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**HANDBOOK OF OPERATION AND
SERVICE INSTRUCTIONS
FOR
TEST SET, ELECTRONIC CIRCUIT,
PLUG-IN UNIT QRC-133A(T)**

NOX



hallicrafters



CONTAINS 138 PAGES

HANDBOOK OF OPERATIONS
AND
SERVICE INSTRUCTIONS
FOR
TEST SET, ELECTRONIC CIRCUIT, PLUG-IN UNIT
QRC-133A(T)

Manufactured by
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4401 West Fifth Avenue
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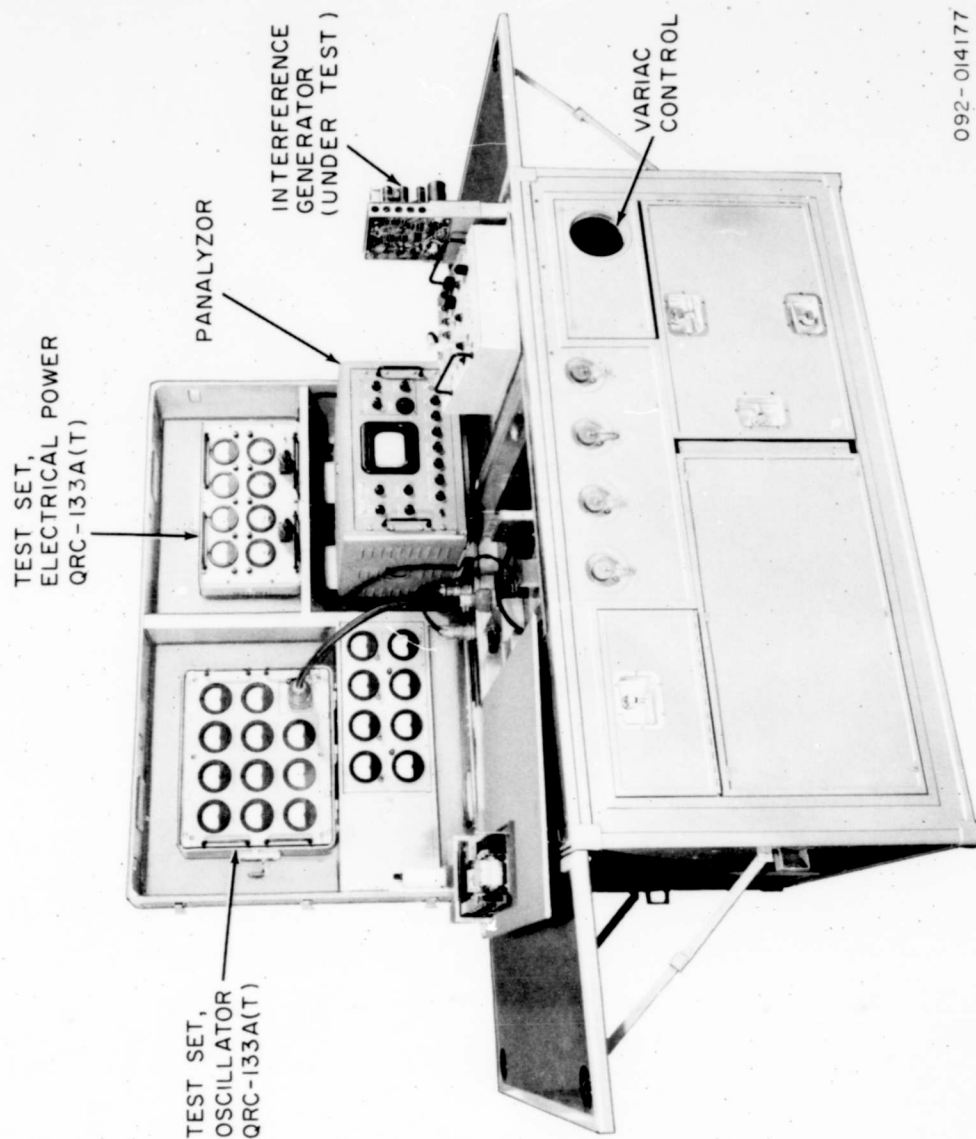
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Figure 1-1. Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T).

SECTION 1

INTRODUCTION AND DESCRIPTION

1-1. PURPOSE OF HANDBOOK.

1-2. This publication contains instructions for the operation and maintenance of Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T). This equipment was developed and manufactured by The Hallicrafters Company, Chicago, Illinois under Call No. 21L of Contract AF33(600)-40992.

1-3. PURPOSE OF EQUIPMENT.

1-4. Plug-in Unit Electronic Circuit Test Set (figure 1-1) is designed to test the following modules of Barrage Jammer QRC-133A(T): 1) Power supply; 2) Voltage regulator; 3) Modulator-power supply; and 4) Interference generator. The outputs of these modules are displayed on various meters and indicators contained in this test set. The displayed outputs are evaluated to determine the performance of the module under test.

1-5. In order to obtain significant test results and readings when testing the four modules of the QRC-133A(T) system, it is necessary to maintain the same conditions under which the modules under test normally operate.

1-6. During normal operation in the QRC-133A(T) system, each of the four modules interacts in some way with at least one other module. The output of each module is affected by inherent loads in the associated modules. Therefore, it is necessary to provide either the actual load or a simulated load at the output of each module under test.

1-7. DESCRIPTION OF EQUIPMENT.

1-8. Plug-in Unit Electronic Circuit Test Set is a self-contained bench-type test set consisting of the following components:

1-9. CABINET. All components of the plug-in unit test set are housed within the cabinet (figure 1-1). The cabinet is designed so that the hinged cover may be lowered to form a compact unit for storage or shipment and to protect the components of the test set from dust and damage. Figure 1-2 shows the closed test set. Eleven luggage-type latches secure the cover when it is lowered. Two metal braces stabilize the cover in the raised position. The cabinet, constructed of Alply (a strong, lightweight, laminated aluminum and plywood material), incorporates several shelves on which the components of plug-in unit test set are mounted. Two side flaps may be raised and secured by braces to provide additional work space.

1-10. OIL-FILLED TEST CHAMBER. The oil-filled test chamber (figure 1-3) located on the main shelf of the cabinet, is filled with liquid coolant and is designed to contain and cool the power supply module, the voltage regulator module, or the modulator-power supply during testing of these modules. The high voltage power supply module and the voltage regulator simulator module of the test set are permanently located in the test chamber where they are cooled during operation. Level switch S3, located in the test chamber, prevents applying power to the modules tested in the test chamber unless there



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Figure 1-2. Test Set, Electronic Circuit, Plug-in Unit
QRC-133A(T) (Closed Configuration).

is adequate coolant level in the chamber. A metal cover that can be used as a drain board encloses the test chamber when it is not being used.

1-11. PUMP COOLANT ASSEMBLY. The pump coolant assembly comprises the oil pump, oil filters, flow switch, pressure switch, solenoid drain valve, interconnecting piping, cooling coil, and oil reservoir. Figure 1-3 illustrates these components. The oil pump and filters are located in the compartment at the bottom left of the cabinet. The oil reservoir located directly below the oil-filled test chamber has a capacity of 20 gallons of liquid coolant. A coolant level gage located on the front of the reservoir indicates the amount of liquid coolant in the reservoir. The cooling coil is located at the extreme left end of the air duct assembly. The pump, driven by a constant-speed motor, circulates the liquid coolant through the cooling coil where it is cooled. The flow switch is located on the output side of the filters. The pressure switch is connected across the filters. The solenoid valve is located at the oil-filled test chamber drain opening.

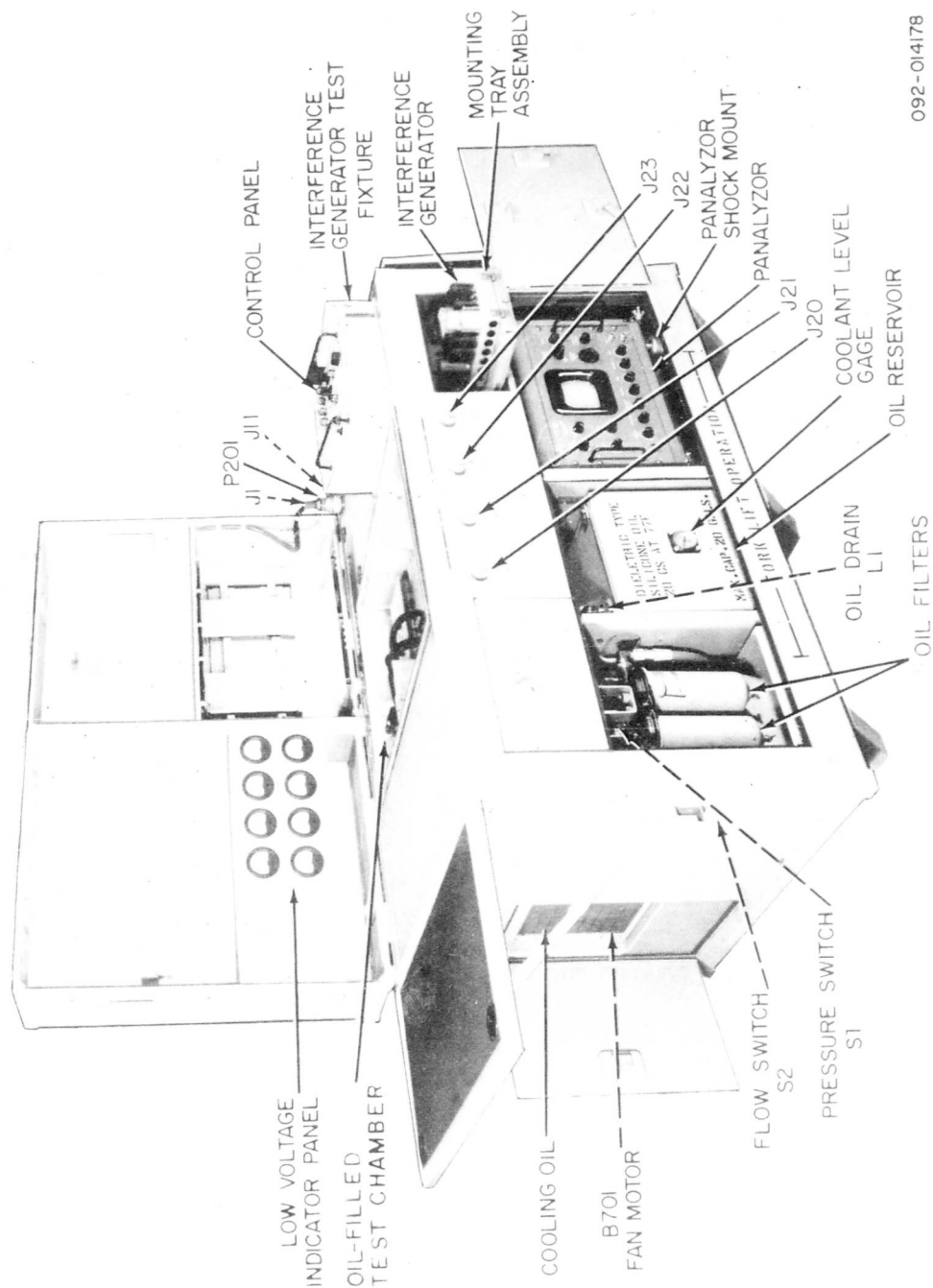
1-12. COOLING-COIL MOTOR AND AIR DUCT ASSEMBLY. The cooling-coil motor and air duct assembly is located at the rear of the cabinet. The air duct lies flat and runs the entire width of the cabinet. The load resistors are mounted within the air duct where they are air cooled. The cooling-coil motor is mounted within the air duct at its left end. The cooling coil is located at the extreme left end of the air duct. A four-blade fan, driven by the motor, cools the load resistors by pulling air through the cooling coil and forcing the air through the entire length of the air duct. Two doors, one at each end of the air duct assembly, cover the air duct opening when the test set is not operating. These doors must be opened before operating the test set.

1-13. MUFFIN FAN. The muffin fan is an auxiliary cooling device that cools the components located in the lower enclosed portion of the cabinet. The fan is mounted in the lower right side of the cabinet. The fan opening is covered by a small door when the test set is not operating. This door must be opened before operating the test set.

1-14. FLOW, LEVEL, AND PRESSURE SWITCHES. Flow switch S2 and level switch S3 are protective interlock devices that prevent applying primary power to the modules being operated in the test chamber unless there is adequate coolant flow and proper coolant level. Indicators DS109 (COOLANT LEVEL) and DS110 (NO FLOW) will light if the above conditions are not maintained. Pressure switch S1 is a pressure differential switch that closes when the filters become clogged, causing an excessive pressure drop across the filters. When S1 closes, a circuit is completed to CHANGE FILTER indicator DS111.

1-15. THREE-PHASE VARIABLE TRANSFORMER (VARIAC). The three-phase Variac, located at the right in the lower enclosed portion of the cabinet, is an adjustable three-phase transformer that allows testing of the modules over the entire range of the specified input voltage limits. A Variac control knob is provided on the front of the test set. This knob is recessed in the cabinet.

1-16. CONSTANT-VOLTAGE TRANSFORMER. The constant-voltage transformer, located at the rear in the lower enclosed portion of the cabinet, provides a constant input voltage to the Panalyzer power supply.



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Figure 1-3. Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T) (Open Configuration).

1-17. LOAD RESISTORS. The load resistors, located in the air duct assembly, simulate the load imposed on the power supply and voltage regulator modules by the BWO tube and series regulator tube in the Barrage Jammer QRC-133A(T) system.

1-18. CONTROL PANEL. The control panel provides indicators and the major controls for operating the test set. The control panel is mounted on the main shelf of the cabinet and is slightly inclined for easy viewing and operation. This unit contains: 1) switches and relays that control the testing functions; 2) indicators that give visual signals of system condition and system faults; and 3) protection circuits that provide the necessary delays for system warm-up and protect against system overload of fault conditions. Also included in the control panel are three transformers that provide: 1) the load (T103) for the sole noise output of the interference generator module under test; 2) the load (T102) for the accelerator noise output of the interference generator module under test; and 3) the load (T104) for the accelerator noise output of the interference generator module in the test set.

1-19. HIGH VOLTAGE POWER SUPPLY MODULE (TEST SET). The high voltage power supply module of the test set is permanently located in a separate compartment at the right rear of the oil-filled test chamber. This module is designed to operate while immersed in the liquid coolant contained by the test chamber. Contained in this module are series-connected 2000-volt and 3200-volt three-phase power supplies, which provide outputs of 3200 volts DC and 5200 volts DC, and a single-phase half-wave 4200-volt power supply. The output of this module is applied to the voltage regulator module under test.

1-20. VOLTAGE REGULATOR SIMULATOR MODULE. The voltage regulator simulator module is located in the same compartment as the high voltage power supply module. This module, which is designed to operate while immersed in liquid coolant, simulates the load of the voltage regulator module used in the Barrage Jammer QRC-133A(T) system. The output of the power supply module under test is applied to this module.

1-21. LOW VOLTAGE POWER SUPPLY MODULE (TEST SET). The low voltage power supply module of the test set is located in the lower right enclosed portion of the cabinet and is mounted behind the interference generator module on a special pull-out mounting tray assembly. This module contains 150-volt, 390-volt, and 400-volt power supplies. The 150-volt and 400-volt power supplies are three-phase bridge-type supplies that operate from individual secondaries of a three-phase power transformer. The 390-volt supply is a single-phase bridge-type "floating" power supply. The three outputs of this module are applied to the interference generator module under test.

1-22. INTERFERENCE GENERATOR MODULE (TEST SET). See paragraph 1-22 of the Classified Supplement to Handbook of Operation and Service Instructions for Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T) (HLC NO. 094-903067) for the description of the interference generator module of the test set.

1-23. LOW VOLTAGE INDICATOR PANEL. The low voltage indicator panel is used when testing either the interference generator module or the modulator-power supply module. Eight meters mounted on the front panel measure voltages and currents of the following power supply outputs:

- A. 150-volt supply - Voltmeter M201 and ammeter M202.
- B. 390-volt supply - Voltmeter M203 and ammeter M204.
- C. 400-volt supply - Voltmeter M205 and ammeter M206.
- D. 1000-volt supply - Voltmeter M207.
- E. Sole modulator balance - Ammeter M208.

The low voltage indicator panel is permanently mounted on a shelf in the hinged cover of the cabinet.

1-24. **SOLE MODULATOR LOAD TEST FIXTURE.** The sole modulator load test fixture is used when testing and aligning the sole modulator section of the modulator-power supply module under test. This fixture simulates the casting that normally surrounds the modulator-power supply module and provides right-angle drives for adjusting capacitors C409 and C413 during testing. A plug-in sole load simulator is also provided as part of the test fixture.

1-25. **EXTERNAL CABLES.** Seven external cables are provided with the test set. They are: 1) Two power input cables; 2) An interconnecting cable for the electrical power test set; 3) An interconnecting cable for the oscillator test set; 4) A power input cable for the Panalyzer; 5) A signal input cable for the Panalyzer; and 6) an RF cable for the input to the sole modulator. These cables are stored in an enclosed compartment in the hinged cover of the cabinet and in the drawer located just below the main shelf of the cabinet.

1-26. **PANALYZOR.** The Panalyzer (Panoramic Radio Products Model SB-8b, Type T-10,000) permits a spectrum analysis of the interference generator and sole modulator outputs. During testing (figure 1-1) the Panalyzer is mounted on a special mounting tray assembly on the lower right shelf on the hinged cover. A compartment in the lower portion of the cabinet provides storage space for the Panalyzer (figure 1-3). In this compartment the Panalyzer is mounted on a special shockmount. Refer to the Instruction Manual for Panoramic Spectrum Analyzer Model SB-8b, Type T-10,000 for complete instructions and parts breakdown.

1-27. **PANALYZOR POWER SUPPLY.** The Panalyzer power supply is specially designed to assure proper performance by supplying accurate input voltages to the Panalyzer. The Panalyzer power supply is mounted on a special mounting tray located at the rear of the cabinet. Refer to the Instruction Manual for Panoramic Spectrum Analyzer for complete instructions and parts breakdown.

1-28. **TEST SET, ELECTRICAL POWER QRC-133A(T).** The electrical power test set permits simultaneous monitoring of the voltage and current inputs to the plug-in unit test set. Monitoring is necessary to ensure required input power to the modules under test--a vital factor for significant test results. This test set is mounted on the upper right shelf of the hinged cover during testing (figure 1-1). When not being used, the electrical power test set is removed from the shelf and stored in its own case. Refer to Handbook of Instructions for Test Set, Electrical Power QRC-133A(T), HLC NO. 094-902831 for complete instructions and parts breakdown of Test Set, Electrical Power QRC-133A(T).

1-29. TEST SET, OSCILLATOR QRC-133A(T). The oscillator test set is used to monitor the high potential outputs of the power supply and the voltage regulator modules under test. Space is provided on the upper left shelf of the hinged cover for mounting the oscillator test set during testing (figure 1-1). When not in use the oscillator test set is removed from the shelf and stored in its own case. Refer to Handbook of Instructions for Test Set, Oscillator QRC-133A(T), HLC NO. 094-902863 for complete instructions and parts breakdown of Test Set, Oscillator QRC-133A(T).

1-30. TECHNICAL CHARACTERISTICS.

1-31. Table 1-1 lists the technical characteristics of Plug-in Unit Electronic Circuit Test Set.

TABLE 1-1. TECHNICAL CHARACTERISTICS.

POWER INPUT:	
AC Three-Phase:	
Voltage	115/200 volts AC, three-phase, four-wire wye, grounded neutral, 380 to 420 CPS
Current	10 amperes.
Voltage Limits	108 to 121 volts AC.
Power	2.8 KVA.
AC Single-Phase:	
Voltage	115 volts AC, single-phase, 60 CPS.
Current	15 amperes (MAX).
Voltage Limits	108 to 121 volts AC.
Power	1725 VA (MAX).
DC:	
Voltage	28 volts DC.
Current	2 amperes.
Voltage Limits	25 to 29 volts DC.
Power	6 watts.
COOLING METHODS:	
	Liquid-to-air heat exchange using DC-200 silicone oil as the coolant.
	Air-to-air motor-driven fan.
TEMPERATURE LIMITS:	
Operating	0°C to +55°C.
Non-operating	-62°C to +85°C.
WEIGHT	Approximately 950 pounds (less Test Set, Oscillator and Test Set, Electrical Power).

TABLE 1-1. TECHNICAL CHARACTERISTICS (CONT).

TESTING CAPABILITIES	Allows testing of all operating parameters of power supply, voltage regulator, modulator-power supply, and interference generator modules of Barrage Jammer QRC-133A(T) system under simulated operating conditions.
NUMBER OF ELECTRON TUBES	13
NUMBER OF RELAYS	13
NUMBER OF SILICON RECTIFIERS	135

1-32. TUBE COMPLEMENT.

1-33. Table 1-2 lists the tube complement of Plug-in Unit Electronic Circuit Test Set.

TABLE 1-2. TUBE COMPLEMENT.

Location	Reference Symbol	Tube Type	Function
Control Panel	V101	6542	150-volt reference voltage for 390-volt supply.
	V102	5787WA	100-volt reference voltage for 390-volt supply.
Interference Generator	V301	6700	Noise source.
	V302A	$\frac{1}{2}$ 5687WA	Cathode follower for noise source.
	V302B	$\frac{1}{2}$ 5687WA	Amplifier for sole noise channel.
	V303	6AH6WA	Amplifier for sole noise channel.
	V304	6AH6WA	Amplifier for sole noise channel.
	V305	6AN5WA	Amplifier for sole noise channel.
	V306	6384	Amplifier for sole noise channel.
	V307	6AH6WA	10-MCS oscillator.
	V308	5787WA	Voltage regulator tube.
	V309	6AH6WA	Amplifier for accelerating anode noise channel.
	V310	6AN5WA	Amplifier for accelerating anode noise channel.
	V311	6384	Modulator amplifier for accelerating anode noise channel.

1-34. RELAY COMPLEMENT.

1-35. Table 1-3 lists the relay complement of Plug-in Unit Electronic Circuit Test Set.

TABLE 1-3. RELAY COMPLEMENT.

Location	Reference Symbol	Contact Type	Function
Control Panel	K101	Four-pole single-throw, break contacts.	Power Relay. Relay K101 applies 115 volts AC three-phase, to the system when energized, and applies 28 volts DC to flow relay K113, to warmup relay K104 and to 150-second delay relay K105.
	K102	Double-pole, double-throw, break-make contacts.	Phase Fault Relay. When energized, relay K102 removes 28 volts DC from power relay K101, SELECTOR switch S104, warmup relay K104 150-second delay relay K105, and flow relay K113. Relay K102 energizes when a phase fault condition occurs in the 115 volt AC, three-phase input to the Variac.
	K103	Double-pole, double-throw, break-make contacts.	Reset Relay. When energized, relay K103 removes ground from phase fault relay K102, and removes 28 volts DC from low volt protect relay K107.
	K104	Double-pole, double-throw, break-make contacts.	Warmup Relay. When energized, relay K104 applies 28 volts DC to SELECTOR switch S104, and applies locking voltage to itself.
	K105	Thermal relay, single-pole, single-throw, make contacts.	150-Second Delay Relay. When energized, relay K105 requires 150 seconds to operate. When in operation, K105 applies 28 volts DC to warmup relay K104.
	K106	Double-pole, double-throw, break-make contacts.	Coolant Level Relay. When energized, relay K106 applies 28 volts DC to pushbutton switches S104B1, S104C1, and S104D1 of SELECTOR switch S104 and 115 volts AC to transformer T105 and HIGH VOLT SELECTOR switch S105B. Relay K106 also removes 28 volts DC from COOLANT LEVEL indicator DS109.
	K107	Double-pole, double-throw, break-make contacts.	Low Volt Protect Relay. When energized, relay K107: removes 28 volts DC from pushbutton switches S104B1, S104C1, and S104D1 of SELECTOR switch, S104; applies 28 volts DC to low voltage OVERLOAD indicator DS107; and applies locking ground to itself.

TABLE 1-3. RELAY COMPLEMENT (CONT).

Location	Reference Symbol	Contact Type	Function
	K108	Four-pole, single-throw, three make contacts, one break contact.	Interference Generator Relay. When energized, relay K108 removes ground from STBY indicator DS103 and applies 115 volts AC to the low voltage power supply module of the test set.
	K109	Four-pole, single-throw, three make contacts, one break contact.	Modulator-Power Supply Relay. When energized, relay K109 removes ground from STBY indicator DS103 and applies 115 volts AC to the modulator-power supply module under test.
	K110	Four-pole, single-throw, three make contacts, one break contact.	Voltage Regulator Relay. When energized, relay K110 removes ground from STBY indicator DS103 and applies 115 volts AC to the high voltage power supply module of the test set.
	K111	Four-pole, single-throw, three make contacts, one break contact.	Power Supply Relay. When energized, relay K111 removes ground from STBY indicator DS103 and applies 115 volts AC to the power supply module under test.
	K112	Double-pole, double-throw, break-make contacts.	High Voltage Relay. When energized, relay K112 applies 28 volts DC to HIGH VOLT SELECTOR switch S105A.
	K113	Double-pole, double-throw, break-make contacts.	Flow Relay. When energized, relay K113 removes ground from indicator DS110 and applies ground to indicators DS103, DS104, DS105, and DS106 and to relays K109, K110, and K111.

1-36. PRINCIPLES OF OPERATION.

1-37. The following paragraphs explain the principles of operation of the control, protection, and testing circuits of Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T). Accompanying block diagrams and partial schematics of the individual circuits further clarify the operating principles.

1-38. PRIMARY POWER.

1-39. Figure 1-4 is a schematic diagram of the primary power circuit. The test set requires three primary power sources: three phase, 380 to 420 CPS, 115/200 volts AC; single phase, 60 CPS, 115 volts AC; and 28 volts DC.

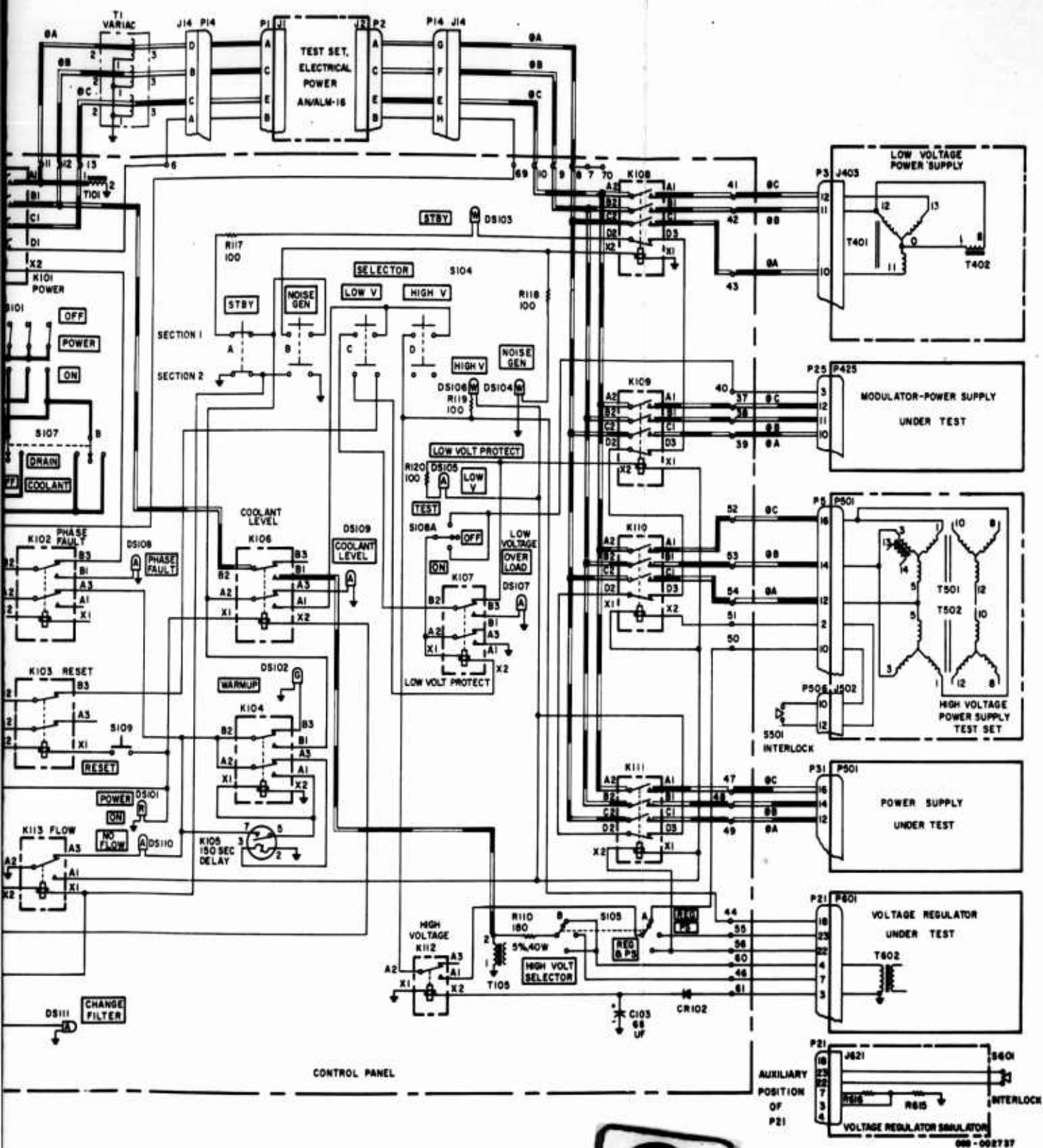


Figure 1-4. Primary Power Schematic.

1-11, 1-12

1-40. The three-phase primary power (indicated by the heavy dashed lines) is initially furnished through circuit breakers CB1, CB2, and CB3 to power relay K101. After relay K101 is energized, the three-phase AC power continues through Variac T1, connector J14, and into Test Set, Electrical Power QRC-133A(T) where the three-phase AC power is monitored. Transformer T101, connected to contact A1 of relay K101, receives phase A power for filament voltage. Connected to contact B1 of relay K101 is phase B power for sole limits transformer T105. The output from Test Set, Electrical Power QRC-133A(T) is connected to four relays (K108, K109, K110, and K111) in parallel. Three-phase power is supplied to the module associated with the energized relay.

1-41. Single-phase, 115-volt AC, 60 CPS primary power (indicated by the heavy solid lines) is furnished to the pump motor B1, fan motor B701, oil-filled test chamber drain solenoid L1, muffin fan B2, convenience outlets J20 to J23, and the constant voltage transformer T2 through circuit breakers CB5 and CB6.

1-42. The 28-volt DC primary power is furnished through circuit breaker CB4, power switch S101, closed contacts B2 and B3 of relay K102, to ground through the winding of power relay K101. The 28-volt DC power is also furnished through contacts D1 and D2 of relay K101 through Test Set, Electrical Power to relays in the control panel. A more detailed description of operation involving the 28-volt DC control circuits is given in paragraph 1-43.

1-43. SEQUENCE OF RELAY OPERATION.

1-44. Figure 1-5 is a partial schematic diagram showing the 28-volt DC energizing path for each of the relays (except phase fault relay K102) and indicators in the plug-in unit test set.

1-45. STARTING RELAY OPERATION. All the relays of the control panel of the plug-in unit test set except relays K102 and K112 receive their energizing power from the 28-volt DC primary power source. When primary power is initially connected to the test set, power from the 28-volt DC source is connected only to POWER switch S101, which is in the OFF position, and to contact D2 of relay K101, which is open. To initiate relay operation, POWER switch S101 is set to the ON position.

1-46. WARMUP CYCLE. The warmup cycle begins when POWER switch S101 is set to ON. Switch S101 is connected directly to six circuits, three of which are energized:

A. Winding of normally open power relay K101. Relay K101 is energized, and its contacts close.

B. POWER indicator DS101. Indicator DS101 lights.

C. Winding of normally open coolant level relay K106. Relay K106 is not energized unless level switch S3 is closed. (The level switch closes only if the coolant level in the test chamber is at the proper level. COOLANT switch S107 must be placed in the PUMP position to start pump motor B1 which pumps coolant into the test chamber to the proper level.)

D. CHANGE FILTER indicator DS111. Pressure switch S1 remains open under normal conditions and indicator DS111 will not light. When the oil filters become clogged, the coolant pressure differential across the filters increases, switch S1 closes, and DS111 lights.

E. Winding of normally open low volt protect relay K107. Under normal operating conditions relay K107 is not energized. The winding of relay K107 is connected through closed contacts B2 and B3 of reset relay K103 to contact A2 of K107 and to LOW VOLT PROTECT switch S108A, which, in turn, is connected to normally open relay K401 in the modulator-power supply module under test. In the event of an overload in the modulator-power supply, relay K401 energizes and provides a ground connection for the winding of relay K107. When relay K107 energizes, 28 volts is applied to low voltage OVERLOAD indicator DS107, which indicates an overload condition. The contacts of K107 close and provide a locking ground through contacts A1 and A2 of K107. Relay K107 also removes primary power to the modulator-power supply by opening the circuit to relay K109. Relay K107 remains energized even if the overload that originally energized K107 is removed, and will remain energized until RESET switch S109 is depressed.

F. Winding of reset relay K103 is energized only when RESET switch S109 is depressed. When relay K103 energizes, contacts B2 and B3 of K103 break and interrupt the circuit to relay K107. When relay K107 de-energizes, low voltage OVERLOAD indicator DS107 goes out and 28 volts DC is again applied to K109. However, if the overload condition is still present, K107 will again energize and DS107 will again light. Relay K103 is de-energized when switch S109 is released.

1-47. When relay K101 is energized (A, paragraph 1-43), contacts D2 and D1 of K101 make and connect 28-volt DC power through Test Set, Electrical Power QRC-133A(T) to two points: contact A2 of phase fault relay K102 and the winding of flow relay K113. Further connections from these two points are explained in the following paragraphs.

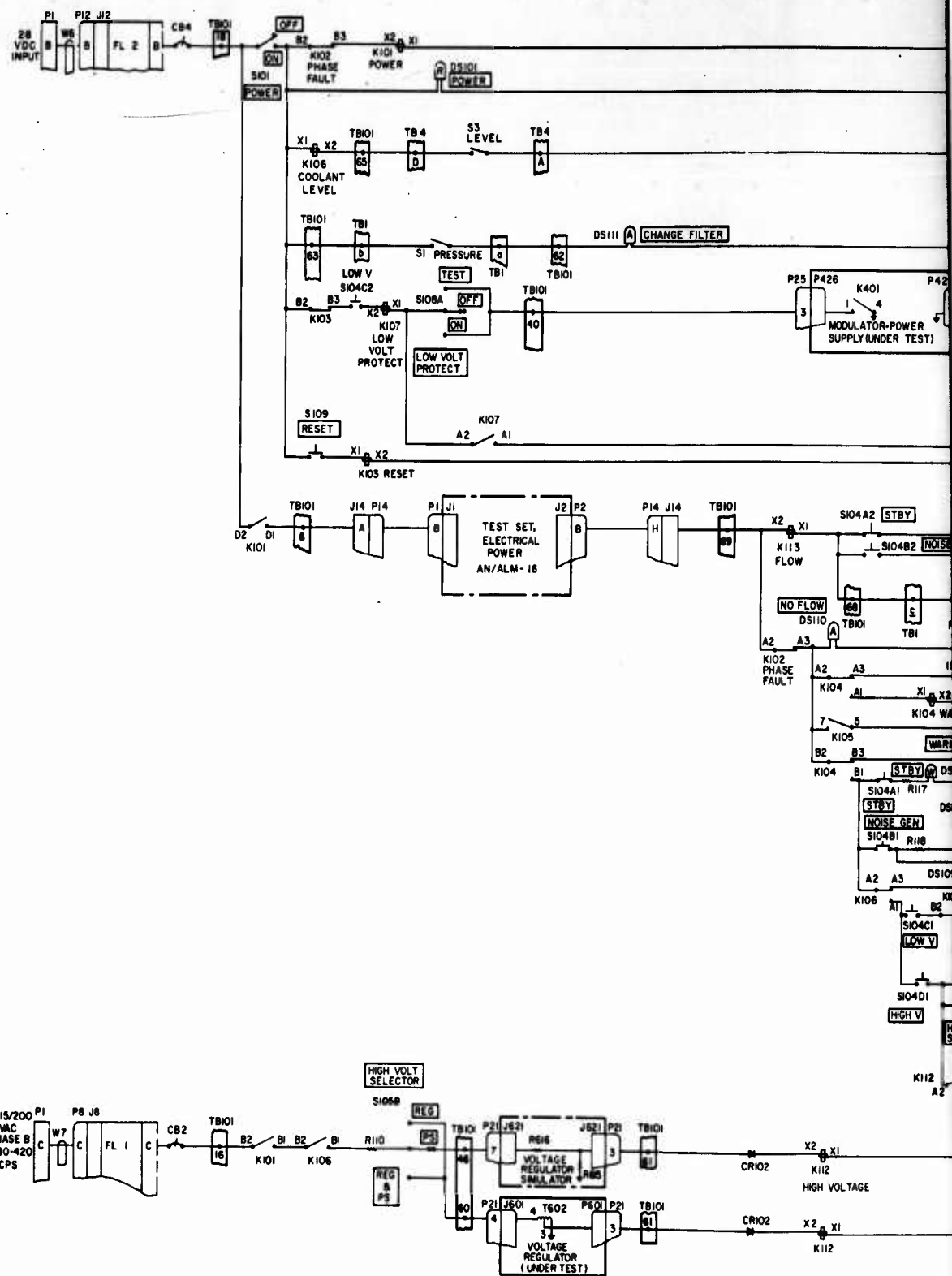
1-48. The winding of relay K113 is connected to the following three circuits:

A. STBY switch S104A2. Switch S104A2 is closed during the warmup cycle and completes the circuit to ground enabling relay K113 to energize.

