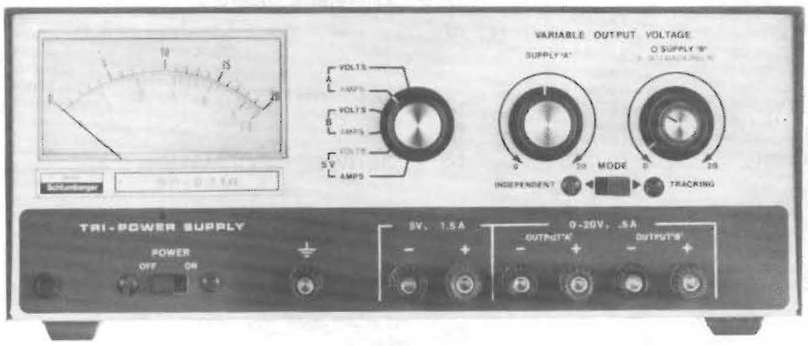
HEATH ZENITH

TRI-POWER SUPPLY

Model SP-2718

595-1841-02



HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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SPECIFICATIONS

Outputs	5 volts DC±5% at 1.5 ampere.
'A' -Supply	0-20 volts DC at 0.5 ampere, continuously adjustable.
'B' -Supply	0-20 volts DC at 0.5 ampere, continuously adjustable.
Regulation	
Load	Less than 0.1% (20 mV) variation from no load to full load on 20-volt supplies. Less than 3% (150 mV) variation from no load to full load on 5-volt supply.
Line	20-volt Supplies: Less than 0.2% (40 mV) for a line voltage change of 10 volts. 5-volt Supply: Less than 0.2% (10 mV) for a line voltage change of 10 volts.
Ripple and Noise	Less than 5 mV rms.
Current Limiting	Limiting for each supply fixed slightly above rated current to provide short-circuit protection.
Tracking Range	2 to 18 volts.
Tracking Error	Less than 1 volt.
Series Operation	All three supplies may be connected in series.
Parallel Operation	20-volt supplies may be operated in parallel by adding 0.5Ω current-equalizing resistors (not supplied).
Voltage-Current Monitor Accuracy	5% of full scale.

Meter Ranges	Voltages, 0-20 and 0-5.5. Current, 0-550 mA and 0-2A.
Power Requirements	100-135 VAC or 200-270 VAC, 50/60 Hz, 100 watts at full load.
Power Switching Overshoot (On-Off)	None.
Voltage Control, 20-Volt Supplies A and B	Continuously variable, 0 to 20 volts.
Dimensions	4-1/2" high × 10-3/4" wide × 9" deep (11.43 cm × 27.3 cm × 22.86 cm).
Weight	10 lbs (3.73 kg).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

OPERATION

Refer to Figure 1 (on the fold-in).

Before you use your Tri-Power Supply, you should become entirely familiar with its capabilities, characteristics, and its features. Study Figure 1 to learn each control and switch function as you read this portion of the Manual.

CONTROL AND SWITCH FUNCTIONS

LINE AND POWER SWITCHES (SW2 and SW1)

Line switch SW2 is located on the underside of the chassis. If the line voltage in your area is 100-135 volts AC, use a screwdriver tip to push the switch slide to expose the "120" on the slide. If the line voltage in your area is 200-270 volts AC, push the switch slide to expose the "240."

The POWER switch on the front panel is a simple slide switch that applies the line voltage to the primary circuit of the power transformer when you push the switch to the ON position. At the same time, power is applied to the pilot light to indicate that power has been applied to the unit.

METER SWITCH (SW4)

It is important that you know that METER switch (SW4) does *not* switch any output voltage or current. The switch permits you to observe any of the Power Supply outputs on the meter, whether voltage or current. The METER switch thus allows you to monitor any of the variable outputs and to set them accurately to any desired levels.

METER

Note that the meter scales are printed in two colors. The lower scale, in red, corresponds to each of the METER switch functions that also are lettered in red: "A-AMPS" (current flowing to a load from the output of the A supply; "B-AMPS" (current flowing to a load from the output of the B supply; and, 5V-VOLTS (the voltage available at the output of the 5-volt supply).

The upper meter scale, in black, corresponds to the following METER switch functions, also printed in black: "A-VOLTS" (the voltage at the output of the A supply); "B-VOLTS" (the voltage at the output of the B supply); and, "5V-AMPS" (current flowing to a load from the output of the 5-volt supply).

SUPPLY A CONTROL (R7)

When you turn this control clockwise from its "0" position, the output of front panel jacks J4 and J5 (OUTPUT A) will increase from zero to any level up to 20 volts and a load current up to 500 milliamperes. Read these levels on the meter when the METER switch is either at "A-VOLTS" or at "A-AMPS." NOTE: In the TRACKING mode of operation, Supply A control R7 is disabled; control of the 20-volt A-supply is transferred to • A TRACKING B control R8 (the small red knob at the right side of the front panel, which operates as a clutched control with ○ SUPPLY B control R9).

○ SUPPLY B CONTROL (R9)

Control R9 is half of the dual control at the right side of the front panel. The other half of this control is turned with the small red knob and is labeled "• A TRACKING B" in red lettering above the two control knobs. The two controls are "clutched" together in such a manner that both controls will turn when either knob is turned. Note that black knob R9 corresponds to the black letters ("○ SUPPLY B") on the panel just above the control.

Control R9 adjusts the amount of voltage at OUTPUT B jacks J6 and J7. This control will vary the available B-supply voltage from zero to 20 volts DC and a load current up to 500 milliamperes. Read the output levels on the meter when the METER switch is turned to B-VOLTS and to B-AMPS.

• A TRACKING B CONTROL (R8)

Control R8 is "clutched" to "O SUPPLY B" control R9. At any time either control is turned, the other will turn with it. Since it is a friction action, either control may be operated independently of the other, providing the other control is held in place. Control R8 is enabled only when MODE switch SW3 is in the TRACKING position. In this manner, the A 20-volt supply is disabled at SUPPLY A control R7, and is controlled by the small red knob at R8. At no time are the electrical and electronic circuits of the A and B 20-volt power supplies connected together internally.

MODE SWITCH (SW3)

In the INDEPENDENT mode of operation, the 20-volt A supply is connected to SUPPLY A control R7 through the contacts of the Mode switch. In this mode, the A-supply is "floating" and control R9 (small red knob) is disconnected from the circuit. When MODE switch SW3 is in the TRACKING mode, control R7 is removed from the circuit, and control R9 is enabled and the A-supply will track with the B-supply through the clutch action of the dual control knobs.

OUTPUT JACKS (J1-J7)

Output jack J1 is a chassis ground connection. If, at any time, you wish to reference any of the three supplies to ground, external connections from the appropriate supply jacks may be connected to J1.

Jacks J2 and J3 are the connections for the fixed 5-volt, 1.5-ampere power supply.

Jacks J4 and J5 are the connections for the variable 20-volt, 500 milliampere A power supply.

Jacks J6 and J7 are the connections for the variable 20-volt, 500 milliampere B power supply.

OPERATING PROCEDURES

Two modes of operation are provided at the output jacks on the front panel. These are the "Independent" and the "Tracking" modes. Each will be discussed under separate headings.

INDEPENDENT MODE

Each of the three power supplies in the Tri-Power supply may be operated independently from one another, either floating or referenced to another AC or DC source, or referenced to the Tri-Power Supply ground connection at J1. In addition, any of the separate supplies may be connected in series with external jumpers to provide up to 45 volts DC, referenced to any external or internal level. NOTE: External references may not exceed 200 volts.

