RANGE

OSCILLATOR

DIODE

REAR WAFER (REAR)

FREQUENCY

R1 470

C3 150

C1 450

C2 2.5-6

R2 22K

V1A 1/2 12AT7

V1B 1/2 12AT7

140

R5 680

C8 7-35

"L"

"C"

RESONANCE C10 450

VERNIER C11 7

V2A 1/2 6AL5

V2B 1/2 6AL5

R10 3.3 MEG

C9 5000

VTVM

80

V3A 1/2 12AU7

V3B 1/2 12AU7

R7 3.3 MEG

C12 .001

R8 3.3 MEG

R9 3.3 MEG

C13 .001

C5

R4 2200

.005

C7 .001

R6 47K

D1

C6 .001

"Q" CAL (REAR)

FRONT WAFER (REAR)

SET LEVEL

C4 .005

R3 10K

RECTIFIER

120 VAC LINE

BLK

RED

RED-YEL

60 MA

RED

210 AC

210 AC

V5 6X5

200

R14 1500 2W

R15 2500 5W

+ C14A 8 μFD

+ C14B 8 μFD

INTERNAL JUMPER

80

V4 OD3 VOLTAGE REGULATOR

R18 100K

-70

R17 4700 2W

R11 2200

R12 3000

R13 2200

SET ZERO

50μA

ON

OFF

BLK

GRN

6.3 AC 2.8A

GRN

V5 6X5

V1 12AT7

V3 12AU7

R16 5.6 1W

V2 6AL5

#47 PILOT LAMP

SCHEMATIC OF THE HEATHKIT® Q METER MODEL QM-1

1. ALL RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE. RESISTOR VALUES ARE IN OHMS (K = 1000, MEG = 1,000,000).
2. CAPACITOR VALUES LESS THAN 1 ARE IN μfd. VALUES OF 1 AND ABOVE ARE IN μμf, UNLESS THEY ARE MARKED OTHERWISE.
3. ⬭ THIS SYMBOL INDICATES A POSITIVE DC VOLTAGE MEASUREMENT (UNLESS MARKED OTHERWISE) TAKEN WITH AN 11 MEGOHM VTVM, FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES MAY VARY ±10%.
4. ALL SWITCH WAFERS SHOWN IN FULL CLOCKWISE POSITION, AS VIEWED FROM THE REAR OF THE SWITCH.

SPECIFICATIONS

Frequency Range.	Band A: 150 kc to 450 kc. Band B: 450 kc to 1500 kc. Band C: 1.5 mc to 5 mc. Band D: 5 mc to 18 mc.
Inductance Scale Range.	1 microhenry to 10 millihenry.
Actual Capacitance Scale Range.	40 $\mu\mu$f to 450 $\mu\mu$f.
Effective Capacitance Scale Range.	40 $\mu\mu$f to 400 $\mu\mu$f.
Vernier Capacitance Scale Range.	-3 $\mu\mu$f to +3 $\mu\mu$f.
Q Scale Range.	250 full scale, multiplied by one (X1) or two (X2).
Tube Complement	1 - 12AT7 Oscillator. 1 - 6AL5 Q Diode. 1 - 12AU7 VTVM Amplifier. 1 - OD3/VR150 Voltage Regulator. 1 - 6X5 Rectifier.
Power Requirements.	105-125 V AC 50/60 cps 30 watts.
Dimensions.	8" high x 17" wide x 6" deep.
Net Weight.	9-1/2 lbs.