B. NOISE GEN switch S104B2. Switch S104B2 is closed when testing an interference generator. With S104B2 closed, relay K113 energizes.

C. FLOW switch S2. Switch S2 closes when there is coolant flow through the system, providing a ground path for K113. If S2 remains open, relay K113 will remain de-energized unless switch S104A (STBY) or S104B (NOISE GEN) is depressed thereby bypassing S2.

1-49. Closed contacts A2 and A3 of relay K102 remain closed as long as relay K102 is not energized by a phase fault in the high voltage power supply module of the test set or in the power supply module under test (refer to paragraph 1-55 for phase fault circuit operation). Contact A3 of K102 is connected to four circuits: NO FLOW indicator DS110, 150-second delay relay K105, the winding of warmup relay K104 through terminals 7 and 5 of K105, and contact B2 of K104.



1

Figure 1-5. Schematic Diagram of Relay



1-15, 1-16

A. NO FLOW indicator DS110. Normally closed contacts A3 and A2 of relay K113 break when relay K113 is energized; therefore, with SELECTOR switch S104 in the HIGH V or LOW V position, DS110 does not light unless a no-flow condition causes flow switch S2 to open.

B. 150-second delay relay K105. Relay K105 is energized through contacts A2 and A3 of K104. After the 150-second delay, contacts A2 and A3 of relay K104 break and contacts A2 and A1 of K104 make, providing a locking path for K104.

C. Winding of relay K104. Relay K104 is first energized when terminal 7 and 5 of relay K105 make. When relay K104 energizes, the circuit to relay K105 is opened and K104 remains energized as in paragraph B above.

D. Contact B2 of relay K104 is connected to B3 during the warmup period. During this time it completes a circuit to ground through WARMUP indicator DS102. After the warmup period, relay K104 energizes and contact B2 disconnects from contact B3 and is connected to contact B1. Connections from contact B1 of K104 are explained in the following paragraphs.

1-50. Contact B1 of relay K104 is connected to STBY switch S104A1, NOISE GEN switch S104B1, and contact A2 of relay K106.

A. STBY switch S104A1. STBY switch S104A1 completes a circuit through STBY lamp DS103 and through closed relay contacts D2 and D3 of K108, D3 and D2 of K109, D3 and D2 of K110, D2 and D3 of K111, and A1 and A2 of energized relay K113.

B. NOISE GEN switch S104B1. NOISE GEN switch S104B1 is depressed when testing an interference generator module. When closed, it energizes the following two circuits:

1. NOISE GEN indicator DS104. DS104 lights.

2. Interference generator relay K108. Relay K108 furnishes three-phase, 115-volt AC primary power to the low voltage power supply module of the test set, which activates the interference generator module under test.

C. Contact A2 of coolant level relay K106 connects to either contact A3 or contact A1. Connections from A1 and A3 are explained in the following paragraphs.

1-51. When relay K106 is de-energized, contact A2 is connected to contact A3 and causes COOLANT LEVEL indicator DS109 to light.

1-52. When relay K106 energizes, contact A1 is connected to A2. Contact A1 of K106 is connected to LOW V switch S104C1 and HIGH V switch S104D1. The connections from S104C1 and S104D1 are as follows:

A. LOW V switch S104C1. LOW V switch S104C1 is depressed when testing a modulator-power supply module. When closed, 28 volts DC is applied to contact B2 of relay K107. If K107 energizes, contact B2 connects to B1 which completes a circuit to low voltage OVERLOAD indicator DS107. If K107 is not energized contact B2 connects to B3 which is connected to the following two circuits:

1. LOW V indicator DS105. DS105 lights through closed contacts A1 and A2 of K113.

2. Modulator-power supply relay K109. Relay K109 energizes through contacts A1 and A2 of K113 and furnishes three-phase, 115-volt AC primary power to the modulator-power supply module under test.

B. HIGH V switch S104D1. HIGH V switch S104D1 is depressed when testing a power supply module or a voltage regulator module. When closed it energizes the following three circuits:

1. HIGH V indicator DS106. DS106 lights through closed contacts A1 and A2 of K113.

2. Winding of relay K601 in the voltage regulator module under test. Relay K601 energizes.

3. Contact A2 of high voltage relay K112. When K112 energizes (refer to paragraph 1-53 for circuit operation of relay K112), contact A2 connects to A1 which is connected to HIGH VOLT SELECTOR switch S105A. Switch S105A may be set to either of the three following positions: REG, PS, and REG & PS.

a. In the REG position, switch S105A energizes voltage regulator relay K110 through closed contacts A1 and A2 of relay K113. The contacts of relay K110 close and provide a path for three-phase, 115-volt AC primary power to the high voltage power supply module of the test set. The high voltage power supply supplies power to the voltage regulator module under test. Interlock switch S501 prevents application of three-phase power to the high voltage power supply of the test set unless both the high voltage power supply and the voltage regulator are properly connected.

b. In the PS position, switch S105A energizes power supply relay K111 through closed contacts A1 and A2 of relay K113. The contacts of relay K111 close and provide a path for three-phase, 115-volt AC primary power to the power supply module under test. Interlock switch S601 prevents application of three-phase power to the power supply module under test unless both the power supply and the voltage regulator simulator are properly connected.

c. In the REG & PS position, switch S105A energizes power supply relay K111 through closed contacts A1 and A2 of relay K113. The contacts of relay K111 close and provide a path for three-phase, 115-volt AC primary power to the power supply module under test.

1-53. CIRCUIT OPERATION OF HIGH VOLTAGE RELAY K112.

1-54. High voltage relay K112 is energized by 115-volt AC power from phase B of the three-phase power input (figure 1-5). The current path is through contacts B2 and B1 of relay K101, B2 and B1 of relay K106, through resistor R110 to HIGH VOLT SELECTOR switch S105B. Switch S105B has the same three positions as S105A: REG, PS, and REG & PS.

A. In the REG or REG & PS position, switch S105B completes a circuit that energizes relay K112 through the primary winding of the BWO filament transformer T602 (in the voltage regulator module under test) and diode CR102.

B. In the PS position, switch S105B completes a circuit that energizes relay K112 through resistor R615 and R616 (in the voltage regulator simulator) and diode CR102.

1-55. OPERATION OF HIGH VOLTAGE PHASE FAULT CIRCUIT.

1-56. Figure 1-6 is a schematic diagram of the phase fault circuit. When a phase fault condition occurs, the voltage at the neutral points of transformers T501(A)

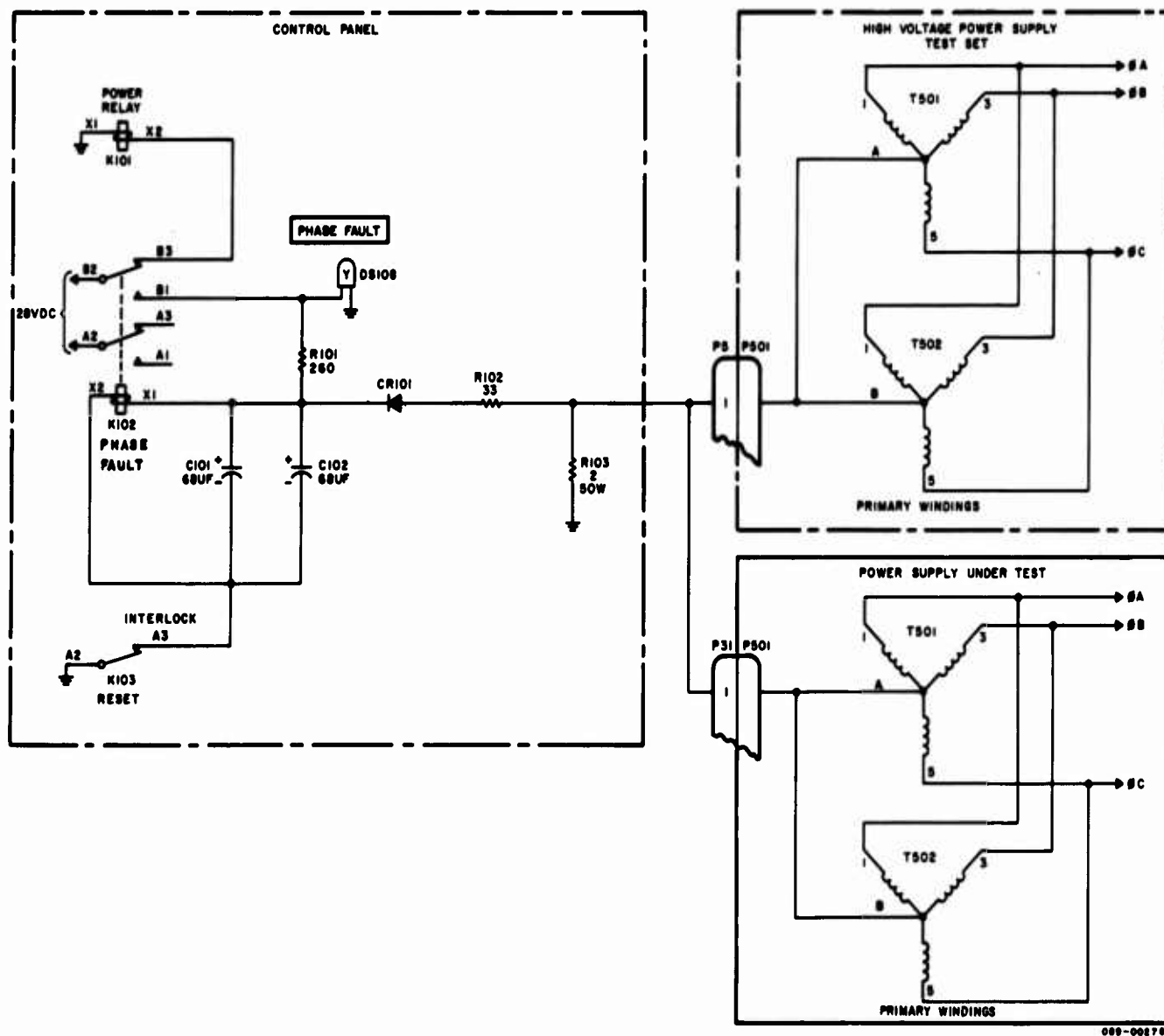


Figure 1-6. Phase Fault Circuit.

and T502(B) of either the power supply module under test or the high voltage power supply module of the test set will increase. This increase in voltage causes an increase in current through phase fault relay K102. Relay K102 energizes and removes 28 volts DC from power relay K101. When relay K102 is energized, contacts B1 and B2 close and apply 28 volts DC to PHASE FAULT indicator DS108. Diode CR101 provides rectification of the AC voltage. Capacitors C101 and C102 provide filtering of the rectified voltage. Power relay K101 is re-energized in the following manner: RESET switch S109 is depressed and energizes reset relay K103. Contacts A2 and A3 of relay K103 break and interrupt the circuit to phase fault relay K102. When K102 de-energizes, the circuit to K101 is again complete.

1-57. COOLANT FLOW SYSTEM.

1-58. Figure 1-7 is a schematic diagram of the coolant system used for cooling the power supply module, voltage regulator module, and modulator-power supply module under test, and the high voltage power supply module and voltage regulator simulator of the test set. When coolant switch S107 is placed in the PUMP position, motor B1 operates and drives the pump which circulates the liquid coolant. The coolant is drawn from the reservoir through the pump, the dual oil filters, flow switch S2, the heat exchanger coil, the oil-filled test chamber, the overflow tube, and back into the reservoir. When S107 is set to the DRAIN position, oil-filled test chamber drain solenoid L1 energizes and opens the valve, allowing a gravitational drain of coolant back into the reservoir.

1-59. A relief valve provides protection against breakdown of the coolant system. If the coolant flow is blocked or reduced, additional pressure will build up across the pump and cause the relief valve to operate; the excessive pressure will be reduced by the coolant flowing through the relief valve, preventing permanent damage to the cooling equipment.

1-60. The modules operating in the oil-filled test chamber are protected against damage from low flow rates by flow switch S2. When the coolant flow falls below 1/2 GPM, flow switch S2 opens, removing ground from relay K113, which, in turn, breaks the circuit to the relay supplying primary power to the module under test in the test chamber. NO FLOW indicator DS110 lights through the closed contacts of K113. When either the STBY or NOISE GEN pushbutton on SELECTOR switch S104 is depressed, flow switch S2 is open because the coolant system is not used when SELECTOR switch S104 is in either of these positions, however, ground is connected to relay K113 through S104 preventing the NO FLOW lamp from illuminating.

1-61. If the level of coolant in the test chamber falls below normal, level switch S3 will open and de-energize coolant level relay K106. Level switch S3 provides a ground connection for energizing coolant relay K106 when the coolant in the test chamber is at the proper level. The closed contacts of relay K106, in turn, complete the path for the primary power relay to the module under test in the test chamber. With S3 open, coolant level relay K106 is de-energized, its contacts interrupt the circuit to the primary power relay and complete the circuit to light COOLANT LEVEL lamp DS109. The overflow tube, located in the test chamber, maintains a specific height of liquid coolant. The liquid coolant reaches a height of approximately 7-3/4 inches in the test chamber. This is the approximate height of the overflow tube. The overflow tube maintains the coolant at this level since if the level rose higher the excess fluid would drain into the reservoir through the tube.

1-62. An indication of the condition of the oil filters is also provided in the system. If the filters become excessively dirty, pressure differential switch S1 will close and apply 28 volts DC to light CHANGE FILTER indicator DS111.

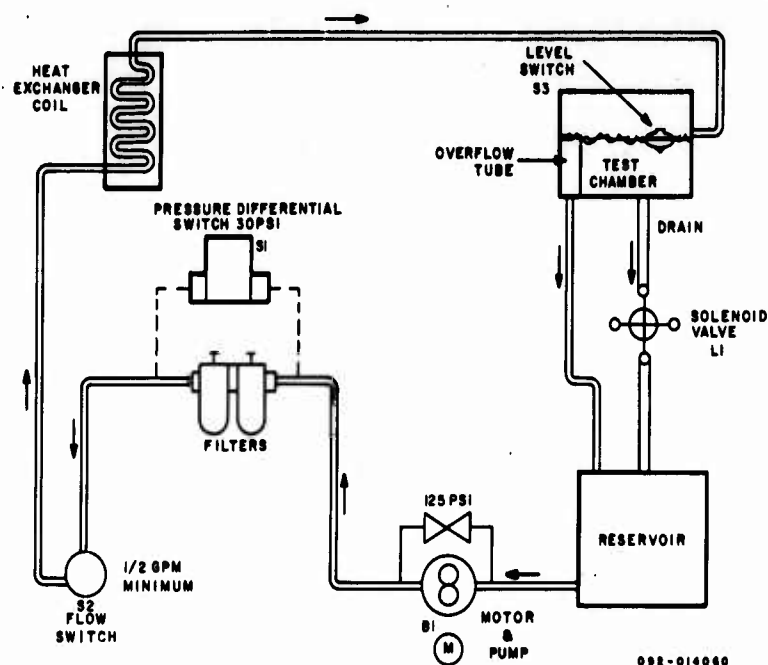


Figure 1-7. Schematic Diagram of Coolant Flow System.

1-63. CONTROL CIRCUITS.

1-64. The following paragraphs explain the circuits that control the application of power to the modules under test. Figure 1-5 illustrates the 28-volt DC path for energizing the relays (K108, K109, K110, and K111) that control the input power.

1-65. CONTROL CIRCUIT FOR MODULATOR-POWER SUPPLY. Modulator-power supply relay K109 controls the application of three-phase, 115-volt AC primary power to the modulator-power supply module under test. The 28-volt DC path for energizing relay K109 is as follows:

- A. Through contacts D2 and D1 of power relay K101, which is energized when POWER switch S101 is placed in the ON position.
- B. Through contacts A2 and A3 of phase fault relay K102.
- C. Through contacts B2 and B1 of warmup relay K104, which energizes when level switch S3 closes.
- D. Through contacts A2 and A1 of coolant level relay K106, which energizes when level switch S3 closes.
- E. Through LOW V switch S104C1, which is closed when testing this module.

F. Through contacts B2 and B3 of low volt protect relay K107.

G. Through the winding of relay K109 to closed contacts A1 and A2 of flow relay K113 to ground. Relay K113 energize when flow switch S2 closes.

1-66. An AC filament voltage for the tubes in the modulator-power supply module under test is supplied by transformer T101 located in the control panel.

1-67. CONTROL CIRCUIT FOR INTERFERENCE GENERATOR. Interference generator relay K108 controls the application of three-phase, 115-volt AC primary power to the low voltage power supply module of the test set. The low voltage power supply module supplies DC input power to the interference generator module under test. The 28-volt DC path for energizing relay K108 is the same as explained in A, B, and C of paragraph 1-65 with the following additions:

A. Through NOISE GEN switch S104B1 which is closed when testing this module.

B. Through the winding of relay K108 to ground.

1-68. An AC filament voltage for the tubes in the interference generator module under test is supplied by transformer T101 located in the control panel. A filament voltage interlock requires a connection between P201 and J11 before filament voltage is supplied to the interference generator.

1-69. CONTROL CIRCUIT FOR POWER SUPPLY. Power supply relay K111 controls the application of three-phase, 115-volt AC primary power to the power supply module under test. The 28-volt DC path for energizing relay K111 is the same as explained in A, B, C, and D of paragraph 1-65 with the following additions:

A. Through HIGH V switch S104D1, which is closed when testing this module.

B. Through contacts A2 and A1 of high voltage relay K112, which is energized as explained in paragraph 1-53.

C. Through HIGH VOLT SELECTOR switch S105A, which is placed in the PS position when testing this module.

D. Through interlock switch S601, which closes when a proper connection is made between the power supply and the voltage regulator simulator.

E. Through the winding of relay K111 to closed contacts A1 and A2 of flow relay K113 to ground. Relay K113 energizes when flow switch S2 closes.

1-70. CONTROL CIRCUIT FOR VOLTAGE REGULATOR. Voltage regulator relay K110 controls the application of three-phase, 115-volt AC primary power to the high voltage power supply module of the test set. The high voltage power supply module supplies DC input power to the voltage regulator module under test. The 28-volt DC path for energizing relay K110 is the same as explained in A, B, C, and D of paragraph 1-65 and A and B of paragraph 1-69 with the following additions:

A. Through HIGH VOLT SELECTOR switch S105A, which is placed in the REG position when testing this module.

B. Through interlock switch S501, which closes when a proper connection is made between the high voltage power supply and the voltage regulator.

C. Through the winding of relay K110 to closed contacts A1 and A2 of flow relay K113 to ground. Relay K113 energizes when flow switch S2 closes.

1-71. An AC filament voltage for the tubes in the voltage regulator module under test is supplied from phase C of the input voltage.

1-72. CONTROL CIRCUIT FOR POWER SUPPLY AND VOLTAGE REGULATOR. Power Supply relay K111 controls the application of three-phase, 115-volt AC primary power to the power supply module under test, which supplies DC voltage to the voltage regulator module under test. The 28-volt DC path for energizing relay K111 when testing both a power supply module and a voltage regulator module is the same as explained in A, B, C, and D of paragraph 1-65 and A and B of paragraph 1-69 with the following additions:

A. Through HIGH VOLT SELECTOR switch S105A, which is placed in the REG & PS position when testing a power supply module and voltage regulator module.

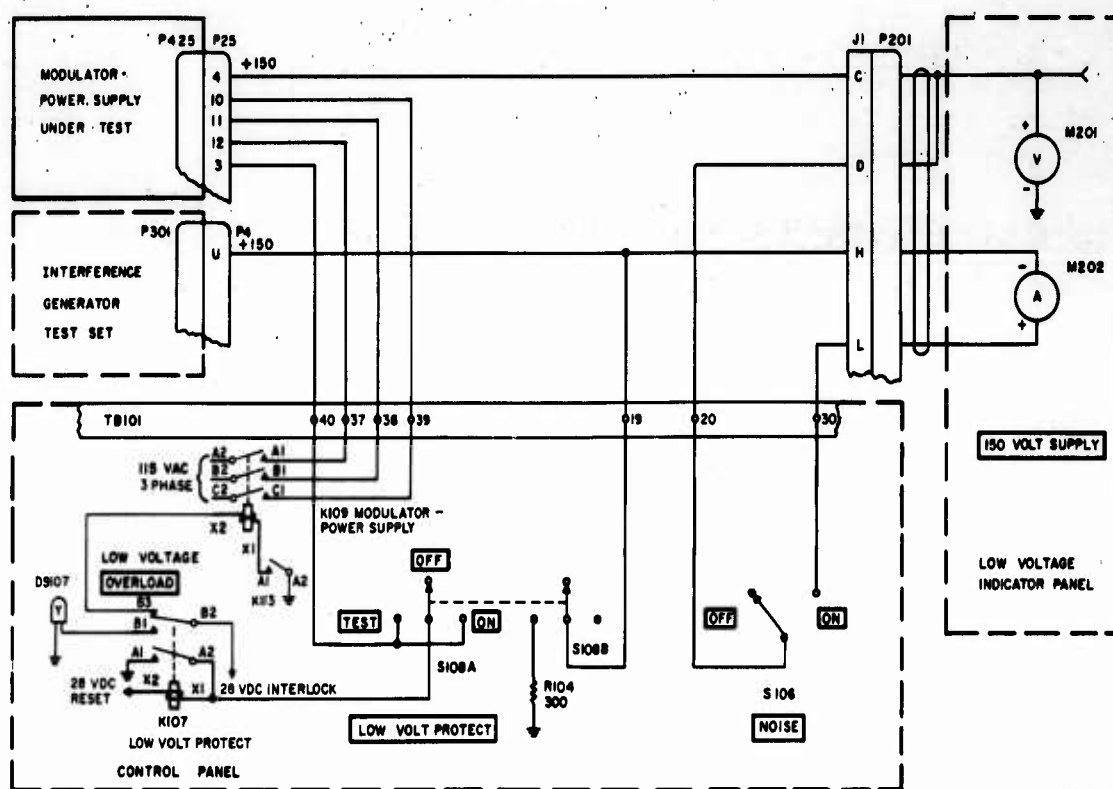
B. Through the winding of relay K111 to closed contacts A1 and A2 of flow relay K113 to ground. Relay K113 energizes when flow switch S2 closes.

1-73. An AC filament voltage for the tubes in the voltage regulator module under test is supplied from phase C of the input voltage.

1-74. MODULATOR-POWER SUPPLY TESTS.

1-75. The following paragraphs describe the individual tests performed on the modulator-power supply module under test.

1-76. 150-VOLT DC POWER SUPPLY AND LOW-VOLTAGE PROTECTION TEST. Figure 1-8 is a simplified schematic diagram of the circuit used for testing the 150-volt DC power supply and overload relay K401 of the modulator-power supply module under test. Meter M201, located on the low voltage indicator panel, is a DC voltmeter connected directly across the 150-volt DC power supply. When the power supply is operating normally, meter M201 will indicate 150 volts DC. Meter M202, of the low voltage indicator panel, is an ammeter that is connected in series with the 150-volt DC power supply and indicates the total current supplied by the power supply. When NOISE switch S106 is placed in the ON position, current flows from the modulator-power supply to meter M202 to the interference generator module of the test set and back to the modulator-power supply. LOW VOLT PROTECT switch S108 allows a test of overload relay K401. When S108 is placed in the TEST position, resistor R104 is connected across the 150-volt DC power supply, causing an overload condition. Relay K401 is caused to operate by the overload condition and operates low volt protect relay K107 located in the control panel by applying a ground through switch S108. Relay K107 receives 28 volts DC from contact B3 of reset relay K103. When K107 operates, it locks itself to ground through its own contacts. Relay K107 removes primary power by opening the circuit to relay K109, and lights low voltage OVERLOAD indicator DS107. Primary power is restored by setting S108 to the ON or OFF position and depressing RESET button S109. When S108 is in the ON position, resistor R104 is removed from the circuit; however, relay K107 still protects against



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Figure 1-8. 150-Volt Power Supply Test Circuit, Modulator-Power Supply.

an overload because of the common connection between the TEST terminal and the ON terminal of switch S108A.

1-77. 390-VOLT DC POWER SUPPLY TEST. Figure 1-9 is a simplified schematic diagram of the circuit used for testing the 390-volt DC power supply of the modulator-power supply module under test. Meter M203, on the low voltage indicator panel, is a DC voltmeter connected across the 390-volt DC supply. Meter M203 measures the total voltage from the negative side of the supply to ground. Meter M204, on the low voltage indicator panel, is a DC milliammeter in series with the supply. Meter M204 measures the load current of the 390-volt DC supply. Two voltage regulator tubes, V101 and V102, simulate the action of the frequency control module of the Barrage Jammer QRC-133A(T) system by regulating the voltage input to the interference generator of the test set at a constant -250 volts. Approximately 140 volts are dropped across M204 and resistor R201. Resistor R202 is a load resistor.

1-78. 400-VOLT DC POWER SUPPLY TEST. Figure 1-10 is a simplified schematic diagram of the circuit used for testing the 400-volt DC power supply of the modulator-power supply module under test. Setting 400 V supply switch S102 in the REG SCR N position enables meter M205 on the low voltage indicator panel, to measure the screen supply voltage for series regulator tube V101. Placing switch S102 in the NOISE SUP position completes the circuit for monitoring the voltage supplies to the interference generator module of the test set. Current flows from the 400-volt DC power supply through the 0.3-ampere fuse F102, through meter M206 on the low voltage indicator panel, and into the interference generator. The DC voltage is monitored by meter M205. Note that current meter M206 monitors the current supplied to the interference generator regardless of the position of switch S102.

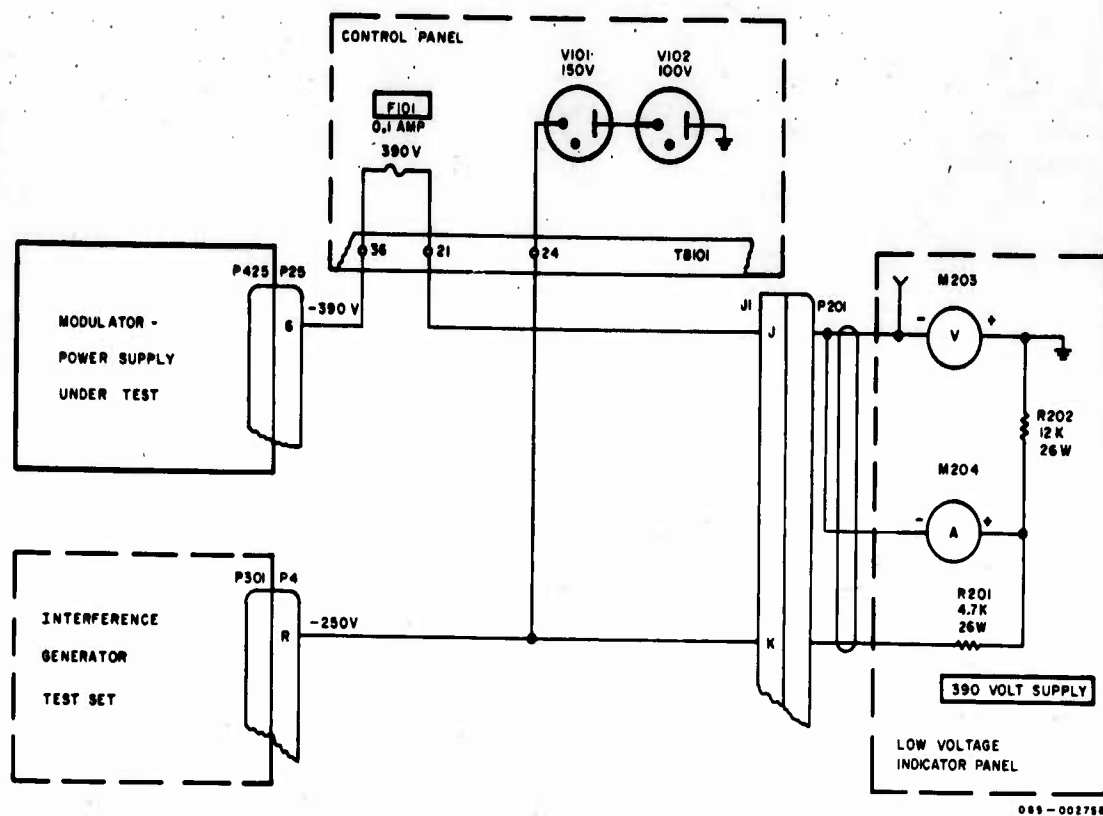


Figure 1-9. 390-Volt Power Supply Test Circuit, Modulator-Power Supply.

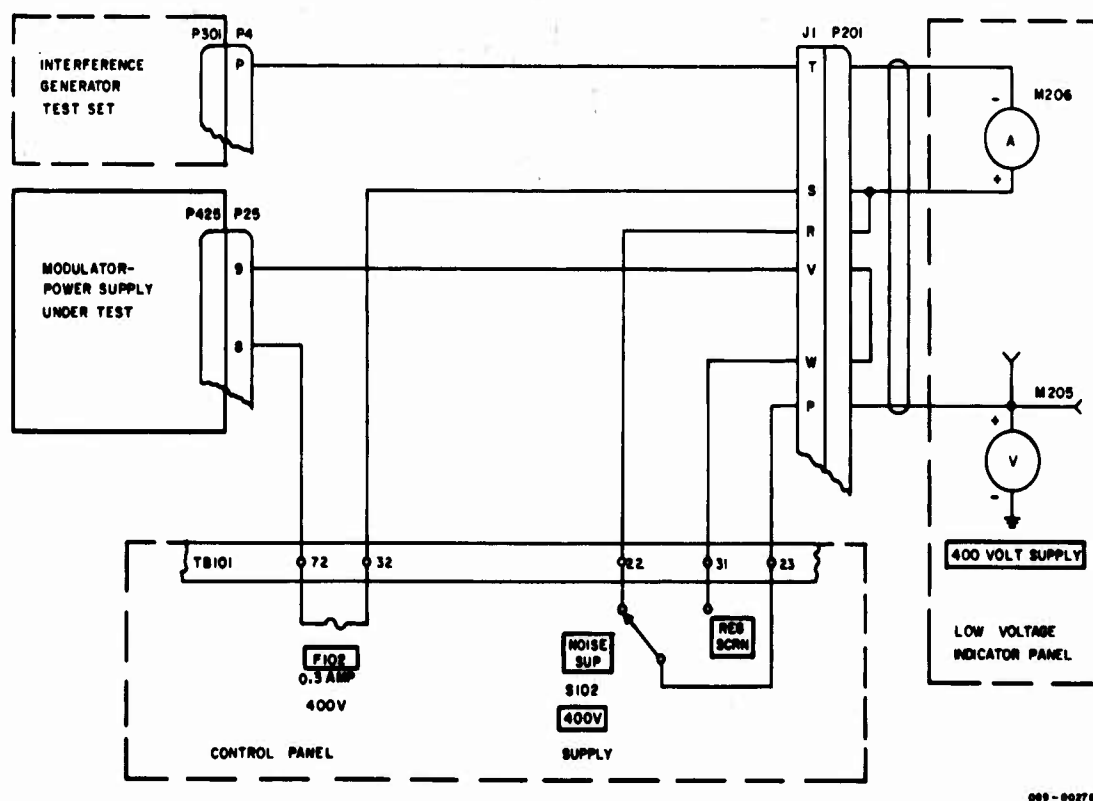


Figure 1-10. 400-Volt Power Supply Test Circuit, Modulator-Power Supply.

1-79. 1000-VOLT DC POWER SUPPLY TEST. Meter M207 on the low voltage indicator panel, is a voltmeter calibrated from 0 to 2000 volts in 50-volt increments. Resistors R401 through R403 (located in the modulator-power supply module under test) provide a voltage divider for the 1000-volt DC power supply. One-tenth of the 1000 volts, or 100 volts, appears across resistor R403. The 100 volts is connected through pin 5 of connector P25 and pin U of receptacle J1 to the low voltage indicator panel and is monitored by meter M207.

1-80. SOLE MODULATOR BALANCE TEST. Figure 1-11 is a simplified schematic diagram of the circuit used for monitoring the current through sole modulator tubes V401 and V402 of the modulator-power supply module under test. When SOLE MOD BALANCE switch S103 is placed in the V401 position, meter M208 on the low voltage indicator panel,

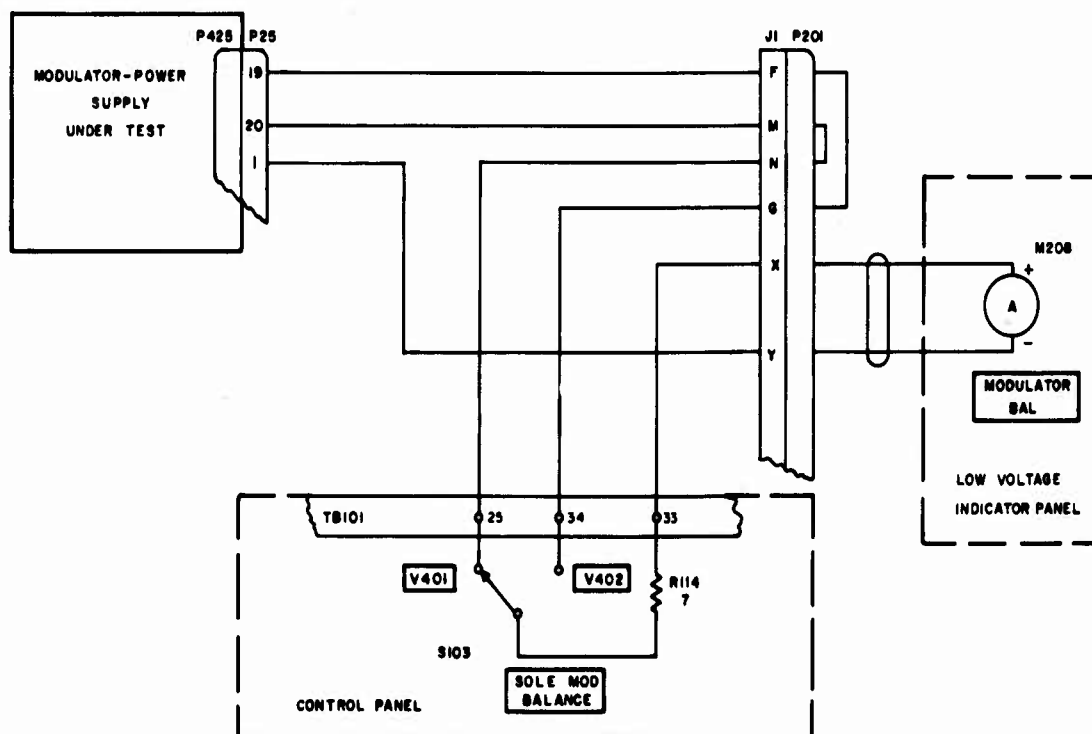
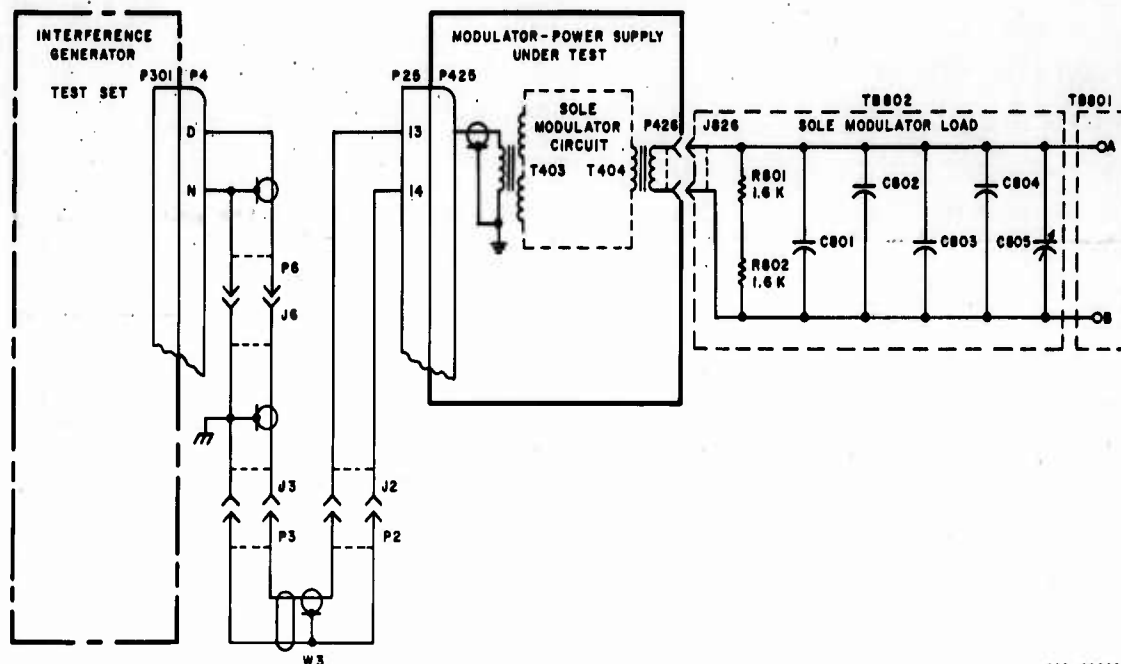


Figure 1-11. Sole Modulator Balance Test Circuit, Modulator-Power Supply.

is connected across the cathode circuit of V401 through pin 20 of connector P25. Meter M208 is calibrated to measure the total plate current through V401. When SOLE MOD BALANCE switch is placed in the V402 position, meter M208 is placed across the cathode circuit of V402 through pin 19 of P25. Meter M208 now indicates the total plate current through V402.

