OPERATION AND SERVICE MANUAL
MODEL 6920B
METER CALIBRATOR
MANUFACTURING CODE A

OPERATING AND SERVICE MANUAL

HEWLETT PACKARD HARRISON DIVISION

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The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

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NOTICE

These preliminary instructions are supplied to permit the earliest possible delivery of your instrument. The information is not as complete as that which will be included in the final version of the manual. The attached card is provided to make certain that the final Operating and Servicing Manual for this instrument reaches the proper person. Please mail this card immediately and we will supply you with a copy of the complete manual as soon as it becomes available.

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OPERATION AND SERVICE MANUAL
MODEL 6920B
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October, 1965

SPECIFICATIONS

Input: 105-125 VAC, single phase, 58-62 cps.

Output: AC or DC.

.01	-	1V	to	5A
.1V	-	10V	to	1A
1V	-	100V	to	100 ma
10V	-	1000V	to	10 ma
1μa	-	100μa*	to	500V
10μa	-	1 ma	to	500V
100μa	-	10 ma	to	500V
1 ma	-	100 ma	to	50V
10 ma	-	1A	to	5V
100 ma	-	5A	to	.5V

*DC only.

Line Regulation: The accuracy specifications will be met with line voltages from 105 to 125 VAC.

Output Impedance: DC - 1 Volt Range: Less than 0.0005 ohms.
Other Ranges: Accuracy specification is met with any load within the listed output capability.

AC - 1 Volt Range: Less than 0.001 ohms.
100μa Range: Greater than 500 megohms.
Other Ranges: Accuracy specification is met with any load within the listed output capability.

On 10 VAC Range - minimum load resistance 5 ohms
100 VAC Range - minimum load resistance 500 ohms
1000 VAC Range - minimum load resistance 50K ohms

Power factor of load 0.9 to 1.0 in AC Ranges.

Operating Temperature: 0° to $50^{\circ}C$.
Accuracy specification met at 25 $\pm 10^{\circ}C$ after 1 hour warm-up in static environment.

DC Accuracy: 0.2% of output ± 1 digit.

AC Accuracy: 0.4% of output ± 1 digit.

Overload Protection: May be shorted in voltage ranges and open-circuited in current ranges without damage.

Grounding: In voltage ranges, the negative terminal is grounded.
In current ranges, both terminals are off-ground--load must be floating.

SECTION I
GENERAL INFORMATION

1-1 DESCRIPTION

1-2 The Model 6920B is a feedback-regulated power source particularly suited for calibration of meters. Ten continuously variable output ranges are provided, ranging from 1 volt to 1000 volts and from 100μa to 5A full output. All ranges provide either DC or AC at the power-line frequency; however, the 100μa range is not calibrated in AC. Power output capability is from 2.5 watts in the 10A range to 10 watts in the 10, 100, and 1000 volt ranges. The AC output, while having the same waveform as the input power line, is controlled to have the correct average value. The 3 digit output dial is calibrated in terms of the RMS value of a sine wave.

1-3 The 6920B is particularly useful for production-line checking of meters for accuracy and for sticking movements. In addition, the wide range of outputs allows convenient checking of multimeters in the laboratory. Compact construction, through the use of all semiconductor circuitry, allows for easy portability.

1-4 Built-in current and voltage limiting circuits protect the 6920B from short circuit loads in voltage ranges and open-circuit loads in current ranges.

1-5 OPTIONAL EQUIPMENT

1-6 A 0.1 ohm shunt is available to extend the voltage capabilities downward to include 1 mv full output, when used in conjunction with the current ranges of the 6920B. When the shunt is used, the source impedance is 0.1 ohm.

1-7 INSTRUMENT IDENTIFICATION

1-8 This manual applies only to the Model 6920B. Change sheets will be supplied which include any differences between your instrument and this manual.

1-9 COOLING SYSTEM

1-10 This instrument is convection cooled and requires no maintenance except for occasional dusting. Adequate space should be provided around the unit to allow free circulation of cooling air.

1-11 POWER CABLE

1-12 A 5-foot three conductor power cable is supplied with the instrument terminated in a polarized three-prong male connector recommended by the National Electrical Manufacturers Association (NEMA). NEMA recommends that the instrument panel and cabinet be grounded. All Harrison Laboratories instruments are equipped with a 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.

1-14 To preserve the protection feature when operating the instrument from a two-prong outlet, use a three-prong to two-prong adaptor and connect the green pigtail on the adaptor to ground.

SECTION II
INSTALLATION

2-1 INCOMING INSPECTION

2-2 The instrument should be unpacked and inspected both mechanically and electrically upon receipt. Observe packing method and retain packing materials until unit has been inspected. Mechanical inspection involves checking for signs of physical damage such as scratched panel surfaces, broken knobs, etc. If damage is present, file a claim with the carrier. The electrical inspection involves checking the instrument against its specifications. Section V includes a performance check which is an in-cabinet check to verify proper instrument operation. It is recommended as an incoming inspection test. Refer to the warranty page if there is any electrical malfunction.

2-3 INSTALLATION

2-4 The meter calibrator is a portable instrument requiring no permanent installation. It is only necessary to connect the power cable supplied with the instrument to the power input and the instrument is ready for operation.

2-5 This instrument is air cooled. Sufficient space to permit free flow of cooling air around the instrument should be considered when installing. It should not be used in an area where the temperature exceeds 50°C (122°F). For rated accuracy, the temperature should be between 15°C and 35°C (59°F to 95°F).

2-6 POWER REQUIREMENTS

2-7 The 6920A operates on 115 volts 60 cps. The average input current with the output fully loaded is 1 ampere.

2-8 REPACKAGING FOR SHIPMENT

2-9 The following list is a general guide for repackaging an instrument for shipment. If you have any questions, contact your authorized Harrison Laboratories sales office.

a. Use the original container designed for the instrument. If a new container is required, a foam pack and container can be ordered from Harrison Laboratories. The stock number is given in the table of replaceable parts under "Miscellaneous".

b. Wrap the instrument in heavy paper or plastic before placing it in the shipping carton.

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

d. Use heavy cardboard carton or wooden box to house the instrument and use heavy tape or metal bands to seal the container.

e. Mark the packing box with "Fragile--Delicate Instrument", etc.

NOTE: If the instrument is to be shipped to Harrison Laboratories for service or repair, attach a tag to the instrument identifying the owner and indicating the service or repair to be accomplished. In any correspondence, be sure to identify the instrument by model number and serial number.

SECTION III
OPERATION

3-1 INTRODUCTION

3-2 The 6920B is ready to use as received from the factory. For maximum accuracy, allow one hour after turning on to allow the internal temperature to stabilize.

3-3 Figure 3-1 describes the operating controls and indicators.

3-4 OPERATING CONTROLS

3-5 Output Switch

3-6 This disconnects the output terminals when it is in the center "OFF" position. It should be "OFF" when changing loads, changing the range or function switch setting and when turning on the instrument. This insures that any voltage transients which may occur at these times do not damage the load or the operator.

3-7 When all other settings are made and the load connected, the output switch can be tipped to either the "ON TEST" or the "ON HOLD" position. In either case power is now being fed into the load. The switch will return to "OFF" from the "ON TEST" position as soon as figure pressure is removed. It will remain in the "ON HOLD" position until manually returned to "OFF".

3-8 Always return the output switch to "OFF" before removing the load. This is particularly important in the current ranges where dangerous voltages will exist if the load is removed with the output still "ON".

3-9 This switch is also used to reset the over-voltage protection circuit. See paragraph 3-28.

3-10 Output Terminals

3-11 The device to be calibrated is connected to the output terminals. In DC the Red (HI) terminal is positive (conventional current flow out of the red terminal).

3-12 In all voltage ranges the Black (LO) terminal is connected to the chassis and to earth ground through the three-wire power cord.

> NOTE: In all current ranges the black terminal is connected to a point in the circuit which is as much as 1 volt off ground potential, depending on the output dial setting. Do not shunt the LO terminal to earth ground with the device being calibrated. Inaccurate results may be obtained or the load could be damaged. There should be no problem of this kind with non-electronic or battery-powered current meters. If line-operated instruments are to be calibrated, see paragraph 3-29.

3-13 Function Switch

CAUTION: Do not turn FUNCTION SELECTOR when OUTPUT SWITCH is on.

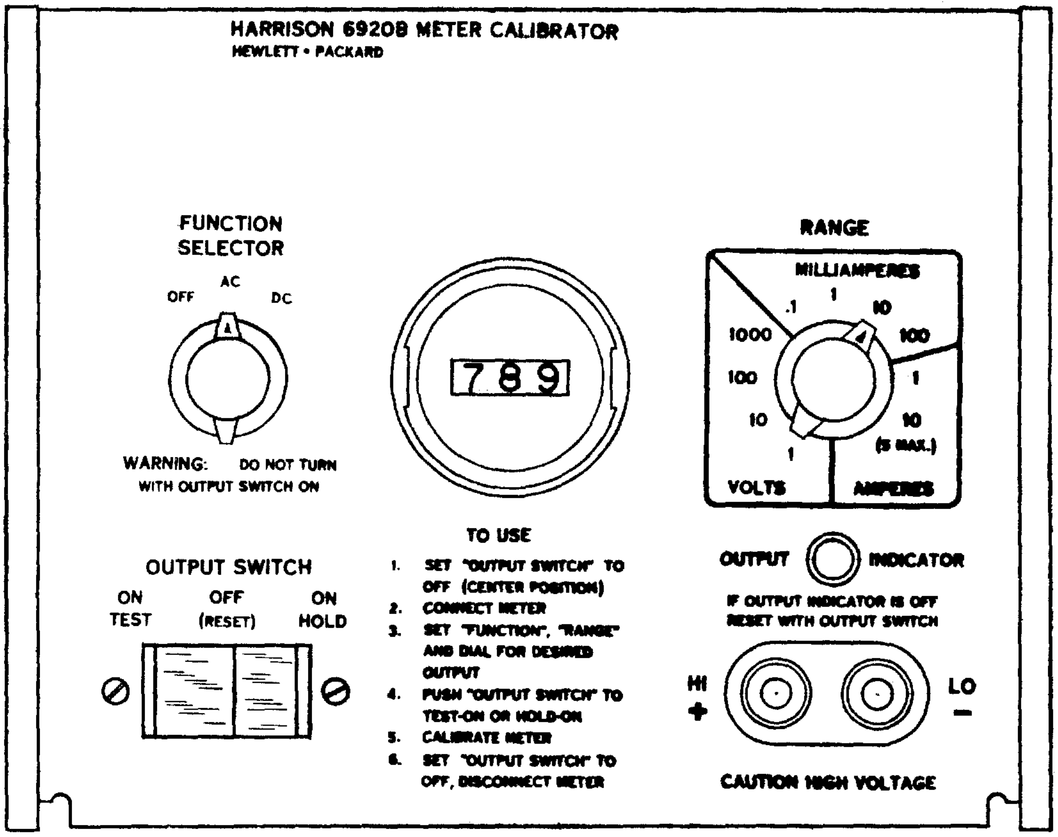


FIG. 3-1

1. Function Selector: Provides line power to meter calibrator when in "AC" or "DC" position. Selects AC or DC at the output terminals.

2. Power Indicator: Lights when instrument is turned on and AC source provided. Not lit if fuse is blown or missing.

3. Output Dial: Allows calibrated adjustment of output over the range selected.

4. Range Switch: Selects the voltage or current available with the output dial at its maximum setting - (1)000.

5. Output Indicator: Brightly lit when power is being delivered at output terminals. Dims if over voltage protection circuit trips. Out when output switch is "off".

6. Output Terminals: Connector for meter being calibrated. LO (-) terminal is connected to chassis ground in all voltage ranges. In current ranges the ground is inside the circuit and neither terminal should be grounded (see paragraph 3-29).

7. Output Switch: Open-circuits output terminals when in Off (reset) position. In this position the over-voltage protection circuit is also reset. In either "On" position power is delivered to the output. "On Test" will return "Off" as soon as finger pressure is removed. "On Lock" will remain on until manually returned to "Off".

3-14 The Function Switch is the input line switch for the meter calibrator. In the "OFF" position, input power is off. In "AC", alternating current will be delivered to the output terminals, while in "DC", direct current is available.

3-15 Range Switch

3-16 The range switch selects the current or voltage range appropriate to the meter being tested. The range indicated by the switch is the output available with the output dial fully clockwise, to (1)000.

3-17 Output Dial

3-18 The three-digit, ten turn output dial allows continuous adjustment of the calibrator output within any range.

3-19 To determine the correct decimal point placement, consider the decimal point to be immediately to the left of the left-hand digit, then multiply this number by the range switch setting. For example: 123 on the 10ma range is .123 x 10ma = 1.23ma.

3-20 Output Indicator

3-21 The output indicator is lit when the meter calibrator is delivering power to the output terminals. The light is out if the output switch is in the "OFF" position. It also will be off dim when the over-voltage protection circuit is activated, which will occur if the load is removed in any of the current ranges.

3-22 If the output light is not on and output power is desired, move the output switch to the "OFF (RESET)" position. Check the load to be sure that it is within the voltage capabilities of the 6920B, then return the output switch to "ON".

3-23 GENERAL OPERATING PROCEDURE

3-24 A brief procedure for using the Model 6920B meter calibrator, printed on the front panel, is also shown in figure 3-1.

3-25 Overload

3-26 The load should be within the current capability of the voltage range with which it is being used. If excessive current is drawn the output voltage will begin to fall, approaching zero for large overloads. Table 3-1 lists the output capabilities of the 6920B in the various ranges.

