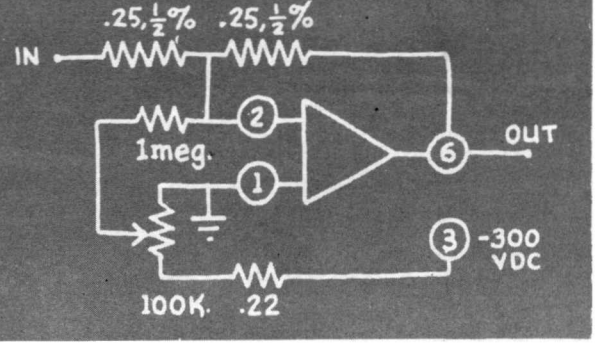
NOTE THAT FOR MANY APPLICATIONS A BIAS ADJUSTMENT IS UNNECESSARY

PRIMARY CELL METHOD
FOR NEGATIVE OR POSITIVE INPUT



(REVERSE POLARITY IF EMPLOYED IN + INPUT)

ALTERNATIVE METHOD
ILLUSTRATED FOR INVERTER



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