OPERATING AND SERVICE MANUAL

MODEL 204B

SERIALS PREFIXED: 416-

OSCILLATOR

01369-4

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SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. The Model 204B Oscillator (figure 1-1) is a transistorized battery-powered instrument which produces sine-wave signals in the 5-cps to 560-kc range. The output is 10 milliwatts into 600 ohms and is continuously adjustable over at least a 40-db range. Into the rated load of 600 ohms, frequency response is within ±3%. The oscillator output is floating, isolated from power line ground and instrument chassis.

1-3. The 600-ohm output impedance of the oscillator makes it compatible with transmission lines and many distribution systems. When battery-powered, the oscillator is useful for isolated applications. The ⓗⓟ Model 403A/B AC Voltmeter, also battery-powered, makes an ideal companion instrument for the Model 204B.

1-4. POWER SUPPLY.

1-5. Normally the oscillator is equipped with a battery pack which consists of four 6.75-volt mercury batteries. If operation from AC is desired, an AC power supply (Option 1) or a power supply with rechargeable batteries (Option 2) may be used. Both of these power supplies operate from 115 or 230 volts, and are in kit form for field installation. The battery pack is also in kit form. All three types of power supplies mount in the same location in the instrument and can be easily interchanged in the field.

1-6. MERCURY AND RECHARGEABLE BATTERIES.

1-7. Mercury batteries used in the Battery Pack are vented to prevent excessive internal pressures from developing. The nickel cadmium batteries are sealed but present no problem if properly used (see Section III). The following precautions should be followed for either type of battery:

a. DO NOT short circuit either type of battery.

b. Dispose of batteries promptly when they have exhausted or will not operate equipment up to specifications.

c. Never dispose of batteries by fire.

d. Turn off battery powered equipment when not in use.

e. Store batteries in a cool well-ventilated place.

1-8. OPTIONS AVAILABLE.

1-9. The following three power supplies are available in kit form for field installation:

Battery Pack Power Supply - 204B-64B
AC Operated Power Supply - 204B-11A
Rechargeable Battery Power Supply - 204B-11C

1-10. INSTRUMENT IDENTIFICATION.

1-11. Hewlett-Packard used a two-section, eight-digit serial number (000-00000). If the first three digits of the serial number on your instrument do not agree with those on the title page of this manual, change sheets supplied with the manual will define differences between your instrument and the Model 204B described in this manual.

Table 1-1. Specifications

FREQUENCY RANGE: 5 cps to 560 kc in 5 ranges, vernier control	DISTORTION: Less than 1%
DIAL ACCURACY: ±3%	NOISE: Less than 0.05%, ac or battery operated
FREQUENCY RESPONSE: ±3%, with rated load	POWER SOURCE: 4 batteries at 6.75 volts each, 7-ma drain, life at least 300 hours.
OUTPUT IMPEDANCE: 600 ohms	DIMENSIONS: Module 6-3/32 in. high, 5-1/8 in. wide, 8 in. deep
OUTPUT: 10 milliwatts (2.5 vrms) into 600 ohms, 5 vrms open circuit, completely floating	NET WEIGHT: 6 lb
OUTPUT CONTROL: Continuously variable bridged "T" attenuator with at least 40-db range	EQUIPMENT AVAILABLE: 204B-11A, AC Supply Kit for field installation, 204B-11C Rechargeable Battery Supply Kit for field installation, 204B-64B, Battery Kit for field installation.

SECTION II
INSTALLATION

2-1. INSPECTION.

2-2. Unpack the instrument upon receipt and inspect it for signs of physical damage such as scratched surfaces, broken knobs, etc. If damage is apparent, proceed as described in the "Claim for Damage in Shipment" section of the warranty in the rear of this manual.

2-3. An electrical inspection should be performed as soon as possible after receipt; see paragraph 5-5 for performance checks. These are good test procedures for incoming quality-control inspection.

2-4. RACK/BENCH INSTRUCTIONS.

2-5. The Model 204B is shipped with plastic feet and a tilt stand attached, ready for use as a bench-type instrument. To adapt the Model 204B for rack mounting, remove the plastic feet identified in figure 5-3 by following the procedure given in paragraph 5-13 (c).

2-6. COMBINING CASE.

2-7. The combining case shown in figure 2-1 is a full-module unit which accepts varying combinations of submodule units such as the Model 204B. Being a full-module unit, the combining case can be used as a bench model or it can be rack mounted. Instructions for use of the combining case are given graphically in figure 2-2 for 1/2-module units. The Model 204B is a 1/3-module unit, therefore it is necessary to use either the right or left divider latch when installing the divider assembly.

2-8. ADAPTER FRAME.

2-9. The adapter frame is simply a rack frame that accepts any combination of submodule units (see figure 2-3); it can only be rack mounted. Instructions are as follows:

a. Place adapter frame vertically on edge of bench as shown in step 1, figure 2-4.

b. Stack submodule units in frame as shown in step 2. Place spacer clamp between units, step 3

c. Place two end spacer clamps as shown in step 4, and push submodule units into frame.

d. Insert screws on either side of frame, step 5, and tighten until submodule units are tight in frame.

e. The complete assembly is now ready for rack mounting.

2-10. BATTERY-POWERED OSCILLATORS.

2-11. Power for battery-powered oscillators is supplied from four 6.75-volt Mallory mercury batteries. There are no special installation instructions for placing battery-powered oscillators into operation. To convert for operation from an ac power supply or a rechargeable battery power supply, refer to paragraph 5-35.

2-12. AC-POWERED OSCILLATORS.

2-13. POWER REQUIREMENTS. When the Model 204B has an ac power supply or the rechargeable battery power supply, a source of 115 or 230 volts ±10%, 50 to 1000 cps will be required. When the source is 115 volts, set the switch, located on the rear panel, so that the number 115 appears. If a 230-volt source is used, place the switch so that the number 230 appears.

2-14. POWER CABLE. For the protection of operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that the instrument panel and cabinet be grounded when being operated from an ac power line. Instruments with the ac power supply or rechargeable battery power supply are equipped with a detachable, three-conductor power cable which, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the power cable three-prong connector is the ground pin.

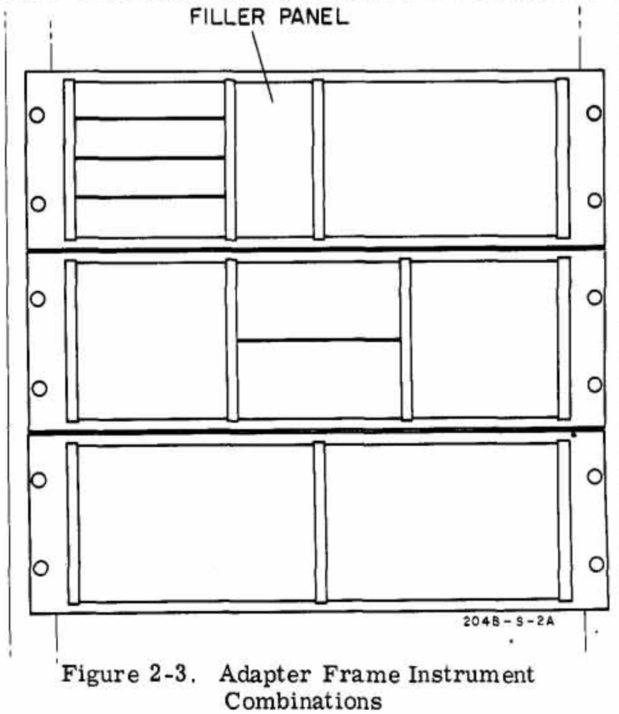


Figure 2-3. Adapter Frame Instrument Combinations

2-15. To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the pigtail on the adapter to ground.

2-16. REPACKING FOR SHIPMENT.

2-17. The following is a general guide for repackaging an instrument for shipment. If you have any questions, contact your local ⓗ sales office or repair facility. Proceed as follows:

a. Place instrument in original container if available. If original container is not available, it can be purchased from your nearest Hewlett-Packard Sales and Service Office (refer to maps in Appendix).

b. If original container is not used, wrap instrument in heavy paper or plastic before placing in inner container.

c. Use a heavy carton or wooden box to house the instrument and inner container and use strong tape or metal bands to seal the shipping container.

d. Mark shipping container with "Delicate Instrument", "Fragile", etc. as appropriate.

Note

If instrument is to be shipped to Hewlett-Packard for service or repair, attach a tag to instrument identifying owner, model number, serial number, and indicating service or repair to be performed. In any correspondence identify instrument by model number and serial number, and serial number prefix.

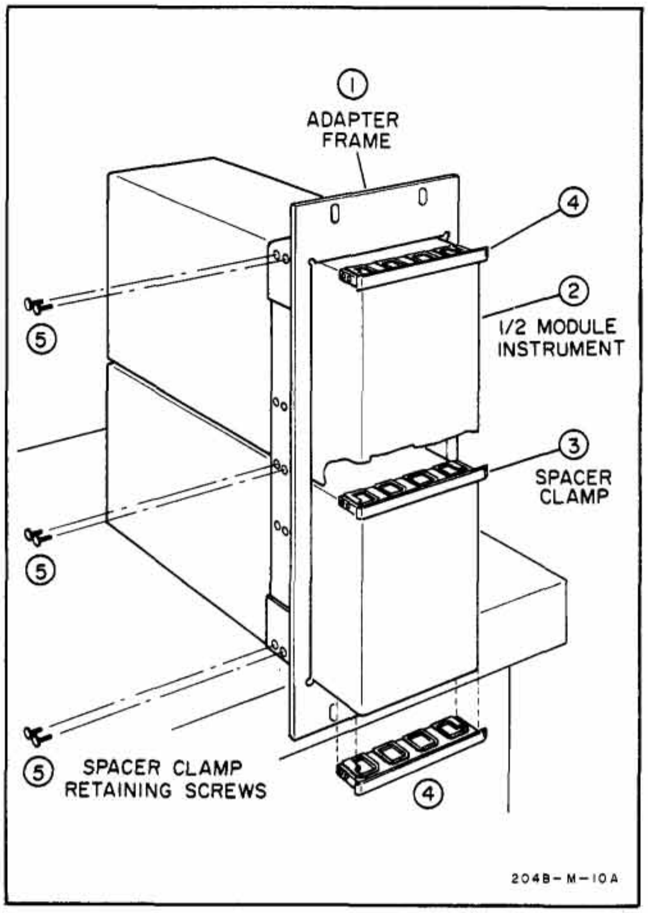
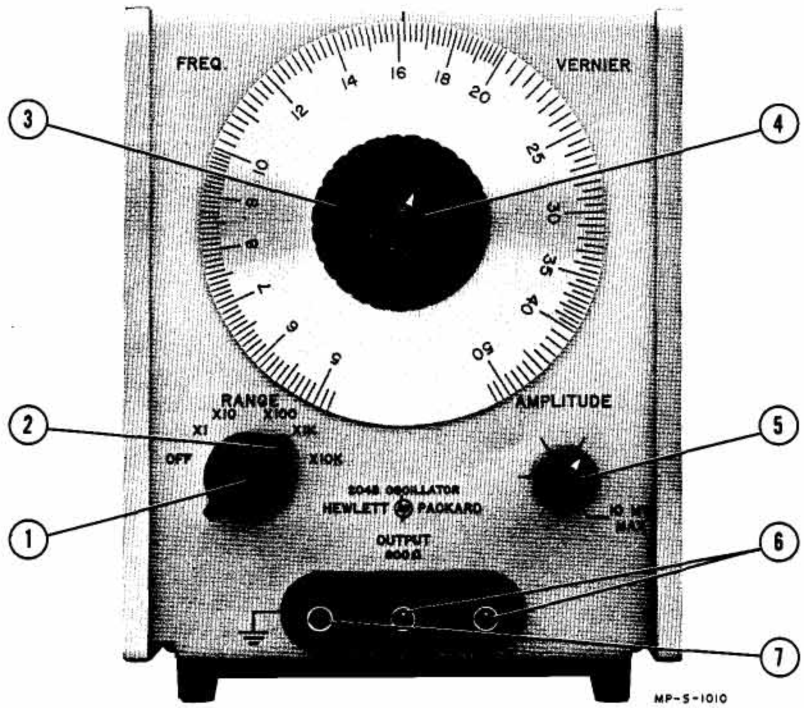


Figure 2-4. Two Submodule Units in Rack Adapter



Controls and Connectors

1. For selecting frequency range. In OFF position oscillator is inoperative.
2. On indicator; glows in all positions of RANGE switch except OFF.
3. For selecting frequency within desired range. Dial calibration multiplied by RANGE switch position gives output frequency in cycles per second.
4. Provides fine frequency adjustment. Dial is calibrated with arrow in vertical position.
5. For selecting desired output level (10 mw maximum into 600 ohms).
6. Output terminals, floating; impedance, 600 Ω.
7. ⏚ is cabinet ground terminal.

Operation

a. Connect load to OUTPUT 600Ω (6) terminals.

b. Select frequency with RANGE (1) and FREQ. (3). Example: If FREQ. is set to 20 and RANGE to X1K, the oscillator's output frequency is 20 kc (20 cps x 1K = 20 kc).

c. Set AMPLITUDE (5) for desired power level.

Note

If oscillator is equipped with AC Power Supply or Rechargeable Battery Power Supply, turning RANGE switch to OFF does not turn AC Power Supply or Battery Charger off. Disconnect power cord to turn either of these two power supplies off.

Figure 3-1. Front Panel Controls, Connectors, and Operating Instructions

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. The Model 204B has four operating controls and one output connector (see figure 3-1). A sinewave signal in the 5-cps to 560-kc range is selected by positioning the FREQ., RANGE, and VERNIER controls. Output power level is controlled by the AMPLITUDE control which has at least a 40-db range. A 115/230 volt switch is on the rear panel when oscillators are equipped with an ac power supply or rechargeable battery power supply.

3-3. PROCEDURE.

3-4. Operating instructions for the Model 204B are given in figure 3-1.

3-5. GENERAL OPERATING CONSIDERATIONS.

3-6. To prevent damage to transistors in the oscillator, a blocking capacitor should be used in series with the output when connecting to a load across which there is a dc potential difference. When the capacitor is used, initial current surge must be limited to a capacitance-voltage product less than 200 microfarad-volts. For example, if a 20-volt potential difference exists across the load, use a 10-μf capacitor (10μf x 20 v = 200 μ fv).

CAUTION

DO NOT CONNECT THE OSCILLATOR ACROSS LOADS WHICH ARE REFERENCED OFF GROUND (⏚) BY MORE THAN ±25 VOLTS; HIGHER VOLTAGES WILL BREAK DOWN COMPONENT INSULATION.

3-7. When the Model 204B is initially turned on and RANGE switch is set to X1, allow 20 seconds for oscillator to stabilize; only a few seconds are necessary for stabilization when switching to other RANGE positions. If FREQ. dial is swept at too fast a rate, output voltage fluctuations will occur (since a wirewound resistor is used as the variable frequency determining element). If sweep speed is decreased or sweeping is stopped, oscillator output will stabilize at its normal level.

3-8. To obtain maximum amplitude stability from battery-powered oscillators, wait 20 minutes after turn-on to permit the battery voltage to stabilize. This effect may cause as much as a 1% change in amplitude during the first 20 minutes of operation.

3-9. When operating from batteries (Mercury or Nickel-Cadmium) the batteries require replacement or recharging (Nickel-Cadmium batteries only) when maximum oscillator output becomes less than 5. 0 volts rms open circuit or less than 2. 5 volts rms into 600 ohms. For mercury battery replacement data, refer to paragraph 3-26. Charging instructions for nickel-cadmium batteries are given in paragraph 3-16.

3-10. OPERATION WITH RECHARGEABLE BATTERIES.

3-11. There is no change in the operating procedure for an instrument in which the rechargeable battery supply has been installed. However, this power supply permits either ac operation for 115/230 vac ±10% (selected by switch on rear) 50 to 1000 cps power sources or battery operation for portable applications. Battery operation only (with charger power cord disconnected) is required at temperatures below 32°F (0°C) and is recommended at temperatures above 104°F (40°C).

3-12. When the RANGE switch is turned OFF, power is removed from the oscillator portion of the instrument and a resistor is connected across the output of the power supply. The charger will continue to operate as long as the power cord is connected to a power source. The resistor, placed across the output of the power supply, acts as a load in place of the oscillator section to maintain a constant charge rate through the batteries. A diode in the output circuit prevents battery discharge when the oscillator is not connected to a power source.