TABLE 3-1

Range	Maximum Output	Meter Resistance
1 volt DC	5 amperes	---
10 volts DC	1 ampere	---
100 volts DC	100ma	---
1000 volts DC	10ma	---
100μa DC	500 volts	---
1ma DC	500 volts	---
10ma DC	500 volts	---
100ma DC	50 volts	---
1 ampere DC	5 volts	---
10 amperes DC	5 amperes/0.5 volts	---
1 volt AC	5 amperes	---
10 volts AC	1 ampere	5 ohms minimum
100 volts AC	100ma	500 ohms minimum
1000 volts AC	10ma	50K ohms minimum
100μa AC	Not Calibrated	---
1ma AC	500 volts	---
10ma AC	500 volts	---
100ma AC	50 volts	---
1 ampere AC	5 volts	---
10 amperes AC	5 amperes/0.5 volts	---

3-27 In current ranges, it should be recalled that an open circuit is the maximum load condition and that a short circuit is minimum load. When testing current meters, the OUTPUT switch should be returned to "OFF" before removing the meter under test. If this is not done, the output voltage will momentarily exceed the full voltage capability of the current range in use, to as much as 1500 volts in the lowest three current ranges.

3-28 If a current meter is inadvertently removed with the output "ON", an over-voltage protection circuit will turn the error amplifier off - preventing further high-voltage operation. When this occurs, the OUTPUT INDICATOR light ceases to glow brightly and becomes very dim, indicating to the operator that the protection circuit has tripped. The protection circuit can also be activated when changing ranges or turning on the meter calibrator with the output switch "ON". The over-voltage protection is reset when the OUTPUT switch is placed in the "OFF (RESET)" position.

NOTE: When the over-voltage protection is energized, the output may be as high as 20% of the range switch setting in DC operation or 30% of range setting in AC, regardless of the setting of the output dial. To avoid the possibility of overloading a meter, always return the output switch "OFF" before changing ranges.

3-29 <u>Grounding</u>

GROUNDING CONSIDERATIONS

I. VOLTAGE RANGES

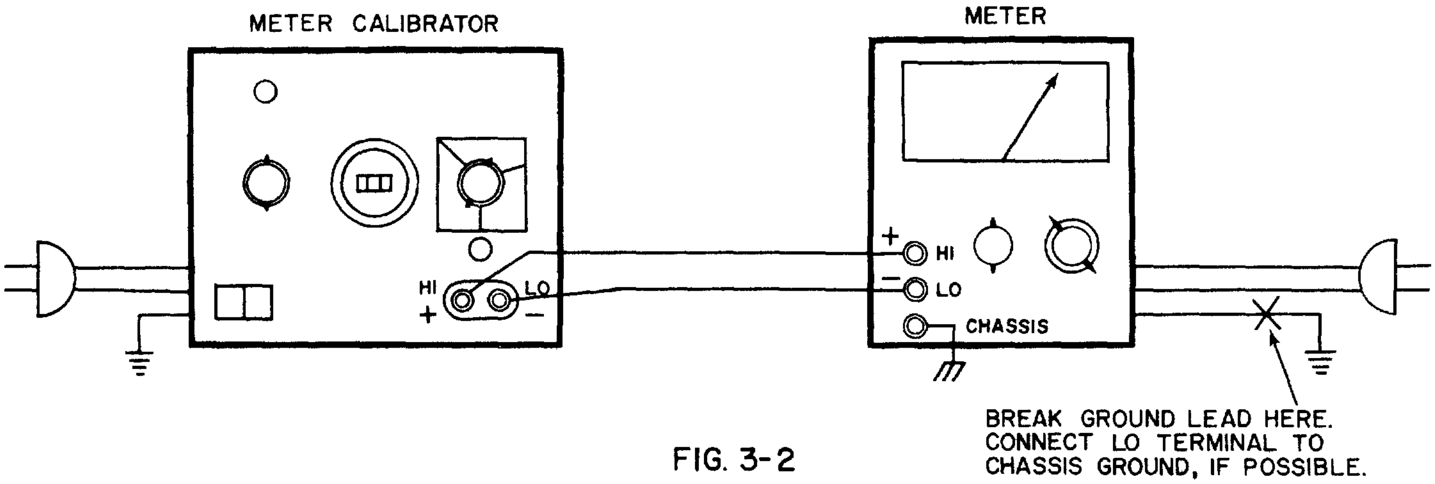
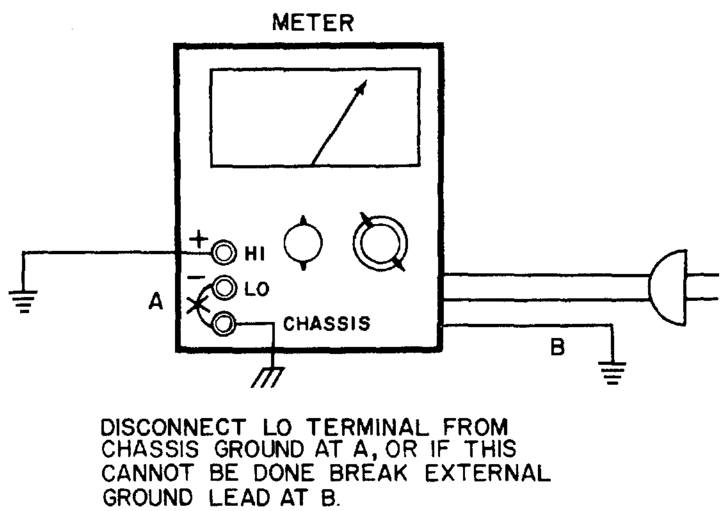


FIG. 3-2

II. TESTING CURRENT METERS FOR GROUND PROBLEMS

A)



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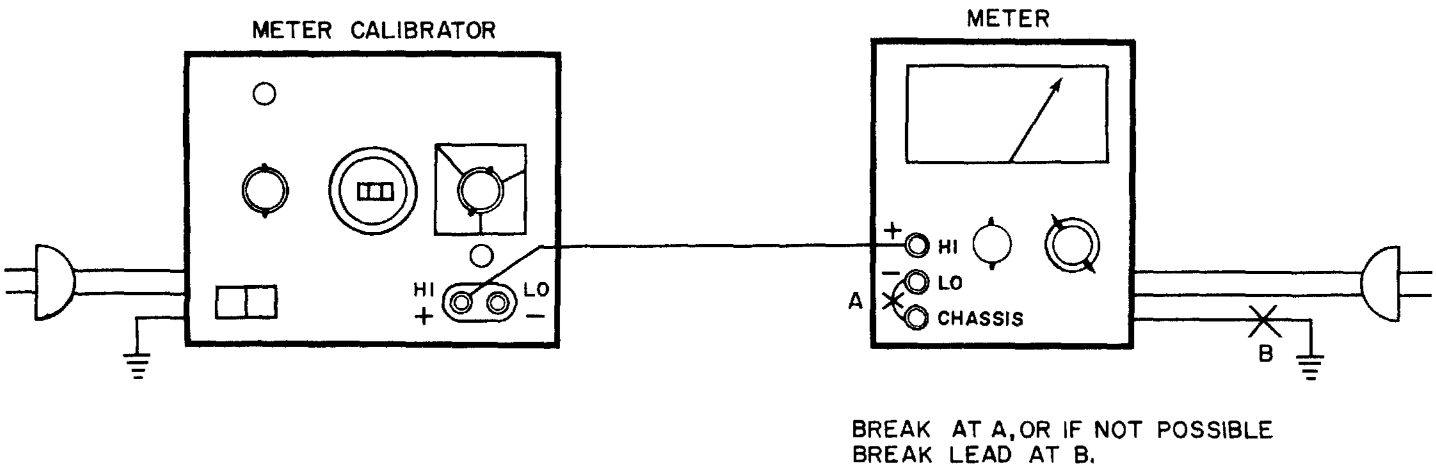


FIG. 3-3

3-30 With panel meters, multimeters, battery operated instruments and clip-on current meters which have no connection with earth ground, no grounding difficulties should be encountered in either the voltage or current ranges.

3-31 When calibrating line-operated meters which may have resistance and capacitance to earth ground and may generate currents between earth ground and the negative lead, some precautions are necessary in grounding. In voltage ranges the best procedure is to break any connection with earth ground in the meter being tested (as shown in figure 3-2), the ground connection being made through the negative terminal of the 6920B.

3-32 Line operated current meters, with the exception of clip-on models, require special care in grounding to avoid inaccurate measurements. Two quick tests, illustrated in figure 3-3, will show where problems exist.

a. Remove any connection between the low or (-) meter terminal and ground. Ground the (+) or high terminal. The meter should read zero within the desired accuracy.

b. Again with the (-) or LO meter terminal ungrounded, connect the (+), high, terminal to a +1 volt source, with respect to ground, AC for AC meters, DC for DC meters. The 1 volt range of the 6920B works well for this. To avoid possible damage to the meter, bring the voltage up slowly from zero until 1 volt is reached. If the meter still reads zero within the desired accuracy limits, no problem will be encountered in calibration if the LO (-) terminal is left ungrounded.

3-33 The above tests are accurate as long as the full-current voltage drop across the meter is small compared with 1 volt. Any guard shields present in the meter should be connected to the (-), LO, terminal but not to ground.

3-34 If the tests in 3-32 show that problems do exist, figure 3-4 shows a way of curing the problem. A (+1) amplifier such as the DY-2460A Solid State DC amplifier with DY-2461A-M4 plus-one gain plug-in is used to isolate the low-side terminal of the meter from the LO (-) terminal of the 6920B.

3-35 <u>Calibrating True RMS AC Meters</u>

3-36 In AC ranges the output waveform of the 6920B will be the same as that of the input power line, which will not be perfectly sinusoidal. The AC reference of the meter calibrator insures that the average value of the output will remain correct regardless of line distortion. The output dial is calibrated in terms of the sinusoidal RMS equivalent of the average value of the output. Thus, any AC meter which is average-sensing, RMS calibrated will be correctly calibrated. Meters of this type include multimeters and most electronic and digital voltmeters.

3-37 For true-reading RMS meters an error will exist as a function of the line distortion. Table 3-2 shows the possible error in terms of second, third and fourth harmonic content of the line.

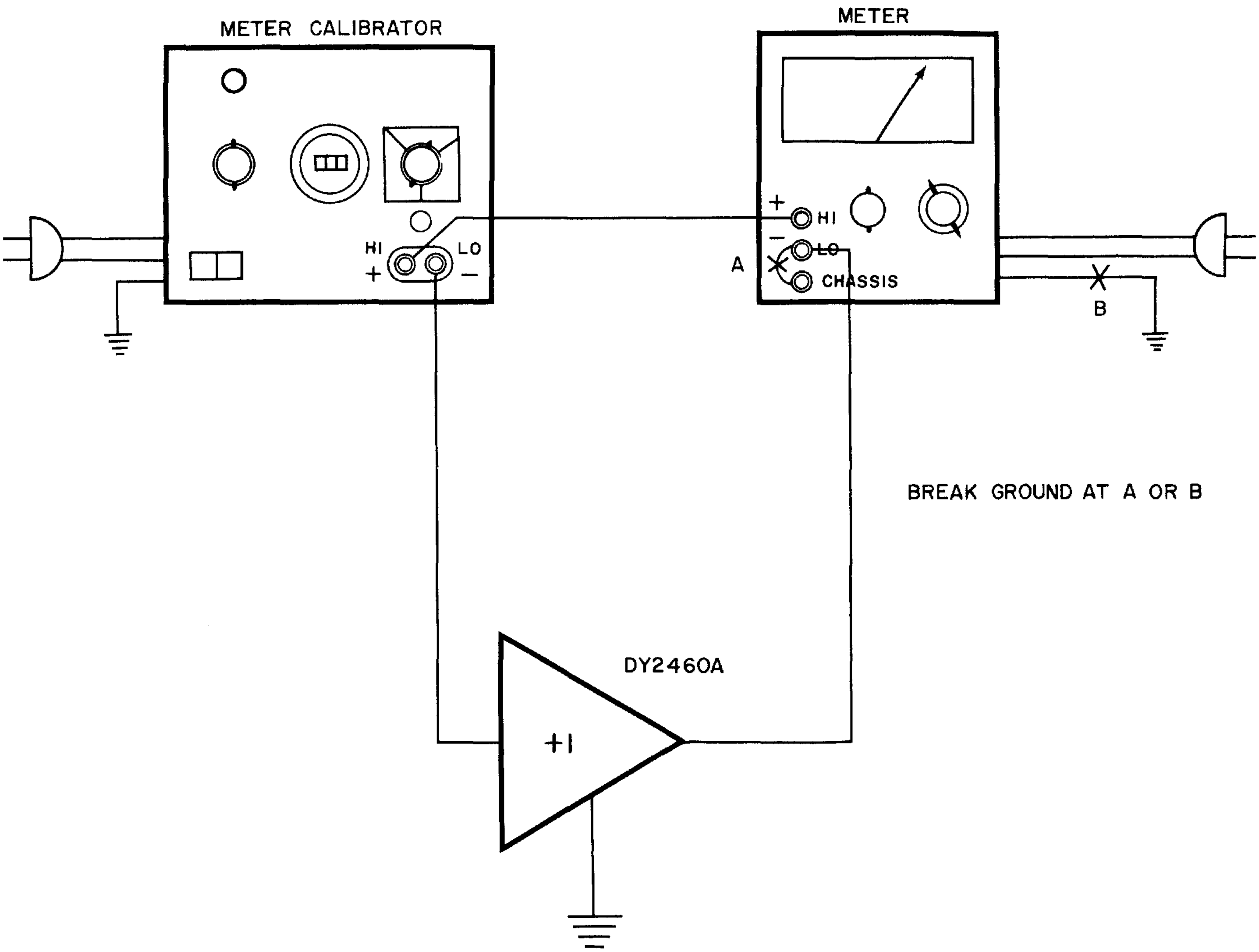


FIG. 3-4
ELIMINATING GROUND PROBLEMS
WITH +I AMPLIFIER

TABLE 3-2

OUTPUT ERROR DUE TO
LINE WAVEFORM DISTORTION

% HARMONIC	% ERROR AVERAGE-SENSING RMS CALIBRATED METER	% ERROR TRUE RMS METER
0	0	0
1% Second	0	-0% to +0.02%
2% Second	0	-0% to +0.02%
5% Second	0	-0% to +0.12%
10% Second	0	-0% to +0.50%
20% Second	0	-0.07% to +1.98%
1% Third	0	-0.65% to +0.69%
2% Third	0	-0.65% to +0.69%
5% Third	0	-1.54% to +1.79%
10% Third	0	-3.14% to +3.53%

3-38 If greater accuracy is needed for true RMS meters, an external sine wave oscillator capable of supplying 60 cps, 15 volts ± 10% at 2ma, can be used to supply the signal to the AC reference regulator. To do this, refer to figure 3-5. Disconnect the lead at terminal 2 of Transformer T1. Connect a pair of shielded leads from the 15 volt AC source to the points shown, the low side going to A1 and the high side going to A2.

