OPERATING AND SERVICE MANUAL

Manual Part No. 00204-90005
Microfiche Part No. 00204-90055

MODEL 204C/204D
OSCILLATOR
INCLUDING H20-204C

Printed: December 1976

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This section contains general information about the -hp- Model 204C, the -hp- Model H20-204C, and -hp- Model 204D Oscillators. Throughout this manual the instrument will be referred to as the Model 204C/D when referring to all instruments, and the Model 204C, the Model H20-204C, or the Model 204D when referring to one of the instruments individually.

1-3. SPECIFICATIONS AND GENERAL INFORMATION.

1-4. Table 1-1 lists the specifications for the Model 204C/D. Table 1-2 lists other useful information about the instruments which is not specified.

1-5. DESCRIPTION.

1-6. The Model 204C/D is a wide range oscillator with a sine wave output at frequencies from 5 Hz to 1.2 MHz. The output impedance is 600 ohms; and the maximum voltage output is 5 V rms into open circuit, or 2.5 V rms into a 600 ohm load.

1-7. The Model 204D is basically the same instrument as the Model 204C, except the Model 204D has a step attenuator added.

1-8. The Model 204C has a variable output with greater than 40 dB attenuation, providing a minimum open circuit output of less than 50 mV rms. The Specification H20-204C has greater than 20 dB attenuation. In addition, the H20-204C is obtainable with the Opt. 02 Power supply board only.

1-9. The Model 204D has greater than 10 dB variable attenuation and 80 dB step attenuation in 10 dB steps, providing a minimum open circuit output of less than 150 μV rms.

1-10. The output of the Model 204C/D may be isolated from the cabinet and power line ground. This floating output is balanced to better than 40 dB for frequencies up to 20 kHz.

1-11. The Model 204C/D may be synchronized with other instruments. The SYNC connector on the front panel provides a sync output signal greater than 100 mV rms over the entire frequency range, or accepts at external sync signal from another source. This permits the Model 204C/D to be synchronized with another signal source of the same frequency or harmonic thereof. With a 5 V rms (≈ 7 V peak sync input signal, the external source may vary as much as +/-5% in frequency and the Model 204C/D will remain synchronized.

p/o Table 1-1. Specifications.

RANGES

Frequency: 5 Hz to 1.2 MHz in 6 overlapping ranges.

PERFORMANCE

Dial Accuracy: +/-3% of frequency setting.

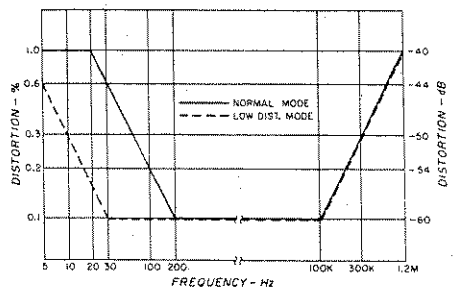
Flatness (At maximum output into 600 ohms resistive load 1 kHz reference):

Low Dist. Mode	+/-1%	+/-0.5%	+/-1%
Normal Mode	+5% -1%	+/-0.5%	+/-1%

5 100 300k 1.2M (Hz)

Hum and Noise: Less than 0.01% of output of 2.5 V rms into a 100 kHz BW (10 Hz to 100 kHz) with the 204C/D tuned above 200 Hz.

Distortion at 2.5 V rms into 600 ohms, or 5.0 V rms open circuit:



OUTPUT CHARACTERISTICS

Output Control: 204C, greater than 40 dB range, continuously adjustable. H20-204C, greater than 20 dB range continuously adjustable. 204D, greater than 10 dB continuously adjustable and 80 dB in 10 dB steps.

Table 1-1. Specifications (cont'd).

204D Attenuator Accuracy: (Amplitude vernier fully clockwise.) Referenced to +10 dB position; +/- 0.3 dB to - 60 dB, +/- 0.5 dB to - 70 dB.

Output Balance: Greater than 40 dB, below 20 kHz. Can be floated up to +/-500V peak between circuit common ▽ and outer chassis ground ⊥.

SYNCHRONIZATION

Sync Output: Sine wave in phase with output; greater than 100 mV rms into less than 100 pF.

Sync Input: Oscillator can be synchronized to an external signal. Sync range, the difference between sync frequency and set frequency, is a linear function of sync voltage. Sync Range ≈ +/-1% of set frequency per VRMS sine wave with a maximum input of +/-7 volts peak.