3-13. It is recommended that the power cord be connected to a power source whenever possible. This will prevent self-discharge of the battery cells and will assure a fully charged battery whenever portable operation is required. Turn the oscillator OFF when not in use, particularly when operating with the power cord disconnected.

3-14. When fully charged, the batteries will power the oscillator for approximately 40 hours of continuous or intermittent operation provided they are at a temperature of 81°F ±10°. If the batteries are operated at higher or lower temperatures their capacity is reduced as the temperature extremes are approached; approximately 28 hours at 122°F (50°C) or approximately 20 hours at -4°F (-20°C). At temperatures beyond these extremes the batteries are not capable of supplying their characteristic stable discharge voltage.

3-15. The +122°F to -4°F temperature range is adequate for most users, however, keep these limits in mind when operating under field conditions. Internal temperatures in excess of 122°F are easily obtained if the instrument is left in the sun, even with a moderate ambient temperature. Good practice would be to avoid storing, transporting, or operating in direct sunlight other than for a very short period. Also avoid placing the instrument in a location where surrounding equipment might excessively raise the internal temperature.

CAUTION

THE HERMETICALLY SEALED CELLS IN THESE BATTERIES MAY BE PERMANENTLY DAMAGED OR THEIR LIFE DRASTICALLY REDUCED IF EXPOSED TO EXTREMELY HIGH TEMPERATURES. THIS DANGER INCREASES UNDER PROLONGED CONDITIONS.

3-16. RECHARGING NICKEL-CADMIUM BATTERIES.

3-17. The batteries should be considered as fully discharged when maximum oscillator output drops below 5.0 volts rms open circuit or less than 2.5 volts rms into 600 ohms. The batteries will not operate much longer when this point is reached and the oscillator probably will not meet specifications. Excessive discharge of batteries may damage them or shorten their life.

3-18. To recharge batteries, turn oscillator OFF and connect power cord to a suitable power source. The batteries will be fully charged in approximately 60 hours at a 5.5 milliampere charge current and 30 hours at a 11 milliampere charge current if they were fully discharged at the beginning. The instrument can be turned on for use after an initial charge of at least 20 minutes. If the batteries were only partially discharged, the oscillator can be turned on for use at any time. The charge rate is the same whether the oscillator is OFF or operating; therefore, very little increase in charging time will be required if the instrument is used while the batteries are being recharged. The charge circuit can be increased with the charge current adjustment R102 (refer to figure 5-11) to a maximum of 11 milliamperes to provide a quick charge. The 11 milliampere charge rate should be used for quick charge only. Repeated charging at a high rate will shorten battery life.

3-19. The batteries can be charged at any temperature between +32°F to +122°F (0°C to +50°C). However, to obtain optimum battery life, recharging should be done at a temperature of 80.6°F ±10°F (27°C ±5.6°C).

CAUTION

THE FOUR NICKEL-CADMIUM BATTERIES ARE HERMETICALLY SEALED AND CAN BE DAMAGED IF CHARGED AT A FAST RATE AT A TEMPERATURE EXCEEDING 122°F (50°C). IF THE CHARGE CURRENT ADJUSTMENT HAS BEEN SET FOR A QUICK CHARGE RATE, PLACE THE INSTRUMENT IN A LOCATION WHERE THE AMBIENT TEMPERATURE DOES NOT EXCEED 104°F (40°C).

3-20. CYCLE-LIFE OF NICKEL-CADMIUM BATTERIES.

3-21. As extremes in temperatures are approached, the cycle-life (complete charge-discharge cycles) of the batteries is reduced. Storage at high temperatures will increase the self-discharge rate and also decrease the cycle-life. Permanent battery damage may result if the batteries are stored at a high temperature for a prolonged period.

3-22. Battery cycle-life can be extended by recharging before the batteries are completely discharged, charging and discharging at a rate which is slower than the maximum ten-hour rate specified by the manufacturer, and by not overcharging.

3-23. The cycle-life of the batteries is based, by the manufacturerer, on an endpoint of 80% of the rated 225 milliampere-hour capacity. This is with a ten-hour charge and discharge current of 22.5 milliamperes with discharge carried to the normal ten-hour end voltage (1.10 volts/cell x 5 = 5.50 volts/battery) on every cycle. Under these conditions a cycle-life in excess of 100 cycles can be expected.

3-24. When used to power the ⓗⓟ Model 204B Oscillator, the batteries are discharged at approximately a 40 hour rate. The batteries are not fully discharged if they are recharged as recommended in paragraph 3-16.

3-25. Optimum battery life can be obtained by following a simple routine of 1) preventing complete battery discharge by recharging before the oscillator output level drops below 5.0 V rms into an open circuit (2.5 V rms into 600 ohms), 2) keeping the use of a quick charge to a minimum, 3) operating at moderate temperatures whenever possible and 4) by disconnecting power cord after 60 hours of continuous charging with oscillator turned OFF (30 hours if charging batteries at a quick charge rate).

3-26. MERCURY BATTERY REPLACEMENT.

3-27. Battery replacement is required when the oscillator output becomes less than 5.0 volts rms open circuit or less than 2.5 volts rms into 600 ohms provided the DC BAL is adjusted correctly. Replace the batteries with four 6.75-volt mercury batteries (Mallory type TR235R or equivalent). Refer to figure 3-2, and proceed as follows:

a. Remove top cover retaining screw and slide cover from instrument.

b. Remove wing nuts and battery clamps.

c. Remove and dispose of batteries according to paragraph 1-6.

d. Install replacement batteries so that battery polarity matches polarity designation on battery clamps.

e. Replace battery clamps and wing nuts.

f. Replace top cover.

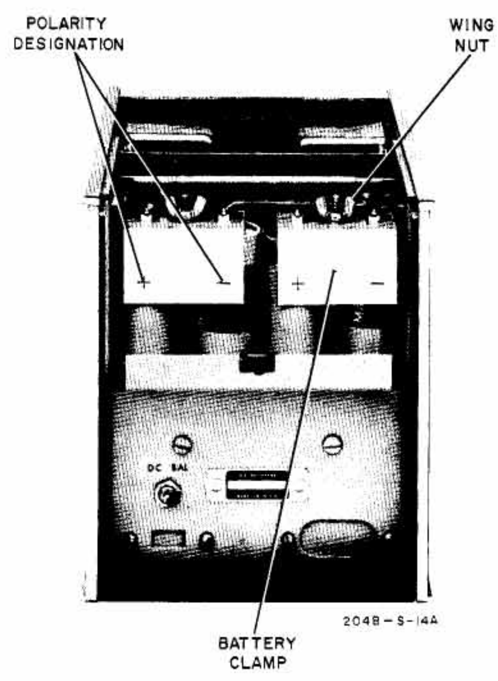


Figure 3-2. Rear View of Model 204B Showing Mercury Batteries Installed.

SECTION IV
PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. The Model 204B consists of an RC bridge oscillator circuit, a peak detector circuit, and an output attenuator (bridged-T type). These circuits and the front panel controls associated with them are shown in the block diagram, figure 4-1.

4-3. The RC bridge oscillator consists of an RC bridge, a two-stage amplifier, and two emitter followers. The output of this circuit is a sine-wave signal which is 1) returned to the RC bridge as feedback, and 2) applied to the output attenuator.

4-4. The RC bridge consists of an RC frequency-selective network and a resistive voltage divider network. The RC frequency-selective network supplies positive feedback to the amplifier and determines the frequency of oscillation. The resistive voltage divider network supplies negative feedback to the amplifier. The output of the amplifier is proportional to the difference between the feedback signals.

4-5. The peak detector detects changes in the RC bridge oscillator output voltage and changes the division ratio of the resistive voltage divider network, thereby changing the amount of negative feedback. The peak detector with the divider network maintains the RC oscillator output at a constant level.

4-6. The attenuator is a bridged-T attenuator which provides continuous control of the oscillator output voltage while maintaining constant output impedance.

4-7. OSCILLATOR CIRCUIT.

4-8. The RC bridge in the oscillator circuit consists of an RC frequency-selective network and a resistive voltage divider network. The frequency-selective network is similar to one leg of a Wien bridge; the resistive voltage divider, the other leg.

4-9. As in any oscillator, an in-phase feedback voltage (from the oscillator circuit output) is necessary to maintain oscillations. The proper phase relationship at the desired frequency is maintained by the RC components in the bridge.

4-10. The frequency-selective network consists of a series branch, C1 and R1, and a parallel branch, C2 and R2, as shown in figure 4-2. For the frequency at which $X_c = R$ in the series and parallel branches, the positive feedback voltage to the amplifier is maximum and is in phase with the oscillator circuit output voltage (figure 4-3). Only that frequency at which $X_c = R$ will be amplified; at frequencies where X_c does not equal R, the positive feedback voltage is not of the right phase and is insufficient in amplitude to sustain oscillation. Figure 4-3 shows the positive feedback curve and phase relationship for frequencies above and below the frequency where $X_c = R$.

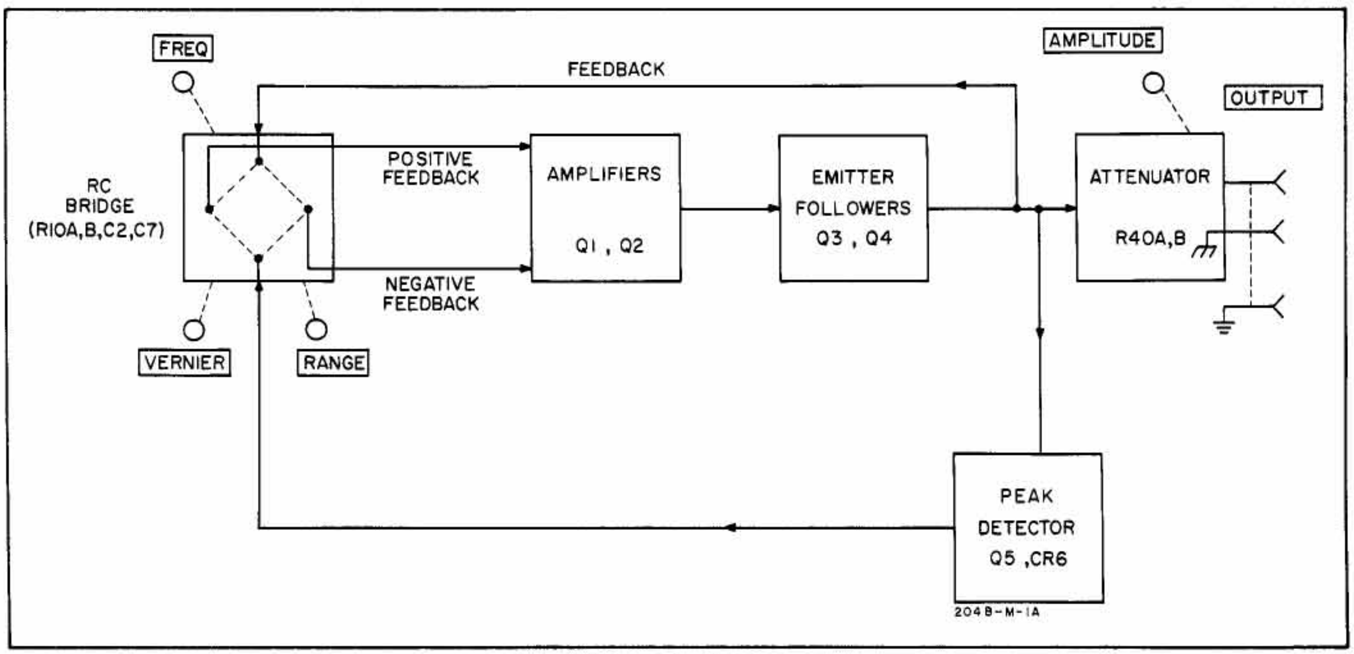


Figure 4-1. Block Diagram

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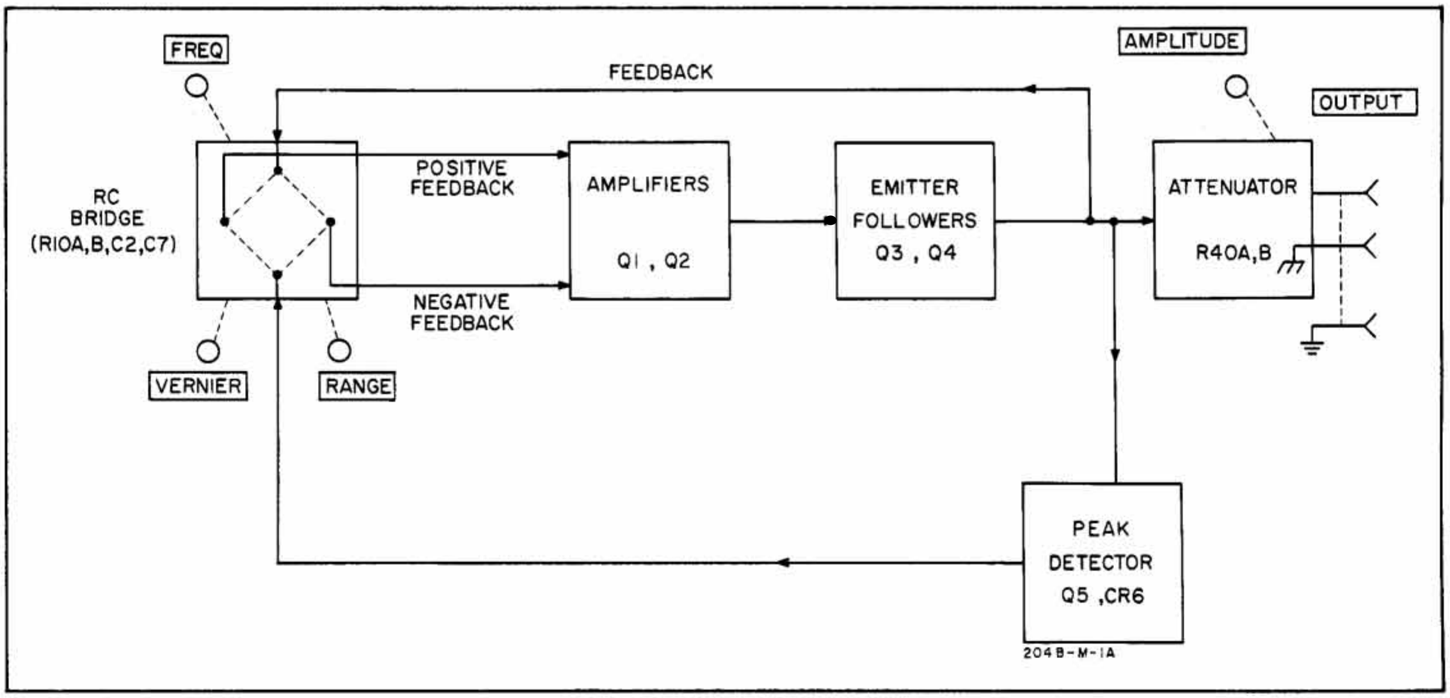