TRACKING MODE

In the TRACKING mode of operation, the 20-volt A and B supplies are clutched together at the front panel dual control R8/R9. As either of the controls is turned, the other will turn in the same manner. To adjust the controls, the voltage output must be observed on the meter for each 20-volt supply, and the level of each set by controls R8 and R9. For example, if you wish to have the A-supply referenced 5 volts greater than the variable B-supply, you should proceed as follows: Turn dual controls R8 and R9 fully counterclockwise. Grasp the black knob at R9 and hold it as you turn the small red knob on R8 until A-VOLTS on the meter indicates +5 volts. Release the red knob. As you turn the black knob, the A-supply voltage will track the B-supply voltage, always at a potential of 5 volts (±5%) higher than produced by the B-supply.

In the TRACKING mode, the A and B supplies may be operated in parallel as a tracking pair of output voltages, either referenced internally with jumpers, or to an external reference voltage not exceeding 200 volts. As in the INDEPENDENT mode, the three supplies may be connected as any combination in series, to supply up to 45 volts total at any desired reference.

APPLICATIONS

The Tri-Power Supply is an ideal instrument for experimenters and engineers. As an example, at Heath Company an engineer developed a transistorized preamplifier circuit for which he needed supply voltages of −16 volts DC and +16 volts DC in order to check out the circuit. Using the Tri-Power Supply, he connected A+ to B−, and set the A and B supplies to 16 volts output. He then connected a jumper from the chassis GND reference to the common connection between the two supplies. In this manner, the A-supply output produced a −16 volts and the B-supply output produced +16 volts.

The following sections of the Manual will show you a number of examples of how you can use your Power Supply. The variety of uses is extensive, however, so only a few are given.

NOTE: Since 5 volts is used extensively in TTL logic applications, it is incorporated into the Tri-Power Supply as a fixed output. This 5 volts DC may be referenced to any other voltage up to 200 volts, or to the Power Supply front panel GND jack at J1.

INDEPENDENT MODE APPLICATIONS

INDEPENDENT FLOATING SUPPLIES

Refer to Figure 2 as you read the following information.

Figure 2 illustrates each of the three Power Supply outputs connected to separate loads. Each of the supplies may be floated at a level up to 200 volts from ground, or from each other. In this example, the MODE switch is at INDEPENDENT; SUPPLY A control R7 controls the output level of one 0-20 volt circuit, and SUPPLY B (black) control R9 controls the output of the other 0-20 volt circuit.

Each of the supplies has fixed current limiting in all modes of operation at slightly above the rated current output. This provides infinite short-circuit protection to the Power Supply.

NOTE: Each circuit output has a .01μF capacitor connected from its negative terminal to chassis ground. The effect of this capacitance on the load circuit should be considered when you attempt to float any of the supplies at a level above chassis ground.

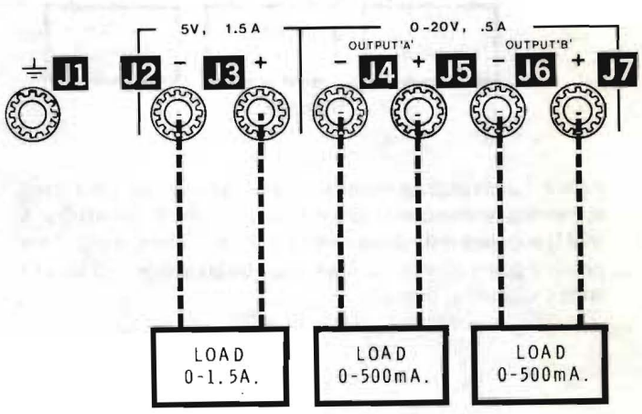


Figure 2

INDEPENDENT GROUND-REFERENCED SUPPLIES

Any of the output terminals, whether + or −, may be connected to ground, and in any combination. The following chart lists many of the possible voltage combinations using chassis ground as a reference.

5 Volt Supply	A-Supply	B-Supply
+5 volts, fixed	0 to +20 volts	0 to +20 volts
+5 volts, fixed	0 to +20 volts	0 to −20 volts
+5 volts, fixed	0 to −20 volts	0 to +20 volts
+5 volts, fixed	0 to −20 volts	0 to −20 volts
−5 volts, fixed	0 to +20 volts	0 to +20 volts
−5 volts, fixed	0 to +20 volts	0 to −20 volts
−5 volts, fixed	0 to −20 volts	0 to +20 volts
−5 volts, fixed	0 to −20 volts	0 to −20 volts

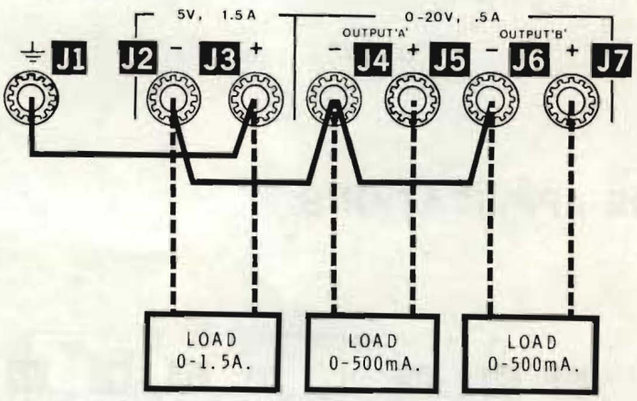


Figure 3

Figure 3 illustrates an example of a circuit in which the +5 volt terminal is referenced to ground, and both the 0 to +20-volt A and B supplies are referenced to −5 volts. Thus, each of the positive-going 20-volt supplies can be varied from −5 to +15 volts (+20 volts, overall).

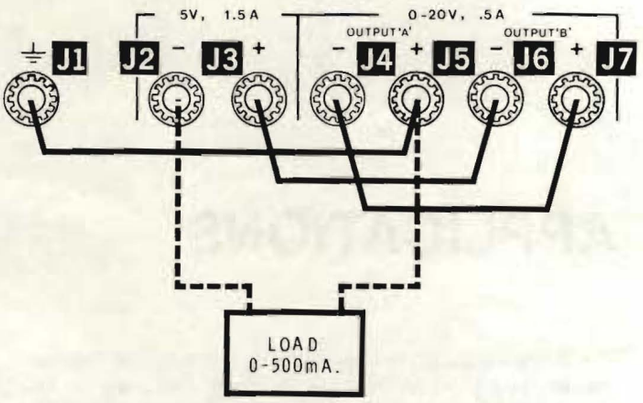


Figure 4

Figure 4 is an example of a circuit in which the three outputs of the circuit are connected in series, with a ground reference at the high end of the circuit. Thus the output to the load is variable from −5 to −45 volts. Load current is limited to 500 mA by the A and B-supply limiters.

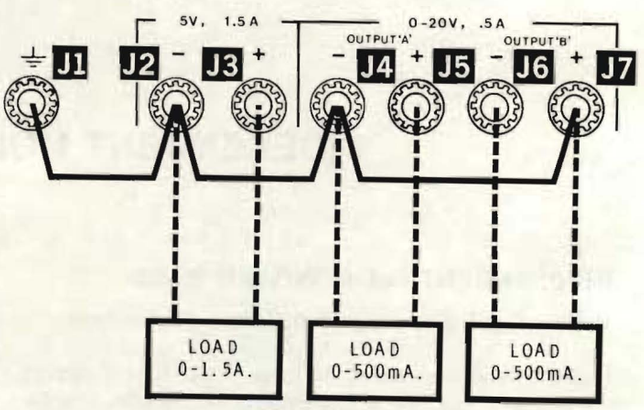


Figure 5

Figure 5 illustrates the Tri-Power Supply connected to produce separate outputs of +5 volts, fixed, the A-supply variable from 0 to +20 volts, and the B-supply variable from 0 to −20 volts.