CAUTION

IF YOUR INSTRUMENT HAS A GROUND STRAP BETWEEN CIRCUIT COMMON AND OUTER CHASSIS GROUND, THE STRAP MUST BE REMOVED BEFORE ANY ATTEMPT IS MADE TO FLOAT THE INSTRUMENT.

Table 1-2. General Information.

Output Voltage: 2.5V rms (10 mW) into 600 ohms; 5V rms open circuit.

Output Impedance: 600 ohms.

Sync Impedance: 10 kΩ.

Operating Temperature: Instrument will operate within specifications from 0°C to 55°C. Except Opt 02, 0°C to 45°C.

Storage Temperature: -40° C to +75° C. Except Opt 02, -40° C to +60° C.

Power: Standard: AC-Line 115V or 230V +/-10%, 48 Hz to 440 Hz, less than 4W.

Opt 001: Mercury batteries 300 hours operation.

Opt 002: Line/Rechargeable batteries 115 V or 230 V +/- 10%, 48 Hz to 440 Hz, less than 4W. 35 hours operation per recharge.

Dimensions: Standard 1/3 module, 6-3/32" high, 5-1/8" wide, 8" deep (155 x 130,1 x 203,2 mm).

1-12. The standard Model 204C/D operates from 115 or 230 V ac, 48 to 440 Hz. The instrument is also available as an Option 001 using a mercury battery power supply, or as an Option 002 using a rechargeable nickel cadmium battery power supply.

1-13. ACCESSORIES AVAILABLE.

1-14. The following accessories are available for field installation in the Model 204C/D:

hp 11135A	AC power Pack (Supplied in standard)
hp 11136A	Mercury Battery Supply (Option 01)
hp 11137A	Rechargeable Battery/Ac Power Supply (Option 02)

1-15. INSTRUMENT AND MANUAL IDENTIFICATION.

1-16. Hewlett-Packard uses a two-section serial number. The first section (prefix) identifies a series of instruments. The last section (suffix) identifies a particular instrument within the series. If a letter is included with the serial number, it identifies the country in which the instrument was manufactured. If the serial prefix of your instrument differs from the one on the title page of this manual, a change sheet will be supplied to make this manual compatable with newer instruments or the backdating information on the schematics will adapt this manual to earlier instruments. All correspondence with Hewlett-Packard should include the complete serial number.

1-17. CHANGE SHEETS.

1-18. If the serial prefix of your instrument is greater than the one listed on the title page of this manual, a change sheet will be supplied. The change sheet is included to correct errors in the manual (ERRATA) and to make the manual compatable with instruments manufactured after the printing date of the manual (numbered changes).

1-19. OPTIONS AVAILABLE.

1-20. The following options are available for either the 204C or 204D:

Option 001	Mercury battery power supply
Option 002	Rechargeable battery power supply
Option 908	Additional Operating and Service Manual

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information and instructions necessary for installing and shipping this instrument. Included are initial inspection procedures, power and grounding requirements, installation information, and instructions for repackaging for shipment.

2-3. INSPECTION.

2-4. This instrument was carefully inspected both mechanically and electrically before shipment. It should be physically free of mars or scratches and in perfect electrical order upon receipt. To confirm this, the instrument should be inspected for physical damage in transit. Also, check for supplied accessories, and test the electrical performance of the instrument using the procedure outlined in Section V of this manual. If there is damage or deficiency, see the warranty on the inside front cover of this manual.

2-5. POWER REQUIREMENTS.

2-6. This instrument will operate from either 115 or 230 Vac, 48 Hz to 440 Hz. The instrument can easily be converted from 115 volt to 230 volt operation by changing the position of the slide switch located on the rear panel, so that the designation appearing on the switch matches the nominal voltage of the power source.

2-7. GROUNDING REQUIREMENTS.

WARNING

THE ⏚ GROUND IS A FLOATING GROUND. THE ⊥ TERMINAL ON THE REAR PANEL SHOULD BE CONNECTED TO EARTH GROUND FOR SAFETY WHEN THE INSTRUMENT IS BATTERY OPERATED.

2-8. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that the instrument panel and cabinet be grounded. All Hewlett-Packard instruments are equipped with a three-conductor power cord which, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the power cord three-prong connector is the ground wire.

2-9. INSTALLATION.

2-10. This instrument is fully transistorized; therefore no special cooling is required. However, the instrument should not be operated where the ambient temperature is outside the limits specified in Table 1-1.

2-11. RACK/BENCH INSTALLATION.

2-12. This instrument is built as a bench-type instrument with plastic feet and tilt stand in place. This instrument can be mounted with other sub-modular size instruments in a combining case for rack-type installation. Rack-mounting kits are available through your local Hewlett-Packard Field Office.