Figure 4-1. Block Diagram

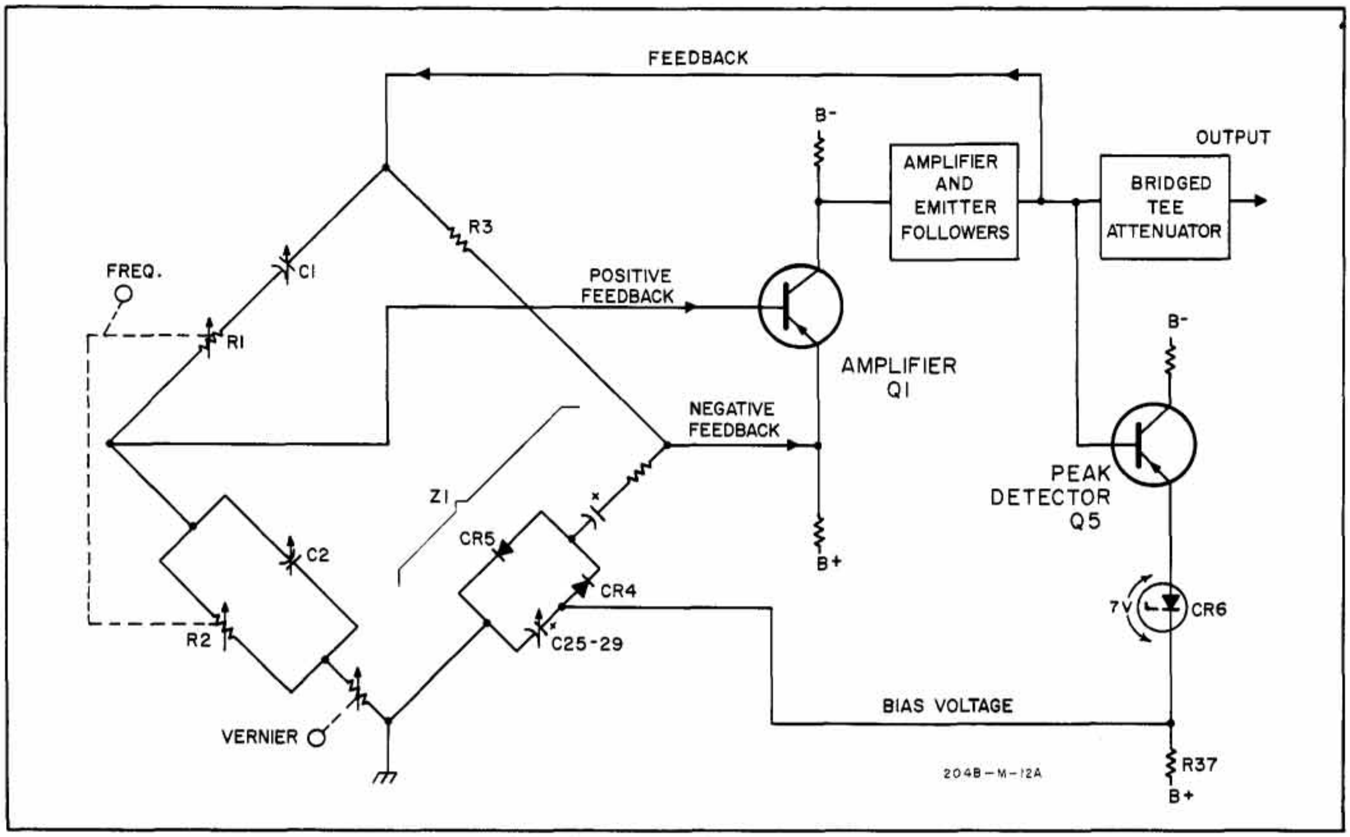


Figure 4-2. Simplified Schematic Diagram

4-11. The resistive voltage divider network consists of R3 and Z1 which provide negative feedback voltage to maintain the oscillator circuit output at a constant level. The negative feedback is developed in part due to the dynamic resistance of CR4 and CR5 which is controlled by the amount of forward bias applied to the diodes by the peak detector circuit. If the oscillator circuit output changes, the peak detector detects the change and converts it to a new bias level for the diodes. Diode conduction changes (seen as an impedance change in the bridge), and results in a differing amount of negative feedback. If the negative peak of the oscillator output signal exceeds -7 volts then, the peak detector circuit would decrease the forward bias on CR4 and CR5, increasing diode dynamic resistance. Increased impedance in Z1 of the divider increases the amount of negative feedback to the emitter of the amplifier. Increasing the negative feedback results in a decrease in the net input to the amplifier and thus the output signal decreases. The oscillator output is maintained at a constant 14 volts peak-to-peak.

4-12. Two amplifiers, Q1 and Q2, (figure 5-9) amplify the signal and apply it to complementary emitter followers Q3 and Q4. The emitter followers are forward biased by CR2 and CR3 and under a no-signal condition are conducting slightly to minimize crossover distortion. The oscillator circuit output is sampled by the peak detector and also coupled to the bridged-T attenuator.

4-13. PEAK DETECTOR.

4-14. The peak detector circuit consists of Q5 and CR6. This circuit samples the oscillator circuit output, and supplies bias proportional to the output signal to control the dynamic resistance of the diodes in the resistive voltage divider network.

4-15. Peak detector Q5 conducts only on the negative peak of the output signal. At 7 volts peak, breakdown diode CR6 breaks down and the voltage at the junction of CR6 and C25 through C29 decreases. This changes the bias to CR4 and CR5, which affects the resistance of these diodes. Capacitors C25 through C29 act to average the bias voltage applied to the diodes over the period of one cycle.

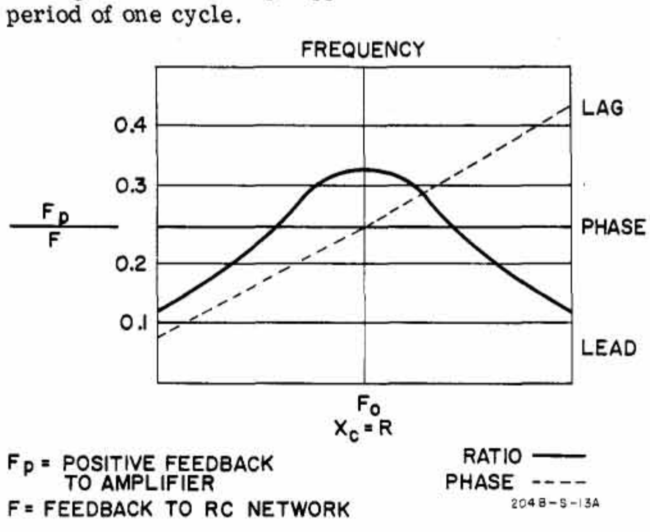


Figure 4-3. RC Network Characteristics

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides maintenance and service information for the Model 204B Oscillator. Required test equipment, replacement and adjustment procedures, and a troubleshooting summary are included in the section. Also includedare performance checks which verify proper instrument operation.

5-3. REQUIRED TEST EQUIPMENT.

5-4. Test equipment required for maintaining and checking performance of the Model 204B is listed in table 5-1. Equipment having similar characteristics can be substituted for the equipment listed.

5-5. PERFORMANCE CHECKS.

5-6. The performance checks verify that the Model 204B is operating normally and is accurately calibrated. These checks may be used after maintenance or as part of incoming quality control inspection. In the following checks be sure the test equipment used has been recently calibrated.

5-7. DIAL ACCURACY CHECK.

a. Connect frequency counter and 600-ohm load to oscillator output as shown in figure 5-1.

b. Set Model 204B controls as follows:

RANGE	X1
FREQ.	5
AMPLITUDE	MAX.
VERNIER	centered

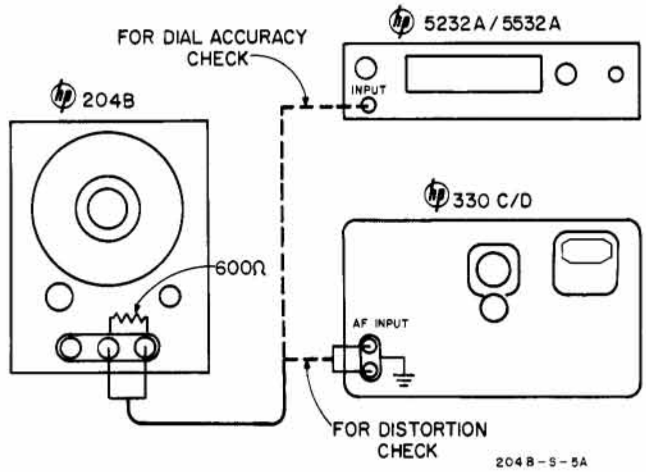


Figure 5-1. Test Setup for Dial Accuracy or Distortion Checks

c. Set frequency counter controls as follows:

Function	100 PERIODS AVERAGED
SENSITIVITY	3
DISPLAY	maximum counterclockwise

d. Counter should read 200 ±6 milliseconds.

e. Set FREQ. dial to 20, counter should read 50.0 ±1.5 milliseconds.

Table 5-1. Required Test Equipment

Instrument Type	Required Characteristics	Use	Recommended Model
Oscilloscope	Passband: dc to 600 kc Sensitivity: 0.1 volts/cm Input Impedance: 1 megohm	Waveform checking	hp Model 175A with plug-in Model 1753A
Distortion Analyzer	Measure distortion to -40 db 1 kc	Distortion measurement	hp Model 330B/C/D
AC Voltmeter	Frequency Range: 5 cps to 600 kc Voltage Range: 1 mv to 5 volts Accuracy: ±1%	AC voltage measurements	hp Model 400H
DC Voltmeter	Voltage Range: Positive and negative voltages from 100 mv to 15 volts Input impedance: at least 10 megohms	DC voltage measurements	hp Model 412A
Clip-On Milliammeter	Range: 5 to 11 milliamperes Accuracy: ±3%	Charge current measurements	hp Model 428A
Frequency Counter	Counting Range: 5 cps to 600 kc Accuracy: 0.03%	Frequency measurements	hp Model 5232A/5532A

f. Set FREQ. dial to 50, counter should read 20.0 ±0.6 milliseconds.

g. Set RANGE to X10 and FREQ. dial to 5, counter should read the same as step f.

h. Repeat steps e and f with RANGE at X10. Counter should read 5.00 ±0.15 milliseconds and 2.00 ±0.06 milliseconds respectively.

i. Set frequency counter function switch to FREQUENCY (.1).

j. Complete check by setting RANGE switch and FREQ. dial as shown in table 5-2, columns one and two. The counter reading should be as shown in column three.

Table 5-2. Dial Accuracy

Range Switch	Freq. Dial	
X100	5	500 cps ± 15 cps
X100	20	2000 cps ± 60 cps
X100	50	5000 cps ± 150 cps
X1K	5	5 kc ± 150 cps
X1K	20	20 kc ± 600 cps
X1K	50	50 kc ± 1.5 kc
X10K	5	50 kc ± 1.5 kc
X10K	20	200 kc ± 6 kc
X10K	50	500 kc ± 15 kc

5-8. FREQUENCY RESPONSE AND OUTPUT VOLTAGE CHECK.

a. Connect ac voltmeter and 600-ohm load to oscillator output as shown in figure 5-2.

b. Set Model 204B RANGE to X1 and FREQ. dial to 25.

c. Adjust AMPLITUDE for 2.5 volt reading on voltmeter.

d. Sweep FREQ. dial by hand to read 50. As dial is swept, voltmeter reading should not vary more than ±0.075 volts.

e. Set Model 204B RANGE to X10.

f. Set FREQ. dial to 5 and repeat step d.

g. Complete check with RANGE switch set to each untested position while repeating step d.

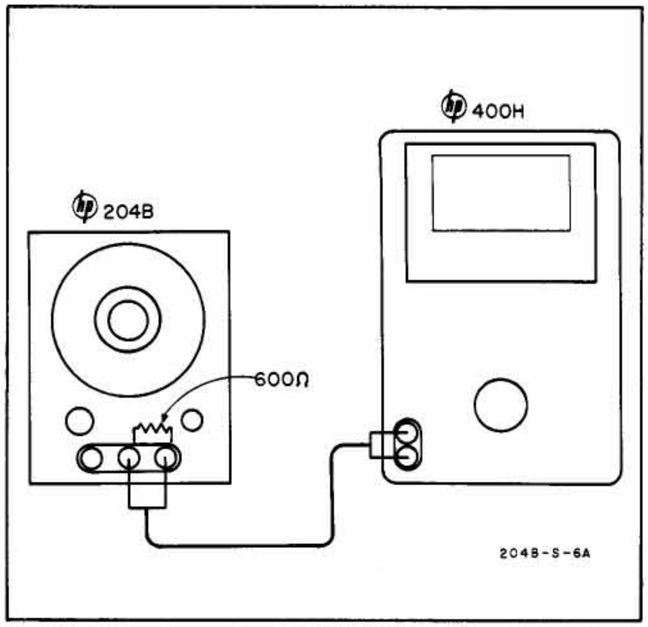


Figure 5-2. Test Setup for Frequency Response and Output Voltage Check

5-9. DISTORTION CHECK.

a. Connect distortion analyzer and 600-ohm load to oscillator output as shown in figure 5-1.

b. Set Model 204B controls as follows:

RANGE.	X100
FREQ.	10 (1 kc)
AMPLITUDE.	MAX.

c. Set distortion analyzer controls as follows:

FREQUENCY RANGE	X100
INPUT	AF
FUNCTION.	SET LEVEL
METER RANGE	100%

d. On distortion analyzer:

(1) Adjust INPUT SENSITIVITY for full scale reading (1.0).

(2) Set FUNCTION to DISTORTION.

(3) Adjust FINE and COARSE frequency controls and BALANCE control for dip at fundamental frequency (1 kc); switch METER RANGE as necessary to monitor dip.

(4) Readjust controls until absolute dip is located

e. Meter reading should be less than 1.0 on the 1% range.

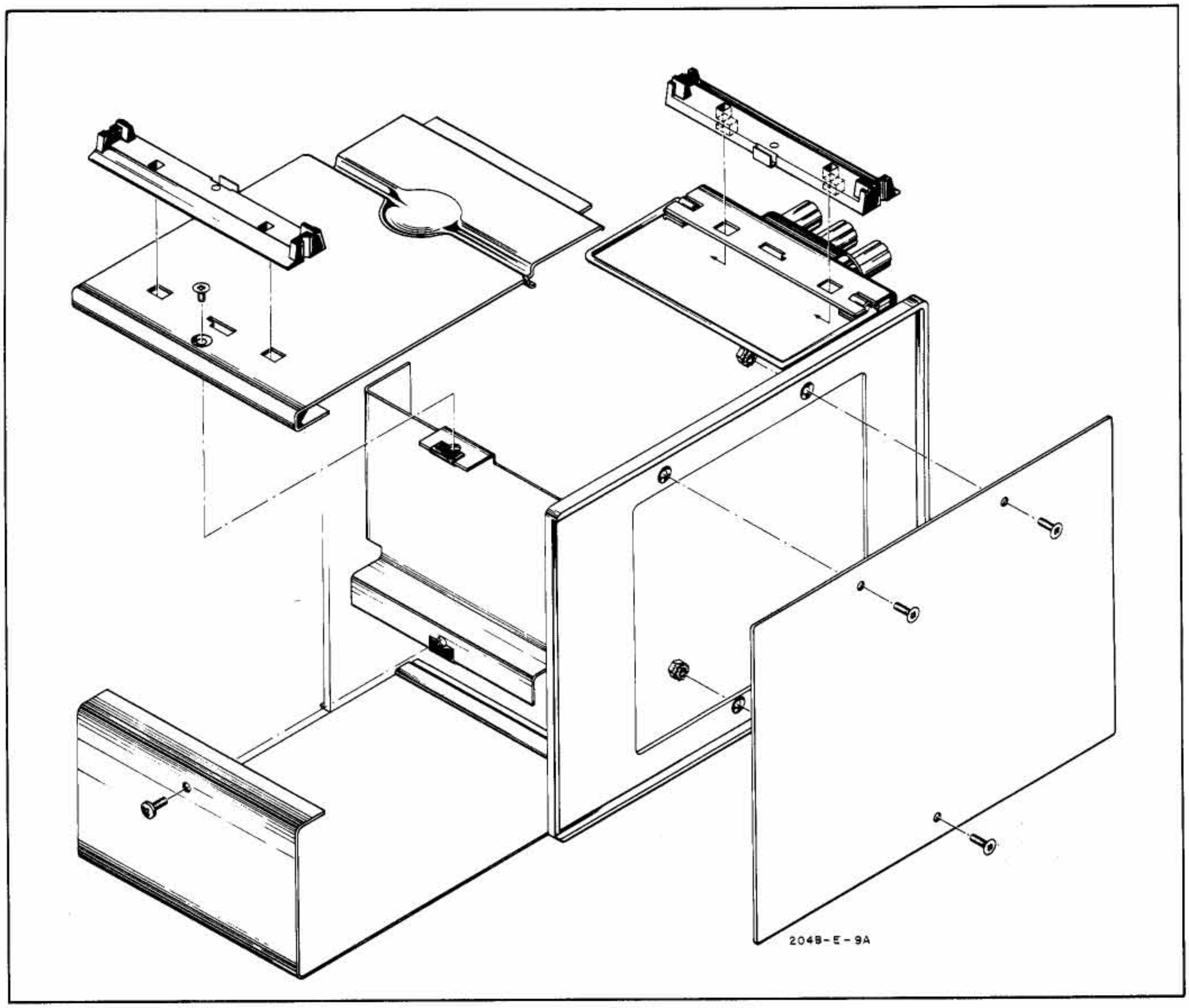


Figure 5-3. Cover Removal

5-10. REPAIR.

5-11. When repairing the Model 204B, use the exploded view, figure 5-4, as an aid to identifying parts.

5-12. COVER REMOVAL.

5-13. Remove covers prior to any check or adjustment which requires power to be applied. Refer to figure 5-3, and proceed as follows:

a. Remove top cover screw.

b. Slide top cover to rear, and lift to remove.

c. Slide rear foot assembly toward side while pushing foot release.

d. Lift foot assembly to remove.

e. Remove bottom cover screw and lift tilt stand.

f. Slide bottom cover to rear and lift to remove.

g. Remove side cover screws and side covers.

h. To replace covers and foot assembly, reverse the order of steps a through g.