TRACKING MODE APPLICATIONS

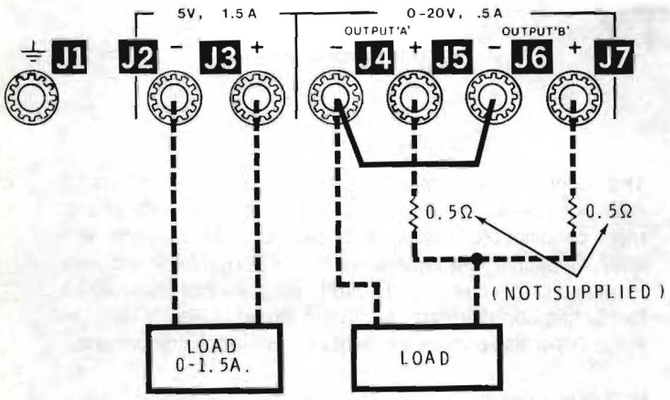


Figure 6

NOTE: In the Tracking Mode of operation, as previously described, A-supply control is clutched to the B-supply control at R8/R9.

PARALLEL OPERATION

The purpose of connecting the two 20-volt power supplies in parallel is to provide higher current through the load. Figure 6 shows a typical Power Supply-to-load connection in which up to 1 ampere of current is available to the load. Note that 0.5 ohm current-sharing resistors (not supplied) are used in the output connections. The output voltage of the circuit is reduced by the IR voltage drop across these equalizing resistors. Each supply is short-circuit and overload protected; either 20-volt supply may current-limit slightly before the other.

TRACKING-FLOATING CIRCUITS

NOTE: Each of the three power supplies is connected to a separate load as shown in Figure 7. Each supply is floating, and independent of reference levels. In this configuration, the MODE switch must be in TRACKING to produce the following outputs: 5 volts fixed and floating, B-supply 0 to +20 volts floating with the A-supply output floating, and tracking the B supply at any predetermined voltage differential. To create a tracking ± supply, the A+ terminal may be connected to the B− terminal, for example. The Power Supply may be wired in any manner of series connections of A, B, and 5-volt outputs in the Tracking mode.

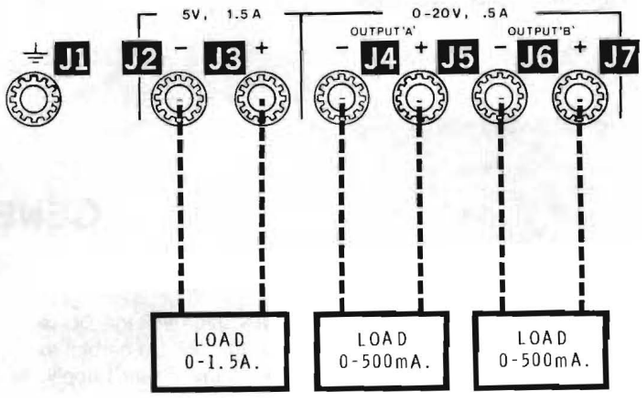


Figure 7

IN CASE OF DIFFICULTY

This part of the Manual will help you locate and correct any difficulty which might occur in your Power Supply. The information is divided into two sections. The first section, "General," contains suggestions of a general nature in the following areas:

A. Bench-testing precautions.

B. Repair techniques.

The second section consists of a "Troubleshooting Chart." It calls out specific problems that may occur and lists one or more conditions or components that could cause each difficulty. Capacitor C-numbers, transistor Q-numbers, etc., are identified in this chart by the same numbers that are used on the Schematic diagram. A "Circuit Board X-Ray View" (on Page 20) is also provided to help you locate the components.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

GENERAL

BENCH TESTING

WARNING: The full AC line voltage and high voltage DC is present at several points in the Power Supply. Be careful to avoid personal shock when you work on the Power Supply. Refer to Figure 8.

- Be cautious when you test the transistors and integrated circuit. Although they have almost unlimited life when used properly, they are more susceptible to damage from excessive voltage and current than other circuit components.
- Do not short any terminals to ground when you make voltage measurements. If the probe should slip, for example, and short out a bias or voltage supply point, it may damage one or more components.
- Do not remove any components while the Power Supply line cord is connected to the AC outlet.
- When you make repairs to the Power Supply, make sure you eliminate the cause as well as the effect of the trouble. If, for example, you should find a damaged resistor, be sure you find out what caused the resistor to become damaged. If the cause is not eliminated, the replacement resistor may also become damaged when the Power Supply is put back into operation.
- Refer to the X-Ray View on Page 20 and the "Schematic" to locate the various components.
- Use a high impedance-input voltmeter to make any voltage measurements.