1-81. SOLE MODULATOR NOISE TEST. Figure 1-12 is a simplified schematic diagram of the circuit used for testing the noise signal output from the sole modulator section of the modulator-power supply module under test. A noise signal of known characteristics is generated in the interference generator of the test set. This signal is fed to the input of the sole modulator circuit through cable W3 and associated connectors. The output of the sole modulator circuit is fed through output receptacle P426 to the sole modulator load. The sole modulator load is a capacitive, resistive



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Figure 1-12. Sole Modulator Noise Output Test Circuit, Modulator-Power Supply.

load that simulates the loading effect of the BWO sole circuit. It is part of the sole modulator test fixture. The sole modulator test fixture has the functions of providing the proper environment for the sole modulator and permitting operational adjustments of capacitors C409 and C413 of the sole modulator. The output developed across the load is used as the input to the oscilloscope. Refer to figure 1-13 for the noise signal test setup.

1-82. **BANDWIDTH TEST.** The **BANDWIDTH** control R109 simulates the control function of the RF **BANDWIDTH** control on the control-indicator of the Barrage Jammer QRC-133A (T) system. This control is used when testing either a modulator-power supply module or an interference generator module and allows checking the response of either module to a change in the setting of the **BANDWIDTH** control. When the **BANDWIDTH** control is changed, the grid bias on two amplifier stages (V303 and V304) in the sole noise channel changes accordingly. A change in the grid bias affects the output of the sole noise channel. This output may be observed on the oscilloscope and on the Panalyzer. Figure 1-13 illustrates the test setup for observing this output. The change in output is observed as a change in amplitude. Rotating R109 clockwise increases the amplitude, counterclockwise decreases amplitude. Figure 1-14 illustrates the bandwidth control circuit when a modulator-power supply module is under test. When an interference generator module is being tested, the bandwidth control circuit is similar to the circuit shown in figure 1-14. Figure 1-12 shows the circuit for checking the sole noise channel output of the modulator-power supply module under test. The output is taken from test points A and B of the sole modulator load. Figure 1-19 shows the circuit for checking the sole noise channel output of the interference generator module under test. The output is taken from the SOLE connector J117.

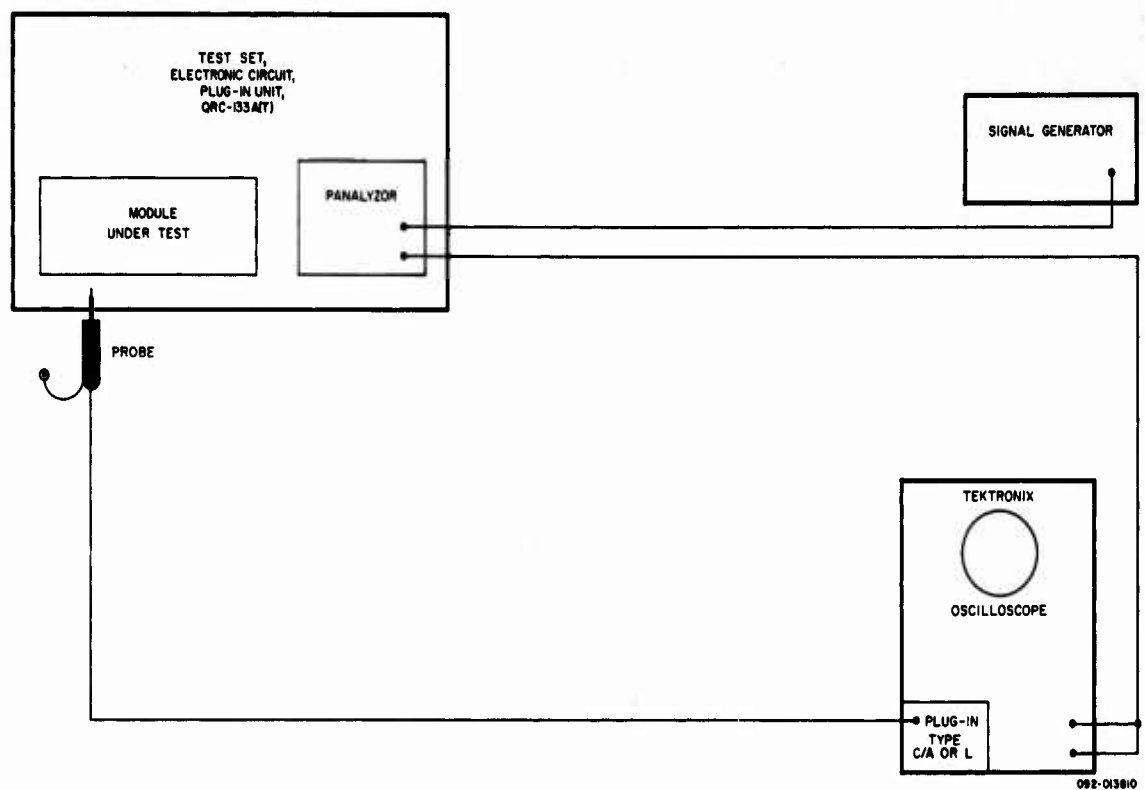


Figure 1-13. Sole and Accelerator Noise Signal Test Setup.

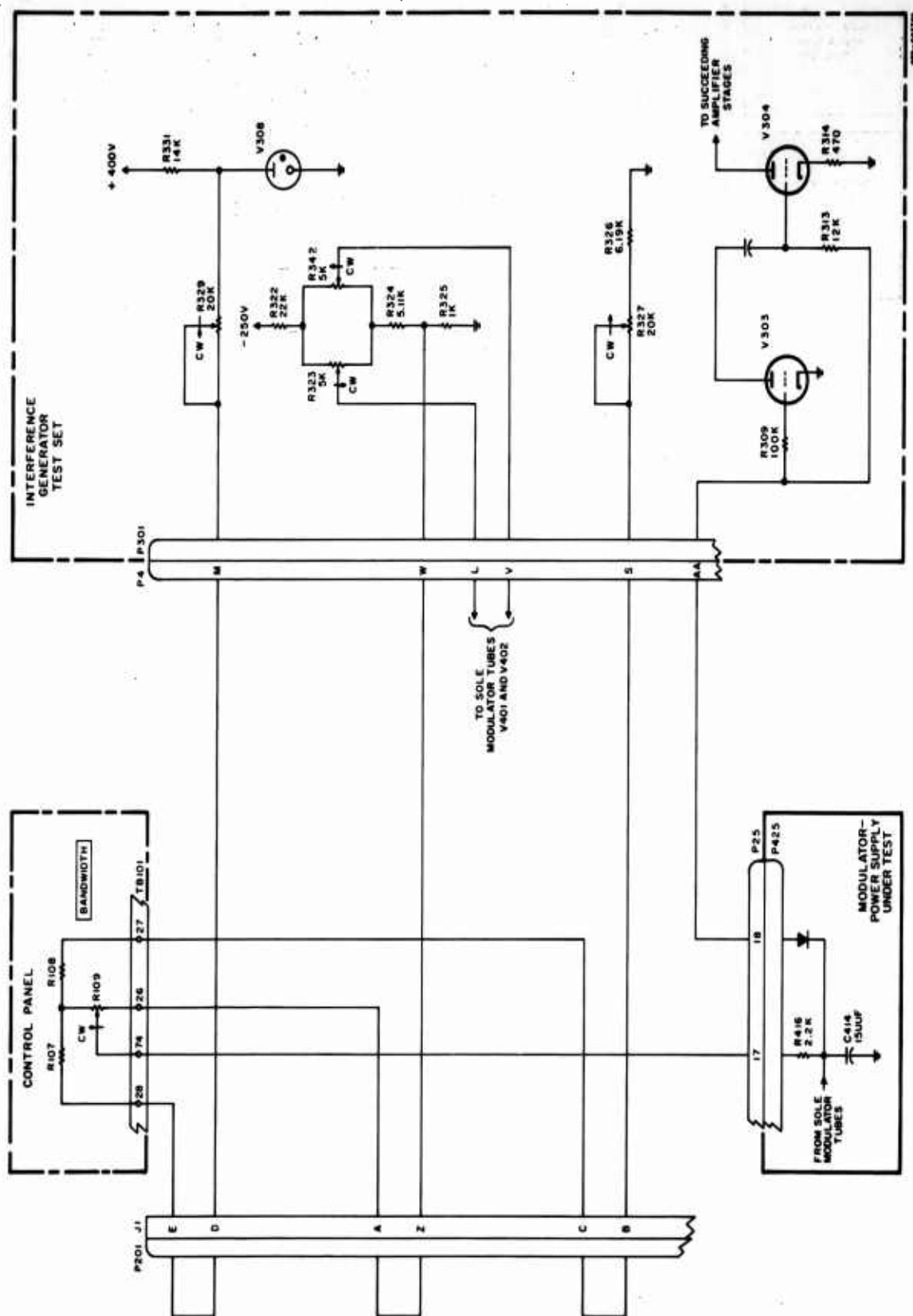


Figure 1-14. Bandwidth Test Control Circuit.

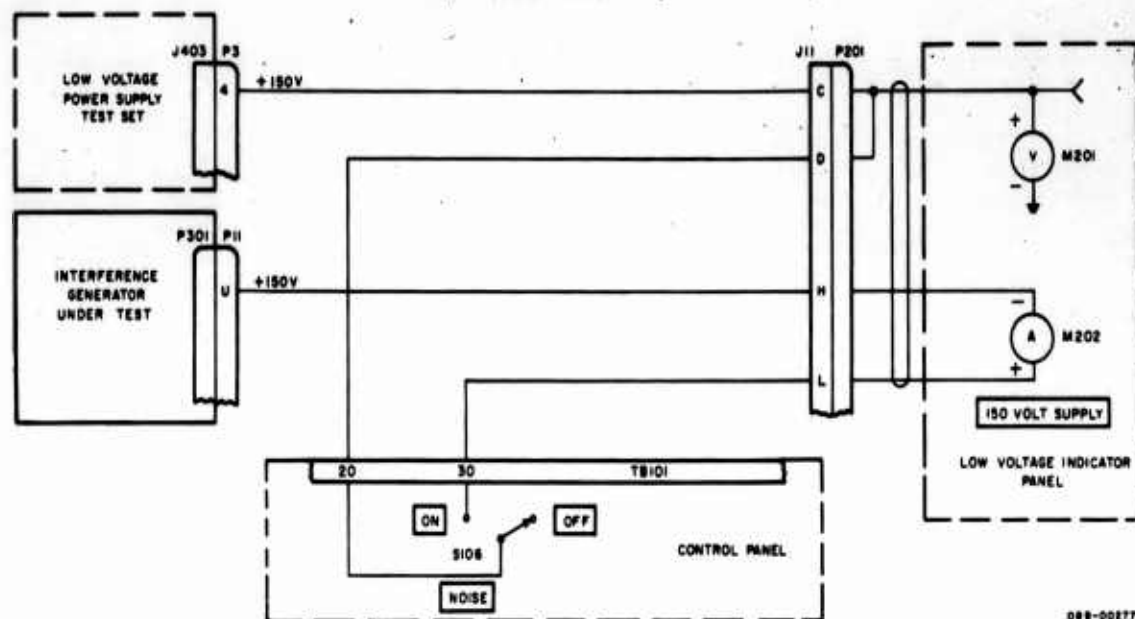


Figure 1-15. 150-Volt Power Supply Test Circuit, Interference Generator.

1-83. INTERFERENCE GENERATOR TESTS.

1-84. The following paragraphs are descriptions of the tests performed on the interference generator module under test.

1-85. 150-VOLT DC POWER SUPPLY TEST. Figure 1-15 is a simplified schematic of the circuit used for testing the voltage and current of the 150-volt DC power supply input to the interference generator module under test. Meter M201, a DC voltmeter located in the low voltage indicator panel, measures the voltage input to the interference generator module under test. When placed in the ON position, NOISE switch S106 allows monitoring the current of the 150-volt DC power supply through milliammeter M202 of the low voltage indicator panel.

1-86. 390-VOLT DC POWER SUPPLY TEST. Figure 1-16 is a simplified schematic diagram of the circuit used for testing the 390-volt DC input to the interference generator module under test. Meter M203 of the low voltage indicator panel is a DC voltmeter connected across the 390-volt supply. This meter measures the voltage from the negative side of the supply to ground. Meter M204 of the low voltage indicator panel is a DC milliammeter in series with the supply and measures the load current of the 390-volt supply. Two voltage regulator tubes, V101 and V102, simulate the action of the frequency control module of the Barrage Jammer QRC-133A(T) system by regulating the voltage input to the interference generator module under test at a constant -250 volts. R202 is a load resistor. R201 is a voltage dropping resistor that drops the voltage from -390 volts DC to -250 volts DC.

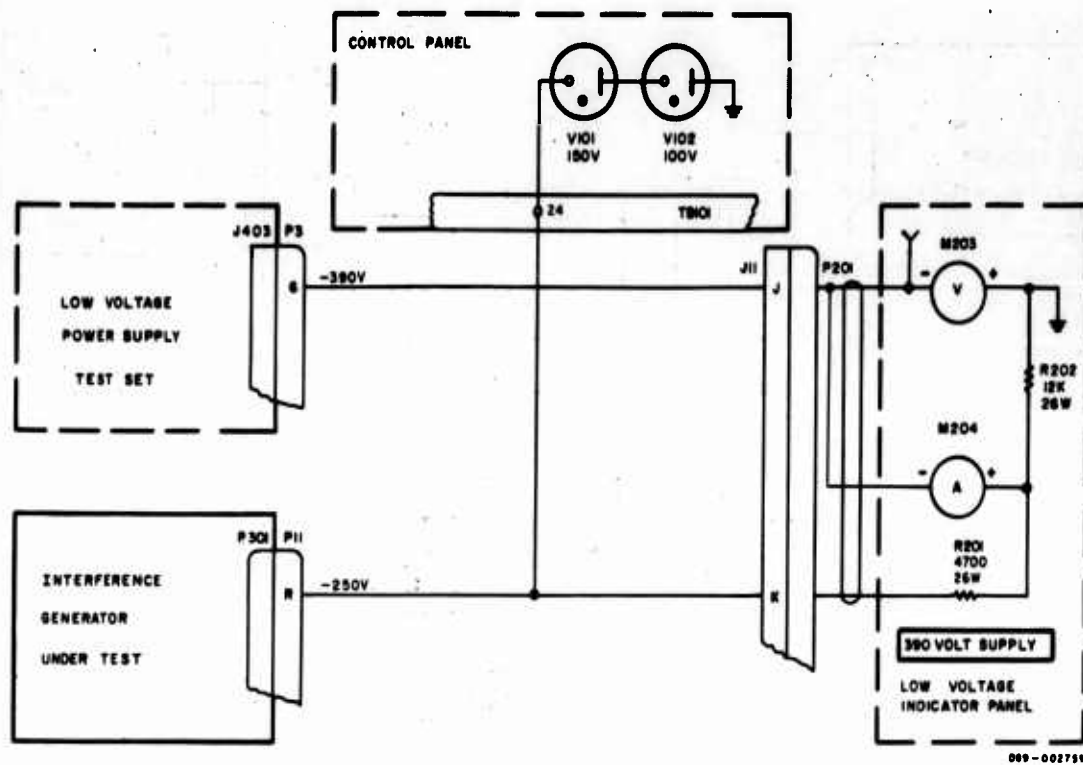


Figure 1-16. 390-Volt Power Supply Test Circuit, Interference Generator.

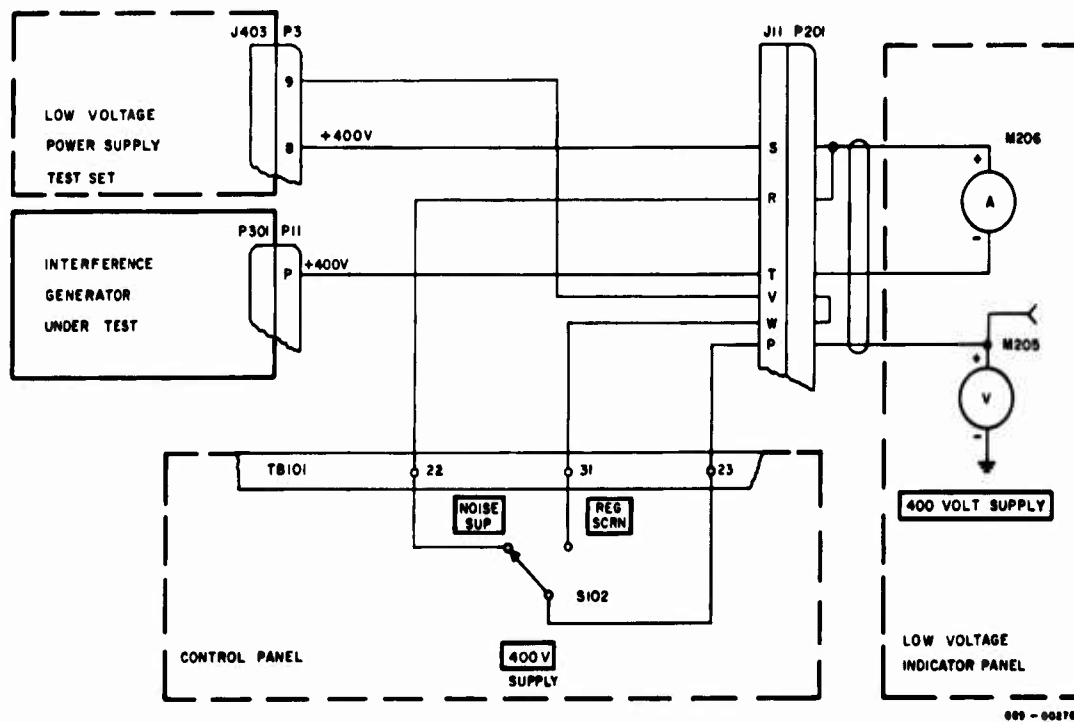
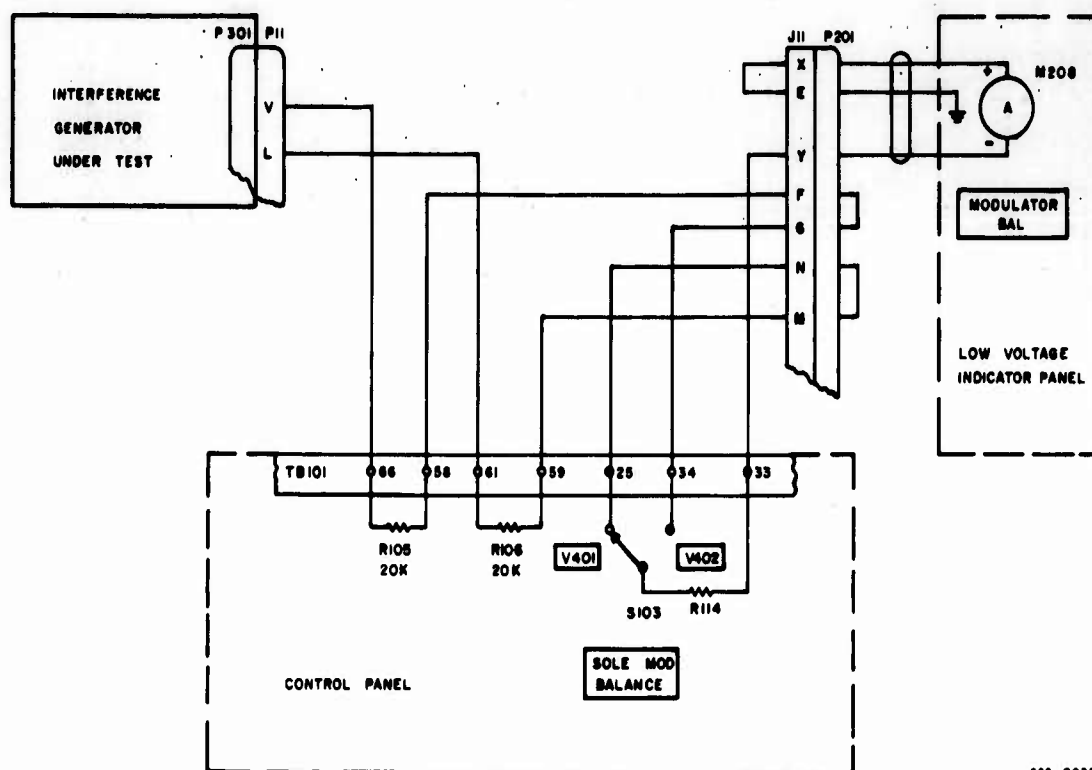


Figure 1-17. 400-Volt Power Supply Test Circuit, Interference Generator.



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Figure 1-18. Sole Modulator Bias Range Test Circuit.

1-87. 400-VOLT DC POWER SUPPLY TEST. Figure 1-17 is a simplified schematic of the circuit used for monitoring the voltage and current of the 400-volt DC power supply input to the interference generator module under test. Milliammeter M206 of the low voltage indicator panel is in series with the power supply and measures the total input current to the interference generator. Placing the 400 V supply switch S102 in the NOISE SUP position allows measuring the voltage input to the interference generator module with voltmeter M205 of the low voltage indicator panel. Placing S102 in the REG SCRN position allows measuring the screen supply voltage to the series regulator tube V101 with meter M205.

1-88. SOLE MODULATOR BIAS RANGE TEST. Figure 1-18 is a simplified schematic diagram of the circuit used for checking potentiometers R323 and R342, the bias controls of sole modulator tubes V401 and V402 respectively. SOLE MOD BALANCE switch S103 selects either of the bias controls for checking. When S103 is placed in the V401 position, meter M208 of the low voltage indicator panel is connected to the sole bias adjustment potentiometer R323 of the interference generator module under test and indicates the bias range. When S103 is placed in the V402 position, the same condition exists except that bias potentiometer R342 of the interference generator is switched into the circuit. Resistors R105 and R106 are voltage-dropping resistors that center the bias range indications.

1-89. SPECTRUM ANALYSIS OF NOISE SIGNALS. Figure 1-19 is a simplified schematic diagram of the circuit used for testing and aligning the sole noise output of the interference generator module under test. The signal is fed through a low capacity

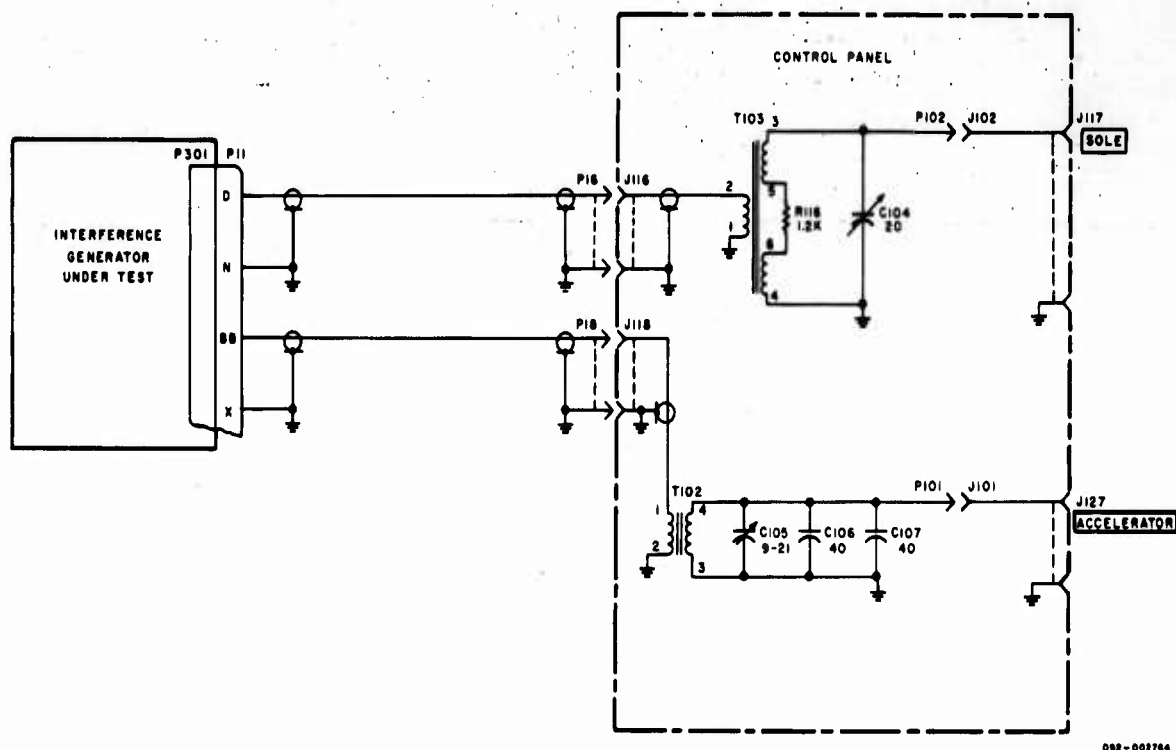


Figure 1-19. Sole and Accelerator Noise Output Test Circuit.

cable to the primary of transformer T103, the sole modulator input transformer. Resistor R116, capacitor C104, and the distributed circuit capacity simulate the loading effect of modulator tubes V401 and V402. Similarly the accelerator noise output is fed through a low capacity cable to the primary of T102, the accelerator modulator transformer. The output of the sole load is available at J117 and the output of the accelerator load is available at J127. See figure 1-13 for the noise signal test setup. The interference generator is mounted so that the underside of the chassis is available for intermediate noise checks in either the sole or accelerator noise channels.

1-90. POWER SUPPLY AND VOLTAGE REGULATOR TESTS.

1-91. The following paragraphs describe the tests performed on the power supply and voltage regulator modules. Figure 1-20 illustrates two alternative high voltage test set-up configurations. Configuration A is used when testing a voltage regulator module. Configuration B is used when testing a power supply and voltage regulator module. These descriptions are true for the alternative configurations where noted.

1-92. ANODE SUPPLY VOLTAGE AND CURRENT TEST. Figure 1-21 is a simplified schematic diagram of the circuit for testing the anode power supply voltage and current. ANODE SUPPLY VOLTS meter M3 of the Test Set, Oscillator QRC-133A(T) is placed across

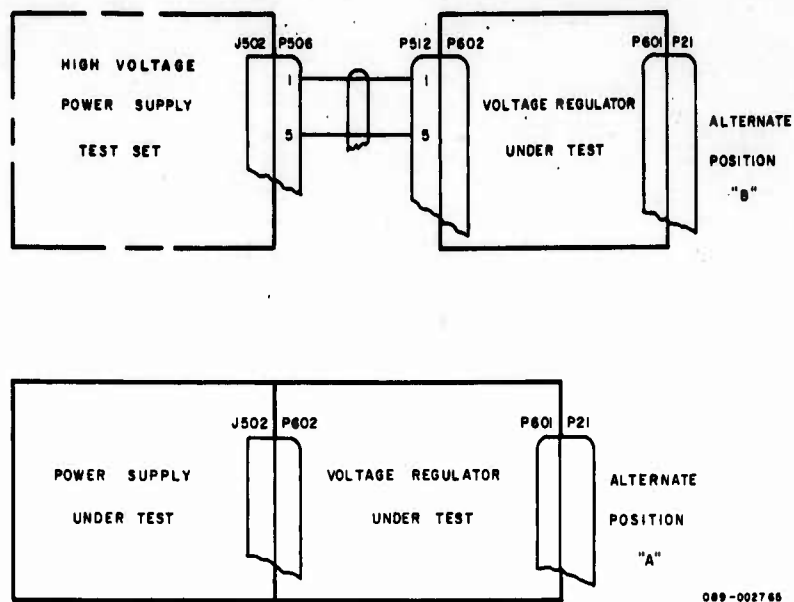


Figure 1-20. Alternative High Voltage Test Setups.

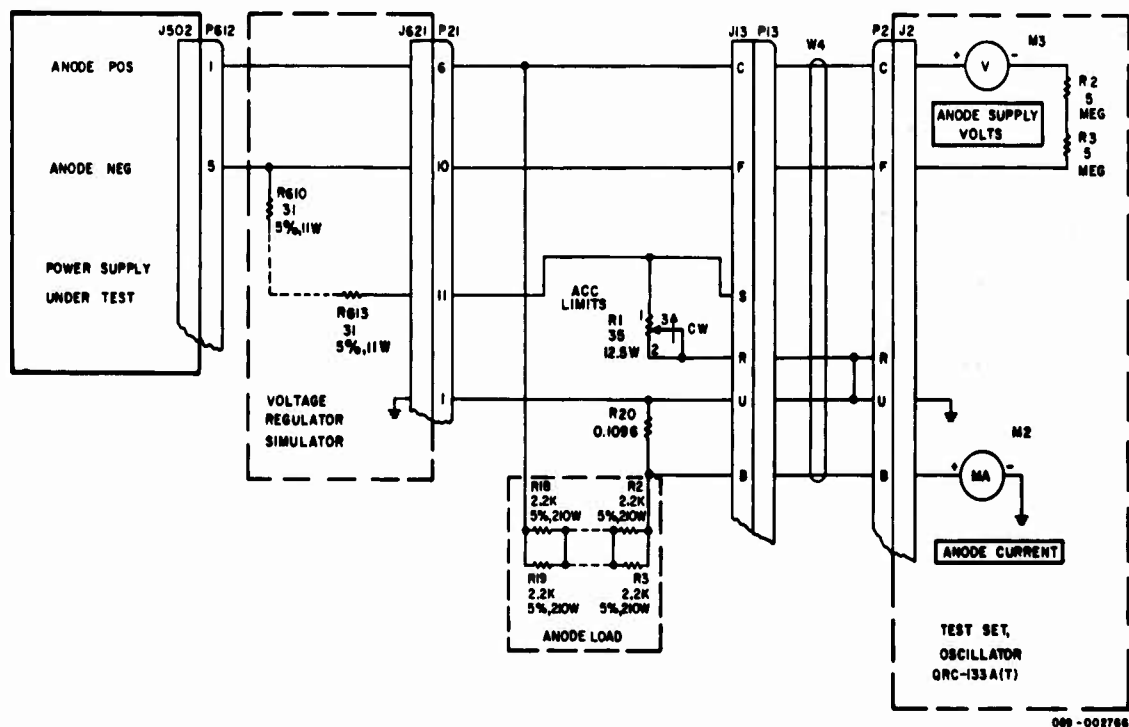


Figure 1-21. Anode Supply Voltage and Current Test Circuit.

the power supply and measures the total anode power supply output voltage. ANODE CURRENT meter M2 of Test Set, Oscillator is a DC milliammeter calibrated to measure the current of the anode power supply through the anode load resistors R2 to R19. Resistor R20 acts as a shunt resistor for meter M2. This same test is made when testing a power supply module, a voltage regulator module, or a power supply module and a voltage regulator module (see figure 1-20).

1-93. ACCELERATOR SUPPLY VOLTAGE TEST. Figure 1-22 is a simplified schematic diagram of the circuit used for measuring the voltage supplied by the accelerator power supply. ACCEL SUPPLY VOLTS meter M11 of Test Set, Oscillator QRC-133A(T) is connected directly across the accelerator voltage output and measures the total DC voltage output of the accelerator power supply. The same test is made when testing a power supply module, a voltage regulator module, or a power supply module and a voltage regulator module (see figure 1-20).

1-94. ACCELERATOR VOLTAGE AND CURRENT TEST. Figure 1-23 is a simplified schematic diagram of the circuit used for testing the accelerator voltage and current. ACCELERATOR VOLTS meter M9 is a DC voltmeter, located in Test Set, Oscillator QRC-133A(T), that measures the DC voltage supplied by the accelerator power supply to the simulated accelerator load R22, R23, and R24. ACCELERATOR CURRENT meter M10 is a DC ammeter connected in series with the simulated accelerator load. It is calibrated to measure the accelerator load current. The same test is made when testing a power supply module, a voltage regulator module, or a power supply module with a voltage regulator module (see figure 1-20).

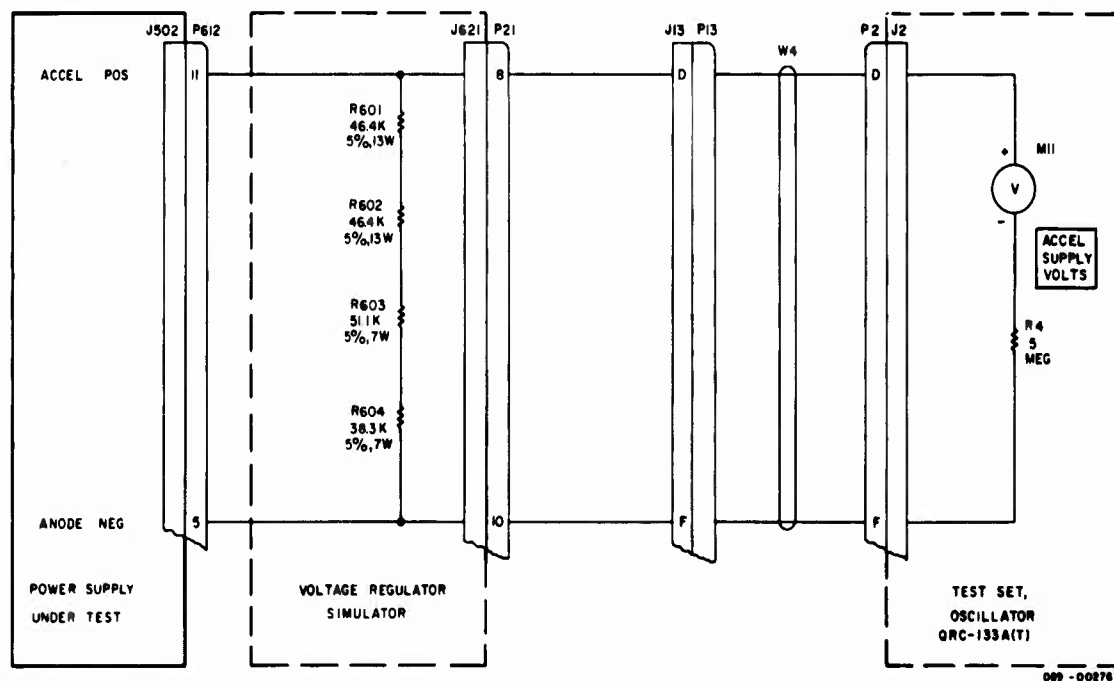


Figure 1-22. Accelerator Supply Voltage Test Circuit.