5-14. SERVICING ETCHED CIRCUIT BOARDS.

5-15. The etched circuit boards used in the Model 204B require that the soldering iron tip be applied to the conductor side of the board when servicing. For large components, such as potentiometers, rotate the soldering iron tip from lead to lead while applying pressure to the part to lift it from the board or use a soldering tip such as Ungar #855 3/4 in. Cup Tip. In addition to the above information, the following should be observed.

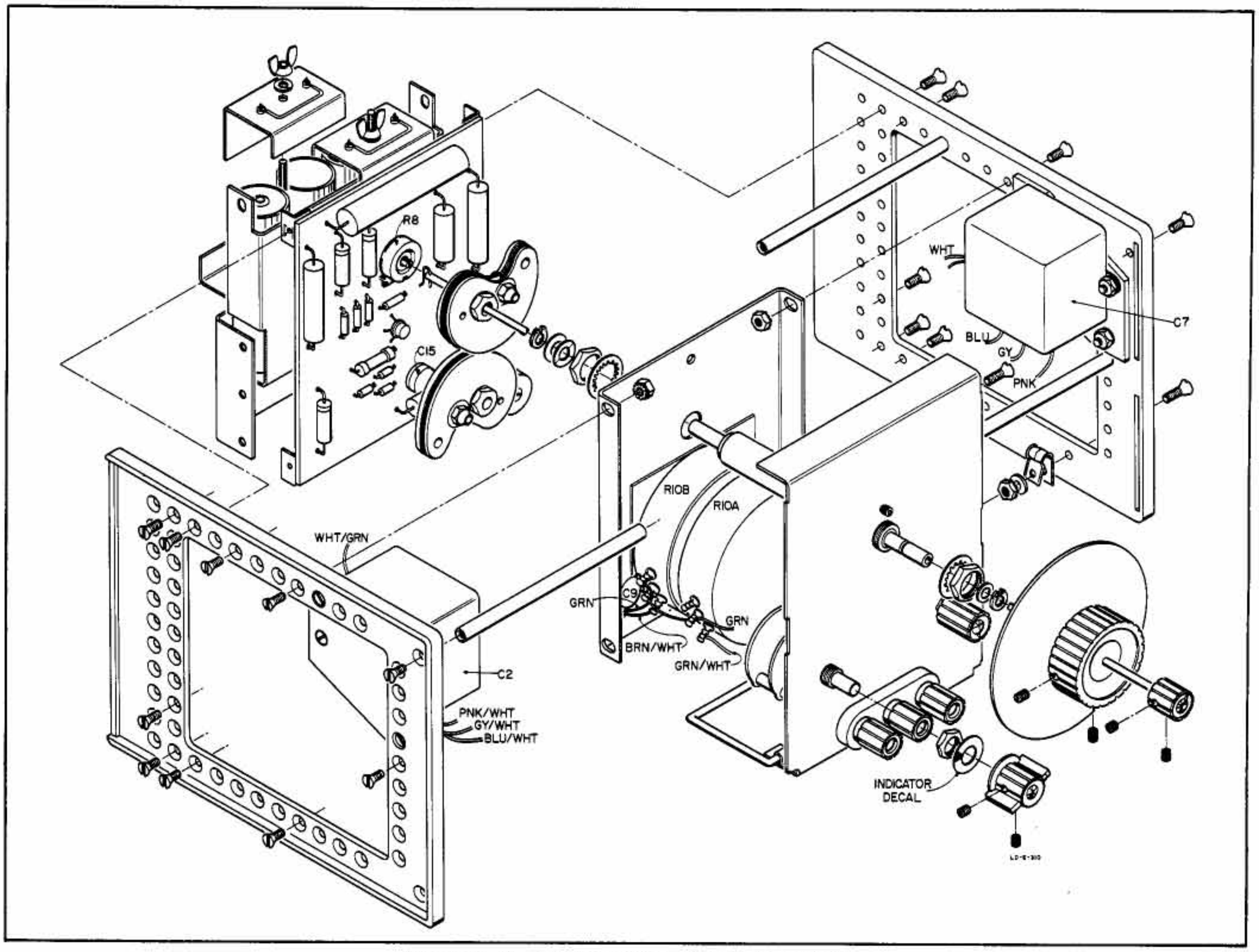


Figure 5-4. Model 204B, Exploded View

a. Do not apply excessive heat.

b. Apply heat to component lead on conductor side of board, and remove lead with a straight upward pull .

c. Use a toothpick or wooden splinter to clean holes.

d. Solder replacement components from the conductor side.

5-16. TROUBLESHOOTING.

5-17. To locate trouble in the Model 204B, start with a thorough visual inspection. Look for burned-out or loose components, loose connections of any other condition which suggests a source of trouble. If a visual inspection does not reveal the trouble, use the block diagram, figure 4-1, and troubleshooting summary, table 5-3, ad aids for isolating the trouble. The troubleshooting summary lists indication of and action to be taken for various troubles; the action should be taken in the order given.

5-18. ADJUSTMENT AND CALIBRATION PROCEDURES.

5-19. AC POWER SUPPLY CHECKS.

5-20. The ac power supply voltages are typically +13 and -13 volts, but may vary from 12 to 13. 5 volts. As line voltage is varied from 103. 5 to 126. 5 volts, supply voltages should remain with the 12 to 13. 5 volt limit.

5-21. Ripple voltage in the ac power supply should be less than 2 mv. To check ripple voltage, it is necessary to connect a wire from circuit ground (⏚) to the junction of R10A and S1D. Measure ripple voltage as the line voltage is varied from 103. 5 to 126. 5 volts .

5-22. When trouble occurs, in the ac power supply check CR15 and CR16 first. If any repair is performed, adjust DC BAL control (paragraph 5-26).

5-23. BATTERY CHARGER CURRENT ADJUSTMENT.

5-24. The battery charger current is set at the factory for 5. 5 ±0. 5 milliamperes to provide maximum battery life. Charge current adjustment R102 can be set to provide a quick charge by increasing the charging current to not more than 11 milliamperes.

5-25. Use the following procedure to set charge current adjust R102 for quick charge operation.

a. Remove top cover from oscillator chassis.

b. Connect power cord to a power source.

c. Turn oscillator OFF.

d. Attach current probe of clip-on milliammeter to one input lead of battery charger circuit. (See figure 5-11.)

e. Set R102 for the desired charge current.

Note
Do not exceed 11 milliamperes. A charge current exceeding 11 milliamperes will shorten battery life.

f. Replace top cover.

5-26. DC BAL ADJUSTMENT.

5-27. When the DC BAL control R15 (rear panel) is properly adjusted there should be no dc voltage present at the oscillator output. If dc voltage is present, proceed as follows:

a. Connect a DC voltmeter to oscillator output. (With the optional Rechargeable Battery Power Supply, connect DC voltmeter between floating ground and the junction of L1 and C102.)

b. Set AMPLITUDE to MAX.

c. Adjust DC BAL on rear of instrument for a zero volt reading. If necessary, change the value of R18 for proper range of R15. If DC BAL will not adjust to zero volts, check power supply for proper voltages.

5-28. DISTORTION ADJUSTMENT.

a. Connect a 600-ohm load across the oscillator output terminals.

b. Using an AC voltmeter, measure the gain control voltage between circuit ground and arm of potentiometer R36. Voltage should be between 90 and 140 mv rms on all ranges. If voltage is high, increase resistance of R34; if low, decrease resistance.

c. Set Model 204B controls as follows:

RANGE X100
FREQ . . . . 10 (1 kc)
VERNIER . . . . centered
AMPLITUDE . . . . MAX.

d. Connect distortion analyzer across 600-ohm load on oscillator output terminals.

e. Measure distortion, and adjust R36 for minimum reading. Reading should be less than 1%.

Note
Do not use coaxial cables (use twin lead only) and disconnect all other equipment from oscillator when making distortion measurements.

5-29. FREQUENCY CALIBRATION ADJUSTMENTS.

5-30. Frequency calibration adjustments should be performed, only if necessary, after repairs are made to frequency sensitive components.

a. Connect frequency counter and 600-ohm load to oscillator output as shown in figure 5-1.

Table 5-3. Troubleshooting Summary

Indication	Action
No output signal; dc voltage at output greater than ±1 volt (dc voltage measured at junction of L1 and C102 on Option 02 Power Supply with Rechargeable Batteries)	Check power-supply voltages (+13 and -13 volts) Check Q3, Q4, CR2, and CR3 for correct dc voltages (refer to schematic diagram) Check Q1, Q2, and CR1 for correct dc voltages (refer to schematic diagram)
No output signal; proper dc voltage at output (zero volts)	Check power-supply voltages (+13 and -13 volts) Check Wien bridge components Check Q1 and Q2 for correct voltages Check peak detector circuit (Q5, CR4, CR5, and CR6)
No output on one or more ranges	Check RANGE switch contacts Check components connected to Wien bridge position when RANGE switch is inoperative position. For example: If inoperative position is X1, check C2A and C7A. Check components connected to peak detector circuit when RANGE switch is in inoperative position.
Output amplitude not correct and/or distorted	Check power-supply voltages (+13 and -13 volts) Check components in upper and lower legs of Wien bridge for proper value ±percent of tolerance (refer to table 6-1 for tolerances). For example: When RANGE switch is in X1 position, check R24, R4, C2A, R10A, R10B, R11, and C7A. Check peak detector circuit (Q5, CR4, CR5, and CR6, for proper operation. Refer to waveforms and voltages in schematic diagram. Be sure CR6 breaks down at 7 volts peak.
If all ranges are affected	Check for incorrect voltages at Q3, Q4, Q2, and Q1 respectively
If all ranges are NOT affected	Check components connected to peak detector circuit in affected range

b. Set Model 204B RANGE to X100, VERNIER to center of its range, and AMPLITUDE to maximum clockwise position.

c. Set FREQ. to 56 (5.6 kc).

d. Lock FREQ. dial shaft with a number 8-32 socket set screw (dial shaft locking screw) which inserts into threaded hole on top of dial shaft housing.

e. Loosen potentiometer (pot) shaft locknut, figure 5-5a, and adjust pot by turning pot arm to obtain a 5.6-kc output.

f. Tighten pot shaft locknut, and loosen dial shaft locking screw.

g. Set FREQ. to 5 (500 cps) and tighten dial shaft locking screw.

h. Loosen dial shaft locknut and adjust dial cam by turning cam to obtain a 500-cps output.

i. Tighten dial shaft locknut and loosen dial shaft locking screw.

j. Repeat steps c through i until frequencies are within approximately ±1%.

k. Set RANGE to X10K, FREQ. to 5 (50 kc), and adjust C8 (figure 5-6) to obtain a 50-kc output.

m. Set FREQ. to 56 (560 kc), and adjust C15 (figure 5-4) to obtain a 560-kc output. If necessary, change the value of C14 for proper range of C15.

Note
Check gain control voltage according to steps a and b of paragraph 5-28.

n. All frequencies across the band should be within ±3%.

5-31. REPLACEMENT PROCEDURES.

5-32. CAM CABLE REPLACEMENT.

5-33. If it is necessary to replace the cam cable, order it by ⓗⓟ Stock No. 8160-0003 and description. For easier access to the cams, remove the screws holding the power supply and circuit board, then swing the two assemblies to the side. Use figure 5-5 as a guide, and proceed as follows:

a. Orient cams as shown in figure 5-5a.

b. Using a hex socket wrench and 3/8-inch wrench, remove both cable terminal bolts.

c. Remove terminal bolts from cable.

d. On replacement cable, place a mark 6-7/8 inches from the end.

e. Slide replacement cable through one terminal bolt so that cable is orientated to terminal bolt as shown in figure 5-5a, lower left detail.

f. With mark on the cable in center of terminal bolt as shown, install terminal bolt on dial cam.

g. Slide cable ends approximately 1/4 inch through second terminal bolt so that cable is orientated to terminal bolt as shown in figure 5-5a, upper left detail.

h. Orientate the cams as shown in figure 5-5b and use the figure as a guide. Slide the cable onto the cams, and install the second terminal bolt on the pot cam. (The shorter cable length should pass over points A and B; the longer length should pass over D, B, and C.

i. Tighten both terminal bolts to remove all slack in cable and allow the dial to cover its full range. Do not overtighten cable.

j. Perform Frequency Calibration Adjustments, (paragraph 5-29).

5-34. FREQUENCY POTENTIOMETER REPLACEMENT.

5-35. To replace the frequency potentiometer (pot), R10A and B, it is necessary to remove the pot cam. For easier access to the cams, remove the screws holding the power supply and circuit board, then swing the two assemblies to the side. Use figure 5-5 as a guide, and proceed as follows:

a. Position cams as shown in figure 5-5a. Some instruments have aluminum cams which have the counterweight shown in figure 5-5. Other instruments

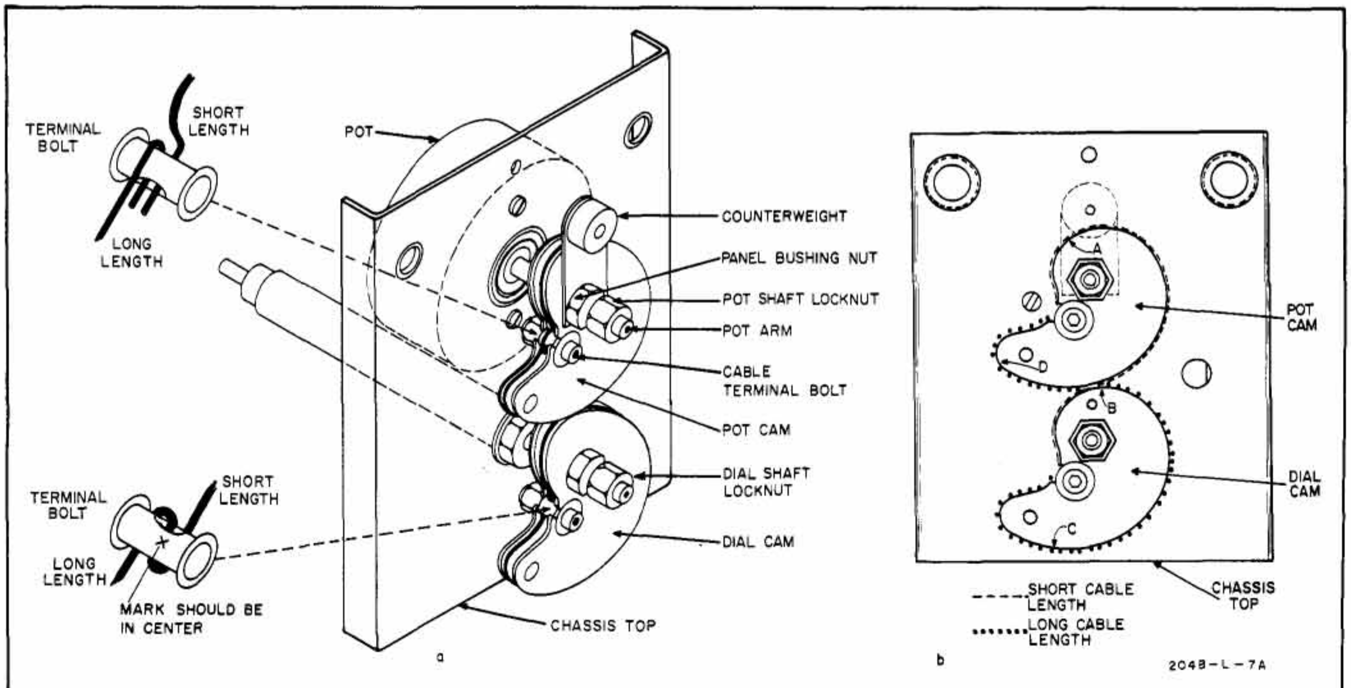


Figure 5-5. Cams and Cable Relationship

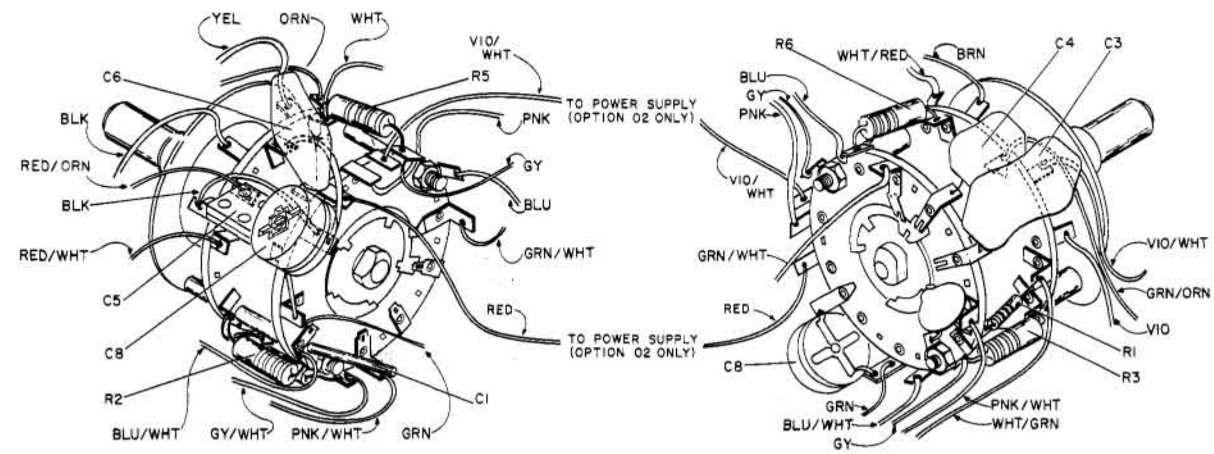


Figure 5-6. Range Switch Detail

have plastic cams which do not require a counterweight. Ignore any references to counterweight in following procedure when your instrument has the plastic cams.