NOTE: The calibrator should never be operated without the 15 volt AC being present as damage to the inverter may result.

3-39 Effects of Rapid Line Voltage Changes

3-40 In order to prevent distortion of the AC waveform in the AC reference circuit, the AC reference feedback loop has been made slow compared with 60 cps. Hence, sudden changes in line voltage will not be immediately corrected, producing a momentary shift in the AC output. If a particularly noisy line is causing excessive instability of the AC output, an external oscillator capable of supplying 60 cps, 15 volt ± 10% at 2ma, can be used to replace the line-derived AC input normally used. See paragraph 3-38 and figure 3-5 for instructions on this procedure.

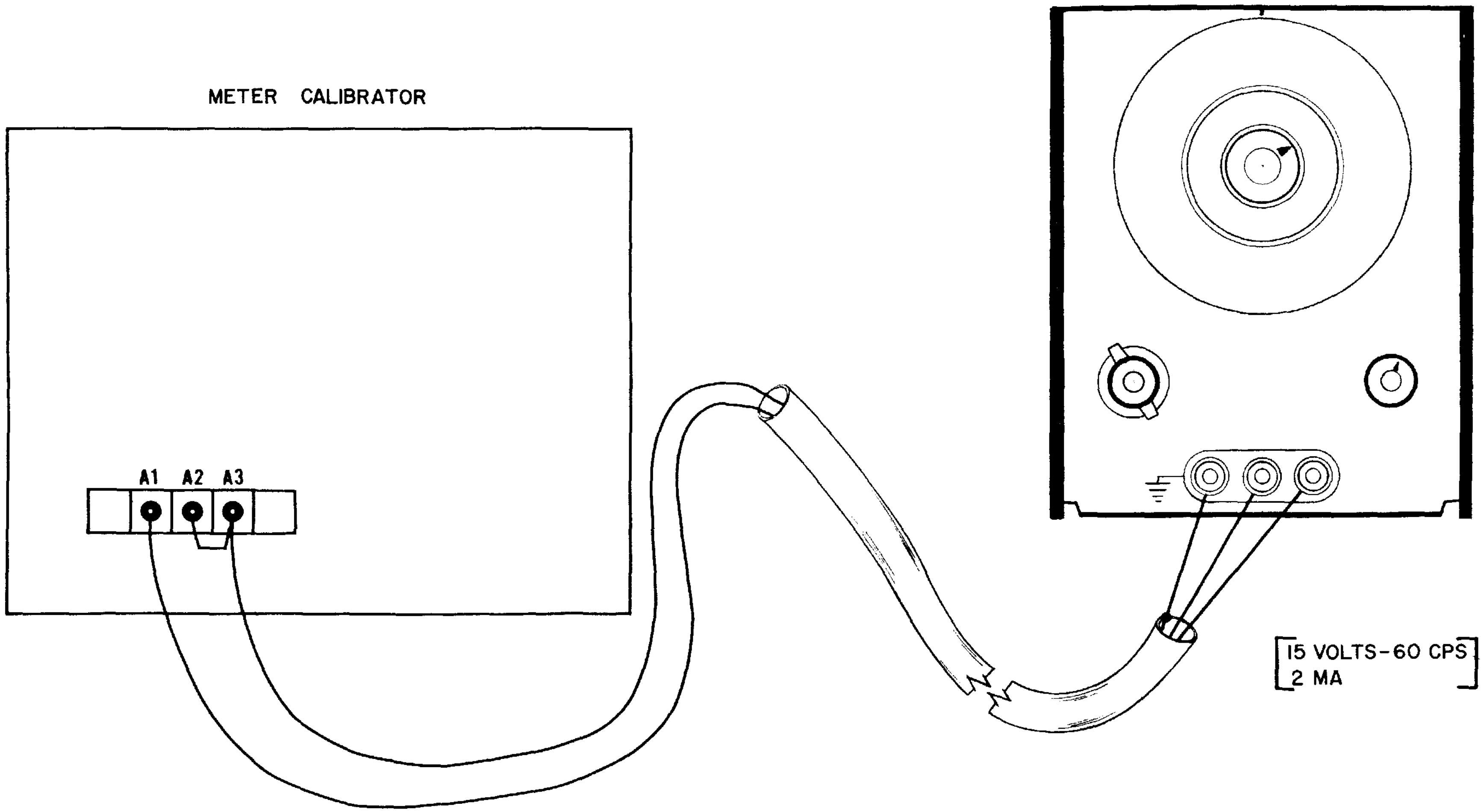


FIG. 3-5
USE OF EXTERNAL OSCILLATOR
TO OPERATE AC REFERENCE

SECTION IV
PRINCIPLES OF OPERATION

4-1 INTRODUCTION

4-2 The 6920B is a multiple-range AC/DC power supply which is suitable for the calibration of voltage and current meters. An inverter circuit is used following A DC series regulator transistor. This provides AC which is fed to a transformer. The various secondary windings provide current up to 5 amps and voltage to 1000 volts. The square wave output is rectified and filtered and supplied to the output terminals.

4-3 A closed-loop feedback system controls the output by comparing a reference voltage, set by the output dial, with a suitable measure of the output. The voltage difference is amplified and operates the series regulator transistor.

4-4 AC operation is similar with the exception that an AC reference is used. The rectifiers are bypassed at the secondary of the output transformer and a synchronous demodulator, in the error amplifier, keyed at the inverter frequency is used to maintain negative feedback during both halves of the inverter cycle.

4-5 Auxiliary circuits include a protective current limit, an over-voltage trip circuit, and an amplifier to maintain the inverter transformer in a state of DC balance. An output indicator lamp is used to show the state of the over-voltage trip.

4-6 BLOCK DIAGRAM

4-7 Figure 4-1 shows an over-all block diagram of the Model 6920B. The output signal is sampled by the range divider to obtain a signal which is 1 volt for full output. In the voltage ranges this is a voltage divider, for example 1000:1 in the 1000 volt range. In current ranges it is a series monitoring resistor; for example, 1000 ohms in the 1ma range. The range resistor configurations are shown in figure 4-2. This signal is fed back to the input amplifier where it is compared with a variable reference voltage, set by means of the output which operates R4.

4-8 The output of the error amplifier is delivered to the synchronous demodulator. In DC this demodulator is bypassed, its function being taken by the output power rectifiers. In AC, the demodulator reverses the amplifier polarity whenever the inverter switches.

4-9 The demodulator feeds a signal to the power regulator. Here the error signal is further amplified and used to control a series regulator power amplifier.

4-10 INVERTER

4-11 The output of the series regulator is applied to an inverter consisting of transistors Q14 and Q15, which is driven synchronously with the AC power line. In the DC mode of operation this produces a square wave signal which is suitable for applying to the output transformer.

4-12 In AC, because the AC reference, the synchronous demodulator and the inverter are all synchronized with the AC power line, the signal applied to the inverter appears as a full-wave rectified sinusoidal waveform. After passing through the inverter the desired sine wave is obtained on the transformer primary.