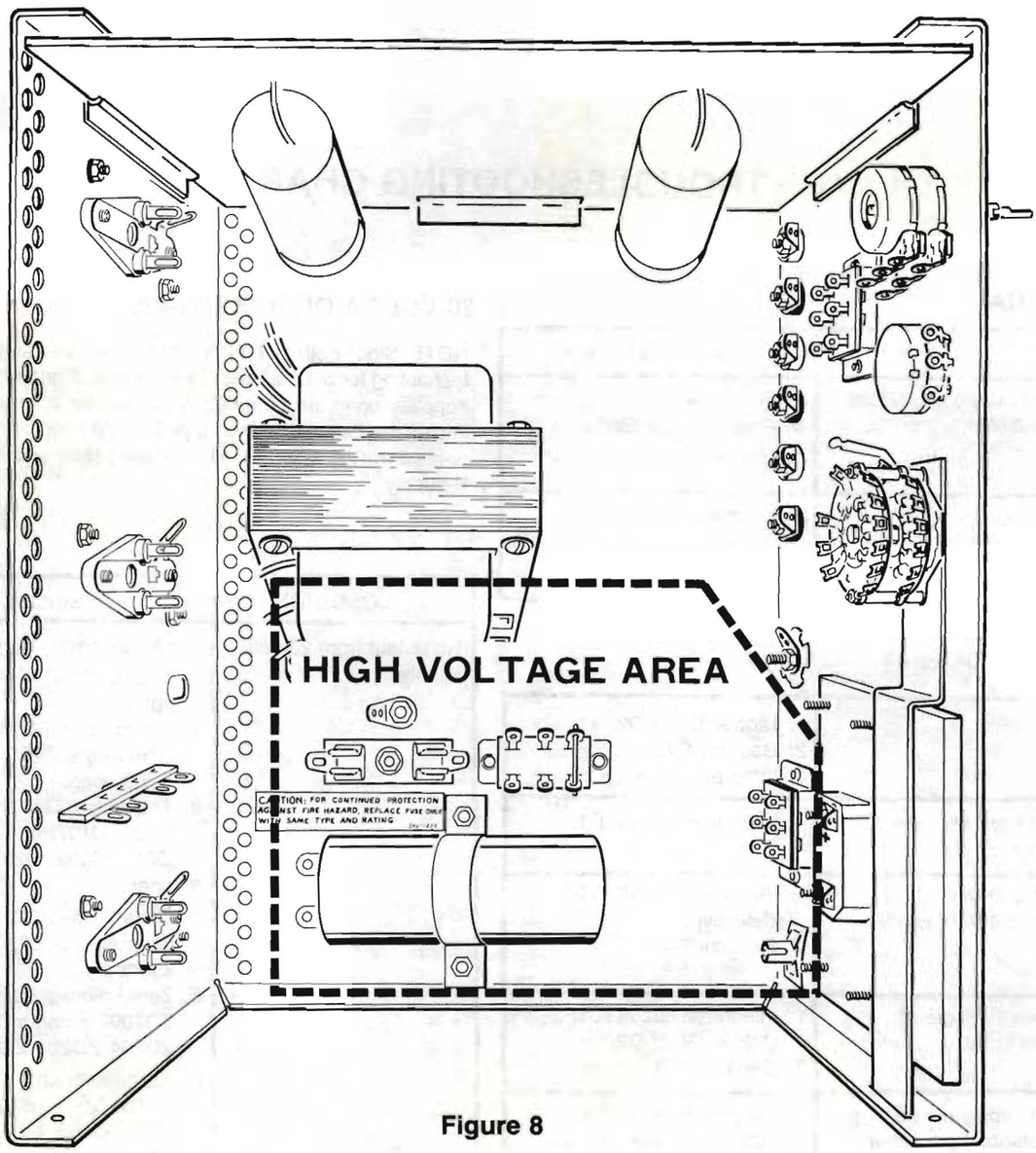


Figure 8

REPAIR TECHNIQUES

Components

Faulty resistors or capacitors should first be clipped from component leads from the circuit board, heat the solder on the foil and allow the lead to fall out of the hole. Preshape the leads of the replacement part and insert them into the holes in the circuit board. Solder the leads to the foil and cut off the excess lead lengths.

Transistors can be removed in the same manner as previously described. The replacement transistor must be installed with its leads in the proper holes. Then quickly solder the leads to avoid heat damage. Cut off the excess lead lengths.

CAUTION: On several areas of the circuit boards, the foil patterns are quite narrow. When you unsolder a part for checking or replacement, avoid excessive heat while removing the part. A suction-type desoldering tool will make part removal easier.

Foil Repair

A break in a circuit board foil can be bridged by soldering across the break. Large gaps in the foil should be bridged with a length of bare wire. Lay the wire across the gap and solder each end to the foil.

TROUBLESHOOTING CHART

GENERAL

CONDITION	POSSIBLE CAUSE
Power Supply completely inoperative.	1. Fuse blown. 2. Power switch SW1. 3. Line switch SW2.
Fuse blows.	1. Integrated circuit IC1. 2. Capacitors C2, C103, C203, C108 or C208 faulty.

5-VOLT SUPPLY

No Output	1. Diodes D1 or D2. 2. Resistor R4. 3. Integrated circuit IC1.
Output greater than 5.25 volts DC.	1. Integrated circuit IC1.
Unable to get 1.5 amperes of current from supply.	1. Integrated circuit IC1 defective. 2. Resistor R4 .
Excessive ripple at output jacks.	1. Integrated circuit IC1. 2. Diodes D1 or D2. 3. Capacitor C2.
5-volt supply not floating. Resistance from either output jack to chassis is less than 1 MΩ.	1. Integrated circuit IC1 case contacting chassis. 2. Capacitor C5.

20-VOLT A OR B SUPPLIES

NOTE: Since both of the 20-volt supplies are identical, troubleshooting for both supplies is the same. If one of the 20-volt supplies operates correctly, you may be able to compare in-circuit voltages to identify a problem. All 100-series components are in the A-supply; all 200-series components are in the B-supply.

CONDITION	POSSIBLE CAUSE
No output from 20-volt supply.	1. Diodes D101, D102, D103, or diodes D201, D202, D203 open. 2. Resistors R101, R103, R109, or resistors R201, R203, R209 open. 3. Transistors Q101, Q102, Q103, Q107, or transistors Q201, Q202, Q203, or Q207 open. 4. Capacitors C102, C109, or capacitors C202, C209 shorted. 5. Zener diodes ZD104, ZD108, ZD109, or zener diodes ZD204, ZD208, ZD209 shorted. 6. Transistors Q104, Q105, Q106, Q108, or transistors Q204, Q205, Q206, Q208 shorted.

CONDITION	POSSIBLE CAUSE
Output too high, cannot be adjusted.	1. Transistors Q102, Q103, Q1, Q107, or transistors Q202, Q203, Q2, Q207 shorted. 2. Diodes D105, D110, or diodes D205, D210 open. 3. Zener diodes ZD108, ZD109, or zener diodes ZD208, ZD209 open. 4. Transistors Q106, Q108, or transistors Q206, Q208 open.
Output current too low.	1. Resistor R109 or resistor R209 open. 2. Transistor Q104 or transistor Q204 faulty.

CONDITION	POSSIBLE CAUSE
Output current does not limit.	1. Solder bridge A or solder bridge B open. 2. Transistor Q104 or transistor Q204 faulty. 3. Resistors R108, R109 or resistors R208, R209 defective.
Excessive ripple in output voltages.	1. Diodes D101, D102 or diodes D201, D202 open or faulty. 2. Capacitors C101, C103, C104, C105, C108 or capacitors C201, C203, C204, C205, C208 open or faulty.
Supply not floating. Resistance from either output jack to chassis is less than 1 MΩ.	1. Transistor Q1 or transistor Q2 case shorted to chassis. 2. Capacitor C6 or capacitor C7 faulty.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram while you read this "Circuit Description." The part numbers on the Schematic are arranged in the following groups to help you locate specific parts on the Schematic, chassis, and circuit boards:

1- 99	Parts mounted on the chassis.
101-199	Parts mounted on the circuit board, and in the 20-volt 'A' Supply.
201-299	Parts mounted on the circuit board, and in the 20-volt 'B' Supply.

The five principal sections of the Tri-Power Supply are the power primary circuit, the 5-volt supply, the 20-volt 'A' Supply, the 20-volt 'B' Supply, and the metering circuit.

PRIMARY CIRCUIT

The primary circuit of the Tri-Power Supply includes hash-filter capacitor C1 across the line cord input, fuse F1, Power switch SW1, pilot lamp PL1 and dropping resistor R1, and Line switch SW2. The purpose of the Line switch is to allow you to switch from 120-VAC operation to 240-VAC operation without rewiring the primary circuit of power transformer T1. To change from 120-VAC operation to 240-VAC operation, for example, you need only to push the slide of switch SW2 to indicate the voltage that agrees with the local AC service.

Three transformer secondary windings provide separate voltage sources for the three voltage regulators of the 5-volt supply and the two 20-volt supplies.

5-VOLT SUPPLY

One secondary winding on transformer T1 provides a voltage to rectifier diodes D1 and D2. The rectified DC voltage is filtered by capacitor C2. Resistor R4 is a current shunt for the metering circuit.

Regulation in the 5-volt circuit is accomplished in integrated circuit IC1. The output voltage is fixed at 5 volts. The IC provides internal overload, short-circuit, and high temperature protection. Capacitor C3 stabilizes the IC-regulator, and capacitor C4 lowers the high-frequency output impedance. Capacitor C5 provides an AC path to chassis ground for voltages induced when the 5-volt supply is used in the floating mode of operation.

20-VOLT 'A' AND 'B' SUPPLIES

NOTE: In the description of the 20-volt supplies, the "A" and "B" circuits are identical. One circuit will be described in this text which applies to either supply. Component callouts (R101, C111, Q103, etc.) in the 100-series are in the A-supply; component callouts in the 200-series are in the B-supply.