b. Loosen pot shaft locknut and panel bushing nut.

c. Using a hex socket wrench, turn cable terminal bolt on pot cam counterclockwise 1/2 turn or until cable slips off cam.

d. Slide pot cam off pot arm. Note that one section of cable is shorter than the other.

e. Remove three screws holding pot to chassis.

f. Remove pot, and install replacement.

g. Orient the cams as shown in figure 5-5b and use the figure as a guide to help you string the cam cable properly. (The shorter cable length should pass over points A and B; the longer length should pass over points D, B, and C.)

h. Turn cable terminal bolt clockwise approximately 1/2 turn to remove some slack in the cable.

i. Install counterweight and tighten panel bushing nut. Counterweight is keyed and should be positioned as shown in figure 5-5. (omit if no counterweight).

j. Align pot cam to the same plane as dial cam.

k. Remove all slack in cable by turning cable terminal bolt clockwise. Do not overtighten cable.

m. With cams aligned, tighten pot shaft locknut.

n. Perform Frequency Calibration Adjustments, paragraph 5-29.

5-36. RANGE SWITCH ASSEMBLY REPLACEMENT.

5-37. To aid in replacing the RANGE switch assembly ⓗ Stock No. 204B-95D, refer to the exploded view, figure 5-4, and range switch detail, figure 5-6.

a. Remove oscillator covers (see paragraph 5-12).

b. Remove RANGE switch knob.

c. Remove indicator decal and the nut which holds the RANGE switch to front panel.

d. In order to remove leads from switch, it is necessary to slide switch away from panel and lift to edge of chassis; clip leads at switch terminals.

e. Solder leads to replacement switch using figure 5-6 as a guide for correct lead connections.

f. Install switch as shown in figure 5-4 using nut removed in step c.

g. Replace indicator decal so that black portion is adjacent to OFF position.

h. Replace switch knob.

i. Perform Frequency Calibration Adjustments and DC BAL Adjustment, Paragraphs 5-29 and 5-26.

5-38. BATTERY-PACK POWER SUPPLY.

5-39. To convert an AC-powered or rechargeable battery-powered Model 204B for operation from mercury batteries, obtain a standard Battery Pack, ⓗⓟ Stock No. 204B-64B. Install Battery-Pack Power Supply according to instructions included with kit. Refer to paragraph 3-26 for battery replacement instructions.

5-40. AC POWER SUPPLY.

5-41. To convert a battery-powered or rechargeable battery-powered Model 204B for operation from AC power, obtain AC Power Supply Kit, ⓗⓟ Stock No. 204B-11A. (Refer to figures 5-8 and 5-12.) Install AC-Operated Power Supply according to instructions included with kit.

5-42. RECHARGEABLE BATTERY POWER SUPPLY.

5-43. The Rechargeable Battery Power Supply can replace the standard Battery Pack or the AC Power Supply. This supply contains four 6.25 volt sealed nickel-cadmium batteries which permit portable operation and a charge circuit which operates from a 115/230 volt (selected by switch on rear panel S101) 50 to 1000 cps power line. Power input to this power supply is approximately 3 watts. To convert an AC powered or a battery-powered Model 204B for operation from a rechargeable battery power supply, obtain Rechargeable Battery Kit, ⓗⓟ Stock No. 204B-11C. Install Rechargeable Battery Power Supply according to instructions included with kit.

5-44. After Rechargeable Battery Power Supply has been installed, turn oscillator on and check maximum output voltage level. If level is below 5.0 V rms open circuit (2.5 V rms into 600 ohms), turn oscillator OFF and recharge batteries following the procedure in paragraph 3-16.

CAUTION
BE SURE TO PLACE 115/230 VOLT LINE SWITCH (S101) IN PROPER POSITION BEFORE CONNECTING POWER CORD TO A POWER SOURCE. (SEE PARAGRAPH 2-12.)

5-45. <u>REPLACEMENT OF RECHARGEABLE BATTERIES.</u>

5-46. When rechargeable batteries require replacement, disconnect power cord and turn oscillator OFF. The following procedure is recommended:

a. Disconnect power cord and remove top, bottom and side covers.

b. Remove six screws holding rear panel in place.

c. Remove four screws holding battery charger circuit board in place.

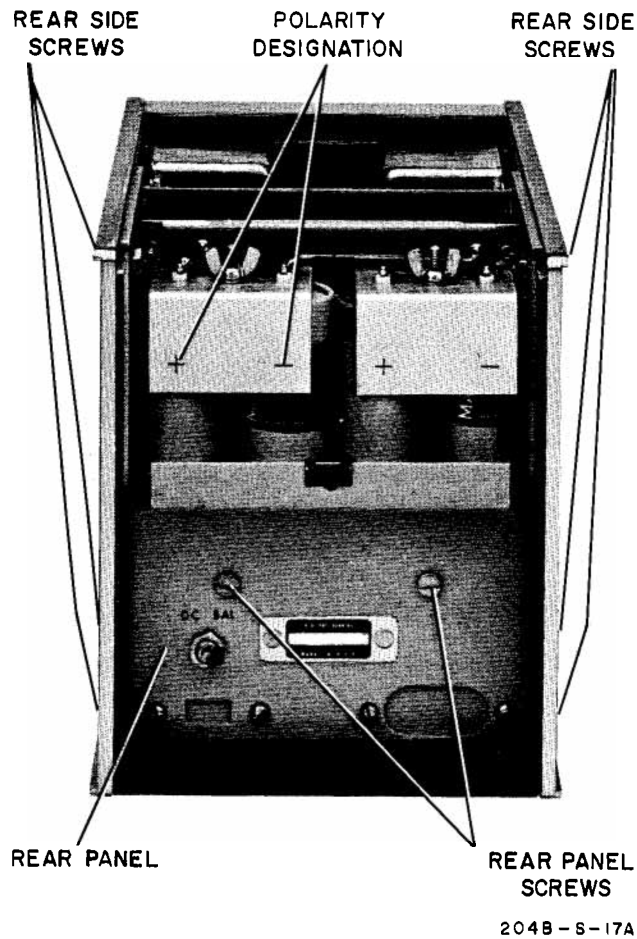


Figure 5-7. Rear View of Battery-Powered Model 204B

d. Loosen two screws holding oscillator board in place.

e. Slide power supply out of oscillator chassis.

f. Unsolder resistor R106 (4.7 ohms), red/orange black, and violet wires from batteries (see figure 5-9).

g. Remove two cap nuts and screws with fiber washers from battery holder and rear panel.

h. Remove and discard old batteries.

CAUTION

DO NOT DISPOSE OF BATTERIES BY BURNING, AS THEY EXPLODE IF INCINERATED.

i. Place four new batteries in instrument observing battery polarity as indicated in figure 5-9.

j. Replace battery holder cap nuts, screws, and fiber washers.

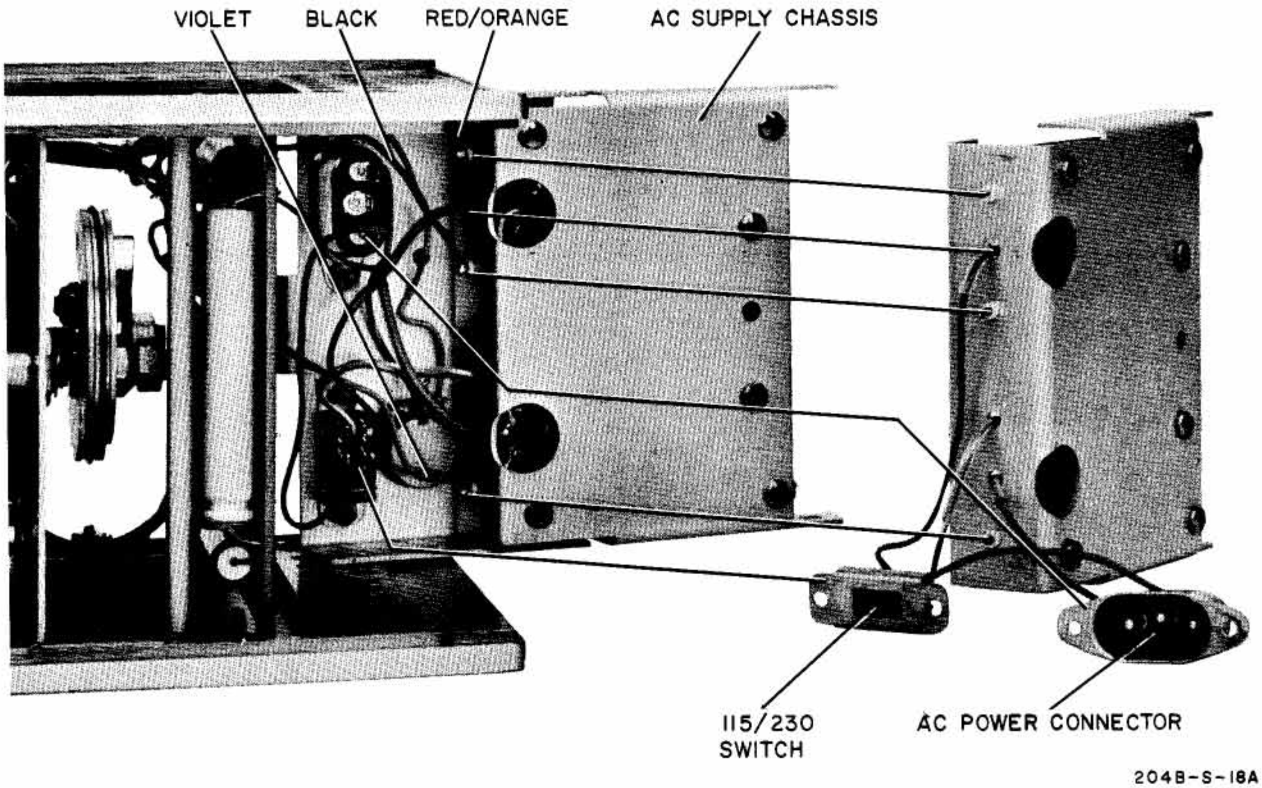


Figure 5-8. AC Power Supply

k. Solder R106, red/orange, black, and violet wires to batteries. (See figure 5-9.)

m. Slide power supply into oscillator chassis and fasten with screws removed in steps b and c.

n. Tighten screws loosened in step d.

p. Check voltage and polarity between floating ground and bottom terminals on batteries BT101 and BT104. (See figure 5-9.) Terminal on BT101 (violet wires) must be negative and terminal on BT104 (red/orange wire) must be positive with respect to floating ground (black wire on bottom terminals of BT102 and BT103). Measured voltage at either terminal will be approximately 13 volts. If polarity is reversed at either terminal or measured voltage is low (usually less than 1 volt), batteries have not been properly installed.

q. When conditions of previous steps have been satisfied, turn oscillator on and measure maximum oscillator output voltage.

r. If maximum oscillator output voltage into an open circuit is less than 5.0 V rms, turn oscillator OFF and recharge batteries by following the procedure in paragraph 3-16.

s. Replace top, bottom and side covers.

