Engineering News

ALTEC LANSING
ALTEC DIVISION OF [illegible] LING ALTEC, INC
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TECHNICAL LETTER NO. 173

PORTABLE PEAK-RESPONDING VOLTMETER, CALIBRATED IN RMS VOLTS

INTRODUCTION

This paper describes a peak-responding voltmeter designed specifically for measuring the peak voltage excursions on 70 Volt loudspeaker distribution lines. This instrument is compact, lightweight, easily constructed, inexpensive, and is self-powered using a single 9V "transistor radio" battery. A more complete explanation of the theory and use of this type of peak-responding instrument is given in "Peak Factor Demonstration Test Set", Altec Technical Letter No. 172.

Circuit

An electrical schematic diagram of the complete circuit is given in Figure 1. The instrument uses two "N-channel" field-effect transistors (FET's) in a balanced bridge configuration. These FET's may be nearly any low cost general purpose type, such as the Motorola MPF-103, which this instrument uses. The meter movement is 100 μA full scale, which has a 0-100 scale, calibrated to provide readings of 0-100 Volts, enabling direct reading without the need for interpolation or calculation. The 750 Ω resistor across the meter serves a twofold purpose. First, it acts as a shunt to improve meter damping and, therefore, decreases pointer overshoot, and second, increases the unbalanced bridge current from 100 μA to 350 μA for improved linearity. The 10K Ω resistor in series with the meter is necessary as a current limiter, since at full scale, there is a 3.5V unbalance between the two Fet's. In addition, it will be noted that the meter circuit is connected between the two SOURCE terminals of the FET's. This corresponds to the vacuum tube cathode follower, and improves linearity due to 100% voltage feedback.

The diodes, CR1 and CR2, are low voltage general purpose silicon diodes, such as IN456A. The input signal is applied to the junction of CR1 and CR2, where it is full-wave rectified and applied to the opposite halves of the bridge formed by Q1 and Q2. This rectified signal charges the 0.47 μF capacitors and unbalances the bridge; the degree of unbalance is determined by the amount of input voltage. Since the FET's represent a very high impedance, the capacitors must discharge through the 4.7 megohm resistors, the time constant being approximately 2.2 seconds. This time constant allows the meter to be read more easily.

Calibration

After construction, the instrument is turned on by switch S1. With no input signal, potentiometer P2 is adjusted for a zero reading on the meter; the bridge is now in balance. The input terminals are now connected across a 70V line carrying a sine-wave signal, in parallel with another meter of known accuracy; potentiometer P1 is adjusted so both meters read the same (70 Volts). This completes calibration and adjustment.

Litho in USA CP-1071-0.5K

ADDENDUM

The meter movement used in this instrument is 0-100 μA, with a nominal internal resistance of 1850 Ω. Other meter movements may be used by changing the limiting resistor. It is recommended that either 100 μA, or possibly 0-1 mA, movement be used, to eliminate the need for a new meter scale so they will directly read 100 Volts full scale. If a 0-1 mA movement is chosen, the limiting resistor will be changed from 10K to approximately 3.6K; the 750 Ω damping will then be unnecessary.

By Lou Garner

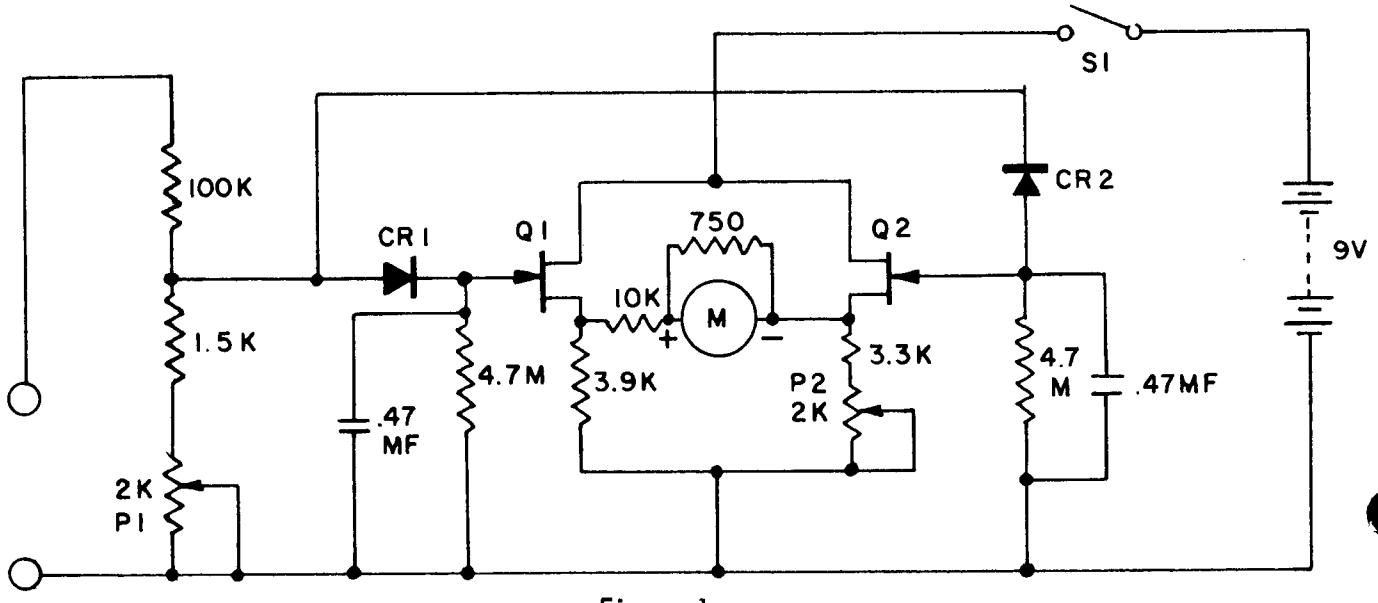

Figure 1.

PARTS LIST

1 Meter, 100 μA movement
2 Field effect transistors - Motorola MPF-103 or equivalent - Q1-Q2.
2 Diodes IN456 or equivalent - CR1-CR2.
2 Trimmer resistors, or potentiometers, 2000 Ω linear - P1-P2.
1 Switch, momentary contact - S1.
1 9 Volt Battery - "Transistor radio" type.
2 Capacitor .47 mfd ±20R 100 V Mylar.
2 Resistor 4.7 megohm ±10% 1/4W.
1 100,000 Ω ±10% 1/4W Resistor.
1 10,000 Ω ±10% 1/4W Resistor.
1 3,900 Ω ±10% 1/4W Resistor.
1 3,300 Ω ±10% 1/4W Resistor.
1 1,500 Ω ±10% 1/4W Resistor.
1 750 Ω 5% 1/4W Resistor.
2 Binding posts
1 Mini-Box
1 Battery plug-snap on type, for above battery.