RECTIFIER-FILTER CIRCUIT

One transformer secondary winding provides an AC voltage to full-wave rectifier diodes D101 and D102. The rectified voltage is routed through blocking diode D103 and is filtered by capacitor C103. Resistor R103 is a bleeder resistor to discharge C103 when the Power Supply is turned off.

A negative voltage is derived through rectifier diodes D106 and D107. This voltage is filtered by capacitor C105, and is then routed to the voltage regulator.

CURRENT SOURCE

Current flows from the positive side of capacitor C103, through zener diode ZD104, through resistor R103, to transistor Q101. The voltage drop across R104 is fixed at a constant value by ZD104 and the constant base-to-emitter voltage of transistor Q102. Thus, the current through R104 is constant. Since the collector current of Q102 is very nearly equal to its emitter current, the collector current will also be constant.

Transistor Q101 acts as a switch, to turn on quickly when the power supply is turned on. However, Q101 turn-off is delayed by the action of capacitor C101 to eliminate transients on the output of the supply when power is switched off.

OUTPUT AMPLIFIER

The output amplifier of the 20-volt supply consists of a power transistor which is driven by transistor Q103 in a Darlington connection. Resistor R5 stabilizes the output amplifier at higher operating temperatures.

VOLTAGE REGULATOR

The reference voltage for the regulator circuit is derived from zener diode ZD109. Constant current for ZD109 is provided by resistor R115 and zener diode ZD108. ZD108 and resistor R106 are a pre-regulator for the reference source.

Differential transistors Q107 and Q108 compare a portion of the reference voltage as set by control R7 with a portion of the output voltage sampled between resistors R123 and R124.

An example of the action of this regulator circuit might be as follows: If the output voltage rises due to a reduction in the load, the base voltage of transistor Q108 will increase. The collector voltage of Q108 will drop, causing an increase in the base current of transistor Q106. This causes an increase in the base current of transistor Q105 and its collector current will also increase. Since transistor Q102 provides a constant output current which is present both at Q103 and Q105, any increase in Q105 collector current will cause a reduction in Q103 base current. As Q103 base current decreases, its emitter current and that of transistor Q1, will also decrease. This decrease in the current from Q1 decreases the current from the Supply, and will lower the output voltage to the correct level. The regulator circuit is designed to hold the output constant within a few millivolts for a full range of loads at the output terminals.

Diode D105, capacitors C102 and C104, with diode D110 and capacitor C108 eliminate overshoot during turn-on and turn-off of the Supply. Resistor R113 sets a negative bias current through current-metering resistor R109 equal to the positive current drawn by the regulator. This allows the meter to indicate the true supply output current when the Meter switch is correctly positioned.

CURRENT LIMITER

Transistor Q104 senses the voltage drop across resistor R109. This resistor carries the output current. As the voltage across R109 reaches approximately .55 volts, Q104 starts to conduct taking some of the current from the output of driver transistor Q103. As the voltage across R109 increases further, Q104 will conduct fully, taking all of the current from source transistor Q102. This causes transistors Q103 and Q1 to turn off. In this manner, output current limiting can be maintained indefinitely.

METERING CIRCUIT

Switch SW4 selects any of the six output functions to be monitored by the meter. NOTE: This switch function does *not* select or affect any of the outputs at the front terminals of the Tri-Power Supply.

CALIBRATION

( ) At the two sides of the cabinet top, remove the six #6 × 1/4 screws from the Power Supply assembly. Set the screws and the top aside temporarily.

NOTE: Do not plug the Tri-Power Supply line cord into an AC outlet until you are instructed to do so.

( ) Preset the front panel switches and controls as follows:

POWER switch: OFF.
METER switch: B VOLTS.
SUPPLY A control: Fully clockwise.
SUPPLY B and A TRACKING B controls: Fully clockwise.
MODE switch: TRACKING.

Refer to Figure 9 for the following steps.

NOTE: Perform the following steps only if the meter pointer is *not* directly over the "0" (zero) on the meter scale.

( ) Locate the small hole in the front panel directly under the center of the meter. Using a small screwdriver, carefully and slowly turn the small meter adjust screw until the pointer is positioned over the "0" at the left side of the meter scale.

CAUTION: WHEN THE LINE CORD IS CONNECTED TO AN AC OUTLET, HAZARDOUS VOLTAGES ARE PRESENT INSIDE THE CHASSIS. REFER TO THE CHASSIS DRAWING ON PAGE 11 TO LOCATE THE AREAS WHERE THESE VOLTAGES ARE PRESENT. DO NOT PUT ANY PART OF YOUR BODY OR ANY TYPE OF TOOL IN THESE AREAS WHILE THE LINE CORD IS PLUGGED INTO AN AC OUTLET.

( ) Plug the line cord into an AC outlet and turn the POWER switch ON.