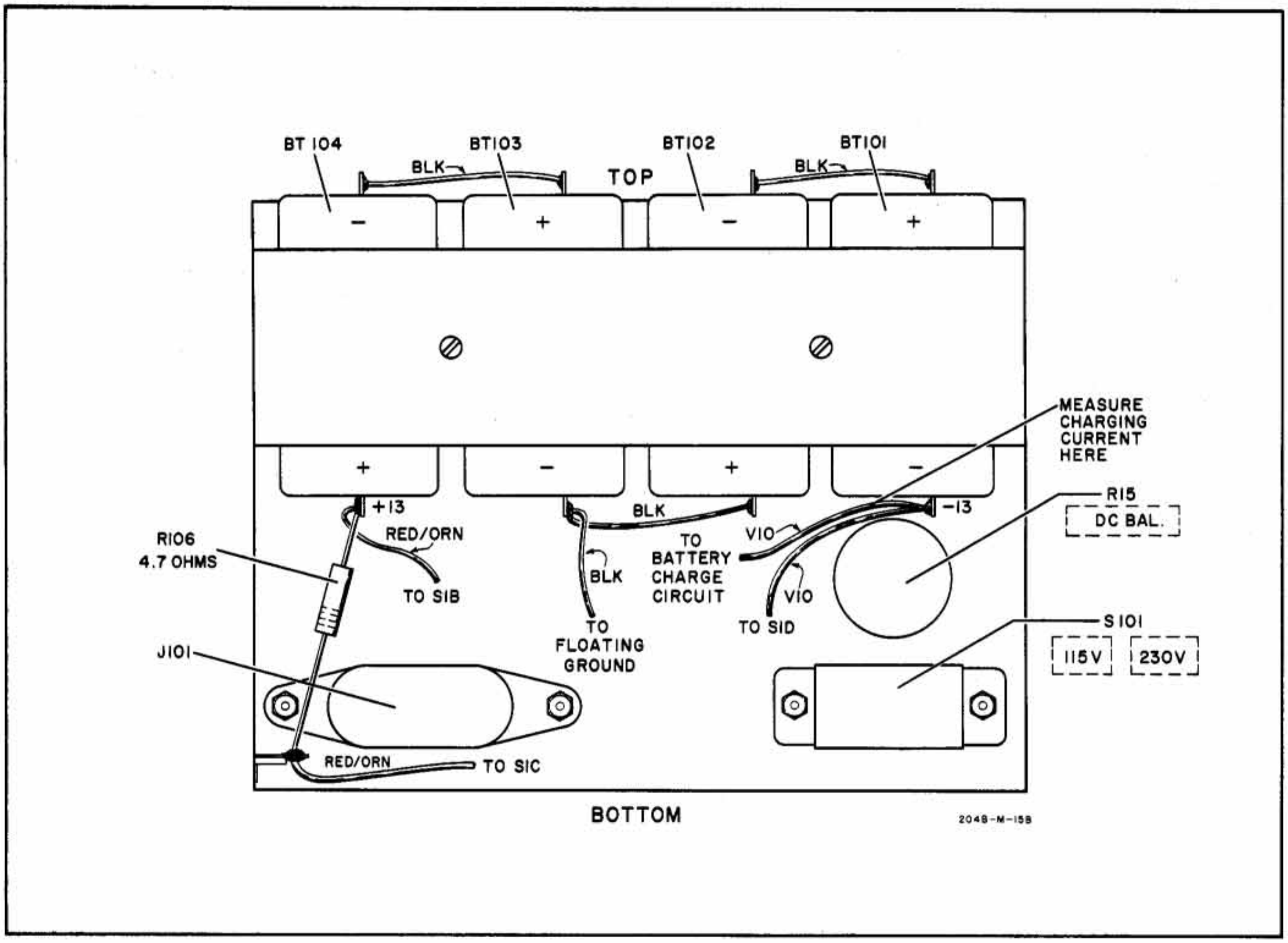
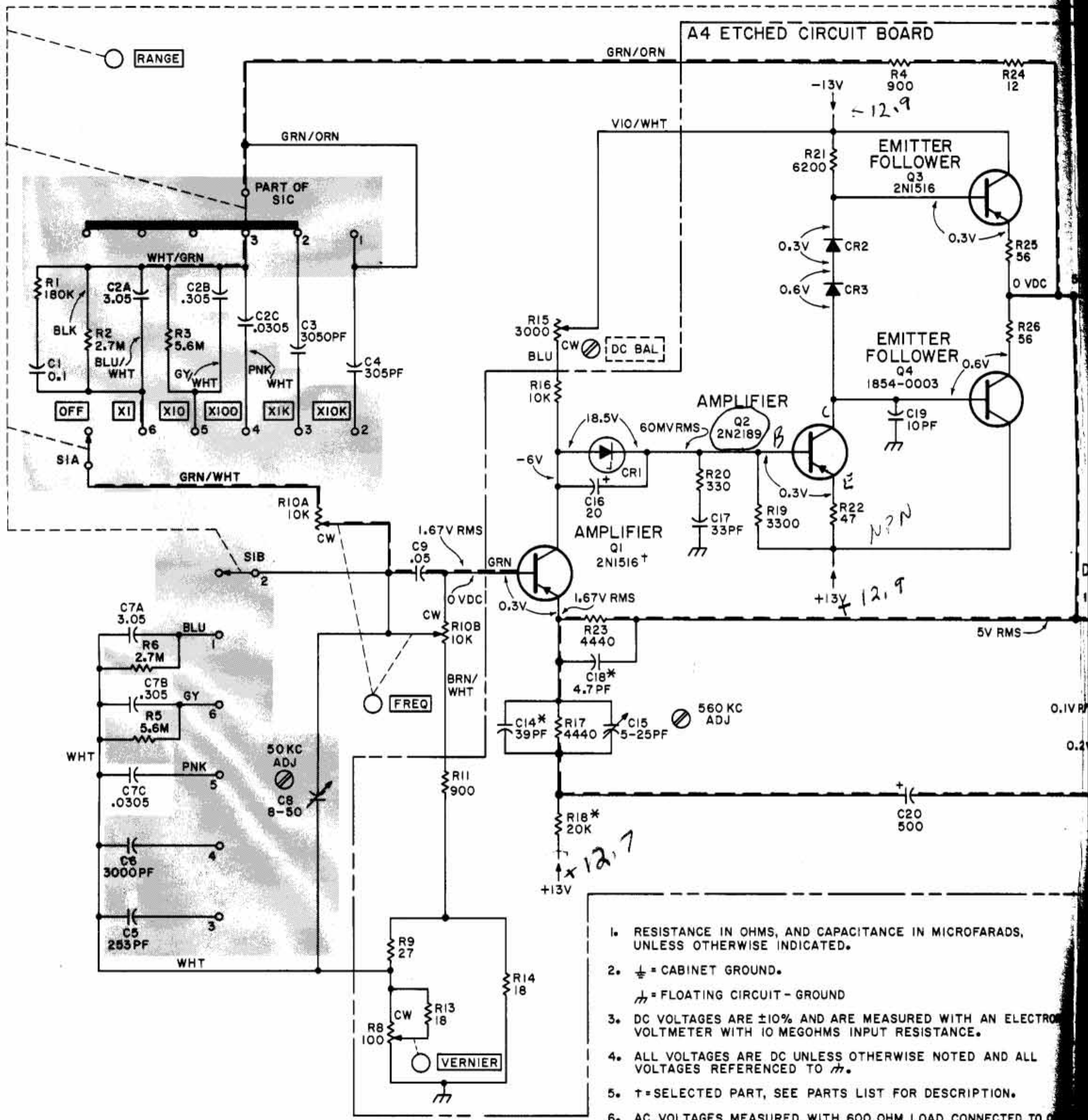
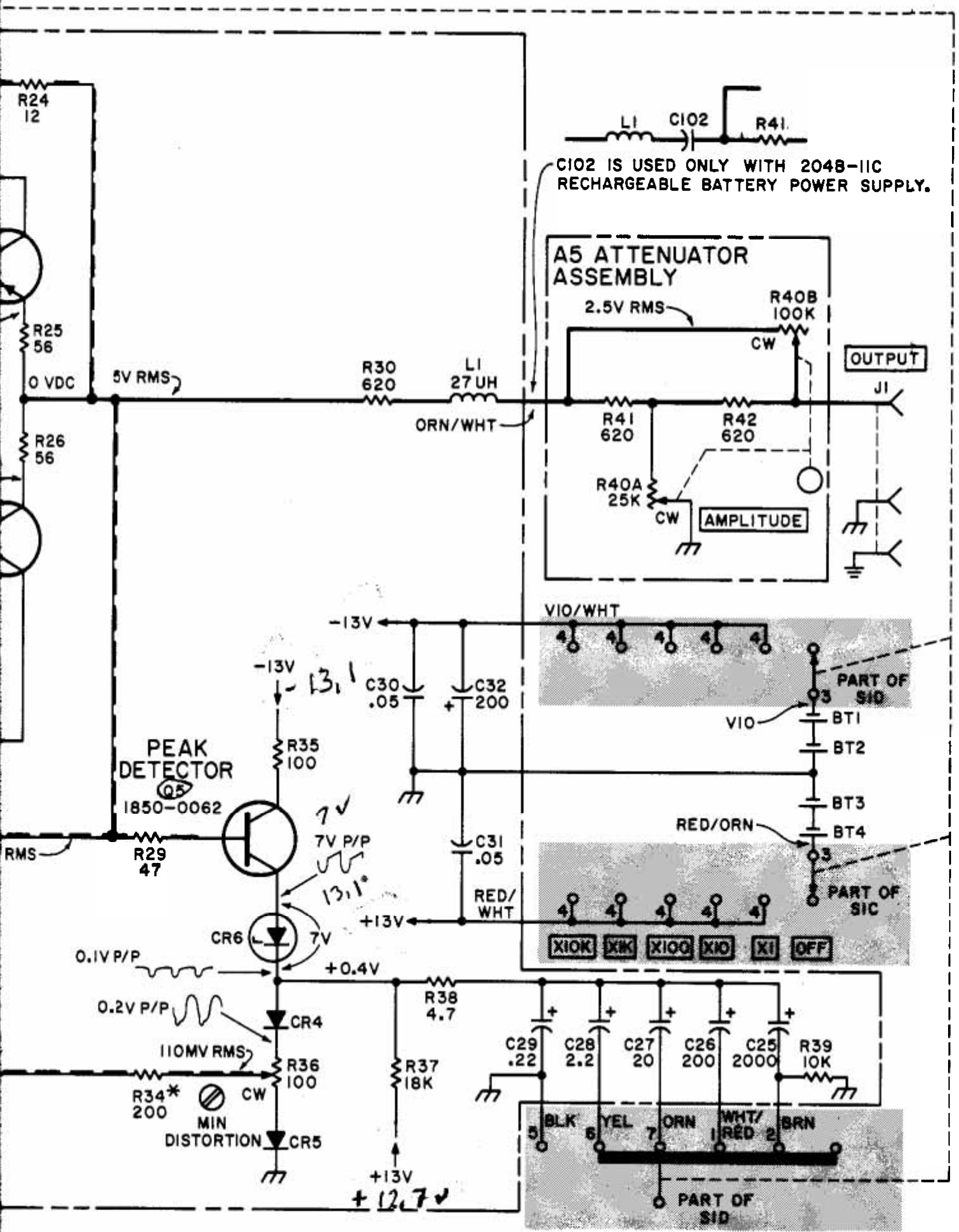


Figure 5-9. Rear Internal View of Rechargeable Battery Power Supply



1. RESISTANCE IN OHMS, AND CAPACITANCE IN MICROFARADS, UNLESS OTHERWISE INDICATED.
2. ⏚ = CABINET GROUND.
   ⏊ = FLOATING CIRCUIT - GROUND
3. DC VOLTAGES ARE ±10% AND ARE MEASURED WITH AN ELECTRO[NIC] VOLTMETER WITH 10 MEGOHMS INPUT RESISTANCE.
4. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED AND ALL VOLTAGES REFERENCED TO ⏊.
5. † = SELECTED PART, SEE PARTS LIST FOR DESCRIPTION.
6. AC VOLTAGES MEASURED, WITH 600 OHM LOAD CONNECTED TO O[UTPUT] OR AMPLITUDE CONTROL SET FOR MINIMUN OUTPUT, BY A VAC[UUM] TUBE VOLTMETER AND 10 MC OSCILLOSCOPE, AND MAYBE ±10%
7. * = AVERAGE VALUE SHOWN, OPTIMUM VALUE SELECTED AT FA[CTORY]
8. REFER TO FIGURE 5-10, NOTE 6.

Figure 5-10. Oscillator and Amplifier with Battery Pack



ADS,

ELECTRONIC

D ALL

N.

TED TO OUTPUT
Y A VACUUM
E ±10%.

AT FACTORY.

REFERENCE DESIGNATORS

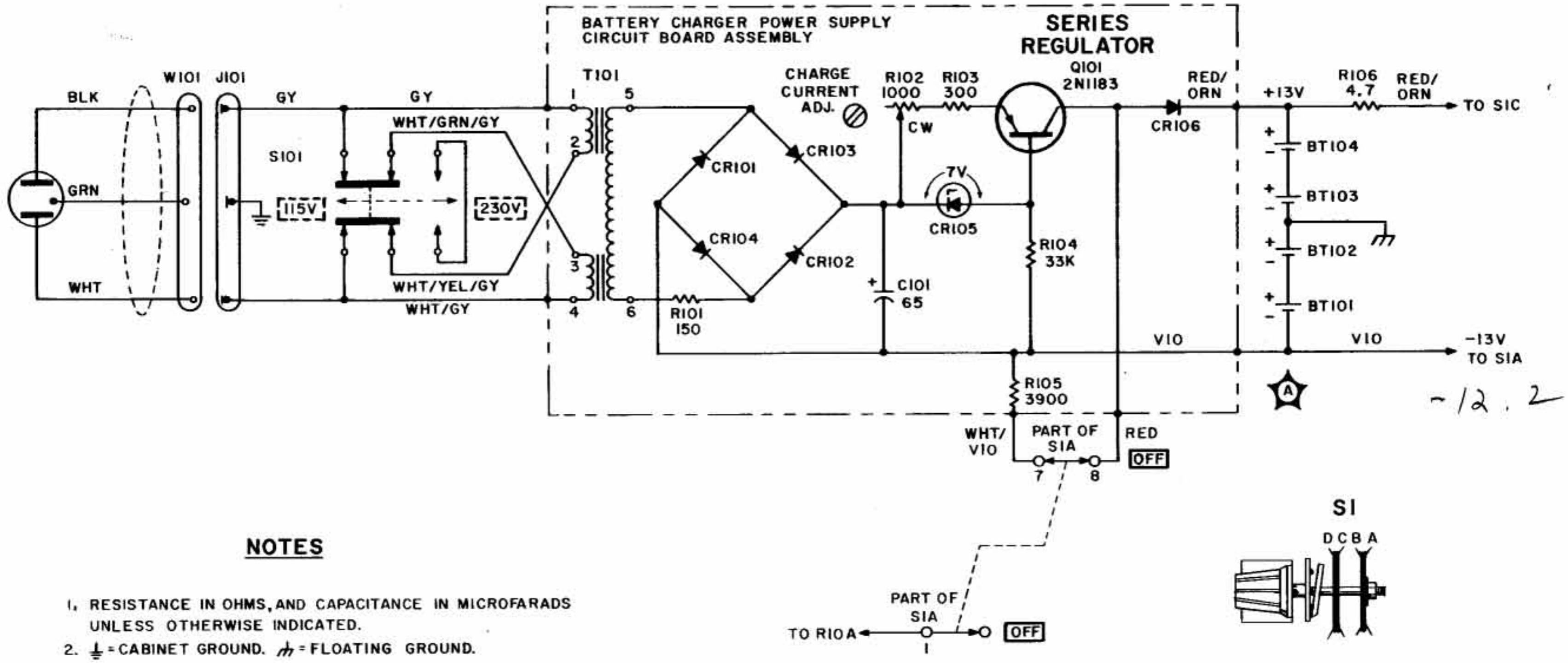
BT1-4
C1-32, C102
CR1-6
J1
L1
Q1-5
R1-42
S1

NOT ASSIGNED:
C10-13, 21-24
R4, 7, 12, 27, 28, 31-33

DELETED:
C72

2048-OSC-AMP-416

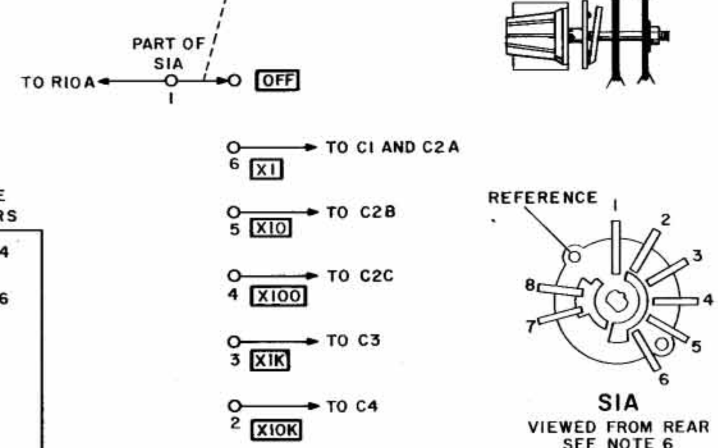
Pack Power Supply



NOTES

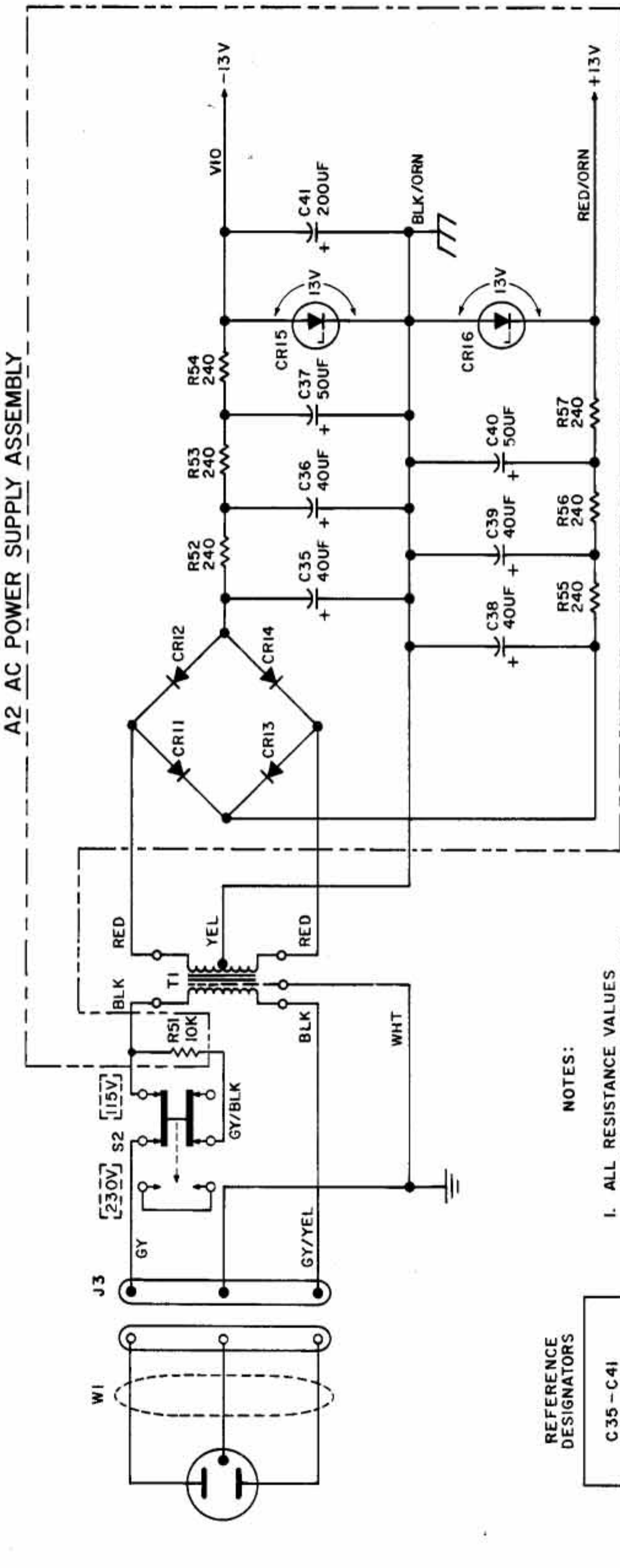
1. RESISTANCE IN OHMS, AND CAPACITANCE IN MICROFARADS UNLESS OTHERWISE INDICATED.
2. ⏚ = CABINET GROUND. ⫽ = FLOATING GROUND.
3. DC VOLTAGES ARE ± 10% AND ARE MEASURED WITH AN ELECTRONIC VOLTMETER WITH 10 MEGOHMS INPUT RESISTANCE.
4. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED AND ALL VOLTAGES REFERENCED TO ⫽.
5. R102 SET FOR 5.5 ± 0.5 MA CHARGE CURRENT.
6. WHEN COUNTING CONTACTS ON WAFERS FROM REFERENCE ONLY FUNCTIONAL CONTACTS ON THE SIDE VIEWED ARE COUNTED.
7. R102 SET FOR 5.5 ± 0.5 MILLIAMPERES (NORMAL CHARGE) OR 11 MILLIAMPERES MAXIMUM (FAST CHARGE) AT POINT Ⓐ

REFERENCE DESIGNATORS
BT101 – 104
C101
CR101 – 106
J301
P3
Q101
R101 – 106
S1D
S101
T101
W1



204B-POWER SUPPLY-416

Figure 5-11. Option 02 Power Supply with Rechargeable Batteries



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204B OPT PS-416

NOTES:

1. ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. S2 SHOWN IN THE 115V POSITION.
3. = FLOATING CIRCUIT-GROUND
   = CABINET GROUND

REFERENCE DESIGNATORS
C35 - C41
CR11 - CR16
J3
P2 - P3
R51 - R57
S2
T1
W1

Figure 5-12. Option 01 AC Power Supply

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. Table 6-1 lists parts in alpha-numerical order of their reference designators and indicates the description and hp stock number of each part, together with any applicable notes. Table 6-2 lists parts in alpha-numerical order of their hp stock numbers and provides the following information on each part:

a. Description of the part (see list of abbreviations below).

b. Typical manufacturer of the part in a five-digit code; see list of manufacturers in appendix.

c. Manufacturer's stock number.

d. Total quantity used in the instrument (TQ column).

e. Recommended spare part quantity for complete maintenance during one year of isolated service available upon request.