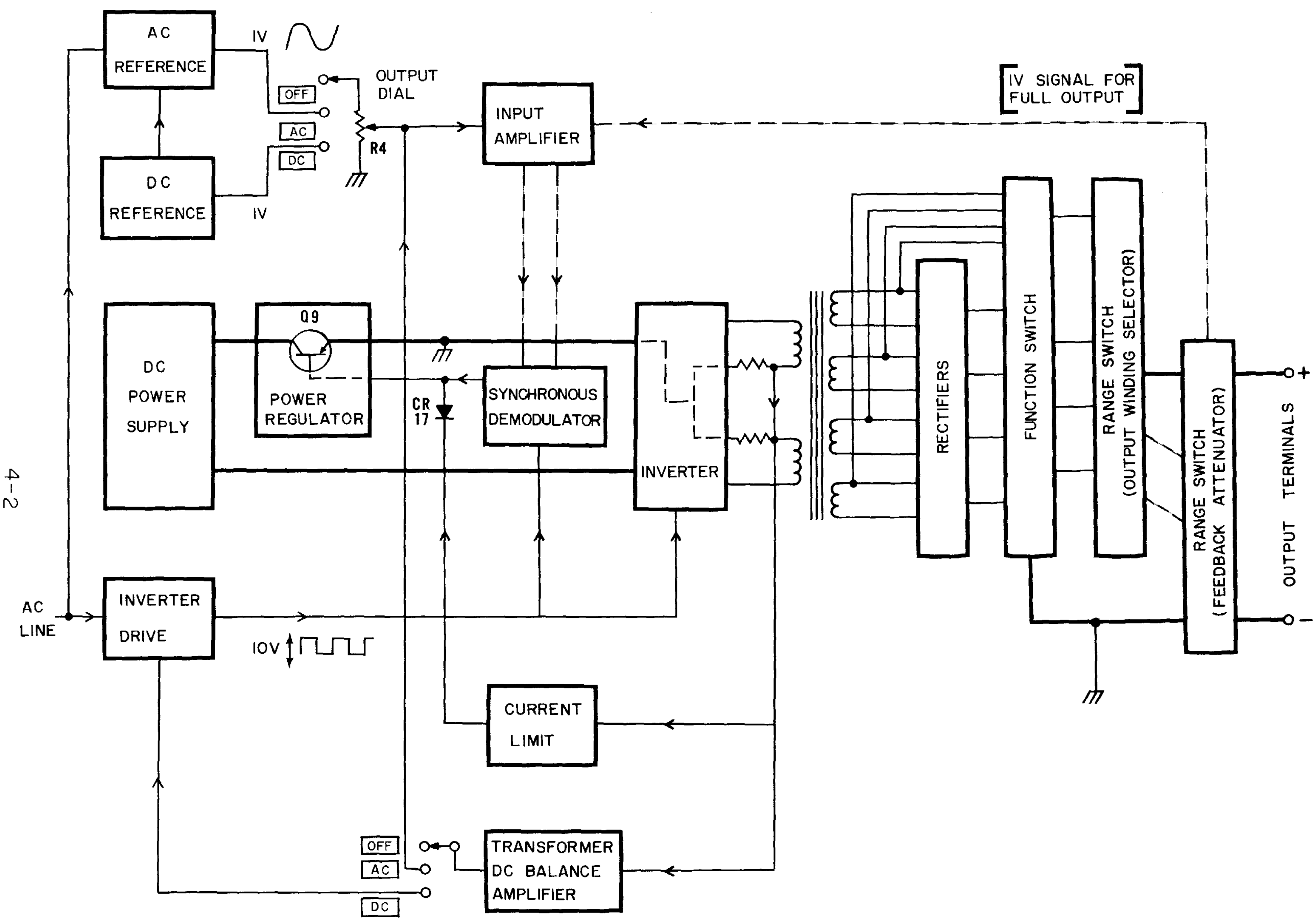


FIG. 4-1
FUNCTIONAL BLOCK DIAGRAM

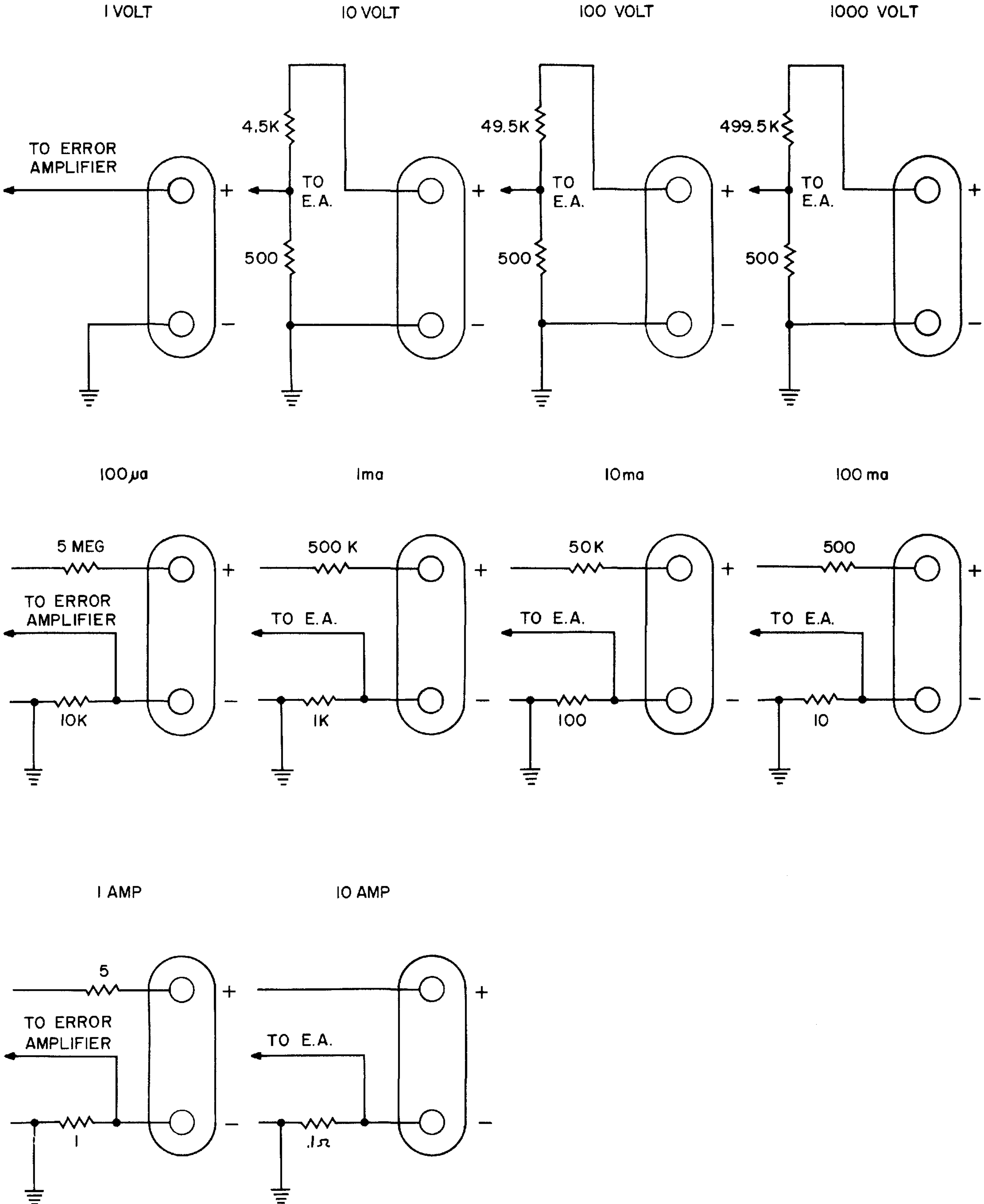


FIG. 4-2
RANGE RESISTOR CONFIGURATION

4-13 OUTPUT TRANSFORMER

4-14 The output transformer changes the power on its primary to one of four impedance levels which are associated with its four secondary windings; these levels correspond to 1000V at 10ma, 100V at 100ma, 10V at 1A and 2V at .5A.

4-15 FUNCTION SWITCH

4-16 This switch selects whether the transformer output is to be rectified or not. In the AC mode of operation the output rectifiers are bypassed. It also selects the AC or DC reference, bypasses the synchronous demodulator in DC and changes the feedback loop equalizers.

4-17 RANGE SWITCH

4-18 The range switch selects the output windings appropriate to the selected output voltage or current range. In addition, it selects the proper divider or series resistor, in current ranges, to provide the 1 volt/full-output sample of the output signal. In figure 4-2 the range resistor configuration for each of the ten ranges is shown.

4-19 DC REFERENCE

4-20 A 6.2 volt temperature compensated reference diode is used as the DC reference. Circuitry is used to minimize the current changes through this diode with changes in the input line. The reference circuit also supplies +12.6 volts and -9.4 volts to operate the low-level error amplifiers.

4-21 AC REFERENCE

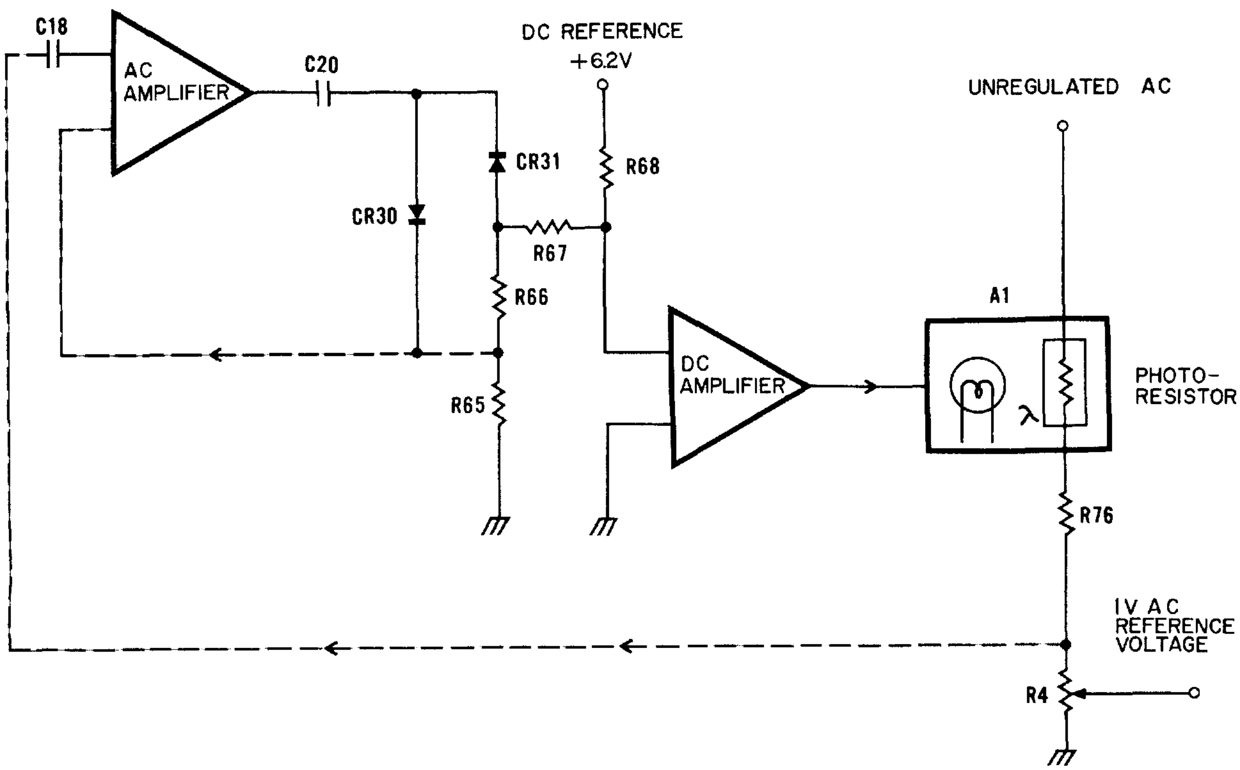


FIG. 4-3
AC REFERENCE

4-22 The AC reference voltage is obtained by taking an AC signal derived from the AC line and controlling its amplitude with a photo-resistor. The AC so obtained is accurately converted to DC, proportional to the average AC. This signal is compared with the DC reference. A DC amplifier consisting of transistors Q1, Q3 and Q5 amplifies the error and drives an incandescent lamp which affects the photo-resistor in such a way as to restore the AC reference to the desired value. A block diagram of this circuit appears in figure 4-3.

4-23 AC to DC conversion is accomplished by an AC-coupled feedback amplifier containing diodes CR30 and CR31 which drive its feedback network. This configuration has the advantage that changes in diode resistance with voltage and temperature have little effect on the accuracy of the AC to DC conversion process.

4-24 <u>BALANCE AMPLIFIER</u>

4-25 An amplifier consisting of Q30 and Q31 is connected to sense the average DC in the transformer primary by means of resistors R46 and R47 as shown in figure 4-4. If a DC unbalance exists, the amplifier output is used to make correction in the circuit to balance the primary current. In the DC mode of operation the timing of the inverter is changed in such a way as to make the "ON" time of one of the two inverter transistors slightly longer with respect to the other. In AC, the balance amplifier output changes the DC level of the AC reference signal which has the effect of balancing the transformer DC.

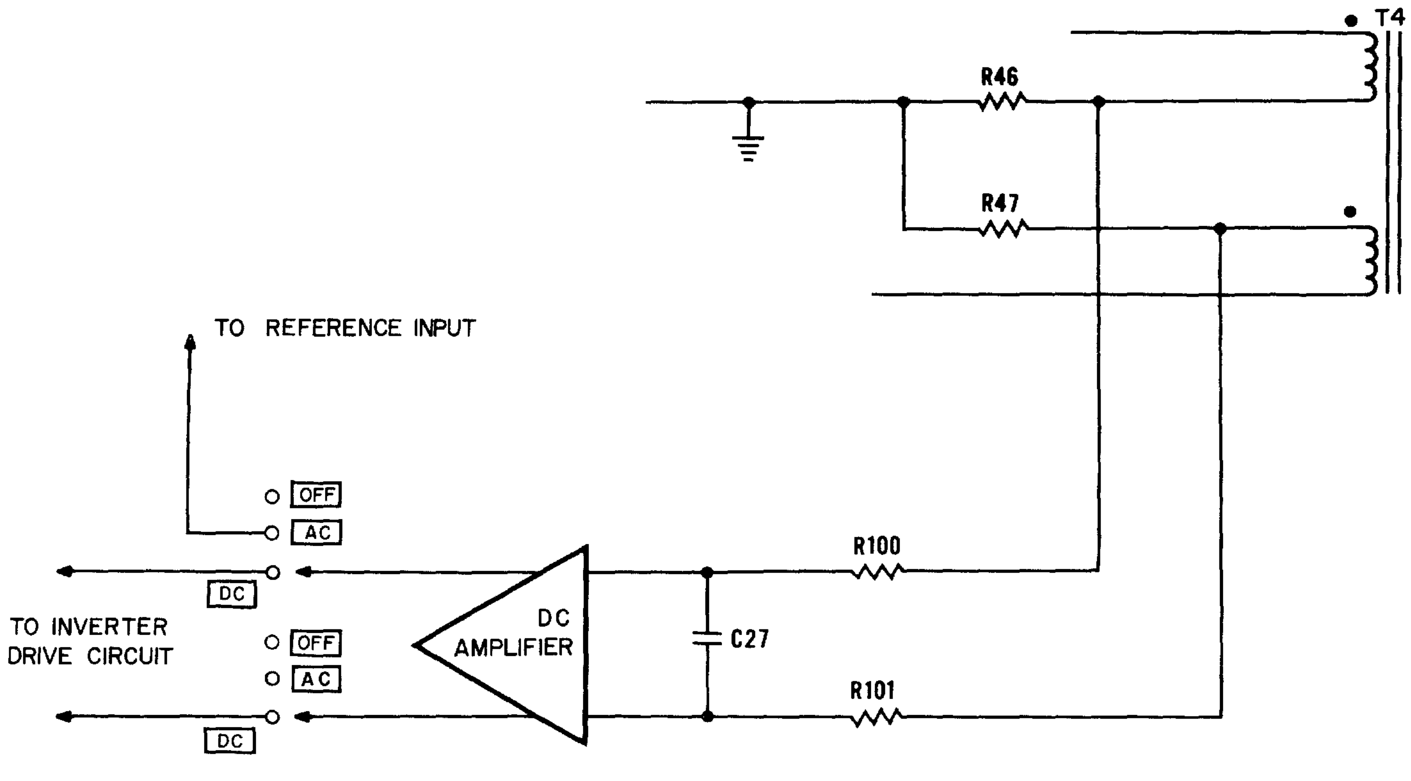


FIG. 4-4
TRANSFORMER DC BALANCE AMPLIFIER

4-26 INVERTER

4-27 The inverter consists of transistors Q14 and Q15 which are driven as switches to apply the output of the series regulator alternately to each half of the output transformer primary. This allows use of a transformer to step up the voltage or current for the output

4-28 INVERTER DRIVER

4-29 A signal obtained from the AC line is used to synchronize the switching of the inverter driver. This signal is applied at the bases of Q26 and Q27. Speed-up networks R87 and C25 and R89 and C26 make the transition from one state to the other more rapid. Transistors Q26 and Q27 drive transistors Q28 and Q29 which in turn drive the inverter transistors.

SECTION V
MAINTENANCE

5-1 INTRODUCTION

5-2 This section contains maintenance and service information for the 6920 . The section includes recommended test equipment, performance checks, replacement, repair, and adjustment procedures and troubleshooting charts.

5-3 TEST EQUIPMENT

5-4 Table 5-1 lists recommended test equipment to be used in performance checks and adjustments.

5-5 PERFORMANCE CHECKS

5-6 The performance check procedures are used to check the 6920 against its specifications. All checks are made from the front panel. Thus, the procedures are useful as incoming or outgoing quality control, periodic maintenance, or after repair checks.

5-7 Refer to the instructions printed on the front panel for general operating procedures.

5-8 GENERAL CHECK

A. Turn OUTPUT switch "OFF".
B. Pilot should light when FUNCTION switch is at "AC" or "DC".
C. Set output dial to (1)000.
D. With "RANGE" in any of the four voltage ranges, yellow "OUTPUT INDICATOR" should light when the "OUTPUT" switch is turned "ON".
E. With output terminals shorted and "RANGE" in any of the six current ranges, the yellow "OUTPUT INDICATOR" should light when the "OUTPUT" switch is turned "ON". On the 10 Amp range, the output dial should be set at 500.

5-9 VOLTAGE CALIBRATION CHECK

A. Allow unit to warm-up one hour.
B. Connect equipment as shown in Figure 5-1.
C. Switch FUNCTION to DC and RANGE to 1 Volt.
D. Set Voltmeter range to 1 Volt DC.
E. Set output dial to (1)000.
F. Voltmeter should indicate 1.000 V $\pm$0.003 V.
G. Set output dial to 100.
H. Voltmeter should indicate 0.100 V $\pm$0.0012 V.
I. Similarly, check the remaining three DC VOLTAGE ranges and the four AC VOLTAGE ranges, referring to Table 5-2 for dial settings and tolerances.