2-13. REPACKAGING FOR SHIPMENT.

2-14. The following is a general guide for repackaging for shipment. If you have any question, contact your local -hp- Sales and Service Office. (See Appendix at the back of this manual for office location.)

NOTE

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

a. Place instrument in original container if available If original container is not available, a suitable on can be purchased from your nearest -hp- Sales an Service Office.

If original container is not used,

b. Wrap instrument in heavy paper or plastic befo placing in an inner container.

c. Use plenty of packing material around all sides instrument and protect panel faces with cardboa strips.

d. Place instrument and inner container in a hea carton or wooden box and seal with strong tape metal bands.

e. Mark shipping container with "DELICATE I STRUMENT," "FRAGILE" etc.

SECTION III

OPERATING INSTRUCTIONS

3-1. INTRODUCTION.

3-2. This section contains the information necessary for operation of the Model 204C/D. Included are Instrument Description, Turn On Procedure, and Operating Considerations.

3-3. INSTRUMENT DESCRIPTION.

3-4. Each operating control, indicator, and connector on the front and rear panels is identified and described in Figure 3-1.

3-5. TURN ON PROCEDURE.

3-6. To turn on the standard Model 204C/D, proceed as follows:

a. Set the two-position voltage selector switch on the rear panel to the value of available line voltage.

b. Connect AC Power Receptacle to power line voltage.

c. Switch RANGE switch from OFF to desired frequency range.

d. Select desired frequency and voltage output with frequency dial and amplitude controls respectively.

3-7. OPERATING CONSIDERATIONS.

WARNING

THE ⏚ GROUND IS A FLOATING GROUND. THE ⏚ TERMINAL ON THE REAR PANEL SHOULD BE CONNECTED TO EARTH GROUND FOR SAFETY WHEN THE INSTRUMENT IS BATTERY OPERATED.

3-8. FLOATING OUTPUT.

3-9. The Model 204C/D inner chassis (circuit common) is electrically isolated from the outer chassis (chassis ground). A d.c. potential difference of up to ±500V may be applied between circuit common ⏚ and chassis ground ⏚. Circuit common can be connected to chassis ground by attaching a grounding strap between the two terminals on the rear panel of the instrument. If this is done a d.c. potential difference can no longer be applied between circuit common and chassis ground.

CAUTION

NO VOLTAGE SHOULD BE APPLIED DIRECTLY ACROSS THE OUTPUT TERMINALS OF THE MODEL 204C/D.

3-10. SYNCHRONIZATION.

3-11. To synchronize the Model 204C/D connect a signa to the SYNC terminal on the front panel. An input signal o 5 volts rms may vary as much as ± 5 % in frequency an still synchronize the 204C/D.

NOTE

The Model 204C/D can also be synchronized to any significant harmonic of a nonsinusoidal external signal. However, if a nonsinusoidal waveform is used to synchronize a Model 204C/D, some portion of the external sync signal will be fed to the output. This small signal will appear as distortion. The amount of this external distortion will be directly proportional to the amplitude of the sync signal. For a nonsinusoidal sync input of 2 volts peak-to-peak, the distortion will be down about -45 dB for frequencies which are normally down -60 dB. The sync range of the instrument is again dependent on the magnitude of the sync voltage (in this case the magnitude of the harmonic component) and conforms to the sync input specification listed in Table 1-1.

3-12. The SYNC terminal also provides an output sync sin wave greater than 100 mV rms at the same frequency as th Model 204C/D output.

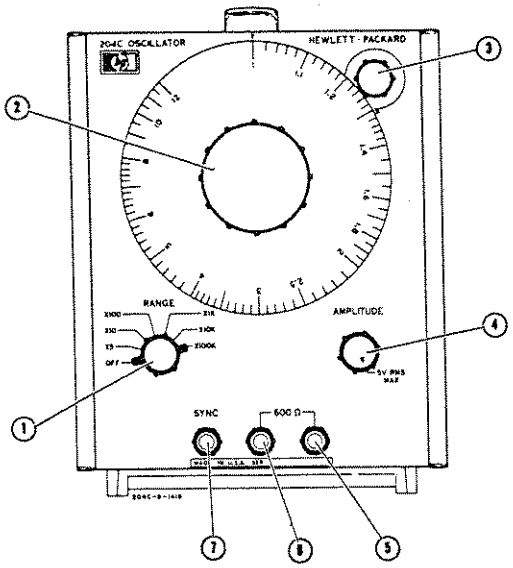
3-13. LOW DISTORTION.