6-3. Miscellaneous parts not indexed in table 6-1 are listed at the end of table 6-2.

6-4. ORDERING INFORMATION.

6-5. To order a replacement part, address order or inquiry to your authorized Hewlett-Packard Sales or Service Office. A map of all Hewlett-Packard Field Offices is provided for your use at the rear of the manual.

6-6. Specify the following information for each part:

a. Model and complete serial number of instrument.

b. Hewlett-Packard stock number.

c. Circuit reference designator.

d. Description.

6-7. To order a part not listed in Tables 6-1 and 6-2, give complete description of the part and include its function and location.

REFERENCE DESIGNATORS

A = assembly
B = motor
C = capacitor
CR = diode
DL = delay line
DS = device signaling (lamp)
E = misc electronic part

F = fuse
FL = filter
J = jack
K = relay
L = inductor
M = meter
MP = mechanical part

P = plug
Q = transistor
R = resistor
RT = thermistor
S = switch
T = transformer

V = vacuum tube, neon bulb, photocell, etc.
W = cable
X = socket
XF = fuseholder
XDS = lampholder
Z = network

ABBREVIATIONS

A = amperes
BP = bandpass
BWO = backward wave oscillator

CER = ceramic
CMO = cabinet mount only
COEF = coefficient
COM = common
COMP = composition
CONN = connection
CRT = cathode-ray tube

DEPC = deposited carbon

EIA = Tubes or transistors meeting Electronic Industries' Association standards will normally result in instrument operating within specifications; tubes and transistors selected for best performance will be supplied if ordered by hp stock numbers.

ELECT = electrolytic
ENCAP = encapsulated

F = farads
FXD = fixed

GE = germanium
GL = glass
GRD = ground(ed)

H = henries
HG = mercury
HR = hour(s)

IMPG = impregnated
INCD = incandescent
INS = insulation (ed)

K = kilo = 1000

LIN = linear taper
LOG = logarithmic taper

M = meg = 10^6
MA = milliamperes
MINAT = miniature
METFLM = metal film
MFR = manufacturer

MTG = mounting
MY = mylar

NC = normally closed
NE = neon
NO = normally open
NPO = negative positive zero (zero temperature coefficient)
NSR = not separately replaceable

OBD = order by description

P = peak
PC = printed circuit board
PF = picofarads = 10^{-12} farads
PP = peak-to-peak
PIV = peak inverse voltage
POR = porcelain
POS = position(s)
POLY = polystyrene
POT = potentiometer

RECT = rectifier
ROT = rotary
RMS = root-mean-square
RMO = rack mount only

S-B = slow-blow
SE = selenium
SECT = section(s)
SI = silicon
SIL = silver
SL = slide
TA = tantalum
TD = time delay
TI = titanium dioxide
TOG = toggle
TOL = tolerance
TRIM = trimmer
TWT = traveling wave tube

U = micro = 10^{-6}
VAC = vacuum
VAR = variable
W/ = with
W = watts
WW = wirewound
W/O = without

* = optimum value selected at factory, average value shown (part may be omitted)
# = number

01194-5

Table 6-1. Index by Reference Designator

Circuit Reference	ⓗ Stock No.	Description	Note
A1		Not Assigned	
A2		Not Assigned	
A3	204B-19A	Assy, range switch, includes: C1 R1 thru R3 C3 thru C6 R5, R6 C8 S1	
A4	204B-65D	Assy, circuit board, includes: C14 thru C20 R4, R8, R9 C25 thru C32 R11, R13, R14 CR1 thru CR6 R16 thru R26 L1 R29, R30 Q1 thru Q5 R34 thru R39	
A5	200CD-34	Assy, output attenuator, includes: R40A/B R41, R42	
A6	204B-64B	Assy, DC power supply, includes: BT1 thru BT4	
A7		Not Assigned	
A8		Not Assigned	
BT1 thru BT4	1420-0010	Battery, mercury type: 5 cell, 6.75 V	
C1	0150-0084	C: fxd, cer, 0.1 µf +80% -20%, 50 vdcw	
C2	0170-0076	C: fxd, poly, 3 sect ±1%, 25 vdcw 3.05 µf 0.305 µf 0.0305 µf	
C3	0140-0174	C: fxd, mica, 3050 pf ±1%, 100 vdcw	
C4	0140-0173	C: fxd, mica, 305 pf ±1%, 100 vdcw	
C5	0140-0108	C: fxd, mica, 253 pf ±2%, 300 vdcw	
C6	0140-0172	C: fxd, mica, 3000 pf ±1%, 100 vdcw	
C7	0170-0076	C: fxd, poly, 3 sect ±1%, 25 vdcw	
C8	0130-0017	C: var, cer, 8-50 pf, 500 vdcw	
C9	0150-0096	C: fxd, cer, 0.05 µf +80% -20%, 100 vdcw	
C10 thru C13		Not Assigned	
C14	0140-0021	C: fxd, mica, 39 pf* ±10%, 500 vdcw	
C15	0130-0016	C: var, cer, 5-25 pf, 500 vdcw	
C16	0180-0045	C: fxd, elect, 20 µf, 25 vdcw	
C17	0140-0100	C: fxd, mica, 33 pf ±5%, 500 vdcw	
C18	0150-0042	C: fxd, TiO_2, 4.7 pf* ±5%, 500 vdcw	
C19	0150-0055	C: fxd, TiO_2, 10 pf ±5%, 500 vdcw	
C20	0180-0063	C: fxd, elect, 500 µf -10%+100%, 3 vdcw	
C21 thru C24		Not Assigned	
C25	0180-0112	C: fxd, elect, 2000 µf, 1 vdcw	
C26	0180-0104	C: fxd, aluminum elect, 200 µf, 15 vdcw	
C27	0180-0045	C: fxd, elect, 20 µf, 25 vdcw	
C28	0180-0111	C: fxd, elect, tanta 2 µf ±20%, 25 vdcw	
C29	0170-0038	C: fxd, my, 0.22 µf ±10%, 200 vdcw	
C30, C31	0150-0096	C: fxd, cer, 0.05 µf +80% -20%, 100 vdcw	
C32	0180-0104	C: fxd, aluminum elect, 200 µf, 15 vdcw	
CR1	1902-0054	Diode, breakdown: 18.5 V ±0.5 V	
CR2	1910-0016	Diode, Ge: 100 ma at 1 V, 60 PIV	
CR3	1901-0025	Diode, Si: 50 ma at 1 V, 100 PIV	
CR4, 5	1910-0016	Diode, Ge: 100 ma at 1 V, 60 PIV	
CR6	1902-0072	Diode, breakdown: 7.75 V ±0.25 V	

See introduction to this section

Table 6-1. Index by Reference Designator (cont'd)

Circuit Reference	ⓗ Stock No.	Description	Note
J1	5060-0634	Binding post, red	
	5060-0635	Binding post, black	
	0340-0086	Insulator, double, black	
	0340-0091	Insulator, triple, black	
L1	9140-0107	Inductor: fxd, RF, 27 μh ±10%	
P1		Not Assigned	
P2, P3		Part of W1	
Q1	1850-0071	Transistor: 2N1516, specially selected from ⓗ stock no. 1850-0003, color coded orange	
Q2	1850-0096	Transistor: Ge, 2N2189	
Q3	1850-0003	Transistor: 2N1516/OC170	
Q4	1854-0003	Transistor: Si	
Q5	1850-0062	Transistor: Ge	
R1	0683-1845	R: fxd, comp, 180K ohms ±5%, 1/4W	
R2	0687-2751	R: fxd, comp, 2.7M ±10%, 1/2W	
R3	0687-5651	R: fxd, comp, 5.6M ±10%, 1/2W	
R4	0727-0095	R: fxd, dep c, 900 ohms ±1%, 1/2W	
R5	0687-5651	R: fxd, comp, 5.6M ±10%, 1/2W	
R6	0687-2751	R: fxd, comp, 2.7M ±10%, 1/2W	
R7		Not Assigned	
R8	2100-0277	R: var, comp, lin, 100 ohms ±20%, 0.3W	
R9	0687-2701	R: fxd, comp, 27 ohms ±10%, 1/2W	
R10A/B	2100-0276	R: var, ww, dual ganged ±1%, 1W 1st sect: 10K ohms 2nd sect: lin, 10K ohms	
R11	0727-0095	R: fxd, dep c, 900 ohms ±1%, 1/2W	
R12		Not Assigned	
R13, R14	0687-1801	R: fxd, comp, 18 ohms ±10%, 1/2W	
R15	2100-0299	R: var, comp, lin, 3K ohms ±20%, 0.3W	
R16	0687-1031	R: fxd, comp, 10K ohms ±10%, 1/2W	
R17	0727-0112	R: fxd, dep c, 1.8K ohms ±1%, 1/2W	
R18	0686-2035	R: fxd, comp, 20K* ohms ±5%, 1/2W	
R19	0686-3325	R: fxd, comp, 3.3K ohms ±5%, 1/2W	
R20	0687-3311	R: fxd, comp, 330 ohms ±10%, 1/2W	
R21	0686-6225	R: fxd, comp, 6.2K ohms ±5%, 1/2W	
R22	0687-4701	R: fxd, comp, 47 ohms ±10%, 1/2W	
R23	0727-0134	R: fxd, dep c, 4.44K ohms ±1%, 1/2W	
R24	0687-1201	R: fxd, comp, 12 ohms ±10%, 1/2W	
R25, 26	0687-5601	R: fxd, comp, 56 ohms ±10%, 1/2W	
R27, 28		Not Assigned	
R29	0687-4701	R: fxd, comp, 47 ohms ±10%, 1/2W	
R30	0686-6215	R: fxd, comp, 620 ohms ±5%, 1/2W	
R31 thru R33		Not Assigned	
R34	0686-2015	R: fxd, comp, 200*ohms ±5%, 1/2W	
R35	0687-1011	R: fxd, comp, 100 ohms ±10%, 1/2W	
R36	2100-0108	R: var, comp, lin, 100 ohms ±30%, 1/3W	
R37	0687-1831	R: fxd, comp, 18K ohms ±10%, 1/2W	
R38	0698-0001	R: fxd, comp, 4.7 ohms ±5%, 1/2W	
R39	0687-1031	R: fxd, comp, 10K ohms ±10%, 1/2W	
R40A/B	2100-0113	R: var, comp, dual tandem, 100K/25K, 2W	
R41, R42	0686-6215	R: fxd, comp, 620 ohms ±5%, 1/2W	

See introduction to this section

Table 6-1. Index by Reference Designator (cont'd)

Circuit Reference	ⓗ Stock No.	Description	Note
S1	3100-0275	Switch, rot: 2 sect, 6 pos. (NSR) (see range switch assembly A3)	
		MISCELLANEOUS	
	204B-6D	Power Supply Bracket	
	204B-40B	Assy, dial	
	204B-108F	Assy, cam (see Figure 5-5)	
	0510-109	Wing Nut (Battery Pack Power Supply only)	
	0510-110	#6 Cap Nut (Rechargeable Battery Power Supply only)	
	0570-0056	Terminal Bolt	
	0590-0035	Clamping Nut (used with locknut)	
	0590-0036	Panel bushing nut	
	0590-0050	Pot shaft locknut	
	1410-0003	Panel Bushing	
	2190-0016	3/8 Internal lock washer	
	3050-0019	#10 flat washer	
	8160-0003	Cable drive - 15-3/5"	
	204B-108E	Cam Plastic	
	0370-0062	Knob, VERNIER	
	0370-0082	Knob, AMPLITUDE	
	0370-0087	Knob, RANGE	
	5000-0702	Cover, side	
	5000-0710	Cover, bottom	
	5040-0615	Battery Holder (Rechargeable Battery Power Supply only)	
	5060-0705	Cover, half recess top	
	5060-0727	Foot assy, third module	
	8160-0003	Cable, cam (16" length)	obd#
	9211-0057	Carton, inner	
	9211-0058	Carton, outer	
	9220-0029	Filler, T & B	
	9220-0080	Filler, ends	
		OPTIONS	
		Option 1	
A1	204B-11A	Assy, AC power supply, includes: J3, S2, T1, A2, W1	
A2	204B-65B	Assy, AC power supply board, includes: C35 thru C41 R51 thru R57 CR11 thru CR16	
C35, 36	0180-0050	C: fxd, aluminum elect, 40 μf -15% +100%, 50 vdcw	
C37	0180-0058	C: fxd, elect, 50 μf -10% +100%, 25 vdcw	
C38, 39	0180-0050	C: fxd, aluminum elect, 40 μf -15% ±100% 50 vdcw	
C40	0180-0058	C: fxd, elect, 50 μf -10%+100%, 25 vdcw	
C41	0180-0104	C: fxd, aluminum elect, 200 μf, 15 vdcw	
CR11 thru CR14	1901-0025	Diode, Si: 50 ma at 1 V, 100 PIV	
CR15, CR16	1902-0238	Diode, breakdown: 12.5 V -13.5 V	
J3	1251-0148	Connector, power: male, 3 pin	
R51	0693-1031	R: fxd, comp, 10K ohms ±10%, 2W	
R52 thru R57	0686-2415	R: fxd, comp, 240 ohms ±5%, 1/2W	
S2	3101-0033	Switch, sl: DPDT	

See introduction to this section

Table 6-1. Index by Reference Designator (cont'd)

Circuit Reference	ⓗ Stock No.	Description	Note
		MISCELLANEOUS (cont'd)	
T1	9100-0120	Transformer, power	
W1	8120-0078	Cord, power	
		Option 2	
A100	204B-11C	Assy, rechargeable battery power supply	
BT101 thru BT104	1420-0015	Battery, rechargeable, NiCd, 6.25 V, 225 ma hours	
C101	0180-0149	C: fxd, elect, 65 μf -10% +100%, 60 vdcw	
C102	0180-0140	C: fxd, elect, 300 μf -10% +100%, 10 vdcw	
CR101 thru CR104	1901-0025	Diode, Si: 50 ma at 1 V, 100 PIV	
CR105	1902-0074	Diode, breakdown: 7.15V ±5%	
CR106	1901-0025	Diode, Si: 50 ma at 1V, 100 PIV	
J101	1251-0148	Connector, power male, 3 pin	
Q101	1850-0064	Transistor, Ge, PNP, 2N1183	
R101	0758-0007	R: fxd, metallic-oxide, 150 ohms ±5%, 1/2W	
R102	2100-0391	R: var, ww, lin, 1000 ohms ±20%, 1.25W	
R103	0686-3015	R: fxd, comp, 300 ohms ±5%, 1/2W	
R104	0687-3331	R: fxd, comp, 33K ohms ±10%, 1/2W	
R105	0687-3921	R: fxd, comp, 3900 ohms ±10%, 1/2W	
R106	0698-0001	R: fxd, comp, 4.7 ohms ±5%, 1/2W	
S101	3101-0033	Switch, sl: DPDT	
T101	9100-0172	Transformer, power	
W101	8120-0078	Cord, power	
	204B-65F	Assy, rechargeable battery power supply board includes: C101, CR101 thru CR106, Q101, R101 thru R105, T101	