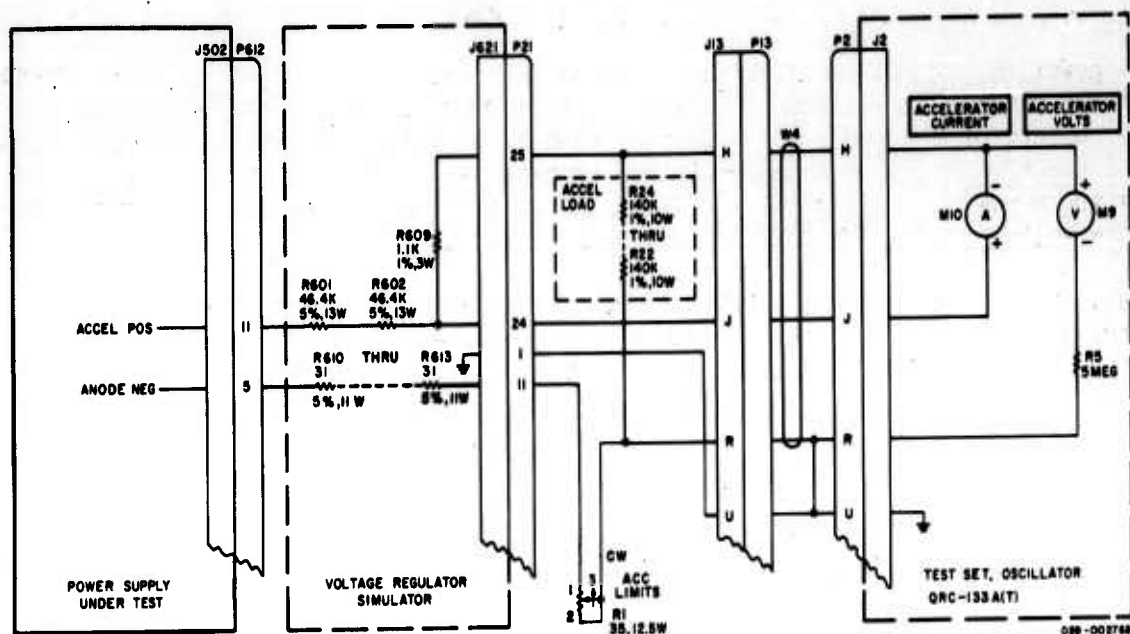


Figure 1-23. Accelerator Voltage and Current Test Circuit.

1-95. SOLE SUPPLY VOLTAGE TEST. Figure 1-24 is a simplified schematic diagram of the circuit used for testing the sole supply voltage of the power supply module under test. SOLE SUPPLY VOLTS meter M7, located in Test Set, Oscillator QRC-133A(T) is connected directly across the output of the sole power supply. The same test is made when testing a power supply module, a voltage regulator module, or a power supply module with a voltage regulator module (see figure 1-20).

1-96. SOLE VOLTAGE AND CURRENT TEST. Figure 1-25 is a simplified schematic diagram of the circuit used for measuring the sole voltage and current. Resistors R25 through R29 constitute the simulated sole load. SOLE VOLTS meter M5 and SOLE CURRENT meter M6 located in Test Set Oscillator QRC-133A(T) indicate the voltage and current supplied to the simulated sole load. Meter M5 is connected directly across the load and measures the DC sole voltage. Meter M6 is a DC ammeter that is calibrated to indicate the sole current through the load. The same test is made for the two alternative high voltage test circuits (see figure 1-20).

1-97. GRID VOLTAGE TEST. Figure 1-26 is a simplified schematic diagram of the circuit used for testing the grid voltage. R21 simulates the grid load. GRID VOLTS meter M4 located in Test Set, Oscillator QRC-133A(T) is a DC voltmeter that indicates the voltage across the simulated grid load. The grid voltage emanates from the sole power supply. The same test is made for the two alternative high voltage test setups (see figure 1-20).

1-98. FILAMENT VOLTAGE TRANSFORMER TEST. Figure 1-27 is a simplified schematic diagram of the circuit used for testing filament transformer T602. R32 is a load resistor that simulates the BWO filament load. The primary voltage for T602 is 400 CPS, 115 volts AC, which is supplied through power relay K101, relay K106,

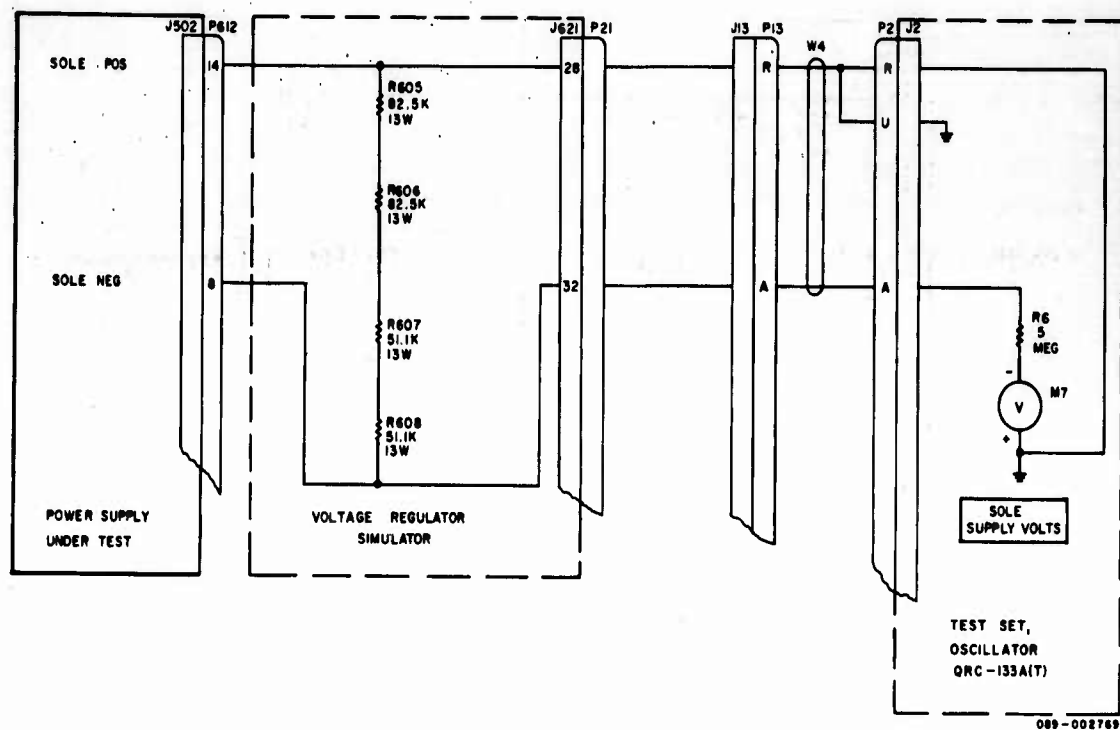


Figure 1-24. Sole Supply Voltage Test Circuit.

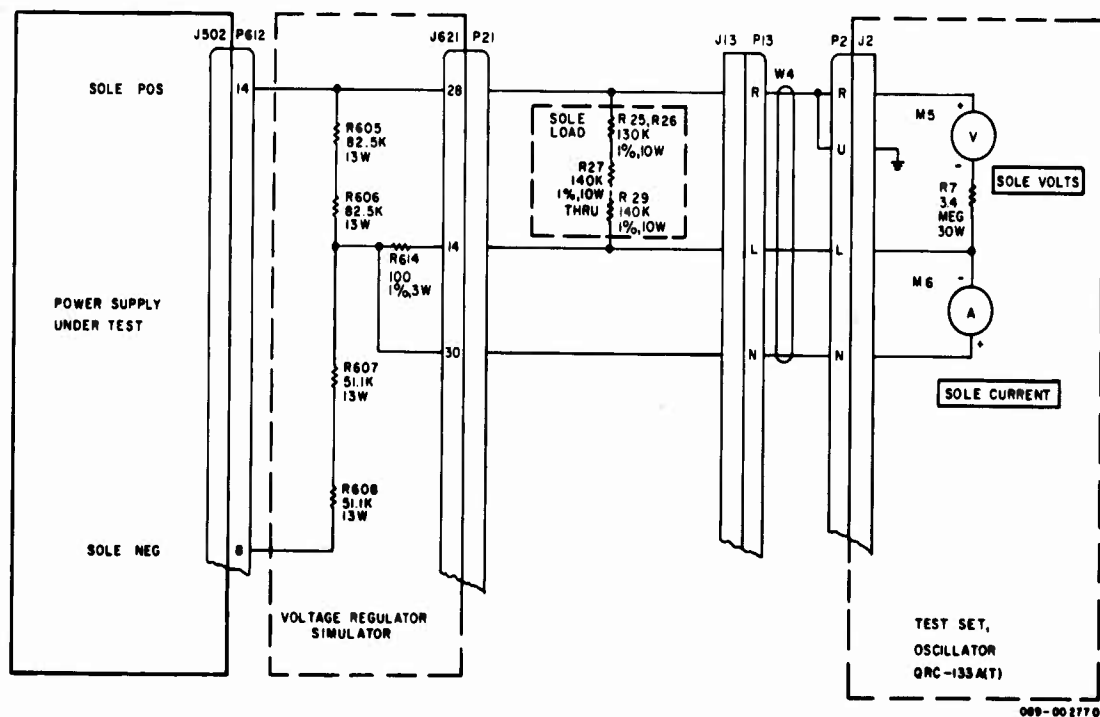


Figure 1-25. Sole Voltage and Current Test Circuit.

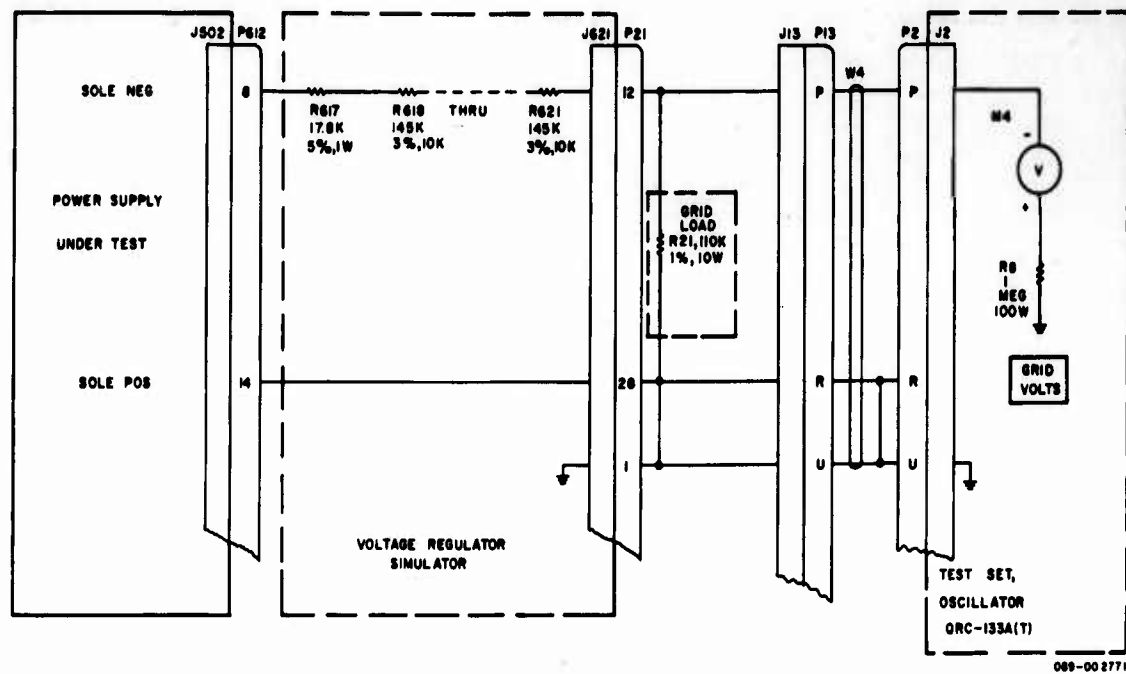


Figure 1-26. Grid Voltage Test Circuit.

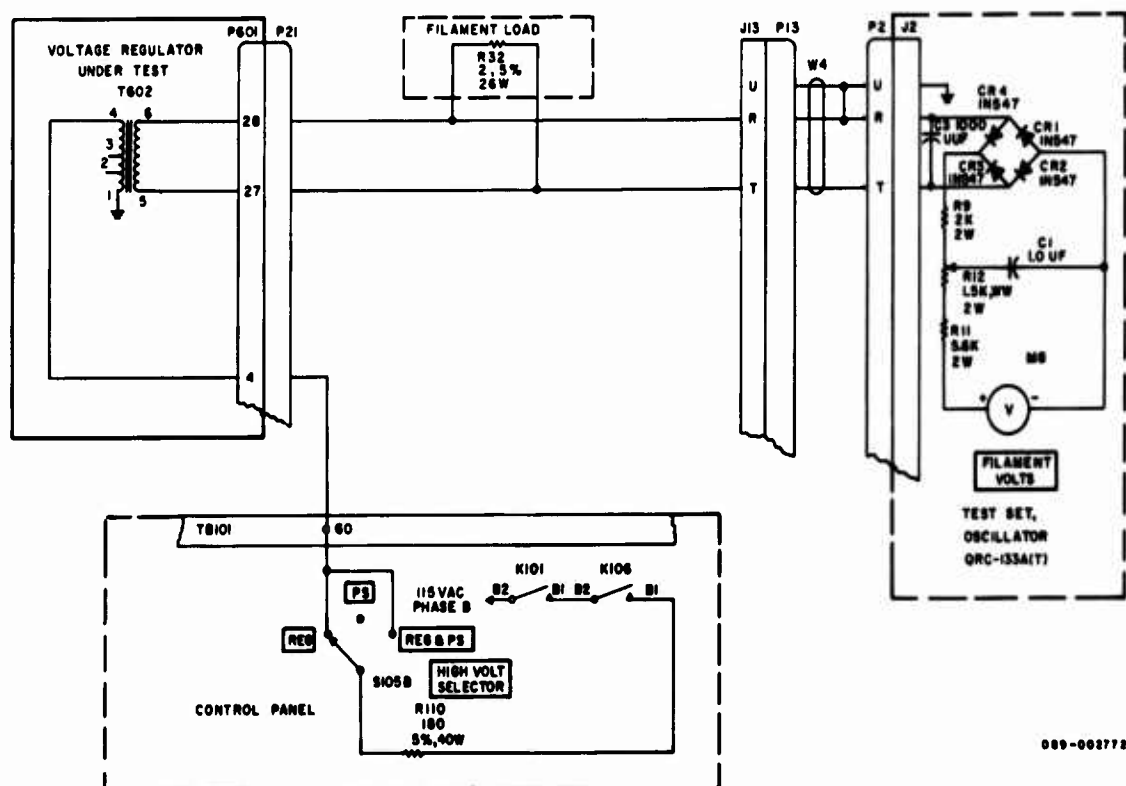


Figure 1-27. Filament Voltage Transformer Test Circuit.

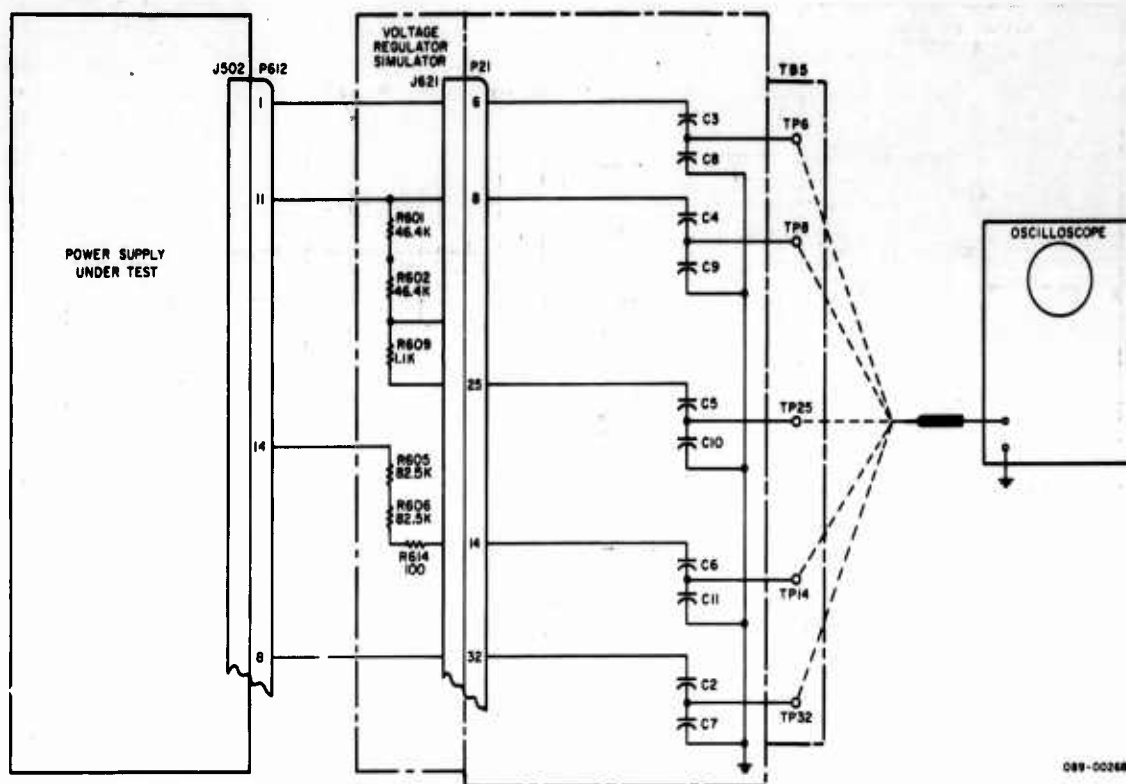


Figure 1-28. Power Supply Ripple Test Circuit.

resistor RL10 (voltage-dropping resistor), and HIGH VOLT SELECTOR switch S105. FILAMENT VOLTS meter M8, located in Test Set, Oscillator QRC-133A(T), is a DC voltmeter and indicates the output filament voltage. The filament voltmeter indicates only when testing a voltage regulator module or a power supply module with a voltage regulator module.

1-99. POWER SUPPLY RIPPLE TEST. Figure 1-28 is a simplified schematic diagram showing the method for testing the ripple outputs of the high voltage circuits. These outputs are displayed on an oscilloscope. Capacitors C2 through C11 form voltage dividers at the various test points. The capacitor values have been selected so that the ratio of total ripple to measured ripple at each test point is 1.5. Ripple measurements are made for each of the alternative high voltage test setups (see figure 1-20).

1-100. SOLE LIMITS TEST. Figure 1-29 is a simplified schematic diagram of the circuit used for testing the limits of the sole regulator. Transformer T105 and SOLE LIMITS resistor RL13 simulate the chopper circuit in the frequency control module of the Barrage Jammer QRC-133A(T) system. By adjusting RL13 through its limits, a 14-volt, 400-cycle signal is continuously varied in amplitude through 0 back to 14 volts while undergoing a 180° total phase change. This variable amplitude and variable phase signal is applied through P21 to the primary of transformer T603 located in the voltage regulator under test. Transformer T603 couples the AC signal to the phase detector which, in turn, varies the bias on V603. The bias on V603

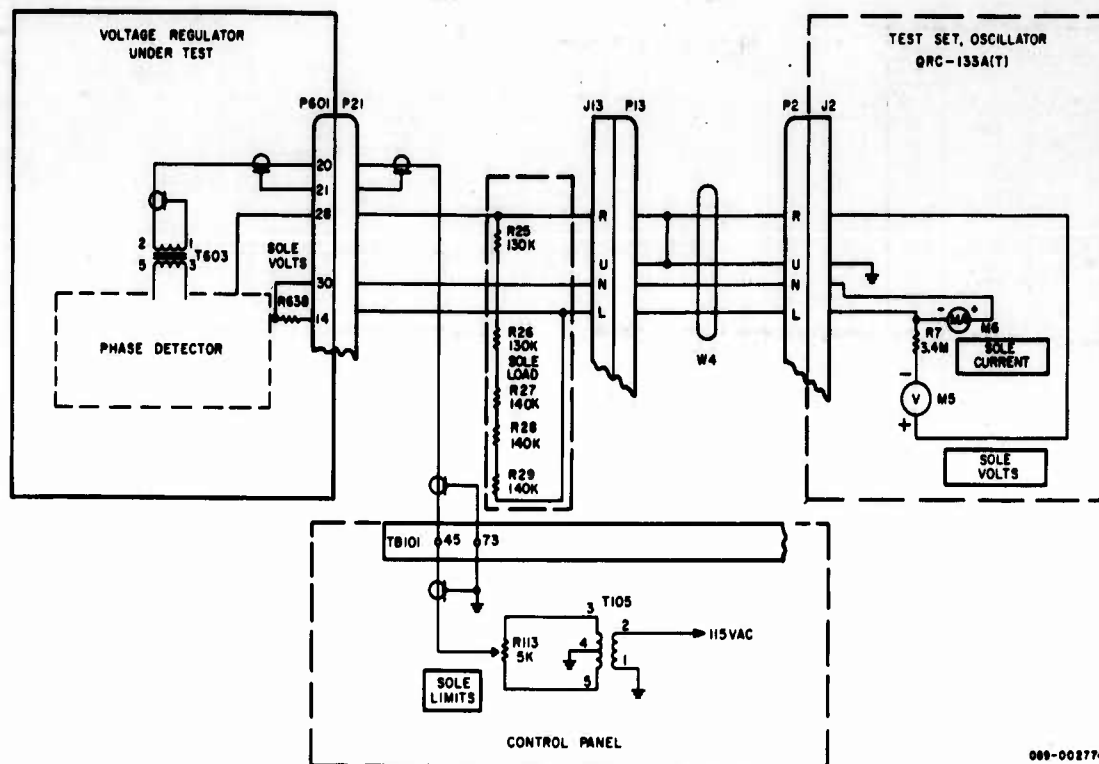


Figure 1-29. Sole Limits Test Circuit.

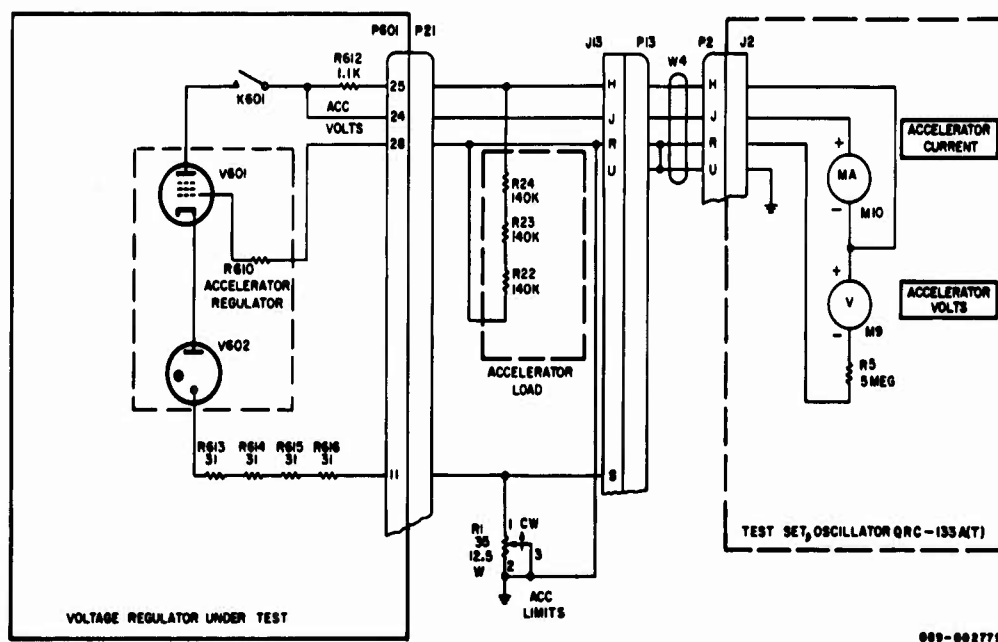


Figure 1-30. Accelerator Limits Test Circuit.

regulates the output voltage to the sole load. Changes in voltage and current are indicated by SOLE VOLTS meter M5 and SOLE CURRENT meter M6 of Test Set, Oscillator QRC-133A(T). This test is performed only when testing a voltage regulator module or a power supply module with a voltage regulator module.

1-101. ACCELERATOR LIMITS TEST. Figure 1-30 is a simplified schematic diagram of the circuit used for testing the dynamic range of accelerator regulator tube V601. Potentiometer R1, the accelerator limits control is connected in series with the anode load. The voltage developed across R1 owing to the anode current is the bias voltage for V601 in the accelerator regulator section of the voltage regulator module. Adjusting the accelerator limits control through its limits gives a corresponding variation in the accelerator volts (meter M9) and accelerator current (meter M10) readings on Test Set, Oscillator QRC-133A(T). This test is performed only when testing a voltage regulator module or a power supply module with a voltage regulator module.

1-102. ANODE VOLTAGE. The anode voltage has no significance because of the method of simulating the anode load in this test set. Therefore, the ANODE VOLTS meter M1 of Test Set, Oscillator QRC-133A(T) indicates zero during all high voltage tests.

SECTION II

SPECIAL SERVICE TOOLS

2-1. SPECIAL TOOLS AND FIXTURES.

2-2. Special tools are required for performing adjustments and maintenance on Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T). The special tools that are required and furnished by the manufacturer are listed in table 2-1.

TABLE 2-1. SPECIAL TOOLS.

Name	Nomenclature	Application
Wrench, Adjustable Hook	HLC NO. 033-001038	For adjusting height of over-flow tube.
Wrench, NO. 2 Bristol	HLC NO. 033-100783	Used in adjustment of sole modulator test fixture.
Wrench, NO. 8 Socket HD Screw	HLC NO. 033-200448	For knob screws on control panel.
Alinement Tool	HLC NO. 033-100881	For adjusting variable capacitors, resistors, and inductor.

SECTION III

PREPARATION FOR USE, STORAGE, OR SHIPMENT

3-1. GENERAL.

3-2. This section contains instructions for unpacking and inspecting Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T).

3-3. UNPACKING AND CHECKING.

3-4. The test set is packaged completely assembled. Unpack the equipment and perform the following checks to insure proper operation.

- 1) Examine test set for dents or scratches incurred during shipment.
- 2) Lift top cover and inspect control panel for broken indicator lamps, defective selector switches, fuses, and pushbuttons.
- 3) Inspect receptacles for physical damage and loose electrical connections.
- 4) Inspect liquid coolant hoses and filters for damage and loose connections.
- 5) Inspect all meters for broken glass or damaged test points.
- 6) Clean and dry equipment if moisture is present.
- 7) Loosen the screw securing interference generator module, slide out interference generator module, and inspect tubes for breakage.

3-5. PREPARATION FOR USE.

3-6. Remove the sole modulator test fixture from the drawer and place on the drain board. For instructions pertaining to installation of the test fixture for use in the test chamber, refer to paragraph 4-5.

3-7. The test set is now ready for operation.

3-8. SPACE REQUIREMENTS. Since the test set requires a clearance of 3 feet on each side for proper cooling and ventilation during operation, a space 14 feet wide, 10 feet deep, and 7 feet high is required. A smaller floor space may be used for storage. (See outline dimensional drawing, figure 3-1.)

3-9. POWER REQUIREMENTS. Power requirements for operating the test set are as follows:

- A. 115/200 volts AC, 3-phase, 4-wire wye, grounded neutral, 380 to 420 CPS.
Power: 4.3 KVA
Current: 12.5 amperes
Voltage Limits: 108 to 121 volts AC

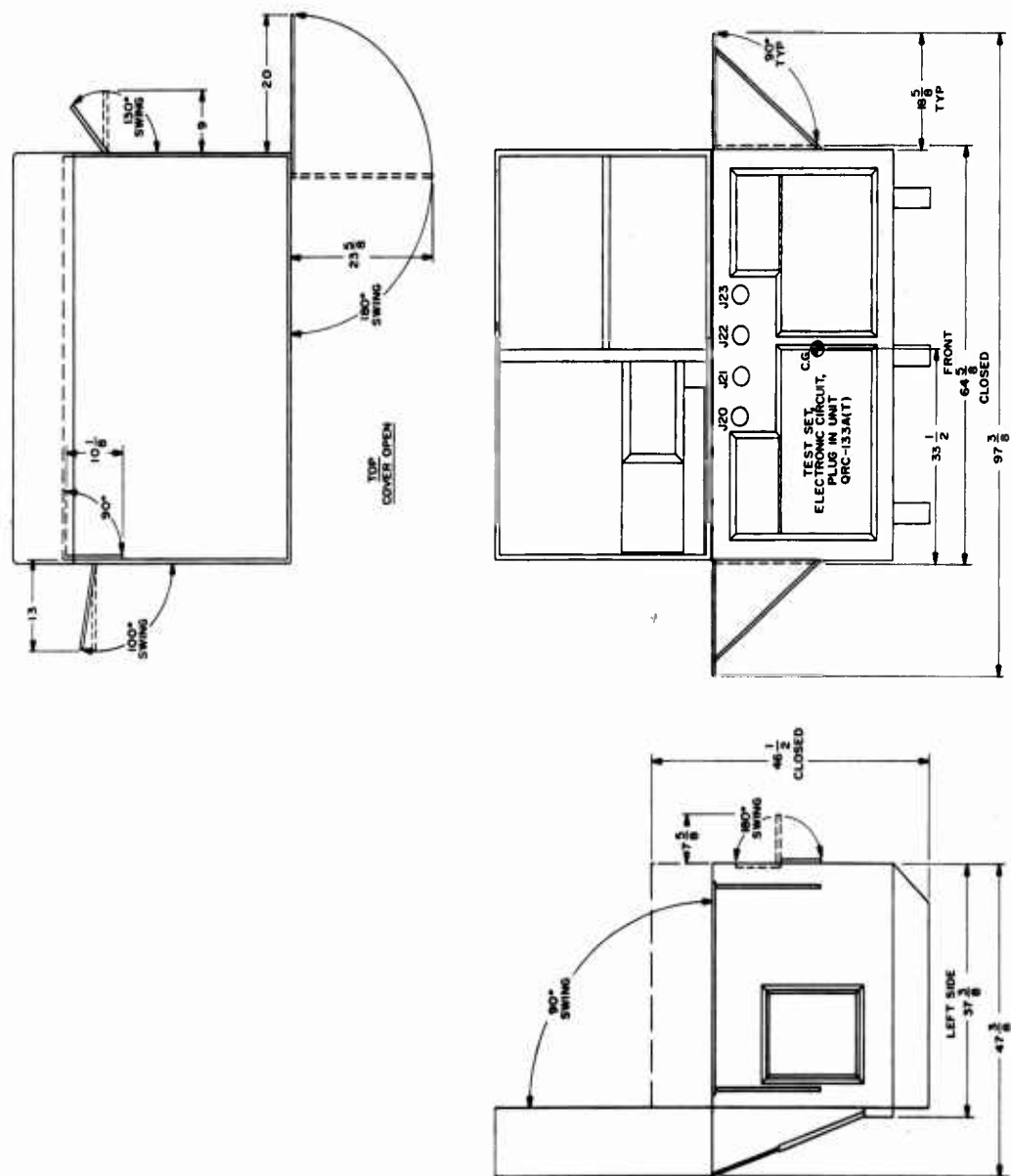


Figure 3-1. Outline Dimensional Drawing, Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T).

B. 115 volts AC, single-phase, 60 CPS.
Power: 2.8 KVA
Current: 25 amperes
Voltage Limits: 108 to 121 volts AC

C. 28 volts DC.
Power: 12 watts
Current: 0.5 amperes
Voltage Limits: 25 to 29 volts DC

3-10. Power sources must be located not more than 15 feet from the test set.

3-11. TEMPERATURE CONTROLLING FLUID REQUIREMENTS. The test set requires 20 gallons of DC-200 silicone oil (20 centistokes viscosity at 25°C).

3-12. STORAGE AND SHIPMENT. No special instructions are required for storage and shipment.

SECTION IV
OPERATION INSTRUCTIONS

4-1. GENERAL.

4-2. This section contains the operation instructions for Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T).

4-3. OPERATION PROCEDURES.

4-4. To prepare the test set for operation, proceed as follows:

A. Unsnap cover latches and lift cover.

B. Extend right leaf outward and insert locking pin into supporting bracket. Position the left leaf in the same manner.

C. Extend balance extension supports (at the bottom rear of the bench test set) outward and insert locking pins.

D. Place Test Set, Oscillator QRC-133A(T) on upper left shelf of the test set cover and connect cable W4.

E. Place Test Set, Electrical Power QRC-133A(T) on the upper-right shelf of the test set cover and connect cable W5.

F. Place Panalyzer on the lower-right shelf of the test set cover and connect cable W1.

CAUTION

Inspect the reservoir for proper amount of liquid coolant by observing the coolant level gauge. Open doors at each end of the air duct assembly before continuing operation sequence.

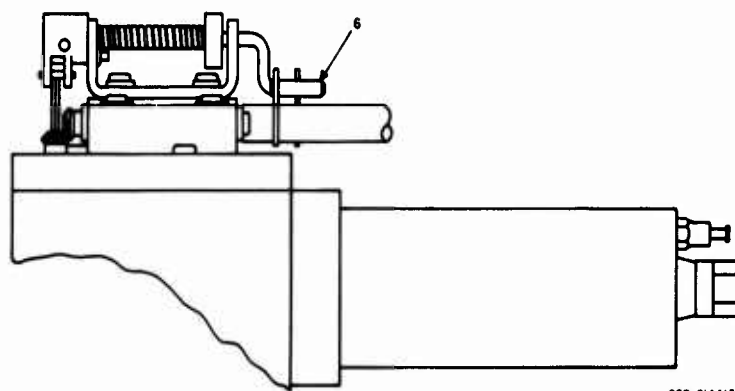
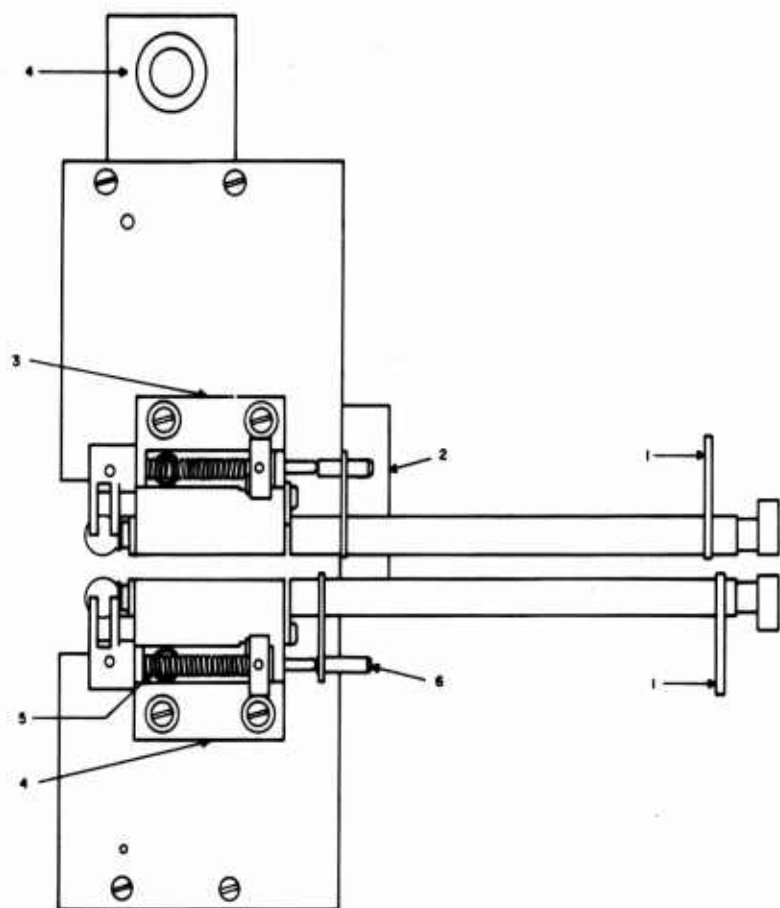
G. Inspect switches on control panel and make certain that the POWER, COOLANT, LOW VOLT PROTECT, and NOISE switches are in their OFF position.

WARNING

VOLTAGES DANGEROUS TO LIFE ARE PRESENT IN THIS EQUIPMENT - PROCEED WITH CAUTION.

H. Remove the power cables from the storage compartment. Connect cable W7 to the 28 volt DC and three-phase, 115-volt AC primary power source. Connect cable W6 to the single-phase, 115-volt AC primary power source.