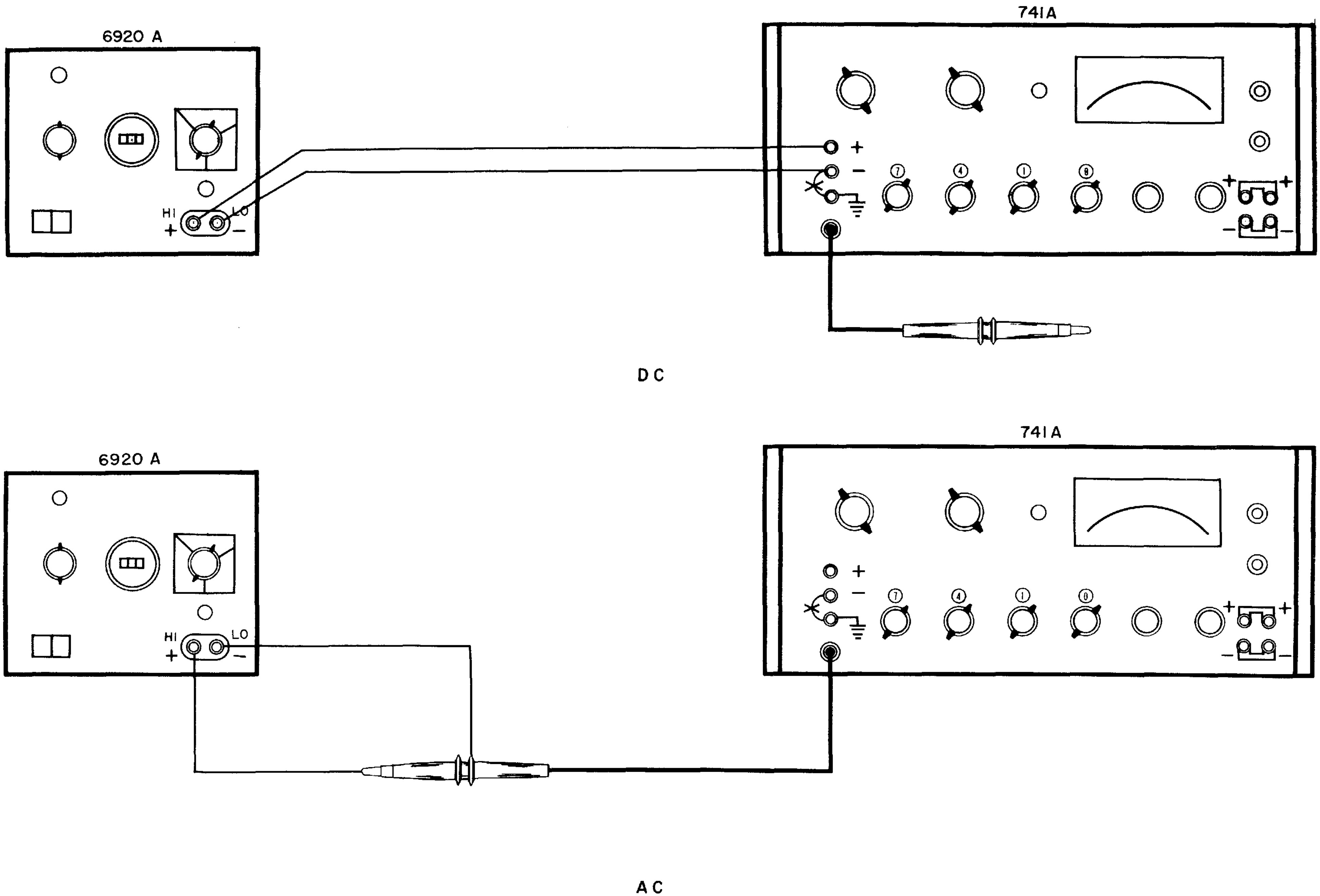
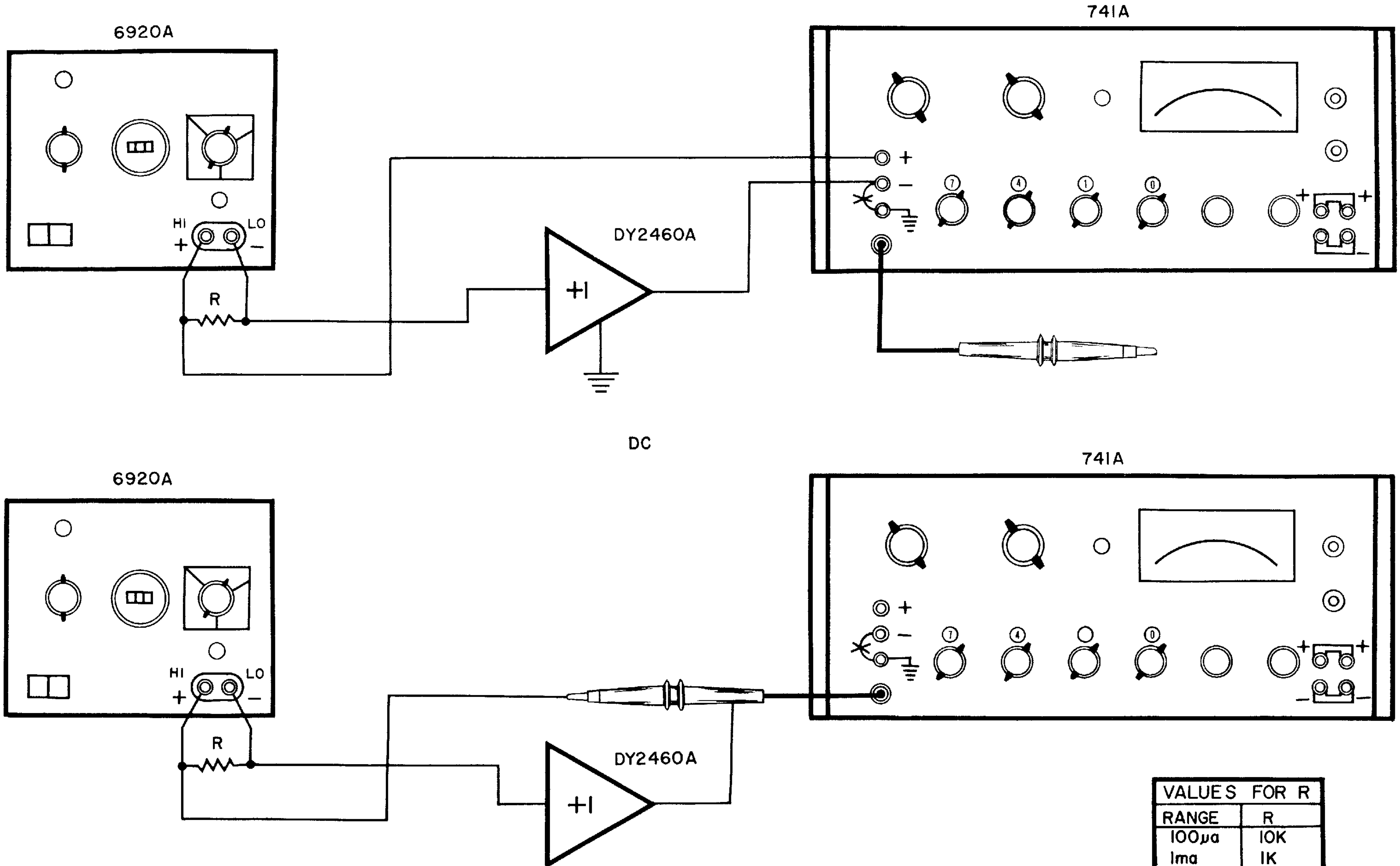


FIG. 5-1
CHECKING VOLTAGE CALIBRATION



VALUES FOR R	
RANGE	R
100μa	10K
1ma	1K
10ma	100Ω
100ma	10Ω
1A	1Ω
10A	0.1Ω

FIG. 5-2
CHECKING CURRENT CALIBRATION

TABLE 5-1

Instrument Type	Required Characteristics	Use	Suggested Test Equipment
AC Voltmeter	Accuracy of $\pm 1\%$ 90-130 Volts Expanded Scale	Measure Input Line Voltage	Triplett Model 420M
Variable Transformer	100-130 Volt Ranges 5 Amp Current Capacity	Change AC Input Voltage	Superior Type Q116U
Oscilloscope	200µv/cm Sensitivity Differential Input	Measure Ripple Transient Response	HP Model 130C
Differential Volt-Meter AC/DC	1 mv Resolution Ranges 1V to 1000V	Measure Output Accuracy	HP Model 741A
Shunt Resistors	.05% Accuracy 10K 1K 100 ohms 10 ohms .1 watt 1 ohm 1 watt 0.1 ohm 2.5 watts	Measure Output Current	Gen. Radio 500-5 500-4 500-D 500-B Leeds & Northrp 4020-B 4221-B
+1 Amplifier	1 Volt rms Output Capability	Isolate ground loops in measuring setup	Dymec DY-2460-A with DY-2461A-M4 Plug-in
2 Resistance Decades	1% Accuracy 10 ohms to 100K per step	Select Value of Calibration Resistors	Precise Model 468

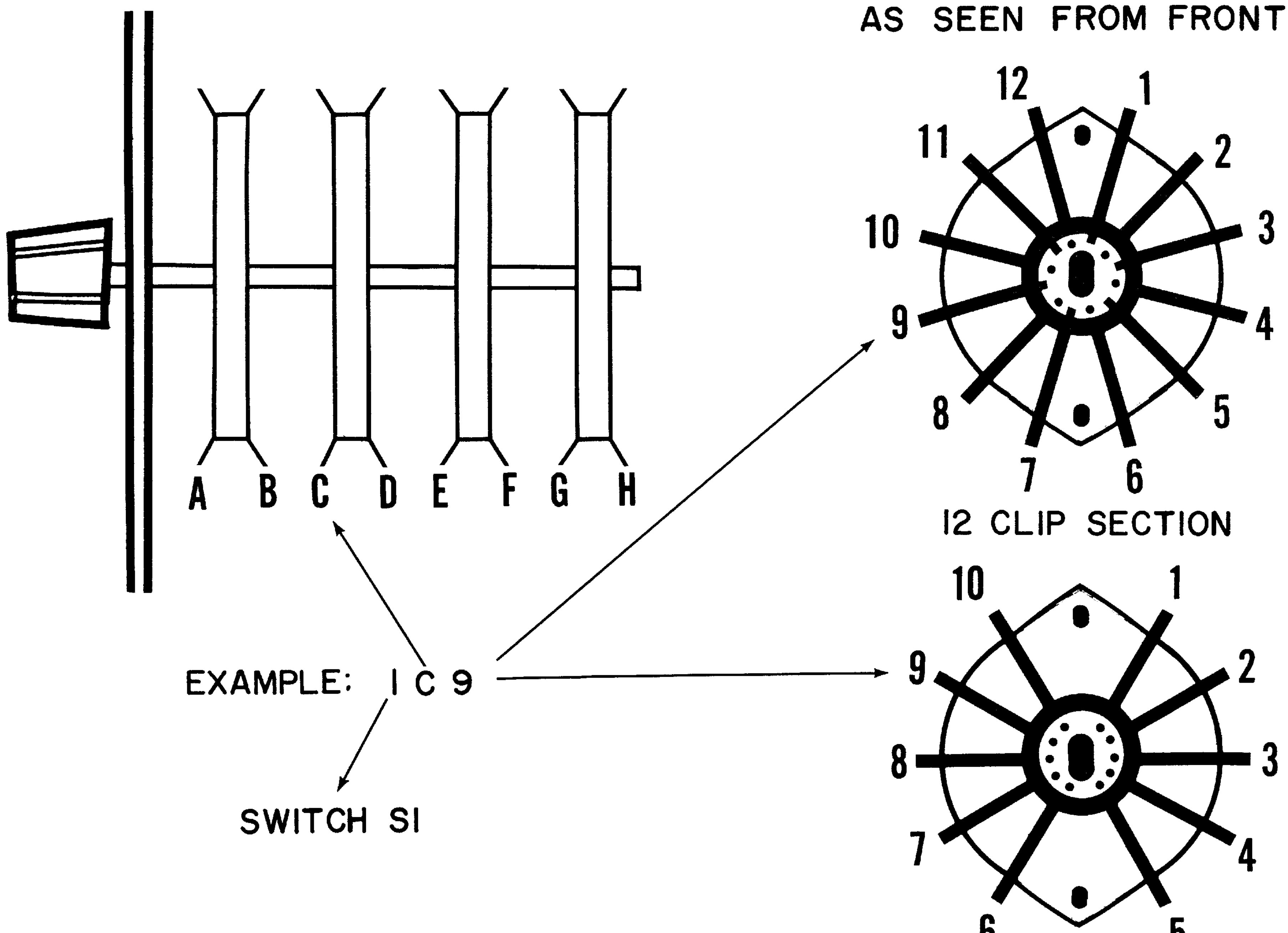


FIG. 5-3
SWITCH CONTACT LOCATIONS

TABLE 5-2

Range	Setting	Output	% Error DC	% Error AC
1V	(1)000	1.000V	±3 mv	±5 mv
	100	0.100V	±1.2 mv	±1.4 mv
10V	(1)000	10.000V	±30 mv	±50 mv
	100	1.00V	±12 mv	±14 mv
100V	(1)000	100.00V	±300 mv	±500 mv
	100	10.0V	120 mv	140 mv
1000V	(1)000	1000.V	±3V	±5V
	100	100.V	1.2V	±1.4V
100μa	(1)000	100.0μa	±0.3μa	----
	100	10.0μa	±0.12μa	----
1 ma	(1)000	1.000 ma	±3μa	±5μa
	100	100.μa	±1.2μa	±1.4μa
10 ma	(1)000	10.00 ma	±30μa	±50μa
	100	1.00 ma	±12μa	±14μa
100 ma	(1)000	100.0 ma	±300μa	±500μa
	100	10.0 ma	±120μa	±140μa
1 Ampere	(1)000	1.000 Ampere	±3 ma	±5 ma
	100	0.100 Ampere	±1.2 ma	±1.4 ma
10 Amperes	500*	5.00 Amperes	±20 ma	±30 ma
	100	1.00 Ampere	±12 ma	±14 ma

In all current ranges, when using the monitoring resistor values shown in Figure 5-2, the equivalent voltage tolerance will be as shown in the 1 Volt range.