All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CIRCUIT DESCRIPTION

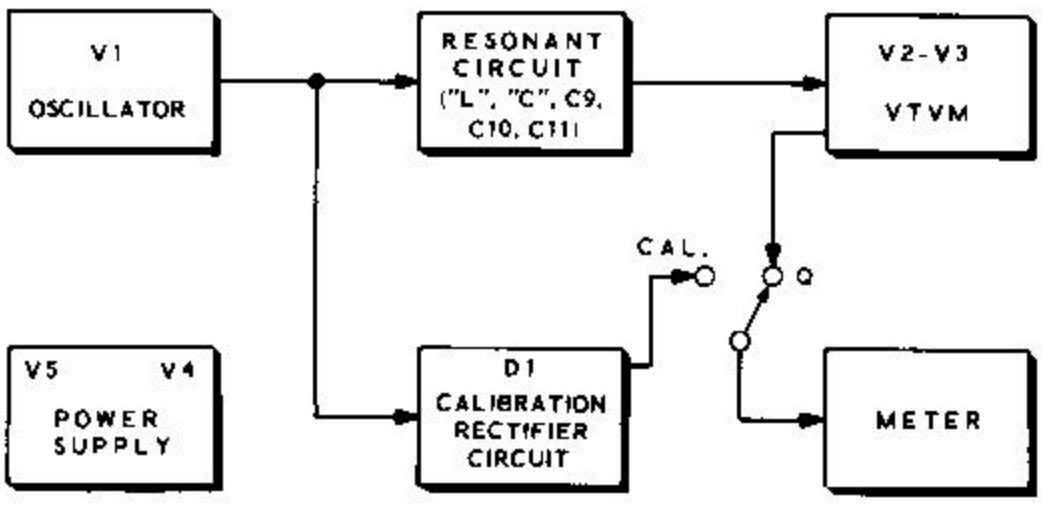
Refer to the Schematic and Block Diagrams when reading the following circuit description.

The principal circuits of the Q Meter are: variable oscillator V1; the resonant circuit, which contains the unknown inductance or capacitance; and the VTVM (vacuum tube voltmeter) and meter circuit. The output voltage from the oscillator circuit is measured and set to a predetermined level, and then coupled into the resonant circuit. The magnitude of the voltage that then appears across the resonant circuit is equal to the voltage injected into the circuit from the oscillator, multiplied by the Q of the circuit. The full resonant circuit voltage is then rectified, applied to the VTVM circuit, and measured on the meter, which is calibrated in Q.

OSCILLATOR

Oscillator stage V1, which operates as a tuned-grid oscillator circuit, is tunable from 150 kc to 18 mc in four bands. The correct oscillator coil for each band is selected by the Range switch. The output signal from the oscillator V1A is coupled through isolation resistor R1 into the grid of cathode follower stage V1B. The level of this signal to V1B is controlled by the Set Level control, which adjusts the plate voltage of oscillator stage V1A.

A portion of the output voltage from the cathode of V1B is rectified and filtered by diode D1, capacitor C6, and resistor R6. The DC output voltage of this circuit which is proportional to the RF voltage at the cathode V1B, is then coupled through the Cal-Q switch to the meter.



BLOCK DIAGRAM

This circuit enables the RF voltage at the cathode of V1B to be adjusted to the predetermined levels that are used for Q measurements.

RESONANT CIRCUIT

The oscillator signal at the cathode of V1B is coupled to the resonant circuit through a capacitive voltage divider that consists of capacitors C8 and C9. The reactance of capacitor C8 is very large (in the order of 250 to 1) compared to the reactance of capacitor C9. Therefore any reactance that is connected in parallel with C9 will have a negligible effect on the RF current being supplied through C8 from the oscillator stage.

Capacitor C9 is specially constructed to be non-inductive within the range of this instrument.

The actual resonant circuit consists of capacitors C9, unknown inductance L, resonant capacitor C10, and vernier capacitor C11. When the proper frequency is applied across capacitor C9 from the oscillator circuit, this entire circuit resonates and a large voltage appears across the circuit. This voltage is equal to the voltage injected into the circuit from V1, multiplied by the circuit Q.

The large voltage that appears across this circuit is rectified by diode V2A. This rectified voltage not only appears across capacitor C10, but is also developed across capacitor C9 through the coil connected to the "L" terminals. The voltage is connected from this low impedance point of the circuit through resistor R7 to the VTVM circuit. Resistor R7 and capacitor C12 function as an RF filter. If no coil is connected between the "L" terminals, the VTVM will not operate properly.