4.5 INSTALLATION OF SOLE MODULATOR TEST FIXTURE. Prior to the operation of the equipment, the sole modulator test fixture is installed. To install the sole modulator test fixture, proceed as follows (figure 4-1):



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Figure 4-1. Sole Modulator Test Fixture.

A. Remove test fixture from drawer and rotate control shafts (1) (counterclockwise for C409 and clockwise for C413). Slide control shafts forward until the plate stop catches. This prevents the adjusting tools from returning to their normal position.

B. Place test fixture (with block guide insulator (2) facing up) over sole modulator section of modulator-power supply module under test and align the mounting screws located on the sole modulator with the threaded holes on the test fixture.

C. Tighten mounting screws.

D. Loosen one of the block and gear assemblies (3) by loosening its two mounting screws. Release control shaft associated with the block and gear assembly.

E. Align the hex wrench or screwdriver by moving the block and gear assembly until the hex wrench or screwdriver lines up with variable capacitor C409 or C413 (the choice of capacitor depends on which block and gear assembly is loosened).

F. After the hex wrench or screwdriver is aligned and inserted into variable capacitor C409 or C413, tighten the two screws holding the block and gear assembly.

G. Repeat steps D to F for the placement of the second adjusting tool.

H. Connect J826 of the sole modulator load to P426 of the sole modulator through the sole modulator load block guide insulator.

I. Connect oil inlet (4) to header on right side of test chamber.

J. The test fixture is now ready for use in performing adjustments.

K. When performing measurements, the wrenches are removed from the variable capacitors because of their effects on the capacitors. To remove the wrench or screwdriver from the capacitor, simply rotate the control shaft (clockwise for C413 and counterclockwise for C409) until the wrench is clear of the capacitor. Then slide control shaft forward and downward until the plate stop catches (this locks the control rod (6) in place). To release the adjusting tools, reverse the aforementioned step taking precautions to release the helical extension springs (5) gradually.

L. An extra screwdriver is supplied with the test fixture. This is required because some of the variable capacitors employed in the Barrage Jammer QRC-133A(T) sole modulators are screwdriver adjustable, while the others require hex wrenches.

M. A bristol wrench is included for adjusting various component parts of the test fixture.

N. One shaft and knob assembly is supplied. This shaft and knob assembly will fit into either of the two collar lock and insert assemblies.

4.6 The test set is now ready for testing the various modules of the Barrage Jammer QRC-133A(T) system. For the operational instructions refer to the Handbook of Instructions for Barrage Jammer QRC-133A(T), Hallicrafters NO. 094-902643.

4-7. STOPPING THE EQUIPMENT. To stop the equipment, proceed as follows:

- A. Place SELECTOR switch S104 to STBY.
- B. Turn COOLANT switch S107 to DRAIN.
- C. Turn LOW VOLT PROTECT switch S108 to OFF.
- D. Turn POWER switch S101 to OFF.

4-8. DESCRIPTION OF CONTROLS, METERS, INDICATORS, AND CONNECTORS.

4-9. The following paragraphs describe all controls, meters, and indicators of Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T).

4-10. CONTROL PANEL.

4-11. The following are the controls and indicators of the control panel. Figure 4-2 illustrates these controls and indicators.

4-12. POWER SWITCH S101. The POWER switch S101 is a two-position (ON-OFF) toggle switch that controls the input power to plug-in unit test set.

4-13. 400V SWITCH S102. The 400V switch S102 is a two-position (NOISE SUP-REG SCRN) toggle switch that selects either of two 400-volt outputs of the modulator-power supply module under test or low voltage power supply module of the test set for testing. When S102 is placed in the NOISE SUP position, the voltage and current of the 400-volt supply to the interference generator is selected for testing. In the REG SCRN position, only the voltage of the 400-volt supply to the anode series regulator tube V101 is selected for testing.

4-14. SOLE MOD BALANCE SWITCH S103. The SOLE MOD BALANCE switch S103 is a two-position (V401-V402) toggle switch. When testing a modulator-power supply module, S103 selects either tube V401 or V402 for testing. In the V401 position, the current through tube V401 is measured by meter M208 of the low-voltage indicator panel. In position V402, the current through tube V402 is measured by M208. When testing an interference generator, switch S103 selects the bias control for either tube V401 or V402, allowing measurement of the range of either bias control.

4-15. SELECTOR SWITCH S104. SELECTOR switch S104 incorporates four pushbutton switches that allow selection of four test conditions. The pushbutton switches are mechanically interlocked so that when one is depressed, any other switch that had been depressed will automatically return to the inoperative condition. A lamp, located within each pushbutton, lights when that button is depressed. The four pushbutton switches and the conditions that they represent are listed below:

A. STBY switch S104A. - STBY switch S104A represents the at-rest condition. When S104A is depressed, the STBY indicator DS103 lights after the initial 150-second delay.

B. NOISE GEN switch S104B. - NOISE GEN switch S104B prepares the test set for testing an interference generator module. When S104B is depressed, the NOISE

GEN indicator DS104 lights and relay K108 operates, applying 115 volts AC to the low-voltage power supply module of the test set. The output of the low-voltage power supply module is applied to the interference generator module under test.

C. LOW V switch S104C. - LOW V switch S104C prepares the test set for testing a modulator-power supply module. When S104C is depressed, the LOW V indicator DS105 lights and relay K109 operates, applying 115 volts AC to the modulator-power supply module under test.

D. HIGH V switch S104D. - HIGH V switch S104D prepares the test set for testing either a power supply module, a voltage regulator module, or both. When S104D is depressed the HIGH V indicator DS106 lights and, depending on the position of the HIGH VOLT SELECTOR switch S105, either relay K110 or K111 operates, applying power to either the power supply module under test or the high voltage power supply module of the test set.

4-16. HIGH VOLT SELECTOR SWITCH S105. HIGH VOLT SELECTOR switch S105 is a two-section, three-position (REG-PS-REG & PS) rotary switch that controls relays K110 and K111. Relay K110, activated when switch S105 is placed in the REG position, applies 115 volts AC to the high voltage power supply module of the test set. Switch S105 is placed in the REG position when testing a voltage regulator module. Relay K111, activated when switch S105 is placed in either the PS or REG & PS position, applies 115 volts AC to the power supply module under test. Switch S105 is placed in the PS position when testing a power supply module and in the REG & PS position when testing both a power supply module and voltage regulator module.

4-17. NOISE SWITCH S106. NOISE switch S106 is a two-position (ON-OFF) toggle switch that allows monitoring of the current of the 150-volt input to the interference generator module under test. Switch S106 also allows monitoring of the current of the 150-volt output of the modulator-power supply module under test. When S106 is placed in the ON position, meter M202 on the low voltage indicator panel is switched in the 150-volt test circuit and monitors the current.

4-18. COOLANT SWITCH S107. COOLANT switch S107 is a three-position (PUMP-OFF-DRAIN) two-section toggle switch. When S107 is placed in the PUMP position, single-phase 115 volts AC is applied to pump motor B1 and fan motor B701. In the DRAIN position, S107 connects single-phase, 115 volts AC to the oil-filled test chamber drain solenoid L1.

4-19. LOW VOLT PROTECT SWITCH S108. LOW VOLT PROTECT switch S108 is a three-position (TEST-OFF-ON) two-section toggle switch. When placed in the TEST position, S108 allows a check of the low voltage protect relay K401 in the modulator-power supply module under test by creating an overload condition. In the ON position the overload condition is removed. If an actual overload condition occurs while in the ON position during testing of the modulator-power supply, the protective circuit will function normally and remove input power to the module under test.

4-20. RESET SWITCH S109. RESET switch S109 is a spring-loaded pushbutton switch that is used to reset the system to an operating condition in the event of a temporary phase fault or low voltage overload condition.

- 4-21. POWER ON INDICATOR DS101. The power ON indicator DS101 when illuminated indicates that POWER switch S101 is in the ON position and input power is applied to the system.
- 4-22. WARMUP INDICATOR DS102. The WARMUP indicator DS102 when illuminated indicates that the system is in its warmup cycle and is not yet ready to perform testing.
- 4-23. STBY INDICATOR DS103. The STBY indicator DS103 located within STBY pushbutton S104A illuminates when S104A is depressed. When illuminated, DS103 indicates that the system has completed its warmup cycle and is ready to perform testing.
- 4-24. NOISE GEN INDICATOR DS104. The NOISE GEN indicator DS104 is located within NOISE GEN pushbutton S104B. This indicator illuminates when S104B is depressed, indicating the application of 115 volts AC to the low voltage power supply module of the test set which supplies the input to the interference generator module under test.
- 4-25. LOW V INDICATOR DS105. The LOW V indicator DS105 located within LOW V pushbutton S104C illuminates when S104C is depressed. When illuminated, DS105 indicates the application of 115 volts AC to the modulator-power supply module under test and also indicates that the various safety interlocks have been satisfied.
- 4-26. HIGH V INDICATOR DS106. The HIGH V indicator DS106 located within HIGH V pushbutton S104D illuminates when S104D is depressed, provided the warmup is completed and safety interlocks are satisfied. When illuminated, S104D indicates the application of 115 volts AC to either the power supply module under test or the high voltage power supply module of the test set which supplies power to the voltage regulator module under test.
- 4-27. LOW VOLTAGE OVERLOAD INDICATOR DS107. The low voltage OVERLOAD indicator DS107 illuminates when an overload condition exists in the 150-volt supply of the modulator-power supply module under test.
- 4-28. PHASE FAULT INDICATOR DS108. The PHASE FAULT indicator DS108 illuminates when a phase fault condition occurs at the three-phase 115-volt AC input to the high voltage power supply module of the test set or the power supply module under test.
- 4-29. COOLANT LEVEL INDICATOR DS109. The COOLANT LEVEL indicator DS109 illuminates when the coolant level falls below the minimum required level.
- 4-30. NO FLOW INDICATOR DS110. The NO FLOW indicator DS110 illuminates when the coolant flow falls below a minimum flow rate.
- 4-31. CHANGE FILTER INDICATOR DS111. The CHANGE FILTER indicator DS111 illuminates when the filters becomes clogged and hampers the flow of liquid coolant through the system. This condition causes a pressure difference across the filters, closing pressure switch S1 and completing the circuit to DS111.
- 4-32. BANDWIDTH CONTROL R109. The BANDWIDTH control R109 simulates the action of the RF BANDWIDTH control R1102 of the control-indicator in the Barrage Jammer QRC-133A(T) system. Control R109 is used when testing an interference generator module or a modulator-power supply module.

4-33. SOLE LIMITS CONTROL R113. The SOLE LIMITS control R113 varies the amplitude of the input signal to the detector network in the voltage regulator module under test. This input signal simulates the signal normally supplied to the detector network by the chopper circuit in the frequency control module of the Barrage Jammer QRC-133A(T) system. The simulated signal allows checking the response of the detector network to an input signal.

4-34. FUSE F101 0.1 AMP. Fuse F101 is a 0.1-ampere fuse that acts as a protective device in the event that the 390-volt power supply of the modulator-power supply module under test draws an excessive amount of current because of a fault in the module under test.

4-35. FUSE F102 0.3 AMP. Fuse F102 is a 0.3-ampere fuse that acts as a protective device in the event that the 400-volt power supply of the modulator-power supply module under test draws an excessive amount of current owing to a fault in the module under test.

4-36. SPARE FUSES. The SPARE fuses are provided for fuses F101 and F102.

4-37. ACCELERATOR (BENCH) CONNECTOR J107. The ACCELERATOR (BENCH) connector J107 permits monitoring the accelerator noise output from the interference generator module of the test set.

4-38. SOLE CONNECTOR J117. The SOLE connector J117 permits monitoring the sole noise output from the interference generator module under test.

4-39. ACCELERATOR CONNECTOR J127. The ACCELERATOR connector J127 permits monitoring the accelerator noise output from the interference generator module under test.

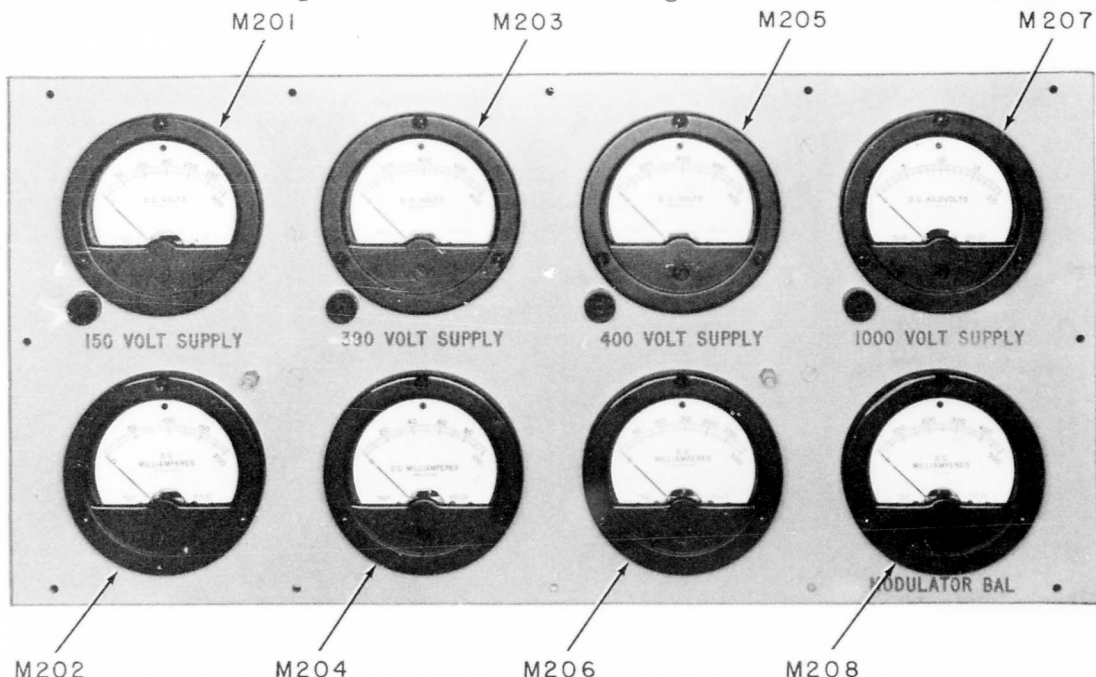


Figure 4-3. Front Panel, Low Voltage Indicator Panel.

092-014207

4-40. LOW VOLTAGE INDICATOR PANEL.

4-41. The following paragraphs describe the meters of the low voltage indicator panel. These meters measure the outputs from the modulator-power supply module under test and the inputs to the interference generator module under test. Figure 4-3 illustrates these meters.

4-42. 150 VOLT SUPPLY METER M201. The 150 VOLT SUPPLY meter M201 is a DC voltmeter calibrated in 10-volt increments from 0 to 300 volts. M201 measures the voltage of the 150-volt power supply.

4-43. 150 VOLT SUPPLY METER M202. The 150 VOLT SUPPLY meter M202 is a DC milliammeter calibrated in 5-milliamperes increments from 0 to 200 milliamperes. M202 measures the current of the 150-volt power supply.

4-44. 390 VOLT SUPPLY METER M203. The 390 VOLT SUPPLY meter M203 is a DC voltmeter calibrated in 20-volt increments from 0 to 800 volts. M203 measures the voltage of the 390-volt power supply.

4-45. 390 VOLT SUPPLY METER M204. The 390 VOLT SUPPLY meter M204 is a DC milliammeter calibrated in 2-milliamperes increments from 0 to 100 milliamperes. M204 measures the current of the 390-volt power supply.

4-46. 400 VOLT SUPPLY METER M205. The 400 VOLT SUPPLY meter M205 is a DC voltmeter calibrated in 20-volt increments from 0 to 800 volts. M205 measures the voltage of the 400-volt power supply.

4-47. 400 VOLT SUPPLY METER M206. The 400 VOLT SUPPLY meter M206 is a DC milliammeter calibrated in 10-milliamperes increments from 0 to 300 milliamperes. M206 measures the current of the 400-volt power supply.

4-48. 1000 VOLT SUPPLY METER M207. The 1000 VOLT SUPPLY meter M207 measures the voltage of the 1000-volt power supply through a voltage divider which drops the voltage to one-tenth of its actual value. M207 is a DC voltmeter calibrated in 50-volt increments from 0 to 2000 volts; however, only one-tenth of these values are actually measured.

4-49. MODULATOR BAL METER M208. The MODULATOR BAL meter M208 is a DC milliammeter calibrated in 10-milliamperes increments from 0 to 500 milliamperes. Meter M208 monitors the bias current to the sole modulator tubes V401 and V402, insuring that the bias currents are equal. M208 also monitors the plate current of sole modulator tubes V401 and V402.

4-50. MISCELLANEOUS CONTROLS AND INDICATORS.

4-51. The following controls and indicators are located in various parts of the test set.

4-52. PRESSURE SWITCH S1. Pressure switch S1 is a pressure differential switch which is placed across the input and output of the oil filters. As the filters become clogged the pressure of the liquid coolant flowing through the pressure switch increases to a level where the abnormally high pressure closes switch S1. When S1 closes, the CHANGE FILTER indicator DS111 illuminates indicating that the filters must be replaced.

4-53. FLOW SWITCH S2. Flow switch S2 located at the output of the oil filters is an interlock switch that indirectly removes power from the modules being operated in the test chamber when the liquid coolant stops flowing. The liquid coolant flowing through the system keeps the flow switch closed. When the liquid coolant stops flowing, the flow switch opens, causing the NO FLOW indicator DS110 to illuminate.

4-54. LEVEL SWITCH S3. Level switch S3 located in the oil-filled test chamber is an interlock switch that indirectly removes power from the modules being operated in the test chamber when the coolant level is below normal. If the liquid coolant falls below the proper level, switch S3 opens, causing the COOLANT LEVEL indicator DS109 to illuminate.

4-55. COOLANT LEVEL GAGE. The coolant level gage is located on the front of the oil reservoir. This gage indicates the amount of liquid coolant in the reservoir. The reservoir should contain 20 gallons of liquid coolant when the oil-filled test chamber is drained.

4-56. ACCELERATOR LIMITS CONTROL R1. The accelerator limits control R1 allows checking the dynamic range of the accelerator regulator tube V601 in the voltage regulator module under test.

4-57. VARIAC CONTROL T1. The Variac control T1 varies the 115-volt AC three-phase input to the test set. This allows testing of the modules over the entire range of the specified voltage limits and also permits compensating for any input voltage variations.

4-58. INTERLOCK SWITCH S501. Interlock switch S501 prevents application of 115-volt AC three-phase power to the high voltage power supply module of the test set unless both the high voltage power supply module and the voltage regulator module under test are properly connected.

4-59. INTERLOCK SWITCH S601. Interlock switch S601 prevents application of 115-volt AC three-phase power to the power supply module under test unless both the power supply module and the voltage regulator simulator are properly connected.

4-60. CIRCUIT BREAKER CB1. Circuit breaker CB1 (figure 8-1) provides overload protection for phase A of the 115/200-volt AC three-phase power source.

4-61. CIRCUIT BREAKER CB2. Circuit breaker CB2 (figure 8-1) provides overload protection for phase B of the 115/200-volt AC three-phase power source.

4-62. CIRCUIT BREAKER CB3. Circuit breaker CB3 (figure 8-1) provides overload protection for phase C of the 115/200-volt AC three-phase power source.

4-63. CIRCUIT BREAKER CB4. Circuit breaker CB4 (figure 8-1) provides overload protection for the 28-volt DC power source.

4-64. CIRCUIT BREAKERS CB5 and CB6. Circuit breakers CB5 and CB6 (figure 8-1) provide overload protection for the 115-volt AC, single-phase power source.

4-65. CONNECTOR J8. Connector J8 (figure 8-1) is the input connection for the 115/200-volt AC three-phase and the 28-volt DC power sources.

4-66. CONNECTOR J12. Connector J12 (figure 8-1) is the input connection for the 115-volt AC, single-phase, power source.

SECTION V

INSPECTION AND MAINTENANCE

5-1. GENERAL.

5-2. This section includes instructions for inspecting and maintaining Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T). A visual inspection should be performed and any obvious faults corrected before operating the test set. Any part that fails to meet standards must be repaired or replaced.

5-3. VISUAL INSPECTION.

5-4. Perform a thorough visual inspection of the test set and all of its parts. Indicate on an appropriate inspection tag any damage that is noticed (table 5-1).

5-5. LUBRICATION.

5-6. A minimum of lubrication is required on Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T). The braces are greased before shipment, but periodic lubrication is required to keep the braces operating smoothly. A silicone grease is used for this purpose.

5-7. The braces that support the cover when it is opened, the storage drawer fastener, and the braces that support the drop leaves are the only moving parts that require lubrication. The period of lubrication is dependent on environmental conditions. In moist climate the test set may require more frequent lubrication than usual. Before applying lubricant, clean off braces with a dry clean cloth. After applying lubricant, wipe off excess.

5-8. PREVENTIVE MAINTENANCE.

5-9. Clean the high voltage standoffs and load resistors in the cut assembly twice monthly. This maintenance may be required more frequently if the test set is operated continuously in a very dusty atmosphere. Clean the heat exchanger coil (preferably by vacuum) as required. Clean the contacts of SELECTOR switch S104 (control panel) with a suitable contact cleaning solution.

TABLE 5-1. VISUAL INSPECTION CHECK LIST

Item	Check
Covers and housings	Cracked, dented, or distorted.
Capacitors	Damaged casings or broken leads.
Control knobs	Cracked or broken.
Indicator lights	Cracked or broken.
Resistors	Cracked, broken, or signs of overheating.

TABLE 5-1. VISUAL INSPECTION CHECK LIST (CONT).

Item	Check
Switches	Positive contact and tightness.
Wiring	Frayed or broken.
Solder connections	Insecure or corroded.
Moveable parts	Binding or faulty adjustments.
Vacuum tubes	Cracked or loose socket connections.
Electrical connectors	Cracked or broken inserts; bent pins.
Hose connections	Oil leaks.
Hydraulic fittings	Oil leaks or cracks.
Meter	Dented casing or cracked glass.
Weld joints	Oil leaks or cracks.
Coolant hoses	Cracked casings or kinks.
Fastening and securing devices	Looseness or misalignment.

SECTION VI

TROUBLESHOOTING

6-1. This section contains troubleshooting procedures for repairing the Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T).

6-2. Table 6-1 lists typical indications of troubles, probable causes, and remedies necessary to restore the equipment to its proper operating condition. The troubles are listed consecutively so that the cause and remedy of any specific trouble assumes that troubles listed previously have been cleared. The chart also assumes units under test are free of trouble. Refer to the schematic diagrams, figures 1-5, 8-28, 8-29, and 8-30. Refer to table 6-1 and check and replace any defective components found listed under the "probable cause" column. Refer to figure 8-1 to 8-27 for the physical location of components. In the event a malfunction occurs in Test Set, Oscillator QRC-133A(T), Test Set, Electrical Power QRC-133A(T), or Panalyzer, refer to their respective instruction manuals for maintenance procedures pertaining to that equipment.

TABLE 6-1. TROUBLESHOOTING CHART FOR TEST SET,
ELECTRONIC CIRCUIT, PLUG-IN UNIT
QRC-133A(T).

Trouble	Probable Cause	Remedy
Power indicator DS101 does not light when switch S101 is switched to ON. Meter M7 of Test Set, Electrical Power QRC-133A(T) reads zero.	Blown fuse F4 in Test Set, Electrical Power QRC-133A(T). Tripped circuit breaker CB4. Defective switch S101. Defective power cable W7.	Replace fuse F4. Check and replace if necessary.
WARMUP indicator DS102 does not light when S101 is switched to ON.	Defective relay contacts in K101, K102, or K104. Defective relay K101. Defective bulb DS102. Improper connections to plug-in unit test set QRC-133A(T). Blown fuse F4 in Test Set, Electrical Power QRC-133A(T).	Check and replace if necessary Tighten cable connections to plug-in unit test set QRC-133A(T). Replace fuse F4.
WARMUP indicator DS102 stays lighted after the initial 150-second delay period with selector switch in HIGH V or LOW V position.	Defective relay K105. Defective pump B1.	Check and replace if necessary.
NO FLOW indicator DS110 lights and remains lighted when S101 is switched to ON.	Defective relay K113 or defective flow switch S2.	Check and replace if necessary

TABLE 6-1. TROUBLESHOOTING CHART FOR TEST SET,
ELECTRONIC CIRCUIT, PLUG-IN UNIT
QRC-133A(T) (CONT).

Trouble	Probable Cause	Remedy
When SELECTOR switch S104 is in HIGH V or LOW V position, COOLANT LEVEL indicator DS109 lights when S101 is switched to ON.	Defective relay K106 or defective level switch S3. Overflow pipe not positioned properly.	Check and replace if necessary Raise overflow pipe to proper level.
Pump motor and fan do not operate when S107 is switched to PUMP.	Tripped circuit breakers (CB5 or CB6). Defective S107. Defective pump motor B1 and/or defective fan B701. Defective or improperly connected power cable W6.	Close circuit breakers. Check and replace if necessary.
When STBY switch S104A1 is depressed, STBY indicator DS103 does not light after initial 150-second delay.	Relay K108, K109, K110 or K111 energized by a fault condition. Defective bulb DS103. Defective relay K113. Contacts of S104A1 dirty or defective.	Replace DS103. Clean or replace.
When NOISE GEN switch S104B1 is depressed, NOISE GEN indicator DS104 does not light after initial 150-second delay.	Defective bulb DS104. Contacts of S104B dirty or defective.	Replace DS104. Clean or replace.
When LOW V switch S104C is depressed, LOW V indicator DS105 does not light after initial 150-second delay.	Defective bulb DS105. Contacts of S104C dirty or defective.	Replace DS105. Clean or replace.
When HIGH V switch S104D is depressed, HIGH V indicator does not light after initial 150-second delay.	Defective bulb DS106. Contacts of switch S104D dirty or defective.	Replace DS106. Clean or replace.
When POWER switch S101 is ON, voltmeters M1, M2, and M3 of Test Set, Electrical Power QRC-133A(T) do not indicate as Variac T1 control is turned clockwise.	Fuses F1, F2, and F3 of Test Set, Electrical Power QRC-133A(T) blown. Circuit breakers TB1, TB2, and TB3 have tripped.	Replace fuses. Reset circuit breakers.

TABLE 6-1. TROUBLESHOOTING CHART FOR TEST SET,
ELECTRONIC CIRCUIT, PLUG-IN UNIT
QRC-133A(T) (CONT).

Trouble	Probable Cause	Remedy
Voltmeter M201 does not indicate voltage when testing the 150V interference generator supply with Variac T1 set for 115-volts input.	Plug P201 connected to the wrong receptacle. Defective low voltage power supply or defective voltmeter M201.	Connect P201 to proper receptacle. Check and replace if necessary.
Ammeter M202 does not indicate current when testing the 150V interference generator supply.	Switch S106 defective or in OFF position. Defective low voltage power supply, or defective ammeter M202.	Check and replace if necessary.
Ammeter M204 does not indicate current when testing 390V interference generator supply.	Open resistor R201, defective ammeter M204, or defective low voltage power supply.	Check and replace if necessary.
Voltmeter M203 does not indicate voltage when measuring 390V interference generator supply.	Defective low voltage power supply, or defective voltmeter M203.	Check and replace if necessary.
Voltmeter M205 does not indicate voltage when testing the 400V interference generator supply.	Defective low voltage power supply. Defective selector switch S102. Defective voltmeter M205.	Check and replace if necessary.
Ammeter M206 does not indicate current when testing the 400V interference generator supply.	Defective ammeter M206. Defective low voltage power supply.	Check and replace if necessary.
Voltmeter M207 does not indicate voltage when testing the 1000V output of the modulator-power supply.	Defective voltmeter M207.	Check and replace if necessary.
With Variac T1 set for 115 VAC input and HIGH V selector depressed, all meters indicate zero on Test Set, Oscillator QRC-133A(T).	Improper cable connections to unit under test. Defective relay K112 or defective diode CR102. Defective switch S501 or S601. P512 not mated securely to P602 or P612 not mated securely to J502.	Correct cable wiring. Check and replace if necessary. Check that mechanical retaining clip is holding mating connectors securely.

TABLE 6-1. TROUBLESHOOTING CHART FOR TEST SET,
ELECTRONIC CIRCUIT, PLUG-IN UNIT
QRC-133A(T) (CONT).

Trouble	Probable Cause	Remedy
Ammeter M2 in Test Set, Oscillator QRC-133A(T) does not indicate anode current during high voltage tests.	Defective resistor in anode load. Defective resistor R1 or R20. Defective ammeter M2. Defective cable assembly W4.	Check and replace if necessary.
Voltmeter M3 in Test Set, Oscillator QRC-133A(T) does not indicate anode supply voltage.	Defective high voltage power supply. Defective voltmeter M3 in Test Set, Oscillator QRC-133A(T).	Check and replace if necessary.
Voltmeter M4 in Test Set, Oscillator QRC-133A(T) does not indicate grid voltage.	Open resistor in series R617 to R621 in voltage regulator simulator. Defective meter M4 in Test Set, Oscillator QRC-133A(T).	Check and replace if necessary
Voltmeter M5 in Test Set, Oscillator QRC-133A(T) does not indicate sole voltage.	Open resistor R607 or R608 in voltage regulator simulator. Defective meter M5 in Test Set, Oscillator QRC-133A(T).	Check and replace if necessary.
Ammeter M6 in Test Set, Oscillator QRC-133A(T) does not indicate sole current.	Open resistor in sole load R25 to R29. Defective meter M6 in Test Set, Oscillator QRC-133A(T).	Check and replace if necessary.
Voltmeter M7 in Test Set, Oscillator QRC-133A(T) does not indicate sole supply volts.	Defective meter M7 in Test Set, Oscillator QRC-133A(T).	Check and replace if necessary.
Voltmeter M9 in Test Set, Oscillator QRC-133A(T) does not indicate accelerator voltage.	Open resistors R601 and R602 in voltage regulator simulator.	Check and replace if necessary.
Ammeter M10 in Test Set, Oscillator QRC-133A(T) does not indicate accelerator current.	Open resistors in accelerator load R22, R23, and R24. Defective ammeter M10 in Test Set, Oscillator QRC-133A(T).	Check and replace if necessary

TABLE 6-1. TROUBLESHOOTING CHART FOR TEST SET,
ELECTRONIC CIRCUIT, PLUG-IN UNIT
QRC-133A(T) (CONT).

Trouble	Probable Cause	Remedy
Voltmeter M11 in Test Set, Oscillator QRC-133A(T) does not indicate accelerator supply voltage.	Defective voltmeter M11 in Test Set Oscillator QRC-133A(T).	Check and replace if necessary.
Voltmeter M8 in Test Set, Oscillator QRC-133A(T) does not indicate filament volts.	Defective M8 or associated components in Test Set, Oscillator QRC-133A(T).	Check and replace if necessary.
Oscilloscope shows no indication of output ripple voltage when measuring at test points TP6, TP8, TP14, TP25, or TP32.	Defective capacitor(s) C2 to C11.	Check and replace if necessary.
Noise signal is not present across sole modulator load when testing the modulator-power supply.	Defective patch cable W3 or improper associated connections. Defective interference generator bench test set. Defective sole modulator load.	Check and tighten or replace if necessary.
Noise signal is not present at jack J117 (SOLE) when testing interference generator.	Defective sole noise load T103 or associated components. Loose connection(s) at J116-P16 or P102-J102.	Check and replace if necessary. Tighten or replace if necessary.
Noise signal is not present at jack J127 (accelerator) of interference generator under test during spectrum test setup.	Defective accelerator noise load T102 or associated components. Loose connection(s) at J101-P101 or J118-P18. No output from interference generator.	Check and replace if necessary Tighten or replace if necessary.

SECTION VII

CALIBRATION

7-1. GENERAL.

7-2. The purpose of this section is to ensure the reliability of indications or readings obtained with Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T).

7-3. CALIBRATION.

7-4. The voltage and current meters of the test set should be checked for proper calibration at 90-day intervals; zero adjustments of the meters may be performed at any time. Check the voltage and current meters of the test set for proper calibration with a reference standard; meters showing incorrect readings should be returned to the manufacturer for recalibration.

7-5. The Panalyzer must be recalibrated for response at 30-day intervals. If the test setup is altered (such as replacing the oscilloscope), the Panalyzer must be recalibrated. Refer to the Instruction Manual for Panoramic Spectrum Analyzer Model SB-8b, Type T-10,000 for Panalyzer calibration procedures.

SECTION VIII
REPLACEABLE PARTS LIST

8-1. GENERAL.

8-2. This section contains the description and part number of each of the replaceable parts used in the Test Set, Electronic Circuit, Plug-in Unit QRC-133(T). Reference symbols are identical to those component symbols indicated on the schematic diagram (figures 8-28, 8-29 and 8-30) and on the illustrations of the test set. Figures 1-1 thru 1-3, 4-1, 4-2 and 8-1 thru 8-27 illustrate the components of the test set. Refer to the Classified Supplement to the Handbook of Operation and Service Instructions for Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T) (HLC NO. 094-903067) for the replaceable parts list for the interference generator.

8-3. MANUFACTURER'S CODE NUMBERS.

8-4. The code numbers listed below are used in the replaceable parts list to denote manufacturers of specific parts. The code numbers were taken from the Federal Supply Code for Manufactueres (Cataloging Handbook H-4-1).

<u>Code NO.</u>	<u>Vendor's Name and Address</u>
01002	General Electric Co., Capacitor Department of Transformer Division of Apparatus Group, Hudson Falls, N.Y.
01121	Allen-Bradley Co., Milwaukee, Wis.
02660	American Phenolic Corp., Chicago, Ill.
04034	Gems Co., Newington, Conn.
04845	Automatic Switch Co., Florham Park, Madison, N.J.
05009	Sealelectro Corp., Mamaroneck, N.Y.
09922	Burndy Corp., New York, N.Y.
09975	Burroughs Corp., Detroit, Mich.
19695	Elco Mfg. Co., Inc., New York, N.Y.
24655	General Radio Co., Cambridge, Mass.
26916	Hallicrafters, Chicago, Ill.
40931	Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
45681	Parker-Hannifin Corp., Cleveland, Ohio
51240	Rochester Mfg. Co., Inc., Rochester, N.Y.
54294	Shallcross Mfg. Co., Selma, N.C.

<u>Code NO.</u>	<u>Vendor's Name and Address</u>
56289	Sprague Electric Co., North Adams, Mass.
61178	Tuthill Pump Co., Chicago, Ill.
71400	Bussmann Fuse Division of McGraw-Edison Co., St. Louis, Mo.
71590	Centralab Division of Globe Union, Inc., Milwaukee, Wis.
72136	Electro Motive Mfg. Co., Williamantic, Conn.
72259	Essex Electronics, Inc., Berkeley Heights, N.J.
72619	Dialight Corp., Brooklyn, N.Y.
72982	Erie Resistor Corp., Erie, Pa.
73899	JFD Electronics Corp., Brooklyn, N.Y.
74868	Industrial Products Co., Division of Amphenol-Borg Electronics Corp., Danbury, Conn.
75173	Jones, Howard B., Division of Cinch Mfg. Corp., Chicago, Ill.
76572	Mossman, Donald P., Inc., Brewster, N.Y.
80052	Panoramic Radio Products, Inc., Mount Vernon, N.Y.
80058	Communication Electronic Nomenclature Subpanel, Washington, D.C.
80294	Bourns Laboratories, Inc., Riverside, Calif.
81073	Grayhill Co., LaGrange, Ill.
81312	Winchester Electronics Co., Inc. Norwalk, Conn.
81349	Military Specifications
82415	Price Electric Co., Frederick, Md.
82877	Rotron Mfg. Co., Inc., Woodstock, N.Y.
83330	Smith, Herman H., Inc., Brooklyn, N.Y.
88044	Aeronautical Standards Group, Departments of Navy and Air Force, Washington, D.C.
88245	U. S. Engineering Co., Glandale, Calif.

Code NO.Vendor's Name and Address

91407	Superior Electric Co., The, Oak Park, Ill.
91418	Radio Materials Co., Chicago, Ill.
91637	Dale Products, Inc., Columbus, Nebr.
93410	Stevens Mfg. Co., Inc., Mansfield, Ohio
93929	G-V Controls, Inc., Livingston, N.J.
94916	Wac Line, Inc., Dayton, Ohio
95275	Vitramon, Inc., Bridgeport, Conn.
96733	San Fernando Electric Mfg. Co., San Fernando, Calif.
96906	Military Standards
98978	International Electronic Research Corp., Burbank, Calif.