3-14. At frequencies below 120 Hz, distortion can b reduced by switching the NORM/LOW DIST switch on th rear panel to LOW DIST. In the LOW DIST mode a Mode 204C/D will have a longer settling time when changin frequencies. To avoid this, set the desired frequency befor switching to the LOW DIST mode.

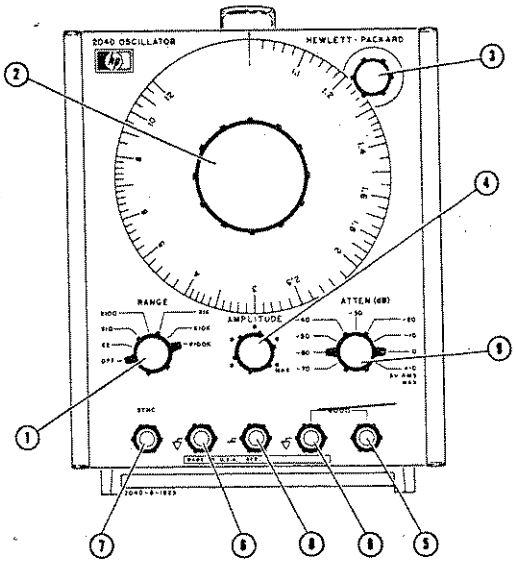
NOTE

The Model 204C/D output may appear unstable, or drop temporarily to zero when turning the frequency dial rapidly or changing the RANGE switch while in the LOW DIST mode.

204C



204D



(1) RANGE Switch: Selects frequency range. In OFF position the oscillator is inoperative.

(2) Frequency Dial: Selects frequency within desired range. Dial setting multiplied by RANGE switch position indicates output frequency.

(3) Frequency Vernier: Provides fine tuning of frequency dial.

(4) AMPLITUDE Control: Adjusts output level up to 5 volts rms. (2.5 volts rms into 600 ohms).

(5) Output Terminal: Provides a 600 ohm output at a frequency and amplitude determined by control settings.

(6) Output Ground Terminal: Provides floating chassis ground.

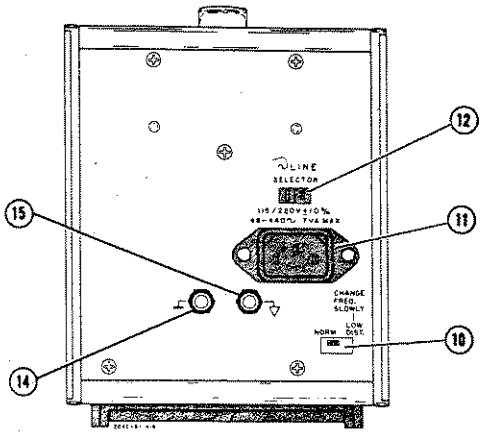
(7) SYNC:
1. Provides an input for an external sync signal.
2. Provides an output sync signal.

(8) Earth Ground: Provides front panel earth ground connector in parallel with rear panel earth ground.

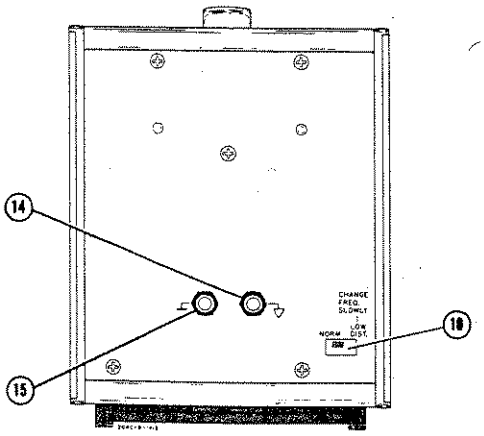
(9) Step Attenuator: Provides 80 dB attenuation in 10 dB steps.

p/o Figure 3-1. Description of Controls, Indicators and Connectors.

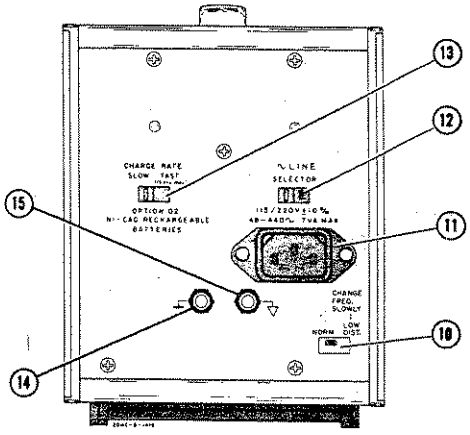
STANDARD POWER SUPPLY



OPTION 01 POWER SUPPLY



OPTION 02 POWER SUPPLY



(10) NORM/LOW DIST. Switch: Selects normal or low distortion on the X5 and X10 ranges.