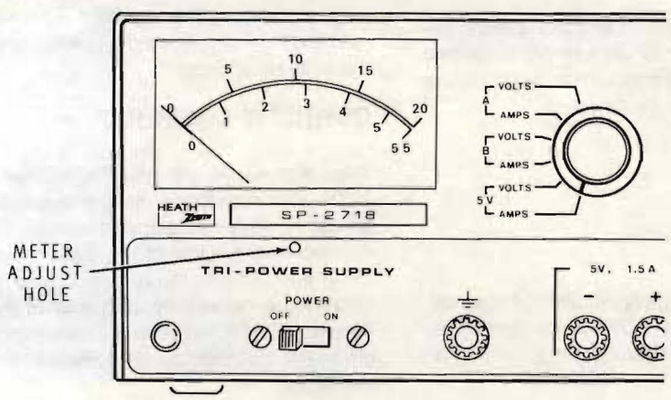


Figure 9

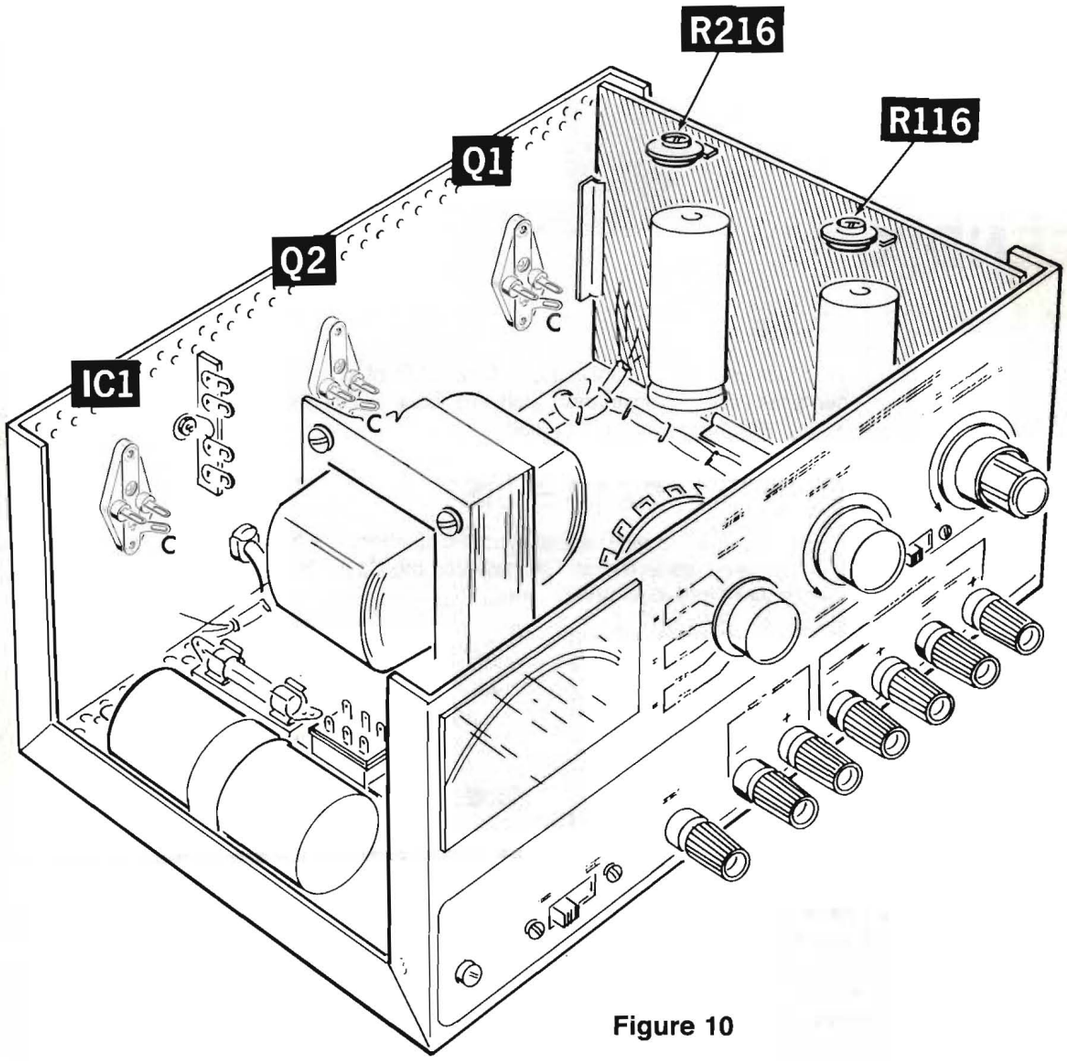


Figure 10

( ) Refer to Figure 10 and adjust circuit board control R216 until the pointer is directly over the "20" on the upper meter scale.

( ) Turn the METER switch to A VOLTS.

( ) On the circuit board, adjust control R116 until the pointer is directly over "20" on the upper meter scale.

( ) Set the MODE switch to INDEPENDENT. The pointer should now indicate between "19" and "21" on the upper meter scale.

This completes the calibration of your Tri-Power Supply.

( ) Turn the POWER switch OFF and remove the line cord from the AC outlet.

( ) Position the cabinet top onto the Power Supply assembly, and secure each side with three of the #6 × 1/4" screws previously removed.

APPENDIX

This section of the Manual includes a Parts List of all components necessary for instrument maintenance, a Circuit Board X-Ray View and a Schematic Diagram.

PARTS LIST

Component values and circuit component numbers are those referred to on the Schematic Diagram, on the Circuit Board X-Ray View, and in related Figures.

CHASSIS-MOUNTED COMPONENTS

CIRCUIT Comp. Number	PART No.	DESCRIPTION
Resistors		
R1	1-25	47 kΩ, 1/2-watt, 10%
R2	1-19-1	220 Ω, 1-watt, 10%
R3	2-296	150 Ω, 1/2-watt, 1%
R4	2-94	0.1 Ω, 1/2-watt, 1%
R5	1-1	47 Ω, 1/2-watt, 10%
R6	1-1	47 Ω, 1/2-watt, 10%
R7	10-281	10 kΩ control
R8/R9	12-156	Dual 10 kΩ control
R10	NOT USED	
R11	2-323	19.95 kΩ, 1/2-watt, 1%
R12	2-181	5490 Ω (5.49K), 1/2-watt, 1%
R13	2-323	19.95 kΩ, 1/2-watt, 1%
Capacitors		
C1	21-72	.005 μF, 1.4 kV disc
C2	25-822	12,000 μF electrolytic
C3	21-173	.0022 μF disc
C4	21-99	0.2 μF disc
C5	21-16	.01 μF disc
C6	21-16	.01 μF disc
C7	21-16	.01 μF disc

CIRCUIT Comp. Number	PART No.	DESCRIPTION
Diodes		
D1	57-42	3A1 silicon rectifier
D2	57-42	3A1 silicon rectifier
Transistors and Integrated Circuit		
Q1	417-282	MJ2841 transistor
Q2	417-282	MJ2841 transistor
IC1	442-30	UA309K integrated circuit
Switches		
SW1	60-2	Slide switch (Power)
SW2	60-54	Slide switch (Line)
SW3	60-2	Slide switch (Mode)
SW4	63-1257	Rotary switch (Meter)
Miscellaneous		
T1	54-918	Power transformer
M1	407-718	Meter
PL1	412-15	Neon lamp
F1	421-1	1-1/2-ampere fuse

CIRCUIT BOARD COMPONENTS

CIRCUIT Comp. Number	PART No.	DESCRIPTION
Resistors		
R101	1-24	33 kΩ, 1/2-watt, 10%
R102	1-16	4700 Ω, 1/2-watt, 10%
R103	1-46	3900 Ω, 1/2-watt, 10%
R104	1-8	820 Ω, 1/2-watt, 10%
R105	1-22-1	1500 Ω, 1-watt, 10%
R106	1-9	1000 Ω, 1/2-watt, 10%
R107	2-24-12	555 Ω, 1/4-watt, 1%
R108	1-157	470 Ω, 1/2-watt, 5%
R109	3-8-1	1.1 Ω, 3-watt, 5%, wire-wound
R110	NOT USED	
R111	1-90	2000 Ω, 1/2-watt, 5%
R112	1-90	2000 Ω, 1/2-watt, 5%
R113	1-56-1	1200 Ω, 1-watt, 10%
R114	1-20	10 kΩ, 1/2-watt, 10%
R115	1-48	390 Ω, 1/2-watt, 10%
R116	10-918	500 Ω control
R117	1-157	470 Ω, 1/2-watt, 5%
R118	1-24	33 kΩ, 1/2-watt, 5%
R119	1-89	2400 Ω, 1/2-watt, 5%
R120	NOT USED	
R121	1-24	33 kΩ, 1/2-watt, 5%
R122	1-128	62 kΩ, 1/2-watt, 5%
R123	2-265	12.2 kΩ, 1/2-watt, 1%
R124	2-247	5000 Ω (5K), 1/2-watt, 1%
R201	1-24	33 kΩ, 1/2-watt, 10%
R202	1-16	4700 Ω, 1/2-watt, 10%
R203	1-46	3900 Ω, 1/2-watt, 10%
R204	1-8	820 Ω, 1/2-watt, 10%
R205	1-22-1	1500 Ω, 1-watt, 10%
R206	1-9	1000 Ω, 1/2-watt, 10%
R207	2-24-12	555 Ω, 1/4-watt, 1%
R208	1-157	470 Ω, 1/2-watt, 5%
R209	3-8-1	1.1 Ω, 3-watt, 5%, wire-wound
R210	NOT USED	
R211	1-90	2000 Ω, 1/2-watt, 5%
R212	1-90	2000 Ω, 1/2-watt, 5%
R213	1-56-1	1200 Ω, 1-watt, 10%
R214	1-20	10 kΩ, 1/2-watt, 10%
R215	1-48	390 Ω, 1/2-watt, 10%
R216	10-918	500 Ω control
R217	1-157	470 Ω, 1/2-watt, 5%
R218	1-24	33 kΩ, 1/2-watt, 5%
R219	1-89	2400 Ω, 1/2-watt, 5%
R220	NOT USED	
R221	1-24	33 kΩ, 1/2-watt, 5%
R222	1-128	62 kΩ, 1/2-watt, 5%
R223	2-265	12.2 kΩ, 1/2-watt, 1%
R224	2-247	5000 Ω (5K), 1/2-watt, 1%
Capacitors		
C101	27-47	0.1 μF Mylar*
C102	25-116	50 μF electrolytic
C103	25-192	2000 μF electrolytic
C104	25-251	50 μF electrolytic
C105	25-283	10 μF electrolytic