See introduction to this section

Table 6-2. Replaceable Parts

ⓗⓟ Stock No.	Description	Mfr.	Mfr. Part No.	TQ		
200CD-34	Assy, output attenuator includes: R40A/B R41, R42	28480	200CD-34	1		
204B-6D	Power Supply Bracket	28480	204B-6D	1		
204B-11A	Assy, AC Power Supply, includes: J3 S2 A2 T1 W1	28480	204B-11A	1		
204B-11B	Not Assigned					
204B-11C	Assy, Rechargeable Battery Power Supply	28480	204B-11C	1		
204B-19A	Assy, Range Switch, includes: C1 R1 thru R3 C3 thru C6 R5, R6 C8 S1	28480	204B-19A	1		
204B-40B	Assy, Dial	28480	204B-40B	1		
204B-64B	Assy, DC Power Supply, includes: BT1 thru BT4	28480	204B-64B	1		
204B-65B	Assy, Power Supply Board, includes: C35 thru C41 CR11 thru CR16 R51 thru R57	28480	204B-65B	1		
204B-65D	Assy, Circuit Board, includes: C14 thru C20 R4, R8, R9 C25 thru C32 R11, R13, R14 CR1 thru CR6 R16 thru R26 L1 R29, R30 Q1 thru Q5 R34 thru R39	28480	204B-65D	1		
204B-65F	Assy, Rechargeable Battery Power Supply Board, includes: C101 R101 thru R105 CR101 thru CR106 T101 Q101	28480	204B-65F	1		
204B-108E	Cam, plastic: pot and dial	28480	204B-108E	2		
204B-108F	Assy, cam	28480	204B-108F	1		
0130-0016	C: var, cer, 5-25 pf, 500 vdcw	72982	557-019-C0P0 39R	1		
0130-0017	C: var, cer, 8-50 pf, 500 vdcw	72982	557-019-U2P0-34R	1		
0140-0021	C: fxd, mica, 39 pf* ±10%, 500 vdcw	00853	DR1439B10	1		
0140-0100	C: fxd, mica, 33 pf ±5%, 500 vdcw	00853	CM15E330J	1		
0140-0108	C: fxd, mica, 253 pf ±2%, 300 vdcw	72136	RCM15E (253 pf G)	1		
0140-0172	C: fxd, mica, 3000 pf ±1%, 100 vdcw	72136	DM19F302F	1		
0140-0173	C: fxd, mica, 305 pf ±1%, 100 vdcw	72136	DM19F3050F	1		
0140-0174	C: fxd, mica, 3050 pf ±1%, 100 vdcw	72136	DM19F(3051)F 100 VDC	1		
0150-0042	C: fxd, TiO_2, 4.7 pf* ±5%, 500 vdcw	82142	Type JM obd#	1		
0150-0055	C: fxd, TiO_2, 10 pf ±5%, 500 vdcw	82142	Type JM obd#	1		
0150-0084	C: fxd, cer, 0.1 μf +80% -20%, 50 vdcw	72982	845-222-Y5VO-1042	1		
0150-0096	C: fxd, cer, 0.05 μf +80% -20%, 100 vdcw	91418	Type TA obd#	3		
0170-0038	C: fxd, my, 0.22 μf ±10%, 200 vdcw	56289	148P22492	1		
0170-0076	C: fxd, poly, 3 sect ±1%, 25 vdcw 3.05 μf 0.305 μf 0.0305 μf	56289	111P	2		

See introduction to this section

Table 6-2. Replaceable Parts (cont'd)

ⓗⓟ Stock No.	Description	Mfr.	Mfr. Part No.	TQ		
0180-0045	C: fxd, elect, 20 μf, 25 vdcw	56289	Type 30 D	2		
9180-0050	C: fxd, aluminum elect, 40 μf, -15% +100%, 50 vdcw	56289	D32538	4		
0180-0058	C: fxd, elect, 50 μf +100% -10%, 25 vdcw	56289	30D186A1	2		
0180-0063	C: fxd, elect, 500 μf -10% +100%, 3 vdcw	56289	30D120A1	1		
0180-0104	C: fxd, aluminum elect, 200 μf, 15 vdcw	56289	30D174A1	3		
0180-0111	C: fxd, elect, tanta, 2 μf +20%, 25 vdcw	56289	109D107C20 30T2	1		
0180-0112	C: fxd, elect, 2000 μf, 1 vdcw	56289	41D Type Y97217	1		
0180-0140	C: fxd, elect, 300 μf -10% +100%, 10 vdcw	56289		1		
0180-0149	C: fxd, elect, 65 μf -10% +100%, 60 vdcw	56289	150D225X00	1		
0180-0155	C: fxd, elect, tanta, 2.2 μf ±20%, 25 vdcw	56289	20AZ			
0340-0086	Insulator: double, black	28480	0340-0086	1		
0340-0091	Insulator: triple, black	28480	0340-0091	1		
0370-0062	Knob, VERNIER	28480	0370-0062	1		
0370-0084	Knob, AMPLITUDE	28480	0370-0084	1		
0370-0087	Knob, RANGE	28480	0370-0087	1		
0570-0056	Terminal Bolt	Nylok	50M-S-3511	2		
0590-0035	Clamping Nut (used with locknut)	05704	100-Z	2		
0590-0036	Panel-bushing nut	05704	100-Z	2		
0590-0050	Pot shaft locknut	84396	ESNA-96NTM	2		
0683-1845	R: fxd, comp, 180K ohms ±5%, 1/4W	01121	CB1845	1		
0686-1035	R: fxd, comp, 10K ohms ±5%, 1/2W	01121	EB1035	1		
0686-2015	R: fxd, comp, 200* ohms ±5%, 1/2W	01121	EB2015	1		
0686-2035	R: fxd, comp, 20K* ohms ±5%, 1/2W	01121	EB2035	1		
0686-2415	R: fxd, comp, 240 ohms ±5%, 1/2W	01121	EB2415	6		
0686-3015	R: fxd, comp, 300 ohms ±5%, 1/2W	01121	EB3015	1		
0686-3325	R: fxd, comp, 3.3K ohms ±5%, 1/2W	01121	EB3325	1		
0686-6215	R: fxd, comp, 620 ohms ±5%, 1/2W	01121	EB6215	3		
0686-6225	R: fxd, comp, 6.2K ohms ±5%, 1/2W	01121	EB6225	1		
0687-1011	R: fxd, comp, 100 ohms ±10%, 1/2W	01121	EB1011	1		
0687-1031	R: fxd, comp, 10K ohms ±10%, 1/2W	01121	EB1031	2		
0687-1201	R: fxd, comp, 12 ohms ±10%, 1/2W	01121	EB1021	1		
0687-1801	R: fxd, comp, 18 ohms ±10%, 1/2W	01121	EB1801	2		
0687-1831	R: fxd, comp, 18K ohms ±10%, 1/2W	01121	EB1831	1		
0687-2701	R: fxd, comp, 27 ohms ±10%, 1/2W	01121	EB2701	1		
0687-2751	R: fxd, comp, 2.7M ±10%, 1/2W	01121	EB2751	2		
0687-3311	R: fxd, comp, 330 ohms ±10%, 1/2W	01121	EB3311	1		
0687-3331	R: fxd, comp, 33K ohms ±10%, 1/2W	01121	EB3331	1		
0687-3921	R: fxd, comp, 3900 ohms ±10%, 1/2W	01121	EB3921	1		
0687-4701	R: fxd, comp, 47 ohms ±10%, 1/2W	01121	EB4701	2		
0687-5601	R: fxd, comp, 56 ohms ±10%, 1/2W	01121	EB5601	2		
0687-5651	R: fxd, comp, 5.6M ohms ±10%, 1/2W	01121	EB5651	2		
0693-1031	R: fxd, comp, 10K ohms ±10%, 2W	01121	HB1031	1		
0698-0001	R: fxd, comp, 4.7 ohms ±5%, 1/2W	01121	EB47GS	1		
0727-0095	R: fxd, dep c, 900 ohms ±1%, 1/2W	19701	DC1/2CR5	2		
0727-0112	R: fxd, dep c, 1.8K ohms ±1%, 1/2W	19701	DC1/2CR5	1		
0727-0134	R: fxd, dep c, 4.44K ohms ±1%, 1/2W	19701	DC1/2BR5	1		
0758-0007	R: fxd, metallic-oxide, 150 ohms ±5%, 1/2W	07115	C20	1		

See introduction to this section

Table 6-2. Replaceable Parts (cont'd)

ⓗⓟ Stock No.	Description	Mfr.	Mfr. Part No.	TQ		
1251-0148	Connector, power: male. 3 pin	0000U	H-10611G-3L	2		
1410-0003	Panel Bushing	28480	50M-A-3611	3		
1420-0010	Battery, mercury type: 5 cell, 6.75 V	09569	TR235R-3164 69	4		
1420-0015	Battery NiCd 6.25 V. 225 ma hours	88220	5N32T	4		
1850-0003	Transistor: 2N1516/OC170	73445	2N1516/OC 170	1		
1850-0062	Transistor: Ge	49956	T51602	1		
1850-0064	Transistor: Ge, PNP, 2N1183	02735	2N1183	1		
1850-0071	Transistor: 2N1516, specially selected from ⓗⓟ stock no. 1850-0003, color code orange.	28480	1850-0071	1		
1850-0096	Transistor: Ge, 2N2189	0000T	2N2189	1		
1854-0003	Transistor, Si	07263	S-3056	1		
1901-0025	Diode, Si: 50 ma at 1 V, 100 PIV	98925	CSD2693	10		
1902-0017	Diode, avalanche, 6.8 V ±10%	28480	1902-0017	2		
1902-0054	Diode, breakdown: 18.5 ±0.5 V	28480	1902-0054	1		
1902-0072	Diode, breakdown: 7.75 V ±0.25 V	28480	1902-0072	1		
1902-0238	Diode, breakdown: 12.5 V -13.5 V	28480	1902-0238	2		
1910-0016	Diode, Ge: 100 ma at 1 V, 60 PIV	73293	HD1445	3		
2100-0108	R: var, comp, linear, 100 ohms ±30% 1/3 W	11237	UPE70	1		
2100-0013	R: var, comp, dual tandem, 2 W	01121	JJ59160	1		
2100-0276	R: var, ww, dual ganged ±1%, 1 W 1st sect: 10 K ohms 2nd sect: lin, 10 K ohms	16688	10-42-1516	1		
2100-0277	R: var, comp, lin, 100 ohms ±20%, 0.3 W	11237	Type UPE65 CV	1		
2100-0299	R: var, comp, lin, 3 K ohms ±20%, 0.3 W	71450	70	1		
2100-0391	R: var, ww, lin, 1000 ohms ±20%, 1/2W	28480	2100-0391	1		
2190-0016	3/8 internal lock washer	78189	obd#	2		
3050-0019	#10 Flat Washer	78471	50MS637	4		
3100-0275	Switch, rot: 2 sect, 6 position (NSR) (see range switch assembly A31)	76854	217393-K2	1		
3101-0033	Switch, si: DPDT	42190	4633	2		
5000-0702	Cover, side	28480	5000-0702	2		
5000-0710	Cover, bottom	28480	5000-0710	1		
5040-0615	Battery Holder (Rechargeable Battery Power Supply only)	28480	5040-0615	1		
5060-0634	Binding post: red	28480	5060-0634	2		
5060-0635	Binding post: black	28480	5060-0635	1		
5060-0705	Cover, half recess top	28480	5060-0705	1		
5060-0727	Foot assy, third module	28480	5060-0727	2		
8120-0078	Cord, power	70903	KH-4147	2		
8160-0003	Cable, cam (15 - 3/5" length) obd#	28480	8160-0003	1		
9100-0120	Transformer, power	98734	9254	1		
9100-0172	Transformer, power	98734	2120	1		
9140-0107	Inductor, fxd, RF, 27 μh ±10%	99800	1840-38	1		
9211-0057	Carton, inner	28480	9211-0057	1		
9211-0058	Carton, outer	28480	9211-0058	2		
9220-0029	Fillter, T & B	28480	9220-0029	1		
9220-0080	Filler, ends	28480	9220-0080	1		

See introduction to this section

MODEL 204B

OSCILLATOR

Manual Serial Prefixed: 416-
Manual Printed: 6/64

To adapt this manual to instruments with other serial prefixes check for errata below, and make changes shown in tables.

NOTE

This backdating manual change sheet makes this manual applicable to the earlier instruments. Instrument-component values that differ from those in the manual, yet are not listed in the backdating sheet, should be replaced using the stock number given in the manual.

Instrument Serial Prefix	Make Manual Changes	Instrument Serial Prefix	Make Manual Changes
252-	1	135-00276 to -00421*	1, 2, 3, 4, 5
244-	1, 2	135-00101 to -00275	1, 2, 3, 4, 5, 6
233-	1, 2, 3		
208-	1, 2, 3, 4		

CHANGE #1

Paragraph 5-22, step b
add: Counter weight on pot will come off at this time.

Table 6, MISCELLANEOUS
delete: ⓗⓟ Stock No. 204B-108E, cam plastic: pot and dial

CHANGE #2

Paragraph 5-14, step b
Add 1st sentence: Top and bottom covers must be removed first in order to reach the nuts on the bolts holding the side covers.

Paragraph 5-14, step c
Change to read: Slide foot release of rear foot assembly towards center of bottom cover.

Paragraph 5-14, step d
Change to read: Slide foot assembly toward side and lift to remove.

Table 6, MISCELLANEOUS
Cover, half recess top: change ⓗⓟ Stock No. to 5000-0706
Cover, bottom: change ⓗⓟ Stock No. to 5000-0710
Cover, side: change ⓗⓟ Stock No. to 204B-44A-1
Foot Assembly, third module: change ⓗⓟ Stock No. to 5060-0725

CHANGE #3

Table 6 and Figure 5-9
R14: change to Resistor, fixed, comp, 22 Ω ±5%, 1/2 W, ⓗⓟ Stock No. 0686-2205
R13: change to Resistor, fixed, comp, .27 Ω ±10%, 1/2 W, ⓗⓟ Stock No. 0687-2701
R11: change to Resistor, fixed, mfgl, 1K Ω ±1%, 1/8 W, ⓗⓟ Stock No. 0757-0029
R9: change to Resistor, fixed, comp, 33 Ω ±5%, 1/2 W, ⓗⓟ Stock No. 0686-3305
R4: change to Resistor, fixed, mfgl, 1K Ω ±1%, 1/8 W, ⓗⓟ Stock No. 0757-0029
Q2: change to Transistor, 2N1516/OC170, ⓗⓟ Stock No. 1850-0003
Table 6, Change to Assy dial to ⓗⓟ Stock No. 204B-40A

Table 1-1, Frequency Range: Change to 5 cps to 500 kc in 5 ranges

CHANGE #4

R51: change to Resistor, fixed, comp, 12K Ω ±10%, 2 W, ⓗⓟ Stock No. 0693-1231

Instrument Serial Prefix	Make Manual Changes
252-	1
244-	1, 2
233-	1, 2, 3
208-	1, 2, 3, 4

Instrument Serial Prefix	Make Manual Changes
135-00276 to -00421*	1, 2, 3, 4, 5
135-00101 to -00275	1, 2, 3, 4, 5, 6

* Exclude serial numbers below:

00377	00388	00399	00411	00420
00378	00390	00400	00413	
00379	00394	00402	00414	
00381	00396	00404	00415	
00383	00397	00407	00416	
00385	00398	00410	00418	

CHANGE #5

CR3: change to Diode, germanium, ⓗ Stock No. 1910-0016
R25, 26: change to Resistor, fixed, composition, 27 ohms ±10%, 1/2 W ⓗ Stock No. 0687-2701

Figure 5-9
change voltage across CR3 to 0.3 volt

CHANGE #6

C18: change to capacitor, 10 pf ±5%, 500 vdcw, ⓗ Stock No. 0150-0055

Supplement B for
204B-904