*Except ±2 mv DC, ±3 mv AC.

5-10 If the line voltage is rapidly fluctuating, some instability may be noted in the AC ranges if an AC meter with rapid response is used. These fluctuations are normal and are due to the slow speed of the feedback loop controlling the AC refer ence.

5-11 CURRENT CALIBRATION CHECK

A. Allow unit to warm-up 1 hour.
B. Connect equipment as shown in Figure 5-2.
C. With OUTPUT switch "OFF", switch FUNCTION to DC and RANGE to 100μa.
D. Connect a 10K ohm ±.05% resistor across the output terminals as in Figure 5-2.
E. With OUTPUT "ON" check calibration at (1)000 and 100 on the dial, referring to Table 5-2 for tolerances.
F. Check the remaining current ranges, using monitoring resistors as shown in Figure 5-2 and referring to the tolerances in Table 5-2.

NOTE: Do not operate the 6920 in any current range with the OUTPUT "ON" without a suitable resistor across the output terminals, as dangerous voltages can occur.

5-12 REFERENCE REGULATOR CHECK

A. Connect a variable Auto-Transformer and Line Voltage Meter ahead of the AC input of the 6920 .
B. Connect power equipment as for the 1 volt calibration check.
C. Output dial to (1)000.
D. Set the input line voltage to 105 VAC and record the output voltage.
E. Raise the line voltage to 125 VAC and again record the output voltage.
F. Repeat the measurements in the AC mode with FUNCTION at AC, recording the AC output at 105V and 125 VAC line.
G. The measurements obtained should be within ±3 mv of 1.000 volt in DC and ±5 mv of 1.000 volts in AC.

5-13 ADJUSTMENTS AND CALIBRATIONS

NOTE

Before performing any adjustments or calibrations turn-on the meter calibrator and allow a one hour warmup.

5-14 Inverter Phasing

A. Set controls on meter calibrator as follows:

FUNCTION SELECTOR	-	AC
RANGE switch	-	1-volt
OUTPUT SWITCH	-	OFF (RESET)
Dial	-	(1)000

B. Direct couple vertical input of oscilloscope between test points 1 and 4 (ground). Set oscilloscope for 0.5v/cm vertical sweep.

C. AC couple the external trigger input of the oscilloscope to the junction of R90 and the collector of Q28. (For physical convenience connect to the end of R90 that is located nearest to potentiometer R7.) Adjust the oscilloscope triggering level so that reversing the triggering polarity control of the oscilloscope causes a phase reversal of the sine wave displayed on the oscilloscope.

D. Check the position of the DC base line on the oscilloscope by shorting the vertical input probe to ground.

E. Reconnect vertical input probe to test point 1 and adjust R86 so that the sine wave display starts at the DC base line ($\pm$0.1 volt tolerance.)

F. Reverse the triggering polarity control on oscilloscope (sine wave display should reverse phase) and adjust R78 so that the sine wave display starts at the DC base line ($\pm$0.1 volt tolerance).

5-15 Balance Amplifier

A. Set controls on the meter calibrator as follows:

FUNCTION SELECTOR	-	AC
RANGE switch	-	1-volt
OUTPUT SWITCH	-	ON HOLD

B. Connect DC voltmeter between test points 11 and 12. (DC voltmeter should have at least 5mv resolution at zero.)

C. Adjust R99 for 0 $\pm$ 5mv Indication on DC voltmeter.

5-16 Dial Phasing (AC Zero)

A. Set controls on meter calibrator as follows:

FUNCTION SELECTOR	-	AC
RANGE switch	-	1-volt
OUTPUT SWITCH	-	ON HOLD
Dial	-	010

B. Connect AC voltmeter with 10 mv range and 2% accuracy across front-panel output terminals. AC voltmeter indication should be 10 $\pm$ 0.25 mv.

C. If AC voltmeter indication is incorrect, loosen the two Allen-head setscrews that are recessed in the knob of the dial, gently push the knob inward to disengage the knob gear from the dial gear, and rotate the knob as necessary to obtain a 10 $\pm$ 0.25 mv indication (dial remains at 010). Gently pull the knob forward to engage the gears and then tighten the setscrews.

5-17 AC Calibration

A. Set controls on meter calibrator as follows:

FUNCTION SELECTOR	-	AC
RANGE switch	-	1-volt
OUTPUT SWITCH	-	ON HOLD
Dial	-	(1)000

B. Connect AC voltmeter with 1-volt range and 0.1% accuracy across front-panel output terminals.

C. Adjust R69 for 1 $\pm$ 0.001 volt indication on AC voltmeter.

5-18 DC Zero

A. Set controls on meter calibrator as follows:

FUNCTION SELECTOR	-	DC
RANGE switch	-	1-volt
OUTPUT SWITCH	-	ON HOLD
Dial	-	010

B. Connect DC voltmeter with 10-mv range and 2% accuracy across front-panel output terminals.

C. Adjust R7 for 10 $\pm$ 0.25 mv indication on DC voltmeter.

5-19 DC Calibration

A. Set controls on meter calibrator as follows:

FUNCTION SELECTOR	-	DC
RANGE switch	-	1-volt
OUTPUT switch	-	ON HOLD
Dial	-	(1)000

B. Connect DC voltmeter with 1-volt range and 0.05% accuracy across front-panel output terminals.

C. Adjust R1 for 1 $\pm$ 0.0005 volt indication on DC voltmeter

5-20 0.1 MA DC Zero

A. Set controls on meter calibrator as follows:

FUNCTION SELECTOR	-	DC
RANGE switch	-	0.1 ma
OUTPUT SWITCH	-	OFF
Dial	-	010

B. Connect DC ammeter with 1-ua range and 5% accuracy across front-panel output terminals. Set OUTPUT SWITCH to ON HOLD.

C. Adjust R22 for 1 $\pm$ 0.05 ua indication on DC ammeter.

SECTION VI
REPLACEABLE PARTS

6-1 INTRODUCTION

6-2 This section contains information for ordering replacement parts.

6-3 Table 6-1 lists parts in the alpha-numerical order of the circuit designators and provides the following information:

A. Description (See list of abbreviations below).
B. Total quantity used in the instrument.
C. Manufacturer's part number.
D. Manufacturer.
E. The Manufacturer's code number as listed in the Federal Supply Code for Manufacturers H4-1.
F. The H-P Part Number.
G. The recommended spare parts quantity for complete maintenance during one year of isolated service. (Column A).

6-4 ORDERING INFORMATION

6-5 To order replacement parts, address order or inquiry either to your authorized Harrison Laboratories sales representative or to Customer Service, Harrison Laboratories, 100 Locust Avenue, Berkeley Heights, New Jersey.

6-6 Specify the following information for each part:

A. Model and complete serial number of instrument.
B. Circuit reference designator.
C. Description.

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

Reference Designators

A = assembly
B = motor
C = capacitor
CR = diode
DS = device signaling (lamp)
E = misc. electronic part
F = fuse
J = jack
K = relay
L = inductor
M = meter
P = plug
Q = transistor
R = resistor
RT = thermistor
S = switch
T = transformer
V = vacuum tube, neon bulb, photocell, etc.
X = socket
XF = fuseholder
XDS = lampholder
Z = network

ABBREVIATIONS

a	=	amperes
c	=	carbon
cer	=	ceramic
coef	=	coefficient
com	=	common
comp	=	composition
conn	=	connection
crt	=	cathode-ray tube
dep	=	deposited
elect	=	electrolytic
encap	=	encapsulated
f	=	farads
fxd	=	fixed
GE	=	germanium
grd	=	ground (ed)
h	=	henries
Hg	=	mercury
impg	=	impregnated
ins	=	insulation (ed)
lin	=	linear taper
log	=	logarithmic taper
m	=	milli = 10^{-3}
M	=	megohms
ma	=	milliamperes
µ	=	micro = 10^{-6}
mfr	=	manufacturer
mtg	=	mounting
my	=	mylar
NC	=	normally closed
Ne	=	neon
NO	=	normally open
nsr	=	not separately replaceable
K	=	kilo = 1000
obd	=	order by description
p	=	peak
pc	=	printed circuit board
pf	=	picofarads = 10^{-12} farads
pp	=	peak-to-peak
ppm	=	parts per million
pos	=	position (s)
poly	=	polystyrene
pot	=	potentiometer
prv	=	peak reverse voltage
rect	=	rectifier
rot	=	rotary
rms	=	root-mean-square
s-b	=	slow-blow
sect	=	section (s)
Si	=	silicon
sil	=	silver
sl	=	slide
td	=	time delay
TiO_2	=	titanium dioxide
tog	=	toggle
tol	=	tolerance
trim	=	trimmer
twt	=	traveling wave tube
var	=	variable
w/	=	with
W	=	watts
ww	=	wirewound
w/o	=	without
cmo	=	cabinet mount only

MANUFACTURERS

AB	Allen-Bradley
B	Bendix Corporation
Beede	Beede Elec. Instr. Co.,Inc.
Buss	Bussman Mfg. Company
Carling	Carling Electric Company
CTS	CTS Corporation
Elco	Elco Corporation
GE	General Electric Company
GI	General Instrument Company
HH	Hardwick-Hindle Company
Hoff	Hoffman Electric Company
Kulka	Kulka Electric
Mot	Motorola, Inc.
RCA	Radio Corporation of America
Reliance Mica	Reliance Mica Corporation
Semcor	Semcor Corporation
Sloan	Sloan Company
Sprague	Sprague Electric
Superior	Superior Electric
Sylv	Sylvania Electric
TI	Texas Instruments
WL	Ward Leonard Electric

Model 6920B

REVISION:

Note the following Changes in the 6920B Manual.

1. Add note on parts list (vacuum epoxy impregnate) on transformer T4 (HT6920T4-H372A).

2. Fuse F1 to be 1A Slo Blo 125V.

3. C15 not assigned.

4. Q10 to be 2N3417.

5. Q11,12,26,27 to be SM9085.

6. Q28,29 to be 853-0001.

7. R1 to be 100 ohms I.R.C. Type 100 2100-1450.

8. R7 to have locating pin 0.156 $^{+.025}_{-.000}$ from mtg. surface.

9. Add 25k Ser. 70 Pot. in series with R82 and R83.

10. Remove (short) old R86

11. R82 and R83 to be 27k 1/2w.

12. R27 to be 500 ohm 7w.

13. R28 and R73 to be 1k 7w.

14. R69 to be 500 ohm I.R.C. Type 100 2100-0898.

15. CR8, CR9, CR10 to be G100D.

16. R40 to be 1.8k.

17. R17 to be 3.6k.

18. R97 to be 200k.

19. R8 to be 75k.

20. R75 to be 1.5k.

21. R39 OMIT (open ckt.).

22. R82 and R83 change to 39k 1/2w A.B.

23. Q10 to be N272.

24. R40 to be selected (normally can be omitted completely).

25. Reverse diode CR13 on P.C.B. and schematic

26. On P.C.Bds. use terminals USECO Type 12006-1 ONLY.

Circuit Reference Number	Description	Quantity	Mfg. Part # or Type	Mfg.	Mfg. Code*	HP Part #	A
A1	Raysistor Photo Modular	1	CK1112P	Raytheon	81453		2
C1,5,7	fxd film .01µf 200 VDC	3	192P10392	Sprague	56289	0160-0161	6
C2	fxd film .22µf 80 VDC	1	192P2249R8	Sprague	56289		2
C3	fxd film .033µf 200 VDC	1	192P33392	Sprague	56289	0160-0163	2
C4	fxd elect 1µf 35 VDC	1	150D105X9 035 A2	Sprague	56289	0180-0291	2
C6	fxd elect 1400 µf 30 VDC	1	D38303	Sprague	56289		2
C8	fxd film .001µf 200 VDC	1	192P10292	Sprague	56289	0160-0153	2
C9,18,25,26	fxd elect 4.7µf 50 VDC	4	150D475X	Sprague	56289		8
			0050 B2	Sprague	56289		8
C10,24	fxd elect 1200µf 20 VDC	2	D33269	Sprague	56289		4
C12	fxd film .068µf 200 VDC	1	192P68392	Sprague	56289	0160-0166	2
C13, 16, 17	fxd elect 100µf 50 VDC	3	D33218	Sprague	56289		6
C14	fxd elect 20µf 15 VDC	1	30D 206G 015 BB4	Sprague	56289		2
C15	Not Used	-					
C19	fxd film 510µµf 500 VDC	1	CM15E511J	Arco	84171		2
C20	fxd elect 20µf 50 VDC	1	30D 206G 050 DC4	Sprague	56289		2
C21	fxd elect 100µf 25 VDC	1	30D107G 025 DH4	Sprague	56289		2
C22, 28	Not Assigned	-					
C23	fxd elect 2250µf 10 VDC	1	D36218	Sprague	56289		2
C27	fxd elect 100µf 6 VDC	1	D28145	Sprague	56289		2
C29	fxd ceram. .02µf 2000 VDC Disc.	1	41C321	Sprague	56289		2
C30	fxd elect 5µf 150 VDC	1	40D505 F 150 DD4	Sprague	56289		2
C31	fxd elect 200µf 15 VDC	1	30D 207G 015 DH4	Sprague	56289	0180-0104	2
C32	fxd elect 4400µf 2 VDC	1	D33267	Sprague	56289		2

