1-4. SPECIFICATIONS.

AS A VOLTMETER:

RANGE: .001 volt full scale to 100 volts in eleven 1x and 3x ranges.

ACCURACY: ±1% of full scale on all ranges exclusive of noise and drift.

ZERO DRIFT: After 1-hour warm-up no more than 2 millivolts in the second hour, and in any subsequent 24-hour period, the average drift will not exceed 200 microvolts per hour.

METER NOISE: ±10 microvolts with input shorted.

INPUT IMPEDANCE: Greater than 10^{14} ohms shunted by 22 picofarads on the VOLTS position of the Range Switch. Input resistance may be selected in decade steps from 10 to 10^{11} ohms with the Range Switch.

AS AN AMMETER:

RANGE: 10^{-14} ampere full scale to 0.3 ampere in twenty-eight 1x and 3x ranges.

ACCURACY: ±2% of full scale on 0.3 to 10^{-11} ampere ranges using smallest available Multiplier Switch setting; ±4% of full scale on 3×10^{-12} to 10^{-14} ampere ranges.

METER NOISE: Less than $\pm 3 \times 10^{-15}$ ampere.

GRID CURRENT: Less than 2×10^{-14} ampere.

AS AN OHMMETER:

RANGE: 100 ohms full scale to 10^{14} ohms on twenty-five linear 1x and 3x ranges.

ACCURACY: ±3% of full scale on 100 to 10^{9} ohm ranges using highest available Multiplier Switch setting; ±5% of full scale on 3×10^{9} to 10^{14} ohm ranges.

AS A COULOMBMETER:

RANGE: 10^{-12} coulomb full scale to 10^{-5} coulomb in fifteen 1x and 3x ranges.

ACCURACY: ±5% of full scale on all ranges. Drift due to grid current does not exceed 2×10^{-14} coulomb per second.

AS AN AMPLIFIER:

INPUT IMPEDANCE: Greater than 10^{14} ohms shunted by 22 picofarads on the VOLTS position of the Range Switch. Input resistance may be selected in decade steps from 10 to 10^{11} ohms with the Range Switch.

OUTPUTS: Unity-gain output and either voltage or current recorder output.

Unity-Gain Output: At dc, output is equal to input within 50 ppm or 100 microvolts, exclusive of zero drift, for output currents of 100 microamperes or less. Up to one milliampere may be drawn for input voltages of 10 volts or less.

Voltage Recorder Output: ±3 volts for full-scale input. Internal resistance is 3 kilohms. Output polarity is opposite input polarity.

Gain: 0.03, 0.1, etc., to 3000.

Frequency Response (Within 3 db): dc to 300 cps at a gain of 3000, rising to 25 kc at a gain of 30, decreasing to 2.5 kc at a gain of 0.03.

Noise: 3% rms of full scale at a gain of 3000, decreasing to 1% at gains below 100.

Current Recorder Output: ±1 milliampere for full-scale input, variable ±5% with 1400-ohm recorders.

GENERAL:

POLARITY: METER Switch selects left zero (positive or negative) or center-zero scales. Output polarity is not reversed.

LINE STABILITY: A 10% change in line voltage will cause less than a 10-microvolt meter deflection on all ranges.

CONNECTORS: Input: uhf type; ground binding post.
Output: Voltage or current, Amphenol 80-PC2F; Unity-gain, binding posts.

POWER: 105-125 or 210-250 volts (switch selected); 50 to 1000 cps; 10 watts.

DIMENSIONS, WEIGHT: Model 610B: 10-1/2 inches high x 6-5/8 inches wide x 10 inches deep; net weight, 12 pounds. Model 610BR: 5-1/4 inches high x 19 inches wide x 10 inches deep; net weight, 12 pounds.

ACCESSORIES SUPPLIED: Mating input and output plugs; 3:2 power line adapter; binding plug.

1-5. APPLICATIONS.

a. Voltmeter applications include directly measuring potentials of vacuum tube plates and grids, pH electrodes, piezo-electric crystals, capacitors and electrochemical cells, and the gate potentials of field effect transistors. With the Model 2501 or 2503 Static Detector Probe, the Model 610B can measure electrostatic voltages.

b. As a picoammeter, the Electrometer can measure mass spectrograph currents. It can be used with photo multiplier tubes, flame and beta ray and lithium ion-drift detectors. Other uses are in gas chromatograph work, nuclear studies, plasma physic studies and vacuum studies. Also, it can be used as a current null detector with an accurate current reference source.

c. As an ohmmeter, its uses include measuring diode characteristics, insulation resistance, and resistor voltage coefficients. With the Model 6105 Resistivity Adapter and a power supply, the Model 610B can measure volume and surface resistivities.

d. In addition to measuring charge directly, other coulombmeter uses are measuring charge current over a period and obtaining integral curves of time-varying currents. The Model 610B can measure the total energy output from a pulsed laser on its coulomb ranges when used with a calibrated photo tube or photo diode. It also can be used as a charge amplifier to measure piezo-electric crystal outputs.