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
<u>CIRCUIT BREAKERS</u>							
1	CB1	8-1	Circuit Breaker (15 amp)	96906	MS25017-15	060-002418	
2	CB2	8-1	Same as CB1				
3	CB3	8-1	Same as CB1				
4	CB4	8-1	Circuit Breaker (5 amp)	96906	MS25017-5	060-002372	
5	CB5	8-1	Circuit Breaker (25 amp)	96906	MS25017-25	060-002374	
6	CB6	8-1	Same as CB5				
<u>SEMICONDUCTOR DEVICES</u>							
7	A401 CR401	8-15	Diode	81349	JAN 1N547	019-002653	
8	A401 CR402	8-16	Same as A401CR401				
9	A401 CR403	8-16	Same as A401CR401				
10	A401 CR404	8-15	Same as A401CR401				
11	A401 CR405	8-15	Same as A401CR401				
12	A401 CR406	8-16	Same as A401CR401				
13	A402 CR401	8-15	Same as A401CR401				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>SEMICONDUCTOR DEVICES (CONT)</u>				
14	A402 CR402	8-16	Same as A401CR401				
15	A402 CR403	8-16	Same as A401CR401				
16	A402 CR404	8-15	Same as A401CR401				
17	A402 CR405	8-15	Same as A401CR401				
18	A402 CR406	8-16	Same as A401CR401				
19	A403 CR407	8-16	Same as A401CR401				
20	A403 CR408	8-15	Same as A401CR401				
21	A403 CR409	8-16	Same as A401CR401				
22	A403 CR410	8-15	Same as A401CR401				
23	A403 CR411	8-15	Same as A401CR401				
24	A403 CR412	8-16	Same as A401CR401				
25	A403 CR413	8-15	Same as A401CR401				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>SEMICONDUCTOR DEVICES (CONT)</u>				
26	A403 CR414	8-16	Same as A401CR401				
27	A403 CR415	8-15	Same as A401CR401				
28	A403 CR416	8-16	Same as A401CR401				
29	A501 CR1	8-18	Same as A401CR401				
30	A501 CR2	8-18	Same as A401CR401				
31	A501 CR3	8-18	Same as A401CR401				
32	A501 CR4	8-18	Same as A401CR401				
33	A501 CR5	8-18	Same as A401CR401				
34	A501 CR6	8-18	Same as A401CR401				
35	A501 CR7	8-18	Same as A401CR401				
36	A501 CR8	8-18	Same as A401CR401				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>SEMICONDUCTOR DEVICES (CONT)</u>				
37	A501 CR9	8-18	Same as A401CR401				
38	A501 CR10	8-18	Same as A401CR401				
39	A501 CR11	8-18	Same as A401CR401				
40	A501 CR12	8-18	Same as A401CR401				
41	A502CR1	8-18	Same as A401CR401				
42	A502CR2	8-18	Same as A401CR401				
43	A502CR3	8-18	Same as A401CR401				
44	A502CR4	8-18	Same as A401CR401				
45	A502CR5	8-18	Same as A401CR401				
46	A502CR6	8-18	Same as A401CR401				
47	A502CR7	8-18	Same as A401CR401				
48	A502CR8	8-18	Same as A401CR401				
49	A502CR9	8-18	Same as A401CR401				
50	A502 CR10	8-18	Same as A401CR401				
51	A502 CR11	8-18	Same as A401CR401				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>SEMICONDUCTOR DEVICES (CONT)</u>				
52	A502 CR12	8-18	Same as A4-01CR4-01				
53	A503CR1	8-18	Same as A4-01CR4-01				
54	A503CR2	8-18	Same as A4-01CR4-01				
55	A503CR4	8-18	Same as A4-01CR4-01				
56	A503CR5	8-18	Same as A4-01CR4-01				
57	A503CR6	8-18	Same as A4-01CR4-01				
58	A503CR7	8-18	Same as A4-01CR4-01				
59	A503CR8	8-18	Same as A4-01CR4-01				
60	A503CR9	8-18	Same as A4-01CR4-01				
61	A503 CR10	8-18	Same as A4-01CR4-01				
62	A503 CR11	8-18	Same as A4-01CR4-01				
63	A503 CR12	8-18	Same as A4-01CR4-01				
64	A504CR1	8-20	Same as A4-01CR4-01				
65	A504CR2	8-20	Same as A4-01CR4-01				
66	A504CR3	8-20	Same as A4-01CR4-01				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>SEMICONDUCTOR DEVICES (CONT.)</u>				
67	A504CR5	8-20	Same as A401CR401				
68	A504CR6	8-20	Same as A401CR401				
69	A504CR7	8-20	Same as A401CR401				
70	A504CR8	8-20	Same as A401CR401				
71	A504CR9	8-20	Same as A401CR401				
72	A505CR1	8-20	Same as A401CR401				
73	A505CR2	8-20	Same as A401CR401				
74	A505CR3	8-20	Same as A401CR401				
75	A505CR4	8-20	Same as A401CR401				
76	A505CR5	8-20	Same as A401CR401				
77	A505CR6	8-20	Same as A401CR401				
78	A505CR7	8-20	Same as A401CR401				
79	A505CR8	8-20	Same as A401CR401				
80	A505CR9	8-20	Same as A401CR401				
81	A506CR1	8-20	Same as A401CR401				
82	A506CR2	8-20	Same as A401CR401				
83	A506CR3	8-20	Same as A401CR401				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>SEMICONDUCTOR DEVICES (CONT)</u>				
84	A506CR4	8-20	Same as A401CR401				
85	A506CR5	8-20	Same as A401CR401				
86	A506CR6	8-20	Same as A401CR401				
87	A506CR7	8-20	Same as A401CR401				
88	A506CR8	8-20	Same as A401CR401				
89	A506CR9	8-20	Same as A401CR401				
90	A507CR1	8-20	Same as A401CR401				
91	A507CR2	8-20	Same as A401CR401				
92	A507CR3	8-20	Same as A401CR401				
93	A507CR4	8-20	Same as A401CR401				
94	A507CR5	8-20	Same as A401CR401				
95	A507CR6	8-20	Same as A401CR401				
96	A507CR7	8-20	Same as A401CR401				
97	A507CR8	8-20	Same as A401CR401				
98	A507CR9	8-20	Same as A401CR401				
99	A508CR1	8-20	Same as A401CR401				
100	A508CR2	8-20	Same as A401CR401				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>SEMICONDUCTOR DEVICES (CONT)</u>				
101	A508CR3	8-20	Same as A401CR401				
102	A508CR4	8-20	Same as A401CR401				
103	A508CR5	8-20	Same as A401CR401				
104	A508CR6	8-20	Same as A401CR401				
105	A508CR7	8-20	Same as A401CR401				
106	A508CR8	8-20	Same as A401CR401				
107	A508CR9	8-20	Same as A401CR401				
108	A509CR1	8-20	Same as A401CR401				
109	A509CR2	8-20	Same as A401CR401				
110	A509CR3	8-20	Same as A401CR401				
111	A509CR4	8-20	Same as A401CR401				
112	A509CR5	8-20	Same as A401CR401				
113	A509CR6	8-20	Same as A401CR401				
114	A509CR7	8-20	Same as A401CR401				
115	A509CR8	8-20	Same as A401CR401				
116	A509CR9	8-20	Same as A401CR401				
117	A510CR1	8-18	Same as A401CR401				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>SEMICONDUCTOR DEVICES (CONT)</u>				
118	A510CR2	8-18	Same as A401CR401				
119	A510CR3	8-18	Same as A401CR401				
120	A510CR4	8-18	Same as A401CR401				
121	A510CR5	8-18	Same as A401CR401				
122	A510CR6	8-18	Same as A401CR401				
123	A510CR7	8-18	Same as A401CR401				
124	A510CR8	8-18	Same as A401CR401				
125	A510CR9	8-18	Same as A401CR401				
126	A510 CR10	8-18	Same as A401CR401				
127	A510 CR11	9-18	Same as A401CR401				
128	A511CR1	8-18	Same as A401CR401				
129	A511CR2	8-18	Same as A401CR401				
130	A511CR3	8-18	Same as A401CR401				
131	A511CR4	8-18	Same as A401CR401				
132	A511CR5	8-18	Same as A401CR401				
133	A511CR6	8-18	Same as A401CR401				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>SEMICONDUCTOR DEVICES (CONT)</u>				
134	A511CR7	8-18	Same as A401CR401				
135	A511CR8	8-18	Same as A401CR401				
136	A511CR9	8-18	Same as A401CR401				
137	A511 CR10	8-18	Same as A401CR401				
138	A511 CR11	8-18	Same as A401CR401				
139	CR101	8-6	Same as A401CR401				
140	CR102	8-6	Same as A401CR401				
141	CR417	8-14	Diode	81349	JAN 1N463	019-002655	
			<u>CAPACITORS</u>				
142	A510C1	8-18	Fixed, Ceramic Dielectric (0.001 uf, 10%, 100V)	91418	JF-001K	047-001491	
143	A510C2	9-18	Same as A510C1				
144	A510C3	8-18	Same as A510C1				
145	A510C4	8-18	Same as A510C1				
146	A510C5	8-18	Same as A510C1				
147	A510C6	8-18	Same as A510C1				
148	A510C7	8-18	Same as A510C1				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>CAPACITORS (CONT)</u>				
149	A510C8	8-18	Same as A510C1				
150	A510C9	8-18	Same as A510C1				
151	A510C10	8-18	Same as A510C1				
152	A510C11	8-18	Same as A510C1				
153	A511C1	8-18	Same as A510C1				
154	A511C2	8-18	Same as A510C1				
155	A511C3	8-18	Same as A510C1				
156	A511C4	8-18	Same as A510C1				
157	A511C5	8-18	Same as A510C1				
158	A511C6	8-18	Same as A510C1				
159	A511C7	8-18	Same as A510C1				
160	A511C8	8-18	Same as A510C1				
161	A511C9	8-18	Same as A510C1				
162	A511C10	8-18	Same as A510C1				
163	A511C11	8-18	Same as A510C1				
164	C1	8-2	Fixed, Paper Dielectric (8 uf, 10%, 600V)	81349	CP70B1EF805K	146-100141	
165	C2	8-3	Fixed, Paper Dielectric (0.005 uf, 10%, 8000V)	26916		047-001632	

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
<u>CAPACITORS (CONT)</u>							
166	C3	8-3	Same as C2				
167	C4	8-3	Same as C2				
168	C5	8-3	Same as C2				
169	C6	8-3	Same as C2				
170	C7	8-3	Fixed, Glass Dielectric (2400 uuf, 5%, 500V)	95275	VY31C	047-001631	
171	C8	8-3	Same as C7				
172	C9	8-3	Same as C7				
173	C10	8-3	Same as C7				
174	C11	8-3	Same as C7				
175	C101	8-6	Fixed, Electrolytic (68 uf, -15+25%, 25V)	05751	TS4K-25-686	046-001009	
176	C102	8-6	Same as C101				
177	C103	8-6	Same as C101				
178	C104	8-5	Variable, Quartz Dielectric (0.8-10 uuf, 1000V)	73899	VC-11	044-100490	
179	C105	8-5	Variable, Quartz Dielectric (9-21 uuf, 1000V)	73899	VC-12	044-000551	
180	C106	8-5	Fixed, Ceramic Dielectric (20 uuf, 500V)	71590	853A-20Z	047-001604	
181	C107	8-7	Same as C106				
182	C108	8-5	Same as C106				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
<u>CAPACITORS (CONT)</u>							
183	C109	8-5	Same as C106				
184	C110	8-5	Same as C105				
185 thru 218	C301 thru C336		See classified supplement				
219	C401	8-14	Fixed, Paper Dielectric (1.0 uf, 20%, 600V)	26916		046-001153	
220	C402	8-14	Same as C401				
221	C403	8-14	Fixed, Paper Dielectric (2.0 uf, 20%, 600V)	96733	C80211	046-001111	
222	C501	8-19	Fixed, Paper Dielectric (0.15 uf, 10%, 600V)	01002	84x39	046-001087	
223	C502	8-19	Same as C501				
224	C801	8-27	Fixed, Ceramic Dielectric (20 uuf, 500V)	71590	853A-20Z	047-001604	
225	C802	8-27	Same as C801				
226	C803	8-27	Same as C801				
227	C804	8-27	Same as C801				
228	C805	8-26	Variable (1-42 uuf, 1000V)	73899	MC604	044-000552	
<u>LAMPS</u>							
229	DS101	4-1	Incandescent	72619	1820	039-000687	
230	DS102	4-1	Same as DS101				
231	DS103	4-1	Incandescent	96906	MS25237-327	039-100042	
232	DS104	4-1	Same as DS103				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T)

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>LAMPS (CONT)</u>				
233	DS105	4-1	Same as DS103				
234	DS106	4-1	Same as DS103				
235	DS107	4-1	Same as DS101				
236	DS108	4-1	Same as DS101				
237	DS109	4-1	Same as DS101				
238	DS110	4-1	Same as DS101				
239	DS111	4-1	Same as DS101				
			<u>CONNECTORS</u>				
240	A501P1	8-18	Jack Tip	88245	1705-D-2	036-000291	
241	A501P2	8-18	Same as A501P1				
242	A501P3	8-18	Same as A501P1				
243	A502P1	8-18	Same as A501P1				
244	A502P2	8-18	Same as A501P1				
245	A502P3	8-18	Same as A501P1				
246	A503P1	8-18	Same as A501P1				
247	A503P2	8-18	Same as A501P1				
248	A503P3	8-18	Same as A501P1				

Table 8. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T)

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>CONNECTORS (CONT)</u>				
249	A504P1	8-20	Same as A501P1				
250	A504P2	8-20	Same as A501P1				
251	A505P1	8-20	Same as A501P1				
252	A505P2	8-20	Same as A501P1				
253	A506P1	8-20	Same as A501P1				
254	A506P2	8-20	Same as A501P1				
255	A507P1	8-20	Same as A501P1				
256	A507P2	8-20	Same as A501P1				
257	A508P1	8-20	Same as A501P1				
258	A508P2	8-20	Same as A501P1				
259	A509P1	8-20	Same as A501P1				
260	A509P2	8-20	Same as A501P1				
261	A510P1	8-18	Same as A501P1				
262	A510P2	8-18	Same as A501P1				
263	A511P1	8-18	Same as A501P1				
264	A511P2	8-18	Same as A501P1				
265	J1	1-3	Receptacle, Electrical	96906	MS3102-E-28-15S	010-002330	

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T)

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
<u>CONNECTORS (CONT)</u>							
266	J2	8-3	Receptacle, Electrical	80058	UG-58A/U	010-100585	
267	J3	8-3	Receptacle, Electrical	02660	82-811	010-101445	
268	J6	8-3	Receptacle, Electrical	24655	874-P9	010-002279	
269	J7	8-3	Receptacle, Electrical	02660	126-218	010-101654	
270	J8	8-1	Receptacle, Electrical	88044	AN3057-10A	010-002401	
271	J9	8-3	Receptacle, Electrical	96906	MS3102-E-28-28	010-002331	
272	J11	1-3	Same as J1				
273	J12	8-1	Receptacle, Electrical	88044	AN3057-8A	076-102900	
274	J13	8-3	Receptacle, Electrical	96906	MS3102A40-302	010-002334	
275	J14	8-3	Receptacle, Electrical	96906	MS3102E-28-9S	010-002332	
276	J20	1-3	Receptacle, Electrical	26916		150-003482	
277	J21	1-3	Same as J20				
278	J22	1-3	Same as J20				
279	J23	1-3	Same as J20				
280	J101	8-5	Receptacle, Electrical	02660	92-831	010-002307	
281	J102	8-5	Same as J101				
282	J103	8-5	Same as J101				

Table 8. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T)

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>CONNECTORS (CONT)</u>				
283	J107	4-1	Post, Binding	81073	29-3R	011-001136	
284	J115	8-5	Receptacle, Electrical	80058	UG-1094/U	010-100877	
285	J116	8-5	Receptacle, Electrical	80058	UG-1098/U	010-101123	
286	J117	4-1	Same as J107				
287	J118	8-5	Same as J116				
288	J127	4-1	Same as J107				
289	J301		See Classified Supplement				
290	J403	8-14	Receptacle, Electrical	02660	26-4100-16P	010-100641	
291	J502	8-18	Receptacle, Electrical	26916		041-137265	
292	J503	8-18	Jack, Tip	88245	1700-D-2	036-000290	
293	J504	8-18	Same as J503				
294	J505	8-18	Same as J503				
295	J506	8-18	Same as J503				
296	J507	8-18	Same as J503				
297	J508	8-18	Same as J503				
298	J509	8-18	Same as J503				
299	J510	8-18	Same as J503				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	HLC PART NO.	FED. STOCK NO.
<u>CONNECTORS (CONT)</u>							
300	J511	8-18	Same as J503				
301	J512	8-20	Same as J503				
302	J513	8-20	Same as J503				
303	J514	8-20	Same as J503				
304	J515	8-20	Same as J503				
305	J516	8-20	Same as J503				
306	J517	8-20	Same as J503				
307	J518	8-20	Same as J503				
308	J519	8-20	Same as J503				
309	J520	8-20	Same as J503				
310	J521	8-20	Same as J503				
311	J522	8-20	Same as J503				
312	J523	8-20	Same as J503				
313	J524	8-18	Same as J503				
314	J525	8-18	Same as J503				
315	J526	8-18	Same as J503				
316	J527	8-18	Same as J503				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>CONNECTORS (CONT)</u>				
317	J621	8-23	Receptacle, Electrical	26916		010-002224	
318	J826	8-26	Receptacle, Electrical	74868		010-001950	
319	P3		Plug, Electrical	02660	26-4200-16S	010-000640	
320	P4		Same as J301				
321	P5	8-3	Same as P3				
322	P6		Plug, Electrical	24655	874-C9	010-002280	
323	P10		Plug, Electrical	02660	82-832	010-002282	
324	P11		Same as P4				
325	P16		Plug, Electrical	80058	UG-260/U	010-101206	
326	P18		Same as P16				
327	P21	8-3	Plug, Electrical	26916		010-002225	
328	P25	8-3	Plug, Electrical	02660	26-4200-24S	010-200642	
329	P31	8-3	Same as P3				
330	P42		Plug, Electrical	96906	MS3106E-28-2P	010-002313	
331	P101	8-5	Same as P10				
332	P102	8-5	Same as P10				
333	P103	8-5	Same as P10				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
<u>CONNECTORS (CONT)</u>							
334	P201	1-3	Plug, Electrical	88044	AN3106E-28-15P	010-002315	
335	P301		See Classified Supplement				
336	P501	8-3	Same as J403				
337	P506	8-17	Same as J403				
338	P512	8-17	Plug, Electrical	26916		010-002218	
339	P612	8-23	Plug, Electrical	26916		010-002219	
340	P701		Plug, Electrical	02660	126-217	010-101013	
341	W1P9	8-4	Same as P42				
342	W1P10	8-4	Plug, Electrical	96906	MS3106E-28-2S	010-002317	
343	W2P1	8-4	Jack, Tip	83330	190	011-001291	
344	W2P2	8-4	Plug, Electrical	80058	UG-94A/U	010-002345	
345	W3P2	8-4	Same as W2P2				
346	W3P3	8-4	Same as W2P2				
347	W4P2	8-3	Plug, Electrical	81312	302-3106A-40	010-002152	
348	W4P13	8-4	Plug, Electrical	81312	301-3106A-40	010-002333	
349	W5P1	8-4	Plug, Electrical	96906	MS3106E-24-2S	010-002004	
350	W5P2	8-4	Plug, Electrical	96906	MS3106E-24-2P	010-002005	

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
<u>CONNECTORS (CONT)</u>							
351	W5P14	8-4	Plug, Electrical	96906	MS3106E-28-9P	010-002314	
352	W6P1	8-4	Plug, Electrical	02660	7-8649	010-002421	
353	W6P12	8-4	Plug, Electrical	96906	MS3106E-16-10S	010-002420	
354	W7P1	8-4	Same as W5P2				
355	W7P8	8-4	Same as W5P1				
<u>RELAYS</u>							
356	K101	8-5	Relay (10 amp, 4pdt)	96906	MS24568-D1	021-000574	
357	K102	8-5	Relay (5.1V, pull-in)	82415	6ES/BRKT	021-000559	
358	K103	8-5	Relay (dpdt)	96906	MS24139-6	021-000561	
359	K104	8-15	Same as K103				
360	K105	8-5	Relay, Thermal (spst)	93929	RF-162-150SEC27Y	021-000557	
361	K106	8-5	Same as K103				
362	K107	8-5	Same as K103				
363	K108	8-5	Same as K101				
364	K109	8-5	Same as K101				
365	K110	8-5	Same as K101				
366	K111	8-5	Same as K101				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
367	K112	8-5	Same as K102				
368	K113	8-5	Same as K103				
369	L1	1-3	Valve, Solenoid				
370 thru 377	L301 thru L309		See Classified Supplement				
378	L401	8-14	Reactor (0.5h, 200 ma)	04845	8030A3	080-000832	
379	L402	8-14	Same as L401	26916		056-000439	
380	L501	8-19	Reactor (2.0 h, 500 ma)	26916		056-000441	5950-845-5577
381	M201	4-2	Voltmeter (0-300 vdc scale)	81349	MR36W300DCVVR	082-000541	
382	M202	4-2	Ammeter (0-200 ma dc scale)	81349	MR36W200DCMAR	082-000539	
383	M203	4-2	Voltmeter (0-800 vdc scale)	81349	MR36W800DCVVR	082-000521	
384	M204	4-2	Ammeter (0-100 ma dc scale)	81349	MR36W100DCMAR	082-000538	
385	M205	4-2	Same as M203				
386	M206	4-2	Ammeter (0-300 ma dc scale)	81349	MR36W300DCMAR	082-000540	
387	M207	4-2	Voltmeter (0-200 vdc movement with 0-2000 vdc meter scale)	94916	36W1001B-14X-30351A	082-000571	
388	M208	4-2	Ammeter (0-5 ma dc movement with 0-500 ma dc meter scale)	94916	AED005DCMA	082-000543	

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
<u>RESISTORS</u>							
389	R1	8-3	Variable (35 ohm, 5%, 25 W)	81349	RP101RD350J	025-002069	
390	R2	8-2	Fixed, Wire Wound (2200 ohm, 5%, 210W)	81349	RW47V222	455-477222	
391	R3	8-2	Same as R2				
392	R4	8-2	Same as R2				
393	R5	8-2	Same as R2				
394	R6	8-2	Same as R2				
395	R7	8-2	Same as R2				
396	R8	8-2	Same as R2				
397	R9	8-2	Same as R2				
398	R10	8-2	Same as R2				
399	R11	8-2	Same as R2				
400	R12	8-2	Same as R2				
401	R13	8-2	Same as R2				
402	R14	8-2	Same as R2				
403	R15	8-2	Same as R2				
404	R16	8-2	Same as R2				
405	R17	8-2	Same as R2				
406	R18	8-2	Same as R2				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T)

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>RESISTORS (CONT)</u>				
407	R19	8-2	Same as R2				
408	R20	8-2	Fixed, Film (0.1096 ohm, 1%, 1/2 W)	26916		024-001350	
409	R21	8-2	Fixed, Wire Wound (110K ohm, 1%, 10W)	91637	Type RS-10		
410	R22	8-2	Fixed, Film (140K ohm, 1%, 10W)	81349	RD70P1403J	458-701403-21	
411	R23	8-2	Same as R22				
412	R24	8-2	Same as R22				
413	R25	8-2	Fixed, Wire Wound (130K ohm, 1%, 10W)	91637	Type RS-10		
414	R26	8-2	Same as R25				
415	R27	8-2	Fixed, Wire Wound (140K ohm, 1%, 10W)	91637	Type RS-10		
416	R28	8-2	Same as R27				
417	R29	8-2	Same as R27				
418	R32	8-2	Fixed, Film (2 ohm, 5%, 26W)	81349	RW33V2R0	455-337020	
419	R101	8-6	Fixed, Wire Wound (260 ohm, 5%, 3W)	81349	RW59V261	455-597261	
420	R102	8-6	Fixed, Composition (33 ohm, 10%, 1/2W)	81349	RC20GF330K	450-242330	
421	R103	8-7	Fixed, Wire Wound (2 ohm, 3%, 40 W)	81349	RH50V2R0H	454-222020	
422	R104	8-7	Fixed, Wire Wound (1400 ohm, 3%, 40W)	81349	RH50V142H	454-222142	
423	R105	8-6	Fixed, Composition (20K ohm, 5%, 1/2W)	81349	RC20GF203J	450-241203	
424	R106	8-6	Same as R105				

TABLE 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T)

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>RESISTORS (CONT)</u>				
425	R107	8-6	Fixed, Composition (3600 ohm, 5%, 1/2 W)	81349	RC20GF392J	450-241362	
426	R108	8-6	Same as R107				
427	R109	4-1	Variable (100 K ohm, 10%, 3 W)	26916		025-002068	
428	R110	8-7	Fixed, Wire Wound (180 ohm, 3%, 30 W)	81349	RH50G181H	454-122181	
429	R113	4-1	Variable (5K ohm, 5%, 2 W)	81349	RA20NASD502A	025-002006	
430	R114	8-5	Fixed, Wire Wound (7 ohm, 1%, 0.4 W)	81349	RB52AK7R000F	024-001416	
431	R116	8-5	Fixed, Composition (1200 ohm, 5%, 2 W)	81349	RC42GF122J	450-541122	
432	R117	8-5	Fixed, Composition (100 ohm, 5%, 1/2W)	81349	RC20GF101J	450-241101	
433	R118	8-5	Same as R117				
434	R119	8-5	Same as R117				
435	R120	8-5	Same as R117				
436	R201	8-8	Fixed, Wire Wound (4700 ohm, 5%, 11 W)	81349	RW31V472	455-317472	
437	R202	8-8	Fixed, Wire Wound (12 K ohm, 5%, 26 W)	81349	RW33V123	455-337123	
438 thru 478	R301 thru R344						
479	R401	8-14	Fixed, Composition (1 megohm, 10%, 2 W)	81349	RC42GF105K	450-542105	
480	R402	8-14	Fixed, Composition (220K ohm, 10%, 2 W)	81349	RC42GF224K	450-542224	

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>RESISTORS (CONT)</u>				
481	R403	8-14	Fixed, Composition (2.2 megohm, 10%, 2 W)	81349	RC42GF225K	450-542225	
482	R404	8-14	Fixed, Wire Wound (8000 ohm, 5%, 11 W)	81349	RW58V802	455-587802	
483	R405	8-14	Fixed, Wire Wound (9000 ohm, 5%, 10W)	81349	RW58V902	024-001376	
484	R406	8-14	Fixed, Wire Wound (4300 ohm, 5%, 10W)	81349	RW56G432	455-564432	
485	R407	8-14	Fixed, Composition (1 megohm, 10%, 1/2W)	81349	RC20GF105K	450-242105	
486	R409	8-15	Fixed, Wire Wound (47K ohm, 5%, 10W)	81349	RW56G473	455-564473	
487	R410	8-15	Same as R409				
488	R411	8-15	Same as R409				
489	R501	8-21	Fixed, Film (750 K ohm, 5%, 4 W)	81349	RD70P7503J	457-707503-41	
490	R502	8-22	Same as R501				
491	R503	8-21	Same as R501				
492	R504	8-22	Same as R501				
493	R505	8-21	Same as R501				
494	R506	8-22	Same as R501				
495	R507	8-21	Same as R501				
496	R508	8-22	Same as R501				
497	R509	8-19	Same as R501				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
<u>RESISTORS (CONT)</u>							
498	R510	8-19	Same as R501				
499	R511	8-19	Same as R501				
500	R512	8-19	Same as R501				
501	R513	8-19	Same as R501				
502	R514	8-19	Same as R501				
503	R515	8-19	Same as R501				
504	R601	8-24	Fixed, Film (46.4 K ohm, 5%, 13 W)	81349	RD33P4642J	457-334642-41	
505	R602	8-24	Same as R601				
506	R603	8-24	Fixed, Film (51.1 ohm, 5%, 7 W)	81349	RD31P5112J	457-315112-41	
507	R604	8-24	Fixed, Film (38.3 K ohm, 5%, 7 W)	81349	RD31P3832J	457-313832-41	
508	R605	8-24	Fixed, Film (82.5K ohm, 5%, 13 W)	81349	RD33P8252J	457-338252-41	
509	R606	8-24	Same as R605				
510	R607	8-24	Fixed, Film (51.1 K ohm, 5%, 13 W)	81349	RD33P5112J	457-335112-41	
511	R608	8-24	Same as R607				
512	R609	8-23	Fixed, Wire Wound (1100 ohm, 1%, 3 W)	91637	RS-2-112F	446-015112-00	
513	R610	8-23	Fixed, Wire Wound (31 ohm, 5%, 11W)	81349	RW58V310	455-587310	
514	R611	8-23	Same as R610				
515	R612	8-23	Same as R610				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
<u>RESISTORS (CONT)</u>							
516	R613	8-23	Same as R610				
517	R614	8-23	Fixed, Wire Wound (100 ohm, 1%, 3 W)	91637	RS-2-101F	446-015101-00	
518	R615	8-23	Fixed, Film (19.6 ohm, 5%, 1W)	81349	RD60P19R6J	457-600196-41	
519	R616	8-24	Fixed, Film (110 ohm, 5%, 13 W)	81349	RD33P1100J	457-331100-41	
520	R617	8-23	Fixed, Film (17.8 K ohm, 5%, 1 W)	81349	RD60P1782J	457-601782-41	
521	R618	8-23	Fixed, Wire Wound (145 K ohm, 3%, 10W)	91637	RS-10-1453H	024-001342	
522	R619	8-23	Same as R618				
523	R620	8-23	Same as R618				
524	R621	8-23	Same as R618				
525	R801	8-26	Fixed, Composition (1600 ohm, 3%, 7W)	91637	NS-7-162H	441-061601-09	
526	R802	8-26	Same as R801				
<u>SWITCHES</u>							
527	S1	1-3	Pressure	26916		060-002437	
528	S2	1-3	Flow	04034	FS-400	060-002386	
529	S3	8-3	Level	04034	LS-1800	060-002385	
530	S101	4-1	Toggle (4 pdt)	96906	MS24525-22	060-002352	
531	S102	4-1	Toggle (spdt)	96906	MS35058-23	060-002325	
532	S103	4-1	Same as S102				

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>SWITCHES (CONT)</u>				
533	S104	4-1	Push	76572	L7704N2	060-002394	
534	S105	4-1	Rotary (dp, 2 position)	54294	2J56A3-LX718	060-002330	
535	S106	4-1	Toggle (spst)	96906	MS35058-22	060-002323	
536	S107	4-1	Toggle (dptt)	96906	MS35059-21	060-002283	
537	S108	4-1	Same as S107				
538	S109	4-1	Push				
539	S501	8-18	Sensitive	96906	MS25089-3C	060-002368	
540	S601	8-23	Same as S501	40931	5SE3-3	060-002371	
			<u>TEST POINTS</u>				
541	TP6	8-3	Jack, Tip, P/O P21				
542	TP8	8-3	Jack, Tip, P/O P21				
543	TP14	8-3	Jack, Tip, P/O P21				
544	TP25	8-3	Jack, Tip, P/O P21				
545	TP32	8-3	Jack, Tip, P/O P21				
546 thru 553	TP301 thru TP308		See Classified Supplement				
			<u>TRANSFORMERS</u>				
554	T1	8-2	Variable (3 phase)	91407	126-3	052-000903	

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
<u>TRANSFORMERS (CONT)</u>							
555	T2	8-2	Power, Constant Voltage (single phase)	80052	T3016-1	052-000902	
556	T101	8-5	Power, Step Down	26916		052-000951	
557	T102	8-5	Radio Frequency (pri 250 uh; sec 650 uh)	26916		150-001670	
558	T103	8-5	Radio Frequency (pri 6.35 uh, sec 21.0 uh)	26916		150-001619	
559	T104	8-5	Same as T102				
560	T105	8-5	Power, Step-Down	26916		052-000900	
561	T401	8-14	Power, Step-Up (3 phase)	26916		052-000835	
562	T402	8-14	Power, Step-Up (single phase)	26916		052-000842	
563	T501	8-19	Power, Step-Up	26916		150-001896	
564	T502	8-19	Power, Step-Up	26916		023-001895	
<u>ELECTRON TUBES</u>							
565	V101	8-6	Electron Tube	81349	JAN 6542	090-801258	
566	V102	8-6	Electron Tube	81349	JAN 5787WA	090-800609	
567 thru 577	V301 thru V311		See Classified Supplement				
<u>LIGHTS</u>							
578	XDS101	8-5	Indicator (red)	81349	LH60BR4	086-000582	
579	XDS102	8-5	Indicator (green)	81349	LH60BG4	086-000584	
580	XDS107	8-5	Indicator (amber)	81349	LH60BY4	086-000601	

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
581	XDS108	8-5	<u>LIGHTS (CONT)</u> Same as XDS107				
582	XDS109	8-5	Same as XDS107				
583	XDS110	8-5	Same as XDS107				
584	XDS111	8-5	Same as XDS107				
585 thru 595	XV301 thru XV311		<u>TUBE SOCKETS</u>				
596	A501	8-18	<u>MISCELLANEOUS</u> Terminal Board Assembly	26916		150-000535	
597	A502	8-18	Same as A501				
598	A503	8-18	Same as A501				
599	A504	8-20	Terminal Board Assembly	26916		150-000534	
600	A505	8-20	Same as A504				
601	A506	8-20	Same as A504				
602	A507	8-20	Same as A504				
603	A508	8-20	Same as A504				
604	A509	8-20	Same as A504				
605	A510	8-18	Terminal Board Assembly	26916		150-000536	

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T)

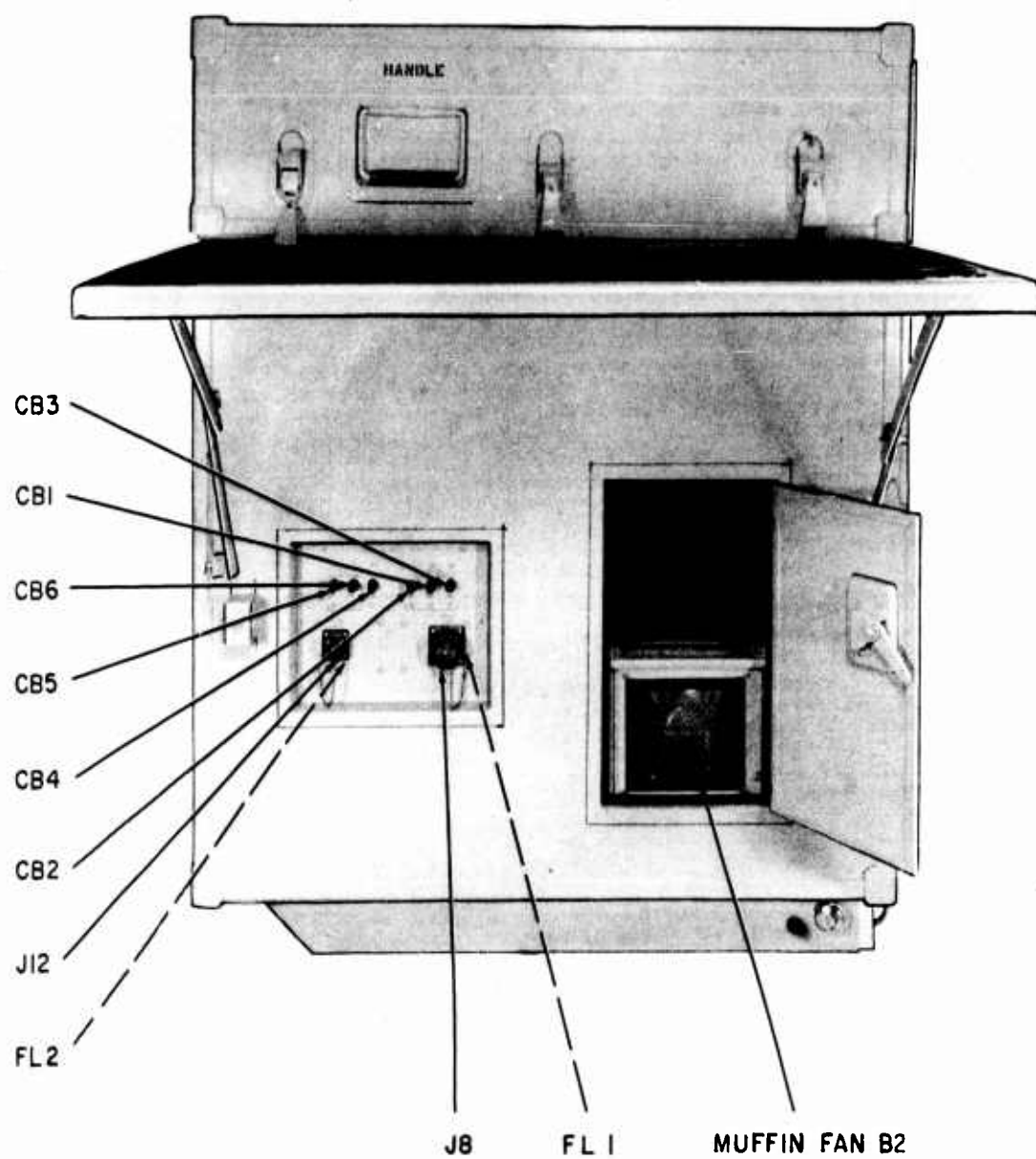
ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
<u>MISCELLANEOUS (CONT.)</u>							
606	A511	8-18	Same as A510	61178	4616L	020-000333-01	
607	B1	8-2	Motor, Alternating Current	82877	50112-1B	020-000325	
608	B2	8-1	Fan, Axial	82877	KS-801	020-000324	
609	B701	1-3	Motor, Alternating Current (115V, 60 cps, single phase)	56289	JN14351	049-000214	
610	FL1	8-1	Filter, Radio Interference	56289	JN4352	049-000215	
611	FL2	8-1	Filter, Radio Interference	71400	KLM-0.1	039-000658	
612	FL01	4-1	Fuse, Cartridge (0.1 amp, slo-blo)	71400	KLM-0.3	039-000659	
613	FL02	4-1	Fuse, Cartridge (0.3 amp, slo-blo)	26916		023-000434	
614	RV501		Resistor, Voltage Sensitive	75173	10-540	088-002416	
615	TB1		Terminal Board	75173			
616	TB2		Same as TB1				
617	TB3		Terminal Board	75173	2-140	088-100872	
618	TB4	8-3	Same as TB3				
619	TB5	8-3	Terminal Board, P/O P21				
620	TB401	8-15	Terminal Board	26916		150-002572	
621	TB402	8-15	Terminal Board	26916		150-002573	
622	TB801	8-25	Terminal Board	26916		150-003392	

Table 8-1. Replaceable Parts List for Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
			<u>MISCELLANEOUS (CONT)</u>				
623	XF101	8-5	Fuseholder	71400	HGC	006-000980	
624	XF102	8-5	Same as XF101				
625			Adapter, Cable	26916		002-003370	
626			Adapter, Cable	88044	AN3057-6A	010-002319	
627			Adapter, Cable	88044	AN3057-4	010-100185	
628			Adapter, Cable	88044	AN3057-8	010-100317	
629			Adapter, Cable	88044	AN3057-12	010-100122	
630			Adapter, Cable	88044	AN3057-16	010-001843	
631			Box Connector, Electrical	88044	AN3064-10	010-002400	
632			Box Connector, Electrical	88044	AN3064-6	010-002185	
633			Box Connector, Electrical	88044	AN3064-4	010-002186	
634			Box Connector, Electrical	88044	AN3064-8	010-002184	
635			Box Connector, Electrical	88044	AN3064-12	010-002209	
636			Box Connector, Electrical	88044	AN3064-16	010-002305	
637			Connector, Straight	45681	12FBTX-SS	029-000961	
638			Connector, Straight	45681	5-4-FBFX-SS	029-000903	
639			Connector, Straight	45681	10-FBFX-10	029-000968	

Table 8-1. Replaceable Parts List For Test Set, Electronic Circuit Plug-In Unit QRC-133A(T).