Circuit Reference Number	Description	Quantity	Mfg. Part # or Type	Mfg.	Mfg. Code*	HP Part #	A
CR1,2,52,53	Rect. Si. 1.5A 100PRV	4	1N1563	Motorola	04713		8
CR3	SCR PRV 25 FBV 25	1	2N2322	GE	03508		2
CR4,11,14,18, 19,24,25,26, 27,37,38,39, 40,41,48,49, 50,51	Rect. Si. 500ma 200 PRV	18	1N3253	RCA	02735	1901-0026	36
CR5,6,7,8,9, 10,12,13,20, 21,28,29, 32.34	Rect. Si. 200 ma 10 PRV	14	111S1	Sylvania	93332		28
CR15,16,22,23, 35,36,42,43	Not Assigned	-					
CR17,30,31,33	Diode Si.	4	1N485B	Sylvania	93332	1901-0033	8
CR44,45,46,47	Rect. Si. 50 ma 1600 PRV	4	1N2359	Elect Dev	81751		8
DS1	Indicator Light Neon	1	858 R	Sloan	08717	1450-0048	2
DS1 (order with clip)	Indicator Light Incandescent 2.7V .06A	1	MCL-B-3 1738	Tec.	07137		2
F1	Fuse Cartridge 2A @ 250V 3AG	1	312002	Littelfuse	75915		2
L1	Coil 100μh	1	692095	H-Lab	09182		2
Q1	Diff. Amp.	1	SA2361	Amelco	15818		2
Q2,3,4,5,6,13, 17,19,20,21, 22,23,30,31	SS NPN Sil.	14	4JX16B533	GE	03508		28
Q7, 18, 25, 32	Not Assigned	-					
Q8,9,33,34	Power PNP Ger.	4	B1217	Bendix	83298		8

Circuit Reference Number	Description	Quantity	Mfg. Part # or Type	Mfg.	Mfg. Code*	HP Part #	A
Q10	SS NPN Ger.	1	N272	TI	01295		2
Q11, 12	SS PNP Ger.	2	GT2555	GI	11711		4
Q14, 15	Power PNP Ger.	2	B1203	Bendix	83298		4
Q16, 26, 27	SS PNP Si.	3	S3251	Fairchild	07623	1853-0001	6
Q24	SS NPN Si	1	4JX11C710	GE	03508		2
Q28, 29	SS PNP Ger.	2	2N1378	TI	01295		4
R1	Var ww 100 ohm	1	3067-P-1-101	Bourns	80294		2
R2	fxd ww 2430 ohm, 2490 ohm, (ohm) 2670, 2550 ohm, 2610 ohm, 1% 1/4 watt	1	Type TX154	PRC	48615		1 (each)
R3, 85, 88, 107	fxd comp 510 ohm ±5% 1/2watt	4	EB5115	AB	01121	0686-5115	
R4 (F.P.)	var ww 500 ohm 10 turn ±3% ±0.05% lin.	1	22018	Borg.	96791		2
R5, 6, 19, 20, 50, 51	fxd comp 5.1K ohm ±5% 1/2watt	6	EB5125	AB	01121	0686-5125	
R7	var ww 250 ohm	1	Type 110-F4	CTS	11236		2
R8, 39, 75, 97	fxd comp Selective ±5% 1/2 watt	4	---	AB	01121		
R9	fxd comp 20K ohm ±5% 1/2watt	1	EB2035	AB	01121	0686-2035	
R10, 61	fxd comp 7.5K ohm " "	2	EB7525	"	"	0686-7525	
R11	fxd comp 6.2K ohm " "	1	EB6225	AB	01121	0686-6225	
R12	fxd comp 3.3K ohm " "	1	EB3325	AB	01121	0686-3325	
R13, 14	fxd comp 430K ohm " "	2	EB4345	AB	01121	0686-4345	
R15, 16	fxd comp 47K ohm ±5% 1/2watt	2	EB4735	AB	01121	0686-4735	
R17, 62, 76	fxd comp 1.3K ohm ±5% 1/2 watt	3	EB1325	AB	01121	0686-1325	
R18	fxd comp 22 meg. ±5% 1/2watt	1	EB2265	AB	01121	0686-2265	
R21	fxd comp 10 meg. ±5% 1/2 watt	1	EB1065	AB	01121	0686-1065	
R22	var comp 100K ohm Ser. 70	1	HQ3427	CTS	71450		2
R23, 33, 34, 36, 38, 55, 72, 79, 80, 100, 101,	fxd comp 1K ohm ±5% 1/2watt	11	EB1025	AB	01121	0686-1025	
R24, 48, 49, 57, 58, 77, 78, 92, 93, 103	Not Assigned.	-					

Circuit Reference Number	Description	Quantity	Mfg. Part # or Type	Mfg.	Mfg. Code*	HP Part #	A
R26	fxd ww 200ohm ±5% 20 watt	1	Type 2BRS-37	HH	73978		2
R27	fxd ww 500 ohm " 5 watt	1	Type 5XM	WL	63743		2
R28	fxd ww 1K ohm ±5% 5 watt	1	Type 5XM	WL	63743		2
R29	fxd ww 12 ohm ±5% 20 watt	1	Type 2BRS-37	HH	73978		2
R30	fxd comp 3K ohm ±5% 1/2 watt	1	EB3025	AB	01121	0686-3025	
R31	fxd comp 10 ohm " "	1	EB1005	AB	"	0686-1005	
R32, 37	fxd comp 620 ohm " "	2	EB6215	AB	01121	0686-6215	
R35, 40	fxd comp 2K ohm " "	2	EB2025	AB	01121	0686-2025	
R36, 108	fxd comp 22 ohm " "	2	EB2205	AB	"	0686-2205	
R41	fxd comp 15K ohm " "	1	EB1535	AB	"	0686-1535	
R42	fxd comp 200 ohm " "	1	EB2015	AB	"	0686-2015	
R43,98	fxd comp 5.6K ohm " "	2	EB5625	AB	"	0686-5625	
R44,45	fxd comp 3.9K ohm " "	2	EB3925	AB	"	0686-3925	
R46,47	fxd ww 0.5 ohm " 3 watt 20ppm	2	Type 3X	WL	63743		4
R52	fxd film 430 ohm ±5% 2 watt	1	Type C42S	Corning	16299		2
R53, 70	fxd comp 10K ohm ±5% 1/2 watt	2	EB1035	AB	01121	0686-1035	
R54	fxd ww 714 ohm ±1% 1/4 watt	1	Type TX-154	PRC	48615		2
R56,66	fxd ww 634 ±1% 1/4 watt	2	Type TX-154	PRC	48615		4
R59,60	fxd comp 100K ohm ±5% 1/2watt	2	EB1045	AB	01121	0686-1045	
R63,96	fxd comp 200K ohm ±5% 1/2watt	2	EB2045	AB	01121	0686-2045	
R64	fxd comp 68 ohm ±5% 1/2watt	1	EB6805	AB	01121	0686-6805	
R65	fxd ww 210 ohm ±1% 1/4watt	1	Type TX-154	PRC	48615		2
R67	fxd ww 2K ohm ±1% 1/4watt	1	Type TX-154	PRC	48615		2
R68	fxd ww 9530 ohm, 9760 ohm, 10.0K ohm, 10.2K ohm, 10.5K ohm ±1% 1/4 watt	1	Type TX-154	PRC	48615		1 (each)
R69	var ww 500 ohm	1	3067P-1-501	Bourns	80294		2
R71	fxd comp 36K ohm ±5% 1/2watt	1	EB3635	AB	01121	0686-3635	
R73	fxd ww 750 ohm ±5% 5 watt	1	Type 5XM	WL	63743		2
R74	fxd comp 300 ohm ±5% 1/2watt	1	EB3015	AB	01121	0686-3015	

Circuit Reference Number	Description	Quantity	Mfg. Part # or Type	Mfg.	Mfg. Code*	Hp Part #	A
R81,84	fxd comp 6.8K ohm ±5% 1/2 watt	2	EB6825	AB	01121	0686-6825	
R82,83	fxd comp 39Kohm " "	2	EB3935	"	"	0686-3935	
R86	var ww 10 ohm	1	Type 110-F4	CTS	11236		2
R87,89	fxd comp 2.2K ohm ±5% 1/2watt	2	EB2225	AB	01121	0686-2225	
R90,91	fxd film 56 ohm " 2 watt	2	Type C42S	Corning	16299		4
R94, 95	fxd comp 12K ohm " 1/2 watt	2	EB1235	AB	01121	0686-1235	
R99	var ww 100 ohm	1	Type 110-F4	CTS	11236		2
R102	fxd comp 51K ohm ±5% 1/2 watt	1	EB5135	AB	01121	0686-5135	
104, 105	fxd comp 680K ohm " 1 watt	2	GB6845	AB	01121	0689-6845	
R106	fxd comp 20K ohm " 1 watt	1	GB2035	AB	01121	0689-2035	
R109	fxd ww 500 ohm ±0.1% 2.5W @ 25°C.	1	Type P1	Mepco	80031		2
R110	fxd ww 4.5K ohm ±0.1% 2.5W @ 25°C.	1	Type P1	Mepco	80031		2
R111	fxd ww 45K ohm ±0.1% 10 W @25°C	1	Type P1000	Mepco	80031		2
R112, 113	fxd ww 225K ohm ±0.1% 1.5 W	2	M55	Mepco	80031		4
R114	fxd ww 5K ohm ±0.1% 2.5 W @25°C	1	Type P1	Mepco	80031		2
R115	fxd ww 5010 ohm ±0.1% 1/4 watt	1	Type TX154	PRC	48615		2
R116	fxd ww 1K ohm ±0.1% 2.5W @25°C	1	Type P1	Mepco	80013		2
R117	fxd ww 100 ohm 0.1% 3.5W @ 25°C	1	Type P3	Mepco	80013		2
R118	fxd ww 10 ohm ±0.1% 2.5W @25°C	1	Type P1	Mepco	80013		2
R119	fxd ww 1 ohm ±0.1% 2.5W 4 lead	1	Type 24H68L8	Gen Res	05591		2
R120	fxd ww 0.1 ohm ±1% 2.5 W 4 lead	1	Type 24H68L8	Gen Res	05591		2
R121	fxd comp 5.1 meg ohm ±5% 1 watt	1	GB5155	AB	01121	0689-5155	
R122	fxd comp 510K ohm ±5% 2 watt	1	Type C42S	Corning	16299		2
R123	fxd ww 50K ohm ±5% 10 watt	1	Type 1AS544	HH	73978	0811-0955	2
R124	fxd ww 500 ohm ±5% 10 watt	1	Type 1AS544	HH	73978	0811-0952	2
R125	fxd ww 5 ohm ±5% 10 watt	1	Type 1AS544	HH	73978	0811-0950	2
S1	Function (on/off) 3 position switch	1	6920-S1C	CRL	71590		2
S2	Range 10 position switch	1	6920-S2B	CRL	71590		2