1-6. ACCESSORIES.

a. Three accessory probes, fully described in Section 5, facilitate measurements and extend the Electrometer's voltage range to 30 kilovolts.

b. Model 6104 Test Shield is suitable for resistance measurements with either 2 or 3-terminal guarded connections, as well as voltage and current tests.

c. Model 6105 Resistivity Adapter is a guarded test fixture for measuring volume and surface resistivities of materials when used with the Model 610B and the Keithley Model 240A High Voltage Supply.

d. Models 2501 and 2503 Static Detector Probes are capacitive voltage dividers with a 10,000:1 ratio, when used with the probe 3/8 inch from the charged surface.

e. Model 6106 Electrometer Connection Kit contains a group of the most useful leads and adapters for electrometer measurements.

f. Model 6107 pH Electrode Adapter has a 2-foot cable and coaxial connector and accepts a Beckman and Coleman (B-C) or a Leeds and Northrup (L & N) connector. The Adapter allows accurate and convenient pH potential measurements with the Model 610B.

g. Model 370 Recorder is uniquely compatible with the Model 610B as well as other Keithley microvoltmeters, electrometers and picoammeters. The recorder is a high quality economical instrument that maximizes the performance of the Model 610B and many other Keithley instruments, even in the most critical applications.

1-7. EQUIPMENT SHIPPED. The Model 610B Electrometer is factory-calibrated and is shipped with all components in place. The shipping carton contains the Instruction Manual and mating plugs for the input and output receptacles. The Model 610BR is shipped with the angles and screws for rack mounting packed separately within the shipping carton.

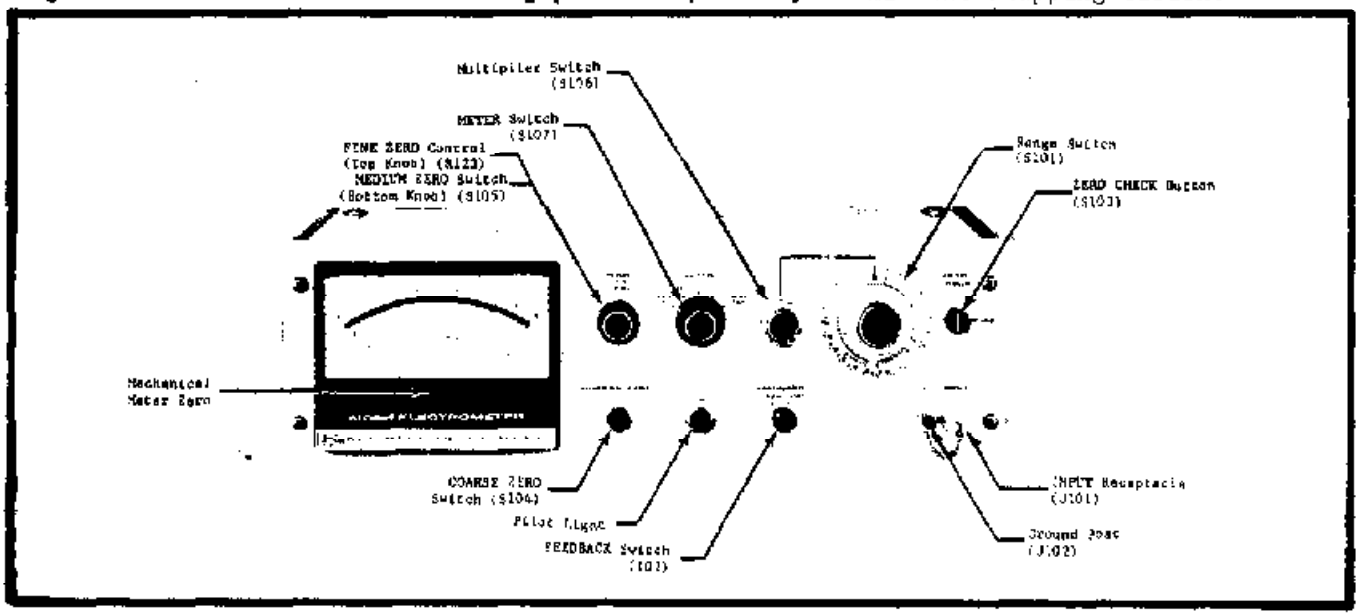

FIGURE 3. Model 610BR Front Panel Controls and Terminals. Circuit designations refer to Replaceable Parts List and the schematic diagram.