ITEM NO.	REF SYM	FIG. NO.	DESCRIPTION	MFR CODE	MFR PART NO.	HLC PART NO.	FED. STOCK NO.
640			<u>MISCELLANEOUS (CONT)</u> Gage, Liquid	51240	3003	080-000827	
641			Jack, Tip	96906	MS16107-2	036-000330	
642			Jack, Tip	26916		011-001282	
643			Shield, Electron Tube	26916		059-001428	5960-894-1190
644			Shield, Electron Tube	98978	T11-20274	069-101108	5960-578-8008
645			Shield, Electron Tube	96906	MS24233-2	059-001397	5960-686-8085
646			Shield, Electron Tube	96906	MS24233-5	059-001396	5960-686-2087
647			Shield, Tube Base	98978	T11-2001-8H	069-001403	



092-014180

Figure 8-1. Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T), Right Side View.

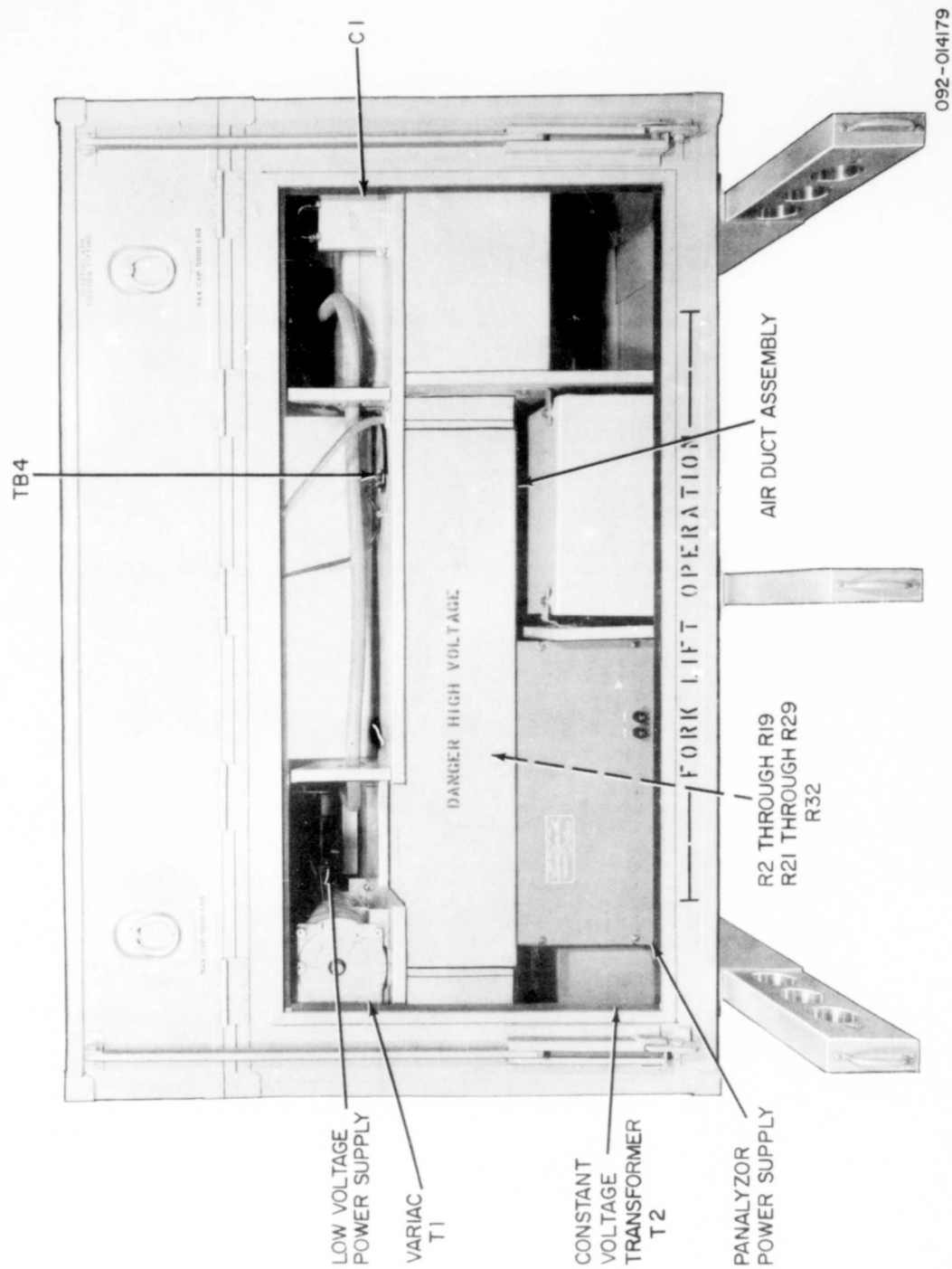


Figure 8-2. Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T), Rear View.

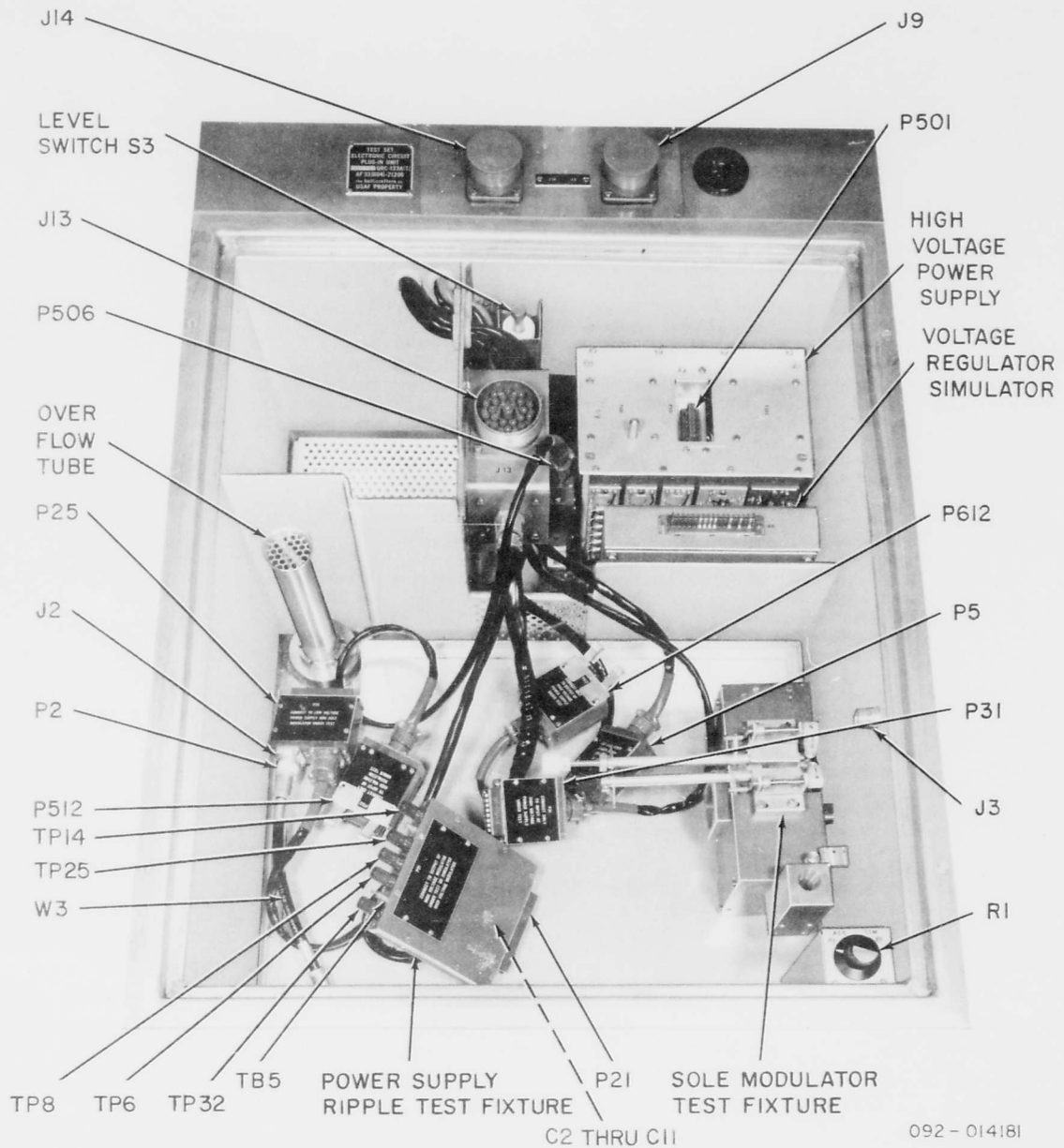


Figure 8-3. Oil-Filled Test Chamber, Plug-in Unit Test Set.

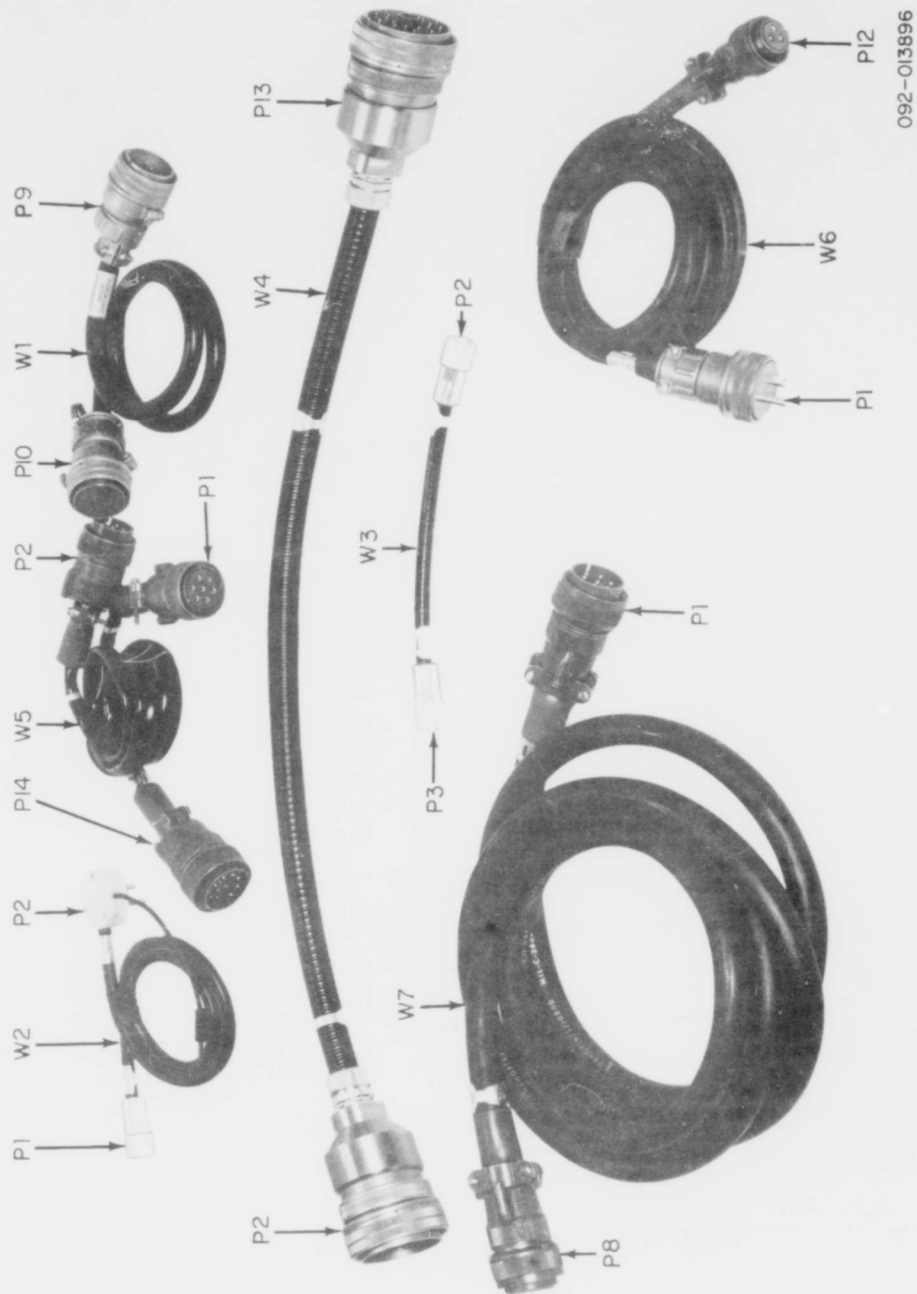
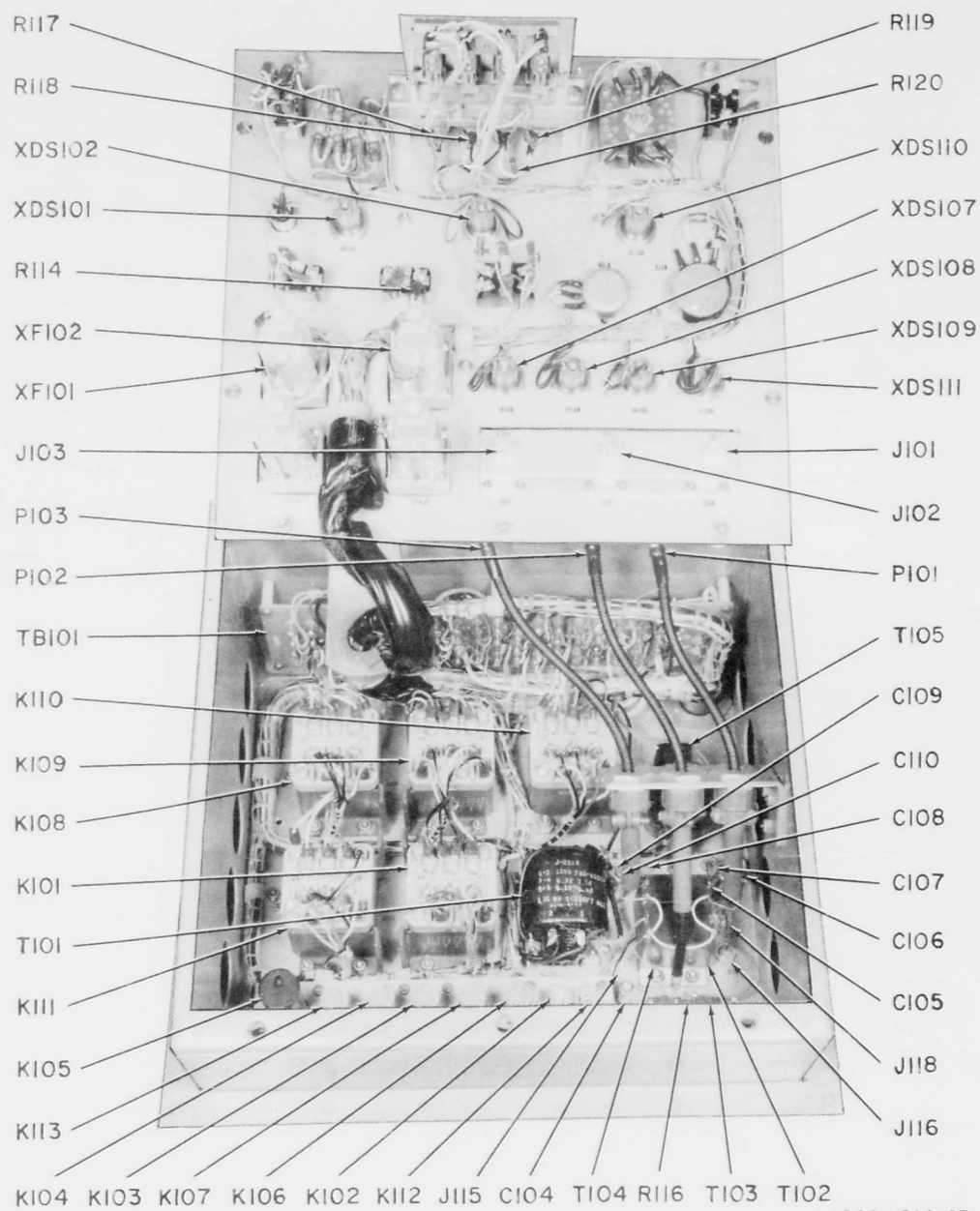


Figure 8-4. Interconnecting Cables for Plug-in Unit Test Set.



092-014183

Figure 8-5. Control Panel, Internal View.

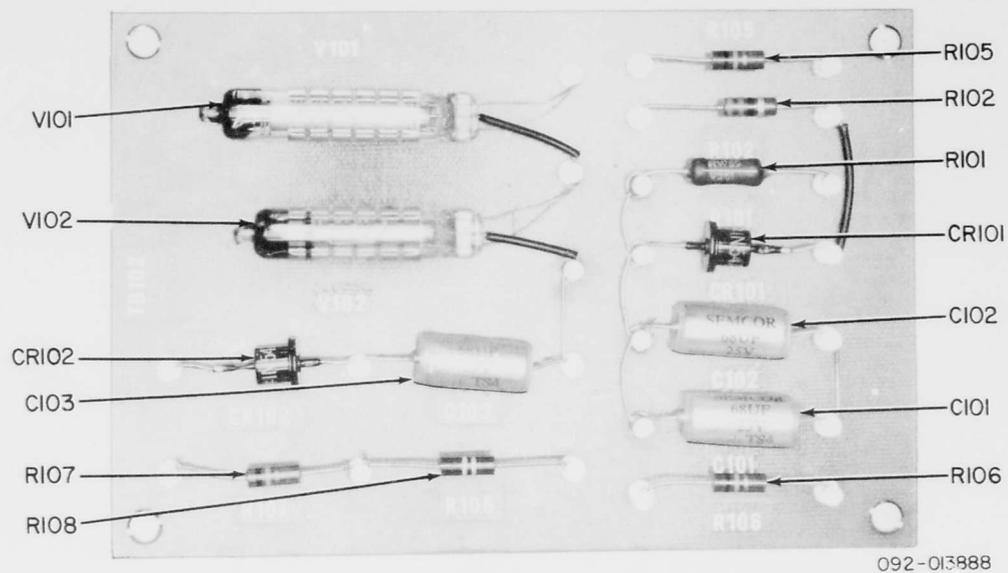


Figure 8-6. Terminal Board TB102, Control Panel.

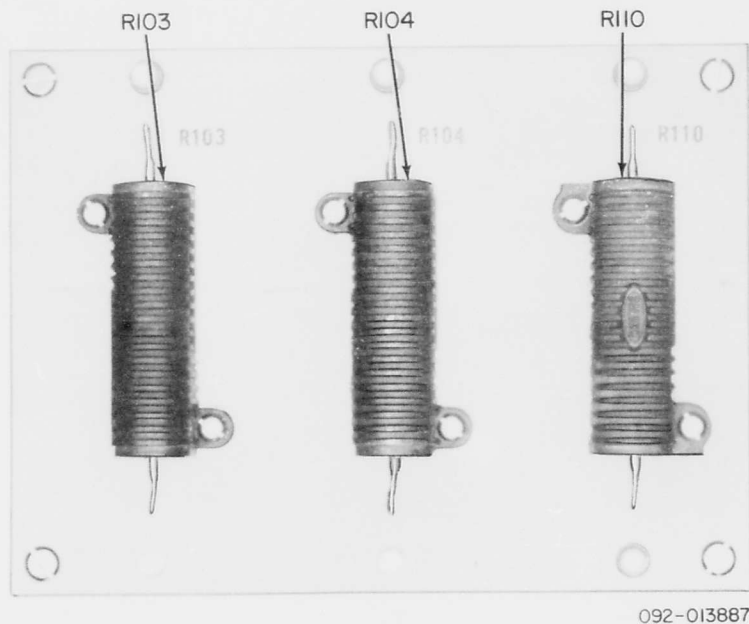
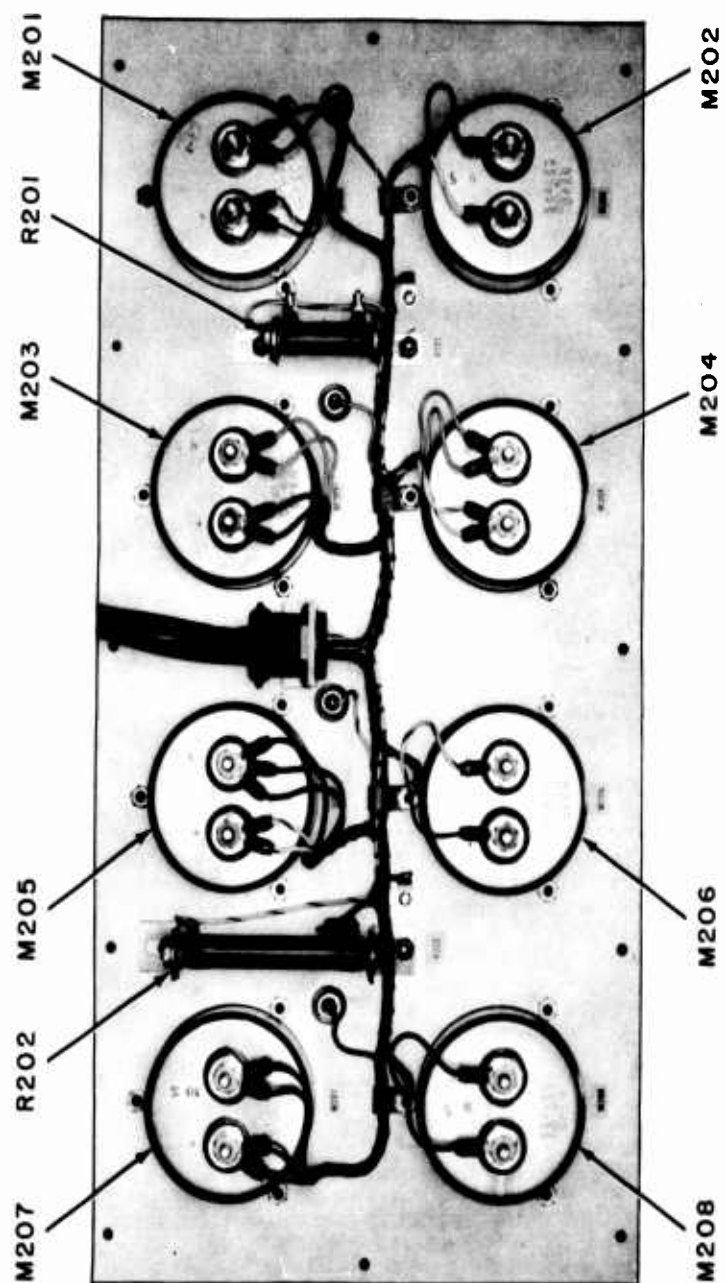


Figure 8-7. Resistor Mounting Board, Control Panel.



092-014206

Figure 8-8. Low Voltage Indicator Panel, Rear View.

Refer to the Classified Supplement to The Handbook of Operation and Service Instructions For Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T)(HLC NO. 094-903067) for photographs of the interference generator.

Figure 8-9. Interference Generator Module, Oblique View.

Figure 8-10. Interference Generator Module, Top View.

Figure 8-11. Interference Generator Module, Bottom View.

Figure 8-12. Terminal Board TB302, Interference Generator Module.

Figure 8-13. Terminal Board TB301, Interference Generator Module.

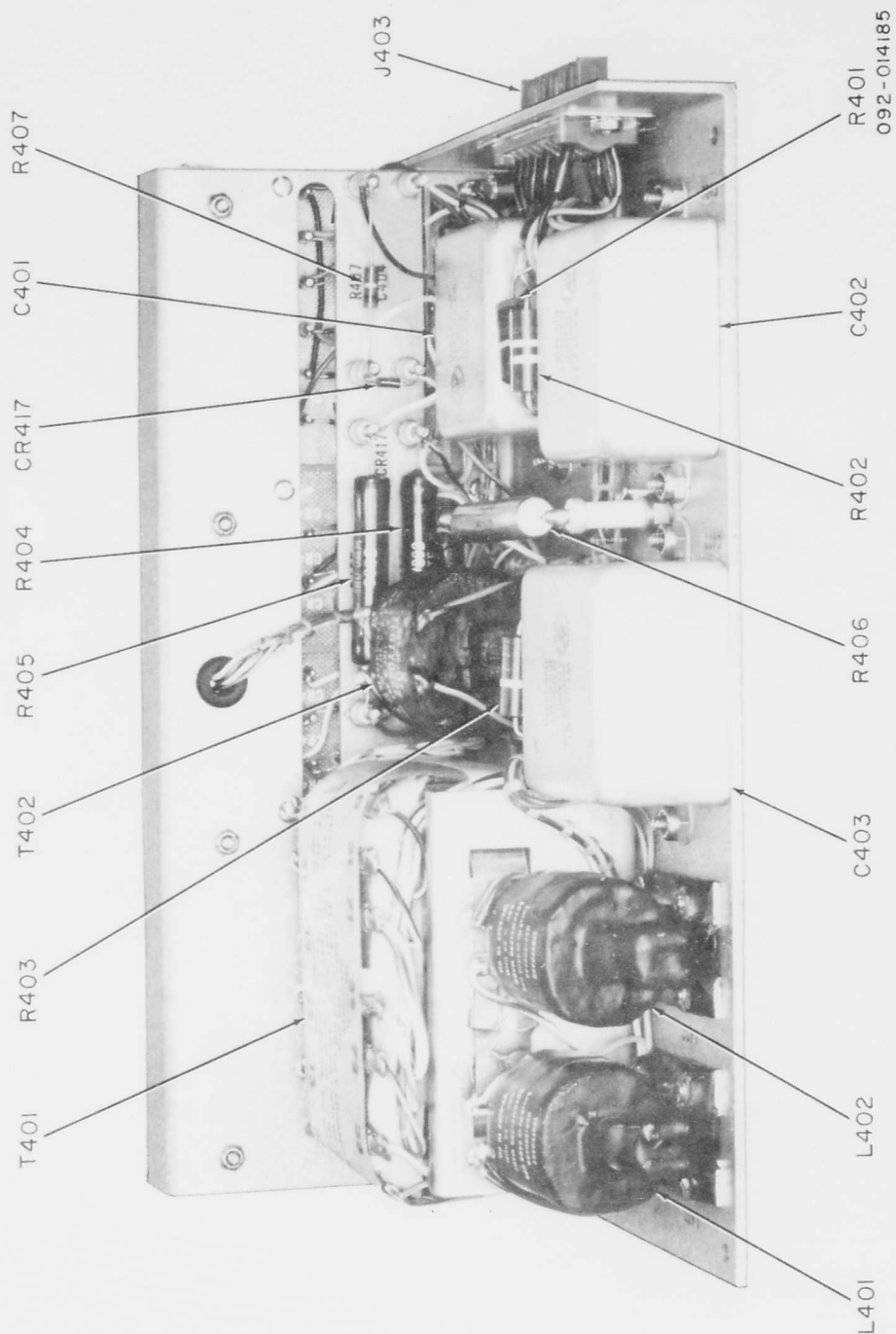


Figure 8-14. Low Voltage Power Supply, Oblique View.

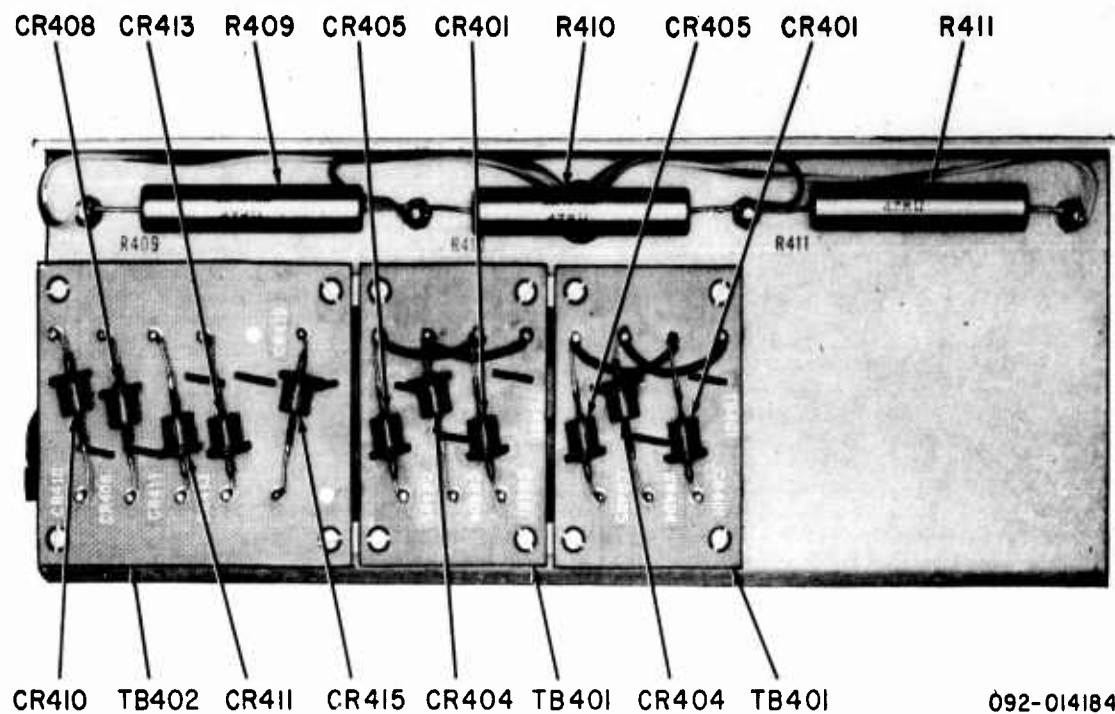


Figure 8-15. Low Voltage Power Supply, Rear View.

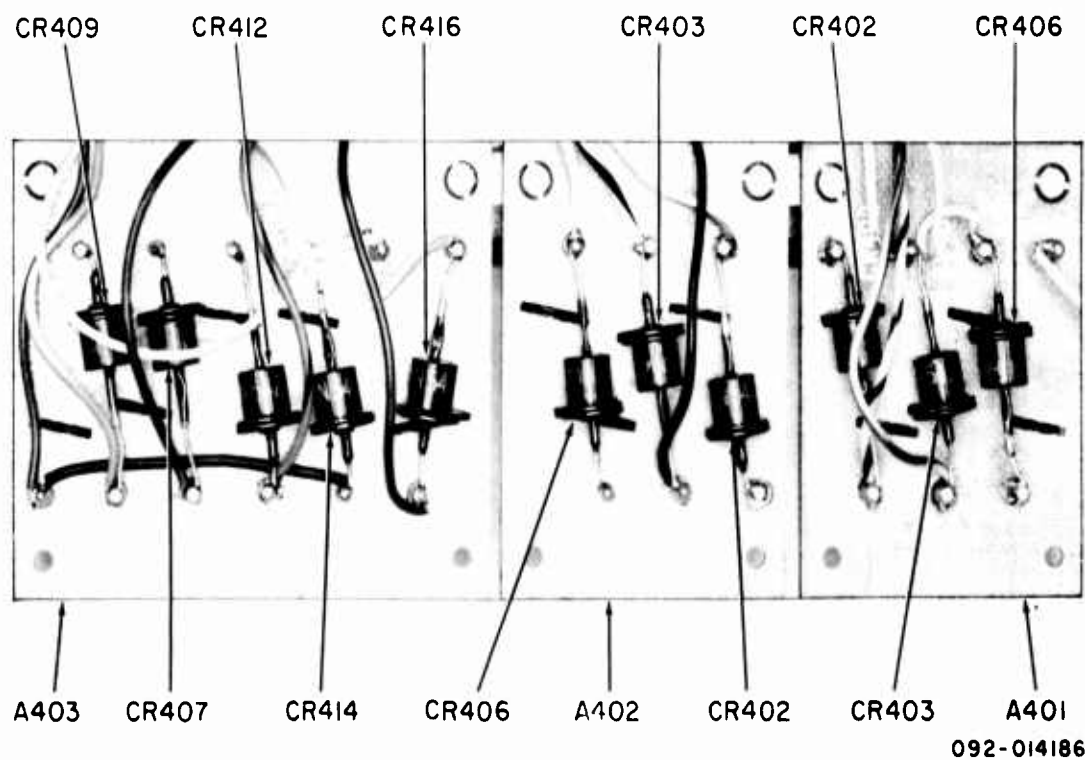


Figure 8-16. Diode Boards, Low Voltage Power Supply.

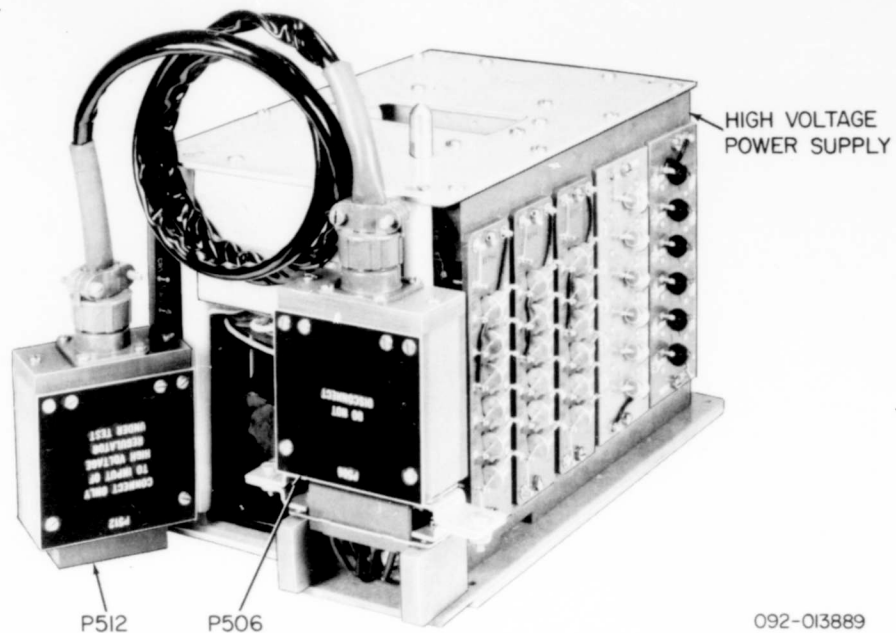


Figure 8-17. High Voltage Power Supply, Oblique View.