CIRCUIT Comp. Number	PART No.	DESCRIPTION
Capacitors (cont'd.)		
C106	21-9	100 pF disc
C107	21-48	.05 μF disc
C108	25-251	50 μF electrolytic
C109	25-283	10 μF electrolytic
C201	27-47	0.1 μF Mylar
C202	25-116	50 μF electrolytic
C203	25-192	2000 μF electrolytic
C204	25-251	50 μF electrolytic
C205	25-283	10 μF electrolytic
C206	21-9	100 pF disc
C207	21-48	.05 μF disc
C208	25-251	50 μF electrolytic
C209	25-283	10 μF electrolytic
Diodes		
D101	57-65	1N4002
D102	57-65	1N4002
D103	57-65	1N4002
ZD104	56-50	DO-7 zener
D105	57-65	1N4002
D106	57-65	1N4002
D107	57-65	1N4002
ZD108	56-57	1N716A zener
ZD109	56-31	PS18775 zener
D110	57-65	1N4002
D201	57-65	1N4002
D202	57-65	1N4002
D203	57-65	1N4002
ZD204	56-50	DO-7 zener
D205	57-65	1N4002
D206	57-65	1N4002
D207	57-65	1N4002
ZD208	56-57	1N716A zener
ZD209	56-31	PS18775 zener
D210	57-65	1N4002
Transistors		
Q101	417-801	MPSA20
Q102	417-201	X29A829
Q103	417-294	MPSA42
Q104	417-801	MPSA20
Q105	417-801	MPSA20
Q106	417-201	X29A829
Q107	417-258	TIS87
Q108	417-258	TIS87
Q201	417-801	MPSA20
Q202	417-201	X29A829
Q203	417-294	MPSA42
Q204	417-801	MPSA20
Q205	417-801	MPSA20
Q206	417-201	X29A829
Q207	417-258	TIS87
Q208	417-258	TIS87

*Registered Trademark, DuPont Corp.

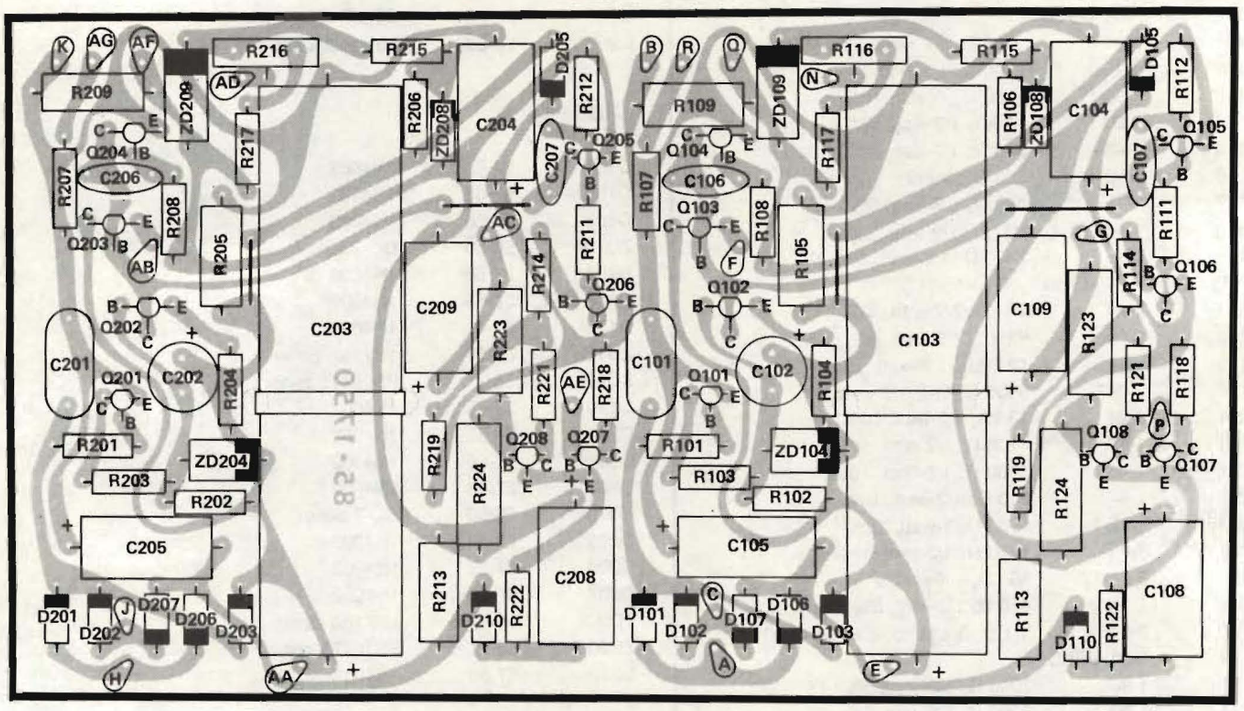
CIRCUIT BOARD X-RAY VIEW

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

A. Find the circuit component number (R111, C101, etc.) on the X-Ray View.

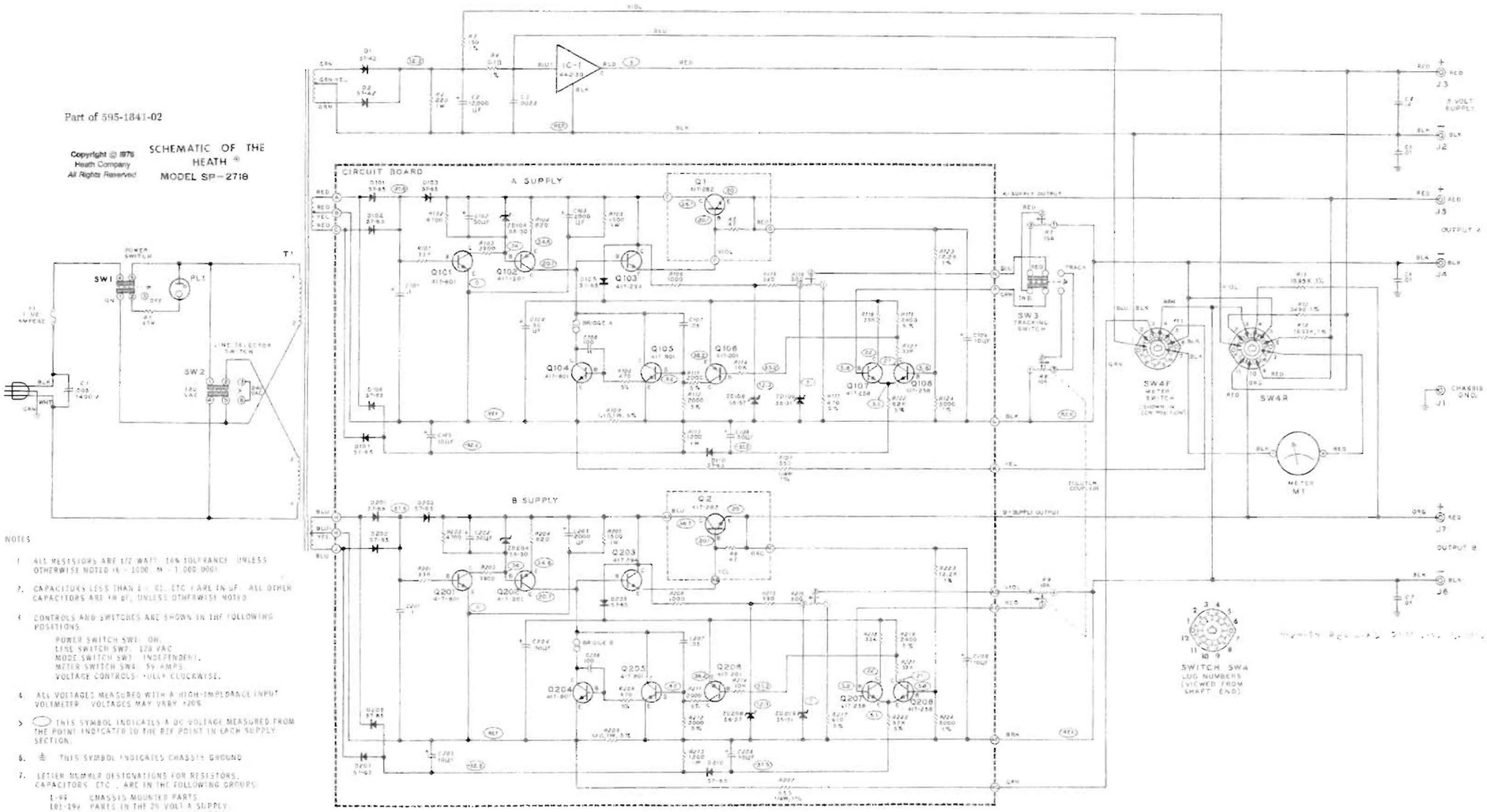
B. Locate this same number in the "Circuit Component Number" column of the "Parts List."