VTVM

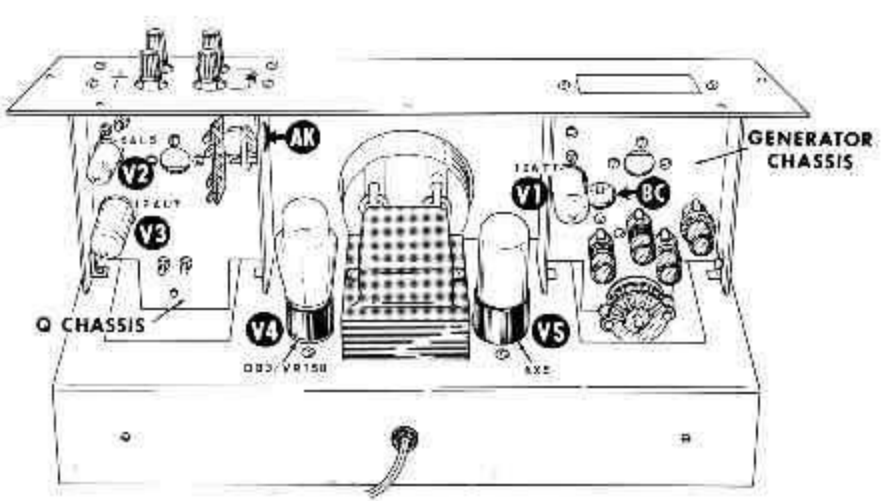
V3A and V3B are connected in a balanced bridge circuit. With zero voltage at the grid of V3A each of the triode sections will draw the same amount of cathode current. Therefore each cathode will be at the same potential. The meter movement, which is connected between the two cathodes (through the Cal-Q switch), will not deflect in this case.

When a negative voltage is coupled to the grid of V3A, this half of the tube will draw less current than V3B, causing a difference in cathode potential between the two tube sections. Since the meter is connected between the two cathodes, the current flows through the meter movement. The meter pointer will respond proportionally to this current and indicate the value of voltage at the grid of V3A.

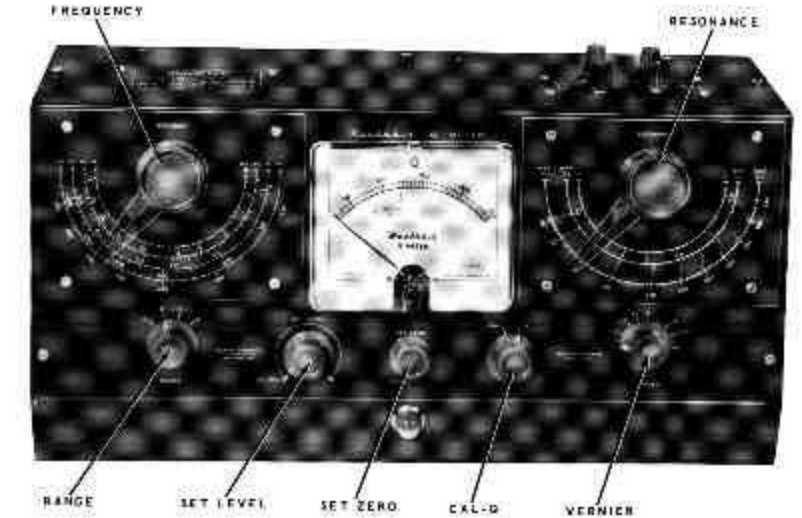
Diode V2B is connected in the grid circuit of V3B to balance out any contact potential at the grid of V3A from diode V2A.

POWER SUPPLY

Rectifier tube V5 is connected in a full wave rectifier circuit. The output voltage from the cathode of V5A is filtered by capacitors C14A and C14B and resistor R14. V4, the voltage regulator tube, maintains a constant 150 volts which is fed to the VTVM circuit.



PICTORIAL 5-1



PICTORIAL 5-2