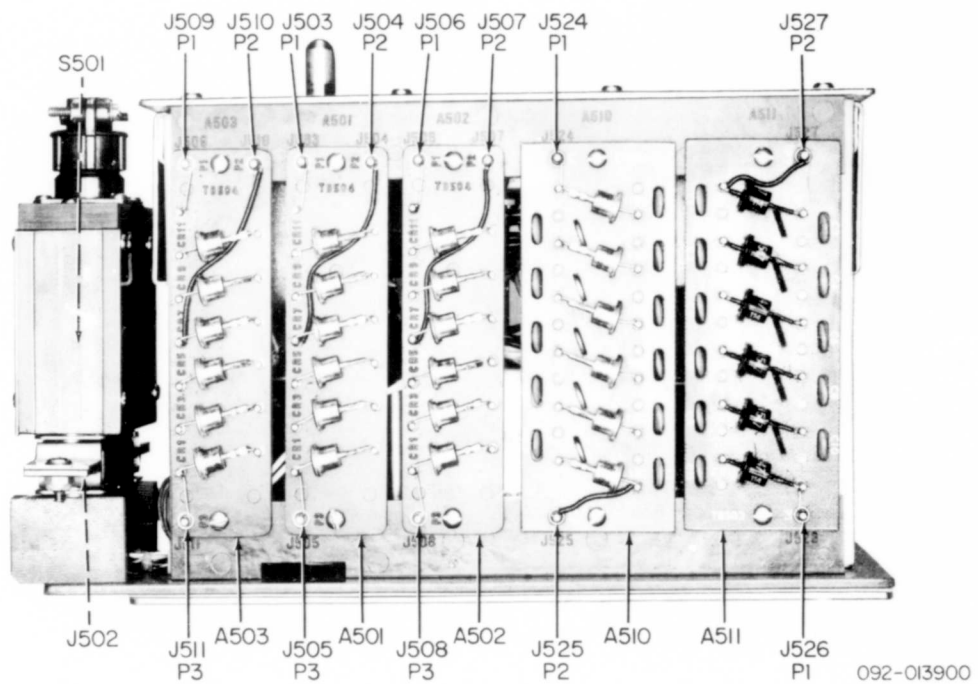


Figure 8-18. High Voltage Power Supply, Right Side View.

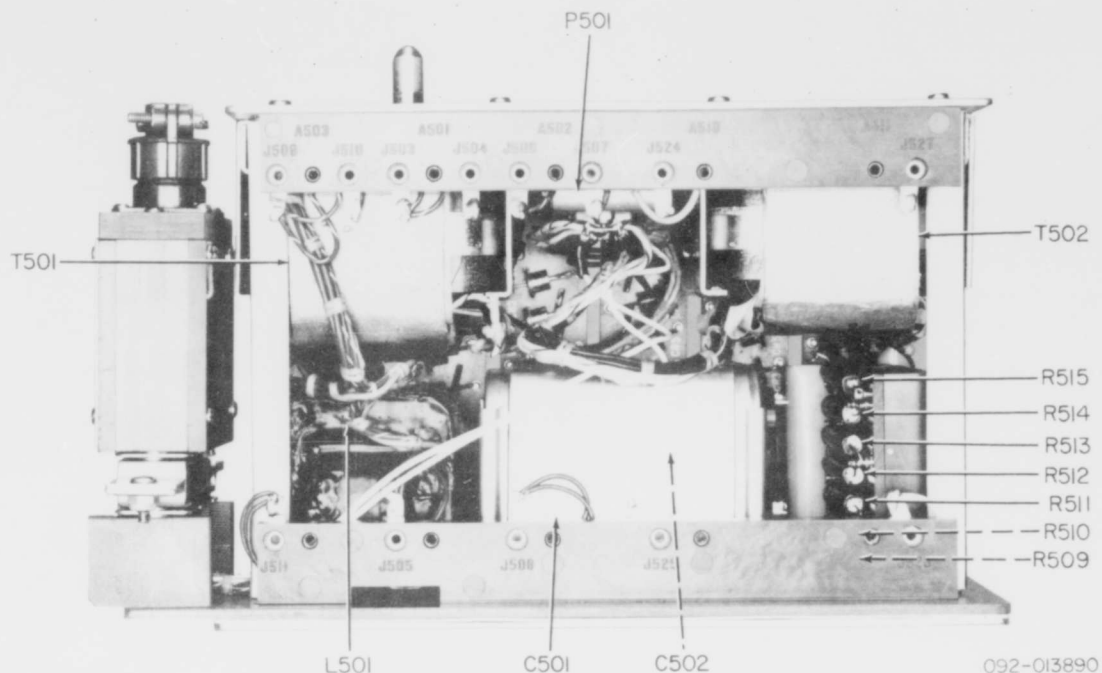


Figure 8-19. High Voltage Power Supply, Right Side Internal View.

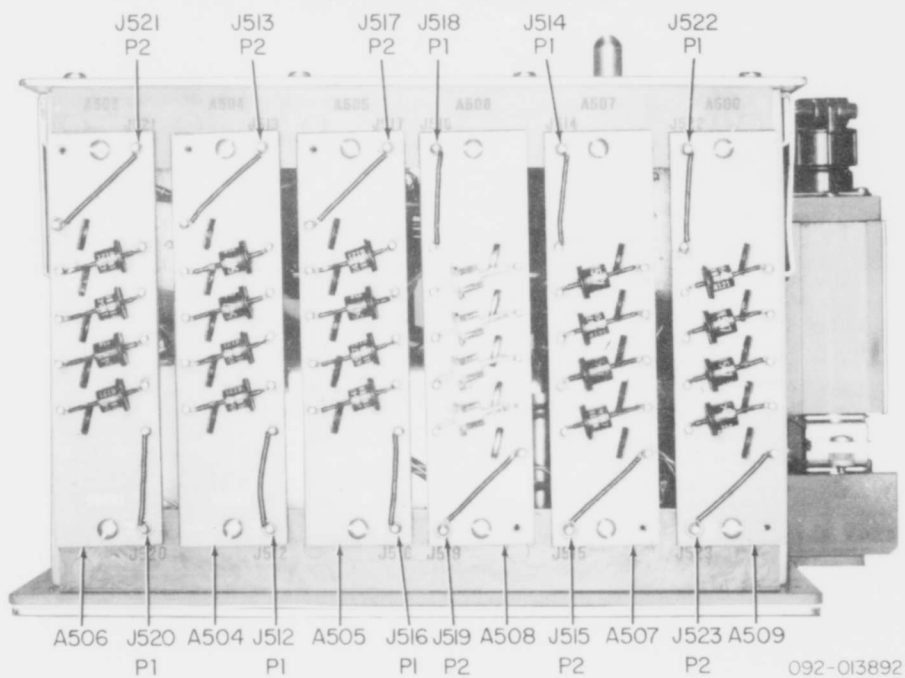


Figure 8-20. High Voltage Power Supply, Left Side View.

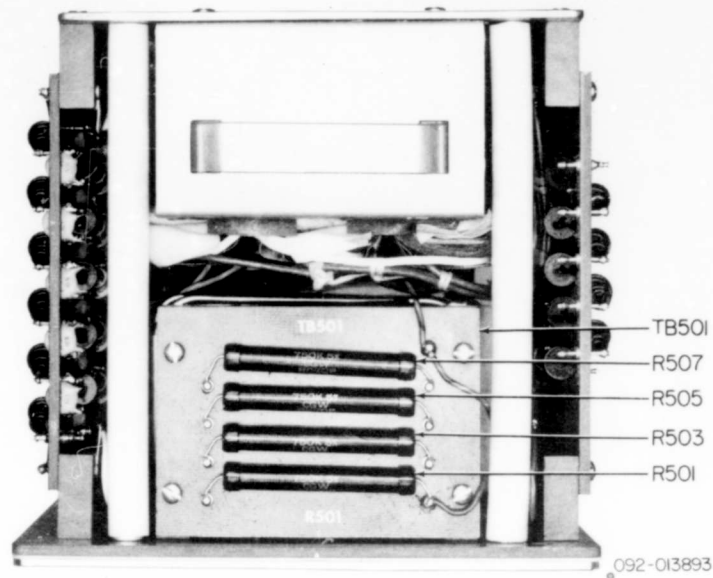


Figure 8-21. High Voltage Power Supply, Rear View.

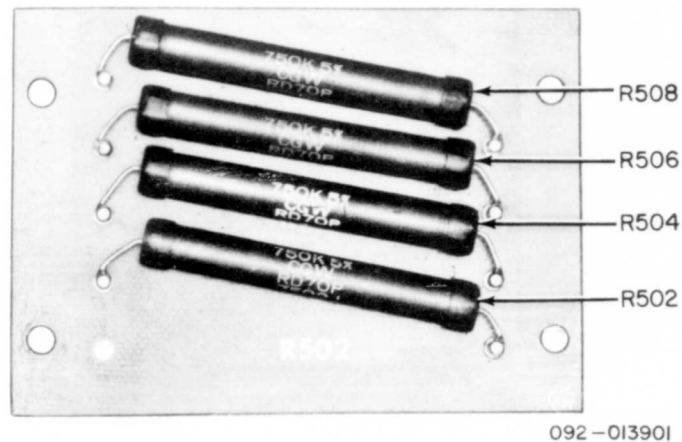


Figure 8-22. Terminal Board TB501, High Voltage Power Supply.

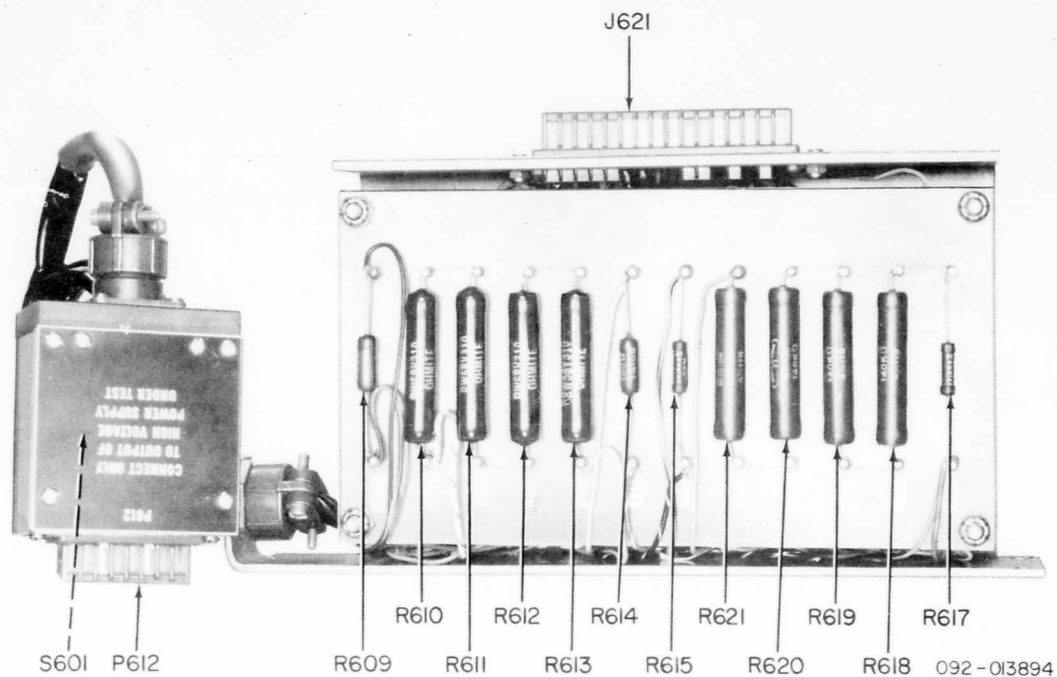


Figure 8-23. Voltage Regulator, Top View.

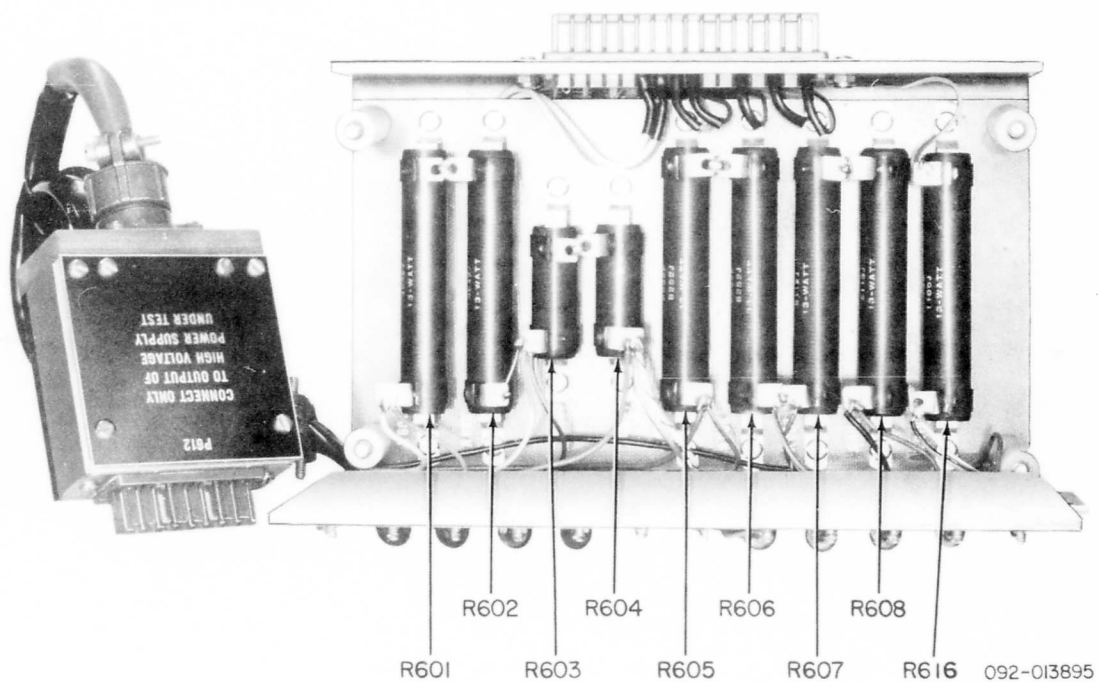


Figure 8-24. Voltage Regulator, Internal View.

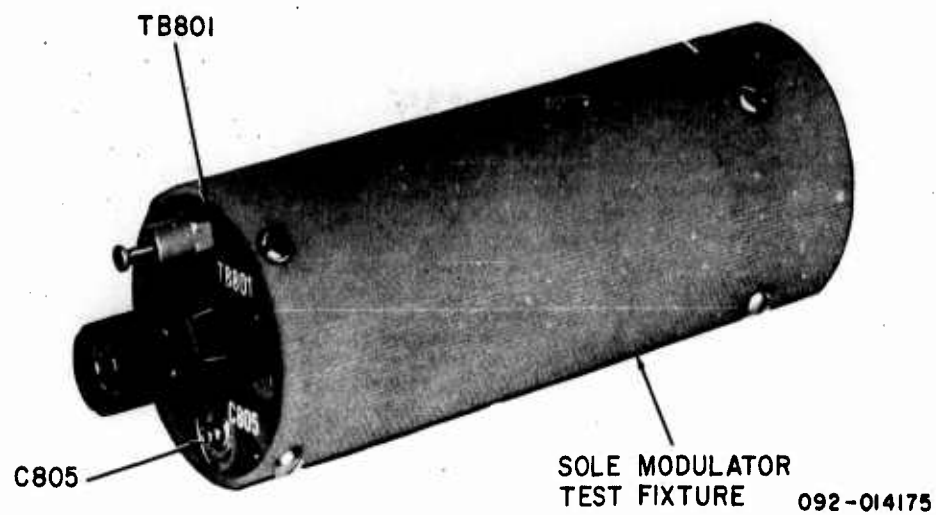


Figure 8-25. Sole Modulator Load, Oblique View.

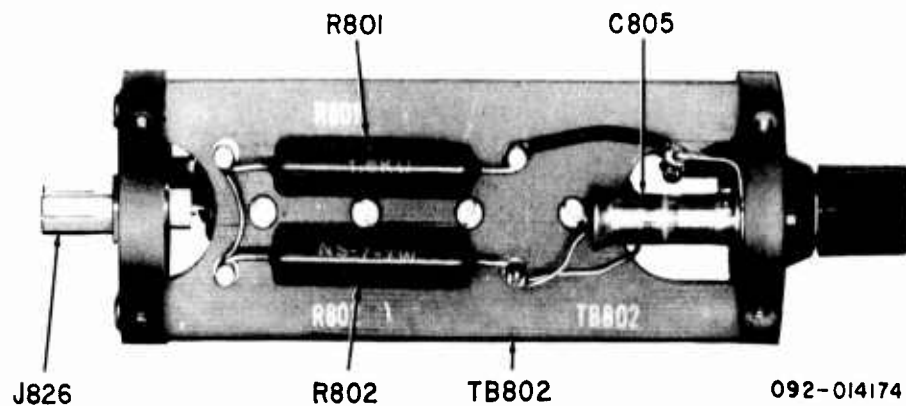


Figure 8-26. Terminal Board TB802, Sole Modulator Load.

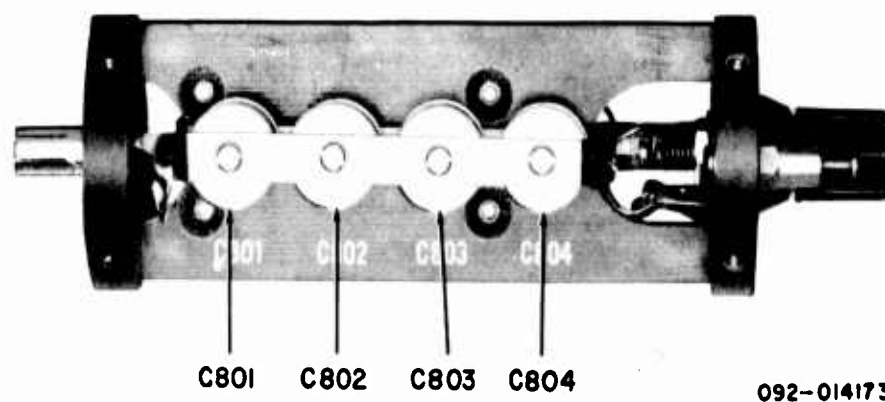


Figure 8-27. Terminal Board TB802, Reverse Side, Sole Modulator Load.

2

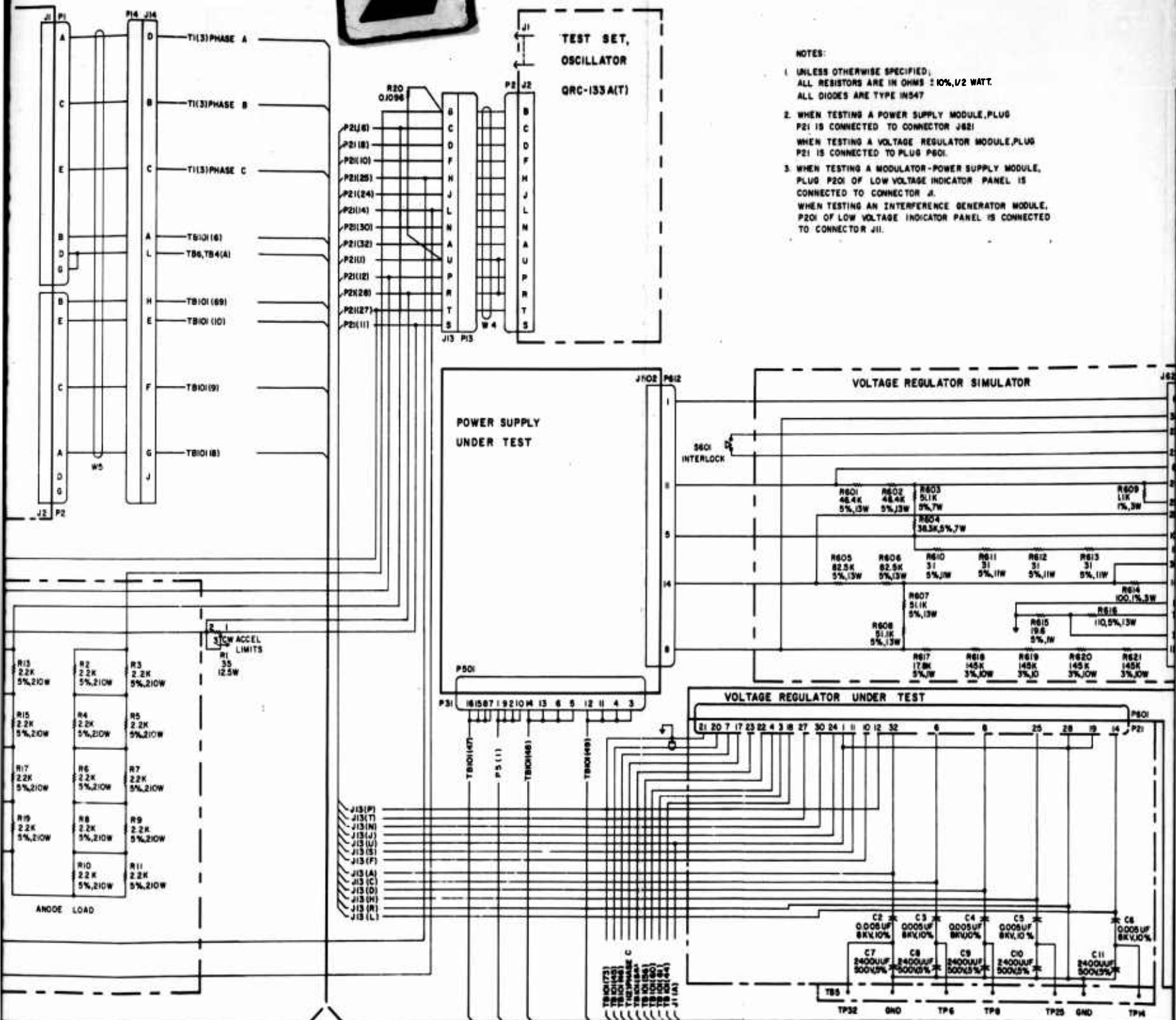


Figure 8-28. Schematic Diagram, Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T) (Sheet 1 of 2).

ICE GENERATOR MODULE,
OR PANEL IS CONNECTED

Figure 1 is a schematic diagram of the 100-1000 Hz audio simulator. The circuit consists of several resistors connected in a specific configuration. At the input, there is a 100K resistor (R608) in series with a 1% 3W resistor (R609). Following this, a 5% 7W resistor (R611) is connected. The output stage includes a 5% 10W resistor (R612) and a 5% 10W resistor (R613). A 100 1% 3W resistor (R614) is also connected to the output. A 10% 5% 13W resistor (R615) is connected to the output. A 145K resistor (R616) is connected to the output. A 3% 10W resistor (R617) is connected to the output. A 145K resistor (R618) is connected to the output. A 3% 10W resistor (R619) is connected to the output. A 145K resistor (R620) is connected to the output. A 3% 10W resistor (R621) is connected to the output.

AUXILIARY POSITION
OF P21 (SEE NOTE 2)

INTERFERENCE	P301	P
GENERATOR	M	T
UNDER TEST	CC	A
	Y	E
	H	C
	BB	X
	D	N
	S	V
	W	R
	AA	P
	L	U

P 301 P

M	T
CC	
A	Y
E	H
C	BB
X	D
N	S
V	W
R	AA
P	L
U	

Diagram showing the pin connections for J1 (16 pins):

- Pin 1: J1(1)
- Pin 2: P4(T)
- Pin 3: J11(g)
- Pin 4: J11(b)
- Pin 5: P16
- Pin 6: P16
- Pin 7: J11(n)
- Pin 8: TBIO(06)
- Pin 9: J11(z)
- Pin 10: TBIO(24), P4(R), J11(K)
- Pin 11: P3(16)
- Pin 12: J11(T)
- Pin 13: TBIO(67)
- Pin 14: J11(h)

3

092-01428
SHEET 1
OF 2

2

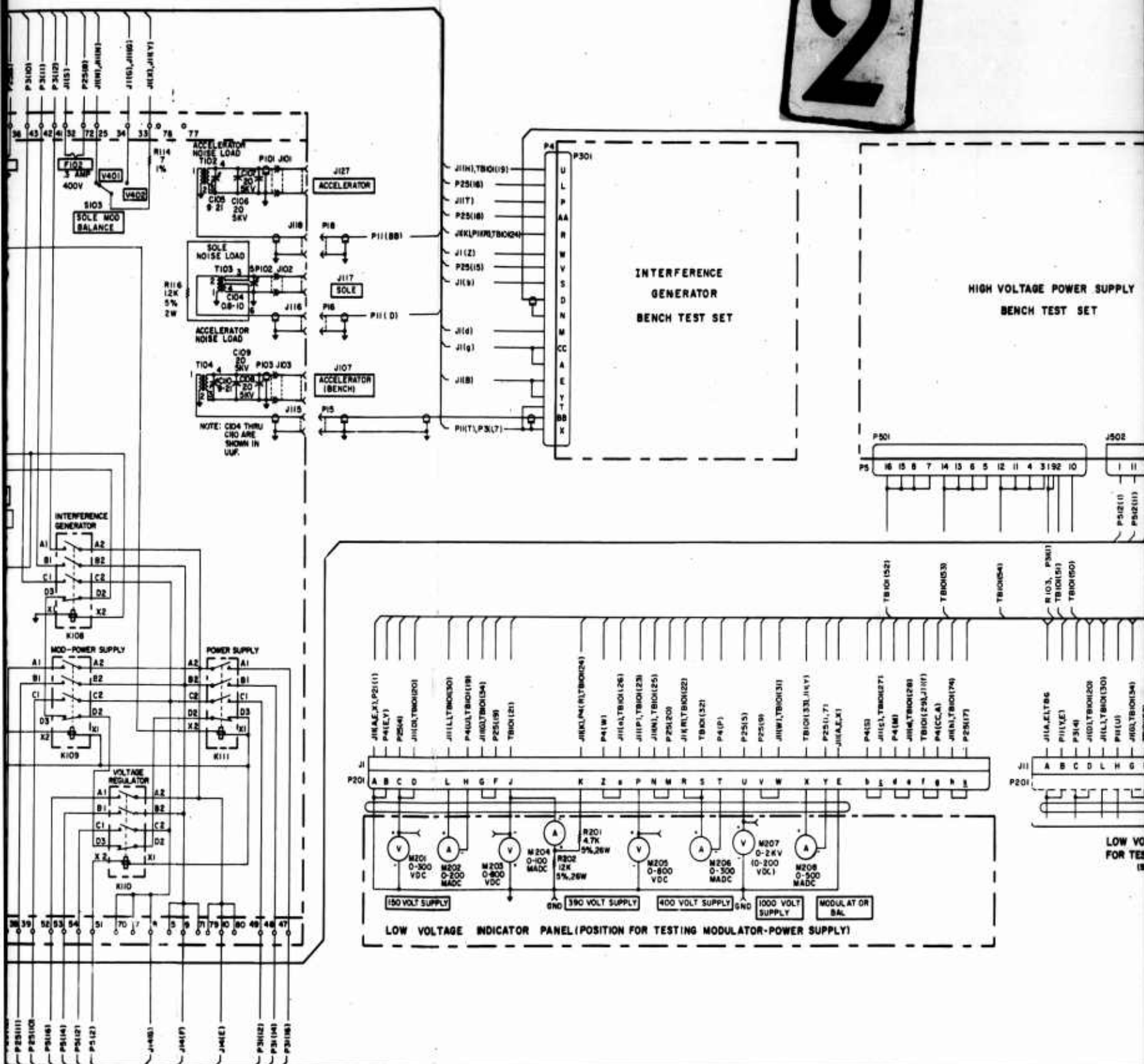
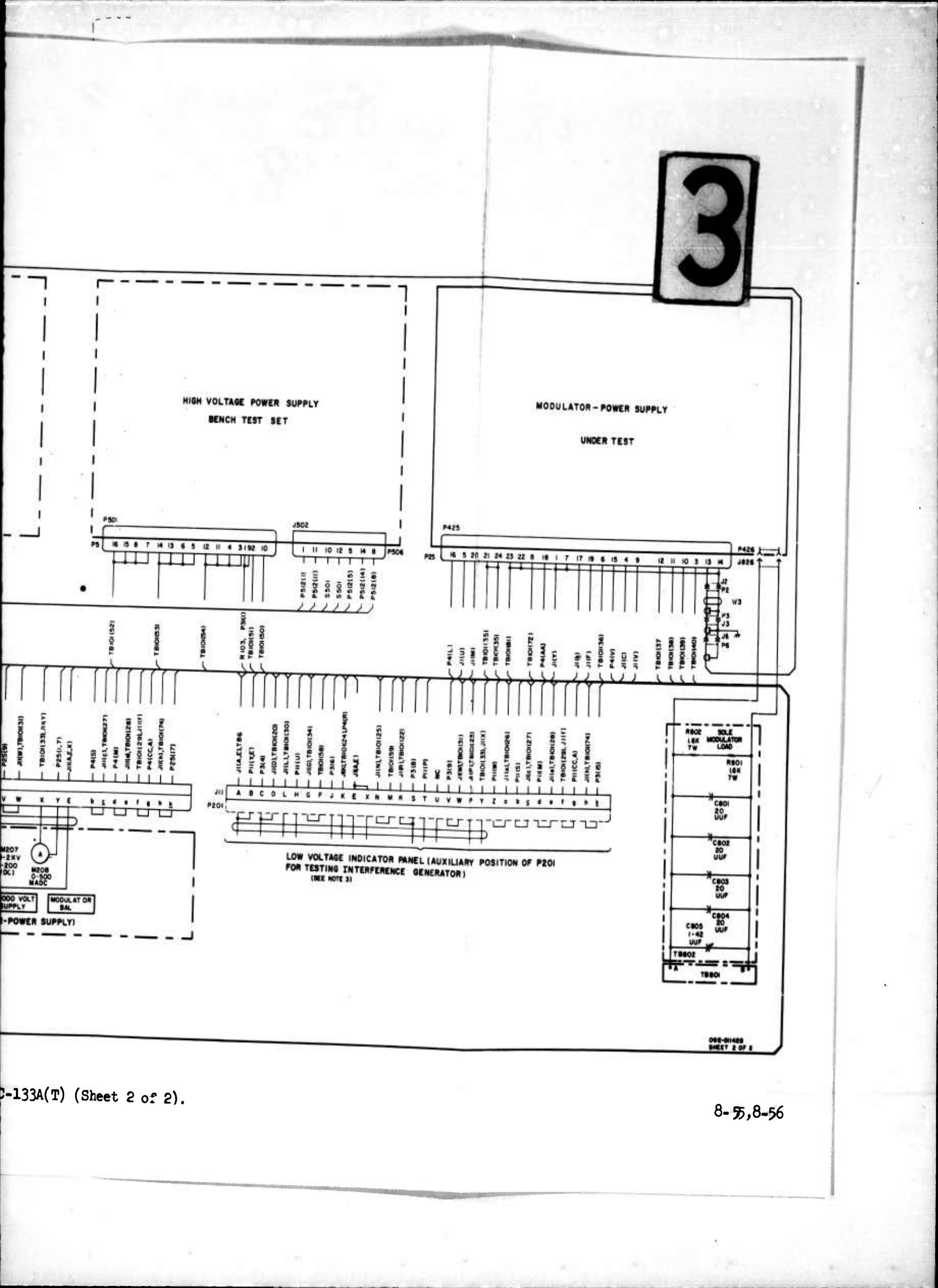


Figure 8-28. Schematic Diagram, Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T) (Sheet 2 of 2).



Refer to the Classified Supplement to The Handbook of Operation and Service Instructions For Test Set, Electronic Circuit, Plug-in Unit QRC-133A(T)(HLC NO. 094-903067) for the schematic diagram of the interference generator.

Figure 8-29. Schematic Diagram, Interference Generator.

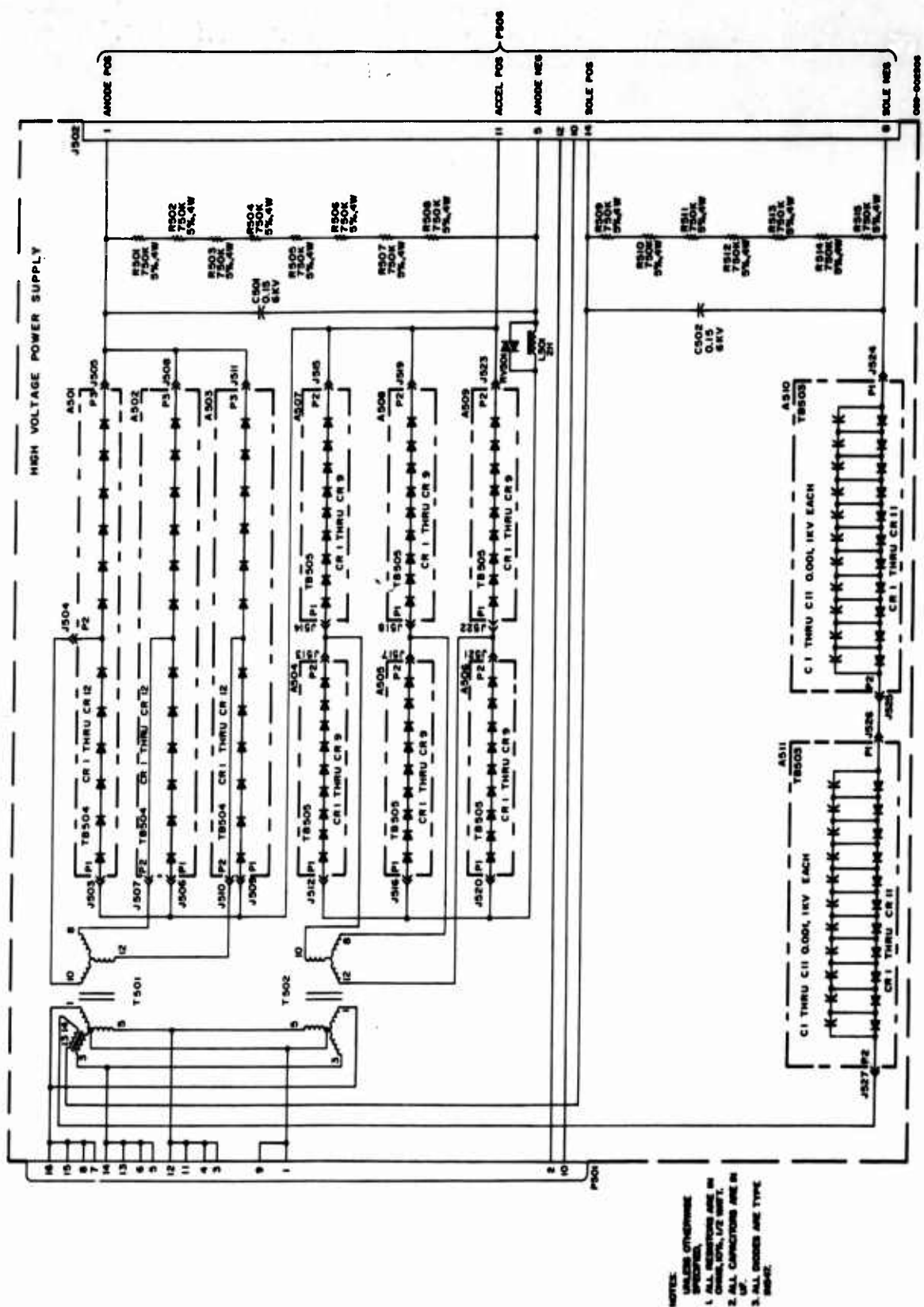


Figure 8-30. Schematic Diagram, High Voltage Power Supply.

UNCLASSIFIED

UNCLASSIFIED