(11) AC Power Receptacle: Mates with AC power cord supplied with this instrument for line power connection.

(12) Voltage Selector Switch: Selects line voltage of 115 or 230 volts ac.

(13) CHARGE RATE Switch: Selects fast or slow rate of recharging the nickel cadmium batteries.

(14) Chassis ground terminal.

(15) Circuit common terminal.

NOTE

Your instrument may have a ground strap between circuit common and chassis ground. This must be disconnected for isolation between the two grounds.

p/o Figure 3-1. Description of Controls, Indicators and Connectors.

3-15. MODEL 204D OUTPUT.

3-16. With the ATTEN switch in the +10 position and the AMPLITUDE control fully CW, the output is greater than 5 V rms. The AMPLITUDE is uncalibrated.

3-17. A 0 dBm output may be set up using the following procedure.

a. Connect a 600 ohm load across the 204D output.

b. Set the ATTEN switch to the 0 dB position.

c. Connect an AC voltmeter across the 600 ohm resistor.

d. Adjust the AMPLITUDE control for Voltmeter indication of 0.775 V.

3-18. BATTERY OPERATION.

3-19. RECHARGEABLE BATTERY OPERATION.

3-20. 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 on 115 or 230 Vac 48 to 440 Hz, 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).

3-21. 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 replacing 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.

3-22. It is recommended that the power cord be connected to a power source whenever possible, with the CHARGE RATE switch in SLOW position. 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.

3-23. When fully charged, the batteries will power the oscillator for approximately 35 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.

3-24. 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.

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.

3-25. RECHARGEABLE NICKEL-CADMIUM BATTERIES.

3-26. The batteries should be considered fully discharged when the voltages drop below ±11 V at the B+ and B- test points, located behind the instruments right side cover. The batteries will not operate much longer when this point is reached, and the oscillator may not meet specifications. Excessive discharge may shorten battery life.

3-27. A symptom of low battery voltage is clipping of the output waveform. Do not attempt calibration of the instrument unless the B+ and B- test points read greater than ±11 V.

3-28. To recharge the batteries, select either FAST or SLOW charge rate and 115 V or 230 V ac on rear panel and connect power cord to a suitable power source. The oscillator can be used during recharging since the charge rate is the same whether the oscillator is off or operating.

3-29. The FAST charge rate should be used only when a quick charge is necessary. Repeated charging at a FAST rate will shorten battery life.

3-30. The batteries will be fully charged in approximately 60 hours at the 6 mA SLOW charge rate, and 15 hours at the 20 mA FAST rate if they were fully discharged initally.

3-31. The batteries can be charged at any temperature between +32° F and +104° F (0° C to +40° 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 TEMPERATURES ABOVE 104° F (40° C). DO NOT CHARGE AT THE FAST RATE FOR MORE THAN 15 HOURS.

3-32. CYCLE-LIFE OF NICKEL-CADMIUM BATTERIES.

3-33. As extremes in temperature 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.

3-34. Battery cycle-life can be extended by recharging before the batteries are completely discharged, by charging at the SLOW rate, and by not overcharging.

3-35. The cycle-life of the batteries is based, by the manufacturer, on an end point 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) of every cycle. Under these conditions a cycle-life in excess of 100 cycles can be expected.

3-36. When used to power the Model 204C/D, the batteries are discharged at approximately a 35 hour rate, The batteries are not fully discharged if they are recharged as recommended in Paragraph 3-26.

3-37. Optimum battery life can be obtained by following these precautions:

a. Prevent complete battery discharge.

b. Keep FAST charges to a minimum.

c. Operate at moderate temperatures when possible.

d. Disconnect power cord after 60 hours of continuous charging with oscillator turned OFF (15 hours if charging batteries at a FAST rate).

3-38. MERCURY BATTERY OPERATION.

3-39. There is no change in operating procedure (paragraphs 3-5 through 3-15) when using the Model 204C/D with Mercury Battery Power Pack. Additional caution should be observed to turn off the instrument when not in use, since these batteries are not rechargeable.

3-40. If the Model 204C/D output is absent or clipped, check for ±11 V present at the B+ and B- test points located behind the instruments right side cover. Refer to Section V of this manual for battery replacement procedure.