C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



Part of 595-1841-02

SCHEMATIC OF THE HEATH ® MODEL SP-2718



NOTES

1. ALL RESISTORS ARE 1/2 WATT, 10% TOLERANCE UNLESS OTHERWISE NOTED (K = 1000, M = 1,000,000).
2. CAPACITORS LESS THAN 1 (.01, ETC.) ARE IN µF. ALL OTHER CAPACITORS ARE IN pF, UNLESS OTHERWISE NOTED.
3. CONTROLS AND SWITCHES ARE SHOWN IN THE FOLLOWING POSITIONS:
   POWER SWITCH SW1: ON.
   LINE SWITCH SW2: 120 VAC.
   MODE SWITCH SW3: INDEPENDENT.
   METER SWITCH SW4: 5V AMPS.
   VOLTAGE CONTROLS: FULLY CLOCKWISE.
4. ALL VOLTAGES MEASURED WITH A HIGH-IMPEDANCE INPUT VOLTMETER. VOLTAGES MAY VARY ±20%.
5. ⬭ THIS SYMBOL INDICATES A DC VOLTAGE MEASURED FROM THE POINT INDICATED TO THE REF POINT IN EACH SUPPLY SECTION.
6. ⏚ THIS SYMBOL INDICATES CHASSIS GROUND.
7. LETTER NUMBER DESIGNATIONS FOR RESISTORS, CAPACITORS, ETC., ARE IN THE FOLLOWING GROUPS:
   1-99 CHASSIS MOUNTED PARTS.
   101-199 PARTS IN THE 25 VOLT A SUPPLY.
   201-299 PARTS IN THE 20 VOLT B SUPPLY.

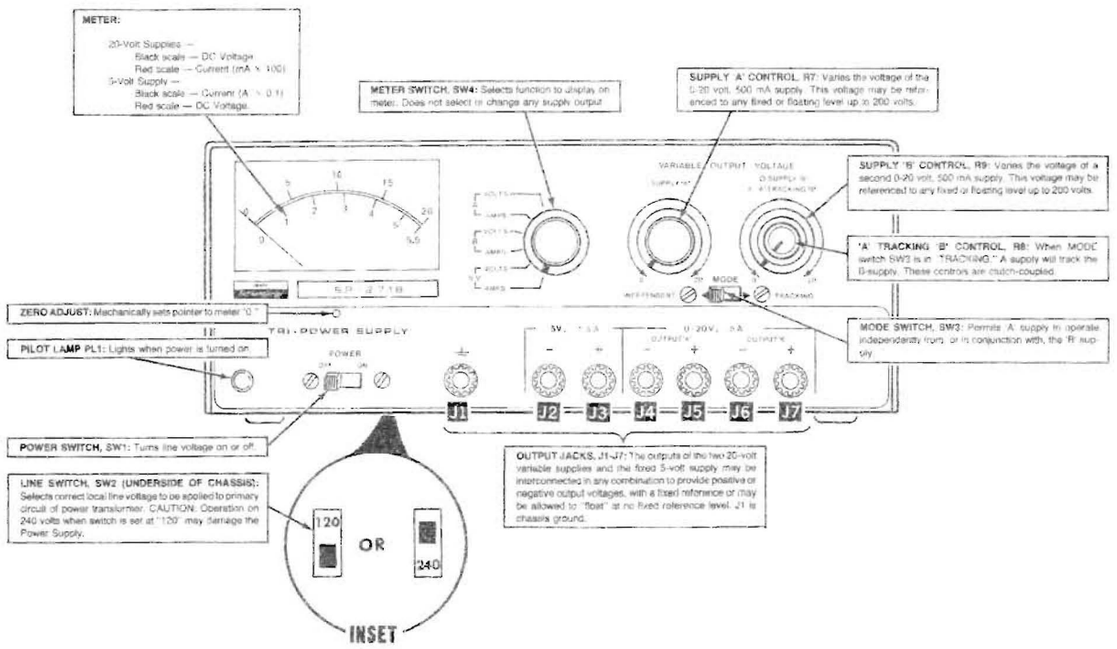

METER:
20-Volt Supplies —
Black scale — DC Voltage
Red scale — Current (mA X 100)
5-Volt Supply —
Black scale — Current (A X 0.1)
Red scale — DC Voltage.
METER SWITCH, SW4: Selects function to display on meter. Does not select or change any supply output.
SUPPLY 'A' CONTROL, R7: Varies the voltage of the 0-20 volt, 500 mA supply. This voltage may be referenced to any fixed or floating level up to 200 volts.
SUPPLY 'B' CONTROL, R9: Varies the voltage of a second 0-20 volt, 500 mA supply. This voltage may be referenced to any fixed or floating level up to 200 volts.
'A' TRACKING 'B' CONTROL, R8: When MODE switch SW3 is in "TRACKING," A supply will track the B-supply. These controls are clutch-coupled.
MODE SWITCH, SW3: Permits A supply to operate independently from, or in conjunction with, the B supply.
ZERO ADJUST: Mechanically sets pointer to meter "0."
PILOT LAMP PL1: Lights when power is turned on.
POWER SWITCH, SW1: Turns line voltage on or off.
LINE SWITCH, SW2 (UNDERSIDE OF CHASSIS): Selects correct local line voltage to be applied to primary circuit of power transformer. CAUTION: Operation on 240 volts when switch is set at "120" may damage the Power Supply.
OUTPUT JACKS, J1-J7: The outputs of the two 20-volt variable supplies and the fixed 5-volt supply may be interconnected in any combination to provide positive or negative output voltages, with a fixed reference or may be allowed to "float" at no fixed reference level. J1 is chassis ground.
VARIABLE OUTPUT VOLTAGE
MODE
INDEPENDENT
TRACKING
TRI-POWER SUPPLY
POWER
OFF
ON
J1
J2
J3
J4
J5
J6
J7
120
OR
240
INSET

Figure 1