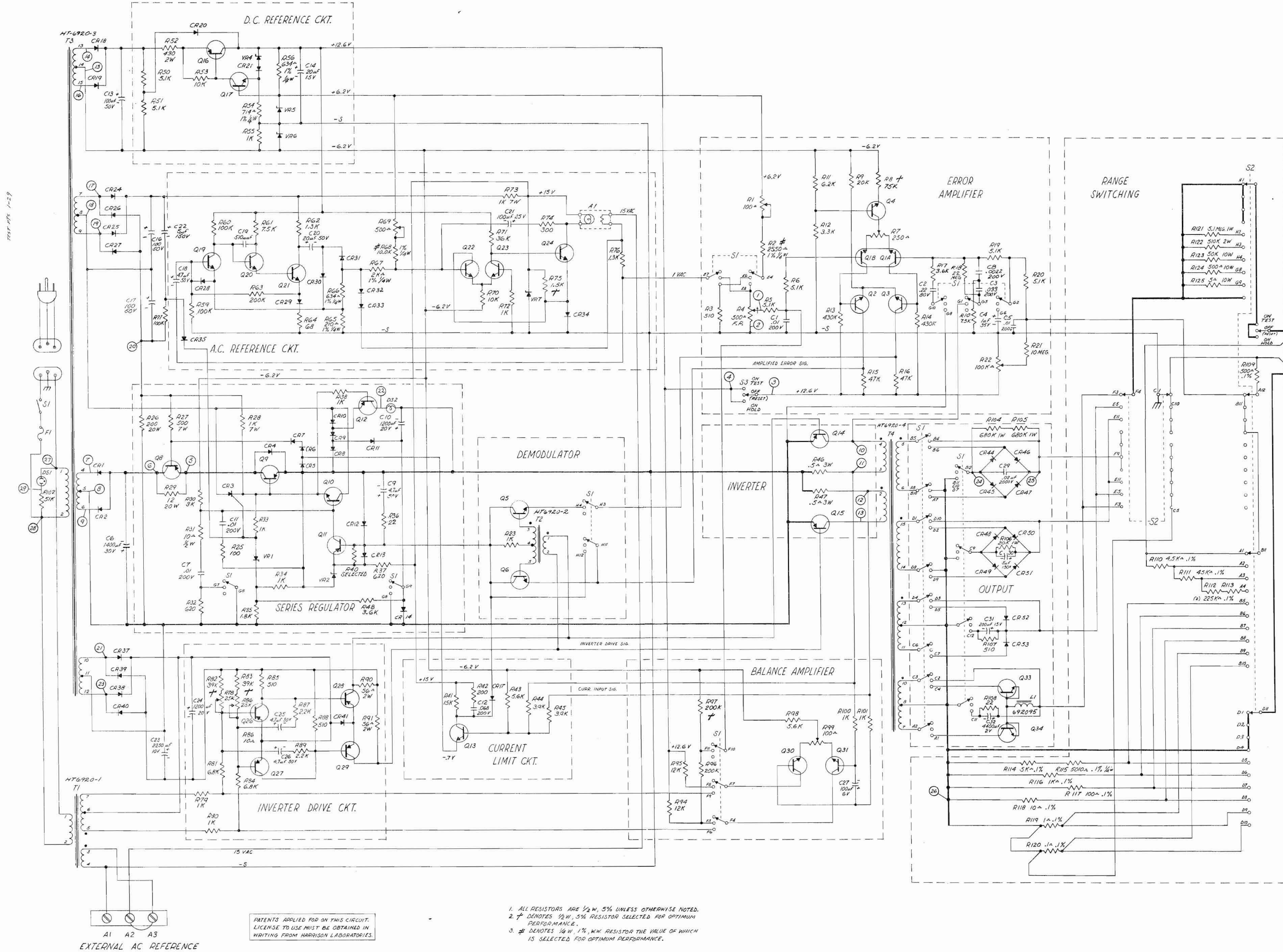
Circuit Reference Number	Description	Quantity	Mfg. Part # or Type	Mfg.	Mfg. Code*	HP Part #	A
S3	Output Switch Type LL Black	1	TIG M6A	Carling	73559		2
T1	Bias transformer	1	HT6920-1	H-Lab	09182		2
T2	Coupling Transformer	1	HT6920-2	H-Lab	09182		2
T3	Power Transformer	1	HT6920-3	H-Lab	09182		2
T4	High Voltage Transformer	1	HT6920-4	H-Lab	09182		2
VR1	Diode Zener 6.2Volt	1	1N753A	Motorola	04713		2
VR2	Diode Zener 4.3Volt	1	1N749	Motorola	04713		2
VR3	Not Assigned	-					
VR4,6	Diode Zener 6.2Volt	2	1N821	NA Elect	06486	1902-0761	4
VR5	Diode Zener 6.2Volt	1	1N825	Transit.	83877		2
VR7	Diode Zener 14.7 Volt 10% 1.5 watt	1	-----	Motorola	04713	1902-0212	2
VR8,9	Thyrector	2	20V P24B	GE	03508		4
	Stand. Tilt Half Module	1	----	H-Lab	09182	1490-0032	2
	Hinge	2	----	H-Lab	09182	5040-0700	4
	Foot Assembly Half Module	2	A-5060-0728-1	H-Lab	09182	5060-0728	4
	Connector	1	H-0161-1G3L	Tower	60437	1251-0148	2
	Cord 18-3 SVT 7.5 feet Male Plug PH151 Female Plug PH243	1	----	H-Lab	09182	8120-0078	2
	Fuse Block Solder Ter.	1	4405	Buss.	71400		2
	Insulator Double	2	----	H-Lab	09182	0340-0086	4
	Nut Captive	4	C8020-632-4	Tinnerm.	89032	0590-0052	4
	Assembly Binding Post (Black)	1	-----	H-Lab	09182	1510-0009	2
	Assembly Binding Post (Red)	1	-----	H-Lab	09182	1510-0008	4
	Knob 1/4 i.d. Insert Pointer (Black)	2	-----	H-Lab	09182	0370-0077	4
	Transistor Socket	5	3305	Elco	91662		10
	Mica washer	4	734	Reliance	08530		8

Circuit Reference Number	Description	Quantity	Mfg. Part # or Type	Mfg.	Mfg. Code*	HP Part #	A
	Standoff Insulator	3	17A1-A6	Whitso	92825		6
	Insulator	8	100151-1	H-Lab	09182		8
	Insulator Transistor Pin.	8	100146-1	H-Lab	09182		8
	Mirco Dial (Spl.-all white on black) wheels	1	Model 1309 Special	Borg	96791		2

① 5080-1920 Service Kit.

A = Recommended spares for one year for 10 units.

* = As listed in Federal Supply Code for Manufacturers H4-1.



PATENTS APPLIED FOR ON THIS CIRCUIT. LICENSE TO USE MUST BE OBTAINED IN WRITING FROM HARRISON LABORATORIES.

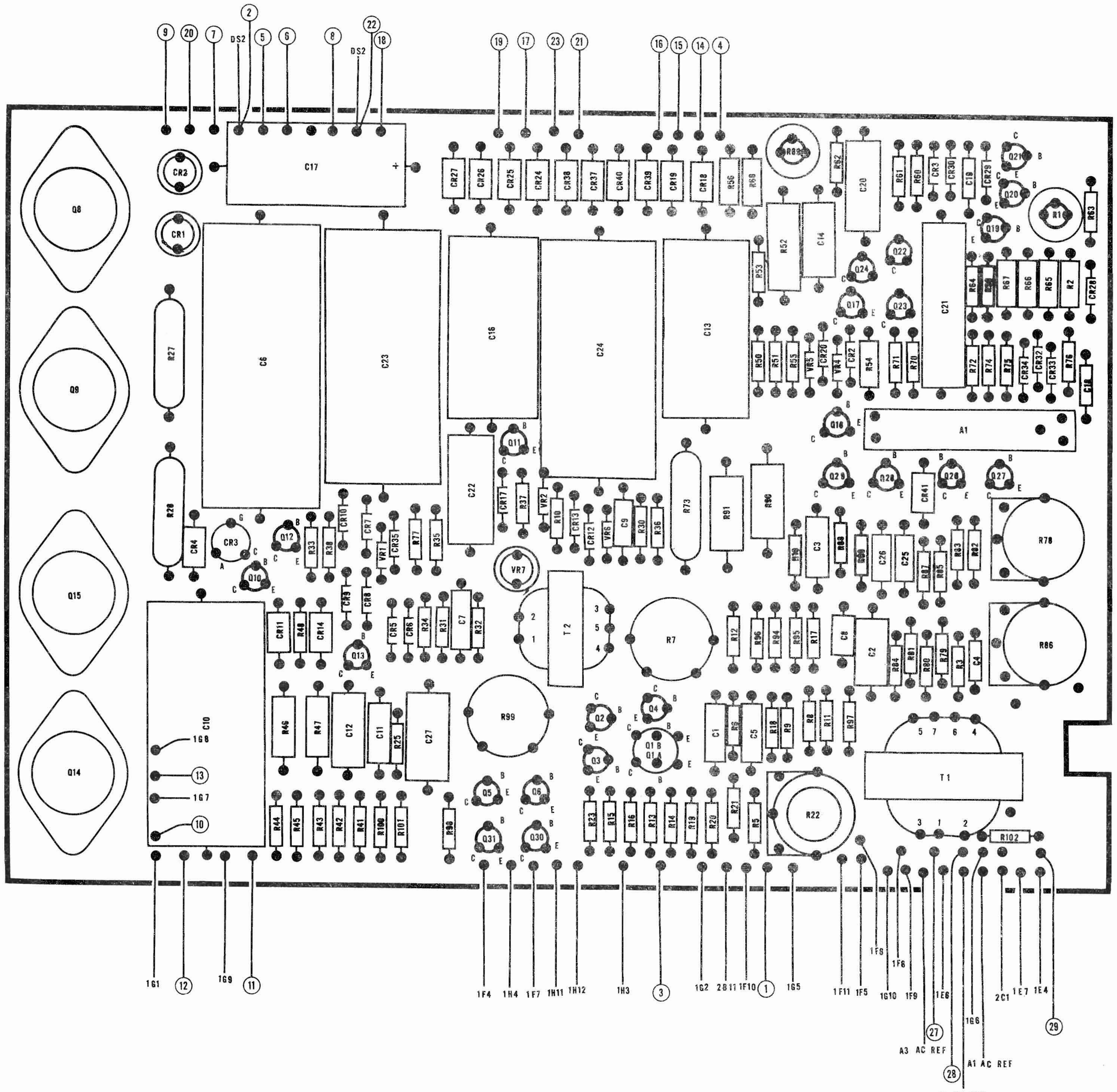
1. ALL RESISTORS ARE 1/2 W, 5% UNLESS OTHERWISE NOTED.
2. ✝ DENOTES 1/2 W, 5% RESISTOR SELECTED FOR OPTIMUM PERFORMANCE.
3. # DENOTES 1/4 W, .1%, W.W. RESISTOR THE VALUE OF WHICH IS SELECTED FOR OPTIMUM PERFORMANCE.

TITLE 6920B SCHEMATIC

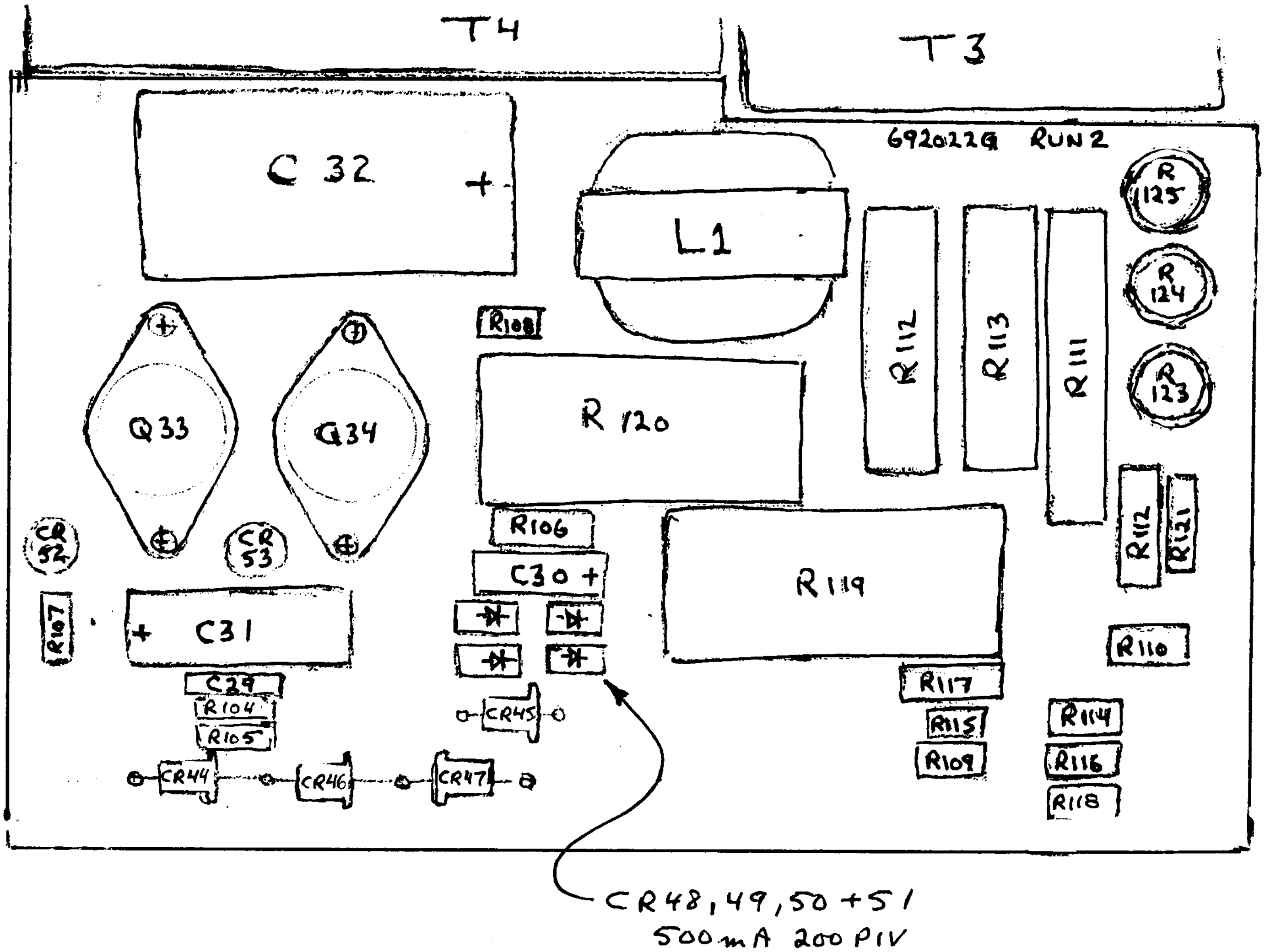
DWG. NO. 692000

NOTES

1. CATHODES OF DIODES ALL FACING TOWARDS BOTTOM OF BOARD
2. POSITIVE SIDES OF ALL CAPACITORS FACING TOWARDS BOTTOM OF BOARD EXCEPT WHERE SHOWN
3. UPPER P.C. BOARD ALL SWITCH NO'S APPLY TO S1 EXCEPT 2B11 & 2C1



JOB 6920	TITLE PC BOARD COMPONENT LOCATIONS
	FIG 2 — DWG NO 692012
	HARRISON LABORATORIES DIVISION OF HEWLETT-PACKARD BERKELEY HEIGHTS, N.J.



LOWER CIRCUIT BOARD LAYOUT

HP/Harrison 6920B Meter Calibrator

sn 5K0246

Approx mfg date late 1965 per date codes

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